



Surface Analysis Tools

Lesson 7 overview

☐ Topographic data

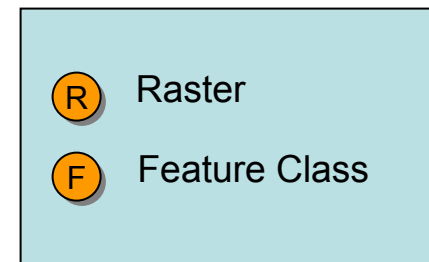
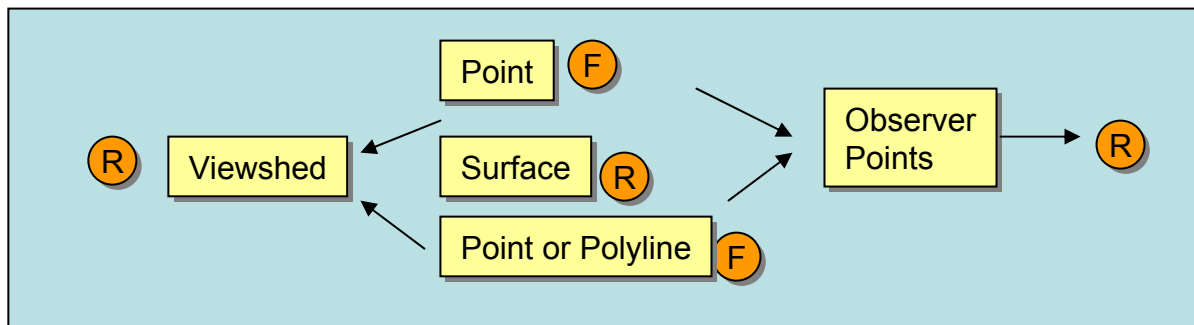
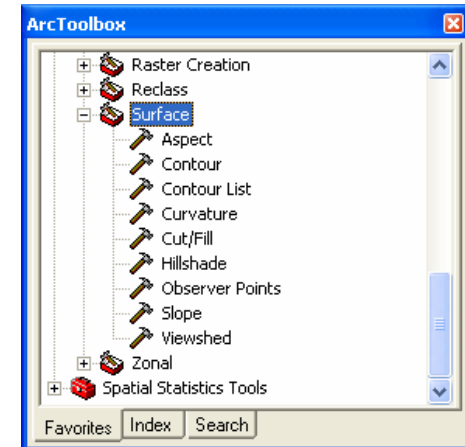
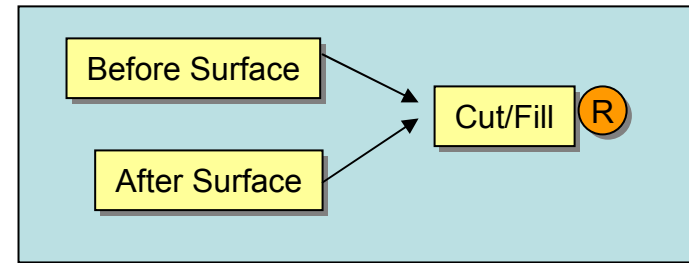
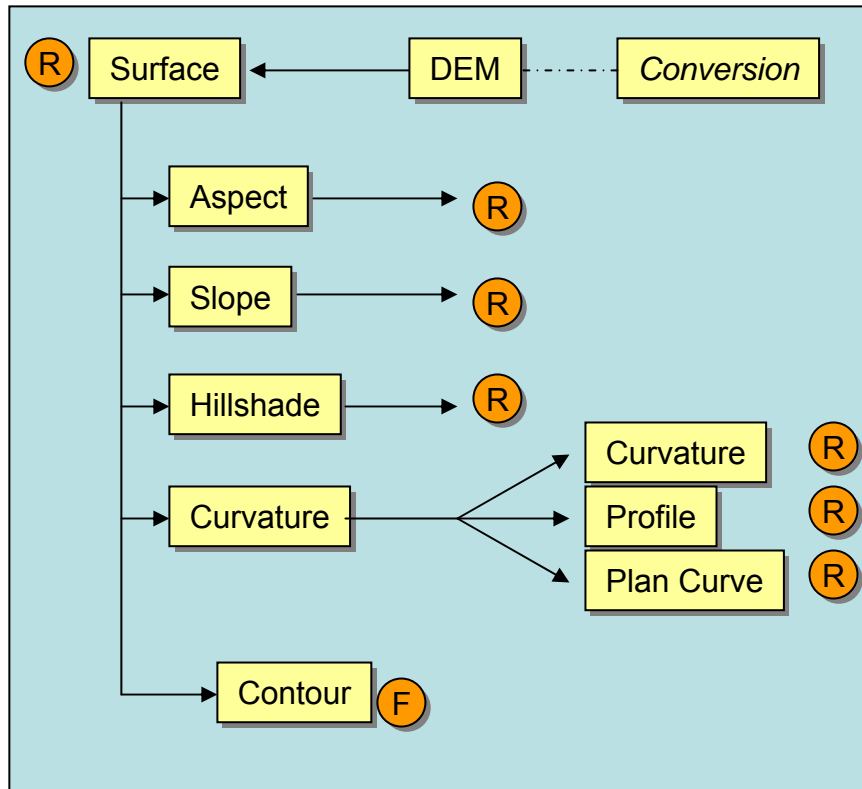
- Sources
- Uses

☐ Topographic analysis

- Hillshade
- Visibility
- Contours
- Slope, aspect, and curvature

☐ Exercise 11

Road map — Surface analysis tools



Sources of topographic data

❑ US Federal Government

- **United States Geological Survey (USGS): OEM**
 - Several resolutions

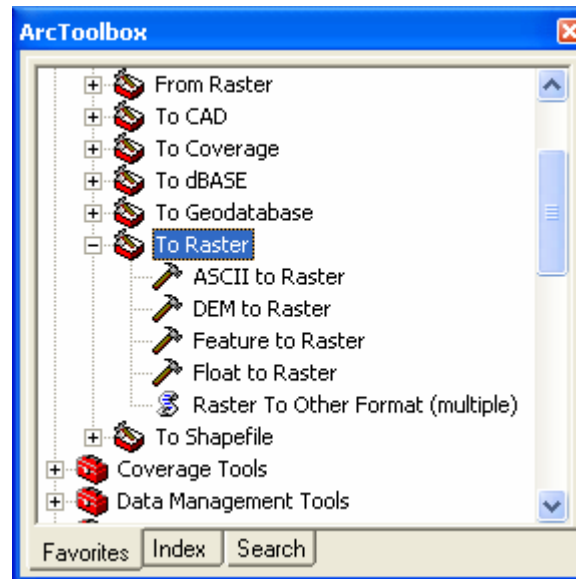
	Spacing	Z Accuracy
7.5 minute	30 meter	± 15 meters
15 minute	2 arc-second	± ½ of contour interval
30 minute	2 arc-second	± ½ of contour interval
1 degree	3 arc-second	± ½ of contour interval

- **National Elevation Dataset (NED)**
- **National Imagery and Mapping Agency (NIMA): DTED**

Surface conversion

❑ Convert surface formats into rasters

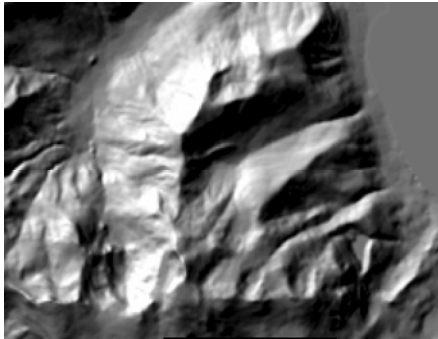
- ASCII to Raster
- DEM to Raster (Digital Elevation Model)
- DTED (Digital Terrain Elevation Data) is a direct read format for ArcGIS



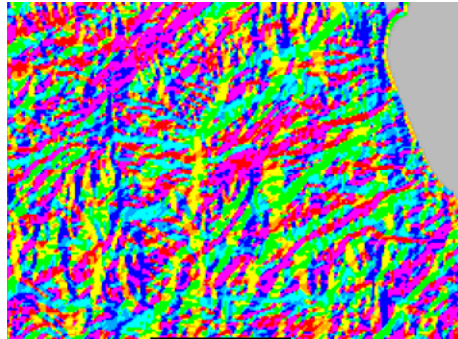
- Output name with no extension returns a grid

Using surfaces in ArcGIS Spatial Analyst

- ❑ • ArcGIS Spatial Analyst provides tools to derive



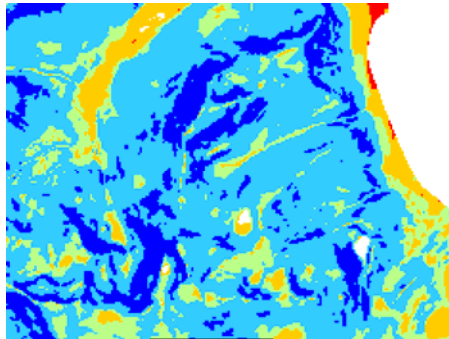
Hillshade



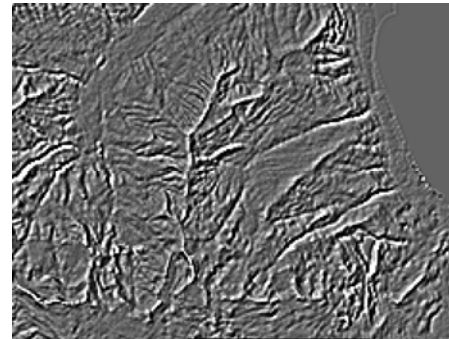
Aspect



Contour



Slope

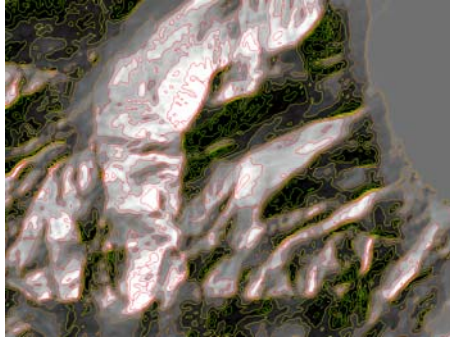


Curvature

- ❑ • Also hydrologic modeling

Contouring

- ❑ Isolines connect locations of equal value
- ❑ Generate contour lines from a surface
 - May specify contour interval and base contour



Contour

Input raster
arhill

Output polyline features
L:\BIO\Project\Ces_lab\Shuart\SPAG\Database\Tahoe\All\

☒ Contour interval

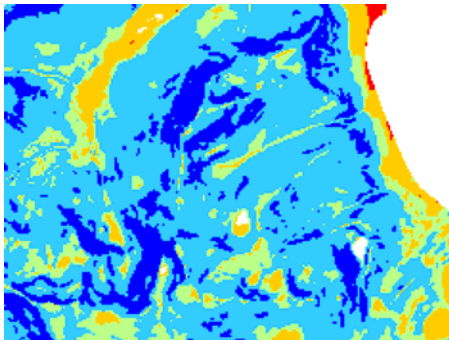
Base contour (optional)
0

Z factor (optional)
1

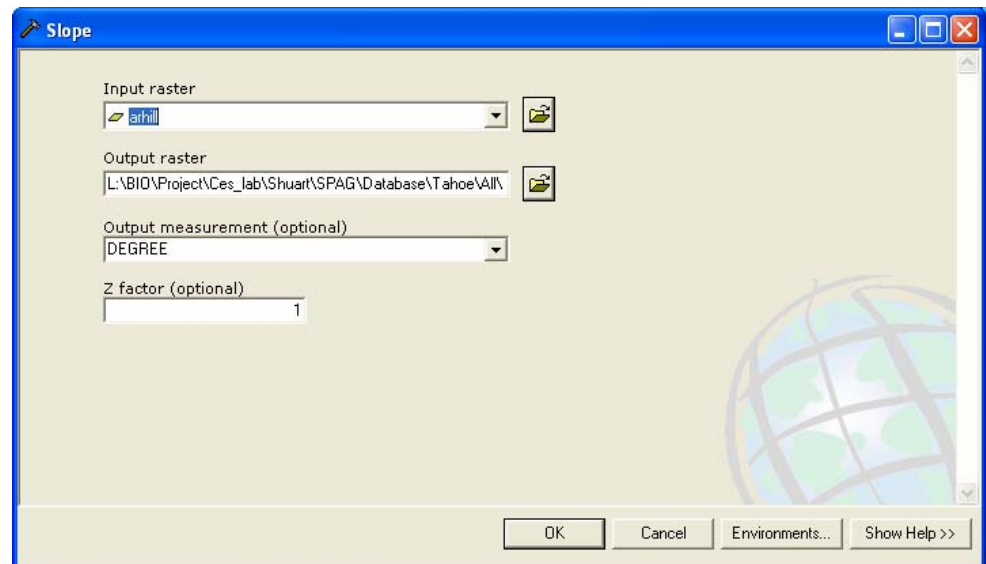
OK Cancel Environments... Show Help >>

Derive slope

- ❑ Maximum rate of change of Z through the cell
- ❑ Uses neighboring cell Z values
- ❑ Returns degrees or percent



$$\frac{\text{Rise}}{\text{Run}} = \tan \theta$$



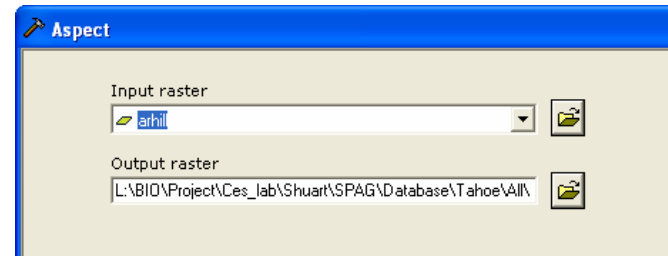
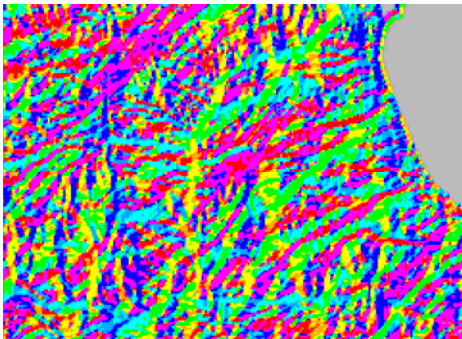
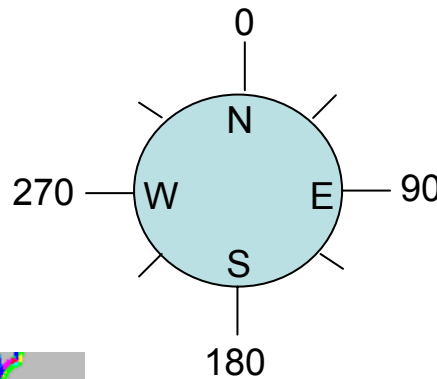
Derive aspect

❑ Direction of the maximum rate of change in Z

- Orientation of cell relative to north
- Returns compass direction 0 to 360
- Flat areas are given a value of -1

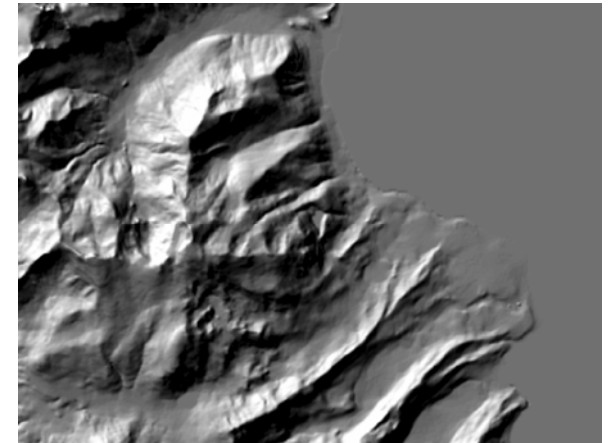
☒ aspect

- Flat (-1)
- North (0-22.5)
- Northeast (22.5-67.5)
- East (67.5-112.5)
- Southeast (112.5-157.5)
- South (157.5-202.5)
- Southwest (202.5-247.5)
- West (247.5-292.5)
- Northwest (292.5-337.5)
- North (337.5-360)



Hillshade

- ❑ **Illuminates a surface**
 - Sets sun position
 - Returns gray scale 0 - 255
- ❑ **Cartographic and analytic uses**

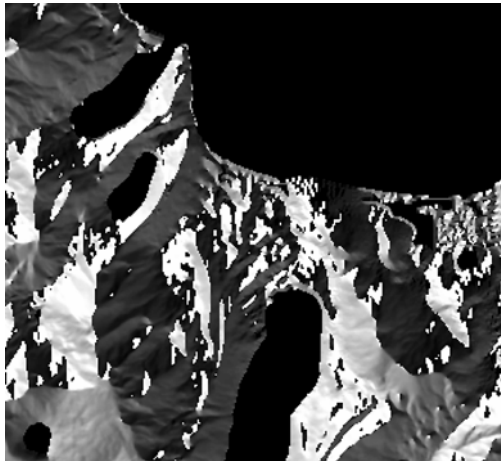


```
HillShade_sa <in_raster> <out_raster> {azimuth} {altitude} {model_shadows} {z_factor}
```

```
HillShade_sa |
```

Visibility analysis

- ❑ Visibility of cells from observation points or lines
- ❑ Output attributes identify observer count or ID



Visibility outputs

❑ FREQUENCY (Viewshed tool)

- No limit to the number of observation points

❑ OBSERVERS (Observer Points tool)

- Only with the POINT option
- When number of observation points LE 16

