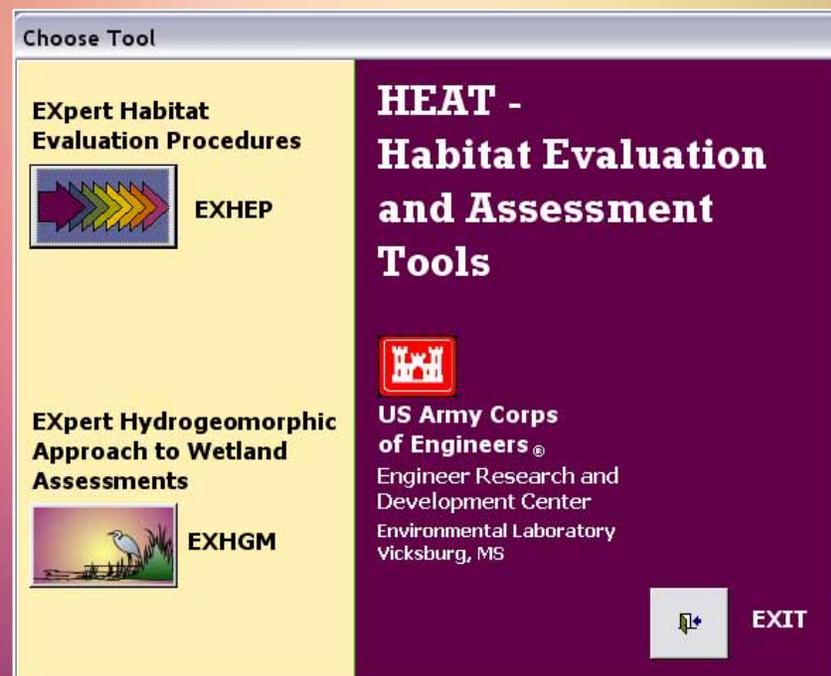
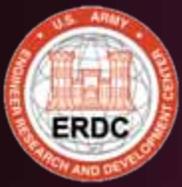


HEAT: Habitat Evaluation and Assessment Tools

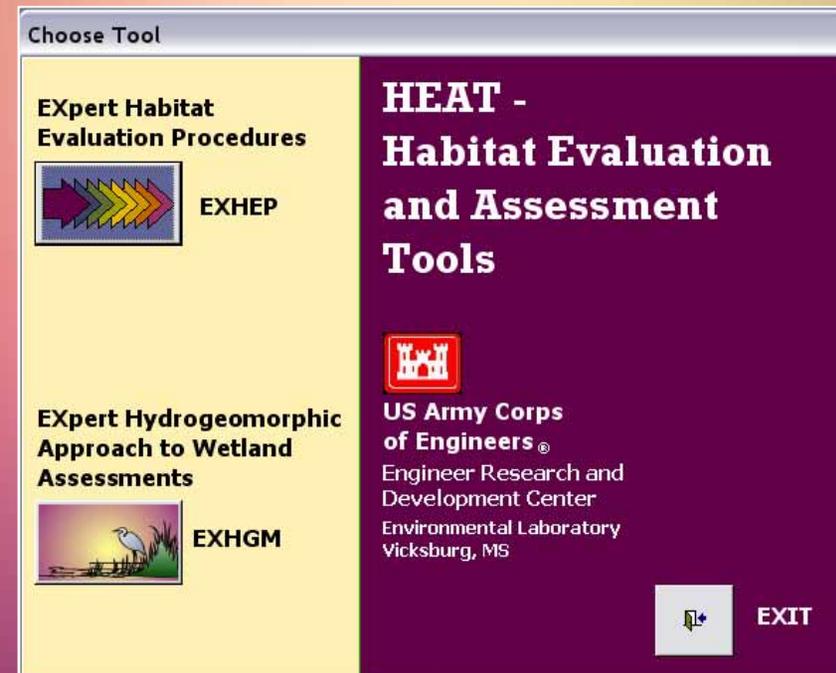
The rapid assessment of changing habitat conditions and the evaluation of the effects these changes have on species, communities and ecosystems must be determined by planners, resource managers, and biologists when comparing environmental design alternatives.

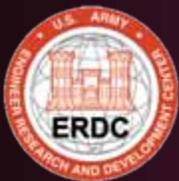




HEAT: Habitat Evaluation and Assessment Tools

Many techniques (e.g., population assessments, qualitative matrices, life-history modeling, and habitat evaluation techniques) have been developed to investigate and predict environmental impacts on ecological systems at numerous scales with varying degrees of success.



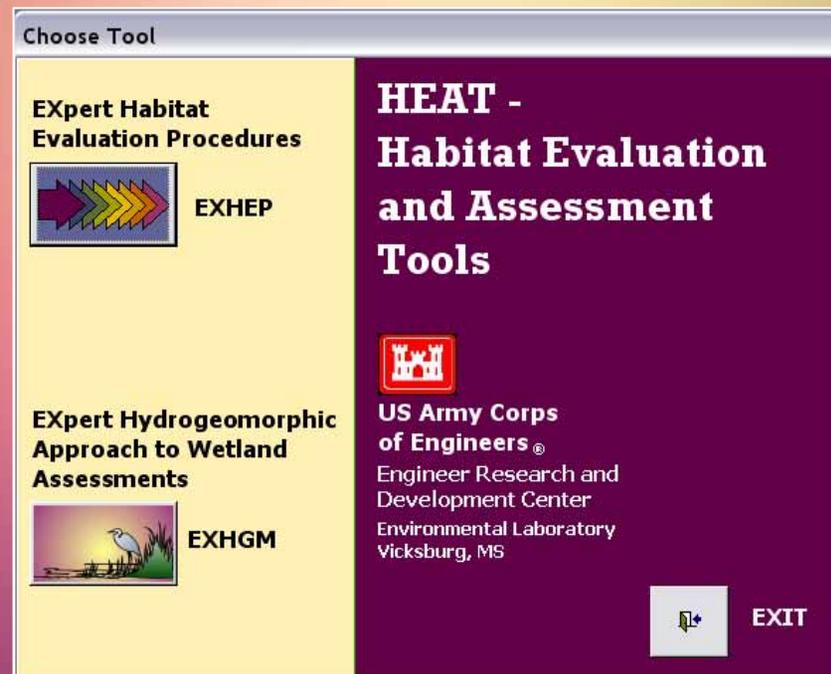


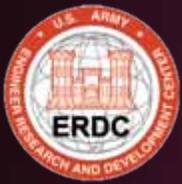
HEAT: Habitat Evaluation and Assessment Tools

Advances in technology have led many agencies to automate and distribute automated environmental evaluation tools to users.

The value and validity of these packages depends greatly on their objectivity, repeatability, and efficiency.

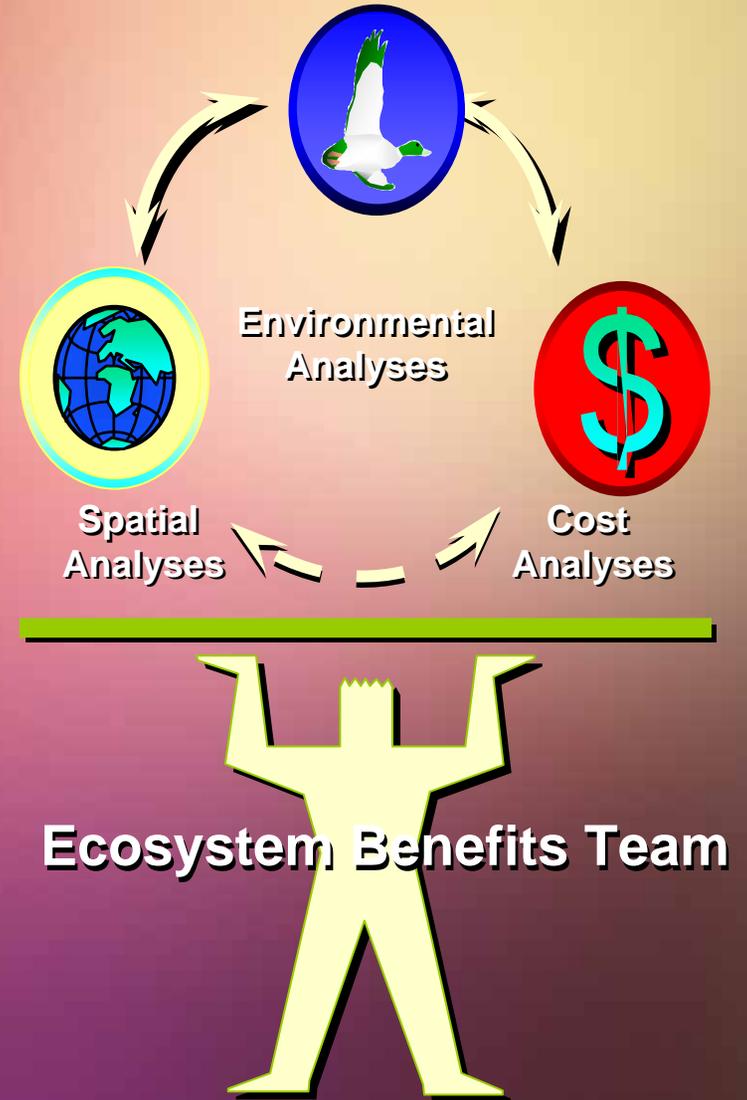
To guarantee their constant use by the users, these systems must be easy to apply, cost-effective, and instantly responsive.

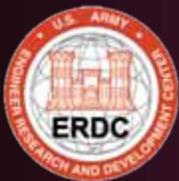




HEAT: Habitat Evaluation and Assessment Tools

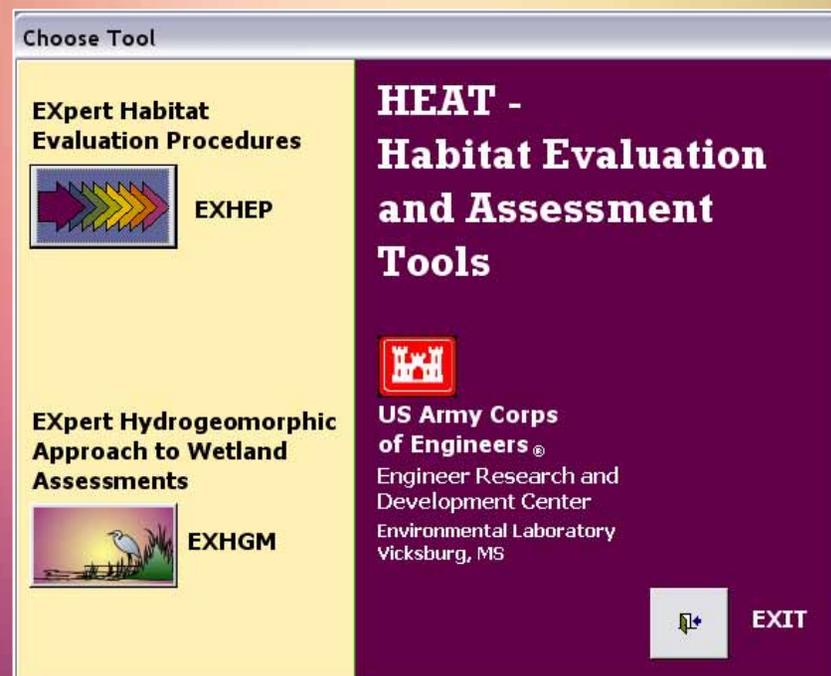
The US Army Engineer Research and Development Center's Environmental Laboratory (ERDC-EL) develops and adapt methods and models to quantify and document the effects of Corps activities under Environment, Flood and Storm Risk Management, and Navigation Business areas in terms of Threatened and Endangered species, ecosystem services and benefits through research, application, facilitation, knowledge management, and technical support.

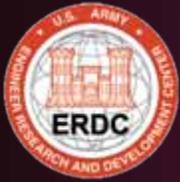




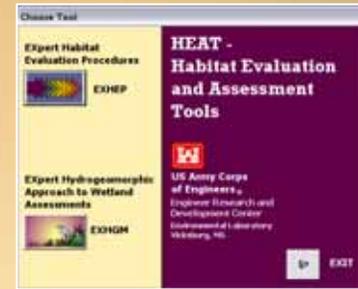
HEAT: Habitat Evaluation and Assessment Tools

The *Habitat Evaluation and Assessment Tools (HEAT)* software was developed to provide a user-friendly (intuitive), flexible, and efficient means to conduct Habitat Evaluation Procedures (HEP) and the Hydrogeomorphic Approach to Wetland Assessments (HGM), using Microsoft® Windows programming capabilities.





HEAT Modules



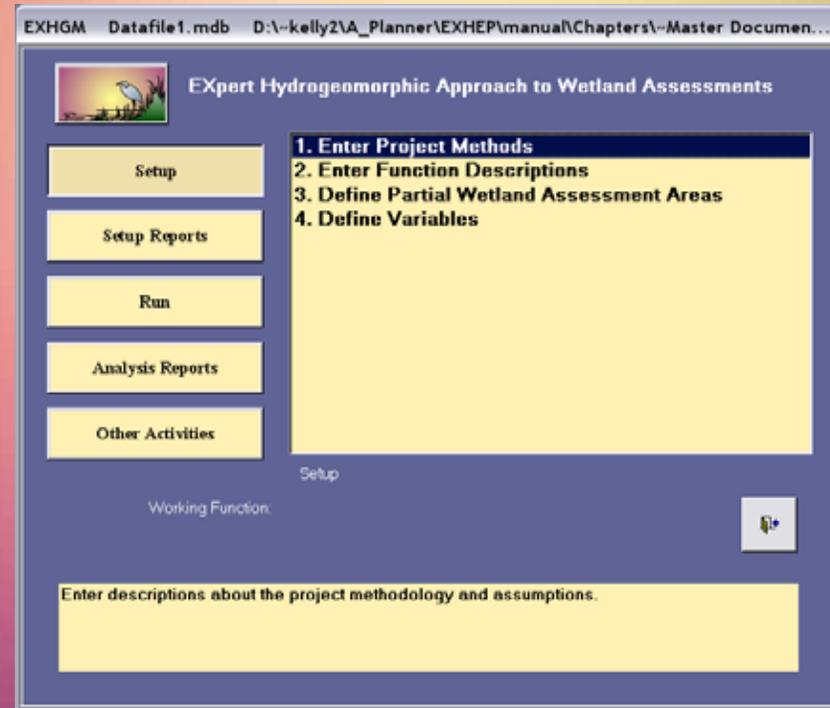
The sheer number of calculations necessary to conduct a HEP or HGM evaluation in a study necessitates the use of automated systems to complete the assessments in a timely manner.

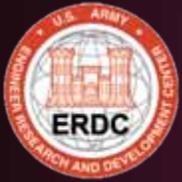
ERDC-EL has developed HEAT – Habitat Evaluation and Assessment Tools to address this need.

Currently comprised of two evaluation MS Access 2003 modules:

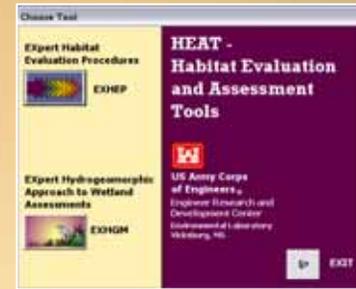
- **EXHEP: EXpert Habitat Evaluation Procedures, and**
- **EXHGM: EXpert Hydrogeomorphic Approach to Wetland Assessments**

The system provides a fully automated interface to facilitate simultaneous HEP and HGM assessments.





System Capabilities



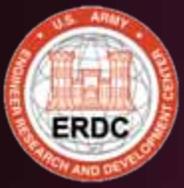
HEAT was designed to process large quantities of data quickly and efficiently, handling a large number of index models simultaneously.

Each model can incorporate any number of:

- **Cover types**
- **Variables**
- **Functions**
- **Target Years**

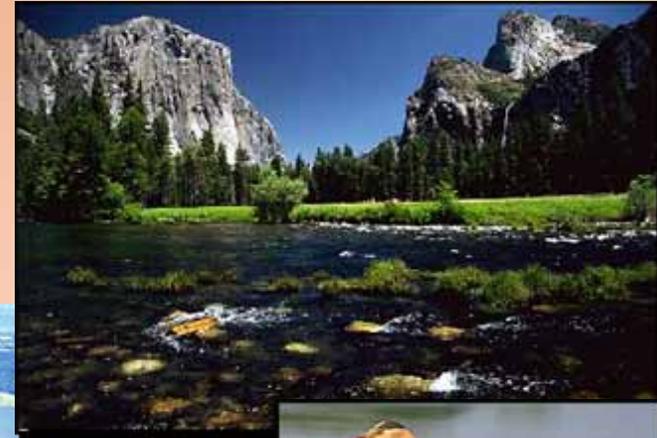
These capabilities support the examination of complex studies with large numbers of permutations.



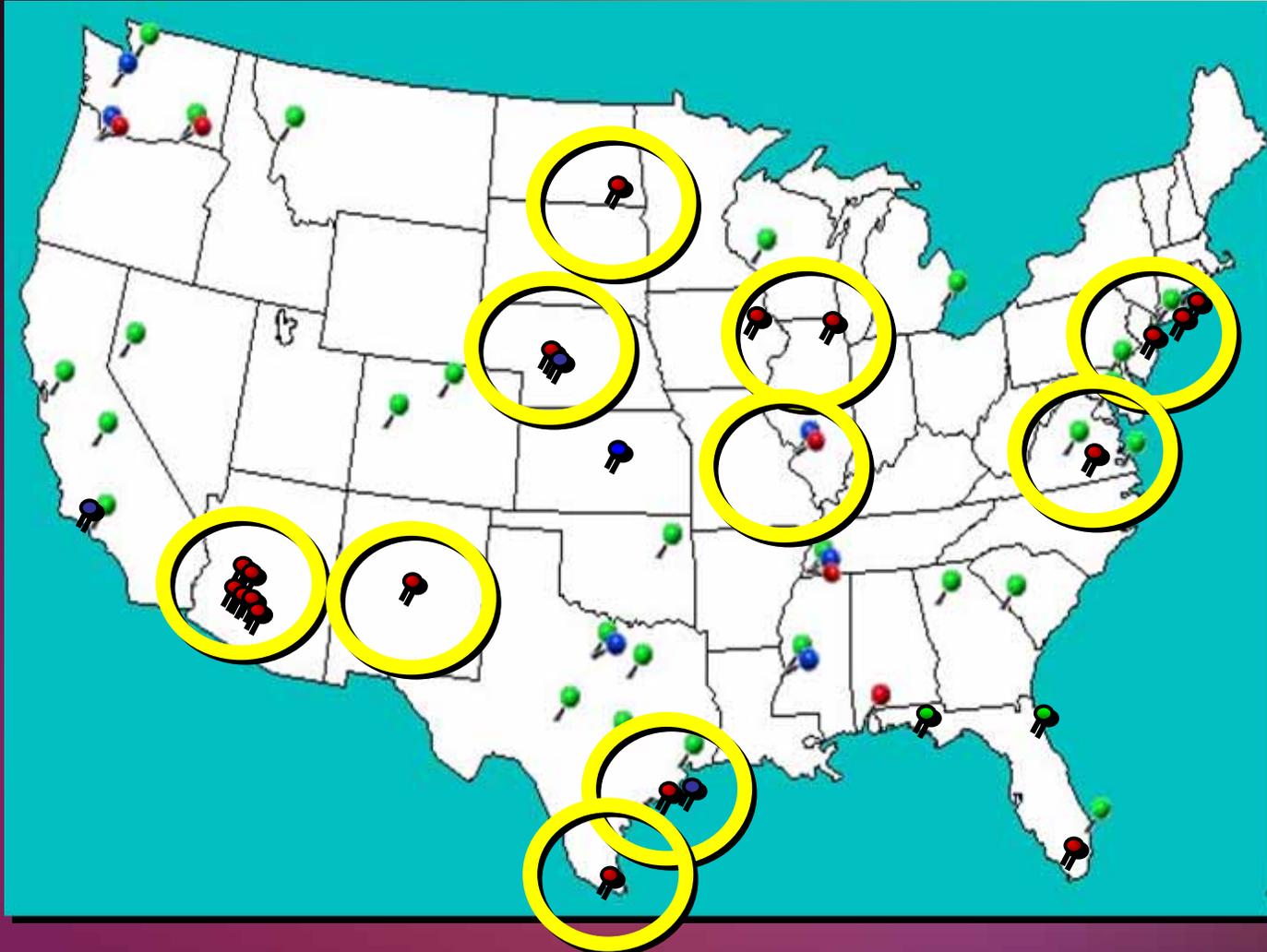


HEAT Applications

Developed to address any occasion, the HEAT tools can be used in restoration, planning & design, and any type of wetland impact assessments.



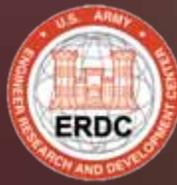
HEAT Applications Nationwide (1993 - Present)

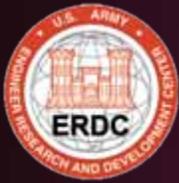


● Training (10)

● Case Studies (23)

● Technology Transfer (29)

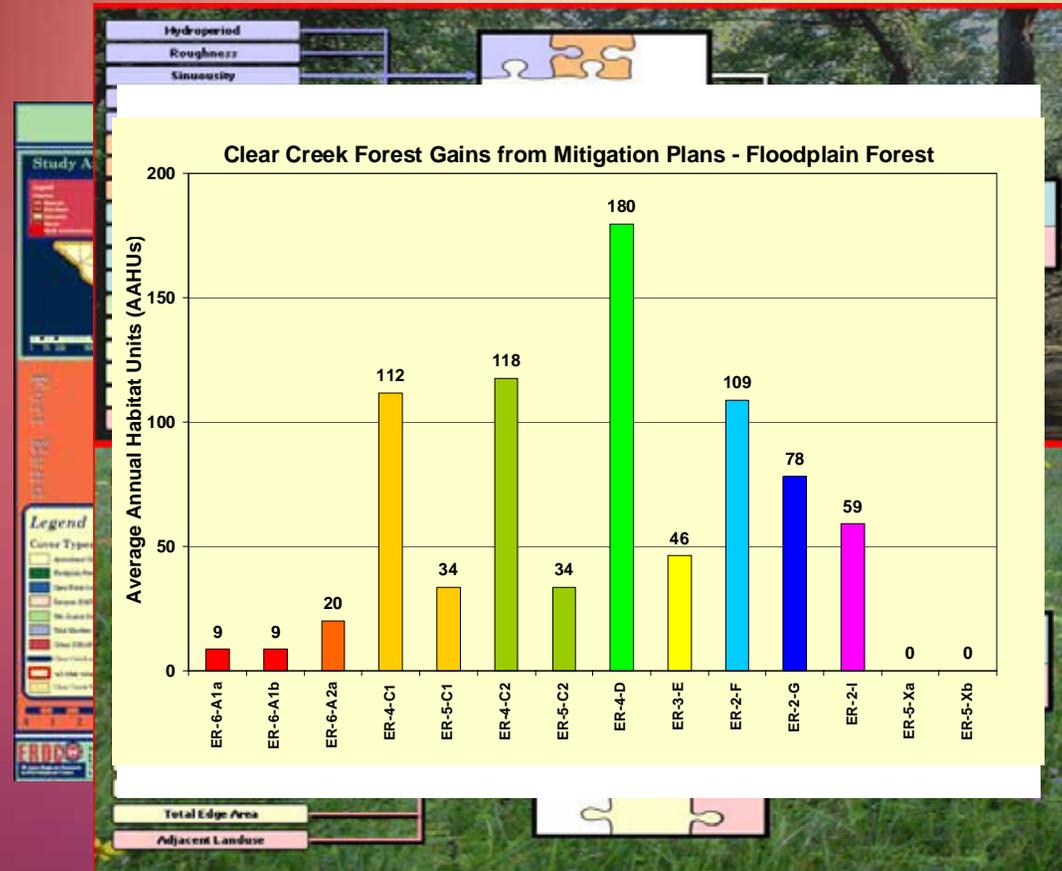


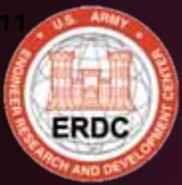


Clear Creek FDR Feasibility Study (Galveston District)



- Over the last 100 years, the cumulative effects of urban development along the Clear Creek (southern Texas) has led to substantial increases in flooding directly attributed to both the narrowing of the floodplain and the construction of buildings and infrastructure in the region's flood-prone areas.
- In 1999, the USACE Galveston District initiated a feasibility study to revise past efforts and formulate new solutions to address the Clear Creek problems, and contacted ERDC-ELin 2003 to assist in these endeavors using HEAT's EXHEP Module.
- 2 Community-based index models were developed and applied in the impact and mitigation assessments:
 - Floodplain Forest
 - Coastal Wet Prairie

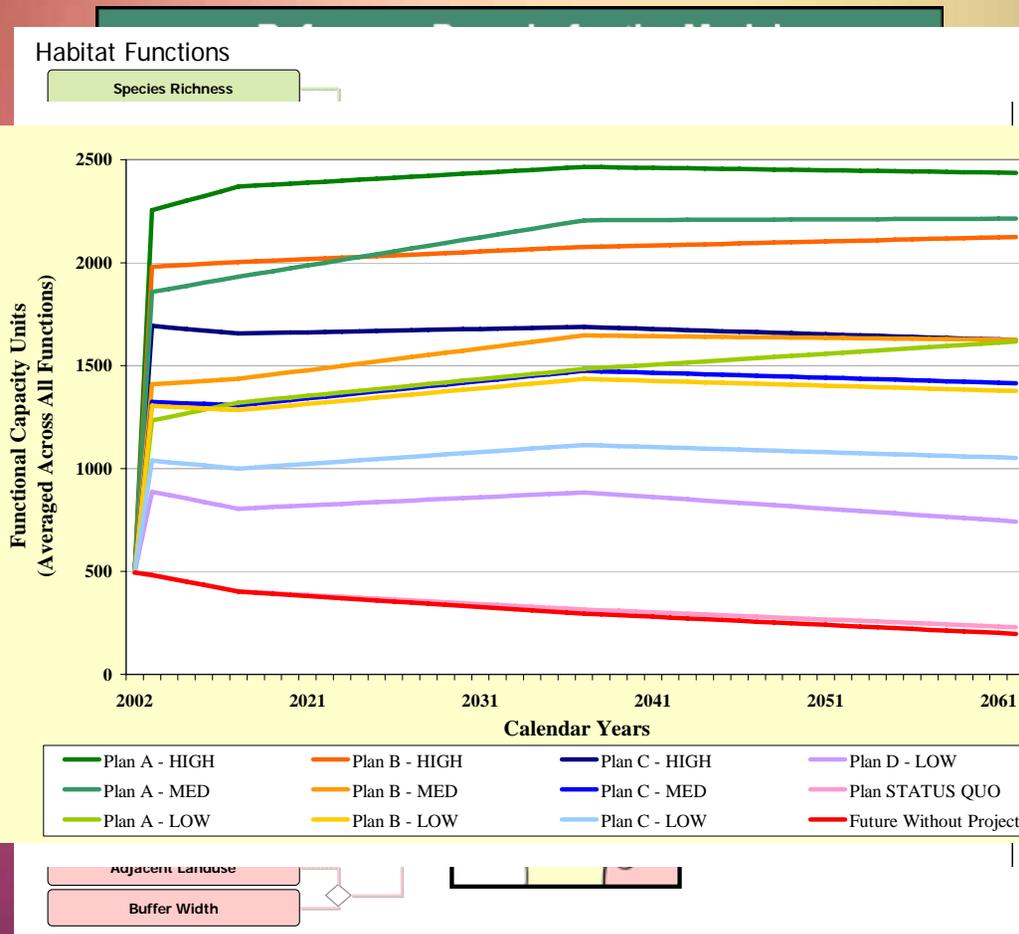


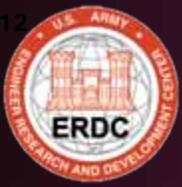


Arizona Feasibility Studies (Los Angeles District)



- Over the last century, Arizona's riverine wetlands have been exposed to significant anthropogenic pressures yielding highly degraded wetland ecosystems that today are poised on the brink of collapse.
- Between 2002 and 2009, the U.S. Army Corps of Engineers (USACE) (Los Angeles District, Phoenix Field Office) was authorized to study these critical ecosystems in 6 separate ecosystem restoration studies.
- They contacted ERDC-EL in 2002 to assist in these endeavors using HEAT
- 10 Functional Capacity Indices were developed and applied in the 6 individual ecosystem restoration assessments:
 - Maintenance of Characteristic Dynamics
 - Dynamic Surface Water Storage/Energy Dissipation
 - Long Term Surface Water Storage
 - Dynamic Subsurface Water Storage
 - Nutrient Cycling
 - Detention of Imported Elements and Compounds
 - Detention of Particles
 - Maintain Characteristic Plant Communities
 - Maintain Spatial Structure of Habitat
 - Maintain Interspersion and Connectivity

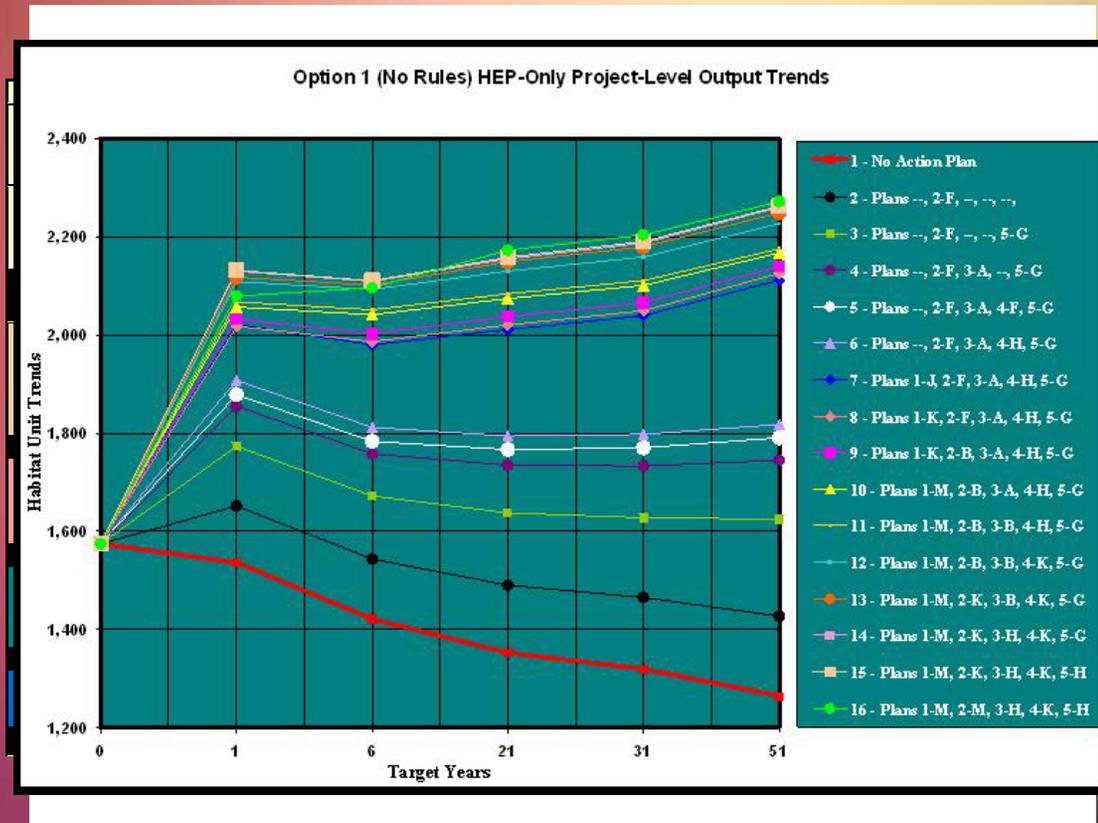




Middle Rio Grande Feasibility Study (Albuquerque District)



- Over the last century, the Middle Rio Grande was subjected to significant anthropogenic pressures producing a highly degraded ecosystem that today is poised on the brink of collapse.
- In 2002, the USACE Albuquerque District was authorized to conduct a Reconnaissance study focused on a 17-mile long stretch of the Rio Grande flowing through the city of Albuquerque, New Mexico.
- The District contacted ERDC-EL to help using the using HEAT's EXHEP Module.
- 1 model was developed and applied for the bosque riparian community

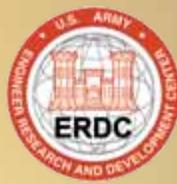


So how does it work?

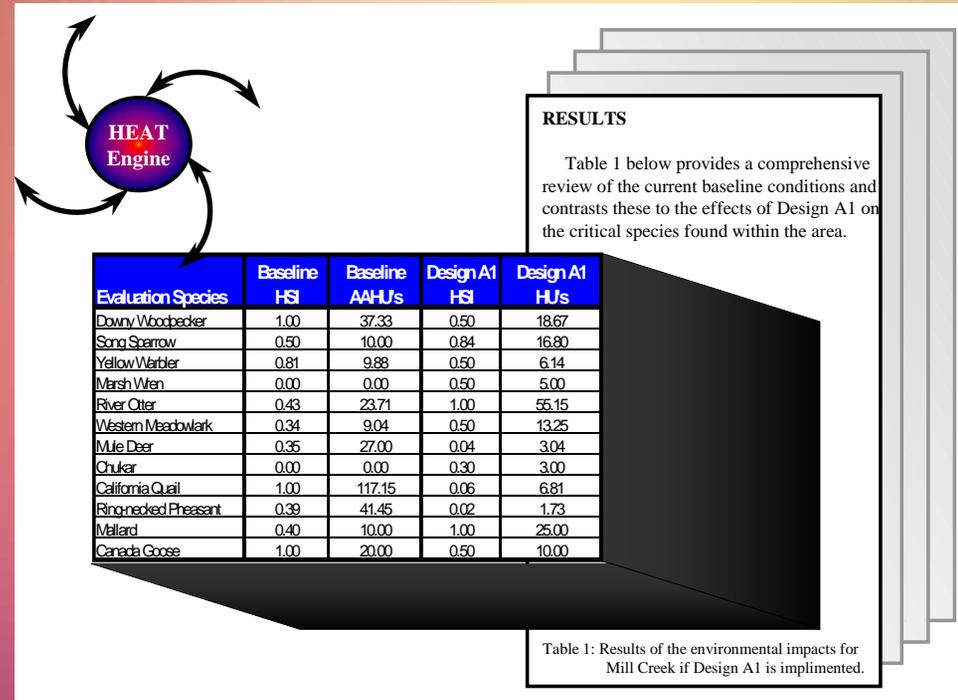


- **There are 12 steps to complete when applying HEP in an ecosystem evaluation.**
 - 1. Build a multi-disciplinary evaluation team.**
 - 2. Define the project.**
 - 3. Map the site's cover types or PWAAs.**
 - 4. Select, modify and/or create index model(s).**
 - 5. Conduct a baseline inventory.**
 - 6. Perform data management and statistical analyses.**
 - 7. Calculate baseline conditions.**
 - 8. Set goals and objectives, and establish the assessment's temporal scale.**
 - 9. Generate without-project conditions and calculate outputs.**
 - 10. Generate with-project conditions and calculate outputs.**
 - 11. Perform trade-offs.**
 - 12. Report the results of the analyses.**

So how does it work?



- Once a model or models have been selected/developed (Step 4), and the evaluation team has inventoried the site using the model's parameters (i.e., Step 5), it becomes necessary to generate outputs [Habitat Units (HUs)].
- It is at this point the HEAT software can be fully deployed. A series of steps have been devised to move through this process quickly and cleanly:
 1. Gather the pertinent information,
 2. Setup the models in EXHEP,
 3. Associate the models,
 4. Enter the baseline data and generate baseline results,
 5. Enter the without-project conditions and calculate the effects,
 6. Enter the with-project conditions and calculate the effects, and
 7. Recycle the datafile and evaluate alternative designs.



What to pull together



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, SI curves, HSI formulas, etc.) early on. The software can be setup incrementally as this information becomes available, but analysis cannot commence without these basics.

Component	Items	Example								
Evaluation Data										
	Target Years	Baseline, end of construction, and life of the project (including additional years when needed). Example: <table border="1"> <tr> <td>TY</td> <td>Calendar Year</td> </tr> <tr> <td>0</td> <td>2002</td> </tr> <tr> <td>1</td> <td>2003</td> </tr> <tr> <td>51</td> <td>2053</td> </tr> </table>	TY	Calendar Year	0	2002	1	2003	51	2053
TY	Calendar Year									
0	2002									
1	2003									
51	2053									
	Acres	Baseline acres per cover type Without-project acres per cover type With-project acres per cover type for each alternative								
	Variables	Baseline means/modes per cover type Without-project means/modes per cover type With-project means/modes per cover type for each alternative								

Component	Items	Example
Background Information		
	Project Name	Mill Creek Ecosystem Restoration Study
	Alternative Name	Design 1
	Methods	Model References and Support Documentation Model Modifications List of Evaluation Team Members Goals and Objectives Data Management Strategies Evaluation Strategies (including tradeoff approaches) Field Sampling Team and Metadata (include locations, assumptions, dates, etc.)
Model Specifics		
	Model(s) and Life Requisite Names	Species/Community and life requisites (both short-hand names or codes and detailed descriptions). Examples: Model: Slider Turtle Life Requisite: Food and Cover
	Cover Type(s)	Short-hand names or codes and detailed descriptions Examples: Deciduous Forested Wetlands Herbaceous Wetlands Freshwater Lakes Riverine Deciduous Scrub-Shrub Wetland
	Variables	Short-hand names or codes, detailed descriptions, sampling protocols, and data management (statistical) activities. Examples: Emergent and submerged vegetation Water depth Water regime Water temperature Velocity
	SI Curves	X,Y coordinates for all variables included in the model(s). For example: 0,0,2,90,1,100,1
	LRSI and HSI Formulas	Mathematical algorithms for each function in each wetland subclass. Example: $Index_{SliderTurtle} = \text{Minimum of } (LRSI_{FoodCover} \text{ OR } LRSI_{Wo} \text{ OR } LRSI_{WaterTemp})$

(Continued)

So how does it work?



Step 1: Model Setup

EXHEP Datafile1.mdb D:\~kelly2\A_Planner\EXHEP>manual\Chapters\~Master Document...



EXpert Habitat Evaluation Procedures

Single Formula Models

Setup Run

Analysis Reports

Multiple Formula Models

Setup Run

Analysis Reports

Setup Reports

Other Activities

1. Enter Project Methods

2. Enter Model Descriptions

3. Define Cover Types and Baseline Acres

4. Define Variables

Single Formula Model Setup

Working Single Formula Model: 

Working Multiple Formula Model:

Enter descriptions about the project methodology and assumptions.

How does it Work?



Step 1: Model Setup

EXHEP Datafile1.mdb D:\~kelly2\A_Planner\EXHEP>manual\Chapters\~Master Document...



EXpert Habitat Evaluation Procedures

Single Formula Models

Setup Run

Analysis Reports

Multiple Formula Models

Setup Run

Analysis Reports

Setup Reports

Other Activities

1. Enter Project Methods

2. Enter Model Descriptions

3. Define Cover Types and Baseline Acres

4. Define Variables

Single Formula Model Setup

Working Single Formula Model: 

Working Multiple Formula Model:

Enter descriptions about the project methodology and assumptions.



How does it Work?

Step 1: Model Setup

The screenshot shows a software window titled "Model Descriptions". It contains a table with two columns: "Identification Code" and "Model Name". The first row has the value "MARSHWREN" in the first column and "Marsh Wren" in the second. A second row is marked with an asterisk and is currently empty. The window has a "Close" button and a record navigation bar at the bottom showing "Record: 1 of 1".

Identification Code	Model Name
MARSHWREN	Marsh Wren
*	

How does it Work?

Step 2: Model Association

EXHEP Datafile3.mdb I:\-kelly2\A_Planner\EXHEP\manual\Chapters_-Master Docum...



EXpert Habitat Evaluation Procedures

1. Choose Working Model
- 2. Associate Parameters**
3. Enter SI Graphs and Variable Data
4. Perform Baseline (TY 0) Calculations*
5. Define Target Years
6. Enter Without-Project Acres
7. Enter Without-Project Projections*
8. Perform Without-Project Calculations*
9. Enter With-Project Acres
10. Enter With-Project Projections*
11. Perform With-Project Final Calculations*

Single Formula Models

Setup Run

Analysis Reports

Multiple Formula Models

Setup Run

Analysis Reports

Setup Reports

Other Activities

Single Formula Model Run

Working Single Formula Model: Marsh Wren

Working Multiple Formula Model:



Develop or review a model by associating these with relevant cover types and variables.

How does it Work?

Step 2: Model Association

Model Associations

Current Record: 2 Total Record Count: 2 Show/Hide Record List: Close

Working Model: MARSHWREN

Cover Type: NEWPALEMER

HSI Model Formula:

1*

Variables Available

7	8	9	/
4	5	6	*
1	2	3	-
0	.	+	^
MIN & MAX			
{	}	[]
()		

Delete

GROWFRM

CANWOOD

DEPTHWATER

WATERFRM

Model Associations

Current Record: 2 Total Record Count: 2 Show/Hide Record List: Close

Working Model: MARSHWREN

Cover Type: NEWPALEMER

HSI Model Formula:

1*[TYPGROWFRM]

How does it Work?

Step 3: Field Data Entry

EXHEP Datafile2.mdb I:\-kelly2\A_Planner\EXHEP\manual\Chapters\~Master Docum...

The logo for EXHEP, consisting of a series of colorful, overlapping chevron shapes pointing to the right in shades of purple, blue, green, and yellow.

EXpert Habitat Evaluation Procedures

1. Choose Working Model
2. Associate Parameters
- 3. Enter SI Graphs and Variable Data**
4. Perform Baseline (TY 0) Calculations*
5. Define Target Years
6. Enter Without-Project Acres
7. Enter Without-Project Projections*
8. Perform Without-Project Calculations*
9. Enter With-Project Acres
10. Enter With-Project Projections*
11. Perform With-Project Final Calculations*

Single Formula Models

Setup Run

Analysis Reports

Multiple Formula Models

Setup Run

Analysis Reports

Setup Reports

Other Activities

Multiple Formula Model Run

Working Single Formula Model:

Working Multiple Formula Model: Slider Turtle

A small icon of a hand with a blue arrow pointing to the right, typically used for help or navigation.

Variable Data and Suitability Index (SI) coordinates are entered here.

How does it Work?



Step 3: Field Data Entry

Step 1: Select Cover Types and Variable Combinations

Model: Marsh Wren

Cover Type: NEWPALEMER Newly Developed Palustrine Emergent Wetlands

Variable: CANEMERG Emergent Herbaceous Vegetation Canopy Cover (%)

CANEMERG	Emergent Herbaceous Vegetation Canopy Cover (%)
CANWOOD6	Percent Canopy Cover Of Woody Vegetation < 6m Tall (%)
DEPTHWATER	Average Water Depth (m)
TYPGROWFRM	Growth Form of Emergent Hydrophytes

Variable Data

Import Data

Export Data

Variable Data

0

Model Description
Marsh Wren

Cover Type Identification Code
NEWPALEMER

Variable Description
Emergent Herbaceous Vegetation Canopy Cover (%)

Graph Coordinates (X,Y):
0,0,50,0.1,80,1,100,1

Record: 1 of



How Does It Work?

Step 4: Calculate Baseline HUs

Click This Button Now

EXHEP Datafile2.mdb I:\-kelly2\A_Planner\EXHEP\manual\Chapters\1-Master Docum...

Expert Habitat Evaluation Procedures

1. Choose Working Model
2. Associate Parameters
- 3. Enter SI Graphs and Variable Data**
4. Perform Baseline (TY 0) Calculations*
5. Define Target Years
6. Enter Without-Project Acres
7. Enter Without-Project Projections*
8. Perform Without-Project Calculations*
9. Enter With-Project Acres
10. Enter With-Project Projections*
11. Perform With-Project Final Calculations*

Single Formula Model Run

Working Single Formula Model: Marsh Wren

Working Multiple Formula Model:

Variable Data and Suitability Index (SI) coordinates are entered here.



How Does It Work?

Step 5: Define & Calculate Without Project

EXHEP Datafile5.mdb I:\-kelly2A_Planner\EXHEP\manual\Chapters_-Master Docum...



EXpert Habitat Evaluation Procedures

- 1. Choose Working Model
- 2. Associate Parameters
- 3. Enter SI Graphs and Variable Data
- 4. Perform Baseline (TY 0) Calculations*
- 5. Define Target Years
- 6. Enter Without-Project Acres**
- 7. Enter Without-Project Projections*
- 8. Perform Without-Project Calculations*
- 9. Enter With-Project Acres
- 10. Enter With-Project Projections*
- 11. Perform With-Project Final Calculations*

Single Formula Models

Setup Run

Analysis Reports

Multiple Formula Models

Setup Run

Analysis Reports

Setup Reports

Other Activities

Single Formula Model Run

Working Single Formula Model: Marsh Wren

Working Multiple Formula Model:



Add and review Without-Project acres.



How Does It Work?

Step 5: Define & Calculate Without Project - Acres

Without-Project Acres

Identification Code	Cover Type (CT)	Without-Project Projections TY	Without-Project Projections Acres	Total Acres Per TY
				150.00
				0.00

Without-Project Acres

Identification Code	Cover Type (CT)	Without-Project Projections TY	Without-Project Projections Acres	Total Acres Per TY
				150.00
				0.00

- AGCROP Agricultural Croplands
- NEWPALEMER Newly Developed Palustrine Emergent Wetlands
- NEWPALSCRIB Newly Developed Palustrine Scrub-Shrub Wetlands
- PALEMERG Palustrine Emergent Wetlands
- PALSCRIBSHR Palustrine Scrub-Shrub Wetland
- RIVERINE Riverine

Without-Project Acres

Identification Code	Cover Type (CT)	Without-Project Projections TY	Without-Project Projections Acres	Total Acres Per TY
1	AGCROP	0	100	150.00
		1	0	0.00
		51	0	0.00

Close

How Does It Work?



Step 5: Define & Calculate Without Project - Variables

Describe Future Conditions

Without-Project Conditions

Cover Type:

Variable:

Model	Target Year	Baseline Mean	Mean	Factor
MARSHWREN	0	0	<input type="text" value="0"/>	<input type="text" value="1.00"/>
MARSHWREN	1	0	<input type="text" value="0"/>	<input type="text" value="1.00"/>
MARSHWREN	51	0	<input type="text" value="0"/>	<input type="text" value="1.00"/>

Is it OK to modify the data? No

Cannot modify TY0.

Enter Mean Values

How Does It Work?



Step 6: Define & Calculate With Project

Click This Button Now

The screenshot shows the EXHEP software interface. The title bar reads "EXHEP Datafile5.mdb I:\kelly\EA_Planner\EXHEP\manual\Chapters\ -Master Docum...". The main window has a purple background and contains the following elements:

- Single Formula Models:** Includes buttons for "Setup" and "Run", and a button for "Analysis Reports".
- Multiple Formula Models:** Includes buttons for "Setup" and "Run", and a button for "Analysis Reports".
- Other Activities:** Includes buttons for "Setup Reports" and "Other Activities".
- Expert Habitat Evaluation Procedures:** A list of 11 steps. Step 7, "Enter Without-Project Projections*", is highlighted in blue. An arrow points from the text "Click This Button Now" to this step.
- Working Single Formula Model:** A text field containing "Slider Turtle".
- Working Multiple Formula Model:** A text field containing "Slider Turtle".
- Multiple Formula Model Run:** A button with a right-pointing arrow and a plus sign.
- Instructional Text:** A yellow box at the bottom contains the text: "Enter the Without-Project projection values. Projections here should reflect anticipated changes in the variables under a 'No Action' plan or scenario. Changes can be attributed to factors such as vegetative succession or urban encroachment."



How Does It Work?

Step 7: Review & Report Results - Setup

EXHEP Datafile1.mdb D:\ARA Documents\Support Docs\Summary Spreadsheets\Slide...

 **EXpert Habitat Evaluation Procedures**

Single Formula Models

Setup **Run**

Analysis Reports

Multiple Formula Models

Setup **Run**

Analysis Reports

Setup Reports

Other Activities

Methods and Assumptions

- Model List - Single Formula Models
- Model List - Multiple Formula Models
- Life Requisites List
- Cover Types and Baseline (TY 0) Acres
- Variables List
- Formulas - Single Formula Models
- Formulas - Multiple Formula Models
- Associations - Single Formula Models
- Associations - Multiple Formula Models
- Suitability Index Curves - Single Formula Models
- Suitability Index Curves - Multiple Formula Models
- Variable Data - Single Formula Models

Setup Reports

Working Single Formula Model: 

Working Multiple Formula Model: 

List of Methods and Assumptions



How Does It Work?

Step 7: Review & Report Results - Analysis

EXHEP Datafile10.mdb I:\-kelly2\A_Planner\EXHEP\manual\Chapters_-Master Docu...



EXpert Habitat Evaluation Procedures

Single Formula Models

Setup Run

Analysis Reports

Multiple Formula Models

Setup Run

Analysis Reports

Setup Reports

Other Activities

Baseline (TY 0) Results

- Without-Project Projections**
- Without-Project Results
- With-Project Projections
- With-Project Results
- With- vs. Without-Project Results
- AAHU Summary
- Overall Net Results - All Models

Single Formula Model Analysis Reports

Working Single Formula Model: 

Working Multiple Formula Model: Slider Turtle

Without-Project Projection Summaries for the Working Single Formula Model

How Does It Work?



Step 7: Review & Report Results

Microsoft Access

Working Single Formula Model's Means and Future Factors - Without...

Mill Creek Ecosystem Restoration Study

Design 1

Means and Future Factors Without-Project Conditions

Model: Marsh Wren

Target Year: 0

Variable: CANEMERG

Graph Coordinates: 0,0,50,0,1,80,1,100,1

Cover Type Code	Baseline Mean	Future Factor	Projected Mean
EMERGENT	42.00	1.00	42.00
NEWEMERG	0.00	1.00	0.00
NEWSCRUB	0.00	1.00	0.00
SCRUBSCRUB	12.00	1.00	12.00

EXHEP Report Date: 8/4/2007 Time: 4:13 PM Page 1 of 7
 EXHEP Database: I:\Training\EXHEP\Exercise 7\Reports\Reports.mdb

Page: 1

Microsoft Access

Working Multi Formula Model's Means and Future Factors - Without ...

Mill Creek Ecosystem Restoration Study

Design 1

Means and Future Factors Without-Project Conditions

Model: Slider Turtle

Target Year: 0

Life Requisite: Food/Cover Component for Slider Turtle

Variable: CANSUBMERG

Graph Coordinates: 0,0,2,90,1,100,1

Cover Type Code	Baseline Mean	Future Factor	Projected Mean
NEWPALEMER	0.00	1.00	0.00
NEWPALECRB	0.00	1.00	0.00
PALEMER	54.00	1.00	54.00
PALECRB/SHR	24.00	1.00	24.00
RIVERINE	22.00	1.00	22.00

EXHEP Report Date: 8/4/2007 Time: 6:17 PM Page 1 of 12
 EXHEP Database: I:\ke/S/A_Planer/EXHEP/Manual/Chapters/Master Document and Chapters/Support Docs/Summary_Spreadsheet/Slider Turtle Data Files & Fields/4.Dead for 1.mdb

Page: 1

Other Features



EXHEP Datafile1.mdb D:\--kelly2\A_Planner\EXHEP>manual\Chapters\--Master Document...



EXpert Habitat Evaluation Procedures

Single Formula Models

Setup

Run

Analysis Reports

Multiple Formula Models

Setup

Run

Analysis Reports

Setup Reports

Other Activities

Rollback Current Datafile

Save Datafile Under New Name

Use Another Datafile

Compact Current Datafile

Clear Database Information

Other Activities

Working Single Formula Model:

Working Multiple Formula Model:



Rollback

Fast Keys – your best friend!

- **Ctrl + c** **Copy**
- **Ctrl + v** **Paste**
- **Ctrl + Enter** **Hard Return**
- **Ctrl + z** **Undo**
- **Esc** **HELP! GET ME OUTTA HERE!**



Support



Software

Demonstrations



On-Site Installation



Training Workshops



User Guides



On-Site Technical

Consultations



Website:

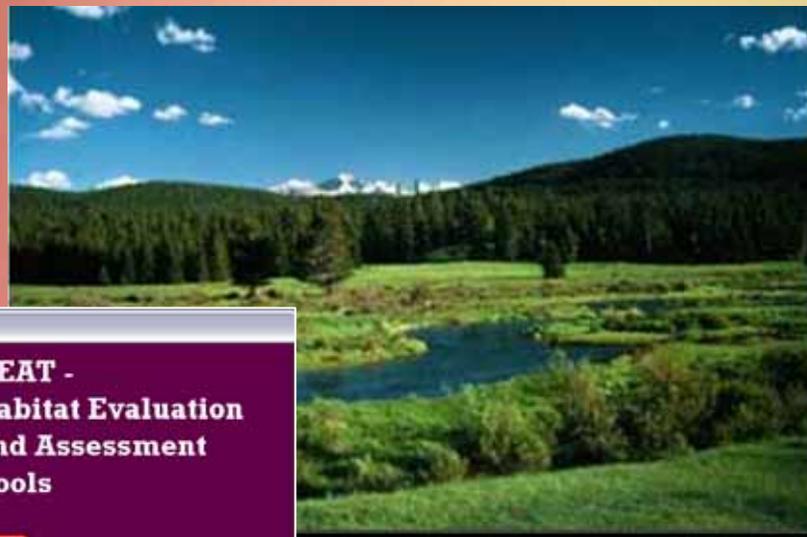
 <http://www.wes.army.mil/el/emrrp/analyt.html>



Summary

- ★ Flexible Programming - Interchangeable
- ★ Dynamic Linkages to Reports
- ★ Multiple Applications
- ★ Full Support Available





Choose Tool

<p>EXpert Habitat Evaluation Procedures</p>  <p>EXHEP</p>	<p>HEAT - Habitat Evaluation and Assessment Tools</p>  <p>US Army Corps of Engineers Engineer Research and Development Center Environmental Laboratory Vicksburg, MS</p>
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 EXIT

