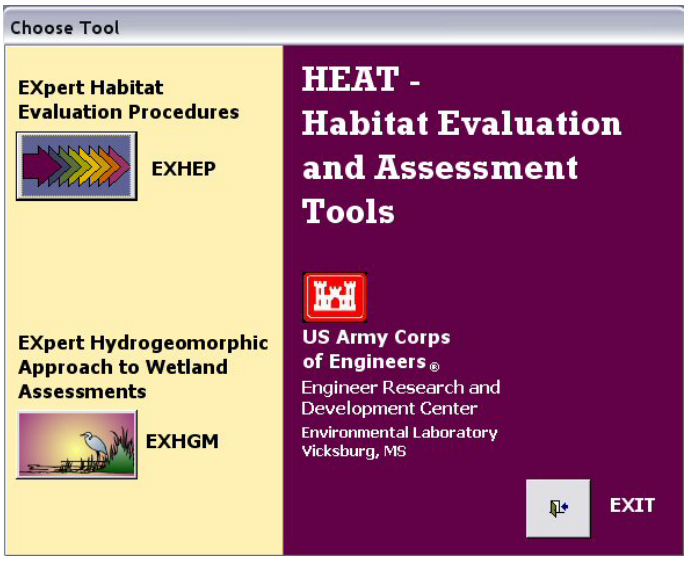
System-Wide Water SWWRP Resources Program

Habitat Evaluation and Assessment Tools (HEAT)



Description: The rapid assessment of changing habitat conditions and the evaluation of the effects these changes have on species, communities and ecosystem functions must be determined by planners, resource managers, and biologists when developing and comparing alternative designs. The Habitat Evaluation and Assessment Tools (HEAT) software was developed to perform Habitat Evaluation Procedures (HEP) and Hydrogeomorphic Wetland Assessments (HGM) using an integrated Microsoft Access database that provides a user-friendly (intuitive), flexible, and efficient means to quantify benefits and impacts to species, communities and ecosystem functions. Two modules within HEAT, namely EXHEP (EXpert Habitat Evaluation Procedures) and EXHGM (EXpert HydroGeoMorphic Approach to Wetland Assessments) calculate, outputs for with-project conditions (comparing these to baseline and without-project conditions). The software package can: Quantify "Baseline," "Without-Project," and "With-Project" conditions using standard HEP and HGM techniques; Incorporate a broad range of user-specified species, community, or functional models; Process large amounts of data quickly and efficiently; Reduce computation time dramatically; Adapt to regional variations; and Accommodates a variety of data input and output file formats.

Application: To date, 14 studies have applied or are using HEAT to quantify project benefits and/or impacts. The most recent applications include: 1) the Middle Rio Grande Bosque ecosystem restoration assessment using EXHEP (USACE, Albuquerque District); 2) the Tres Rios del Norte ecosystem restoration functional assessment using EXHGM (USACE, Los Angeles District); 3) the Clear Creek Watershed flood risk management impact and mitigation assessment using EXHEP (POC Andrea Ca); 4) the Upper Des Plaines River and tributaries multi-purpose project using both EXHEP and EXHGM (USACE, Chicago District); and the 5) the Cottonwood Management Plan for the Missouri River BiOp using EXHEP (USACE, Omaha District).

Benefits: The HEAT software was designed to process large amounts of data quickly and efficiently, handling a large number of HEP and HGM models simultaneously. Each model can incorporate any number of habitats or wetland types. Each cover type can include any number of variables, and the user can incorporate as many life requisites or functions into each model as demanded. These capabilities support the examination of complex studies with large numbers of permutations.

more . . .

Habitat Evaluation and Assessment Tools (HEAT)

In some studies, it is not unusual to evaluate 10 - 15 models (with more than 25 cover types) in an attempt to describe complex interdependencies (i.e., interrelationships) within the ecosystem. The large amount of tedious mathematical calculations necessary to compute HEP and HGM at this level requires a powerful tool to evaluate environmental output. HEAT, enhanced by its ability to communicate these activities in an organized fashion, can quickly accomplish this task. The number of permutations, processing speed, and program performances are limited only by the capacity of the user's hardware, where data storage becomes the limiting factor.

Data Requirements: Basic information regarding the study's goals, objectives, opportunities and constraints are always useful to capture early on in the analysis process. EXHEP allows the user to store this information iteratively, and provides access to this data at the touch of a button. Issues surrounding model selection, modification and creation can also be addressed and documented in the software. Model architecture can have a profound affect on the analysis strategy, and should be recorded and incorporated into this data gathering process as well. It is also important to gather all information supporting the application of the models prior to setting up the software. Collect basic information (i.e., references, cover types, variables, sampling protocols, Suitability Index (SI) curves, Habitat Suitability Index (HSI) formulas, etc.) early on. The software can be setup incrementally as this information becomes available, but analysis cannot commence without these basics. A checklist has been provided here to help organize the necessary information and data.

Future Capabilities: Although the system accommodates the manual entry of spatially explicit data, the system could be modified to operate from inside a Geographic Information System (GIS) interface. In addition, the designers have developed a process to organize data in such a fashion to support its rapid entry into the tool, but this prototype is extremely sensitive and should be automated to a greater degree prior to dissemination. Sensitivity analysis and uncertainty analyses are not current capabilities of this version of HEAT, but research has been initiated to develop an architectural concept to address the upgrade of the software to incorporate these methods. Acknowledging that HEP and HGM are common methodologies, but not the only approaches used to quantify impacts/benefits, the HEAT team is always interested in adding more modules into the HEAT toolbox to address new approaches. Finally, HEP and HGM assessments often incorporate data from several physical and chemical analyses. To date, the modeling approach has been loosely coupled, but an effort is underway to tightly couple the HEAT modules with other SWWRP tools (GSSHA, EDYS, etc.) to provide critical hydrologic, water quality, and sediment information directly into the analytical framework.

Point of Contact: Kelly A. Burks-Copes, Environmental Laboratory, U.S. Army Engineer Research and Development Center, (601) 634-2290, Kelly.A.Burks-Copes@usace.army.mil.

System-Wide Water SWWRP Resources Program