

~ Protecting clean water and fish in the waters of the Rogue

Thomas Imeson, Chair Oregon Board of Forestry 2600 State Street Salem, OR 97310

March 7, 2018

Re: Public Comment on Agenda Item 2: Eastern Oregon/Siskiyou Monitoring Streamside Protections

Dear Chair Imeson and Members of the Board:

Thank you for the opportunity to provide public comment on Agenda Item 2: Eastern Oregon/Siskiyou Monitoring Streamside Protection. Rogue Riverkeeper works to protect and restore clean water and native fish populations in the Rogue River Basin through advocacy, accountability, and community engagement. On behalf of our more than 3,500 members and supporters, we remain concerned that the Siskiyou region's salmon, steelhead, and bull trout streams are currently left with weaker protections than those in the rest of western Oregon, following the Board of Forestry's November 2015 decision to exclude our region from its new stream buffer rule.

Consistent with the Board's decision in November 2016 to direct the Oregon Department of Forestry (ODF) develop a monitoring strategy for the Siskiyou and eastern Oregon, we urge the Board to approve the monitoring strategy under Option 2: Modified Siskiyou Alternative. Under Option 2, ODF would conduct a literature review of small and medium fish streams in the Siskiyou Georegion reviewing stream temperature, shade, and vegetation relative to desired future condition (DFC); and context of fish status and trend. Although we do not support removing eastern Oregon from the proposed monitoring strategy, we strongly urge the Board and ODF to move forward with a comparable monitoring strategy for this region where the Protecting Cold Water (PCW) water quality standard applies equally.

Compliance with the Protecting Cold Water (PCW) Water Quality Standard in the Siskiyou Georegion

The Rogue River watershed stretches across more than 3 million acres, from its headwaters near Crater Lake to the mouth of the river along Oregon's southern coast at Gold Beach. The Rogue Basin includes approximately 1 million acres of private forest land managed under the Oregon Forest Practices Act. The 2002 statewide sufficiency analysis and the results of the RipStream study in 2011 demonstrated that current stream buffer rules under the Forest Practices Act are not protective of stream temperature and violate the Protecting Cold Water (PCW) water quality

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standard.¹ Under ORS 527.765(1), the Board is required to establish regulations and best management practices to "insure that to the maximum extent practicable" water quality standards are achieved and maintained. Critically, the PCW water quality standard applies statewide in streams that support salmon, steelhead, and bull trout ("SSBT") and to upstream stream reaches necessary to meet the criterion downstream. Data from Oregon Department of Forestry (ODF) show that 64% of small and medium fish-bearing streams (Type F) in the Siskiyou region are SSBT streams. In other words, more than half of the small and medium fish-bearing streams in the Siskiyou that would qualify for the proposed revised buffer standard are now left with the current inadequate prescriptions. By approving Option 2, the Board will continue to make progress in addressing inadequacies in current stream buffer standards in the Siskiyou.

Riparian Management Impacts on Shade and Stream Temperature in the Siskiyou Georegion

Impacts to Shade and Stream Temperature from Existing Riparian Management Practices

As evidenced in the literature compiled in Attachment A, the science is clear that removing trees near streams reduces shade and can increase stream temperature. As Lewis et al. write, "Canopy has been widely acknowledged as influencing stream temperature. It has been shown that forest harvesting or road building that removes riparian vegetation (canopy) increases the water temperature of the adjacent stream."² A 2004 Independent Multidisciplinary Science Team (IMST) report emphasized the impact of stream buffers, concluding that "the vast majority of published studies document that riparian shade has a significant effect on stream temperature." ³ Leinenbach et al. further state that:

"Substantial effects on shade have been observed with "no-cut" buffers ranging from 20 to 30 m (Brosofske et al. 1997, Kiffney et al. 2003, Groom et al. 2011b), and small effects were observed in studies that examined "no-cut" buffers 46 m wide (Science Team Review 2008, Groom et al. 2011a)."⁴

Further, these temperature increases as a result of riparian management practices can result in violations of the PCW water quality standard. In the RipStream study conducted by Groom et al. and the basis for the new stream buffer standard, the authors state that:

"For streams adjacent to harvested areas on privately owned lands, preharvest to postharvest year comparisons exhibited a 40% probability of exceedance. Sites managed

¹ Groom et al. 2011. *Response of Western Oregon (USA) stream temperature to contemporary forest management*, Forest Ecology and Management, 262: 1618-1629.

² Lewis T. E., D. W. Lamphear, D. R. McCanne, A. S. Webb, J. P. Krieter, and W. D. Conroy (1999), Executive summary: Regional assessment of stream temperatures across northern California and their relationship to various landscape-level and site-specific attributes, Forest Science Project report, 14 pp., Humboldt State Univ. Found., Arcata, Calif. P. 13.

³ Independent Multidisciplinary Science Team. 2004. Oregon's Water Temperature Standard and its Application: Causes, Consequences, and Controversies Associated with Stream Temperature. Technical Report 2004-1 to the Oregon Plan for Salmon and Watersheds, Oregon Watershed Enhancement Board, Salem, Oregon, p. 8.

⁴ Leinenbach, Peter, George McFadden, and Christian Torgersen. (2013). Effects of Riparian Management Strategies on Stream Temperature. Science Review Team Temperature Subgroup. P. 6.

according to the more stringent state forest riparian standards did not exhibit exceedance rates that differed from preharvest, control, or downstream rates (5%)."⁵

These findings were further reviewed in the systematic review of existing stream buffer standards completed by Czarnomski in 2013, which stated that:

"The Oregon Board of Forestry ("Board") made a finding of degradation that stream protections afforded to small- and medium-sized fish-bearing streams under the Forest Practices Act (FPA) were not likely protective of the Oregon Department of Environmental Quality (ODEQ) Protecting Cold Water (PCW) criterion. This criterion prohibits human activities, such as timber harvest, from increasing stream temperatures by more than 0.3 °C, for all sources taken together at the point of maximum impact, at locations critical to salmon, steelhead or bull trout."⁶

Critically, both Groom et al. and Czarnomski state that their findings apply to western Oregon and do not explicitly exclude southwestern Oregon. As one example, Groom et al. state that "the principal results of this study are applicable to the policy issue at hand; the results may directly inform timber management decisions in Oregon and may apply to other timber-harvesting regions with antidegradation or cold-water standards."⁷

Impacts to Threatened Salmonids from Existing Riparian Management Practices

In addition to compliance with the PCW water quality standard, there is evidence that current buffer standards are not protective of threatened salmonids in the Siskiyou region. The Independent Multidisciplinary Science Team (IMST) clearly links the health of salmonids to stream temperature. In reviewing forest practices, including existing riparian buffer standards, the IMST states that "current rules for riparian protection, large wood management, sedimentation, and fish passage are not adequate to reserve depressed stocks of wild salmonids."⁸

Within the Siskiyou region, the Rogue watershed provides habitat for the Southern Oregon/Northern California Coast (SONCC) Evolutionarily Significant Unit (ESU) of coho salmon, listed as a threatened species under the Endangered Species Act first in 1997 and reaffirmed in 2005.⁹ In the Rogue Basin, independent populations of SONCC coho in the Middle Rogue, Applegate River, and Illinois River are identified as at high risk for extinction.¹⁰ The 2014 Final SONCC Coho Recovery Plan from NOAA Fisheries states that the Oregon Forest

⁵ Groom, Jeremiah, Liz Dent, and Lisa Madsen. (2011). Stream temperature change detection for state and private forests in the Oregon Coast Range. Water Resources Research. Vol. 47. P. 2.

⁶ Czarnomski, Nicole. (2013). Effectiveness of riparian buffers at protecting stream temperature and shade in Pacific Northwest Forests: A systematic review. Final Report September 2013. P. 1.

⁷ Groom, Jeremiah, Liz Dent, and Lisa Madsen. (2011). Stream temperature change detection for state and private forests in the Oregon Coast Range. Water Resources Research. Vol. 47. P. 2.

⁸ Independent Multidisciplinary Science Team (IMST). 1999. Recovery of Wild Salmonids in Western Oregon Forests: Oregon Forest Practices Act Rules and the Measures in the Oregon Plan for Salmon and Watersheds Technical Report 1999-1. p. 2

⁹ 2014 SONCC plan <u>http://www.nmfs.noaa.gov/pr/recovery/plans/cohosalmon_soncc.pdf</u> p. ES3-ES4

¹⁰ 2014 SONCC plan <u>http://www.nmfs.noaa.gov/pr/recovery/plans/cohosalmon_soncc.pdf</u> p. ES 5

Practices Act and related regulations are the least protective within the SONCC coho ESU.¹¹ NOAA Fisheries identifies improving timber harvest practices under the Oregon Forest Practices Act as one of the highest priority recovery actions for the Illinois River, Middle Rogue/Applegate, and Upper Rogue coho populations.¹² NOAA Fisheries further states that:

"Because of the preponderance of private timberland and timber harvest activity in the range of this ESU, and potential adverse effects, careful consideration of state forest practices rules and regulations is prudent. At the time of listing, most reviews of the forest practice rules indicated that implementation and enforcement of these rules did not adequately protect coho salmon or their habitats (CDFG 1994, Murphy 1995, Ligon et al. 1999, IMST 1999)."¹³

As one example, NOAA Fisheries found that for the Illinois River population, private forestlands had both the most potential to support coho salmon and at the same time had the least watershed protection. Specifically, the report states that "although much of the habitat in the Illinois River is federally owned, the future threat of timber harvest in the next ten years is high because much of the habitat with the best potential to support coho salmon will be harvested using less protective management actions than those used on Federal lands."¹⁴ In other words, the inadequate protections under the Oregon Forest Practices Act, including stream buffer standards as identified by the IMST, remains a significant threat to the recovery of native salmonids in the Rogue watershed.

Examples of Temperature Impairment and Shade Loss Connected to Riparian Management in the Siskiyou

Based on an initial review of the available data, as summarized by Frissell and Nawa, there is no evidence to suggest that canopy shade conditions, stream temperatures, or the relationship between canopy cover and shade to stream temperatures are systematically different in the Siskiyou than in the rest of western Oregon.¹⁵ For example, Dent's 2001 study analyzed percent cover prior to harvesting for two Siskiyou streams and for 22 streams in other western Oregon ODF georegions. Percent cover for the 8 streams in the study classified as Large ranged from 76 to 94 percent cover, with a median of 78 percent. Glade Creek in the Siskiyou, classified as a Large size class stream, had 80 percent cover. Similarly, percent cover for the 9 streams in the study classified as Small ranged from 83 to 97 percent cover, with a median of 91 percent. Jamison Creek in the Siskiyou, classified as a Small size class stream, had 91 percent cover.¹⁶ Similarly, an initial review of stream temperature data through the NorWest project's "Thermalscape" map does not reveal evidence that stream temperatures in the Siskiyou are warmer than in western Oregon. As discussed by Frissell and Nawa, some smaller streams in the

¹¹ Final Recovery Plan for the Southern Oregon/ Northern California Coast Evolutionarily Significant Unit of Coho Salmon (*Oncorhynchus kisutch*). NOAA Fisheries. 2014. P. 3-57.

¹² 2014 SONCC plan <u>http://www.nmfs.noaa.gov/pr/recovery/plans/cohosalmon_soncc.pdf</u> p. ES 5

¹³ Final Recovery Plan for the Southern Oregon/ Northern California Coast Evolutionarily Significant Unit of Coho Salmon (*Oncorhynchus kisutch*). NOAA Fisheries. 2014. P. 3-54.

^{14 2014} SONCC 30-22

¹⁵ Frissell, Christopher A. and Richard K. Nawa. (2016). Protecting Coldwater for Salmon and Steelhead on Private Timberland Streams of Oregon's Siskiyou Region: A Synoptic Scientific Look at Stream Warming, Shade, and Logging. 2016.

¹⁶ Dent, L. 2001. Harvest Effects on Riparian Function And Structure Under Current Oregon Forest Practice Rules ODF Technical Report, 12 July 2001. Oregon Department of Forestry, Salem, OR. P. 37.

Cascade region at higher elevations may be cooler than other areas in western Oregon due to geohydrologic differences.¹⁷ Finally, a review of Total Maximum Daily Loads (TMDLs) in the Siskiyou where private forestlands are a dominant land use reveal a relationship similar to streams in western Oregon between canopy cover and effective shade related to observed water temperature. For example, data from the Sucker Creek TMDL (1999) demonstrate a relationship between stream temperature increase and loss of riparian cover and effective shade that is approximately the same magnitude as reported for streams in western Oregon by Groom et al. in the RipStream study.¹⁸ Frissell and Nawa further state that:

"The evidence from these TMDL data and modeling projections appear to fall well in line with Ripstream results and predictions from sites in other western Oregon streams, offering no evidence that Siskiyou Region streams operate differently with regard to the thermal effects of shade and shade loss."¹⁹

Additionally, as summarized in Appendix A, the TMDLs for the sub-watersheds of the Rogue including Sucker Creek and the Applegate as well as the Water Quality Restoration Plans developed by the Bureau of Land Management (BLM) for many sub-watersheds in the Rogue provide further evidence connecting dominant private forestry land uses, streams listed for temperature impairment, and the presence of threatened salmonids.

Deer Creek Watershed

As one example, the Deer Creek watershed is located approximately 15 miles southwest of Grants Pass in the Siskiyou Georegion and stretches across 55,922 acres. Deer Creek is approximately 15 miles long and is a major tributary to the Illinois River in the Rogue watershed. Private land is the dominant ownership in the watershed, with the BLM managing 41 percent of lands and private ownership totaling 43 percent. According to the Water Quality Restoration Plan, the primary land uses in the watershed are agriculture and logging. Within the watershed, Deer Creek from the mouth to river mile 17, Anderson Creek from the mouth to river mile 3.2, and Squaw Creek from the mouth to river mile 3 were listed as water quality limited for temperature.²⁰

The BLM states that, "due to the mixed ownership in the Deer Creek Watershed, attainment of the water temperature standard requires multi-ownership participation and commitment to improve riparian function."²¹ Further, the Water Quality Restoration Plan documents how the reduced riparian zone on private lands decreases stream shade and increases solar radiation. Specifically, the BLM states:

¹⁷ Frissell, Christopher A. and Richard K. Nawa. (2016). Protecting Coldwater for Salmon and Steelhead on Private Timberland Streams of Oregon's Siskiyou Region: A Synoptic Scientific Look at Stream Warming, Shade, and Logging. 2016. P. 5.

¹⁸ ODEQ (Oregon Department of Environmental Quality). 2002. Lower Sucker Creek Illinois River Subbasin Total Maximum Daily Load and Water Quality Management Plan. Portland, OR. 122 pp.

¹⁹ Frissell, Christopher A. and Richard K. Nawa. (2016). Protecting Coldwater for Salmon and Steelhead on Private Timberland Streams of Oregon's Siskiyou Region: A Synoptic Scientific Look at Stream Warming, Shade, and Logging. 2016. P. 6.

²⁰ Water Quality Restoration Plan Deer Creek Watershed. Bureau of Land Management. 2011.

²¹ Water Quality Restoration Plan Deer Creek Watershed. Bureau of Land Management. 2011. P. 13.

"Based on the ownership distribution and aerial scanning (Google Earth), approximately 70% of the riparian zones in the Deer Creek Watershed lack mature tree structure necessary to provide large instream wood. On private lands, in the lower gradient floodplain reaches of Deer, Anderson/Clear, Draper, and Crooks creeks, reductions in riparian vegetation have decreased stream shade, thereby increasing solar radiation input into surface waters."²²

Below, Appendix B. Figure 3 overlays streams that are water quality limited for temperature with salmon, steelhead, and bull trout (SSBT) streams, and private forestlands in the Deer Creek watershed. As demonstrated in this initial GIS map, most of the main stem of Deer Creek both supports salmon, steelhead, and bull trout and is listed as temperature impaired as it flows through private forestlands.

Appendix B. Figure 3. Deer Creek HUC-10 watershed with SSBT streams, temperature water quality limited streams, and private forestlands



The maps in Appendix B demonstrate other sub-watersheds in the Rogue watershed where SSBT streams that are also water quality limited for temperature flow through private forestlands.

The Board Should Approve Option 2: Modified Siskiyou Alternative

In conclusion, we ask the Board to approve Option 2: Modified Siskiyou Alternative. Under Option 2, ODF would conduct a literature review of small and medium fish streams in the Siskiyou Georegion reviewing stream temperature, shade, and vegetation relative to desired future condition (DFC); and context of fish status and trend. Oregon law requires the Board to

²² Water Quality Restoration Plan Deer Creek Watershed. Bureau of Land Management. 2011. P. 5.

establish regulations and best management practices to "insure that to the maximum extent practicable" water quality standards are achieved and maintained (ORS 527.765(1)). The Siskiyou Georegion encompasses the Rogue watershed, where many streams are already impaired by warm temperatures and support habitat for threatened populations of coho salmon. The results of the RipStream study and an initial literature review of existing peer-reviewed science and gray papers do not provide evidence that there are any systematic differences between southwestern Oregon and the rest of western Oregon in the relationship between canopy cover and effective shade related to observed water temperature. Although we do not support removing eastern Oregon from the proposed monitoring strategy, we strongly urge the Board and ODF to move forward with a comparable monitoring strategy for this region where the Protecting Cold Water (PCW) water quality standard applies equally.

Thank you for the opportunity to provide comment regarding Agenda Item 2: Eastern Oregon/Siskiyou Monitoring Streamside Protections.

Sincerely,

Stacey Detwiler Conservation Director Rogue Riverkeeper Appendix A. Riparian Management Impacts on Shade and Stream Temperature in the ODF Siskiyou Georegion

Riparian management impacts on shade and stream temperature in the ODF Siskiyou Georegion

I. Peer-reviewed literature

A. Data from RipStream Study Analysis

- Groom, Jeremiah, Liz Dent, and Lisa Madsen. (2011). Stream temperature change detection for state and private forests in the Oregon Coast Range. Water Resources Research. Vol. 47.
- Brown, George W. and James T. Krygier. (1970). Effects of Clear-Cutting on Stream Temperature. Water Resources Research. Vol. 6, No. 4.
- Brosofske K. D., J. Chen, R. J. Nairman, and J. F. Franklin (1997), Harvesting effects on microclimatic gradients from small streams to uplands in western Washington, Ecol. Appl., 7, 1188–1200.
- Johnson S. L. (2004), Factors influencing stream temperatures in small streams: Substrate effects and a shading experiment, Can. J. Fish. Aquat. Sci., 61, 913–923.
- Lewis T. E., D. W. Lamphear, D. R. McCanne, A. S. Webb, J. P. Krieter, and W. D. Conroy (1999), Executive summary: Regional assessment of stream temperatures across northern California and their relationship to various landscape-level and site-specific attributes, Forest Science Project report, 14 pp., Humboldt State Univ. Found., Arcata, Calif.

B. Other

Adams, Paul W. (2007). Policy and Management for Headwater Streams in the Pacific Northwest: Synthesis and Reflection. Forest Science 53(2). 2007.

II. Peer-reviewed gray literature

A. ODF and EPA Analysis

Czarnomski, Nicole. (2013). Effectiveness of riparian buffers at protecting stream temperature and shade in Pacific Northwest Forests: A systematic review. Final Report September 2013.

Leinenbach, Peter, George McFadden, and Christian Torgersen. (2013). Effects of Riparian Management Strategies on Stream Temperature. Science Review Team Temperature Subgroup.

B. Threatened and Endangered Species Recovery Plans

Final Recovery Plan for the Southern Oregon/ Northern California Coast Evolutionarily Significant Unit of Coho Salmon (*Oncorhynchus kisutch*). NOAA Fisheries. 2014.

III. Gray literature

A. Bureau of Land Management (BLM) Water Quality Restoration Plans

Water Quality Restoration Plan Southern Oregon Coastal Basin Big Butte Creek Watershed. Bureau of Land Management (BLM) Medford District Butte Falls Resource Area. January 2008.
Althouse Creek Watershed Assessment. Bureau of Land Management. February 2005.
Water Quality Restoration Plan Deer Creek Watershed. Bureau of Land Management. 2011.
Grants Pass Water Quality Restoration Plan Southern Oregon Coastal Basin Middle Rogue Subbasin Grants Pass-Rogue River Watershed Bureau of Land Management (BLM), Medford District Office Grants Pass Resource Area. 2012.

Water Quality Restoration Plan Southern Oregon Coastal Basin Evans Creek Watershed. Bureau of Land Management (BLM) Medford District Butte Falls Resource Area. July 2009. Water Quality Restoration Plan Jumpoff Joe Creek Watershed. Bureau of Land Management. September 2009.

- Water Quality Restoration Plan Klamath Basin Jenny Creek Watershed. Bureau of Land Management. 2011.
- B. Total Maximum Daily Loads
 - Rogue River Basin TMDL Chapter 2: Temperature. Oregon Department of Environmental Quality. 2008.
 - Lower Sucker Creek Illinois River Subbasin Total Maximum Daily Load and Water Quality Management Plan (Lower Section of Sucker/Grayback Watershed: 1710031103) (USFS boundary at Mile 10.4 to the Mouth). Oregon Department of Environmental Quality. April 2002.
 - Applegate Subbasin Total Maximum Daily Load (TMDL) HUC # 17100309. Oregon Department of Environmental Quality. December 2003.
- C. Other gray literature

Stream habitat and water quality in the Applegate Basin. OWEB Grant 99-485 Final Report. Applegate River Watershed Council. November 2004.

Betts, M., B. Bourgeois, R. Haynes, S. Johnson, K. Puettmann, and V. Sturtevant. 2014. Assessment of Alternative Forest Management Approaches: Final Report of the Independent Science Panel. Prepared with assistance from D.C.E. Robinson, A.W. Hall and G. Stankey, ESSA Technologies Ltd. (Vancouver, BC) for Oregon Department of Forestry (Salem, OR).

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I. Peer-reviewed literature

- A. Data from RipStream Study Analysis
- (1) Groom, Jeremiah, Liz Dent, and Lisa Madsen. (2011). Stream temperature change detection for state and private forests in the Oregon Coast Range. Water Resources Research. Vol. 47.
- "For streams adjacent to harvested areas on privately owned lands, preharvest to postharvest year comparisons exhibited a 40% probability of exceedance. Sites managed according to the more stringent state forest riparian standards did not exhibit exceedance rates that differed from preharvest, control, or downstream rates (5%)." (p. 1)
- "Several previous studies link timber harvest with increases in stream temperature [Beschta and Taylor, 1988; Moore et al., 2005, and references therein], and federal endangered species listings of trout and salmon species (*Oncorhynchus spp.*) in the Pacific Northwest <u>cite stream temperature increases due to logging as a limiting factor for</u> <u>population recovery</u> [Bryant and Lynch, 1996; Myers and Bryant, 1998; Myers et al., 1998]." (p. 1)
- "Since removal of shade is strongly associated with stream temperature increases, timber harvest operations are considered in compliance with Oregon Department of Environmental Quality (DEQ) water quality standards if harvest operations comply with

the FPA [DEQ, 2004]. However, ODF must periodically conduct studies to validate the efficacy of the FPA at meeting state water quality standards [ODF, 2007b]." (p. 1)

- "The principal results of this study are applicable to the policy issue at hand; the results may directly <u>inform timber management decisions in Oregon and may apply to other</u> <u>timber-harvesting regions with antidegradation or cold-water standards</u>."
- "Our analysis indicated that timber harvested according to minimum FPA standards along medium or small fish-bearing streams resulted in a 40.1% probability that a preharvest to postharvest comparison of 2 years of data will detect a temperature increase of >0.3C." (p. 9)
- "The results from these analyses and others will inform Oregon Board of Forestry policy discussions on current regulations and potentially inform riparian timber harvest policy regulations elsewhere." (p. 11).

(2) Brown, George W. and James T. Krygier. (1970). Effects of Clear-Cutting on Stream Temperature. Water Resources Research. Vol. 6, No. 4.

- "Temperature differences between watersheds and all of the temperature anomalies within the clear-cut watershed can be explained in terms of shade differences. The patchcuts on Deer Creek did not produce any significant changes in temperature in the main stream. Strips of timber 100 feet long were left beside each perennial stream; the amount of shade on the stream surface was essentially unchanged. On Needle Branch, little shade remained after the clear-cutting and burning were completed. As a result, large changes in annual and daily patterns of temperature were observed." (p. 1138).
- (3) Brosofske K. D., J. Chen, R. J. Nairman, and J. F. Franklin (1997), Harvesting effects on microclimatic gradients from small streams to uplands in western Washington, Ecol. Appl., 7, 1188–1200.
- "We conclude that a buffer at least 45 m on each side of the stream is necessary to maintain a natural riparian microclimatic environment along the streams in our study, which were characterized by moderate to steep slopes, 70–80% overstory coverage (predominantly Douglas-fir and western hemlock), and a regional climate typified by hot, dry summers and mild, wet winters. This buffer width estimate is probably low, however, since it assumes that gradients stabilize within 30 m from the stream and that upslope edge effects extend no more than 15 m into the buffer (a low estimate based on other studies). Depending on the variable, required widths may extend up to 300 m, which is significantly greater than standard widths currently in use in the region (i.e., ;10–90 m). Our results indicate that even some of the more conservative standard buffer widths may not be adequate for preserving an unaltered microclimate near some streams." (p. 1188).

(4) Johnson S. L. (2004), Factors influencing stream temperatures in small streams: Substrate effects and a shading experiment, Can. J. Fish. Aquat. Sci., 61, 913–923.

- "Changes in vegetation near streams can have major impacts on stream temperature (Brown and Krygier 1970; Beschta and Taylor 1988; Johnson and Jones 2000). Streams

and their riparian areas have been greatly modified across most ecosystems (Bisson et al. 1992; Sugimoto et al. 1997). Small forested streams historically have not been protected under riparian management guidelines or forest harvest best management practices; agricultural or urban streams of all sizes have had even less protection." (p. 914).

- "Riparian vegetation influences microclimatic conditions through biological functions such as evapotranspiration and release of water vapor as well as through physical means such as decreasing wind speeds. Vegetation also provides bank stability, which can impact width to depth ratios and the exposed surface area of the stream. Accumulations of large organic matter inputs have an effect on hydraulic retention times. Although incoming radiation levels in dense natural forests can be as low as those under the experimental shade, riparian forests would have more variability of incoming light levels because of the shape and structure of the vegetation." (p. 919).
- (5) Lewis T. E., D. W. Lamphear, D. R. McCanne, A. S. Webb, J. P. Krieter, and W. D. Conroy (1999), Executive summary: Regional assessment of stream temperatures across northern California and their relationship to various landscape-level and site-specific attributes, Forest Science Project report, 14 pp., Humboldt State Univ. Found., Arcata, Calif.
- "Canopy has been widely acknowledged as influencing stream temperature. It has been shown that <u>forest harvesting or road building that removes riparian vegetation (canopy)</u> increases the water temperature of the adjacent stream." (p. 13).

B. Other

(1) Adams, Paul W. (2007). Policy and Management for Headwater Streams in the Pacific Northwest: Synthesis and Reflection. Forest Science 53(2). 2007.

- "Under this backdrop, the National Marine Fisheries Service (NMFS 1998) proposed that Oregon adopt significantly greater Forest Practice Rule restrictions on timber harvest and other practices in western Oregon riparian areas, including headwater streams (Table 3). The NMFS proposal met significant resistance by landowner and other interests, and the Oregon Board of Forestry declined to act on it due to questions about its technical and policy bases. However, the issue did reveal the high level of federal agency concern as well as the nature and scope of the favored riparian forest protection policies." (p. 108)
- "The relatively limited measures required for headwater streams on private lands in Oregon (Table 7) have been the subject of considerable discussion and debate in recent years. For example, although the CWA generally allows state policies to prevail, recent comments from federal agency officials to the Oregon Board of Forestry (OBF) stated that "... improvements to management of small non-fish streams, landslide prone areas, and cumulative watershed effects would be necessary to argue convincingly that forest practices meet the [water quality] standards and TMDLs" (Markle 2004), and "... we are not confident that [the rule-making and voluntary measures proposed by the Board] can be relied on to meet Oregon's water quality standards ... we believe additional improvements to the rules are needed" (Gearhard 2004). This input, while simply

advisory in nature, came after the OBF had deferred action on draft rule changes to increase protection of small nonfish-bearing streams, although they had also initiated rulemaking for increased protection of headwater woody debris." (p. 111)

II. Peer-reviewed gray literature

C. ODF and EPA Analysis

(1) Czarnomski, Nicole. (2013). Effectiveness of riparian buffers at protecting stream temperature and shade in Pacific Northwest Forests: A systematic review. Final Report September 2013.

- "The Oregon Board of Forestry ("Board") made a finding of degradation that stream protections afforded to small- and medium-sized fish-bearing streams under the Forest Practices Act (FPA) were not likely protective of the Oregon Department of Environmental Quality (ODEQ) Protecting Cold Water (PCW) criterion. This criterion prohibits human activities, such as timber harvest, from increasing stream temperatures by more than 0.3 °C, for all sources taken together at the point of maximum impact, at locations critical to salmon, steelhead or bull trout. The Board's finding was based on scientific outcomes of the Oregon Department of Forestry (ODF) Riparian and Stream Function (RipStream) monitoring project. ODF has therefore undertaken a systematic science review in support of a riparian rule analysis to address concerns about meeting the PCW criterion." (p. 1).
- The geographic scope of the findings of degradation are based on Groom et al. (2011b), which studied streams in the Coast Range and Interior Geographic Regions of Oregon (as defined in OAR 629-635-0220). While the exact geographic extent of the rule analysis is yet to be determined, it will be limited to western Oregon. This limitation is due to the vegetation, climate and hydrologic characteristics of eastern Oregon being significantly different enough from those included in the RipStream study to preclude extending a rule to eastern Oregon." (p. 7).

(2) Leinenbach, Peter, George McFadden, and Christian Torgersen. (2013). Effects of Riparian Management Strategies on Stream Temperature. Science Review Team Temperature Subgroup.

- "The Science Roundtable Team (SRT) of technical experts was requested by the Interagency Coordinating Subgroup (ICS) to evaluate models that predict changes in shade and stream temperature as a result of the removal of trees in riparian areas. The management concern is that stream temperature in the summer may increase as a result of riparian management activities and negatively affect coldwater fishes, including salmon, trout, and associated aquatic ecosystems. The area of interest includes conifer forests of the Oregon Coast Range, but the <u>findings of the SRT are intended to be applicable to a</u> <u>broader range of forests in western Oregon and Washington</u>." (p. 1).
- "The effects of riparian vegetation on shade and stream temperature have been studied extensively, and it is generally accepted that removing trees in riparian areas reduces the

amount of shade which leads to increases in thermal loading to the stream (Moore and Wondzell 2005). " (p. 2).

- "We focus on shade and the factors that influence its spatial extent, temporal duration, and quality. The primary factors that influence shade are riparian vegetation (Groom et al, 2011b) and the surrounding terrain (Allen et al. 2007)." (p. 3).
- "No-cut buffers adjacent to clearcut harvest units: Substantial effects on shade have been observed with "no-cut" buffers ranging from 20 to 30 m (Brosofske et al. 1997, Kiffney et al. 2003, Groom et al. 2011b), and small effects were observed in studies that examined "no-cut" buffers 46 m wide (Science Team Review 2008, Groom et al. 2011a). For "no-cut" buffer widths of 46-69 m, the effects of tree removal on shade and temperature were either not detected or were minimal (Anderson et al. 2007, Science Team Review 2008, Groom et al. 2011a, Groom et al. 2011b) (Figure 4). The limited response observed in these studies can be attributed to the lack of trees that were capable of casting a shadow >46 m during most of the day in the summer (Leinenbach 2011; Appendix C of this document). Reductions in shade and increases in stream temperature were more apparent at ~30 m "no-cut" buffer widths, as compared to the 46-69 m wide buffers, but the magnitude and direction of response was highly variable for both shade and stream temperature (Kiffney et al. 2003, Gomi et al. 2006, Science Team Review 2008, Groom et al. 2011a, Groom et al. 2011b). At "no-cut" buffer widths of <20 m, there were pronounced reductions in shade and increases in temperature, as compared to wider buffer widths. The most dramatic effects were observed at the narrowest buffer widths (<10 m) (Jackson et al. 2001, Curry et al. 2002, Kiffney et al. 2003, Gomi et al. 2006, Anderson et al. 2007)." (p. 6).
- B. Threatened and Endangered Species Recovery Plans

(1) Final Recovery Plan for the Southern Oregon/ Northern California Coast Evolutionarily Significant Unit of Coho Salmon (*Oncorhynchus kisutch*). NOAA Fisheries. 2014.

Inadequacy of Oregon Forest Practices Act:

- "Because of the preponderance of private timberland and timber harvest activity in the range of this ESU, and potential adverse effects, careful consideration of state forest practices rules and regulations is prudent. At the time of listing, most reviews of the forest practice rules indicated that implementation and enforcement of these rules did not adequately protect coho salmon or their habitats (CDFG 1994, Murphy 1995, Ligon et al. 1999, IMST 1999)." (p. 3-54)
- "Though significant improvements have been made to the current rule package, the Oregon Forest Practice Rules represent the least conservative forest practice regulations administered by the state governments within the SONCC coho salmon ESU. Some riparian areas may be protected by narrow, no-harvest zones; however, the stands located upslope of the no-harvest zones could be subject to intense harvest, leading to diminished riparian function and cumulative effects to anadromous salmonid habitat. In a 2010 status review of Oregon Coast (OC) coho salmon, NMFS concluded that the Oregon

Forest Practices Act does not adequately protect OC coho habitat in all circumstances. In particular, disagreements persist regarding: (1) whether the widths of riparian management areas (RMAs) are sufficient to fully protect riparian functions and stream habitats; (2) whether operations allowed within RMAs will degrade stream habitats; (3) operations on high-risk landslide sites; and (4) watershed-scale effects." (p. 3-57)

- "Timber harvest poses an overall very high threat to the coho salmon population. <u>Private</u> industrial timber lands managed under the Oregon Forest Practices Act occupy 30 percent of the landscape, but they coincide with nearly all the low gradient intrinsic potential streams. Therefore, these lands have a disproportionate effect on coho salmon. The high harvest rates and associated roads negatively impact multiple aspects of coho salmon habitat. Deep Creek is an example of where short timber harvest rotations are likely inhibiting channel and coho salmon recovery. Studies of adjacent southwest Oregon basins found that "downstream, cumulative impacts of human activity are pervasive in southwest Oregon, wherever logging has occurred over an extensive portion of a drainage basin or has involved operations on steep, unstable slopes. The downstream effects of channel sedimentation and aggradation can severely damage streams even where buffer zones of riparian vegetation have been retained, and such effects persist more than 20-30 years after logging activities have ceased" (Frissell 1992)." (p. 12-15)

Illinois Population:

- "Degraded riparian forest condition is one of the most significant stresses affecting coho salmon recovery in the Illinois River watershed. Reduction of riparian trees and gallery forests that once covered the alluvial valley floor led to reduced pool frequency and habitat simplification, has increased bank erosion, and contributed to stream warming by widening the waterways (BLM 1997, 2006, USFS 1997a). ODFW surveyed extensive reaches of coho salmon-bearing Illinois River reaches and tributaries (e.g., East Fork Illinois, West Fork Illinois, Deer, Sucker, Althouse, Elk) and found poor conifer density with fewer than 75 trees (>36" dbh) per 1000 feet." (p. 30-14)
- "The riparian zones have been cleared or substantially modified along the mainstem Illinois River and at the mouth of Free and Easy Creek. Overall, there is a very low amount/volume of large wood in channels throughout the Illinois River sub-basin (USFS 1997a, BLM 2005a)." (p. 30-15)
- In addition, the Independent Multidisciplinary Science Team (IMST 1999) concluded that the Oregon Forest Practice Rules for riparian protection, large wood management, sedimentation, and fish passage are not adequate to recover depressed stocks of wild salmonids...Most habitat with potential to support coho salmon is privately owned and managed under Oregon's Forest Practices Act, which NMFS' analysis determined has the lowest score for watershed protection measures of all management methods evaluated (Appendix B). Therefore, although much of the habitat in the Illinois River is federally owned, the <u>future threat of timber harvest in the next ten years is high because much of the habitat with the best potential to support coho salmon will be harvested using less protective management actions than those used on Federal lands.</u>" (p. 30-22)

- One of the Highest Priority Recovery Actions for the SONCC is to "improve timber harvest practices by revising Oregon Forest Practices Act." (p. 30-1)

National Marine Fisheries Service 2014: 30-25

Table 30-4. Recovery action implementation schedule for the Illinois River population.

				Illinois	s River Population		
Table 30-4. Reco end of Chapter 5.	overy action	implementatio	n schedule for the	llinois River	population. Recovery actions	for monitoring and research are listed	in tables at the
Action ID	Target	KLS/T	Strategy		Action Description	Area	Priority
Step ID		Step Description	n				
SONCC-IllR.7.2.53	Riparian	No	Improve timber h	arvest practices	Improve regulatory mechanisms	Population wide	1
SONCC-11 R, SONCC-11 R, SONCC-11 R, SONCC-11 R,	7.2.53.1 7.2.53.2 7.2.53.3 7.2.53.4 7.2.53.5	Determine ho Adopt rules fo Adopt rules to Ensure mana Until more pe areas, includi buffers on int	w to revise Oregon I or fish-bearing streat o increase protection gement measures fo ermanent regulatory ing increased natural termittent streams	Forest Practice Ru ns sufficient to pr of non-fish-beari Landslide prone nechanisms can recruitment of la	iles so that they do not limit recovery otect both water quality and fish had ng streams that address practices th areas include protection of water qua areas include protection of water qua be put in place, immediately adopt in rge wood on perennial and intermitte	of SONCC coho salmon and make appropriate itat at adversely impact water quality and fish habi lity and fisheries habitat terim rules that increase protection for salmon int streams, increased shade on perennial strea	revisions tat habitat in forested ams, and protective

Middle Rogue/Applegate Population:

- One of the Highest Priority Recovery Actions for the SONCC Middle Rogue / Applegate Population Coho Population is to "improve timber harvest practices by revising the Oregon Forest Practices Act." (p. 31-1)
- "Reeves et al. (1993) found that the rate of timber harvest in Oregon coastal watersheds should not exceed 25 percent of a watershed to minimize risks and disturbances to aquatic resources. The study covered a period of 30 years (Reeves, G., pers. comm. 2003) and watersheds exceeding that level of harvest did not maintain channel integrity or Pacific salmon species diversity. Middle Rogue-Applegate sub-basin timber harvest rates are typically greater than this threshold on private timber land; therefore, the threat from timber harvest on private land will likely remain high. This private land encompasses most of the high IP coho habitat. The greatest risk from timber harvest is on private industrial timberlands that are managed under the Oregon Forest Practices Act, such as in private in-holdings in upper Slate Creek, Cheney Creek, and the decomposed granitic soils of the upper Beaver Creek watershed." (p. 31-24).

National Marine Fisheries Service 2014:31-28

Table 31-4. Recovery action implementation schedule for the Middle Rogue/Applegate rivers population.

SONCC-MRAR.7.2.50	Riparian	No	Improve timber harvest practices	Improve regulatory mechanisms	Population wide	1
SONCC-MRAR.7.2. SONCC-MRAR.7.2. SONCC-MRAR.7.2. SONCC-MRAR.7.2. SONCC-MRAR.7.2.	50.1 50.2 50.3 50.4 50.5	Determine how Adopt rules fo Adopt rules to Ensure manag Until more per areas, includir	w to revise Oregon Forest Practice Rul pr fish-bearing streams sufficient to pro- p increase protection of non-fish-bearin pement measures for landslide prone a rmanent regulatory mechanisms can b g increased natural recruitment of lar.	les so that they do not limit recovery of 3 tect both water quality and fish habitat g streams that address practices that ac reas include protection of water quality e put in place, immediately adopt interii ge wood on perennial and intermittent s	SONCC coho salmon and make appropriate revisions dversely impact water quality and fish habitat and fisheries habitat m rules that increase protection for salmon habitat in forest streams, increased shade on perennial streams, and protect	ted iive

Upper Rogue Population (entirely within the Siskiyou ODF unit):

 One of the Highest Priority Recovery Actions for the SONCC Upper Rogue River Coho Population is to "improve timber harvest practices by revising the Oregon Forest Practices Act." (p. 32-1) National Marine Fisheries Service 2014:32-27 Table 32-3. Recovery action implementation schedule for the Upper Rogue River population.

Action ID	D	Target	KLS/T	Strategy	Action Description	Area	Priority
Ste	tep ID		Step Descripti	ion			
SONCC-URR	R.10.5.14	Water Quality	No	Improve timber harvest practices	Improve regulatory mechanisms	Privately held timberlands	1
SONCC-URR.10.5.14.1 Dete SONCC-URR.10.5.14.2 Ado SONCC-URR.10.5.14.3 Ado SONCC-URR.10.5.14.4 Ensi SONCC-URR.10.5.14.5 Unti area all p			Determine how Adopt rules for Adopt rules to i Ensure manage Until more pern areas, including all perennials, a	to revise Oregon Forest Practice Ru fish-bearing streams sufficient to pr increase protection of non-fish-beari ment measures for landslide prone- manent regulatory mechanisms can i n increased natural recruitment of la nd protective buffers on small inter	iles so that they do not limit recovery of SONCC o otect both water quality and fish habitat ng streams that address practices that adversely areas include protection of water quality and fish be put in place, immediately adopt interim rules t rge wood on perennial and intermittent streams li mittent streams.	oho salmon and make appropriate revisions impact water quality and fish habitat rries habitat hat increase protection for salmon habitat in I kely to deliver wood downstream, increased 1	forested shade on

III. Gray literature

- A. Water Quality Restoration Plans Bureau of Land Management (BLM)
- (1) Water Quality Restoration Plan Trail Creek Watershed. Bureau of Land Management. February 2011.

Trail Creek Watershed at a Glance				
Hydrologic Unit Code Number (Trail	1710030706			
Creek)				
WQRP Area/Ownership	Total: 35,307 acres			
_	BLM: 14,697 acres (42%)			
	U. S. Forest Service: 4,358 acres (12%)			
	Private: 16,176 acres (46%)			
	Oregon Dept. of Forestry: 76 acres (<1%)			
303(d) Stream Miles Assessed	Total: 19.2 miles			
	BLM Ownership: 4.8 miles			
303(d) Listed Parameters	Dissolved Oxygen, E. Coli			
Key Resources and Uses	Salmonids, domestic, aesthetic			
Known Human Activities	Agriculture, forestry, roads, recreation, livestock,			
	rural residential development			
Natural Factors	Geology: volcanic			
	Soils: various series and complexes, pervasively			
	high clay content (30%-60%) in subsoil horizons (6			
	to 12 inches)			

- "Land ownership patterns, past timber harvest, wildfires, and fire exclusion have contributed to the existing conditions in the watershed. Fire exclusion and harvest methods have contributed to the current high density and multiple-layered stand conditions in many of the proposed harvest units. Past harvest methods also influenced the locations and conditions of the roads within this watershed. Use of the mainstem streams to transport wood during historic timber harvest contributed to removal of large woody debris from streams, and harvest of streams in the watershed providing no riparian buffer has contributed to a reduction of shade provided by riparian canopy to streams, especially on private land, where this form of timber harvest was most common." (p. 7)
- Figure 4. BLM Land Ownership in the Trail Creek Watershed (p. 6)



Figure 4. BLM Land Ownership in the Trail Creek Watershed

- Table 5 Summary of Watershed Conditions on BLM-Administered Lands in the Trail Creek Watershed (p. 14)

Table 5. Summary of Watershed Conditions on BLM-Administered Lands in the Trail Creek Watershed

Shading				
Historical Condition	 Shading was higher, at least in the upper forks of Trail Creek, prior to heavy timber harvesting 			
Present Condition	• Less than 25% of all fishbearing streams provide greater than 80% stream shading.			

- "Stream temperature and habitat recovery is largely dependent on vegetation recovery. Actions implemented now will not begin to show returns in terms of reduced stream temperatures or improved aquatic habitat for a number of years." (p. 19)
- (2) Water Quality Restoration Plan Southern Oregon Coastal Basin Big Butte Creek Watershed. Bureau of Land Management (BLM) Medford District Butte Falls Resource Area. January 2008.

Big Butte Creek Watershed at a Glance					
Hydrologic Unit Code Number	1710030704				
(Big Butte Creek)					
WQRP Area/Ownership	Total: 158,330 acres				
	BLM: 29,544 acres (19%)				
	U. S. Forest Service: 58,168 acres (37%)				
	City of Medford: 1,427 acres (1%)				
	Private: 69,144 acres (44%)				
	Oregon Dept. of Forestry: 40 acres (<1%)				
303(d) Stream Miles Assessed	Total: 54.2 miles				
	BLM Ownership: 17.2 miles				
303(d) Listed Parameters	Temperature, Dissolved Oxygen, E. Coli				
Key Resources and Uses	Salmonids, domestic, aesthetic				
Known Human Activities	Agriculture, forestry, roads, recreation,				
	rural residential development				
Natural Factors	Geology: volcanic				
	Soils: various series and complexes				

Temperature Impairment:

- Within the Big Butte Creek Watershed, North Fork Big Butte, Clark, Dog, Doubleday, Hukill, and Jackass Creeks are on the 2004/2006 303(d) list for exceeding the 64.0°F 7day statistic for rearing salmonids as found in the 1996 standard. There are a total of 64.4 stream miles listed for temperature in the Big Butte Creek Watershed of which 24 miles are on BLM-administered lands (Table 6 and Figure 9)." (p. 16)
- Table 7. Temperature Summary for the Big Butte Creek Watershed

		7-day Statistic	Range of 7-day Statistic (for all years)	
Stream Name	Period of Record ¹	(ave. for all years) (°F)	Minimum (°F)	Maximum (°F)
Big Butte Creek (above Rogue River)	1998, 1999	69.2	54.4	65.0
Big Butte Creek (above Dog Creek)	1994-1999, 2001, 2007	62.4	50.4	64.9
Clark Creek (34S-2E-7)	1995-1999,2001, 2003-2005, 2007	64.7	50.9	70.1
Dog Creek (above Big Butte Creek)	1994-1999, 2003, 2005, 2007	71.7	55.1	75.0
Doubleday Creek (35S-2E-13)	1998, 1999, 2002-2007	65.1	53.6	66.7

Table 7. Temperature Summary for the Big Butte Creek Watershed

		7-day Statistic	Range of 7-day Statistic (for all years)	
Stream Name	Period of Record ¹	(ave. for all years) (°F)	Minimum (°F)	Maximum (°F)
Hukill Creek (35S-2E-15)	1995-1999, 2001-2007	63.3	48.6	66.7
Jackass Creek (above North Fork Big Butte Creek	1994-1999, 2001, 2003-2007	68.1	50.8	71.6
North Fork Big Butte Creek (above South Fork confluence)	1994-2002, 2004, 2005, 2007	68.0	58.6	71.7

¹Temperature measured from June to September

- Figure 9. 2004/2006 303(d) Temperature Listed Streams for the Big Butte Creek Watershed.





*Note the mixed ownership on Big Butte/ North Fork Big Butte.

- Figure 5. Coho Distribution in the Big Butte Creek Watershed (p. 5).

Figure 5. Coho Distribution in the Big Butte Creek Watershed



- "Prior to the completion of the TMDL for the plan area, guidance from the DEQ assumes that streams at system potential will not meet the temperature criterion during the hottest time of year (ODEQ 2004:11).Therefore, 100 percent of the load allocation for the Big Butte Watershed is assigned to natural sources and the allocation for BLM-managed lands is zero percent. <u>Any activity that results in anthropogenic caused heating of the</u> <u>stream is unacceptable</u>. This load allocation may be modified upon completion of the Rogue Basin TMDL." (p. 20-21)
- "It must be noted that only 32 percent of the 303(d) listed stream miles in the plan area are located on lands under BLM jurisdiction. Other organizations or groups that are (or will be) involved in partnerships for implementing, monitoring, and maintaining the Rogue Basin WQMP include the Upper Rogue Watershed Association, Jackson County, Oregon Department of Forestry (ODF), Oregon Department of Agriculture (ODA), Oregon Department of Transportation (ODOT), Oregon Department of Fish and Wildlife (ODFW), Oregon Water Resources Department (WRD), Oregon DEQ, and the U.S. Forest Service. The problems affecting water quality are widespread; coordination and innovative partnerships are key ingredients to successful restoration efforts." (p. 31)

(3) Althouse Creek Watershed Assessment. Bureau of Land Management. February 2005.

- "The first 7.5 miles of Althouse Creek (from its mouth to approximately the mouth of Tartar Gulch) is identified as "water quality-limited" due to warm summer temperature. Observations indicate that other streams in the watershed may warrant examination for water quality limitations due to high summer temperatures, flow modification, and sedimentation." (p. 7).
- "Factors limiting salmonid production include: inadequate stream flows in the summer months; high water temperatures; erosion and sedimentation; lack of large woody material in the stream and riparian area; lack of rearing and holding pools for juveniles and adults, respectively; channelization of streams in the canyons and lowlands; and blockages of migration corridors." (p. 10)

- "Coho salmon within Althouse Creek Watershed are part of the Southern Oregon / Northern California Coho ESU, which was federally listed as threatened on May 6, 1997 (Fed. Reg./Vol. 62, No. 87). The ESU includes all naturally spawned populations of coho salmon in coastal streams between Cape Blanco, Oregon, and Punta Gorda, California. Most of the coho in this ESU are in the Rogue River, with the largest remaining population in the Illinois River (Stouder et al. 1997). Currently summer water temperatures in the valley limit coho production from reaching historical levels (USDA, USDI 1997)." (p. 56)
- "Within the low-gradient reaches of the valley floor where private land ownership dominates, summer stream temperatures are not likely to improve as riparian vegetation is not returned and the demand on water allocation remains." (p. 104)
- "Changes in summer temperatures and the loss of stream complexity in Althouse Creek have affected coho and steelhead freshwater rearing habitat. The lower reaches have been affected most by the development of private land. As a result, the potential is great for private land owners to affect stream health downstream of federal ownership. However, sections of Althouse Creek on BLM and FS land are most likely to continue to provide the best coho and steelhead habitat. Key watersheds within the Illinois Basin will allow remnant stocks of coho to survive while areas disturbed by past practices recover." (p. 104)

Deer Creek Watershed at a Glance				
Hydrologic Unit Code	1710031105			
Watershed area/ownership	Total: 55,922 acres			
	BLM: 23,052 acres			
	USFS: 7,905 acres			
	State: 1,026 acres			
	Private: 23,939 acres			
2010 303(d) listed parameters	None			
Water Quality Limited for Temperature	Deer Creek mouth to river mile 17,			
	Anderson Creek mouth to river mile 3.2,			
	Squaw Creek mouth to river mile 3			
Beneficial Uses	Fish (salmonids) and aquatic life,			
	irrigation, domestic water supply			
Known Impacts (human)	Water diversions, bank erosion,			
	agriculture w/o riparian buffer, riparian			
	harvest, woody debris removal, mining			
Natural factors	Serpentine soils			

(4) Water Quality Restoration Plan Deer Creek Watershed. Bureau of Land Management. 2011.

- "Due to the mixed ownership in the Deer Creek Watershed, attainment of the water temperature standard requires multi-ownership participation and commitment to improve riparian function." (p. 13)
- Water Quality Limited for Temperature: Deer Creek mouth to river mile 17, Anderson Creek mouth to river mile 3.2, Squaw Creek mouth to river mile 3
- Map 1. 2010 Water Quality Limited for Temperature Streams in the Deer Creek Watershed (p. 2)



Map 1. 2010 Water Quality Limited for Temperature Streams in the Deer Creek Watershed

- "Land ownership is mostly a mix of private and BLM (Map 1), with <u>private being the</u> <u>dominant ownership.</u> The BLM, Medford District administers 41 percent of the lands, private ownership totals 43 percent, U.S. Forest Service manages 14 percent, and the State of Oregon lands total 2 percent...Major land uses in the watershed are agriculture and logging." (p. 2)
- "Based on the ownership distribution and aerial scanning (Google Earth), approximately 70% of the riparian zones in the Deer Creek Watershed lack mature tree structure necessary to provide large instream wood. On private lands, in the lower gradient floodplain reaches of Deer, Anderson/Clear, Draper, and Crooks creeks, reductions in riparian vegetation have decreased stream shade, thereby increasing solar radiation input into surface waters. While harvest activities fragmented riparian habitats, typical stream shade on BLM-managed land in the Deer Creek Watershed is high." (p. 5)
- Table 1. Deer Creek Watershed Water Quality Limited (WQL) Streams (p. 8)

Stream Segment	WQL Stream Miles	Miles on BLM	Pollutant	Season	Standard
Deer Creek	0 - 17	2.8	Temperature	October 15- May 15	7-day- average max. ≤ 13°C.
Deer Creek	0 - 17	2.8	Temperature	Year Around (Non- spawning)	7-day average max.≤ 18°C
Anderson Creek	0 - 3.2	0.1	Temperature	Year Around (Non- spawning)	7-day average max.≤ 18°C
Squaw Creek	0 - 3	0.6	Temperature	Year Around (Non- spawning)	7-day average max.≤ 18°C

Table 1. Deer Creek Watershed¹ 2010 Water Quality Limited (WQL) Streams

1/ Deer Creek Watershed, excluding the McMullin Creek Subwatershed (USDI 2005).

(5) Grants Pass Water Quality Restoration Plan Southern Oregon Coastal Basin Middle Rogue Subbasin Grants Pass- Rogue River Watershed Bureau of Land Management (BLM), Medford District Office Grants Pass Resource Area. 2012.

Grants Pass-Rogue River Watershed at a Glance						
Hydrologic Unit Code	1710030804					
Watershed area/ownership	Total: 53,809 acres BLM: 12,482 acres Private: 40,677 acres State: 627 acres Local Government: 23 acres					
303(d) Stream miles assessed	20.6 Total miles, 0.6 BLM miles					
303(d) listed parameters	Temperature, fecal coliform					
Beneficial Uses	Salmonid rearing, migration and spawning; cold water habitat; livestock watering; water supply; recreation					
Known Impacts (human)	Timber harvest, roads, diversions, urban development, agriculture					
Natural factors	Soils: Serpentine soils – poor growing conditions and low infiltration					
Water Quality limited streams	Savage Creek—Mouth to mile 4.8 Rogue River—Mouth to mile 124.8					

- "In 1997, the DEQ found maximum water temperatures above 23°C in Savage Creek exceeding the 17.8°C rearing maximum, leading to the 303(d) listing. A reduction of both baseflow and riparian vegetation in these are primarily responsible for increased water temperatures. Reduced volumes of water are more susceptible to warming and reduced vegetative cover increases solar radiation input. The current average shade on the 0.6 mile of Savage Creek that crosses BLM-managed land is 97 percent and the target shade is 97 percent (ODEQ 2004)." (p. 11)
- (6) Water Quality Restoration Plan Southern Oregon Coastal Basin Evans Creek Watershed. Bureau of Land Management (BLM) Medford District Butte Falls Resource Area. July 2009.

Evans Creek Watershed at a Glance				
Hydrologic Unit Code Number (Evans	1710030803			
Creek)				
WQRP Area/Ownership	Total: 143,349 acres			
	Bureau of Land Management: 59,285 ac. (41%)			
	Private entities: 82,817ac (58%)			
	U. S. Forest Service: 1,104ac (<1%)			
	Oregon Dept. of Forestry: 142ac (<<1%)			
303(d) Stream Miles Assessed	Total: 89.6 miles			
	BLM Ownership: 26.1 miles			
303(d) Listed Parameters	Temperature, fecal coliform			
Key Resources and Uses	Salmonids, domestic, aesthetic			
Known Human Activities	Agriculture, forestry, roads, recreation,			
	rural residential development			
Natural Factors	Geology: volcanic			
	Soils: various series and complexes			

- Figure 10. Temperature Monitoring Sites for the Evans Creek Watershed (p. 19)



Stream	Period of Record ¹ 7-day statistic 7-day stat		istic range	
Section 201	i cirou or iccoru	(average for all years °F)	Minimum (°F)	Maximum (°F)
Battle Creek (above W. Fk. Evans Ck.) - BATI	1994-1996, 2000- 2002, 2007	65.9	58.1	67.9
Battle Creek (in 34s-03w-09) - BTI 1	2000-2002	66.6	56.4	68.4
Battle Creek (in 34s-03w-09) – BTL2	2000-2002	63.9	56.4	66.1
Cold Creek (above Rock Creek) - COLD	1994-1996	69.0	60.8	69.8
Cold Creek (in 33s-03w-33) – CLDC	2000, 2002, 2004, 2005	65.5	53.3	68.7
East Evans Creek (above Sprignett Creek) – EEVN	1994, 1996-2002, 2007	76.8	58.3	82.0
East Evans Creek (above Wolf Creek) – EEAW	2000-2002	63.3	55.4	65.2
East Evans Creek (below Wolf Creek) – EEBW	1998	63.7	59.4	64.9
Pleasant Creek (in 33s-4w-35) - PLZM	2003-2006	66.5	58.7	70.8
Pleasant Creek (below Rt. Fk. Pleasant Ck.) – PLEZ	1994-1997, 1999, 2000	66.4	57.0	70.5
Pleasant Creek (in 34s-04w-15) -PLES	1998, 2003, 2004, 2006	66.5	57.3	68.0
Ramsey Canyon (above Evans Creek) – RAMS	1995-2002, 2004, 2005, 2007	69.3	54.1	73.7
Rock Creek (in 333s-03w-34) – ROCR	2000, 2002, 2004	67.3	57.6	69.6
Salt Creek (above W. Fk. Evans Ck.) – SALT	1996	66.2	59.9	67.1
Salt Creek (above W. Fk. Evans Ck.) – SLTC	2000	68.4	57.1	69.8
West Fork Evans Creek (above Swamp Creek) – WWAS	2004	64.8	57.4	66.0
West Fork Evans Creek (above Elderberry Flat) – WWAE	2004	67.4	58.3	68.4
West Fork Evans Creek (below Elderberry Flat) – WWBE	2004	67.8	60.1	69.0
West Fork Evans Creek (above Evans Creek) – WEVN	1994-1997, 2004- 2007	72.7	62.6	77.6
West Fork Evans Creek (above Salt Creek) – WEAS	2000, 2001, 2006	71.8	60.0	75.5
West Fork Evans Creek (above Rock Creek) – WEAR	2000-2002, 2004	72.1	55.1	74.9
West Evans Creek (above Battle Creek) – WEAB	2000-2002, 2006, 2007	75.8	60.5	79.2

Table 7. Temperature Summary for the Evans Creek Watershed

1/ Temperature measured from June to September

(7) Water Quality Restoration Plan Jumpoff Joe Creek Watershed. Bureau of Land Management. September 2009.

Jumpoff Joe Creek at a Glance			
Hydrologic Unit Code	17/10/03/10/01		
Watershed area/ownership	Total: 69,382 acres		
	BLM Ownership: 21,456 acres		
	State, County, Private: 47,926 acres		
303(d) listed parameters	Temperature		
Beneficial Uses	Fish (salmonids) and aquatic life,		
	irrigation, domestic water supply		
Known Impacts(human)	Water diversions, bank erosion,		
	riparian harvest, woody debris removal,		
	mining		
Natural factors	Serpentine and Granitic soils		
Water Quality limited streams	Jumpoff Joe Creek mouth to river mile		
	21.3, Louse Creek to river mile 12.3,		
	and Quartz Creek to river mile 7.3		

- "Known Impacts(human) Water diversions, bank erosion, riparian harvest, woody debris removal, mining" (p. 3)
- "DEQ found 7-day average maximum stream temperatures above 18° C in Jumpoff Joe Creek, leading to 303(d) listing. The listed stream segment is River Mile (RM) 0 to RM 21.3, measured at 2 sites on Jumpoff Joe Creek. This is not reflected by water temperatures measured by BLM in the upper part of Jumpoff Joe Creek in section 3, T35S, R5W, estimated RM 15. DEQ found 7-day average maximum stream temperatures above 18° C in Louse Creek, leading to 303(d) listing. The listed stream segment is River Mile (RM) 0 to RM 12.3, measured at 2 sites. DEQ found 7-day average maximum stream temperatures above 18° C in Quartz Creek, leading to 303(d) listing. The listed stream segment is River Mile (RM) 0 to RM 12.3, measured at 2 sites. DEQ found 7-day average maximum stream temperatures above 18° C in Quartz Creek, leading to 303(d) listing. The listed stream segment is River Mile (RM) 0 to RM 7.3, measured at 2 sites. <u>A reduction of both baseflow and riparian vegetation in the mid- and lower reaches of Jumpoff Joe, Louse, and Quartz Creeks are primarily responsible for increased water temperatures. Reduced volumes of water are more susceptible to warming and reduced vegetative cover increases solar radiation input." (p. 6).
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(8) Water Quality Restoration Plan Klamath Basin Jenny Creek Watershed. Bureau of Land Management. 2011.

Jenny Creek Watershed at a Glance				
Hydrologic Unit Code Number	1801020604			
WQRP Area/Ownership	Total: 134,348 acres			
	BLM: 58,534 acres (44%)			
	BOR: 3,023 acres (2%)			
	USFS: 1,328 acres (1%)			
	State of Oregon: 80 acres (<0.1%)			
	Private: 71,383 acres (53%)			
303(d) Stream Miles Assessed	Total: 55.7 miles			
	BLM Ownership: 23.6 miles			
303(d) Listed Parameters	Temperature			
Key Resources and Uses	Resident salmonids, domestic, recreation, aesthetic			
Known Human Activities	Agriculture, forestry, roads, rural residential			
	development, and recreation			
Natural Factors	Geology: volcanic landforms			
	Soils: various series and complexes			

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(9) Total Maximum Daily Loads (TMDLs)

(1) Rogue River Basin TMDL Chapter 2: Temperature. Oregon Department of Environmental Quality. 2008.

"Temperature Issues in the Rogue River Subbasins: Salmonids, often referred to as cold water fish, and some amphibians are highly sensitive to temperature. In particular, Chinook salmon (*Oncorhynchus tshawytscha*) and coho salmon (*Oncorhynchus kisutch*) are among the most temperature sensitive of the cold water fish species in the Rogue River subbasins (DEQ 1995). Excessive summer water temperatures have been recorded in a number of tributaries. These high summer temperatures are reducing the quality of rearing and spawning habitat for chinook and coho salmon, steelhead and resident rainbow trout. The potential causes of high water temperatures in the Rogue River

subbasins include urban and rural residential development near streams and rivers, reservoir management, irrigation water return flows, past forest management within riparian areas, NPDES regulated point sources, agricultural land use within the riparian area, water withdrawals, and road construction and maintenance." (p. 2-2).

Figure 2.1 Fish Use Designations (map from OAR 340-041-0028, Figure 271A) (p. 2-7)



Figure 2.1. Fish Use Designations (map from OAR 340-041-0028, Figure 271A)

- "Monitoring has indicated that water temperatures in the Rogue River subbasins exceed the State of Oregon temperature criteria. The Rogue River basin has 101 individual temperature listings on the 2004/2006 Assessment (one of them is listed in error). Some streams may have more than one temperature listing. For example, Deer Creek in the Illinois River subbasin is listed for exceeding the rearing criteria and the spawning criteria. Figure 2.3 and Table 2.6 highlight the streams on the 2004/2006 303(d) list for temperature." (p. 2-9)
- Figure 2.3 2004/2006 303(d) list for temperature (Red) (p. 2-9)

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Figure 2.3. 2004/2006 303(d) list for temperature (Red)



- "The pollutant targeted in this TMDL is heat from the following sources: (1) heat from warm water discharges from various point sources, (2) heat from human caused increases in solar radiation loading to the stream network, and (3) heat from reservoirs and irrigation ditches which, through their operations, increase water temperatures or otherwise modify natural thermal regimes in downstream river reaches." (p. 2-13)
- "Near-stream vegetation disturbance/removal reduces stream surface shading via decreased riparian vegetation height, width and/or density, thus increasing the amount of solar radiation reaching the stream surface (shade is commonly measured as percent-effective shade or open sky percentage3). Furthermore, forests even beyond the distance necessary to shade a stream can influence the microclimate, providing cooler daytime temperatures (Chen et al. 1999). Riparian vegetation also plays an important role in shaping channel morphology, resisting erosive high flows, and maintaining floodplain roughness. Table 2.9 shows the potential for improvement in shade for the Rogue River and selected tributaries as the difference between current and system potential effective shade. The system potential condition as defined in this TMDL is the near-stream vegetative community that can grow on a site at a given elevation and aspect in the absence of human disturbance." (2-19).
- "Effective shade is the surrogate measure that translates easily into solar heat load. It is simple to measure effective shade at the stream surface using a relatively inexpensive instrument called a Solar PathfinderTM. The term 'shade' has been used in several contexts, including its components such as shade angle or shade density. For purposes of this TMDL, effective shade is defined as the percent reduction of potential daily solar radiation load delivered to the water surface. The role of effective shade in this TMDL is to prevent or reduce heating by solar radiation and serve as a linear translator to the loading capacities. Unless otherwise stated within this chapter, the applicable nonpoint source load allocations for Rogue River Basin streams are based upon potential effective

shade values presented in this section and the human use allowance (0.04oC cumulative increase at the point of maximum impact)." (p. 2-36)

- "<u>Most streams simulated have no assimilative capacity, which translates into a zero heat</u> <u>load allocation for nonpoint sources</u>. When a stream has assimilative capacity, nonpoint and point sources may receive allocations greater than background." (p. 2-36)
- (2) Lower Sucker Creek Illinois River Subbasin Total Maximum Daily Load and Water Quality Management Plan (Lower Section of Sucker/Grayback Watershed: 1710031103) (USFS boundary at Mile 10.4 to the Mouth). Oregon Department of Environmental Quality. April 2002.
- "Load Allocations (Nonpoint Sources): The numeric temperature criteria in Lower Sucker Creek is not expected to be met and <u>therefore no measurable surface water</u> <u>temperature increases from anthropogenic activities are allowed</u>. Wasteload Allocations (Point Sources): Applies to NPDES permitted point source discharges. The numeric temperature criteria in Lower Sucker Creek is not expected to be met and therefore no measurable surface water temperature increases from anthropogenic activities are allowed. NPDES dischargers, currently and in the future, are allowed no measurable surface water temperature impacts." (p. 29)

(3) Applegate Subbasin Total Maximum Daily Load (TMDL) HUC # 17100309. Oregon Department of Environmental Quality. December 2003.

- "Temperature Issues in the Applegate Subbasin: Salmonids, often referred to as cold water fish, and some amphibians are highly sensitive to temperature. In particular, Chinook salmon (Oncorhynchus tshawytscha) and coho salmon (Oncorhynchus kisutch) are among the most temperature sensitive of the cold water fish species in the Applegate subbasin. Excessive summer water temperatures have been recorded in a number of tributaries and the mainstem Applegate River. These high summer temperatures are reducing the quality of rearing and spawning habitat for chinook and coho salmon, steelhead and resident rainbow trout. The potential causes of the high water temperatures include past forest management within riparian areas, upslope timber harvest practices, agricultural land use within the riparian area, road construction and maintenance, and rural residential development near streams and rivers." (p. 13).
- "Nonpoint Sources: Riparian vegetation, stream morphology, hydrology, climate, and geographic location influence stream temperature. While climate and geographic location are outside of human control, riparian condition, channel morphology and hydrology are affected by human land use. Human activities that contribute to degraded thermal water quality conditions in the Applegate Subbasin are associated with agriculture, forestry, roads, urban development, and rural residential-related riparian disturbance. For the Applegate Subbasin temperature TMDL there are 4 nonpoint source categories which may result in increased thermal loads: 1. Near stream vegetation disturbance/removal 2. Channel modifications and widening 3. Hydromodification Water Withdrawals 4. Natural Sources." (p. 21)

(10) Other gray literature

(1) Stream habitat and water quality in the Applegate Basin. OWEB Grant 99-485 Final Report. Applegate River Watershed Council. November 2004.

- The assessment of the Stream Habitat and Water Quality in the Applegate basin emphasizes the impacts of sediment, stream flow and temperature on salmonid habitat. Thompson Creek, Little Applegate River, and the upper Applegate were area selected to conduct more specific investigations. (p. 3)
- The ODEQ reports in the Applegate Subbasin Total Maximum Daily Load (ODEQ 2003), "Of the 700 miles of streams and creeks in the Applegate subbasin, approximately 126 miles of streams are known to exceed the 64°F (17.8° C)summer rearing temperature criteria, 2 miles of streams exceed the 55°F (12.8° C)spawning temperature criteria, 9 miles exceed the sedimentation criteria, 9 miles exceed the biological criteria, 14 miles are listed for habitat modification, and 64 miles are listed for flow modification." In the Applegate subbasin, the following streams are on the EPA's Clean Water Act Section 303(d) list of water-quality limited streams for temperature: (p. 7)

• Applegate River • Star Gulch • Beaver Creek • Sterling Creek • Humbug Creek • Thompson Creek • Little Applegate River • Waters Creek • Palmer Creek • Williams Creek • Powell Creek • Yale Creek • Slate Creek

- (2) Betts, M., B. Bourgeois, R. Haynes, S. Johnson, K. Puettmann, and V. Sturtevant. 2014. Assessment of Alternative Forest Management Approaches: Final Report of the Independent Science Panel. Prepared with assistance from D.C.E. Robinson, A.W. Hall and G. Stankey, ESSA Technologies Ltd. (Vancouver, BC) for Oregon Department of Forestry (Salem, OR).
- "Increases in stream temperature summer maxima have been observed at a number of the fish bearing stream sites harvested using FPA in the RipStream study (Groom et al. 2011a, 2011b) and in the Alsea Paired Watershed Study- Revisited (J. Light, pers. comm.) and in a systematic review on stream temperature (Czarnomski et al. 2013). <u>The RipStream and Alsea studies showed increased summer maxima onsite, and also exceeded the "Protecting Cold Water" non-degradation standard set by EPA and the State of Oregon.</u> Downstream of harvest in both studies, maximum stream temperatures decreased. Non-fish streams have shown a range of temperature responses after harvest using FPA; several showed increased summer maxima for stream temperature on site (Kibler 2007, Gomi et al. 2006, Surfleet and Skaugset 2013, M. Reiter, pers. comm.) and showed that the maxima decreased as the stream water travelled downstream through buffers. Streams without any buffers showed the highest temperature increases (Gomi et al. 2006, Bisson et al. 2013)." (p. 37-38).
- "If FPA were applied in State Forests, there would be an increase of forest harvest near streams, due to two main differences: (1) no designation of no-cut or limited entry riparian zones around headwater streams without fish (N), and (2) narrower limited entry zones on all other stream types (see Appendix B: Riparian Guidelines). Under FPA, riparian buffers are not required for N type streams and fewer trees are required to remain standing in the outer riparian management zone of F type streams. Removing all riparian

trees near streams has been shown to have multiple impacts to water quality, instream habitat and aquatic biota (see Section 4.2.3)." (p. 85)

Appendix B. Maps of Private Forestland, SSBT Streams, and Temperature Water Quality Limited Streams

Maps of the Oregon Department of Forestry (ODF) Siskiyou Georegion Figure 1. Private Forestland and SSBT in Rogue Basin



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Agenda A Attachment 7 Page 32 of 38 Figure 2. Map of the Siskiyou Georegion with SSBT streams, temperature water quality limited streams, and private forestlands by HUC-10 watershed



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Figure 3. Deer Creek HUC-10 watershed with SSBT streams, temperature water quality limited streams, and private forestlands

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Figure 4. Jumpoff Joe Creek HUC-10 watershed with SSBT streams, temperature water quality limited streams, and private forestlands

Figure 5. Evans Creek HUC-10 watershed with SSBT streams, temperature water quality limited streams, and private forestlands

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Figure 6. Applegate HUC-10 watersheds, SSBT streams, temperature water quality limited streams, and private forestlands



Figure 7. Big Butte Creek HUC-10 watershed, SSBT streams, temperature water quality limited streams, and private forestlands



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