

Mapping Channels and Floodplains with FACET

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Acknowledgments & Timeline

Funding

USGS Ecosystems Mission Area, USEPA Chesapeake Bay Program, William Penn Foundation Delaware Watershed Research Fund, and Smithsonian Institute

Timeline

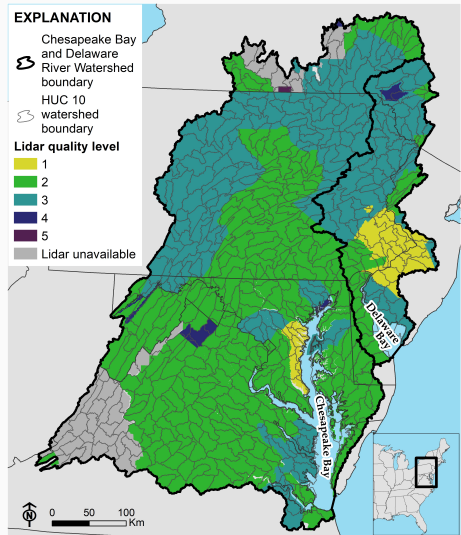
- Code release: December, 2019
- Data release for Chesapeake and Delaware: April, 2020
- Manuscript on methods and validation: In-review

What is FACET?

- Floodplain and Channel Evaluation Tool (FACET) is an automated tool to measure fine-scale geomorphometry using high resolution digital elevation models (DEMs)
- Open-source written in Python and R
- Only *required input is a DEM (3-meter or finer resolution)*

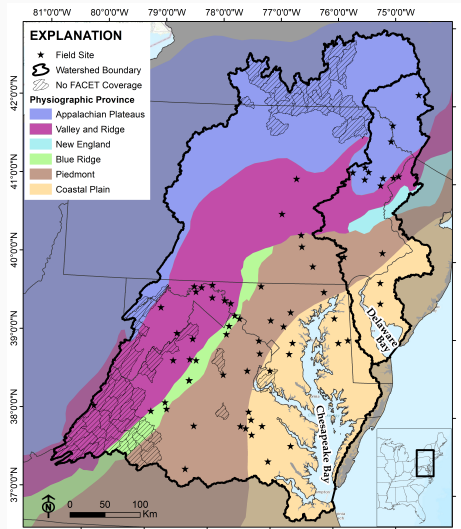
LiDAR: Availability and Coverage

- Study area:
Chesapeake Bay Watershed (CBW) and
Delaware River Basin (DRB)
- Ran FACET on 3-m
DEMs in 85% CBW and
100% in DRB



Calibration and Validation

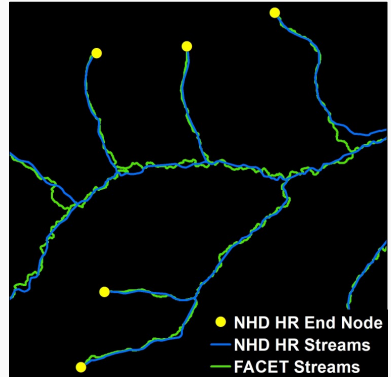
Bank and floodplain
geomorphic measurements
validated against field data
at 67 reaches

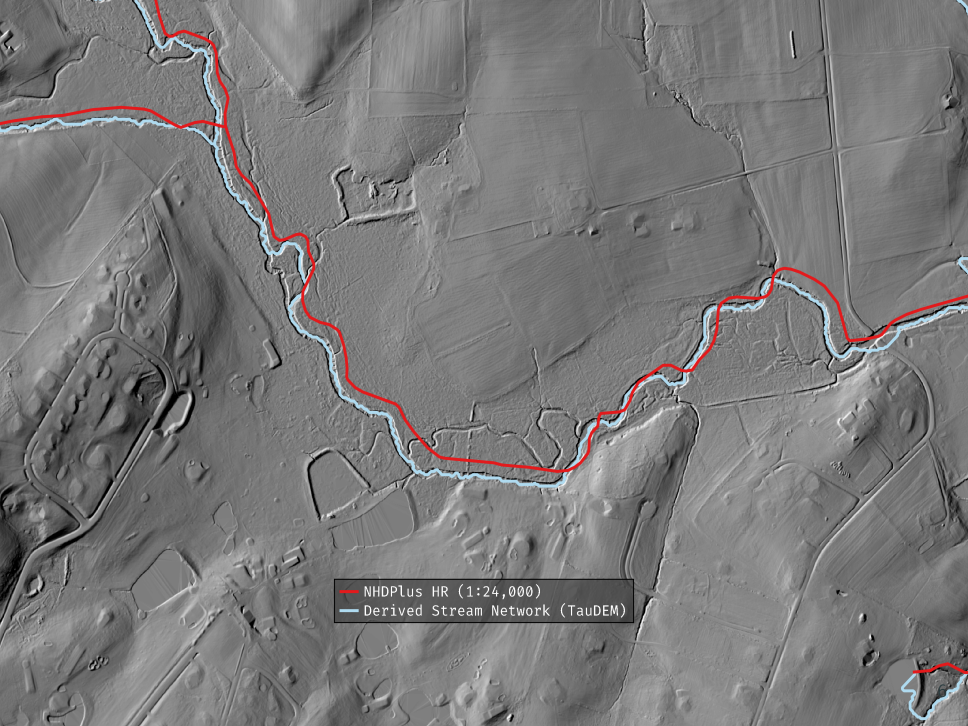


- Hydrologically conditions DEM and generates a synthetic stream network
- Identifies *stream-banks* and calculate *channel width*, *bank height*, *bank angle*, channel shape and area
- Identifies *active floodplain extent* and calculate *floodplain width*, elevation and depth along the floodplain

Hydrologic Conditioning

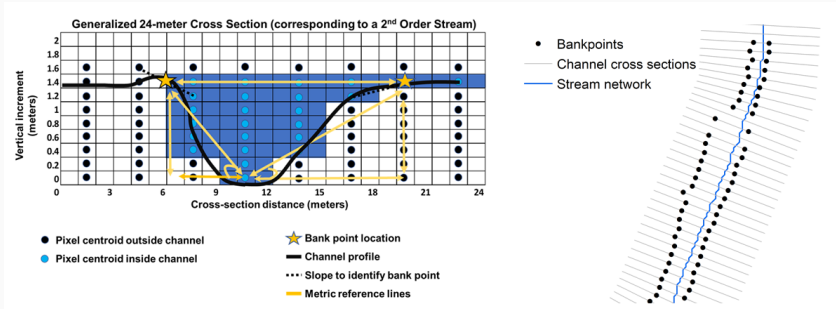
- NHDPlus HR (1:24,000 scale) stream network's end nodes are used as channel initiation points
- Hydro-condition the DEM to improve breaching through road and railroad embankments then run Whitebox's BreachDepressions algorithm
- Generate D8 flow direction and flow accumulation (TauDEM 5.3) to derived a stream network





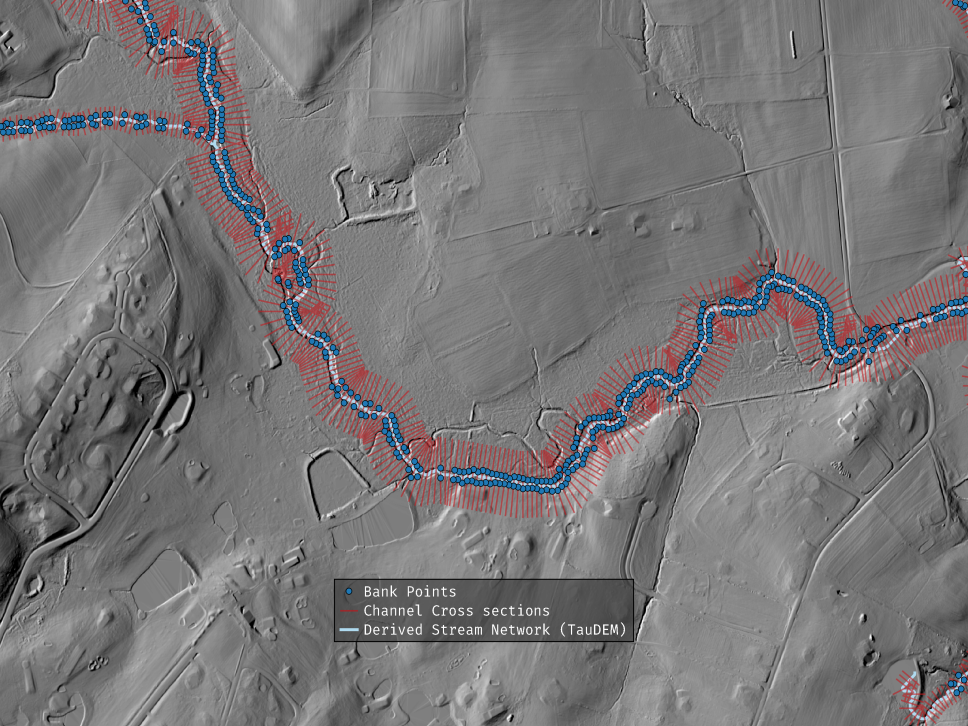
— NHDPlus HR (1:24,000)
— Derived Stream Network (TauDEM)

Stream-bank: cross-section method



1-D Cross-sections are automatically created parallel to the reach at user defined spacing (9-meters).

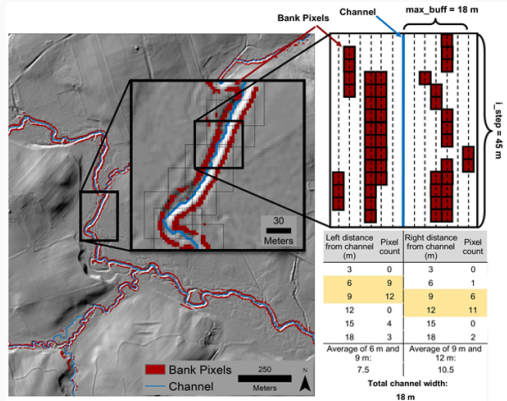
Metrics calculated: *Bank height* and *channel width*

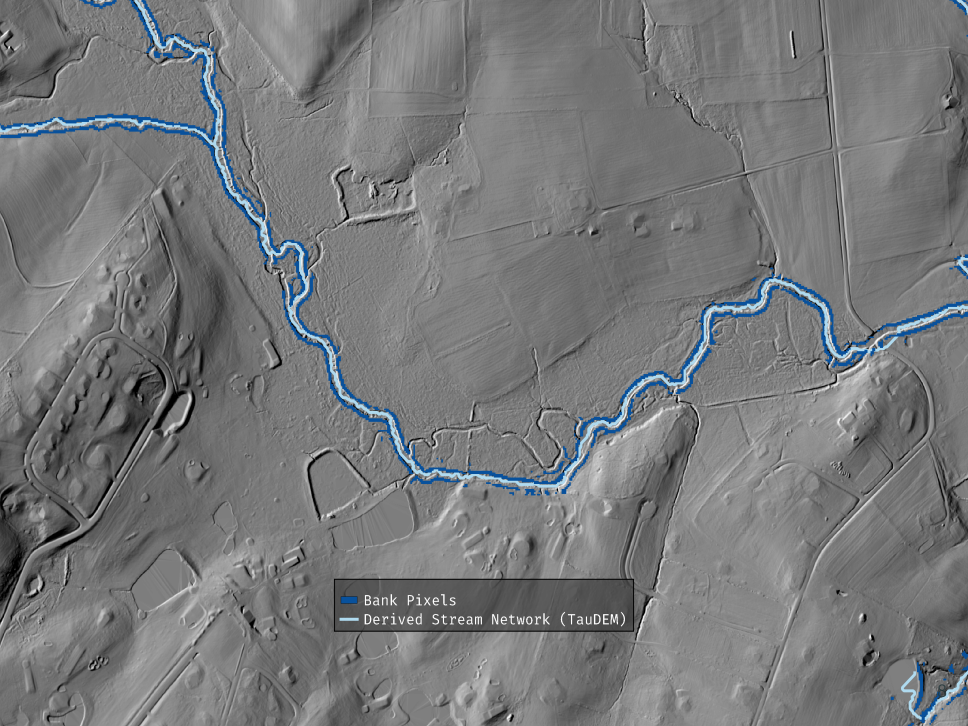


- Bank Points
- Channel Cross sections
- Derived Stream Network (TauDEM)

Stream-bank: Raster-based curvature analysis

- Curvature is calculated within a moving window that traverses the stream network
- Threshold applied to identify the bank pixels
- Buffer window used to estimate *channel width* based on the pixel counts

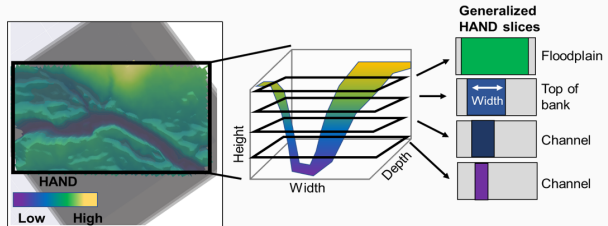




— Bank Pixels
— Derived Stream Network (TauDEM)

Stream-bank: Height Above Nearest Area (HAND) Analysis

- HAND grid within a window are extracted for each reach
- 50 vertical slices used to identify location of the channel
- Slices used to estimate *channel width* and *bank height*

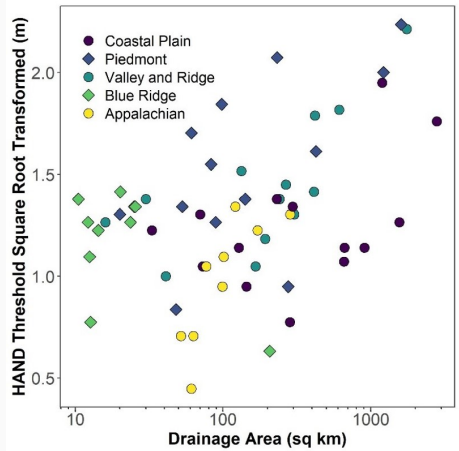


Floodplain Width

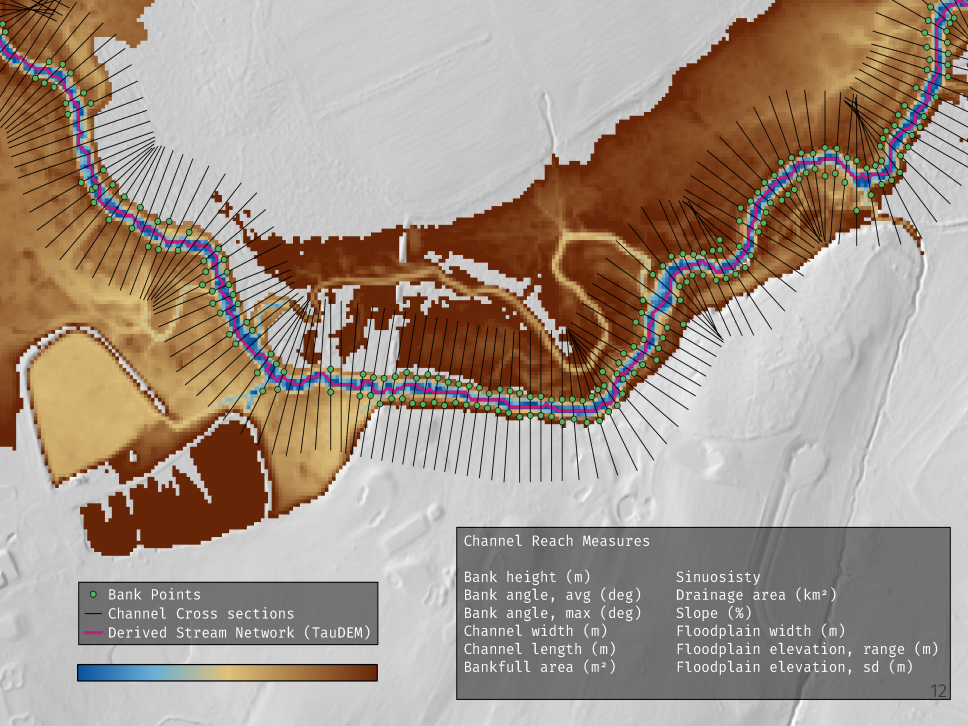
- Identify active floodplain extent in field
- Identify HAND threshold aligning with field measured floodplain extent at each site
- Predictive linear model related HAND height thresholds to drainage area and physiographic province

Contd.

- The *mean HAND threshold* for the *Coastal Plain* sites (*1.65 meters*) and *Blue Ridge* (*1.56 meters*) were used to define the active floodplain (1.5 year)
- Other three provinces, a *linear model was developed relating the HAND threshold to drainage area and physiographic province* ($R^2=0.59$, $p < 0.001$)



- Stream network
- 1-D Cross-section bank points
- Raster-based curvature bank pixels
- Floodplain extent Raster (HAND)



- Bank Points
- Channel Cross sections
- Derived Stream Network (TauDEM)




Channel Reach Measures

Bank height (m)	Sinuosity
Bank angle, avg (deg)	Drainage area (km ²)
Bank angle, max (deg)	Slope (%)
Channel width (m)	Floodplain width (m)
Channel length (m)	Floodplain elevation, range (m)
Bankfull area (m ²)	Floodplain elevation, sd (m)

<https://code.usgs.gov/water/facet/-/releases/v0.1.0>

<https://doi.org/10.5066/P9RQJPT1>



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Geomorphometry for Streams and Floodplains in the Chesapeake and Delaware Watersheds

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Dates

Publication Date : 2020-04-28

Citation

Hopkins, K.G., Ahmed, L., Metes, M.J., Claggett, P.R., Lamont, S., and Noe, G.B. 2020. Geomorphometry for Streams and Floodplains in the Chesapeake and Delaware Watersheds: U.S. Geological Survey data release. <https://doi.org/10.5066/P9RQJPT1>.

Summary

Geomorphometry for Streams and Floodplains in the Chesapeake and Delaware Watersheds was generated as part of the project Quantifying Floodplain Ecological Processes and Ecosystem Services in the Delaware River Watershed funded through the William Penn Foundation's Delaware Watershed Research fund. This dataset contains geomorphometry for streams and floodplains in the Chesapeake and Delaware River watersheds. Geomorphometry is a quantitative representation of landscape surface form (e.g., channel width and depth) obtained from digital elevation models (DEMs). The dataset contains geomorphometry derived from running 3-m DEMs through the Floodplain and Channel Evaluation Tool (FACET) version 0.1.0. FACET generates shapfiles and rasters of the stream network, cross sections, streambank point locations, floodplain extent, height above nearest drainage (HAND), and reach-scale summaries of bank height, channel width, floodplain width, and a suite of other metrics outlined in the data dictionary. These data were generated to aid in modeling the amount of sediment and nutrients trapped on floodplains or eroded from streambanks in the Chesapeake and Delaware River watersheds.


Files are organized into folders by hydrologic unit code (HUC) for subbasins within the Chesapeake and Delaware watersheds. Each folder contains the following files within the main folder and a sub folder called "post processing - XXXX" where XXXX is a 4-digit HUC.

[show more](#)

Child Items (6)

- 0204
- 0205
- 0206
- 0207
- 0208
- Chesapeake and Delaware Basin Combined Files

Map »



Spatial Services

ScienceBase WMS : <https://www.sciencebase.gov/catalog>

Communities

- Chesapeake and Delaware Floodplain Network
- USGS Chesapeake Bay
- USGS Data Release Products

Associated Items

- alternate Data Release
- [View Associated Items](#)

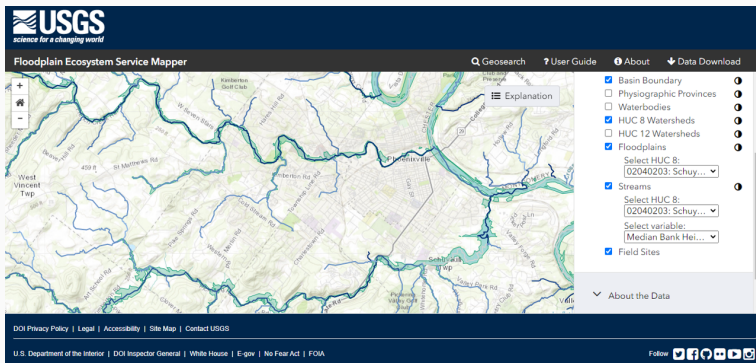
Tags

Theme : Floodplain, Geomorphology, Hydrography, Stream, geospatial, lidar, mapping, remote sensing, streambank

Place : Chesapeake Bay Watershed, Delaware River Basin

Floodplain Ecosystem Service Mapper

<https://www2.usgs.gov/water/southatlantic/projects/floodplains/>





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Questions?

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