

Outcomes Estimation Tools Training Webinar Series

**Model My Watershed
(water quality tool)**

Michelle Perez, PhD
Water Initiative
Director

Aysha Tapp Ross
Water & Soil
Health Scientist

June 7, 2023

Kinzie Reiss
Ag Conservation
Innovations Program &
Communications
Manager

Agenda



- Welcome, Reminders, Poll
- Recap
- Model My Watershed Presentation
- Model My Watershed Demonstration
- Q&A



Zoom Webinar Reminders

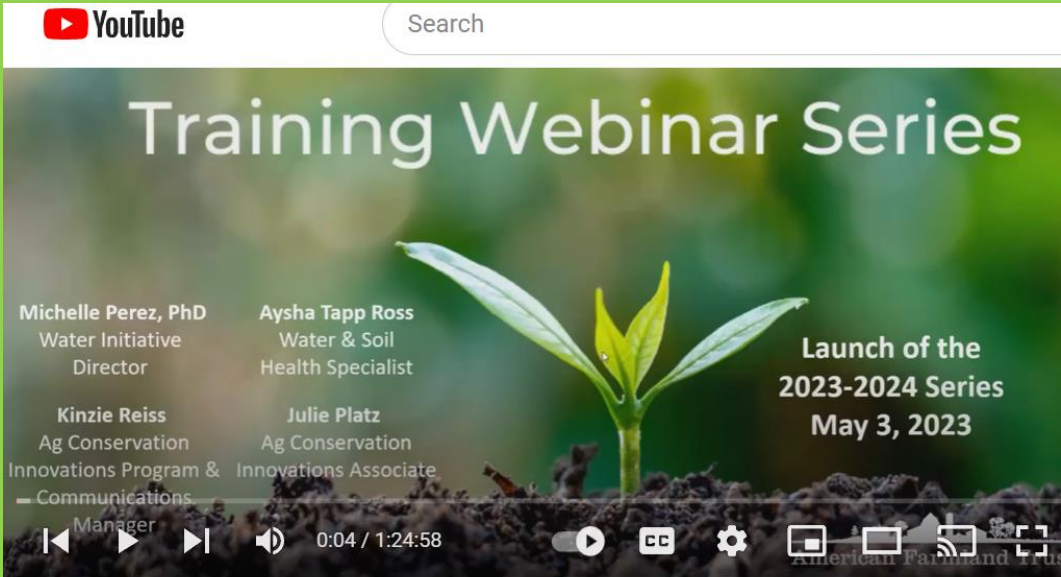
- Use Q&A Box - last 15 minutes (Vote up!)
- Use Zoom Direct Message feature to Kinzie if having technical difficulties
- Email with resources to follow each webinar
- Recordings posted on the webinar series site the following Monday
- Evaluation survey in the Chat Box



Time for 3 polls!

Recap May 3 Webinar

- Reviewed the results of the Needs Assessment
- Presented the Outcomes Estimation Tools Guide
- Debuted the simple Projects by County Outcomes Calculator (PCOC) Tool
- Recording: Outcomes Estimation Tools Training Webinar Series - FIC (farmlandinfo.org)



The image shows a YouTube video player interface. At the top, the YouTube logo and a search bar are visible. The video title is "Training Webinar Series". The main visual is a green seedling growing from soil. Text overlays on the video include: "Michelle Perez, PhD Water Initiative Director", "Aysha Tapp Ross Water & Soil Health Specialist", "Kinzie Reiss Ag Conservation Innovations Program & Communications Manager", "Julie Platz Ag Conservation Innovations Associate", and "Launch of the 2023-2024 Series May 3, 2023". The video player controls show a progress bar at 0:04 / 1:24:58. Below the video, the channel name "AmericanFarmland" with 1.26K subscribers and a "Subscribe" button are shown. The video title "AFT Outcomes Estimation Tools Webinar Series: Session 1 - Overview" is displayed, along with 3 likes and a share button. The video description states: "95 views 1 month ago With support from EPA and the Walton Family Foundation, American Farmland Trust is providing project managers with an Outcomes Estimation Tools Training Webinar Series to aid in their quantification of outcomes associated with farm conservation practices. Show more".

Tools in 2023 Trainings*

May 3: Webinar Launch & PCOC (recording)

June 7: Model My Watershed (water quality)

July 12: Nutrient Tracking Tool (NTT) (water quality)

August 2: NRCS Cover Crop Economics Tool (economic)

September 6: FieldPrint Platform (climate & water quality)

October 4: AFT Retrospective-Soil Health Economics (R-SHEC) Tool (economic)

November 1: PTMApp Web Tool (water quality)

December 6: EPA PLET (water quality)

Tools in 2024 Trainings*

January 10: SIPES Method/SIDMA Tool (social)

February 7: Fast-GHG (climate)

March 6: Cool Farm Tool (climate)

April 3: Cropping Systems Calculator (economic)

May 1: COMET-Farm & COMET-Planner (climate)

June 5: CAST Tool (water quality)

July 3: TBD

*Subject to change

: 19

Next steps in our outcomes estimation journey

- Remember the NTT July webinar is on Wed, July 12!
- Fill out a 6-question (2-min) online evaluation survey
- Schedule a free “coaching” session with us
 - Email atappross@farmland.org, RE: Coaching Request
- Order a free print copy of the OET Guide
 - Keyword: “AFT outcomes tools”



*Please keep in touch:
outcomestools@farmland.org*

Model My Watershed®

An online water quality modeling app

Matt Ehrhart, MSAE

Director of Watershed Restoration,

Dave Arscott, Ph.D.

Executive Director, Research Scientist



Anthony Aufdenkampe, Ph.D.

Senior Environmental Scientist



Water | Scientists
Environment | Engineers



Outcomes Estimation Tools Webinar Series

7 June, 2023

hosted by





A Team Effort

David Arscott, Steve Kerlin, Melinda Daniels,
Matt Ehrhart, Scott Ensign, Shannon Hicks,
Sara Damiano, Susan E. Gill (retired)...

Anthony Aufdenkampe, LimnoTech

Barry Evans, Penn State U., Stroud Center

David Tarboton, Utah State U.

Jeffrey S. Horsburgh, Utah State U.

Scott Haag, formerly at Academy Nat. Sci., Drexel U.

Lin Perez, Academy Nat. Sci., Drexel U.

Robert Cheetham, Azavea

Emilio Mayorga, U. Washington

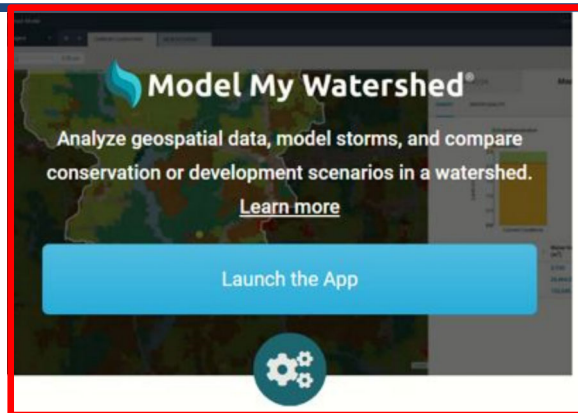
Nanette Marcum-Dietrich, Millersville U.

Carolyn Staudt, Concord Consortium






<https://WikiWatershed.org/>



Model My Watershed®
Analyze geospatial data, model storms, and compare conservation or development scenarios in a watershed.
[Learn more](#)

Launch the App



Monitor My Watershed®
Discover and map monitoring data from multiple sources. Share and compare your monitoring data with the world. [Learn more](#)

Launch the App




Macroinvertebrates.org
The Atlas of Common Freshwater Macroinvertebrates
Identify common freshwater macroinvertebrates with this resource designed for citizen scientists. [Learn more](#)

Visit Macroinvertebrates.org



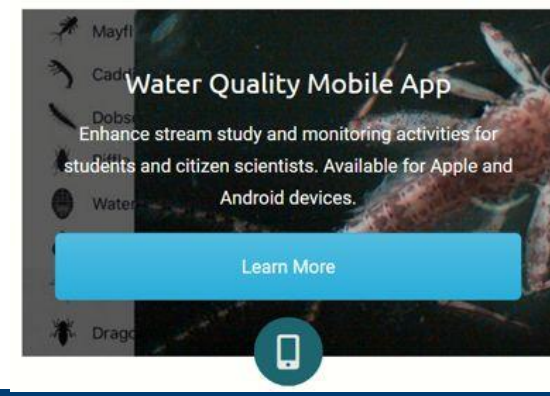

EnviroDIY
Join a community of do-it-yourself enthusiasts sharing open-source ideas for environmental science and monitoring.

Visit EnviroDIY




Leaf Pack Network®
Discover what aquatic insects can tell you about your stream's health by performing a simple leaf pack experiment.

Visit Leaf Pack Network



Water Quality Mobile App
Enhance stream study and monitoring activities for students and citizen scientists. Available for Apple and Android devices.

Learn More



History of Model My Watershed® Development



Investment

\$2.3M

\$5M

>\$60M

- **Model My Watershed**
- **Monitor My Watershed**
- **EnviroDIY**
- **FieldDocs**
- **DRWI Dashboard**
- **Custom datasets**

Water Data
+ Land Analysis
+ Hydro Models
+ Compare Scenarios
= Decision Support

Educators & Students
Conservation Practitioners
Land Use Decision-Makers
Citizens

Return on Investment

Restore Water
Quantity & Quality

Effective
Outcomes

Conservation
Implementation

Effective
Implementation

Effective
Planning

Conservation
Planning

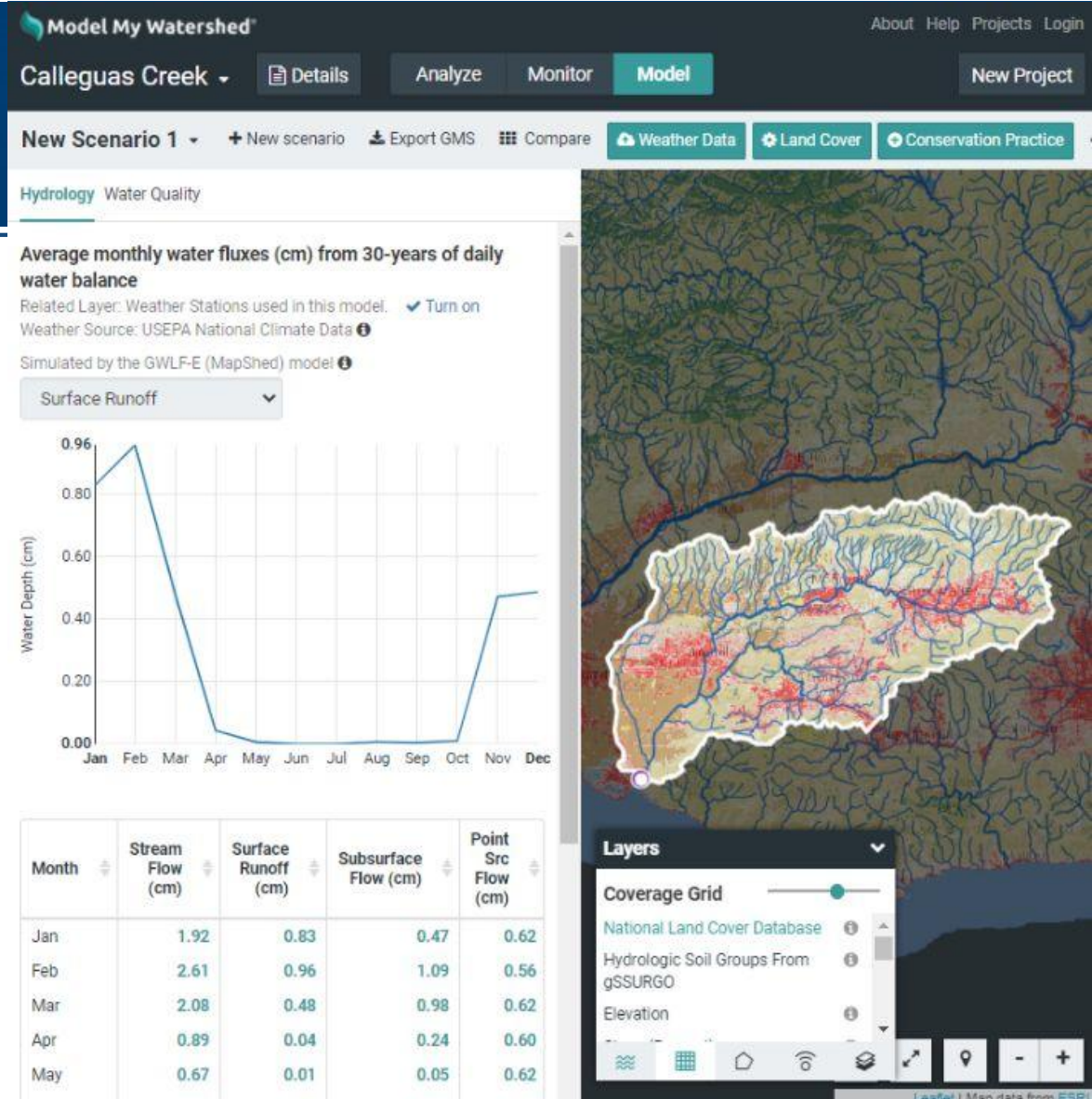


What is

Model My Watershed®

<https://modelmywatershed.org>

- Web app for conservation decision support
 - Automated watershed modeling
 - 30-y daily water balance
 - Quantifies benefits of different conservation & climate scenarios
- Widely used:
 - 15,000 registered users
 - 40,000 uses per month
 - 4 awards
 - Preferred tool by Pennsylvania for TMDLs & MS4 permits.



What is

Model My Watershed®

<https://github.com/WikiWatershed>

- High-performance Features:
 - Automatic watershed delineation
 - Models runoff and water quality to find hotspots
 - Calculates and compares benefits of protection & restoration projects
- Open-Source & Expandable:
 - API to integrate with other apps
 - Modular models for expansion
 - Continental USA, but could go global

Model My Watershed®

Calleguas Creek ▾ Details Analyze Monitor **Model** New Project

New Scenario 1 ▾ + New scenario Export GMS Compare Weather Data Land Cover Conservation Practice

Hydrology **Water Quality**

Average annual loads from 30-years of daily fluxes
Related Layer: Weather Stations used in this model. ✓ Turn on
Weather Source: USEPA National Climate Data ⓘ
Simulated by the GWLF-E (MapShed) model ⓘ

Sources	Sediment	Total Nitrogen	Total Phosphorus
Total Loads (kg)	123,920,473.4	707,785.7	168,966.6
Loading Rates (kg/ha)	1,781.16	10.17	2.43
Mean Annual Concentration (mg/L)	1,311.70	7.49	1.79
Mean Low-Flow Concentration (mg/L)	1,832.62	8.04	2.86

Mean Flow: 94,472,843 (m³/year) and 3 (m³/s)

Download this data

Sources	Sediment (kg)	Total Nitrogen (kg)	Total Phosphorus (kg)
Hay/Pasture	108,632.6	446.1	260.1
Cropland	5,639,127.2	23,203.0	11,625.9
Wooded Areas	16,207.5	1,177.4	88.9
Wetlands	66.9	26.1	1.5
Open Land	198,817.4	3,609.6	420.5
Barren Areas	104.6	40.2	1.5
Low-Density Mixed	30,522.7	784.6	84.2

Layers

Streams

- Continental US Medium Resolution Stream Network
- Delaware River Basin High Resolution Stream Network
- DRB TN conc. from SRAT ⓘ

Leaflet | Map data from ESRI

What is Model My Watershed® ?

- Watershed analyses within the Conterminous U.S. (CONUS), that include:
 - Land cover (2001, '06, '11, '16, '19), protected areas, soil, weather, elevation & slope, agric. animals, point sources, active river area (NE & Mid Atlantic)
- Water quality models:
 - Site Storm Model (use at scales \leq 1-2 sq. mi)
 - *Runoff* from TR55 + Robert Pitts' urban small storm algorithms in WinSLAMM
 - *Water Quality* from EPA STEP-L
 - Watershed Multi-year Model (use at scales \geq 1-2 sq. mi)
 - *Hydrology & Water Quality* modeling using MapShed model (a.k.a., GWLF-E)
- Ability to create, compare, & save scenarios of modeled changes to land cover and conservation practices; Connect and save to <https://www.hydroshare.org/>

Explore Human Impacts on Your Watershed

Analyze mapped watershed data, visualize monitoring data, and run model simulations of human impacts on water quality.

Select Area and Analyze

Explore map layers and select your area of interest. Analyze land cover, hydrologic soil groups, permitted point source discharges and other natural and human influenced features.

Monitor My Watershed

Search for monitoring data in various data repositories. Share your monitoring data to view in WikiWatershed.

Model My Watershed

Run one of two models to compare impacts of different conservation and development scenarios on water quality. Share your modeling results for others to find, copy, and edit.

[Get started →](#)



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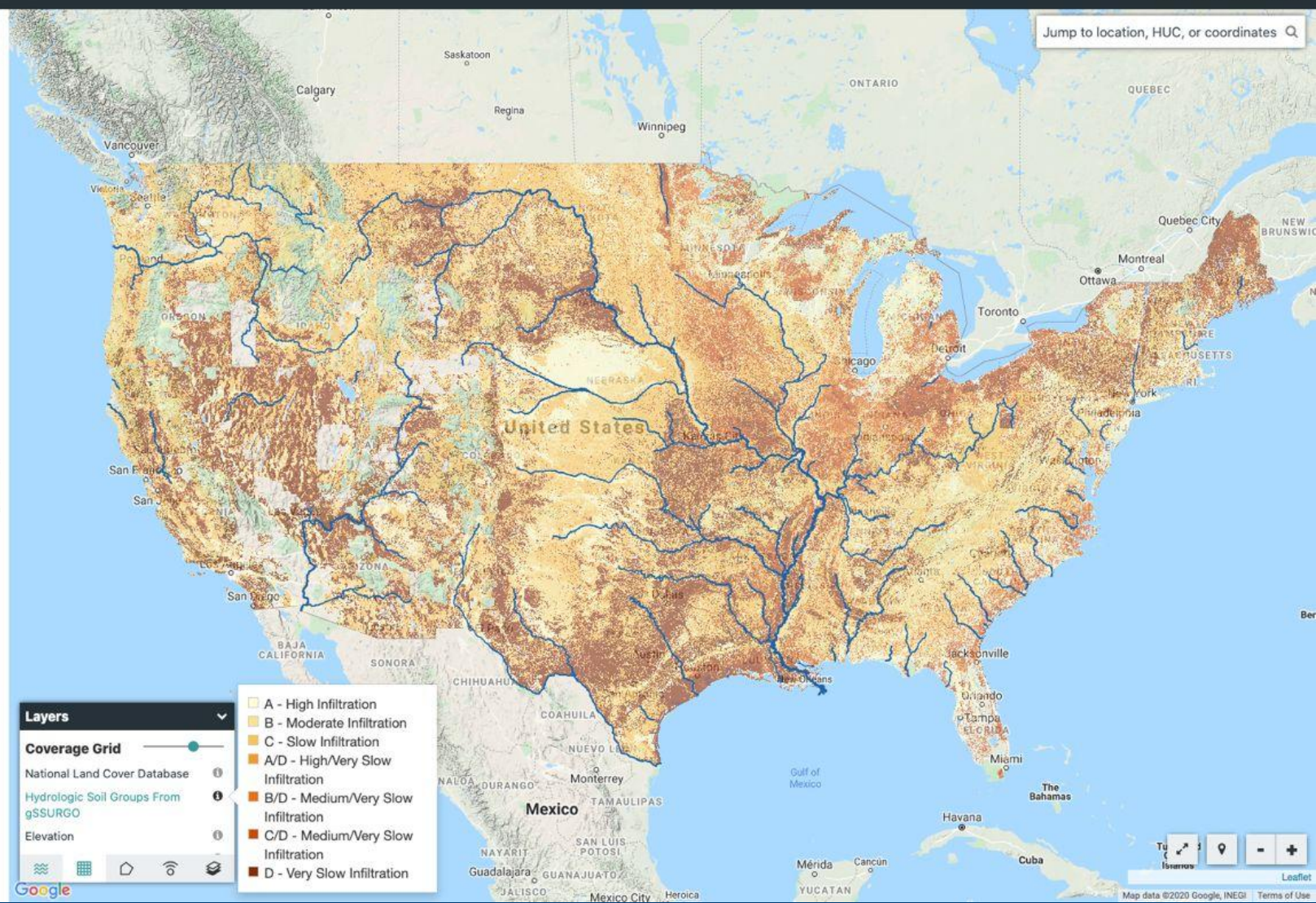
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[Get started →](#)



Jump to location, HUC, or coordinates 🔍

Layers

- Coverage Grid
- National Land Cover Database
- Hydrologic Soil Groups From gSSURGO
- Elevation

- A - High Infiltration
- B - Moderate Infiltration
- C - Slow Infiltration
- A/D - High/Very Slow Infiltration
- B/D - Medium/Very Slow Infiltration
- C/D - Medium/Very Slow Infiltration
- D - Very Slow Infiltration

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Analyze mapped watershed data, visualize monitoring data, and run model simulations of human impacts on water quality.

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Explore map layers and select your area of interest. Analyze land cover, hydrologic soil groups, permitted point source discharges and other natural and human influenced features.

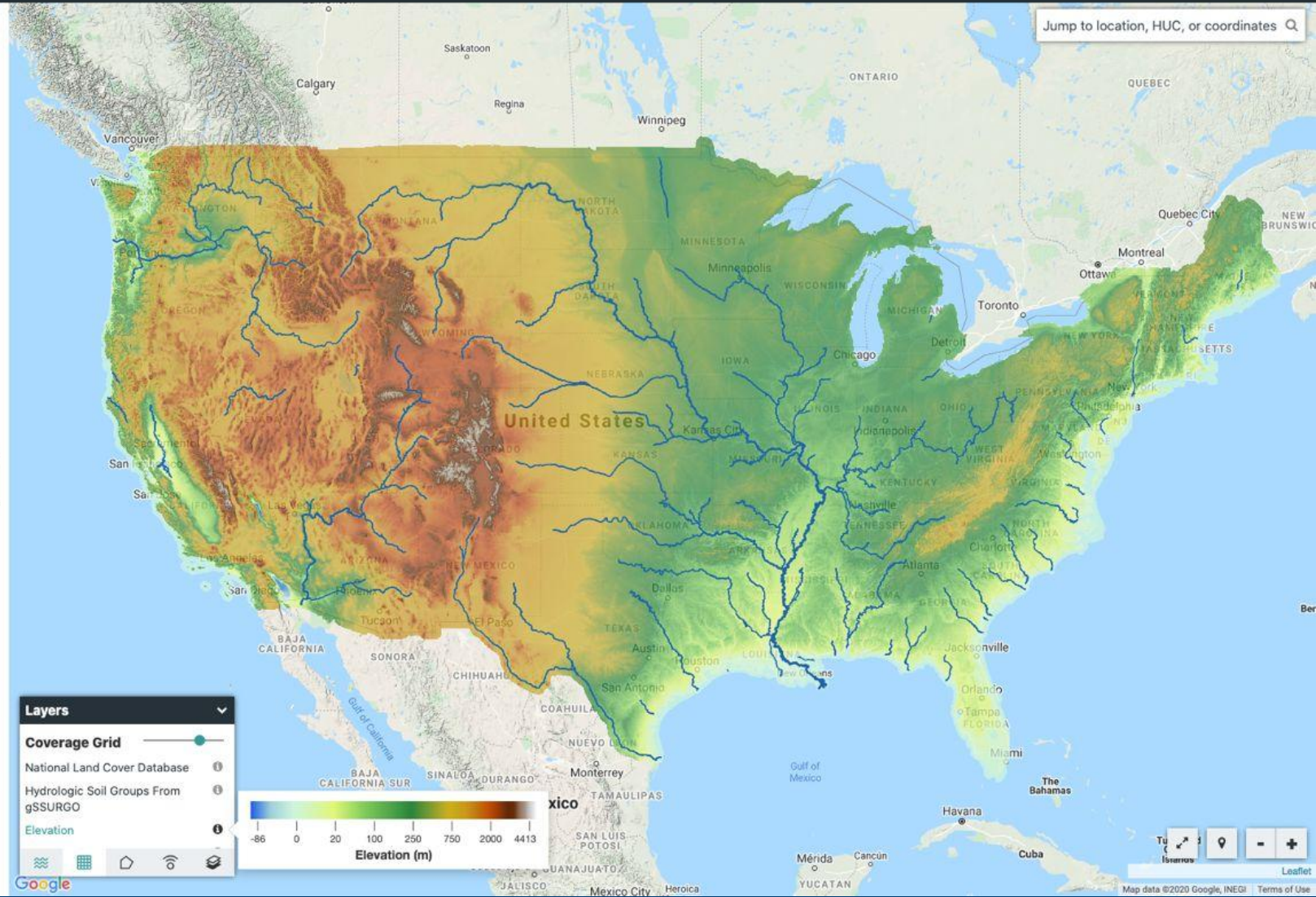
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Model My Watershed®

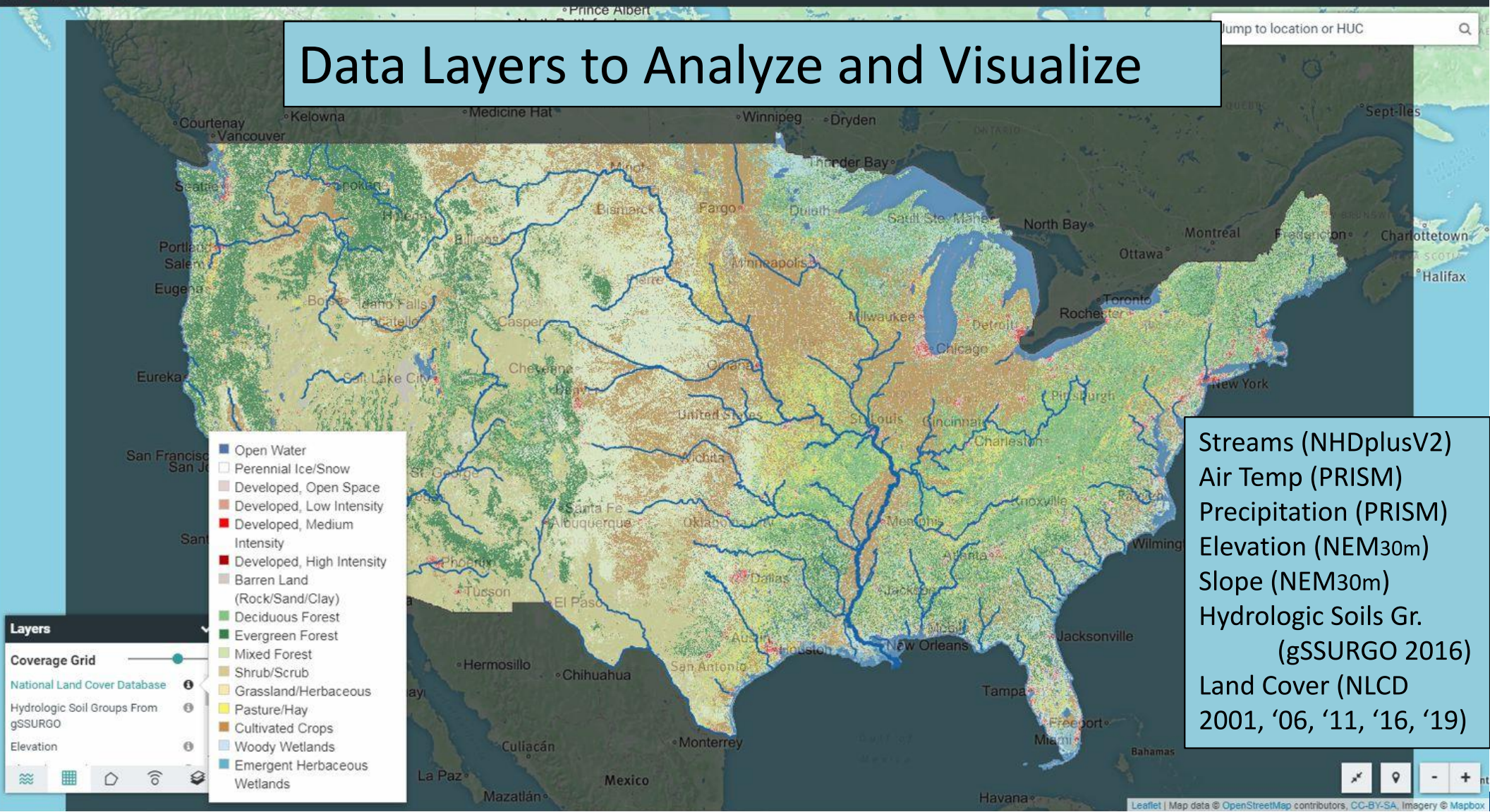
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[Get started →](#)



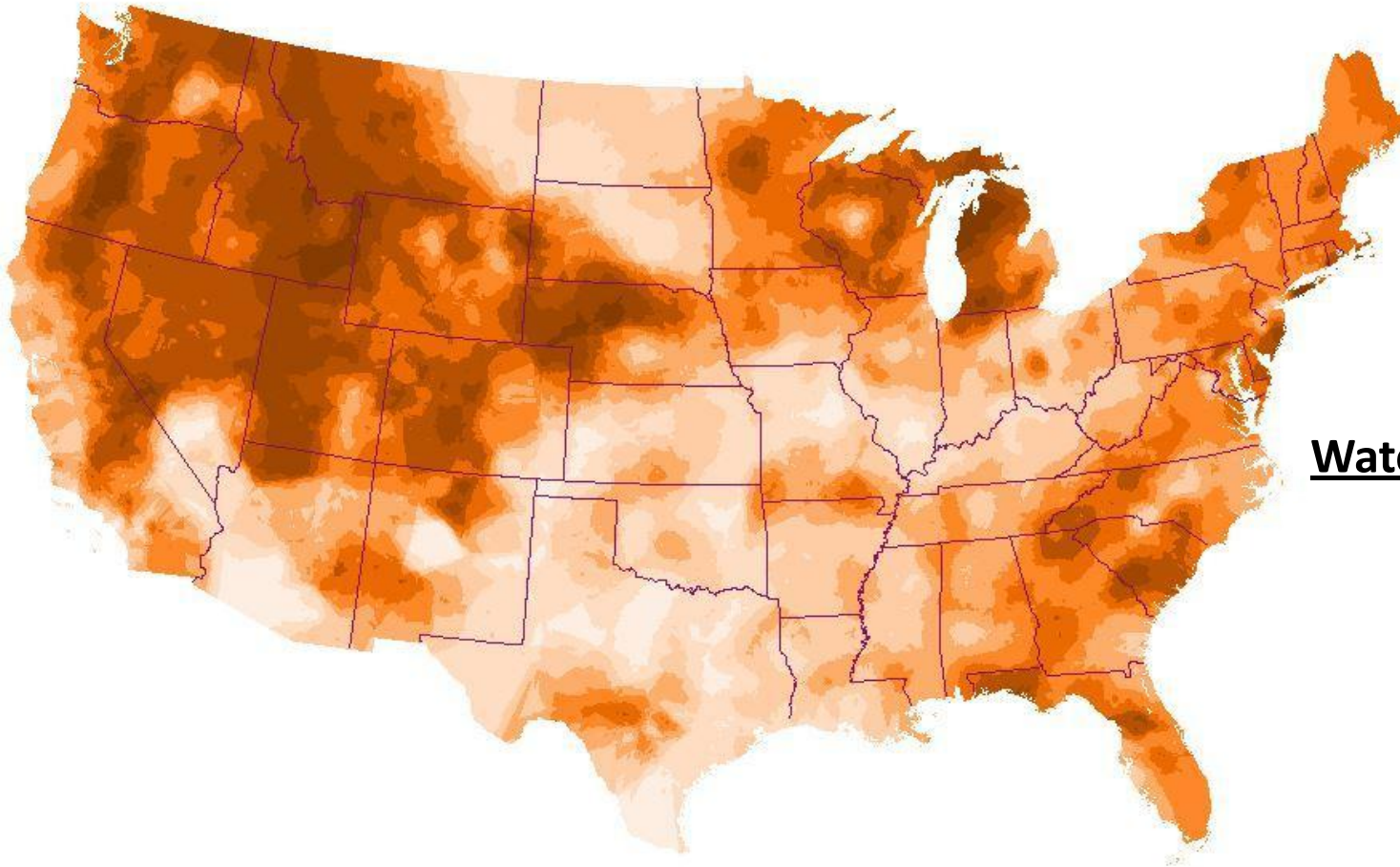
Data Layers to Analyze and Visualize

Jump to location or HUC



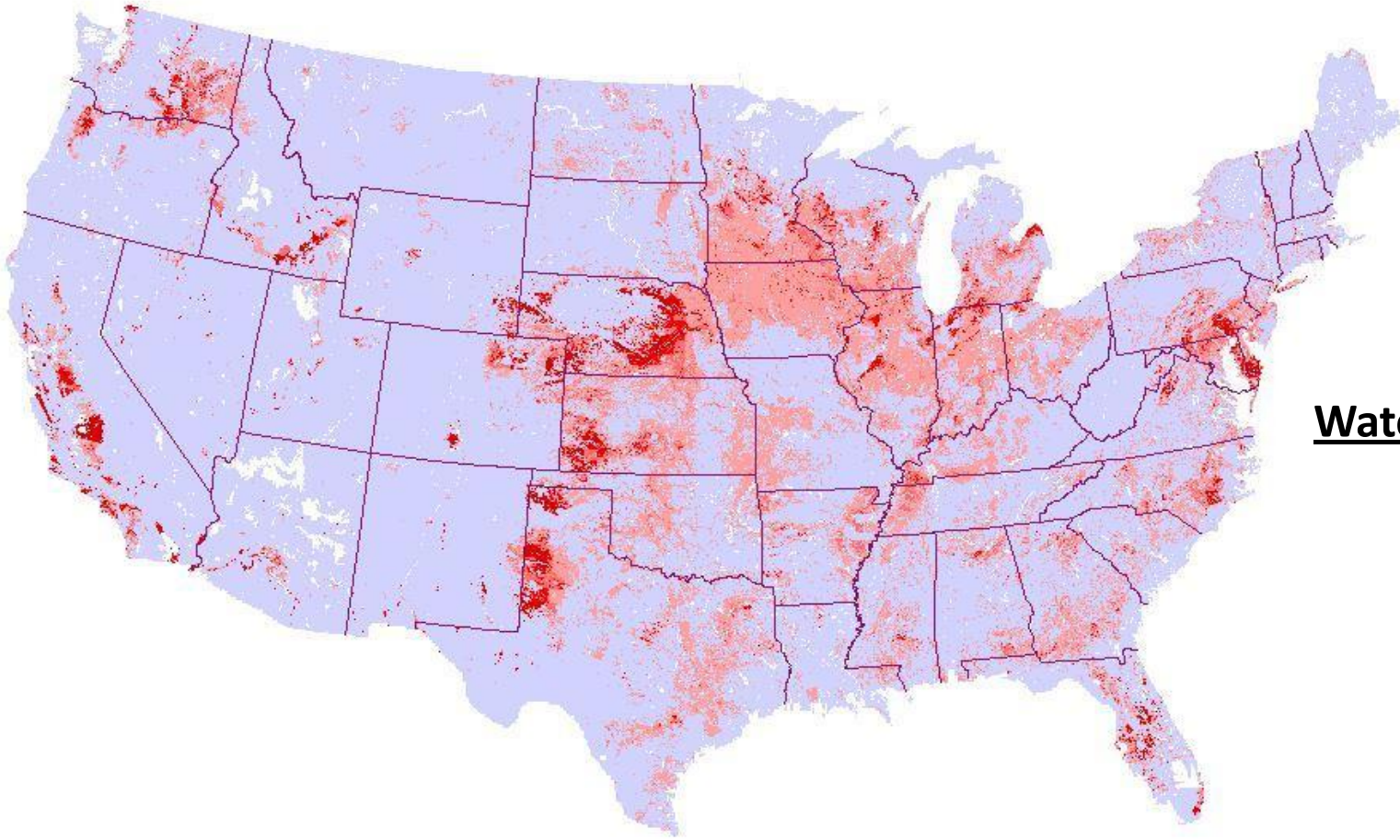
Streams (NHDplusV2)
Air Temp (PRISM)
Precipitation (PRISM)
Elevation (NEM30m)
Slope (NEM30m)
Hydrologic Soils Gr. (gSSURGO 2016)
Land Cover (NLCD 2001, '06, '11, '16, '19)

USGS Baseflow Estimates



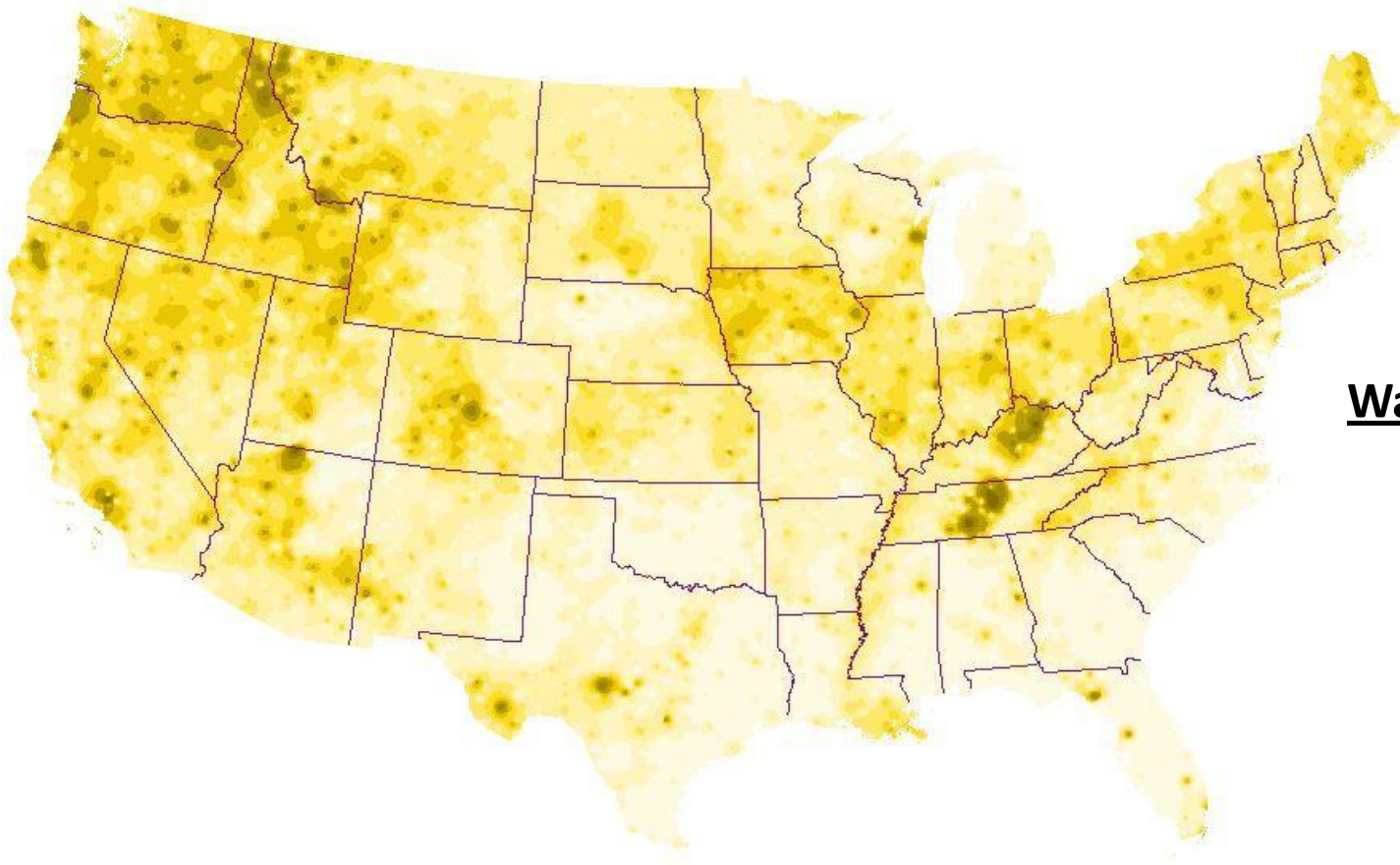
Input layers for
Watershed Multi-Year Model
(not visualized)

Groundwater Nitrogen Estimates



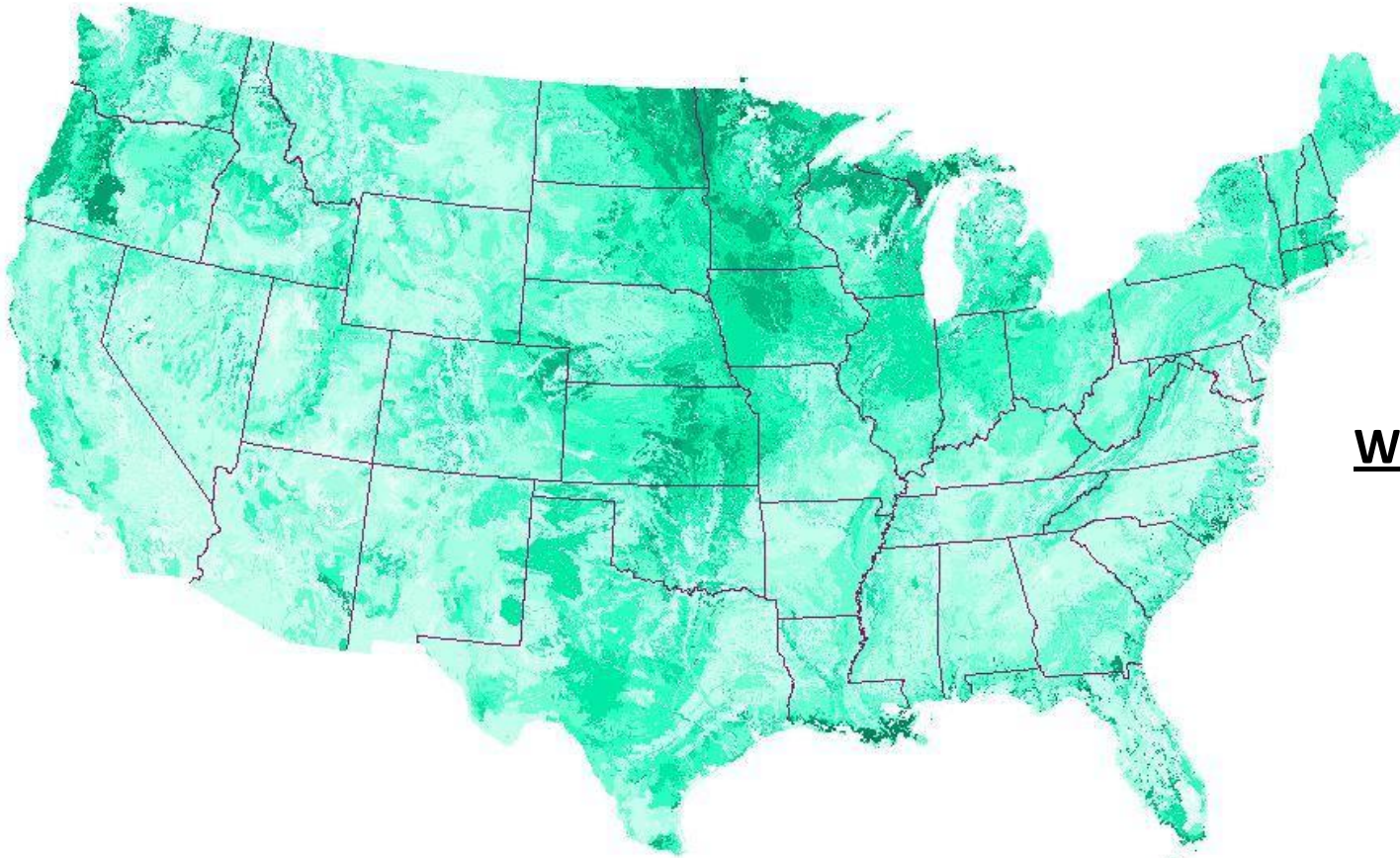
Input layers for
Watershed Multi-Year Model
(not visualized)

Soil Phosphorus Estimates



Input layers for
Watershed Multi-Year Model
(not visualized)

Soil Nitrogen Estimates



Input layers for
Watershed Multi-Year Model
(not visualized)

Weather Station Network for Precipitation Input



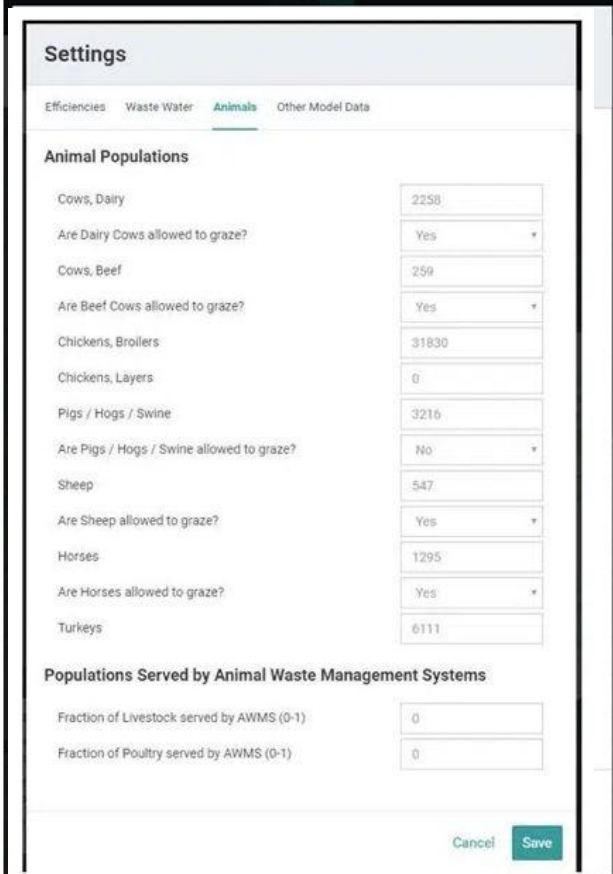
Input layers for
Watershed Multi-Year Model

Demo Model My Watershed® .

Watershed Multi-Year Model

- The appropriate size (total area/acreage) of your Area of Interest when using the Watershed Multi-Year Model is from several hundred acres to ~1,500 square miles (HUC 8 scale; although modeling larger areas are possible)
- Utilizes daily temperature and precipitation data (1960-90 is provided; custom weather is possible) and is designed to estimate average monthly and annual values for water quality and quantity, specifically:
 - Quantity: stream flow, subsurface flow, evapotranspiration, point source flow (if in your area)
 - Quality: total sediment, total nitrogen, total phosphorus
- Add BMPs, change land cover, and modify “settings” offer customization of your project
- 5 minutes to a couple of hours, no extra data needed, easy to use

Technical Documentation - <https://wikiwatershed.org/kbcategories/mmw-tech/>



The screenshot displays the 'Settings' page for the Model My Watershed application, with the 'Animals' tab selected. The page is organized into several sections:

- Animal Populations:** A list of animal types with corresponding population counts and grazing options.

Animal Type	Population	Grazing Option
Cows, Dairy	2258	Yes
Are Dairy Cows allowed to graze?		Yes
Cows, Beef	259	
Are Beef Cows allowed to graze?		Yes
Chickens, Broilers	31830	
Chickens, Layers	0	
Pigs / Hogs / Swine	3216	
Are Pigs / Hogs / Swine allowed to graze?		No
Sheep	547	
Are Sheep allowed to graze?		Yes
Horses	1295	
Are Horses allowed to graze?		Yes
Turkeys	6111	
- Populations Served by Animal Waste Management Systems:** Two input fields for the fraction of livestock and poultry served by AWMS, both currently set to 0.

At the bottom right of the settings panel, there are 'Cancel' and 'Save' buttons.

Help? and Resources

Online HELP?

- <https://wikiwatershed.org/help/model-help/>
- Contact for questions/requests <https://wikiwatershed.org/contact/>

Technical Documentation

- <https://wikiwatershed.org/help/model-help/>

Resources

- <https://WikiWatershed.org>
- <https://ModelMyWatershed.org>
- <https://github.com/WikiWatershed>

Open Source Project Documentation

- <https://github.com/WikiWatershed>



WikiWatershed

A web toolkit to support citizens, scientists, conservation decision-makers and students to collaboratively advance knowledge and stewardship of fresh water

http://wikiwatershed.org

Repositories 9 | People 12 | Projects 0

Search repositories... | Type: All | Language: All

model-my-watershed

The web application front end for Model My Watershed.

JavaScript | 20 stars | 24 forks | Apache-2.0 | Updated 18 hours ago



gwlf-e

Port of Generalized Watersheds Loading Functions - Enhanced (MapShed)

GAMS | 3 stars | 7 forks | Apache-2.0 | Updated 15 days ago



MMW-BMP-spreadsheet-tool

Spreadsheet for advanced BMP planning using MMW output, for MS4 permitting and watershed conservation plans.

BSD-3-Clause | Updated on Aug 9



Top languages

- Shell
- Python
- Scala
- CSS
- GAMS

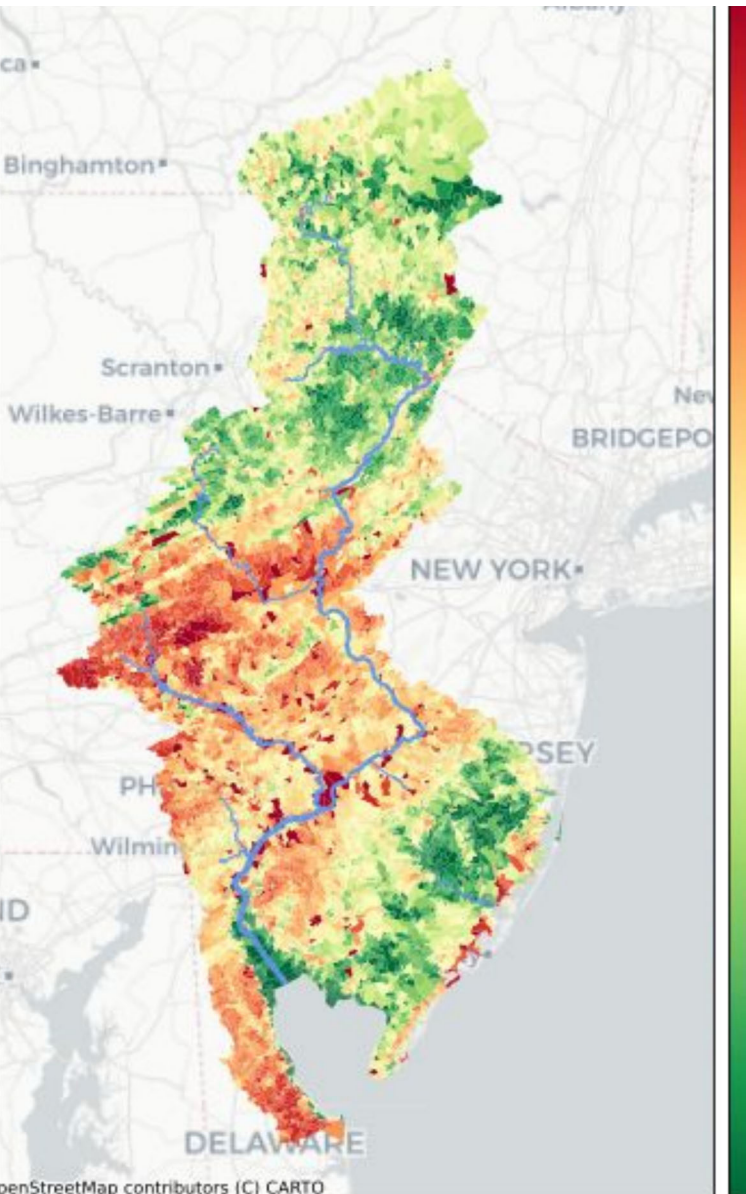
People

12 >



GitHub





DELAWARE RIVER WATERSHED INITIATIVE POLLUTION ASSESSMENT

Project Update

May 10, 2023

Anthony Aufdenkampe
Dave Arscott, Sara Damiano
Lin Perez, Barry Evans, Mike Campagna
Caitlin Lulay, Sarah Jordan



Utilization of the Tool?

- >15,000 registered users
 - conservation practitioners/planners, state and federal government, university/academic, k-12 students and teachers
- Agricultural BMP planners (e.g., Delaware River Watershed Initiative)
- Restoration project impact tracking and assessment (William Penn Foundation and NFWF)
- Estimating Water-Related Benefits of Open Space Protection
 - Chester, Delaware, and Montgomery County's (PA), Mercer Co. (NJ)
- Optional tool for PA DEP MS4 planning, WIPs (also utilized by DEC/DEPs in NY, MA, ME,...)
- Environmental consultants to municipalities

FEATURE

Data and Models Help Define Effective Strategies In The Delaware River Watershed Initiative

Paul Freedman, David B. Arscott, Scott Haag and Kathy Hall

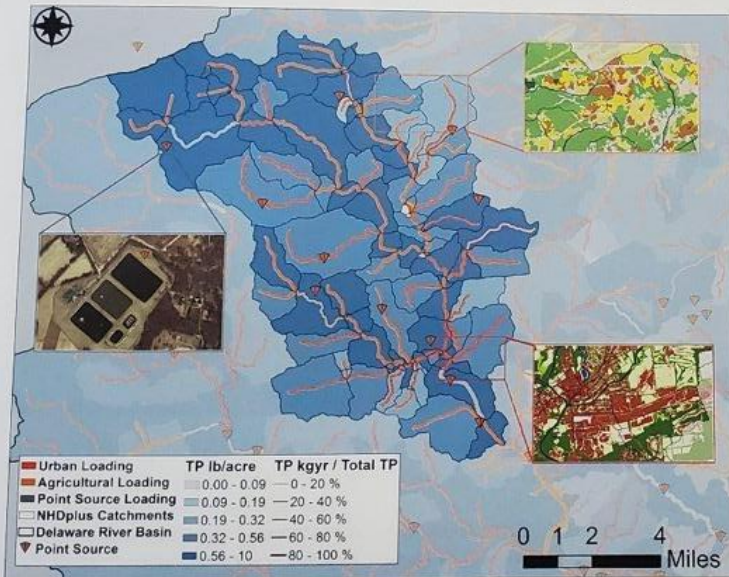


Figure 1: An example of the output from the Stream Reach Assessment Tool SRAT showing Phosphorus Loading from Urban, Agricultural and Point Sources.

As a first step, DRWI selected eight smaller areas within the basin, termed clusters, where analysis indicated that investment could deliver significant returns, and where there was sufficient non-governmental organization (NGO) capacity to implement actions. Within these targeted clusters, more than 60 NGOs were brought together by the William Penn Foundation to develop plans to implement agricultural best management practices (BMPs), protect forested land in sensitive landscapes and work in partnership with municipalities to implement urban stormwater BMPs. However, each of these NGOs had its own historical emphasis and priorities that needed to be coordinated to help achieve the DRWI vision. Initial efforts to establish goals, develop plans and select projects were challenging.

To address these challenges, DRWI, working with a team of scientists and planners, developed a science-informed approach to prioritize investments, guide cluster plans and facilitate the

Water Resources Impact
Sept 2018 v20(5)

American Water Resources
Association periodical

he Delaware River Watershed Initiative (DRWI) was

Example project abstract from 2023 NWQMC: Linking Nutrient Management to Receiving Water Quality Improvements and Ecological Responses

P. Aron¹, J. Weiss¹, S. Kumar², Abbey Johnson³, S. Palmate³, and C. Owen⁴

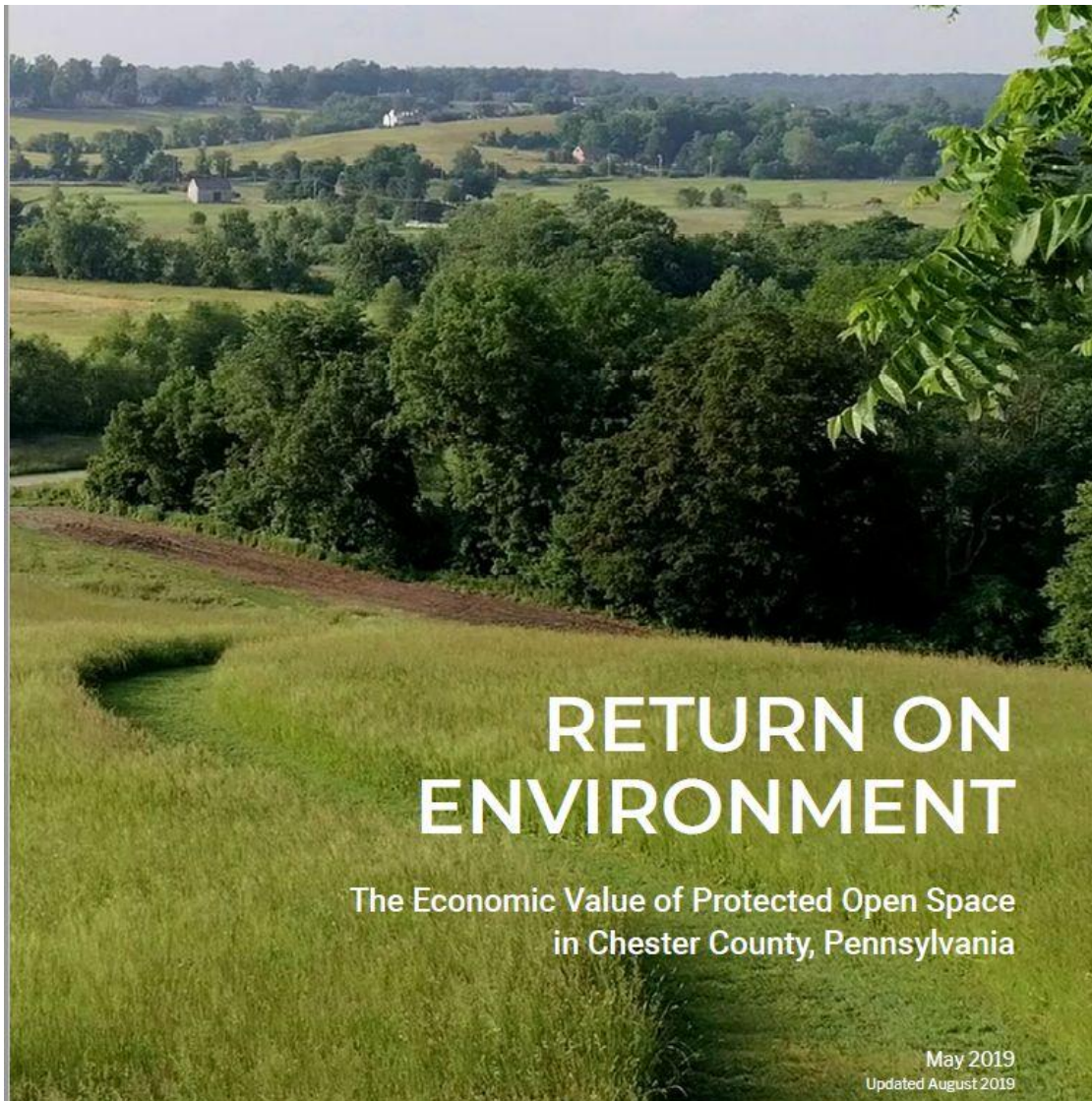
1- Hazen and Sawyer, Baltimore, Maryland; 2 -Arizona State University, Tempe, Arizona; 3-Texas A&M, El Paso, Texas 4 - Hazen and Sawyer, Tampa, Florida

Water Research Foundation Funded Project #5078

Project will develop 1) an online database of case studies in nutrient reductions and receiving water responses and 2) an interactive tool to explore common drivers associated with successful nutrient management.

Excessive nutrient loadings to natural waters cause numerous challenges to water resource managers, from aesthetic, ecological, and recreational issues to public health impacts associated with harmful algal blooms and costly drinking water treatment. The traditional approach to manage nutrient loading consists of establishing water quality impacts and linkages to sources, evaluating costs and benefits of management actions, implementing controls, and assessing improvements in water quality and ecosystem outcomes. However, in practice it can be exceedingly difficult to link watershed and source water nutrient control actions to specific water quality and ecosystem responses because we often lack monitoring data to evaluate nutrient management actions or calibrate models that can support quantitative assessment of management alternatives....

https://whova.com/portal/webapp/nmc_202303/Agenda/2956534



Avoided Stormwater Impacts and Costs from Open Space Protection in the Brandywine Creek Watershed – Return on Environment



Report and related materials are available online at:
<http://chescoplanning.org/openspace/roe.cfm>

Amazon Names the Stroud Center's Model My Watershed a "City on a Cloud Innovation Challenge" Winner

Press Releases » Amazon Names the Stroud Center's Model My Watershed a "City on a Cloud Innovation Challenge" Winner



The Stroud Center was one of three winners in the Partners in Innovation category, along with Utility Associates and University of Münster. Stroud Center Assistant Director Scott Ensign (left) and Simon Araya from Utility Associates are shown accepting the award on behalf of their institutions.

<https://stroudcenter.org/press/watershed-model-amazon-challenge-winner/>

Amazon Web Services has announced Stroud Water Research Center — a global leader in the advancement of



WikiWatershed®

Funding from:

- William Penn Foundation
- NSF DRK12 Grant No. DRL- 1418133 “Teaching Environmental Sustainability - Model My Watershed” 4-year Project
- Pennsylvania Dept. of Environmental Protection
- Past NSF Grant: DRL #0929763
- Stroud Water Research Center
- Virginia Wellington Cabot Foundation
- The Dansko® Foundation
- Generous donations from Peter Kjellerup and Mandy Cabot



National Science Foundation
WHERE DISCOVERIES BEGIN

FUTURE OF MODEL MY WATERSHED

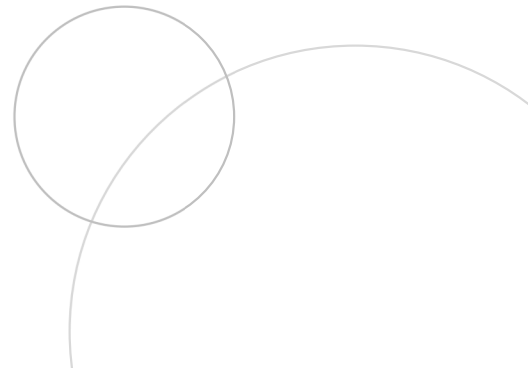
- Our vision real-time decision support platform
- Collective of many technical and funding partners





Future Developments: Other Projects?

- Add new, enhanced or local datasets?
 - Recent / Future Climate Drivers (i.e. daily precipitation and temperature)?
 - Localized data?, Global data?
 - Future land-cover forecasts?
- Add new modeling features?
 - Localized BMPs; BMP cost estimates & tracking
 - Detailed site design?
- Add new models?
 - HSPF?, SWAT?, SWMM?
 - Water Temperature?, Flooding?
 - Ecosystem services? / natural capital?
- Add model output viewers/explorers?
 - Calibrated model results from TMDL studies?
 - National Water Model?



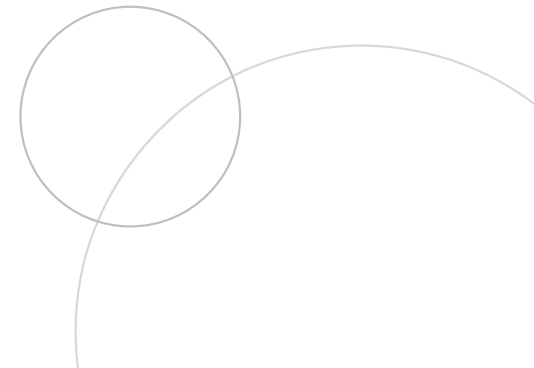


Hydrological Simulation Program in Python (HSP2, HSPsquared)

- Identical results as Hydrological Simulation Program - FORTRAN (HSPF)
 - HSPF is one of the most widely used and respected models for watershed management
 - Used by VA DEQ
- HSP2 is built on modern software stack for cloud computing
 - Python 3.7
 - OS: Windows, Linux, Mac
 - Compute performance via Pandas & Numba
 - Parallel processing
 - Storage performance via HDF5



<https://github.com/respec/HSPsquared>
AGPL-3.0 License



Enhance MMW: Project Tracking

- Open-source foundation for web apps
 - rebrand or not
- Add model modules for decision support on:
 - Water security & risk
 - Crop sustainability
 - Climate change resiliency
 - Carbon sequestration
 - Biodiversity
 - Etc.
- Expandable to anywhere in the world

Wiki Watershed

Proctor Creek Conserva... Details Analyze Monitor Model Share New Project

Utoy Creek-Chattahoochee River, HUC-10 Watershed ID 0313000201 307 km²

Conservation Projects

Filters (1) Contribute Data

NRCS Your Program NFWF

Infiltration Basin, Greenway

- Water Volume: 30.9 ML/y
- Sediment: 80,000 kg/y
- Carbon: 12.6 kg/y

Stormwater pond, Mableton, GA

- Flood mitigation: 400 ML/storm
- Sediment: 56,000 kg/y
- Carbon: 28 kg/y

Urban reforestation, along Southwest PKWY, GA

- Water Volume : 39 ML/storm
- Sediment: 56,000 kg/y
- Phosphorus: 185 kg/y
- Carbon: 56 kg/y
- Biodiversity score: 8.3

Wetland restoration , Proctor Creek at Jackson Parkway

- Flood mitigation: 600 ML/storm
- Sediment: 36,000 kg/y
- Carbon: 60 kg/y
- Biodiversity score: 7.4

Mockup for Illustration

Layers

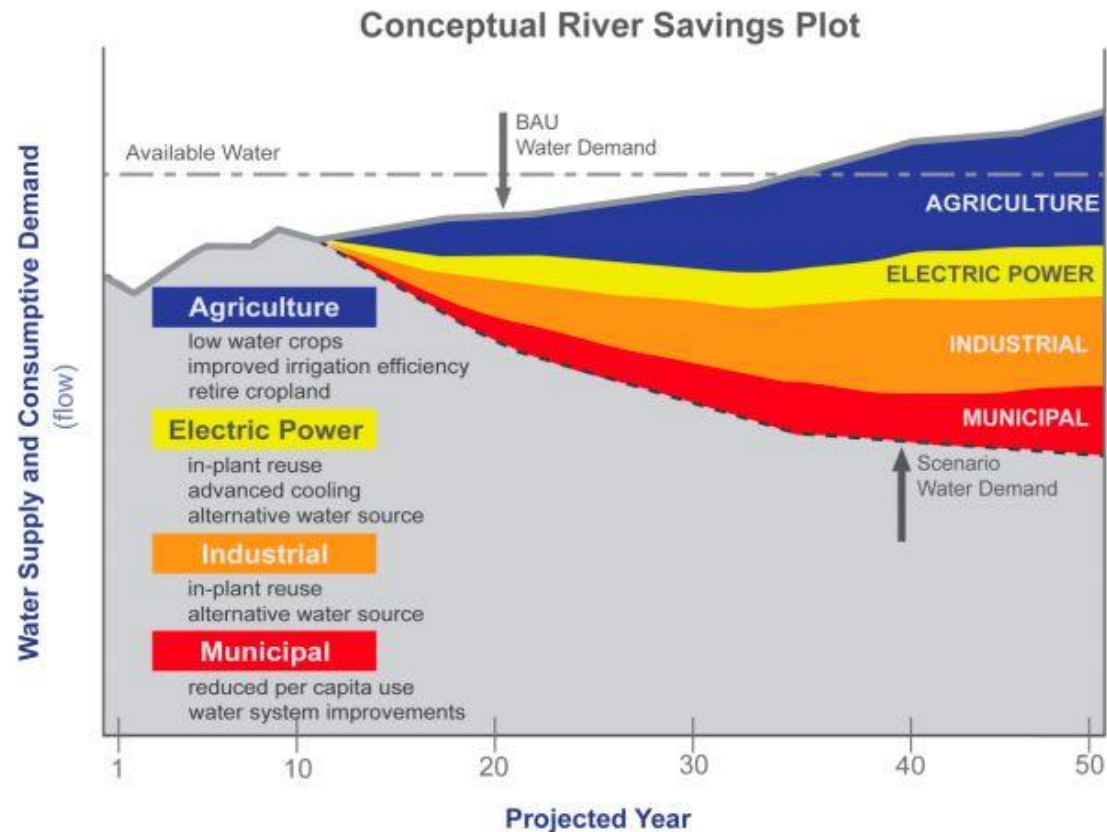
- Coverage Grid
- Protected Lands
- Active River Area - NE & Mid-Atlantic
- DRB Urban Land 2011 Baseline

Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox



Real-Time Decision Support for Water Risk

- Water availability forecasting
 - Changing consumption
 - Changing climate
 - Considering environmental flow limits
- Water quality forecasting
 - Drinking water inlets
 - Source watershed protection
 - Recreational use
 - Community sustainability
- Flood risk forecasting
 - Requires real-time data & HPC modeling
- Investment Risks
 - Synthesis of all types of risk!

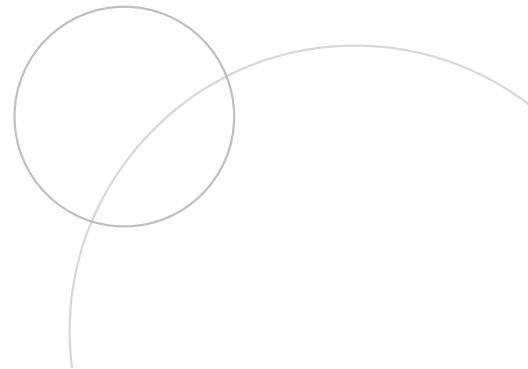


Weintraub, Laura H.Z., Hua Tao, and Todd M. Redder, 2017. *Water Prism: A Tool to Assess Water Availability Risk and Investigate Water Management Strategies*. Journal of the American Water Resources Association (JAWRA) 1-21. DOI: 10.1111/1752-1688.12519



Many Other Opportunities, and growing!

- Visualize outputs from Federal Modeling & Data Systems?
 - NOAA National Water Model
 - USGS Water Services (REST APIs for flow, water quality data)
 - USGS Hydro Network-Linked Data Index (NLDI)
 - USEPA Water Quality Data Portal (WQP) and Exchange (WQX)
 - NASA N. American Land Data Assimilation Systems (NLDAS) & Data Rod API
 - Many others
- Visualize outputs from other sources?
 - Amazon Open Data on AWS S3 storage
 - Google Earth Engine & Earth Map
 - Academia



WikiWatershed

About Model Monitor Manage Help News Events Donate

Web Tools Advancing Knowledge and Stewardship of Fresh Water

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STRoud WATER RESEARCH CENTER

WikiWatershed is an initiative of [Stroud™ Water Research Center](#). The Stroud Center seeks to advance knowledge and stewardship of freshwater systems through global research, education, and watershed restoration.

Welcome to WikiWatershed, a web toolkit designed to help citizens, conservation practitioners, municipal decision-makers, researchers, educators, and students advance knowledge and stewardship of fresh water. [Learn more](#)

Explore the WikiWatershed Toolkit

Model My Watershed®

Analyze geospatial data, model storms, and compare conservation or development scenarios in a watershed. [Learn more](#)

Launch the App

Runoff Simulation

Explore how land use and soil determine runoff for the Site Storm Model package of Model My Watershed. [Learn more](#)

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Resource: **White Clay Creek's Stage Streamflow / Discharge**

Discover and map monitoring data from multiple federal, state, academic, and citizen sources. Share and compare your monitoring data with the world.

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Innovative Technology Science Inquiry

Colorado STEM Students Use WikiWatershed Tools in Service Project

2017-11-08

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EVENTS

Leaf Pack Coming to Michigan!

May 19, 9:30 AM - 4:00 PM EDT

[View All Events](#)

Teaching Environmental Sustainability With Model My Watershed (TES-MMW)

The TES-MMW curriculum gives students the ability to use data to understand how human actions impact watershed health. TES-MMW is funded by National Science Foundation grant [DRL #1418133](#).

Web Demo and Related Resources

- <http://WikiWatershed.org>
- <https://ModelMyWatershed.org>



THANK YOU



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aaufdenkampe@limno.com

Matt Ehrhart
mehrhart@stroudcenter.org



<https://wikiwatershed.org>



Backup Slides below, if ModelMW
doesn't function properly

Select Area

Explore mapped layers, such as streams, land cover, soils, boundaries and observations, using the layer selector in the lower left of the map. See our [documentation on layers](#).

Select an Area of Interest in the continental United States, using the suite of tools below, to analyze the factors that impact water in your area and to begin to model different scenarios of human impacts. Different modeling options for using these tools are described in the technical documentation.

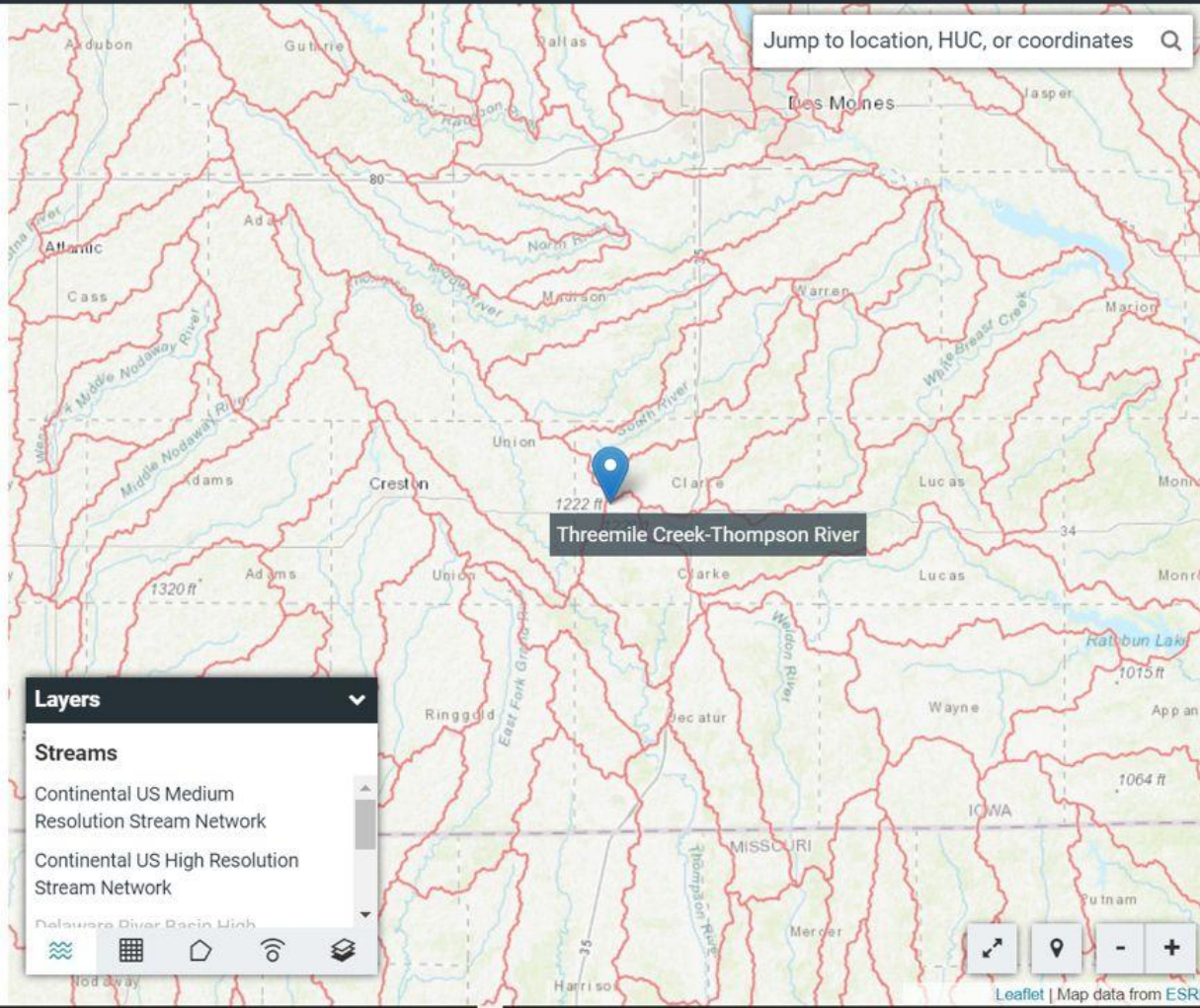
Select boundary
Choose a predefined boundary from several types

USGS Watershed unit (HUC-10): Click on a boundary.

Draw area
Free draw an area or place a square kilometer

Delineate watershed
Automatically delineate a watershed from any point

Upload file
Upload a polygon for your area



Threemile Creek-Thompson River, HUC-10 Watershed

ID 1028010202 313 mi²

Streams Land Soil Terrain Climate Pt Sources Animals Water Qual

NHD Medium Resolution Streams

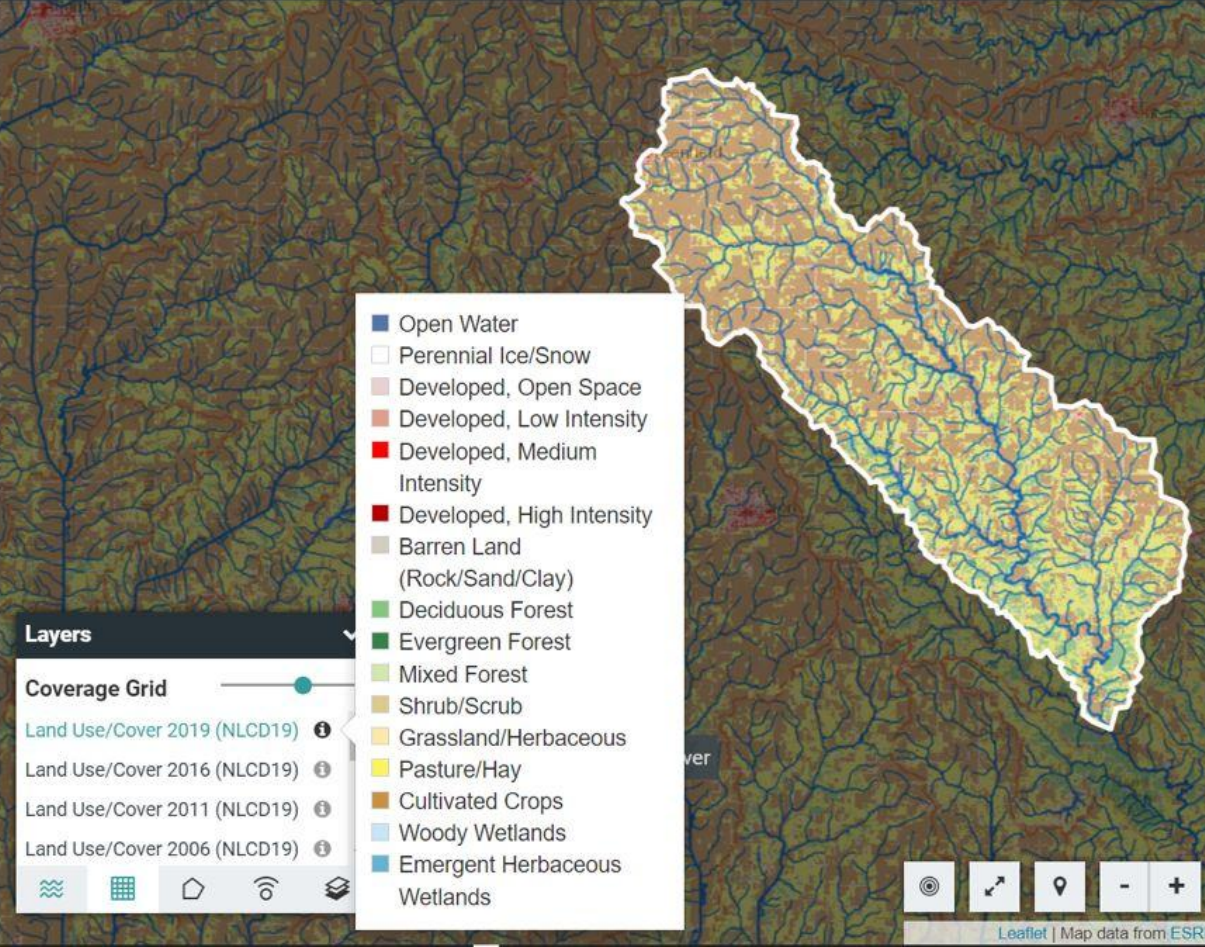
NHD Medium Resolution Stream Network Statistics

Related Layer: Continental US Medium Resolution Stream Network

Turn off

Source: NHDplusV2

Stream Order	Total Length (mi)	Mean Channel Slope (%)
1st	309.28	1.30%
2nd	79.75	0.37%
3rd	62.16	0.17%
4th	23.54	0.09%
5th	35.37	0.06%
6th	0.00	No Data
7th	0.00	No Data
8th	0.00	No Data
9th	0.00	No Data
10th	0.00	No Data



Threemile Creek-Thompson River, HUC-10 Watershed

ID 1028010202 313 mi²

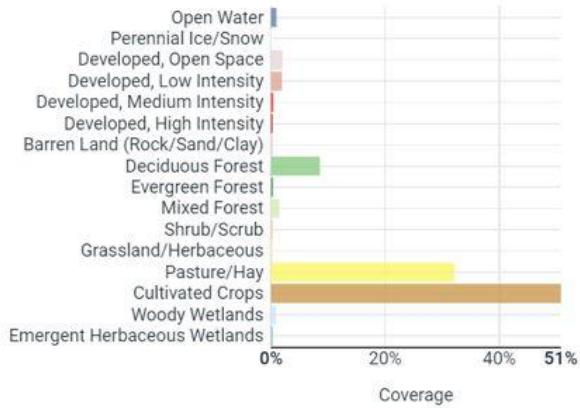
Streams Land Soil Terrain Climate Pt Sources Animals Water Qual

Land Use/Cover 2019 (NLCD19)

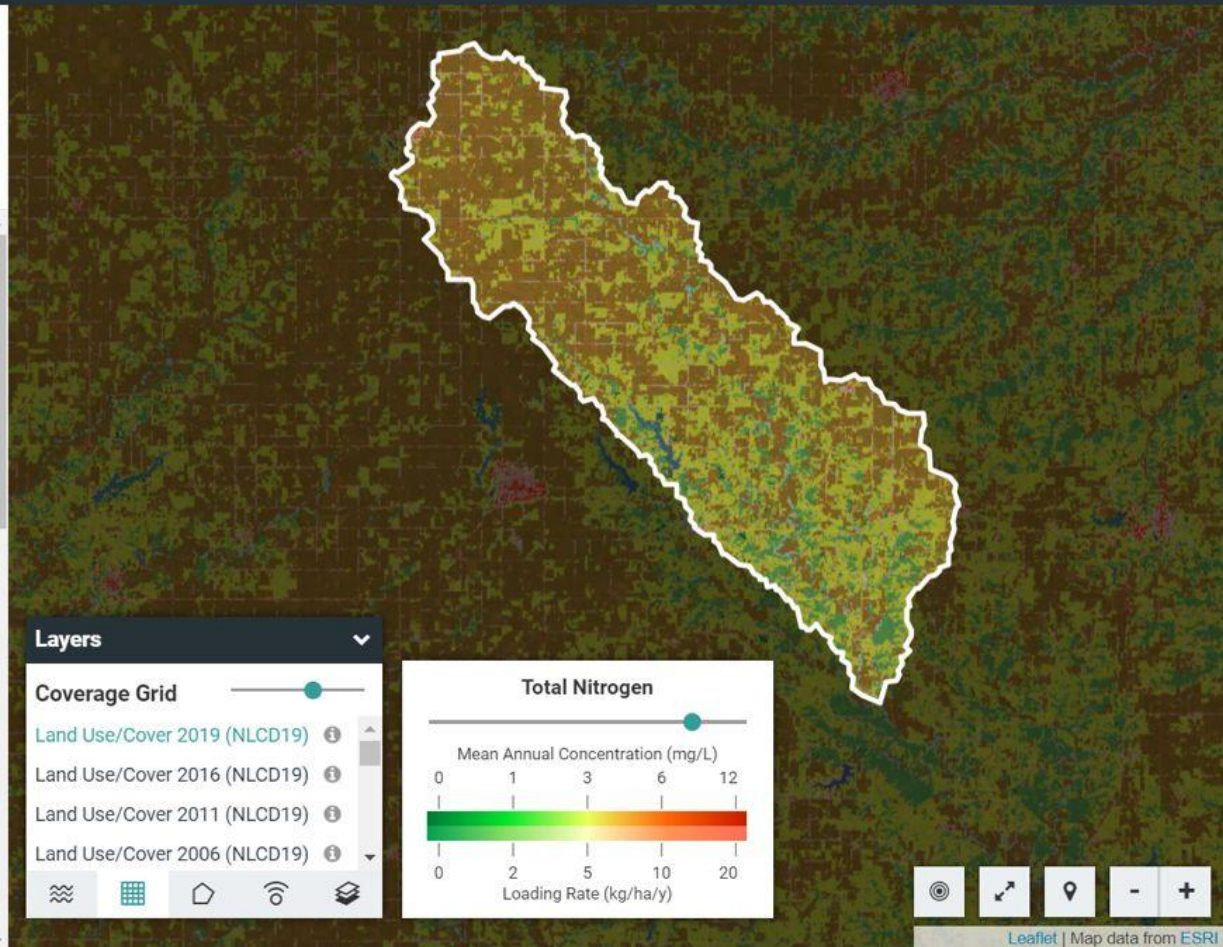
Land Use/Cover 2019 (NLCD19)

Related Layer: Land Use/Cover 2019 (NLCD19) [Turn off](#)

Source: National Land Cover Database (NLCD 2019) ⓘ



Type	Area (mi ²)	Coverage (%)	Active River Area
------	-------------------------	--------------	-------------------



Map navigation controls: Home, Full Screen, Location, Zoom In, Zoom Out. Leaflet | Map data from ESRI

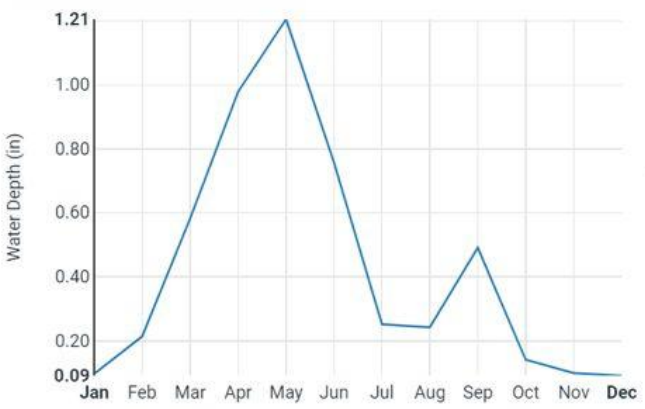
Average monthly water fluxes (in) from 30-years of daily water balance

Related Layer: Weather Stations used in this model. Turn on

Weather Source: USEPA National Climate Data ⓘ

Simulated by the GWLF-E (MapShed) model ⓘ

Stream Flow



Month Stream Flow Surface Runoff Subsurface Point Src

Upper East Nishnabotna River

Layers

Coverage Grid

Land Use/Cover 2019 (NLCD19) ⓘ

Land Use/Cover 2016 (NLCD19) ⓘ

Land Use/Cover 2011 (NLCD19) ⓘ

Land Use/Cover 2006 (NLCD19) ⓘ

Map navigation controls: Home, Full Screen, Location, Zoom In, Zoom Out

Average annual loads from 30-years of daily fluxes

Related Layer: Weather Stations used in this model. Turn on

Weather Source: USEPA National Climate Data

Simulated by the GWLF-E (MapShed) model

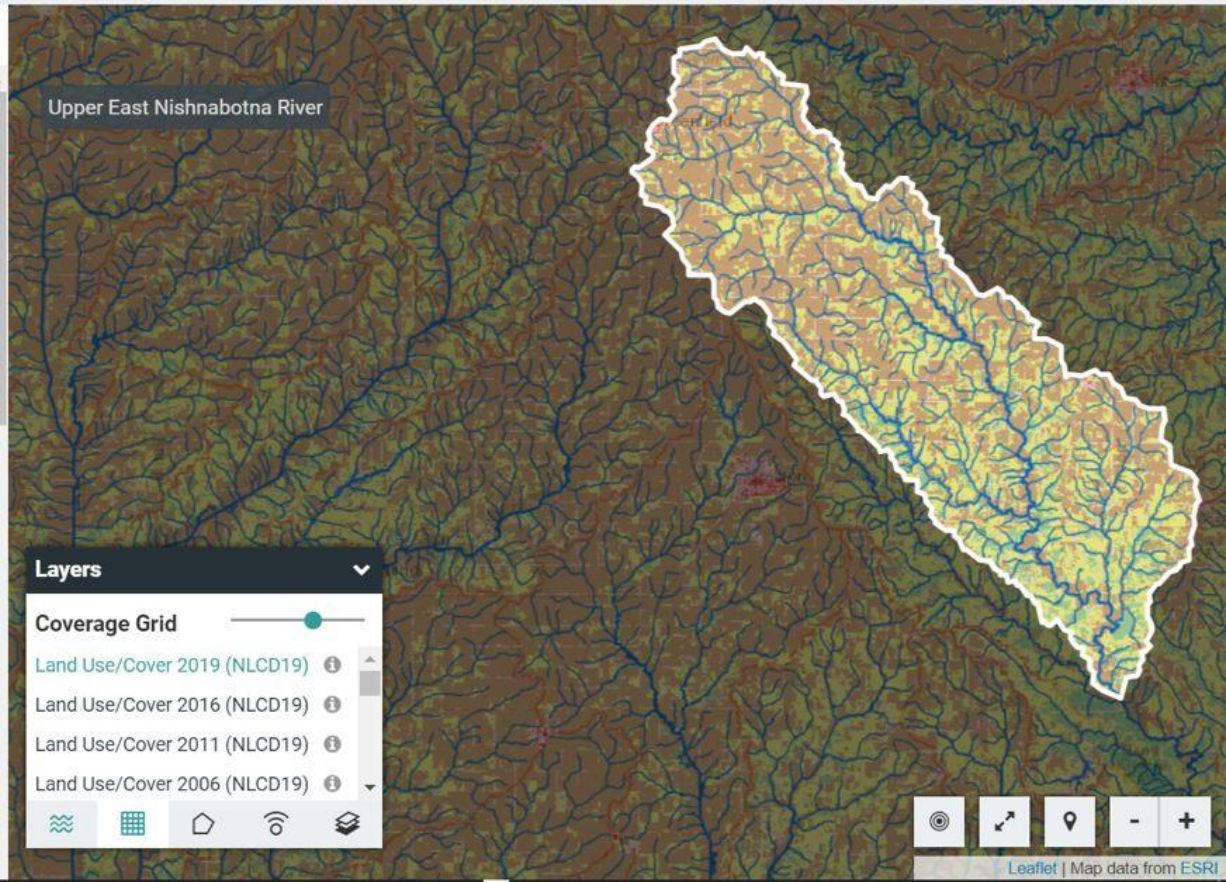
View subbasin attenuated results

Sources	Sediment	Total Nitrogen	Total Phosphorus
Total Loads (lb)	102,265,234.8	707,708.5	136,592.7
Loading Rates (lb/ac)	515.18	3.57	0.69
Mean Annual Concentration (mg/L)	441.11	3.05	0.59
Mean Low-Flow Concentration (mg/L)	1,875.31	10.99	2.20

Mean Flow: 3,713,645,174 (ft³/year) and 117.76 (ft³/s)

Download this data

Sources	Sediment (lb)	Total Nitrogen (lb)	Total Phosphorus (lb)



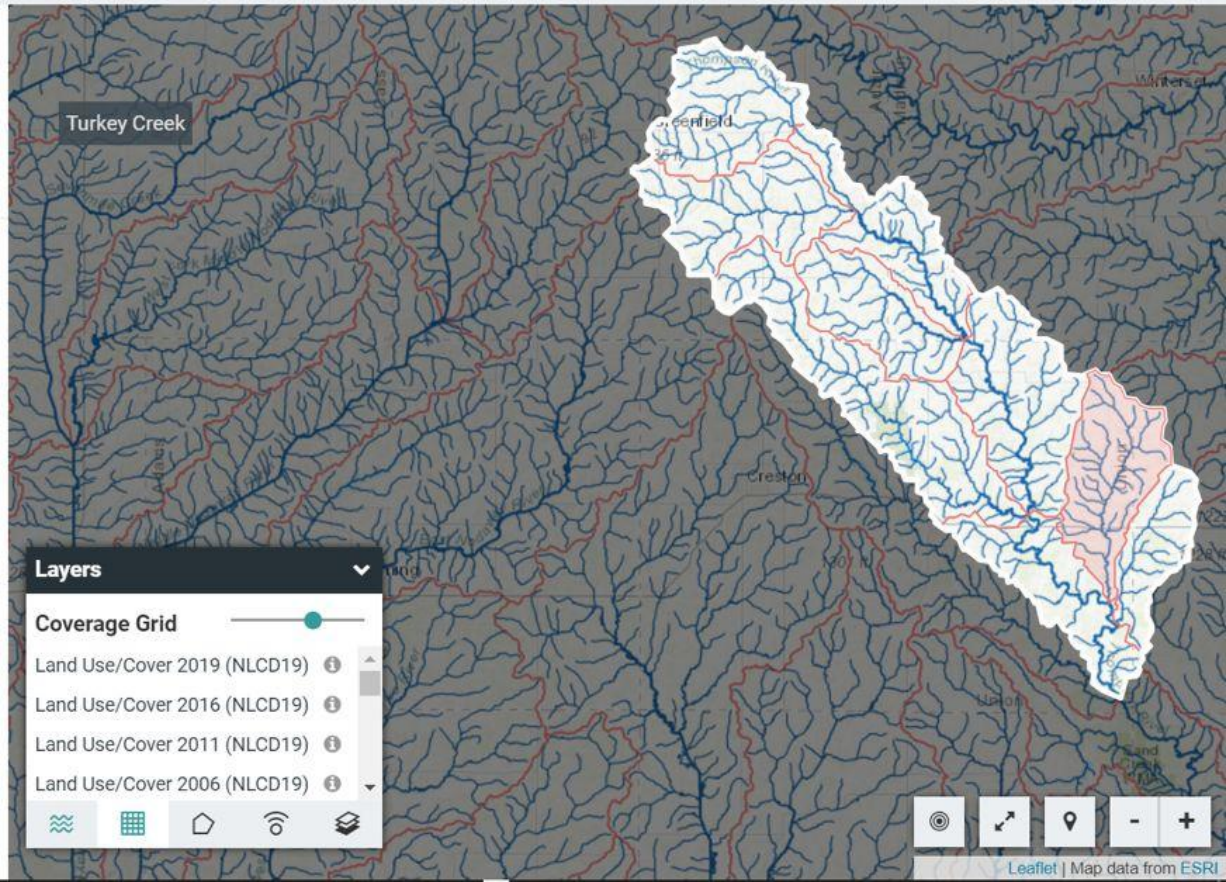
Exit subbasin attenuated results

Threemile Creek-Thompson River, HUC-10 Watershed (ID 1028010202)

Displaying average annual loads from 30-years of fluxes

Sources HUC-12

Marvel Creek-Thompson River	102801020201	21,468.25	30,521,212.68	2
Ninemile Creek-Thompson River	102801020202	23,697.63	27,259,954.22	1
West Branch Creek	102801020203	18,707.10	15,824,922.92	1
City of Macksburg-Thompson River	102801020204	18,607.27	14,916,078.96	1
Threemile Creek	102801020205	35,078.31	12,306,991.94	1
Wolf Creek-Thompson River	102801020206	28,226.58	12,914,114.83	1
Fourmile Creek	102801020207	20,963.17	13,926,642.94	1
Sevenmile Creek	102801020208	12,456.57	10,291,746.79	1
Star Branch-Thompson River	102801020209	19,299.90	7,147,132.62	1



for

← Back

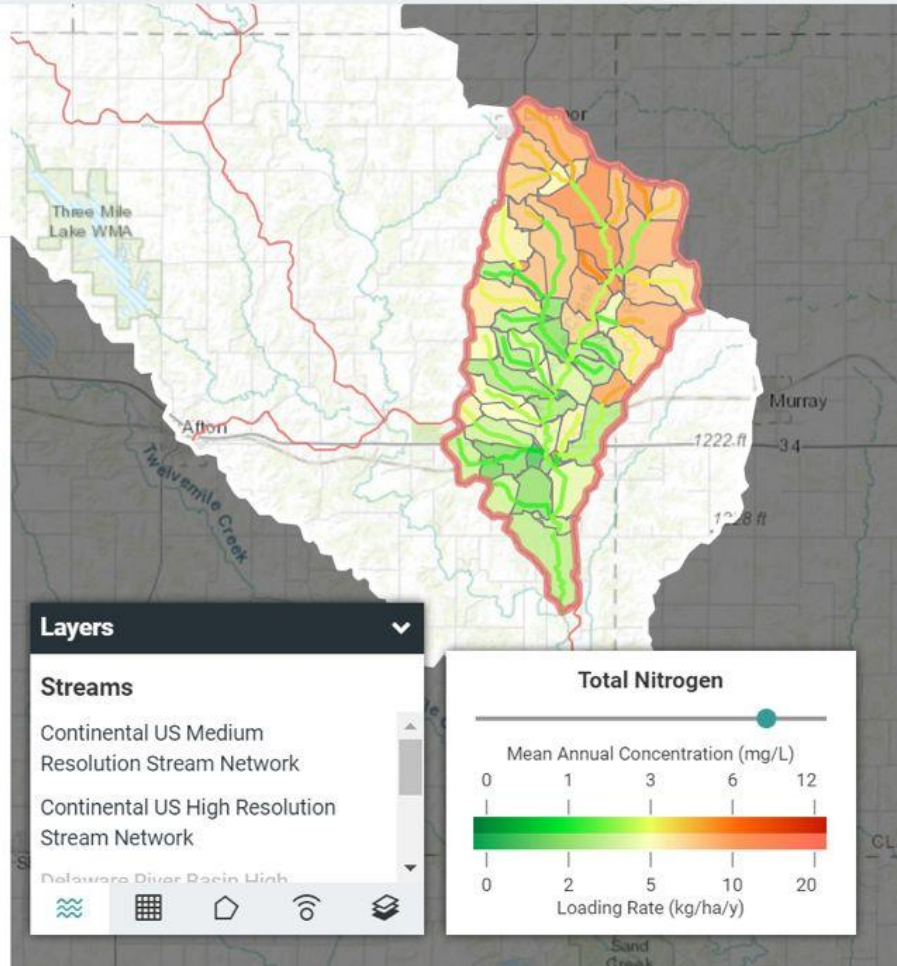
Fourmile Creek, HUC-12 Watershed

Displaying average annual loads from -years of fluxes

Related Layer: Total Nitrogen ▾

Sources Catchments

Sources	Area (acre)	Total Loads (not normalized)		
		Sediment (lb/yr)	Total Nitrogen (lb/yr)	Total Phosphorus (lb/yr)
Hay/Pasture	8,180.51	1,664,112.29	12,656.52	3
Cropland	9,422.78	10,856,900.35	79,574.40	14
Wooded Areas	2,124.34	4,683.99	169.60	
Open Land	68.71	2,988.34	57.79	
Barren Areas	74.04	32.06	28.52	
Low-Density Mixed	485.39	9,060.84	256.50	
Medium-Density Mixed	89.16	9,737.87	192.30	
High-Density Mixed	18.46	2,037.26	39.95	
Low-Density Open Space	440.03	8,218.50	232.60	



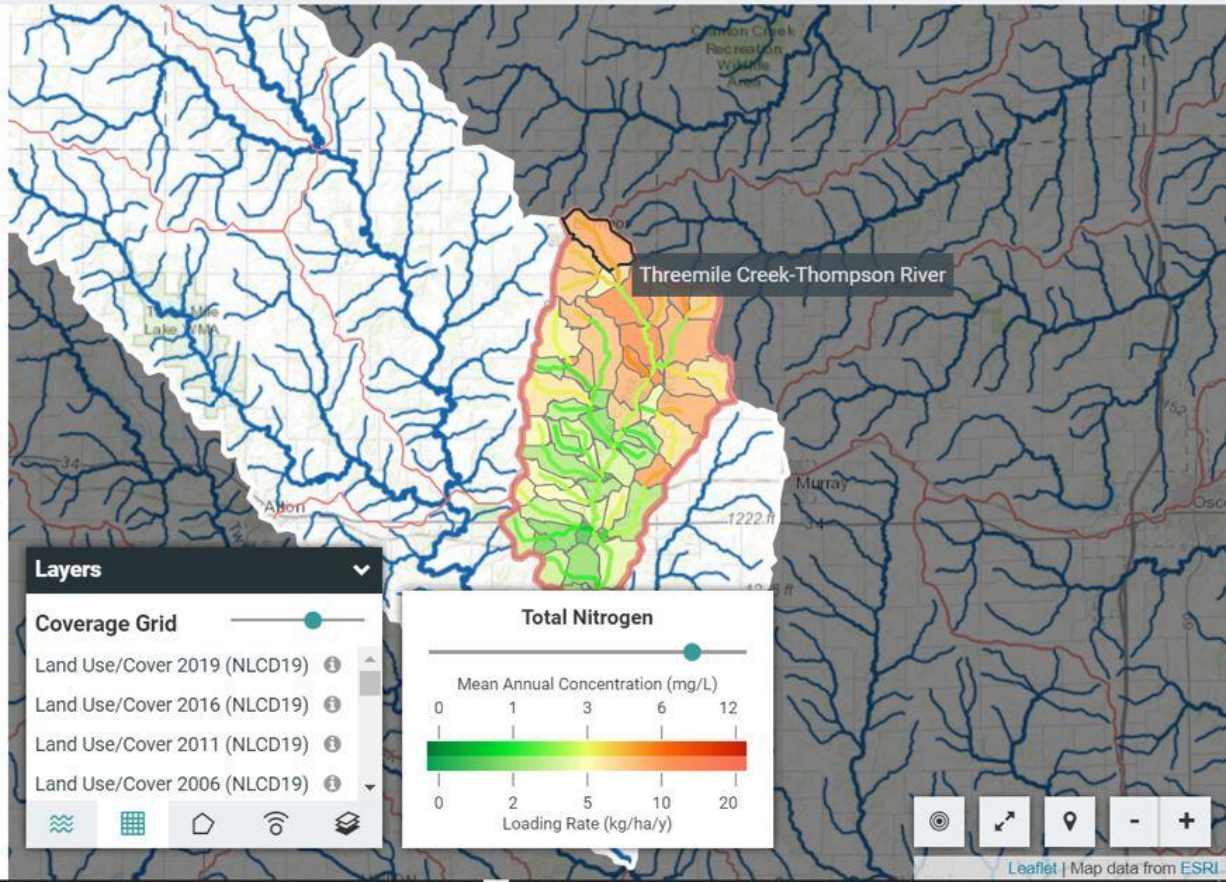
Fourmile Creek, HUC-12 Watershed

Displaying average annual loads from -years of fluxes

Related Layer: Total Nitrogen

Sources Catchments

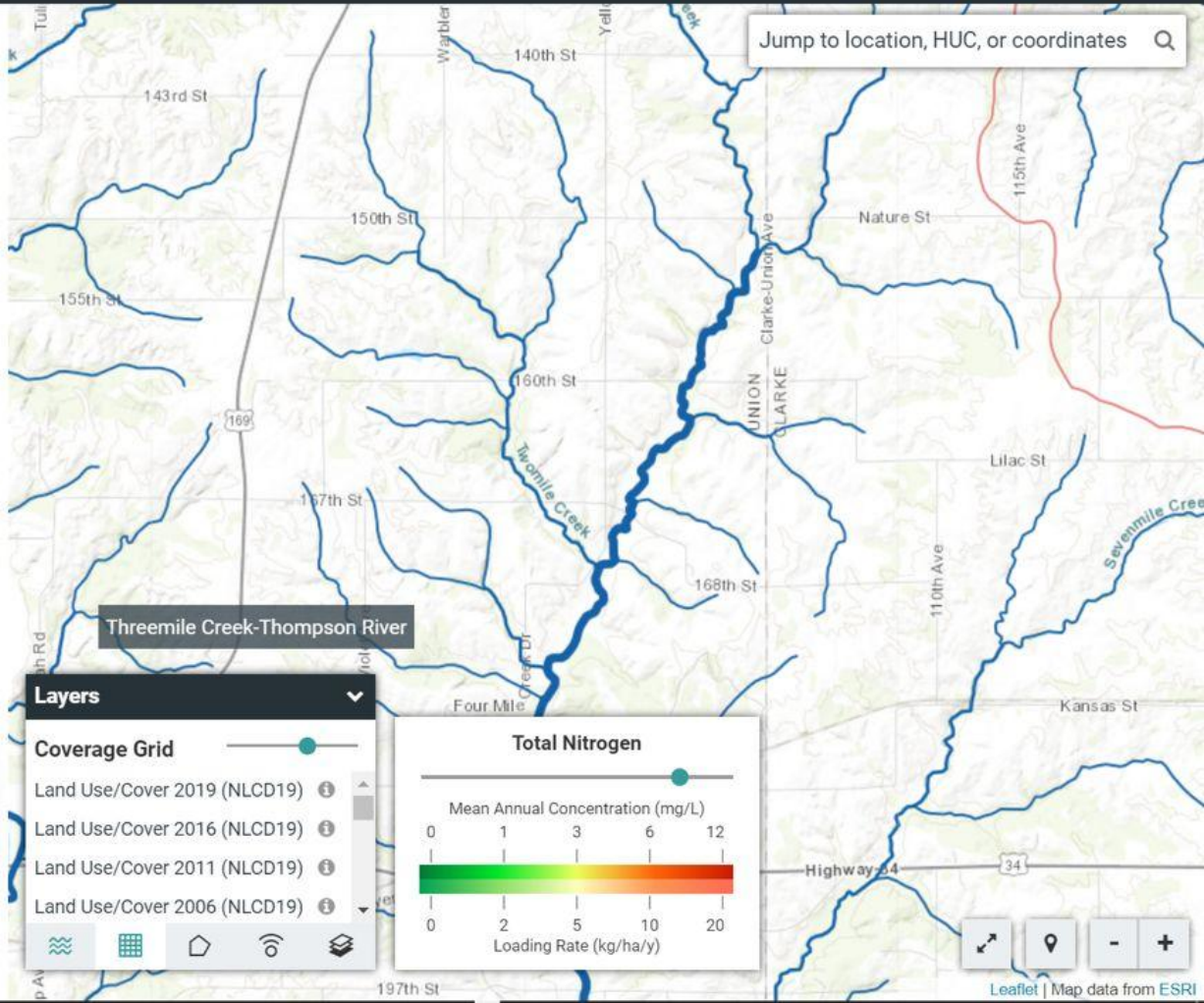
NHD+ ComID	Area (acre)	Total Loads (not normalized)		
		Sediment (lb/yr)	Total Nitrogen (lb/yr)	Total Phosphorus (lb/yr)
5134207	346.27	292,393.40	2,324.23	
5134209	509.73	349,572.38	2,887.20	
5135279	786.61	836,021.41	6,249.38	1
5135295	384.74	381,536.01	2,707.56	
5135309	105.42	79,847.04	643.43	
5135311	164.35	90,382.40	774.61	
5135319	419.21	346,148.11	2,725.90	
5135351	243.08	257,981.74	2,057.29	
5135355	4.00	1,343.68	7.45	
5135361	223.28	194,831.43	1,530.01	
5135367	10.67	2,658.10	27.65	



Select Area

Explore mapped layers, such as streams, land cover, soils, boundaries and observations, using the layer selector in the lower left of the map. See our documentation on layers. Select an Area of Interest in the continental United States, using the suite of tools below, to analyze the factors that impact water in your area and to begin to model different scenarios of human impacts. Different modeling options for using these tools are described in the technical documentation.

- Select boundary**
Choose a predefined boundary from several types
- Draw area**
Free draw an area or place a square kilometer
- Delineate watershed**
Automatically delineate a watershed from any point
- Continental US Medium Resolution
- Delaware High Resolution



Continental US Medium Resolution 20 mi²

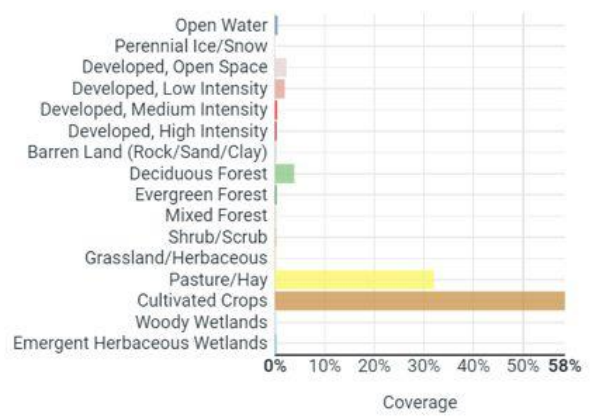
Streams Land Soil Terrain Climate Pt Sources Animals Water Qual

Land Use/Cover 2019 (NLCD19)

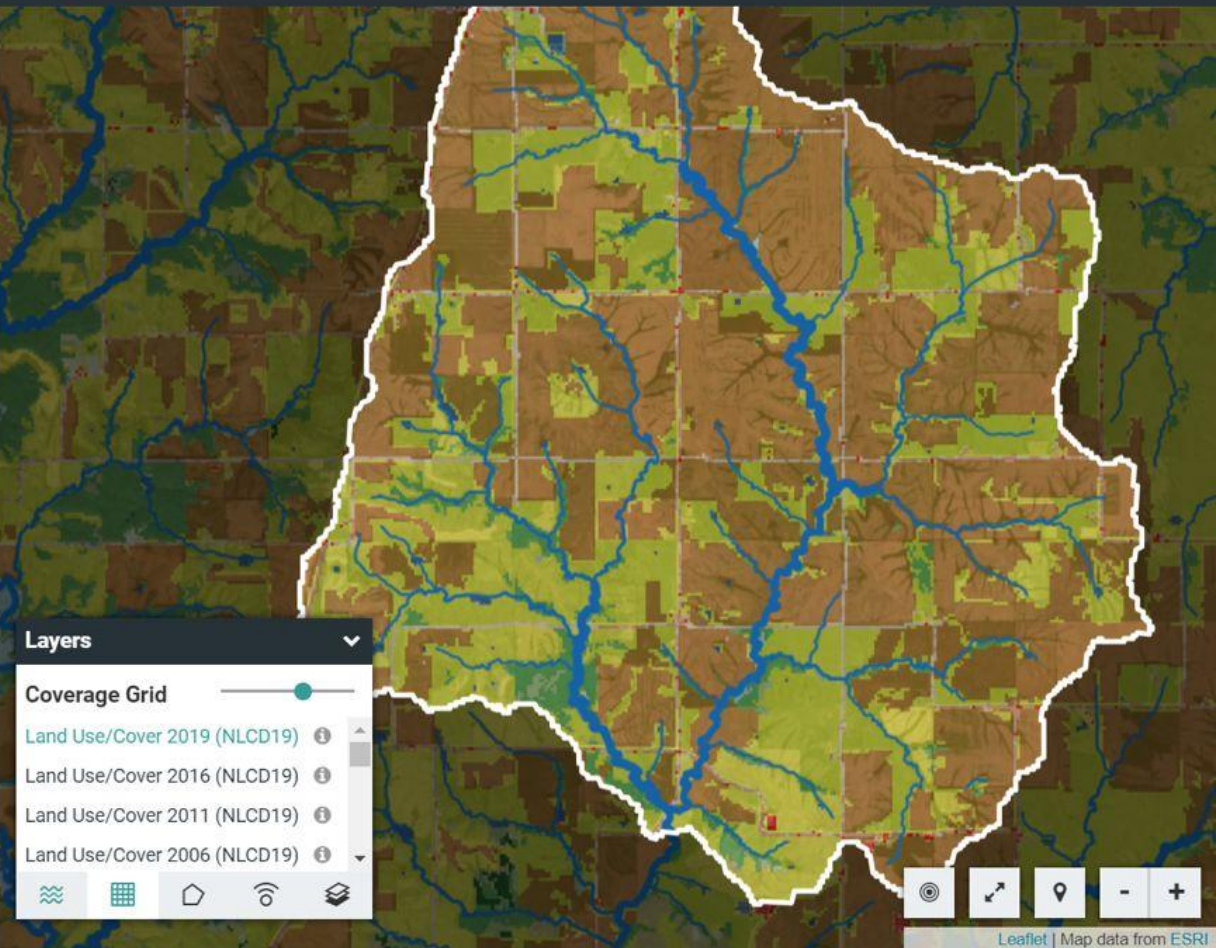
Land Use/Cover 2019 (NLCD19)

Related Layer: Land Use/Cover 2019 (NLCD19) Turn off

Source: National Land Cover Database (NLCD 2019)



Type	Area (mi ²)	Coverage (%)	Active River Area (mi ²)



Layers

- Coverage Grid
- Land Use/Cover 2019 (NLCD19)
- Land Use/Cover 2016 (NLCD19)
- Land Use/Cover 2011 (NLCD19)
- Land Use/Cover 2006 (NLCD19)

Hydrology Water Quality

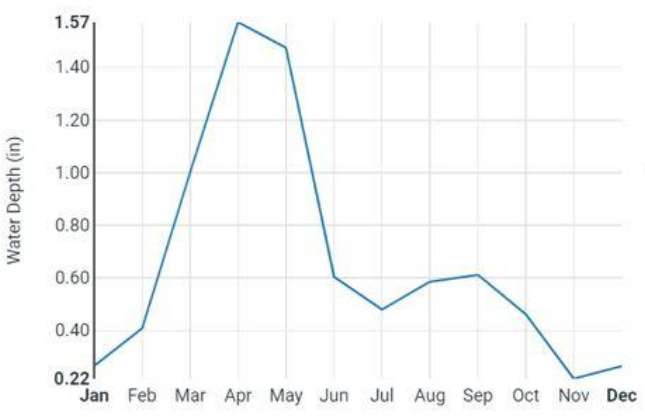
Average monthly water fluxes (in) from 18-years of daily water balance

Related Layer: Weather Stations used in this model. Turn on

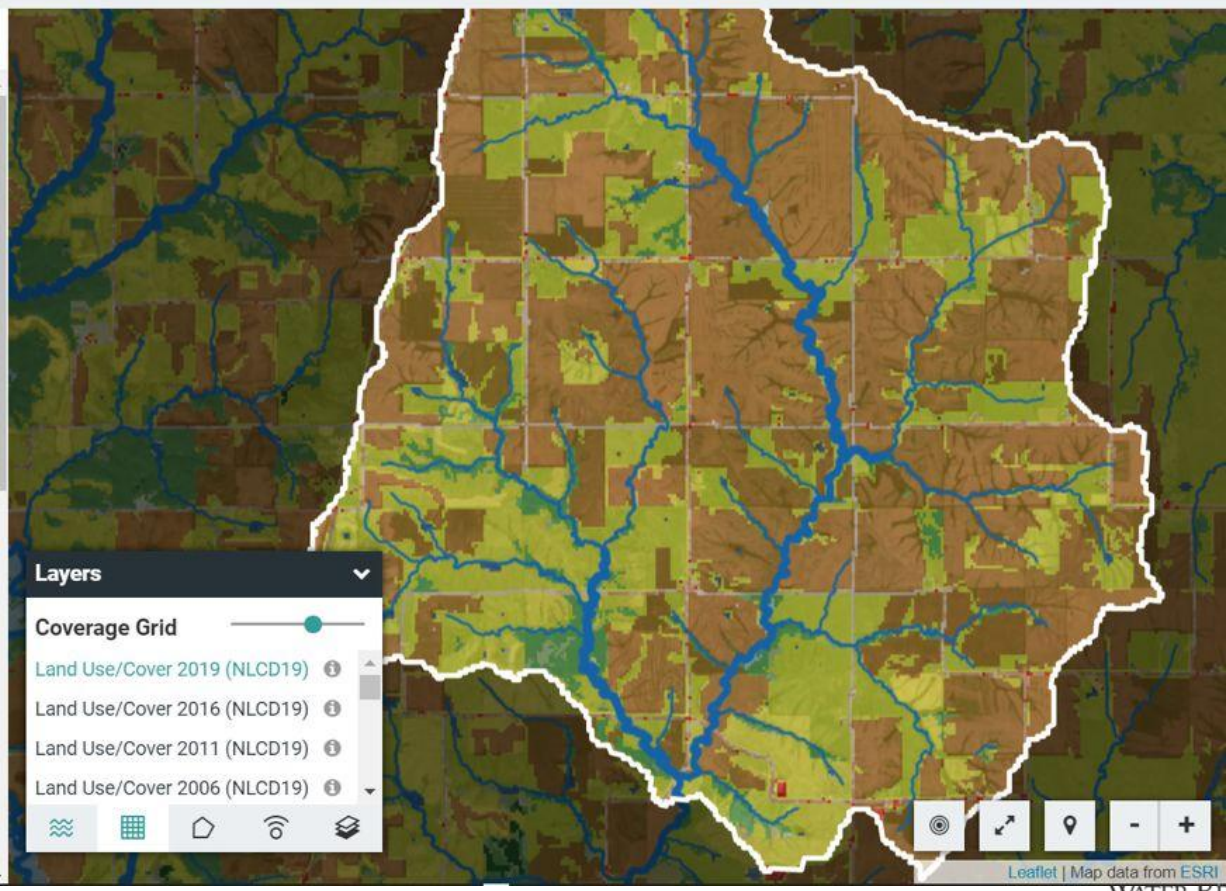
Weather Source: USEPA National Climate Data

Simulated by the GWLF-E (MapShed) model

Stream Flow



Month	Stream Flow (in)	Surface Runoff (in)	Subsurface Flow (in)	Point Src Flow (in)
Jan	0.22			
Feb	0.40			
Mar	1.00			
Apr	1.57			
May	1.45			
Jun	0.60			
Jul	0.48			
Aug	0.58			
Sep	0.60			
Oct	0.45			
Nov	0.22			
Dec	0.25			



Average annual loads from 18-years of daily fluxes

Related Layer: Weather Stations used in this model. Turn on

Weather Source: USEPA National Climate Data

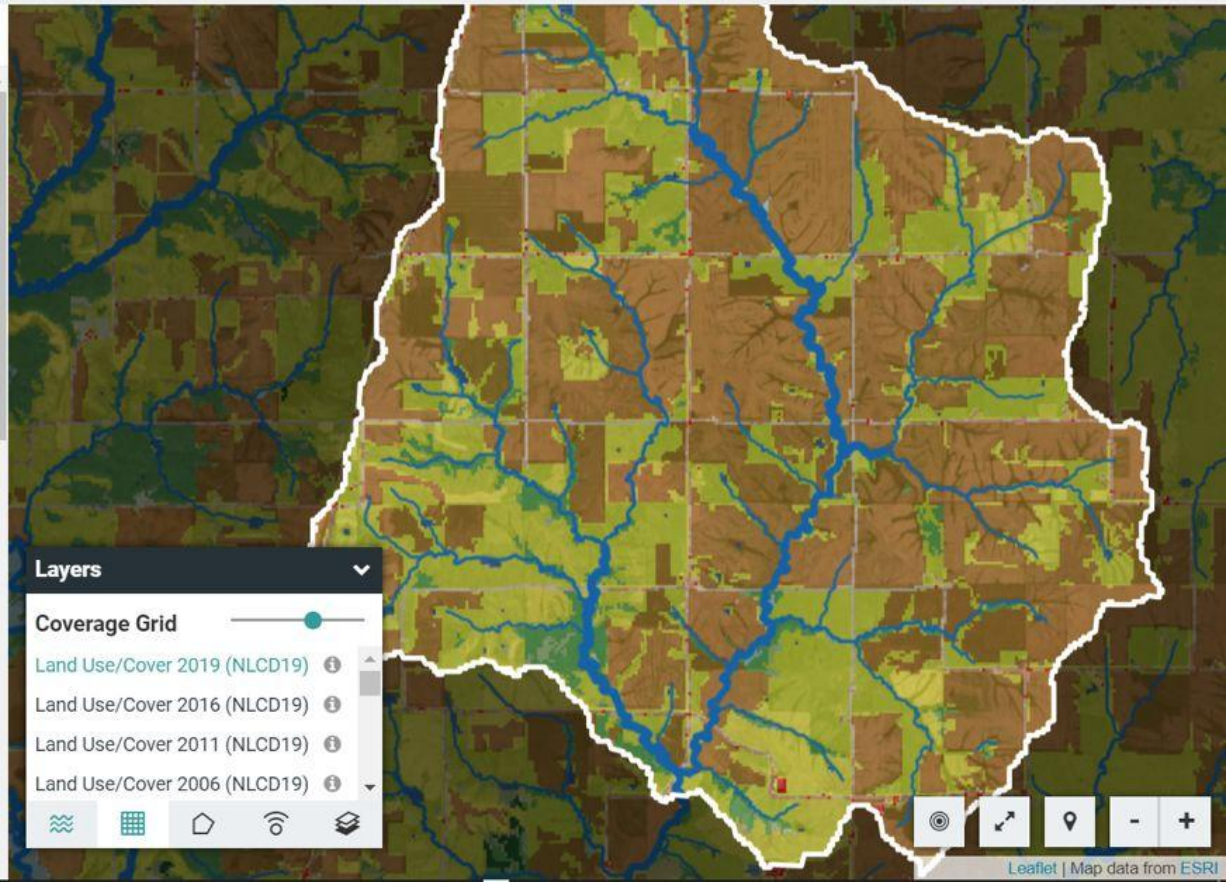
Simulated by the GWLF-E (MapShed) model

Sources	Sediment	Total Nitrogen	Total Phosphorus
Total Loads (lb)	12,487,578.7	96,797.4	18,548.3
Loading Rates (lb/ac)	991.44	7.69	1.47
Mean Annual Concentration (mg/L)	550.48	4.27	0.82
Mean Low-Flow Concentration (mg/L)	1,874.56	11.82	2.34

Mean Flow: 363,379,595 (ft³/year) and 11.52 (ft³/s)

Download this data

Sources	Sediment (lb)	Total Nitrogen (lb)	Total Phosphorus (lb)
Hay/Pasture	1,119,184.0	8,048.1	2,162.7



Average annual loads from 18-years of daily fluxes

Related Layer: Weather Stations used in this model. Turn on

Weather Source: USEPA National Climate Data

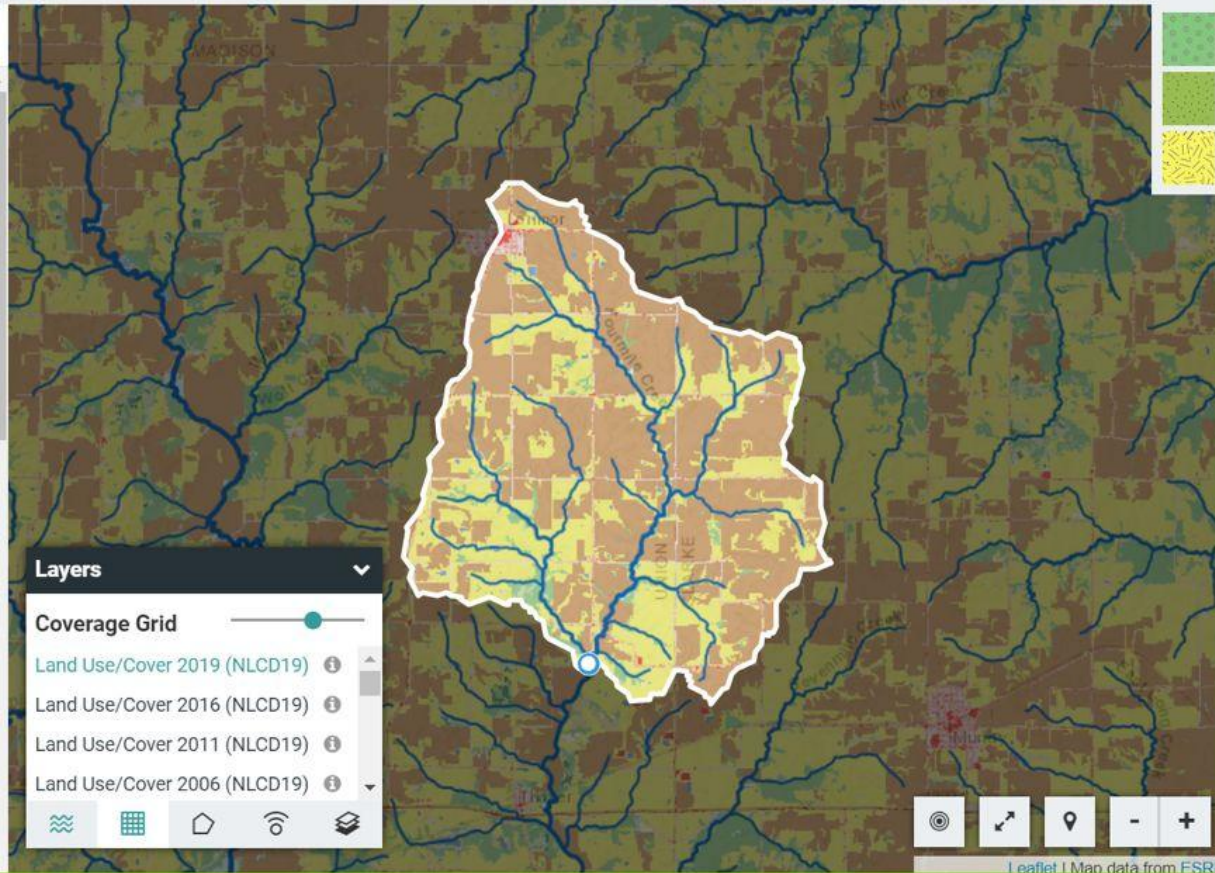
Simulated by the GWLF-E (MapShed) model

Sources	Sediment	Total Nitrogen	Total Phosphorus
Total Loads (lb)	7,037,679.1	53,278.8	9,343.5
Loading Rates (lb/ac)	558.75	4.23	0.74
Mean Annual Concentration (mg/L)	319.28	2.42	0.42
Mean Low-Flow Concentration (mg/L)	1,862.02	11.41	2.28

Mean Flow: 353,083,060 (ft³/year) and 11.2 (ft³/s)

Download this data

Sources	Sediment (lb)	Total Nitrogen (lb)	Total Phosphorus (lb)
Hay/Pasture	1,119,184.0	8,048.1	2,162.7



Hydrology Water Quality

Average annual loads from 18-years of daily fluxes

Related Layer: Weather Stations used in this model. Turn on

Weather Source: USEPA National Climate Data

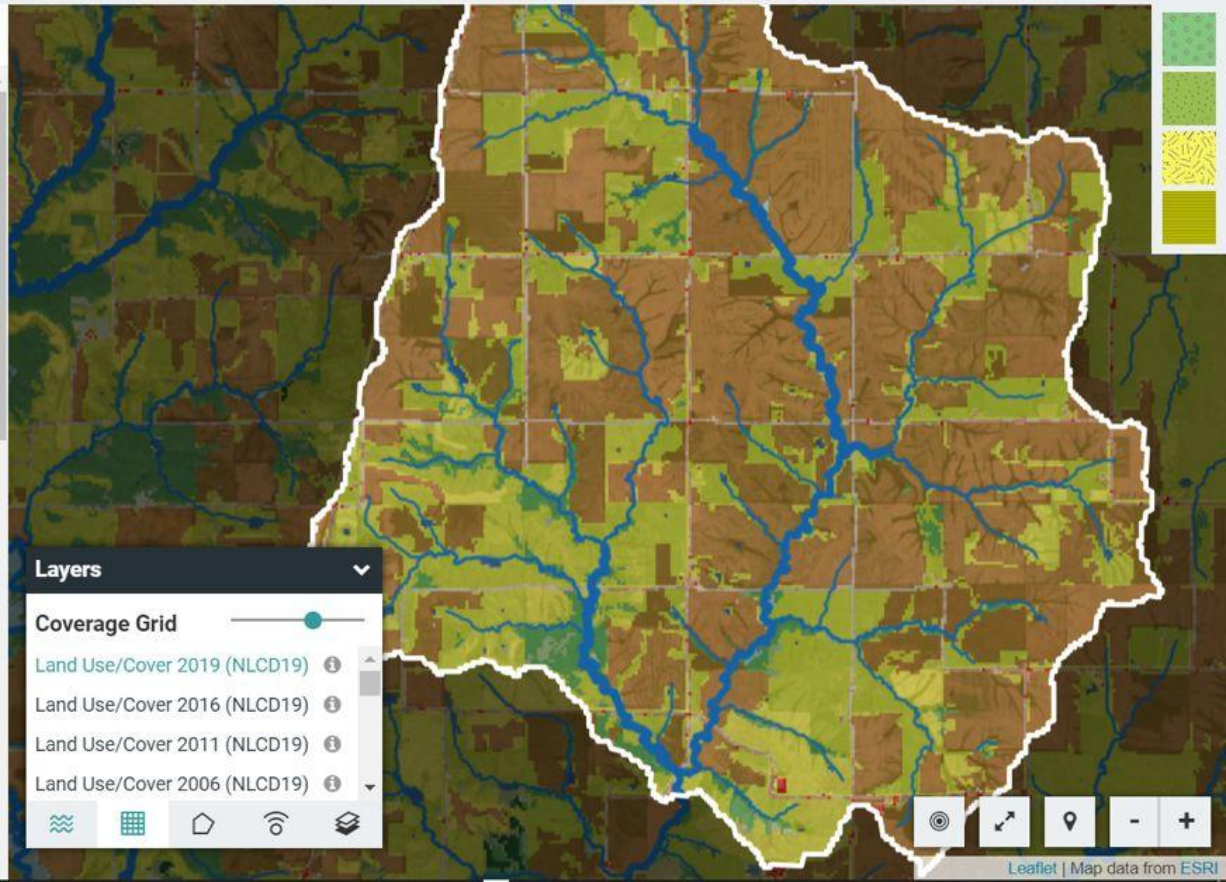
Simulated by the GWLF-E (MapShed) model

Sources	Sediment	Total Nitrogen	Total Phosphorus
Total Loads (lb)	5,800,017.2	46,059.2	8,296.9
Loading Rates (lb/ac)	460.49	3.66	0.66
Mean Annual Concentration (mg/L)	263.61	2.09	0.38
Mean Low-Flow Concentration (mg/L)	1,840.99	11.29	2.26

Mean Flow: 352,448,692 (ft³/year) and 11.18 (ft³/s)

Download this data

Sources	Sediment (lb)	Total Nitrogen (lb)	Total Phosphorus (lb)
Hay/Pasture	1,119,184.0	8,048.1	2,162.7



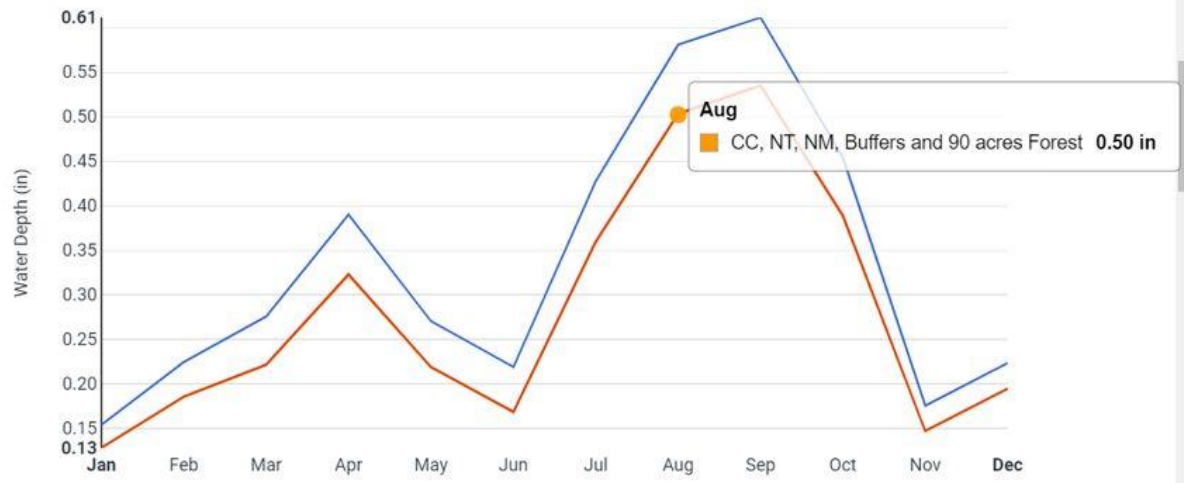
Compare

Hydrology Water Quality

Scenarios

- Current Conditions
- Cover and NoTill +NM
- CC, NT, NM, Buffers and 90 acres Forest

Surface Runoff



Subsurface Flow

1.27

Model My Watershed
Two & Four M
CC, NT, NM, Buf
Hydrology Water Qual
Average annual loa
Related Layer: Weathe
Weather Source: USEP
Simulated by the GWL
Sources
Total Loads (lb)
Loading Rates (lb/ac
Mean Annual
Concentration (mg/L
Mean Low-Flow
Concentration (mg/L
Mean Flow: 352,448,6
Download this da
Sources
Set
(lb)
Hay/Pasture

Compare

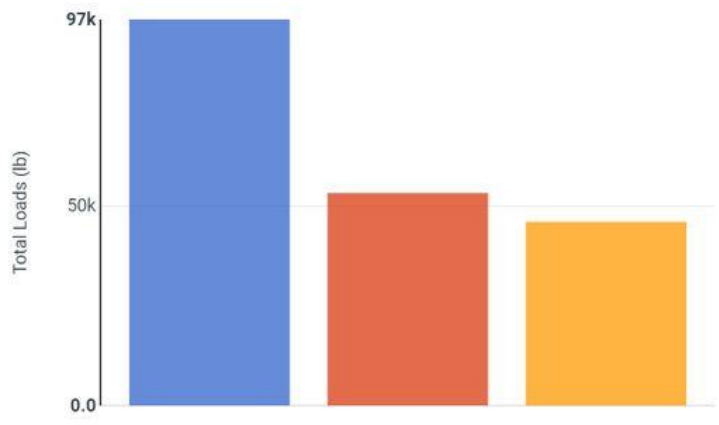
Hydrology **Water Quality**

Scenarios

- Current Conditions
- Cover and NoTill +NM
- CC, NT, NM, Buffers and 90 acres Forest

Total Loads

Total Nitrogen



Total Phosphorus



Model My Watershed
Two & Four M
CC, NT, NM, Buf
Hydrology Water Qual
Average annual loa
Related Layer: Weathe
Weather Source: USEP
Simulated by the GWL
Sources
Total Loads (lb)
Loading Rates (lb/ac)
Mean Annual
Concentration (mg/L)
Mean Low-Flow
Concentration (mg/L)
Mean Flow: 352,448,6
Download this da
Sources
Set
(lb)
Hay/Pasture

Compare

Hydrology Water Quality

Scenarios

- Current Conditions
- Cover and NoTill +NM
- CC, NT, NM, Buffers and 90 acres Forest

Total Loads

	Current Conditions	Cover and NoTill +NM	CC, NT, NM, Buffers and 90 acres Forest
Sediment	12,487,578.657 lb	7,037,679.129 lb	5,800,017.151 lb
Total Nitrogen	96,797.402 lb	53,278.827 lb	46,059.187 lb
Total Phosphorus	18,548.334 lb	9,343.492 lb	8,296.87 lb

Compare

Hydrology Water Quality

Scenarios

- Current Conditions
- Cover and NoTill +NM

Surface Runoff

Month	Current Conditions (in)	Cover and NoTill +NM (in)
Jan	0.15	0.13
Feb	0.22	0.19
Mar	0.28	0.22
Apr	0.39	0.32
May	0.27	0.22
Jun	0.22	0.17
Jul	0.43	0.35
Aug	0.58	0.50
Sep	0.60	0.53
Oct	0.45	0.38
Nov	0.18	0.14
Dec	0.22	0.19

Subsurface Flow

Current Conditions	1.27
Cover and NoTill +NM	1.20

Model My Watershed

Two & Four M

Cover and NoTill

Hydrology Water Qua

Average annual loa

Related Layer: Weathe

Weather Source: USEP

Simulated by the GWL

Sources

Total Loads (lb)

Loading Rates (lb/ac)

Mean Annual Concentration (mg/L)

Mean Low-Flow Concentration (mg/L)

Mean Flow: 353,083,0

Download this da

Sources

Se (lb)

Hay/Pasture

Projects darscott +

New Project

Practice

Settings

Compare

Hydrology Water Quality

Scenarios

● Current Conditions

● Cover and NoTill +NM

Total Loads



Sediment

12,487,578.657 lb

7,037,679.129 lb

Total Nitrogen

96,797.402 lb

53,278.827 lb

Total Phosphorus

18,548.334 lb

9,343.492 lb

Ending Demo here