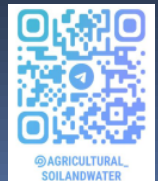




Watershed Management Using SWAT (Soil Water Assessment Tool)

Ahmed Al-wadaey

May 3, 2010



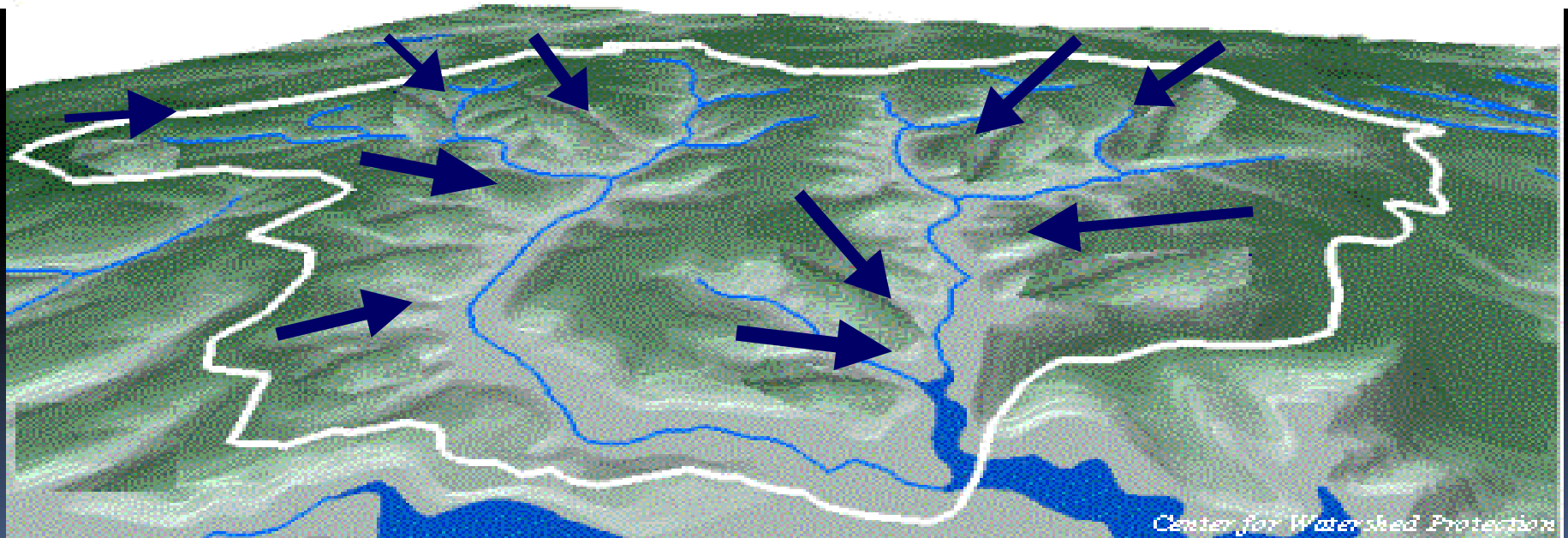
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SOILANDWATER



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What is a watershed?

A watershed is all the land area that drains to a given body of water.





Why do we need Models?

- Monitoring is very costly, it is unrealistic to monitor each and every field or stream segment in the large watershed .
- Process interactions in the watershed are too complex.
- To understand and learn from the events of the past and plan for the future.
- Protection and sustainable use of water resources

What is, and why, SWAT?

- **SWAT (*USDA/ARS*)**
 - **Objective:** “...to predict 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.”
 - **Strengths**
 - **Best at NPS-pollution loads from agricultural practices; improving routines for urban loads**
 - **Good interface with GIS software (Arc View)**

SWAT Model Input

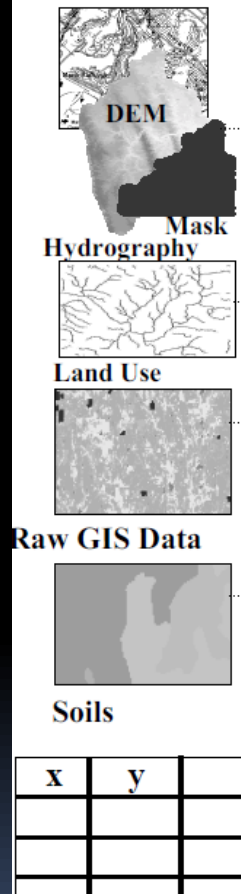
INPUT DATA:

- **Physical**
 - Elevation, Land cover, soil
- **Weather**
 - Rainfall, air temperature (Min and max), solar radiation, wind speed and relative humidity
- **Hydrological**
 - Stream flow, sediment and nutrient delivery data
- **Non-point and point source pollution data**
 - Fertilizer and pesticide application data
 - Point source of pollution

SWAT Model Input: Chemicals

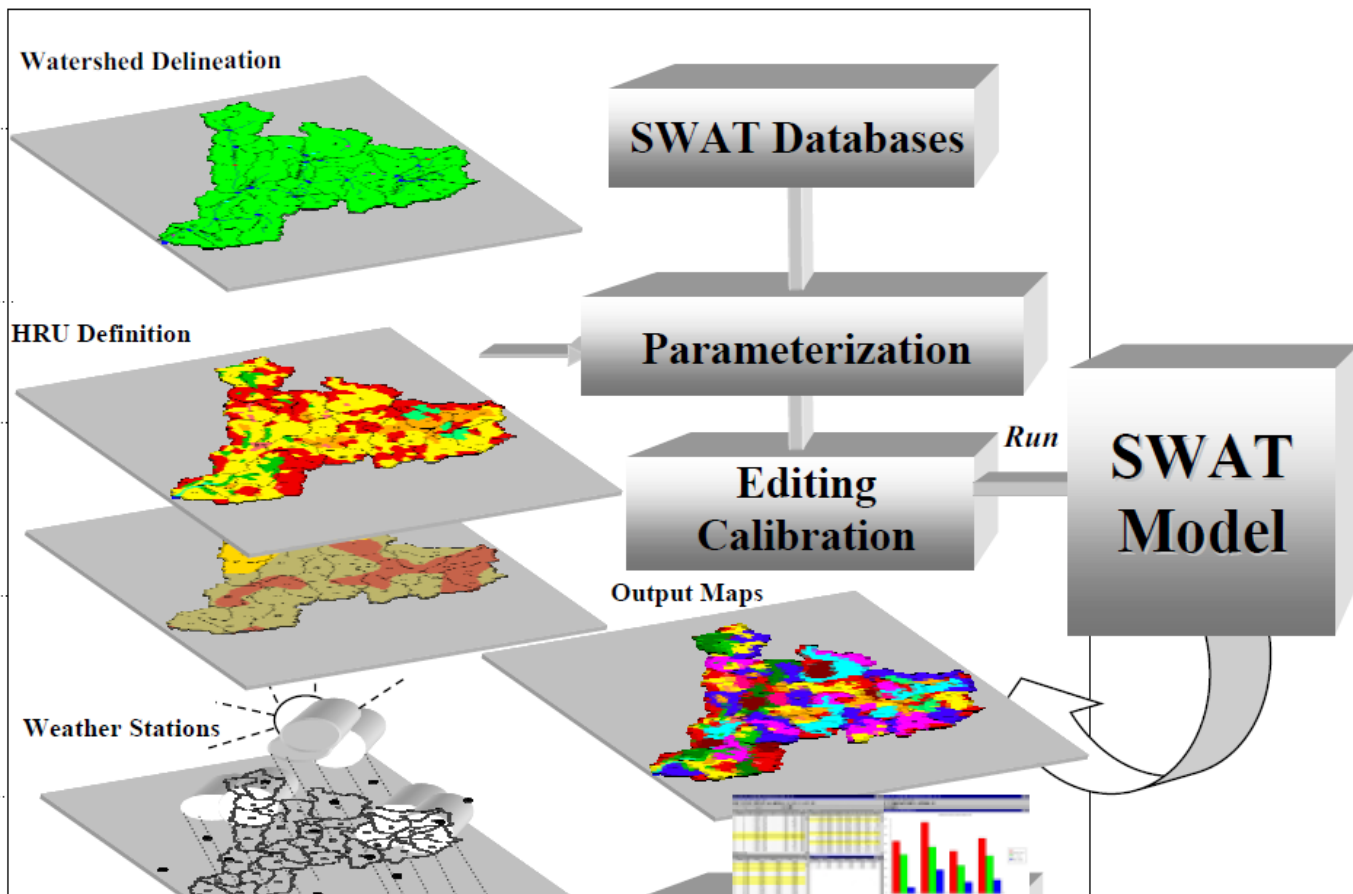
- Fertilizer and pesticide data
- Large number of names of fertilizer and pesticide in the SWAT database
- New chemicals can be entered
- Allows if manure is used in the application

Input Data



Processing and Display

AVSWAT



Primary Watershed and Reach Delineation Tool:

SWAT - ArcView: Watershed, Subbasins and Stream definition

DEM Set Up

Dem grid: d:\avswat\avswatdb\example\dem Properties

Mask grid: d:\avswat\avswatdb\example\amask ☒ Mask working area

☐ Burn_in option

Preprocessing of the Dem: Apply

Stream definition

Threshold Area: 1300 [ha] ---> Number of cells: 1300

Max: 21770.8

Apply

Outlet definition

Subbasin Outlets

Table of outlets locations: strflow.dbf

Add Remove

Whole Watershed outlet(s)

Select Undo

Calculation of subbasin parameters: Apply

Current number of outlets/subbasins: 16

Help Minimize Cancel

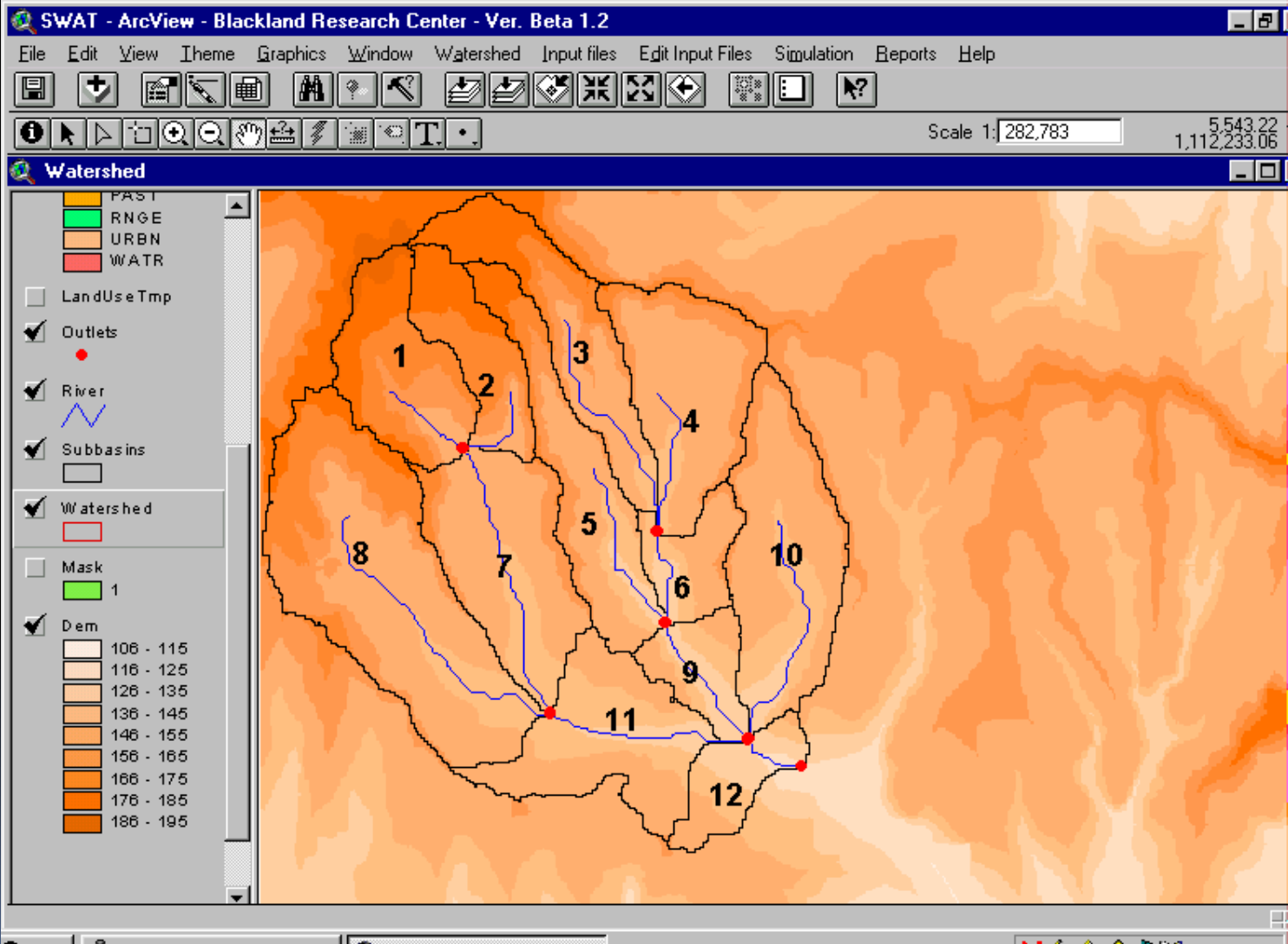
Specify DEM Source

Superimpose RF-x Layer

Threshold to control
drainage density

Modify sub-watershed
outlets

Derive spatial attributes
required for modeling!



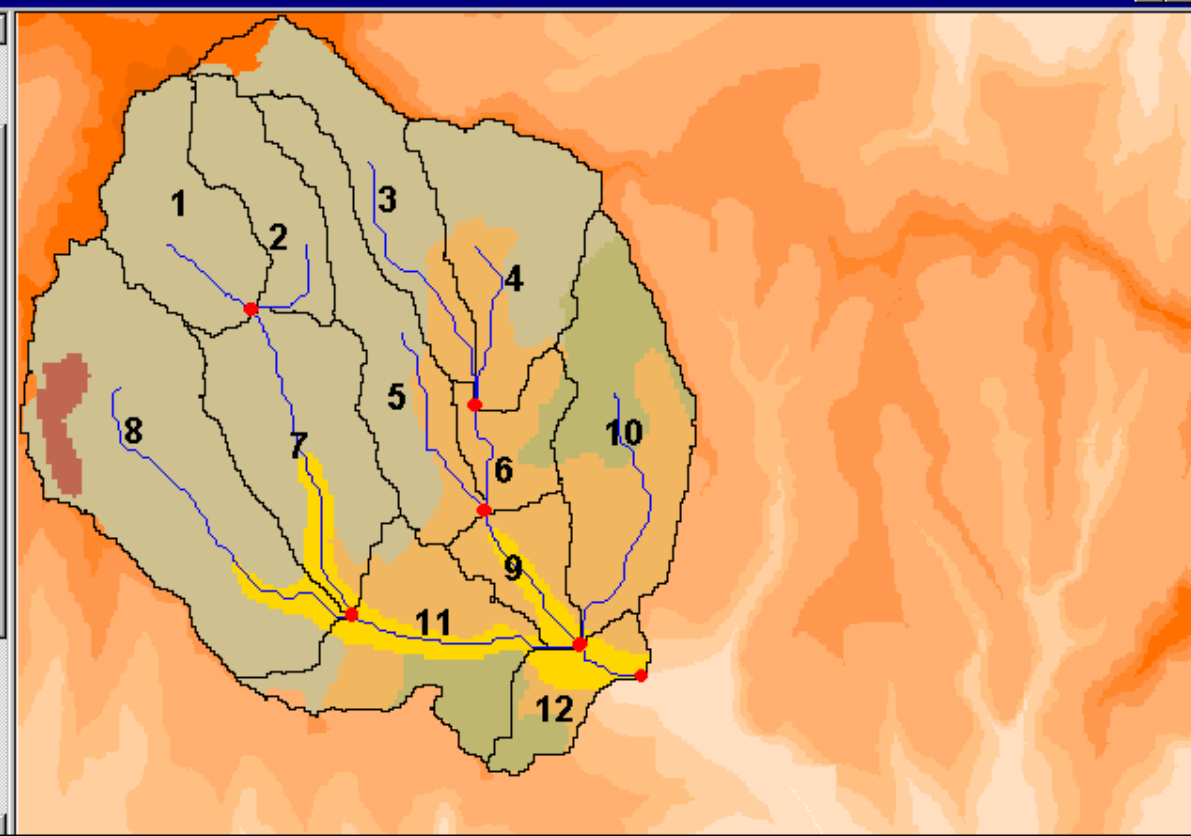
Watershed

- ☐ Raingages
- ☐ Soils Tmp
- ☐ LandUse Tmp
- ☒ Outlets
- ☒ River
- ☒ Subbasins
- ☒ Watershed
- ☐ Mask
- ☒ SwatLandUseClass
- ☐ SwatSoilC lass

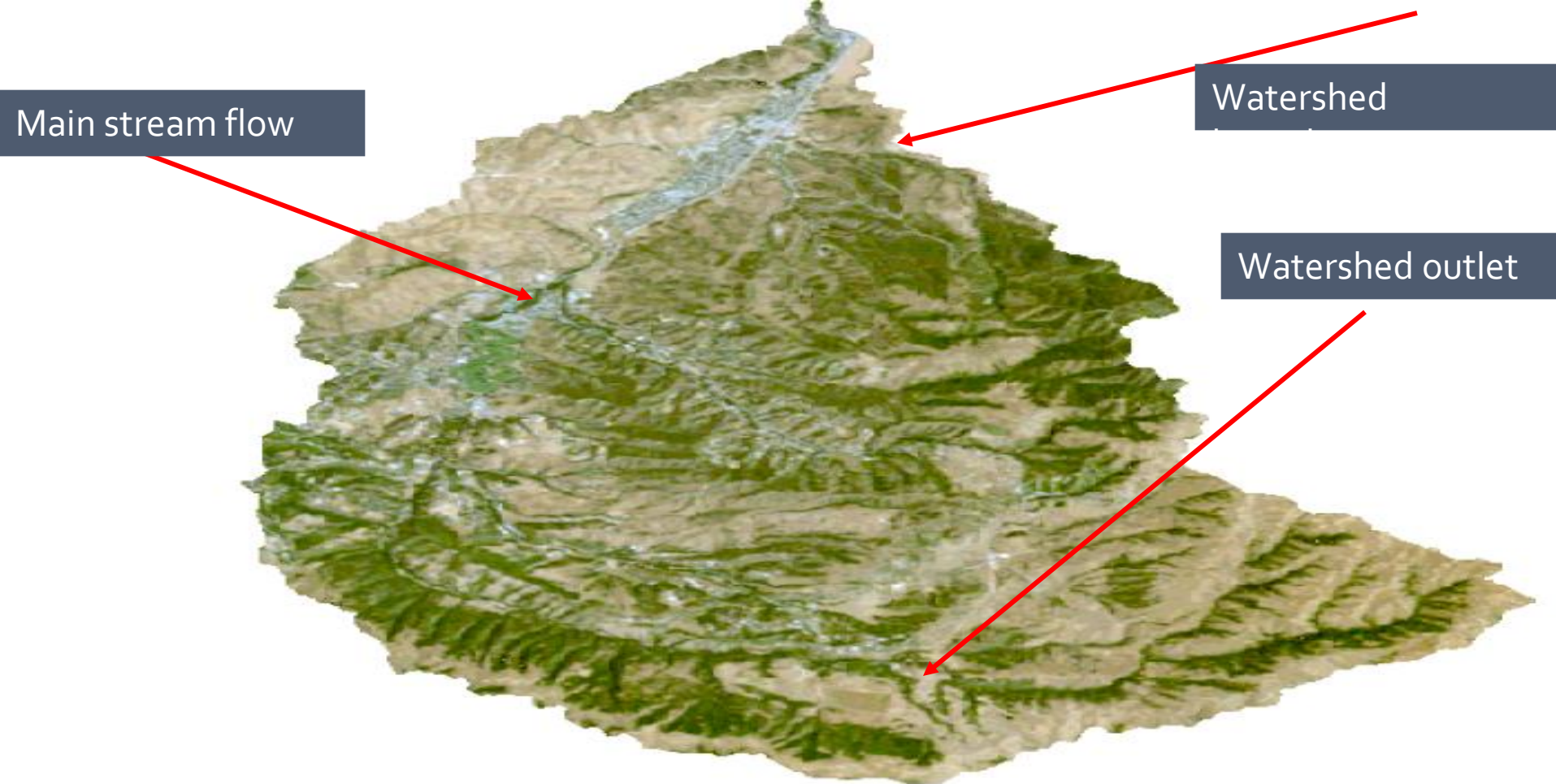
SWAT - ArcView - Blackland Research Center - Ver. Beta 1.2

Watershed

- ☐ Raingages
- ☐ Soils Tmp
- ☐ SwatLandUseClass
- ☐ LandUse Tmp
- ☒ Outlets
- ☒ River
- ☒ Subbasins
- ☒ Watershed
- ☐ Mask
- ☒ SwatSoilC lass



Watershed management example of SWAT simulation

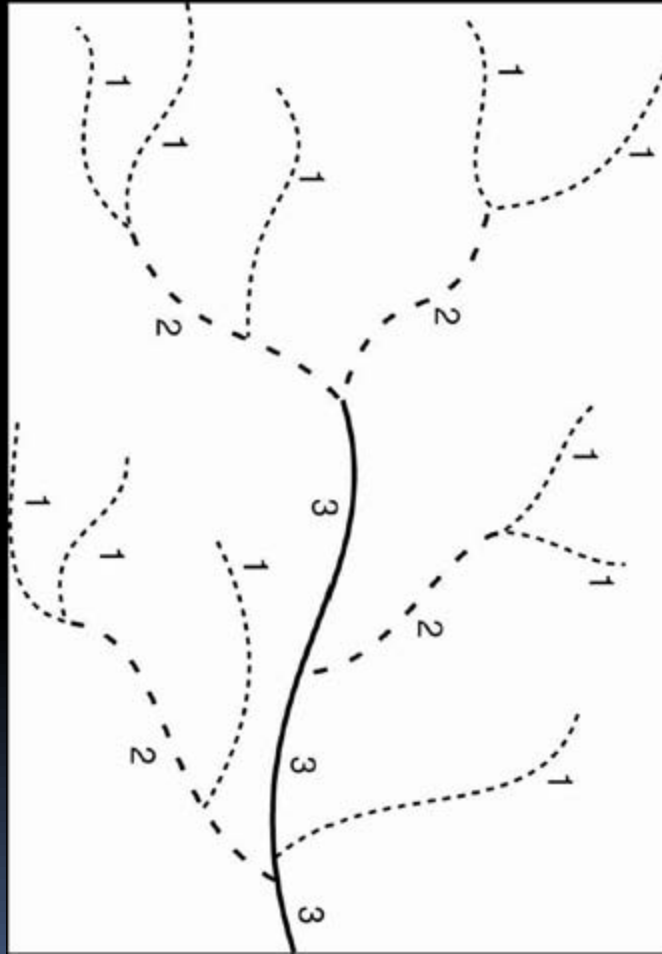




Impact of Watershed Characteristics on Water Harvesting Techniques

- **Watershed size or area**
 - **Shape of watershed**
 - **Surface or land use**
 - **Soils and subsurface media**
 - **Drainage and Stream Networks**
 - **Man-made controls**
- 

Stream order



B. Basin Morphometry

refers to the geometry of the basin

Drainage Composition

refers to the distinct fabric of the drainage basin



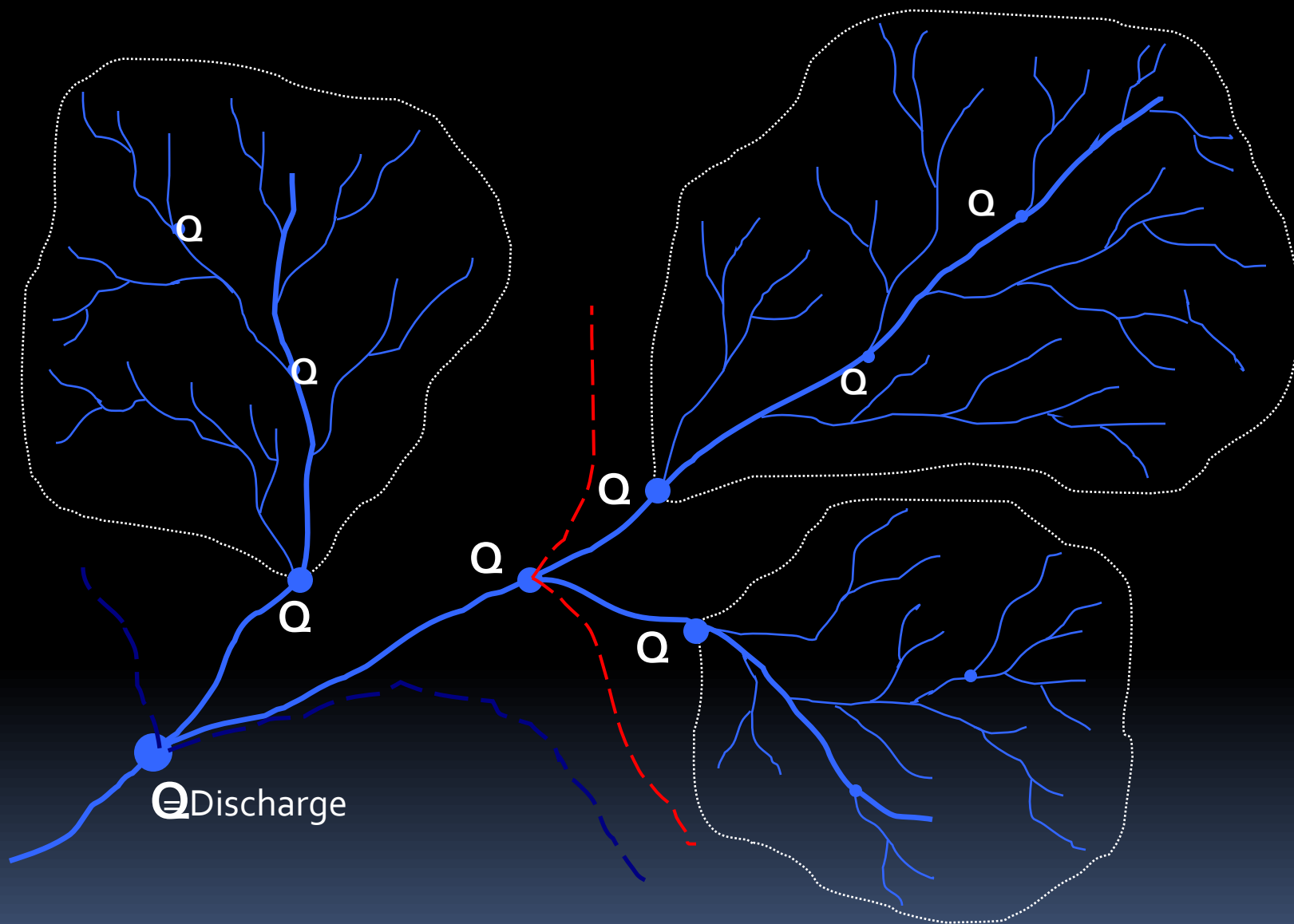


Fig. Flow rates or discharge at points of interest along streams

Sediment Transport and Denudation





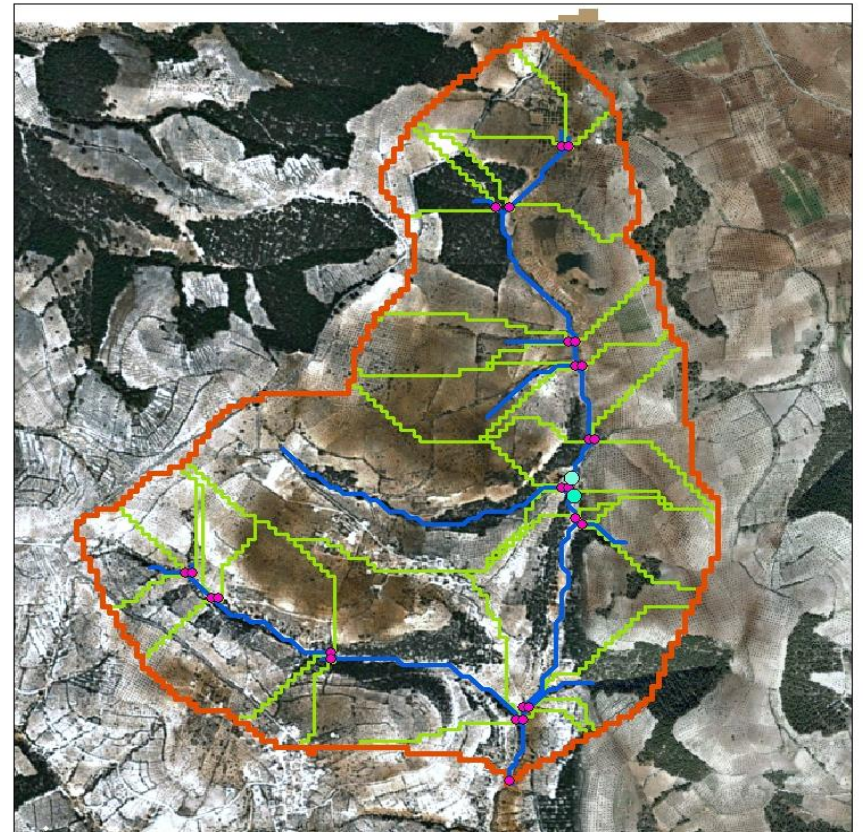
0.398 km²

SWAT Database: Fertilizer

 **Fertilizer database**

00-06-00	Fertilizer Name	00-06-00	
00-15-00	FERTNM	00-06-00	[8 characters]
02-09-00	FMINN	0.000	[kg min N/kg fertilizer]
03-06-00	FMINP	0.026	[kg min P/kg fertilizer]
04-08-00	FORGN	0.000	[kg org N/kg fertilizer]
05-10-05	FORGP	0.000	[kg org P/kg fertilizer]
05-10-10	FNH3N	0.000	[kg NH3 N/kg min N]
05-10-15	BACTPDB [OPTIONAL]	0.000	[#bacteria/kg manure]
06-24-24	BACTLPDB [OPTIONAL]	0.000	[#bacteria/kg manure]
07-00-00	BACTKddb [OPTIONAL]	0.000	[fraction]
07-07-00	Is Manure	☐	
08-08-00			
08-15-00			

Default Add New [Modify] Add New Help Exit



- Measure_1
- Measure_2
- stream Outlet
- Reach
- Basin
- Sub-watershed

Meters

0 125 250 500 750 1,000







SWAT model example



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