

# SWAT: Soil and Water Assessment Tool

<b>Model Uses</b>	Soil and Water Assessment Tool (SWAT) is a river basin scale model developed to quantify the impact of land management practices in large, complex watersheds.	
<b>Major Categories</b>	Water Quality; Hydrology and Water Use	<u>Subject Knowledge Level</u> Advanced
<b>Minor Categories</b>	Watershed Conditions; Flow; Run-Off; Reservoirs; Groundwater; Surface Water; Pesticides; Nutrient Flow	<u>Technical Difficulty Level</u> Advanced
<b>Model Type</b>	Physical Model	<u>Geographic in Nature?</u> Yes

## **Abstract**

SWAT is a river basin scale model developed to quantify the impact of land management practices on water, sediment and agricultural chemical yields in large complex watersheds with varying soils, land use and management conditions over long periods of time. The main components of SWAT include weather, surface runoff, return flow, percolation, evapotranspiration, transmission losses, pond & reservoir storage, crop growth & irrigation, groundwater flow, reach routing, nutrient & pesticide loading, and water transfer.

SWAT is a public domain model actively supported by the USDA Agricultural Research Service at the Grassland, Soil and Water Research Laboratory in Temple, Texas.

## **Future Developments**

Recently added routines for pathogen transport, subsurface tile flow and autocalibration and uncertainty analysis.

Currently work is being done on improving forest growth and riparian simulation.

## **Model Features**

- Daily time step-long term simulations
- Basins subdivided to account for differences in soils, land use, crops, topography, weather, etc.
- Basins of several thousand square miles can be studied
- Soil profile can be divided into ten layers
- Basin subdivided into sub-basins or grid cells
- Reach routing command language to route and add flows
- Hundreds of cells / sub-basins can be simulated in spatially displayed outputs
- Groundwater flow model
- SWAT accepts output from EPIC
- SWAT accepts measured data & point sources
- Water can be transferred from channels and reservoirs
- Nutrients and pesticide input/output
- Windows Interface
- GRASS GIS links to automate inputs

## **Required Data Types**

SWAT requires specific information about weather, soil properties, topography, vegetation, and land management practices occurring in the watershed. The minimum data required to make a run are commonly available from government agencies

Five of the input files required for a SWAT simulation are

## **Model Limitations**

Unknown

## **Model Outputs**

A number of output files are generated by **SWAT**. These files can be grouped by the type of data stored in the file. There are four output files generated in every SWAT simulation. These files are: the standard output file (.std), the Hydrologic Response Units (HRU) output file (.sbs), the sub-basin output file (.bsb), and the main channel or reach output file (.rch). Other files that may be generated include

provided with the model--the plant growth database, tillage database, fertilizer database, pesticide database, and urban database. They are included in the interface downloads or may be downloaded individually from the web site--they are not included in the executable/source code downloads.

In addition to the five database input files, two other databases are provided to users: the soils database and the weather generator database. These databases are collections of soils and weather generator parameters for soils and weather stations in the United States.

pesticide summary file (.pso), Stream Water Quality Summary File (.wqo), Reservoir Summary File (.rsv), Lake Water Quality Summary File (.lqo)  
Other than the standard output (.std) file, the files produced during a model run are formatted as spreadsheets to facilitate importation of the data into spreadsheet software.

The detail of the data printed out in each file is controlled by the print codes in the input control code (.cod) file. Average daily values are always printed in the HRU, sub-basin and reach files, but the time period they are summarized over will vary. Depending on the print code selected, the output files may include all daily values, daily amounts averaged over the month, daily amounts averaged over the year, or daily amounts averaged over the entire simulation period.

**Source**

USDA Agricultural Research Service at the Grassland, Soil and Water Research Laboratory in Temple, Texas

**Source (URL)**

<http://www.brc.tamus.edu/swat/swatmod.html>

**Hardware Requirements**

unknown

<b>Supported Platforms</b>			
DOS	<input checked="" type="checkbox"/>	UNIX	<input checked="" type="checkbox"/>
Windows	<input checked="" type="checkbox"/>	Macintosh	<input type="checkbox"/>

**Software Requirements**

Three Interfaces exist for running SWAT:

- Util (non-GIS) interface
- ArcView (GIS) interface that runs in windows
- Unix version that uses GRASS as its GIS interface.
- Windows (non-GIS) interface (not currently available)

In addition to SWAT, several software programs have been developed by the SWAT Team to assist in the processing of SWAT input and calibration. These programs include: *Conversion program*, *SWAT input checker program*, *Potential Heat Unit program*, and *Baseflow filter program*. Information on these programs can be found at

<http://www.brc.tamus.edu/swat/swatmod.html> .

**Cost, Licensing and Availability**

Model is offered free of charge from USDA through the link provided above.