

Regular Board Meeting – February 10, 2015
Natural Resources Building, Room 172, Olympia

Please note: All times are estimates to assist in scheduling and may be changed subject to the business of the day and at the Chair’s discretion. The meeting will be recorded.

AGENDA

9:00 a.m. - 9:05 a.m.	Welcome and Introductions Safety Briefing – Patricia Anderson, Department of Natural Resources (DNR)
9:05 a.m. - 9:15 a.m.	Approval of Minutes <i>Action: Approve November 12, 2014, meeting minutes</i>
9:15 a.m. – 9:25 a.m.	Report from Chair
9:25 a.m. – 9:40 a.m.	Public Comment – This time is for public comment on general Board topics. Comments on any Board action item that will occur later in the meeting will be allowed prior to each action taken.
9:40 a.m. – 10:00 a.m.	Staff Reports A. Adaptive Management - Chris Hanlon-Meyer, DNR B. Board Manual Development - Marc Ratcliff, DNR C. Compliance Monitoring - Donelle Mahan, DNR D. Rule Making Activity - Marc Engel, DNR E. Small Forest Landowner Advisory Committee and Small Forest Landowner Office -Tami Miketa, DNR F. TFW Cultural Resources Roundtable - Jeffrey Thomas and Karen Terwilleger, Co-chairs G. TFW Policy Committee’s Work Priorities - Stephen Bernath and Adrian Miller, Co-chairs H. Upland Wildlife Working Group - Terry Jackson, Washington Department of Fish and Wildlife (WDFW)
10:00 a.m. – 10:15 a.m.	Rule Making on Unstable Slope Information – Gretchen Robinson, DNR <i>Action: Consider rule adoption.</i>
10:15 a.m. – 10:30 a.m.	Progress on Board Manual Section 16 Unstable Slopes - Marc Ratcliff, DNR
10:30 a.m. – 10:45 a.m.	Break
10:45 a.m. – 11:15 a.m.	Northern Spotted Owl Technical Team - Lauren Burnes, DNR
11:15 a.m. – 11:25 a.m.	Northern Spotted Owl Implementation Team Next Steps - Lauren Burnes, DNR
11:25 a.m. – 11: 40 a.m.	Legislative Update - Chris Hanlon-Meyer, DNR

Future FPB Meetings

Next Meeting: May 12, August 11, and November 10, 2015

Special Meeting: February 11, February 12

Check the FPB Web site for latest information: <http://www.dnr.wa.gov/>

E-Mail Address: forest.practicesboard@dnr.wa.gov

Contact: Patricia Anderson at 360.902.1413

11:40 a.m. – 11:55 a.m.	TFW Policy Committee’s 2014 Activities - Stephen Bernath and Adrian Miller, Co-chairs
11:55 a.m. – 12:10 p.m.	CMER Committee’s 2014 Accomplishments – Mark Hicks, Department of Ecology and Todd Baldwin, Kalispel Tribe
12:10 p.m. – 1:10 p.m.	Lunch
1:10 p.m. – 1:25 p.m.	Public Comment – This time is for public comment on general Board topics. Comments on any Board action item that will occur later in the meeting will be allowed prior to each action taken.
1:25 p.m. – 1:35 p.m.	Public Comment on the Riparian Management Zone Bird Resample Report
1:35 p.m. – 1:50 p.m.	Riparian Management Zone Bird Resample Report - Chris Hanlon-Meyer, DNR <i>Action: Consider TFW Policy Committee’s recommendation.</i>
1:50 p.m. – 2:00 p.m.	Public Comment of Small Forest Landowner Alternate Plan Template
2:00 p.m. – 2:20 p.m.	Small Forest Landowner Alternate Plan Template – Elaine Oneil, Washington Farm Forestry Association and Marc Engel, DNR <i>Action: Consider Proposal Initiation</i>
2:20 p.m. – 2:30 p.m.	Public Comment on Board’s 2015 Work Plan
2:30 p.m. – 2:45 p.m.	2015 Work Planning - Marc Engel, DNR <i>Action: Consider changes.</i>
2:45 p.m. – 3:05 p.m.	Department of Ecology’s Nonpoint Plan – Ben Rau and Stephen Bernath, Department of Ecology
	Executive Session To discuss anticipated litigation, pending litigation, or any other matter suitable for Executive Session under RCW 42.30.110

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**Special Board Meeting/2015 Science Conference
February 11 & 12, 2015
DSHS Office Building 2, Auditorium, Olympia**

Please note: *A quorum of Board Members may attend this conference. The Board Members attending will not convene as a Board to consider or vote upon any Board matter, nor will the Board receive any public comment during the conference. The meeting will be recorded.*

The Cooperative Monitoring, Evaluation, and Research Committee (CMER) will host the ninth Forest Practices Adaptive Management Science Conference in Olympia, Washington. CMER is responsible for conducting research and monitoring in support of adaptive management of the Forest Practices Rules, which governs forestry practices on private and state forestlands in Washington State. This conference will highlight recent CMER studies.

Wednesday, February 11 - 8:00 A.M. to 4:30 P.M.

The first day of the conference will be devoted to the preliminary findings of the Type N Experimental Buffer Treatment – Basalt Lithologies (Hard Rock) Study. This is a landscape-level experiment designed to examine the effectiveness of the state's current riparian buffer prescription on non-fish-bearing streams in protecting stream resources. Presentations will include the following suite of response variables:

Riparian Vegetation	Woody Debris
Water Temperature	Discharge
Nutrient and Suspended Sediment Exports	Sediment
Channel Characteristics	Litterfall and Detritus
Periphyton	Macroinvertebrates
Amphibians	Fish
Trophic Pathways	

Thursday, February 12 - 8:30 A.M. to 3:00 P.M.

The second day of the conference will present findings covering a broad range of work examining the effect of forest practices on aquatic resources. Presentation topics include:

Findings from a Forested Wetlands Literature Synthesis for the NW
CMER's Wetlands Research Strategy
Eastern Washington Type N Forest Hydrology - Modeling and Characterization Study
Eastern Washington Type F Bull Trout Overlay Temperature/Shade Project
Eastern Washington Riparian Assessment Project (EWRAP)
Buffer Integrity-Shade Effectiveness Study – Amphibian and macroinvertebrate response
RMZ Study Re-Sample - Bird response 10 years post-harvest
Riparian Hardwood Conversion Study – Evaluating success

There is no fee for the conference; however, reservations are required. To register, please send an e-mail including your name, affiliation, and e-mail address to patti.shramek@dnr.wa.gov.

1 **FOREST PRACTICES BOARD**
2 **Regular Board Meeting**
3 November 12, 2014
4 Natural Resources Building, Room 172
5 Olympia, Washington
6

7 **Members Present**

8 Aaron Everett, Chair, Department of Natural Resources
9 Bill Little, Timber Products Union Representative
10 Brent Davies, General Public Member
11 Court Stanley, General Public Member
12 Dave Somers, Snohomish County Commissioner
13 David Herrera, General Public Member
14 Joe Stohr, Designee for Director, Department of Fish and Wildlife
15 Heather Ballash, Designee for Director, Department of Commerce
16 Julie Morgan, Designee for Director, Department of Agriculture
17 Paula Swedeen, General Public Member
18 Tom Laurie, Designee for Director, Department of Ecology
19

20 **Members Absent**

21 Bob Guenther, General Public Member/Small Forest Landowner
22 Carmen Smith, General Public Member/Independent Logging Contractor
23

24 **Staff**

25 Chris Hanlon-Meyer, Forest Practices Division Manager
26 Marc Engel, Forest Practices Assistant Division Manager
27 Patricia Anderson, Rules Coordinator
28 Phil Ferester, Senior Counsel
29

30 **WELCOME AND CALL TO ORDER**

31 Aaron Everett called the Forest Practices Board (FPB or Board) meeting to order at 9 a.m.
32

33 **APPROVAL OF MINUTES**

34 **MOTION:** Bill Little moved the Forest Practices Board approve the May 12 & 13, 2014 meeting
35 minutes as presented today.
36

37 **SECONDED:** Heather Ballash
38

39 **ACTION:** Motion passed. 1 Abstention (Brent Davies).
40
41

42 **MOTION:** Court Stanley moved the Forest Practices Board approve the August 12, 2014
43 meeting minutes.
44

45 **SECONDED:** Tom Laurie
46

47 **ACTION:** Motion passed unanimously.
48

1 **MOTION:** Tom Laurie moved the Forest Practices Board approve the September 3 & 4, 2014
2 meeting minutes.

3
4 **SECONDED:** Dave Herrera

5
6 **ACTION:** Motion passed. 1 Abstention (Joe Stohr).
7

8 **REPORT FROM CHAIR**

9 Aaron Everett noted the continuous evaluation efforts of staff and Timber, Fish and Wildlife (TFW)
10 Policy Committee (Policy) on unstable slopes as indicated by the agenda and the commitment of
11 Board Members to this issue. He also said that 2014 marks the 15th anniversary of the Forests and
12 Fish law and 40th anniversary of the Forest Practices Act.
13

14 **GENERAL PUBLIC COMMENT**

15 Ken Miller, Washington Farm Forestry Association (WFFA), shared information on a new company,
16 the Family Forest Legacies program. He said the program is a tool for small forest landowners to
17 protect natural resources while maintaining a viable timber industry. It is a for-profit business for
18 those landowners who do not have someone to leave their legacy to. The goal is to conserve and
19 sustainably manage timberlands. He said landowners could sell their land or exchange land for
20 income and as an income stream to share with family.
21

22 Karen Terwilleger, Washington Forest Protection Association (WFPA), supports three of DNR's
23 budget packages-Family Forest Fish Passage Program, Forestry Riparian Easement Program, and
24 Riparian Open Space as well as the acquisition of LiDAR. She stated concern over the 15% budget
25 reduction to Forest Practices and replacing those monies with a different fund source. She also
26 expressed WFPA's concern in the event the funding request is not approved for the Adaptive
27 Management Program.
28

29 Mary Scurlock, Conservation Caucus, stated the Conservation Caucus strongly supports the funding
30 request for the Adaptive Management Program and encouraged the Board to do what they can to
31 ensure the request is added to the Governor's budget request.
32

33 Peter Goldman, Washington Forest Law Center/Conservation Caucus, identified three priorities
34 related to the Board's work, which include the steep and unstable slopes, Northern spotted owl and
35 Forests and Fish implementation issues (use of interim water typing rule and approval of the board
36 manual on perennial initiation points). He asked the Board to recognize the unfinished business
37 relating to steep and unstable slopes in the South Willapa Report and the Mass Wasting Study since
38 both presented findings that the rules do not cover all portions of the forested landscapes and there
39 are gaps in screening.
40

41 **STAFF REPORTS**

42 Adaptive Management

43 Amy Kurtenbach, DNR, describe the Lean process and the on-going commitment required by all
44 participants.
45

46 She said Lean is a simple concept in that it's a continuous improvement methodology based on
47 problem solving and creativity, with mastery and purpose. She indicated that Lean is not without its

1 challenges as it challenges the status quo and questions why we do what we do and if we can do it
2 better.

3
4 Kurtenbach will be completing a Lean Black Belt Project in order to obtain a Lean Six Sigma Black
5 Belt through the University of Washington. She said her project deliverables are a status update of the
6 Lean Pilot and recommendations and employing the process improvement tools to adopt the pilot for
7 use on some, or all full scale Cooperative Monitoring, Evaluation and Research Committee (CMER)
8 research projects.

9
10 She continued in updating the Board on the five Technical Writing and Implementation Groups. The
11 five projects included *The Forested Wetland Effectiveness*, *The Unstable Slopes Criteria*, *The*
12 *Westside Type F Riparian Prescription Effectiveness*, *The Eastside Type N Riparian Buffer*
13 *Effectiveness*, and *The Roads Effectiveness BMP*.

14
15 Chris Hanlon-Meyer, DNR, said the following reports have been or will be in the near future
16 submitted to Policy: *The BTO Temperature and Solar Radiation/Effective Shade*; *Effectiveness of*
17 *Riparian Management Zones in Providing Habitat for Wildlife*; *Effects of Forested Roads and Tree*
18 *Removal In or Near Wetlands of the Pacific Northwest*; *Wetland Research and Monitoring Strategy*;
19 *and Review and Synthesis of Literature on Tailed Frogs (genus Ascaphus) with Special Reference to*
20 *Managed Landscapes*.

21
22 He also invited the Board to attend the CMER Science Conference to take place on February 11th and
23 12th. The conference will include one full day on the very comprehensive Type N Experimental
24 Buffer Treatment (Hard Rock Study) and presentations on eight other CMER research projects.

25
26 No further discussion on the following staff reports:

- 27 • Board Manual Development
- 28 • Compliance Monitoring
- 29 • Rule Making Activity & 2014 Work Plan
- 30 • Small Forest Landowner Advisory Committee and Small Forest Landowner Office
- 31 • TFW Cultural Resources Roundtable
- 32 • Upland Wildlife Working Group

33 34 **2015-2017 BUDGET REQUESTS**

35 Chris Hanlon-Meyer, DNR, provided an overview on the Department's and the Forest Practices
36 Program's 2015-17 budget requests. He said two decision packages respond to the Governor's
37 request for a 15% reduction in General Fund-State (GF-S) dollars by proposing a shift of \$8.158
38 million from the GF-S appropriation to the Aquatic Lands Enhancement Account.

39
40 Hanlon-Meyer also indicated DNR has submitted six budget requests that will directly benefit the
41 Forest Practices Program and include:

- 42 • Two operating budget proposals: Forest Practices Compliance - \$3.2 million and Forests and
43 Fish Adaptive Management - \$5.9 million
- 44 • Three capital budget proposals: Family Forests Fish Passage Program - \$11.5 million; Forest
45 Riparian Easement Program - \$11.2 million; and Rivers and Habitat Open Space Program - \$4
46 million

1 Megan Duffy, DNR, provided an overview on the Geology and Earth Resources budget request for
2 \$6.5 million for Geological Hazards and LiDAR.

3
4 Dave Somers supported the budget requests and suggested the Board do a motion of support.

5
6 **MOTION:** Dave Somers moved the Board support DNR's Forest Practices and Geology's
7 operating and small forest landowner related capital budget requests for inclusion in
8 the Governor's budget.

9
10 **SECONDED:** Bill Little

11
12 **ACTION:** Motion passed unanimously.

13
14 **PUBLIC COMMENT ON BOARD MANUAL SECTION 16 UNSTABLE SLOPES**

15 Scott Swanson, West Fork Timber Company, recommended the Board not take final action on the
16 board manual revisions. He said the efforts of the science team have advanced the understanding of
17 steep slopes issues, however more time is needed to consider the comments received, and to clarify
18 aspects of the manual that remain unclear.

19
20 Stephen Bernath, Department of Ecology, submitted their comments on the manual, but were not
21 included in the meeting packet. He also indicated that the comments were for the first draft and that
22 while the second draft before the Board is an improvement, he would like time to update his
23 comments to reflect the second draft. He suggested that the Board revise the second phase to include
24 a review of this draft by stakeholders.

25
26 Tim McBride, Hancock Forest Management, provided an historical perspective on revising the
27 channel migration zone board manual and encouraged a stakeholder process rather than approve the
28 proposed manual.

29
30 Norm Schaaf, Merrill & Ring, asked the Board to delay approval of Board Manual Section 16
31 because the revisions go beyond the Board's May 2014 motion and detail specific technical
32 requirements necessary for a complete application, which is not guidance. He also stated that the
33 revisions do not have consensus among stakeholders and qualified experts.

34
35 Mary Scurlock, Conservation Caucus, urged the Board to approve the revisions to Board Manual
36 Section 16 in its entirety immediately.

37
38 Peter Goldman, WFLC and Conservation Caucus, urged the Board to approve Board Manual Section
39 16. He also thanked and applauded DNR for the quick turnaround and that it is a major improvement
40 to the last version.

41
42 Kara Whitaker, WFLC, commended DNR and the qualified experts for proposing substantial, science
43 based improvements to Board Manual Section 16. She also asked the Board to approve the revisions
44 and expedite the second phase.

45
46 Chris Mendoza, Conservation Caucus, said the qualified experts' revisions to the board manual
47 reflect the importance of using the best available science and methods that ensure glacial deep-seated

1 landslides and their associated groundwater recharge areas are accurately identified and located on
2 the ground. He suggested that a “risk matrix” be developed to ensure that the best available science is
3 used in assessing the potential risk of unstable landforms to public resources and public safety.
4

5 Ken Miller, Washington Farm Forestry Association, said they support the efforts to protect public
6 safety regarding scientifically predictable landslides to inappropriate forest practices on certain steep
7 slope conditions. However, he said they have concerns about small landowners understanding the
8 expectations and that the rush to judgment regarding the tragedy will inappropriately expand the
9 regulatory disincentive to keep more of our forestland forested.
10

11 Bill Monahan, Rayonier, said that more time is needed to refine the manual and recommended the
12 Board delay approval.
13

14 John Gold, Sierra Pacific Industries, said the scope exceeds the Board motion and that it did not go
15 through the Administrative Procedures Act. He also said the manual did not have TFW consensus
16 and asked the Board to defer approval.
17

18 Kevin Godbout, Weyerhaeuser, said his concerns include the inappropriate co-mingling and creep of
19 ground water recharge area guidance for glacial deep-seated landslides and deep-seated landslides.
20 He also said the amendments are a significant deviation from the intent of the Board’s motion and
21 include strong recommendations for expensive, time consuming, and in most cases unnecessary
22 quantitative analyses. He also said the board manual as written is in effect a rule.
23

24 Karen Terwilleger, WFPA, asked for a delay in approval to refine the document through a
25 stakeholder process. She suggested the Board approve as an interim manual with clear direction to
26 revise.
27

28 Kendra Smith, Skagit County, said they support taking the time needed to get an accurate guidance
29 document.
30

31 Harry Bell, Washington State Society of American Foresters, recommended the manual go back to
32 DNR to go through the TFW process.
33

34 **BOARD MANUAL SECTION 16 UNSTABLE SLOPES**

35 Marc Ratcliff, DNR, requested the Board approve Board Manual Section 16, *Guidelines for Unstable*
36 *Slopes and Landforms*. He said the rules require that no forest practice activity can take place on
37 unstable areas in a manner that is likely to cause or contribute to further movement of the slope and
38 delivery of sediment to public resources or threaten public safety. He said the best practices, technical
39 procedures and guidance for how these situation can be evaluated is provided in the board manual.
40

41 He indicated that the group of experts stayed true to the Board’s motion by amending the manual for
42 the identification and delineation of groundwater recharge areas. He highlighted substantial
43 amendments, which included:

- 44 • Stating in the introduction that the manual is the technical advisory supplement to the forest
45 practice rules.
- 46 • Emphasizing that the provided in-depth analysis tools and methodologies are recommended steps,
47 and will depend on the specific situation.

- 1 • Assisting users in identifying landforms, determining when a further assessment may be needed
2 and what to include in the geotechnical report if that is required.
3

4 He concluded by stating that the amended manual provides improved technical guidance to:

- 5 • Accurately identify unstable landforms and assess the influence an activity may have on a
6 landform;
7 • Pathways for successful office reviews during remote sensing and data gathering phase and
8 during field assessments for identifying features on the ground; and
9 • Information users need to evaluate when planning forest practice activities so that DNR is
10 confident in our Forest Practices Application (FPA) decision that public resources are protected,
11 and threats to public safety avoided.
12

13 Aaron Everett commended staff for the diligent work in the short amount of time and said that he was
14 not willing to delay action on the manual section.
15

16 **MOTION:** Aaron Everett moved the Forest Practices Board approve as interim the amended
17 Board Manual Section 16, Guidelines for Evaluating Potentially Unstable Slopes and
18 Landforms. He further moved the Board allow staff to make minor spelling and
19 grammatical corrections if necessary prior to distribution of the interim Manual.
20

21 He further moved the Forest Practices Board direct staff to convene a stakeholder
22 process to complete revisions of the interim Board Manual Section 16, and to
23 complete guidance specific to assessing delivery potential as directed in the second
24 phase of the Board's May 2014 motion. He further moved to direct staff to provide a
25 final Board Manual Section 16 for Board approval at the August 11, 2015 meeting,
26 with progress reports at the February 10, 2015 and May 12, 2015 meetings.
27

28 **SECONDED:** Tom Laurie
29

30 Board Discussion:

31 Dave Somers said he supports the motion as well as having the expert panel providing the
32 information. He also stated that it clearly states that it is guidance and not rule.
33

34 Court Stanley asked DNR to work with landowners to make sure it can be implemented in the field to
35 ensure a better product.
36

37 **ACTION:** Motion passed unanimously.
38

39 **GENERAL PUBLIC COMMENT**

40 None.
41

42 **PUBLIC COMMENT ON TFW POLICY COMMITTEE'S RECOMMENDATIONS ON** 43 **UNSTABLE SLOPES**

44 Karen Terwilleger, WFPA, described the work put in by Policy members that resulted in an
45 exhaustive set of responses to the Board's motion passed in May. She provided a brief overview of
46 the elements in the motion and Policy's response. She said the transparency change in the process has
47 provided stakeholders a better understanding of DNR's process in identifying issues.

1 **TFW POLICY COMMITTEE’S RECOMMENDATIONS RELATED TO UNSTABLE**
2 **SLOPES**

3 Stephen Bernath, TFW Policy co-chair, provided an overview of Policy’s responses and
4 recommendations to the Board’s motion passed in May. He said Policy completed the following:

- 5 • Process review of the Mass Wasting Effectiveness Study, including public safety.
- 6 • Identified recommendations to close potential information gaps on locating glacial deep seated
7 landslides (GDSL).
- 8 • Evaluated existing mitigation measures under current rule related to ground water recharge areas
9 (GWRA) associated with GDSLs.
- 10 • Reviewed the mass wasting research strategy, including threats to public safety.

11
12 Recommendations included:

- 13 • Update flowchart for FPA review process relating to unstable slopes and landforms changes.
- 14 • UPSAG/CMER to consider doing a periodic retrospective review of FPAs associated with
15 GDSLs and associated GWRAs.
- 16 • Allow access to the FPA and related SEPA documentation for any Class IV Special, and DNR
17 documentation and SEPA decisions within FPARS.
- 18 • Reconvene UPSAG in the fall of 2014.
- 19 • UPSAG to begin exploring the options outlined in TFW Policy’s Technical Subgroup proposal
20 that relates to the research strategy for GWRAs on GDSLs.
- 21 • UPSAG to complete a review of the research strategy for unstable slopes, which includes a
22 review of the critical questions and specific studies.
- 23 • UPSAG/CMER to develop and execute a scope of work for a focused literature review to provide
24 a baseline for further development of the unstable slopes research strategy.
- 25 • Incorporate information sources into the board manual process.
- 26 • Improve the use of FPA level information.
- 27 • Access improved to stereo air photos.
- 28 • Prioritize additional mapping of GDSLs.
- 29 • Continue and expand training opportunities.

30
31 Bernath described the review process conducted by Policy on FPA’s for mitigation measures. He also
32 said that Policy had not spent any time on Type F since the Board re-directed the priorities.

33
34 Aaron Everett questioned the next steps and if any Board action is necessary. Bernath responded that
35 Policy would like the Board to accept the recommendations presented which would support the
36 continued efforts by Policy.

37
38 **MOTION:** Court Stanley moved the Forest Practices Board accept TFW Policy’s
39 recommendations as presented related to unstable slopes. The Board requests progress
40 reports at each quarterly meeting.

41
42 **SECONDED:** Dave Somers

43
44 **ACTION:** Motion passed unanimously.
45
46

1 **PUBLIC COMMENT ON UNSTABLE SLOPE INFORMATION RULE MAKING**

2 Stephen Bernath, Department of Ecology, expressed support of the rule proposal. However, he said
3 there is one sentence that may not be necessary and that the need can be determined during the public
4 comment period.

5
6 Mary Scurlock, Conservation Caucus, said they support the rule as presented today.
7

8 Karen Terwilleger, Washington Forest Protection Association, expressed support of the rule proposal.
9 She also commented that their experience for the cost of a geotechnical report is \$10,000 rather than
10 \$500-5,000 as indicated in the Cost Benefit Analysis.

11
12 **RULE MAKING ON UNSTABLE SLOPE INFORMATION**

13 Gretchen Robinson, DNR, requested the Board direct staff to file a CR-102 with draft rule language
14 related to unstable slopes information in Forest Practices Applications (FPAs). She said staff
15 developed rule language, with input from TFW Policy leads, after the Board’s May 2014 meeting
16 when it directed staff to file a CR-101. She explained the draft language is focused on DNR’s ability
17 to require additional geologic information prepared by a qualified expert if there is not enough
18 information to make a classification decision. She mentioned that FPA classification is one of the
19 primary tools DNR uses to ensure a proposal is thoroughly analyzed for any potential risk to public
20 safety and public resources. She said the intent of the language is to clarify in rule that DNR requires
21 additional geologic information if needed before classifying FPAs that include activities where
22 potentially unstable slopes or landforms exist.
23

24 **MOTION:** Heather Ballash moved the Forest Practices Board approve for public review the
25 draft rule proposal amending WACs 222-10-030 and 222-20-010. These changes
26 will inform prospective applicants that specific geologic information prepared by a
27 qualified expert may be required to appropriately classify Forest Practices
28 Applications.
29

30 She further moved the Board direct staff to file a CR-102 with the Office of the
31 Code Reviser to initiate permanent rule making.
32

33 **SECONDED:** Paula Swedeen
34

35 **AMENDMENT:** Aaron Everett moved to add “with the targeted final adoption at the February 2015
36 meeting” to the end of the second paragraph.

37 She further moved the Board direct staff to file a CR-102 with the Office of the
38 Code Reviser to initiate permanent rule making with the targeted final adoption
39 at the February 2015 meeting.
40

41 **SECONDED:** Tom Laurie
42

43 **ACTION ON**

44 **AMENDMENT:** Motion passed unanimously.
45

46 **ACTION:** Motion passed unanimously.
47
48

1 **REVISED TIMELINE FOR TYPE F ACTION ITEMS**

2 Stephen Bernath, TFW Policy co-chair, reviewed the schedule as originally planned prior to the Oso
3 event. Next steps will include Policy to determine what is ready to move forward, schedule a field
4 trip, update the timeline, and report to the Board in February on progress and revised timeline.
5

6 **PUBLIC COMMENT ON BOARD’S 2015 WORK PLAN**

7 Ken Miller, WFFA, spoke on behalf of Dick Miller and said WFFA intends to present two board
8 manual templates to the Board at their February meeting. He said that they would ask the Board to
9 direct the Adaptive Management Program to review the templates and provide recommendations to
10 the Board. He also requested that this be included on the Board’s 2015 work plan.
11

12 Karen Terwilleger, WFPA, alerted the Board on the possibility of the need for the dispute resolution
13 process for the Bull Trout Overlay study that is before Policy that could affect workload for both
14 Policy and the Board. She also said that the TFW Cultural Resources Roundtable is having extensive
15 discussions on FPA conditioning authority and anticipates a report to the Board sometime next year.
16 She also encouraged the need to spend time on reinvigorating the Forests and Fish process to
17 continue to be science based and collaborative.
18

19 **2015 WORK PLANNING**

20 Marc Engel, DNR, presented a 2015 work plan and proposed 2015 meeting dates.
21

22 Paula Swedeen and Court Stanley support adding the small forest landowner templates to the 2015
23 work plan. Aaron Everett is also in support, however said that he would like to see the templates first
24 to better determine the necessary workload.
25

26 **MOTION:** Tom Laurie moved the Forest Practices Board approve the 2015 Work Plan as
27 presented today.
28

29 **SECONDED:** Heather Ballash
30

31 **ACTION:** Motion passed unanimously.
32
33

34 **MOTION:** Dave Somers moved the Forest Practices Board change the 2015 meeting dates to the
35 2nd Tuesday of February, May, August and November.
36

37 **SECONDED:** Julie Morgan
38

39 **ACTION:** Motion passed unanimously.
40

41 **2014 WILDFIRE IMPACTS, FOREST HEALTH LANDOWNER ASSISTANCE**

42 Mary Verner, DNR, provided highlights on the 2014 wildfire impacts and the landowner assistance
43 available after a fire. She said that severe lightning storms started the majority of the fires and that
44 during July, DNR had responded to over 100 fires.
45

46 Verner reviewed the post-fire landowner assistance provided by DNR. She said that DNR conducts
47 resource fairs and site visits to evaluate tree survival, estimate losses, aid salvage decisions, and plan
48 for reforestation.

1 **NORTHERN SPOTTED OWL IMPLEMENTATION TEAM**

2 Lauren Burnes, DNR, announced the completion of the Technical Team's report on *Identifying and*
3 *Evaluating Opportunities for Conservation of Northern Spotted Owls on Non-federal Lands in*
4 *Washington*, and will be distributed to the Board soon. She said a discussion on the report would
5 occur at the Board's February meeting. She also updated the Board on the voluntary "opt-in"
6 programmatic Safe Harbor Agreement and the Rivers and Habitat Open Space Program.

7

8 **EXECUTIVE SESSION**

9 None.

10

11 Meeting adjourned at 3:25 p.m.



MEMORANDUM

January 22, 2015

TO: Forest Practices Board

FROM: Chris Hanlon-Meyer, Adaptive Management Program Administrator (Acting)

SUBJECT: Adaptive Management Program Administrator Cooperative Monitoring Evaluation and Research Committee Status Update

This Quarterly update includes a formal introduction of the New Adaptive Management Program Administrator, a report of the great CMER work and accomplishments in 2014, a report that provides the status of CMER projects, and finally some information on the CMER Science Conference taking place the two days following the February 2015 Board meeting.

Adaptive Management Program Administrator

Hans Berge started as the AMPA on February 1st. His experience and knowledge in scientific research, project management, and administration comes from his fifteen years as a fisheries biologist for King County. He has extensive experience with project management, funding, reporting, and decision making. He is an effective communicator, having served on several committees and forums representing King County.

2014 CMER Accomplishments

The attached CMER 2014 Accomplishments Report provides an accounting of the progress made on CMER projects during 2014. One highlight is the progress made on the seventeen chapters in Type N Experimental Buffer Treatment Project in Hard Rock Lithologies study (Hard Rock Study). This incredibly comprehensive effort is expected to come together for ISPR review in 2015.

Project Status Update Spreadsheet:

Attached is the updated CMER project status report that provides a general overview of the status of all projects in CMER, how they correspond to the completion of CWA milestones, and some general information pertaining to next steps in the process.

CMER Science Conference-February 11 &12, 2015:

The CMER Science Conference will be a two-day conference in Olympia (the agenda for the two-day event is attached). The conference is scheduled to occur the day after the February 10, 2015 Forest Practices Board meeting in order to accommodate Board members' schedules; especially those who travel. The first day of the conference will be dedicated to the Hard Rock Study and the second day will be for general CMER project status and findings presentations. Many of these projects will be coming to the Board for consideration in the next 18 months.

2014 CMER Accomplishments

CMER Budget:

- CMER projects stayed within projected 2014 budget
- CMER projects did not use the contingency fund to pay for project budget expenditures

Project Accomplishments:

- Wetland Literature Synthesis Report (WetSAG)
 - ✓ Completed SAG-approved draft report for CMER review and approval for submission to ISPR
 - ✓ Completed SAG-approved ISPR response matrix for CMER review and approval
 - ✓ Completed CMER-approved final report
 - ✓ CMER approved findings report for Policy review.
- Wetland Strategy
 - ✓ Completed SAG-approved draft report for CMER review and approval (10-wks)
 - ✓ Completed CMER-approved final report
 - ✓ Completed CMER-approved findings report for Policy review
- Bull Trout Overlay Temperature (Eastside Riparian Shade/Temperature) Project (RSAG)
 - ✓ CMER-approved final report
 - ✓ Completed CMER-approved findings report for Policy review
- Effectiveness of Riparian Management Zones in Providing Habitat for Wildlife: Resampling at the 10-year Post-treatment Interval, reanalysis of bird data (LWAG)
 - ✓ Completed SAG-approved draft report for CMER review and approval
 - ✓ Completed SAG-approved ISPR response matrix for CMER review and approval
 - ✓ Completed CMER-approved final report and findings report for Policy Review
- Stream-Associated Amphibian Response to Manipulation of Forest Canopy Shading (Buffer Integrity-Shade Effectiveness Project) (LWAG)
 - ✓ Completed SAG-approved final report for CMER review and final approval
- Westside Type N Experimental Buffer Treatment – Hard Rock Study (LWAG/RSAG)
 - ✓ Maintained/renewed access permits for all study sites
 - ✓ Worked with DNR to ensure continued access to two reference sites that were up for potential harvest in the next several years. DNR has agreed to postpone harvest of these study sites until FY2019
 - ✓ Conducted regular meetings with PIs (monthly or as needed) for development of final report and to promote consistency.
 - ✓ Assigned SAG/CMER Reviewers for chapters 1-17
 - ✓ The following chapters for the Type N Hardrock Final Report were submitted for CMER review, and comments received:
 - Chapter 7 – Water Temperature
 - Chapter 10 – Sediment

2014 CMER Accomplishments

Chapter 11 – Channel Characteristics
Chapter 12 – Litterfall and Detritus
Chapter 13 – Periphyton
Chapter 14 – Macroinvertebrates
Chapter 16 – Fish
Chapter 17 – Trophic Pathways

- ✓ The following chapter will be submitted for CMER review (possible that comments will not be received by end of calendar year):
 - Chapter 14 – Stream-associated Amphibians

- ✓ The following reviewed chapters have been revised based on CMER review comments and approved:
 - Chapter 1 – Intro and Background
 - Chapter 2 – Study Design
 - Chapter 3 – Management Description
 - Chapter 4 – Unanticipated Disturbance Events

- ✓ The following reviewed chapters will be revised and submitted to CMER, though approval is not guaranteed prior to end of calendar year:
 - Chapter 5 – Riparian Vegetation
 - Chapter 8 – Discharge (new chapter with components from already reviewed chapters Sediment and Nutrient Export)
 - Chapter 9 – Nutrient Export
 - Chapter 10 – Sediment
 - Chapter 11 – Channel Characteristics
 - Chapter 12 – Litterfall and Detritus
 - Chapter 16 – Fish

- Tailed Frog Literature Review (LWAG/RSAG)
 - ✓ Completed SAG-approved ISPR response matrix for CMER review and approval
 - ✓ Completed CMER- approved final report.

- Eastside Type N Buffer Effectiveness Study (TWIG)
 - ✓ Technical Writing and Implementation Group (TWIG) formed
 - ✓ Policy approval (with motion) of Study objectives, problem statement, and critical research questions refined by TWIG and presented to Policy for approval
 - ✓ Scientific merits of best available science and alternative approaches to addressing the study objectives presented to and approved by CMER and Policy
 - ✓ Study design alternatives presented to and approved by CMER and Policy

- Eastside Type N Characteristics Forest Hydrology Project (SAGE)
 - ✓ Completed draft report for SAG review and approval
 - ✓ Completed CMER-approved draft report for ISPR review

- Eastern Washington Riparian Assessment Project (EWRAP) (SAGE)

2014 CMER Accomplishments

- ✓ Completed SAGE review and approval of first draft of chapters 1, 2, 3, and 4
- Hardwood Conversion Project (RSAG)
 - ✓ Draft report approved by RSAG
 - ✓ Completed CMER-approved draft report
 - ✓ Authorized implementation of 10-year resample project
- Westside Type F Riparian Prescription Effectiveness Project (TWIG)
 - ✓ Technical Writing and Implementation Group (TWIG) formed
 - ✓ Policy presented and approved study objectives, problem statement, and critical research questions as refined by TWIG
- Unstable Slope Criteria Project (TWIG)
 - ✓ Technical Writing and Implementation Group (TWIG) formed
- Eastside Type F Extensive Status and Trends Monitoring Report
 - ✓ Completed final report for CMER review and approval
 - ✓ Completed and submitted a Findings Report to Policy

LEAN Process Improvement:

- Assessment of Lean Pilot completed for review and consideration by CMER, Policy, and the Board
- CMER initiated projects to pilot the new process for developing study designs
 - ✓ Eastside Type N Buffer Effectiveness Study (TWIG formed and active)
 - ✓ Road Prescriptions BMP Monitoring (IWT and TWIG formed)
 - ✓ Westside Type F Buffer Effectiveness (TWIG formed and active)
 - ✓ Unstable Slope Criteria (TWIG formed and active)
 - ✓ Forest Wetlands Effectiveness (IWT formed and TWIG selection process completed)

Field Work:

- Westside Type N Experimental Buffer Treatment Study - Hard Rock
 - ✓ Completed field work for extended sampling effort
- Westside Type N Buffer Effectiveness Study - Soft Rock
 - ✓ Harvest completed at five of twelve sites
- Eastside Type F Riparian Prescription Monitoring (Bull Trout Add On)
 - ✓ Completed field work for extended sampling effort
- Eastside Type N Buffer Effectiveness Study
 - ✓ Completed field work for extended sampling effort

RFPs/RFQs:

- Forest Practices and Wetlands Systematic Literature Review amendment completed

2014 CMER Accomplishments

CMER Monthly Science Sessions

- Greg Stewart, Eastside Type N Buffer Effectiveness
- Jeff Ricklefs and Chris Snyder, Capitol Forest LiDAR-Based Stream Typing Model

2015 Work Plan Review Budget and Master Project Schedule:

- Completed and approved by CMER, Policy, and Forest Practices Board

CMER Data Information Management:

- New and historical scoping documents, study designs, reports, maps, and data collected and forwarded to NWIFC by SAGs, PMs, and others for new projects to be included in the CMER Data Information Management.

CMER Administration

- CMER monthly agendas consistently developed and sent out on time
- Continued leadership/facilitation by SAG and CMER co-chair volunteers
- Voluntary coordination within SAGs when co-chairs or PM is absent from meetings
- CMER minutes completed and approved monthly
- CMER agendas and minutes and reports loaded on the AMP web site
- Held 3 CMER meetings in Eastern Washington (Ellensburg) with plans to have 3 more in 2015
- Leah Beckett joins CMER Staff at NWIFC as the new CMER Wetlands Scientist
- Two dedicated CMER Co-Chairs: Mark Hicks and Todd Baldwin

SAG Administrative Accomplishments

- **LWAG:**
 - ✓ Advisory input to WetSAG for wetlands monitoring discussions/development
 - ✓ Advisory input on Type N Soft rock Study
 - ✓ Budget development and discussion of Van Dyke's project to CMER and Forest Practice's Board.
- **WetSAG**
 - ✓ Participated in the hiring of the CMER Wetland Scientist
 - ✓ Two Co-Chairs: Debbie Kay and Harry Bell
- **SAGE**
 - ✓ Two Active Co-Chairs: Kodi Jo Jaspers and Joel Adams
- **RSAG**
 - ✓ One long-Standing Chair: Jo Murray
- **UPSAG**
 - ✓ Re-formation of UPSAG.
 - ✓ New Chair: Isabelle Sarikhan

CMER PROGRAM PROJECT STATUS SPREADSHEET

	Human Resources		Milestone	Task		Task	Task	Milestone	Task	Task	Task	Milestone	Task	Task	Task	Milestone	Task	Task	Task	Task	Milestone	Task	Task	Task	Milestone	Task	Task	Task	Milestone	General Status Comments																										
	PM	PI		START	FINISH																										START	FINISH	START	FINISH	START	FINISH	START	FINISH	START	FINISH	START	FINISH	START	FINISH	START	FINISH	START	FINISH	START	FINISH	START	FINISH	START	FINISH	START	FINISH
	INWFC	7 M		2 M	3 M																										2 M	7 M	4 M	2 M	1 M	18 M	6 M	2 M	8 M	2 M	1 M	4 M	15 + M	3 M	3 M	5 M	PROJECT SPECIFIC	4 M	25 M	5 M	4 M	3 M	8 M	2 M	3 M	1 M
TYPE N RULE GROUP																																																								
WWA Type N Buffer Characteristics Integrity and Function (BCIF) - Re-sample	HH	DS		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Mar-15	Extended sampling field work completed September 2013. Data input and QA/QC done. Data and statistical analysis to occur early 2015.																								
Type N Experimental Buffer Treatment - Hard Rock (Report Writing)	AK	AM	DS GS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Jul-14	May-13	Jun-15	CWA 2014	Completed first full draft of all 17 chapters in Dec 2014. Chapters will be forwarded onto ISPR in the spring of 2015 following review, comment, and revisions by Authors.																						
Type N Experimental Buffer Treatment - Hard Rock - Amphibian Genetics Component	AK	AM		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	FY 2016	CWA 2014	Part of original hard rock study design; need a second generation of the population for genetics component																							
Type N Experimental Buffer Treatment - Hard Rock - Amphibian Demographics & Channel Metrics	AK	AM		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	FY 2013	FY 2019	Extended field sampling proposed for Amphibian Demographics FY18, FY19. Extended Field sampling for Channel Metrics FY13, 14, 17, 18 and 19.																							
Type N Experimental Buffer Treatment - Hard Rock - Extended Sampling Temp/ Sediment/ Veg./ Litter Fall	AK	AM	BE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Apr-13	FY 2019	Extended field sampling: FY13, 14, 18 and 19.																							
Type N Experimental Buffer Treatment - Soft Rock	HH	GS	GS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	FY 2017	CWA 2018	Pre-harvest sampling FY 2013-2014, 2-year post-harvest sampling FY 2015-2017, Data analysis 10/2016 - 12/2017, and CMER approval Winter 2018. Harvesting of sites is underway and on schedule.																						
EWA Type N Characterization - Forest Hydrology	AK	DM	GS																													Apr-10	Aug-14	Dec-14	A report has been forwarded to ISPR for review and consideration.																					
EWA Type N Riparian Effectiveness - Perennial	AK	GS	GS	Lean Pilot																												Nov-13	CWA 2012	Jan-15	CWA 2013	CWA 2019	BAS review and recommended alternatives approved by Policy Nov. 2013. Science team is currently working on study design for perennial reaches.																			
EWA Type N Riparian Effectiveness - Dry Intermittent	AK	RW	GS	Lean Pilot																												Nov-13	CWA 2012	Jan-15	CWA 2013	CWA 2019	BAS review and recommended alternatives approved by Policy Nov. 2013. Policy has requested the science team study both dry intermittent reaches and perennial. The science team completed preliminary fieldwork to evaluate temporal distribution of flows in dry intermittent reaches this last summer 2014. TWIG has been analyzing the data and discussing an approach for linking the perennial and dry Intermittent streams in one study. The team will be presenting to Policy in February 2015.																			
WWA Type N Buffer Integrity - Shade Effectiveness (Amphibians)	AK	JT		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Dec-13	Oct-14	CWA 2012	ISPR response matrix and revised report submitted for CMER approval Nov. 2013 (nonconsensus). Scientists have been working on the report and intent to have a complete revised report for CMER review and approval by Spring 2015. Work on the revisions has been delayed due to workload.																	
WWA Amphibians in Intermittent Streams		MH		2019 Start per MPS																																		CWA 2015	CWA 2017	Settlement Agreement scheduled start date FY 2016 with an anticipated end date of 2025 (final report). Start date of 2019 per new Master Project Schedule. This project is on hold until the Hard Rock Rpt. completed to determine if needed.																

CMER PROGRAM PROJECT STATUS SPREADSHEET

	Human Resources		Milestone	Task	Task	Task	Milestone	Task	Task	Task	Milestone	Task	Task	Task	Milestone	Task	Task	Task	Task	Task	Milestone	Task	Task	Task	Milestone	Task	Task	Task	Milestone	General Status Comments		
	PM	PI																													INWFC	START
Estimated Timeframe (Months)			7 M	2 M	3 M	2 M	7 M	4 M	2 M	1 M	18 M	6 M	2 M	8 M	2 M	1 M	4 M	15 + M	3 M	3 M	5 M	PROJECT SPECIFIC	4 M	25 M	5 M	4 M	3 M	8 M	2 M	3 M	1 M	
Extensive Alternative (Remote Sensing Approach)			New Project	Feb-15																											The Riparian Assessment Science Advisory Group (RSAG) was asked by Policy to provide an assessment of alternative remote sensing methodologies that may be used to conduct the Extensive Monitoring Program. This pilot project replaces the prior list of Extensive Monitoring Studies in past CMER workplans. RSAG is working on developing clearly defined monitoring objectives, defined questions and performance targets which will be provided to Policy for review and approval. RSAG has contacted the UW Precision Forestry Lab (Dr. Monika Moskal) for assistance with development of the pilot study as they have familiarity with existing sources of data and software.	
EWA Riparian Assessment Project (EWRAP)	HH	AR		N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Drafts of chapters 1 through 4 of report complete and reviewed by SAGE. Per SAGE direction PI is in process of addressing all outstanding comments. Once this is completed the revised chapters will go back to SAGE for a final review. Once the revised report is reviewed and approved by SAGE, it will be sent to CMER for review/approval. Completion of the revised chapters is anticipated to occur around April 2015.
WWA Type F Riparian Prescription Monitoring	HH	DS	Lean Pilot	June-14			CWA 2014	Jan-14	Oct-14	Oct-14	Feb-15																				BAS work complete. TWIG continuing work on study design alternatives, identification of a recommended preferred alternative and a report for Policy.	
EWA Bull Trout Overlay Temperature (Riparian Shade/Temperature)	AK	EC	GS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A																				Feb-14 (CWA 2011)	COMPLETED - Report is in Policy for consideration.
EWA Type F Riparian Effectiveness Monitoring (BTO Add-on)	HH	DS	DS	N/A	N/A	N/A	N/A	N/A	N/A	N/A																						Field work for 5-year Post Harvest Survey complete. NWIFC CMER staff working on QA/QC of data.
Riparian Hardwood Conversion	HH	AR	AR	N/A	N/A	N/A	N/A	N/A	N/A	N/A																						Draft report approved by CMER at its August 2014 meeting. CMER approved placing report put on hold until the approved 10-year resample is completed and can be incorporated into a final report. Once the revised report is approved by CMER the ISPR review process will begin. It is not likely that ISPR review will begin before the 4th quarter of 2016.
Extensive Riparian Status and Trends Monitoring - Temperature - Type F Westside, Type N Westside	HH	BE		N/A	N/A	N/A	N/A	N/A	N/A																							CMER review of draft rpt. has been completed. Final revisions based on CMER comments expected by the end of first quarter 2015.
UNSTABLE SLOPE RULE GROUP																																
Unstable Slopes Criteria Evaluation and Development	HH	GS	Lean Pilot	Jun-14	Jun-14		CWA 2012	Sep-14	Feb-15																							TWIG working on developing objectives, problem statement, and revision of critical questions for submittal to Policy for review and approval. The project may require initial data mining of the mass wasting report data prior to completion of the problem statement and selection of a particular project alternative.
Glacial deep-seated landslide program strategy review/scoping				Jul-05																												New project - FY15



MEMORANDUM

January 16, 2015

TO: Forest Practices Board

FROM: Marc Ratcliff 
Forest Practices Policy and Services Section

SUBJECT: Board Manual Development Update

The following provides information on the current progress and anticipated development and amending of Sections of the Forest Practices Board Manual:

- Section 16, *Guidelines for Evaluating Potentially Unstable Slopes and Landforms*. DNR Staff has convened and is facilitating stakeholder meetings to complete the second phase of the Board's motion to amend this Section. Work will concentrate on improving and expanding guidance regarding delivery and run-out language for inclusion in this Section;
- Section 7, *Guidelines for Riparian Management Zones*. This Section will be amended in conjunction with development of draft RMZ rule language. Manual Section work will coincide with the Board's RMZ rule making timeline;
- Section 23, Part 2, *Guidelines for Field Protocol to Identify the Uppermost Point of Perennial Flow in Type Np Waters*. DNR will convene a stakeholder process to develop this Section when the TFW Policy Committee has completed development of a wet season methodology to identify the upper most point of perennial flow in Type Np Waters.

Please feel free to contact me with any questions at 360.902.1414 or marc.ratcliff@dnr.wa.gov.

MR



MEMORANDUM

TO: Forest Practices Board
FROM: Garren Andrews, Compliance Monitoring Program Manager
SUBJECT: Current status of the Compliance Monitoring Program

The Compliance Monitoring program has completed all field reviews and data input from the field reviews for the 2014 season. The process of screening of Forest Practices Applications for the upcoming 2015 field season has also been completed.

The position for the Compliance Monitoring Program Manager is being temporarily filled by Garren Andrews from the Southeast Region Forest Practices Office.

If you have any questions please contact me at (360) 902-1366 or garren.andrews@dnr.wa.gov

GA/

GM A



MEMORANDUM

January 22, 2015

TO: Forest Practices Board

FROM: Marc Engel, Assistant Division Manager, Policy and Services
Forest Practices

SUBJECT: 2015 Rule Making Activity

A handwritten signature in blue ink, appearing to be 'ME', is placed over the 'FROM' line of the memorandum.

Rule making activity includes the unstable slopes information in Forest Practices Applications. Staff will request your adoption of the rule proposal to file a CR-103 at your February meeting.

Staff anticipate requesting your approval at the May meeting to file a CR101 to begin rule development on the riparian management zone clarification.

I look forward to answering any questions you may have on February 10.



MEMORANDUM

January 14, 2015

TO: Forest Practices Board

FROM: Tami Miketa, Manager, Forest Practices Small Forest Landowner Office *TM*

SUBJECT: Small Forest Landowner Office and Advisory Committee

Small Forest Landowner Advisory Committee (SFLAC)

Since my last staff report, the Small Forest Landowner Advisory Committee met twice; October 29 and December 16, 2014. Issues discussed included:

- Potential ideas for funding small forest landowner technical assistance needs;
- Methods to help inform and educate small forest landowners regarding land management options and marketing opportunities;
- Western gray squirrel voluntary management approach;
- Joint meeting with SFLAC and TFW Cultural Resources Roundtable – discuss potential agenda topics; and
- Draft WFFA Small Forest Landowner Smaller Buffer Template.

The Forest Practices Board recently requested WDFW staff member, Penny Becker, to attend a SFLAC meeting to discuss western gray squirrel educational opportunities for small forest landowners. Penny, Terry Jackson, and Gary Bell attended the December 16th SFLAC meeting and discussed the western gray squirrel voluntary management approach. WDFW staff and the SFLAC brainstormed opportunities to provide additional education on this topic to small forest landowners specifically located in Klickitat County.

Forestry Riparian Easement Program (FREP)

In the 2013 legislative session, DNR requested full funding to complete acquisition of the FREP backlog, which totaled approximately \$13 million at the time the request was developed. The legislature funded FREP at \$2 million for FY14-15, a doubling from FY 12-13 levels. With this \$2 million it is estimated that FREP will purchase 29 easements during the FY14-15 biennium.

Since FREP began, funding has not kept up with demand. There has been a backlog of applications waiting for sufficient funding to acquire the easements. During the 2014 fiscal year, 30 new applications were received. The program has been getting approximately 25-30 easement applications per year, which is an increase from about 15 applications per year in previous years. There are now 138 forestry riparian easement applications on the list for compensation.

Rivers and Habitat Open Space Program (R&HOSP)

The Legislature appropriated \$500,000 to this program for the Fiscal Years 13-15 biennium. Funding to purchase easements is available through the remainder of the 2013 to 2015 biennium. Applications are prioritized for funding based on:

- The ecological value of the property.
- Potential benefits to water quality.
- The biological characteristics of the property.
- Historic, biological or cultural significance.
- The viability of management actions applied to the property.

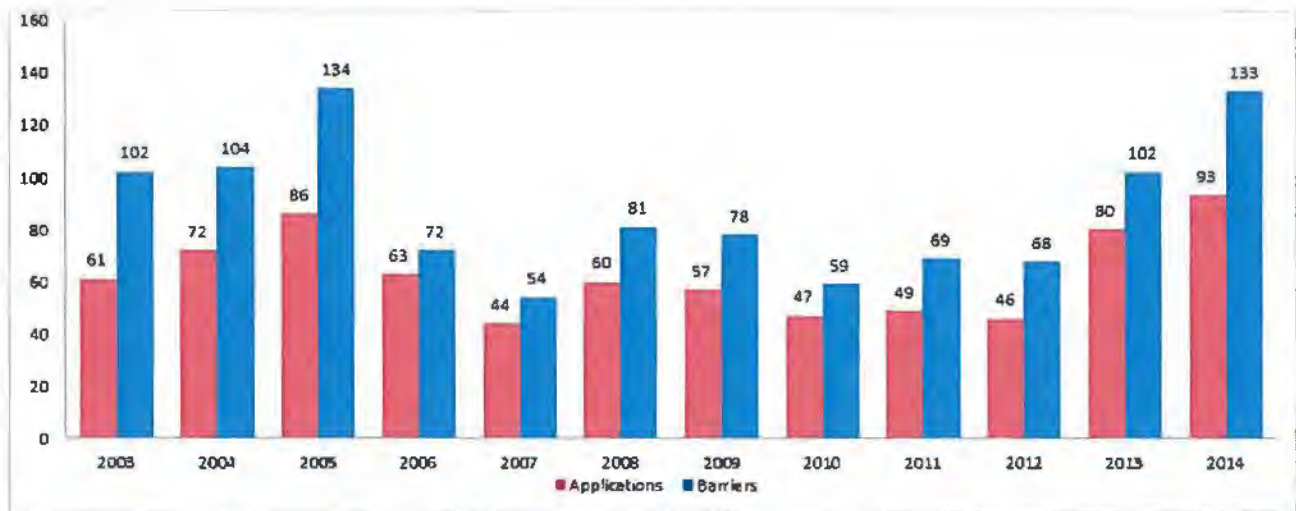
Properties will be funded in order of ranked priority until all funds have been expended. All applications were due to be submitted by September 30, 2014. DNR received a total of 20 applications encompassing critical habitat for state threatened or endangered species and areas encompassed in channel migration zones. The 20 applications were evaluated for eligibility and were prioritized using the criteria listed above. The valuation process for the top applications are currently occurring. The purchase of the easement(s) are proposed to occur in spring of 2015.

Family Forest Fish Passage Program (FFFPP)

The FFFPP was allotted \$2 million from the Legislature for the Fiscal Years 13-15 biennium. For the 2014 construction season, FFFPP used the remaining funds (approximately \$6 million) from the Jobs Now Act and a portion of the \$2 million allotted by the Legislature to complete projects eliminating 47 fish passage barriers and opening 115 stream miles.

Nearly one hundred private owners of forestland took part in salmon recovery efforts through the Family Forest Fish Passage Program during the FY 2013-2014 biennium. The Legislature, as part of the Jobs Now Act, allowed the program to complete 95 fish barrier passage projects, reconnecting 261 miles of habitat for fish. These barrier replacement projects create construction jobs in rural communities, help revive salmon and trout populations, and are a great asset to landowner's property. It is estimated that for every \$100,000 invested in fish passage projects, 1.57 local jobs are created during the construction season.

Below is a chart showing the number of FFFPP applications received each year since the start of the program in 2003, as well as the number of barriers that were evaluated each year. As you can see, in 2014, the FFFPP received the highest number of applications and conducted the second highest number of barrier evaluations.



Long Term Applications (LTA's)

There are now a total of 191 approved long term applications; which is an increase of 7 approved applications since the end of the last reporting period (10/13/2014).

LTA Applications	LTA Phase 1	LTA Phase 2	TOTAL
Under Review	4	2	6
Validated	23	0	23
Approved	2	189	191
TOTAL	29	191	220

Small Forest Landowner Outreach

The January issue of Small Forest Landowner News was distributed over 3,100 subscribers and continues to have an open rate of 38% - well above the average open rate of 25% for government publications. Our most popular articles are those focused on forest health, the message from the Manager of the Small Forest Landowner Office, and features addressing topics such as cultural resources.

All SFLO program applications have been converted to electronic forms that can be submitted on line or by regular mail.

Small Forest Landowner Grant Applications

Staff continue to research federal grant possibilities (Grants.gov) and charitable foundation environmental grants, however, finding grant categories that are open to state government remains difficult.

Please contact me at (360) 902-1415 or tamara.miketa@dnr.wa.gov if you have questions.

TM/



Cultural Resource Roundtable

January 22, 2015

MEMORANDUM

TO: Forest Practices Board

FROM: Timber/Fish/Wildlife Cultural Resources Roundtable Co-Chairs
Jeffrey Thomas, Puyallup Tribe of Indians
Karen Terwilleger, Washington Forest Protection Association

SUBJECT: Staff Report of Timber/Fish/Wildlife Cultural Resources Roundtable to the February 2015 Quarterly Forest Practices Board meeting

The TFW Cultural Resources Roundtable is pleased to submit this latest report to the Forest Practices Board.

Again, the report is in the form of the Roundtable's Action Item list. This list is reviewed quarterly by the Roundtable and updated here to reflect current activities. Changes from our previous report (dated November, 2014) are highlighted in red and italic print. For the Board's information, we've also added more detail on our top three priorities below:

- Review DNR's FPA conditioning authority: The Roundtable is continuing work describing DNR's authority, identifying issues and potential options. In a letter to the Umatilla Tribe, dated October 23, 2014, Commissioner Goldmark mentioned the Roundtable's activities (both letters attached). We view this as confirmation for the Roundtable to continue to working on this issue, but please advise us.
- Seek funding and staff support for the Roundtable's work: The Roundtable Co-Chairs will bring a formal funding request to the Board in May. We anticipate requesting assistance with note-taking and meeting organization.
- Prepare the cultural resource guidance documents and tools as agreed to in the CRPMP: The Roundtable's work on the guidance documents has been delayed due to the discussion about DNR's FPA conditioning authority.

We look forward to your February meeting to answer questions or respond to Board requests. Please do not hesitate to contact one of us before the meeting.

jeffrey.thomas@puyalluptribe.com and (253) 405-7478

kterwilleger@wfpa.org and (360) 480-0927

Enclosures



October 23, 2014

Eric Quaempts, Director
Department of Natural Resources
Confederated Tribes of the Umatilla Indian Reservation
Nixyáawii Governance Center
46411 Timine Way
Pendleton, OR 97801

Subject: August 29, 2014 Letter to Washington State Forest Practices Board “WDNR Forest Practices reinterpretation of WAC 222-20-120(4)”

Dear Mr. Quaempts:

I received your letter of concern regarding the Washington State Department of Natural Resources (DNR) conditioning forest practices applications for cultural resources plans under Washington Administrative Code (WAC) 222-20-120(4). This part of the cultural resources rule is specific to how forest practices applications are conditioned in accordance with agreed upon plans for cultural resources protection developed between the landowner and Tribe. I recognize the importance of this matter.

The Forest Practices Board (Board), at their September 3, 2014 meeting, was informed of this cultural resources conditioning issue during the FY2014 annual report presentation by our Timber/Fish/Wildlife Cultural Resources Roundtable (Roundtable). The Roundtable informed the Board they are working with DNR to gain a mutual understanding between Tribes and DNR of the cultural resources rule requirements and the DNR’s conditioning authority under the Forest Practices Rules, Title 222 WAC. The Roundtable suggested the review of the conditioning authority for cultural resources under the forest practices rules be the basis for their collaborative deliberations and, if needed, recommendations to Board. The Board believes this approach is appropriate given the Roundtable’s proven ability to reach consensus agreements on sensitive and complicated cultural resources issues, and record of consensus products that ensure protection of cultural resources.

To keep the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) informed on the current efforts of the Roundtable, I will ask the Roundtable to add your email address to their contact list so you directly receive their meeting agendas and meeting notes. Additionally, Roundtable agendas and notes are posted on the Board’s website at Timber/Fish/Wildlife Cultural Resources Roundtable.

Eric Quaempts
October 23, 2014
Page 2 of 2

DNR has been taking steps to ensure forest practices applications are properly conditioned in accordance with landowner – Tribe agreed to protection plans for cultural resources, including statewide meetings with region managers. DNR must be vigilant to not over-step or under-step the Board's authority. The Washington State legislature sets this authority via the laws of chapter 76.09 Revised Code of Washington (RCW) *Forest practices act*.

Additionally, DNR will continue to pre-screen proposed forest practices using the Washington Department of Archaeology and Historic Preservation's (DAHP) Archaeology and Historic Sites database to alert us of known cultural resources. DNR will continue to require review of proposed forest practices according to the State Environmental Policy Act, including screening with Bureau of Land Management Government Land Office (GLO) maps and U.S. Geologic Survey and Army Mapping Service maps. DNR will continue to require the landowner to meet with the Tribes pursuant to WAC 222 20-120 *Notice of forest practices that may contain cultural resources to affected Indian tribes*, including when a Tribe requests a meeting.

Thank you, Mr. Quaempts, for advising me and the Board of the CTUIR's concerns about conditioning forest practices applications for cultural resources plans under WAC 222-20-120 (4). I look forward to resolving this issue, transparently and cooperatively. Please do not hesitate to directly contact me at 360-902-1004 or peter.goldmark@dnr.wa.gov.

Sincerely,

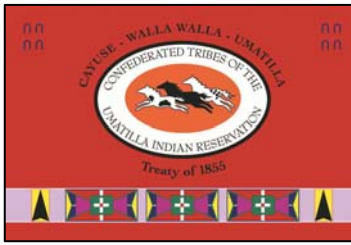


Peter Goldmark
Commissioner of Public Lands

c: Lenny Young, Department Supervisor
Aaron Everett, Deputy Supervisor, Forest Practices and Federal Relations
Joanne McGerr, Tribal Liaison
Chris Hanlon-Meyer, Forest Practices Division Manager
Todd Welker, Southeast Region Manager
Loren Torgerson, Northeast Region Manager
Eric Wisch, Pacific Cascade Region Manager
Art Tasker, South Puget Sound Region Manager
Jean Fike, Northwest Region Manager
Sue Trettvik, Olympic Region Manager
Jeffrey Thomas, Co-chair, TFW Cultural Resources Roundtable
Karen Terwilliger, Co-chair, TFW Cultural Resources Roundtable
14-174

Confederated Tribes *of the*
Umatilla Indian Reservation

Department of Natural Resources
Administration



46411 Timine Way
Pendleton, OR 97801

www.ctuir.org ericquaempts@ctuir.org
Phone 541-276-3165 Fax: 541-276-3095

August 29, 2014

Washington State Forest Practices Board
1111 Washington Street SE
P. O. Box 47012
Olympia, WA 98504-7012

Subject: WDNR Forest Practices reinterpretation of WAC 222-20-120(4)

Dear Commissioner Goldmark and Forest Practices Board Members:

The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) has concerns with the way the Washington Department of Natural Resources (WDNR) Forest Practices Division (FPD) is protecting and managing cultural resources in accordance with Washington Administrative Code (WAC) 222-20-120, specifically in regards to forest practice applications in accordance with plans agreed upon between landowners and Tribes to protect archaeological and cultural resources.

Earlier this year the FPD stated they do not have the authority to condition forest practice applications in accordance with plans agreed upon between landowners and Tribes. The CTUIR disagrees with this. The FPD has conditioned applications in accordance with agreed upon plans going back as early as 1998 and the authority has been in the rules since January 1988. The Forest Practices Rules for Cultural Resources Protection, WAC 222-20-120 clearly states:

- (1) The department shall notify affected Indian tribes of all applications in geographic areas of interest that have been identified by such tribes, including those areas that may contain cultural resources.
- (2) **Where an application is within a tribe's geographic area of interest and contains cultural resources the landowner, at the tribe's discretion, shall meet with the affected tribe(s) prior to the application decision due date with the objective of agreeing on a plan for protecting the archaeological or cultural value.**
- (3) The department will consider the requirements in subsection (2) of this section complete if prior to the application decision due date:
 - (a) The landowner meets with the tribe(s) and notifies the department that a meeting took place and whether or not there is agreement on a plan. The department shall confirm the landowner's information with the tribe(s); or
 - (b) The department receives written notice from the tribe(s) that the tribe(s) is declining a meeting with the landowner; or
 - (c) The tribe(s) does not respond to the landowner's attempts to meet and the landowner provides to the department:
 - (i) Written documentation of telephone or e-mail attempts to meet with the tribe's designated cultural resources contact for forest practices; and
 - (ii) A copy of a certified letter with a signed return receipt addressed to the tribe's cultural resources contact for forest practices requesting a meeting with the tribe; or
 - (d) The department receives other acceptable documentation.
- (4) **The department may condition the application in accordance with the plan.**

WAC 220-20-120 (emphasis added.)

CTUIR DNR Letter to Washington State Forest Practices Board
Subject: Interpretation of WAC 222-20-120, Cultural Resource Plans
August 29, 2014
Page 2 of 2

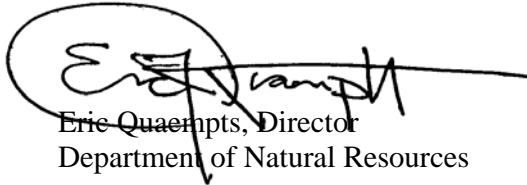
In March, participants of the Timber/Fish/Wildlife Cultural Resources Roundtable (Roundtable) were informed of the FPD's new interpretation of WAC 222-20-120(4). The Roundtable was asked to submit written questions and concerns regarding this issue. The FPD Manager, Chris Hanlon-Meyer, provided verbal explanations to the Roundtable's comments and concerns at the July 2014 Roundtable meeting in Olympia, Washington; however, he did not disclose how FPD came to their new interpretation of WAC 222-20-120.

The FPD did not consult with affected Tribes about this decision or reinterpretation of WAC 222-20-120. This decision does not demonstrate transparency or an interest in a cooperative working relationship between the agency and tribes, as per Commissioner's Order 201029 on Tribal Relations, or the Millennium Agreement for working with Tribes.

The CTUIR formally requests that the Forest Practices Board take action to ensure archaeological and cultural resources are adequately protected and managed by directing the WDNR and FPD to follow WAC 222-20-120(4) for all forest practice applications and conditioned in accordance with agreed upon protection plans between the landowners and Tribes. Furthermore, we would like to request the Forest Practices Board require a pre-assessment provision for all forest practice applications that incorporates the Department of Archaeology and Historic Preservation (DAHP) archaeological risk assessment model and an inadvertent discovery plan as a condition. This will ensure archaeological and cultural resources are being properly protected and managed, a duty of the State of Washington. Lastly, the Forest Practices Board is encouraged to propose and support legislation to protect cultural and archaeological resources information as a public resource.

Thank you for your time and immediate consideration of this serious matter. If there are any questions regarding this request, please feel free to contact Teara Farrow Ferman, Cultural Resources Protection Program Manager or Audie Huber, Intergovernmental Affairs Manager, at (541) 276-3447.

Respectfully,



Eric Quaempts, Director
Department of Natural Resources

cc: Chuck Sams, Communications Director, CTUIR
Lisa Ganuelas, Legislative Affairs, CTUIR
Allyson Brooks, State Archaeologist, DAHP
Chris Hanlon-Meyers, Forest Practices Division Manager, WDNR
Joenne McGerr, Tribal Liaison, WDNR

T/F/W Cultural Resources Roundtable					1/21/2015	Changes from the previous report are in Red or Italics
Project Priority	Action Items		Lead	Status	Next Action	Relationship to the CRPMP
High	1	Review DNR's FPA conditioning authority	Jeffrey, Karen, David, Sherri	Beginning	Identify specific issues and policy framework	
High	2	Seek funding and staff support for the Roundtable's work		<i>Roundtable will bring a request to the FPB in May</i>	Identify needs and potential resources	
High	3	Prepare the cultural resource guidance documents and tools as agreed to in the CRPMP		Target completion date: 2015		Educational Program and Commitments
		Scope the guidance/manual project to develop a detailed description and outline of the proposed guidance or manual.		Complete		
		Work products: 1) Guidance for T/F/W stakeholders, 2) Guidance specific to forest landowners, and 3) Guidance specific to Tribes.	Jesse and Gretchen	In progress	Schedule work group in April to review completed drafts; prepare drafts on remaining sections	
		Post Roundtable guidance documents and other information and training material on the DNR Forest Practices web site		On going		
High	4	Investigate opportunities to develop training workshop curricula and presentation for private industrial foresters.	Jeffrey Karen	Planning	Schedule work group in 2014	An education component of the CRPMP
Medium	5	Develop a Logo for the Cultural Resources Roundtable	Jeffrey and dAve	In progress	Draft logo under review	Publicity

T/F/W Cultural Resources Roundtable					1/21/2015	Changes from the previous report are in Red or Italics
Project Priority	Action Items		Lead	Status	Next Action	Relationship to the CRPMP
Medium	6	CRPMP amendments to consider and further discuss:	All	Scoping	Members of the Roundtable will provide suggestions for amendments after the guidance document task is completed.	CRPMP Support
		Regarding MOUs, consider adding a statement specifying when DNR has a role in implementing MOUs and if there is a role, specifying its nature.				
		Under "Education Program and Commitments," modify #2 to recognize that agreements are often executed at the field level without the need for higher level contacts				
		Reference a role for the CRPMP in Forest Practices ID team deliberations and preparation of SEPA documents for Class IV Special FPAs	Jeffrey			
Low	7	Prepare a report to the Forest Practices Board on the impact to cultural resource protection and management when forest land is converted to another use and regulatory responsibility passes to local government (county or city)	Jeffrey and Karen	On hold	Wait for other higher priority items to be addressed	

T/F/W Cultural Resources Roundtable					1/21/2015	Changes from the previous report are in Red or Italics
Project Priority	Action Items		Lead	Status	Next Action	Relationship to the CRPMP
On-Going Tasks	1	The Roundtable will: (a) meet quarterly; (b) Report- to the FP Board at each regular meeting; (c) Review the CRPMP each year; (d) Report to the FP Board each August on progress of the CRPMP and implementation of WAC 222-20-120 during the previous FY (e) <i>suggest recommendations for modification to CRPMP</i> .	Co-Chairs	FPB meeting report due		Annual & quarterly obligation
	2	Give a CRPMP presentation at Regional TFW meetings as new CRPMP support material is released.	All	Next opportunity for TFW presentations after the 20-120 rule and supporting manual is passed by the FPB		Communication
		Create a Roundtable presentation about the CRPMP and Roundtable activities with a singular message and bullet points	Jeffrey and Jesse			
	3	Maintain an annual calendar of recurring Roundtable tasks and functions and post on DNR's website. Include FP Board report due dates, DNR regional TFW meetings and upcoming training opportunities. Emphasize accomplishments when communicating progress on implementing the CRPMP. Post examples of successes and cooperative opportunities on the DNR Forest Practices web site.	Jeffrey	Planning	Select calendaring software	CRPMP Support; Communication
	4	Contact individual FP Board members to "champion" CR Roundtable issues	All	Collaborate with current FP Board members regarding cultural resources issues coming to the Board.		Advance the Roundtable's work
	5	Individual caucuses will continue to support funding for a full time position at DAHP for the maintenance of CR data in support of the forest practices risk assessment tool.	Individual Caucuses	Currently the position has 1/2 time funding	Next opportunity is the 2014 Legislature	DNR Forest Practices Program support
	6	Seek funding for a CR Module pilot project		On hold	Waiting for the next opportunity	Board Manual Section 11 Appendix J

T/F/W Cultural Resources Roundtable					1/21/2015	Changes from the previous report are in Red or Italics
Project Priority	Action Items		Lead	Status	Next Action	Relationship to the CRPMP
Completed Items	1	Cultural Resource Protection and Management Plan (CRPMP)		Completed 2003		
	2	Forest Practices Board adopted the rules recommended in the CRPMP		Completed 2005		
	3	Statutory exemption for sensitive cultural resource information gathered during a watershed analysis CR module or stand-alone CR module		Completed 2005		
	4	Updates to the CRPMP		Completed 2008		
	5	Recommendation to DNR staff and the Board for changes to the historic site definitions in Class III and Class IV Special definition to correct long standing interpretation issues		Completed 2008		
	6	A recommendation to include a cultural resource question on the Phase II 15-year small landowner permit application.		Completed Spring 2009		
	7	Draft a motion for the Forest Practices Board to request that the staff create a CR page on the Department's forest practices website		Complete (Board action was unnecessary)		
	8	With the support of the Commissioners Office, a Charter for the Timber/Fish/Wildlife Cultural Resources Roundtable (formerly known as TFW Cultural Resources Committee) delivered to the Forest Practices Board		Completed 2011		
	9	Consensus recommendation on changes to WAC 222-20-120 delivered to the Forest Practices Board		Completed 2011		
	10	As requested by the FPB, review and comment on a suggestion to amend 222-20-120 Sub-Section (3)(c)(i)		Completed 2011	Recommendation adopted by the Board in Feb, 2012	
	11	Prepare a streaming video of Lee Stilson's lecture on cultural resources that typically may be found in Washington's managed forests		Completed May 2012		

T/F/W Cultural Resources Roundtable				1/21/2015	Changes from the previous report are in Red or Italics
Project Priority	Action Items	Lead	Status	Next Action	Relationship to the CRPMP
12	In time for the FY 2012 report to the FPB, develop a method for formally assessing the performance CRPMP in accomplishing its purposes as stated on page 1 of the plan.		Completed June 2012		
13	Two new cultural resource links have been added to the DNR Forest Practices webpage. Roundtable agendas, notes and action item list are on the Forest Practices Board's webpage		Completed September 2012		
14	Improve knowledge, understanding and use of the GLO, historic and current USGS quad maps and other publicly available information to identify historic features recognized during 19th century land surveys.		Completed October 2012		Making available tools to improve identification and recognition of cultural resources in the field
15	Update the instructions for question 7 of the forest practices application.	Sherri	Completed October 2013	Draft submitted to DNR for inclusion in the next update of FPA Instructions.	This would be an edit to Appendix B of the Cultural Resources Protection and Management Plan
16	Follow the State Environmental Policy Act rule making by the Department of Ecology to draft rules to increase categorical exemptions.	Gretchen	Completed November 2014	<i>Ecology is recommending that Cultural Resource be considered as one of three top priorities for Phase 2 rulemaking.</i>	



Timber, Fish & Wildlife Policy Committee

Policy Co-Chairs:

Stephen Bernath, Department of Ecology
Adrian Miller, Olympic Resource Management

February 10, 2015

TO: Forest Practices Board

FROM: Stephen Bernath, Co-Chair
Adrian Miller, Co-Chair

SUBJECT: Policy Committee Quarterly Update since November 2014

The Timber, Fish, & Wildlife Policy Committee (Policy) continues to manage an increasing workload driven by both internal process deadlines as well as priorities directed by the Forest Practices Board. To accomplish this, Policy scheduled additional meetings in 2014 beyond regularly scheduled monthly meetings to better address the issues and meet deadlines.

Existing Priorities

- **Water Typing**
 - **Type N**
 - § Policy took action on separate proposals, none of which were approved by consensus. The state, industrial landowners, and conservation caucuses indicated a willingness to discuss how to move forward for gaining consensus. We anticipate this conversation happening in 2015.
 - **Type F**
 - § Policy developed a plan in early 2014 to accomplish the Board's motions from February 2014. Soon after, the tragedy at Oso occurred leading to a re-focusing of Policy's attention to respond to the Board's motions regarding unstable slopes. It was not until late November 2014 that Policy was able to come back to Type F.
 - § See attached Type F Process for more information:
 - Policy's responses to Board's motions on Type F
 - Graphic timeline for accomplishing Type F actions
 - § The Co-chairs will provide a verbal update on progress at the Board meeting in February.

- **Mass Wasting Effectiveness Monitoring Project**
 - Policy agreed upon the outline of recommendations to follow-up from the Mass Wasting Effectiveness Monitoring Project. These were presented to the Board in 2014 and were accepted.
- **CMER Studies**
 - Policy reviewed and approved the following TWIG studies:
 - § Study objectives, problem statement, and critical research questions for the Westside Type F Buffer Effectiveness Study, and
 - § Study objectives, problem statement, and critical questions for the Roads Prescription-Scale Effectiveness Study.
 - Policy accepted the Bull Trout Overlay Final Report with no formal action for the Board but an agreement that Policy would do further work to analyze the data to answer remaining questions.
- **Adaptive Management Program Administrator**
 - Hans Berge, starting February 2015

New Issues

- **Unstable Slopes**
 - In response to the Oso landslide, Policy responded to the Board's motions by developing a set of recommendations. These were presented to the Board in November 2014 and were accepted. Some of recommendations were a continuation of the work under the Mass Wasting effectiveness Monitoring Project.
- **CMER Master Project Schedule**
 - Policy worked to create a new Master Project Schedule that was presented to and approved by the Board.

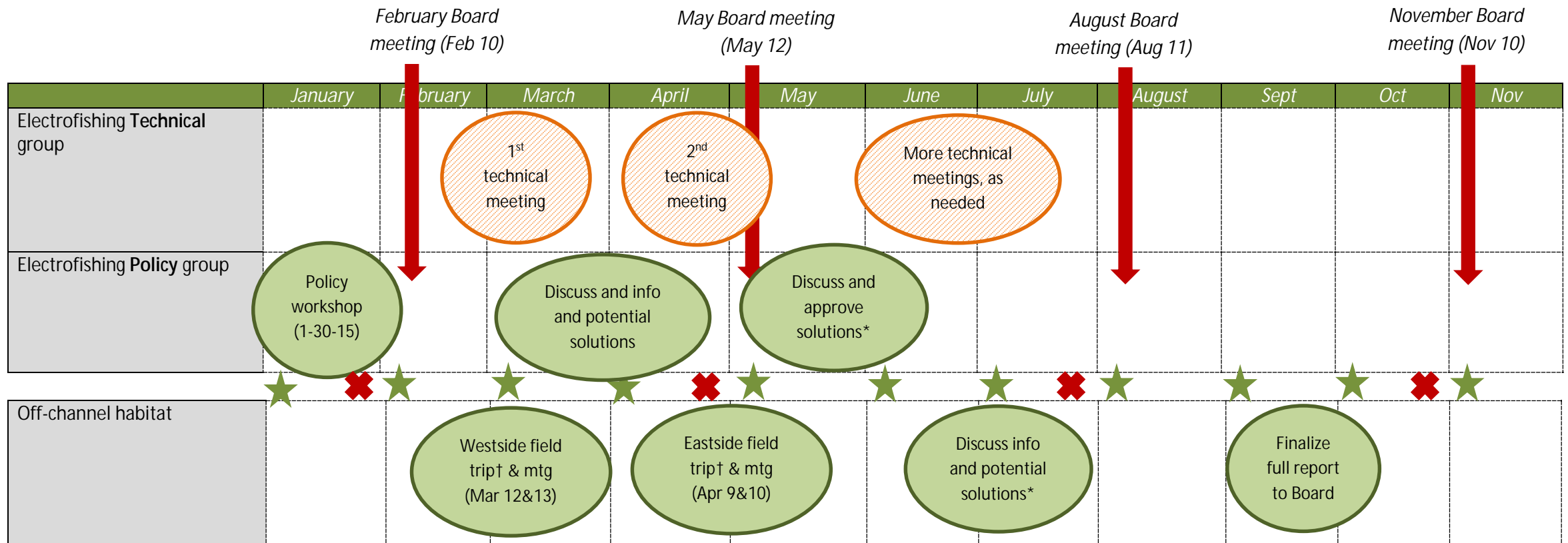
Upcoming Work in 2015

- **Type F**
 - **Electro-fishing workshop** – January 30
 - **Off-channel habitat field trips** – March (westside) and April (eastside)
- **Bull Trout Overlay Project Recommendations**
- **Complete wet season methodology for inclusion in Type N Water board manual guidance. This will allow DNR to convene a stakeholder group to complete Forest Practices Board Manual Section 23, Part 2, *Locating the Upper Most Point of Perennial Flow in Type N Waters***
- **CMER studies coming to Policy** (timelines and specific studies unknown at this point)

The Policy Committee workload is heavy, yet must also remain sensitive to the changes in various timelines and to new issues as they come up. The capacity for Policy to accept any new work as assigned by the Forest Practices Board, or taken on for other reasons, could require delaying existing priorities. Even considering the existing priorities may require scheduling additional meetings. Attached for your review is the Policy committee's anticipated monthly workload and a summary of last year's accomplishments.

Attachments

cc: Forest Practice Board Liaisons
FFR Policy



Orange = Technical staff commitments (tentative at this time)

Green = Policy Committee caucus leads commitments (others welcome)

★ = Monthly Policy meetings

* These meetings could be combined if the timeline aligns

† Field trips to include at least 1 day of travel

✘ = Materials to Board

- Products for February Board meeting update:
- Outcome of first Policy electrofishing workshop
 - Schedule to complete the Board's direction
- Products for May Board meeting update:
- Outcome of off-channel habitat field trips (photos)
 - Updated schedule to complete the Board's direction
 - Outcome of first technical electrofishing meeting: timeline and schedule for work deliverables (tentative)

Summary of 2014 Activities
From TFW Policy Committee Co-Chairs
v. 1-22-15

The following outlines major discussions, decisions, and accomplishments by the TFW Policy Committee for 2014. These are categorized by topic and are in no particular order or rank.

Unstable Slopes

- Agreed upon the Mass Wasting outline of recommendations (as an outcome from the Mass Wasting Effectiveness Monitoring Report). Sent these recommendations to the Board.
- In response to the Oso landslide, the Board made motions on unstable slopes. Policy worked between June and October to respond to each motion. Approved a set of findings and recommendations, sent to the Board for their November meeting. This was accepted by the Board with no further direction beyond quarterly updates on progress of outstanding tasks.

Interaction with CMER's work

- Approved the CMER workplan and added an appendix page to clarify the work.
- Approved FY15 AMP budget with the addition of \$50,000 to scope the Glacial Deep-Seated Landslides Program.
- Worked between April and August to create a new Master Project Schedule that was approved by Policy and sent to the Board. This Master Project Schedule now incorporates the latest funding information for projects as well as a "Hold List" of projects that are not yet included in the Master Project Schedule's funding estimates because those projects are awaiting more information.
- Kept forward momentum for several studies in the TWIG process:
 - Approved the study objectives, problem statement, and critical research questions for the Westside Type F Buffer Effectiveness Study.
 - Approved the study objectives, problem statement, and critical questions for the Roads Prescription-Scale Effectiveness Study.
 - Accepted the Bull Trout Overlay Final Report with no formal action for the Board but an agreement that Policy (or individual caucuses) would do further work to analyze the data to answer remaining questions.

Type F

- Took the Board's motions on Type F and created a workplan to complete them in a timely and comprehensive manner.
- While this was interrupted by work Board directed Policy to do to address unstable slopes (following the Oso landslide), Policy was able to get back to this issue in November.
- Approved the next steps for how to continue work: field trips to view off-channel habitat on the west and east sides, and a workshop detailing the technical and field issues of electrofishing.

Type N

Although this issue was not resolved in 2014, Policy did take action on separate proposals, none of which were approved by consensus. The state, industrial landowners, and conservation caucuses indicated a willingness to discuss how to move forward for gaining consensus.

General

- Agreed upon the prioritization flowchart as a template for making decisions in the future about Policy's workload and how much to take on addressing new topics.
- Approximately 21 Policy meetings (full and subgroup) and 5 Board meetings.

February 2015	March 2015	April 2015	May 2015	June 2015	July 2015
<p>February Policy meeting, Room R0A-36</p> <ul style="list-style-type: none"> Prep for Board meeting Update from RSAG on extensive monitoring matrix, costs Legislative updates Type F: continued discussions Eastern WA Type N Riparian Effectiveness TWIG proposal Discuss wetlands mitigation (?) AMP Activities from 2014 	<p>March Policy meeting</p> <ul style="list-style-type: none"> Mar 12/13: westside field trip and meeting Review/approve biennial CMER workplan Review/approve biennial budget. Review to-date and projected expenditures for FY15 Amphibian Buffer Shade Integrity Study (or Apr) Review Roads BMP TWIG's best available science Board Manual Section 16 and rule language update Legislative updates AMPA's quarterly report on status of CMER projects Tailed Frog Report and Package View video of eastside off-channel habitat 	<p>April Policy meeting</p> <ul style="list-style-type: none"> April 9/10: eastside meeting and field trip Update from RSAG on extensive monitoring Review biennial budget for 15-17 Legislative updates Amphibian Buffer Shade Integrity Study (or Mar) Westside Type F Buffer Effectiveness Study – review/decide on best available science and recommended approach report 	<p>May Policy meeting, Room R0A-36</p> <ul style="list-style-type: none"> Review legislative appropriations and see if the MPS should be tweaked Update from Ecology on draft Nonpoint Source Plan 	<p>June Policy meeting, Room R1S-16/17</p> <ul style="list-style-type: none"> Update from RSAG on extensive monitoring (?) 	<p>July Policy meeting, Room R1S-16/17</p> <ul style="list-style-type: none"> Check in on Board Manual Section 16 and unstable slopes rule language processes
<p>Additional meetings:</p> <ul style="list-style-type: none"> CMER science conf: February 11 & 12 	<p>Additional meetings:</p> <ul style="list-style-type: none"> Off-channel habitat field trip (westside) 	<p>Additional meetings:</p> <ul style="list-style-type: none"> Off-channel habitat field trip (eastside) 	<p>Additional meetings:</p> <ul style="list-style-type: none"> 	<p>Additional meetings:</p> <ul style="list-style-type: none"> 	<p>Additional meetings:</p> <ul style="list-style-type: none">
<p>Forest Practices Board mtg</p> <ul style="list-style-type: none"> Update on Type F progress 			<p>Forest Practices Board mtg</p> <ul style="list-style-type: none"> Review/approve CMER workplan and biennial budget for 15-17 		

August 2015	September 2015	October 2015	November 2015	December 2015	January 2015
August Policy meeting, Room R0A-32 • Complete FPA review process for unstable slopes on Board Manual Section 16	September Policy meeting, Room R1S-16/17 • Finalize Type F package to the Board	October Policy meeting, Room R1S-16/17 • Finalize Type F package to the Board	November Policy meeting, Room R0A-36 •	December Policy meeting, Room R1S-16/17 • Legislative updates	January Policy meeting •
Additional meetings: •	Additional meetings: •	Additional meetings: •	Additional meetings: •	Additional meetings: •	Additional meetings: •
Forest Practices Board mtg •			Forest Practices Board mtg •		

Parking Lot Topics:

- CMER streamlining
 - How to prevent science/policy decision split (consider changes from CMER; hear from Nancy Sturhan about protocols document, organization, etc.)
 - LEAN process – consider how to increase efficiency and speed up timeline
 - Long-term CMER strategy: CMER priorities and 2-year budget/workplan (for 2015-17 biennium)
 - Increase CMER’s capacity and/or efficiency to do more projects, especially if the AMP gets more money through another funding source in the future
- CMZ Effectiveness
- Policy’s procedure for when to produce a majority/minority report instead of seeking 100% consensus
- Clarify performance targets, understanding that changes to Schedule L-1 affect the HCP
- Consider adding fish experts to the CMER table, especially for the Fish Passage Rule Group
- Does the Wetlands Protection Rule Group research help answer potential effects to altering groundwater flow and temperature?
- Evaluate types of monitoring and their effectiveness
- How to make a stronger coalition for environmental issues that includes diverse stakeholder groups (like the Washington Watershed Restoration Initiative)
- Look at Westside Type F Effectiveness research questions and see how they fit into the larger Rule Group strategy
- Discuss the volatility of the B&O excise surcharge and how to adjust/plan for that (discussion between CMER, Policy, and DNR administration)
- How to expand the use of the information collected in CMER studies?
- How to fund CMER studies that must go through ISPR, which is a costly and time-consuming process.
- Further discussions on options and priorities for fish passage effectiveness.

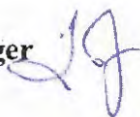


State of Washington
Department of Fish and Wildlife

Mailing Address: 600 Capitol Way N, Olympia WA 98501-1091, (360) 902-2200, TDD (360) 902-2207
Main Office Location: Natural Resources Building, 1111 Washington Street SE, Olympia WA

January 21, 2015

MEMORANDUM

To: Forest Practices Board
From: Terry Jackson, Forest Habitats Section Manager 
Subject: Upland Wildlife Update

Since the last forest practices board meeting in November, little has occurred for reporting on new activities; however, the following provides a brief status update for ongoing or pending actions pertaining to priority wildlife species.

Fisher

1998: State listed as endangered
2014: Federally proposed to be listed as threatened.
Oct 2015: Expected final rule for listing

Current Status:

WDFW is continuing to work with USFWS, National Park Service, U.S. Geological Survey, and U.S. Forest Service to return fishers to their historic range. Successful reintroductions of fisher occurred in the Olympic National Park in 2008-2010. Fisher reintroductions are planned in the South Cascades in late 2015, with releases to Mount Rainier National Park and U.S. Forest Service lands. Two to three years later, releases will follow in the North Cascades (North Cascades National Park and U.S. Forest Service lands).

WDFW is continuing to work with the USFWS to finalize development of a Candidate Conservation Agreement with Assurances (CCAA), and hopes to have a draft CCAA template approved by USFWS in February or March. Representatives from WFPA and small forest landowners are working with WDFW to come up with appropriate conservation measures. DNR staff is also reviewing and providing input on the CCAA. After going through the NEPA and approval processes, landowners will then be able to sign on to the agreement, committing to the conservation measures for the species. By doing so, they will not be subject to additional requirements beyond those in the CCAA, should the proposed listing of the species become final in 2015 or at a later date. The development of the CCAA is on a quick timeline, as it must be approved and in place prior to the final federal listing decision.

Canada Lynx

1993: State listed as threatened
1996: Board established voluntary protection approach
2000: Federally listed as threatened
Sept. 2014: Revised federal critical habitat designation

Current Status:

WDFW is:

- Continuing to work with DNR to implement, as well as to revise and update, their 2006 Lynx Habitat Management Plan for DNR managed lands.
- Assessing lynx habitat included within the critical habitat designation on private lands owned by small forest landowners in order to develop habitat management plans as appropriate.
- Working with the two large landowners and other appropriate stakeholders to revise and update their lynx habitat management plans.
- Continuing to screen FPAs for possible conflicts and work with landowners as necessary to ensure adequate protection is afforded to lynx and their habitats.

Western Gray Squirrel

1993: State listed as threatened
Federally recognized as species of concern
1996: Protection covered under the Board's voluntary management approach

Current Status:

WDFW:

- Continues to screen FPAs for possible impacts to western gray squirrels (WGSs).
- Continues to conduct nest surveys as needed, and works with landowners to develop voluntary management plans.
- Documents/tracks information on FPAs having potential impacts in order to better assess the effectiveness of the voluntary protection approach.
- Began having discussions with the Small Forest Landowner Advisory Group to scope out possible outreach and training opportunities for increasing western gray squirrel conservation efforts by small forest landowners.
- Is currently gathering information from interested parties on WGS demographics, habitat conditions, threats, etc. In April 2015, expect to begin process of compiling best available scientific information to prepare a periodic status review for determining whether a change is warranted in the current "threatened" listing status. If a change is warranted, the public will have at least 30 days to comment on the recommendation before being presented to the Fish and Wildlife Commission for action.

Oregon Spotted Frog

1997: State Endangered
2014: Federally listed as threatened
2015: Expected Federal designation of critical habitat early in the year.

As mentioned in earlier updates, the species is not generally dependent on forested landscapes; therefore, it was not included in the list of covered amphibian species in the Forest Practices HCP. Possible areas of concern are limited to a very small subset of lands subject to the

Washington State forest practices rules, and adverse effects from forest practices are likely minimal.

Current Status:

WDFW and DNR are coordinating with USFWS to:

- Define any potential areas of concern for the Oregon spotted frog that might intersect with industrial and small forest landowners.
- Assess the habitat needs within these specific areas and the forest practices activities, if any, that could impact the frog or their habitats.
- Identify optional strategies and protection measures, where needed, which will provide adequate protection for the Oregon spotted frog and their habitats, associated with forest practices activities.

Future Updates to the Board

The forest practices rules require that when a species is listed by the U.S. Secretary of the Interior or Commerce, the Department of Natural Resources (DNR) consults with the Department of Fish and Wildlife (WDFW) and makes a recommendation to the Forest Practices Board (Board) as to whether protection is needed under the Critical Habitat (State) rule (WAC 222-16-080). WDFW and DNR continue to coordinate in order to anticipate federal actions and/or state action in response to changes in the status of a species.

cc: Penny Becker
Gary Bell
Marc Engel
Sherri Felix
Eric Gardner
Julie Henning



January 29, 2015

MEMORANDUM

TO: Forest Practices Board

FROM: Gretchen Robinson
Forest Practices Division, Policy and Services Section

SUBJECT: Rule Making: Unstable Slopes Information in FPAs

On February 10, 2015, I will request that you adopt forest practices rules to clarify that DNR may require additional information, including additional geologic information, when reviewing forest practices applications (FPAs).

At the November 12, 2014 meeting, the Board directed staff to file proposed rule language, which was published in the Washington State Register on December 3, 2014 and was available for public review and comment until January 8, 2015.

The Board held one public hearing in the Natural Resources Building in Olympia on January 7, 2015, during which six people provided testimony. The language enclosed is the result of staff recommendations after taking all of the comments into consideration.

Enclosed for your review are:

- The staff-recommended rule proposal;
- A Draft Concise Explanatory Statement which includes a summary of the comments received, staff-recommended changes to the draft rules, and reasons for the recommended changes;
- Seven comment letters received during the public comment period; and
- The cost-benefit analysis. This document is a slightly modified version of the preliminary cost-benefit analysis you received in your November documents for this rule making activity; we made minor editorial changes to it and modified endnote III regarding the estimated cost for a geotechnical report.

Finally, the small forest landowners long-term application analysis requirement under WAC 222-20-016(4) is not required for this rule making. It is required when proposed rule amendments are intended to directly achieve resource protection objectives. This rule proposal only clarifies DNR's FPA review process and does not change resource protection objectives in the rules.

I look forward to seeing you on February 10th when you consider rule adoption. If you have questions before then, please email or call me at (360) 902-1705.

GR/

Enclosures: Rule Proposal for Unstable Slopes Information in Forest Practices Applications
Draft Concise Explanatory Statement
Comment letters 15-01 to 15-07
Cost-benefit Analysis

FOREST PRACTICES BOARD

Rule Proposal for Unstable Slopes Information in Forest Practices Applications January 2015

1 **WAC 222-10-030 *SEPA policies for potentially unstable slopes and landforms.**

2 In addition to SEPA policies established elsewhere in this chapter, the following policies apply to forest
3 practices described in WAC 222-16-050(1)(d) relating to construction or harvest on potentially unstable
4 slopes or landforms.

5 (1) In order to determine whether such forest practices are likely to have a probable significant
6 adverse impact, and therefore require an environmental impact statement, the applicant must
7 submit the following additional information, prepared by a qualified expert as defined in
8 subsection (5) of this section. The qualified expert must describe the potentially unstable
9 landforms in and around the application site and analyze:

10 (a) The likelihood that the proposed forest practices will cause movement on the potentially
11 unstable slopes or landforms, or contribute to further movement of a potentially unstable
12 slope or landform;

13 (b) The likelihood of delivery of sediment or debris to any public resources, or in a manner
14 that would threaten public safety; and

15 (c) Any possible mitigation for the identified hazards and risks.

16 (2) The department's threshold determination will include an evaluation of whether the proposed
17 forest practices:

18 (a) Are likely to increase the probability of a mass movement on or near the site;

19 (b) Would deliver sediment or debris to a public resource or would deliver sediment or debris
20 in a manner that would threaten public safety; and

21 (c) Such movement and delivery are likely to cause significant adverse impacts.

22 If the department determines that (a), (b) and (c) of this subsection are likely to occur, then the
23 forest practice is likely to have a probable significant adverse impact.

24 (3) The department will evaluate the proposal, using appropriate expertise and in consultation with
25 other affected agencies and Indian tribes.

26 (4) Specific mitigation measures or conditions must be designed to avoid accelerating rates and
27 magnitudes of mass wasting that could deliver sediment or debris to a public resource or could
28 deliver sediment or debris in a manner that would threaten public safety.

29 (5) Qualified expert for the purposes of this section ~~and for~~, reanalysis of watershed analysis mass
30 wasting prescriptions under WAC 222-22-030, and preparation of required geologic information
31 under WAC 222-20-010(9), means a person licensed under chapter 18.220 RCW as either an
32 engineering geologist or as a hydrogeologist (if the site warrants hydrologist expertise), with at
33 least three years of field experience in the evaluation of relevant problems in forested lands.

34 **WAC 222-20-010 Applications and notifications—Policy.**

35 (1) **No Class II, III or IV forest practices** shall be commenced or continued unless the department
36 has received a notification for Class II forest practices, or approved an application for Class III or
37 IV forest practices pursuant to the act. Where the time limit for the department to act on the
38 application has expired, and none of the conditions in WAC 222-20-020(1) exist, the operation
39 may commence. (NOTE: OTHER LAWS AND RULES AND/OR PERMIT REQUIREMENTS
40 MAY APPLY. SEE CHAPTER 222-50 WAC.)
41

FOREST PRACTICES BOARD
Rule Proposal for
Unstable Slopes Information in Forest Practices Applications
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- 1 (2) **The department shall** prescribe the form and contents of ~~the notification~~s and application~~s~~,
2 ~~which. The department~~ shall specify ~~what the~~ information ~~is needed~~required for a notification,
3 and the information required for the department to approve or disapprove ~~the an~~ application.
- 4 (3) **Except as provided in subsection (4) of this section, applications and notifications** shall be
5 signed by the landowner, the timber owner, and the operator, ~~or the operator and accompanied by~~
6 ~~a consent form signed by the timber owner and the landowner. A consent form may be another~~
7 ~~document if it is signed by the landowner(s) and it contains a statement acknowledging that~~
8 ~~he/she is familiar with the Forest Practices Act, including the provisions dealing with conversion~~
9 ~~to another use (RCW 76.09.060(3)) if the operator is known at the time the application is~~
10 submitted.
- 11 (4) In lieu of a landowner's signature, where the timber rights have been transferred by deed to a
12 perpetual owner who is different from the forest landowner, the owner of perpetual timber rights
13 may sign a forest practices application or notification for operations not converting to another use
14 and the statement of intent not to convert for a set period of time. The holder of perpetual timber
15 rights shall serve the signed forest practices application or notification and the signed statement of
16 intent on the forest landowner. The forest practices application shall not be considered complete
17 until the holder of perpetual timber rights has submitted evidence acceptable to the department
18 that such service has occurred.
- 19 (5) **Where an application** for a conversion is not signed by the landowner ~~or accompanied by a~~
20 ~~consent form, as outlined in subsection (3) of this section~~, the department shall not approve the
21 application. Applications and notifications for the development or maintenance of utility rights of
22 way shall not be considered to be conversions.
- 23 (6) **Transfer of the** approved application or notification to a new landowner, timber owner or
24 operator requires written notice by the former landowner or timber owner to the department and
25 should include the original application or notification number. This written notice shall be in a
26 form acceptable to the department and shall contain an affirmation signed by the new landowner,
27 timber owner, or operator, as applicable, that he/she agrees to be bound by all conditions on the
28 approved application or notification. In the case of a transfer of an application previously
29 approved without the landowner's signature, the new timber owner or operator must submit a
30 bond securing compliance with the requirements of the forest practices rules as determined
31 necessary by the department. If an application or notification indicates that the landowner or
32 timber owner is also the operator, or an operator signed the application, no notice need be given
33 regarding any change in subcontractors or similar independent contractors working under the
34 supervision of the operator of record.
- 35 (7) **The landowner or timber owner must provide notice of hiring or change of operator to the**
36 **department within forty-eight hours of the change. The department shall promptly notify the**
37 **landowner if the operator is subject to a notice of intent to disapprove under WAC 222-46-070.**
38 **Once notified, the landowner will not permit the operator, who is subject to a notice of intent to**
39 **disapprove, to conduct the forest practices specified in the application or notification, or any other**
40 **forest practices until such notice of intent to disapprove is removed by the department.**
- 41 (8) **Applications and notifications**, if complete, will be considered officially received on the date
42 and time shown on any registered or certified mail receipt, or the written receipt given at the time
43 of personal delivery, or at the time of receipt by general mail delivery. The department will

FOREST PRACTICES BOARD
Rule Proposal for
Unstable Slopes Information in Forest Practices Applications
January 2015

1 immediately provide a dated receipt to the applicant. Applications or notifications that are not
2 complete, or are inaccurate will not be considered officially received until the applicant furnishes
3 the necessary information to complete the application.

- 4 (a) A review statement from the U.S. Forest Service that evaluates compliance of the forest
5 practices with the Columbia River Gorge National Scenic Area Act (CRGNSA) special
6 management area guidelines is necessary information for an application or notification
7 within the CRGNSA special management area. The review statement requirement shall be
8 waived if the applicant can demonstrate the U.S. Forest Service received a complete plan
9 application and failed to act within forty-five days.
- 10 (b) A complete environmental checklist (WAC 197-11-315) is necessary information for all
11 Class IV applications.
- 12 (c) A local governmental entity clearing and/or grading permit is necessary information for all
13 Class IV applications on lands that will be converted to a use other than commercial
14 timber operations if the local governmental entity has jurisdiction and has an ordinance
15 requiring such permit.
- 16 (d) A checklist road maintenance and abandonment plan is necessary information for all small
17 forest landowners' applications or notifications for timber harvest (including salvage),
18 unless exempt under WAC 222-24-0511, or unless the application is a small forest
19 landowner long-term application which requires a roads assessment.

20 ~~(8) **An operator's name, if known, must be included on any forest practices application or**~~
21 ~~**notification. The landowner or timber owner must provide notice of hiring or change of operator**~~
22 ~~**to the department within forty-eight hours. The department shall promptly notify the landowner if**~~
23 ~~**the operator is subject to a notice of intent to disapprove under WAC 222-46-070. Once notified,**~~
24 ~~**the landowner will not permit the operator, who is subject to a notice of intent to disapprove, to**~~
25 ~~**conduct the forest practices specified in the application or notification, or any other forest**~~
26 ~~**practices until such notice of intent to disapprove is removed by the department.**~~

27 ~~(9) **Where potentially unstable slopes or landforms are in or around the area of an application,**~~
28 ~~**the department may require the landowner to provide additional information in order to classify**~~
29 ~~**the application appropriately. If necessary, the department may require additional geologic**~~
30 ~~**information prepared by a qualified expert. The department may request that the qualified expert**~~
31 ~~**explain the methods the qualified expert used to evaluate the proposed harvest or construction**~~
32 ~~**activities with respect to the potentially unstable slopes or landforms. Nothing in this subsection is**~~
33 ~~**intended to require a geotechnical report if the geologic information provided is sufficient to**~~
34 ~~**appropriately classify the application.**~~

35 ~~(a) **"Qualified expert" is defined in WAC 222-10-030.**~~

36 ~~(b) **"Potentially unstable slopes or landforms" are those listed in WAC 222-16-**~~
37 ~~**050(1)(d)(i)(A) through (E).**~~

38 ~~(10) **Financial assurances** may be required by the department prior to the approval of any future~~
39 ~~forest practices application or notification to an operator or landowner under the provisions of~~
40 ~~WAC 222-46-090.~~

As required by
the Administrative Procedure Act
Chapter 34.05 RCW

DRAFT CONCISE EXPLANATORY STATEMENT
AND
RESPONSIVENESS SUMMARY
FOR THE ADOPTION OF
Amendments to chapters 222-10 and 222-20 WAC
Rules Related to Unstable Slopes Information in Forest Practices Applications

Prepared by: Gretchen Robinson
January 2015

1. Introduction

The Forest Practices Board’s “Unstable Slopes Information in Forest Practices Applications” rules amend WAC 222-10-030 and WAC 222-20-010. The purpose is to inform prospective applicants that the Department of Natural Resources (DNR) will require specific geologic information, including information prepared by a qualified expert, if DNR needs it to appropriately classify Forest Practices Applications (FPAs) per WAC 222-16-050. This applies to FPAs that include proposals where potentially unstable slopes or landforms are on or around the area of an FPA.

The Board added this clarification to ensure applicants understand that DNR may require geologic information if the information initially provided in an FPA is not sufficient for DNR to determine the appropriate classification of the FPA.

The Board adopted the rule on _____, and it will become effective on _____.

2. Describe Differences Between Proposed and Final Rule

Proposed rules were published in the Washington State Register on December 3, 2014 for public review and comment. Differences between the proposed and final rules follow; additional details can be found in the Responsiveness Summary below.

WAC 222-10-030(5)

Change from “...preparation of requested geologic information...” to “...preparation of **required** geologic information...” for consistency with the use of “required” in new subsection (7) in WAC 222-20-010.

WAC 222-20-010(2)

Added, "...the operator is known at the time the application is submitted" to account for situations where the landowner or landowner/timber owner does not, at the time the application is submitted, know who the operator will be.

WAC 222-20-010(9)

- Changed first sentence.
From: "...Where potentially unstable slopes or landforms are **on** or around the area of an application..."
To: "...Where potentially unstable slopes or landforms are **in** or around the area of an application..."

See Comments 3a and 3b and Response 3a and 3b.

- Added a sentence: "Nothing in this subsection is intended to require a geotechnical report if the geologic information provided is sufficient to appropriately classify the application."

See Comment 7 and Response 7.

- Eliminated a sentence: "This information is for classification purposes only."

See Comment 6 and Response 6.

3. Responsiveness Summary

The Board received comments from seven individuals on the rule proposal. Log numbers accompany each comment. The commenters and their assigned log numbers are:

Log #	Received From
15-01	Howard S. Wilson, Grays Harbor Chapter, Washington Farm Forestry Association (WFFA)
15-02	Ken Miller, WFFA
15-03	Elaine Oneil, WFFA
15-04	Stephen Bernath, Washington Department of Ecology
15-05	Karen Terwilleger, Washington Forest Protection Association (WFPA)
15-06	Forests and Fish Conservation Caucus
15-07	Don Lentz

WAC 222-20-010(2)

Comment 1: Add the following or similar sentence to WAC 222-20-010(2) to memorialize the current public policy intent to increase transparency and accountability around its decision making: *The department will ensure that information upon which it relies to appropriately classify and approve or disapprove an application is adequately documented.* (Log #15-06)

Response 1: Transparency is provided via the ability for stakeholders to review pending applications via the Forest Practices Application Review System (FPARS). Challenges to DNR’s permitting decisions occur at the Pollution Control Hearings Board (PCHB), a separate quasi-judicial agency (RCW 76.09.020(2) and RCW 76.09.205). The PCHB’s decisions may be further reviewed in the court system. Thus, DNR is already accountable for its decisions by law, and therefore, this change is unnecessary.

WAC 222-20-010(7)

Comment 2: Add the following sentence to the end of WAC 222-20-010(7) to relieve operators of record or landowner/operators from notifying DNR if subcontractors are changed: *If an application or notification indicates that the landowner or timber owner is also the operator, or an operator signed the application, no notice need be given regarding any change in subcontractors or similar independent contractors working under the supervision of the operator of record.* (Log #15-05)

Response 2: The recommended sentence is not added to WAC 222-20-010(7). Notice of a change in subcontractor is not required under current rule. The recommendation would not change the ability for landowners to hire or transfer subcontractors without notifying DNR per subsection (6). Subsection (7) addresses the timing requirement to notify DNR of the hiring or change in the operator of record, separate from the subcontractor, so DNR can verify that the operator is not subject to a notice of intent to disapprove (NOID) issued under RCW 76.09.140(1) and WAC 222-46-070.

The Board could consider combining the contents of (6) and (7) in a future rulemaking.

WAC 222-20-010(9)

Comment 3a: Change “on or around” to “on or adjacent to”: for consistency with the Board Manual and the Forest Practices Application Slope Stability Form; and to clarify DNR’s authority to request additional necessary information for decision making about classification, including “geologic information prepared by a qualified expert.” (Log #15-05)

Comment 3b: Change “on or around” to “on or near” because “on or near” encompasses the very real possibility that a forest practice could influence a potentially unstable landform that is not strictly “adjacent” to the harvest unit, but is nonetheless possibly within the zone of influence of that landform. (Log #15-06)

Response 3a and 3b:

- We have changed this to “in or around.” The language refers to whether a potentially unstable slope or landform is **in** the application site, and what lands must be considered. DNR expects applicants, forest practices foresters, and qualified experts, to evaluate the lands **around** the application site to assess possible effects from an activity proposed to take place within the application site. The same approach is used in WAC 222-10-030(1).
- Board Manual Section 16, approved by the Board on November 12, 2014, defines “around” in this context: ... *potentially unstable slopes and landforms that exist “around” a proposed timber harvest or construction activity are those that could possibly be influenced by, or be caused to move due to, the harvest or construction activity.*¹
- DNR will review all application forms and Board Manual Section 16 for inconsistencies and make changes accordingly.

Comment 4: Add “including but not limited to.” This would clarify DNR’s authority to request any necessary information for decision making about classification, **including but not limited to** geologic information prepared by a qualified expert. (Log #15-04, Log #15-05)

Response 4: We have modified the language to ensure understanding that DNR can request any additional information, and it may require geologic information prepared by a qualified expert, if DNR needs it to classify an application appropriately. These modifications conform to DNR’s

¹ Forest Practices Board Manual Section 16, page 32, footnote 40.

existing authority to specify the form and contents for forest practices applications and determine their completeness upon submittal.

Comment 5a: Do not include the sentence regarding "...an explanation of how the qualified expert evaluated the proposed harvest or construction activities..." It is unclear what information will be required in the qualified expert's explanatory statement. (Log #15-05)

Comment 5b: It is important to include a statement regarding how the qualified expert evaluated the proposed harvest or construction activities with respect to potentially unstable slopes or landforms in order to determine the adequacy of this information and if better quality information is needed to classify the FPA properly. (Log #15-06)

Response 5a and 5b: We have retained the sentence, but clarified that DNR **may** request that the qualified expert explain **the methods** the qualified expert used to evaluate the proposed activity. DNR would communicate the need for such information to the applicant.

Comment 6: There is no need to re-state that the additional information is for classification purposes only. (Log #15-06)

Response 6: Agreed.

Comment 7: Add the following sentence to WAC 222-20-010(9) to clarify that information may be provided in a variety of ways, and that a geotechnical report is not required if another form of information satisfies DNR's needs: *Depending on the extent and type of information requested, documentation may be provided by memo, letter, field verification, geotechnical report or other form. Nothing in this section is intended to require preparation of a geologic report if the department determines that other forms of information are sufficient to appropriately classify an application.* (Log #15-05)

Response 7: DNR does accept geologic information from a qualified expert in a variety of formats for applications that are not Class IV-special applications. To clarify that point, we decided to add a sentence similar to the second sentence of the commenter's recommendation.

Comment 8: The average cost of a geotechnical report is closer to \$10,000 per report, rather than up to \$5,000 as is stated in the Preliminary Cost-Benefit Analysis. (Log #15-05)

Response 8: We added the Washington Forest Protection Association's estimate to the endnote in the cost-benefit analysis.

Comment 9: How will the rule change impact operations under existing small forest landowner long-term permits that were approved but not yet harvested? (Log #15-03)

Response 9: The rule change will not impact operations under existing approved small forest landowner long-term applications. Protections for unstable slopes and landforms are not changing.

Comment 10: I understand the Board must consider public safety in making regulations but should not make forestry activity physically and financially impossible. (Log #15-07)

Response 10: The rule is a clarification of DNR's existing process when reviewing applications; it does not change the required protection measures related to unstable slopes and landforms. Public safety has always been a factor in DNR's application review.

Comment 11: Is the Board going to provide DNR geologists to help with or produce the geology reports so the small forest landowners can manage and harvest on their land? (Log #15-07)

Response 11: The rule is a clarification of DNR's existing process when reviewing applications. DNR employs geologists to analyze proposals for accuracy and make recommendations to DNR's forest practices foresters who make classification and approval/disapproval decisions. DNR geologists will not produce slope stability reports. When necessary, the DNR forest practices forester may request the DNR geologist to review the site. The forest practices foresters will continue, when possible, to assist small forest landowners by helping them identify areas containing potentially unstable slopes and landforms, and providing guidance on completing application forms and other application steps. The Forest Practices program will continue to maintain a current list of qualified experts and post contact information on the Forest Practices web page for small forest landowners to receive further assistance.

Comment 12a: A greater reliance on qualified experts is almost assured under this rule change; the increased cost for affected small forest landowners could absorb all profit. In these cases, they are likely to be disproportionately affected using two or three comparison techniques allowed in a small business economic impact assessment (cost per person, per hour of labor, or per \$100 of sales). Comment 12b: Please clarify whether DNR is planning to use existing mechanisms under RCW 76.13.020(2) and/or WAC 222-21-048(3) to help small forest landowners with the cost of obtaining geologic information. (Log #15-03)

Response 12a: The rule is a clarification of DNR's existing process when reviewing applications, and it does not impose new regulations; DNR's requirements will continue to depend on the quality and completeness of applications received.

Response 12b: DNR uses existing mechanisms under the WAC and RCW cited to help compensate small forest landowners for disproportionate impacts of regulations:

- [WAC 222-21-048\(3\)](#) – Cost reimbursement for geotechnical reports under the Forestry Riparian Easement Program.
- [RCW 76.13.020\(2\)](#) – Technical assistance for small forest landowners including, but not limited to:
 - Help with identifying unstable slopes and landforms on their forest land; and
 - Providing unstable slopes training (taught by DNR's Forest Practices Science Team) two times per year, free of charge.²

Comment 13: Due to the Oso landslide, regulators will require more geotechnical reports, and geotechnical engineers will be extremely cautious. The end result will be more and more timberland deemed not harvestable due to unstable slopes. The \$50,000 Forestry Riparian Easement Program limit for trees not harvestable due to unstable slopes needs to be raised proportionately. (Log #15-01)

Response 13: Raising the \$50,000 limit would require legislative action.

² In addition to the unstable slopes trainings, DNR also provides:

- Foresters to visit small forest landowners' properties, answer questions, offer management advice customized to the landowner's goals, and help landowners create stewardship plans;
- Regular Small Forest Landowner News newsletters;
- Annual Family Forest Field Days in western and eastern Washington.

Also, alternate plan templates, checklist RMAPs, the Forest Riparian Easement, Family Forest Fish Passage, and Riparian and Habitat Open Space programs are all designed to address small forest landowners for costs of complying with regulations.

Additional comments:

- We urge DNR to consider requiring applicants to disclose exactly which methods were used to “bound out” potential steep and unstable landforms from an application, whether or not “further geologic information” from QE is requested. (Log #15-06)
- It is within DNR’s authority to require whatever information is necessary to make a classification decision with high confidence. Where there is high uncertainty, for example around the exact location of a groundwater recharge area for a glacial deep-seated landslide, the department may require the equivalent of a geologic report in order to preserve the option of preserving or reverting to a Class III. This clarification could be part of future rules. (Log #15-06)
- DNR should quantify and take into consideration how uncertainty in the modeling process will impact slope stability determinations when using a relatively new product (LiDAR) as the basis of the determination. There should be some detail in future board manual updates that provides guidance on incorporating model uncertainty into the interpretation of risk factors derived from LiDAR data. (Log #15-03)

4. Summary of public involvement actions.

- | | |
|---------------|--|
| May 13, 2014 | Forest Practices Board meeting: The Board approved filing <i>Preproposal Statement of Inquiry</i> form CR-101. |
| June 11, 2014 | CR-101 published in Washington State Register (WSR 14-11-103, file 5-21-14). |
| Nov. 12, 2014 | Forest Practices Board meeting: The Board approved filing <i>Proposed Rule Making</i> Form CR-102 and the draft rule language for public review and comments. There was a public comment opportunity at the meeting prior to the Board action. |
| Dec. 3, 2014 | CR-102 published in the Washington State Register (WSR 14-23-047, filed 11-14-14). The public comment period took place from 12-3-14 through 1-8-15. |
| Jan. 7, 2015 | Public hearing in Olympia. |

January 7, 2015

Washington State Forest Practice Board
P.O. Box 47012
Olympia, WA 98504-7012

Re: Proposed Unstable Slope Rules

Chairperson Everett and Members of the Board,

SFLOs cannot afford the extremely high upfront costs to hire geotechnical engineers that are not readily available to them. For a SFLO, contracting for a geotechnical report is not a fixed price contract. The work is priced at a daily rate (usually \$700 to \$1,000), plus travel and accommodations. Every additional question or meeting with DNR raises the bill. It is a black hole and the SFLO doesn't know the final cost until the FPA is approved. In some cases no harvest may be allowed. **DNR and the SFLO Office need to provide technical and financial assistance to SFLOs for preparing geotechnical reports and providing specific geologic information required by DNR.**

In 2012, a wet, snowstorm tore down about \$12,000 worth of alder on my parcel at Lilliwaup, Washington. DNR required me to do a geotechnical report on the entire 26 acres before I could submit my FPA even though it was for salvage logging. I actually tried to hire a geotechnical engineer but most of those on the "approved DNR list" that I contacted, did not want the work, were retired, or were busy with other jobs. The cost of the geotechnical report would likely exceed the income I would receive from the harvest. Additionally, by the time I hired the engineer, got the report done, prepared the FPA, got the FPA approved, and contracted with a logger, the alder would be stained and worthless. Thus, the alder stayed on the ground and rotted. I lost income, contractors lost a potential job, and employees lost work.

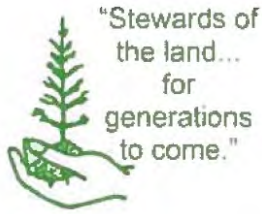
DNR required a geotechnical report for the entire parcel when it appears to a layman that only a portion of the parcel is potentially unstable. WAC 222-21-048 (3) limits geotechnical report reimbursement to "the cost of that portion of a geotechnical report that is applicable to the area determined to contain qualifying timber". Thus, it appears that the cost of preparing the geotechnical report for those portions of the parcel **required by DNR** that do not contain qualifying timber are not reimburseable. That is very unfair.

FREP is not a viable funding source to pay for geotechnical services. I submitted a FREP application in 2008, and now, almost seven years later, I am scheduled to be paid this year. SFLOs cannot afford to wait years to be reimbursed for expenses on timber they may never harvest.

An additional obstacle is the \$50,000 limit on payment for trees not harvestable on unstable slopes that was put in place before the Oso landslide. Due to this event, regulators will require more geotechnical reports and geotechnical engineers will be extremely cautious. The end result will be more and more timberland deemed not harvestable due to unstable slopes. The \$50,000 FREP limit on unstable slopes needs to be raised proportionately.

Sincerely,

Howard S. Wilson
Owner, Wilson Tree Farm
President, Grays Harbor Chapter WFFA



P.O. Box 1010
Chehalis, WA 98532
Phone (360) 388 7071
info@wafarmforestry.com
www.wafarmforestry.com

15-02

January 7, 2015

Washington State Forest Practice Board
P.O. Box 47012
Olympia, WA 98504-7012

Re: Proposed unstable slope rules

Chairperson Everett and Members of the Board:

Small forest land owners certainly support reasonable risk management of harvest activities around steep slopes. However very few if any of us have the knowledge or capability to provide the kind of technical assessments currently required or proposed. If the experts are confused or conflicted, imagine SFLOs trying to understand what's expected. Expanded use of LIDAR and increased risk aversion rather than risk management by regulators will take more forestland out of production – hitting some SFLOs pretty hard!

The kind of technical analysis required now and in the future for steep slope areas seems a classic example of the "disproportionate impacts" of Forest and Fish on SFLOs – disproportionate impacts addressed and intended to be mitigated in Forest and Fish. Some regulatory intent for technical assistance to SFLOs in these special circumstances is found in:

- RCW 76.13.020 (2) "Provide direct technical assistance . . ."
- WAC 222-21-048 (3) "The costs of a geotechnical report . . . "(Forestry Riparian Easement Program).
- STRATEGIC PLAN 2014-2017 GOLDMARK AGENDA JUNE 2014 – Goal 2 D 4 Family Forest Landowners: "Increase the availability of regulatory assistance services for completing Forest Practice Applications, layout and management planning."

The intent for technical assistance to SFLOs particularly in situations like steep & unstable slopes is clear – what's not clear is the unique decision tree for SFLOs that's far more complex, more expensive, and more uncertain than what's already faced by other landowners. We do need an updated SFLO Database from U of W to see how many SFLOs are potentially affected to guide appropriate solutions. More importantly, I believe the Small Landowner Advisory Committee could help you with pertinent recommendations – especially if the Forest Practice Board asked for advice as envisioned in RCW 76.13.110 (4): "An advisory committee . . . recommending rules to the forest practices board".

Smalls want to be part of the solution – but we need your help complying with whatever guidance and rules you ultimately determine.

Ken Miller



P.O. Box 1010
Chehalis, WA 98532
Phone (360) 388 7074
info@wafarmforestry.com
www.wafarmforestry.com

15-03

Washington State Forest Practices Board
P.O. Box 47012
Olympia, WA 98504-7012

January 8, 2015

Re: Testimony regarding proposed modifications to the rule for unstable slopes

Consistent with the oral testimony of Ken Miller and Howard Wilson, two WFFA board members and small forest land owners, WFFA supports reasonable risk management of harvest activities on steep slopes and adjacent areas. The issue is in defining 'reasonable' given the expected additional costs that will accrue to the landowner to determine if the slopes on new or existing FPAs are stable or potentially unstable consistent with the requirements of DNR as laid forth in the proposed rule change. WFFA urges the DNR to both quantify and take into consideration how uncertainty in the modeling process will impact slope stability determinations when using a relatively new product (LiDAR) as the basis of the determination. We would like to see some detail in subsequent board manual updates that provides guidance on incorporating model uncertainty into the interpretation of risk factors derived from LiDAR data. This detail is particularly critical on flatter ground water recharge areas - on or adjacent to - (whichever ends up in the final rule) the potentially unstable slope. We would also like clarity as to how this change will impact operations under existing long term permits that were approved, but not yet harvested under prior rules.

We understand that this rule change was triggered by an horrific event. We also recognize that state funds are extremely tight. These factors combine to put DNR in a very difficult position. For that reason we would like clarification regarding the assertion in the proposed rule that a small business economic impact statement is not required as *"The rule proposal is not expected to impose additional costs on businesses."* Greater reliance on qualified experts is almost assured under this rule change. With current information it is highly uncertain what percentage of small forest landowners will be affected by this rule. However, for those that are, the increased costs to cover qualified experts could absorb all profit. In these cases small landowners with potentially unstable slopes, or adjacent areas, are likely to be disproportionately affected using at least 2 of 3 comparison techniques allowed in a small business economic impact assessments (cost per person, per hour of labor, or per \$100 of sales). Please clarify whether DNR is planning on using existing mechanisms under RCW 76.13.020 (2) and/or WAC 222-21-048 (3) as noted in Ken Miller's testimony, or some other mechanism, to reduce the expected substantive cost increases for the subset of small landowners so affected by the rule.

Elaine Oneil, PhD
Executive Director
Washington Farm Forestry Association

Talking points for testimony for Forest Practices Board on Unstable Slopes Rule Public Hearing, 1/7/15, NRB 172, 4pm.

1. I am Stephen Bernath, Forest and Environmental Policy Advisor for the Water Quality Program at Ecology.
2. Thank you for the opportunity to comment on the proposed rule.
3. Ecology supports this rule and the concept that DNR should be able to ask for additional information from applicants to assure that an application, that may be in or near an unstable slope, is classified properly (along with other stakeholders).
4. The information that may be requested can be wide ranging (e.g. maps or other information regarding the application in relation to potentially unstable slopes, to specific geologic information prepared by a qualified expert).
5. Ecology suggests the following language as a replacement to what was proposed by the FPB to eliminate duplication of other rules and simplification of the proposed rule.

“WAC 222-20-010(9) Where potentially unstable slopes or landforms are on or around the area of an application, for classification purposes only, the department may require the landowner to provide additional information, including, if necessary, geologic information prepared by a qualified expert.”

6. Ecology believes this language (or something close to it), can achieve the same objective.
7. Thank you for the opportunity to comment. Any questions?

Stephen Bernath
Senior Forest and Environmental Policy Advisor
Water Quality Program
Department of Ecology
PO Box 47600
Olympia, WA 98504-7600
(360) 407-6459
(360) 451-0314 cell
(360) 407-6426 fax
sber461@ecy.wa.gov



WASHINGTON FOREST PROTECTION ASSOCIATION
724 Columbia St NW, Suite 250
Olympia, WA 98501
360-352-1500 Fax: 360-352-4621

15-05

January 8, 2015

Patricia Anderson
Washington Department of Natural Resources
1111 Washington Street S.E.
Olympia, WA 98501
Forest.practicesboard@dnr.wa.gov

**RE: Washington Forest Protection Association Final Comments on WSR 14-23-04
(Department of Natural Resource's Draft Unstable Slope Rule Related to Information
Requested in a Forest Practice Application**

Dear Ms. Anderson:

Thank you for this opportunity to comment on the Washington State Department of Natural Resources ("Department") proposed changes to the administrative rules related to information requests for potentially unstable slope or landforms (WSR 14-23-04). The Washington Forest Protection Association ("WFPA") is a forestry trade association representing large and small forest landowners and managers of nearly 4 million acres of productive working timberland located in the coastal and inland regions of Washington State. Our members support rural and urban communities through the sustainable growth and harvest of timber and other forest products for U.S. and international markets.

We greatly value the work and commitment to this process by Department staff and appreciate your willingness to address our concerns. Please take our comments in the spirit that they are offered - to improve this set of proposals. As the draft rule progresses through the official Administrative Procedures Act process, we will continue to work with the Department.

WFPA understands that the general intent of the rule is to clarify the Department's existing administrative authority to require information in the approval process for a forest practice activity (see, WAC 222-20-010). The rule's intent is specifically outlined in the Preproposal Statement of Inquiry (CR 101; dated May 21, 2014):

- To "clarify applicant expectations about additional geotechnical information on Forest Practices Applications (FPAs) that DNR may require where unstable slopes and landforms exist in and around the areas of the FPA."
- To "ensure that additional geologic information conforms to appropriate technological and professional standards needed to help DNR assess threats to public safety and appropriately classify these FPAs."

We're managing private forests so they work for all of us. ®

Further, under the Forest Practices Act, rulemaking proposals that address substantive policy or procedural changes to regulations for unstable slopes must follow the adaptive management process. This process requires CMER to submit a report to TFW Policy, for TFW Policy to review the report and make a recommendation to the Forest Practices Board, and ultimately draft the petition for rule-making. RCW 34.05.220(5) requires that any proposed or adopted rule should be “simply and clearly stated, so that it can be understood by those required to comply.”

In evaluating this proposal, WFPA used several guiding criteria including the following:

- Is the rule clear, unambiguous and understandable so that applicants understand how to comply with the requirements?
- Will the rule result in timely decisions?
- Is the information requested reasonable and necessary for decision-making?
- Does the rule create potential for additional litigation?
- Is the rule flexible, allowing for appropriate compliance pathways?

In light of these considerations, WFPA provides the following suggestions to ensure that the rule stays within the stated rule-making intent, does not stray into the jurisdiction of the adaptive management process, and does not result in unintended consequences. The page references relate to draft rule provisions in WSR 14-23-047.

Page 2, WAC 222-20-010(7), after "department." add the following: "If an application or notification indicates that the landowner or timber owner is also the operator, or an operator signed the application, no notice need be given regarding any change in subcontractors or similar independent contractors working under the supervision of the operator of record."

Rationale: This change duplicates language from (6) which relieves operators of record or landowner/operators from notifying the department if subcontractors are changed. WFPA views this as a technical change necessary to ensure that the current reporting practice is retained as rule language is shifted.

Page 2, WAC 222-20-010(9) replace the current language with the provision below. This language clarifies that the Department has the authority to request additional information to classify an application.

“Where potentially unstable slopes or landforms are on or adjacent to the area of an application, for classification purposes only, the department may require the landowner to provide additional information, including, if necessary, geologic information prepared by a qualified expert.

(a) “Qualified expert” is defined in WAC 222-10-030.

(b) “Potentially unstable slopes or landforms” are those listed in WAC 222-16-050(1)(d)(i)(A) through (E).”

Rationale: This language makes the term “on or adjacent” consistent for the draft rule, the Board Manual and the Forest Practices Application Slope Stability Form. It also clarifies the Department’s authority to

request additional necessary information for decision-making about classification, including “geologic information prepared by a qualified expert.” For example, the Department may ask for additional maps which would not be considered “geologic information prepared by a qualified expert.” As currently drafted, WAC 222-20-010(9) specifies that the Department may ask for an “explanation of how the qualified expert evaluated the proposed harvest...” As such, a landowner cannot predict what information will be required in the qualified expert’s explanatory statement in violation of RCW 34.05.220(5). That sentence should be stricken because implementation of the rule is most efficiently left to the Department’s discretion to address in the board manual or in Department policy or procedure. WFPA believes that the recommended language above also reduces litigation risk over whether the Department’s request for information was adequate.

If further clarification is necessary to ensure that the Department has flexibility in the form of information requested, add the following language to WAC 222-20-020(9) as well: “Depending on the extent and type of information requested, documentation may be provided by memo, letter, field verification, geotechnical report or other form. Nothing in this section is intended to require preparation of a geologic report if the department determines that other forms of information are sufficient to appropriately classify an application.”

Rationale: Clarifies that information may be provided in a variety of ways and that a geotechnical report is not required if another form of information satisfies the Department’s needs.

Finally, economic analysis documents base the financial assumptions on an average \$5,000 cost for a geotechnical report. In WFPA’s experience, the average cost is closer to \$10,000 per report. Please revise the analysis with the updated numbers.

In closing, WFPA looks forward to continued work with you on these draft rules. If you have questions or comments, please do not hesitate to contact me.

Sincerely,



Karen Terwilleger

Senior Director for Forest and Environmental Policy

M E M O R A N D U M

To: Patricia Anderson (forestpracticesboard@dnr.gov)
Marc Engel (marc.engel@dnr.wa.gov)
Fr: Forests and Fish Conservation Caucus
Re: Comments on Proposed Rule Language
Dt: 8 January 2015

Overview of Proposed Rule

DNR staff has characterized this proposed rule as simply a memorialization of what the agency already does, i.e. ask for additional information it perceives as necessary to classify an application. The substantive determinations this information is intended to inform are those related to WAC 222-16-050(d) defining a Class IV special. The central question at issue for this stage of the process is: *Is the activity being proposed on or near a potentially unstable slope or landform?*

The rule change amends the "Application and Notifications--Policy" subsection of the State Environmental Policy Act section of the current Forest Practices Rules, with the operative language adding a new section at WAC 222-20-010(9). The proposed language to which these comments pertain is as follows and constitutes new rule text in its entirety:

WAC 222-20-010 (9): Where potentially unstable slopes or landforms are on or near the area of an application, the department may require the landowner to provide additional geologic information prepared by a qualified expert in order to classify the application appropriately. The information shall include an explanation of how the qualified expert evaluated the proposed harvest or construction activities with respect to the potentially unstable slopes or landforms. This information is for classification purposes only.

- (a) "Qualified expert" is defined in WAC 222-10-030.
- (b) "Potentially unstable slopes or landforms" are those listed in WAC 222-16-050(1) (d) (i) (A) through (E)."

General Support, Recommended Changes

The Forests and Fish Conservation Caucus strongly supports DNR's assertion of its authority and discretion to ask an applicant for more information, including but not limited to geologic information generated by a Qualified Expert, where it deems such information necessary to make accurate and well-founded determinations as to the classification of forest practices applications under WAC 222-16-050. The final proposed language at WAC 222-16-010(9) generally accomplishes the Department's stated purpose of clarifying that DNR may ask for Qualified Expert-prepared information in order to classify applications.

Although the current draft language is an improvement on earlier informal drafts of the rule language, the Conservation Caucus recommends minor changes as follows (in strikethrough and ALL CAPS):

WAC 222-20-010 (9): Where potentially unstable slopes or landforms are on or around NEAR the area of an application, the department may require the landowner to provide additional geologic information prepared by a qualified expert in order to classify the application appropriately. SUCH The information shall include an explain nation of how the qualified expert evaluated the proposed harvest or construction activities with respect to potentially unstable slopes or landforms. This information is for classification purposes only.

(a) "Qualified expert" is defined in WAC 222-10-030.

(b) "Potentially unstable slopes or landforms" are those listed in WAC 222-16-050(1) (d) (i) (A) through (E). "

We support retaining the sentence requiring that information provided by qualified experts should explain how (e.g. the methods used) the potential impact of the proposed activities on the unstable slope were evaluated. We also prefer the term "on or near the area of the application" because it encompasses the very real possibility that a forest practice could influence a potentially unstable landform that is not strictly "adjacent" to the harvest unit, but is nonetheless possibly within the zone of influence that landform. We agree that this term should probably correlate to that used on Slope Stability Information Forms which currently only asks specifically for information about potentially unstable slopes "within", or "adjacent to" or which have been "bounded out" (which could include non-adjacent areas proximal to the PUS. The form should t be changed to comport with this rule.

We further recommend that DNR add the following sentence to WAC 222-20-010(2) asserting and specifying the department's responsibility and authority to prescribe the form and content of notifications and applications:

"The department will ensure that information upon which it relies to appropriately classify and approve or disapprove an application is adequately documented."

This or a similar statement would memorialize in rule the current public policy intent of the department and the Board to increase transparency and accountability around its decisionmaking.

- **This rule improves transparency and accountability in decision-making, but further improvements are needed.**

The proposed rule will help to increase transparency around DNR's decision making, an improvement that comports with other recent changes in the application process for activities on or near unstable slopes.

One of the other major improvements has been the inclusion of new items on the Slope Stability Information Form (SSI) required for FPAs with potentially unstable slopes or landforms within or adjacent to the forest practices activity area (see e.g. questions 11 and 12). This change resulted from stakeholder discussions during the pendency of and in the wake of the Mass

Wasting Effectiveness Monitoring Report (aka the Post Mortem study). This change has added rigor to DNR's process and facilitated external review of DNR decisions by the interested public. However, we note that there is still a range allowed in the level of detail that is required and provided on these forms. We urge DNR to consider requiring applicants to disclose exactly which methods were used to "bound out" potential steep and unstable landforms from an application, whether or not "further geologic information" from a QE is requested, under question 6 on the SSI form. Because FPA forms change and may not persist over time, we believe it is important for this rule to include a statement regarding "how the qualified expert evaluated the proposed harvest or construction activities with respect to the potentially unstable slopes or landforms" in order to determine the adequacy of this information and if further, better quality information is needed to classify the FPA properly. The methods used to assess slope stability are not all of equal quality and should not be treated as such in the FPA classification process. We expect this will be reflected in the forthcoming Risk Matrix within the revised Board Manual.

- **It is our goal to increase transparency and accountability around what is often an entirely internal dialogue between DNR and applicants by requiring the agency to document each step of its deliberations, including the one this rule is focused on: the point at which DNR asks an applicant for more geologic information in order to correctly classify and approve or disapprove an FPA.**

The ultimate goal of changes like the one proposed in this rule should be to enable better tracking and oversight of those FPAs that deserve a high level of scrutiny, i.e. those that start out meeting the Class IV Special criteria (RIL with potential to deliver to public resources or threaten public safety), but later get reclassified as Class III because DNR staff has received further, presumably adequate information about RIL location and risks, and/or the landowner has agreed to mitigate forest practices impacts via avoidance or other conditions on the FPA. There is currently no way to track these FPAs (Class IV lowered to Class III) under DNR's present record-keeping system as the Conservation Caucus has repeatedly requested such FPAs and been told by DNR staff they do not keep track of them.

- **In our view, there are circumstances under which all or virtually all the analysis required for a Class IV geotechnical report will be necessary to consider during what is currently an informal negotiation process with landowners.**

Under certain circumstances – such as where there is high uncertainty around the exact location of the groundwater recharge area for a glacial deep-seated landslide. Because it is within DNR's existing authority to determine the form and content of information required in applications, under such circumstances the department may require the equivalent of a geologic report in order to preserve the option of the application's remaining or reverting to a Class III when further information is obtained. While the criteria for triggering such a requirement are not part of this rule, they could be part of future rules. It is within DNR's authority to require whatever information it deems necessary to make a classification decision in which it has high confidence.

From: Don Lentz
To: DNR RE FP BOARD
Subject: Proposed Unstable Slope Rules
Date: Thursday, January 08, 2015 9:07:52 AM

January 8, 2015

Washington State forest Practice Board
Unstable Slope Rules
P.O. Box 47012
Olympia, WA 98504

Re: proposed

Chairman Everett and Members of the Board

I understand that you must consider public safety in making regulations but you should not make forest activity both physically and financially impossible. As a small landowner in Grays Harbor County, I have experienced trying to permit land with a deep seeded land slide and unstable slopes. In the case of the landslide, the state geologist told me , I could log, but did not want to tell me what I could log. When I contacted several geologist they said they could not do a report on this landslide because there were homes and a public road on the slide below my property and their insurance would not allow them to do it. They also said that the value of the timber on the affected area would be less than the cost of an report.

This being said can we afford these added regulations? How is the small landowner going to afford this added burden? Is the Board going to allow small landowner to be compensated under FREP and if so how will it get the money so we get paid in less than 10 years? Is the Board going to provide DNR geologist to help or do the geology reports so the small landowner can manage and harvest on HIS land?

I hope you consider the large effect these regulations will have on the small landowner and adjust the rules accordingly to provide us with help in complying with them.

Thank you.

Donald Lentz
17 Lentz Drive
Aberdeen, WA 98520
360-533-4375

COST-BENEFIT ANALYSIS
Pursuant to RCW 34.05.328
Forest Practices Board
Unstable Slopes Information in Forest Practices Applications
Department of Natural Resources
January 2015

Introduction

The Forest Practices Board is proposing rule amendments related to information in forest practices applications (FPAs). The Administrative Procedure Act (chapter 34.05 RCW) requires agencies to make certain determinations before adopting rules. This document is structured generally to fulfill agency requirements listed in [RCW 34.05.328\(1\)\(a\) through \(e\)](#), and small business impact per [chapter 19.85 RCW](#). In addition, parenthetical information that may interest readers is provided in endnotes at the end of the document.

Goal and Need

Before adopting rules, agencies are required to determine that rules are needed to achieve the general goals and specific objectives of the statute the rules implement.¹ In this case, the statute being implemented is RCW 76.09.060(1): *The department shall prescribe the form and contents of the notification and application. ...The information required may include, but is not limited to...Soil, geological, and hydrological data with respect to forest practices.* This statute establishes DNR's authority to receive sufficient information to make regulatory decisions (approvals, disapprovals, and classification decisions) on FPAs.

The Board's *Preproposal Statement of Inquiry* (CR-101) indicates that the proposed rule may be needed to clarify applicant expectations that DNR may require additional geotechnical information where unstable slopes and landforms exist in and around the areas of the FPA.² The subsequent CR-102 states the reason supporting the proposal is to ensure that applicants understand DNR may require geologic information prepared by a qualified expert if the information initially provided in an FPA is not enough information for DNR to determine the appropriate classification of the FPA.³ The goal of the rule proposal, then, is to clarify applicant expectations related to the possibility of DNR requiring additional geologic information if needed for its classification decision.

Although both statute and rule (RCW 76.09.060(1) and WAC 222-20-010(2)) state that DNR "...shall prescribe the form and contents of the notification and application...", the Board determined there is a need to include specific language in rule to clarify that DNR may require additional geologic information related to unstable slopes and landforms prepared by a qualified expertⁱ, if DNR determines such information is needed to appropriately classify an FPA.

Rule Proposal

The rule proposal amends WAC 222-10-030 and WAC 222-20-010. The substantive content is in a new subsection (9) in WAC 222-20-010; the remaining amendments are minor editorial language clarifications which are not analyzed in this document. New subsection (9) explains that DNR may

¹ RCW 34.05.328(1)(b).

² CR-101 *Preproposal Statement of Inquiry*, filed May 21, 2014 and published in WSR 14-11-103.

³ CR-102 *Proposed Rulemaking*, filed November 14, 2014 and published in WSR 14-23-047.

require additional information, including information prepared by a qualified expert if necessary to appropriately classify an FPA:

- (9) **Where potentially unstable slopes or landforms are in or around the area of an application**, the department may require the landowner to provide additional information in order to classify the application appropriately. If necessary, the department may require additional geologic information prepared by a qualified expert. The department may request that the qualified expert explain the methods the qualified expert used to evaluate the proposed harvest or construction activities with respect to the potentially unstable slopes or landforms. Nothing in this subsection is intended to require a geotechnical report if the geologic information provided is sufficient to appropriately classify the application.
- (a) “Qualified expert” is defined in WAC 222-10-030.
- (b) “Potentially unstable slopes or landforms” are those listed in WAC 222-16-050(1)(d)(i)(A) through (E).

Alternatives to Rule Making, Consequences of Not Adopting a Rule, and Least Burdensome Alternative

Agencies must analyze alternatives to rule making and the consequences of not adopting a rule⁴, and must determine, after considering alternatives, that the rule being adopted is the least burdensome alternative for those required to comply with it.⁵ The Board is not considering alternative versions of the proposed rule, but there may be alternative ways to accomplish the Board’s goal, “clarifying applicants’ expectations.” Alternatives that may be considered are as follows:

Alternative 1: Adopt the proposed rule.

Alternative 2: Do not adopt the proposed rule.

Alternative 3: Do not adopt the proposed rule but accomplish the goal using another method.

Alternative 4: Adopt the proposed rule and accomplish the goal by another method.

- Alternative 1 would accomplish the goal.
- Alternative 2 would not accomplish the goal.
- Alternative 3 could accomplish the goal to some extent without adopting a rule because clarification language could be added to the FPA instructionsⁱⁱ to target affected applicants.
- Alternative 4 covers both modes of communication and would accomplish the goal to a greater extent than either Alternatives 1 or Alternative 3.

Alternative 4 may be the most effective method because it would reach prospective applicants who rely on the rules for their information, and also applicants who rely on the FPA instructions for their information.

In regard to the consequence of not adopting the rule, the rule is not needed to allow DNR to require information from landowners. DNR is currently authorized to require additional information per RCW 76.09.060(1) and WAC 222-20-010(2). However, the goal of the rule is not to establish authority but to clarify applicants’ expectations. If the Board were not to adopt the rule (Alternative

⁴ RCW 34.05.328(1)(b).

⁵ RCW 34.05.328(1)(e).

2), the goal to clarify expectations could still be accomplished by adding the clarifying language to the FPA instructions.

Regarding a “least burdensome alternative”, none of the listed alternatives would be more burdensome for applicants than DNR’s current FPA review process.

Benefit and Cost of the Rule

Before adopting rules, agencies must determine that the probable benefits of the rule are greater than its probable costs, taking into account both the qualitative and quantitative benefits and costs, and the specific directives of the statute being implemented.⁶

For this rule, neither the benefits nor the costs can be evaluated quantitatively because it is a clarification of DNR’s FPA review process and does not change requirements for those required to comply with it.

Benefit: WAC 222-20-010(2) states generally that, “The department shall prescribe the form and contents of the notification and application...” The rule proposal points out that for certain types of applications, those that contain activities where potentially unstable slopes or landforms are in or around the area of an application, DNR may require information prepared by a qualified expert. This specificity is expected to benefit prospective applicants because it will put them on notice that if DNR cannot conclusively determine the class of an FPA with the information initially provided in and attached to the FPA, DNR will require additional information, including geologic information if necessary, prepared by a qualified expert to make the classification decision. It is important that applicants understand this possibility because of the potential cost to produce the information.ⁱⁱⁱ

Cost: Because DNR already requires information needed to appropriately classify an FPA, it is not expected that landowners will bear any additional costs due to the rule clarification itself.

Small Business Impacts

The Regulatory Fairness Act (chapter 19.85 RCW) requires state agencies to prepare a small business economic impact statement (SBEIS) for proposed rules if the rules will impose more than minor costs on businesses in an industry.⁷ The purpose of the SBEIS is to look at how a rule might impact small businesses. When cost impacts are identified the agency must try to find ways to reduce those impacts.

As stated under “Costs”, the rule is not expected to impose additional costs on forest landowners because it is a clarification of existing rule and does not change DNR’s FPA review process. Therefore, the proposed rule does not meet the threshold of imposing more than minor costs on businesses, and an SBEIS is not required.

Summary

Goal of the rule proposal

The Board’s goal in adopting the rule proposal is to clarify applicant expectations related to the possibility of DNR requiring additional geologic information if needed for its classification decision. The proposed rule language supplements the existing language in WAC 222-20-010(2) by

⁶ RCW 34.05.328(1)(d).

⁷ RCW 19.85.030.

specifying that DNR may require additional geologic information prepared by a qualified expert in order to classify the FPA appropriately.

Alternatives to rule making and consequence of not adopting a rule

An alternative method to accomplish the Board's goal could be to add similar clarification language to FPA instructions and perhaps also on forest practices web pages. This would direct the information to the subset of applicants it would most likely affect. However, some prospective applicants may rely more on the rules for their information than on FPA instructions. For that reason, the consequence of not adopting the rule may be that this subset of prospective applicants will not be adequately informed. The most effective way to reach the targeted audience, therefore, may be to both adopt the proposed rule and to add the information to the FPA instructions to assure that as many applicants as possible receive the information.

Benefit and cost of the rule proposal

It is expected that adding specific clarifying language to WAC 222-20-010 regarding geologic information will be beneficial for prospective applicants. It would put landowners on notice that they may be required to supply additional geologic information prepared by a qualified expert if DNR cannot conclusively determine the class of an FPA with the information initially provided in and attached to the FPA.

It is not expected that landowners will bear additional costs due to the rule clarification itself because DNR's application review process already allows for requiring additional information, including the geologic information needed to appropriately classify an FPA.

ⁱ "Qualified expert" is defined in WAC 222-10-030(5): *Qualified expert...means a person licensed under chapter 18.220 RCW as either an engineering geologist or as a hydrogeologist (if the site warrants hydrogeologist expertise), with at least three years of field expertise in the evaluation of relevant problems in forest lands.*

ⁱⁱ Current Forest Practices Application and Notification Instructions can be found on DNR's website at http://www.dnr.wa.gov/BusinessPermits/Topics/ForestPracticesApplications/Pages/fp_forms.aspx


ⁱⁱⁱ According to DNR staff, the cost of information prepared by a qualified expert ranges from \$500 to \$1000 for memoranda or letters (in which the qualified expert explains how the proposal avoids impacts), to \$2000 to \$5000 for full geotechnical analyses. WFPA estimates the average cost for a geotechnical report is closer to \$10,000 (see comment letter 15-05). DNR estimates that it requires such additional information on less than three percent of FPAs that include timber harvest and construction where potentially unstable slopes exist, and that are not initially submitted with geologic information prepared by a qualified expert.



MEMORANDUM

January 15, 2015

TO: Forest Practices Board

FROM: Marc Ratcliff 
Forest Practices Policy and Services Section

SUBJECT: Forest Practices Board Manual Section 16, Phase 2 Progress

At the November 2014 Forest Practices Board meeting, the Board approved the first phase of requested amendments to Forest Practices Board Manual Section 16, *Guidelines for Evaluating Potentially Unstable Slopes and Landforms*. This phase of the work included improved guidance for the identification and delineation of groundwater recharge areas.

DNR has now convened a stakeholder group and is implementing work to complete the second phase of Board Manual Section 16 work as requested by the Board. Development under this phase is to identifying methods to assess delivery and run-out potential of unstable slopes and landforms and the amending for clarity of the phase one guidance with input from TFW Policy stakeholders. The latter work is in response to further direction provided by the Board at their November meeting, specifically to allow time for a review of the technical guidance, organizational flow and sequencing of the current material in Section 16.

DNR staff convened the stakeholder group in December setting the first task to review and clarify existing manual language. It is expected the review and clarification will be completed by the end of February to ensure adequate time for addressing the technical materials related to delivery and run-out situations. Thereafter the stakeholder group will meet every other week through June to identify and add methods to assess delivery and run-out potential of unstable slopes and landforms. The aggressive work schedule is to achieve the anticipated approval of Board Manual Section 16 at the August 2015 meeting.

Four stakeholder meetings will be completed prior to the February Board meeting and I will be available to answer any questions regarding meeting status and progress to date.

Please feel free to contact me with any questions at 360.902.1414 or marc.ratcliff@dnr.wa.gov.

MR



MEMORANDUM

January 23, 2015

TO: Forest Practices Board

FROM: Chris Hanlon-Meyer, Adaptive Management Program Administrator (Acting) *Ch*

SUBJECT: AMPA Recommendation on Action Resulting from Completion of the RMZ Resample (birds) Final Report

CMER recently finalized a report titled “Riparian Management Zone Resample (birds) Final Report” also known as the Bird RMZ Resample Report. This recommendation to the Board is accompanied by the Final CMER report and a document that provides the basis for the Policy committee consensus: the Six Questions Leading to a Forests & Fish Policy Adaptive Management Recommendation to the Forest Practices Board, rules and guidance. This report, which represents part of the culmination of 10 Year resample effort on RMZ study found no significant harvest treatment effects on bird response based on their total abundance, richness and the responses of the large majority of individual bird species. TFW Policy Committee consensus recommendation is for the Forest Practices Board to take no action at this time.

Upon completion of final reports such as this, the TFW Policy Committee is expected to make a recommendation to the Forest Practices Board (Board) regarding formal petition for either rulemaking or a non-rulemaking alternative action. Among alternative actions, the policy committee may also recommend that the Board take no action in response to the study’s findings.

In this study, scientist revisited study sites 10 years post-harvest to examine potential effects on the bird species assemblage over the longer-term. This study has some importance because nearly all studies examining harvest impacts have been conducted only over the short-term (1-3 years). Using the identical Before-After-Control-Impact (BACI) experimental approach and temporally replicated point counts used in the original RMZ study, the report authors estimated population- and community-level responses for the bird assemblage while incorporating variation in the detection process across treatments and years. CMER granted final approval of the report at their August 2014 meeting. A findings report titled “CMER/Policy Interaction Framework Six Questions Riparian Management Zone Resample (birds) Final Report” was completed to accompany the study report as it was submitted to TFW Policy for their consideration at the December 2014 meeting.

Washington State regulates forest practices within riparian buffers in order to limit effects resulting from the loss of canopy cover during forest harvest that may influence physical processes (such as stream temperature) and potentially affect fish and wildlife resources. This study represent one segment of that effort.

Specifically, this Bird RMZ Resample Report represents one useful part of a larger data collection and analysis study titled: “Effectiveness of Riparian Management Zones in Providing Habitat for Wildlife: Resampling at the 10-year Post-treatment Interval” also known as the RMZ Resample Report. That report was completed in 2008 and had been reviewed by LWAG, CMER, and ISPR. The contract with the consultant that collected the data and prepared the final report was not renewed; therefore, the report was never completely finalized or revised based on ISPR comments. LWAG developed a memorandum that summarized the complex issues surrounding the inability to finalize the RMZ Resample Report. LWAG also provided suggestions for addressing any useful information that might be extracted from the RMZ Resample Report. The LWAG memorandum and the ISPR comments were attached as an addendum to the report and submitted to CMER for final approval which was granted but with the caveat that following evaluation of which report elements merited further analysis, appropriate analyses could address them. Following this milestone, LWAG examined the available data from the larger report and determined that only the bird and amphibian portions of the report contained data have some potentially merited further analysis and development of useful additional products. Because of the approach to collection and extensive nature of the data, the bird data were given a higher priority. This Bird RMZ Resample Report is the result of that effort. This CMER-approved Final Report was developed in 2013, has gone through ISPR review and was approved by CMER in August 2014.

What the study tells us:

1. Bird species richness increased on both the narrow and wide buffer treatment in the short- and long-term post-harvest.
2. No loss of species from either treatment was detected in either the short- or long-term interval post-harvest.
3. Strong evidence exists that the high species turnover on both treatments post-harvest was driven not by species loss but by the gain of species on the buffer treatments post-harvest. The change in species turnover did not become evident until 10 years post-harvest for the wider buffer treatment.
4. No change in total bird abundance was detected on treatments post-harvest.
5. No decline in the abundance of riparian associated birds was detected on either treatment post-harvest.
6. When we examined buffer width as a continuous variable, some loss of species and some decrease in total bird abundance occurred on two very narrow buffer stands (≤ 40 feet), but not on others, suggesting that stand-level differences exist in bird response. However, no loss of species or decrease in bird abundance occurred on stands with buffers greater than the current 50 foot two-sided buffer for non-fish bearing streams.

What the study does not tell us:

1. If differences exist in survival or reproduction for birds associated with narrow or wider buffers.
2. Did not identify a precise threshold buffer width where breeding bird abundance declined but brackets buffer widths where changes in abundance are observed in some stands (specifically between 39.4 feet and 69 feet).

In closing, based on the final study report and the responses to the six questions, and TFW Policy Committee consensus, I propose that the Board make a “no action” decision on the need for rule change in response to the RMZ Bird Resample Study.

Attachments (2) Riparian Management Zone Resample (birds) Final Report

CMER/Policy Interaction Framework Six Questions Riparian
Management Zone Resample (birds) Final Report

CMER/Policy Interaction Framework Six Questions
Riparian Management Zone Resample (birds) Final Report
Scott F. Pearson
Washington Department of Fish and Wildlife
Wildlife Science Division
Olympia, Washington

A.J. Kroll
Timberlands Technology
Weyerhaeuser NR
Federal Way, Washington

1. Does the study inform a rule, numeric target, performance target, or resource objective (Yes/No)? If Yes, go to the next question. If No, provide a short explanation on the purpose of the study.)

Yes.

2. Does the study inform the Forest Practices Rules, the Forest Practices Board Manual guidelines, or Schedules L-1 or L-2 (Yes/No - Include whether or not the study answers the critical questions found in the CMER Work Plan.)? (If yes, describe briefly what rules, guidelines, key questions, critical question, resource objectives, performance targets, etc. the study informs, preferably in bulleted format. If no, provide a short explanation on the purpose of the study; do not repeat if already explained in question 1 above. Note: Schedule L1 contains resource objectives and associated functional objectives and performance targets. For the most part, the CMER Work Plan critical questions have replaced L-2. Be sure to use Forest Practice Board approved Schedule L-1 with a Feb 14, 2001 date on it.)

Yes, rule group critical question (see Table 44 in the Fiscal year 2014 CMER Work Plan):

- *“What roles do RMZs, UMAs, and other forest patches play in maintaining species and providing structural and vegetative characteristics thought to be important to wildlife?”*
- *Helps inform the buffer width prescription (by not disagreeing with) under current rules for non-fish bearing streams.*

3. Was the study carried out pursuant to CMER scientific protocols (i.e., study design, peer review)? (Provide short explanation. Be clear on use of ISPR.)

Yes, the following protocols/process was followed:

- *Study design was a before-after control-treatment experiment with sampling immediately post-harvest and 10 years post-harvest. Original study design was developed by the University of Washington and was approved by CMER.*
- *Draft reviewed by LWAG, comments addressed in writing and report revised accordingly*
- *ISPR review (SRC 13-14-01) process followed and Dr. John Richardson synthesized the blind reviews by three peer reviewers plus he provided additional comments. All three reviewers were described as senior scientists with international respect. In addition, the Reviewers had considerable experience with*

the ecology of forest birds and effects of habitat alterations, especially forestry. Two had very detailed knowledge of occupancy models and all have expertise with a range of other statistical methods. In synthesizing the reviews, the AE stated “There are exceedingly few studies that revisit such experiments...” such as this study and he went on to say because of this the “report provides new insights into the use of riparian area buffers by birds as adjacent forests regrow.” Also the Associate Editors stated that “the reviewers are very positive about the manuscript, but also have some suggestions for how it can be improved.”

- *A comment and response matrix was developed by DNR staff*
- *The authors responded to all reviewer comments using the matrix and revised the report accordingly*
- *The revised report was approved by CMER*

4. What does the study tell us? What does the study not tell us? (This is where the study and its relationship to rules, guidance, targets, etc are to be described in detail. Consider technical findings; study limitations; and implications to rules, guidance, resource objectives, functional objectives, and performance targets; in addition to other information.)

What the study tells us:

- *Species richness increased on both the narrow and wide buffer treatment in the short- and long-term post-harvest.*
- *No loss of species from either treatment was detected in either the short- or long-term post-harvest.*
- *There is strong evidence that the high species turnover on both treatments post-harvest was driven not by species loss but by the gain of species on the buffer treatments post-harvest. The change in species turnover did not become evident until 10 years post-harvest for the wider buffer treatment.*
- *No change in total bird abundance was detected on treatments post-harvest*
- *No decline in the abundance of riparian associated birds was detected on either treatment post-harvest.*
- *When we examined buffer width as a continuous variable, some loss of species and some decrease in total bird abundance occurred on two very narrow buffer stands (40' ≤) but not on others, suggesting that stand-level differences exist in bird response. However, no loss of species or decrease in bird abundance occurred on stands with buffers greater than the current 50' buffer for non-fish bearing streams.*

What the study does not tell us:

- *If differences exist in survival or reproduction for birds associated with narrow or wider buffers.*
- *Did not identify a threshold buffer width where breeding bird abundance declined but brackets buffer widths where changes in abundance are observed in some stands (between 39.4 and 69 feet).*

5. What is the relationship between this study and any others that may be planned, underway, or recently completed? Factors to consider in answering this question include, but are not limited to:

- a. Feasibility of obtaining more information to better inform Policy about resource effects.

- b. Are other relevant studies planned, underway, or recently completed? (If yes, what are they?)
- c. What are the costs associated with additional studies?
- d. What will additional studies help us learn?
- e. When will these additional studies be completed (i.e., when will we learn the information)?
- f. Will additional information from these other studies reduce uncertainty? (Consider recommendations on additional studies that may not be in current CMER work plan.)

No relationship exists between this study and those planned or currently underway. However, a deliberate relationship exists between a previously funded CMER project (TFW-LWAG1-00-001) - specifically the bird portion of this study that was ultimately published (Pearson and Manuwal 2001). In contrast to the previous study, this current study was designed to examine the long-term effectiveness of riparian buffers for providing habitat used by wildlife. Although the 10-year resample included birds, mammals and amphibians (Hawkes 2007), we were contracted to analyze the bird data only. This work differed from the previous study by:

- *Providing longer-term responses of breeding birds to riparian forest buffers. As pointed out by Marczak et al. (2010, page 132), estimated effects of forested buffers on riparian fauna that have been calculated from short-term data (≤ 5 years post-harvest) should be “viewed with caution” because both short- and long-term effects may be associated with harvesting forests adjacent to buffers. This new study explicitly addresses this concern.*
 - *Addressing issues of detectability that may have been confounded with treatment. If detectability issues are not addressed, they could result in apparent treatment effects that are not present.*
 - *Including a new analysis that was not conducted with the short-term data. Specifically, we took advantage of the variability in buffer width both within and among treatments to examine the relative influence of riparian buffer width and vegetation (trees and shrubs) on species occupancy and abundance. This new analysis allowed us to look for thresholds in the effects of buffer width on species associated with riparian habitats, which were not evident.*
6. What is the scientific basis that underlies the rule, numeric target, performance target, or resource objective that the study informs? How much of an incremental gain in understanding do the study results represent? (The specific basis for the current program element may not be known, and in such a case, focus the discussion on the level of confidence in the results, realizing this may be somewhat subjective. Describe any reduction in uncertainty in the science behind the rules as a result of this study, or any changes in level of assessed risk to key aquatic resources processes affected by forest practices (see Schedule L-1) as a result of this study.)
 - *By providing longer-term (10 year post-harvest) breeding bird response to buffer treatments, we address the need to view the previous study with caution.*
 - *We identified longer-term effects – bird colonization continued for up to a decade post-harvest.*
 - *No long-term effect on stand-level species loss or total bird abundance was detected, even in the narrow buffer treatments.*

- *Narrow buffer treatments apparently maintained riparian associated breeding birds even in the longer-term.*
- *However, bird abundance declined on a couple of stands with very narrow buffers ≤ 40 feet but not on other stands with very narrow buffers suggesting that bird response at the narrow end of the spectrum may be site-specific.*

1) If not already done so within the answers to the six questions above, provide the technical implications/recommendations resulting from the study-. Examples of areas on which to comment include:

- New rule tools, models, or field methods that should be developed;
- New research/monitoring for Policy to consider to fill gaps in information and understanding;
- Suggested rules/board manual sections to review/revise. CMER should not directly state whether or not a rule, guidance, or program procedure should be changed; only the results from using the program component, and where known, the relative merits of other approaches. Deciding whether to make any changes is the purview of Policy or the Forest Practices Board; although, Policy or the Board may request CMER participation in the decision process.
- Evaluation of whether key aquatic resource objectives (Schedule L-1) are being met.
- Other areas

New methods:

- *Regardless of the taxa being addressed, it is critical that issues of detectability are considered in all monitoring and research methods/designs. Fortunately, new statistical approaches exist that can be employed to address issues of process and sampling variation if the study is designed appropriately.*

New research to fill in the gaps:

- *Information from this study indicates that presence of bird species associated with riparian habitats is being maintained on relatively narrow riparian buffers. Future research might focus on whether reproduction and survival of birds in these narrow buffers is equivalent to birds in unlogged controls.*
- *Information from this study suggests that bird abundance declined on a couple of very narrow stands but not on others. Future research might focus on identifying what factors influence these apparent differences. Ultimately, this information could be used to help identify these types of stands on the landscape and ultimately influence management prescriptions to decrease the likelihood that bird abundance will decline. However, if maintaining species presence is the target considered adequate, then this research is not needed.*

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Effectiveness of riparian buffers. Breeding bird response to riparian buffer width: 10 years post-harvest.

By:

Scott F. Pearson, Jack Giovanini, Jay E. Jones and Andrew J. Kroll



WASHINGTON STATE DEPARTMENT OF
Natural Resources
PETER GOLDMARK - Commissioner of Public Lands

August 2014



CMER #12-1204

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Washington State Forest Practices Adaptive Management Program

The Washington State Forest Practices Board (FPB) has established an Adaptive Management Program (AMP) by rule in accordance with the Forests & Fish Report (FFR) and subsequent legislation. The purpose of this program is to:

Provide science-based recommendations and technical information to assist the FPB in determining if and when it is necessary or advisable to adjust rules and guidance for aquatic resources to achieve resource goals and objectives. The board may also use this program to adjust other rules and guidance. (Forest Practices Rules, WAC 222-12-045(1)).

To provide the science needed to support adaptive management, the FPB established the Cooperative Monitoring, Evaluation and Research (CMER) committee as a participant in the program. The FPB empowered CMER to conduct research, effectiveness monitoring, and validation monitoring in accordance with WAC 222-12-045 and Board Manual Section 22.

Report Type and Disclaimer

This technical report contains scientific information from research or monitoring studies that are designed to evaluate the effectiveness of the forest practices rules in achieving one or more of the Forest and Fish performance goals, resource objectives, and/or performance targets. The document was prepared for the Cooperative Monitoring, Evaluation and Research Committee (CMER) and was intended to inform and support the Forest Practices Adaptive Management program. The project is part of the Eastside Type F Riparian Effectiveness Program, and was conducted under the oversight of the Riparian Scientific Advisory Group (RSAG).

This document was reviewed by CMER and was assessed through the Adaptive Management Program's independent scientific peer review process. CMER has approved this document for distribution as an official CMER document. As a CMER document, CMER is in consensus on the scientific merit of the document. However, any conclusions, interpretations, or recommendations contained within this document are those of the authors and may not reflect the views of all CMER members.

The Forest Practices Board, CMER, and all the participants in the Forest Practices Adaptive Management Program hereby expressly disclaim all warranties of accuracy or fitness for any use of this report other than for the Adaptive Management Program. Reliance on the contents of this report by any persons or entities outside of the Adaptive Management Program established by WAC 222-12-045 is solely at the risk of the user.

Proprietary Statement

This work was developed with public funding, as such it is within the public use domain. However, the concept of this work originated with the Washington State Forest Practices Adaptive Management Program and the authors. As a public resource document, this work should be given proper attribution and be properly cited.

Full Reference

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Author Contact Information

Scott F. Pearson
Wildlife Research Division
Washington Department of Fish and Wildlife
1111 Washington St. SE
Olympia, Washington, USA

Jack Giovanini
Statistics, Mathematics, and Operations Research
Weyerhaeuser NR
Federal Way, Washington, USA

Jay E. Jones
Statistics, Mathematics, and Operations Research
Weyerhaeuser NR
Federal Way, Washington, USA

Andrew J. Kroll
Timberlands Technology
Weyerhaeuser NR
Federal Way, Washington, USA

**Effectiveness of riparian buffers.
Breeding bird response to riparian buffer width: 10 years post-harvest.**

August 2014

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Prepared by:

Scott F. Pearson
Wildlife Research Division
Washington Department of Fish and Wildlife
1111 Washington St. SE
Olympia, Washington, USA

Jack Giovanini
Statistics, Mathematics, and Operations Research
Weyerhaeuser NR
Federal Way, Washington, USA

Jay E. Jones
Statistics, Mathematics, and Operations Research
Weyerhaeuser NR
Federal Way, Washington, USA

Andrew J. Kroll
Timberlands Technology
Weyerhaeuser NR
Federal Way, Washington, USA

Effectiveness of riparian buffers

Breeding bird response to riparian buffer width: 10 years post-harvest

Scott F. Pearson¹, Jack Giovanini², Jay E. Jones² and Andrew J. Kroll³

¹Wildlife Research Division, Washington Department of Fish and Wildlife, 1111 Washington St. SE, Olympia, Washington, USA

²Statistics, Mathematics, and Operations Research, Weyerhaeuser NR, Federal Way, Washington, USA

³Timberlands Technology, Weyerhaeuser NR, Federal Way, Washington, US

ABSTRACT

Buffer strips of intact native vegetation are often left between harvested forest cutblocks or between agricultural fields and aquatic habitats in order to reduce potentially negative effects of tree harvest and agriculture activities on aquatic systems. Previously, we described the 1-2 year post-harvest bird community responses to two riparian buffer treatments: 1) a relatively uniform width forested riparian buffer (~13m) and, 2) a wider and more variable width buffer (~30m) (unharvested reserves), both created after clearcut harvest of the uplands adjacent to small streams in western Washington, USA. In this study, we revisited study sites (10 years post-harvest) to examine longer-term bird community effects. Using the same Before-After-Control-Impact (BACI) experimental approach and temporally replicated point counts, we estimated population- and community-level avian responses while incorporating variation in the detection process across treatments and years, an aspect not previously included.

Post-harvest, average riparian buffer width was 13 (± 2.0 SE) and 29 m (± 2.2 SE) on the Narrow and Wide treatments respectively. Across all years [1993 (pre-treatment year), 1995-1996 (immediate post-harvest sample), and 2003-2004 (10 year post-harvest sample)] and treatments (Control, Wide and Narrow buffer), 28 species were detected at least 10 times for a total of 2,064 detections. We did not find a treatment effect on total bird abundance. Buffer treatments exhibited a 31-44% increase in mean species richness in the post-harvest years, relative to their respective pre-harvest year, a pattern most evident 10 years post-harvest. In contrast, we found a 13-18% increase in species richness post-harvest on controls. When comparing probability of species turnover between the pre-harvest year and either the two immediate post-harvest years or the two ~10 year post-harvest years, turnover was much higher on both treatments (63-74%) relative to the controls (29%). Post-harvest, we found strong evidence (no overlap in 95% credible intervals) for an increase in site occupancy on treatments relative to the controls for approximately 29% and 100% of the species in the immediate post-harvest and the ~10 year post-harvest sample respectively. Occupancy increased for more species on the wider buffer treatment, but we found no clear evidence for a species-level decrease in occupancy on either treatment after harvest. Taking advantage of the existing variation in vegetation characteristics and buffer width among harvested sites and ignoring site treatment assignments (Wide vs. Narrow), our model predicted an increase in total bird abundance with increasing buffer width but the evidence was weak (a 16% probability of no/negative change). Some of the narrowest

buffered sites had lower bird abundance and species richness than the controls. When assessing the relationship between buffer width and site level abundance of the four species associated with riparian habitats, Pacific-slope flycatcher (*Empidonax difficilis*), Pacific wren (*Troglodytes troglodytes*), American robin (*Turdus migratorius*), and black-throated gray warbler (*Dendroica nigrescens*), we found weak evidence that Pacific wren abundance was reduced on some of the very narrow buffered sites. Our results suggest that local extinction does not occur even on the very narrow buffers that we examined, that buffer treatments increased species richness regardless of their width, and that birds continued to colonize riparian buffers for up to 10 years post-harvest.

Key words: Riparian buffers, riparian zones, riparian birds, species turnover, site-level extinction, forest practices. Key phrases: Effects of riparian buffer width; bird species richness vs. riparian buffer width, local bird species extinction vs. riparian buffer width, breeding bird abundance vs. riparian buffer width, riparian associates in riparian zones; breeding birds in riparian zones

INTRODUCTION

Riparian areas associated with rivers and streams are dynamic portions of the landscape because they integrate aquatic and terrestrial communities (Pollock et al. 1998, Swanson et al. 1988, Naiman et al. 2005). They are dynamic because of seasonal and episodic changes in hydrology that influence soil erosion and deposition and ultimately plant and animal composition and structure. As a consequence, riparian areas are typically more structurally diverse (Bull 1978, Planty-Tabacchi et al. 1996, Pollock et al. 1998) and more productive (Pollock et al. 1998) than adjacent uplands. In some cases, riparian zones support a greater number of plant and vertebrate species (Thomas et al. 1979, Oakley et al. 1985, Gregory et al. 1991, NRC 2002) but in others, they support different but not necessarily more species (Sabo et al. 2005). Many of these riparian-associated species are uniquely adapted to exploit the temporally and spatially variable nature of river systems (Naiman and Bilby 1998).

Buffer strips of standing trees or intact native vegetation are often left between harvested stands or agricultural fields and aquatic environments because of the ecological importance of riparian areas and to reduce the negative effects of harvest on terrestrial, riparian and aquatic systems, (Stauffer and Best 1980, Knopf et al. 1988, Keller et al. 1993, Peak and Thompson 2006). Buffer strips are left to: (1) maintain natural processes and functions of the aquatic system (e.g., shading, sedimentation interception, inputs of large wood and leaf litter, etc.) (Chamberlin et al. 1991), (2) maintain aquatic species and communities (Osmundson et al. 2002, Kiffney et al. 2003), and (3) protect riparian vegetation and animals (Naiman et al. 2000, 2005, Richardson et al. 2005). Buffer strips may also serve as dispersal corridors or as important connections between fragmented forest patches, and consequently, may counteract some of the problems associated with landscape fragmentation [(Wilcox and Murphy 1985, Saunders et al. 1991) but see Hannon and Schmiegelow (2002) and Schmiegelow and Monkkonen (2002)]. When conserving riparian systems in forest landscapes, riparian buffer width is the primary variable influenced by state and provincial guidelines in the United States and Canada (Blinn and Kilgore 2001, Lee et al. 2004). Despite their apparent importance and substantial research devoted to their effectiveness in conserving species and ecological process, considerable variation in buffer width guidelines exists among jurisdictions (Blinn and Kilgore 2001, Lee et al. 2004). From an ecological perspective, the discrepancy is understandable given the variation

in how biotic and abiotic factors respond to riparian buffers. For example, in a meta-analysis using data from 397 comparisons of species abundance in riparian buffers and unharvested riparian sites, responses of terrestrial species were not consistent between taxonomic groups (Marczak et al. 2010). In general, bird and arthropod abundances increased in buffers relative to unharvested areas, whereas amphibian abundance decreased (Marczak et al. 2010).

To examine effectiveness of riparian buffer width on avian community abundance and richness in forested landscapes, investigators have used a variety of approaches. Some have looked at changes in species richness with distance from the stream in unharvested forests (e.g. Spackman and Hughes 1995). Others have correlated buffer width with species abundance and richness after timber harvest (Kinley and Newhouse 1997, Hagar 1999, Whitaker and Montevecchi 1999). A few studies have used an experimental approach to examine the effect of buffer width on species and communities (e.g., Darveau et al. 1995, Pearson and Manuwal 2001) and others have experimentally examined the effects of tree harvest within riparian habitats (Hanowski et al. 2003). To date, few studies focused on species responses to buffer width have: (1) documented the long-term effectiveness of the buffer in maintaining the presence or abundance of riparian associated species; (2) quantitatively identified riparian associates and consequently the effectiveness of the buffer in maintaining those species; and (3) addressed issues of detectability that may have been confounded with treatment (Gimenez et al. 2008, Perry et al. 2011, Jones et al. 2011, Archaux et al. 2012) and consequently resulted in apparent effects (Perry et al. 2011). Estimated effects of forested buffers on riparian fauna that have been calculated from short-term data (≤ 5 years post-harvest) should be “viewed with caution” (Marczak et al. 2010, page 132) because both short- and long-term effects may be associated with harvesting forests adjacent to buffers. Interior forest species that exhibit some degree of philopatry may “pack” into the adjacent forested buffer resulting in a higher density than expected in the years immediately following harvest (Hagan et al. 1996). Over the longer-term, regeneration of trees and shrubs in the adjacent harvest area may “soften” the contrast between the harvested upland and unharvested riparian buffer resulting in an increased use by species sensitive to “hard” or high contrast edges (Fletcher and Koford 2003, Ries et al. 2004). The animal species composition and structure within the buffer is also likely to change over time. Changes in temperature and light and wind speeds can penetrate as much as 40 m into buffers, which results in changes in the structure and composition of the shrub and canopy layers and potentially increases in downed

wood resulting from blow down (Brosofske et al. 1997, Harper and Macdonald 2001, Hannon et al. 2002, Kiffney et al. 2003). Although, longer-term changes in buffer structure and composition post-harvest are likely to influence abundance and composition of the animals that reside in the buffer, these long-term effects are unexamined to date (Marczak et al. 2010).

For many studies, it is difficult to evaluate the effect of buffer width on species that are highly dependent upon riparian zones because we do not know which species are in fact highly dependent upon riparian environments (but see Whitaker and Montecchi 1999 and Pearson and Manuwal 2001). As a consequence, species that decline or disappear in riparian buffers may not be species dependent upon riparian zones for reproduction or survival but are simply responding to the loss of forest.

When considering issues of detectability, we know that patch occupancy is not generally detected with certainty (MacKenzie et al. 2002). It therefore follows that a researcher's ability to assess patterns in species richness or abundance in riparian buffers before and after harvest in forested landscapes could be influenced by changes in species detectability post-harvest. This potential change in detectability can occur for a variety of reasons including: 1) real changes in species abundance that influences their detectability (e.g., in the case of birds, singing frequency which is related to density); 2) changes in the structure and composition of the riparian buffer or the adjacent cutblock (see below), such as vegetation density that influences an observer's ability to detect the individual or species; or 3) changes between sampling periods, such as in environmental conditions (weather, stream noise) or observers that differ in their ability to detect the species. In our review of the riparian buffer literature, we found only one study (Perry et al. 2011) that explicitly accounted for changes or differences in detectability when examining the effectiveness of riparian buffers.

In the precursor to our study, Pearson and Manuwal (2001) described the immediate post-harvest (1-2 year post-harvest) responses to two buffer treatments: 1) a relatively uniform width riparian buffer and, 2) wider and more variable width buffers created after clearcut logging the uplands adjacent to small streams in western Washington, USA (Figure 1). For this current study, we revisited our study sites (~10 years post-harvest) and used the same Before-After-Control-Impact (BACI) experimental approach to examine longer-term effects on the avian community. Specifically, we looked at buffer treatment effects on species abundance and richness, local extinction (site-level species loss) and turnover, and similarity in community composition

between treatments and controls. At the species level, we examine treatment effects on occupancy and abundance. In a second analysis that was not conducted with the short-term data, we took advantage of the variability in buffer width both within and among treatments to examine the relative influence of riparian buffer width and vegetation (trees and shrubs) on species occupancy and abundance. This new analysis allows us to identify thresholds in the effects of buffer width on species associated with riparian habitats. Unlike our previous study and most riparian studies to date, we incorporate contemporary statistical methods to account for potential influence of detectability on apparent treatment effects (e.g., Dorazio and Royle 2005, Zipkin et al. 2009, Russell et al. 2009, Archaux et al. 2012, Giovanini et al. 2013).

METHODS

Study area and experimental design

The experiment was conducted on the west side of the southern Cascade Mountains and the coast range of Washington, USA. All sites were located in the Western Hemlock forest zone (Franklin and Dyrness 1973; Figure 1). Forests in this zone are dominated by conifers including Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*) and western red cedar (*Thuja plicata*). Deciduous tree species are not common in this zone except in recently disturbed sites, talus slopes, and riparian habitats. Riparian habitats are often dominated by red alder (*Alnus rubra*) and big-leaf maple (*Acer macrophyllum*) in early seral stages and by western hemlock and red cedar in later stages. The region is characterized by ridges and steep valleys and the climate consists of warm dry summers and cool wet winters. Lands used in this research were owned by the State of Washington, the City of Seattle, and private timber companies (see Acknowledgments). The primary management objective on these lands is the production of even-aged conifer stands dominated by Douglas-fir and much of the landscape has been harvested once or twice previously.

We used a Before-After-Control-Impact experimental design (McDonald et al. 2000) to examine bird response to narrow and wider, forested riparian buffers left along streams after clearcut harvest of the uplands. In 1991 and 1992, 18 sites were selected along small streams between the Cedar River watershed (east of Seattle) to the north and the Columbia River to the

south. Sites were randomly assigned to treatments (Figure 1). Site selection was based on the following criteria: 1) low elevation (< 620 m); 2) second growth forest (45 - 65 yrs old); 3) dominated by Douglas-fir and western hemlock in the uplands; 4) second and third order streams (Strahler 1957); 5) predominantly coniferous riparian canopy with deciduous tree component; 5) at least 500 m in stream length and 300 m wide (150 m wide on each side of the stream) to accommodate point counts (see Bird Sampling below); and 6) experienced a common management history (e.g., harvested and thinned at the same time in the past) and were likely to be harvested as a single unit in the future. Sites size ranged from ~33 to 50 ha, and each site was located along a different stream. The experimental design consisted of three treatments each with six replicates. The treatments were: 1) forested control sites with no harvest; 2) sites harvested according to 1992 Washington State Forest Practices regulations that consisted of clearcut uplands on each side of the stream with narrow unharvest forest reservers or buffers (~ 13m) along each side of the stream (Narrow treatment); and 3) sites harvested with a variable width unharvested buffer reserve that was wider and more variable than the Narrow treatment (~ 30 m; Wide treatment). Wide buffered sites were modified to accommodate local features such as seeps and structural components such as snags and down wood. Sites were harvested in 1994. We collected pre-harvest data in the spring of 1993 from all 18 sites; immediate post-harvest data in the spring of 1995 and 1996 (n = 6 Control, 6 Narrow buffer, and 6 Wide buffer); and long-term data approximately 10 years after harvest in 2003 and 2004 (n = 5 Control, 5 Narrow buffer, and 5 Wide buffer). Three sites in each treatment category were lost to harvest or not available for sampling in the second post-harvest period, resulting in a reduction in sample size between sampling periods from 18 to 15 sites.

Bird Sampling

We surveyed the avian community using 15-m fixed radius point counts (Verner 1985). In each site, we established 10 riparian point count stations along the edge of the stream with five stations spaced evenly on each side of the stream. The center of each riparian station was located 15 m (perpendicular distance) from the usual high water line, 100 m from other stations and at least 50 m from the edge of the study site. Ten additional point count stations were located parallel and 100 m upslope from the riparian stations in the adjacent uplands. Data from the

upland stations were only used in the pre-harvest year to identify birds that were more abundant in the riparian habitat (Pearson and Manuwal 2001). Reference flags were placed 15 m to each side of each station. Small radius point counts allowed us to examine differences in bird abundance along narrow strips of potential habitat post-harvest and also to reduce detection issues associated with adjacent stream noise. Point counts rather than strip transects were used because it would have been difficult to both walk and observe birds in the dense vegetation and rugged terrain. However, we note that point count stations in the Narrow treatment will sample small areas outside of the riparian buffer after harvest. As a result, all inference about bird community responses to buffer treatments is made with reference to distance from the stream channel. Censuses usually started within 30 minutes of dawn and were completed within 5 hours. Upon arriving at a survey point, observers remained stationary and quiet for a minimum of 1 minute to allow birds to settle and then recorded all birds heard or seen during a 6-minute period. To avoid biases among observers, observers were rotated among the 18 study sites. To avoid biases associated with visiting riparian or upland sites first, we alternated travel routes. Each site was visited 6 times between mid-April and late-June. The surveys were evenly spaced throughout the breeding season to account for differences in breeding phenology among species. We did not conduct surveys during heavy precipitation or high winds. Every attempt was made to avoid counting individual birds more than once.

Habitat before and after harvest

We measured habitat variables in 15-m² square plots at each bird point count station (n = 10 per site) and the variables included in this study were: 1) counts of Douglas-fir, western hemlock/red cedar, and deciduous tree stems > 10 cm at 1.5 m above the ground (hereafter referred to as DBH or Diameter at Breast Height), and 2) visually estimated percent cover of shrubs (> 1m tall). At each point count station, we also measured the distance between the mean high water mark and the outer edge of the standing trees on all treatment sites. Upland habitats on both buffer treatments were clearcut leaving approximately two standing trees per acre as required by State law. In most cases, these standing trees were incorporated into the riparian buffer.

Data analyses

For all analyses, detections of Hermit (*Setophaga occidentalis*) and Townsend's (*Setophaga townsendi*) warblers were grouped as one species (hereafter hermit/Townsend's warbler) because these species hybridize extensively in this region (Rohwer and Wood 1998) and cannot be distinguished by song in regions of hybridization (Pearson and Rohwer 1998). In addition, we excluded from all analyses individuals that flew over the site, migrants that did not breed in the area [e.g., Ruby-crowned Kinglet (*Regulus calendula*) and Golden-crowned Sparrow (*Zonotrichia leucophrys*)], and all species not adequately sampled by point counts (grouse, raptors, and waterfowl). In addition, we excluded all species that were not detected on at least ten total occasions from all analyses; these species tended to be those for which we had no evidence of breeding on the experimental units, which generally do not breed in western hemlock forests, or have very large territories that are not adequately sampled using small radius point counts (e.g., pileated woodpecker *Dryocopus pileatus*).

For all analyses we aggregated over all point count stations within a site to obtain one response per site. This was done to avoid spatial autocorrelation of point count stations within sites, to help with model convergence by reducing the number of species that are not observed at the analysis level, and because the experimental unit was the site. All sites had the same 10 station \times 15 meters radius sampling area. However given that the buffer widths varied between treatments, the samples represent bird populations within 30 meters of the stream edge, not bird within the riparian buffer.

We used multispecies site occupancy and abundance models (Dorazio and Royle 2005, Zipkin et al. 2009, Yamaura et al. 2012) to estimate species level covariate effects as well as population level summaries of occupancy and abundance, such as species richness, species similarity, and total abundance. We estimated occupancy dynamics, including species turnover and extinction (Russell et al. 2009, Giovanini et al. 2013). For both occupancy and abundance, we constructed three models. First, we fit the design-based model, in which treatment is modeled as a categorical covariate. Second, we fit a model in which buffer-width and vegetation effects are modeled as continuous covariates (we expect the treatments to modify buffer width as well as vegetation composition and structure). Finally, in order to understand how species richness and total abundance varied solely as a function of buffer width, we fit a model with a random effect

for site but without treatment or covariate effects for either occupancy or abundance. We plotted these estimates against buffer width to determine if any thresholds existed in the association. We fit the third model to avoid forcing a linear relationship of buffer width. Following Russell et al. (2009), we do not account for the contribution of unobserved species in our population estimates, instead conditioning on the set of observed breeding species in our study.

Occupancy models--We let $z_{i,j,k}$ denote true the occupancy status, in which $z_{i,j,k} = 1$ if species i in year j occupies site k or $z_{i,j,k} = 0$ otherwise. The occupancy state is taken to be a Bernoulli random variable, $z_{i,j,k} \sim \text{Bern}(\psi_{i,j,k})$, where $\psi_{i,j,k}$ is the probability that species i in year j occupies site k . We take species detection, also, to follow a Bernoulli distribution, $y_{i,j,k,l} \sim \text{Bern}(p_{i,j,k,l} \cdot z_{i,j,k})$, where $y_{i,j,k,l}$ is 1 if the species i in year j is detected at site k during visit l , or 0 otherwise and where $p_{i,j,k,l}$ is the detection probability. Note that under this parameterization, the probability of detecting species i during year j at site k during will be zero if it does not occupy site k , since $z_{i,j,k} = 0$.

The first model that we considered was the model based on the experimental design, in which detection probability varied by treatment type (Control, Narrow, and Wide treatments) and year. For the detection model, the treatment status effect is the treatment at time of measurement. Therefore, in 1993, all sites had control for the detection model. In addition, we included linear and quadratic terms for Julian date (January 1 = 1, December 31=365) because avian detection rates are known to vary seasonally (Kéry et al. 2005). We centered and scaled the date covariate. The species-specific detection probability mean model is:

$$\begin{aligned} \text{logit}(p_{i,k,j,l}) = & \beta_{0i} + \beta_{1i} \cdot \text{Year.1995}_j + \beta_{2i} \cdot \text{Year.1996}_j + \beta_{3i} \cdot \text{Year.2003}_j + \\ & \beta_{4i} \cdot \text{Year.2004}_j + \beta_{5i} \cdot \text{Trt.Narrow.det}_{k,j} + \beta_{6i} \cdot \text{Trt.Wide.det}_{k,j} + \beta_{7i} \cdot \text{Date}_{j,k,l} + \\ & \beta_{8i} \cdot \text{Date}_{j,k,l}^2 \end{aligned}$$

Occupancy was allowed to vary by species, site, year, treatment, and by an interaction of treatment type and year. The occupancy mean model is:

$$\begin{aligned} \text{logit}(\psi_{i,j,k}) = & \alpha_{0i} + \alpha_{0k} + \alpha_{1i} \cdot \text{Year.1995}_j + \alpha_{2i} \cdot \text{Year.1996}_j + \alpha_{3i} \cdot \text{Year.2003}_j + \\ & \alpha_{4i} \cdot \text{Year.2004}_j + \alpha_{5i} \cdot \text{Narrow}_k + \alpha_{6i} \cdot \text{Wide}_k + \alpha_{7i} \cdot \text{Year.1995}_j \cdot \text{Narrow}_k + \\ & \alpha_{8i} \cdot \text{Year.1996}_j \cdot \text{Narrow}_k + \alpha_{9i} \cdot \text{Year.2003}_j \cdot \text{Narrow}_k + \alpha_{10i} \cdot \text{Year.2004}_j \cdot \text{Narrow}_k + \\ & \alpha_{11i} \cdot \text{Year.1995}_j \cdot \text{Wide}_k + \alpha_{12i} \cdot \text{Year.1996}_j \cdot \text{Wide}_k + \\ & \alpha_{13i} \cdot \text{Year.2003}_j \cdot \text{Wide}_k + \alpha_{14i} \cdot \text{Year.2004}_j \cdot \text{Wide}_k \end{aligned}$$

The terms α_{0i} and α_{0k} are random effects for species and site, respectively. Even though there is substantial variability of buffer widths within the Narrow and Wide buffer treatments (Table 2), this analysis allows us to examine how the buffer treatments would act within the context of operational variability of harvest prescriptions.

To examine how species occupancy differed among buffer prescriptions, we estimated treatment effect sizes (Christensen 1996, Kroll et al. 2012, Betts et al. 2013). In our parameterization, the year \times Narrow and year \times Wide coefficients compare occupancy of the respective treatments to the Control, and are estimates of the treatment effects on occupancy. After back transformation, these terms are interpreted as the multiplicative change in odds of occupancy. We estimated species richness (s), where $nspp$ is the total number of species across all sites by year, for treatment and control plots separately as:

$$\hat{s}_{j,k} = \sum_{i=1}^{i=nspp} \sum_{k=1}^{k=sites} \hat{z}(i, j, k).$$

To examine the effect of buffer treatment on species richness, we estimated the mean species richness for the three treatment \times five year combinations. In addition to estimated species richness, we estimated species similarity both between and among treatment and control sites (Dorazio and Royle 2005) by calculating the proportion of species that occupy both sites.

Species similarity in year j for sites k_1 and k_2 , is defined as:

$$S_{j,k_1,k_2} = \frac{2 \sum_i (z_{i,j,k_1} \times z_{i,j,k_2})}{\sum_i z_{i,j,k_1} + \sum_i z_{i,j,k_2}}.$$

Within each year, we estimated the similarity for all pairwise combinations of sites. This set of summary statistics allows us to determine the impact of buffer treatment on species similarity.

We estimated species turnover (τ), the probability that a species chosen at random from the community at time j is a species not present at time $j - 1$, and local-extinction rates (ϵ) as:

$$\tau(j) = \frac{\sum_{i=1}^{i=nspp} \sum_{k=1}^{k=sites} z(i,k,j) \times [1 - z(i,k,j-1)]}{\sum_{i=1}^{i=nspp} \sum_{k=1}^{k=sites} z(i,k,j-1)}$$

$$\varepsilon(j) = \frac{\sum_{i=1}^{i=nspp} \sum_{k=1}^{k=sites} 1 - z(i,k,j) \times z(i,k,j-1)}{\sum_{i=1}^{i=nspp} \sum_{k=1}^{k=sites} z(i,k,j-1)}.$$

The second model that we used examined effects of buffer width (the treatment) and vegetation covariates on occupancy for sites that were harvested. Observations from the pre-treatment year and all control sites were not included in this analysis. The detection model included effects of year, average buffer width (based on 10 measurements) at each site (BufferWidth), percent shrub cover (Shrub), number of Douglas-fir stems > 10 cm DBH (DougFir), number of deciduous stems > 10 cm DBH (Decid), and number of western hemlock and western red cedar stems > 10 cm DBH (HemCedar). We included linear and quadratic terms for Julian date. We centered and scaled all continuous covariates. The species-specific detection probability mean model is:

$$\begin{aligned} \text{logit}(p_{i,k,j,l}) = & \beta_{0i} + \beta_{1i} \cdot \text{Year.1996}_j + \beta_{2i} \cdot \text{Year.2003}_j + \beta_{3i} \cdot \text{Year.2004}_j + \\ & \beta_{4i} \cdot \text{BufferWidth}_{k,j} + \beta_{5i} \cdot \text{Shrub}_{k,j} + \beta_{6i} \cdot \text{DougFir}_{k,j} + \beta_{7i} \cdot \text{Decid}_{k,j} + \beta_{8i} \cdot \text{HemCedar}_{k,j} + \\ & \beta_{9i} \cdot \text{Date}_{j,k,l} + \beta_{10i} \cdot \text{Date}_{j,k,l}^2. \end{aligned}$$

The occupancy model had the same terms as the detection model, except for the date covariates, and also included a site effect. The species-specific occupancy probability mean model is:

$$\begin{aligned} \text{logit}(\psi_{i,k,j}) = & \alpha_{0i} + \alpha_{ok} + \alpha_{1i} \cdot \text{Year.1996}_j + \alpha_{2i} \cdot \text{Year.2003}_j + \alpha_{3i} \cdot \text{Year.2004}_j + \\ & \alpha_{4i} \cdot \text{BufferWidth}_{k,j} + \alpha_{5i} \cdot \text{Shrub}_{k,j} + \alpha_{6i} \cdot \text{DougFir}_{k,j} + \alpha_{7i} \cdot \text{Decid}_{k,j} + \alpha_{8i} \cdot \text{HemCedar}_{k,j}. \end{aligned}$$

We constructed a third model to provide site-specific estimates of species richness without any covariate effects except year. We used only the 2003 and 2004 data because we were interested in finding a buffer width that matched the control in the longer-term time frame. The detection model included effects of year, average buffer width (based on 10 measurements) at each site (BufferWidth), percent shrub cover (Shrub), number of Douglas-fir stems > 10 cm DBH (DougFir), number of deciduous stems > 10 cm DBH (Decid), and number of western hemlock and western red cedar stems > 10 cm DBH (HemCedar). We included linear and quadratic terms for Julian date. We centered and scaled all continuous covariates. The species-specific logistic detection probability model is:

$$\begin{aligned} \text{logit}(p_{l,k,j,i}) = & \beta_{0i} + \beta_{1i} \cdot \text{Year.2004}_j + \\ & \beta_{2i} \cdot \text{BufferWidth}_{k,j} + \beta_{3i} \cdot \text{Shrub}_{k,j} + \beta_{4i} \cdot \text{DougFir}_{k,j} + \beta_{5i} \cdot \text{Decid}_{k,j} + \beta_{6i} \cdot \text{HemCedar}_{k,j} + \\ & \beta_{7i} \cdot \text{Date}_{j,k,l} + \beta_{8i} \cdot \text{Date}_{j,k,l}^2. \end{aligned}$$

The occupancy model included site and year effects. We did not include either buffer width or vegetation effects because we did not want to ‘force’ a relationship between buffer width and occupancy. The species-specific logistic occupancy probability model is:

$$\text{logit}(\psi_{i,k,j}) = \alpha_{0i} + \alpha_{ok} + \alpha_{1i} \cdot \text{Year.2004}_j.$$

Abundance models-- For the abundance data, we fit a multispecies version of the N-mixture model (Yamaura et al. 2012, Chandler et al. 2013). This model is a natural extension of the single species N-mixture model (Royle 2004, Kéry 2008) and the multispecies occupancy model (Dorazio and Royle 2005). We let $n_{i,j,k,l}$ be the number of individuals of species i in year j that are detected at site k , and during visit l . We define $N_{i,j,k}$ as the unobserved site level abundance, assumed constant over visits. We then model the observed count, $n_{i,j,k,l}$ as a

Binomial($N_{i,j,k}, p_{i,j,k,l}$) random variable. Following Royle (2004), we assume the site level abundance $N_{i,j,k}$ follows a Poisson($\lambda_{i,j,k}$) distribution. Abundance covariates are incorporated in the model by assuming that the log-transform of $\lambda_{i,j,k}$ is described by a linear function of the covariates. Detection probability is modeled similarly, where we assume that the logit transform of $p_{i,j,k,l}$ is a linear function of the covariates.

The first model that we constructed was based on the experimental design, in which detection probability varied by treatment type (Control, Narrow, and Wide buffers) and year. For the detection model, the treatment status effect is the treatment at time of measurement. Therefore in 1993, all sites had control for the detection model. Similar to the occupancy models, we included linear and quadratic effects of date. We centered and scaled the date covariate. The species-specific logistic detection probability model is:

$$\begin{aligned} \text{logit}(p_{i,k,j,l}) = & \beta_{0i} + \beta_{1i} \cdot \text{Year.1995}_j + \beta_{2i} \cdot \text{Year.1996}_j + \beta_{3i} \cdot \text{Year.2003}_j + \\ & \beta_{4i} \cdot \text{Year.2004}_j + \beta_{5i} \cdot \text{Trt.Narrow.det}_{k,j} + \beta_{6i} \cdot \text{Trt.Wide.det}_{k,j} + \beta_{7i} \cdot \text{Date}_{j,k,l} + \\ & \beta_{8i} \cdot \text{Date}_{j,k,l}^2 \end{aligned}$$

Similar to occupancy, abundance was allowed to vary by site and by an interaction of treatment type and year. The log linear abundance model is:

$$\begin{aligned} \log(\lambda_{i,j,k}) = & \alpha_{0i} + \alpha_{0k} + \alpha_{1i} \cdot \text{Year.1995}_j + \alpha_{2i} \cdot \text{Year.1996}_j + \alpha_{3i} \cdot \text{Year.2003}_j + \alpha_{4i} \cdot \text{Year.2004}_j + \\ & \alpha_{5i} \cdot \text{Narrow}_k + \alpha_{6i} \cdot \text{Wide}_k + \alpha_{7i} \cdot \text{Year.1995}_j \cdot \text{Narrow}_k + \alpha_{8i} \cdot \text{Year.1996}_j \cdot \text{Narrow}_k + \\ & \alpha_{9i} \cdot \text{Year.2003}_j \cdot \text{Narrow}_k + \alpha_{10i} \cdot \text{Year.2004}_j \cdot \text{Narrow}_k + \alpha_{11i} \cdot \text{Year.1995}_j \cdot \text{Wide}_k + \\ & \alpha_{12i} \cdot \text{Year.1996}_j \cdot \text{Wide}_k + \alpha_{13i} \cdot \text{Year.2003}_j \cdot \text{Wide}_k + \alpha_{14i} \cdot \text{Year.2004}_j \cdot \text{Wide}_k. \end{aligned}$$

As with the occupancy model, the year \times Narrow and year \times Wide coefficients compare abundance of the respective treatments to the Control, adjusting for differences due to year. After back transforming, a treatment contrast of 1 indicates that abundance is equal across treatments.

We estimated the total abundance of all individuals for all species that occupy a site for treatment and control plots separately as:

$$\text{Total } \hat{N}_{j,t} = \sum_{i=1}^{i=nspp} \sum_{k=1}^{k=sites} \hat{N}_{i,j,k},$$

where *nspp* is the total number of species across all sites and *t* is an indicator variable for treatment type. This estimate represents the total number of individuals across all species, where abundance for each species is adjusted by a species-specific detection probability.

The second model that we considered examined the effect of buffer width and vegetation covariates on abundance for sites that were harvested. Observations from the pre-treatment year and all control stands were not included in this analysis. The detection model included effects of year, site buffer width, percent shrub cover, number of Douglas-fir stems > 10 cm DBH, number of deciduous stems > 10 cm DBH, and number of western hemlock and western red cedar stems > 10 cm DBH. We centered and scaled all continuous covariates. The species-specific detection probability mean model is:

$$\begin{aligned} \text{logit}(p_{i,k,j,l}) = & \beta_{0i} + \beta_{1i} \cdot \text{Year.1996}_j + \beta_{2i} \cdot \text{Year.2003}_j + \beta_{3i} \cdot \text{Year.2004}_j + \\ & \beta_{4i} \cdot \text{Width}_{k,j} + \beta_{5i} \cdot \text{Shrub}_{k,j} + \beta_{6i} \cdot \text{DougFir}_{k,j} + \beta_{7i} \cdot \text{Decid}_{k,j} + \beta_{8i} \cdot \text{HemCedar}_{k,j} + \\ & \beta_{9i} \cdot \text{Date}_{j,k,l} + \beta_{10i} \cdot \text{Date}_{j,k,l}^2. \end{aligned}$$

The abundance model had the same terms as the detection model and also included a site effect.

The species-specific abundance mean model is:

$$\log(\lambda_{i,k,j}) = \alpha_{oi} + \alpha_{ok} + \alpha_{1i} \cdot Year.1996_j + \alpha_{2i} \cdot Year.2003_j + \alpha_{3i} \cdot Year.2004_j + \alpha_{4i} \cdot Width_{k,j} + \alpha_{5i} \cdot Shrub_{k,j} + \alpha_{6i} \cdot DougFir_{k,j} + \alpha_{7i} \cdot Decid_{k,j} + \alpha_{8i} \cdot HemCedar_{k,j}.$$

We wanted to determine at what buffer width abundance of riparian-associated species and total avian abundance were similar to abundance in the Control sites. To estimate these quantities for each site, we averaged the posterior medians of total abundance and species richness over the years in the study. The resulting means were plotted vs. buffer width of the site.

The third model that we constructed examined the association between buffer width and total abundance for harvested sites as compared to control sites. We used only the 2003 and 2004 data because we wanted to identify a buffer width that matched the control in the longer-term time frame. The detection model included effects of year, average buffer width (based on 10 measurements) at each site (BufferWidth), percent shrub cover (Shrub), number of Douglas-fir stems > 10 cm DBH (DougFir), number of deciduous stems > 10 cm DBH (Decid), and number of western hemlock and western red cedar stems > 10 cm DBH (HemCedar). We included linear and quadratic terms for Julian date. We centered and scaled all continuous covariates. The species-specific detection probability mean model is:

$$\text{logit}(p_{l,k,j,i}) = \beta_{oi} + \beta_{1i} \cdot Year.2004_j + \beta_{2i} \cdot BufferWidth_{k,j} + \beta_{3i} \cdot Shrub_{k,j} + \beta_{4i} \cdot DougFir_{k,j} + \beta_{5i} \cdot Decid_{k,j} + \beta_{6i} \cdot HemCedar_{k,j} + \beta_{7i} \cdot Date_{j,k,l} + \beta_{8i} \cdot Date_{j,k,l}^2.$$

The abundance model included site and year effects. We did not include either buffer width or vegetation effects because we did not want to force a relationship between buffer width and abundance. The species-specific abundance probability mean model is:

$$\log(\lambda_{i,k,j}) = \alpha_{oi} + \alpha_{ok} + \alpha_{1i} \cdot Year.2004_j.$$

To examine the association of buffer width and vegetation covariates with species richness and total abundance in the continuous covariate model (2nd model), we used average predictive comparisons (Gelman and Pardoe 2007, Jones et al. 2012,) to quantify directly associations (and uncertainty) between *predicted* species richness and *predicted* total abundance with each model covariate. Predictive comparisons evaluate the difference in expected response for a unit

difference in an input covariate, using the fitted model, and averaging over the distribution of all other covariates. Following Jones et al. (2012), we extend this approach to species richness and total abundance by summing over the species-specific predictions to obtain averaged expected differences in species count. For dataset $(x, y)_j$, $j = 1, \dots, n$, we denote our input of interest u , and all other inputs v , such that $x = (u, v)$, where n is the number of sites. We let $i = 1, \dots, N$, be the index of species, where N is the total number of observed species. We estimated the average predictive comparison for species richness using the following equation:

$$\hat{\Delta}_u = \frac{\sum_{j=1}^n \sum_{k=1}^n \sum_{s=1}^S w_{jk} \sum_{i=1}^N \left(E(y | u_k, v_j, \theta^s) - E(y | u_j, v_j, \theta^s) \right) \text{sign}(u_k - u_j)}{\sum_{j=1}^n \sum_{k=1}^n \sum_{s=1}^S w_{jk} (u_k - u_j) \text{sign}(u_k - u_j)}$$

Let θ^s be a set of $s = 1, \dots, S$ simulations were sampled from the posterior distribution. Let w_{jk} be a weight that reflects how likely a transition from u_j to u_k when $v = v_j$. We calculated predictive comparisons for all model inputs, treating each in turn as the input of interest. Standard errors for $\hat{\Delta}_u$ are estimated following Gelman and Pardoe (2007), and account for the uncertainty in model parameter estimates, while treating all covariates as fixed.

For all four of the hierarchical community models, we assume that the species-specific effects for a given parameter are drawn from a common normal distribution, e.g., that $\alpha_{1,i} \sim N(\mu_1, \sigma_1^2)$ for parameter α_1 of species i , where the mean and variance of $\alpha_{1,i}$ are population-level hyper-parameters. This population-level distribution provides a summary of community response, both in terms of the mean behavior as well as the variability in behavior. The extent to which information is shared across species depends on both the degree of uniformity across the population, as estimated by the population-level parameters, and the amount of information available for each species. For species with little information, those with low detection probabilities, estimates will tend to shrink toward the population mean value. To account for the fact that the same sites are sampled in multiple years, we included a site level random effect, $\alpha_{0k} \sim N(0, \sigma_k^2)$. This approach is analogous to a ‘compound symmetric’ correlation structure for years within a site (Littell et al. 2006).

We fit our model using JAGS (Plummer 2003) called from R version 2.15.2 (R Development Core Team 2010) using the ‘jags’ function in package R2jags version 0.03-08 (Su

and Yajima 2012). For all models, we ran 3 Markov chains of length 400,000 with a burn-in period of 200,000 and 1/50 thinning. We provide all code for the models in the supplementary material. We assessed convergence using the Gelman-Rubin statistic (Gelman et al. 2004) and visual inspection of the chains, with both measures indicating a reasonable assumption of convergence. To assess consistency between our models and data, we used posterior predictive checks (Gelman and Hill 2007). We did not find any evidence of lack of fit in the models that we evaluated (Appendix 2). We provide details and an example for the posterior predictive checks in the supplementary material.

RESULTS

Experimental Approach

Overall.--Across all years (1993, 1995-1996, and 2003-2004) and treatments (Control, Wide and Narrow buffer), we had 28 species detected at least 10 times total for a total of 2064 detections (Table 1). A few species constituted the majority (60%) of the detections including the Pacific wren (*Troglodytes pacificus*), Pacific-slope flycatcher (*Empidonax difficilis*), chestnut-backed chickadee (*Poecile rufescens*), Wilson's warbler (*Cardellina pusilla*), Swainson's thrush (*Catharus ustulatus*), and American robin (*Turdus migratorius*). For reference, we provide the effect (95% credibility interval) of three riparian buffer treatments on detection and capture probabilities for all 28 species in Table S3 and S4.

The average riparian buffer was 13.1 (± 9.1 SD) and 29.9 m (± 15.5 SD) on the Narrow and Wide treatments, respectively, but we found considerable within-treatment variation (Table 2). In fact, the widest forested buffer on the Narrow treatment (25.5 ± 12.1 SD) overlaps with the narrowest buffer on the Wide treatment (21.7 ± 5.1 SD). In our “*covariate effects*” and “*buffer width thresholds*” analysis below, we took advantage of this variation in buffer width both within and among treatments to examine effect of buffer width on abundance and occupancy while ignoring treatment assignments (see the X axis in Figures 9 and 10 for the distribution of all site buffer widths). In general, the treatments resulted in greater shrub cover and number of deciduous and Douglas-fir trees in the riparian and fewer western hemlock and western red cedar trees 10 years post-harvest (Table 3) than the control.

Community responses.—We found broad overlap in the credible intervals associated with our estimates of total bird abundance for controls and treatments for the pre- and post-harvest time periods (Figure 2). Within sampling year, we found less variation in the mean point estimates of abundance among treatments relative to the uncertainty associated with those estimates (Figure 2). Note that the credible intervals are wide indicating uncertainty about parameter estimates and a lack of power to detect treatment effects. In general, avian abundance moved up and down between time periods similarly among all sites post-treatments (Figure 2). Across all years and treatments, mean estimates of species richness ranged from approximately 13-24 avian species with lower pre-harvest richness on all treatments. Estimates of post-harvest richness change little on Control sites relative to pre-harvest levels (Figure 3), while both treatments exhibit a similar 31-44% increase post-harvest (Figure 3). Richness estimates on both treatments continued to increase by about 1-2 species between the immediate post-harvest survey (slight credible interval overlap between treatments and controls) and the 10 year post-harvest survey (no credible interval overlap between treatments and control; Figure 3). Species similarity among treatments overlapped broadly before and after harvest (Figure 4). Site-level estimates of species local-extinction rates were almost identical between treatments and controls regardless of the time periods compared (Figure 5). Species turnover was also almost identical for the two buffer treatments and controls for all years compared except when comparing the pre-harvest sample to the 10 year post-harvest sample when there was little overlap in credible intervals between the Narrow treatment and the Control (Figure 5) and with much higher turnover on both treatments (63% and 74%) relative to the controls (29%).

Species responses. — Pre-harvest, species-level estimated probability of site occupancy was very similar for the control and each treatment (95% credible intervals for differences broadly overlap 0 for all species; Figure 6). Post-harvest, 7 and 21% of the species increased their probability of site occupancy (95% credible intervals associated with the probability of species occupancy did not overlap zero) in the short-term and 29 and 93% increased their probability of site occupancy in the long-term on the Narrow and Wide buffer treatment respectively (Figure 6). Probability of site occupancy did not decrease for any species (Figure 6). This increase in the probability of occupancy held for interior conifer forest species like the golden-crowned kinglet (*Regulus satrapa*) and for species associated with edge and more open habitats like the northern flicker (*Colaptes auratus*). We found no clear evidence for species-level differences (all credible

intervals overlapped zero) in abundance between buffer treatments and the Control for either time period assessed (Figure 6).

Moving Beyond the Experiment

Covariate effects.--When taking advantage of the existing variation in vegetation characteristics and buffer width among harvested sites only (excluding controls) and ignoring site treatment assignments (Wide vs. Narrow), we found no effect of vegetation (deciduous trees, Douglas-fir trees, western hemlock/red cedar trees, and shrubs) or buffer width covariates on species richness or total avian abundance (Figure 7). For buffer width, we found little (16%) overlap between total avian abundance and zero, providing some evidence (84%) for a positive effect of buffer width on avian abundance.

Nearly all credible intervals broadly overlapped zero for the relationship between individual species abundance/occupancy and either buffer width or the vegetation variables (Figure 8). The few relationships (8 out of 280) where credible intervals did not overlap zero were: 1) a positive effect of buffer width on chestnut-backed chickadee abundance, 2) negative effect of deciduous tree density on Pacific-slope flycatcher, chestnut-backed chickadee, golden-crowned kinglet, and dark-eyed junco abundance, 3) positive effect of Douglas-fir tree density on Steller's jay abundance, 4) negative effect of western hemlock and western red cedar density on Wilson's warbler abundance, and 5) a positive effect of shrub cover on warbling vireo occupancy (Figure 8).

Buffer width thresholds.--Again, taking advantage of the variability in average site buffer widths within and among treatments and ignoring treatment assignments, we compared species richness and total avian abundance across buffer widths (Figure 9). Averaged across all years post-treatment, richness was generally similar between various width buffers and Controls except for lower richness on a on a very narrow buffer and greater richness on a wider buffer (Figure 9). Abundance was less than controls on two relatively narrow buffers and greater than controls on one wider buffer (Figure 9). For all species associated with riparian habitats (Pacific-slope flycatcher, Pacific wren, black-throated gray warbler, and American robin; Figure 10), overlap occurred between the credible intervals between controls and all stands regardless of width. Although Pacific wren abundance point estimates for two relatively narrow treatments were

below the credible intervals of the Controls, their credible intervals overlapped those for controls.

DISCUSSION

Long- and short-term effects of buffer width – the experimental approach

Using an experimental approach, we found no evidence for a long- or short-term change in estimated total avian abundance among riparian buffer treatments, regardless of the year compared. Similarly, we did not find any site-level loss of species (local-extinction) due to buffer treatments. Instead, turnover in the avian community on both the Narrow and Wide treatments resulted in the addition of species (43-47% increase; Figure 5). As a result of this increase in richness on the two buffer treatments, treatments were more similar to each other in species composition than either was to the control. The increase in richness on the two treatments was manifested by greater odds of site occupancy for a number of species on the treatments post-harvest (Figure 6). Many species had twice the odds of occupying treatment sites compared to the control. Interestingly, for most species, strong evidence for an increase in probability of occupancy on treatments relative to the controls did not become evident until ~10 years post-harvest, suggesting that colonization was occurring over an extended period of time (compare the long- to short-term occupancy effects in Figure 6). The change in the avian community within the riparian buffers on the treatments post-harvest was driven by the colonization of early successional species such as spotted towhee (*Pipilo maculatus*) and song sparrow (*Melospiza melodia*) and edge species like the northern flicker and olive-sided flycatcher (*Contopus cooperi*) (Figure 6). The harvest resulted in more varied forest conditions relative to controls – the buffers contained forest, edge and early successional conditions - which, in turn, resulted in an increase in the detections of edge and open habitat species. The potential competitive interaction among the new species assemblages within riparian buffers remains unexplored.

All studies included in Marczak et al.'s (2011) meta-analysis were short-term (<5 years following forest harvest) and consequently, they recommend that the results be viewed with “caution”. This is the case because species may be lost or they may colonize riparian buffers

with increasing time since buffer establishment, a pattern that may not be evident in short-term studies (Marczak et al. 2010). For example, philopatric and territorial forest-associated species returning to their previous years' territory may pack into the remaining habitat in the forested buffer resulting in an increase in abundance immediately post-harvest but with a gradual reduction in density as birds sort out territorial boundaries. We found no short-term increase in avian abundance following our treatments and therefore no support for the packing hypothesis. Alternatively, one might predict delayed colonization or extinction within a buffer as the result of gradual changes in the buffer plant community. For example, edge effects created by clearcutting the forest adjacent to riparian buffers can penetrate as much as 40 m into buffers (Brosofske et al. 1997), resulting in greater risk of blow-down, larger quantities of downed wood, and other structural and compositional forest changes (Harper and Macdonald 2001, Hannon et al. 2002). Edge effects can continue to influence forest structure and composition for upwards of 15 years post-harvest (Harper and Macdonald 2001). Interestingly, in our study, species richness and probability of individual species occupancy continued to increase between the immediate post-harvest surveys and the 10 year post-harvest surveys with no similar evidence for local species extinction over the same time period. In addition, this pattern appeared to be driven primarily by the treatments and not by other structure or compositional changes within the buffer. Because the increase in species richness on buffer treatments was gradual and may well continue beyond the time frame of this experiment, the effect of treatment (buffer width) on species turnover did not become pronounced until 10 years post-harvest lending support to being cautious in assuming that short-term results are necessarily reflective of the long-term.

Moving beyond the experiment – the influence of buffer width and vegetation

Relatively few studies differentiate the effect of buffer width from the effect of vegetation composition and structure on the breeding bird community. Although we had clear differences between treatments in buffer width (see averages in Table 2), we also had considerable variability in buffer width within and among our treatments (range = 6.7 - 40.7 m; Table 2). This variability allowed us to move beyond site (stand) treatment assignments and our experimental approach to an analysis where we could examine the influence of buffer width and tree and shrub

characteristics on species abundance and occupancy (this analysis did not include controls). On the treated sites, we found weak evidence for a positive relationship between total avian abundance and buffer width was positive but weak (84% for a positive relationship; Figure 7). At the same time, we found almost no estimated effect of the other shrub and tree covariates on abundance suggesting that buffer width alone is responsible for nearly all of the positive patterns observed (Figure 7). Perry et al. (2011) examined both forest structure and buffer width on species occupancy in the southeastern U.S. and found that, for many species, both variables were important. However, they examined the structure of the surrounding forests (not that of the riparian buffer) on the avian community in the buffer. In our study, the forest adjacent to the riparian buffer was clearcut on all treatments and as a consequence, we examined forest composition/structure variables within the riparian buffer and not in the adjacent harvest unit. To understand how species richness and total abundance varied solely as a function of buffer width, we fit a model with a random effect for site but without treatment or covariate effects. We plotted these site estimates of buffer width and compared them to that of controls to determine if any thresholds existed in the association (Figures 9 and 10). These results suggest that there is no difference or greater species richness and abundance for forested buffers ≥ 21 m when compared to controls and there is some evidence for reduced abundance and richness on a few sites with buffers ≤ 12 m (Figure 9). Some sites with very narrow buffers (<12 m) appear to have similar total avian abundance and richness to controls suggesting considerable variation in avian response even at the narrowest buffer widths. Because we were unable to identify other vegetation covariates that might provide insight into this variation in response, we recommend research focused on identifying those mechanisms responsible for variation in narrow buffer effectiveness. This information can direct site-specific prescriptions for maintaining avian abundance and richness when narrow buffers are desired.

Riparian associates

When establishing buffer guidelines, agencies rarely differentiate between supporting organisms at their original abundance and simply maintaining the presence of a species (Marczak et al. 2010, Richardson and Thompson 2009). In addition, few studies have identified which species are more abundant in riparian zones when compared to adjacent uplands. In our previous

research (Pearson and Manuwal 2001), we identified “riparian associates” by comparing the relative abundance of all species in un-harvested riparian to upland habitats. This comparison identified four species that were more abundant in riparian habitats, the Pacific wren, Pacific-slope flycatcher, black-throated gray warbler and American robin (Pearson and Manuwal 2001). This result is supported, in part, by other studies (e.g., McGarigal and McComb 1992). The black-throated gray warbler, for example, forages and nests almost exclusively in deciduous trees or mixtures of deciduous and conifer trees (Morrison 1982, Guzy and Lowther 1997) which are most abundant in the riparian zone in this region (Swanson et al. 1982). Also, when compared to adjacent upslope conifer dominated habitats, Pacific-slope flycatchers in riparian habitats are more likely to attract mates, pair earlier, and have higher fecundity (Leu 2000). As a result, the riparian habitat is particularly important to these species. Despite the disproportionate use of riparian environments, we found no evidence that the Narrow or Wide buffer treatment reduced the abundance of these species relative to the controls (Figure 6). When attempting to identify buffer width thresholds for riparian associates, only the Pacific wren abundance demonstrated very weak evidence for reduced abundance on two of the Narrow sites (Figure 10). Our results suggests that the riparian buffer guidelines in the Pacific region are close to the minimum needed to maintain the abundance of riparian-associated birds but more than adequate to maintain the species on the landscape (especially when also considering the forested portions of the landscape).

Buffer guidelines

Are current riparian buffer guidelines adequate for maintaining riparian-associated species? In a quantitative review of riparian buffer width guidelines and regulations from Canada and the United States, average buffer width varied from 15.1 - 29.0 m (Lee et al. 2004). This variation was driven by the water body type (lake, stream, wetland, etc.) being buffered and its size and the average width varied geographically, with larger buffers in Canada and particularly narrow buffers in the Southeastern United States (Lee et al. 2004). In addition, buffer width guidelines are likely to vary depending on the biotic and abiotic focus of the guideline or political considerations. Although forested buffers can be established to maintain species associated with aquatic and riparian conditions (e.g., Wesche et al. 1987), other factors such as minimizing sedimentation (Steedman and France 2000), moderating stream temperature and light penetration

(Johnson and Jones 2000), and maintaining riparian vegetation (Harper and MacDonald 2001) and input of large organic debris (Fetherston et al. 1995) may be dominant factors when establishing buffer width guidelines. In the Pacific region where our research was conducted, average buffer width on small and large permanent streams ranged from 22.7-24.3 m (Lee et al. 2004). These guidelines for this region are within the range of buffers included in our study. They are also within a range where we observed no evidence (>12 m) for avian species loss or for a decline in species abundance (including that of riparian associated species). Based on our results, buffers in this range are likely to maintain or increase avian species richness and abundance and not result in site-level species extinction.

In contrast to our results, several authors have suggested that buffers ≥ 100 m are needed to maintain the complete pre-harvest avian community (Tiquet et al. 1990, Hodges and Kremetz 1996, Kilgo et al. 1998, Lambert and Hannon 2000, Shirley and Smith 2005, Perry et al. 2011) while others have suggested that buffers ≥ 60 m or even narrower are needed to maintain the pre-harvest avian community (Darveau et al. 1995, Hagar 1999). The relationship between buffer width and avian abundance or species composition appears to vary geographically, and it appears that wider buffers are needed in eastern deciduous forests than in the relatively wet coastal coniferous forests.

Landscape context and study limitations

Landscape context beyond the riparian buffer can also influence abundance of species within the buffer (Lambert and Hannon 2000, Hannon et al. 2002, Martin et al. 2006) and ultimately might influence buffer width guidelines. For example, characteristics of the landscape matrix, particularly amount of urban development surrounding a forest, can be better predictors of avian community composition than forest buffer width (Miller et al. 2003, Rodewald and Bakermans 2006). Our research was conducted in a landscape with little urban development. Our study sites were embedded in large contiguous blocks of commercial or state forest properties (primarily in blocks $> 30,000$ ha). These large blocks consist of a tapestry of stands differing in size and age but generally composed of stands where the dominant trees range from 0-60 years in age and nearly all stands on the landscape had been harvested 1-3 times previously. Adjacent to these very large blocks of commercial/state timberlands were rural/agricultural lands at lower

elevations and hundreds of thousands of hectares of forested federal lands (National Forest and Parks) at upper elevations. Other studies have classified landscapes similar to ours as “wildlands” (Hepinstall et al. 2008) where the human footprint is relatively low (Leu et al. 2008). In this context, landscape structure (composition and configuration) typically explains a relatively small amount of the variation in avian species abundance and species’ abundances are generally greater in more heterogenous landscapes (McGarigal and McComb 1995). Although we do not evaluate the effect of landscape context on our observed treatment effects, it is important to consider that the landscape backdrop was relatively consistent among our study sites, that all sites had to meet specified criteria for inclusion, and that the assignment of treatments and controls was random. Finally, we included a random effect for “site” in our model that can incorporate heterogeneity resulting from unmodeled landscape-scale variation. Even though we consider it unlikely that a landscape scale factor is influencing the observed results, it is important to consider the landscape context of this experiment when thinking about the application of our results to other areas. For example, riparian zones appear to be more influential in relatively arid environments. In arid regions of the western United States, riparian habitats make up less than 1% of the landscape, yet 82% of all avian species annually breeding in northern Colorado occur in riparian vegetation (Knopf 1985), and 51% of all avian species in southwestern states are completely dependent upon this habitat type (Johnson et al. 1977). In this context, we might expect very different influences of buffer width on species composition, abundance, and local extinction probabilities.

We did not evaluate the effects of riparian buffers on avian reproduction and survival and the potential exists that birds within narrow riparian buffers or forest fragments may not reproduce as successfully as those located in large blocks of intact forests (Robbinson et al. 1995, Vander Haegen and Degraaf 1996). This relationship between reduced fecundity and habitat fragmented may not hold in all western riparian forests (Tewksbury et al. 1998, Davidson and Knight 2001). Geographical differences may be associated with the occurrence of brown-headed cowbirds (*Molothrus ater*), a brood parasite that is common in eastern U.S. forests but rarely encountered in some western forests (Carey et al., 1991; Bryant et al., 1993; Schieck et al., 1995). In addition, abundance of nest predators such as crows (*Corvus* spp.) and jays (*Cyanositta*) are not related to patch size in the western United States (Lehmkuhl et al., 1991; Schieck et al., 1995; Tewksbury et al., 1998) although they do prefer fragmented habitats

(Marzluff et al., 2004) and respond favorably to human habitation (Marzluff and Netherlin 2006). The only corvid detected frequently enough to assess treatment effects in our study was the Steller's jay (*Cyanocitta stelleri*). Abundance of Steller's jays on treatments did not differ from Controls although it was twice as likely to occupy the Wider buffer treatment compared to the Control, which could result in higher nest predation within wide buffers. Without data on nest success or other vital rates, we cannot evaluate the potential influence of this nest predator on fecundity.

Conclusion

We conducted a large-scale manipulation using a BACI experimental design where we accounted for time lag-effects and inherent variability among treatments through replication and by selecting sites from similar managed forest landscapes and by randomly assigning treatments and controls. Finally, we used recent statistical developments that allow us to address issues of detectability among treatments and years by using replicated counts within season. Depending on the landscape context, land owner, and individual forester, considerable variability in how the boundaries riparian buffers are designated on-the-ground is likely. This variation was apparent within and among our treatments. This variability provided an opportunity to examine the relative effect of buffer width as a quasi-continuous variable to identify potential thresholds on avian abundance and occupancy. Taken together, our results suggest that local site-level extinction does not occur regardless of the buffer width that we examined, that buffer treatments increased species richness regardless of their width and that birds continued to colonize riparian buffers for up to 11 years post-harvest. We found only weak evidence for a positive effect of buffer width on total avian abundance and some suggestion that some very narrow buffered sites have lower total avian abundance and richness than controls.

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Table 1. Number of detections by species, year, and riparian buffer treatment, western Washington, USA, 1993, 1995-1996, and 2003-2004. C = Control, N = Narrow, and W = Wide prescriptions, respectively.

Species	Code	1993			1995/1996			2003/2004			TOTAL
		C	N	W	C	N	W	C	N	W	
Rufous hummingbird <i>Selasphorus rufus</i>	RUHU	1	1	3	5	10	12	5	24	18	79
Red-breasted sapsucker <i>Sphyrapicus ruber</i>	RBSA	0	0	1	0	3	6	0	13	16	39
Hairy woodpecker <i>Picoides villosus</i>	HAWO	0	2	1	13	15	8	6	11	8	64
Northern flicker <i>Colaptes auratus</i>	NOFL	0	0	0	0	1	0	0	6	6	13
Olive-sided flycatcher <i>Contopus cooperi</i>	OSFL	0	0	0	0	7	4	0	6	3	20
Hammond's flycatcher <i>Empidonax hammondi</i>	HAFL	0	1	1	3	5	7	2	0	1	20
Pacific-slope flycatcher <i>Empidonax difficilis</i>	PSFL	21	21	11	44	50	34	49	33	32	295
Hutton's vireo <i>Vireo huttoni</i>	HUVI	0	0	0	2	4	1	1	3	0	11
Warbling vireo <i>Vireo gilvus</i>	WAVI	2	0	0	5	20	16	2	17	3	65
Steller's jay <i>Cyanocitta stelleri</i>	STJA	3	1	0	6	7	6	5	18	23	69
Chestnut-backed chickadee <i>Poecile rufescens</i>	CBCH	21	25	17	25	18	20	32	31	28	217
Brown creeper <i>Certhia americana</i>	BRCR	3	3	2	6	1	5	20	0	1	41
Winter wren <i>Troglodytes troglodytes</i>	WIWR	21	26	18	44	52	38	52	41	34	326
Golden-crowned kinglet <i>Regulus satrapa</i>	GCKI	9	11	7	15	2	2	29	4	8	87
Varied thrush <i>Ixoreus naevius</i>	VATH	0	2	0	3	0	1	11	0	2	19
Swainson's thrush <i>Catharus ustulatus</i>	SWTH	4	4	3	14	8	13	20	18	21	105
American robin <i>Turdus migratorius</i>	AMRO	7	0	1	12	22	13	11	16	14	96

Cedar waxwing <i>Bombycilla cedrorum</i>	CEWA	0	0	0	0	7	4	1	17	6	35
Hermit/Townsend's warbler <i>Dendroica occidentalis/townsendi</i>	HETO	3	4	1	3	0	1	0	0	0	12
Black-throated gray warbler <i>Dendroica nigrescens</i>	BTYW	3	2	1	4	0	0	2	4	1	17
Macgillivray's warbler <i>Oporornis tolmei</i>	MGWA	0	0	0	0	0	0	1	11	4	16
Wilson's warbler <i>Wilsonia pusilla</i>	WIWA	10	4	7	26	15	28	22	38	29	179
Western tanager <i>Piranga ludoviciana</i>	WETA	1	0	2	2	4	12	6	13	11	51
Spotted towhee <i>Pipilo maculatus</i>	SPTO	0	0	0	0	0	0	0	15	3	18
Song sparrow <i>Melospiza melodia</i>	SOSP	0	0	0	0	26	11	0	31	5	73
Dark-eyed junco <i>Junco hyemalis</i>	DEJU	0	0	0	5	27	11	0	1	1	45
Black-headed grosbeak <i>Pheucticus melanocephalus</i>	BHGR	0	0	0	3	9	2	2	12	11	39
Evening grosbeak <i>Coccothraustes vespertinus</i>	EVGR	1	1	0	0	1	4	3	2	1	13
TOTAL		110	108	76	240	314	259	282	385	290	2064

Table 2. Summary of post-treatment riparian buffer widths by treatment type (n=5 for each treatment type), western Washington, USA, 1993, 1996, and 2004.

Site Name	Treatment	Year	Average (m)	Standard deviation
Blue Tick	Wide	1996	32.0	13.9
Blue Tick	Wide	2003	36.1	22.1
Eleven 31	Wide	1996	21.9	10.8
Eleven 31	Wide	2003	21.9	10.4
Ms Black	Wide	1996	31.0	10.7
Ms Black	Wide	2003	28.1	9.3
Ryderwood 860	Wide	1996	21.7	5.1
Ryderwood 860	Wide	2003	21.7	5.1
Side Rod	Wide	1996	34.4	14.1
Side Rod	Wide	2003	40.7	24.9
	All wide buffers		29.9	15.5
Eleven 32	Narrow	1996	8.8	4.0
Eleven 32	Narrow	2003	6.7	5.2
Kapowsin	Narrow	1996	14.5	4.0
Kapowsin	Narrow	2003	6.7	4.7
Night Dancer	Narrow	1996	10.4	3.8
Night Dancer	Narrow	2003	9.3	5.4
Potpourri	Narrow	1996	25.5	12.1
Potpourri	Narrow	2003	21.3	6.7
Simmons Creek	Narrow	1996	15.6	8.8
Simmons Creek	Narrow	2003	8.7	5.4
	All narrow buffers		13.1	9.1

Table 3. Summaries (average and standard error) of four vegetation covariates, percent shrub cover and total number of stems >10 cm in diameter for all deciduous trees combined, Douglas-fir, and western hemlock and western red cedar combined, by treatment type (n=5 for each treatment type), western Washington, USA, 1993, 1996, and 2004.

Treatment and year	Shrub cover	SE	Deciduous	SE	Douglas-fir	SE	Western hemlock/ western red cedar	SE
Control 1993	15.7	2.8	97.8	25.8	13.8	1.0	57.6	22.7
Control 1996	19.8	3.9	74.4	23.1	17.4	3.3	80.8	23.2
Control 2004	4.3	1.9	61.2	36.0	26.4	5.2	121.4	16.1
Narrow 1993	14.0	2.9	78.4	10.6	22.4	6.6	79.8	22.8
Narrow 1996	18.0	4.1	99.6	14.3	31.4	16.9	73.4	18.9
Narrow 2004	6.5	2.0	89.4	15.3	44.8	13.0	85.4	22.6
Wide 1993	7.8	3.4	82.8	33.2	29.6	9.2	101.4	25.4
Wide 1996	6.8	3.3	68.8	31.1	11.8	1.9	97.8	18.3
Wide 2004	9.5	1.4	148.8	10.4	42.6	9.5	86.2	15.2

Figure 1. Distribution of study sites and treatments in western Washington, USA.

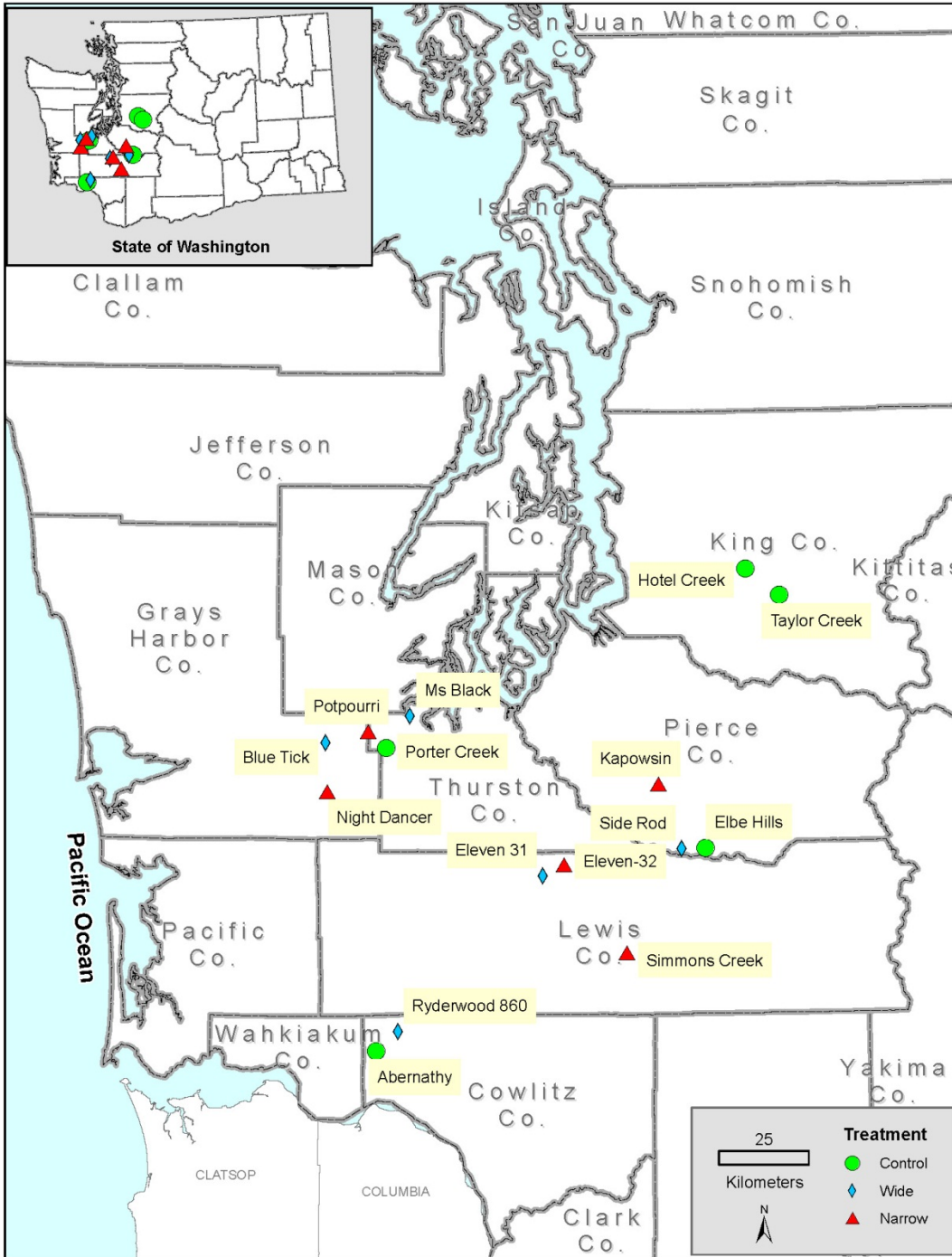


Figure 2. Estimated total number (95% credible interval) of birds of all species per point count station by treatment (C, Control; N, Narrow; and W, Wide) in western Washington, USA, 1993 (pre-harvest), 1995-1996, and 2003-2004. Each treatment had 5 experimental units (n=15). Estimates were corrected for species-specific detection. In some instances, 95% CRI extend beyond the range of the y-axis.

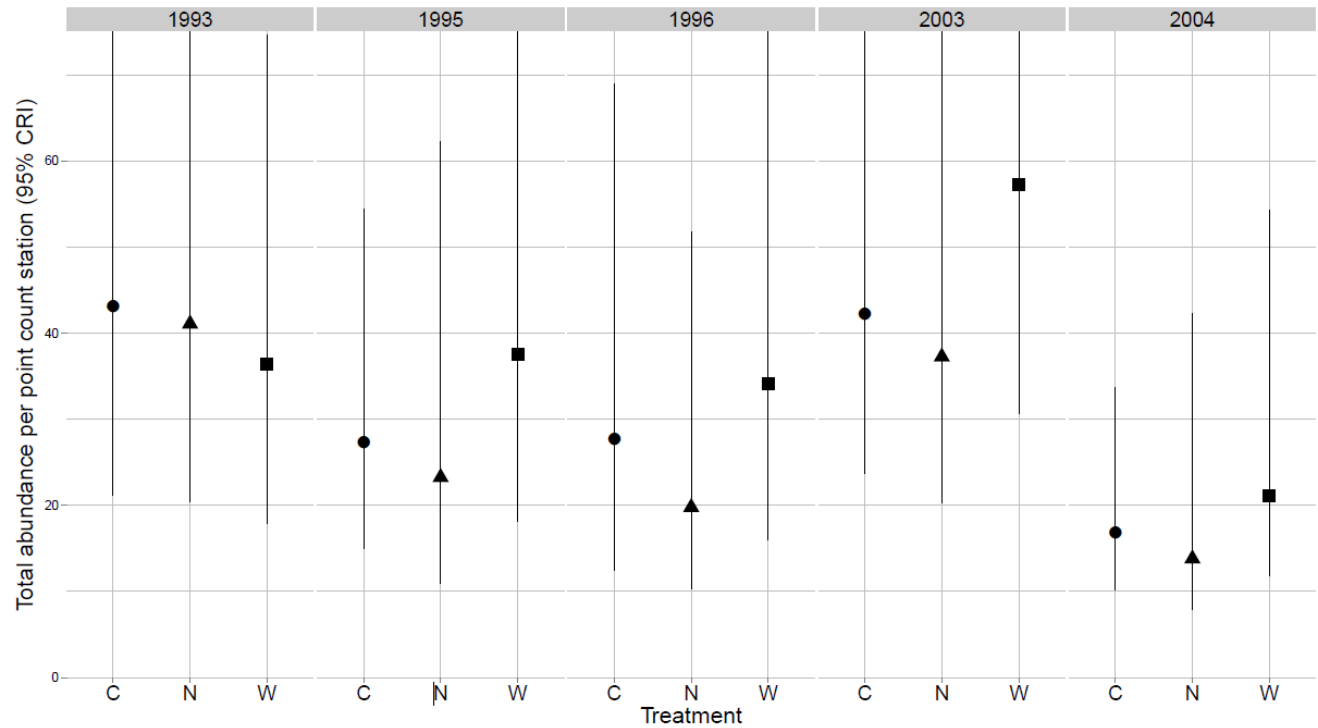


Figure 3. Estimated median number of species (95% credible interval) by year and treatment (C, Control; N, Narrow; and W, Wide) in western Washington, USA, 1993 (pre-harvest), 1995-1996, and 2003-2004. Each treatment had 5 experimental units (n=15).

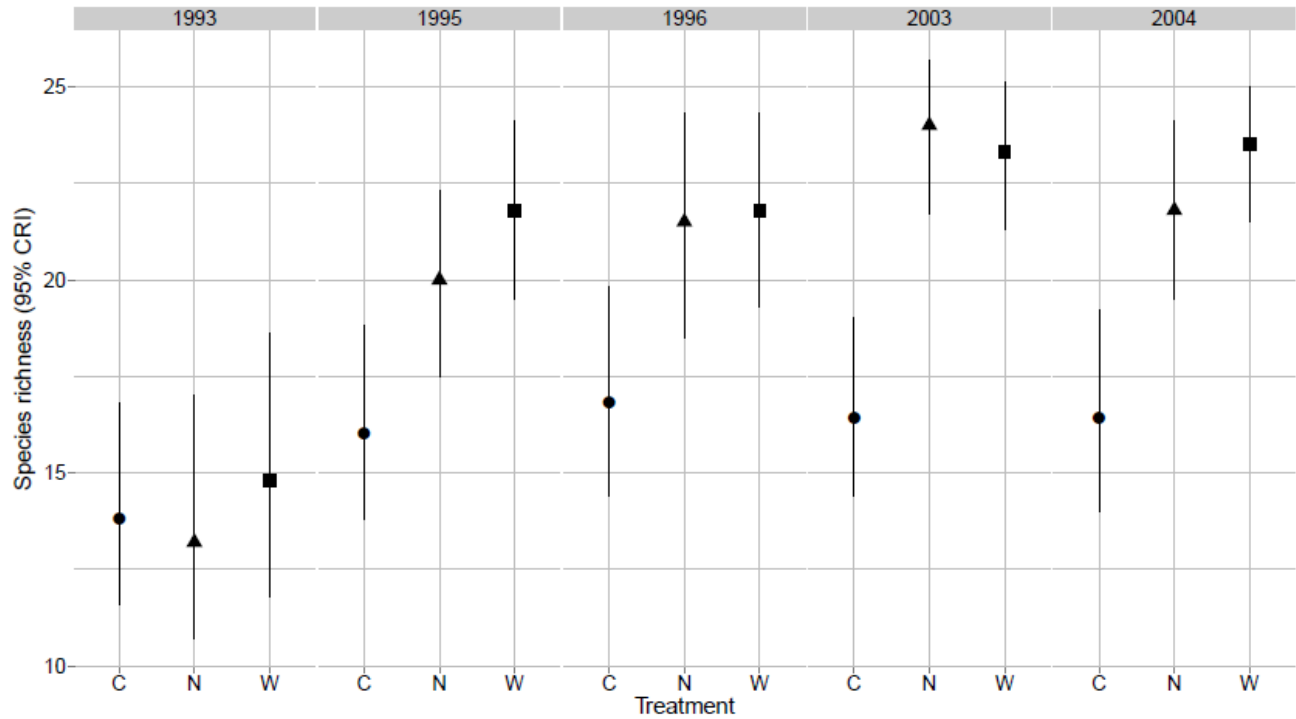


Figure 4. Estimated annual median species similarity (95% credible interval) by year and treatment (C, Control; N, Narrow; and W, Wide) in western Washington, USA, 1993 (pre-harvest), 1995-1996, and 2003-2004. Each treatment had 5 experimental units (n=15). Species similarity is an estimate of the percent of species shared by two treatments in a given year.

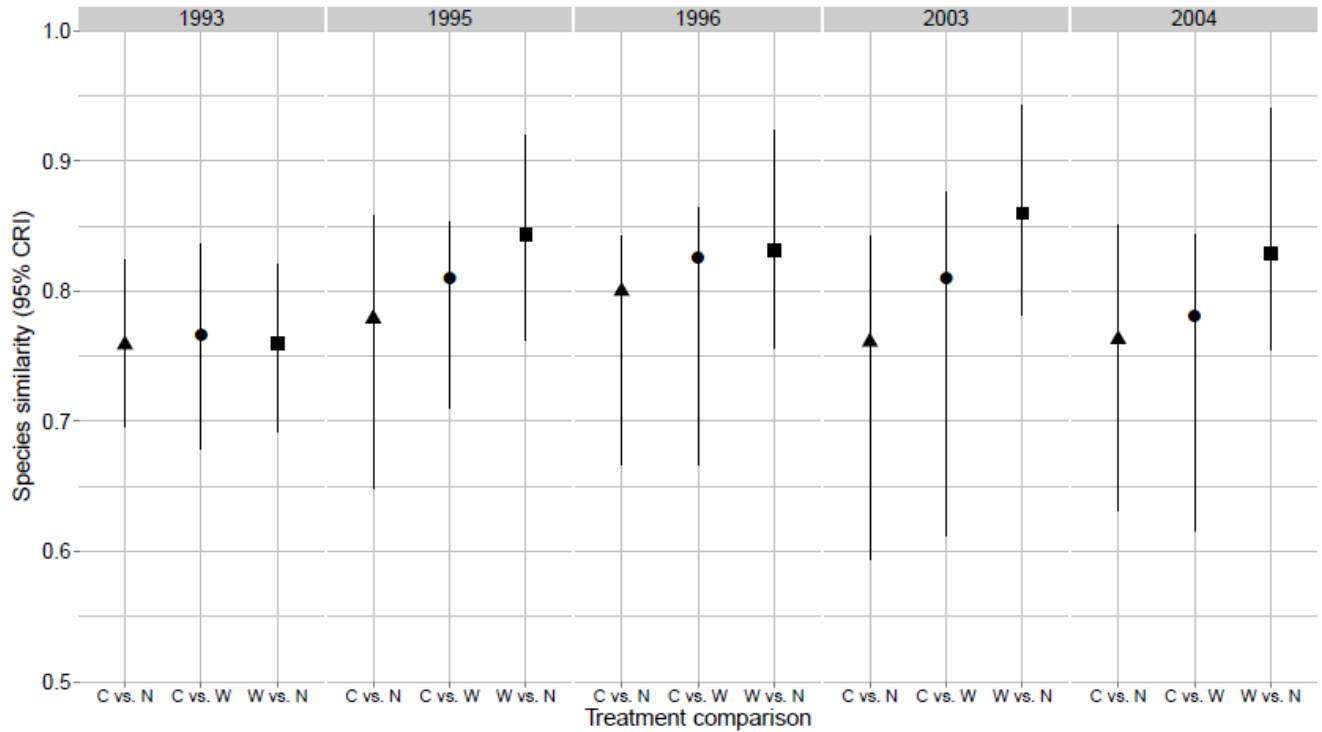


Figure 5. Estimates (95% credible interval) of local extinction and turnover probabilities between pairs of years by treatment (C, Control; N, Narrow; and W, wide) in western Washington, USA, 1993 (pre-harvest), 1995-1996, and 2003-2004. Each treatment had 5 experimental units (n=15). Turnover is the probability that a species selected at random from a treatment at time t is a “new” species. Local-extinction is the probability that a species that occupied a treatment in time t did not occupy the treatment in time $t + 1$.

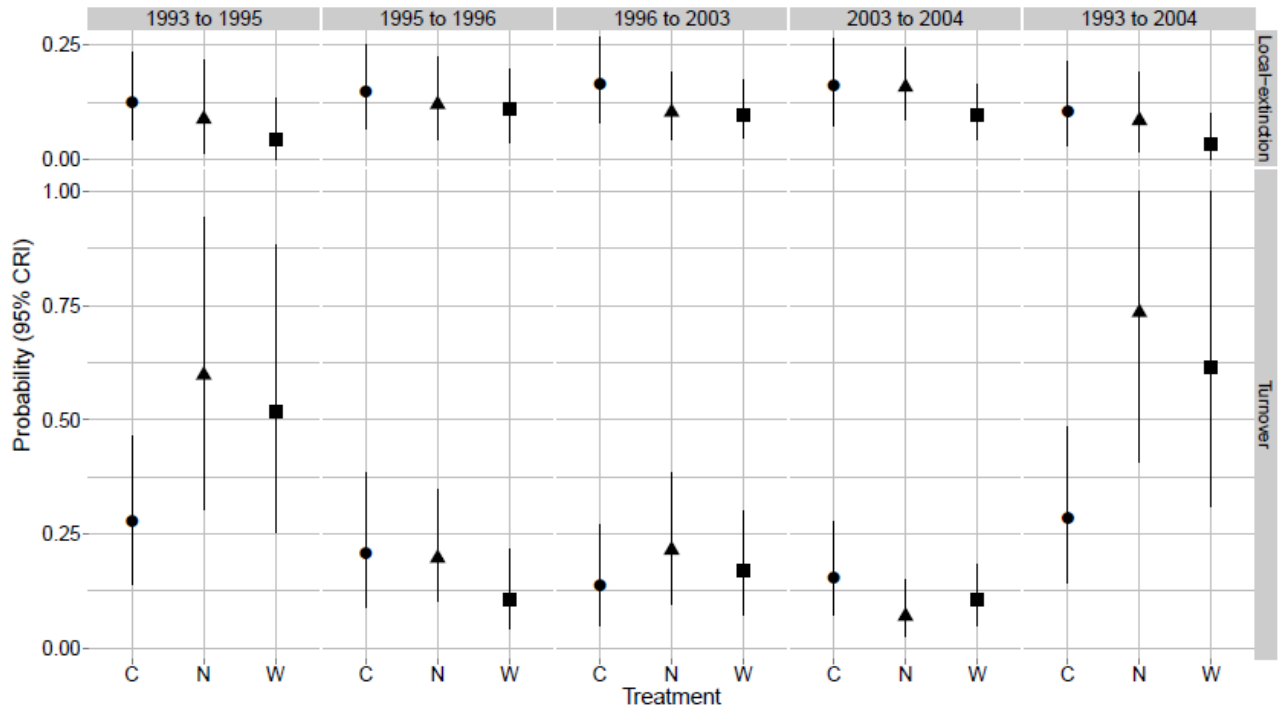


Figure 6. Contrasts (95% credible interval) in the probability of occupancy (top) and abundance (bottom) between the control and each treatment (wide and narrow forested riparian buffers) before harvesting, immediately following, and 10 years post in western Washington, USA, 1993(pre-harvest), 1995-1996, 2003-2004. A point estimate of 1 suggests that a given species has ~2.7 times greater odds to occupy the treatment as the control or is 2.7 times as abundant on the treatment than the control. A solid symbol indicates 95% CRI do not overlap 0; an open symbol indicates that the 95% CRI does include 0. Species acronyms are provided in Table 2.

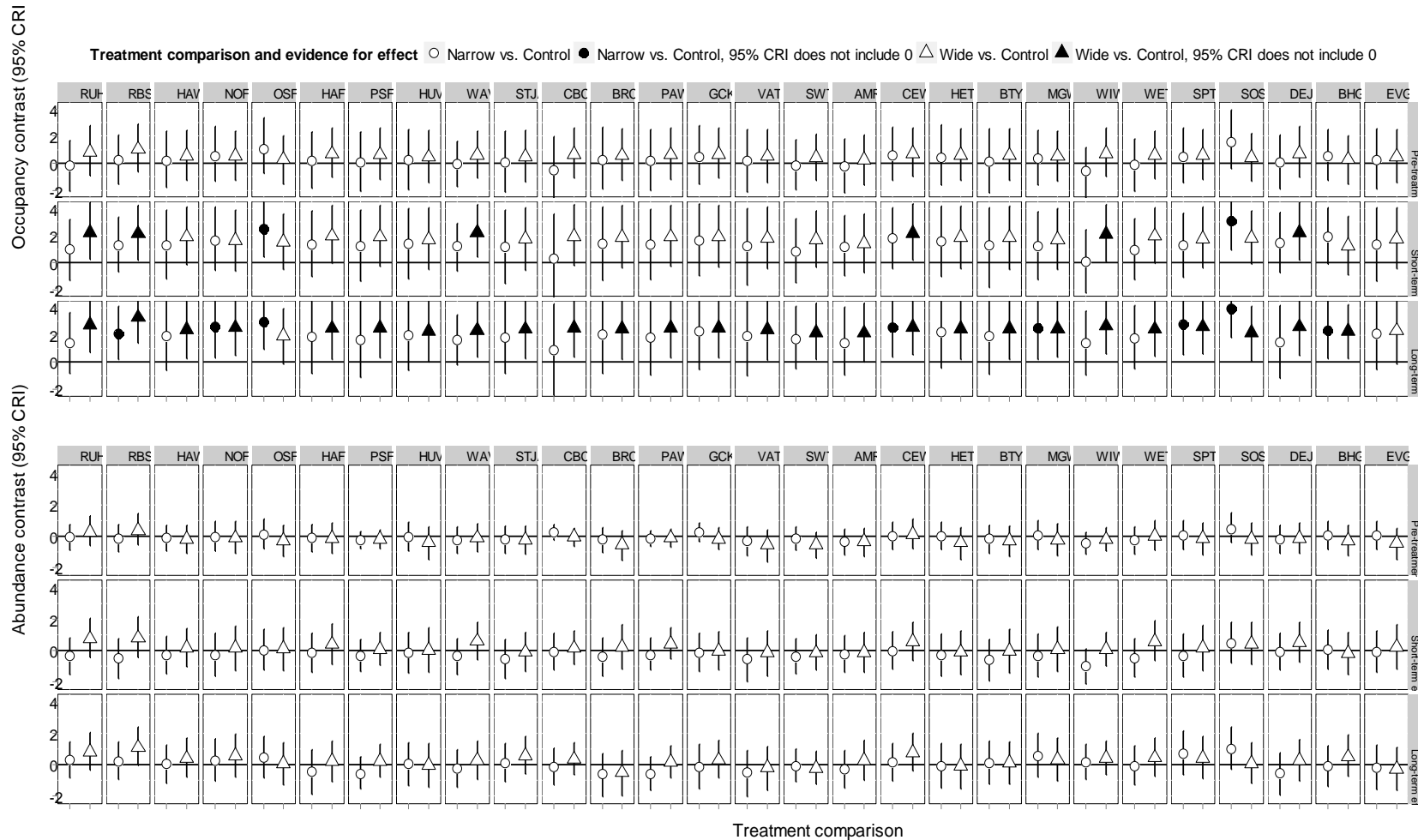


Figure 7. Average (95% credible interval) predicted effect (while holding the other 4 covariates at their mean values) of each vegetation (trees and shrubs) and buffer width covariate on species richness (A) and total bird abundance (B).

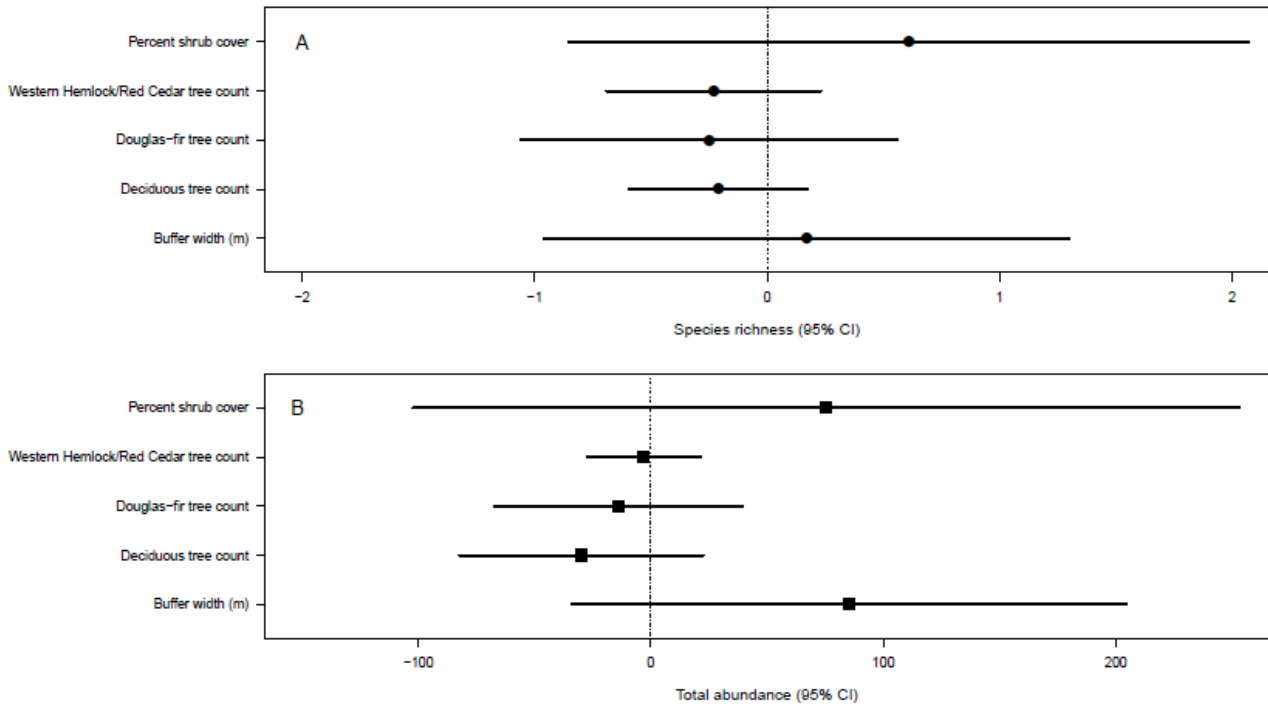


Figure 8. Effect (95% credible interval) of vegetation (shrub and tree abundance) and buffer width covariates on the probability of species occupancy (circles) and abundance (triangles). This analysis disregards treatment assignments and takes advantage of the variation in the covariates within and among the two buffer treatments to examine their relative effect on site level occupancy. A solid symbol indicates 95% CRI do not overlap 0; an open symbol indicates that the 95% CRI does include 0. Bird species acronyms are provided in Table 2.

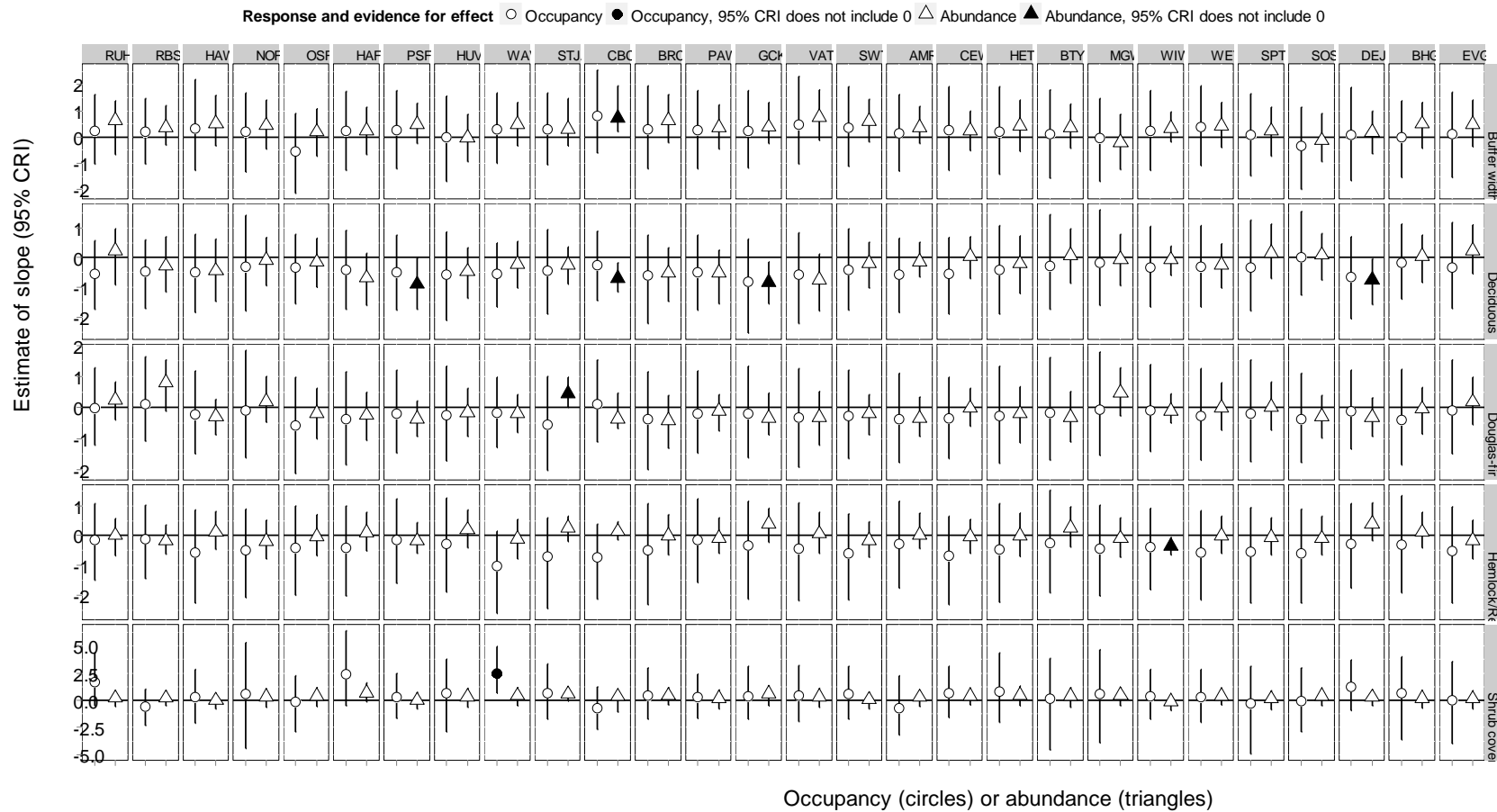


Figure 9. Estimates (95% confidence interval) of site level species richness (A) and total abundance (B) as functions of site specific buffer width. We used the variation in buffer width across sites to identify potential buffer width thresholds. Control site species richness and abundance are provided on the right sides (triangle) of both graphics. Estimates are calculated from the model based on the treatment design. We calculated mean richness values for each site and plotted these by buffer width. Intervals are not credibility intervals, but rather confidence intervals. Estimates for all sites were averaged across 1995-2004. Horizontal lines extending from the upper and lower bounds of the confidence intervals for the control sites are provided as reference lines.

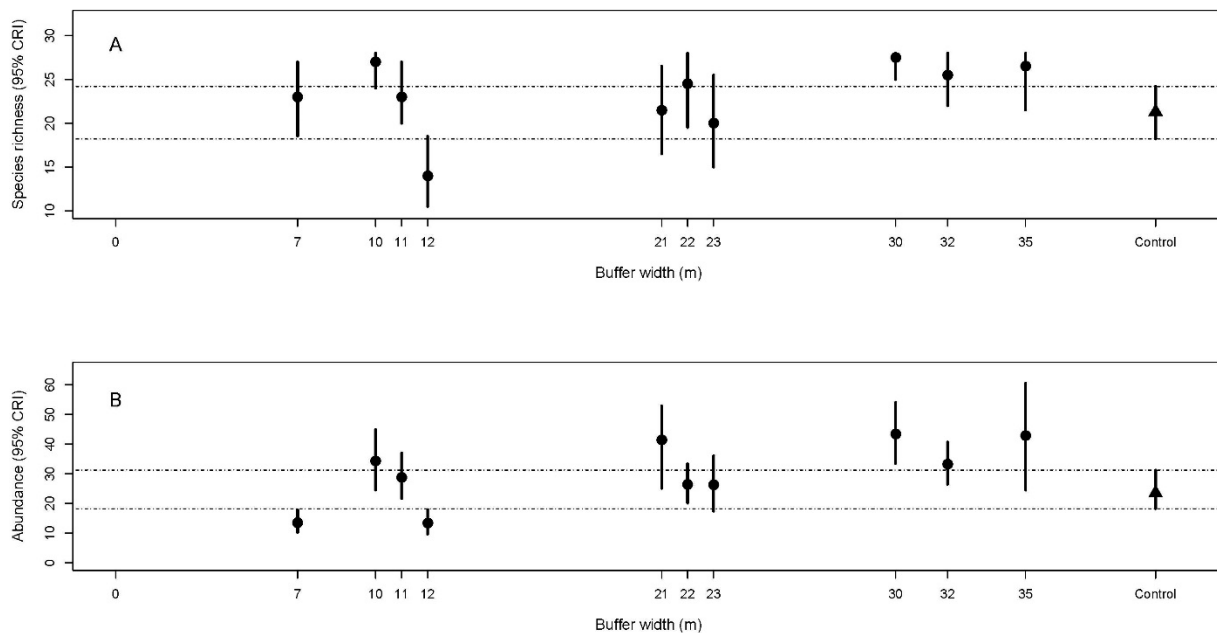
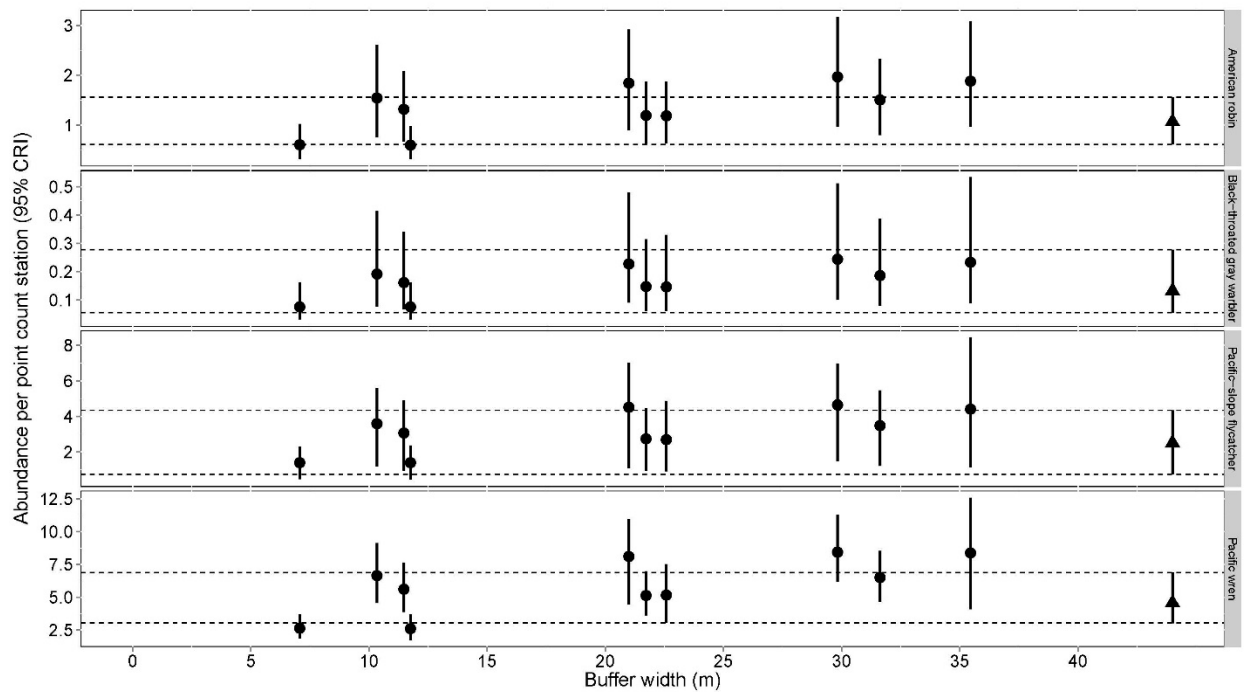


Figure 10. Site level abundance (95% confidence interval) for the four species previously identified in Pearson and Manuwal (2001) as riparian associates. We used the variation in buffer width across sites to identify potential buffer width thresholds. Control site species richness and abundance are provided on the right sides (triangle) of both graphics. Estimates are calculated from the model based on the treatment design. We calculated mean richness values for each site and plotted these by buffer width. Intervals are not credibility intervals, but rather confidence intervals. Estimates for all sites were averaged across 1995-2004. Horizontal lines extending from the upper and lower bounds of the confidence intervals for the control sites are provided as reference lines.



Supporting Information

Additional supporting information may be found in the online version of this article.

Text S1: R code and data for the MCMC implementation of the hierarchical community model and average predictive comparisons of species richness, western Washington, USA, 1993-2004.

Text S2: Posterior predictive checks (Bayesian p-values) to assess goodness of fit for Bayesian models, western Washington, USA, 1993-2004.

Table S3: Median effect (95% credibility interval) of three riparian buffer treatments on detection probabilities for 28 species, western Washington, USA, 1993, 1995-1996, and 2003-2004. Treatment effects were averaged across all 5 years.

Table S4: Median effect (95% credibility interval) of three riparian buffer treatments on capture probabilities for 28 species, western Washington, USA, 1993, 1995-1996, and 2003-2004. Treatment effects were averaged across all 5 years.



P.O. Box 1010
Chehalis, WA 98532
Phone (360) 388-7074
info@wafarmforestry.com
www.wafarmforestry.com

January 21, 2015

Forest Practices Board
c/o Department of Natural Resources
Forest Practices Division
PO Box 47012
Olympia WA 98504-7012

(via electronic transmittal to forestpracticesboard@dnr.wa.gov)

Dear Board Members:

The Washington Farm Forestry Association (WFFA) is a membership based non-profit organization that represents approximately 1300 tree farming families that collectively own about 150,000 acres of forest land in Washington State. Our objectives include educating small landowners about improved management of forest land, representing small forest landowners in the legislative process and by participation in Adaptive Management through CMER, science, and Policy, and educating the public on the contribution of small forest landowners to the environment and rural economies in Washington.

WFFA respectfully requests inclusion of an agenda item for the February 10, 2015 Forest Practices Board meeting. For the last year, WFFA has been working within the forest landowner community and with external scientists to develop an alternate plan template for RMZs along typed waters. WFFA requests that the Board initiate the Adaptive Management process and direct CMER and Policy to review the proposed alternate template.

In order to facilitate the Board's understanding of our request and the role of the Adaptive Management program, WFFA requests 15 minutes to present a summary of the template and answer any questions the Board members may have.

As the Board members are aware, the Adaptive Management Program is an integral part of the Forest Practices Habitat Conservation Plan (FP HCP) and the Forest Practices Rules. Adaptive Management is the method agreed on by the stakeholders to examine alternative strategies for meeting measurable biological goals and objectives. (FP HCP at 173; WAC 222-12-045(1)). The Implementation Agreement for the FP HCP requires the stakeholders to use the Adaptive Management Program to determine if and when it is necessary or advisable to adjust rules and guidance to achieve the goals of the Forests & Fish Report. (IA at §10.1; WAC 222-10-045(1)). The Board may also use the Adaptive Management Program to adjust rules and guidance to further the purpose of the Forest Practices Act. (WAC 222-08-160(2)).

The template is appropriate for review by the Adaptive Management Program because it is a modification to improve forest practices management and aquatic resource protection. (Board Manual, Section 22 at M22-8). Templates are discussed in both Forests & Fish and in rule. Forests & Fish anticipated that generic templates, such as the proposal developed by WFFA, would be developed for planning situations of differing levels of complexity. (Forests & Fish Report, Appendix H at p. 59 (h); WAC 222-12-0403(3)). As a participating representative for small forest landowners, WFFA believes existing science supports the

proposed template and as a participant, requests the Board initiate Adaptive Management review of the proposal. *See* Board Manual at M22-8; WAC 222-12-045(2)(d)(i).

WFFA is not requesting a Board vote to approve the template, but is asking the Board to forward the attached proposal initiation document, template, and supporting documentation to the Adaptive Management Administrator to initiate the process required by Part 3 of Board Manual Section 22 (August 2013) and Appendix L of the Forests & Fish Report (Appendix B to the Forest Practices HCP). *See* RCW 76.09.370(3), (6); WAC 222-12-045(2).

Under the Adaptive Management process, the Board sets priorities for action. (WAC 222-12-045(2)(b)(iv); Appendix L at L.2.(a); Board Manual at M22-8). If the Board accepts Adaptive Management review of the template, it will first be evaluated for the need for scientific review by CMER. (WAC 222-12-045(2)(b)(i), (d)(ii)-(v); L.2.(b); M22-10). CMER will report its results to Policy, which will use the CMER findings to make specific recommendations to the Board. (WAC 222-12-045(2)(b)(ii), (d)(vi); L.4(a); M22-10). The Board then makes a final determination. (WAC 222-12-045(2)(d)(vii); L.2.(a); M22-14).

WFFA acknowledges that CMER and Policy continue to have full agendas, and in recognition of this, requests that the Board direct evaluation of the template proposal within nine months. If workload priorities prevent CMER and Policy from completing the Adaptive Management process within nine months, WFFA requests that the timeline be reviewed and an alternate timeline proposed at the November Board meeting.

The Legislature recognized the value of alternate plans to balance its objectives of sustainable forestry and to protect the environment. (RCW 76.09.010, 76.09.368, 76.13.100). It required the Board to consult with the small forest landowner office to develop alternate approaches that meet the public resource protection standard while lowering the overall cost of regulation. (RCW 76.09.368). Alternate plans are permitted where the proposed activity has a relatively low impact on aquatic resources, meets the resource protection standards, and lowers the cost of regulation for small forest landowners. (RCW 76.09.368, 76.13.100).

Our proposed Alternate Plan template responds to this legislative intent by proposing alternate harvest restrictions for riparian management zones (RMZs) along typed waters. The template is designed to provide protection of RMZ functions at least equal in effectiveness to those in existing rules, meet current performance standards, and support economic viability of small forest landowners. WAC 222-12-0401(6).

Although small forest landowners can propose alternate plans for any proposed forest practices, (WAC 222-12-040 through -0404 and Section 21 of the Board Manual), the Department of Natural Resources, through its Small Forest Landowner Office, has identified certain situations where more management flexibility is appropriate. Currently, there are two alternate plan templates and five scenarios where site specific management flexibility may be needed, including riparian hardwood management, overstocked stands, forest health, and seasonal streams. These template alternate plans ensure consistency and compliance with best available science in forest practices on small forest landowner property. They also provide regulatory certainty and minimize the regulatory costs which disproportionately impact small forest landowners. After careful consideration and development, WFFA proposes this template to fulfill an additional area where management flexibility is appropriate to meet protection standards but reduce regulatory impact.

WFFA developed the template in consultation with Dr. Douglas Martin, a fish biologist with Martin Environmental and an active member of the adaptive management scientific committee. Dr. Martin used the best available science to develop a template that meets or exceeds the standards in existing rules while decreasing the regulatory burden on small forest landowners. His scientific justification is documented in the accompanying Attachment 3 for the Board members' reference.

In order to ensure our template was based on sound science, we solicited technical review of Dr. Martin's scientific justification by Dr. Peter Bisson, a retired USFS fish biologist. We included Dr. Bisson's commentary in its entirety in Attachment 4. As Dr. Bisson indicates, templates are best addressed through application of the adaptive management process. Dr. Bisson suggests "a dedicated monitoring program that would yield data for various functions from a variety of sites, over an extended time period." His recommendations, as well as Dr. Martin's, are included in the Proposal Initiation document.

WFFA is confident that the proposed template is based on the current best-available science *and* addresses the uncertainties associated with implementation of any adaptive management protocols through monitoring. However, our objective in the adaptive management process is to gain more insights from the variety of stakeholder perspectives and expertise, suggest appropriate changes, and improve the template to ensure it meets the Legislative objectives and the Forest Practices HCP. Following completion of the review by CMER and Policy and any appropriate revisions to the template, WFFA anticipates the template will be brought back to the Board for review and adoption, based on Policy's recommendation.

Our goal in developing this template is to provide more options for ensuring the long-term economic viability of small forest landowners, thereby improving their ability to remain on the land and keep trees growing in Washington. Consistent with the balance inherent in the Forest Practices Act, the template also protects habitat and water quality consistent with our long-term view of forest management and its role in supporting rural community stability and quality of life for all Washingtonians. WFFA believes this proposal meets these goals, and looks forward to working with the members of CMER and Policy to improve the template to meet all stakeholder needs. Moreover, we hope the pending process will serve as a testament to the cooperative spirit that led our predecessors to include adaptive management as part of the original TFW and FFR agreements.

Thank you in advance for your consideration of our request to initiate Adaptive Management review of our proposed alternate plan template.

Sincerely,



Elaine Oneil, PhD
Executive Director
Washington Farm Forestry Association

Encl:

- Attachment 1: Proposal Initiation Document
- Attachment 2: Template including riparian function assessment
- Attachment 3: Scientific Justification
- Attachment 4: Peer Review Comments



P.O. Box 1010
Chehalis, WA 98532
Phone (360) 388-7074
info@wafarmforestry.com
www.wafarmforestry.com

Attachment 1:

Proposal Initiation Document, WFFA request to the Forest Practices Board, February 10, 2015

The Washington Farm Forestry Association (WFFA) Alternate Plan Template proposal (Attachment 2) details alternative harvesting restrictions/prescriptions for Westside riparian management zones (RMZs) based on best available science. Consistent with "Proposal Initiation" requirements in the Forest Practices Board Manual Section 22, part 3.1, we have highlighted the five elements of import for our request to the Forest Practices Board, including: 1) specifics on the affected sections of forest practices board manual, 2) our assessment of level of urgency based on scientific uncertainty and resource risk, 3) a summary of outstanding TFW, FFR, and Policy agreements supporting the proposal, 4) how results of the proposal could address Adaptive Management Program key questions and objectives, or other rule, guidance, or DNR product, and 5) extensive detail on the best available science and more broad scale details in support of advancing the template proposal through the adaptive management process.

1. The affected forest practices rule, guidance, or DNR product:

The WFFA Alternate Plan template proposal would affect Board Manual Section 21, Guidelines for Alternate Plans by adding a new template in addition to those that now exist: Template #1 (Overstocked Stands) and Template # 2 (Fixed Width Buffers). It is possible that the proposed template could substitute for a previously drafted, but not ratified, Hardwood Conversion template, and WFFA hopes to utilize the Adaptive Management process to discuss the merits of this approach.

Utilizing the "template" process provides the Board, the DNR, and stakeholders greater assurance that future changes to prescriptions and guidance in these templates can be readily made by DNR as, and when, changes are warranted based on long term monitoring projects.

2. The urgency based on scientific uncertainty and resource risk:

For nearly a decade, the Northwest Environmental Forum has been convening to discuss how to keep forests as forests. Efforts such as the 2007 Future of Washington's Forests demonstrated that the risk of land conversion was substantial, especially in the lowlands of Puget Sound. Data from the then Small Forest Landowner Database (now Washington State Parcel Database) show that forest land moves from industrial to small private ownership and then to development in an ongoing trend. Since 2007 additional NW Environmental Fora have been convened that examine a range of solutions aimed at keeping forests as forests. Most revealing was the October 2013 challenge from a long time participant

(Ecotrust) that asserted that as a state we had not moved the needle very far in our efforts to keep forests as forests - if at all. The trend toward conversion and development continues particularly in the interface where small landowners easily succumb to development pressure. Once converted, the lands rarely return to forest land that provides a high level of protection to public resources.

Like Ecotrust, WFFA believes that retaining working forests is important to citizens and communities in Washington State. We also believe the needle hasn't moved all that far in support of retaining small forest landowners as a viable part of the continuum of forestry ownerships. WFFA has been an active small landowner education organization for over 60 years. Our members come from all walks of life and represent a continuum of small landowner views. Like the NW Environmental Forum, our internal discussions focus on the very issues of maintaining the family tree farm in the face of development pressure and an aging cohort of owners. What we hear from our members is that while alternate harvest prescriptions that are equal in overall effectiveness are unlikely to prevent conversion in all cases, they are a move in the right direction to incentivize forest land ownership. Incentives are especially critical for those that would like to maintain their forest as forest but have financial challenges, or would like to pass it to their heirs if they can show demonstrable benefits of forest land ownership.

The proposed template (Attachment 2) seeks to address these disincentives for keeping forestland forested by reducing regulatory complexity and cost and increasing financial returns while still maintaining a residual stand that meets the effectiveness standards identified in rule (see Attachment 3 Table 3) and addresses cumulative effects via monitoring and modification as needed. It reflects the views of a dedicated, committed group of small forest landowners who, with the input of scientists, were able to develop a package that both honors current legislative language regarding resource protection and the original intent of Forest and Fish Regulations (FFR) (1999), which SFLOs helped pass.

3. Any outstanding TFW, FFR, or Policy agreements supporting the proposal:

The Legislature recognized the value of alternate plans to small forest landowners in the Forest Practices Rules. Alternate plan templates provide even greater value to small forest landowners for situations warranting greater management flexibility where resource protection can be met or exceeded. The proposal is consistent with and could provide valuable information for the following CMER projects due to its inclusion of a monitoring element: Westside buffer, DFC validation, Westside riparian effectiveness, hardwood conversion, and riparian status and trends. For more details see CMER Fiscal Year 2015 Work Plan, §§ 6.2.3, 6.3.1, 6.3.4, 6.3.6, 6.3.7 at:

http://www.dnr.wa.gov/Publications/bc_cmer_workplan.pdf

According to RCW 19.85.030 requirements for the Small Business Economic Impact Statement (SBEIS) that was completed when the Forest and Fish Agreement was adopted by rule, there are identified methods that the agency must consider, *without limitation*, for reducing the impact of the proposed rule on small businesses. These methods include:

- a) *“Reducing, modifying, or eliminating substantive regulatory requirement:”*
 - a. The WFFA proposal would modify the board manual to include the template for SFLO in Western Washington, based on science that is expected to ensure equal overall effectiveness.
- b) *“Simplifying, reducing, or eliminating recordkeeping and reporting requirements:”*
 - a. The WFFA template simplifies the assessment procedure for riparian stands.
- c) *“Reducing the frequency of inspections”;*
 - a. Not part of this proposal.
- d) *“Delaying compliance timetables”;*
 - a. Not part of this proposal
- e) *“Reducing or modifying fine schedules for noncompliance”;*
 - a. Not part of this proposal
- f) *“Any other mitigation techniques including those suggested by small businesses or small business advocates”.*
 - a. WFFA support additional monitoring and evaluation in support of long term adaptive management needs.

Because of the findings of the SBEIS, alternate plans were included in RCW 76.09.368 which states that small forest landowners (SFLO) “have access to alternate plan processes or alternate harvest restrictions, or both if necessary, that meet the public resource protection standard set forth in RCW 76.09.370(3), but which also lowers the overall cost of regulation to small forest landowners including, but not limited to, timber value forgone, layout costs, and operating costs”. WFFA asserts that the proposed template is consistent with this language and also with the language on alternate plans as documented in WAC 222-12-040, 0401, & 0403 and in similar RCW’s 76.09, 76.13, and 77.85.180(4). These assertions about fulfilling statutes and rules are based on science-based evidence provided below in item 5, which also describes meeting standards of all alternate plans.

4. How the results of this proposal could address Adaptive Management Program key questions and resource objectives or other rule, guidance, or DNR product:

The proposed template supplements Board Manual guidance by offering optional harvesting prescriptions along with useful guidelines for selecting a prescription that best fits reach-specific conditions and landowners’ objectives. Implementation of the prescriptions in these templates will provide equal effectiveness to current rule for protecting riparian functions, yet provide opportunity to harvest more trees by landowners who desire increased economic viability to help justify retention

of forest ownership. Further, as addressed above, the monitoring element could provide valuable data for CMER work plan projects.

Justification for including these templates in Board Manual section 21 is based on interpretation of the literature as noted in item 5 below, Appendix 1 of the template, and attachment 3. In summary the review indicates that depending on width of associated fish-bearing streams, all five riparian functions can be protected by 25 to 75 ft – wide, no-cut core buffers. In addition to providing full long-term riparian function, these buffers will also allow greater harvest within the typical mosaic of species and stocking in riparian stands, thus addressing the disproportionate effect of riparian rules on SFLOs as expressed in WAC 222-12-040(1) and (2).

Alternate plans (APs) without templates lower some costs and can better fit harvest plans to site-specific or reach-specific conditions than harvesting per default rules. However, APs without templates fail to fully address the disproportionate impact of Forest and Fish legislation on SFLOs. Because small forest landowners generally own acreage in the lower portion of watersheds, their land often has more acreage in streams and wetlands. Because their holdings are small, the percentage of acreage affected by RMZ regulation is greater. Moreover, most SFLOs do not have personal knowledge or resources to deal with complex regulations designed to protect water quality and associated fish and amphibians. Hence, cost of professionals to complete these tasks reduces income from harvesting.

Because of both location and greater operating costs, small landowners or their heirs are more likely to convert their forest to other uses. To retain these private tracts in forestry, more simplicity and flexibility are needed in harvest restrictions. This would fulfill the legislature's intent and may improve compliance as monitored by the DNR.

Templates are simpler to implement by landowners than alternate plans and have additional advantages. In contrast to the considerable time and effort required to change forest practice rules or legislation, unanticipated problems with a template can be corrected promptly and simply within the board manual by the Forest Practices Division of DNR. Thus, when cumulative field experience or monitoring results demonstrate that template corrections will better meet the objectives of the Forest Practices Rules, these are easier to make than rule changes, allowing fine tuning that better fits all four goals of Forest and Fish, including economic viability.

This template differs from rule-based harvest prescriptions within the RMZ by utilizing thinning and small patch-cuts that integrate elements of economic viability, improved forest health, and RMZ functionality, and to begin a DFC trajectory to historical species composition and stocking levels.

5. Available literature, data and other information supporting the proposal:

Science-based opinions to support WFFA's template (Attachment 2) were prepared by Dr. Douglas Martin, a fish biologist with more than a decade of association with Washington State's Adaptive Management Program. Dr. Martin's prescription proposal and riparian function assessment are found in Attachment 3. As noted in the introductory letter, Dr. Martin's scientific assessment was reviewed

by Dr. Peter Bisson, a fish biologist most recently employed by the USFS, Pacific Northwest Research Station. Dr. Bisson's assessment is found in Attachment 4. Dr. Bisson raises policy and monitoring questions WFFA looks forward to addressing in Adaptive Management.

Reviews and commentary on best available science do not determine how much risk to riparian functions is acceptable and on whom the burden of proof should fall. For guidance in working with Dr. Martin's recommendations we relied heavily on the findings and reports of Dr. Tom Hruby, Washington State Department of Ecology. In particular Dr. Hruby makes reference to risks as they pertain to riparian resources and decision making that were used in the decision matrix. Pertinent quotes from Hruby, T., 2010, *Setting Buffers for Wetlands When the Science is Not Specific*, Washington Department of Ecology, Oct, 8, 2010 are included here (**our emphasis in bold**):

"Laws and regulations have not specified a minimum threshold at which the risk is considered to be acceptable. Some will argue therefore that the slightest indication that an activity will damage streams justifies its rejection. On the other hand, the "absolute scientific proof" required by some proponents of the "innocent until proven guilty" philosophy can never be achieved. The cost of collecting data at each individual site is too costly and time consuming, and the results are never absolute. We still have to decide how much risk of being wrong we will accept.

*The laws require us to protect the functions and values of wetlands. The question facing decision makers becomes will not be protected for a given buffer width? Conversely, how certain are we that the buffers are adequate? Dealing with uncertainty and the risk of being wrong, however, is not new to our culture. **In fact, our legal system has formalized three qualitative levels of certainty used in making legal decisions that can also be applied to other types of decisions.** These are:*

- ***Beyond a reasonable doubt**" is the highest standard of proof that must be met to ensure that a decision is correct. In this case the risk of being wrong and having a buffer that does not protect wetland functions is very small. Buffers have to be large enough so there is no reasonable doubt that all functions of the wetland will be protected. "Beyond a reasonable doubt" in scientific studies usually means that the probability a decision will be wrong is less than 5%, and there is a 95% chance it is correct.*

- ***Clear and Convincing Proof**" is evidence that establishes a high probability that the fact sought to be proved is true. The standard for evidence needed to meet this criterion is less than that needed for "beyond a reasonable doubt," but higher than that needed for "preponderance of evidence" described below. It means decision makers must be persuaded by the evidence that it is highly probable that any buffer widths chosen will protect the functions of wetlands in a jurisdiction. Conversely, the probability that the buffers will not be adequate is relatively low but higher than 5%. If the risk of being wrong and not protecting wetland functions is "low" for the previous criterion, it can be considered "moderate" in this case.*

• **“A preponderance of the evidence”** simply means that one side has more evidence in its favor than the other, even by the smallest degree. A preponderance of evidence has been described as just enough evidence to make it more likely than not that the fact the claimant seeks to prove is true. From a scientific perspective this means that the probability the decision is correct, and a buffer will protect the functions of a wetland is only 50% or more. This level of evidence results in much weaker decisions. **The chance that a buffer is too small is as high as 50% rather than the 5% needed to meet the “beyond a reasonable doubt” criterion.** If buffers are established based on this criterion, there is a much higher risk that the buffer is not wide enough to protect the resource.”

WFFA used the second level of certainty: “clear and convincing proof” as a guide, which implies risk of not adequately protecting functions and values of riparian stands is more than 5%, but not as high as 50%. With these criteria in mind, WFFA, working in conjunction with Dr. Martin to confirm that there is scientific justification for the proposed metrics included in the template, recommends the buffer widths as documented in Attachment 2.

Alternate Harvest Prescriptions for Small Forest Landowners in Western Washington

Background

In Forest and Fish Legislation, legislators stated their intent that small forest landowners (SFLOs) have access to alternate plans or alternate harvest restrictions, or both if necessary, to lower costs of regulation including, but not limited to, timber value forgone, layout costs, and operating costs (RCW76.09.368). These alternatives must meet the public resource protection standard set forth in [RCW 76.09.370\(3\)](#).

This template applies to small forest landowners (SFO) defined in WAC 222-21-010(13) and RCW 76.13.120(2)(c) as landowners who have harvested from their own lands in the state of Washington less than 2 million board feet per year for the three years prior to the year of application, and who certify at the time of application that they do not expect to harvest more than 2 million board feet per year during the ten years following application.

This template contains 13 optional prescriptions that landowners may use to harvest and manage stands near fish-bearing and non-fish-bearing streams in western Washington. Landowners can select the prescription that best fits their management objectives and the stand and site conditions near their streams. Optional prescriptions are useful because individual Westside RMZs usually are a mosaic of species composition ranging from pure hardwoods to pure conifers. Moreover, stand age and stocking, by tree numbers or basal area per acre, can also differ among stands composing this mosaic.

Purpose

The purpose of this Westside template is to provide optional prescriptions for harvesting trees near Types S/ F, Np, and Ns streams. Landowner choice depends on landowner objectives and on reach-specific stream, stand, and site conditions. To improve efficiency of harvesting permitted by a Forest Practices Application (FPA), these RMZ prescriptions can be combined concurrently with upland harvests proposed in the same FPA. Objectives of this template are to increase economic viability of small forest landowners and protect riparian functions to achieve the goal of WAC 222-30-010(2): ". . . to protect aquatic resources and related habitat to achieve restoration of riparian function; and the maintenance of these resources once they are restored." Meeting performance standards for stream shade and recruitment of large wood into streams is emphasized in these template prescriptions.

Optional harvest prescriptions in this template differ mostly in width of the RMZ and the no-cut streamside buffer or "core" zone. Both widths are based on local reach and site conditions. Contrary to rule, site quality based on soils maps is not considered. Outside the no-cut core zone is the harvest zone where commercial thinning to harvest overstocked portions can be combined

with small gap clearings to regenerate new coniferous stands or to reduce shade that can result in some increase in water temperature, but increase instream productivity.

Process

Adherence to prescriptions within this template will meet riparian function requirements for approval of an alternate plan as described in WAC 222-12-0401(6): "An alternate plan must provide protection for public resources at least equal in overall effectiveness to the protection provided in the act and rules." An alternate plan must include the template form, available through the DNR. The form must be included with the Forest Practices Application (FPA). This template form provides the technical justification as required in WAC 222-12-0401(3) (b), (c), and (d), identifying how the alternate plan addresses the various functional requirements of the RMZ. Information in APPENDIX A will be useful for completing this form.

As for any proposed alternate plan, an Interdisciplinary (ID) Team may be called to review an application using this template (see WAC 222-12-0401(5)). However, by following provisions in this template, an ID team may only be necessary if site-specific issues arise.

Qualifying Stands

Qualifying stands are adjacent to Type S, F, or Np waters. These riparian stands often are a mosaic of hardwoods and conifers at varying combinations of species, age, and stocking. Because of stand conditions and the small riparian acreage available (**Table 1**) some riparian stands may not have sufficient merchantable volume to justify commercial harvest. Combining harvests in riparian with upland harvest can be a viable option.

Landowners planning to harvest a qualifying stand within an RMZ protected by the Shoreline Management Act (RCW 76.09.910) must consult with the county of jurisdiction and include written documentation from the county stating that the operation complies with the Shoreline Management Act. This documentation must be included with the Forest Practices Application.

Riparian Management Zones

This template separates the RMZ into two management zones: no-harvest and harvest by thinning to reduce stocking and/or patch cuts for regenerating conifers.

This template differs from standard rules by:

- Not requiring a before-harvest, Desired Future Condition (DFC) - type inventory of core and inner zones. Within the proposed harvest zone, trees designated for retention after thinning will be identified by spot or band of paint to assist loggers, ID and monitoring teams.
- Re-defining widths of RMZ and no-harvest core along typed streams within the FPA (**Table 2**), RMZ width varies between 75 and 25 feet, depending on stream width of F-streams, and width and seasonal flow in Np streams. Site quality is not considered. To accommodate on-site topography and vegetative conditions, landowners will have the alternative that these widths are either fixed or variable. Specifically:

Table 1. Area of RMZ Harvest and Its Percentage of Total FPA Acreage by Length of RMZ and, where width for thinning, A = a two-sided harvest and B = one-sided.

Total of FPA (acres)	Length of RMZ and Option					
	500 Feet		1000 Feet		1500 Feet	
	A	B	A	B	A	B
	<i>RMZ harvest acreage</i>					
	0.57	0.29	1.15	0.57	1.71	0.86
	<i>Percent of total FPA</i>					
20	2.8	1.4	5.8	2.8	8.6	4.3
30	1.9	1	3.8	2	5.7	2.9
40	1.4	0.7	2.9	1.4	4.3	2.2

Note: Depending on the total acreage of the FPA (including both upland and 75-foot RMZ areas), length of the RMZ, and the no-cut buffer width, 0.7 to 8.6 percent of total FPA harvest area will be within the RMZ.

For Type S and F Waters with bankfull width of five feet or more, width of no-cut buffers is 25 to 75 ft where harvest is by thinning or a minimum of 25 feet where harvest is by patch- regeneration cuts. Within 50 or 75 ft- wide no-cut buffers along F- streams, individual tree may be marked for harvest and felled after approval of the DNR forester.

For Type S and F Waters with bankfull widths less than five feet, width of the RMZ is reduced to 25 feet and the no-cut core width is 25 feet. Outside this core buffer, thinning or patch-cut harvesting are part of the upland harvest. Within the 25 ft- wide no-cut buffers along F- streams, individual tree may be marked for harvest and felled after approval of the DNR forester.

For Type Np Waters, the RMZ has a continuous 25 feet- wide, no-cut buffer on both sides of the stream for the first 300 feet above the Np/F junction. Current rule specifies a 50 ft- wide buffer for 300 or more feet above this junction, depending on the total length of the Np stream below the upper-most point of perennial flow (UMPPF). Determining total Np length can be problematic, because the UMPPF is often located on another ownership. Above the 300 ft long no-cut buffer, the 25-ft-wide buffer is retained, but may be thinned from above by removing merchantable trees and leaving smaller trees and shrubs to provide shade and small wood to these narrow reaches. Isolated intermittent reaches that are seasonally dry and are not connected downstream to F-streams by perennially flowing water may be thinned or patch cut.

Table 2. Decision-Logic for Westside Template

Table 2. Riparian Prescriptions by Stream Type and Bankfull Width										
Decision Logic										
If Water Type is:	And bankfull width is:	And flow is:	And seasonal reach is connected to F-stream:	Then the two-sided		And area for			Prescription Option Number	
				RMZ is:	No-Cut Zone is:	Thinning: (mostly conifers)	Regeneration Harvest: (mostly hardwoods)			
	<i>in feet</i>			<i>in feet</i>						
S or F	>15	all seasons or seasonal	--	75	50	50 - 75	(7)	50 - 75		1
				75	75	beyond 75	(1)	40% of F	*(9)	2
	5 - 15	"	--	50	25	25 - 50	(8)	50% of F	*(10)	3
				50	50	beyond 50	(2)	beyond 50		4
				50	50	beyond 50	(11)	beyond 50		5
	<5	"	--	25	25	beyond 25	(3)	beyond 25		6
Np	> or = 5	all seasons	yes	25	25 x 300	beyond 300**	(4)	"		7
		seasonal	yes	25	25 x 300	"		"		8
		"	no	0	0	beyond 0		beyond 0		9
	<5	all seasons	yes	25	0	beyond 0**	(5)	beyond 25		10
		seasonal	yes	25	0	"		"		11
		"	no	0	0	beyond 0		beyond 0		12
Ns	--	seasonal	no	0	0	beyond 0	(6)	beyond 0		13
*Maximum length of individual patches is 500 ft; minimum thinnable width between patch cuts is 100 ft ; Cumulative total length of patch cuts along Type F streams within FPA: 40% (>15ft), 50% (<15ft)										
**Remove larger trees (thin-from-above)										
<i>(Numbers in Italics)</i> reference "situation numbers" in Table 2, Attachment 3 - Technical Assessment by Dr. Douglas Martin.										

This template is the same as standard rules, as follows:

- Outside the RMZ, upland harvest rules apply.
- RMZ widths on all typed waters are measured horizontally from the outer edge of bankfull width (BFW) or the channel migration zone (CMZ), whichever is wider (see Board Manual Section 2).
- In situations where type S and F streams have stream-adjacent wetlands, RMZ measurement will start from the vegetation line change separating wetland and upland plant communities.

- No equipment is permitted to operate within 30 feet from edge of bankfull width or the CMZ.
- Minimum number and size of leave trees after thinning are same as required by rule; however residual trees must have live crown in 30 or more percent of total height to ensure survival and rapid growth.

Harvest Prescriptions

In this template, harvest prescriptions differ, depending on stream type, stream width, and seasonal flow. Table 3 provides considerations to guide landowners' decisions. For all typed waters within an FPA, average stream width is calculated from 10 equally spaced measurements of BFW. Landowners are advised to flag measurement locations to enable subsequent checking by regulatory personnel.

Type S and F Streams Averaging Five Feet or More in Width (RMZ = 75 or 50 ft)

Six harvest options are available within the RMZ of Type S and F waters. Width of no-cut core or stream-side buffers is 25, 50, or 75 feet. (**Table 2**). Choice of option depends largely on the need for stream shading and wood recruitment in site-specific reaches. Corresponding widths of the harvest zone within the RMZ for thinning or regeneration harvest is 25 ft. Within the core zone, some individual or groups of trees designated by landowners may be removed if approved by the DNR forester. Both patch cuts to regenerate new stands of conifers and thinning overstocked conifers must be at least 25 feet from BFW or CMZ. Regeneration cuts may merge with upland harvests.

Type S and F Streams Averaging Less than Five Feet (RMZ =25 ft)

Width of the no-cut core is 25 feet, the full width of the RMZ. Area outside the RMZ is considered upland harvest. Within the core zone, some individual or groups of trees designated by landowners may be removed if approved by the DNR forester.

Table 3. Fish-Bearing Streams: Guidance for Choosing among Prescription Options based on Landowner Objectives and On-Site Conditions

Objective and Conditions
<p><u>Provide more shade, where:</u></p> <ul style="list-style-type: none"> • No tall stand or blocking ridges to south • Stream is wide (> 20 ft) and oriented N-S • Few tall, dense shrubs near stream • Stand stocking in RMZ is sparse (< RD 20) • No reverse break in slope within RMZ
<p><u>Provide less shade at short intervals, where:</u></p> <ul style="list-style-type: none"> • Warming of stream is likely to increase food for fish
<p><u>Provide more channel wood recruitment, where:</u></p> <ul style="list-style-type: none"> • No or few boulder-caused pools in stream reach • No evidence of wood recruitment by natural bank erosion, especially near wide streams
<p><u>Provide wider no-cut buffer, where:</u></p> <ul style="list-style-type: none"> • Hazard of blow-down from wind storms is high • Concurrent harvest outside RMZ is clearcutting • A road is within the RMZ

Harvesting guidelines for the thinning zone are:

RMZ harvest prescriptions using this template have two general objectives: limit thinning intensity to avoid over-cutting and meet residual tree metrics to provide long-term riparian functions, especially shade to moderate stream temperature and recruitment of large wood into streams. Meeting rule-based performance standards for these RMZ functions is critical. To attain these thinning objectives:

- Limit harvest of trees 4 inches DBH and larger to about 50 % of before-harvest basal area per acre or about 60% of before-harvest trees. Maintain a minimum of 57 large conifer trees per acre (28 ft average spacing) after harvest. These residuals must have at least 30 % of their total height in live crown.
- Thin-from-below by harvesting mostly intermediate and weak co-dominant crown classes.

In general, harvest most hardwoods and lower crown classes of conifers. Retain dominant and co-dominant conifers about 28 feet apart (57 trees / acre). To leave more canopy cover or to reduce thinning intensity, retain additional conifer trees with live crowns at least 30 % of their total height. After harvest, residual stands could have a relative density of about 20 or more or a Stand Density index (SDI) of about 400 (*Table 4*).

Table 4. Rule-Based Minimum Number of After-Harvest Leave Trees per Acre and Corresponding Basal Area per Acre and Relative Density (RD)

Mean DBH	57 Trees per Acre – 28 Ft Spacing (Westside)	
	Basal Area per Acre	RD**
8	20	7
10	31	10
12	45	13
14	61	16
16	80	20
18	101	24
20	124	28
22	145	31
24	180	37

** $RD = (\text{basal area per acre}) / \text{square root of } (\text{basal area per acre} / \text{trees per acre})$. Do not count suppressed trees; counting small trees inflates calculated RD. Therefore, count only trees 4 inches DBH and larger.

Harvesting guidelines for patch cuts are:

Limit individual patch harvests for regeneration to not exceed 500 feet of the type F stream reach, and additionally constrain that:

- Patches are no closer to BFW than 25 feet on perennially flowing Type Np waters;
- Combined lengths of patch-harvests do not exceed 40 or 50% of the F stream within the FPA (Table 2).
- Individual small regeneration/patch-harvests are separated by at least 100 feet of thinned or non-thinned areas;
- Where patch-cuts are on both sides of the stream, attempt to offset these small patch-cuts so that they are not directly across the stream from one another;
- Where large wood is needed in adjacent streams, the DNR may specify directional falling instructions and provide any applicable permits. See Template 1 (Overstocked Stand) for further details.
- Until effectiveness of these template prescriptions is assessed, limiting length of individual regeneration/patch harvests to generally less than 500 feet and a maximum cumulative length of 40 or 50% of the total stream reach in the FPAs is a precautionary restriction.
- Additional regeneration/patch harvest entries proposed in future FPAs for this stream reach are not permitted until the area of an earlier regeneration harvest by the landowner is well stocked with an average height of dominant and co-dominant trees equal to or greater in height to

bankfull width plus 6 feet. On streams that average wider than 34 feet, the average height of dominant and co-dominant trees does not need to exceed 40 ft.

Type Np Waters Harvest Prescriptions

Six alternative prescriptions may be applied along Type Np waters (Table 2). Choice depends on stream width and whether a given reach flows above-ground in all seasons or is seasonally dry. Reaches with above-ground flow in all seasons shall have a 25 foot- wide RMZ. Where the Np stream is 5 ft or wider, then the first 300 ft above the F/Np junction has a no-cut buffer that is continuous on both sides of perennially flowing reaches. Thinning or clearcutting to within 25 feet of BFW may be implemented. Above that 300-ft distance, larger trees may be removed (thinning from above), because smaller trees and shrubs are likely to provide adequate shade and because small streams lack power to transport bole wood downstream.

Np streams narrower than 5 ft need not be fully buffered (Table 2). Merchantable trees may be harvested. Shrubs and small trees are likely to provide sufficient shade and organic debris.

Complying with standard rules for S/F Type waters, harvesting near Np water types also must not occur within any sensitive site buffers. Sensitive sites include the 56-foot radius buffer patch centered on the point of intersection of two or more Type Np waters, headwall seeps, sidewall seeps, headwater springs or the points at the upper-most extent of Type Np waters, or within an alluvial fan. See WAC 222-30-021(2)(b)(i) through (vi).

Where a landowner objective is to supplement natural wood recruitment through time, consider the Large Woody Debris Placement Strategy detailed in Template 1 (Overstocked stand template). Risk of downstream damage from displaced long logs or boles is less likely in narrow streams with low power.

Summary

Applying this template will allow small forest landowners to submit an alternate plan for harvesting within riparian stands in western Washington as part of a completed forest practices application (FPA). The FPA will be processed as an alternate plan as outlined in WAC 222-12-0401. The template form must be included with the FPA, and is available through DNR. This form provides the technical justifications, as required in WAC 222-12-0401 (3) (b), (c), and (d), identifying how the alternate plan addresses the various functional requirements of the RMZ. Information in APPENDIX A will be useful for completing this form.

An Interdisciplinary (ID) team may be called to review the proposed harvest (see WAC 222-12-0401(5)). However, by adhering to the guidelines in this template, the need for an ID Team will be minimal and only necessary if specific issues arise.

WFFA Note: Appendix A is the riparian function assessment from the Martin Environmental Scientific Justification (Attachment 3 of the proposal; page 10-26). It is included here for ease in using the template as a stand-alone document.

Appendix A: Riparian Function Assessment

Shade

The primary function of riparian vegetation in controlling water temperature is to block incoming solar radiation (direct and diffuse). Direct solar radiation on the water's surface is the dominant source of heat energy that may be absorbed by the water column and streambed. Absorption of solar energy is greatest when the solar angle is greater than 30° (i.e., 90 to 95 % of energy is absorbed as heat) and decreases as the solar angle declines due to the reflection of radiation off the water surface. Therefore, riparian vegetation that blocks direct solar radiation along the sun's pathway across the sky is the most effective for reducing radiant energy available for stream heating (Moore et al. 2005). Research shows that the attenuation of direct beam radiation by riparian vegetation is a function of canopy height, vegetation density, and buffer width (Beschta et al., 1987, Sridhar et al. 2004, DeWalle 2010). Light attenuation increases with increasing canopy height and increasing buffer density as a result of the increased solar path and extinction of energy. Buffer width has a variable influence on light attenuation depending on stream azimuth (e.g., effective buffer widths for E-W streams may be narrower than for N-S streams due to shifts in solar beam pathway from the sides to the tops of the buffers; Dewalle 2010). Riparian buffer width is important for a given stand type and age, but is not a good predictor of stream shading among different stands because of differences in the shade-controlling variables. For example, Beschta et al. (1987) showed that shade levels¹ similar to old-growth forests (i.e., range 75% to 90%) varied from 65 ft. to 100 ft. depending on stand types in western Oregon. Similarly, Sridhar et al. demonstrated the most effective shading for temperature control in eastern and western Washington Cascade conifer stands was predicted for mature (high leaf-area-index) canopies close to the stream (i.e., within 33 ft. of the stream bank) and overall buffers of about 100 ft.

High levels of shading can be provided by buffers ranging from 25 ft. to 75 ft. wide, because most shade is provided by trees directly adjacent to the stream (Table A-1). For example, Teply et al. (2013) demonstrated that thinning the outer portion of a buffer with a 25-ft. no-harvest core in a grand fir-western red cedar stand reduces the overall potential shade by 6% to 15% depending on the width and level of thinning in the outer zone. Also, they indicated that similar buffer treatments in the western hemlock-subalpine fir and Douglas-fir stands of western Idaho could provide relatively high shade levels.

Predictions of effective shade (i.e., percentage of potential daily solar radiation blocked by vegetation and topography) were simulated with the Ecology shade model (<http://www.ecy.wa.gov/programs/eap/models.html>) to demonstrate how stand height, composition, buffer width, and stream aspect influence shade. Effective shade was simulated for a hypothetical low-gradient (2 - 3%) stream, with no topographic shading, located in Olympia vicinity, and having conifer/deciduous riparian stands that are typical of western Washington (Table 2). The simulation results are consistent with the findings described by others and show that effective shade is mostly provided by trees within 15-25 ft. of the stream regardless of stand height, composition, and aspect (Figure A-1, Appendix B). Trees beyond 25 ft. only contribute a small amount of shade. Shade is correlated with tree height as high shade levels (i.e., exceeding 75%) are provided by small trees along 5-ft. streams, and by

¹ Based on measure of angular canopy density (ACD) which is a projection of the canopy at the angle above the horizon at which direct-beam solar radiation passes through the canopy (Beschta et al 1987).

medium to large size trees along streams up to 25 ft. wide. Shade potential declines with increasing stream width and is lowest for the wider streams with a N-S aspect. Note, the mixed-medium and mixed-large stands provide slightly more shade than the conifer stands of similar size (Appendix B). The latter is partly due to the greater overhang which blocks direct beam radiation. Similarly, high shade levels can be maintained along E-W streams (aspects 270° and 225°) with dense stands on the south side and sparse stands on the north side because most radiation is blocked by the south side stand (Figure A-2).

Shade levels in headwater streams without buffer strips are typically greater than zero initially following timber harvest as a result of cover from logging slash. Even though BMPs (e.g., 30-ft ELZ) are intended to minimize slash input, studies show that slash is relatively common in seasonal streams (Type Ns). For example, shade levels in four headwater streams bordered by clearcut units in southern Oregon averaged 66% after harvest (i.e., average 20% reduction from pre-harvest levels) (Kibler et al. 2013) and similarly, Ehinger et al. (unpub.) observed a mean decreased in canopy cover at the water surface from 91% pre-harvest to 52% as a result of logging slash in headwater streams in western Washington. In both studies the longitudinal distribution of slash cover was patchy and associated shade was highly variable. The effectiveness of slash to provide shade is likely to decline over time with decay and debris export.

Shade from riparian vegetation is not the only factor influencing stream temperature. Research shows that temperature response from timber harvest is variable and is highly dependent on the volume of stream flow, substrate type, groundwater inflow, and surface/subsurface water exchange (i.e., hyporheic exchange) (Moore et al. 2005). Stream size is a key driver with sensitivity decreasing in relation to increasing depth, velocity, and discharge (Moore et al. 2005). Velocity influences exposure duration which decreases with increasing velocity in steeper channels (cascade channels). Stream depth has significant influence because it affects both the magnitude of the stream temperature fluctuations and the response time of the stream to changes in environmental condition (Adam and Sullivan 1989). The temperature response to heat input is dampened by hyporheic exchange rate which is a function of bed composition. Streams with alluvial gravel/cobble bed material (pool riffle, alluvial fan channels) enables increased hydraulic retention (promotes conductive cooling) and are less sensitive to shade loss compared to streams with less-permeable boulder/bedrock substrate (e.g., cascade, bedrock channels) (Johnson 2004, Dent et al. 2008). In general, stream sensitivity to shade loss is a function of reach-scale physical characteristics. For example, streams at lower elevations (i.e., warmer air temperature), or with no topographic shading, or with shallow-wide channels (i.e., high width-to-depth ratio), or with bedrock substrate (i.e., hyporheic exchange limited) are more sensitive to heating from shade loss than are streams with the following conditions: at higher elevations, or with topographic shading, or with deep-narrow channels, or with alluvial substrate.

Table A-1 Summary of stream shade provided by different buffer treatments similar to proposed template.

Location	Stand type	Buffer treatment	metric	Post-harvest		Reference
				amount	change	
western WA	df, hem, 35-50 yrs	50-ft. no-harvest	canopy cover	81%	-10%	Schuett-Hames et al. 2011
western WA	df, hem, 60-110 yrs	33 to 50-ft. no-harvest	canopy density ^a	86%	-8%	Janisch et al. 2012
coastal OR	df, alder, 50-70 yrs	50 to 70-ft.; inner 20 ft. no-harvest, outer thinned	shade	78%	-7%	Groom et al. 2011
western ID	grand fir-redcedar	50-ft. no-harvest	effective shade	82%	-8%	Teply et al. 2013
western ID	grand fir-redcedar	75-ft. no-harvest	effective shade	87%	-3%	Teply et al. 2013
western ID	grand fir-redcedar	50-ft.; inner 25 ft. no-harv., outer 25 ft. thinned	effective shade	75%	-15%	Teply et al. 2013
western ID	grand fir-redcedar	75-ft.; inner 25 ft. no-harv., outer 50 ft. thinned	effective shade	84%	-6%	Teply et al. 2013

^aincludes topographic shading

Table A-2. Description of riparian stand characteristics used for modeling. Data derived from riparian shade study in Stillaguamish River by Ecology (<http://www.ecy.wa.gov/programs/eap/models.html>). Note, canopy density of 75% approximates levels found in unmanaged stands.

Stand description	Height (ft)	Canopy density (%)	Overhang (ft)
css - conifer, small, sparse	49	25	5
csd - conifer, small, dense	49	75	5
cms - conifer, medium, sparse	148	25	15
cmd - conifer, medium, dense	148	75	15
cls - conifer, large, sparse	174	25	17
clid - conifer, large, dense	174	75	17
msd - mixed, small, dense	49	75	6
mms - mixed, medium, sparse	66	25	7
mmd - mixed, medium, dense	121	75	15
mld - mixed, large, dense	148	75	18
clearcut	0	0	0

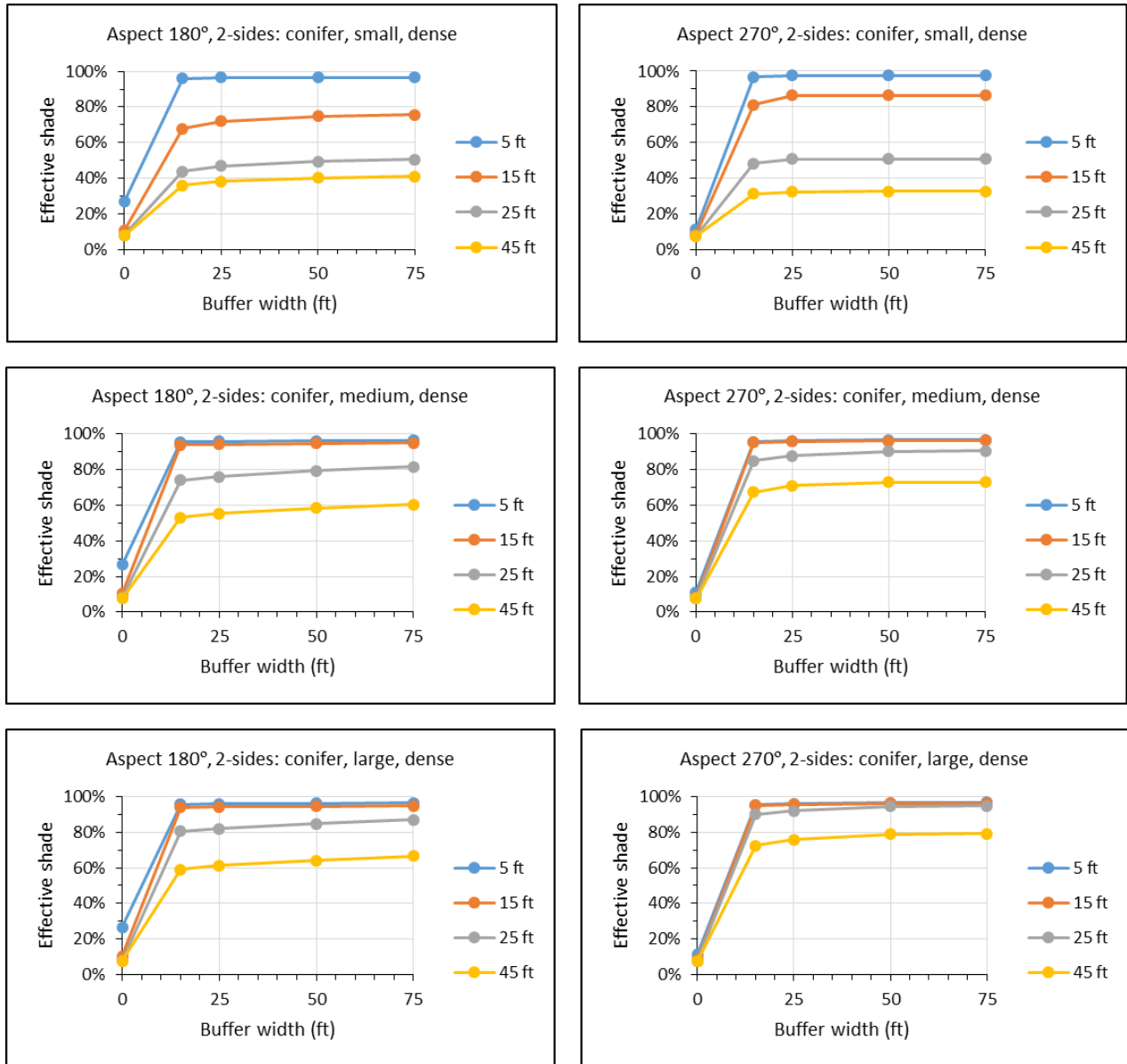


Figure A-1. Predicted effective shade in relation to buffer width, channel width, and aspect for riparian stands with different tree heights and composition. Shade simulated for streams with N-S and E-W aspects, and with dense conifer stands on two sides. Stand specifications are listed in Table A-2.

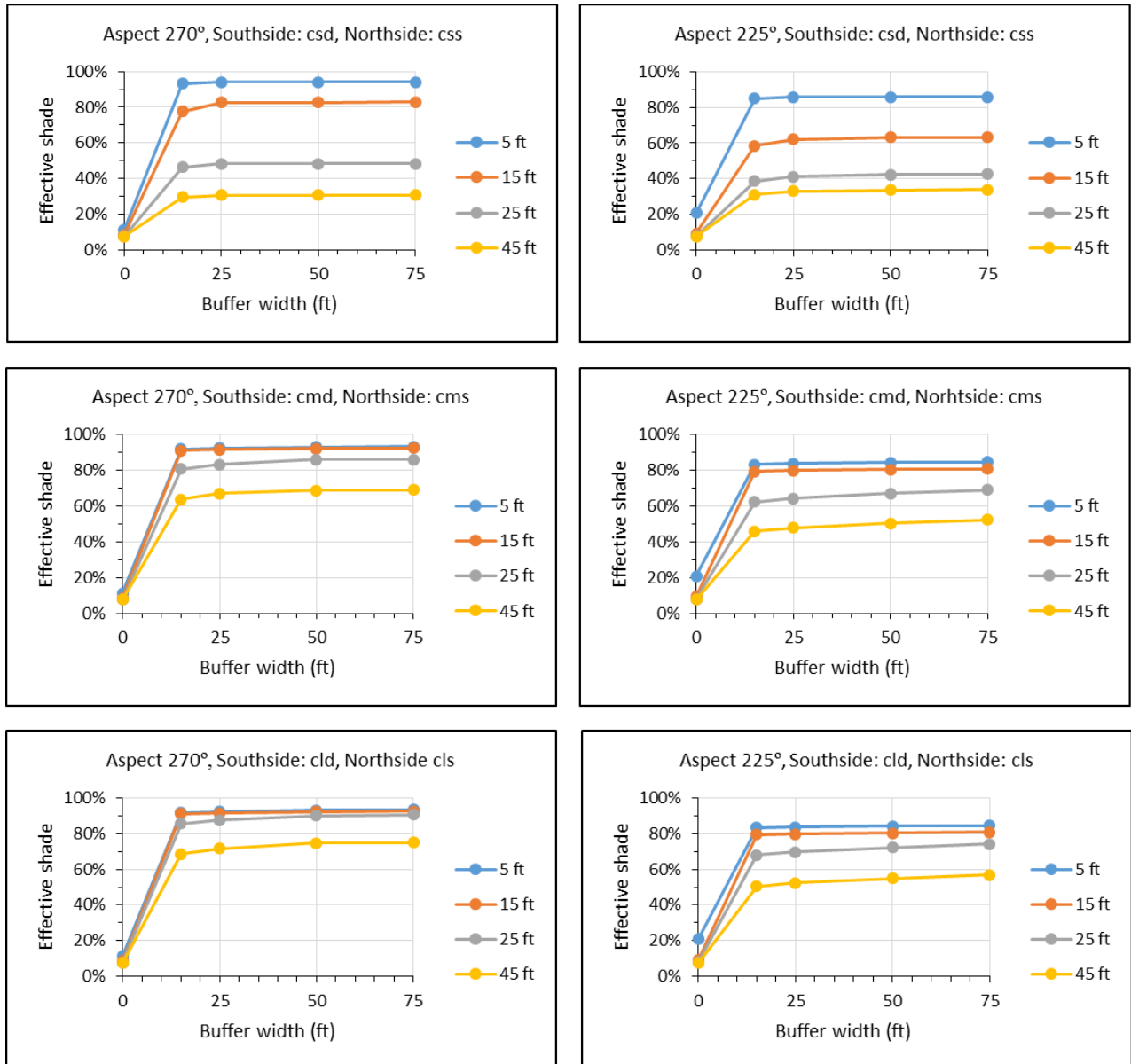


Figure A-2. Predicted effective shade in relation to buffer width, channel width, and stream aspect for riparian stands with different tree heights and composition. Shade simulated for streams with dense conifer stands on south side and sparse conifer stands on north side. Stand specifications are listed in Table 2.

Large Wood

The primary factors controlling large wood (LW) recruitment to streams are tree height and stand mortality processes. In general the distances to sources of stream wood increase with increasing tree height. For example, the source distances for tall old growth Douglas fir or coastal redwoods of California may extend out to 200 ft., but recruitment of shorter Sitka spruce in Southeast Alaska may only extend to 125 ft. (Benda & Bigelow 2014, Martin & Grotefendt 2007, McDade et al. 1990). Similarly, smaller trees in second-growth stands will have shorter source distances than trees from old-growth stands. However, the tree height source distance relationship is modified by site-specific factors (i.e., valley morphology, stream width, and wind exposure) that can have a strong influence on stand mortality. For example, LW recruitment by bank erosion is the dominant wood input process for low- to moderate-gradient channels in unconfined valleys and bank erosion recruitment increases with increasing stream width (Benda & Bigelow 2014, Johnston 2011, Martin & Benda 2001). Most of the LW in erosion prone channels is derived from the stream banks (e.g., 86% to 98% may be recruited from within 25 ft.; Table A-3, Figure A-3). Recruitment by stand mortality (e.g., stem suppression) is generally dominant where bank erosion is limited, such as in riparian stands adjacent to smaller streams and streams of any width that are confined by bedrock or hillslopes. Also, there is a strong tendency for dead trees to fall towards the channel on steeper hillslopes (i.e., >40%) that may increase recruitment by 1.5 to 2.4 times over levels from lower-gradient landforms (Sobota et al. 2006). In areas where stand mortality dominates, the source distance distribution shifts away from the stream bank and most recruits are derived from within 50 to 75 ft. (Table A-3, Figure A-3). Note, the far right shift of source distances for the McDade (1990) data (Figure A-3) are due, in part, to significant recruitment from trees and tree pieces that slid down steep side slopes (50% of study sites were located on slopes > 40%). Windthrow can extend the source distance by increasing recruitment from trees along the outer edge of buffer strips (Rollerson et al. 2009, Martin & Grotefendt 2007, Liquori 2006). Local landslides can extend the source distances even farther from the channel up the hillslopes (Benda & Bigelow 2014). The rank ordering of source distances for all mortality processes are bank erosion < tree mortality < windthrow < local landslides.

Table A-3. Summary of large wood inputs to streams by riparian source distance and dominant recruitment process (recruitment by landslides excluded).

Location	Stand type	Dom. recruit process	Percentage input by source distance				Reference
			25 ft.	50 ft.	75 ft.	100 ft.	
Southeast AK	old-growth	bank erosion	86	93	96	98	Martin & Grotefendt (2007)
South-Central BC	old-growth/mat. conif.	bank erosion	98	99	100	100	Johnston (2011)
South-Central BC	old-growth/mat. conif.	mortality	81	95	98	100	Johnston (2011)
Cascade, WA,OR	mature conif.	mortality	40	71	85	94	McDade et al. (1990) ^a
Cascade, WA,OR	old-growth	mortality	33	62	76	84	McDade et al. (1990) ^a
Southeast AK	Old-growth	mixed	75	91	97	99	Murphy & Koski (1989)
Cascade, WA	conifer (50-80 yrs)	mixed	82	96	98	100	Mckinley (1997)
Cascade, CA	Unmanaged	mixed	75	97	99	100	Benda & Bigelow (2014)

^aData include trees and tree pieces from given distance.

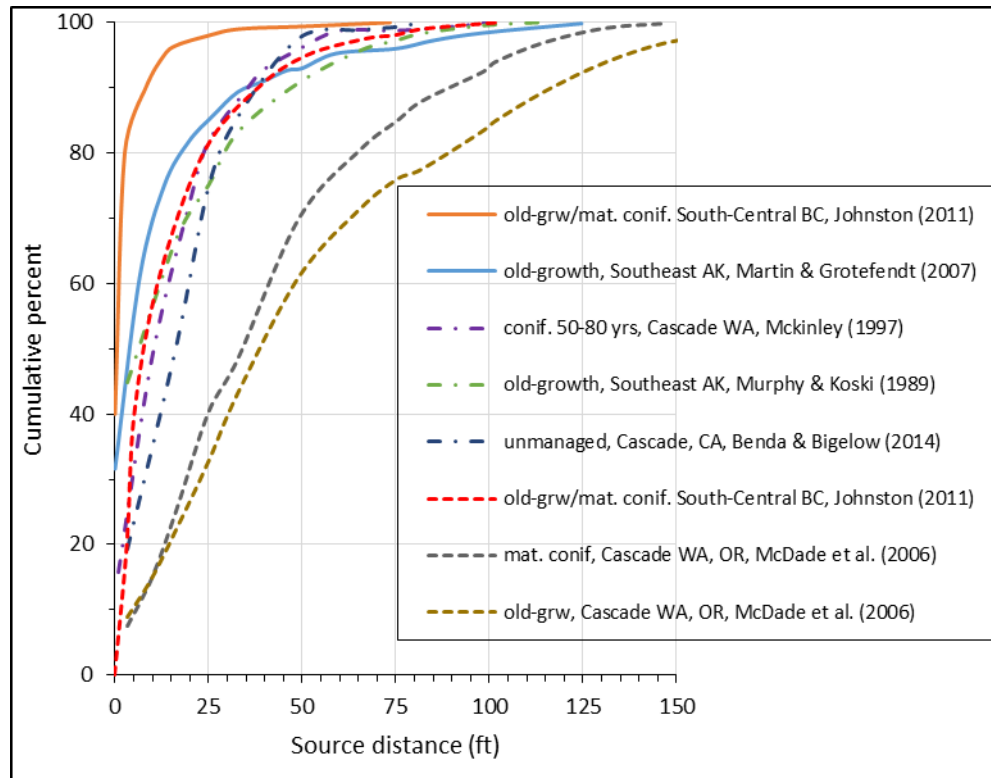


Figure A-3. Large wood source distance curves for riparian forests similar to stands typical of western Washington. Dominant recruit processes are bank erosion (solid line), stand mortality (dashed line), mixed (dash-dot line). Note, the far right shift of source distances for the McDade (1990) data are due, in part, to significant recruitment from trees and tree pieces that slid down steep side slopes (50% of study sites were located on slopes > 40%).

Windthrow can increase the probability of LW recruitment from buffer strips over the short-term and can influence the long-term supply at locations prone to wind damage. At the landscape scale, windthrow mortality is highly variable; having a skewed mortality distribution (i.e., most sites have low mortality and a few have high mortality (Grizzel and Wolff 1998, Martin and Grotefendt 2007, Rollerson et al. 2009). Wind damage is strongly associated with buffer orientation relative to the predominant storm direction (i.e., southeast, south, southwest in the Pacific Northwest) and local conditions including wind fetch length resulting from the size of clearcut units (Kramer et al. 2001, Mitchell et al. 2001, Rollerson et al. 2009). At the scale of individual trees, windthrow mortality is associated with low percent live crowns (< 40%) and high height-diameter ratios (>60%) (Scott 2005). Reductions in windthrow mortality are feasible when site and landscape factors are considered in harvest unit plans (Kramer et al. 2001; Mitchell et al. 2001)

The transport of LW in streams provides connectivity between upstream sources areas and downstream processes that create channel complexity and form aquatic habitat. Debris flows that result from channelize landslides are an important mechanism for delivery of LW from steep headwaters to larger fish bearing streams (May and Gresswell 2003, Reeves et al. 2003). Debris flows can transport wood in small streams that lack the capacity for fluvial transport of wood, and for transporting wood that is longer than the bank-full width of the channel. In the absence of debris flows, drainage area (i.e., stream size) is the primary factor controlling the fluvial transport of LW in streams. Studies by Martin & Benda (2001) in Southeast Alaska and by Benda and Bigelow (2014) in four regions of northern California (Coast,

Klamath, Cascade, and western Sierra ranges) show that fluvial transport of LW increases with increasing stream size. In both studies the predicted wood transport distance (over the lifetime of wood in streams varied from a few hundred ft. to ten thousand ft. in channels with drainage areas of 250 ac to 18,000 ac, with transport distance increasing with drainage area. For example, in the smallest channel (10-15 ft. wide), Martin and Benda (2001) estimated there was a 90% probability that LW would be transported at least 150 ft. and only a 10% probability that transport could exceed 1000 ft. Also, the length of nearly all mobile LW is less than or equal to the bank-full width of the channel. Therefore, only a small proportion of LW is exported by fluvial processes in smaller headwater streams and only the lower-larger portions of headwater channels are likely transport LW to larger streams. Correspondingly, the residence time of LW accumulations in streams is inversely related to channel size (Martin & Benda 2001, Benda and Bigelow 2014).

The size of LW (diameter and length of wood pieces) required to form habitat increases with increasing stream width (Bilby and Ward 1989). For example, Bilby and Ward (1989) found that functional size pieces ranged from 25 to 65 cm in diameter and 5 to 12 m in length in streams 13 to 65 ft wide. Beechie and Sibley (1997) regressed wood diameter with channel width and showed the minimum diameter for forming pools ranged from 5 inches to 10 inches for streams 15 ft. and 30-ft. wide, respectively. In small headwater streams (range 3 - 12 ft wide), Jackson and Sturm (2002) found that wood smaller than 8 inches diameter is more likely to function than is larger wood and that smaller wood along with inorganic material and organic debris (< 4 inches diameter) were major step-forming agents.

The formation of fish habitat in streams is not only a function of LW supply and size, but on reach-scale physical characteristics (channel width, morphology, substrate composition) that influence the channel response to wood loading. For example, research shows that large wood has a stronger influence on the formation of pools and gravel bars in moderate gradient, unconfined channels (e.g., plan bed, pool riffle, alluvial fan channel types) compared to either high-gradient-confined channels or low-gradient channels (Montgomery et al. 1995, Beechie and Sibley 1997, Martin 2001). The cobble-boulder-bedrock substrate typical of steeper high-energy channels controls bedform (e.g., step pool, cascade) and pool formation is independent of LW; although LW may function to trap sediment in step-pool channels (Montgomery and Buffington 1997, Benda and Bigelow 2014). In very low-gradient meandering channels (e.g., dune ripple) the dependency on LW is limited as free-formed pools are common (Beechie and Sibley 1997).

Sediment

Timber harvest in or adjacent to riparian management zones can influence surface erosion and sediment input to streams as a result of ground disturbances from yarding activities (e.g., skid trails, yarding ruts), or to increases in root-pit formation from windthrow. Sediment retention within a riparian forest is controlled by vegetative ground cover, hillslope gradient, and soil erodibility (WFPB 1997). Ground cover including roots, stems, and debris (logs, slash) bind soils and create roughness elements minimizes surface runoff and traps soil particles (Liquori et al. 2008, Litschert and MacDonald 2009). Sediment delivery potential increases with slope. Therefore, the sediment retention function of riparian ground cover is most important in steeper terrain

Research shows that current harvest procedures and BMPs are largely effective in reducing erosion and sediment delivery to streams. Post-harvest evaluations of erosion features across a wide range of sites indicates that buffers and the prevention of ground disturbances within 30-ft of streams effectively prevented sediment inputs in most cases (Rashin et al. 2006, Litschert and MacDonald 2009). For example, Schuett-Hames et al. 2011 found that implementation of a 30-ft equipment exclusion zone (ELZ) in clearcut units met the performance targets for sediment control at seven of eight clear-cut reaches. In a related study of buffer and ELZ effectiveness in headwater streams Stuart et al. (unpub.)

reported the area of bank erosion (or lack thereof) was similar among reference and treatment sites suggesting the absence of a treatment effect. Root-pit formation is increased as result of post-harvest windthrow. However, the density of root-pits with sediment delivery were no different among reference and buffer treatment sites in two separate studies of BMP effectiveness (Schuett-Hames et al. 2011, Stuart et al. unpub). In both studies the mean distance to stream for root-pits that delivered sediment was less than 9 ft.

Biotic Productivity/Litter

Research shows that algal biomass and invertebrate prey biomass generally increase with increasing canopy openness and/or increasing densities of deciduous vegetation. Autotrophic (algal) production responds most with an open canopy and heterotrophic (detrital) production responds most to a full canopy consisting of red alder. Light is the primary factor limiting primary productivity in temperate-forest streams (Gregory 1980, Kiffney et al. 2004) and is strongly associated with productivity at higher trophic levels (Wilzbach et al. 2005, Kiffney and Roni 2007). For example, biotic responses to moderate light levels or to deciduous vegetation ingrowth is detectable in buffers that range from 33 ft to 66 ft wide, in defoliated or thinned buffers (e.g., Danehy et al. 2007, Hoover et al. 2007), and in regenerated riparian stands (12 to 27 years old; Moldenke & Ver Linden 2007). Also, the longitudinal variation in light levels and chlorophyll *a* concentrations are significantly correlated with canopy gaps that occur along streams in late-successional (multi-structured) stands (Stovall et al. 2009). In contrast, biotic productivity in streams with conifer-dominated buffer strips that are wider than 100 ft (i.e., low quality detritus, low light levels) is similar to that observed in an unlogged forest (Newbold et al. 1980, Castelle and Johnson 2000, Moldenke & Ver Linden 2007).

The literature is consistent in showing that aquatic invertebrate assemblages are closely associated with litter composition (deciduous and conifer) and that alder is an important contributor of readily available and nutritious litter. For example, Wipfli & Musselwhite (2004) found (in SE Alaska) that small fishless headwater streams dominated by red alder contributed more detritus and more aquatic invertebrates to downstream fish habitat than did tributaries not dominated by alder. In Oregon coastal streams, Romero et al. (2005) showed that invertebrate drift under deciduous and mixed canopies was about 30% more abundant than under conifer due to a higher biomass of terrestrial macroinvertebrates. Allan et al. (2003), using insect fallout traps near streams in Southeast Alaska, captured a greater biomass of terrestrial macroinvertebrates beneath red alder compared to that beneath conifers (western hemlock, Sitka spruce). The quality of litter from red alder is the most nutritious and available for biological processing compared to other deciduous species and conifer; the latter being generally less available and more difficult to process (Allan, 1995; Cummins 2002).

There are no quantitative studies of source distances for litter and terrestrial subsidies. The FEMAT (1993) team, using professional judgment, estimated that most litter input comes within 0.5 tree heights. Streambank erosion and flooding of the adjacent forest floor in flood plain areas is also known to be a significant source of litter and invertebrates (White and Harvey 2007). Therefore, by inference, stream adjacent trees and shrubs, especially overhanging vegetation, are considered the most important contributors of litter and terrestrial insect fallout. Riparian management for high quality litter and terrestrial macroinvertebrate inputs would be most effective by maintaining stream adjacent (e.g., one tree crown width or about 30 ft) deciduous overstory and understory vegetation, especially near streams with moderately confined or unconfined channels (i.e., locations susceptible to bank erosion and flooding). Small streams are more tightly connected to riparian biotic inputs as a result of the closed canopy and the high edge-to-area ratio (Richardson et al. 2005).

The retention and subsequent biological processing of organic litter is dependent on channel morphology and flow regime (Richardson et al. 2009). Retention of detrital particles increases with increasing channel roughness which is associated with complex channels consisting of an intermingling of rock and debris (stones, twigs, logs; pool riffle, step pool, alluvial fan). Channel types with low roughness (plane-bed, cascade, bedrock) would have low retention of litter. Litter transport increases rapidly with discharge as particles become entrained and are transported downstream (Richardson et al. 2009).

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Proposed Riparian Prescriptions and Technical Assessment for Small Forest Landowners

Prepared by Douglas Martin
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Proposed Riparian Prescriptions

Management Objectives

The riparian prescription (Rx) are formulated to address landowner’s desired management objectives and the resource potential of a given site and stand condition (Table 1). The intent is provide prescription options that range from simple to more complex in terms of effort and expertise needed for design and permitting.

Table 1. Prescription options, landowner riparian management objectives and associated stand conditions.

Landowner Objective	Riparian Objective	Stand Condition	Rx Options
Implement prescription that is easy to lay-out with the least effort and cost for permitting.	Provide overall function effectiveness at or near FPR levels	None specified	Standard
Optimize ecological and economic benefits of resource protection and timber utilization	Implement treatments to balance protections and harvest	Well-stocked (70% conifer), harvestable age	Thinning
Restore/improve desired riparian conditions, where appropriate, for long-term benefit to functions and aquatic resources, and facilitate harvest to offset costs of proactive management.	Implement riparian silviculture treatments to alter stand structure and composition that will restore/improve desired ecological functions, biotic productivity, and stand quality	Overstocked conifer or dominated by hardwoods, high fire-fuel loads or disease-prone species	Patch harvest

The riparian prescriptions vary by stream type and bankfull width (BFW) (Table 2). Prescriptions for Type F are focused on maintaining habitat and water quality for fish. Those for Type Np focus more on limiting export of heat and sediment while promoting biotic productivity (e.g., invertebrates, smaller wood, organic litter) and amphibian habitat. Both lateral and longitudinal source distance functions are addressed by breaking stream types into large and small stream-width categories. The width break at 15 ft. for Type F separates larger channels with a higher potential for fluvial transport of large wood (LW) from smaller channels where there is little or no potential for fluvial transport^a (e.g., probability of LW

^a Streams with a high probability for debris flows are not included in the proposed Type F or N prescriptions and require buffers for unstable slopes as specified in the state Forest Practices Act.

movement is less than 1000 ft. in a 15-ft channel over life of wood, see Appendix A). The <5-ft break for Type F and Np streams delineates smaller, low-energy fish-bearing and non-fish streams where seasonal flows (e.g., spatially intermittent) are likely to influence vertebrate occupancy, small trees and shrubs are capable of providing shade, and small wood including tree limbs effectively contribute habitat and create retention structures for sediment storage/biological processing. The 5 to 15-ft wide Type F streams are more likely to be perennial and would be sensitive to shade loss during low summer flows. Also, streams in this category have an increasing dependency on LW to form habitat and retention structures with increasing BFW.

Table 2. Riparian prescription options by stream type and bankfull width (BFW) category. The prescription is coded with a number followed by a slash and letters; where the number is the outer buffer distance (ft) and letters identify the treatment for that distance. If there is an “x” in between two numbers, the second number/percentage (%) indicates the length of the prescription or applicable portion of reach. The riparian management zone (RMZ) starts at the stream bank or outer edge of Channel Migration Zone whichever is greater distance from stream. Buffers for unstable slope are applicable as defined by WAC and the 30-ft equipment limitation zone (ELZ) is applicable for all RMZ’s less than 30-ft wide.

Prescription group	Stream Type	BFW (ft)	RMZ (ft)	Prescription options ^a	Situation No.
Standard	F	>15	75	75/nc	1
Standard	F	5-15	50	50/nc	2
Standard	F	<5	25	25/nc	3
Standard	Np	>5 ft	25	25x300/nc ^b 25/tha	4
Standard	Np	<5 ft	25	25/tha	5
Standard	Ns	NA	NA	30/elz	6
Thinning	F	>15	75	50/nc, 75/hth	7
Thinning	F	5-15	50	25/nc, 50/mth	8
HC Regen. Harvest	F	>15	75	40%/ph ^c 75x60%/nc	9
HC Regen. Harvest	F	<15	50	50%/ph 50x50%/nc	10
Biotic Regen. Harvest	F	<15	50	50%/hth 50x50%/nc	11

^aPrescription codes: nc = no-cut, tha = thin from above, hth = heavy thin from below, mth = moderate thin from below, ph = patch harvest, elz = equipment limitation zone

^bThere are two prescriptions in this cell for Np; top one is for lower 300-ft of reach and lower one is for upper remaining portion of reach.

^cThe percentages (%) for prescriptions in Situations 9-11 refer to the proportion of total FPA reach where each prescription (e.g., 40%/ph = 40% of FPA reach has patch harvest) is applicable; see text for details.

Description of Prescriptions

Standard Prescription

The standard group of prescriptions are applicable for most riparian stands where the landowner wants to minimize effort/cost for unit layout and has a management objective is to protect existing ecological functions, at or near, levels provided by the FPR. Prescription options consist of simple no-cut buffers and thinned buffers that vary in width and application depending on stream type and BFW. For F streams, large wood supply and shade are the primary and secondary factors, respectively, that set buffer widths. Therefore, the no-cut buffer width for F streams increases with increasing BFW in keeping with the increasing dependence on LW and the reduced function of small wood (SM) as streams become larger. Because LW residence time also decreases with increasing channel size, the needed LW supply varies accordingly. Similarly, buffers widths affect shade potential that also varies in relation to stream BFW. Sediment filtering and biotic subsidies (i.e., litter, invertebrates) are influenced most by near-stream undisturbed soil and vegetation that are maintained by minimum 25-ft no-cut or thinned buffers for all prescriptions.

The prescription for $N_p > 5$ ft. includes a 25-ft wide continuous no-cut buffer for 300 ft. upstream of the N/F break and a 25-ft radius no-cut buffer around all tributary junctions within the N_p network. The remaining upstream N_p reach has a 25-ft continuous buffer that may be thinned to a canopy cover of 25%. In the thinned reach, all seeps and springs including the perennial initiation point (PIP) would receive the thinning prescription to minimize surface disturbances and to maintain the unique vegetation at these locations. Thinning of merchantable trees (i.e., thinning from above; tha) is permitted where ground disturbance is controlled (i.e., subject to ELZ rules) and includes the removal of windthrow-prone trees (i.e., small crown ratio) within 10 ft. of the stream to minimize the potential for sediment delivery from windthrow-root-pits. In the lower-wider portion of the N_p stream where perennial flows are probable, the no-cut buffer will provide LW and shade for habitat and temperature protection. Upstream, the thinning prescription addresses longitudinal connectivity of sediment and biotic processes in the extensive upstream network (i.e., headwaters account for 60-80% of total stream length, Benda 2005). The thinned stand will maintain sediment filtering, reduce slash and heat loading, and supply wood retention structures for sediment storage and biological processing. Also, the thinned stand will increase light and associated biotic subsidies over the short-term, and with appropriate silviculture facilitate the development of a multi-aged (structured) riparian stand over the long-term.

The prescription for $N_p < 5$ -ft is identical to the thinning prescription for $N_p > 5$ and includes the 25-ft radius no-cut buffer around all tributary junctions within the N_p network. This prescription is focused on sediment filtering, slash control, and longitudinal functions for sediment storage and biological processing.

Thinning

The objective for the thinning prescriptions group on Type F streams is to implement active management schemes that are designed to optimize the trade-offs between protecting ecological functions and providing economic benefits from timber harvest. The prescriptions (Table 2) consist of a no-cut buffer adjacent to the stream and heavy or moderate thinning intensity in the outer 25-ft portion of the RMZ. For large Type F (i.e., > 15-ft wide, Situation 7), the no-cut buffer is 50-ft wide and the outer zone (50 to 75 ft) may be thinned to a minimum 57 large (dominant crown class) trees per acre (i.e., heavy thin, [hth]). For narrower Type F (5-15 ft wide, Situation 8) the no-cut buffer is 25-ft wide and the outer zone (25 to 50 ft) may be thinned to a minimum 100 large trees per acre (i.e., moderate thin,

[mth]). Thinning is focused on removing the smaller trees and trees with short crowns that are more susceptible to windthrow than are trees with long crowns. Also, thinning should avoid removing trees leaning toward the stream and trees located on slopes > 40% in order to retain future mortality trees that are likely to fall towards the stream.

The thinning prescriptions are designed to increase diameter growth of residual trees, while minimizing losses of future large dead trees that could potentially contribute LW to the stream. Therefore, intensity of thinning increases with distance from the stream where function is increasingly dependent on tree size and where LW recruitment potential is inversely proportional to distance. The moderate thinning intensity within 25 to 50 ft for Situation 8 will result in more large trees (i.e., > 20" dbh) in trade for a small reduction in the potential supply of LW from dead trees following the thinning treatment than would result if no thinning had occurred (see Function Evaluation for explanation). The heavier thinning within 50 to 75 ft for Situation 7 reduces production of LW from dead trees, compared to the moderate thin, but this has a minor effect on the potential LW supply, because only a small proportion of trees are recruited to the stream from this distance. Also, heavier intensity thinning will promote faster production of large (>20") and very large (> 40") trees which benefits both ecological and economic resources.

Regeneration Harvest

The landowner objective of the regeneration harvest prescriptions is restore or improve desired riparian conditions, where appropriate, for the long-term benefit to riparian functions and aquatic resources. Also, these prescriptions facilitate timber harvest in the RMZ that may help offset the costs of permitting and implementation of a project. The riparian management objective is accomplished through active manipulation of stand structure and composition near or adjacent to streams. This approach is more effective than either the standard or thinning prescriptions because the effectiveness to influence buffer functions diminishes with distance.

The situations where regeneration harvest may be applied are limited to two common stand conditions; riparian areas dominated by hardwoods, where conditions are suitable to restore a conifer stand (i.e., subject to same requirement as WAC 222-30-021); and, riparian areas with overstocked single-age conifer where heavy thinning would increase light, promote biotic productivity, and a diverse stand structure. Other stand conditions that could likely benefit from active management are not addressed because they typically require a site-specific evaluation that goes beyond a template approach (e.g., see VTAC 2012).

The hardwood (HC) regeneration harvest prescriptions are comprised of alternating riparian segments with patch harvest and intervening no-cut zones. On larger streams (Situation 9), the total length of patch harvest is limited to 40% of the stream length within the FPA and 50% on smaller streams (Situation 10). The 40% restriction on larger streams is intended to minimize the reduction in existing LW supply, whereas the 50% limit is allowed on the smaller streams because both large and small wood effectively contribute to function. The intervening no-cut reaches are a minimum of 100-ft long and should be located, where feasible, along segments with the highest potential for maintaining shade (e.g., south side of streams oriented east-west), and/or where there is high potential for LW recruitment (e.g., reaches with active bank erosion). The patch-cut segments should be located where conditions are suited for conifer regeneration. All trees within the regeneration patches may be harvested except for conifers and trees that occur within 25 ft. of the stream. The latter will provide some shade, LW, and bank stability in the patch-cut reaches during the period of stand regeneration.

The biotic regeneration prescription (Situation 11) is intended to improve ecological diversity by developing canopy openings along smaller streams to emulate natural disturbances. Openings would be created by heavy intensity thinning (57 tpa, thin from below) up to the stream edge within riparian segments no greater than 150-ft long and cumulatively no more than 50% of the project reach. Canopy opening segments alternate with intervening no-cut segments that are a minimum of 150-ft long. Precautions to minimize ground disturbance and ELZ rules are applicable. Small, especially lower gradient) streams are better suited for the biotic regeneration prescription than larger streams because shade is typically limiting (e.g., > 90%) both instream and riparian (deciduous) productivity and there is lower dependence on LW supply.

Function Evaluation

Standard Prescription

This effectiveness evaluation assesses the potential of the riparian forest to provide LW, shade, sediment filtering, and biotic processes both on-site and downstream (i.e., considers both lateral and longitudinal connectivity of ecological functions). Given the large variability in riparian stands and site characteristics, a number of assumptions, as described below, are necessary to facilitate the evaluation. Therefore, this assessment provides a relative index of prescription effectiveness to provide riparian functions.

Information from the literature and modeling (Appendix A and B) are used to quantify or qualify function effectiveness. Both modeling and empirical source- distance data from fish-bearing streams are used to quantitatively evaluate shade and LW effectiveness; and, best professional judgment based on literature is used to assign qualitative rankings to other functions. The Department of Ecology model (Appendix A Figures A-1, A-2) is used to assess potential shade for a conifer stand with mean height 148 ft. and canopy densities of either 25% (sparse) or 75% (dense) depending on the prescription. Large wood source-distance curves based on empirical data from the Northwest and Southeast AK (Appendix Figure A-3) are used to evaluate LW supply potential. One dataset (McDade et al. 1990) was excluded from this evaluation because these data include both tree pieces and trees unlike the other datasets that were based on counts of recruited trees (i.e., data not comparable because source-distances for trees and pieces likely differ).

Sediment filtering is ranked as H (high), M (moderate), or L (low) based on following conditions: a minimum 25-ft RMZ with 25% stand density within a 30-ft. ELZ = H; a clearcut with 30-ft ELZ = M; and, a clearcut with no ELZ = L. Biotic subsidies are based on the potential to provide litter and invertebrates. Litter potential is ranked as H if riparian stand is at least 25-ft wide or L if clearcut. Invertebrate potential is based on the availability of light and presence of diverse understory and overstory riparian vegetation (e.g., shrubs, deciduous) which promotes both aquatic macroinvertebrate and terrestrial insect productivity. Therefore, thinned riparian stands within 25-ft of stream that retains trees and understory vegetation = H, clearcuts = M, and no-cut riparian stands at least 25-ft wide = L. Longitudinal connectivity is ranked as Y (yes) if riparian prescription for stream type F and N RMZ's are contiguous or N (no), if not (i.e., clearcut, no contiguous RMZ).

Function effectiveness for the standard prescription are compared to that for the FPR prescriptions in Table 3. The effectiveness for both groups of prescriptions is based on the BFW's listed for the proposed prescriptions. In stream type F, function effectiveness is evaluated for both the "no inner zone" and "thin from below" options for Site Class 3. Effectiveness for shade is based on the width (distance at

outer edge) of the no-cut or thinned buffer that is located adjacent to the stream. Effectiveness for LW supply is based on the widths of the no-cut buffer and the thinned buffer. The LW supply potential for the thinned zone is reduced by tree harvest. Therefore the post-thinning LW supply potential is adjusted as follows. First the LW supply potential for the no-cut width and the width at the outer edge of the thinning zone (i.e., outer edge of “inner zone” for FPR rules) are derived from the source distance curves (Appendix A). Second, the difference in LW supply between the no-cut and thinned zone widths, is adjusted based on the predicted loss in dead tree production due to thinning as shown in modeling by Pollock and Beechie (2014). The reduction in dead tree production for trees > 20” (i.e., 50 cm dbh) at 50 years post-treatment for thinning levels of 57 tpa and 100 tpa (i.e., 150 tph and 250 tph, respectively) are based on results presented in Figure 5b of Pollock and Beechie (2014). Using these results, the relative production of dead trees for thinning treatments of 57 (heavy thin) and 100 tpa (moderate thin) are 45% and 73%, respectively, of the potential production for an un-thinned stand at 50 years. For example, LW supply potential after heavy thinning (retain 57 tpa) in Situation 8 (50/nc, 75/hth) is > 93%. This estimate is based on LW supply potential of 91% and 96%, respectively for the no-cut buffer distance at 50 ft and thinning distance at 75 ft respectively; with difference of 5% and relative dead tree production of 45%; results in LW potential of 93% (i.e., $0.91 + (0.05 \times 0.45) = 0.93$).

The increased growth of residual trees as a result of thinning are based on live tree production estimates from Figure 6 of Pollock and Beechie (2014).

Table 3. Comparison of riparian function potential between proposed and Forest Practices Rule (FPR) prescriptions. In FPR type F streams, function effectiveness is evaluated for both the “no inner zone” and “thin from below” options for Site Class 3, respectively. See Table 2 caption for description of prescription codes.

Prescription No.	Stream Type	Riparian function potential										Riparian function potential							
		BFW (ft)	RMZ (ft)	Prescript.	Shade	LW	Sed.	Litter	Invert	Long. Cont.	BFW (ft)	Prescript.	Shade	LW	Sed.	Litter	Invert	Long. Cont.	
		Standard Prescription										FPR Prescriptions							
1	F	>15	75	75/nc	max	>96%	H	H	L	Y	>10	105/nc ^c	max	>98%	H	H	L	Y	
											>10	50/nc, 105/hth	>94%	>94%	H	H	L	Y	
2	F	5-15	50	50/nc	>94%	>91%	H	H	L	Y	<10	93/nc	max	>97%	H	H	L	Y	
											<10	50/nc, 93/hth	>94%	>93%	H	H	L	Y	
3	F	<5	25	25/nc	>95%	>75%	H	H	L	Y	<10	93/nc	max	>97%	H	H	L	Y	
											<10	50/nc, 93/hth	>96%	>93%	H	H	L	Y	
4	Np	>5 ft	25	25x300/nc 25/tha	>94% 43% ^a	>75% >19% ^b	H	H	L	Y	NA	50x50%/nc 50%/cc	>94% >0	>91% slash	H	H	L	Y	
												50x50%/nc 50%/cc	>96% 59% ^d	>91% slash	H	H	L	Y	
5	Np	<5 ft	25	25/tha	43% ^a	>19%	H	H	H	Y	NA	50x50%/nc 50%/cc	>96% 59% ^d	>91% slash	H	H	L	Y	
6	Ns	NA	0	30/elz	>0	slash	M	L	M	N	NA	30/elz	>0	slash	M	L	M	N	
		Thinning Prescription										FPR Prescriptions							
7	F	>15	75	50/nc, 75/hth	>94%	>93%	H	H	L	Y	>10	50/nc, 105/hth	>94%	>94%	H	H	L	Y	
8	F	5-15	50	25/nc, 50/mth	>95%	>87%	H	H	L	Y	<10	50/nc, 93/hth	>94%	>93%	H	H	L	Y	

^aShade in upper portion of Np reach based on cms stands (i.e., 25% density)

^bAssume 75% supply potential for a 25-ft buffer which is reduced by 25% stand density (i.e., 0.25 x 0.75 = 0.19)

^cTop and bottom cell Rx's are no-inner-zone-harvest and thin-from-below, respectively

^dBase on mean canopy cover for headwater streams with slash (see Appendix A).

The comparison of riparian function potential between the proposed and FPR prescriptions (Table 3) shows there are similarities in effectiveness, particularly for the wider F streams, and unique differences, particularly for the Np streams. Function effectiveness for F streams 5-15 ft and F >15 ft wide are nearly identical to that for the FPR prescription options in the same BFW categories. Differences in effectiveness between prescription groups are small, because most function potential is provided within 50-ft of the stream. Therefore, increases in buffer width beyond 50 ft provide relatively small gains in effectiveness of riparian functions. The effectiveness for F Type < 5-ft is also similar to the FPR prescription options for all functions except LW supply which is reduced to 75% by the narrower buffer. The effect of this small reduction in LW supply potential on habitat is a lesser concern for small streams considering that smaller wood from limbs and tree pieces are effective habitat formers and fluvial export of LW is limited.

Prescription effectiveness for Np streams depends on differences in treatments for the lower (i.e., adjacent to F/N break) and upper portions of the stream. Effectiveness for the lower reach of Np Type > 5-ft (Situation 4) is similar to the FPR prescription for all functions except for potential LW supply which is reduced by about 20% (Table 3). However, there are large differences in overall effectiveness between prescription groups because the FPR prescription stops at 50% of the stream length, but the proposed prescription has a continuous 25-ft buffer up to the end of the Np reach. This continuous vegetated

buffer is more effective at reducing the potential negative effects of clearcutting (e.g., erosion, sediment transport, heat loading, excessive slash) by providing longitudinal connectivity for key functions (sediment filtering, shade, biotic inputs) along the entire channel including all adjacent seeps and wetlands. In contrast, the FPR prescription does not provide longitudinal connectivity of functions and is less likely to mitigate the negative effects that are exported from upstream clearcut areas.

The function effectiveness for Np streams < 5 ft (Situation 5) is similar to that described for Situation 4. In these small low-energy streams, a continuous 25-ft wide buffer provides longitudinal connectivity of functions that minimizes the negative effects from clearcutting on-site. Increases in function effectiveness along the entire stream reduces the need for a wider “mitigation” buffer in the lower reach of the Np stream.

Thinning Prescriptions

Effectiveness of the proposed thinning prescriptions are similar to the FPR thinning prescriptions for all functions with small difference for LW supply (Table 3). The LW supply in Situation 8 is reduced partly by the narrower RMZ and by the small reduction in dead tree production after the thinning treatment. However, at 50 years post treatment the moderate thinning for Situation 8 will result in about 45 large (> 20” dbh) live trees per acre in the thinned zone compared to about 34 large live trees per acre in the inner zone of the FPR prescription (from Figure 6 of Pollock and Beechie, 2014). This difference is a result of heavy thinning within the inner zone for the FPR prescription.

Regeneration Harvest Prescriptions

Function effectiveness for the regeneration harvest prescriptions is based on the future potential conditions and functions resulting from the treatment including planting; not the immediate post-treatment condition as evaluated in Table 3. The hardwood conversion and biotic regeneration harvest prescriptions are designed to minimize short-term reductions in riparian functions in trade for rapidly improving ecological functions that have a long-term benefit to instream habitat and aquatic biota. The hardwood conversion is focused on restoring conifer stands to improve the LW supply potential for streams where instream wood loading and associated LW dependent habitat is limited. The alternating patch-cut and no-cut segments not only minimize negative effects from treatment, but will promote longitudinal diversity in stand structure/composition when the conifer stands are re-established. Similarly, the 25-ft tree retention buffer in the patch-cuts reaches contributes to stream protection. Allowing flexibility in size and location of conifer regeneration patches is recommended and is likely to improve regeneration success (Roorbach et al. unpublished).

The biotic regeneration harvest prescription will be applied to overstocked single-age conifer stands with dense canopies that significantly limit light and reduces litter quality in small streams. Maintaining a fixed-width buffer under these conditions may protect some functions (e.g., temperature and LW), but restricts other functions (primary productivity, invertebrates, food production) that are beneficial to aquatic biota (Liquori et al. 2008). Research shows that canopy openings and multi-structured riparian stands with deciduous litter improves biotic productivity (see Appendix A). Further, there is growing support for active management of riparian stands (e.g., create canopy openings) to facilitate riparian structural diversity and associated biotic productivity by emulating natural disturbances (Kreutzweiser et al. 2012, Moore and Richardson 2012). For example, MacCracken et al. (unpublished) demonstrated with experimental canopy openings that moderate increases of light along stream reaches 150-ft long resulted in small temperature increases (< 1° C), benefited amphibian taxa, and had no negative effects on benthic macroinvertebrates.

Spatial Context for Prescriptions

The overall effectiveness of the proposed prescriptions to provide functions is not only due to their site-specific effectiveness, but also related to the frequency of implementation across the landscape. One way to assess the relative rate of implementation is to compare the prescription width categories to channel width data from the CMER extensive temperature studies (Peter and Engeness 2014). The distribution of channel widths (Figure 1) are based on a random sample from all streams on private forestlands in western Washington. The cumulative frequency distribution for Type F indicates that the > 15, 5-15, and < 5-ft. width categories would occur on 48%, 41%, and 11% of the network length, respectively. The Type Np streams > 5 ft and < 5 ft width categories would occur on 51% and 49% of the network length, respectively. Therefore, in F streams, the F >15 and F 5-15 standard prescriptions which have similarly high function effectiveness are likely to be applied on streams that are typical for 89% of the F network. Whereas, the F <5 prescription may only occur on streams typical for 11% of the F network.

The two Np prescriptions are likely to be applied equally across all Np streams because the 5-ft break between small and large is equivalent to the 50th percentile (Figure 1). However, the Np prescriptions will probably occur on more streams than the F prescriptions because headwater streams occupy from 60% to 80% of the total length of streams in the hydrographic network (Benda 2005).

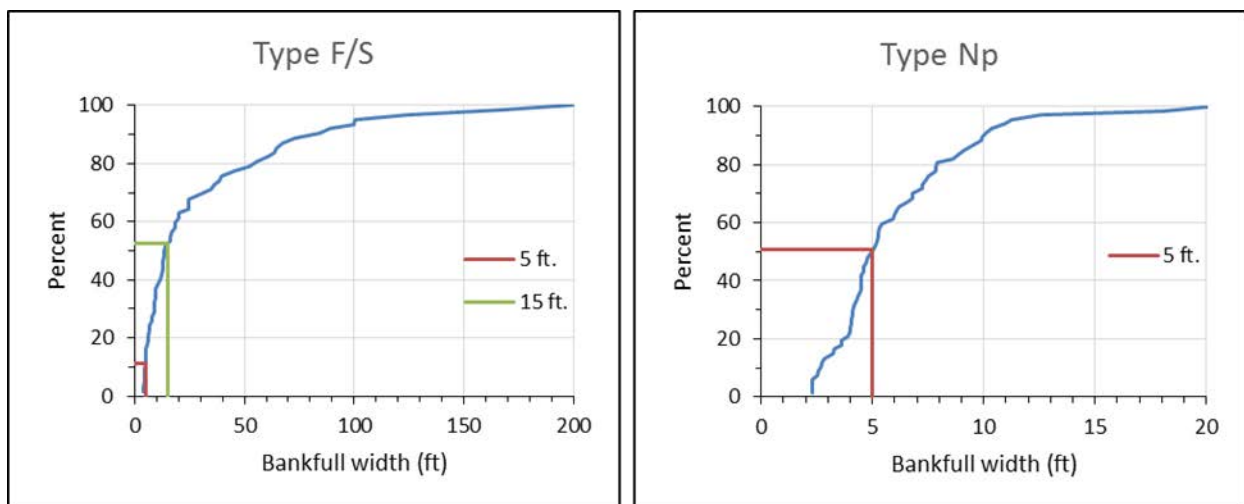


Figure 1. Cumulative frequency distributions of channel bankfull widths for Type F/S (n = 62) and Np (n = 67) streams. Data based on random sample from all streams on private forestlands in western Washington. Data from W. Ehinger, WDOE, personal communication.

Appendix A: Riparian Function Assessment

Shade

The primary function of riparian vegetation in controlling water temperature is to block incoming solar radiation (direct and diffuse). Direct solar radiation on the water's surface is the dominant source of heat energy that may be absorbed by the water column and streambed. Absorption of solar energy is greatest when the solar angle is greater than 30° (i.e., 90 to 95 % of energy is absorbed as heat) and decreases as the solar angle declines due to the reflection of radiation off the water surface. Therefore, riparian vegetation that blocks direct solar radiation along the sun's pathway across the sky is the most effective for reducing radiant energy available for stream heating (Moore et al. 2005). Research shows that the attenuation of direct beam radiation by riparian vegetation is a function of canopy height, vegetation density, and buffer width (Beschta et al., 1987, Sridhar et al. 2004, DeWalle 2010). Light attenuation increases with increasing canopy height and increasing buffer density as a result of the increased solar path and extinction of energy. Buffer width has a variable influence on light attenuation depending on stream azimuth (e.g., effective buffer widths for E-W streams may be narrower than for N-S streams due to shifts in solar beam pathway from the sides to the tops of the buffers; Dewalle 2010). Riparian buffer width is important for a given stand type and age, but is not a good predictor of stream shading among different stands because of differences in the shade-controlling variables. For example, Beschta et al. (1987) showed that shade levels^b similar to old-growth forests (i.e., range 75% to 90%) varied from 65 ft. to 100 ft. depending on stand types in western Oregon. Similarly, Sridhar et al. demonstrated the most effective shading for temperature control in eastern and western Washington Cascade conifer stands was predicted for mature (high leaf-area-index) canopies close to the stream (i.e., within 33 ft. of the stream bank) and overall buffers of about 100 ft.

High levels of shading can be provided by buffers ranging from 25 ft. to 75 ft. wide, because most shade is provided by trees directly adjacent to the stream (Table A-1). For example, Teply et al. (2013) demonstrated that thinning the outer portion of a buffer with a 25-ft. no-harvest core in a grand fir-western red cedar stand reduces the overall potential shade by 6% to 15% depending on the width and level of thinning in the outer zone. Also, they indicated that similar buffer treatments in the western hemlock-subalpine fir and Douglas-fir stands of western Idaho could provide relatively high shade levels.

Predictions of effective shade (i.e., percentage of potential daily solar radiation blocked by vegetation and topography) were simulated with the Ecology shade model (<http://www.ecy.wa.gov/programs/eap/models.html>) to demonstrate how stand height, composition, buffer width, and stream aspect influence shade. Effective shade was simulated for a hypothetical low-gradient (2 - 3%) stream, with no topographic shading, located in Olympia vicinity, and having conifer/deciduous riparian stands that are typical of western Washington (Table 2). The simulation results are consistent with the findings described by others and shows that effective shade is mostly provided by trees within 15-25 ft. of the stream regardless of stand height, composition, and aspect (Figure A-1, Appendix B). Trees beyond 25 ft. only contribute a small amount of shade. Shade is correlated with tree height as high shade levels (i.e., exceeding 75%) are provided by small trees along 5-ft. streams, and by medium to large size trees along streams up to 25 ft. wide. Shade potential declines with increasing stream width and is lowest for the wider streams with a N-S aspect. Note, the mixed-medium and mixed-large stands provide slightly more shade than the conifer stands of similar

^b Based on measure of angular canopy density (ACD) which is a projection of the canopy at the angle above the horizon at which direct-beam solar radiation passes through the canopy (Beschta et al 1987).

size (Appendix B). The latter is partly due to the greater overhang which blocks direct beam radiation. Similarly, high shade levels can be maintained along E-W streams (aspects 270° and 225°) with dense stands on the south side and sparse stands on the north side because most radiation is blocked by the south side stand (Figure A-2).

Shade levels in headwater streams without buffer strips are typically greater than zero initially following timber harvest as a result of cover from logging slash. Even though BMPs (e.g., 30-ft ELZ) are intended to minimize slash input, studies show that slash is relatively common in seasonal streams (Type Ns). For example, shade levels in four headwater streams bordered by clearcut units in southern Oregon averaged 66% after harvest (i.e., average 20% reduction from pre-harvest levels) (Kibler et al. 2013) and similarly, Ehinger et al. (unpub.) observed a mean decreased in canopy cover at the water surface from 91% pre-harvest to 52% as a result of logging slash in headwater streams in western Washington. In both studies the longitudinal distribution of slash cover was patchy and associated shade was highly variable. The effectiveness of slash to provide shade is likely to decline over time with decay and debris export.

Shade from riparian vegetation is not the only factor influencing stream temperature. Research shows that temperature response from timber harvest is variable and is highly dependent on the volume of stream flow, substrate type, groundwater inflow, and surface/subsurface water exchange (i.e., hyporheic exchange) (Moore et al. 2005). Stream size is a key driver with sensitivity decreasing in relation to increasing depth, velocity, and discharge (Moore et al. 2005). Velocity influences exposure duration which decreases with increasing velocity in steeper channels (cascade channels). Stream depth has significant influence because it affects both the magnitude of the stream temperature fluctuations and the response time of the stream to changes in environmental condition (Adam and Sullivan 1989). The temperature response to heat input is dampened by hyporheic exchange rate which is a function of bed composition. Streams with alluvial gravel/cobble bed material (pool riffle, alluvial fan channels) enables increased hydraulic retention (promotes conductive cooling) and are less sensitive to shade loss compared to streams with less-permeable boulder/bedrock substrate (e.g., cascade, bedrock channels) (Johnson 2004, Dent et al. 2008). In general, stream sensitivity to shade loss is a function of reach-scale physical characteristics. For example, streams at lower elevations (i.e, warmer air temperature), or with no topographic shading, or with shallow-wide channels (i.e., high width-to-depth ratio), or with bedrock substrate (i.e., hyporheic exchange limited) are more sensitive to heating from shade loss than are streams with the following conditions: at higher elevations, or with topographic shading, or with deep-narrow channels, or with alluvial substrate.

Table A-1 Summary of stream shade provided by different buffer treatments similar to proposed template.

Location	Stand type	Buffer treatment	metric	Post-harvest		Reference
				amount	change	
western WA	df, hem, 35-50 yrs	50-ft. no-harvest	canopy cover	81%	-10%	Schuett-Hames et al. 2011
western WA	df, hem, 60-110 yrs	33 to 50-ft. no-harvest	canopy density ^a	86%	-8%	Janisch et al. 2012
coastal OR	df, alder, 50-70 yrs	50 to 70-ft.; inner 20 ft. no-harvest, outer thinned	shade	78%	-7%	Groom et al. 2011
western ID	grand fir-redcedar	50-ft. no-harvest	effective shade	82%	-8%	Teply et al. 2013
western ID	grand fir-redcedar	75-ft. no-harvest	effective shade	87%	-3%	Teply et al. 2013
western ID	grand fir-redcedar	50-ft.; inner 25 ft. no-harv., outer 25 ft. thinned	effective shade	75%	-15%	Teply et al. 2013
western ID	grand fir-redcedar	75-ft.; inner 25 ft. no-harv., outer 50 ft. thinned	effective shade	84%	-6%	Teply et al. 2013

^aincludes topographic shading

Table A-2. Description of riparian stand characteristics used for modeling. Data derived from riparian shade study in Stillaguamish River by Ecology (<http://www.ecy.wa.gov/programs/eap/models.html>). Note, canopy density of 75% approximates levels found in unmanaged stands (Beschta et al. 1987).

Stand description	Height (ft)	Canopy density (%)	Overhang (ft)
css - conifer, small, sparse	49	25	5
csd - conifer, small, dense	49	75	5
cms - conifer, medium, sparse	148	25	15
cmd - conifer, medium, dense	148	75	15
cls - conifer, large, sparse	174	25	17
clid - conifer, large, dense	174	75	17
msd - mixed, small, dense	49	75	6
mms - mixed, medium, sparse	66	25	7
mmd - mixed, medium, dense	121	75	15
mld - mixed, large, dense	148	75	18
clearcut	0	0	0

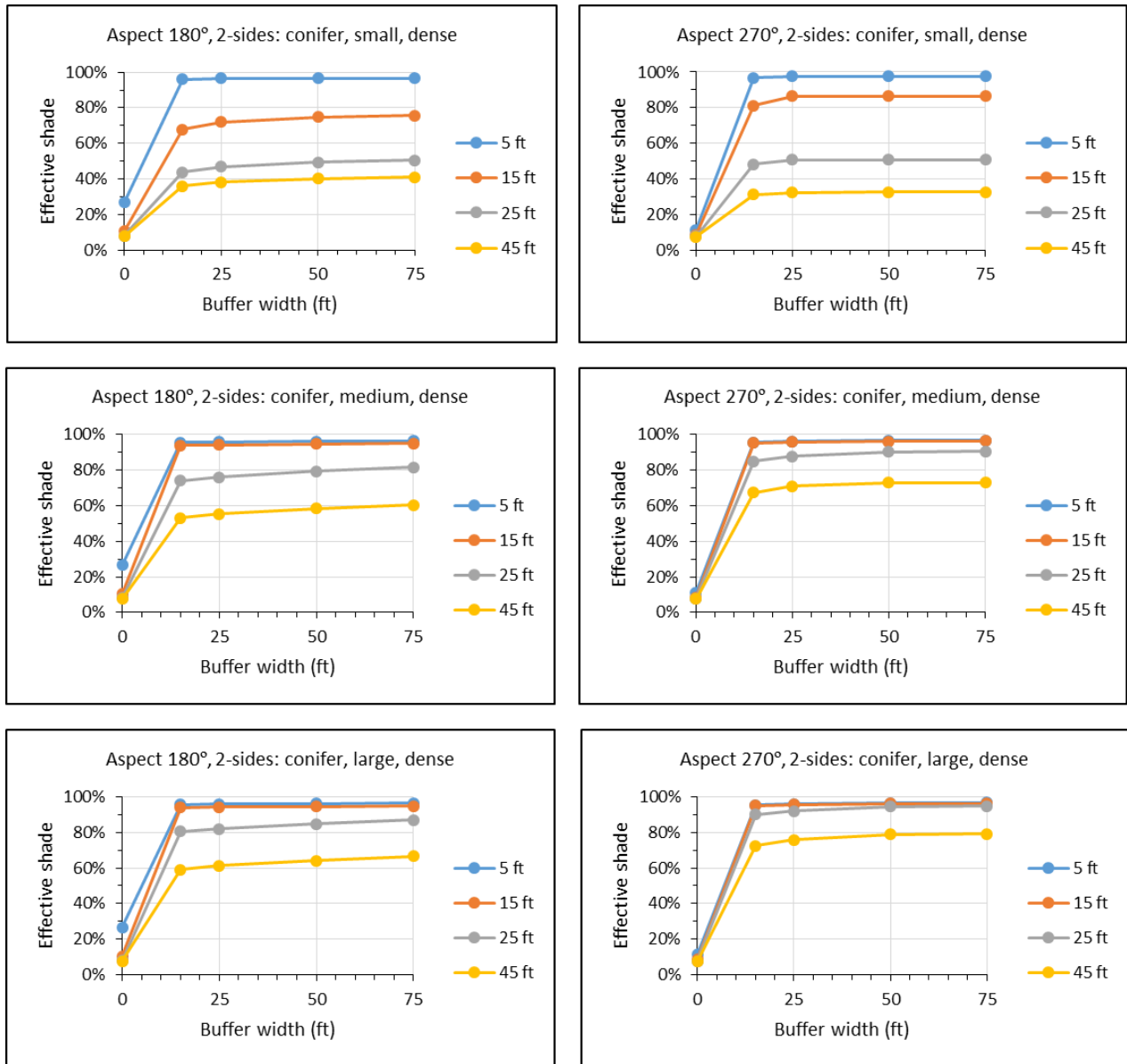


Figure A-1. Predicted effective shade in relation to buffer width, channel width, and aspect for riparian stands with different tree heights and composition. Shade simulated for streams with N-S and E-W aspects, and with dense conifer stands on two sides. Stand specifications are listed in Table A-2.

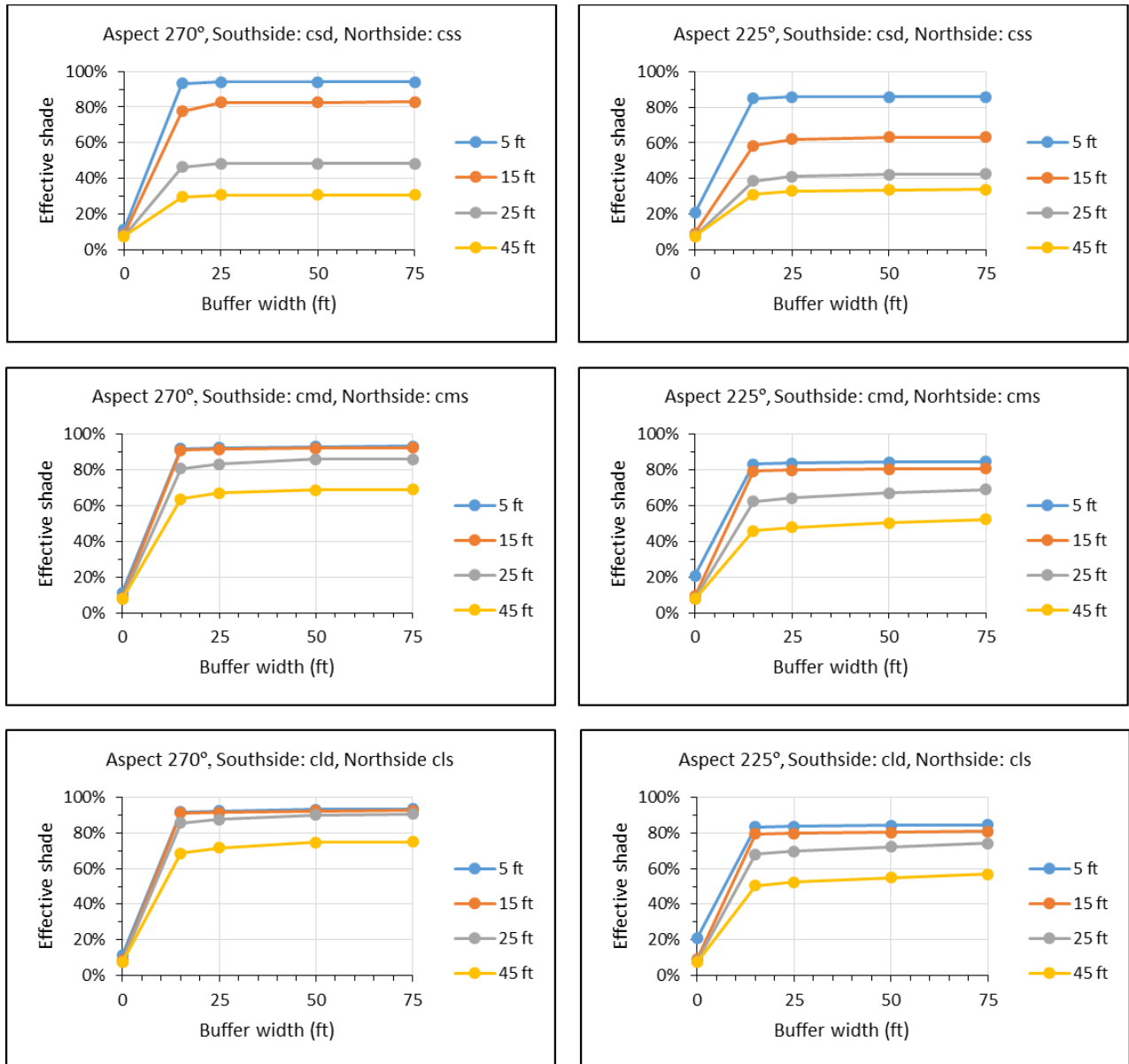


Figure A-2. Predicted effective shade in relation to buffer width, channel width, and stream aspect for riparian stands with different tree heights and composition. Shade simulated for streams with dense conifer stands on south side and sparse conifer stands on north side. Stand specifications are listed in Table 2.

Large Wood

The primary factors controlling large wood (LW) recruitment to streams are tree height and stand mortality processes. In general the distances to sources of stream wood increase with increasing tree height. For example, the source distances for tall old growth Douglas fir or coastal redwoods of California may extend out to 200 ft., but recruitment of shorter Sitka spruce in Southeast Alaska may only extend to 125 ft. (Benda & Bigelow 2014, Martin & Grotefendt 2007, McDade et al. 1990). Similarly, smaller trees in second-growth stands will have shorter source distances than trees from old-growth stands. However, the tree height source distance relationship is modified by site-specific factors (i.e., valley morphology, stream width, and wind exposure) that can have a strong influence on stand mortality. For example, LW recruitment by bank erosion is the dominant wood input process for low- to moderate-gradient channels in unconfined valleys and bank erosion recruitment increases with increasing stream width (Benda & Bigelow 2014, Johnston 2011, Martin & Benda 2001). Most of the LW in erosion prone channels is derived from the stream banks (e.g., 86% to 98% may be recruited from within 25 ft.; Table A-3, Figure A-3). Recruitment by stand mortality (e.g., stem suppression) is generally dominant where bank erosion is limited, such as in riparian stands adjacent to smaller streams and streams of any width that are confined by bedrock or hillslopes. Also, there is a strong tendency for dead trees to fall towards the channel on steeper hillslopes (i.e., >40%) that may increase recruitment by 1.5 to 2.4 times over levels from lower-gradient landforms (Sobota et al. 2006). In areas where stand mortality dominates, the source distance distribution shifts away from the stream bank and most recruits are derived from within 50 to 75 ft. (Table A-3, Figure A-3). Note, the far right shift of source distances for the McDade (1990) data (Figure A-3) are due, in part, to significant recruitment from trees and tree pieces that slid down steep side slopes (50% of study sites were located on slopes > 40%). Windthrow can extend the source distance by increasing recruitment from trees along the outer edge of buffer strips (Rollerson et al. 2009, Martin & Grotefendt 2007, Liquori 2006). Local landslides can extend the source distances even farther from the channel up the hillslopes (Benda & Bigelow 2014). The rank ordering of source distances for all mortality processes are bank erosion < tree mortality < windthrow < local landslides.

Table A-3. Summary of large wood inputs to streams by riparian source distance and dominant recruitment process (recruitment by landslides excluded).

Location	Stand type	Dom. recruit process	Percentage input by source distance				Reference
			25 ft.	50 ft.	75 ft.	100 ft.	
Southeast AK	old-growth	bank erosion	86	93	96	98	Martin & Grotefendt (2007)
South-Central BC	old-growth/mat. conif.	bank erosion	98	99	100	100	Johnston (2011)
South-Central BC	old-growth/mat. conif.	mortality	81	95	98	100	Johnston (2011)
Cascade, WA,OR	mature conif.	mortality	40	71	85	94	McDade et al. (1990) ^a
Cascade, WA,OR	old-growth	mortality	33	62	76	84	McDade et al. (1990) ^a
Southeast AK	Old-growth	mixed	75	91	97	99	Murphy & Koski (1989)
Cascade, WA	conifer (50-80 yrs)	mixed	82	96	98	100	Mckinley (1997)
Cascade, CA	Unmanaged	mixed	75	97	99	100	Benda & Bigelow (2014)

^aData include trees and tree pieces from given distance.

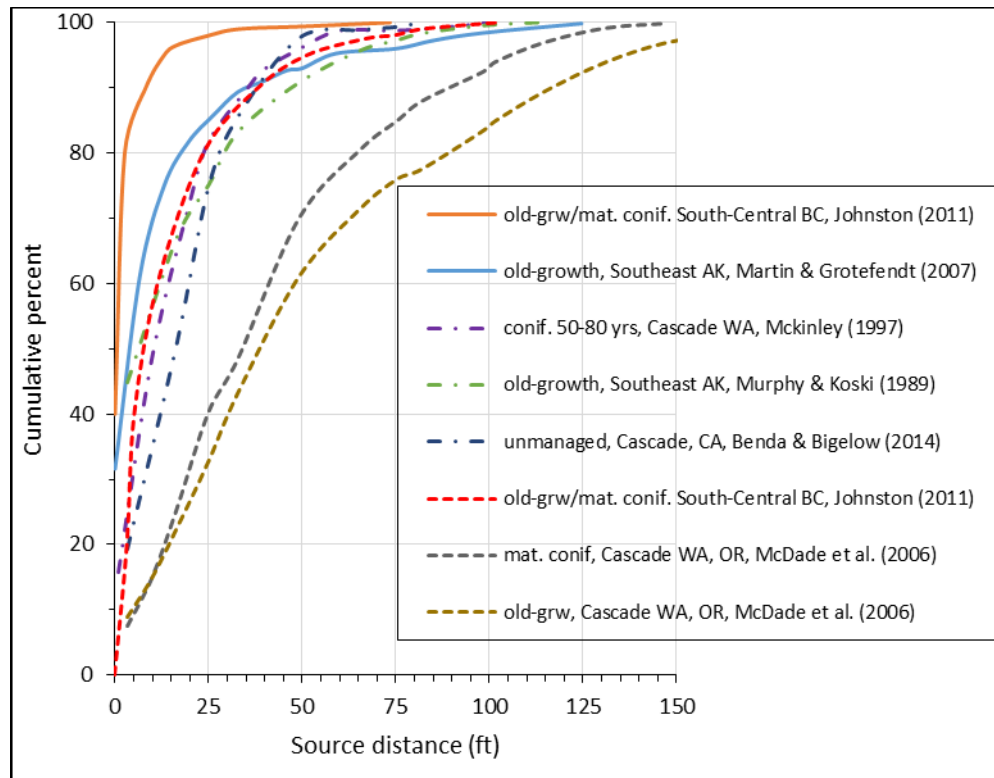


Figure A-3. Large wood source distance curves for riparian forests similar to stands typical of western Washington. Dominant recruit processes are bank erosion (solid line), stand mortality (dashed line), mixed (dash-dot line). Note, the far right shift of source distances for the McDade (1990) data are due, in part, to significant recruitment from trees and tree pieces that slid down steep side slopes (50% of study sites were located on slopes > 40%).

Windthrow can increase the probability of LW recruitment from buffer strips over the short-term and can influence the long-term supply at locations prone to wind damage. At the landscape scale, windthrow mortality is highly variable; having a skewed mortality distribution (i.e., most sites have low mortality and a few have high mortality (Grizzel and Wolff 1998, Martin and Grotefendt 2007, Rollerson et al. 2009). Wind damage is strongly associated with buffer orientation relative to the predominant storm direction (i.e., southeast, south, southwest in the Pacific Northwest) and local conditions including wind fetch length resulting from the size of clearcut units (Kramer et al. 2001, Mitchell et al. 2001, Rollerson et al. 2009). At the scale of individual trees, windthrow mortality is associated with low percent live crowns (< 40%) and high height-diameter ratios (>60%) (Scott 2005). Reductions in windthrow mortality are feasible when site and landscape factors are considered in harvest unit plans (Kramer et al. 2001; Mitchell et al. 2001)

The transport of LW in streams provides connectivity between upstream sources areas and downstream processes that create channel complexity and form aquatic habitat. Debris flows that result from channelize landslides are an important mechanism for delivery of LW from steep headwaters to larger fish bearing streams (May and Gresswell 2003, Reeves et al. 2003). Debris flows can transport wood in small streams that lack the capacity for fluvial transport of wood, and for transporting wood that is longer than the bank-full width of the channel. In the absence of debris flows, drainage area (i.e., stream size) is the primary factor controlling the fluvial transport of LW in streams. Studies by Martin & Benda

(2001) in Southeast Alaska and by Benda and Bigelow (2014) in four regions of northern California (Coast, Klamath, Cascade, and western Sierra ranges) show that fluvial transport of LW increases with increasing stream size. In both studies the predicted wood transport distance (over the lifetime of wood in streams varied from a few hundred ft. to ten thousand ft. in channels with drainage areas of 250 ac to 18,000 ac, with transport distance increasing with drainage area. For example, in the smallest channel (10-15 ft. wide), Martin and Benda (2001) estimated there was a 90% probability that LW would be transported at least 150 ft. and only a 10% probability that transport could exceed 1000 ft. Also, the length of nearly all mobile LW is less than or equal to the bank-full width of the channel. Therefore, only a small proportion of LW is exported by fluvial processes in smaller headwater streams and only the lower-larger portions of headwater channels are likely transport LW to larger streams. Correspondingly, the residence time of LW accumulations in streams is inversely related to channel size (Martin & Benda 2001, Benda and Bigelow 2014).

The size of LW (diameter and length of wood pieces) required to form habitat increases with increasing stream width (Bilby and Ward 1989). For example, Bilby and Ward (1989) found that functional size pieces ranged from 25 to 65 cm in diameter and 5 to 12 m in length in streams 13 to 65 ft wide. Beechie and Sibley (1997) regressed wood diameter with channel width and showed the minimum diameter for forming pools ranged from 5 inches to 10 inches for streams 15 ft. and 30-ft. wide, respectively. In small headwater streams (range 3 - 12 ft wide), Jackson and Sturm (2002) found that wood smaller than 8 inches diameter is more likely to function than is larger wood and that smaller wood along with inorganic material and organic debris (< 4 inches diameter) were major step-forming agents.

The formation of fish habitat in streams is not only a function of LW supply and size, but on reach-scale physical characteristics (channel width, morphology, substrate composition) that influence the channel response to wood loading. For example, research shows that large wood has a stronger influence on the formation of pools and gravel bars in moderate gradient, unconfined channels (e.g., plan bed, pool riffle, alluvial fan channel types) compared to either high-gradient-confined channels or low-gradient channels (Montgomery et al. 1995, Beechie and Sibley 1997, Martin 2001). The cobble-boulder-bedrock substrate typical of steeper high-energy channels controls bedform (e.g. step pool, cascade) and pool formation is independent of LW; although LW may function to trap sediment in step-pool channels (Montgomery and Buffington 1997, Benda and Bigelow 2014). In very low-gradient meandering channels (e.g., dune ripple) the dependency on LW is limited as free-formed pools are common (Beechie and Sibley 1997).

Sediment

Timber harvest in or adjacent to riparian management zones can influence surface erosion and sediment input to streams as a result of ground disturbances from yarding activities (e.g., skid trails, yarding ruts), or to increases in root-pit formation from windthrow. Sediment retention within a riparian forest is controlled by vegetative ground cover, hillslope gradient, and soil erodibility (WFPB 1997). Ground cover including roots, stems, and debris (logs, slash) bind soils and create roughness elements minimizes surface runoff and traps soil particles (Liquori et al. 2008, Litschert and MacDonald 2009). Sediment delivery potential increases with slope. Therefore, the sediment retention function of riparian ground cover is most important in steeper terrain

Research shows that current harvest procedures and BMPs are largely effective in reducing erosion and sediment delivery to streams. Post-harvest evaluations of erosion features across a wide range of sites indicates that buffers and the prevention of ground disturbances within 30-ft of streams effectively prevented sediment inputs in most cases (Rashin et al. 2006, Litschert and MacDonald 2009). For

example, Schuett-Hames et al. 2011 found that implementation of a 30-ft equipment exclusion zone (ELZ) in clearcut units met the performance targets for sediment control at seven of eight clear-cut reaches. In a related study of buffer and ELZ effectiveness in headwater streams Stewart et al. (unpub.) reported the area of bank erosion (or lack thereof) was similar among reference and treatment sites suggesting the absence of a treatment effect. Root-pit formation is increased as result of post-harvest windthrow. However, the density of root-pits with sediment delivery were no different among reference and buffer treatment sites in two separate studies of BMP effectiveness (Schuett-Hames et al. 2011, Stewart et al. unpub). In both studies the mean distance to stream for root-pits that delivered sediment was less than 9 ft.

Biotic Productivity/Litter

Research shows that algal biomass and invertebrate prey biomass generally increase with increasing canopy openness and/or increasing densities of deciduous vegetation. Autotrophic (algal) production responds most with an open canopy and heterotrophic (detrital) production responds most to a full canopy consisting of red alder. Light is the primary factor limiting primary productivity in temperate-forest streams (Gregory 1980, Kiffney et al. 2004) and is strongly associated with productivity at higher trophic levels (Wilzbach et al. 2005, Kiffney and Roni 2007). For example, biotic responses to moderate light levels or to deciduous vegetation ingrowth is detectable in buffers that range from 33 ft to 66 ft wide, in defoliated or thinned buffers (e.g., Danehy et al. 2007, Hoover et al. 2007), and in regenerated riparian stands (12 to 27 years old; Moldenke & Ver Linden 2007). Also, the longitudinal variation in light levels and chlorophyll *a* concentrations are significantly correlated with canopy gaps that occur along streams in late-successional (multi-structured) stands (Stovall et al. 2009). In contrast, biotic productivity in streams with conifer-dominated buffer strips that are wider than 100 ft (i.e., low quality detritus, low light levels) is similar to that observed in an unlogged forest (Newbold et al. 1980, Castelle and Johnson 2000, Moldenke & Ver Linden 2007).

The literature is consistent in showing that aquatic invertebrate assemblages are closely associated with litter composition (deciduous and conifer) and that alder is an important contributor of readily available and nutritious litter. For example, Wipfli & Musselwhite (2004) found (in SE Alaska) that small fishless headwater streams dominated by red alder contributed more detritus and more aquatic invertebrates to downstream fish habitat than did tributaries not dominated by alder. In Oregon coastal streams, Romero et al. (2005) showed that invertebrate drift under deciduous and mixed canopies was about 30% more abundant than under conifer due to a higher biomass of terrestrial macroinvertebrates. Allan et al. (2003), using insect fallout traps near streams in Southeast Alaska, captured a greater biomass of terrestrial macroinvertebrates beneath red alder compared to that beneath conifers (western hemlock, Sitka spruce). The quality of litter from red alder is the most nutritious and available for biological processing compared to other deciduous species and conifer; the latter being generally less available and more difficult to process (Allan, 1995; Cummins 2002).

There are no quantitative studies of source distances for litter and terrestrial subsidies. The FEMAT (1993) team, using profession judgment, estimated that most litter input comes within 0.5 tree heights. Streambank erosion and flooding of the adjacent forest floor in flood plain areas is also known to be a significant source of litter and invertebrates (White and Harvey 2007). Therefore, by inference, stream adjacent trees and shrubs, especially overhanging vegetation, are considered the most important contributors of litter and terrestrial insect fallout. Riparian management for high quality litter and terrestrial macroinvertebrate inputs would be most effective by maintaining stream adjacent (e.g., one

tree crown width or about 30 ft) deciduous overstory and understory vegetation, especially near streams with moderately confined or unconfined channels (i.e., locations susceptible to bank erosion and flooding). Small streams are more tightly connected to riparian biotic inputs as a result of the closed canopy and the high edge-to-area ratio (Richardson et al. 2005).

The retention and subsequent biological processing of organic litter is dependent on channel morphology and flow regime (Richardson et al. 2009). Retention of detrital particles increases with increasing channel roughness which is associated with complex channels consisting of an intermingling of rock and debris (stones, twigs, logs; pool riffle, step pool, alluvial fan). Channel types with low roughness (plane-bed, cascade, bedrock) would have low retention of litter. Litter transport increases rapidly with discharge as particles become entrained and are transported downstream (Richardson et al. 2009).

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Appendix B. Predicted effective shade in relation to buffer width, channel width, and stream aspect for riparian stands with different tree heights and composition. Shade simulated WDOE model for two conditions: streams with dense conifer stands on two sides, and streams with dense stands on south side with sparse conifer stands on north side. Stand specifications are listed in Table A-2.

BFW (ft)	Buffer width (ft)	Buffer	Effective shade (%)		Effective shade (%)		
			two sides	aspect 180°	aspect 270°	Sside/Nside	aspect 270°
5	0	cc	26.7	11.3	cc/cc	11.3	20.7
5	15	csd	96.1	96.8	csd/css	93.2	85.0
5	25	csd	96.6	97.6	csd/css	94.2	85.7
5	50	csd	96.7	97.6	csd/css	94.2	85.8
5	75	csd	96.7	97.6	csd/css	94.2	85.8
5	0	cc	26.7	11.3	cc/cc	11.3	20.7
5	15	cmd	95.6	95.5	cmd/cms	91.9	83.4
5	25	cmd	95.9	96.0	cmd/cms	92.5	84.0
5	50	cmd	96.2	96.6	cmd/cms	93.2	84.4
5	75	cmd	96.4	96.7	cmd/cms	93.3	84.8
5	0	cc	26.7	11.3	cc/cc	11.3	20.7
5	15	clد	95.5	95.4	clد/clس	91.8	83.3
5	25	clد	95.8	95.9	clد/clس	92.3	83.7
5	50	clد	96.1	96.5	clد/clس	93.0	84.2
5	75	clد	96.3	96.8	clد/clس	93.4	84.6
5	0	cc	26.7	11.3	cc/cc	11.3	20.7
5	15	msد	96.2	96.9	msد/mss	93.4	85.0
5	25	msد	96.7	97.7	msد/mss	94.4	85.7
5	50	msد	96.8	97.7	msد/mss	94.4	86.0
5	75	msد	96.8	97.7	msد/mss	94.4	86.0
5	0	cc	26.7	11.3	cc/cc	11.3	20.7
5	15	mmd	95.8	95.9	mmd/mms	92.4	84.4
5	25	mmd	96.2	96.5	mmd/mms	93.1	85.0
5	50	mmd	96.5	96.8	mmd/mms	93.4	85.4
5	75	mmd	96.7	96.8	mmd/mms	93.4	85.6
5	0	cc	26.7	11.3	cc/cc	11.3	20.7
5	15	mld	95.8	95.8	mld/mls	92.2	83.8
5	25	mld	96.1	96.3	mld/mls	92.8	84.3
5	50	mld	96.4	96.9	mld/mls	93.5	84.8
5	75	mld	96.6	97.0	mld/mls	93.6	85.2
15	0	cc	10.5	8.5	cc/cc	8.5	9.2
15	15	csد	67.8	81.1	csد/css	77.5	58.3
15	25	csد	71.9	86.4	csد/css	82.7	62.0
15	50	csد	74.6	86.5	csد/css	82.8	63.1
15	75	csد	75.6	86.5	csد/css	82.8	63.2
15	0	cc	10.5	8.5	cc/cc	8.5	9.2
15	15	cmd	93.9	95.2	cmd/cms	91.2	79.5
15	25	cmd	94.2	95.7	cmd/cms	91.8	80.0
15	50	cmd	94.6	96.2	cmd/cms	92.4	80.5
15	75	cmd	94.8	96.2	cmd/cms	92.5	80.9
15	0	cc	10.5	8.5	cc/cc	8.5	9.2
15	15	clد	93.9	95.1	clد/clس	91.1	79.3
15	25	clد	94.2	95.5	clد/clس	91.6	79.8
15	50	clد	94.5	96.1	clد/clس	92.2	80.3
15	75	clد	94.8	96.3	clد/clس	92.5	80.7
15	0	cc	10.5	8.5	cc/cc	8.5	9.2
15	15	msد	77.9	90.7	msد/mss	87.3	68.2
15	25	msد	81.1	92.2	msد/mss	89.0	71.4
15	50	msد	83.4	92.2	msد/mss	89.0	72.1
15	75	msد	83.7	92.2	msد/mss	89.1	72.2
15	0	cc	10.5	8.5	cc/cc	8.5	9.2
15	15	mmd	94.0	95.7	mmd/mms	90.3	76.4
15	25	mmd	94.4	96.2	mmd/mms	91.0	77.0
15	50	mmd	94.7	96.5	mmd/mms	91.2	77.5
15	75	mmd	95.0	96.5	mmd/mms	91.3	77.8
15	0	cc	10.5	8.5	cc/cc	8.5	9.2
15	15	mld	94.1	95.5	mld/mls	91.5	79.9
15	25	mld	94.5	96.0	mld/mls	92.1	80.4
15	50	mld	94.8	96.5	mld/mls	92.7	81.0
15	75	mld	95.1	96.5	mld/mls	92.8	81.4

Appendix B continued.

Buffer BFW (ft)	width (ft)		Effective shade (%)		Effective shade (%)		
			two sides	aspect 180°	aspect 270°	Sside/Nside	aspect 270°
25	0	cc	8.1	7.8	cc/cc	7.8	7.9
25	15	csd	43.7	48.4	csd/css	46.2	38.5
25	25	csd	46.9	50.7	csd/css	48.3	41.2
25	50	csd	49.3	50.8	csd/css	48.3	42.2
25	75	csd	50.3	50.8	csd/css	48.4	42.4
25	0	cc	8.1	7.8	cc/cc	7.8	7.9
25	15	cmd	73.9	85.0	cmd/cms	80.7	62.4
25	25	cmd	76.0	87.6	cmd/cms	83.3	64.3
25	50	cmd	79.2	90.3	cmd/cms	86.1	67.1
25	75	cmd	81.6	90.4	cmd/cms	86.2	69.1
25	0	cc	8.1	7.8	cc/cc	7.8	7.9
25	15	cld	80.5	90.0	cld/cls	85.7	68.1
25	25	cld	82.0	91.8	cld/cls	87.5	69.6
25	50	cld	84.8	94.4	cld/cls	90.1	72.1
25	75	cld	87.0	94.7	cld/cls	90.5	74.1
25	0	cc	8.1	7.8	cc/cc	7.8	7.9
25	15	msd	46.1	50.7	msd/mss	49.0	41.4
25	25	msd	49.3	53.0	msd/mss	51.1	44.1
25	50	msd	51.5	53.1	msd/mss	51.1	45.0
25	75	msd	52.5	53.1	msd/mss	51.2	45.2
25	0	cc	8.1	7.8	cc/cc	7.8	7.9
25	15	mmd	77.7	89.3	mmd/mms	83.9	63.0
25	25	mmd	79.7	91.6	mmd/mms	86.2	64.9
25	50	mmd	82.8	92.3	mmd/mms	86.9	67.5
25	75	mmd	85.1	92.3	mmd/mms	87.0	69.1
25	0	cc	8.1	7.8	cc/cc	7.8	7.9
25	15	mld	85.4	93.9	mld/mls	89.7	72.5
25	25	mld	86.7	94.4	mld/mls	90.2	73.8
25	50	mld	88.9	94.8	mld/mls	90.6	75.7
25	75	mld	90.4	94.8	mld/mls	90.7	76.5
45	0	cc	7.6	7.5	cc/cc	7.5	7.6
45	15	csd	35.8	31.3	csd/css	29.7	31.1
45	25	csd	38.2	32.4	csd/css	30.6	33.0
45	50	csd	40.2	32.5	csd/css	30.6	33.7
45	75	csd	41.1	32.5	csd/css	30.6	33.8
45	0	cc	7.6	7.5	cc/cc	7.5	7.6
45	15	cmd	53.0	67.3	cmd/cms	63.8	46.0
45	25	cmd	55.3	71.0	cmd/cms	67.2	48.0
45	50	cmd	58.3	72.8	cmd/cms	68.9	50.5
45	75	cmd	60.5	72.8	cmd/cms	69.0	52.2
45	0	cc	7.6	7.5	cc/cc	7.5	7.6
45	15	cld	59.1	72.5	cld/cls	68.6	50.6
45	25	cld	61.2	75.7	cld/cls	71.6	52.4
45	50	cld	64.2	78.8	cld/cls	74.7	54.9
45	75	cld	66.5	79.2	cld/cls	75.1	56.9
45	0	cc	7.6	7.5	cc/cc	7.5	7.6
45	15	msd	36.9	32.1	msd/mss	30.8	32.2
45	25	msd	39.3	33.1	msd/mss	31.6	34.1
45	50	msd	41.2	33.2	msd/mss	31.7	34.8
45	75	msd	42.0	33.2	msd/mss	31.7	35.0
45	0	cc	7.6	7.5	cc/cc	7.5	7.6
45	15	mmd	56.0	70.7	mmd/mms	66.4	46.8
45	25	mmd	58.4	74.5	mmd/mms	70.0	48.8
45	50	mmd	61.2	74.8	mmd/mms	70.2	51.1
45	75	mmd	63.3	74.9	mmd/mms	70.3	52.6
45	0	cc	7.6	7.5	cc/cc	7.5	7.6
45	15	mld	64.0	78.6	mld/mls	74.7	55.1
45	25	mld	66.3	81.8	mld/mls	77.8	57.1
45	50	mld	69.2	83.5	mld/mls	79.5	59.6
45	75	mld	71.5	83.5	mld/mls	79.6	61.3

Attachment 4: Commentary on Dr. Doug Martin's science documentation in support of the WFFA Alternate Plan Template

By: Dr. Pete Bisson

I'd like to make a couple of general observations about the buffer proposals, as I think WFFA would like me to comment on the prescriptions from a broad scale perspective. My overall impression from reviewing the November 2014 template and from reading this draft is that the proposed prescriptions represent a fairly significant reduction in the width of buffers required on small tree farms relative to current state buffer requirements for small streams. As pointed out in the draft, these reductions may not translate into a linear corresponding reduction in various ecological functions. I agree with the conclusion that the trees closest to the channel will have the greatest influence on the aquatic ecosystem, but my personal opinion is that not enough studies have been conducted under a variety of conditions and forest types to allow us to predict function impairment at different distances from the channel with much accuracy at this time. I've always felt that the FEMAT curves were a useful starting point for testing hypotheses, but that more field verification is needed and it will require a lot of case studies before it is possible to develop quantitative predictions of function vs. distance from channel. Therefore, I think any document that includes graphs of function vs. distance from channel for purposes of justifying buffer widths should be careful to note that such graphs are based on fairly limited field evidence or on expert opinion-based models. For this reason I would suggest that if the Forest Practices Board were to accept the proposal that it would be accompanied by a dedicated monitoring program that would yield data for various functions from a variety of sites, over an extended time period. I know that's asking a lot, but I'm convinced that without a well-organized riparian status and trends monitoring program on managed forests we will continued to be plagued with uncertainty about the effectiveness of different buffer strategies. I can see value in monitoring sites on federal lands (most conservative buffers), state and large private industrial lands, and small landowners (least conservative buffers) as a spectrum of conservation approaches that could be tested. Perhaps the point doesn't need to be made in this document, but I hope it finds its way into policy discussions. For more details on this reasoning please see a paper John Richardson, Bob Naiman, and I wrote on fixed-width buffers a couple of years ago [<http://www.bioone.org/doi/full/10.1899/11-031.1>].


My second observation is that the report doesn't deal with how the proposed alternative buffers address the issue of resiliency. Most of the proposed widths on the smallest streams are only 1-2 standing trees wide, which means that they will need to remain standing until the surrounding forest has regenerated to the point that it provides sufficient replacement ecological functions. If those buffer trees die, some functions will be impaired until the adjacent forest recovers. The notion of "buffering the buffer" has been examined in several studies (e.g., <http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.164.1291>) and seems to be a part of many policy deliberations. This is another topic that may be deferred until later, but I'd be surprised if it didn't come up at some point.

I think the draft report is an effective document to present to the policy folks. I'll be interested to see what the response is.



MEMORANDUM

January 28, 2015

TO: Forest Practices Board 

FROM: Marc Engel, Assistant Division Manager, Policy and Services

Subject: 2015 Work Plan

Attached is your proposed 2015 Work Plan with a few schedule changes. Board Manual Section 7 and the Riparian Management Zone rule clarification moved from August to November for completion and the quarterly report for the Clean Water Act Assurances will move to May.

MDE/paa
Attachment

FOREST PRACTICES BOARD
2015 DRAFT WORK PLAN
November 2014

TASK	COMPLETION DATE/STATUS
Adaptive Management Program	
• CMER Master Project Schedule Progress*	May
• Effectiveness of Riparian Management Zones in Providing Habitat for Wildlife Study*	May
• Effects of Forested Roads and Tree Removal In or Near Wetlands of the Pacific Northwest Literature Synthesis	May
• Program Funding	On-going
• Review and Synthesis of Literature on Tailed Frogs with Special Reference to Managed Landscapes	August
• Temperature and Solar Radiation/Effective Shade Study*	August
• Type F*	November
• Type N*	August
• Wetland Research and Monitoring Strategy: Forest Practices and Wetlands Report	May
Annual Reports	
• Clean Water Act Assurances	August
• Compliance Monitoring Annual Report	August
• Northern Spotted Owl Conservation Advisory Group	May
• Taylor's Checkerspot Butterfly Report	May
• TFW Cultural Resources Roundtable including WAC 222-20-120	August
• TFW Policy Committee Priorities*	August
• Western Gray Squirrel	May
Board Manual Development	
• Section 7, Guidelines for Riparian Management Zones	August <u>November</u>
• Section 16, Evaluating Potentially Unstable Slopes and Landforms	August
• Section 23 (Part 2), Guidelines for Field Protocol to Locate Mapped Divisions Between Stream Types and Perennial Stream Identification*	November
CMER Membership	
As needed	
Rule Making	
• Unstable slopes information on Forest Practices Applications	February
• RMZ Clarification	August <u>November</u>
Upland Wildlife - Northern Spotted Owl	
On-going	
Quarterly Reports	
• Adaptive Management Program & Strategic Plan Implementation*	Each regular meeting
• Board Manual Development	Each regular meeting
• Compliance Monitoring	Each regular meeting
• Clean Water Act Assurances	February <u>May</u>
• Legislative Update	February & May
• NSO Implementation Team	Each regular meeting
• Rule Making Activities	Each regular meeting
• Small Forest Landowner Advisory Committee & Office	Each regular meeting
• TFW Cultural Resources Roundtable	Each regular meeting

Italics = proposed changes

*= TFW Policy Committee

FOREST PRACTICES BOARD
2015 DRAFT WORK PLAN
November 2014

TASK	COMPLETION DATE/STATUS
· TFW Policy Committee Work Plan Accomplishments & Priorities*	Each regular meeting
· Upland Wildlife Working Group	Each regular meeting
Work Planning for 2016	November

Italics = proposed changes
**= TFW Policy Committee*