Pre and Post Harvest Assessment of Uppermost Points of Perennial Flow in the Lower Skagit Watershed

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Introduction

According to the Washington State Forest Practice Rules, perennial streams are defined as "flowing waters that do not go dry any time of a year of normal rainfall" (WAC-222-16-30 (3)). The uppermost point of perennial flow (UMPPF) is considered the upper extent of a perennial stream segment. UMPPF locations can either be found at transition points between Np (perennial streams) and Ns (non-perennial) streams or at the channel head of a stream. The latter possibility was a more common finding amongst studies in Washington State examining the question of UMPPF locale (Veldhuisen, 2003; Jaegar et al., 2007; Hunter et al., 2005). Though UMPPFs are more commonly concentrated at or near stream channel heads, identifying these points can still sometimes be challenging, as hydrologic and weather conditions can vary both inter-annually and intra-seasonally (Hunter et al., 2005).

Natural variation in perennial stream dynamics has been explored, but few studies in the state have looked at UMPPF dynamics as a result of a controlled disturbance, such as clearcut timber harvesting, which has been shown to affect hydrologic regimes and water yield (Rothacher, 1970). This study aims to compare differences in UMPPF dynamics and locations pre and post clearcut harvesting.

Methods

The clearcut in question, nicknamed "Eddie," is an 89-acre harvest unit located on Cultus Mountain in the Lower Skagit watershed (Figure 1). The permit was submitted by Longview Timberlands LLC, now Weyerhauser Columbia Timberlands. It was harvested in summer of 2014. The unit was comprised of second-growth, even-aged conifers. It's located on a southwest-facing slope, with an average slope of approximately 30%. Elevation ranges from 2,800ft to 3,500ft. All UMPFF points received a 56' radius buffer and select Np segments received a 50ft no-cut buffer.

Two pre-harvest and post-harvest visits were made to the site. These took place in August in order to capture seasonal low flow dynamics and more accurately identify Np and Ns streams. The initial effort in August 2012 focused on mapping the stream network both within and upstream of the harvest unit, identifying all UMPPF locations and making Np/Ns stream designations. Streams were walked to the channel head, GPS'ed and mapped. A pre-harvest verification visit was done again in August 2013 and post-harvest field visits occurred in 2015 and 2016. All UMPPF locations were tracked, even those upstream of the actual harvest. Flow consistency or intermittency below these points was not thoroughly documented.

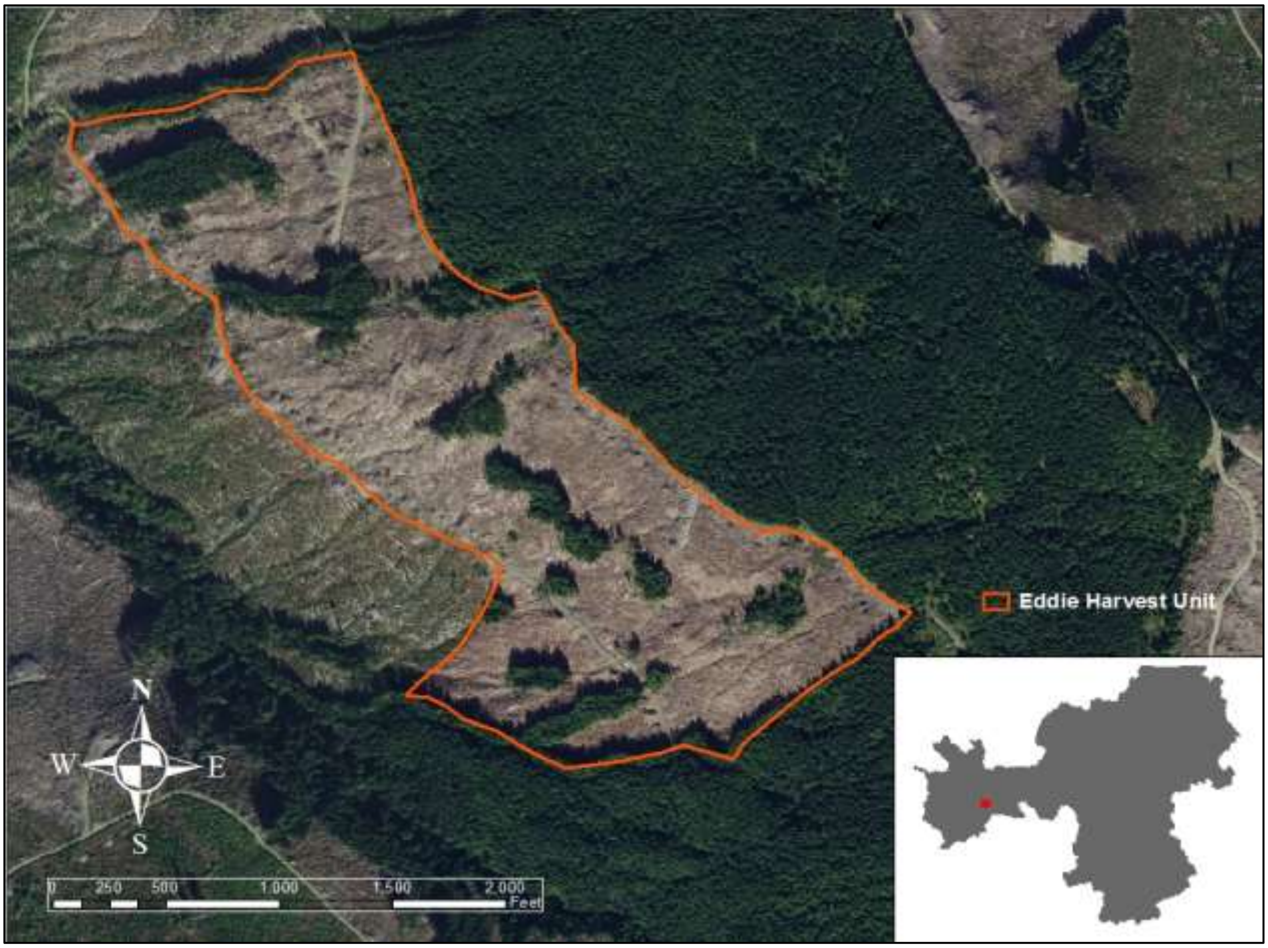

Figure 1: Aerial view of Eddie harvest unit.

Results

Within Eddie Unit

Eleven UMPPF locations were originally identified within the Eddie harvest unit (Figure 2). The majority of these were located at stream channel heads. All but one point were found to be flowing in both 2015 and 2016. This point was dry in 2015. A new perennial stream was found in 2015 that had not been mapped as part of the 2012-2013 effort. It was either missed or had formed post-harvest.

Upstream of Eddie Unit

Nine UMPPF points were located upstream of the harvest unit. Six of these were located at the channel head and two were within 100ft of the channel head. Four points were found flowing in both 2015 and 2016 and all but one point were flowing in 2016. This northernmost location was also inconsistent during the 2012-2013 survey (Figure 2). The year 2015 yielded more variability: two points were flowing, but ~100ft downstream of the original UMPPF locations and three were found to be completely dry.

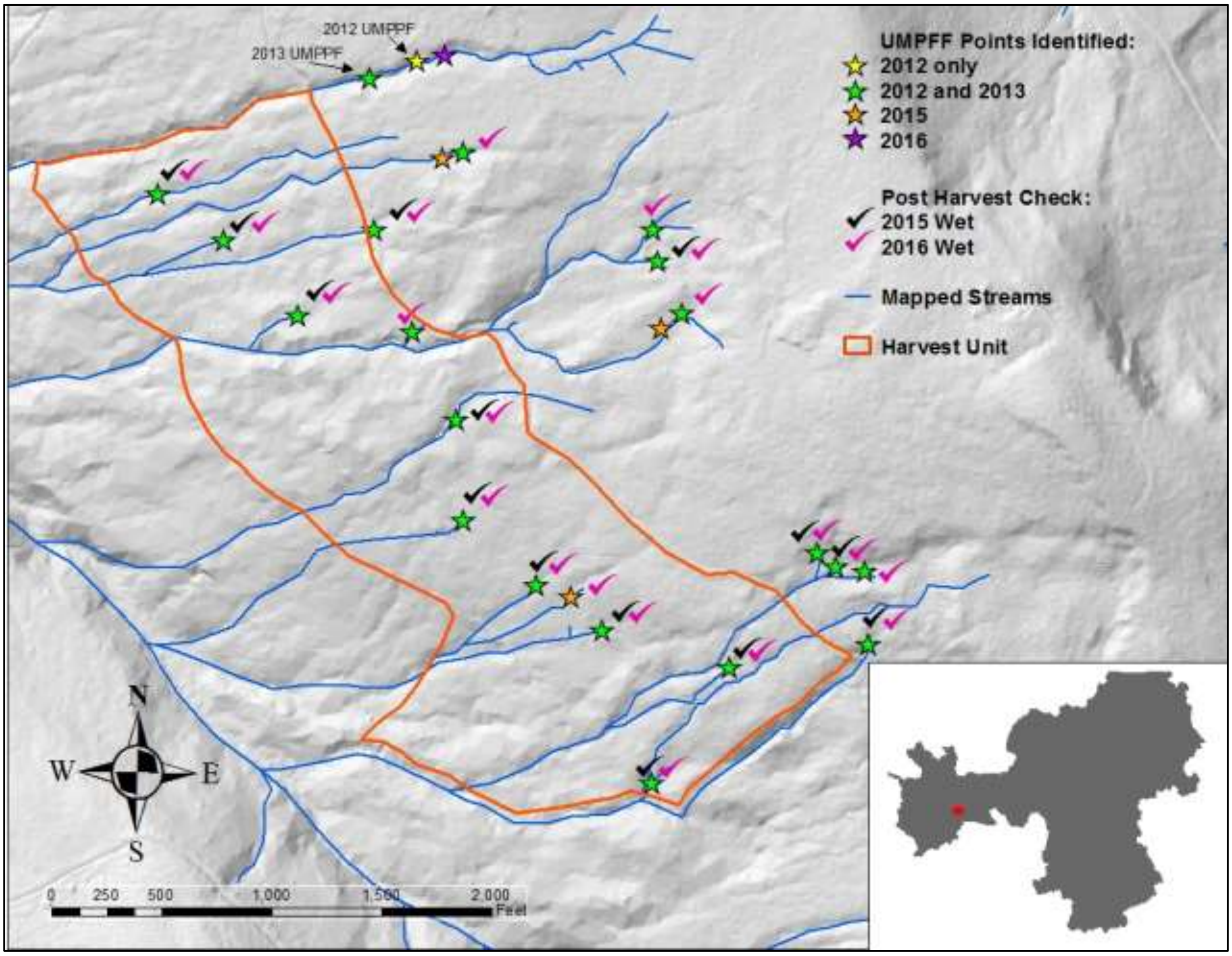

Figure 2: Eddie harvest unit and UMPPF points with pre and post-harvest information.

Discussion

The harvest prescription did not appear to influence UMPPF dynamics, as nearly all points were consistent in flow during both years. This isn't surprising, as both annual water yield and minimum flows are known to increase following a clearcut (Rothacher, 1970; Harr and Krygier, 1972). This is due to reduction of evapotranspiration and interception after removal of an overstory canopy. Increased water yield could also account for the formation of a new stream within the unit.

More variability was observed upstream of the unit, an area that had not been harvested, with several UMPFF points either going dry or moving downstream. Since most of these inconsistencies occurred in the year 2015, they could be due to the summer's unusually dry weather patterns (Figure 3). June, July and August precipitation totals in 2015 were all below average. Though some July or August months fell below the norm for other years, the below average totals could have been offset by June precipitation amounts being close to or above average for those same water years.

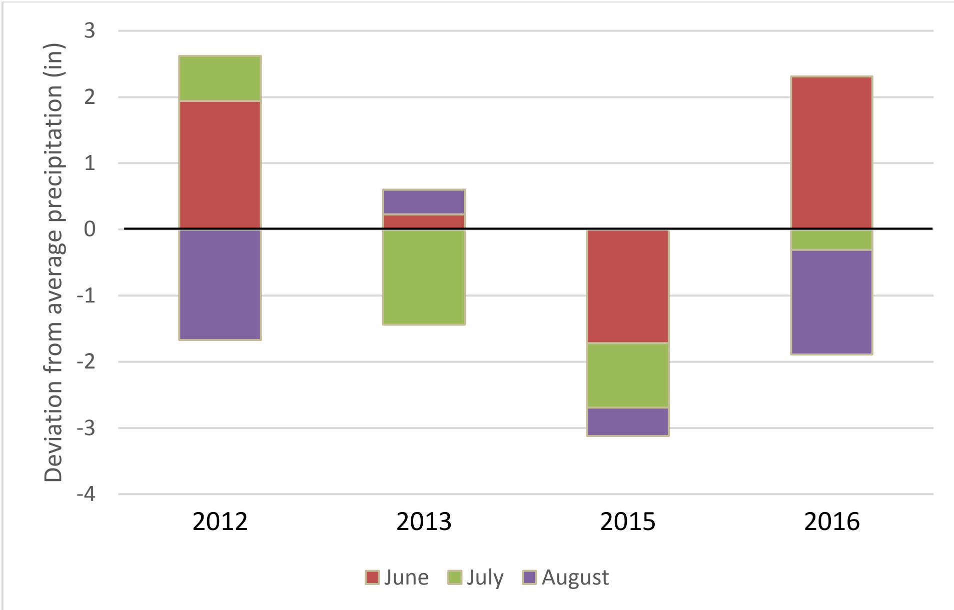

Figure 3: Monthly deviation from average precipitation amounts (1896-present) for four years.[1] Data obtained from Sedro Woolley weather station.

The upstream area is more subject to natural flow regime fluctuations since the forest canopy is still intact. This explains why 2015, a dry season, yielded greater UMPPF variability. The clearcut unit on the other hand is less likely to be affected by low precipitation years such as 2015, since flows naturally increase following a harvest.

The proximity of UMPPF locations to respective stream channel heads is consistent with previous findings (Veldhuisen, 2003; Jaegar et al., 2007; Hunter et al., 2005). Of the twenty one total points examined, seventeen (81%) were located either at or within 100ft of the channel head.

Conclusions

1) Clearcutting did not influence UMPPF dynamics, likely because of increased water yield post-harvest.
2) More variability in UMPPF locations was observed upstream of the Eddie unit, an area that had not been harvested.
3) The variability of UMPPF points observed in 2015 is most likely a factor of precipitation patterns for that year.
4) The majority of points were located at or close to the channel head, confirming findings of previous studies.

[1] NOAA Climate Data Online website: https://www.ncdc.noaa.gov/cdo-web/

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