

## **Appendix 3. Hydrologic Condition Assessment Tools—Module of Indicators for Roads Analysis (HCAT—MIRA)**

The Module of Indicators for Roads Analysis is a collection of GIS-based analytical tools to evaluate the aquatic, riparian zone, and water quality effects of road networks as part of roads analysis. It could serve as a mechanism to organize and distribute the various indicator tools that currently exist and are developed for roads analysis in the watershed disciplines (see appendix 2). It contains a graphical user interface that corresponds with the steps of roads analysis. It is built on the Arc Macro Language of ESRI ArcInfo, but contains programs and modules written in other programming languages including C. This module has been designed so that many of the programs can be distributed, used, and modified separately from the entire module. HCAT-MIRA development is presently in progress.

### **Background**

Geographic Information Systems (GIS) are an important tool for analysis of roads in the National Forests, but their value depends on several factors, including the user's:

- Knowledge of the problem to be solved in the context of spatial data;
- Understanding of the digital data available, including awareness of data limitations and attendant ramifications on the analysis results; and
- Familiarity with the necessary computer hardware and software;
- Knowledge of and access to existing tools that accomplish the task at hand with little or no modification.

In the context of GIS, these tools may take various forms, ranging from:

- General descriptions of similar problems and how they were approached; to
- A program written to perform a very specific analysis; to
- More complete programs written generically to perform similar analysis on different data sets; to
- Fully packaged programs with user interfaces to aid in use.

Without access to all available tools or awareness that they exist, much redundant time and effort is spent trying to figure out how to solve a particular spatial data problem using GIS.

With these facts in mind, the Module of Indicators for Road Analysis is being designed to meet multiple needs:

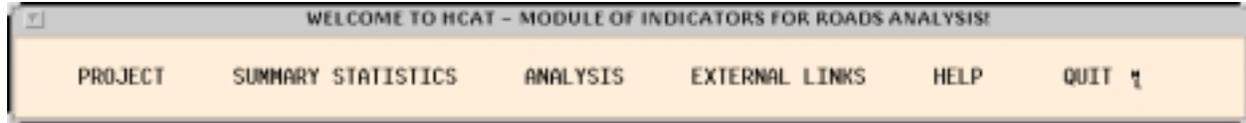
- Document and assemble pertinent information about the relevant data available for a given National Forest or other area of interest.
- Provide the analyst with easy-to-follow steps that correspond to those outlined in the Roads Analysis process, including: identifying data availability, quality, and needs; describing existing conditions; and performing analysis and sensitivity scenarios.
- Provide a mechanism to organize, maintain, and distribute available tools of use in the GIS-assisted analysis of aquatic, riparian zone, and water quality effects in Roads Analysis.

The intent is *not* to lock a user into a particular interface, but rather to provide an interface which *can* be used fully, but can also be used simply as a means of distributing tools of interest.

**Credits:** Judy Wartella, Stan Thiesen, and Mike Furniss designed this software. Judy Wartella did the programming.

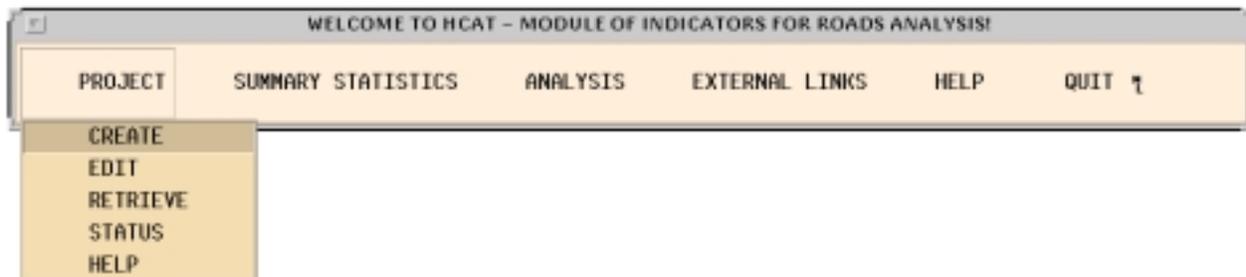
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## The HCAT—Module of Indicators for Road Analysis (under development)



The opening menu of the Roads Analysis module appears above. A sample of screen displays follow with brief descriptions of intended functions. Only the first level of pull-down menus are fully displayed here and most of the subsequent submenus are **not** shown.

### PROJECT



A **PROJECT** is defined as the assemblage of all data inputs to be used by this module in performing roads analysis tasks. All information known about the spatial data for a given area of interest is input here to **CREATE** a new project; updated to **EDIT** an existing project; or **RETRIEVED** for a new analysis session. A given project stores such information as names of spatial data themes with paths to where they reside, and database item names needed for analysis. Because many people may have institutional knowledge about different aspects of a Forest's digital data, a hard-copy worksheet will accompany the user manual; the worksheet can be completed before the user sits down at a computer to create a new project. All input information is saved under the project name and can be retrieved and edited in subsequent sessions. The **STATUS** option reports a listing of all currently available indicators that may be run, given the input project information, with limitations of the existing data for running particular indicators. The **PROJECT** option in the main menu equates to the "**Setting up the Analysis**" step of the Roads Analysis process. Below is an example of the first menu that appears after selecting the **CREATE** project option. Subsequent menus will follow after existing data is identified on this menu with pertinent questions about the digital data.

INPUT USER INFORMATION

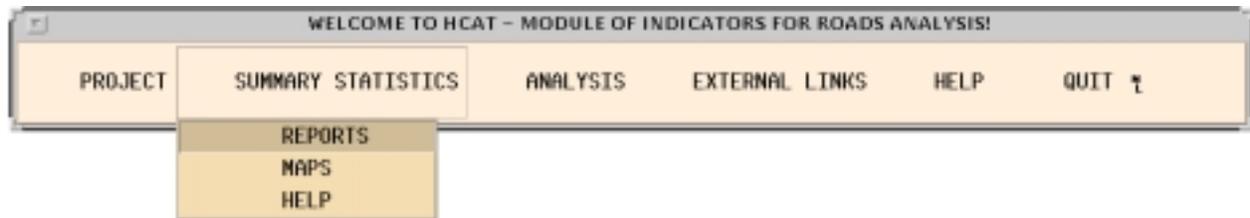
INDICATE UNITS OF PROJECTION OF ALL DATA:  METERS  FEET

INPUT NAME OF PROJECT:

CHECK THE FOLLOWING FOR WHICH  
DIGITAL DATA IS PRESENTLY AVAILABLE:

- ROADS
- STREAMS
- ROAD INVENTORY
- GEOLOGY
- QUATERNARY LANDSLIDES
- DIGITAL TERRAIN MODEL
- SOIL SURVEY
- VEGETATION
- TIMBER HARVEST HISTORY
- WILDLIFE HABITAT
- THREATENED & ENDANGERED SPECIES
- USFS BOUNDARY
- WATERSHED DIVIDES
- CONTOURS
- OTHER BOUNDARY

## SUMMARY STATISTICS



The **SUMMARY STATISTICS** menu option corresponds with the “**Describing the Situation**” step of the Roads Analysis. Multiple submenu options (not shown) appear that allow the user to choose report and map options, such as hydrographic area of interest and output units of measure. For example, the user may choose to display and provide summary reports for a particular watershed, forest, or district, chose to report information on a road-by-road basis, or both. In addition to ASCII reports, data base files of statistical output are produced for spreadsheet manipulation. Illustrative maps with AML code for ARCPLOT can be produced. An example of a possible road-by-road summary statistics report is shown on the next page.

**EXAMPLE OF POSSIBLE ROAD-BY-ROAD STATISTICAL SUMMARY OUTPUT:**

```

*****
                                Route No. 10N50
*****
Forest: Six Rivers NF   District: Orleans   Watershed: Red Cap Creek

Road Length:   1.41 miles   Maintenance level: Level 2   Surface: aggregate

Screening criteria: yes if >10% of road length in lower slope position
or >10% of road length on hillslopes greater than 50%.
                                Screen road for further review? NO

    Percent of road "connected":      50%

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Predicted Crossing Indicators
-----
    Count of predicted crossings: 3      Predicted crossings/mile: 2.1

    By Strahler order: -
    First: 3      Second: 0      Third: 0      Fourth:0      Fifth: 0

    By slope position:  Upper: 1   Middle: 2   Lower: 0   Weighted Value: 1.67

    Estimated Volume (cubic yds) of predicted crossings: 567   Volume/mile: 402

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Inventoried Crossing Indicators
-----
    Count of inventoried crossings: Not inventoried

    By slope position:  Upper:      Middle:      Lower:      Weighted Value:

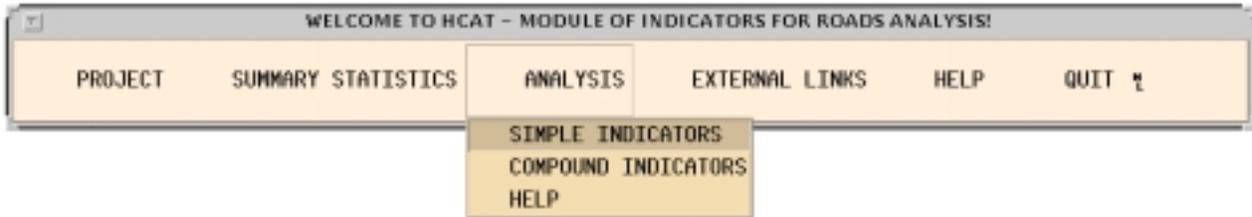
    Total Volume (cubic yds) of inventoried crossings:      Volume/mile:

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Mass Wasting Indicators
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    Geologic units:      87% Intermediate Sedimentary
                        13% Intermediate Igneous

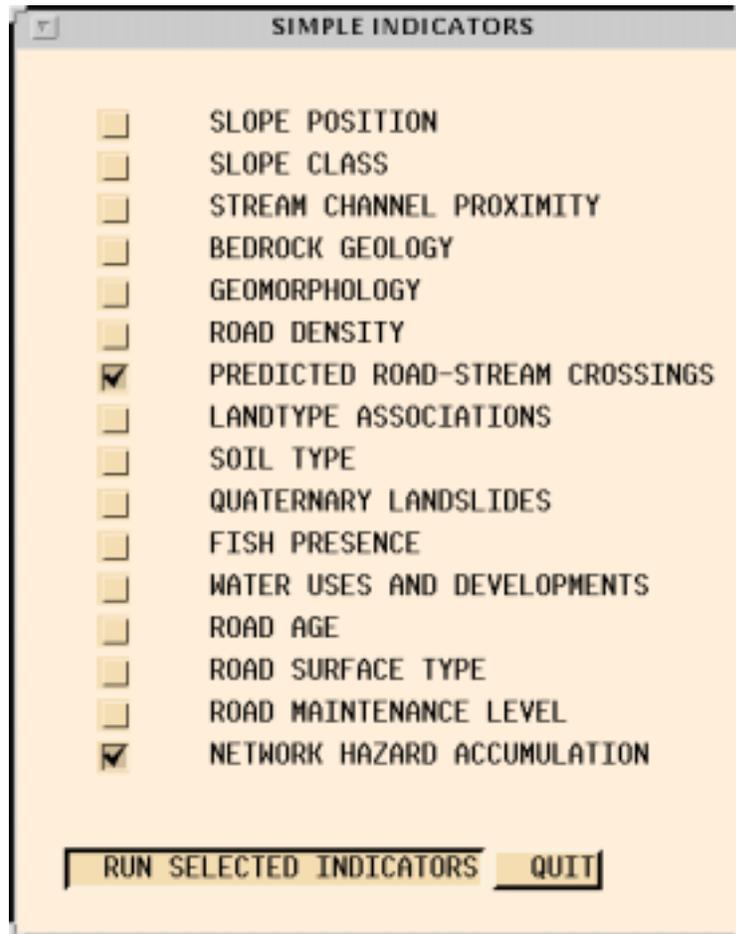
    Slope Classification:  0-30%: 40%      >31-50%: 54%      >50%: 6%
    Slope Position:      Upper: 43%      Middle: 56%      Lower: 2%
    Aspect:              South: 51%      North: 49%
    Elevation Range:     1250 - 2303 feet

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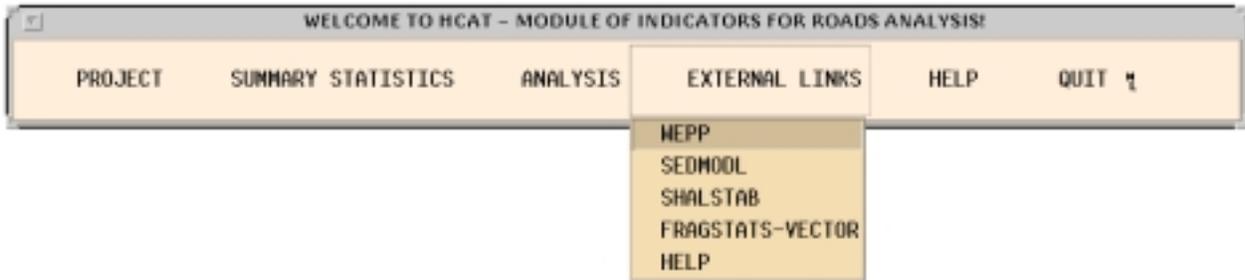
## ANALYSIS



The **ANALYSIS** menu option allows the user to choose specific indicators to run, with submenu options (not shown) for running sensitivity analysis. A map-making option may be incorporated to support display of results. The **SIMPLE INDICATORS** menu is shown below:

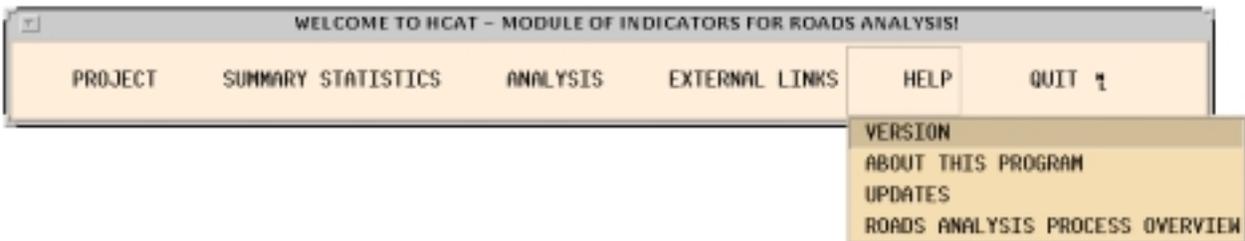


## EXTERNAL LINKS



This option provides access to non-proprietary models, programs, and code that may be useful in Road Analysis. References and linkages are provided for further information on use and interpretation of specific programs.

## HELP



The **HELP** option provides general information about the module, including the current **VERSION** of the program with lists of currently available indicator tools and a cross-reference for accessing and distributing them individually; plus information **ABOUT THIS PROGRAM** including hardware and software requirements and program organization. **UPDATES** will provide users with instructions for updating an older version of the module, and the **ROADS ANALYSIS PROCESS OVERVIEW** option indicates which indicators may support the analyst in answering specific questions as outlined in the Roads Analysis procedure.

**QUIT ends the current session.**

## **Future Direction**

The Module of Indicators for Roads Analysis is currently a work-in-progress and will continue to be developed as beta users provide feedback on their needs. As existing tools are enhanced or as new tools are developed, they can be incorporated into this module and distributed and accessed by users. Additional modules may be added to assist with other aspects of Hydrologic Condition Assessment.

## **Recommended Reference:**

McCammon, B.P.; Rector, J.R.; Gebhardt, K. 1998 A framework for analyzing the hydrologic condition of watersheds. Denver, CO: USDA Forest Service and USDI Bureau of Land Management. 40 p. *www.stream.fs.fed.us*