The i_SWAT Software Package: A Tool for Supporting SWAT Watershed Applications

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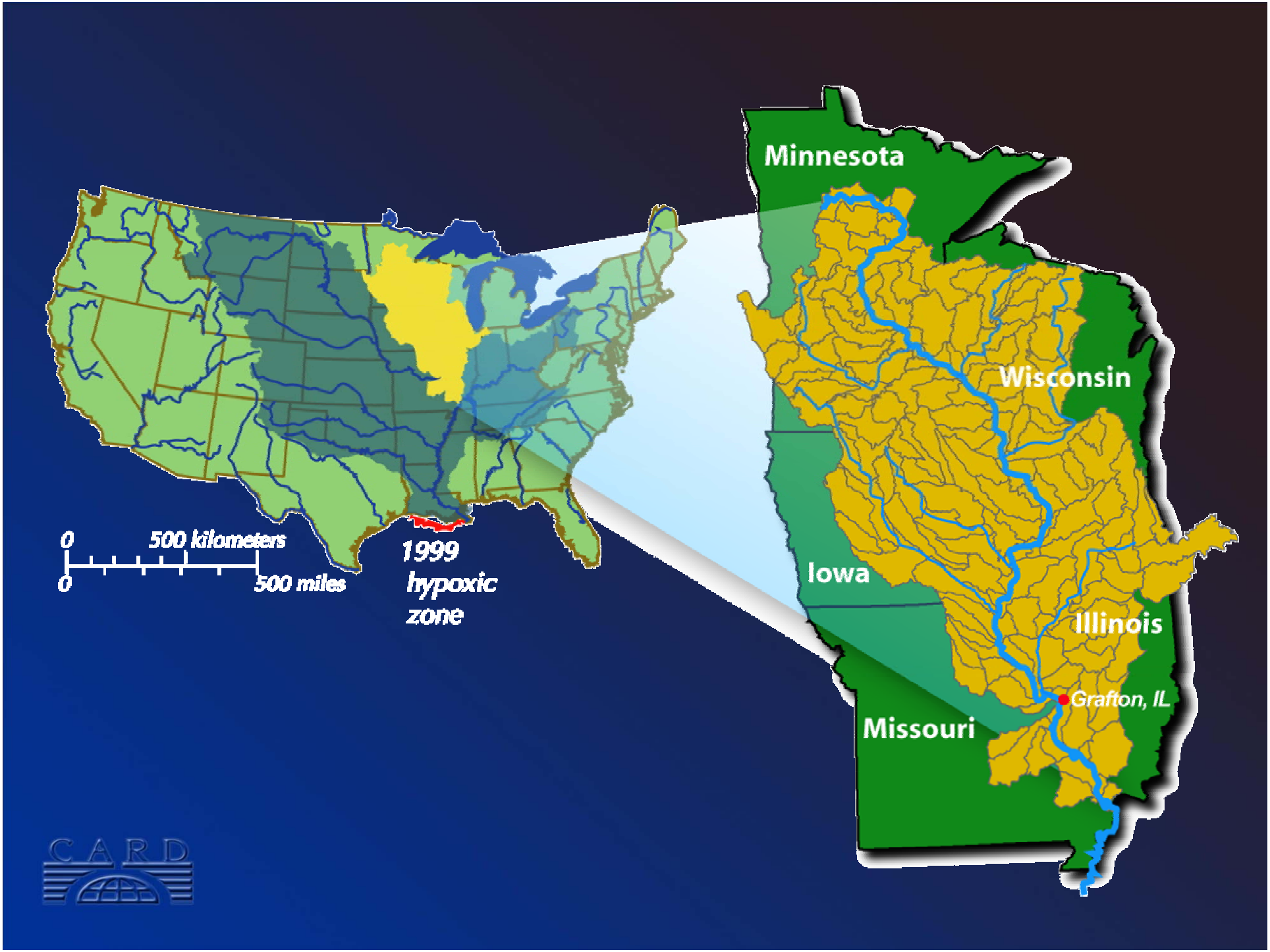
UMRB Initiative

- Upper Mississippi River Basin (UMRB)
  - drainage area covers 480,000 km^2
  - stream segments impacted by nutrients, sediments and other pollutants (TMDLS)
  - Gulf of Mexico seasonal hypoxic zone
- SWAT modeling study has been initiated to address these issues


Minnesota
Wisconsin
Iowa
Illinois
Missouri
Grafton, IL
0
500 kilometers
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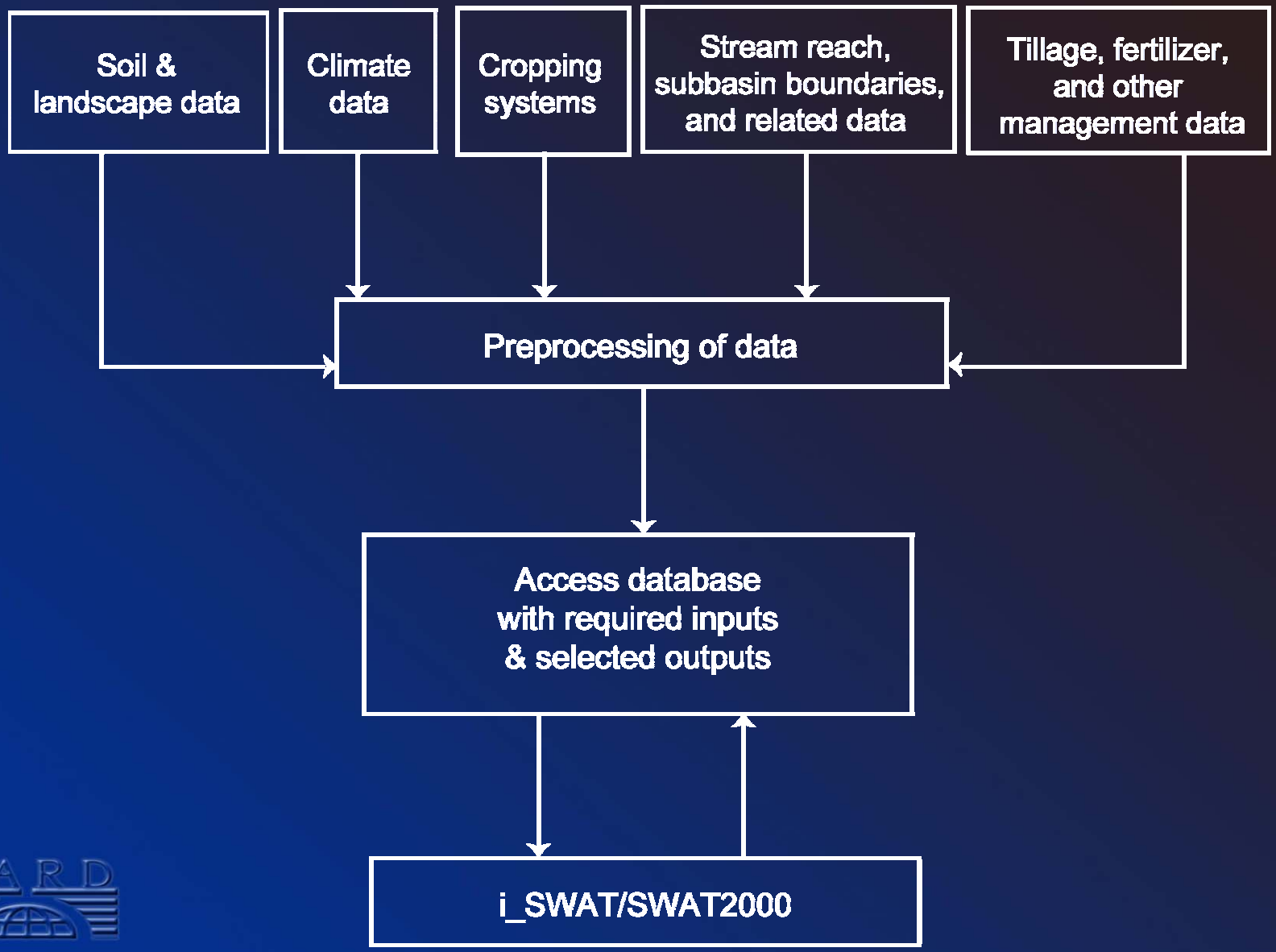
500 miles
1999
hypoxic
zone
CARD

NRI Database

- National Resources Inventory (NRI)
  - USDA-NRCS national statistical survey (~1 million “points”)
  - collected every 5 years between 1982-97
  - comprehensive cropping history (rotations) & other landuse, conservation practices, and other data
- Non-GIS based
  - coordinates not available to the public
  - AVSWAT approach could not be used
  - led to creation of interactive SWAT (i_SWAT) software

Schematic of i_SWAT System



Developer's Page - Netscape

File Edit View Go Bookmarks Tools Window Help

http://www.public.iastate.edu/~elvis/ Search

Home Radio Netscape Search Shop Bookmarks

Developer's Page

Todd Campbell

Ongoing Work:

- i_EPIC - EPIC model control system for Windows
- i_CENTURY - CENTURY model control system for Windows
- i_SWAT
- CARD's Interactive LDP Database
- Challenge Environmental Systems

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Ames, IA 50010
515 294-9677

Links:

- Weather.com: 50014

CARD

Start Developer's Page - Ne... gassman iswat bari prese... 9:52 AM

i_SWAT

SWAT Home Page at Blacklands Research Center

Operation Diagram:

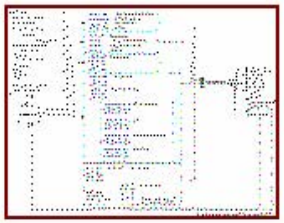
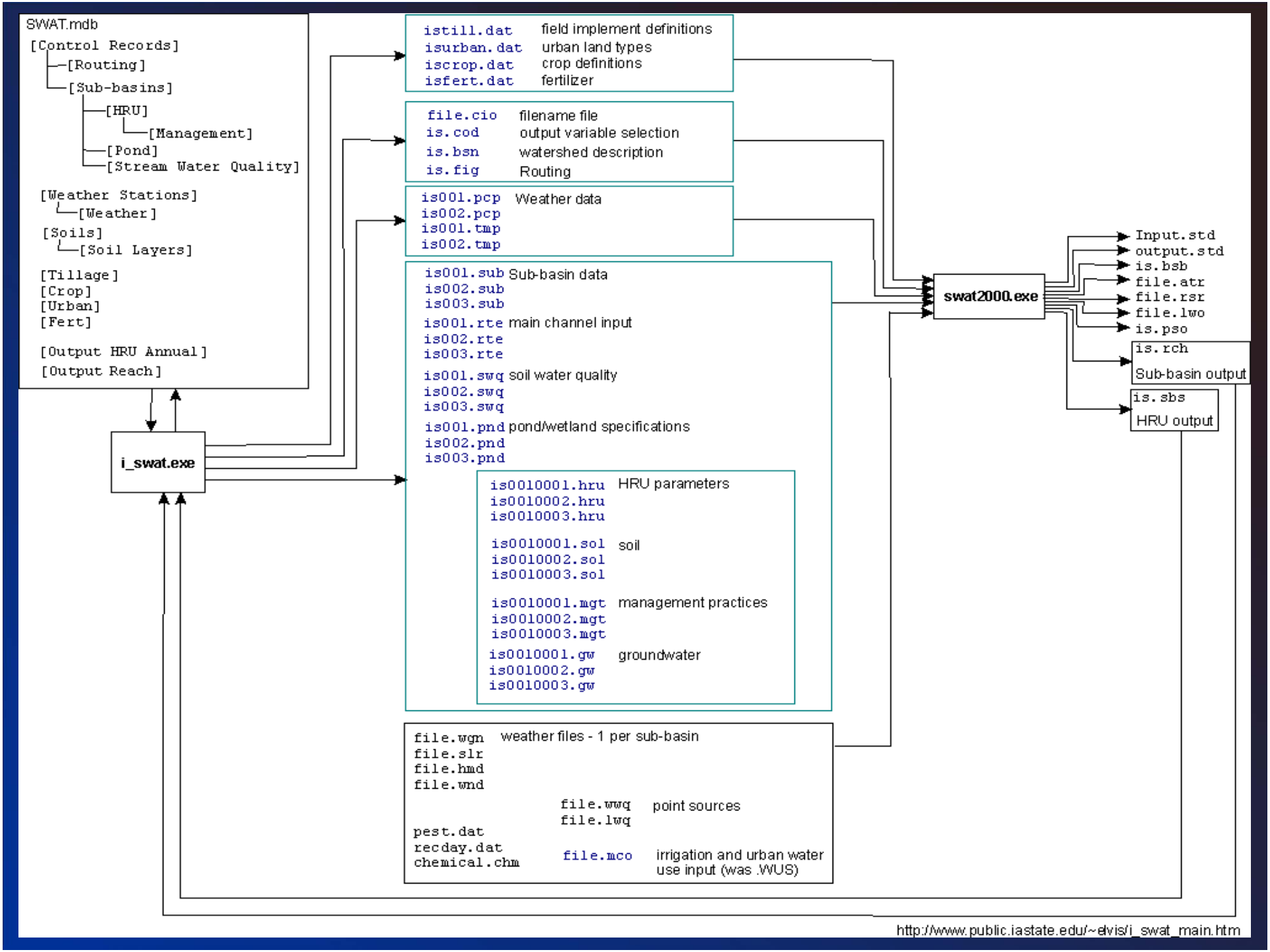
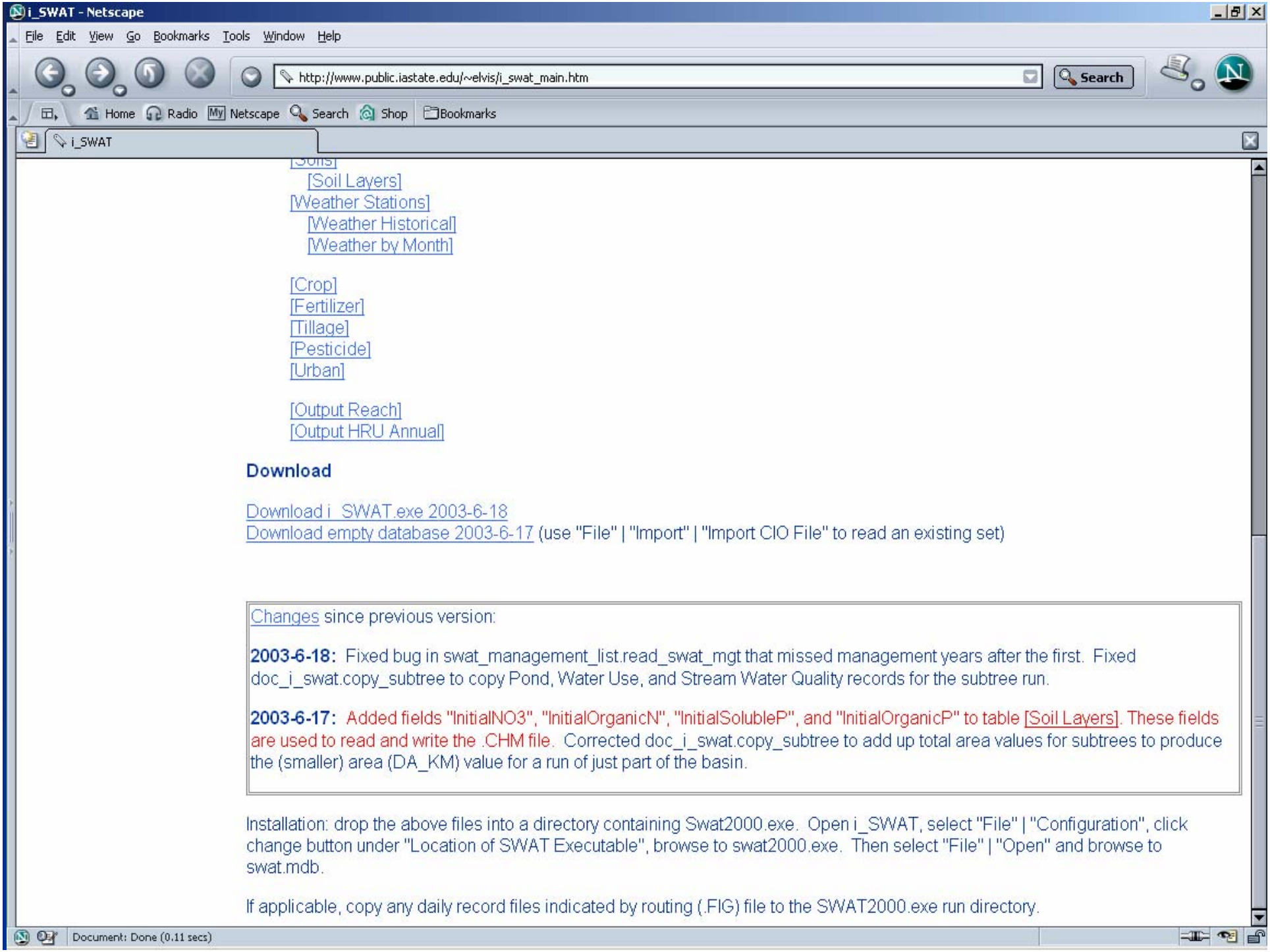


Table Structures:


SWAT.mdb
[Control Records]
[Routing]
[Sub-basins]
[HRU]
[Management]
[Pond]
[Stream Water Quality]
[Weather Stations]
[Weather]
[Soils]
[Soil Layers]
[Tillage]
[Crop]
[Urban]
[Fert]
[Output HRU Annual]
[Output Reach]
i_swat.exe
istill.dat field implement definitions
isurban.dat urban land types
iscrop.dat crop definitions
isfert.dat fertilizer
file.cio filename file
is.cod output variable selection
is.bsn watershed description
is.fig Routing
is001.pcp Weather data
is002.pcp
is001.tmp
is002.tmp
is001.sub Sub-basin data
is002.sub
is003.sub
is001.rte main channel input
is002.rte
is003.rte
is001.swq soil water quality
is002.swq
is003.swq
is001.pnd pond/wetland specifications
is002.pnd
is003.pnd
is0010001.hru HRU parameters
is0010002.hru
is0010003.hru
is0010001.sol soil
is0010002.sol
is0010003.sol
is0010001.mgt management practices
is0010002.mgt
is0010003.mgt
is0010001.gw groundwater
is0010002.gw
is0010003.gw
file.wgn weather files - 1 per sub-basin
file.slr
file.hmd
file.wnd
file.wwq point sources
file.lwq
pest.dat
recday.dat
chemical.chm
file.mco irrigation and urban water use input (was .WUS)
swat2000.exe
Input.std
output.std
is.bsb
file.atr
file.rsr
file.lwo
is.pso
is.rch
Sub-basin output
is.sbs
HRU output
http://www.public.iastate.edu/~elvis/i_swat_main.htm


i_SWAT - Netscape
File Edit View Go Bookmarks Tools Window Help
http://www.public.iastate.edu/~elvis/i_swat_main.htm
Search
Home Radio Netscape Search Shop Bookmarks
i_SWAT
[Soils]
[Soil Layers]
[Weather Stations]
[Weather Historical]
[Weather by Month]
[Crop]
[Fertilizer]
[Tillage]
[Pesticide]
[Urban]
[Output Reach]
[Output HRU Annual]
Download
Download i_SWAT.exe 2003-6-18
Download empty database 2003-6-17 (use "File" | "Import" | "Import CIO File" to read an existing set)
Changes since previous version:
2003-6-18: Fixed bug in swat_management_list.read_swat_mgt that missed management years after the first. Fixed doc_i_swat.copy_subtree to copy Pond, Water Use, and Stream Water Quality records for the subtree run.
2003-6-17: Added fields "InitialNO3", "InitialOrganicN", "InitialSolubleP", and "InitialOrganicP" to table [Soil Layers]. These fields are used to read and write the .CHM file. Corrected doc_i_swat.copy_subtree to add up total area values for subtrees to produce the (smaller) area (DA_KM) value for a run of just part of the basin.
Installation: drop the above files into a directory containing Swat2000.exe. Open i_SWAT, select "File" | "Configuration", click change button under "Location of SWAT Executable", browse to swat2000.exe. Then select "File" | "Open" and browse to swat.mdb.
If applicable, copy any daily record files indicated by routing (.FIG) file to the SWAT2000.exe run directory.
Document: Done (0.11 secs)

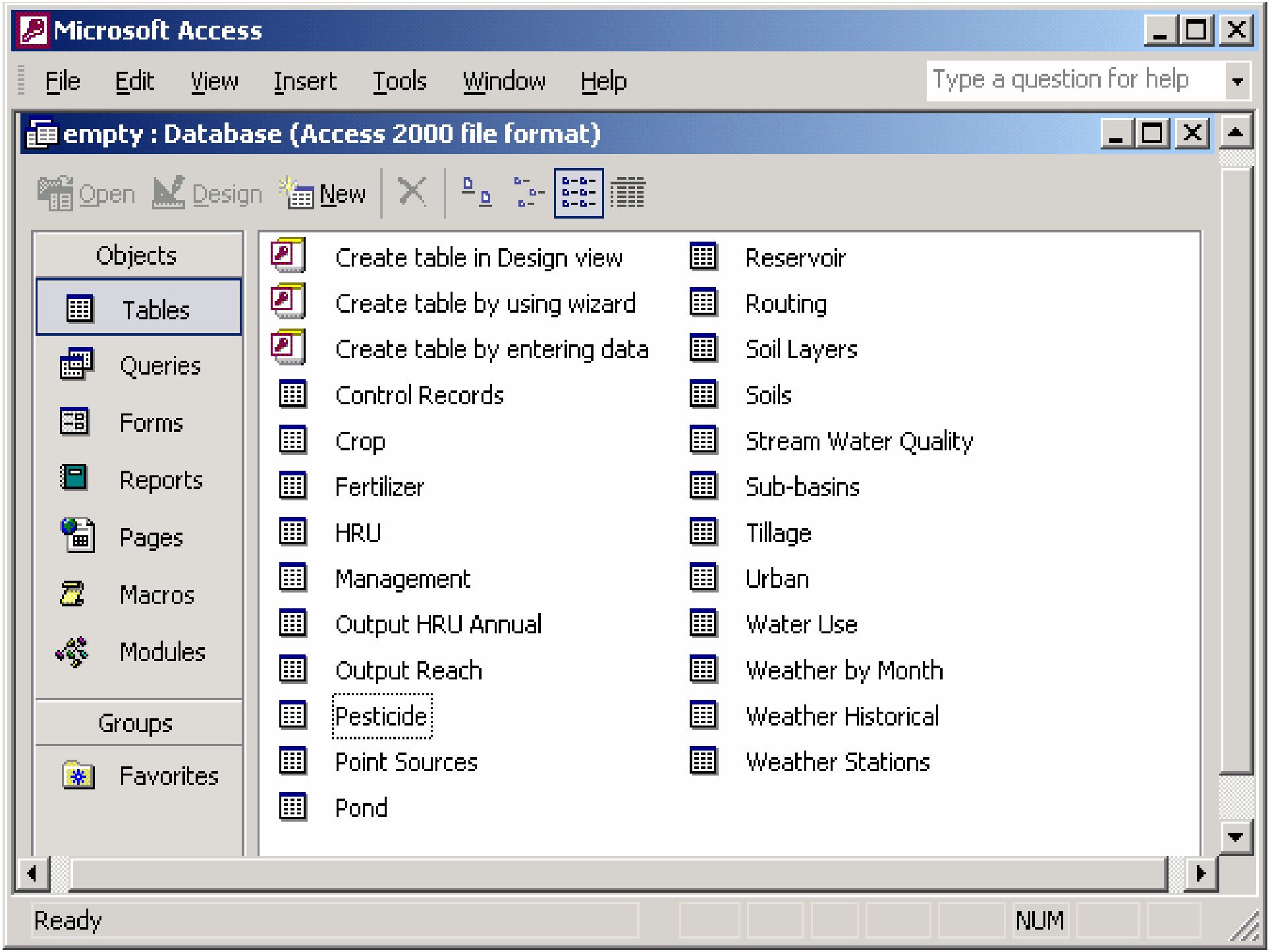
Access Database/SWAT Files

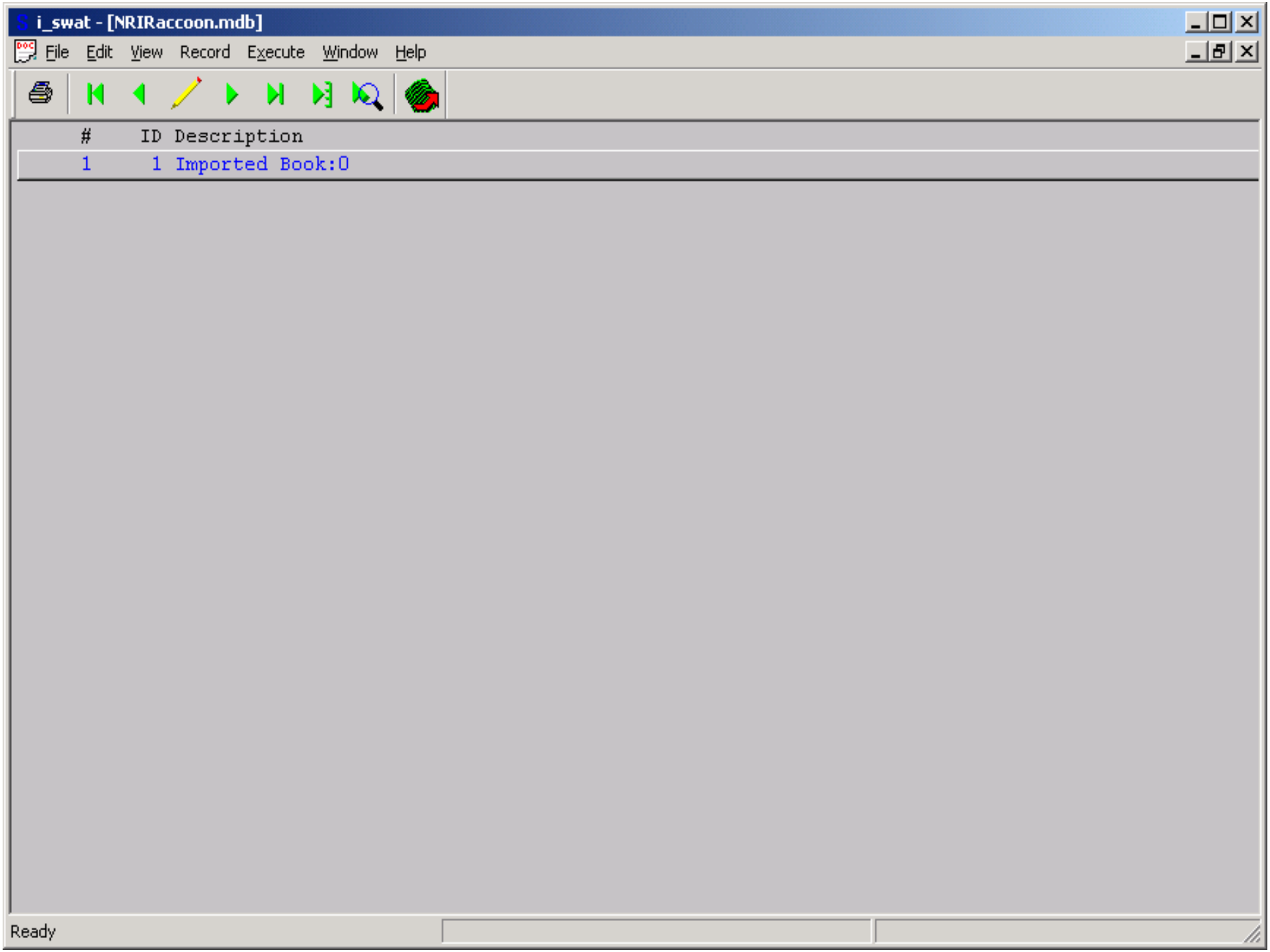
- Currently 23 tables in database
  - 19 for input data → 24 SWAT input files
  - 2 for output data
    - output currently only extracted from .rch file
    - HRU output table under development
  - 1 help text table (under development)

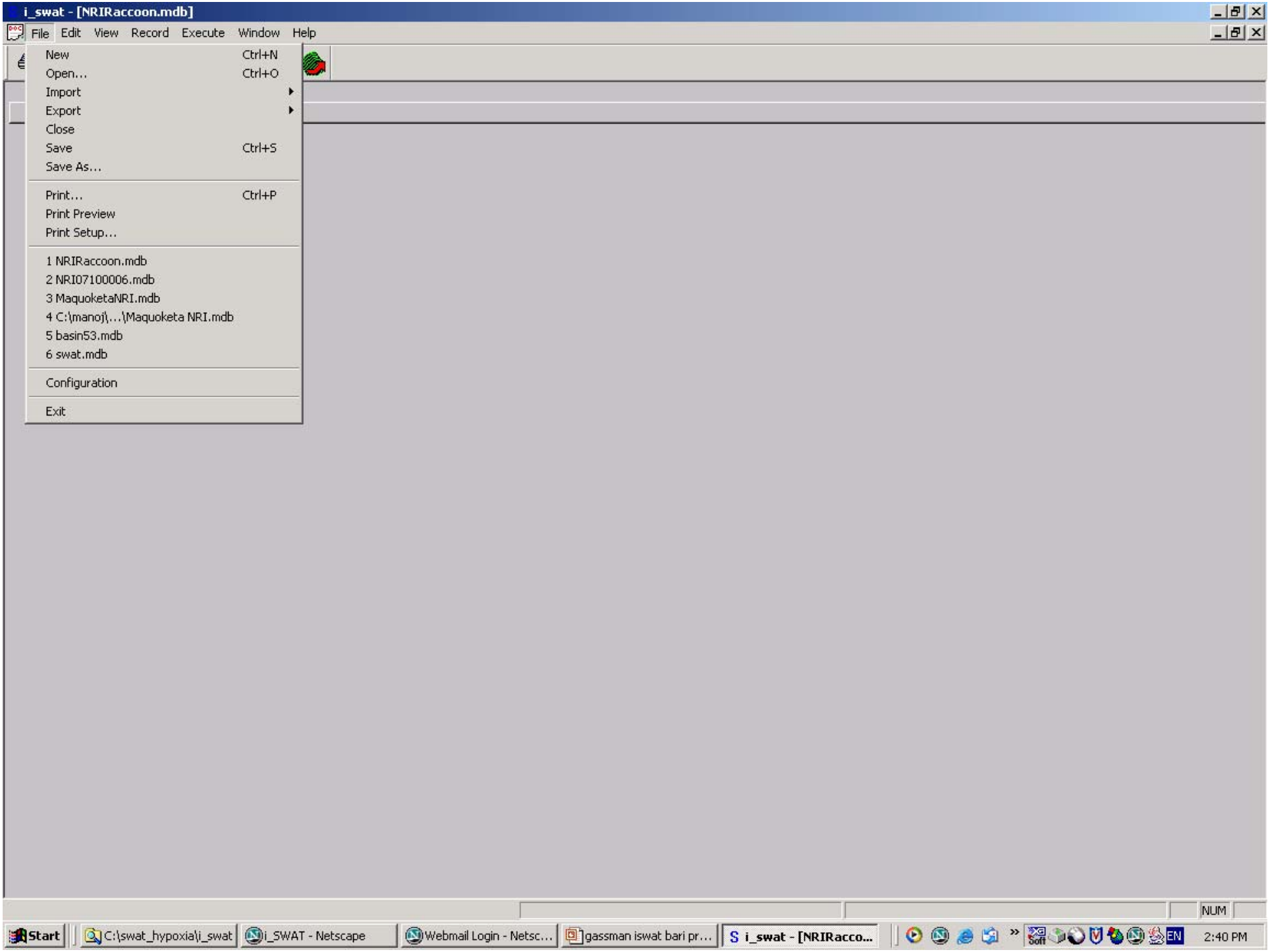
- file.cio is created when i_SWAT is executed

Access Database/SWAT Files

- 9 SWAT files currently not supported
  - listed in paper
  - not needed for the UMRB simulation
  - have to be in swat2000.exe run directory if needed for application
- .chm file now partially supported
  - initial soil NO_3-N, org. N, soluble P, & org. P concs.


Microsoft Access
File Edit View Insert Tools Window Help
Type a question for help
empty : Database (Access 2000 file format)
Open Design New
Objects
Tables
Queries
Forms
Reports
Pages
Macros
Modules
Groups
Favorites
Create table in Design view
Create table by using wizard
Create table by entering data
Control Records
Crop
Fertilizer
HRU
Management
Output HRU Annual
Output Reach
Pesticide
Point Sources
Pond
Reservoir
Routing
Soil Layers
Soils
Stream Water Quality
Sub-basins
Tillage
Urban
Water Use
Weather by Month
Weather Historical
Weather Stations
Ready
NUM


i_swat - [NRIRaccoon.mdb]
File Edit View Record Execute Window Help
ID Description
1 1 Imported Book:0
Ready


i_swat - [NRIRaccoon.mdb]
File Edit View Record Execute Window Help
New Ctrl+N
Open... Ctrl+O
Import
Export
Close
Save Ctrl+S
Save As...
Print... Ctrl+P
Print Preview
Print Setup...
1 NRIRaccoon.mdb
2 NRI07100006.mdb
3 MaquoketaNRI.mdb
4 C:\manoj\...\Maquoketa NRI.mdb
5 basin53.mdb
6 swat.mdb
Configuration
Exit
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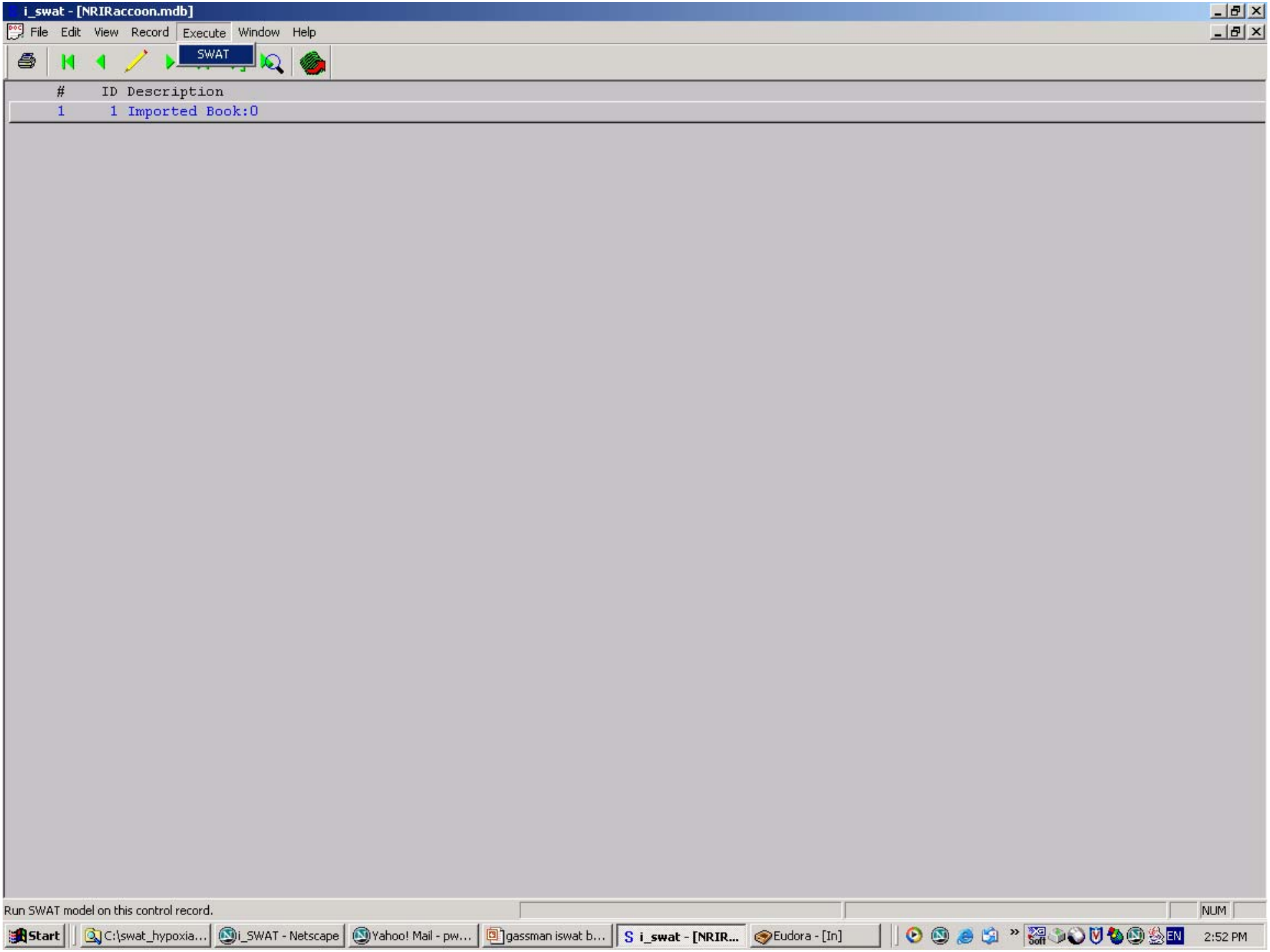
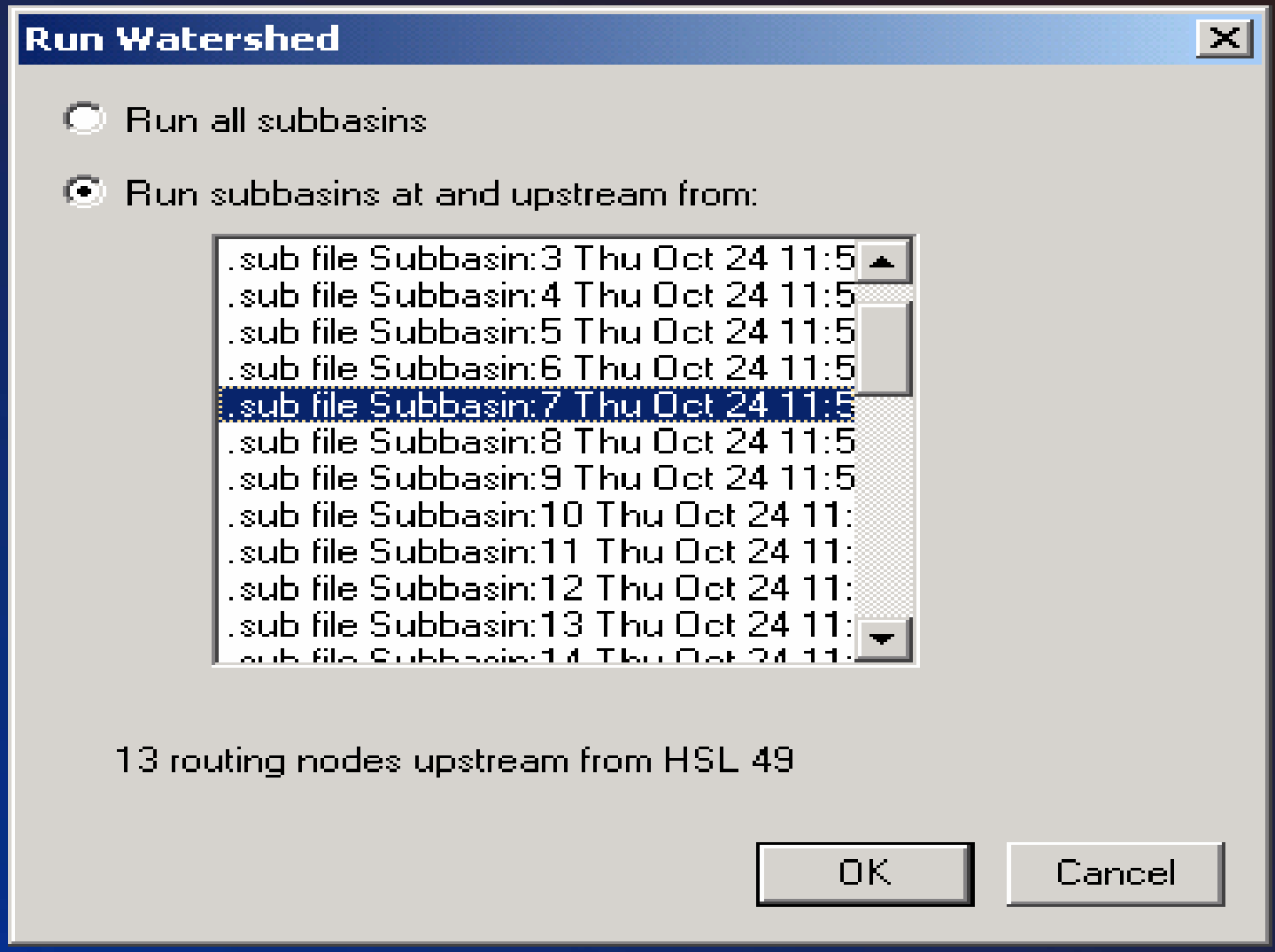
i_swat - [NRIRacco...
2:40 PM

i_SWAT Execution Options

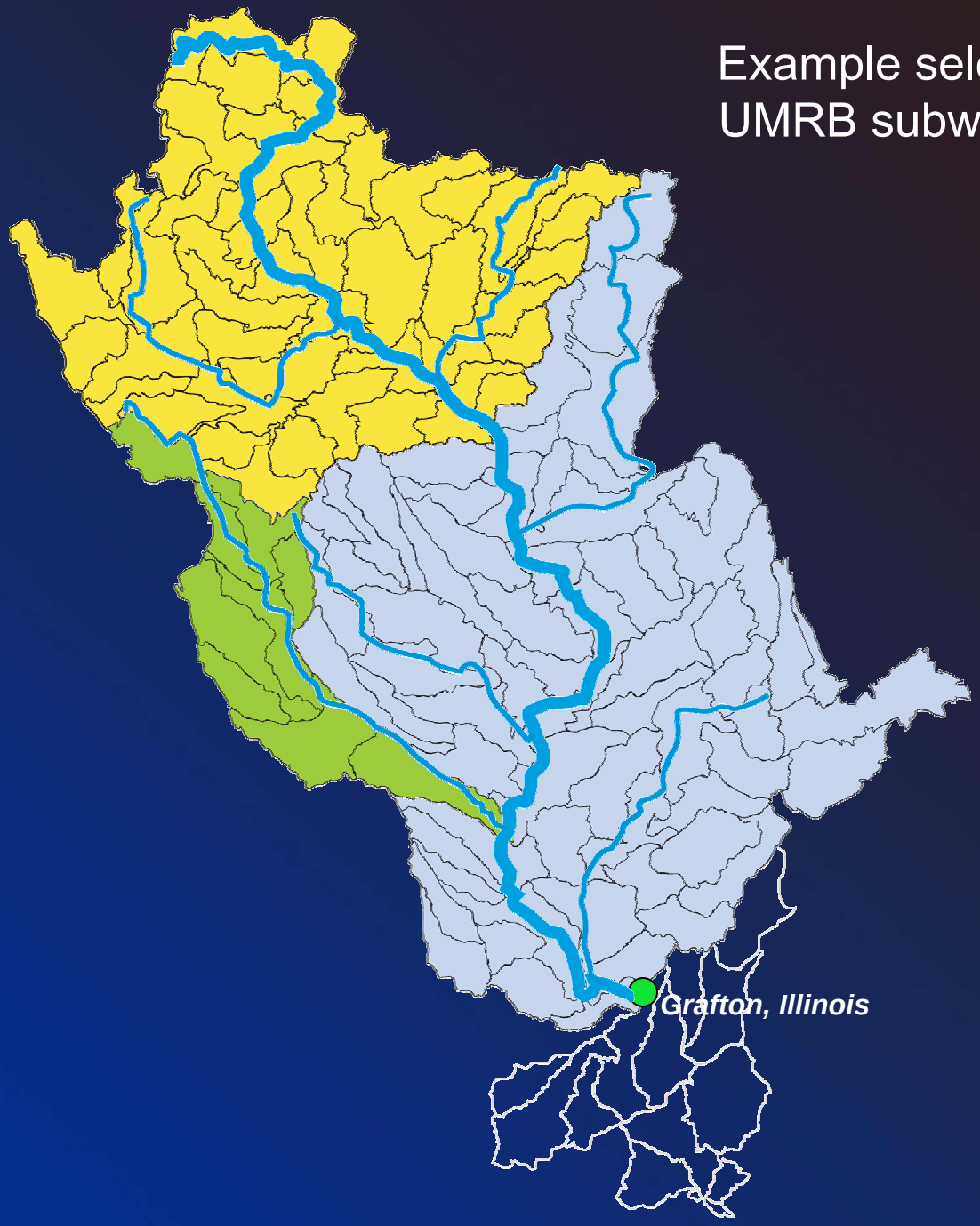
1. Execute complete simulation

2. Execute a subset of subwatersheds
   - user can select any subwatershed; i_SWAT will only execute the portion of the total watershed that drains to that subwatershed


i_swat - [NRIRaccoon.mdb]
File Edit View Record Execute Window Help
SWAT
ID Description
1 1 Imported Book:0
Run SWAT model on this control record.
NUM
Start
C:\swat_hypoxia...
i_SWAT - Netscape
Yahoo! Mail - pw...
gassman iswat b...
i_swat - [NRIR...
Eudora - [In]
2:52 PM


Run Watershed
Run all subbasins
Run subbasins at and upstream from:
.sub file Subbasin:3 Thu Oct 24 11:5
.sub file Subbasin:4 Thu Oct 24 11:5
.sub file Subbasin:5 Thu Oct 24 11:5
.sub file Subbasin:6 Thu Oct 24 11:5
.sub file Subbasin:7 Thu Oct 24 11:5
.sub file Subbasin:8 Thu Oct 24 11:5
.sub file Subbasin:9 Thu Oct 24 11:5
.sub file Subbasin:10 Thu Oct 24 11:
.sub file Subbasin:11 Thu Oct 24 11:
.sub file Subbasin:12 Thu Oct 24 11:
.sub file Subbasin:13 Thu Oct 24 11:
13 routing nodes upstream from HSL 49
OK
Cancel

Example selections of UMRB subwatersheds



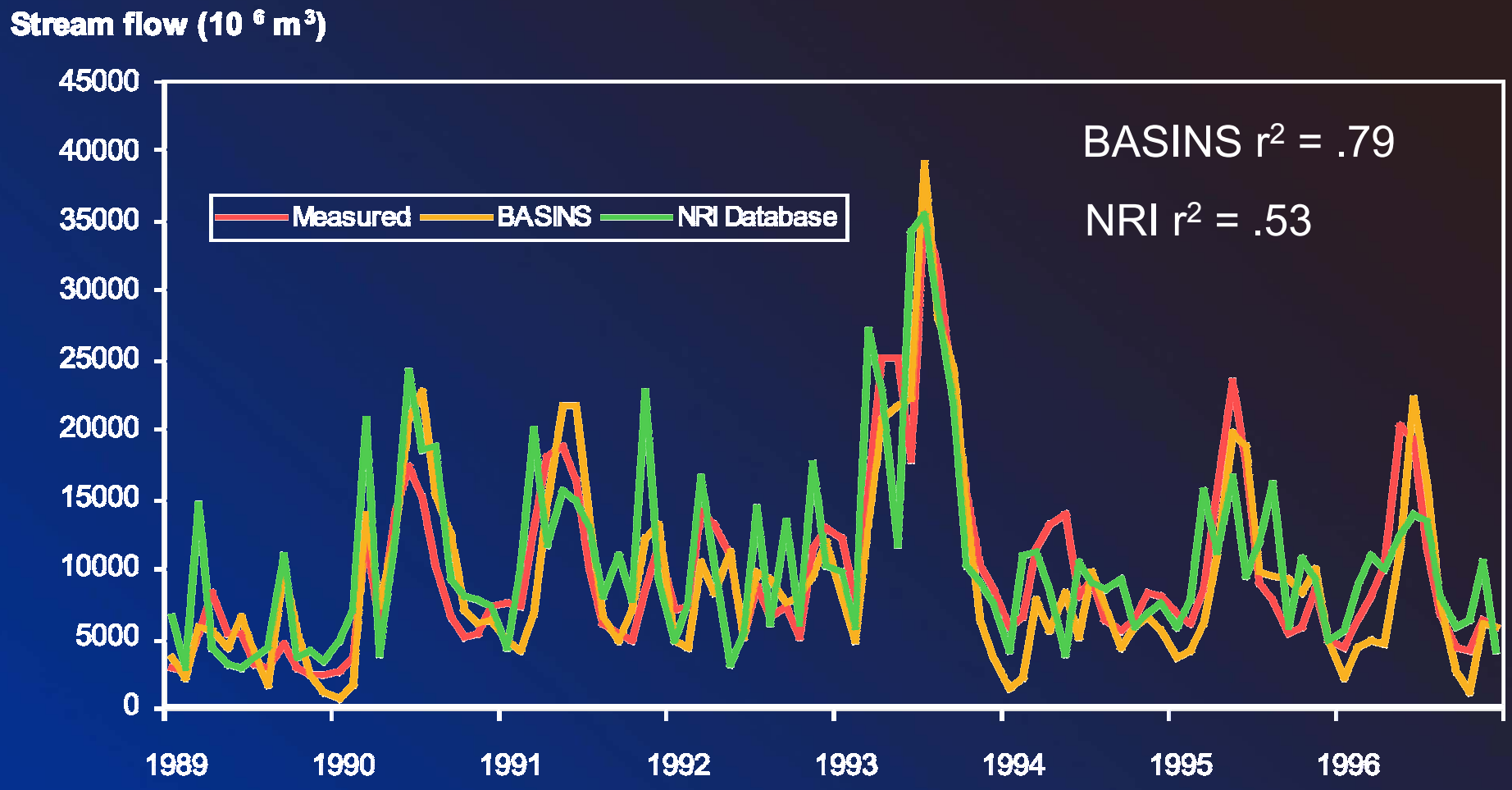
Other i_SWAT Options

- Importing of existing SWAT2000 data sets
  - database (e.g., empty.mdb) must already be open
- Editing of selected SWAT input files
- Charts of selected output by subbasins or HRUs
- Print & print preview of management system lists
- Maps of subbasin routing structures
  - requires latitude and longitude for each subbasin

UMRB Run Structure

- 131 subwatersheds
  - USGS 8-digit watersheds
- ~15,500 HRUs constructed from NRI data
  - greatest density in intensive agricultural areas
  - experimenting with reduced numbers of HRUs
- Management data obtained from other USDA surveys

Initial UMRB Flow Results



Conclusions

- i_SWAT has proven to be a useful tool for CARD SWAT applications
  - have ranged from plot scale to the UMRB
- Initial UMRB NRI-based results are encouraging
  - in-depth calibration & validation runs have been initiated
  - assessment of optimal HRU levels will also be performed

Conclusions

- i_SWAT development is ongoing
  - enhancements driven by immediate CARD research needs
  - open to “suggestions for improvement” ... no promises that requests can be met

Internet Address

- http://www.public.iastate.edu/~elvis/
- Todd Campbell – programmer
  - elvis@iastate.edu
- Downloads – i_SWAT & empty.mdb
  - i_SWAT source code not provided