Western Oregon State Forest HCP

Riparian Conservation Area and Temperature Protection

Introduction

The Oregon Department of Forestry (ODF) is preparing a multi-species Western Oregon State Forests Habitat Conservation Plan (HCP) to support the issuance of incidental take permits (ITPs) under the federal Endangered Species Act (ESA) for Western Oregon State Forests that are managed by ODF. The HCP is a long-term plan that will support the conservation of threatened and endangered species, or those species that are likely to become listed, while allowing management of the forest including ongoing timber harvest activities.

Covered species are those species for which US Fish and Wildlife Service (USFWS) and National Marine Fisheries Services (NMFS) will provide take authorization to ODF to conduct the covered activities. The permit area provides habitat for a variety of species, including species listed under state and federal endangered species protection laws, and others that are not yet listed, but may become listed during the permit term. ODF selected the covered species for the HCP based on review of all species of conservation concern known or suspected to occur in the plan area during the permit term.

As part of HCP development agencies coordinated on the development of riparian buffers that would protect watershed processes, and specific to this memo, stream temperatures to benefit the covered species that utilize streams and adjacent riparian forests. These include nine fish and two amphibians: Oregon Coast coho, Oregon Coast spring chinook, Lower Columbia River coho, Lower Columbia River chinook, Columbia River chum, Upper Willamette River spring chinook, Upper Willamette River steelhead, Southern Oregon/Northern California coast coho, eulachon, Columbia torrent salamander, and Cascade torrent salamander.

Riparian Conservation Area Designation

Degraded water quality, especially elevated stream temperature, is one of the primary threats to many of the covered fish species (NMFS 2013, 2014; ODFW and NMFS 2011). The restoration of riparian function, through the implementation of riparian conservation areas (RCAs) in the permit area, will help reduce stream temperature increases by maintaining or increasing shading, the primary driver of stream temperature (Beechie et al. 2012). This will benefit the covered species and provide longer-term climate change resilience.

ODF will establish Riparian Conservation Areas (RCAs) adjacent to streams. The functions of streams within the permit area will be maintained by retaining vegetation in riparian areas during adjacent harvest activities. No harvest will occur within the RCAs.

The buffer widths provided for RCAs represent a minimum buffer and are reported in horizontal distance unless otherwise noted, meaning that the width is applied and measured in the field horizontally, regardless of slope. It is measured beginning at the aquatic zone, which can be one of the following: the average high-water level of the water body, the edge of the stream-associated wetland or side channel, or the channel migration zone,[1] whichever is farthest from the waterway, and extends perpendicular from the stream toward the uplands. Since the buffers are reported using horizontal distance, as slope increases, the effective width (i.e. distance along slope) of the conservation area in the field also increases.

[1] The area where the active channel of a stream or river is prone to move, and the movement results in a potential near-term loss of riparian function and associated habitat adjacent to the stream.

Scientific Basis for the Temperature Protection Zone

Harvest activities adjacent to fish bearing streams can increase summer stream temperatures through reduction of shade that results in increased solar radiation reaching the water's surface. This can also occur on small, non-fish bearing streams that flow into fish bearing streams, particularly in stream reaches immediately above fish bearing streams. Temperature increases, if not managed, can extend downstream into fish bearing waters and affect the covered fish species. To address potential effects to the covered species from harvest activities in the permit area, the width of RCAs have been designated based on fish presence, stream size and flow duration (perennial versus seasonal), and potential to deliver wood.

RCAs adjacent to small non-fish bearing perennial and seasonal streams will be narrower than RCAs adjacent to fish bearing and medium and large non-fish streams (see Chapter 4 *Conservation Actions* for full RCA description). Small perennial non-fish bearing streams will have RCAs that extend 120 feet (horizontal distance) from the aquatic zone for the first 500 feet upstream of the end of fish use to protect stream temperatures in water within that 500 feet, as well as allowing for some temperature recovery from upstream, as it flows from a small non-fish perennial stream into a fish bearing stream. Upstream of the 500-foot process protection zone, the buffer will be 35 feet (horizontal distance) from the aquatic zone (Table ; Figure).

Table 1. Minimum Riparian Conservation Area Widths (Horizontal Distance) for Small Perennial and Seasonal Type N Streams

	Within Process Protection Zone		Upstream of 500-foot Process Protection Zone
Stream Type	Temperature	Wood	
Perennial Small Type N	120	--	35
Potential debris flow track (Seasonal Type N) [a]	--	50	35
High energy (Seasonal Type N) [b]	--	50	35
Seasonal other (Type N)[c]	0[d]	0[d]	0[d]

Notes:

[a] Potential debris flow tracks: Reaches on seasonal Type N streams that have a high potential of delivering wood to a Type F stream by debris flow.

[b] High Energy: Reaches on seasonal Type N streams that have a high potential of delivering wood and sediment to a Type F stream during a high-flow event.

[c] Seasonal: A stream that does not have surface flow after July 15.

[d] Seasonal other (Type N) streams will have a 35' equipment restriction zone.

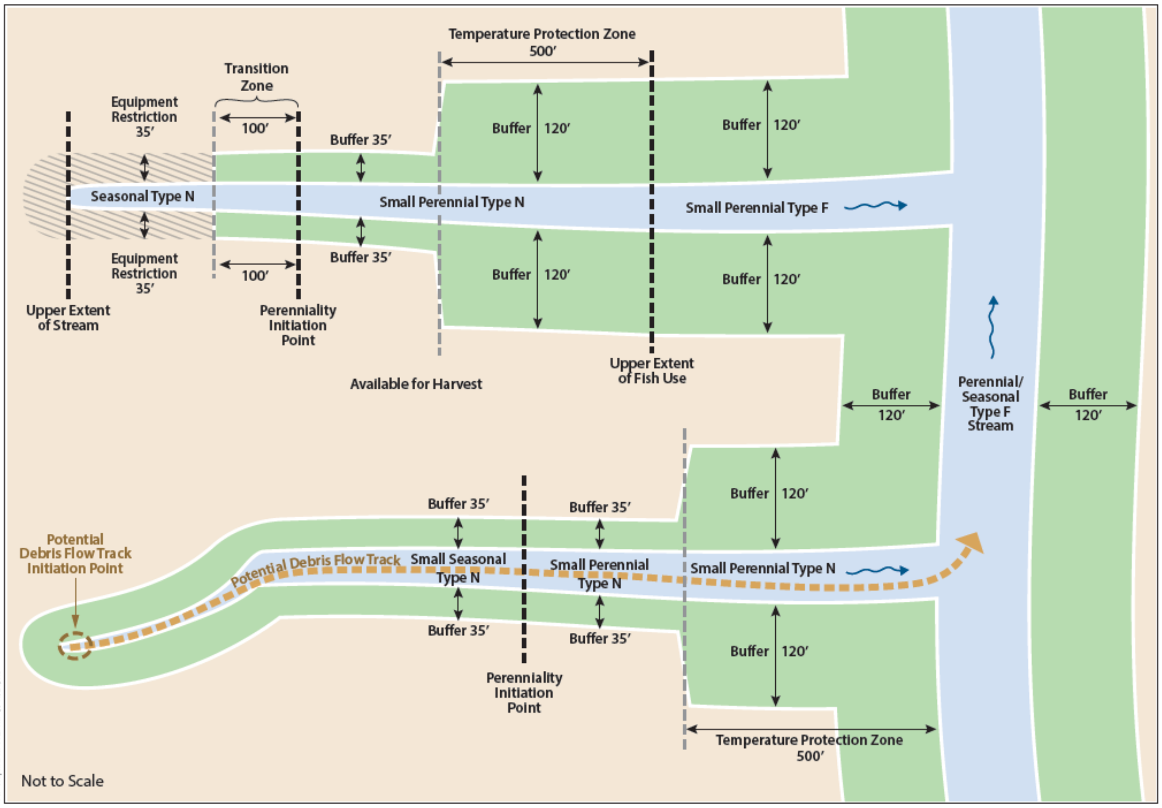

Figure 1. Riparian Conservation Areas Scenarios with Temperature Protection Zones

The 120-foot RCA (horizontal distance) within the 500-foot temperature zone at the intersection of fish and small perennial non-fish streams will help ameliorate stream temperature increases. The temperature protection zone was identified based on a literature review process with the Western Oregon State Forest HCP Scoping Team[2]. A list of sources reviewed by the Scoping Team to assess how forestry activities and riparian management strategies affect downstream temperatures and identify the proposed temperature protection zone is provided in Attachment 1 and summarized below.

Julie Firman (ODFW) performed a literature review (Figure 2) and assessment (Figure 3) of heating related to buffer width, and Blandon et al. (2018) performed a similar analysis for buffer length (Figure 4). In addition, Leinenbach (2016) Bayesian model of stream temperature response to buffering was reviewed (Figure 5). The results of these analysis and the studies discussed below indicate that while a 120-foot wide by 500-foot long temperature protection zone buffer will not entirely dissipate accumulated heat from the harvested area, it will allow stream temperatures to return to near the pre-harvest temperature regime prior to reaching a fish bearing stream.

Effects of rising temperature on the listed species could include physiological stress and reduced growth, disruption of life cycle timing, and increased predation and disease that would potentially reduce survival and

[2] The Scoping Team is comprised of representatives from: Oregon Department of Forestry, Oregon Department of State Lands, Oregon Department of Environmental Quality, Oregon Department of Fish and Wildlife, U.S. Fish and Wildlife Service, and National Marine Fisheries Service.

reproductive success (NMFS 2016). During the summer months, many of the streams coho salmon juveniles inhabit are already close to lethal temperatures, and with the expectation of rising stream temperatures due to global climate change, increases in infection rates of juvenile coho salmon by parasites may become an increasingly important stressor both for freshwater and marine survival (NMFS 2016).

Lestelle (2007) summarized several studies on effects of water temperature on juvenile coho salmon. For example, a study in the Mattole River (Northern California) reported coho were not found in streams that exceeded a maximum weekly temperature[3] of 18°C (Welsh et al. 2001 in Lestelle 2007). Another study in the Sixes River (Southern Oregon) reported juvenile coho salmon to be absent or rare in stream segments where temperatures exceeded 21°C (Frissell 1992 in Lestelle 2007). Overall, it is recommended that water temperatures not exceed 20-21°C to avoid lethality to coho salmon (Richter and Kolmes 2005).

While the 500-foot by 120-foot temperature protection zone is not expected to totally offset the effects of harvest on stream temperature, it would result in substantial reduction of water temperature changes prior to entering fish bearing streams. Bladon et al. (2018) found that while maximum daily stream temperatures were elevated in small, non-fish bearing headwaters after harvest there was not measurable downstream warming related to upstream harvest activities.

Numerous upstream-downstream longitudinal studies examined temperature recovery downstream of single harvest units. Davis et al. (2015), in an analysis of sites from ODF's RipStream study, found that the temperature change 300m (984ft) downstream of harvest units on small and medium fish bearing streams was approximately 56% of the change at the harvest unit, on average (range of 1-82% of harvest unit change). However, this behavior was highly site-dependent (streams with lower gradients and/or greater surface area showed lower temperature change magnitudes at 300m). Arismendi and Groom (2018), in another RipStream analysis, also showed a tendency for downstream sites to converge towards the pre-harvest equilibrium, that the tendency generally strengthened with time, and post-harvest temperature regimes with wide buffers returned to behavior that was statistically similar to their pre-harvest characteristics while sites with narrow buffers often did not. Several other studies examining the extent of stream temperature recovery towards pre-harvest conditions downstream of harvest units show incomplete downstream mitigation of single harvest unit temperature increases that were due to narrow streams buffers (Keith et al. 1998: 0.5° of 5.0°C of the temperature increase remaining after 73m (240ft) and 0.5° of 6.0°C temperature increase remaining after 46m (151ft); MacDonald et al. 1998: 2° of 3.0°C increase remaining after 500m (1640ft); Rutherford et al. 2004: 0.77 to 7.18°C increase reduced by 0.35 to 2.51°C, over distances of 153 to 892m (502 to 2,926ft); Wilkerson et al. 2006 (unbuffered streams): 1.8° of 2.8°C of increase remaining and 1.3° of 2.5°C increase remaining after 100m (328ft); and Zwieniecki and Newton 1999: study mean across sites was 0.4° of 1.09°C increase remaining after 150m (492ft).

Unlike the small non-fish bearing streams observed by Bladon et al. 2018, some of the above studies were primarily on fish bearing streams. Non-fish bearing headwater streams often have very high groundwater inputs, low flow volumes relative to fish bearing streams, and substantial post-harvest flow increases so heat loss and dilution may be a greater factor in return to equilibrium than in fish bearing streams (e.g. Moore et al. 2003, Story et al. 2003, Kibler et al. 2013). Heated water from harvested sites around non-fish bearing headwaters can rapidly decrease in temperature and move towards pre-harvest equilibrium upon flowing through fully forested stream reaches in the absence of subsequent harvest units, depending on site conditions such as gradient and cold water inputs. With other harvest units present, measureable cumulative

[3] Seven-day maximum temperature

heating is probable unless harvest site BMPs prevent substantial riparian shade loss. Cole and Newton (2013) showed cumulative temperature increases through multiple harvest units with private forest-type buffers (0 to 50 feet), even when separated by uncut reaches, on 3 of 4 study streams. The 120ft wide buffers in the temperature protection zone will likely prevent additional harvest related heating through this reach.

While temperature recovery may not be total through the 500ft temperature protection zone, the relative total flow contribution of non-fish streams in a harvest unit to the receiving fish bearing stream is critical. For example, a temperature increase of 0.5°C in a non-fish stream will be undetectable (≤0.2°C) if it provides 40% or less of the total fish-bearing stream's flow, while an increase of 1.5°C must comprise no more than 13% of the total combined flow. Figure 3 shows an average increase of 1°C for a 35ft buffer, which falls within the range of responses in the longitudinal studies described above. With attenuation to 0.75°C at 500ft (see figure 3 in Davis et al. 2015), temperature increases may be undetectable if the non-fish streams' contributions in a particular harvest area are no more than 27% of the combined total flow of the receiving fish bearing stream. Using Figure 4 derived from Bladon et al (2018), that non-fish stream contribution could be as high as 67%. Considering the range of temperature recovery responses in the literature, the semi-conservative nature of heat pollution, and the dependence on site-specific characteristics, the 500 foot temperature protection zone provides a reasonable degree of certainty that measureable temperature impacts to fish bearing reaches will be avoided.

Buffer width (m)	Buffer width (ft)	Heating C	Location	Reference
0	0	6.1	HJ Andrews	Johnson and Jones 2000
0	0	5.5	Alsea	Harris 1977
0	0	5	BC coastal mtns	Moore et al. 2005
0	0	4	Newfoundland	Curry et al. 2002
0	0	3.9	BC coastal mtns	Feller 1981
0	0	3.6	Maine	Wilkerson et al. 2006
0	0	3	Bull Run	Harr and Fredriksen 1988
0	0	2.9	Maine	Wilkerson et al. 2006
0	0	2.5	Vancouver Island	Holtby and Newcombe 1982
0	0	2.5	SW BC	Kiffney et al. 2003
0	0	2	Alsea	Harris 1977 (patches)
0	0	1.5	W. WA	Janisch et al. 2012
8	26	0.3	Trask	Bladon et al. 2018
8	26	0.5	Trask	Bladon et al. 2018
10	33	0.6	W. WA	Janisch et al. 2012
10	33	1.1	W. WA	Janisch et al. 2012
10	33	3	WA coast range	Jackson et al. 2001
10	33	2.4	WA coast range	Jackson et al. 2001
10	33	2.4	WA coast range	Jackson et al. 2001
10	33	1	BC coastal mtns	Gomi et al. 2006
11	36	1.2	Maine	Wilkerson et al. 2006
11	36	0.4	Trask	Bladon et al. 2018
12	39	0.6	Trask	Bladon et al. 2018
15	49	0	Alsea	Bladon et al. 2016
15	49	0.3	Alsea	Bladon et al. 2018
15	49	0.7	W. OR	Groom et al 2011
17	56	0.4	Trask	Bladon et al. 2018
18	60	0.6	N. Umpqua	ODEQ for science team review 2008
20	66	1	Newfoundland	Curry et al. 2002
23	75	0	Maine	Wilkerson et al. 2006
30	98	0	Deschutes	Reiter
30	98	0.5	N. Umpqua	ODEQ for science team review 2008
30	98	0.1	BC coastal mtns	Gomi et al. 2006
46	150	0.03	N. Umpqua	ODEQ for science team review 2008
50	164	0	W. OR	Groom et al 2011

Figure 2. Sources Reviewed for Heating Related to Buffer

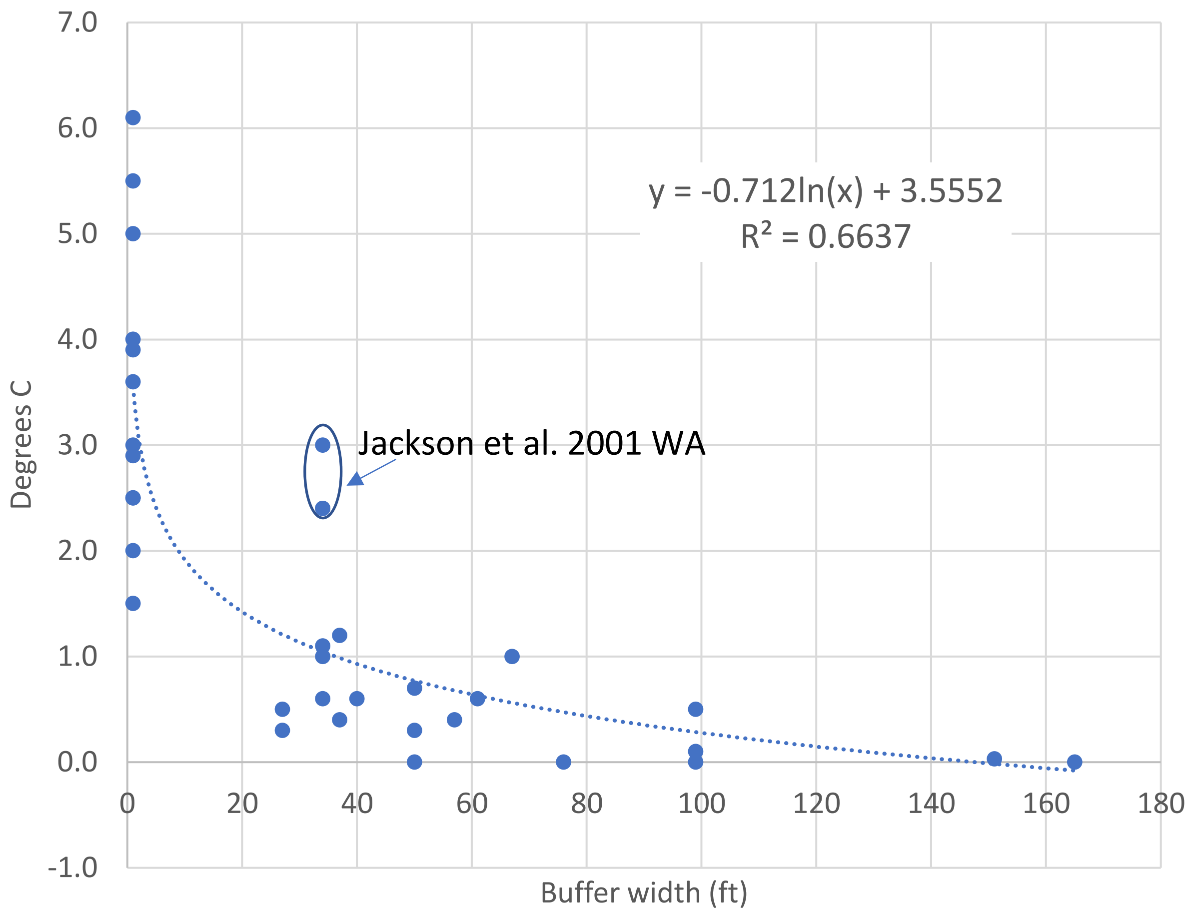

Figure 3. Heating Related to Buffer Width

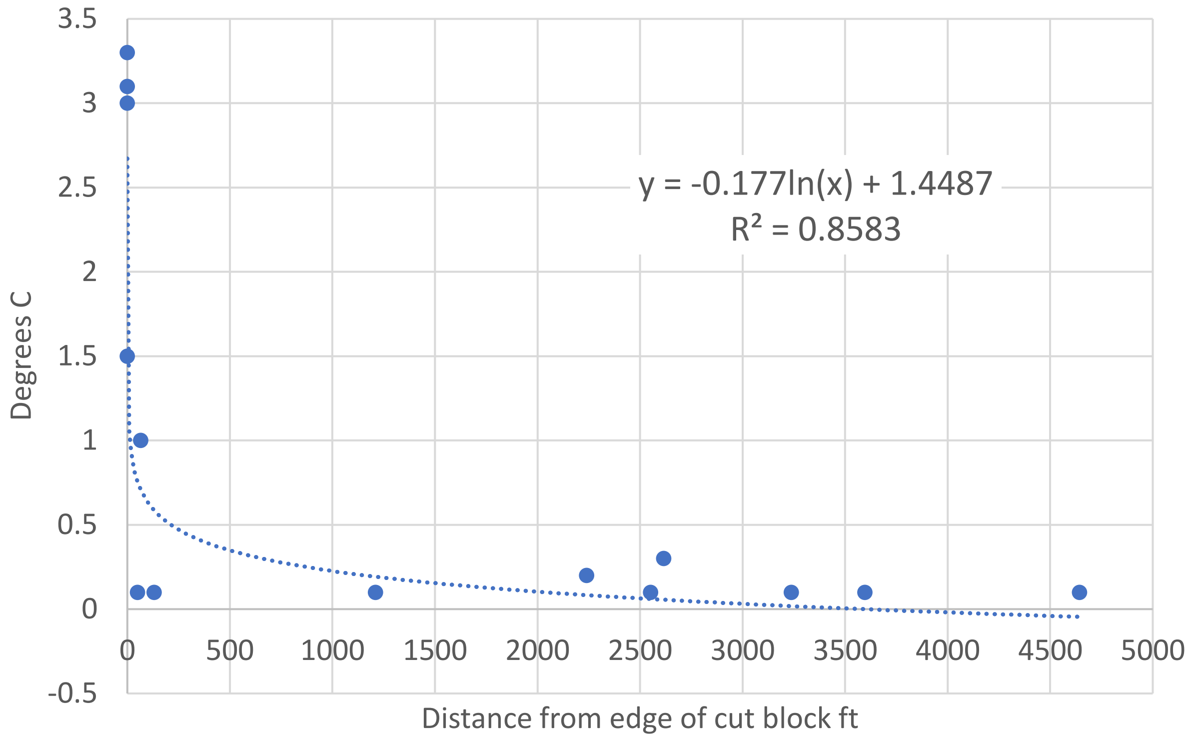

Figure 4. Temperature Exceedance or Elevation Changes as Water Moves Downstream from a Harvested Area (Bladon et al. 2018)

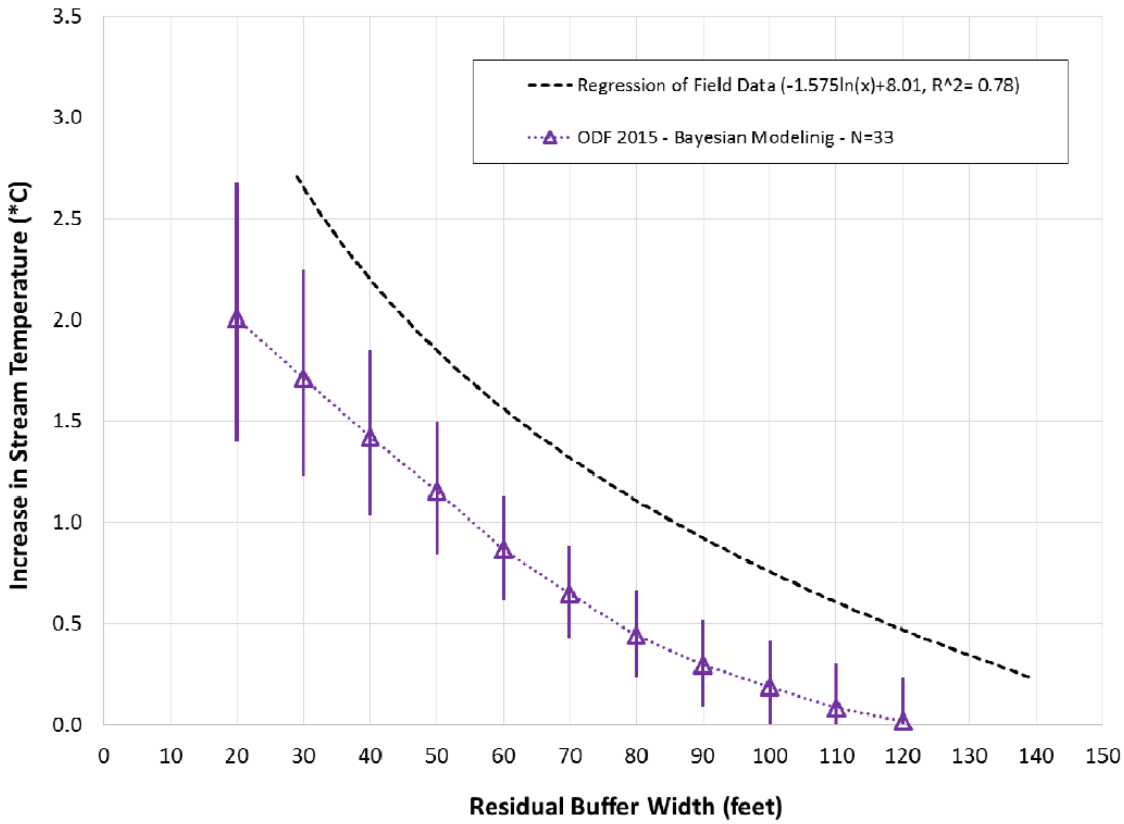

Figure 5. Modeled mean stream temperature response associated with "no-cut" riparian buffers with adjacent clearcut harvest (Leinenbach 2016)

Attachment 1 – References

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