System-Wide Water Resources Program
SWWRP

HydroMussel (HDM): Flow-Based Modeling of Mussel Populations

Description: HydroMussel (HDM) represents a process combining the use of hydraulic and habitat suitability models to predict freshwater mussel distribution and abundance. Adaptive Hydraulic (ADH) model outputs include estimates of current velocity (CV), bathymetry, substratum, and relative shear stress (RSS), which are used to describe physical habitat conditions within spatial and temporal limits. The habitat suitability model (HSI) is used to evaluate how freshwater mussels respond to spatio-temporal changes in habitat suitability. Therefore HSI can be used to predict or simulate population responses to changes in riverine habitat conditions.

Concept: One of the most fundamental tenets of ecology is that organisms respond to functional changes in environmental or physical habitat conditions. It stands to reason that variable hydraulic conditions in riverine environments can affect ecological interactions, distribution, and recruitment among aquatic organisms.

HydroMussel is a software application that facilitates the use of hydraulic model output to drive an ecological habitat suitability model. The software can improve project-related ecological impact assessments by directly incorporating both hydraulic and ecological modeling capabilities into a single package (i.e., project-related changes in geomorphology, habitat values, ecological interactions, and T&E population effects).

Freshwater mussels are relatively long-lived filter feeders that rely on substrate stability to survive. Relative shear stress (RSS) is the ratio of actual shear to the shear value required to displace sediments; displacement of substratum is initiated as RSS approaches 1.0.

Morales et al. (2006) suggested a habitat suitability curve describing the expected response of freshwater mussels to RSS. Values less than one represent stable substratum which is expected to result in high survivorship. As RSS approaches 1.0, however, substratum becomes unstable and many mussels will be displaced, which is assumed to result in approximately 90% mortality. RSS values greater than 1.25 are expected to result in 100% mortality.

Applications: HydroMussel (HDM) predicts how freshwater mussel populations respond to changes in environmental conditions, which enables:

a) Quantitative analysis of suitable habitat units and/or habitat quality

b) Development of environmental management or restoration plans

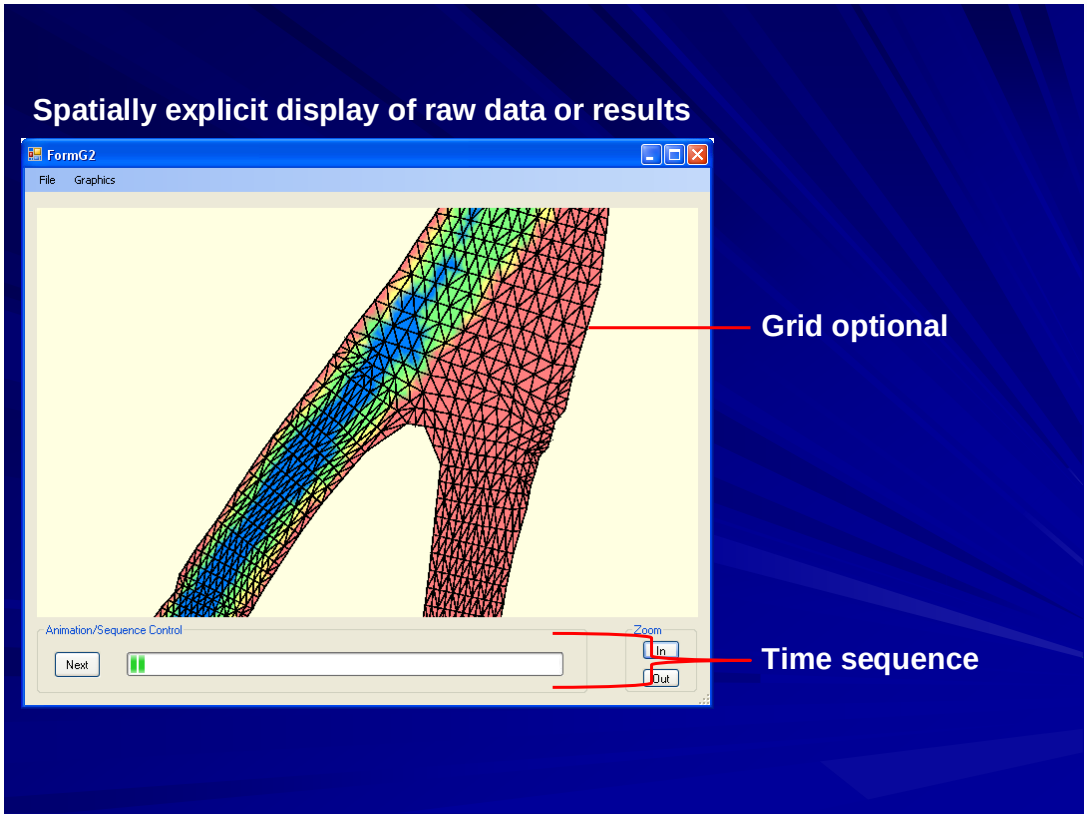
c) Decision support analyses for evaluating alternative project plans

d) Threatened and Endangered Species impacts - conservation plans

e) Multi-scale or scale-sensitivity analyses

more . . .

HydroMussel (HDM): Flow-Based Modeling of Mussel Populations



Benefits: HydroMussel allows a user to analyze hydraulic data to estimate habitat suitability.

Data Requirements: 2D hydraulic model output.

Future Capabilities: Analysis of change between or among multiple time steps.

Point of Contact: Mark Farr, Environmental Laboratory, U.S. Army Engineer Research and Development Center, (601)634-3049, Mark.D.Farr@erdc.usace.army.mil.

System-Wide Water Resources Program SWWRP