The Simulation Programs of the Instream Flow Incremental Methodology

Robert T. Milhous
Fort Collins Science Center, U.S. Geological Survey, Fort Collins, Colorado

Abstract. The Instream Flow Incementail Method (IFIM) is a logical guide to analysis of the various issues related to developing an instream flow policy that incorporates multiple or variable flow rules to meet the needs of the aquatic ecosystem while considering habitat-flow relationships, timing of flow events, institutional arrangements, and water supply and water allocation. The simulation programs (models) of IFIM include the Physical Habitat Simulation System (PHABSIM), Time Series Analysis Library (TSLIB), SALMOD, Legal Institutional Analysis Model (LIAM), Stream Network Temperature Model (SNTEMP), and the Stream Segment Temperature Model (SSTEMP). The various models are designed to give the user information required to select environmental (instream) flow needs. The models do not calculate an environmental flow need - selecting an environmental flow need is the responsibility of the user.

PHABSIM is a set of programs designed to predict microhabitat conditions in rivers as a function of streamflow and the relative suitability of those microhabitat conditions to aquatic life. *TSLIB* programs provide for data entry, analysis, and display of daily or monthly flow or habitat values. Some programs are useful for integrating microhabitat and macrohabitat, and some are of value in the analysis of water operations systems. *LIAM* was designed to accomplish three goals: (1) plan for participation in a negotiation, (2) predict organizational behavior, and (3) examine likely negotiation strategies. *SALMOD* is a computer model that simulates the dynamics of freshwater salmonid populations. Developed and used for the Trinity River, California, Chinook salmon evaluation, SALMOD has wide applicability for freshwater habitat-limited salmonid populations. *SNTEMP* predicts the water temperature in streams and rivers from data describing the stream's geometry, meteorology, and hydrology. It handles a dendritic network of streams through time and space. *SSTEMP* is a scaled down version of SNTEMP suitable for single (to a few) reaches and single (to a few) time periods.

Each of the various models is improved as a result of new information and improved knowledge. An additional module is being developed that includes analysis of flows needed to flush unwanted sediment from a river channel (flushing flows) and for the analysis of channel change. All of the various models are used worldwide and have had a significant impact on the allocation of water resources.