Minimizing Visual Data-Loss Using Alternative Hillshading Techniques

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GEOG 593

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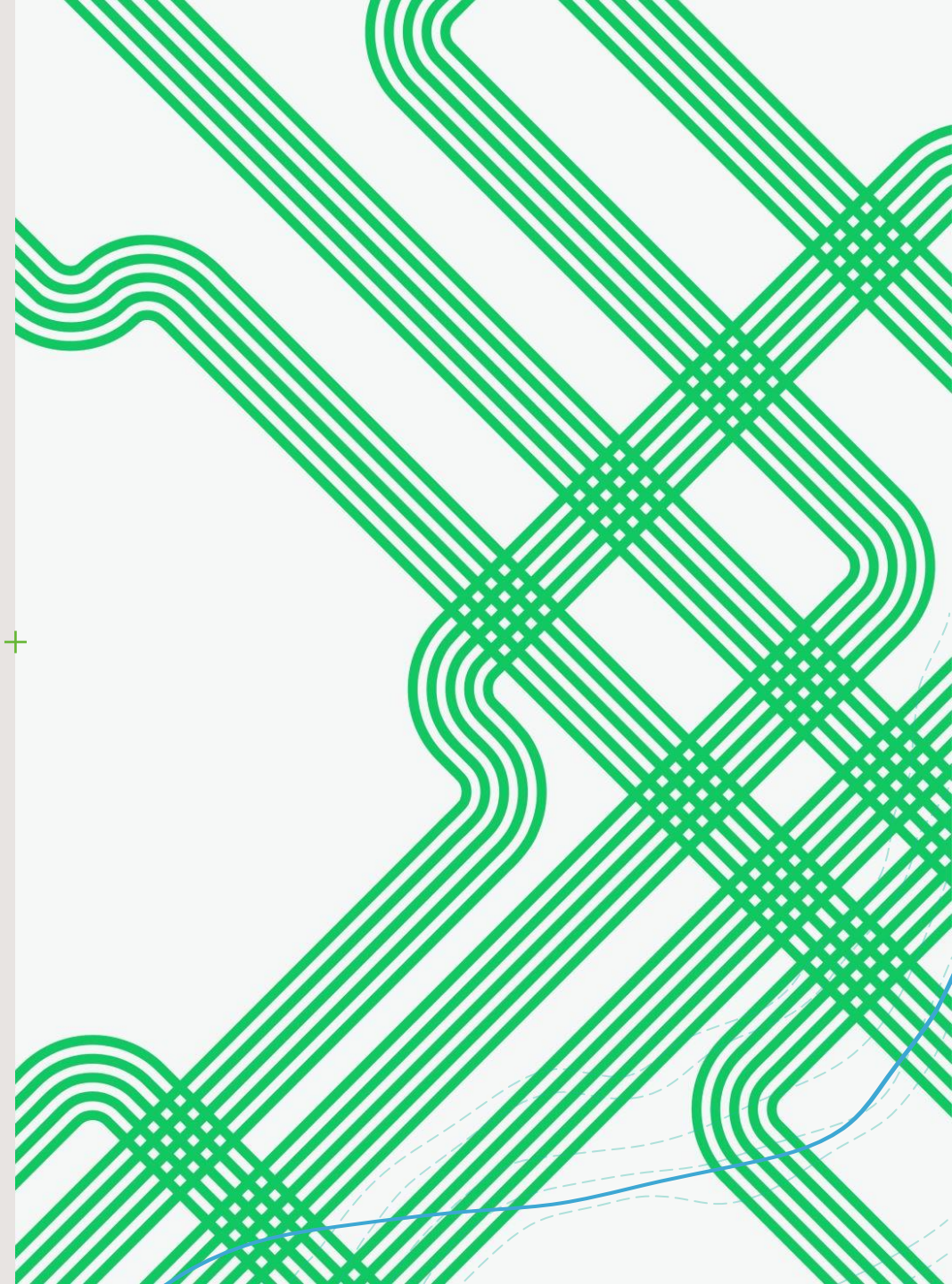


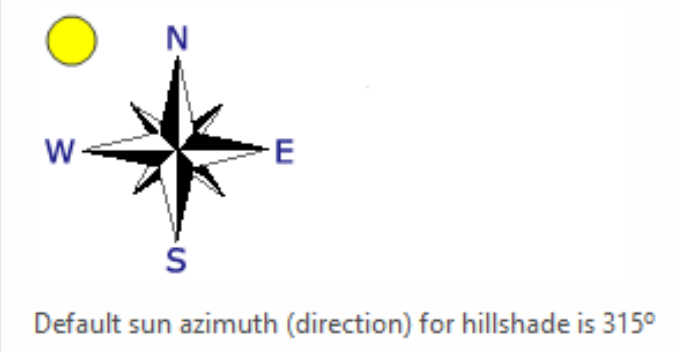
Intro

- Hillshading (shaded relief) is a technique used to visualize the illumination of each cell of a DEM/DSM given the azimuth and altitude of a hypothetical light source.
  - Azimuth - angular direction of light source.
  - Altitude - angle of light source above horizon.
- ArcGIS can generate usable, rudimentary hillshaded surfaces, but visual data loss is common in heavily shaded areas.

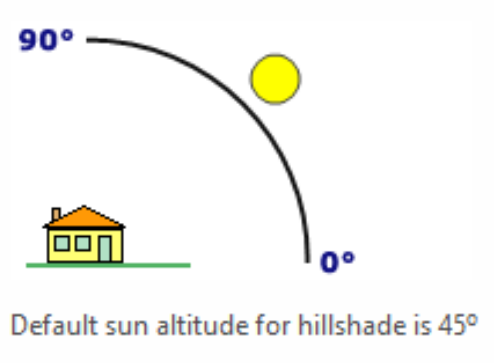
- **Research Question**: How, then, can we minimize data loss when generating hillshaded surfaces?

ArcGIS Hillshade

- ArcGIS, by default, uses an azimuth of 315° and an altitude of 45°.



Default sun azimuth (direction) for hillshade is 315°



Default sun altitude for hillshade is 45°

- Optionally, ArcGIS can model shadows in a hillshade, but given the limited flexibility of the tool, it is easy to lose detail in your DEM/DSM.

ArcGIS

Azimuth: 315°
Altitude: 45°
Shadows: No
Data: 3ft Highest-hit LiDAR Derived DSM

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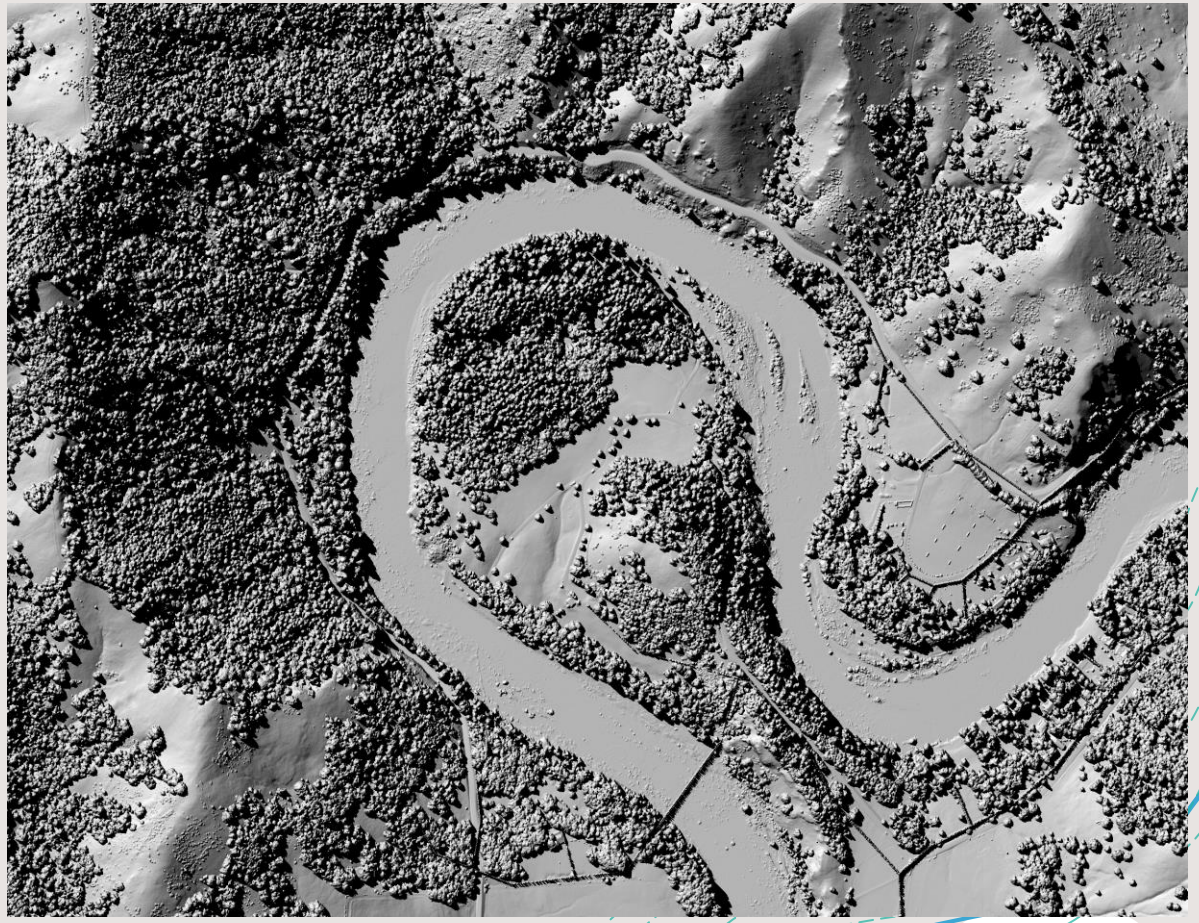
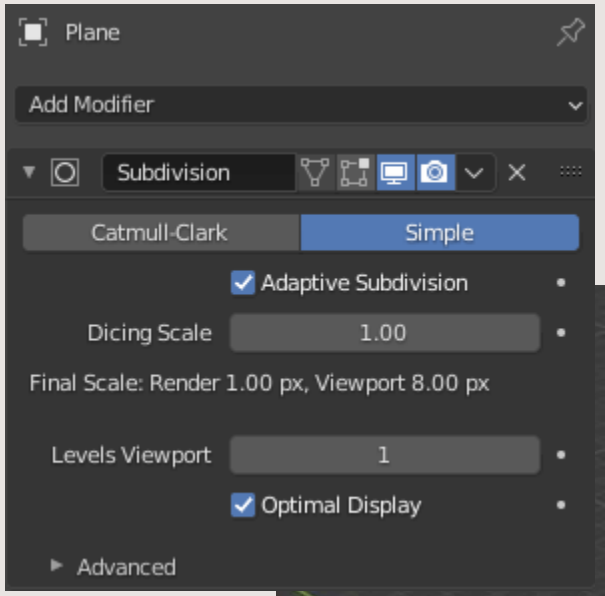
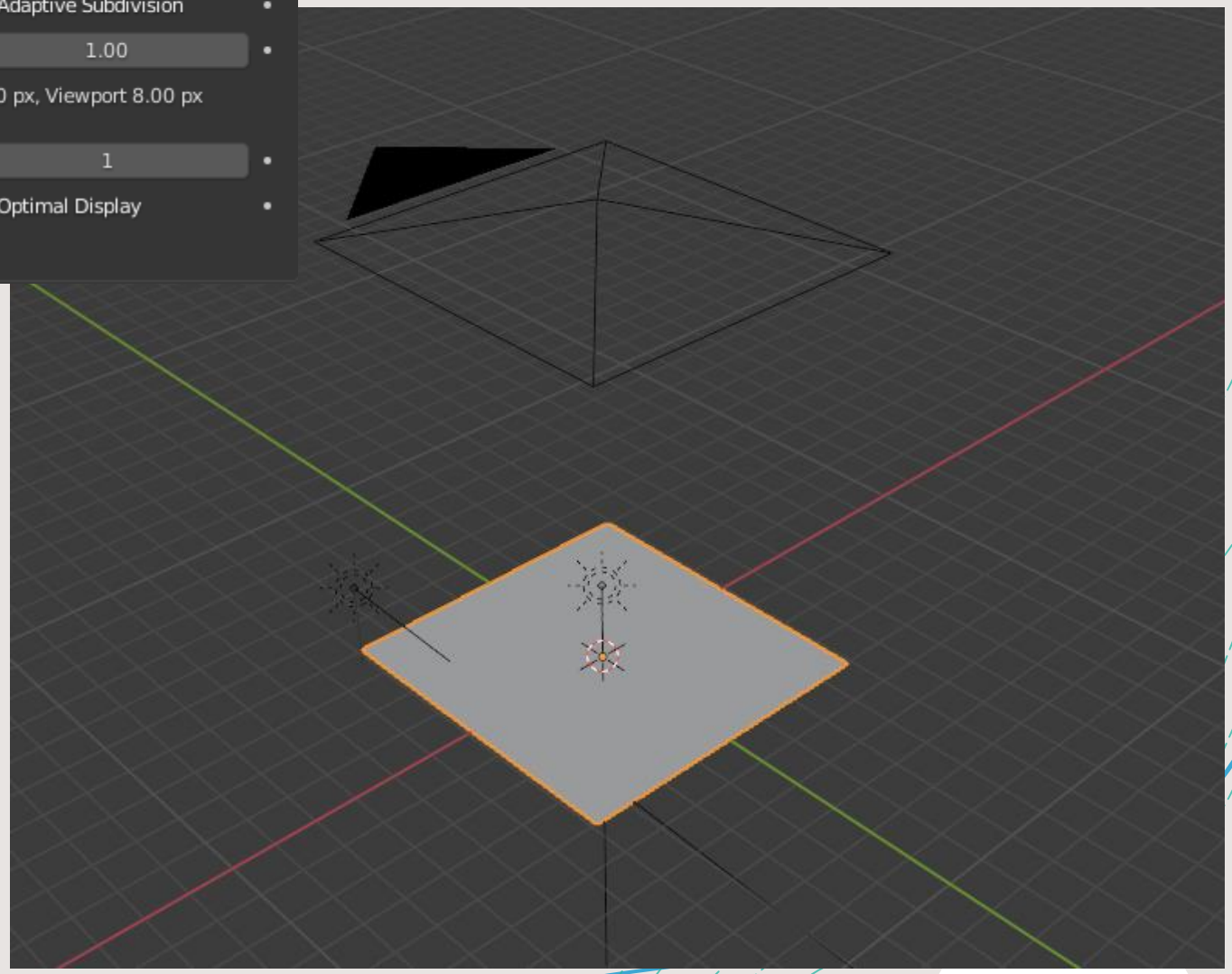


Blender Hillshade

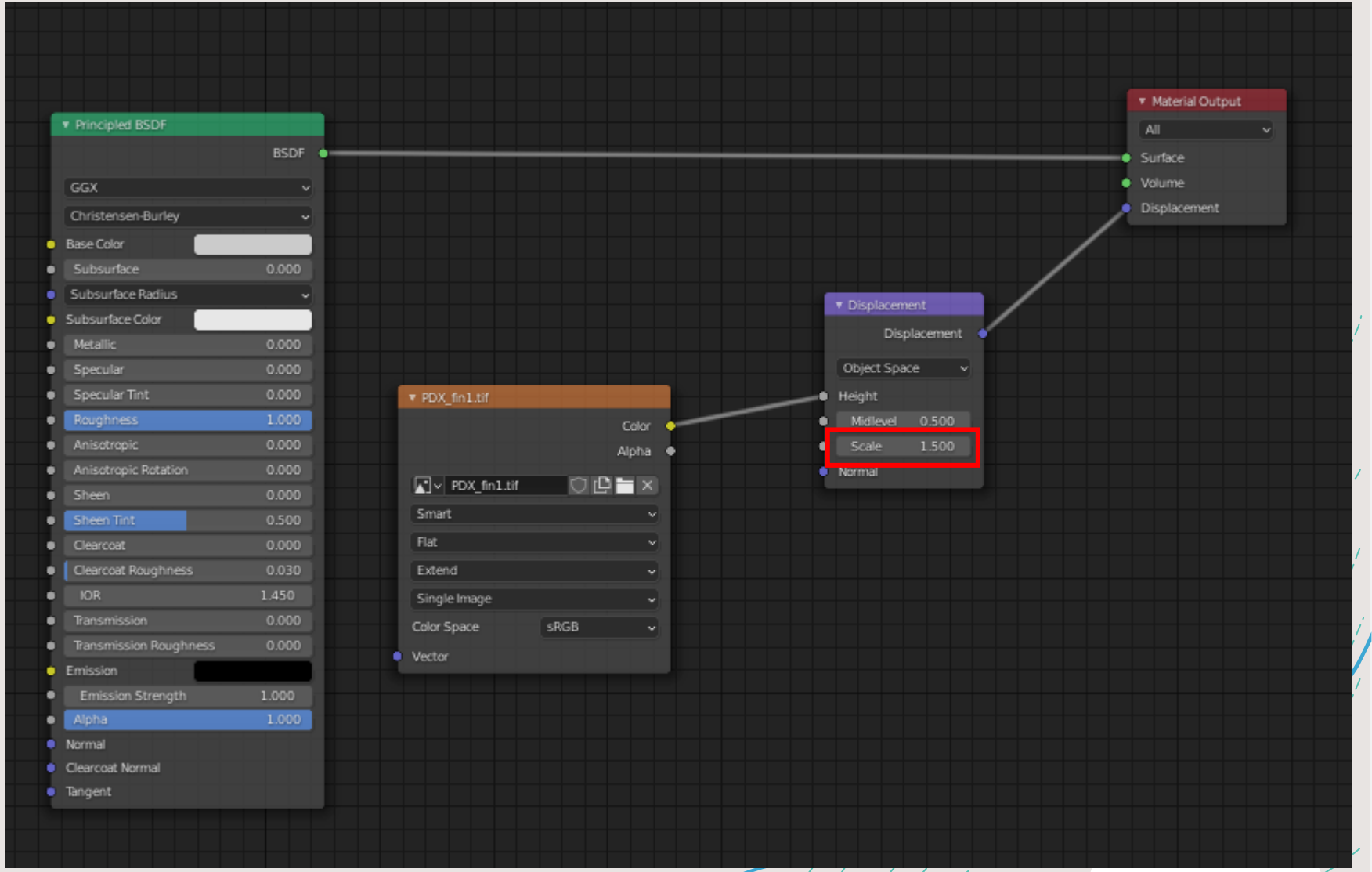
- Step-by-step Guide
- The guide in the link above walks through the process of preparing data and creating hillshading using Blender.
- **Basic steps for prep**:
  - Rescale raster data values to 16-bit unsigned range (0-65535)
  - Clip raster to study area
  - Export raster as 16-bit unsigned TIFF

- **Basic scene setup:**
  - Flat plane
    - Subdivision modifier divides plane into smaller squares (think spatial resolution).
  - Overhead camera
  - Two light sources
    - Light 1:
      - Azimuth – 315°
      - Altitude – 45°
      - Angular diameter – 45° (creates darker cast shadows)
    - Light 2:
      - Azimuth – 315°
      - Altitude – 0° (pointed straight down)
      - Angular diameter – 90° (creates lighter, diffuse shadows)





+ **Basic material setup:**
+ BSDF (bi-direction scattering distribution)
+ Image Texture
+ Vector Displacement



ArcGIS – No Shadows

ArcGIS - Shadows

+ Light 1:
  + Azimuth – 315°
  + Altitude – 45°
  + Angular diameter – 45°
  + Strength - 5
+ Light 2:
  + Azimuth – 315°
  + Altitude – 0°
  + Angular diameter – 90°
  + Strength - 1

+ Light 1:
  + Azimuth – 135°
  + Altitude – 45°
  + Angular diameter – 45°
  + Strength - 5
+ Light 2:
  + Azimuth – 315°
  + Altitude – 0°
  + Angular diameter – 90°
  + Strength - 1

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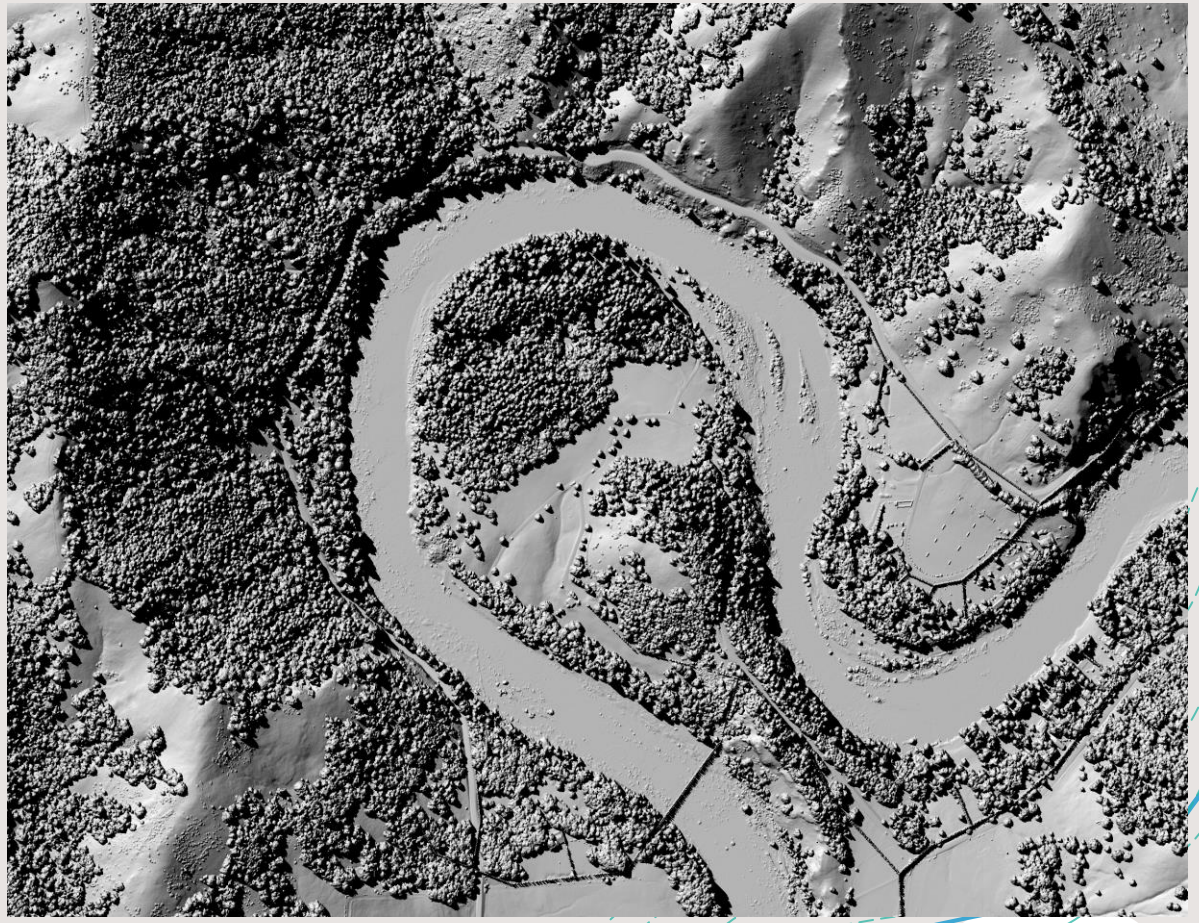

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+ Light 1:
  + Azimuth – 135°
  + Altitude – 45°
  + Angular diameter – 45°
  + Strength - 5
+ Light 2:
  + Azimuth – 315°
  + Altitude – 0°
  + Angular diameter – 90°
  + Strength - 1

Pros & Cons of Using Blender

+ Pros:

+ Better control of lighting and surface material properties.
+ Less loss of visual data.
+ Results look (subjectively) great.
+ Fairly easy to reproduce with new data after initial setup.
+ Fun to step away from ArcGIS!

+ Cons:

+ A bit of a learning curve (new software & terminology).
+ Initial setup can take a while.
+ Potentially high computational needs.
+ Loss of georeferencing.
    + **Workaround for cartography:** If using any other spatial data in your map, make sure it is all in the same projection and clipped to the same area of interest – the layers should then line up in photo or vector editing software like photoshop or illustrator.

Questions?

+References/Guides:

+https://somethingaboutmaps.wordpress.com/2017/11/16/creating-shaded-relief-in-blender/

+https://desktop.arcgis.com/en/arcmap/10.3/tools/spatial-analyst-toolbox/how-hillshade-works.htm