Today

• Topographic functions (surface analysis)
• Slope, Aspect, Hillshade, Viewshed
• Pause
• Help with HW assignment?
Surface analysis tools

- Surface
- DEM
- Conversion
  - Aspect
  - Slope
  - Hillshade
  - Curvature
    - Profile
    - Plan Curve
  - Contour
- Before Surface
  - Cut/Fill
- After Surface
- Raster
- Feature Class

- Viewshed
- Surface
- Observer Points
- Point
- Point or Polyline
Using surfaces in ArcGIS Spatial Analyst

- **Hillshade** (typically as semi transparent overlay)
- **Aspect** (8 different directions only)
- **Contour** (lines)
- **Slope** (degrees or percent, may need elevation conversion factor if elev. is in feet)
- **Curvature** (change of slope i.e. change of change of elevation)
Digital Elevation Model (DEM)

- Digital Terrain Model (DTM)
- Topography: Elevation (ft. or meter, sometimes: elevation in feet, horizontal distances in meters!)
- US Geological Survey:
  - 7.5’ maps (quads), 10 m, 30 m; 90 m
- National Elevation Dataset (NED): 10 m
- Shuttle Radar Topography Mission (SRTM): 90 m
- Raster values: large integers (1243 ft) or float (543.2 m)
Slope & Azimuth

...terrain surface is characterized by inclination (slope) and orientation (azimuth)
Slope

- Based on elevation difference of cell to elevation of surrounding cells
- Gradient at cell (center)
- Problem: if X/Y are in meters, elevation (Z) is in feet
- Solution: multiply elevation by 3.280 (Z-factor)
- Spatial Analyst -> Surface Analysis or ArcToolbox - Spatial Analyst tools (not TIN slope!)
- geol588\data\mgisdata\BlackHills\rasters\dem2
Slope

- How to symbolize?
- Properties - Symbology: Classified vs Stretch
- Apply a color ramp from elevation A (1230 ft) to elevation B (1423 ft)
- Gotcha: A and B are not always min and max!
- Types of Stretch: Standard deviations (2 sigma default), user sets min & max, none (data min & max)
- Select color ramp by name (right-click - Graphic View)
- New in 9.2: pick same color map as other layer
Aspect

- direction of cell center, when looking down towards max. (!) slope
- in degrees (0 - 360) from North, *circular* data type
- flat areas (i.e., no slope): encoded as -1

Problem: How to effectively convey direction?
- Looks like “3D” slopes (similar to hill shading)
- Spatial Analyst - Surface Analysis, ArctoolBox - Spatial Analysis Tools(!)- Aspect
Hillshading

- Trick to fool our eyes to see 3D relief
- Simulate Sun from direction (0-360) and angle (0-90), creates grey scale map (0-255)
- Gotcha: Sun must be in the North (270 - 90), otherwise relief looks inverted (human evolution: sun from above)
- 10-50% transparent, drape over DEM
- graphical only(Symbolization) - less options, not as good?
- Spatial Analyst - Surface Analysis, ArctoolBox - Spatial Analysis Tools(!)
Viewshed

- needs a shapefile with points (Sturgis -summits)
- Which cells can be seen from these points?
- Shoots rays from point to each cell, check for intersect with terrain
- Can be more complex - add more data to points: height, view angle, distance (more next lab)
- Observer points tool: which points can see other points?
- Spatial Analyst - Surface Analysis, ArctoolBox - Spatial Analysis Tools(!)
HW 1 questions? Help?