A Generalized Habitat Model for Rocky Mountain Streams

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Abstract. Damming and diversion of stream flows has the potential to dramatically change freshwater ecosystems. The depth, velocity and width of a stream are important habitat variables for many aquatic species and are directly affected by flow change. Widely used hydraulic habitat methods (e.g. PHABSIM, River2D) predict how these variables change with flow, based on intensive site surveys and calibrations. A major hurdle for the implementation of hydraulic habitat methods is the cost. The aim of this research was to predict the response function between hydraulic habitat and flow using riverscape and rapid-survey variables.

Existing PHABSIM data for 17 sites in Colorado's Rocky Mountains were used to train a generalized habitat model for juvenile brown trout. The habitat-flow response curves were represented using (1) magnitude (flow at maximum habitat), and (2) shape (a dimensionless quadratic function with one unknown parameter). Multiple regression was then used to model the two parameters from relevant riverscape variables, but little improvement could be achieved over univariate models. Mean annual flow provided adequate predictions of flow at maximum habitat, and stream slope was an adequate predictor of the shape parameter. Together, the two functions allow desktop predictions of habitat-flow response for juvenile brown trout. Improved predictions are possible using rapid-survey estimates of the channel inflection width (used to convert mean annual flow to a unit-width discharge). Potential applications of the generalized habitat model include basin-wide assessments, initial screening for high value streams and rapid assessment of less valued streams.

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