CBP Geospatial Support Cooperative Agreement Overview

FAIN: 96363001 | Active: 2018-2024

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University of Vermont Spatial Analysis Lab

USGS science for a changing world

Chesapeake Bay Program Science. Restoration. Partnership.

Conservation Innovation Center

Long-term Land Cover/Land Use Monitoring Program Development and Implementation

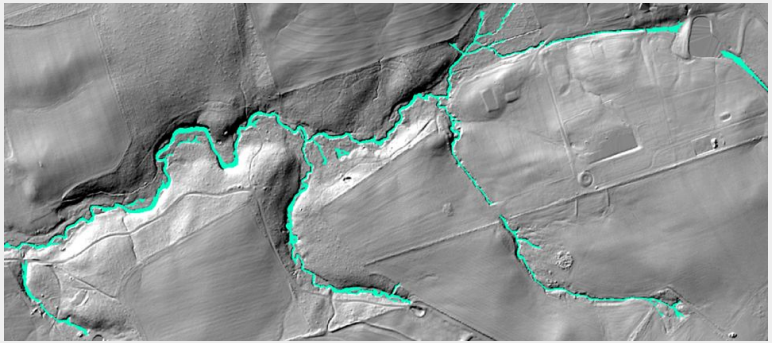
Purpose: Continue developing the Chesapeake Bay High-Resolution Land Use/Land Cover Database with the addition of two time periods of static data and first-time production of change data, including research and development of expanded classification schema.

Timeline + Outputs

- 2024 edition of the CBP 1-meter LULC Database - county scale data available in September, state/CBW mosaics pending on USGS data release review
    - 2021/22 LULC and LC Data (T3)
    - Updated data for 2013/14 (T1) and 2017/18 (T2)
    - LULC and LC Change Data for T1-T3
    - LULC Change matrices
- Accuracy assessment on 2024 edition LULC change data - Sept
- Data viewer - Sept

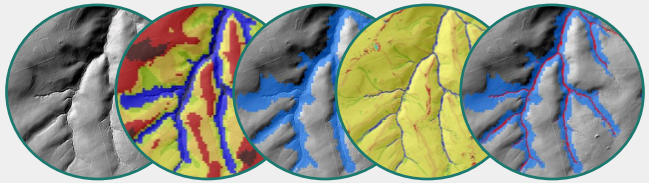
Hydrology Mapping Supporting Targeted Restoration and Protection

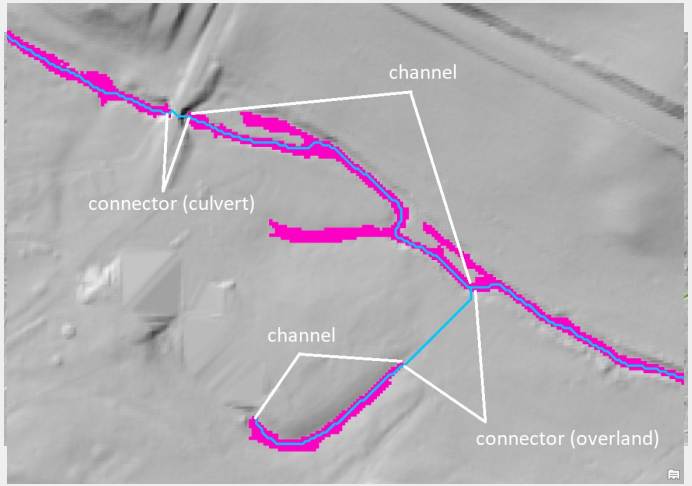
Purpose: Classify channel-like features using LiDAR and principles of geomorphology to develop a connected hydrography network that better accounts for headwater areas.



How its made...

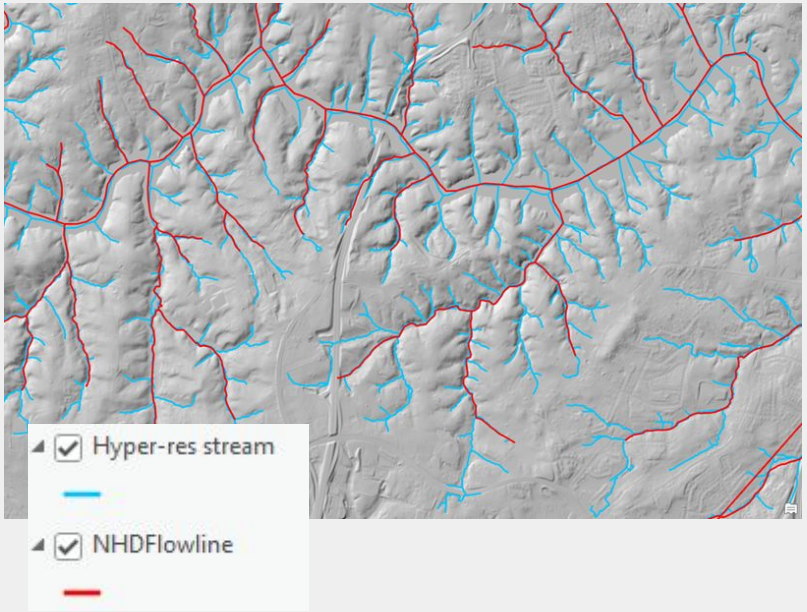
- 1-meter digital elevation models (DEMs) serve as the primary input
- Geomorphic interpretation identifies coarse-scale valleys and then within those areas identifies channelized areas
- Tracing algorithm connects 2D stream polygons into 1D linear stream network
- Attributed with information about bank height, channel width, and valley/floodplain dimensions, as well as highlighting areas that are channel features versus connectors or ditches





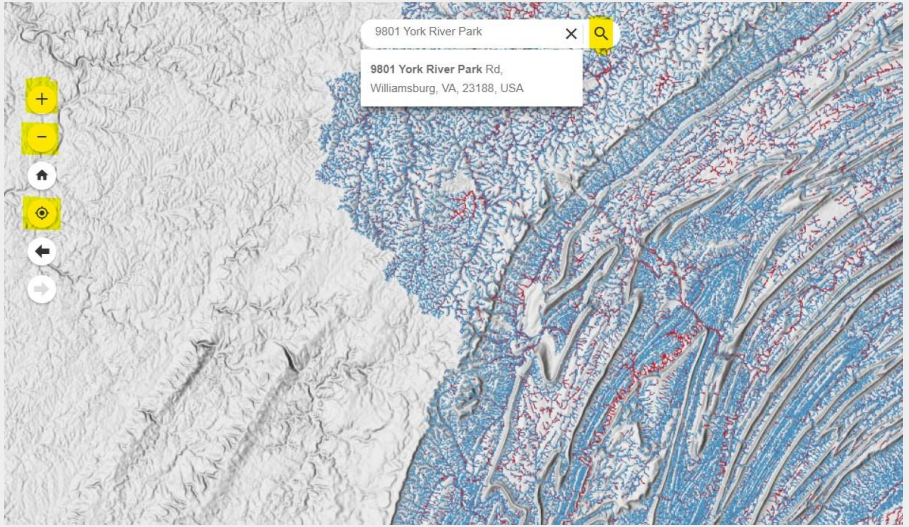
Why a new stream map?

- Maps headward extent and lateral positioning of stream channels more precisely than NHD
- Maps approximately 2.5x as many stream miles as 1:24,000 resolution NHD
- Fully automated, parallel processing workflow allows for rapid production and repeatability as lidar is updated
- Site-scale detail allows for use in identifying opportunities for BMP implementation, such as unbuffered streams or headcut areas in need of stream restoration work



Timeline + Outputs

- 2024 edition of the CBP hyper-resolution hydrography - available via ScienceBase in September
  - Stream polylines
  - Stream polygons
  - Agricultural and roadside ditches
  - Channel and valley-scale geomorphons
- Accuracy assessment and final report - Sept
- Data viewer - Sept



Purpose: develop a platform that helps organize on-the-ground action towards priority gaps for nutrient loading and better inform funding programs/state agencies in near real-time to support annual progress tracking.

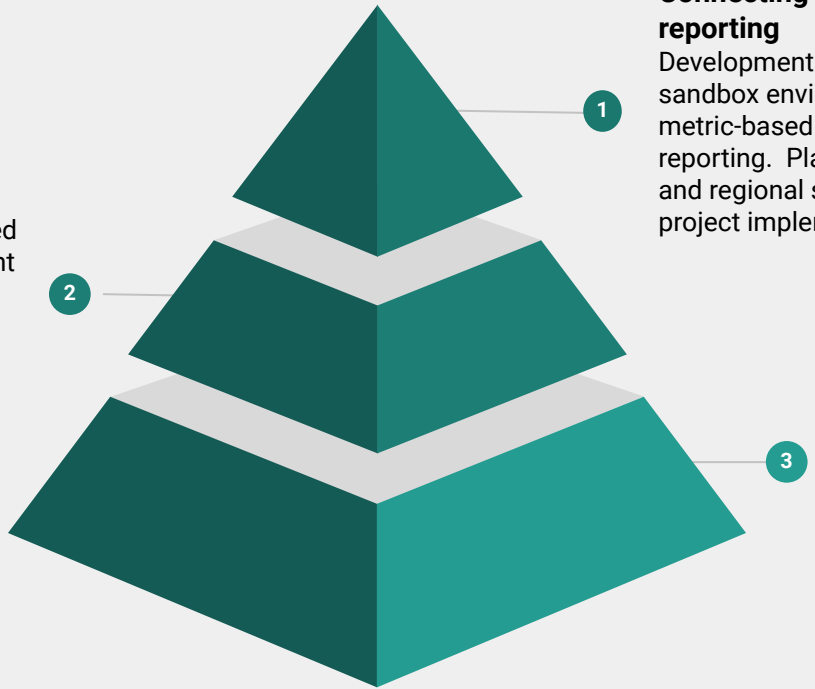
BMP Planning and Reporting: Scaling Precision Conservation

What is being produced through this effort?

BMP Planning and Reporting: Scaling Precision Conservation in the Chesapeake Bay Watershed

Understanding BMP impacts at the site scale

Researchers at Drexel University, developed software to estimate nutrient and sediment reduction impacts of specific BMP polygons on-the-fly. These estimates can also be compared to regional averages to gauge confidence for effective impacts.



Connecting BMP planning, tracking, and reporting

Development of a concept platform which connects sandbox environments for BMP planning, metric-based BMP tracking workflows, and project reporting. Platform supports BMP planning at site and regional scales and allows data transfer between project implementers and program administrators.

BMP Opportunity Layers

Based on research from USDA and insights from on-the-ground restoration practitioners, uses geospatial data to generate footprints of potential opportunities for BMP implementation to support watershed planning.

Drexel UNIVERSITY

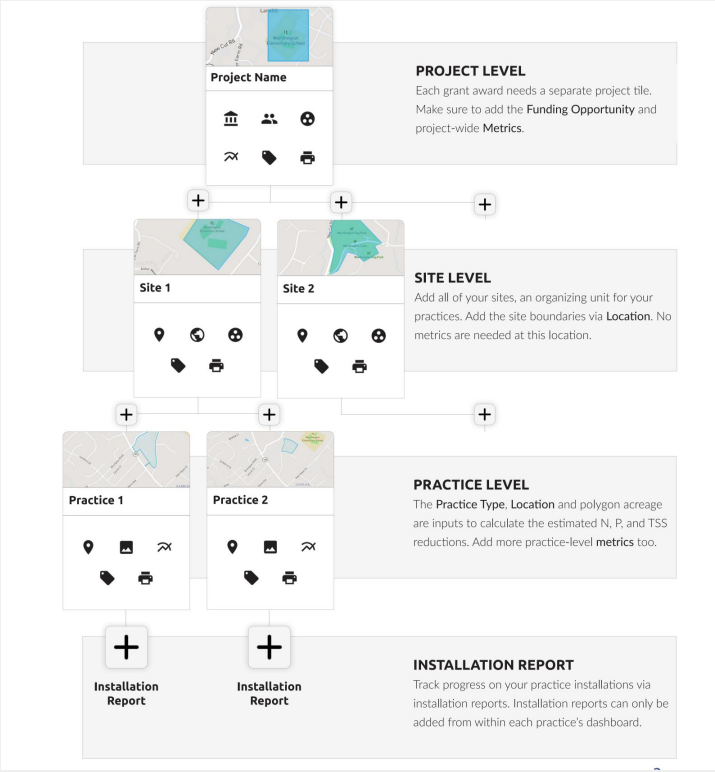
Chesapeake Bay Program
Science. Restoration. Partnership.

Chesapeake Conservancy

What is FieldDoc?

https://www.ourcommoncode.org/fielddoc

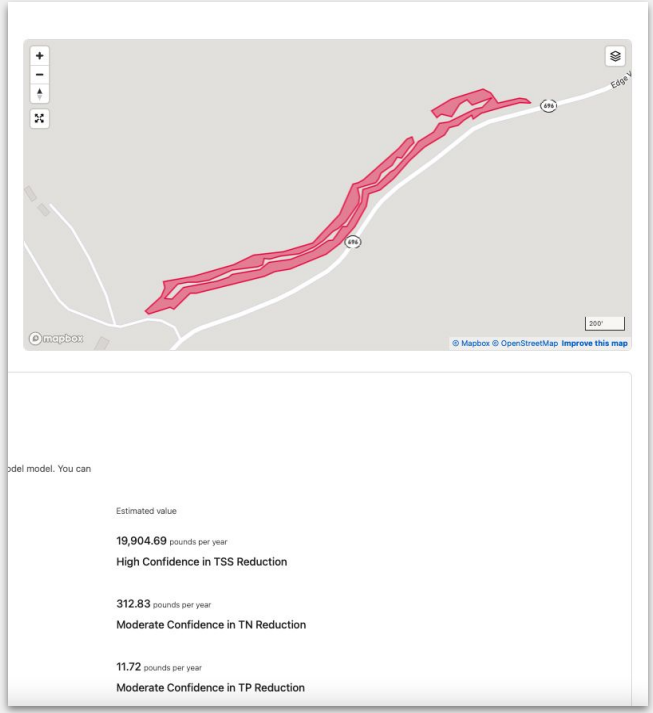
- An online platform developed by The Commons for metric based restoration planning and tracking that can also help practitioners set goals and track progress towards goals.
  - Standardized metrics, reporting processes, and project implementation reports
  - Supports grant program managers with metric-specific dashboards that rollup insight across their grant portfolio
  - Functionality to aide planning from individual practices on site to regional grant programs
- Current users
  - Grant administrators/managers
  - Regional WIP planners
  - Grant recipients/project implementers



Understanding BMP impacts at the site scale

Relative Confidence Index (RCI) pilot

- **Goal**: to provide site-specific information about the impacts of BMP projects, and encourage BMP planning efforts to identify opportunities that could not only meet, but exceed expected water quality outcomes
- Evaluating implementation scenarios on their likelihood to achieve, exceed, or fall short of a CAST-ISO-based load reduction calculation based on site-specific metrics
- Incorporate high resolution data with current CAST ISO model estimates to provide a location and practice-specific confidence index to provide users a more locally relevant idea of reduction efficiency for a given best management practice (BMP) footprint
- Provided as an API through which user defined polygons and practice types can be returned as the RCI ratio of underperforming, performing, and overperforming. Currently available for forest and grass buffer practices, including narrow and exclusion fencing sub-types.

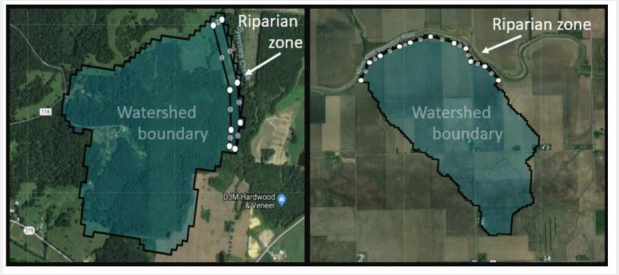


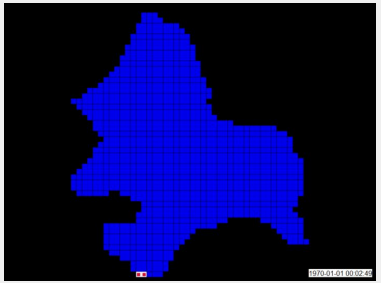
http://watersheds.cci.drexel.edu/docs

Powering on-the-fly modeling

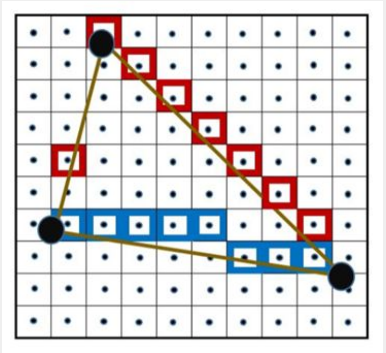
http://watersheds.cci.drexel.edu/docs

- Watershed API
  - Drainage area delineation
  - Uses marching algorithm that scales with perimeter
  - Works for points, lines, and polygons





- Fast Zonal Statistics API
  - Based on Green's Theorem
  - Scales with perimeter
  - Requires pre-processing

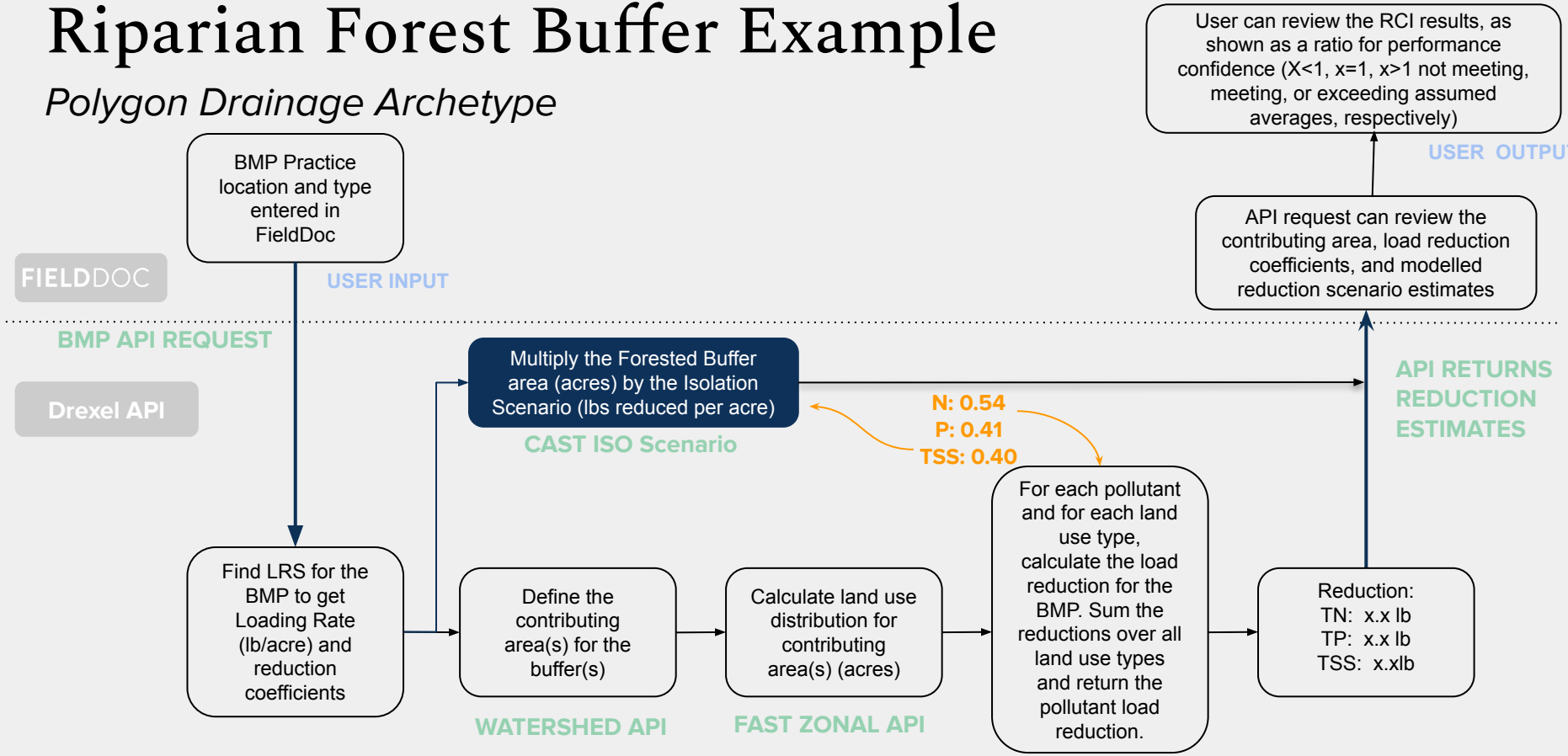


Results from Jupyter Notebook

HUC Level	FZS imp	Raster Stats imp	FZS retrieval time	Raster Stats retrieval time	Polygon Area
	Σ	Σ	*seconds*	*seconds*	*(1,000s km)*
2L	464,936,066	464,936,066	3.468	76.262	178.02
4L	75,097,455	75,097,455	1.328	4.836	15.21
4L	138,308,609	138,308,609	1.875	10.656	38.02
4L	137,562,599	137,562,599	2.587	19.705	71.22
4L	113,967,403	113,967,403	1.878	13.421	53.57
6L	75,097,455	75,097,455	0.739	4.327	15.21
6L	15,682,206	15,682,206	1.451	4.738	18.07
6L	43,807,532	43,807,532	1.638	8.753	29.28

Riparian Forest Buffer Example

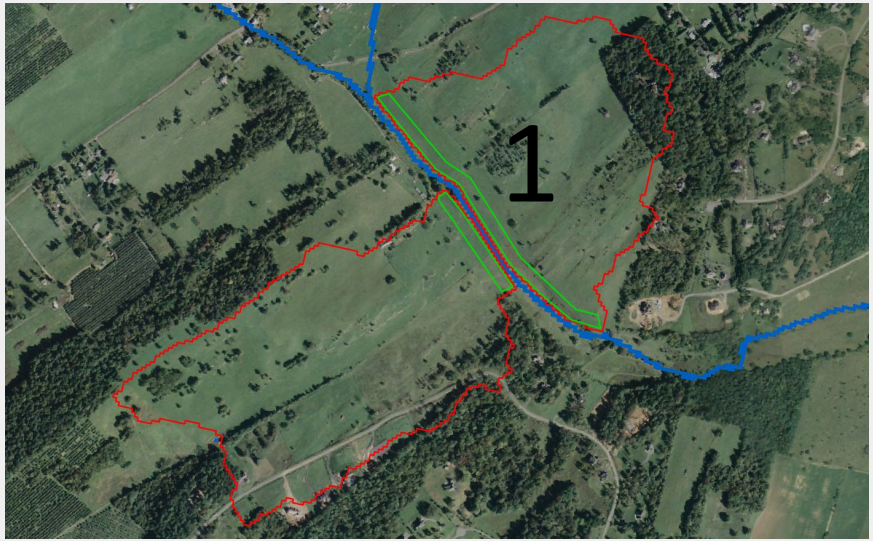
Polygon Drainage Archetype



Example: Testing Two Riparian Buffers

- Two riparian buffers, 100 ft wide each
- Buffer 1 is roughly 0.5 miles long, while buffer 2 is roughly 0.2 miles long

"confidence_index": {"tn": 1.74, "tp": 1.56, "tss": 0.062}



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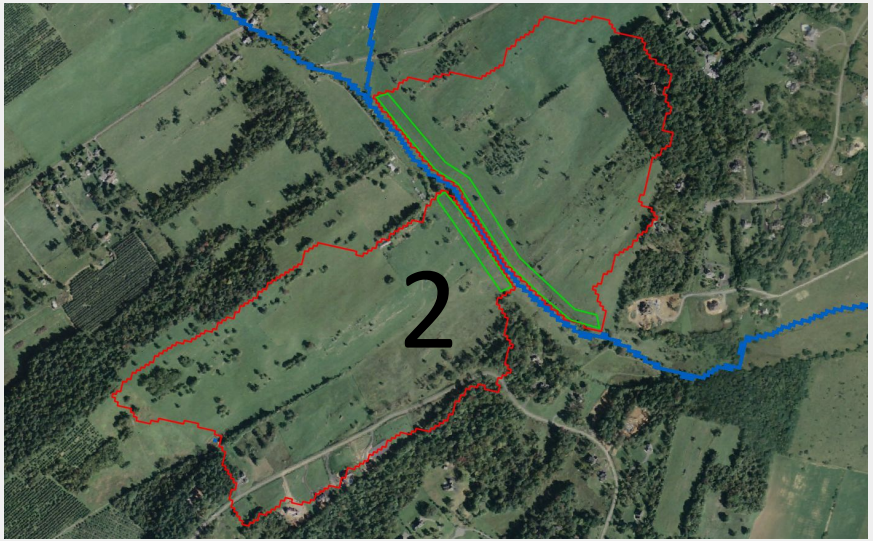
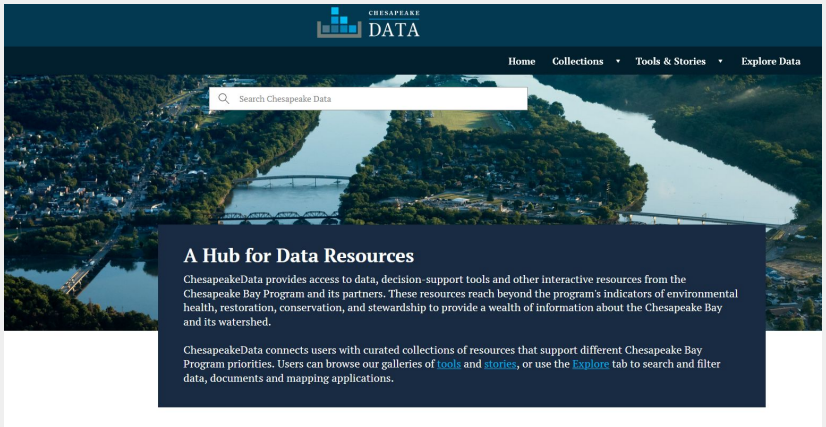


Cross-GIT Mapping Support

Purpose: Support ongoing cartographic and analytic needs across Goal Implementation Teams, including identifying opportunities to integrate high-resolution data.



CBP GIS User Needs

Prototypes and Review

Take action on key recommendations to kick-start improving the user experience and better engage folks with GIS resources; allow for iterative review and feedback for continued improvement

Interviews, Surveys, and Market Research

Contracted RTI International to perform user needs research and identify science-based solutions to shared concerns about access to and use of GIS resources across CBP

Outcomes

Present deliverables to user groups for continued use and maintenance

Recommendations and Action Items

Distill and summarize extensive interviews and other research into actionable recommendations for improving GIS resources and experience among the Partnership ecosystem

User Research Interviews

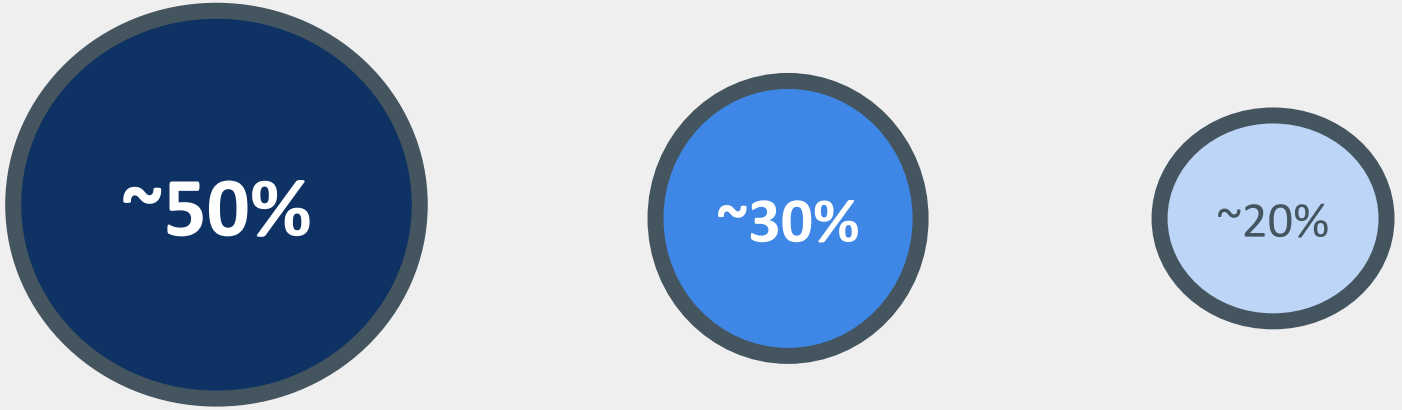
Discussion Topics	Types of Questions Asked
1. **"Top of mind" mapping products critical for achieving GIT outcomes & how they are used**	• What **types of mapping products** (data layers, tools, and/or mapping outputs) do you and your team currently use to achieve goals/outcomes? • What **specific mapping products** are you using that are **most critical** for achieving outcomes? How are they used? • What **aspects** of these specific mapping products do **you like**?
2. **Targeted users of mapping products**	• Who are the **primary end users** for these specific mapping products (data layers, tools, and/or mapping outputs) that are critical for achieving goals/outcomes (at GIT or cross-GIT level)?

3. **Challenges with existing mapping products & mapping-product needs**	• What **pain points** do you experience with current mapping products?
	• What are the **biggest barriers for the current/future adoption and/or effective use** of these products? (If relevant, is it at the data-layer, tool, or mapping-output level?)
	• What **improvements/additions** to mapping products or how they are delivered would have the greatest impact on
	  ◦ Your **team's success** in achieving goals/outcomes?
	  ◦ **Cross-GIT success** in achieving goals/outcomes?

4. **Additional perspectives on improving cross-GIT delivery/use of products**	• Do current cross-GIT mapping products enable effective **cross-GIT decision making**? Why or why not? • What does the **perfect cross-GIT mapping product** look like?

User Research Interviews

About half of the interviewees are infrequent, direct users of mapping data or decision support tools (DSTs).



Infrequent User

- Familiar with GIS and DSTs pertinent to their work
- Infrequently use the tools, use in a plug and play manner

Frequent User

- Comfortable using GIS DSTs
- Frequently consults tools in day-to-day work

Expert User

- Design and build GIS DSTs
- Consulted for complex GIS analysis

User Research Results

"**Central location for tools**" was the highest ranked solution, and "**new types of data**" ranked highest for data.

Potential Solutions Presented in Survey	Overall Rank	Score*	Total Respondents
Create a **central location for tools** where users can find details on each tool—e.g., what it is, why one might use it, who should use it, how to use it.	1	409	103
Provide **training on how to use tools**.	2	237	80
Provide **case studies on the successful use of tools** to achieve outcomes—to help communicate why a tool might be used.	3	223	78
Provide **tools that allow for cross-GIT analysis**.	4	204	72
Provide **new types of data** (e.g., aquatic, ecological, demographic, climate change, etc.).	5	177	60
Provide **improved data resolution**.	6	172	59
Provide **more timely data**.	7	133	56
Provide **new formats of data**—e.g., tabular, shapefiles, text.	8	50	27

Top four potential solutions are tool-specific.

Data-specific solutions ranked lower than tool-specific.

Top rated overall and tool-specific solution—rated significantly higher than any other solution

Top rated data-specific solution