January 5, 2017

TFW Policy Presentation of SFLO Perspective

INTENT

Will Touch on 1st 10 Pages
Balance is Background

YEARS OF DISCONNECT

REINVIGORATION/FRESH START/NEW HOPE

CORE ELEMENTS/ISSUES OF OUR TEMPLATE PROPOSAL

RECOGNITION OF ISSUES LIKELY NEEDING TO BE ADDRESSED

COMMON INTERESTS

SUMMARY

OUR INTENTIONS & HOPES FOR NEXT FEW MONTHS

THANKS FOR LISTENING!!

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.

Section 21

Guidelines for Alternate Plans

This section provides guidelines for developing and analyzing alternate plans for activities that vary from specific forest practices rules. Alternate plans may be useful in a variety of situations. Examples could be:

- Where the cumulative impact of rules disproportionately affects a landowner's income production capability.
- Where a landowner's minor on-the-ground modifications could result in significant operational efficiencies.
- Where site conditions have created an economically inaccessible management unit when using the forest practices rules.
- Where local landforms lend themselves to alternate forest management practices.
- Where a landowner proposes methods to facilitate landscape, riparian or stream restoration.

Synopsis of the RCW's and associated WAC's pertinent to SFLO's. Emphasis added in bold.

- **RCW 76.13.100 (2)** partial – "The legislature further finds that small forest landowners should have the option of alternate management plans **or alternate harvest restrictions on smaller harvest units that may have a relatively low impact on aquatic resources.** The small forest landowner office should be responsible for assisting small landowners in the development and implementation of these plans or restrictions."

- **RCW 76.13.110 (3)** – "The small forest landowner office shall develop criteria to be adopted by the forest practices board in rules and a manual for alternate management plans or alternate harvest restrictions. These alternate plans or **alternate harvest restrictions shall meet riparian functions while requiring less costly regulatory prescriptions.** At the landowner's option, alternate plans or alternate harvest restrictions may be used to further meet riparian functions."

- **RCW 76.13.110 (4)** – "An advisory committee is established to assist the small forest landowner office in developing policy and **recommending rules to the forest practices board."**

- **RCW 76.13.110 (5), (e)** – "The small forest landowner office shall provide a report to the board and the legislature containing: (e) Recommendations on ways the board and the legislature could provide more effective **incentives to encourage continued management** of nonindustrial forests and woodlands for forestry uses in ways that better protect salmon, other fish and wildlife, water quality, and other environmental values."

  Note: continued management in itself will better protect salmon, etc vs parcelization/conversion.

- **RCW 76.13.005 (5)** "In order to encourage and maintain nonindustrial forests and woodlands for their present and future benefit to all citizens, Washington's **nonindustrial forest and woodland owners' long-term commitments to stewardship** of forest resources **must be recognized and supported** by the citizens of Washington State."

- **RCW 76.13.010 (5)** "Stewardship" means managing by caring for, promoting, protecting, renewing, or reestablishing or both, forests and associated resources **for the benefit of the landowner,** the natural resources and the citizens of Washington state, **in accordance with each landowner's objectives,** best management practices, and legal requirements."

- **RCW 76.09.370(3)** – "The rules adopted under this section **should** be as specific as reasonably possible while also allowing an applicant to propose alternate plans in response to site-specific physical features. Alternate plans **should** provide protection to public resources at least equal in overall effectiveness by alternate means."

  Note: this legislative intent language "should" allows far more subjective interpretation than the subsequent language "will" in WAC 222-12-040(1) and the "must" in WAC 222-12-0401(6)

- **RCW 76.09.370(7)** " The purpose of the adaptive management process is to make adjustments as quickly as possible to forest practices that are not achieving resource objectives" ....." and provide recommendations to the board on proposed changes to the forest practices rules to meet timber industry **viability** and salmon recovery.

  Note: assuming economic viability here; Implies viability is equal in priority with salmon recovery.

- **RCW 76.09.368 Intent –** "The legislature intends that small forest landowners have access to alternate plan processes or alternate harvest restrictions, **or both if necessary**, that meet the public resource protection standards 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.** The forest practices board shall consult with the small forest landowner office advisory committee in developing these alternate approaches". By **July 1, 2003,** the FPB shall **provide the legislature** with a written report that describes the **boards progress** in **developing** alternate plan processes or alternate harvest restrictions, or both if necessary, that meet legislative intent"

- **RCW 77.85.180(4)-** "The legislature recognizes that the adoption of forest practices rules consistent with the FFR as defined in RCW 76.09.020 will impose substantial financial burdens on forest landowners which **if not partially offset through other changes in the laws and rules governing forestry, could lead** to significantly reduce silvicultural investments on nonfederal land, deterioration in the quality, condition and amounts of forests on those lands, and **long-term adverse effects on fish and wildlife habitat and other environmental amenities associated with well managed forests .....**"

- **RCW 77.85.180 (5) (e) – "**As an integral part of implementing the salmon recovery strategy, provides for small landowners to have costs shared for a portion of any extraordinary economic losses attributable to the revisions to the forest practices rules required ....."

The Associated WAC's ---

- **WAC 222-12-040(1)** – "The alternate plan process can be used as a tool to deal with a variety of situations, including where the **cumulative impacts of regulations disproportionately impact a landowner.** In some instances an alternate plan may be used to make minor on-the-ground modifications, which result in significant operation efficiencies. The alternate plan process may be used to address circumstances where a landowner has an economically inaccessible unit. The alternate plan process **may also be used to facilitate voluntary landscape, riparian or stream restoration.** In all cases, the alternate planning process **will** result in a plan that provides protection to public resources at least equal in **overall effectiveness as provided by the act and rules while seeking to minimize constraints to the management of the affected lands."**

- **WAC 222-12-0401 (6)** - "Approval standard. An alternate plan **must** provide protection for public resources at least equal in overall effectiveness to the protection provided in the act and rules."
  Note: The WAC changed *should* in RCW 76.09.370(3) to *must;*

- **WAC 222-12-040 (2)** – "The legislature has found in RCW 76.13.100(2) that small forest landowners should also have the option of alternate management plans or **alternate harvest restrictions on smaller harvest units that may have a relatively low impact on aquatic resources.** These alternate plans are intended to provide flexibility to small forest landowners that will still provide protection of riparian functions based on specific field conditions or stream conditions on the landowner's property."

- **WAC 222-12-0402 * Assistance available for small forest landowners.** _ The small forest landowner office has been established .....a resource and focal point for small forest landowner concerns and policies" ..... "The legislature has directed that office to assist small forest landowners in preparing alternate plans .....". "The office may provide .....technical assistance in developing an individualized alternate plan". And facilitate interactions with the ID team.

- **WAC 222-12-0403-** "The (Board) manual should include:. . . . (3)Template Prescriptions designed to meet resource objectives to address common situations that are repeatedly addressed in alternate plans or strategies to simplify the development of future plans or strategies, including low impact situations and site-specific physical features;" (4) Appropriate **recognition or credit for improving the condition of public resources**; and (5) **Criteria** to assist the department in determining whether a small forest landowner **alternate plan qualifies as a low impact** alternate plan."

- **WAC 222-12-0404 *Cooperation for effective alternate planning. "**The department will work cooperatively with associations representing the interests of large and small forest landowners to develop more efficient alternate planning guidance and processes. In pursuing greater efficiency and technical assistance, the department will consider:
  1) Successful alternate plans and small forest landowner alternate management strategies and processes that can be used by other small forest landowners as examples of the plan development and approval process;
  2) Auditing and monitoring results;
  3) Maintain a list of technical experts available to landowners in preparing such plans;
  4) Partnerships between the department and organizations supporting forest land stewardship principles."

- **WAC 222-30-010 Timber Harvesting (3)**-_"the rules provide for conversion and/or **treatment of riparian forests** which may be understocked, overstocked or uncharacteristically hardwood dominated **while maintaining minimum acceptable levels of function on a landscape scale.** The **diversity of riparian forests** across the landscapes is addressed by **tailoring riparian prescriptions to the site productivity and tree community at any site**".

- **RCW 76.13.100 (2)** partial – "The legislature further finds that small forest landowners should have the option of alternate management plans **or alternate harvest restrictions on smaller harvest units that may have a relatively low impact on aquatic resources.** The small forest landowner office should be responsible for assisting small landowners in the development and implementation of these plans or restrictions."

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WAC 222-12-0401 (6) –

Approval standard:

An alternate plan **must** provide protection for public resources at least equal in overall effectiveness to the protection provided in the act and rules."

Note: The WAC changed *should* in RCW 76.09.370(3) to *must;*

Draft Template Simplified

First determine Bank Full Width and Stream Type (S/F or Np), then select the stream appropriate prescription A, B, C, **or** D below.

A. **If "Fish" & BFW 15'+: flag line at 75' BFW and treat outside as "upland" and inside as "no-cut".**
More complex/aggressive options:
   - Thin to 57 best TPA in the area between 50-75' of BFW - save biggest conifer every 28' of stream reach – no stream reach limit
   - If hardwoods dominant and conifer site, can clear-cut all non-conifer to within 50' BFW (500' max segments or 40% limit if multiple segments).
   - Subject to special DNR approval, may get ok to harvest few single tree/group selection anywhere within the 75' line.
   - Redraw this 75' line to a variable width line that averages 75' (min/max? TBA)

B. **If "Fish" & BFW 5' or more and less than 15': flag line at 50' BFW and treat outside as "upland" and inside as "no-cut".**
More complex/aggressive options:
   - Thin to 100 best TPA in area between 25-50' BFW - save biggest conifer every 21' of stream reach
   - If hardwoods dominant and conifer site, can clear-cut all non-conifer to within 25' BFW (500' max segments or 50% limit if multiple segments)
   - If believe stream deficient in nutrients/too much shade and want to improve fish "productivity", can thin (to best 57 TPA) to BFW in stream segments not to exceed 150', multiple segments separated by 150' forested areas, not more than 50% of stream reach if more than one segment.
   - Subject to special DNR approval, may get ok to harvest few single tree/group selection anywhere within the 50' line.
   - Redraw this 50' line to a variable width line that averages 50' (min/max? TBA)

C. **If "Fish" & BFW less than 5': flag line at 25' BFW and treat outside as "upland" and inside as "no-cut".**
More complex/aggressive option:
   - Subject to special DNR approval, may get ok to harvest few single tree/group selection anywhere within the 25' line.

D. **If Non-Fish/Perennial Water (Np) for all BFWs: flag line at 25' BFW and treat outside as "upland" and inside as "no-cut".**
More complex/aggressive option:
   - Remove larger trees (thin from above), **EXCEPT** cannot thin first 300' above TYPE F junction if BFW >5'.
   - Clear-cut all timber to BFW along the intermittent dry portions of the Np channel and where there is no defined channel connecting to TYPE F

"RELATIVELY LOW IMPACT"

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.

TEMPLATE FOREST & FISH

		Riparian function potential									Riparian function potential							
Prescription No.	Stream Type	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
				25x300/nc	>94%	>75%	H	H	L	Y		50x50%/nc	>94%	>91%	H	H	L	Y
4	Np	>5 ft	25	25/tha	43%[a]	>19%[b]	H	H	H	Y	NA	50%/cc	>0	slash	M	L	M	N
												50x50%/nc	>96%	>91%	H	H	L	Y
5	Np	<5 ft	25	25/tha	43%[a]	>19%	H	H	H	Y	NA	50%/cc	59%[d]	slash	M	L	M	N
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

[a]Shade in upper portion of Np reach based on cms stands (i.e., 25% density)

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

[c]Top and bottom cell Rx's are no-inner-zone-harvest and thin-from-below, respectively

[d]Base on mean canopy cover for headwater streams with slash (see Appendix A).

PARTIAL

Proposed Riparian Prescriptions and Technical Assessment for Small Forest Landowners

Prepared by Douglas Martin
January 19, 2015

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

[a]Prescription 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

[b]There 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.

[c]The 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 Np > 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 Np network. The remaining upstream Np 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 Np 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 Np < 5-ft is identical to the thinning prescription for Np > 5 and includes the 25-ft radius no-cut buffer around all tributary junctions within the Np 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 confer 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., shurbs, 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 x 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.

		Riparian function potential									Riparian function potential							
Prescription No.	Stream Type	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	H H	L H	Y Y	NA	50x50%/nc 50%/cc	>94% >0	>91% slash	H M	H L	L M	Y N
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 M	H L	L M	Y N
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

[a]Shade in upper portion of Np reach based on cms stands (i.e., 25% density)

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

[c]Top and bottom cell Rx's are no-inner-zone-harvest and thin-from-below, respectively

[d]Base 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 steams 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 steams < 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).

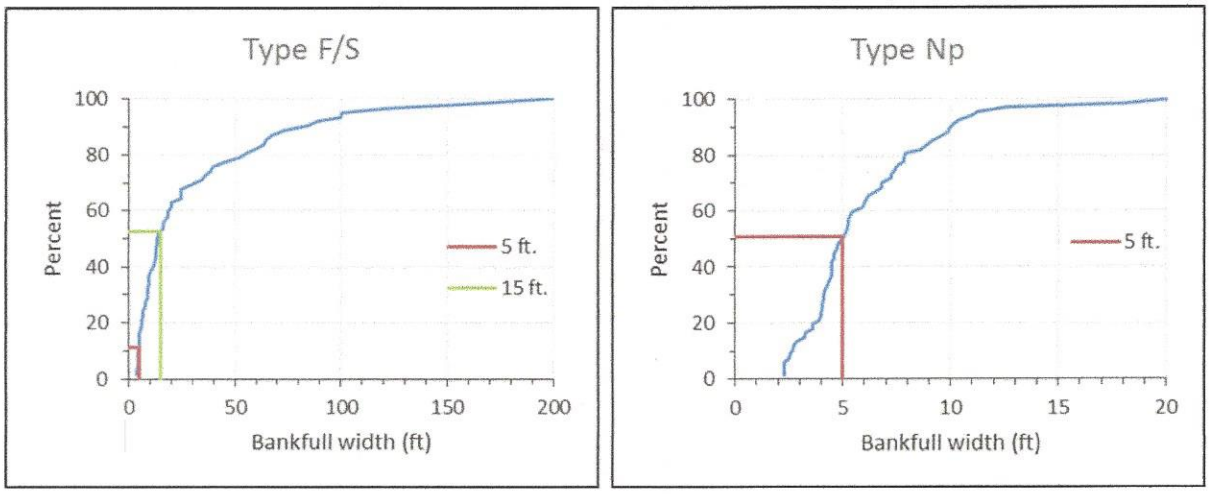

Figure 1. Cumulative frequency distributions of channel bankfull widths for Type F/S (n = 62) and Np (n = 67) streams. Data based on random sample from all streams on private forestlands in western Washington. Data from W. Ehinger, WDOE, personal communication.

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