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Incorporating retention time to refine models predicting thermal regimes of stream networks across New England.

Thermal regimes are a critical factor in models predicting effects of watershed management activities on fish habitat suitability. We have assembled a database of lotic temperature time series across New England (> 7000 station-year combinations) from state and Federal data sources. Using principal component analysis, we reduced 78 thermal metrics from the ThermoStat software package to four independent fish habitat predictor variables: July or August median temperature, Julian day of maximum daily temperature, mean daily temperature range, and maximum daily rate of temperature change. We are creating spatial statistical models for stream temperature regime metrics, using an approach developed by the U.S. Forest Service. Median July and August stream temperatures are best predicted by a combination of median monthly air temperatures, main channel slope, solar radiation (corrected for topographic and riparian shading), coarse surficial deposits, and watershed storage (August only). Predictors for daily July or August stream temperature range and growing season maximum temperature also include corresponding air metrics, watershed percent imperviousness and mean discharge (daily ranges only). With one exception, only maximum daily rate of change (ROC) in air temperature was retained in predictive models for stream ROC values. Best models based on Akaike Information Criteria values included spatial covariance terms using both proximity along the stream network (upstream and/or downstream) and, in some cases, Euclidean distance. Performance of models constructed using travel (retention) time to estimate spatial covariance are being compared with those based on instream distance. Predicted thermal regime variables will be used as input to models that predict relative abundance of selected fish species, chosen based on their sensitivity to urban development. Predicted versus observed fish community composition will be compared for watersheds in which stormwater best management practices have been applied.

Keywords: stream network, temperature, spatial statistical model, New England