GEOL 452/552 - GIS for Geoscientists I

Lecture 22 - Chapter 8 (Raster Analysis, part 3)

- More on raster functions:
  - Interpolation (Inverse Distance based, IDW)
  - Zonal Analysis (statistics) for polygons, lines, points
  - Effects Toolbar
- more: Geol 488/588 - GIS II (rasters, TIN, ArcScene), **Spr. 2013**
- Iowa Ortho image server and USGS Seamless raster data server
- **Suitability Analysis** HowTo (possible class project idea?)

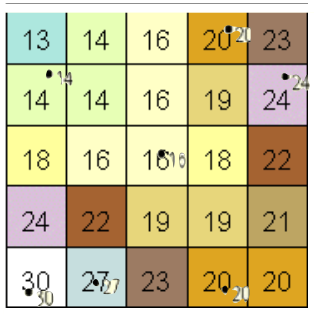
- copy geol552/data/follow along/**Ch8C_more_data**
- into your U:\ArcGIS\Ch8A_class_ex folder
- start mxd file in U:\ArcGIS\Ch8A_class_ex
- ArcMap: add layers from **Ch8C_more_data** to your data frame
- Activate Spatial Analyst
- Geoprocessing - Environments:
  - Workspace: U:\ArcGIS\Ch8a_class_ex
  - set Extent to extent of dem.img

Spatial Interpolation

- fills a raster (with a extent and cell size) with new values based on point samples' locations and values
- point samples (x,y,"value"): here 7 samples, (A) irregular distribution
- for a raster (B) fill each cell with a value ("between samples")
- Principle: a cell value should be *similar to the cell's closest samples*
- different spatial interpolation algorithms (IDE, spline, kriging)
- distance to sample **and** sample value matter

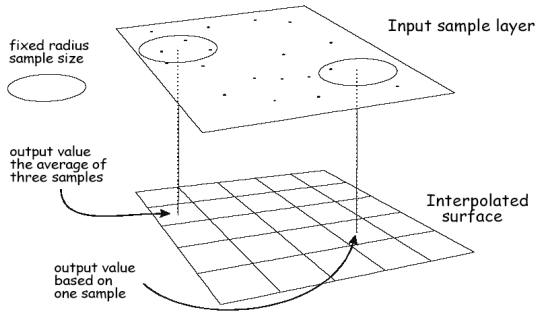
A)

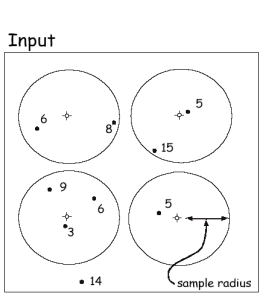
B)

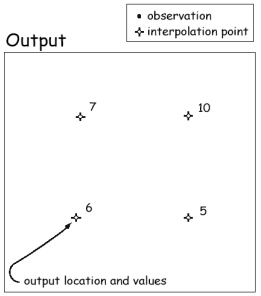


Interpolation

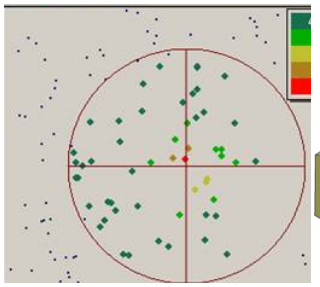
- Need: point samples (here: elevation, think GPS points)
- Go over all cells of an empty raster, for each cell:
- Grab all the closest point samples (here: within a radius around the cell)
- Do some spatial math with these point samples
- IDW: faster, Spline: smoother
- result: cell's elevation

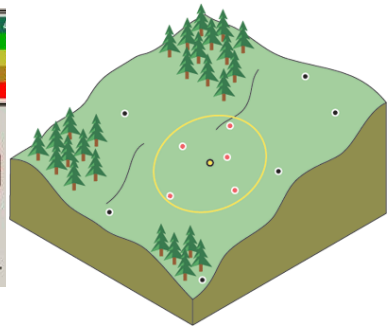




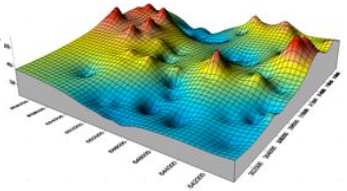


Inverse distance Interpolation: search radius

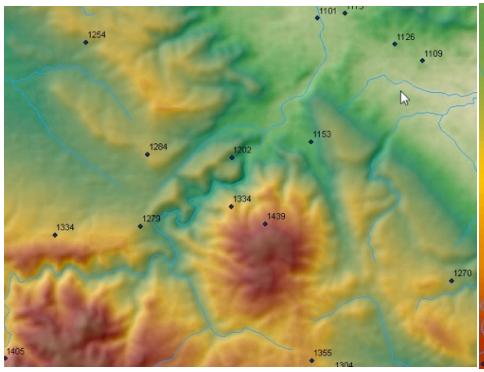


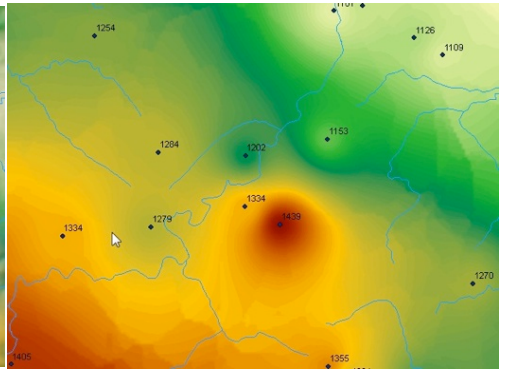


- **variable** search radius:
  grab n (12) closest points
  - (... up to a max. distance, 0=no distance limit)
- **fixed** search radius:
  grab ALL points within a distance of X units
  - (... but use at least n points, 0=use all)



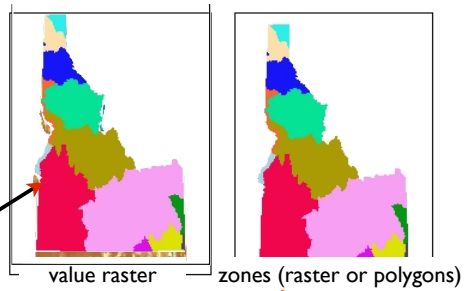
- "blurry" results from IDE interpolation (compared to "true" dem2)
- same raster resolution (50 m) but far less samples were used than when making the real DEM
- would get much better results with more sampling points
- we'll revisit this in last lecture: making DEM from Lidar

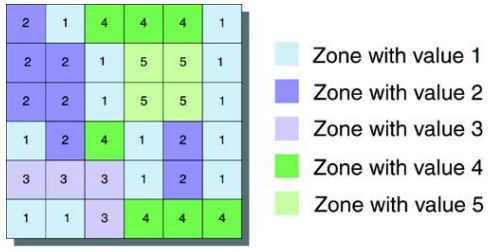




Zonal functions (statistics)

- Needs 2 inputs:
  - a **value** raster (e.g. elevation)
  - a **zone layer**: polygons, lines or points; or integer raster
- Zones in a "zone raster" don't need to be "continuous" (see instead: regions)





- Zonal Statistics Tool **as Table**

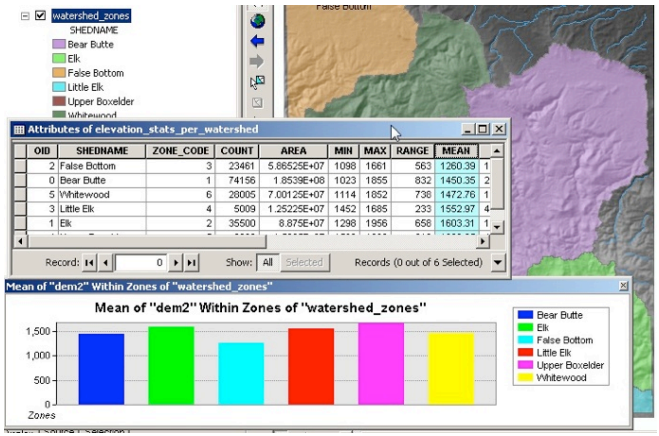
value raster = elevation raster
zone layer = watersheds

average elevation of yellow watershed = 234.6 m

avg. elevation of blue watershed = 674.5 m

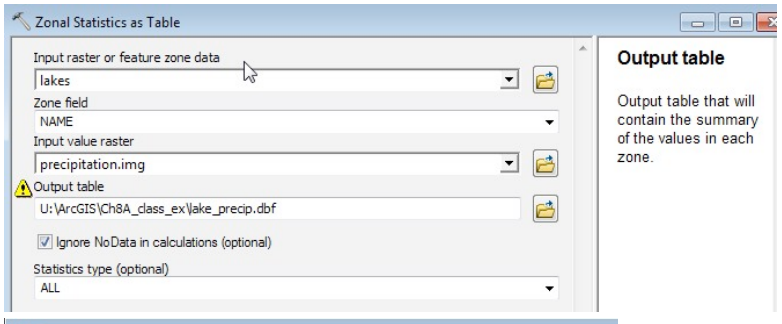
- for each zone, calculate summary **statistics** for all value raster cells that are **inside** this zone
- Automatically creates all types of stats per zone "id"
- creates a **standalone table**
- Table can be joined to zone layer (via OID as key)
- think: **Summary** but with spatial grouping instead of group attribute
- for each watershed get statistics (mean,min, max, etc.)of the elevation

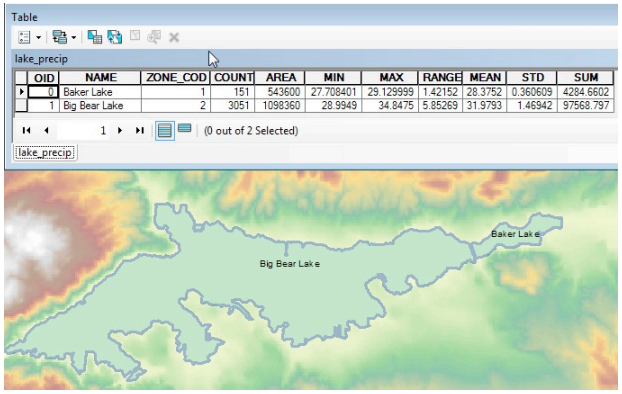
- Which watershed (or type of outcrop) has the **lowest** average (or min, max, mean, ...) elevation of any ?
- Spatial Analyst - Zonal Statistics
- for zone layer: watershed_zones (or geol_zones.img)
- for value raster: dem2 (elevation)
- Join output to zone: **Yes**, Save joined as elev_per_watershed.shp
- All Stats are about elevation
- Sort by MEAN
- COUNT: number of cells with each watershed
- Points and lines can also be used as zones



Zonal Statistics exercise

- **summarizes** the values of cells inside a zone
- **Search**: Zonal Statistics Tool **as Table** (Spatial Analyst)
- giver of zones ("feature zone data"): **lakes** layer (not buffered!) NAME as Zone field
- giver of values (to summarize) "value raster": **precipitation.img** (rain per year in **centimeters**) (also try: DEM.img)
- Output **table**: U:/ArcGIS/ch8a_class_ex/lake_precip.dbf (DBase file) or inside a GeoDB
- Statistics Type: ALL (gives you all types of summary stats)



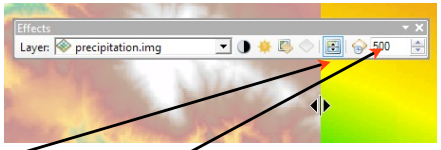


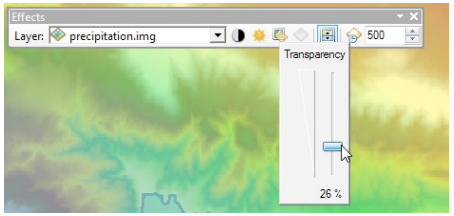
Why 2 rows?
COUNT?
Why very similar MEAN?

optional: join lake_precip to lakes using NAME

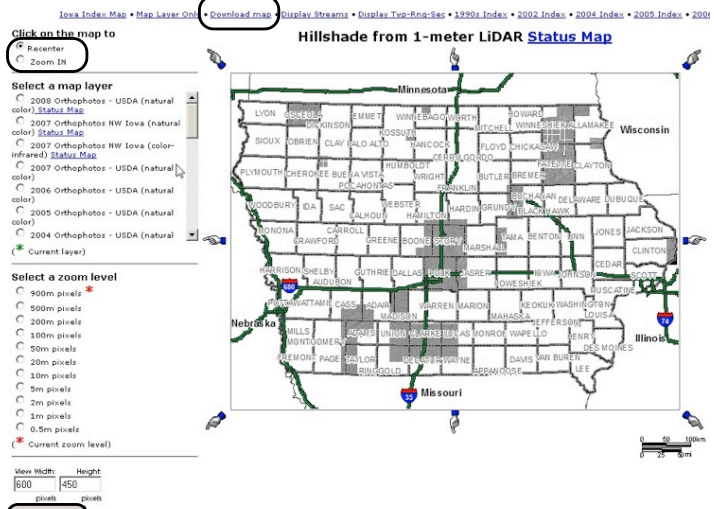
The Effects toolbar

- Helps deal with clutter (or might drive you insane :)
- in TOC: put precipitation over DEM
- Activate the **Effects** Toolbar
- Set Effect bar Layer Precipitation (sets the "effected" raster layer)
- press swipe button and drag left mouse
- press flicker (500 ms) button (seizure warning :)
- Also: adjust contrast, transparency on the fly





ortho.gis.iastate.edu raster data



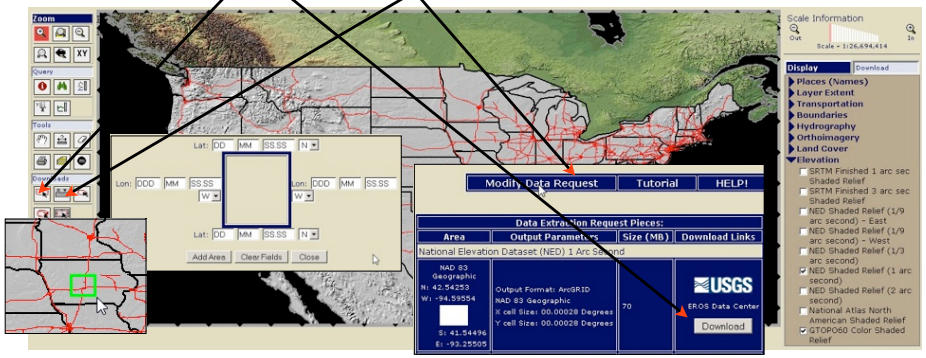
- Home > Map type (here: Lidar Hillshade) > Status map (shown here)
- Recenter vs. Zoom in, may need to press "Refresh Map"
- Change width/height (e.g. to 2000 x 2000 pixels), will keep center but may be too big to view)
- When viewing the right area, press "Download map"

	GEOTIFF	TIFF	JPEG
200x200m pixels (20x20)	Image *(1.1k)*	Image *(1.1k)* MapInfo Header ArcView Header	Image *(0k)* MapInfo Header ArcView Header
100x100m pixels (40x40)	Image *(4.6k)*	Image *(4.6k)* MapInfo Header ArcView Header	Image *(0.3k)* MapInfo Header ArcView Header
50x50m pixels (80x80)	Image *(18.7k)*	Image *(18.7k)* MapInfo Header ArcView Header	Image *(1.3k)* MapInfo Header ArcView Header
20x20m pixels (200x200)	Image *(117.1k)*	Image *(117.1k)* MapInfo Header ArcView Header	Image *(8.2k)* MapInfo Header ArcView Header
10x10m pixels (400x400)	Image *(468.7k)*	Image *(468.7k)* MapInfo Header ArcView Header	Image *(32.8k)* MapInfo Header ArcView Header
5x5m pixels (800x800)	Image *(1875k)*	Image *(1875k)* MapInfo Header ArcView Header	Image *(131.2k)* MapInfo Header ArcView Header
2x2m pixels (2000x2000)	(Image too large) *(11718.7k)*	(Image too large) *(11718.7k)* MapInfo Header ArcView Header	Image *(820.3k)* MapInfo Header ArcView Header
1x1m pixels (4000x4000)	(Image too large) *(46875k)*	(Image too large) *(46875k)* MapInfo Header ArcView Header	Image *(3281.2k)* MapInfo Header ArcView Header

- 10 Mb (10,000 Kb) download limit
- Get Geotiff (georeferenced to UTM 15 NAD83)
- Or: get JPEG version AND **ArcView Header** (.jgw worldfile, coordinates of corners)
- put 1234.jpg and 1234.jpg in same folder, if rename: keep same base name !

Seamless.usgs.gov

- Web based raster download (interface can be very clunky!)
- Display = preview in Browser (not all types of data are available everywhere!)
- Request download area: interactive rectangle or extent (lat/long)
- Download data or modify Data request (wait for refresh)
- If possible get geotifs, warning: data can be large, don't download multiple files!



Suitability Analysis in 10 min

- Suitability analysis: predicts the suitability for X within a raster
- example: Bald Eagle Habitat (BE)
- find 3-5 factors that influence X (prediction model)
- BE really like elevation 2250 to 2400 ft to nest, OK with 1500-2250, don't like higher than 2400
- BE need access to lakes to fish (short distance to lake is good)
- BE hate people (long distance to city limits, roads)

- set environment extent to largest raster (here: DEM)
- For each factor:
  - if needed: create a raster (distance to ...)
  - covert features to raster (Feature to raster tool)
  - reclassify each to 1 - 3 (1: bad ... 3: good) (or: 1-5, 1-10)
  - name rasters well: dist_lake_recl.img dist
  - check that low reclass value really means bad !!!
  - **low** distance to lake is good but **high** distance to city is bad
- Check that all rasters have same value range (1,2,3) and cover the same area

- Use Raster calculator to get the average of all reclassed rasters (Final suitability raster)
- Simple average:
  - (dist_to_lake.img + dist_to ... + ...) / N
  - N = number of rasters
- Weighted average:
  - R1 * w1 + R2 * w2 + R3 * w3
  - w1 + w2 + w3 = 1.0 (!!!!)
  - R1 * 0.3 + R2 * 0.6 + R3 * 0.1
- Symbolize Final suitability raster with bad to good colors

Wrap up

10-Nov	Ch 8 - Raster Analysis	terrain functions
15-Nov	Ch 8 - Raster Analysis	zonal analysis
17-Nov	Ch 8 - Raster Analysis	lidar ex. / suitability analysis
22-Nov	Thanksgiving Break	Thanskgiving break
24-Nov		Thanskgiving break
29-Nov	Work on Class Project (Geol 552)	Work on class project
1-Dec		Work on class project
6-Dec	Review for Final	Work on class project
8-Dec	Project Presentations	
TBA	Final exam	

- Lab: Ch 8 Tut 36 - end
- HW 11 on Bb
- Next lecture: Lidar data
- Review session Dec. 6
- Project presentations (all need attend): Dec. 9
- Please let me know what you plan to do for the class project