

# Geol 588

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## GIS for Geoscientists II

lecture 3

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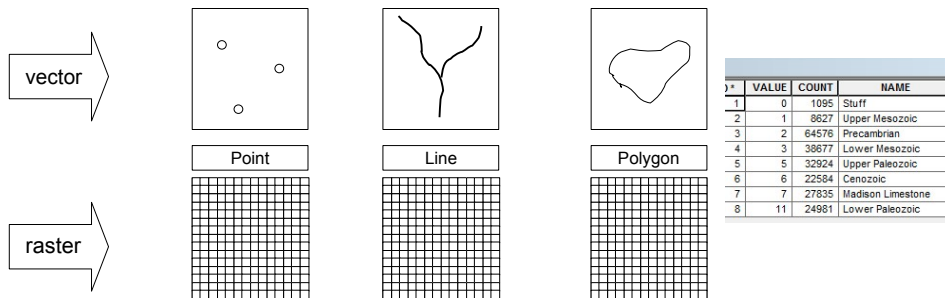
# Today

- HW 1 status?
- vector to raster conversion
- raster attribute tables (VAT) for discrete rasters
- environment settings: extent, mask, cellsize, etc.
- lab: raster calculator
- HW 2 (Lodge planning exercise) will be given on Thursday (due 1 week later)
- Start on Surface analysis tools

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### Features as raster

- Features lose uniqueness with raster representation (e.g. a line becomes a collection of cells)
- “outside” of feature => Nodata in the raster
- Tools: Conversion Tools - To Raster - Feature to Raster

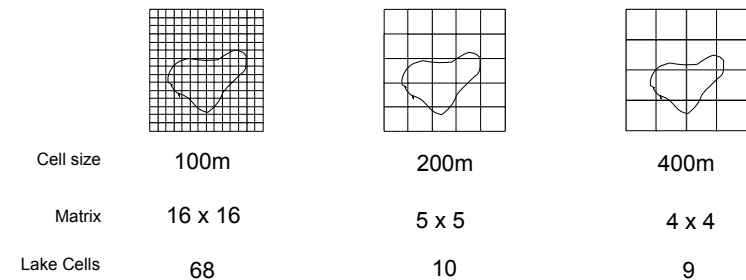


Typically creates discrete rasters - one of the feature class' field (attribute) will be transferred into the Raster (here NAME). There will always (?) be a VALUE field (int) for discrete rasters

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### Raster resolution

- Rasters always generalize spatial data
  - A function of cell size (smaller cells = higher resolution)
  - Impacts accuracy, processing speed, storage space



angle based resolutions:

- 1 arc second means around 30 m (90 ft) resolution
- 1/3 arc second => 10 m (30 ft) resolution
- 1/9 arc sec => 3 m (10 ft) resolution

How does the error for the lake's area change as cell size goes up?

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# Discrete Raster attribute tables

- Single-band, integer rasters have “virtual” attribute tables (VAT)
- “fakes” a feature attribute table
- each line (“feature”) all cells of a certain Value (except NoData?)
- Count: number of cells of this value
- You can add more fields (Add Field..)
- Supports table joining: if you have only the Value field but you know what each value means (in a lookup table) you can create a “translation” of the values
- You can edit values of some user-made fields (needs to be in edit mode)
- Field names can be use in raster calculator expressions: <raster>.<field> geolgrid.COUNT

Integer			
0	1	1	2
No data	1	1	1
no data	1	2	2
1	1	2	2

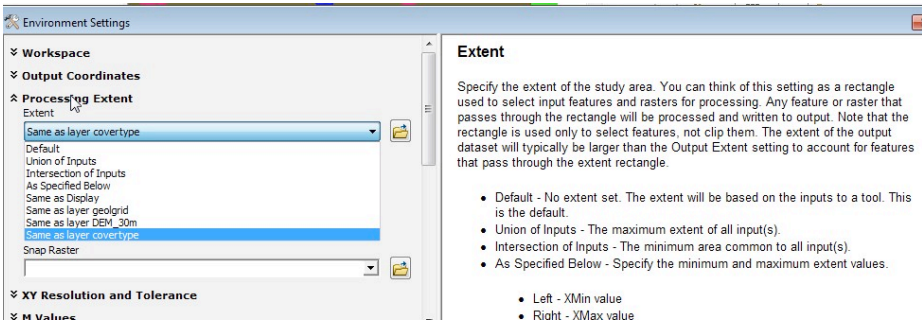
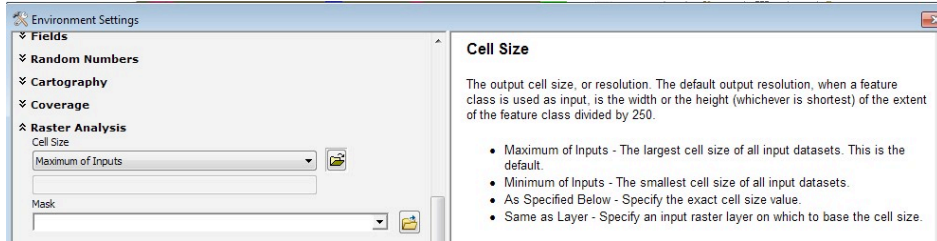
Landcover  
 0 = Rock  
 1 = Forest  
 2 = Water

Value	Count	Landcover
0	1	Rock
1	7	Forest
2	4	Water

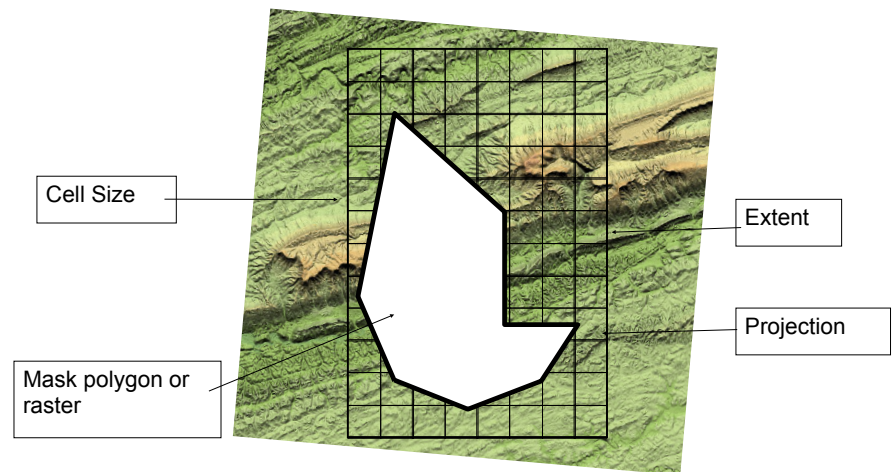
* VALUE	COUNT	NAME
1	0	1095 Stuff
2	1	8627 Upper Mesozoic
3	2	64576 Precambrian
4	3	38677 Lower Mesozoic
5	5	32924 Upper Paleozoic
6	6	22584 Cenozoic
7	7	27835 Madison Limestone
8	11	24981 Lower Paleozoic

# Environment Settings

- Similar to Spatial Analyst - Options in ArcGIS 9 (now: under raster analysis and processing extend)
- Kick in when a tool is run (write a raster - what extent, cellsize?)
- ArcGIS 10: ArcMap wide settings (“global” settings) via Geoprocessing - Environment Settings
- Most settings have defaults (which cellsize will the tool use if the user did not yet specify anything?)
- Local settings: Globals settings **can** be overwritten by tools (e.g. globally cell size may be set to 30 but when using the hillshade tool the output’s cell size should be 10)
- (Also: environment can be set per model in Modelbuilder)
- ArcMap env. setting should be saved inside the .mxd file
- ArcToolBox - Save Settings (to file or as Defaults)



Some of the settings needed to create an output raster

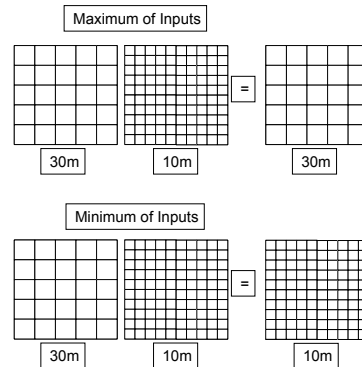


## Output raster's cell size

- You can use input rasters with different cell sizes
- rasters are internally resampled during processing

### Output options:

- Maximum of inputs (default)
- Minimum of inputs
- Same as layer
- Specified directly (30 m)
- 



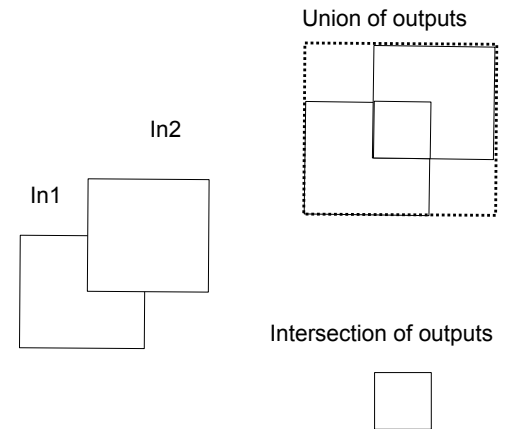
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## Processing Extent

- Controls the width and height of the output raster
- Combine extent of input rasters - output another extent

### Output options:

- Union of inputs
- Intersection of inputs
- Same as layer
- Same as current display
- Directly specify
- Snap to existing raster
- (Not clear on what the default is in ArcGIS 10)



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**Extent**

Specify the extent of the study area. You can think of this setting as a rectangle used to select input features and rasters for processing. Any feature or raster that passes through the rectangle will be processed and written to output. Note that the rectangle is used only to select features, not clip them. The extent of the output dataset will typically be larger than the Output Extent setting to account for features that pass through the extent rectangle.

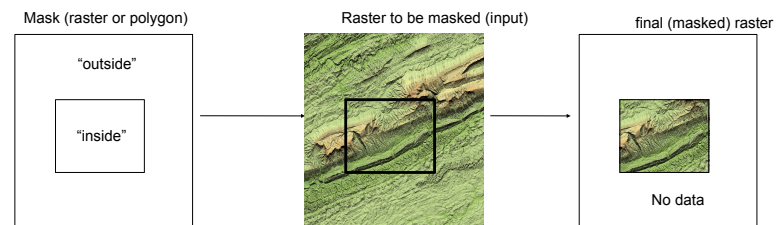
- Default - No extent set. The extent will be based on the inputs to a tool. This is the default.
- Union of Inputs - The maximum extent of all input(s).
- Intersection of Inputs - The minimum area common to all input(s).
- As Specified Below - Specify the minimum and maximum extent values.
  - Left - XMin value
  - Right - XMax value
  - Bottom - YMin value
  - Top - YMax value
- Same as Display - the extent of the current ArcMap, ArcScene, or ArcGlobe display will be used.
- Same as layer <layer> - the extent will be based on the extent of the specified layer.

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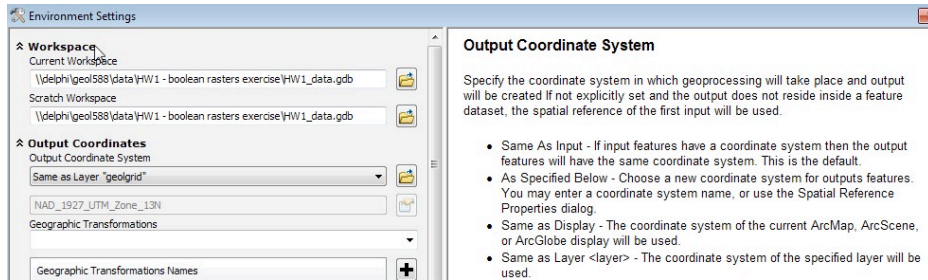
## Masking a raster (analysis mask)

- If a Mask (polygon/raster) is set, any output raster created will be masked
  - Useful for clipping a raster to an irregular shape
  - Each cell of the Raster is compared to the mask
  - Cells inside the mask are not changed
  - Cells outside the mask are set to NoData
  - Can use a polygon or a special Mask raster
- Polygon (shapefile)
  - Anything "outside" of polygon is filled with NoData values
- Raster mask (2. raster)
  - cells with any non-NoData VALUE counts as "inside", NoData cells counts as "outside"
  - NOT the same as a classic binary (1 or 0), 0 does not count as "outside"
  - ex: 1 vs NoData, 0,1,2,11 vs NoData
  - Mask from converting another Raster? Create NoData values (reclassify) or via Raster Calculator's SetNull()



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- Output coordinates (Coordinate system / Projection):
  - Use existing layer as template (Same as DEM.img or Same as polygon.shp)
  - specify explicitly (As Specified below -> NAD\_1927\_UTM\_Zone\_13N)
  - Use current Dataframe's coordinate system: Same As Display (?)



- Workspace:
  - Current Workspace - Default folder or GeoDB for output
  - Scratch: temporary - setting to local folder (C:\temp) could be faster

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# Raster calculator exercise

- Let's use the HW 1 data
- set environment (Geoprocessing - Environment settings)
  - coordinate system to UTM 13 NAD 27 (same as geolgrid)
  - Processing extent to same as geolgrid
  - Cell size to 30 m
- The Raster calculator will evaluate boolean and relational expressions to 0 or 1
- "DEM" > 1400.0 to create a binary raster where 1 is > 1400 m
- "geolgrid" == 7 Create a binary raster with 1 where geolgrid's value is 7
- ("geolgrid" == 7) | ("DEM" > 1400.0) | => OR & => AND ~ => NOT
- ArcGIS help: search for Overview of the Map Algebra Operators
- SetNull() (also a Tool) - generates NoData (Null) value if a condition is true
- SetNull( <input raster>, <output if condition is False>, <Condition>)
- SetNull("DEM", "DEM", "VALUE > 1400")
- Con( <expression true?>, <yes>, <no>)
- geoprocessing options: overwrite the outputs ON
- scratch workspace -> used as default for rasters!

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## More on Raster calculator tool (add to Feb. 3 handout)

- Creates a new raster, subject to extent, cell size, mask, coordinate system, etc. set in environment
- given an boolean and relational expression, it will evaluate it and return 0 (if False) or 1 (if True)
- "DEM" > 1400.0 to create a binary raster where 1 is > 1400 m, rest is 0
- "binary\_raster" \* -1 + 1 What does that expression do?
- "geolgrid" == 7 creates a binary raster with 1 where geolgrid's value is 7
- ("geolgrid" == 7) | ("DEM" > 1400.0) | => OR & => AND ~ => NOT (must use & | ~)
- Will always use the VALUE attribute (can't use "geolgrid.NAME" in ArcGIS 10, see lookup tool instead)
- SetNull() (**see Tool help**) - generates NoData (Null) value if a condition is **True**
- SetNull( <input raster>, <output if condition is **False**>, <Condition to give True or False>)
- SetNull("DEM", 1, "VALUE > 1400") sets cell's where DEM's VALUE is >1400 to Nodata, rest to 1
- SetNull("DEM", "DEM", "VALUE > 1400"), sets cell's where DEM > 1400 to Nodata, rest to DEM
- SetNull("DEM", "geolgrid", "VALUE > 1400") sets DEM > 140 to Nodata, rest to geolgrid
- Con( <expression>, <value if true>, <value if false>)
- Con("DEM > 1400", 1, 0) Con("DEM > 1400", "Geolgrid", -999)
- IsNull("raster\_w\_Nodata") => 1 where raster\_w\_Nodata has Nodata, 0 everywhere else
- geoprocessing options: set overwrite the outputs to ON
- scratch workspace -> can be used as default folder for rasters

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