

WATERSHED CHARACTERIZATION OF TEMPERATURE – UMPQUA BASIN¹

The screening procedure described in the Water Quality Assessment component will often raise further questions about the spatial distribution of temperature exceedances in the watershed. A more detailed watershed characterization, such as described here, can be used to answer these questions. The Elk Creek Temperature Study (Umpqua Basin Watershed Council 1998) provides a good example of how to conduct and interpret data from a more comprehensive study.

The Oregon temperature criteria is measured as the 7-day moving average of the maximum daily temperatures. The reason for using a moving average in the water quality standards is to decrease the effect of a single peak temperature on data interpretation. Aquatic organisms are affected more by exposure to high temperature over an extended period than to a single excursion over the criteria. As noted in this study, the seasonal maximum temperature was, for this particular watershed and season, consistently about 3°F higher than the 7-day moving average. This finding shows the utility of using the simpler daily maximum of 64°F as a screening tool, as described in the watershed assessment manual.

Study Area

The Elk Creek Watershed is located in southwestern Oregon in Douglas County. The watershed is approximately 350 square miles in size and is primarily in private ownership: 40% private ownership, 40% private commercial forestland, and 20% federal. Elevation ranges from 90 feet at the mouth to 2,000 feet at the top of the watershed. The vegetation is typical of southwest Oregon: the forest lands are dominantly Douglas fir; the riparian areas contain alder, willow, and cottonwood. Vegetative recovery of disturbed areas is relatively rapid in the form of woody brush and grass.

Objectives

The objectives of the study were to provide an understanding of how temperature varies spatially throughout the watershed, provide data for the evaluation of aquatic habitat, and develop a database for development of a Temperature Management Plan for the watershed.

Methods

The Elk Creek study used an intensive monitoring approach during one field season to eliminate the between-year variability. Twenty-eight sites were chosen to obtain a representative sample of various stream types and conditions throughout the watershed. Continuous temperature data loggers were set to record data every 20 minutes from July 1 through the end of September. Quality control procedures included the following: (1) calibration of each unit against a reference thermometer at two different temperatures both before deployment and after retrieval of the units, (2) photo documentation of each site saved in digital format, (3) standardized field data sheets, and (4) field verification of data logger temperature against the reference thermometer. The accuracy assessments indicated that all data loggers remained within 0.3°F of the reference temperature during the study period.

¹ Elk Cr. Temperature Study. Courtesy of Umpqua Basin Watershed Council and Insight Consultants, Roseburg, Oregon.

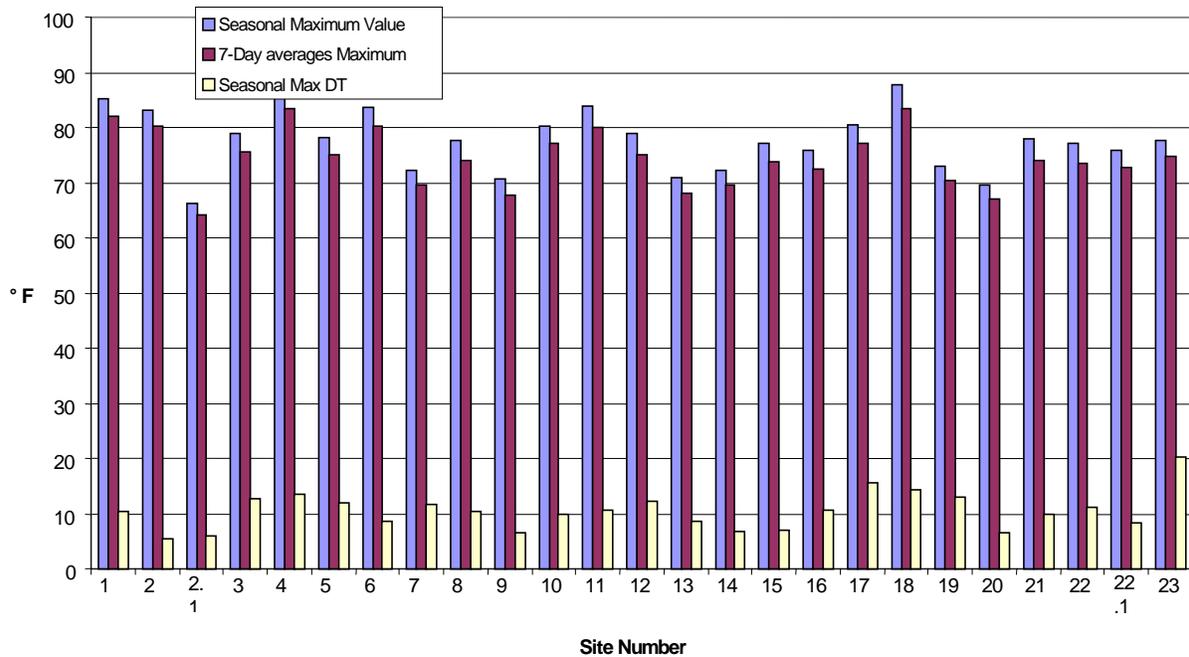


Figure 2. Station summary of maximum seasonal temperature, 7-day moving average of maximum daily temperatures, and maximum daily change in temperature.

Discussion

This study provides data to better understand how stream temperature varies both seasonally and daily at various points within a watershed. This information, when tied to observations on channel conditions, shade, canopy, and riparian vegetation, can be used to make viable recommendations for developing a temperature management strategy. The study identified tributaries that consistently contributed cooler water to Elk Creek: These tributaries may be important in moderating temperature and providing cool water refuges for fish. The downstream change in temperature also showed areas of significant heating or cooling. Areas with temperature gain can be further investigated to identify the specific reason for higher temperatures (e.g., wide shallow channels, reduced canopy) and potential site-specific solutions. The areas of cool water may serve as important holding areas for juvenile and adult fish, and can be identified for protection as part of the watershed restoration plan.

The database associated with this project provides an opportunity to develop other statistics and test stream temperature modeling efforts. For example, there may be an interest in the average daily temperature for a site. This statistic could be calculated from the data and used to calibrate temperature models such as SSTEMP, which predicts mean daily temperature for different conditions.