**EPA Impact Statement**

Stream temperatures are driven by both natural processes (e.g., weather) and anthropogenic impacts (e.g., land-use change). This research addresses the need to better understand patterns of stream temperatures across river networks and how natural and anthropogenic controls balance with each other. To do this, we developed a model selection process that uses statistical spatial stream network models in which various land-use, climate, and water management processes compete and/or combine with each other to predict stream temperature patterns. We tested this model selection process across three study basins in the Pacific Northwest, USA during three months of the growing season (May [start], August [warmest], and September [last]). The results from this work provide insight into how restoration of streams (including the landscapes they intersect) could be managed to maintain and restore cold-water habitat for cold-water species (e.g., Pacific salmon).

**ScienceHub Metadata fields needed to generate DOI for data:**

<https://intranet.ord.epa.gov/sciencehub/doi-process>

**Dataset Title:**

Spatial and Temporal Variability in Stream Thermal Regime Drivers for Three River Networks During the Summer Growing Season

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**Description:**

Many aquatic organisms adapted to cold-water habitats are suffering habitat losses and population declines during warm seasons when water temperatures are increasing above thermal tolerances. Therefore, identifying the mechanisms driving local and regional stream temperature regimes are useful for implementing targeted restoration and management activities at appropriate scales to help mitigate cold-water habitat loss. Controls on stream temperature vary across landscapes but also temporally within basins during ecologically important growing seasons. We developed a modeling process that identified statistical relationships between potential drivers of stream temperature and incorporated management-related covariates that could be adjusted as part of restoration planning scenarios. We tested this model development process in three river networks of the Pacific Northwest with pre-existing temperature total maximum daily loads for protecting cold-water habitat during three months of the growing season (May [start], August [warmest], and September [end]). When averaged across months and the three river networks, the covariates in our models with the highest relative importance represented the physical landscape (elevation [1st], catchment area [3rd], main channel slope [5th]) and temporally-variable climate covariates (mean monthly air temperature [2nd], and mean monthly discharge [4th]). Management-related covariates such as ground water use (6th) and riparian shade (7th) were of lesser but still significant relative importance. However, variation in the importance of covariates through time and among the river networks indicates that local nuances are important and should be addressed when planning restoration activities. The modeling process we developed demonstrated its ability to identify regional (similar across study areas) and local (unique to each study area) relationships among multiple drivers of stream temperature across complex landscapes. The data included provides the necessary inputs, code, and metadata for reproducing the models and output from this study.

**Keywords:** spatial stream network model; model selection; stream temperature; Pacific Northwest; information criterion; covariate relative importance