

Agricultural Watershed Management Models as Data Model Workbenches?

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Overview

- Why Ag Watershed Management Models are Ideal
- A Use Case
- Discussion

ArcSWAT and TauRkSWAT as First Steps?

300+ Peer-reviewed articles a year

3500+ over life

Oodles and oodles of data centers required for
each and every initialization

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- 300+ Peer-reviewed articles a year
- 3500+ over life
- Oodles and oodles of data centers required for each and every initialization
- Example published initializations world-wide



Journals

Models

Broad Application Categories

Primary Application Categories

Secondary Application Categories

Languages

Years: 1984 to 2019

(search on any word or phrase)

3855 Articles Displayed

	Year	Title and Journal	Model	Broad Application Category
<input type="checkbox"/>	2019	Modeling effectiveness of broiler litter application method for reducing phosphorus and nitrogen losses Hydrology Research	SWAT	hydrologic & pollutant
<input type="checkbox"/>	2019	Land use/cover change effects on river basin hydrological processes based on a modified Soil and Water Assessment Tool: A case study of the Heihe River Basin in northwest China's arid region Sustainability	LU-SWAT & SWAT	hydrologic only
		Integrating terrestrial and aquatic processes toward watershed-scale modeling of dissolved		



Journals

Models

Broad Application Categories

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Languages

Years: 2018 to 2019

(search on any word or phrase)

Submit Reset Selections

586 Articles Displayed

Compare Checked

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Hydrological Modeling Data

Survey of Hydrological Modelers for the IDRC-Canada
"Advancing The Application Of Climate and
Hydrological Information and Its Translation Into
Policy" meeting, October 2014

- What biophysical data sets do you currently use?
- What observational climate data sets do you currently use?
- What projected climate data sets do you currently use?

What biophysical data sets do you currently use?

Water level (river, groundwater), River discharge, Soil properties, Remotely sensed vegetation, Salinity, Sediment concentration, Water quality, Digital elevation models, Arc GIS shapefiles, Hydrometeorological data, GIS data, Satellite images (land use data), Soil map, DEM, Social statistics data, Hydrological data (water flow), Water master plan, Heath, Population, Land cover, MODIS, Albedo, Land surface temperature, NDVI, Air temperature, Net radiation, Agro-ecological, ALT (Binational Authority of Titicaca lake basin) data, Cultivated area, Irrigated area, Fertilizers, Tubewells, Tractors, Area under crops, Water use of crops.

What climate data sets do you currently use?

In situ, National met synoptically stations data, TRMM, Worldclim, Chirps, CFSR, CRU, WATCH, WFDEI, RCM outputs, MeteoLiban (land surface stations), NCDC, Micrometeorological stations in experimental sites, APHRODITE and IMPAC-T projects, ERA-Interim, CSAG data sets, NCEP final analysis FNL, NCDC, GPCC, UDel, CLARIS Database.

Ag Watershed Use Case

Datasets Required

- Elevation
 - Global SRTM
 - 30m, 90m
 - Global GDEM 30m
 - US 30m NED
 - US 10m NED
 - US 3m NED
- Landuse
 - Global MODIS
 - Global USGS NLCD
- Soils
 - Global FAO Vector
 - US SSURGO Vector
- Historical Daily Weather
 - Global CFSR Gridded
 - Global GHCN Point
- Forecasts
 - Daily Global 16day
- Climate
 - Global Last Century Gridded
 - Global Next Century Gridded

Overview of Global Climate Data Sources

Product	Spatial Resolution	Temporal Resolution	Time Horizon	Variables
CMAP	2.5 degree	Monthly	1979 - 2009	Precipitation
GPCP	2.5 degree	Monthly	1979 - 2010	Precipitation
GPCC	0.5 degree	Monthly	1951 - 2010	Precipitation
WorldClim	30 sec	Monthly	Climatology	Precipitation Min, mean and max temp
TRMM	0.25 degree	3-hr, Daily	1957 - 2002	Precipitation
R1, R2	2.5 degree	6-hr, Daily	1948 – 2009 (present)	Climate variables
ERA40	2.5 degree	6-hr, Daily	1979 - 2001	Climate variables
CFSR	0.312 degree (~38km)	Hourly, Daily	1979 - 2010	Climate variables, and Hydrological quantities

Data Centers

USGS - DAP, GeoTiff, WCS, WFS

NASA - DAP, NetCDF, Tabular

NCAR - NetCDF, Tabular, GRIB2

NCEI - Tabular

USDA - WFS, Tabular

FAO - Shapefile, Tabular

CGIAR - Shapefile, WCS, WFS, Tabular

IPCC-DDC - Gridded, Tabular

Every Initialization has Scales Basin to the Resolution of DEM

Z. M. Easton et al.: Multi basin SWAT model analysis

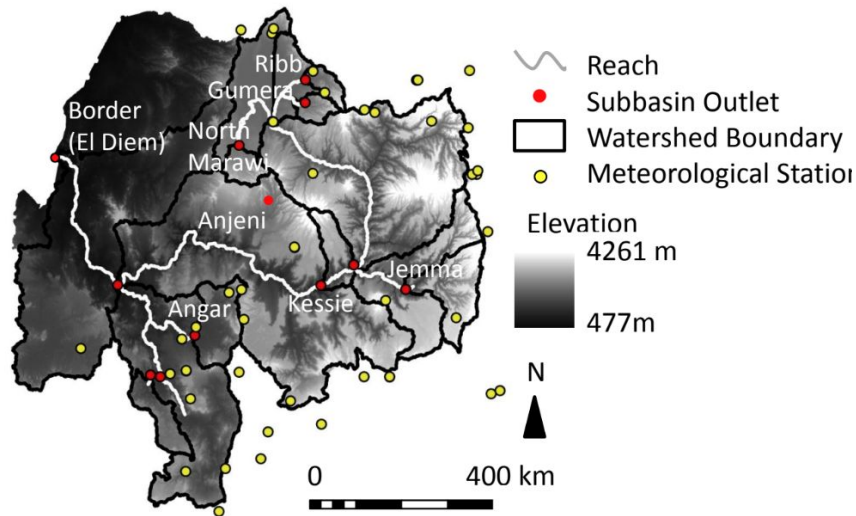


Fig. 1. Digital Elevation Model (DEM), reaches, subbasins and subbasin outlets initialized in the Blue Nile Basin SWAT model. Also displayed is the distribution of meteorological stations used in the model.

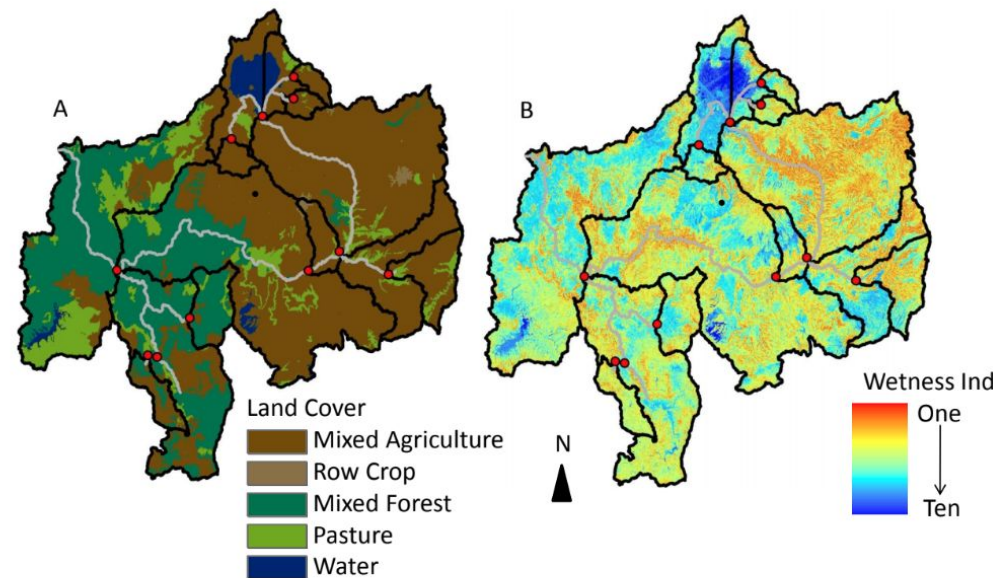


Fig. 2. Land use/landcover (A) in the Blue Nile Basin (source E TRO), and the Wetness Index (B) used in the SWAT-WB Blue Nile Model.

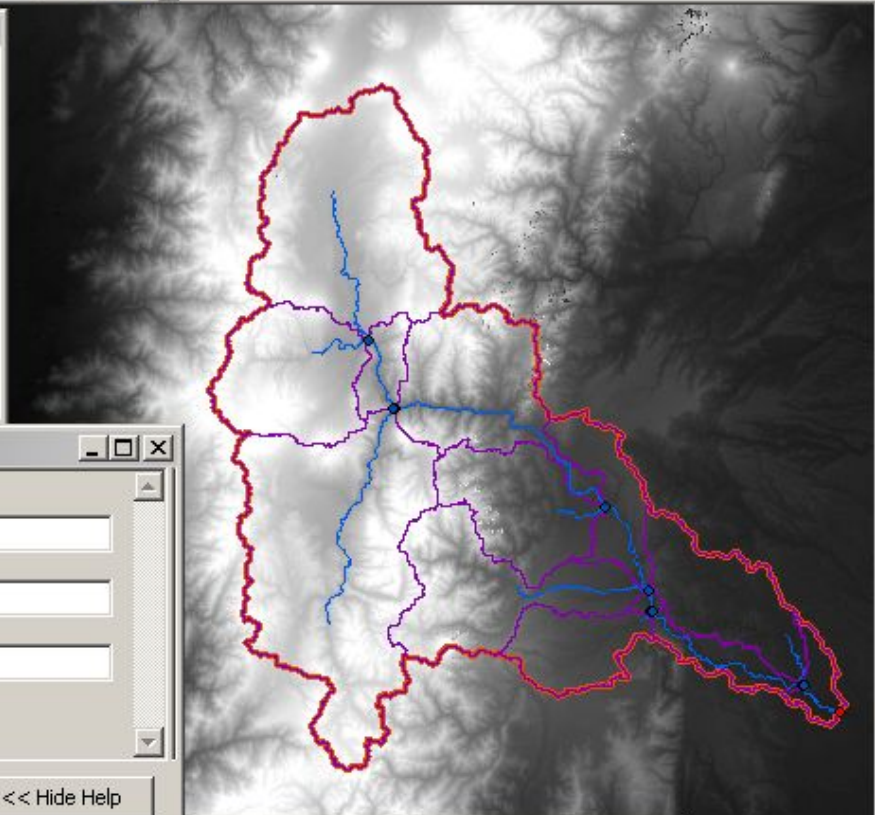
SWAT Project Setup ▾ Watershed Delineator ▾ HRU Analysis ▾ Write Input Tables ▾ Edit SWAT Input ▾ SWAT Simulation ▾

File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help

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100%

- ArcToolbox**
- Linear Referencing Tools
 - Multidimension Tools
 - Network Analyst Tools
 - Parcel Fabric Tools
 - Schematics Tools
 - Server Tools
 - Spatial Analyst Tools
 - Spatial Statistics Tools
 - TopoSWAT
 - BCubeDEM
 - TopoSoil
 - Tracking Analyst Tools



- Catalog**
- Location: GDEMCLUTM17S
- AddIns
 - Default.gdb
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 - ASTGTM2_501W079_dem
 - ASTGTM2_501W080_dem
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 - ASTGTM2_504W078_dem
 - ASTGTM2_504W079_dem
 - ASTGTM2_504W080_dem
 - ASTGTM2_504W081_dem
 - GDEM
 - GDEMCL
 - GDEMCLUTM17S
 - SRTMv3_3_504W080
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 - Z:\dan\Moscow
 - Z:\dan\vt\amy

BCubeDEM

Center Lat: -1.666

Center Lon: -78.66

Extent in DecDeg: 1.5

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OK Cancel Environments... << Hide Help

Watershed Delineation

DEM Setup

Open DEM Raster: C:\Documents and Settings\Administrator\Desktop\da...

DEM projection setup

Outlet and Inlet Definition

Subbasin outlet
 Inlet of draining watershed
 Point source input
 Add point source to each subbasin

Add by Table

911642.493 9830245.038 Meters

SWAT Project Setup ▾ Watershed Delineator ▾ HRU Analysis ▾ Write Input Tables ▾ Edit SWAT Input ▾ SWAT Simulation ▾

File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help

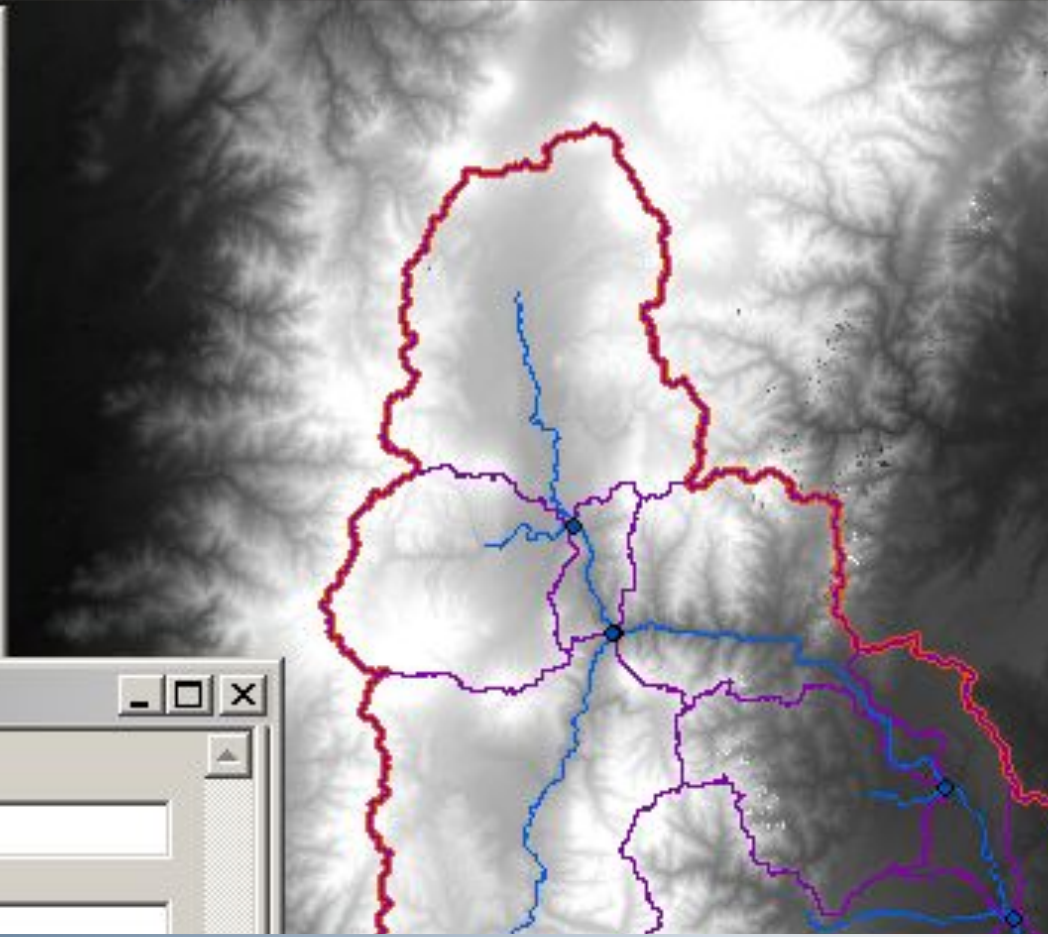


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BCubeDEM

Center Lat
-1.666

Center Lon
-78.66



Methods Sections are Generally Not Reproducible

associated soils properties for the λ -soils hybrid map were extracted from the FAO database and look up tables were linked to the map using the ARCSWAT 9.2 interface. We lumped the watershed's λ into 10 equal area intervals ranging from 1 to 10, with index class 1 covering the 10% of the watershed area with the lowest λ (i.e. lowest propensity to saturate) and index class 10 containing the 10% of the watershed with the highest λ (i.e. highest propensity to saturate) (Fig. 2). These wetness index classes were intersected with the land use to create 962 HRUs in 16 subbasins

(Fig. 2). A digital elevation model (DEM) of the basin was obtained from the International Water Management Institute (IWMI) with 76 m \times 76 m horizontal and 1 m vertical resolutions. Land use/land cover maps containing 19 land cover classifications were obtained from the Eastern Nile Technical Regional Office (ENTRO), and reclassified into five dominant land use/land covers (Fig. 2).

Though, all analysis/initialization processes are well automated once data is downloaded

ArcSWAT - Mature ESRI ArcGIS interface to initialize SWAT model

TopoSWAT - Toolbox to extend ArcSWAT initializations for sub-field-scale processes

TauRkSWAT - Developmental R interface to initialize SWAT model including sub-field-scale

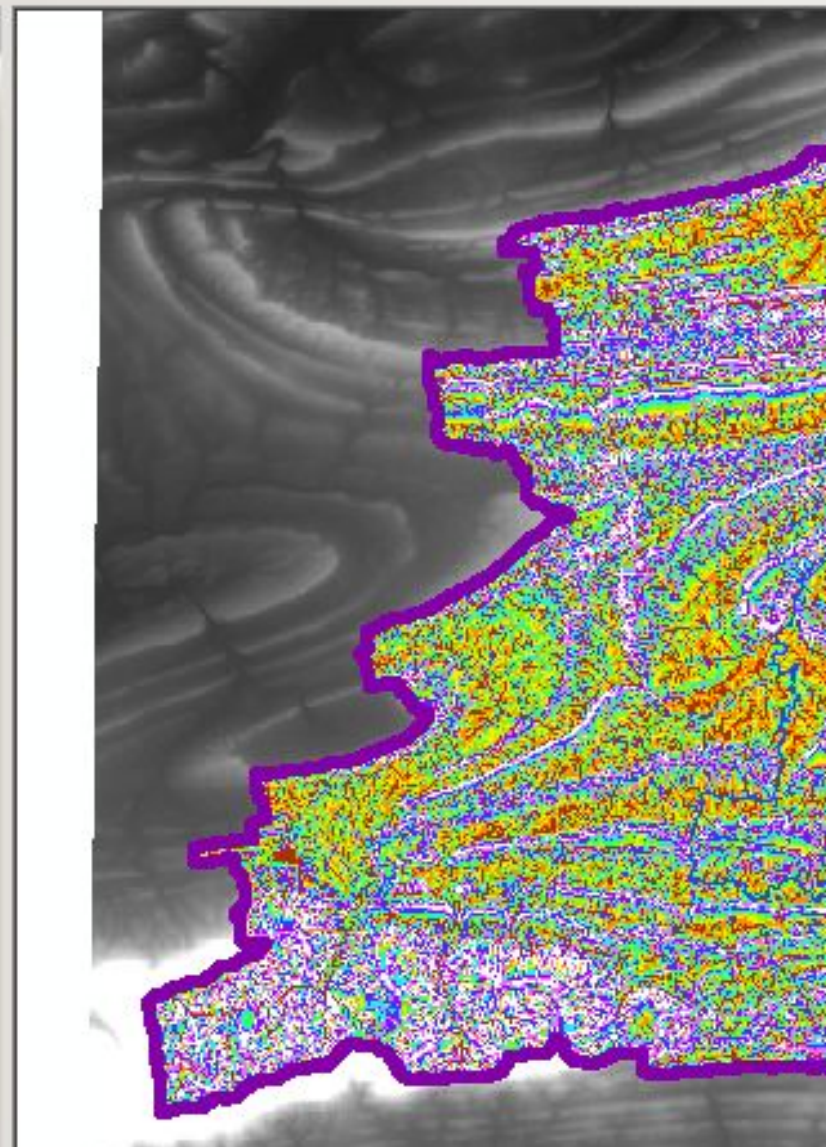
ArcToolbox

- Cartography Tools
- Conversion Tools
- Data Interoperability Tools
- Data Management Tools
- Editing Tools
- Geocoding Tools
- Geostatistical Analyst Tools
- Linear Referencing Tools
- Multidimension Tools
- Network Analyst Tools
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 - 02 GoTo Watershed Delineator
 - 03 BCubeLU script
 - 04 TopoSoil script
 - 05 GoTo HRU Analysis
 - 06 GetCFSR script
 - 07 GoTo Write Input Tables
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 - 09 GoTo Edit/Rewrite SWAT Input
- Tracking Analyst Tools

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Layers

- MonitoringPoint
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 - ◆ Manually add
- Outlet
 - <all other val
 - Type
 - ◆ Manually add
- Reach
 -
- FullHRU
 -
- Watershed
 -
- LongestPath
 -
- Basin
 -
- LandUse3
 - 0
 - 4
 - 8
 - 10



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Drawing ▾ Arial 10 B I U

SWAT Project Setup ▾ Watershed Delineator ▾ HRU Analysis ▾ Write Input Tables ▾ Edit SWAT Input ▾ SWAT Simulation ▾

File Edit **03 BCubeLU script** [X]

Basin

Close this dialog when completed successfully

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05 GoTo HRU Analysis
06 GetCFSR script
07 GoTo Write Input Tables
08 VSADistribute script
09 GoTo Edit/Rewrite SWAT Inout

Results ArcToolbox

LandUse3

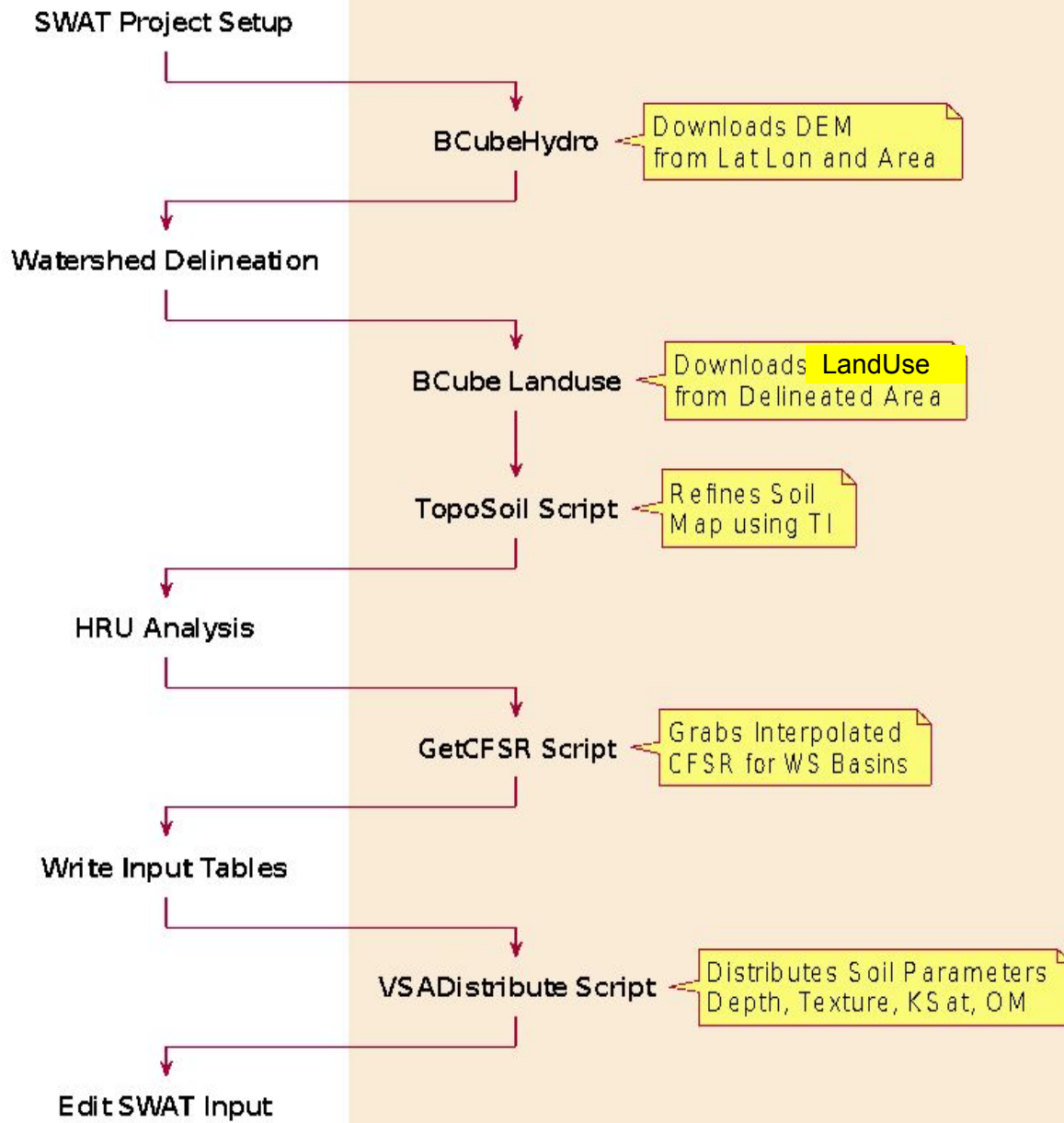
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4	Green
8	Blue
10	Red

-94.323 35.155 Decimal Degrees

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ArcSWAT

TopoSWAT



ArcToolbox

- Cartography Tools
- Conversion Tools
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TopoSWAT

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- 09 GoTo Edit/Rewrite SWAT Input

Tracking Analyst Tools

Results ArcToolbox

- Water
- Long
- Basin
- Land
- 0
- 4
- 8
- 10

← → ↻ gradlab4.bse.vt.edu/catalogdan.xml

Apps My Account Home | Save to Mendeley Property Details - Im AppDevelMap IDRC stocks

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Enough about us!
How we will help them.

NEW DATA POLICIES, NSF/AGU/Journals

“Earth and space science data should be widely accessible in multiple formats and long-term preservation of data is an integral responsibility of scientists and sponsoring institutions.”

- all data necessary to understand, evaluate, replicate, and build upon the research must be made available and accessible whenever possible.
- data include, but are not limited to: data used to generate, or be displayed in, figures, graphs, plots, videos, animations, or tables in a paper.
- AGU reserves the right to refuse publication when authors are unwilling to make the underlying data available or otherwise refuse to comply with this Data Policy.

As Hydrological Model Paper Reviewers

Before:

Is this study repeatable?

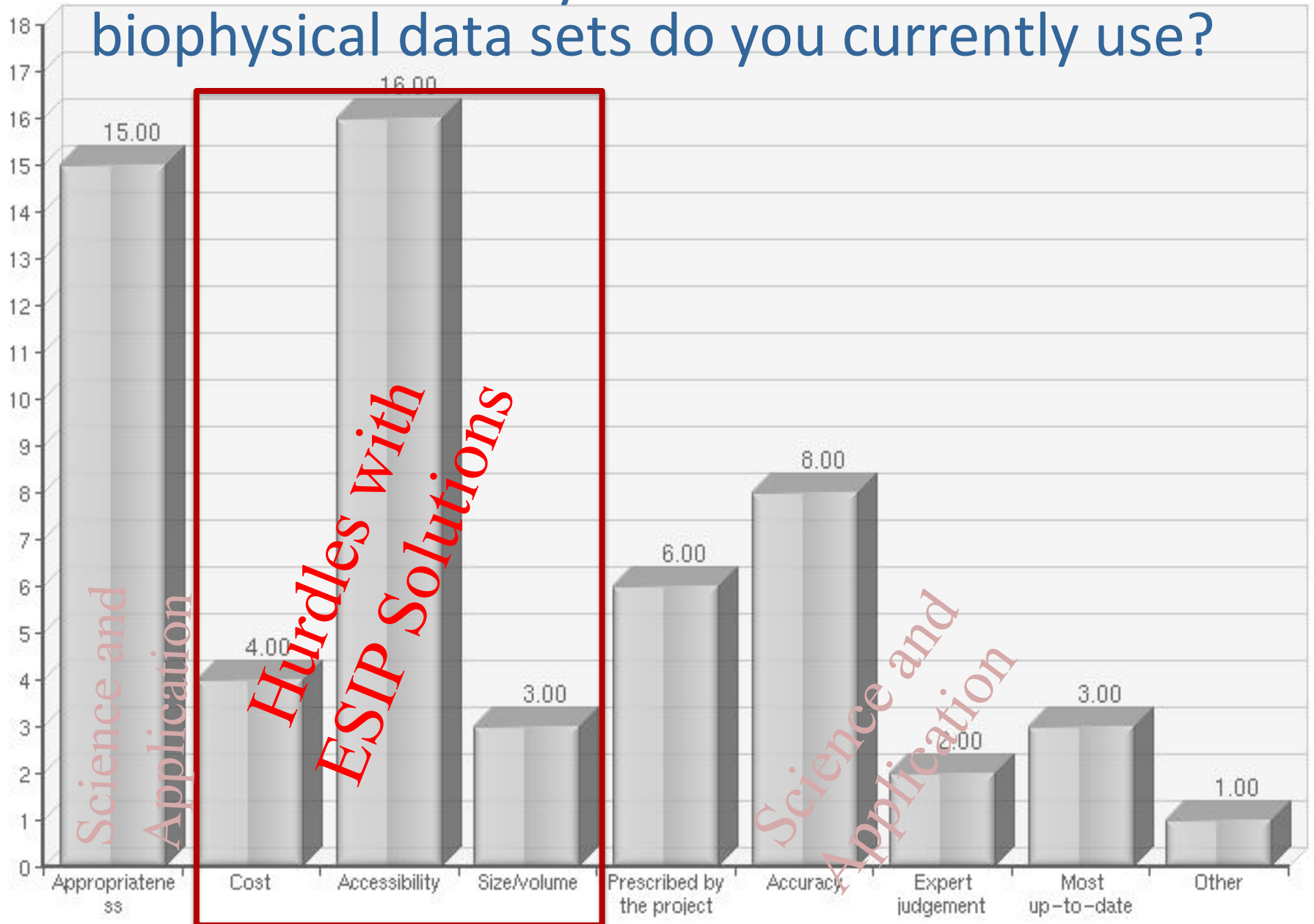
Now Adding:

Can I locate and access all the data needed to repeat this study?

As reviewers, we need to reject the papers when we can not access the data!

Our initial reviews are now easier?

What are the key considerations for the biophysical data sets do you currently use?



Benefits to Community

- Validate data sources
- Monitor past project data availability
 - Warn when a dataset no longer exists/available
- Pre-screen methods data availability for new modeling projects
- Source of information to retire previous methods/models

Discussion

Is this a project ESIP Ag and Climate "members" might be interested in pursuing?
What are other models with similar interfaces can be added?
Brian: Challenge: Using things like ArcSWAT to help with data citations.