

Assessment and Synthesis of ISPR Review (ISPR 18-19-04):

Small Forest Landowner Alternate Plan Template Review (9/30/2018)

of

Cooperative Monitoring, Evaluation and Research Committee

and

Washington Department of Natural Resources

By

[REDACTED]

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Introduction

Through the Independent Scientific Peer Review Committee (ISPR) of the University of Washington, a peer review was conducted of the Cramer Fish Sciences' *Small Forest Landowner Alternate Plan Template Review* (dated September 30, 2018). The review team consisted of three anonymous reviewers (designated **R1**, **R2**, and **R3** in the following report) and an associate editor who operated under the protocols administered by the ISPR in cooperation with the Washington Department of Natural Resources. Peer reviewers were selected by [REDACTED] the Associate Editor for this review, in consultation with Dr. Daniel Vogt, Managing Editor of ISPR. The **Associate Editor** and the three **reviewers** are all experts in the general topic of landscape and riparian influences on streams and their biota, albeit with a variety of specialty knowledge and experience within this field. The **Associate Editor** is a physical geomorphologist and hydrologist, with a 30+ year publication record through his work in agencies, industry, and academia. He also has been the Senior Editor of a leading international scientific journal, [REDACTED], for 13 years, and has served as associate editor on several other CMER publications. The three **reviewers** bring a diversity of technical and professional backgrounds, with all having extensive experience in Pacific Northwest forestry issues. Both **R1** and **R2** are or have been [REDACTED]; **R2** and **R3** both have served in public or tribal resource agencies; and all have extensive private consulting experience. **R1** has a particular focus on statistical methods and analyses; **R2** is an extensively published forest hydrologist with long-standing research interests in stream buffers and stream temperature; **R3** is an aquatic ecologist with many decades of Pacific Northwest experience in forest management issues from both technical and policy perspectives.

Overview of Findings

Summary of the Evaluations

The charge to the review panel was to address 11 questions, discussed in sequence below, with the common theme of evaluating whether the Cramer Fish Sciences review of the *Small Forest Landowner Alternate Plan Template* was technically sound and unbiased. The unequivocal judgment of the three **reviewers** and the **Associate Editor** is that the review met this standard, as enumerated in some detail in the following section. However, these reviewers also raised substantive questions about the framing of the initial review request, and indeed about the overall framework in which this evaluation has been conducted. **R3** articulated most clearly the divergence between the conclusions of the requested “technical assessment” and the broader context in which small-landowner forestry is conducted: “Personally, I am quite sympathetic to the needs of the small forest landowners who wish to extract value from their riparian adjacent ownership, but their proposals [i.e., the *Alternate Plan Template*] have some serious shortcomings.” This judgment was echoed explicitly by **R2** and is consistent with the more focused comments of **R1** (see below). The **Associate Editor** fully supports this dual judgment as well.

Thus, some discussion of this “broader context” is offered prior to the reviewers’ response to the 11 questions that constitute the bulk of this synthesis report.

The Context of Small Landowner Forest Practices

The most extensive discussion of the *context* for both the WFFA proposal and the Cramer Fish Science evaluation was provided by **R2**, whose comments on this subject are quoted as follows:

“Neither the WFFA proposal nor the Alternate Plan Template Review provide data to evaluate how small landowner streams differ from the larger population of streams to which the FPA applies. This is important because the functions and effectiveness of riparian buffers are highly contextual based on landscape and stream network position. For example, on a large river, shade and leaf litter input are inconsequential for habitat quality, while the bank stability function of near-riverbank trees becomes more important. On a small low gradient stream in a large river floodplain, wood recruitment processes differ from those in a steep mountainous stream. Accounting for these spatial differences in stream sensitivities was the point of Watershed Analysis, but Watershed Analysis was too expensive. BMP rules are simple and relatively uniform for practical reasons, not scientific reasons. Before considering the effectiveness of the WFFA proposal, and the adequacy of the Alternate Plan Template Review, it would be extremely helpful to understand the spatial distribution of small landowner parcels in western Washington and how the distribution of stream characteristics in these lands differs from streams outside small landowner parcels.”

The document *Concerns about the CFS review of template science* asserts that “The WFFA Proposal is clearly for small forestland owners only: with inherently smaller harvests; with limited stream reaches;

and greater separation between harvests in stream reaches than the industrial models that are the basis of most effectiveness studies.”

This statement is intuitive reasonable. Yet, as **R3** notes:

“I think a really BIG shortcoming of the WFFA proposal is that there is no attempt to give context to where and when on the landscape these timber harvest might occur. It would seem a simple enough matter to map out where these small ownership riparian zones are, identify where in a particular stream network they occur, give a reasonable analysis of the known current and prospective condition of the watershed as it relates to fish habitat and water quality conditions, and match up those basins needing much more protection for riparian functions and adjust the timber harvest prescriptions for those corridors accordingly. Where environmental processes and riparian functions are pretty resilient, give the small landowner some flexibility to try some ‘out of the box’ approach, and watch what happens. Without context, this is all an exercise in blindly approving actions without the institutional capacity to gage the consequences.”

R2 continues in this vein:

“This question of landscape context of streams affected by the WFFA proposal is a portion of a larger question of whether it is possible to evaluate the strengths and weaknesses of the proposal or the Alternate Plan Template Review using only stream research. Science itself cannot be used to evaluate holistically the question of whether a riparian buffer of given width and stocking is adequate because:

- 1) the question has important social, economic, and landscape ecology dimensions that are well-outside the domain of stream studies, and
- 2) the number and scale of studies will always be small with respect to the environmental noise in the data.”

In other words, the charge to reviewers in part sought to substitute a scientific judgment for what must be, in part, a policy decision. As **R2** notes, unless the width–response curve is flat over the entire range of prospective buffer widths, there is no feasible way for a narrower buffer at a site to achieve the same level of protection as a wider buffer. This is hardly a matter requiring a commissioned review, followed by multiple assessments of that review—it’s common sense. At issue, however, is the protection of the resource, and this is not simply a function of at-a-site protections but also the distribution of those sites, the density of harvest within them, the management of lands beyond the buffer strip, and the long-term trajectory of those lands. Will the land remain in forestry? How long is the cutting rotation? How carefully are the harvested areas protected and replanted? These are all factors that integrate into the state of “landscape protection,” but they were addressed by neither the WFFA proposal nor the charge to the contractor for their review of that proposal.

Both **R2** and **R3** also affirm the recommendation offered by Pete Bisson as an attachment to the review package:

“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 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.”

R3 also notes that any institutional construct for forest practices needs to anticipate and adapt to the upcoming changes in climate, given our uncertainty in “the trajectory of plant succession (how quickly will those harvested near-riparian zones actually re-grow, and with what species mix), watershed processes (e.g., the rate delivery of sediment), or terrestrial insect and aquatic invertebrate community response to a changing climate AND a changed riparian forest condition.”

In conclusion, all **reviewers** and the **Associate Editor** are keenly aware of the challenges of developing and applying robust, scientifically defensible prescriptions to achieve both ecological and social goals. If “adaptive management” is to be more than just a slogan, however, then future proposals such as that from the WFFA (and their evaluation such as the one commissioned here) must include some critical additional elements:

- the magnitude of existing scientific uncertainty,
- the degree to which that uncertainty may increase over time,
- the socio-economic context in which the forest practices are embedded,
- the manner in which both ecological and economic progress will be monitored, and
- the vehicles by which those findings will further inform the management of these resources.

Responses to DNR/CMER Questions

In the text that follows, these highlights indicate explicit recommendations for any revision to the Cramer Fish Sciences review document:

'green' for consideration to help improve the manuscript,
'turquoise' for strongly suggested for improvement of the manuscript, or
'yellow' for required change for manuscript.

1. How well does the contractor's report assess in a technically accurate, transparent, and unbiased manner if best available science (BAS) was used to develop the Small Forest Landowner's proposed prescriptions?

The charge to the contractor was stated as determining "If the function analysis is supported by Best Available Science (BAS) In terms of a formal judgment of whether or not the WFFA proposal met the standards of BAS." The contractor's report (henceforth, "the Assessment") approached this question by developing an independent determination of BAS and compared that guidance to the recommendations of the WFFA proposal (henceforth, "the Proposal"). The evaluation of the Proposal's use of BAS for each of the five riparian functions was based on the Assessment's review of both overlapping and differing conclusions from the application of BAS by the Assessment and the Proposal.

Although the Assessment took this somewhat circuitous route to making this requested BAS determination, it does provide a summary section "Best Available Science Determination" for each function. Its approach and logic are clear. The most consistent conclusion of the Assessment, namely that the Proposal provided an overly limited suite of references used to support less restrictive buffer recommendations than is justified by a more comprehensive literature review, may appear "biased" but, in the judgment of **reviewers** and **Associate Editor** alike, simply articulates the objective findings of the Assessment's own literature evaluation.

The consensus of **reviewers** is that the Assessment of the Proposal was executed appropriately, although not in the manner apparently anticipated by this question. In the words of **R1**, the contractor's approach was to collect "scientific literature independently of the WFFA analysis, created their own "function evaluation" using the WFFA proposal literature and their own, and examined the outcomes and differences between the WFFA proposed prescriptions and the Washington Forest Practices Rule (FPR) prescriptions. The contractor examined their independent function evaluation alongside the WFFA proposal analysis results (Table 3 in the WFFA proposal's Background Information section)." An exclusive reliance on sources from the Pacific Northwest was noted by both **R2** and **R3**, with somewhat differing levels of expressed comfort in that restriction (see below). "The contractor's assessments of Best Available Science for each of the five riparian functions in the report did not include an assessment of the literature used in the contractor's report and WFFA proposal. A table of sources used by each that evaluated source relevance and quality would have been informative." (**R1**)

No bias in the Assessment was noted by any reviewer; R3 specifically affirmed that “Overall, I found their analysis to be a clear and coherent with no obvious bias in their interpretation beyond what one would expect from any independent reviewer.”

Implicit, but never stated overtly in the Assessment, was that recommendations that differed between the two applications of BAS indicated a deficiency in the Proposal’s application of BAS. However, the Assessment appeared to acknowledge the difficulty in providing a strict black-and-white answer to this question. “BAS,” particularly in areas where published research (peer-reviewed or otherwise) is limited, can invite alternative credible judgments. The Assessment’s approach in response to this question was appropriate.

R1 provided a detailed evaluation of the treatment of the five riparian functions in response to this question. Paraphrasing that review, the following conclusions were offered:

Large Woody Debris (LWD): The Assessment noted both appropriate inclusions and problematic absences in the documents cited by the Proposal. The evaluation of BAS was hampered because the Assessment listed many studies without indicating their quality or relevance, and it did not highlight contrasting findings among sources or use the information from citations to provide actual estimates.

Shade: The Assessment focused on shade metrics, for which studies are limited, instead of instream temperature, for which studies are abundant (including those by CMER). It appropriately questioned the use of *Shade.xls*, but its alternative approach (combining results from multiple shade studies) may not represent much improvement.

Leaf and Litterfall: The Assessment concluded that the Proposal did not include BAS, particularly since the Proposal relied disproportionately on a single reference that itself was not strongly related to litterfall, and cited several articles. The Assessment, however, was also limited insofar as it asserts that litterfall should return in ten years to unharvested levels without providing supporting citations. It also cited articles published after the 2015 publication date of the Proposal, which is hardly a fair evaluation of the application of BAS. The Assessment should have stated whether the newer citations altered BAS substantially.

Sediment Filtration: The Assessment made use of many of the citations used in the Proposal but interpreted the findings differently, particularly with respect to sediment filtration from 25-foot buffer widths (since the literature cited generally examined 50-foot buffers or wider). R1 found the contractor’s assessment reasonable, unbiased, and transparent as they were forthcoming about other studies’ post-harvest estimates of delivery volumes and contradictory findings around windthrow effects and delivery.

Streambank Stability: As noted by the Assessment, the Proposal did not directly investigate the effect of their harvest prescriptions on streambank stability.

2. How well does the contractor evaluate the quantitative estimates of the relative effectiveness of the proposed prescriptions as depicted in Table 3 in the Background information: “WFFA Template Proposal – Scientific Justification” compared to the existing Forest Practices Rules?

The Assessment offered an alternative version of the Proposal’s Table 3, considering each of the five riparian functional components. **R1** and **R3** found this approach broadly appropriate, and generally concurred (with exceptions—see below) with the Assessment’s conclusions. **R2** found this approach to be overly simplistic, setting an almost impossibly high bar for demonstrating equivalency of narrower buffers. This is shortcoming of the mandated approach rather than an expression of reviewers’ disagreement: indeed, all **reviewers** and the **Associate Editor** concur that the Assessment made an explicit evaluation of relative buffer effectiveness, with judgments of “equivalency” appropriately tailored to each of the five riparian functions.

Despite concurrence as to the response to the question as posed, **R2** raised a significant reservation to the value and utility of any such a comparison in the absence of any contextual information. “To make such an assessment would require defensible quantitative estimates of the likelihood of land conversion if less onerous prescriptions are not adopted, as well as defensible quantitative estimates of likely riparian conditions that would occur on lands converted from forestry... If we take a limited view of equal protection such that we are evaluating only riparian protection across the two forest management prescriptions, then the only way the thinner buffers could provide equal protection is if the resource-riparian width response curves were flat over the interval between the FPA prescriptions and the [Proposal].” (**R2**)

In other words, any analysis focused strictly on buffer widths could conclude “equal protection” *only* if the available data showed no dependency of the function in question over the range of buffer width being considered. This criterion was the charge given to the Assessment, and this is what was accomplished. It may not be the most appropriate one, however, within the broader context of future land conversions and where these small-landowner holdings are located.

R1 and **R2** both provided individual comments on each of the riparian functions for this question. Paraphrasing those reviews:

LWD: R1 notes that the Assessment found that BAS may not have been achieved by the Proposal. The Assessment relies on their own BAS findings to change the signs for all estimates from Table 3 in the Proposal’s Attachment 2 from “>” to “<” (see Table 8 in the Assessment), **although the basis for this change is not transparent.**

R2 evaluated this (and each other) riparian function in terms of response curves: “We can say with some certainty that all published LWD recruitment curves aren’t flat over the buffer width range of interest. Both the proposed template and the review are clear on this. They are, however, getting pretty flat past 50 feet. So, if the standard is “equally protective,” then it will be very difficult to meet this. If the standard is “pretty close to equally protective,” then yes, but

it's a judgement call. For any stream, the answer is contextual, depending on channel characteristics, current and future riparian characteristics, and hillslope morphology, all of which affect recruitment processes.”

R3 also provided an explicit commentary on this function, noting the Assessment's conclusion that wind throw is an important factor controlling the post-harvest LW dynamic of wood input, and that the loss of LW inputs from the riparian and adjacent areas is likely greater than shown in Table 3 of the Proposal, citing a number of relevant studies. Over time, it does seem reasonable that available stems for input will be significantly reduced in the thinning of managed riparian areas.

Shade: The Assessment dismisses the Proposal findings as likely biased towards little impact. **R1** judged that the reasons behind this dismissal are likely sound, but the Assessment provides no information regarding the potential degree of bias or demonstrates an objective basis for its judgment.

R2 noted the fundamental disagreement between the DOE shade model, used by the Proposal, to show flat shade curves in the range of interest, whereas field studies cited by the Assessment show instances where additional shade and temperature protection are gained from wider buffers (i.e., the response curve isn't flat). “Shade, or lighting of stream channels, is controlled by complications not included in shade models (**R2**)”; unlike **R1**, however, this reviewer seems skeptical that this complication can be broadly quantified or readily resolved.

Leaf and Litterfall: The Assessment and the Proposal are in agreement, based on a reasonable review of the literature.

Sediment Filtration: The Assessment evaluated the Proposal using an expanded body of literature, finding it equal or less protective than the FPR prescriptions. **R1** judged that the Proposal's assertion 25-foot buffers provide “high” levels of sediment filtration is untested and therefore risks lower levels of protection; **R2** was less convinced that the body of literature is sufficiently extensive to provide much definitive guidance.

Streambank Stability: The Proposal provided no quantitative estimates to evaluate.

3. How well does the contractor's report assess and clearly describe the scientific strength and weaknesses of the conclusions made in the “WFFA Template Proposal – Scientific Justification”?

Reviewers had some difficulty in separating the intent of this question and that of Question #2, and so there is some overlap in answers (100% overlap in the case of **R2**, who referenced the prior responses). In general, the reviewers found the evaluation by the Assessment of the Proposal's strengths and

weakness to be clear and unbiased, highlighting them both as appropriate. The **Associate Editor** concurs.

R1 and **R3** both provided some function-specific response, as follows:

LWD: The Assessment judged that the background literature used by the Proposal was insufficient to fully describe its potential consequences. From **R3**: "...the contractor found that the [Proposal] did a reasonable job in evaluating short-term, post-harvest effects of their alternative prescriptions, as far as it went. They observed that while their estimates of short term LW recruitment losses from young stands not subject to wind throw generally agreed with the various reliable sources, it does not go far enough and consider evidence from the literature about long-term losses to LW availability and subsequent recruitment." From **R1**: "The Assessment takes no issue with the papers that were used by the Proposal but suggest some additional considerations based on other papers that do not appear thoroughly considered by the [Proposal] ... Otherwise, the assessment is clear, and the contractor describes areas of agreement with the [Proposal] and areas that need further consideration."

Shade: R1 found that the Assessment described well the strength and weaknesses of the Proposal, particularly the limitations of *Shade.xls*. However, **R1** felt that this evaluation **would have been strengthened by discussing the potential degree of bias that the non-validated use of *Shade.xls* could cause.**

Leaf and Litterfall: The Assessment focused on one of the articles cited in the Proposal, which was judged appropriate by both **reviewers**. Curiously, that one study (White and Harvey 2007) did not actually measure litter fall from managed riparian zones; the Proposal offered no evidence of other references in support of their source-distance relationships of riparian width and litterfall.

Sediment Filtration: The Assessment clearly identified areas of agreement and disagreement with those of the Proposal, mainly around the efficacy of 25-foot buffers. This evaluation was supported by a broader body of literature, **although the relevance of every such reference was not clearly stated.**

Streambank Stability: Not applicable.

4. How well does the contractor's report provide a technical basis for the contractor's conclusions about the WFFA Template Proposal?

Again, **reviewers** had some difficulty discriminating this question from the preceding ones; **R2** in particular answered them all as a group (and so separate responses from that **reviewer** are not included here). **R3** judged that the Assessment "did a good job of providing a review of relevant scientific information (which constitutes a "technical basis") to back up their conclusions about the merits and

shortcomings of the Proposal. Interpretation of relevant literature to support or counter some of the conclusions in the [Proposal] was metered out in a seemingly fair balance, with no obvious bias.”

R1 provided some specific comments keyed to the riparian functions, paraphrased as follows. They are consistent with the more generalized responses from the other reviewers, and they align with the judgment of the **Associate Editor** as well:

LWD: The Assessment’s conclusions are based on numerous cited articles, although the strength or relevance of articles are not evaluated and their general findings combined. **The contractor provides no discussion of contrary findings.** The reader must assume that all relevant papers are discussed in the review; if true, the findings appear sound.

Shade: The technical basis of the shade Assessment is fairly firm – empirical studies generally find larger declines in shade values than the Proposal predicted, the *Shade.xls* model can produce biased results, and the Proposal accepted non-validated output.

Leaf and Litterfall: As mentioned above in Question 1, **the Assessment’s treatment of literature could have been more transparent and structured.** The contractor made some unsupported statements and treated information from an unpublished draft report as equal to published materials.

Sediment Filtration: The Assessment’s conclusions appeared technically sound and supported by the provided citations—specifically, windthrow may be a problem and the efficacy of 25-foot buffers remain untested.

Streambank Stability: There is limited literature from which to draw; given this, the Assessment’s conclusions are reasonable, particularly the uncertainty of protection offered by 25-foot wide riparian areas.

5. How well does the contractor’s report assess if the WFFA Template Proposal provided a complete and accurate presentation of the relevant scientific literature?

This question mirrors that of Question 1—assessing the application of “Best Available Science” is nearly equivalent to assessing the presentation of “the relevant scientific literature.” Nonetheless, **reviewers** had a number of broad comments to offer on this specific question. The **Associate Editor** also found this question to have substantial overlap with Q1, and the overall agreement of the **reviewers** and the **Associate Editor** on that question applies here as well.

An issue raised by **R2** of the restriction of both the Proposal and the Assessment to “PNW-specific studies,” however, is more challenging. **R2** argues that “physics are not different in the PNW. Shade models and stream temperature models are based on universal geometry and thermodynamics, and there is no reason not to consider non-PNW science with respect to shade and stream temperature. Similarly, sediment transport and settling mechanics, phosphorus sorption, herbicide mobility, and

nitrate movement are not different in the PNW. There is no good reason not to use non-PNW buffer studies evaluating sediment movement through riparian buffers.”

This is true, but as **R2** also notes, PNW landscapes include “deep, highly-infiltrative duff layers, usually low-intensity precipitation, occasional high-velocity wind storms, frequency of steep inner gorges in certain terrains, the social and economic importance of cold-water salmonid species, and the use of headwater streams by cold-water amphibians of conservation concern.” A credible argument can be made that a more nuanced evaluation of relevant scientific literature would permit application of selective, appropriate application of extra-regional studies. However, application of the cautionary principle affirms the more geographically limited approach taken by both the Proposal and Assessment. This is not judged a critical flaw of either report.

The Assessment did not address Question 5, as stated, directly. Instead of testing whether the Proposal “provided a complete and accurate presentation of the relevant scientific literature,” its approach was to develop its own independent list of the “relevant scientific literature,” based on a largely a binary evaluation using the following stated yes/no criteria:

- Which Board Manual 21 parameters are addressed?
- Is the study published in a peer-reviewed science journal?
- Does the study address natural stands, managed stands, or both?
- Is the study a literature review, field study, or modeling exercise?
- Does the study follow an experimental design or is it a synoptic survey?
- What states or provinces and what broad regions are covered?

It then evaluated the relative “value” of these studies using these rules:

- Peer-reviewed literature was generally more reliable than “gray literature;”
- Field studies were more reliable than unvalidated modeling exercises; and,
- Experimental studies testing the effects of forest practices on riparian function were more reliable than synoptic surveys that infer functional relationships.

R2 found that some of these rules incorporated some unhelpful biases beyond that of geography. “The whole point of environmental modeling is to create algorithms that generalize specific field or experimental findings and allow prediction to cases not previously captured by a field study or experiment...All other things being equal, peer-reviewed literature is much more reliable than gray literature, but in the case of the highly relevant Type N study, the DNR report that just came out contains data that is highly relevant to these buffer questions...Finally, **the ideas that a cross-landscape or gradient studies (synoptic survey) are not designed and are inherently less reliable than an ‘experimental study’ is unfounded.**”

Although the Assessment did not directly evaluate the Proposal’s “accurate presentation of the relevant scientific literature” (which does not appear to be part of the original charge to the contractor), the approach taken accomplished an equivalent result with greater long-term utility. The Assessment’s independent review of the relevant scientific literature, including synoptic surveys and unpublished reports, not only served as a basis to judge the completeness of the Proposal’s scientific basis but also offers a framework to evaluate where that proposal has the greatest uncertainties and/or deficiencies.

Specific disparities between the Proposal and the Assessment’s consideration of the scientific literature were noted. A particularly good example was highlighted by **R3** from page 25 of the Assessment: “We are concerned, however, that WFFA’s analysis did not incorporate science about long-term LWD availability and recruitment (i.e., from taller stands).” The Assessment noted that the Proposal’s assumed tree height was lower than the tree height potential of mature conifer stands that would develop over time, and thus should serve as the reference value for estimating LW recruitment loss.

R1 offered some function-specific comments with respect to this question, paraphrased as follows:

LWD: The Assessment agreed with the Proposal regarding thinning but critiqued the lack of tree height or windthrow suitably, based on number of articles that found similar trends.

Shade: The Assessment did not discuss or take issue with the literature used in the Proposal, which appears to be an omission in the evaluation.

Leaf and Litterfall: The Assessment found the Proposal lacking in relevant source–distance relationships from the literature. The latter missed one reference (Kiffney and Richardson 2010, from British Columbia) that related to source-distance, and two (Bisson et al. 2013, Hetrick et al. 1998) that examined the difference between clearcut and unharvested riparian areas. (**R3** also pointed out that the Assessment noted the Proposal’s reliance on inferences from a study by White and Harvey [2007] that did not actually measure litter fall from riparian zones at all.) The remainder of the articles noted in the Assessment’s literature review were published after the Proposal was released and so cannot be used to assert its shortcomings.

Sediment Filtration: The Assessment did not assess whether the Proposal provided a complete and accurate presentation of the relevant scientific literature.

Streambank Stability: The Assessment correctly noted that the Proposal did not directly address bank stability.

6. How well does the contractor’s report provide an adequate assessment of the level of confidence in the prescription response estimates for shade and temperature used in the WFFA Template Proposal?

This question touches on the level of uncertainty inherent in any “one-size-fits-all” prescription. **All reviewers**, to some degree, noted the absence of any substantive discussion of this issue in either the Proposal or the Assessment, and found it to be a significant shortcoming of both. The **Associate Editor** concurs with this judgment. For shade, the Assessment stated that the model alone is insufficient to make reliable predictions of shade loss (and inversely, shade retention) from the riparian prescriptions that are part of the Proposal, noting that the shade model has had limited field validation (and is based on limited sites from just one basin, the Stillaguamish River). The Assessment noted that validation

efforts elsewhere have shown inconsistencies in results, but there was no effort to quantify the magnitude of that uncertainty.

R3 opined that “...there is too much reliance on the pseudo-precision of poorly validated model outputs, and too little acknowledgement of the margin of error and the highly variable nature of different locations and localized climate influences... It would seem that some field testing of shade model predictions, at the very least, should be a requirement if these WFFA prescriptions were to be allowed even at a pilot scale.”

R1 also touched on the issue raised by this question, judging that “the [Assessment] could have been stronger had they specified what degrees of bias have been observed for the *Shade.xls* model and treated the findings in their literature as representing a range of responses instead of combining them into a single mean model.”

7. How well does the contractor’s report assess, in sufficient detail, the extent to which the template prescriptions provide (or do not provide) protection for public resources at least equal in overall effectiveness to the protection provided by the standard forest practices rules (WAC 222-30 -021, Timber Harvesting – Western Washington riparian management zones) that they would replace (described by performance goals and targets in FFR Schedule L1 and as affected by the five riparian functions)?

The three **reviewers** approached this question in different ways. In the judgment of the **Associate Editor**, these differing approaches come to the same fundamental conclusion: the Assessment is sufficient in evaluating the “overall effectiveness of protection” relative to the standard forest practice rules.

However, the concerns discussed in the first section of this synthesis document are relevant to this question. They relate to the context in which small-landowner forestry is conducted. **R2** characterized this issue in the following way: “The question of whether the WFFA template prescriptions provide equal or greater protection is unanswerable from the stream data...To make such an assessment would require defensible quantitative estimates of the likelihood of land conversion if less onerous prescriptions are not adopted, as well as defensible quantitative estimates of likely riparian conditions that would occur on lands converted from forestry. If we take a limited view of equal protection such that we are evaluating only riparian protection across the two forest management prescriptions, then the only way the thinner buffers could provide equal protection is if the resource-riparian width response curves were flat over the interval between the FPA prescriptions and the WFFA prescriptions.” This is not a direct response to the question, but instead addresses the underlying question of whether the Proposal’s prescriptions are equally protective. As noted previously, both the **reviewers** and the Assessment judge that the available scientific literature does not support such an assertion.

R3 attempts to provide a more direct answer to this question, although here also it is difficult to separate the presentation of the Assessment from the **reviewer's** own technical judgments. Quoting the **R3** response to this question in full, this evaluation is quite supportive of the Assessment's efforts to articulate and justify its conclusions:

The synthesis section of the review provides good detail on the overall merits and shortcomings of the WFFA template proposal. Type F (fish bearing streams) would receive less than maximum riparian function under both the standard regulations and the WFFA proposal, but the latter provided less protection than standard rules, but this was variable depending upon the use of the 25 ft. fixed-width no-harvest buffer. The contractor provides considerable detail (p. 42).

For type F streams, LW recruitment under the WFFA prescriptions would be somewhat lower than standard rules. Overhead shade loss would be greater with WFFA prescriptions compared to standard rules. They note that in the case of the WFFA proposal to use 25 ft. buffer there really is no basis for comparison with standard rules in terms of litter fall, sediment and streambank stability. They conclude in Table 8 (p. 43) that differences between riparian WFFA and FPR prescriptions are greater than indicated in Table 3 of the WFFA analysis, and especially so for Rx # 3 and #8 for Type F streams of <5 ft., and 5-15 ft. bfw.

For Type Np streams, the [Assessment] notes and demonstrates that under some circumstances the WFFA prescriptions provide better riparian function than the standard rules do, and in other cases, less protection. The FPR currently allow no buffers on intermittent streams which provide near zero retention of short-term riparian function.

The [Assessment] noted where, in their opinion based upon their interpretation of the supporting evidence, the proposed template prescriptions would exceed, at least equal or be less than the protection afforded by the standard FFR. The also noted those cases where the protection would be less than standard forest practices rules, and for channels <5 ft. wide, where the [Proposal] would actually provide more protection for some riparian functions because the FPR allow cutting to the edge of the stream with no buffer.

With respect to sediment delivery and filtration from the 25 ft. buffers subject to no-harvest and/or thinning as proposed in the [Proposal], the **reviewers** noted that field studies on such narrow buffers have not been tested directly and their effectiveness is unknown. [The Proposal's] conclusions about the "high" function of such buffers in reducing sediment input are not supported by the science, and therefore would likely be less protective than current rules.

Also, the [Assessment] noted that the *streambank stability* riparian function evaluation provided by [the Proposal] did not compare outcomes with standard forest practice rules. In addition, there is no field data available that supports the effectiveness of 25 ft. fixed-width no harvest buffers in minimizing sediment input. They also note that streambank stability as a separate riparian function was not explicitly included in the [Proposal's] Table 3, but was likely included in their *sediment filtration* function. Since no reference to relevant science was offered, the contractor states that there is no way to gage how effective the [Proposal's] prescriptions might be in limiting sediment input into streams.

R1's evaluation of the Assessment's performance with respect to this question is similarly supportive, although some caveats are noted. For LWD, its **coarse estimate of the Proposal's impacts is not well justified in detail**. Its more detailed revision to the **shading impacts is considered "over-simplistic," as it treated all cited references equally**. The evaluations of leaf and litterfall, sediment filtration, and streambank stability were more broadly affirmed.

8. Does the contractor's report provide adequate technical assessment of Questions 5., 6. and 7. on Page 17 of 23, Agreement No. 93-096940 in assessing the relative effectiveness of the prescriptions proposed in the WFFA Template Proposal? They are:

1. *What are the tradeoffs in wood recruitment to the stream, both site-specifically and basin-wide, in using (1) site-class (with site potential tree height) and stream size vs. (2) stream size alone, for determining RMZ width? Do both methods provide equivalent wood recruitment to the stream (site-specifically and basin-wide)?*
2. *Are the proposed RMZ prescription buffer widths (especially 25 ft.) more prone to windthrow than the current rule potentially changing protection to riparian function?*
3. *Has the shade model been validated for the purpose and range of buffer configurations for which it is used in the proposal? If not, what are the implications?*

This question posed some challenges to the **reviewers**. **R3** notes that "Assessing the 'relative effectiveness' of one set of regulation vs. another, in the abstract, is at best an educated guess largely predicated on one's ability to imagine the two different scenarios both before, after and long after they are imposed on the riparian context. Unless someone has direct experience surveying different stream reaches that have methodically been subjected to different riparian harvest 'treatments' this seems a fool's errand."

R2 considered the response to this question fully incorporated into other answers and did not provide a separate response.

R1, however, attempted to respond to each point in turn; as such, the **Associate Editor** found it to be most useful in providing explicit answers to the specific questions. Quoting the responses:

8.5 – The contractor only generally addresses this question. **The contractor does not consider findings site-specifically or basin-wide per se**. Although not explained explicitly, the trade-offs appear to be that site-class defined buffer widths would provide more LWD than relying on stream size alone, as cited reports indicate that taller trees provide LWD from greater distances than shorter trees.

8.6 – Yes, it appears that the proposed prescription buffers will be more prone to windthrow than current prescription buffers.

8.7 – I believe the contractor has addressed this question well, citing their own experience and published work on validating *Shade.xls*.

9. Are uncertainties and limitations of the WFFA Template Proposal analysis by the contractor's report stated and described adequately?

R2 provided the broadest overview in response to this question, finding that the review “does a good job stating its assumptions, its data sources, and their limitations. The presentation of the analysis was straightforward.” The **Associate Editor** agrees with this judgment.

R3 provided greater details in arriving at essentially the same conclusion. “I appreciated how the contractor compared and contrasted their independent riparian ecological ‘function evaluation’ with that of the WFFA, following the general guidance provided in BM 21... The contractor was clear to point out the uncertainties and limitations they observed in the WFFA proposal, based on their comparison of their independent function evaluation and that done by WFFA... For example, the contractor noted that studies focused on the effects on LW recruitment from riparian buffers subjected to thinning prescriptions are not well represented in the available literature... The contractor states their concern that the WFFA conclusions with respect to the short and long-term effects of thinning in or adjacent to riparian zones lacked grounding in empirical studies and relied too much on the use of models that have not been adequately field validated, and the WFFA projections on LW recruitment gain or loss cannot be corroborated.”

R1 commented on each of the riparian functions in the context of this question. As with the other **reviewers**, the overriding conclusion was affirmative with respect to the Assessment's performance. The shortcomings of the *Shade.xls* model was noted by this review (and others), although the alternative approach offered by the Assessment (shade diminishing by 0.2% for each foot of harvest nearer than 100 feet from the stream) was not considered a particularly suitable substitute.

10. Are assumptions in the contractor's report stated and described adequately?

The **reviewers** were not entirely in agreement on this question, although the differences appear to be more in the interpretation of what was being asked, and in how the Assessment presented its approach and findings. Both **R2** and **R3** were quite positive with regard to the Assessment's statement of assumptions; indeed, **R3** found significantly more fault in the “opaqueness of those corresponding assumptions in the Template Proposal,” citing in particular the Assessment's explicit discussion of the Proposal's underlying assumptions regarding LW input mechanisms. **R1** acknowledges the same passages but did not perceive them as addressing “assumptions.” Similarly, **R1** found no stated assumptions for most of the other functions.

The **Associate Editor's** reading of the various passages in the Assessment that address "assumptions" suggests that this seeming disparity between reviews is more interpretive than substantive. The Assessment is more focused on articulating and evaluating the assumptions of the Proposal than on presenting its own framework. This is an appropriate emphasis: the primary task for a review is to critique a proposal, not to create an alternative. To the extent that the Assessment offered a "counter-proposal" (at least implicitly), its underlying assumptions were largely implicit (and, presumably, invoking those already enshrined in the existing forest practice regulations). More explicit direction to the contractor on this question would have undoubtedly produced a more uniform (and positive) evaluation by **reviewers**, but in the judgment of the **Associate Editor** the Assessment should not be considered deficient in this regard.

11. Is the information in the contractor's report presented in an accurate, clear, complete, and unbiased manner and in a proper context?

This question was, to varying degrees, considered redundant by all **reviewers**. **R3** directed readers of this review to Questions 1 and 2; **R2** saw full overlap with Questions 1 and 5 (which, as noted above, were considered overlapping as well). Review of these earlier responses indicates that all **reviewers** judged the Assessment to be broadly "accurate, clear, complete, and unbiased." The **Associate Editor** agrees with this judgment.

The matter of "context" is one for which the **reviewers** have had more to say than the Assessment itself, as previously discussed at the opening of this synthesis report. They noted that the "one-size-fits-all" prescriptions favored by forest practices ignores critical issues of the placement of harvests in the watershed and stream network; the intensity, size, and density of such sites; and the interrelated issues of harvest rotation and land conversion to non-forestry uses. Neither the Proposal nor the Assessment address these issues, which in the judgment of the **reviewers** (and the **Associate Editor**) are at least as important to the protection of stream resources as the width of a riparian buffer.

Only **R1** attempted a separate, more specific answer to this question, as paraphrased below:

LWD: As stated above, results from selected studies could have been presented in a more complete manner **by discussing which findings represented high-quality information and which did not.**

Shade: The contractor did not provide rankings, ratings, or other measures of citation strength for the citations they used; and the Assessment's use of the citations in the report's Table 7 **may reflect a misunderstanding of how Oregon has applied its riparian harvest laws on privately-owned land.** The shade aspects of the report were not biased.

Leaf and Litterfall, Sediment Filtration, and Streambank Stability: I found the contractor's reporting on this subject area to be clear and unbiased.