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Environmental predictors of stream flow in semi-arid watersheds for biological assessments

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ABSTRACT

The aim of this study is to test a spatially explicit statistical model to identify indicators of natural stream flow using readily available stream, climate and landscape data. Understanding flow behavior of unmonitored streams at different temporal scales using environmental indicators is of great interest considering the logistic constraints of providing comprehensive flow instrumentation for all stream reaches in a region. Our results have applications to assess human impact in watersheds, to study environmental changes in fresh water resources, and in the management of local ecosystem. This study uses classification and regression tree analysis to identify significant explanatory variables for a predictive model of stream flow in semi-arid watersheds of Southern California, USA. The study collected 77 variables with 30 years record, for a set of 48 sites, interpolated to create raster files at 30m spatial resolution. After applying Pearson correlation analyses to eliminate redundant variables, nine variables were found to have strong positive predictive value for estimating stream flow at ungauged sites. Nine prediction rasters portraying spatial variation of stream flow for the study region at three key index months during wet, dry, and average rainfall conditions. The predictive power of the variables was tested and cross validated over a subset of data not included when building the model. Model validation by site at monthly temporal resolution showed mixed results. While some sites where accurately predicted others did not. The comparison of observed vs predicted values by month suggest that this statistically based approach is able to predict the general patterns of stream flow at the regional scale, however it may be inaccurate in estimating actual flow values by month since the models tends to under-predict monthly discharge.