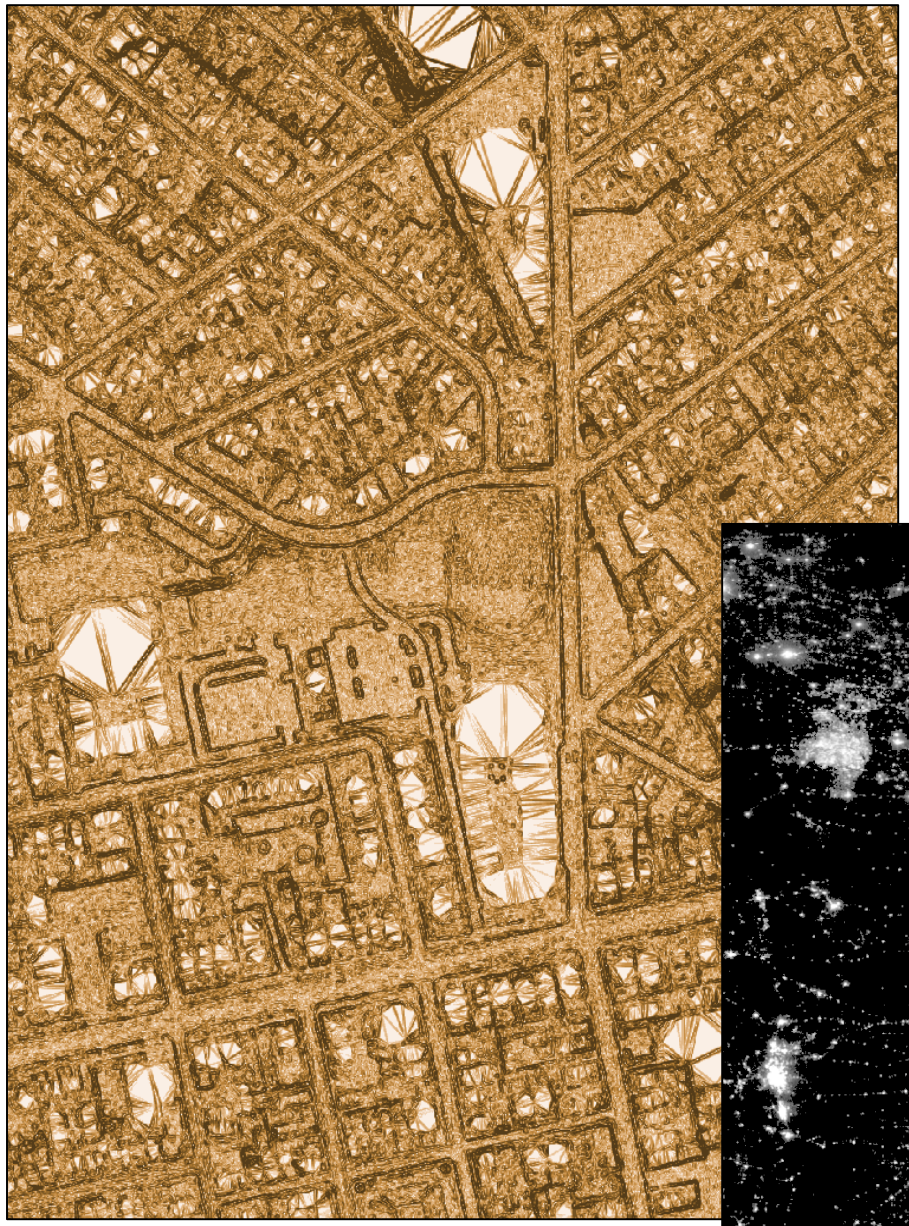
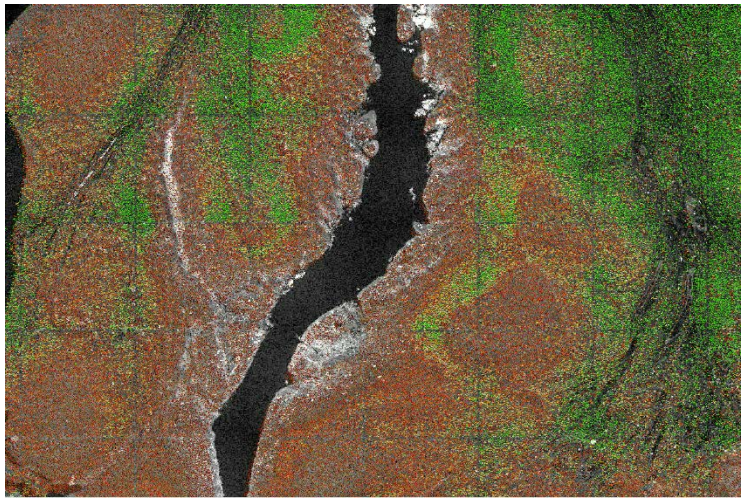
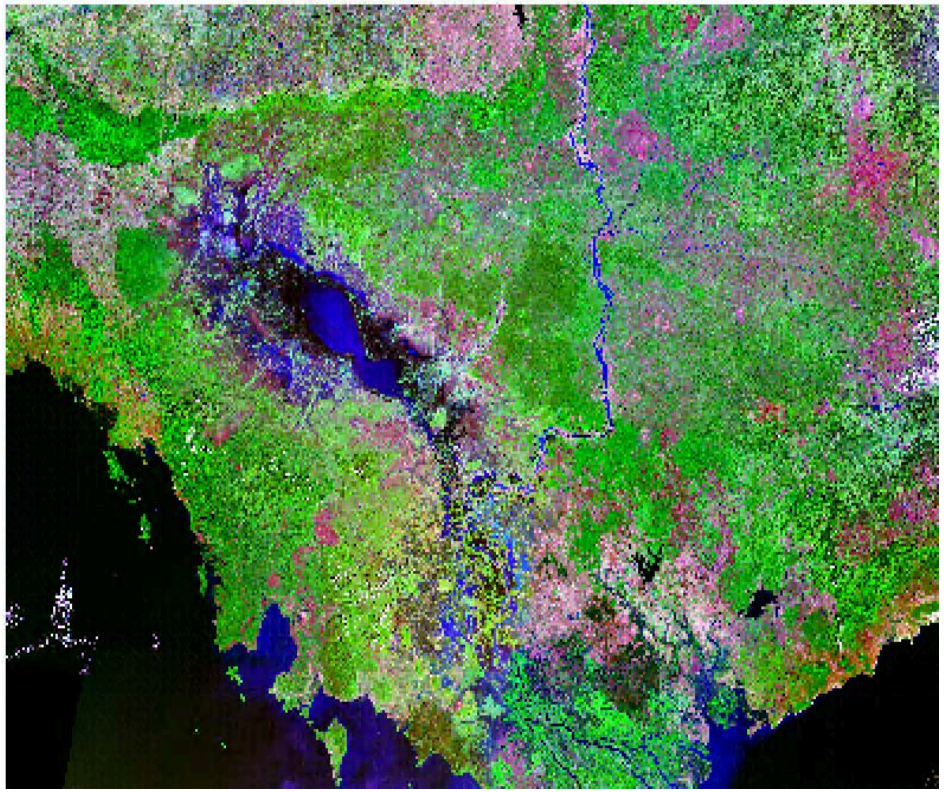
Spatial Analysis: Raster





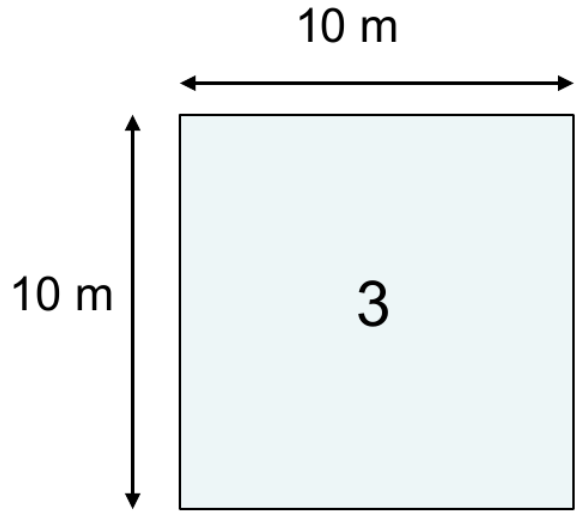
Rasters are beautiful.



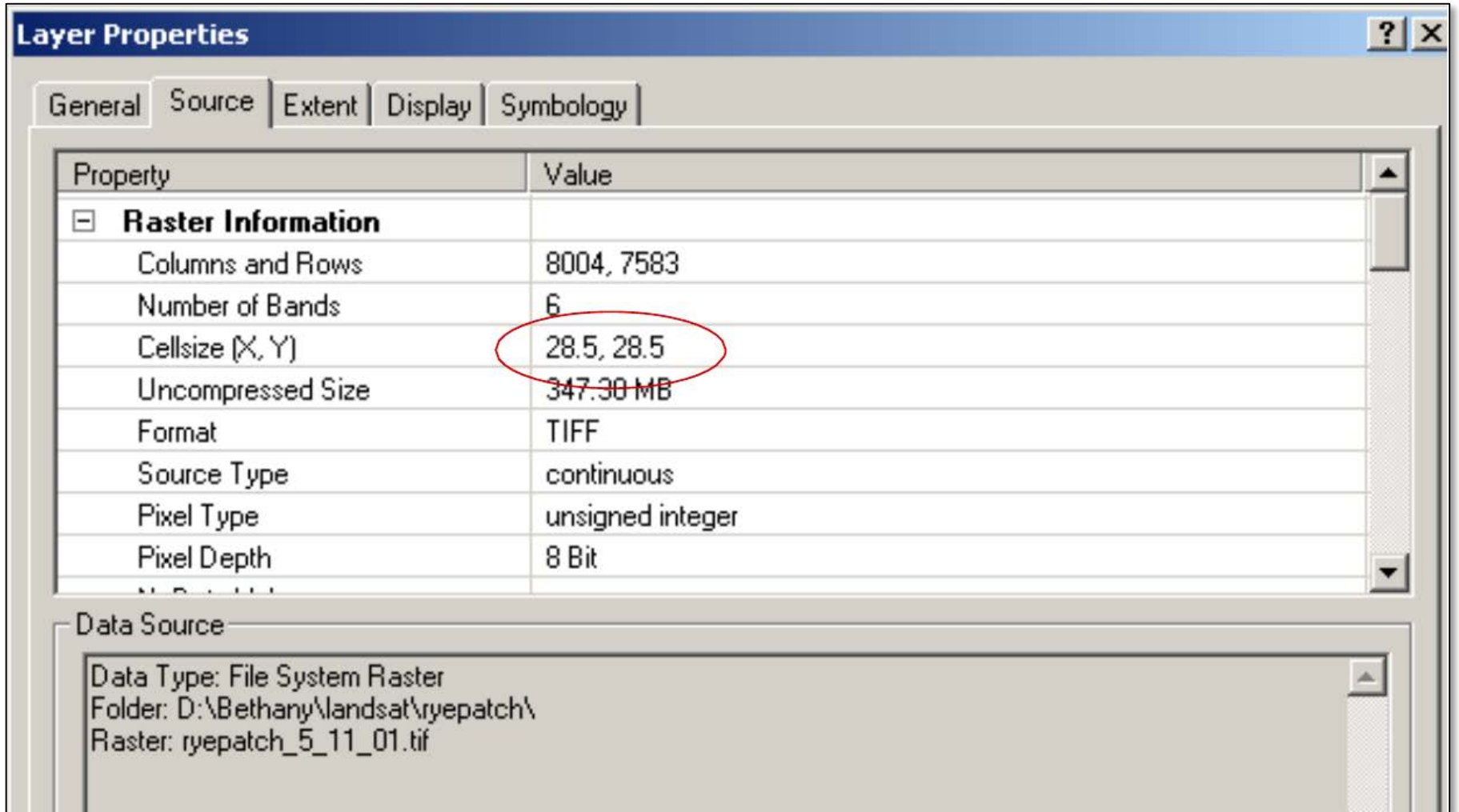
Rasters don't depict objects; they represent space.

Rasters are made of pixels, called cells. The cells are squares of a fixed size, and each contains a single value.

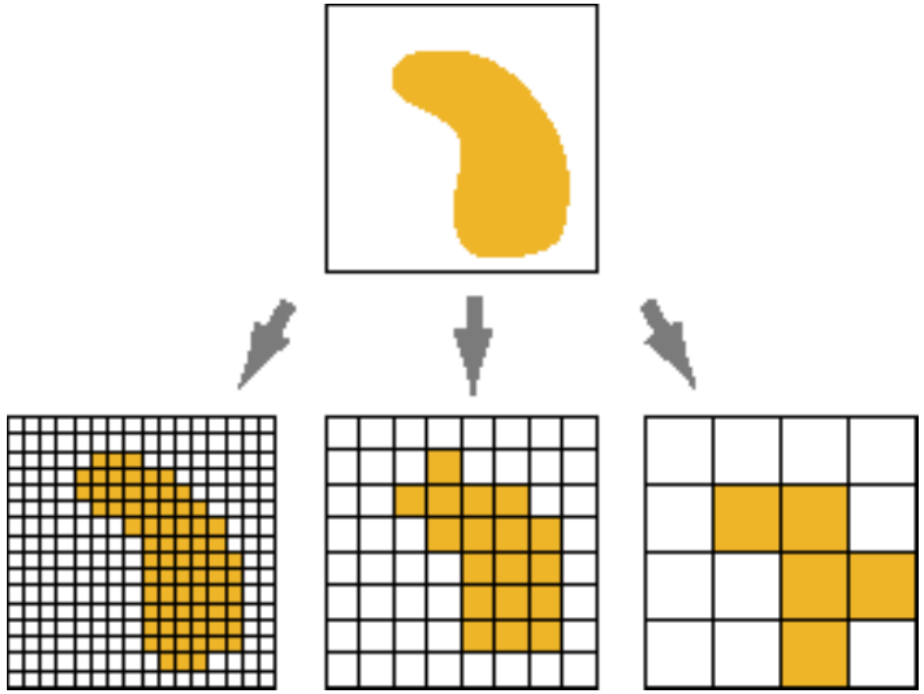
They are arranged in rows and columns.

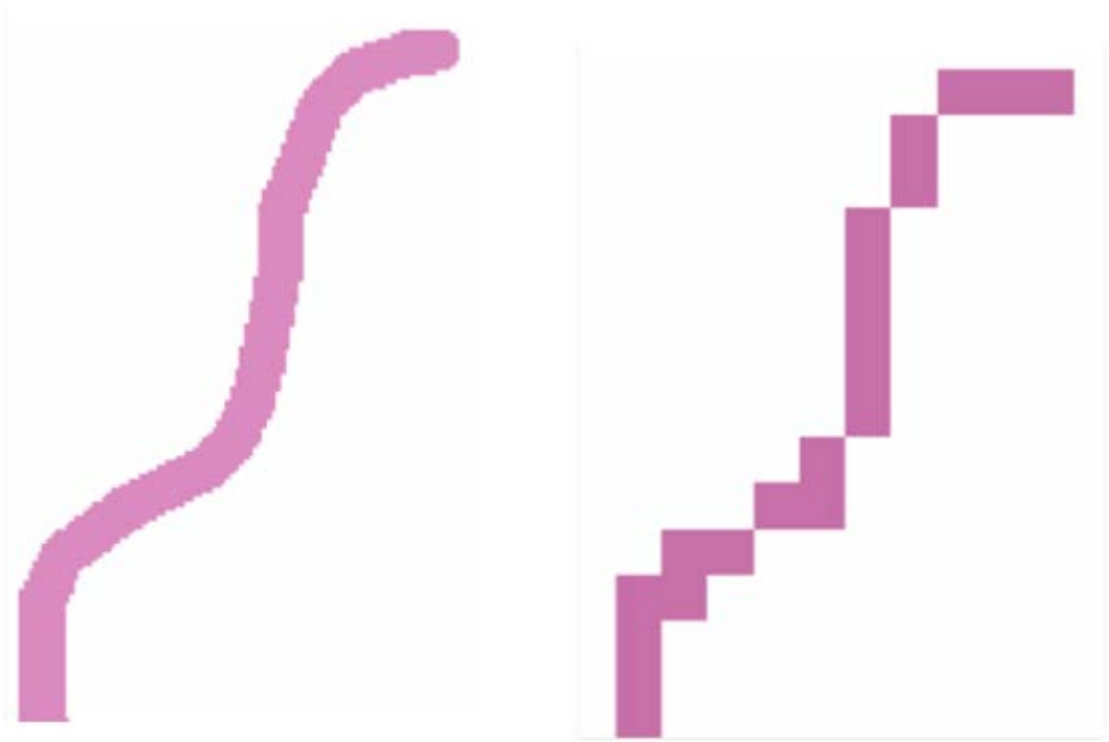


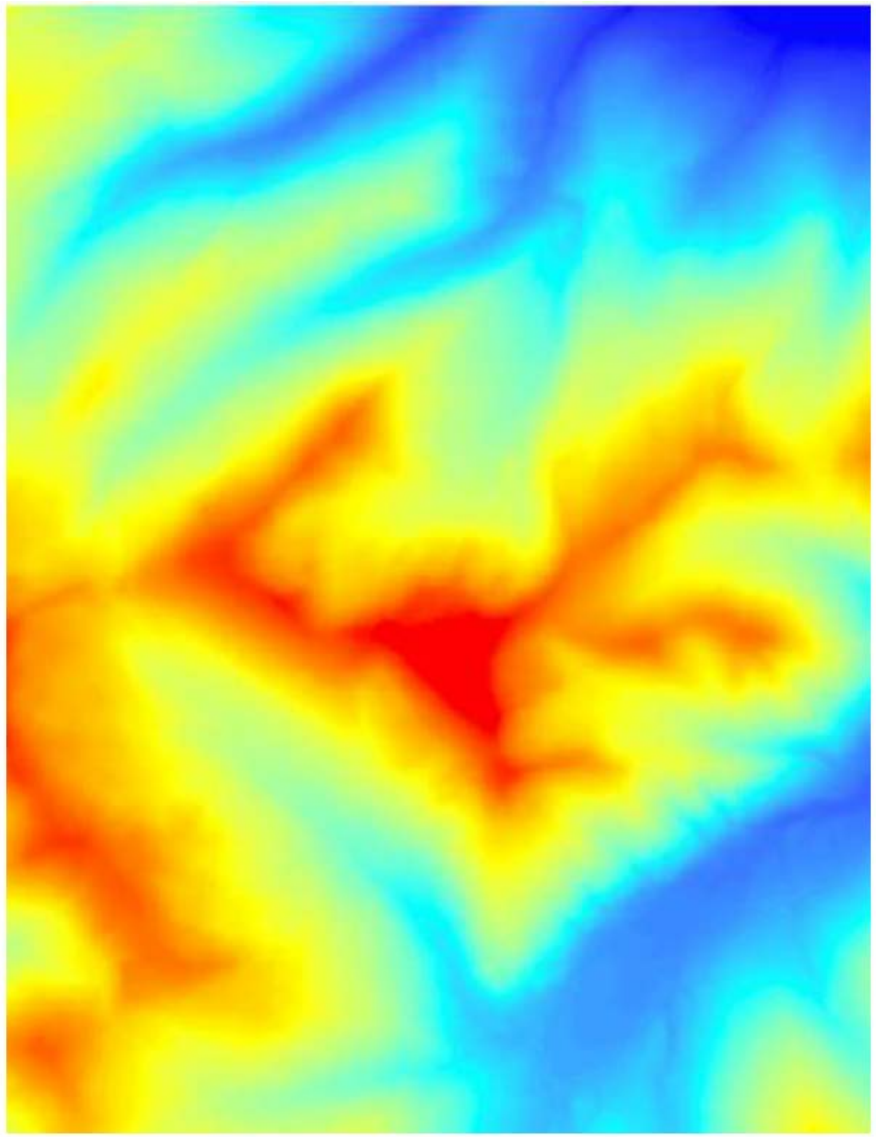
The pixel size and number of rows and columns can be viewed under Properties › Source.

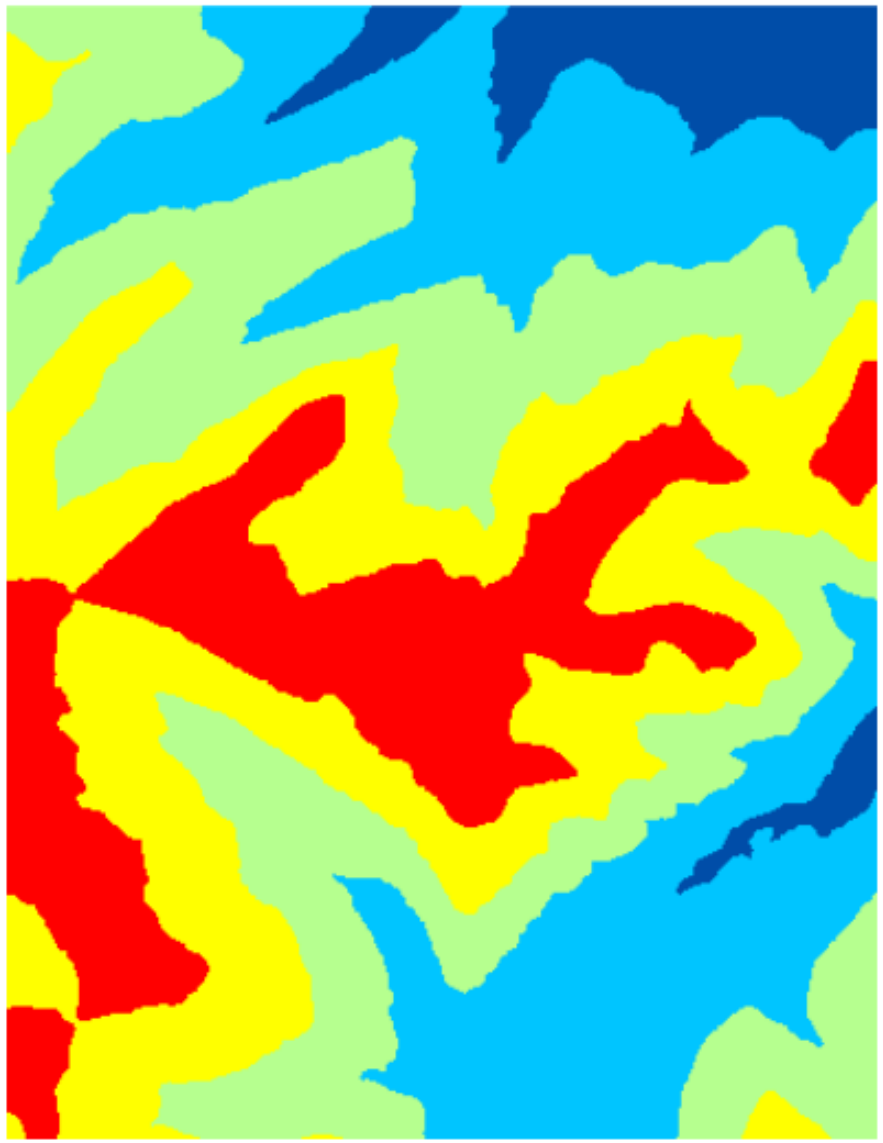


The pixel size determines the resolution of the raster.





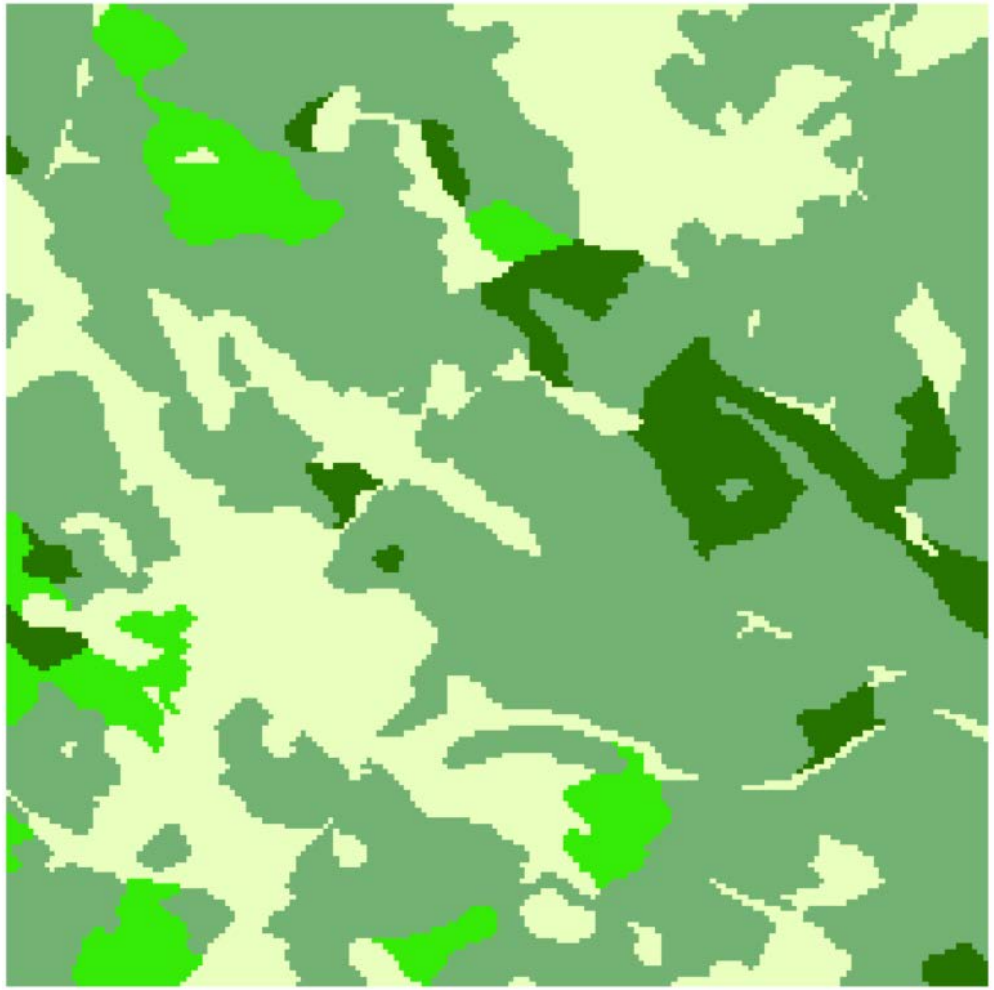


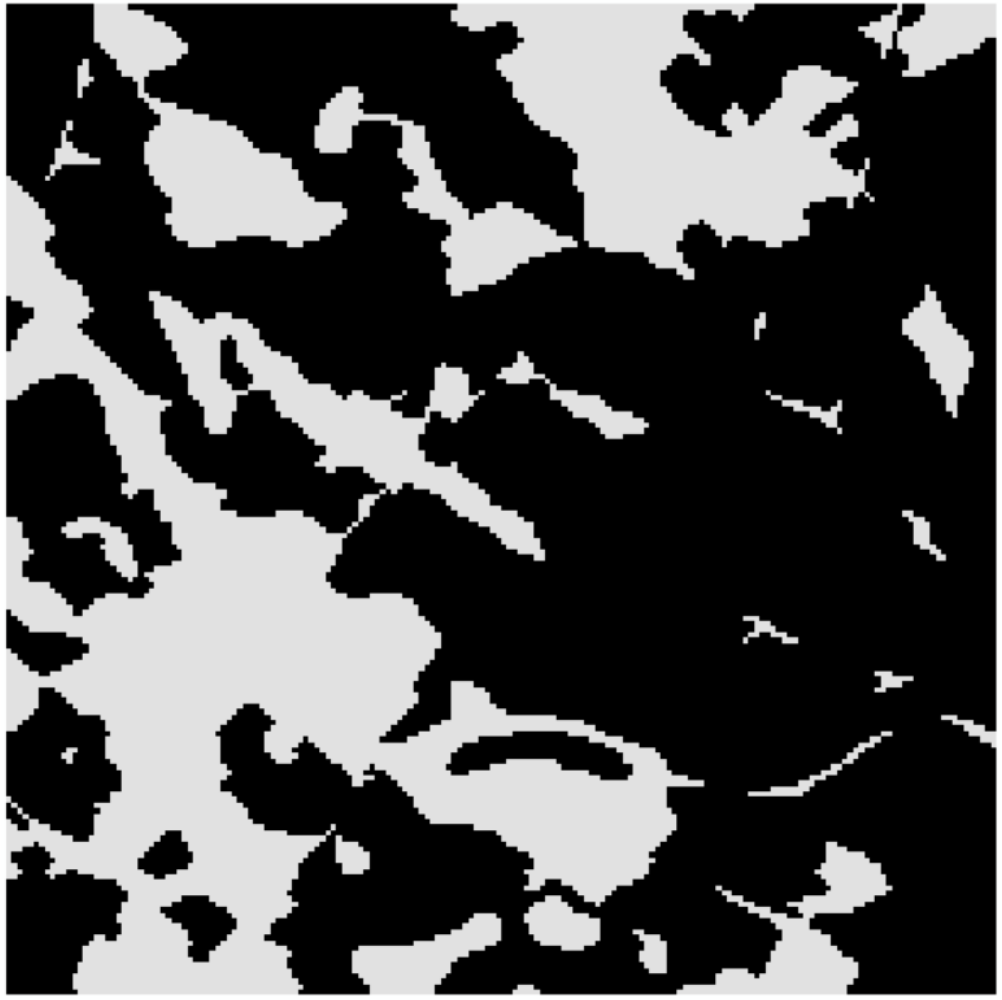


Rasters can be continuous or discrete -- "classified."

Continuous rasters can be displayed with a classified symbology or they can be actually reclassified.

Special classified rasters include binary rasters and rasters with a limited set of values, such as landcover.





Raster data comes in as many formats as other image data.

Sometimes a number of rasters are packaged together in a "stack."

Taking apart a raster stack or opening some proprietary formats can require special techniques or outside software.

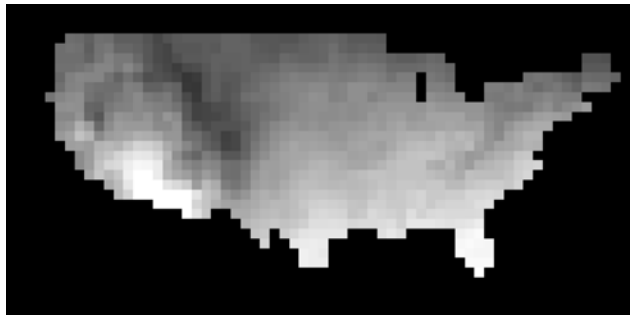
- ESRI Grid
- Geo TIFF
- IMG
- JPEG
- MrSID
- netCDF
- HDF
- USGS DEM

In multi-band rasters, each band can be a range of wavelengths, for example the red/green/blue bands of an RGB composite image.

A single band raster holds one value per cell.

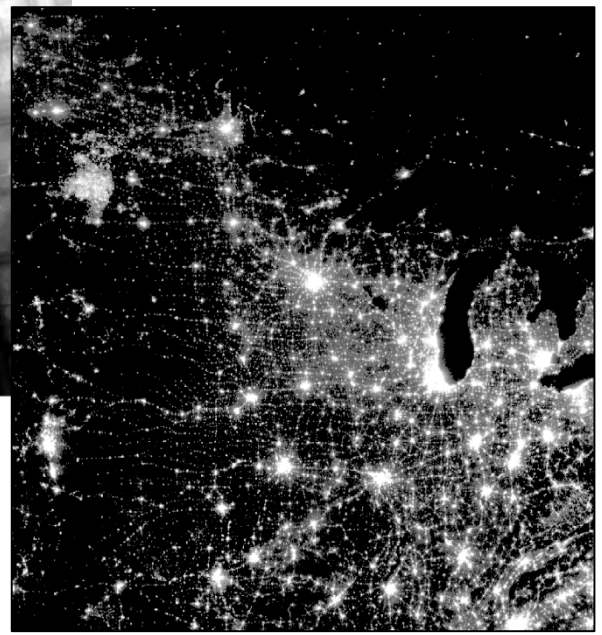
color

elevation

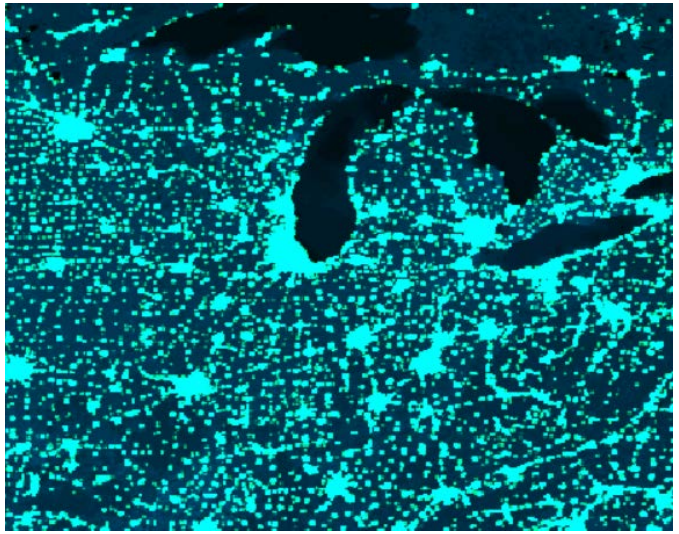


temperature

A raster image with scaled values between 0 and 256 is sometimes called "grayscale."



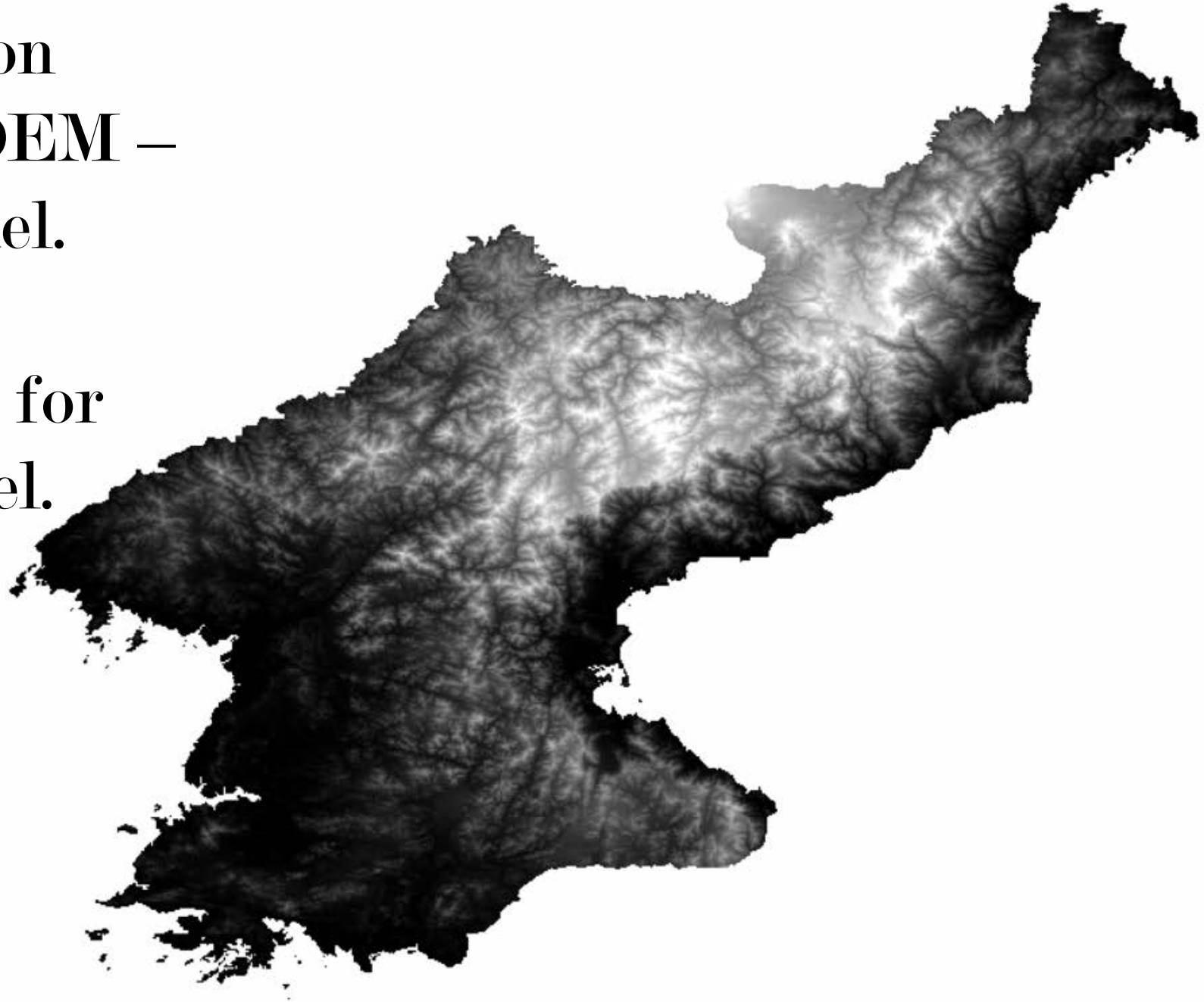
light intensity



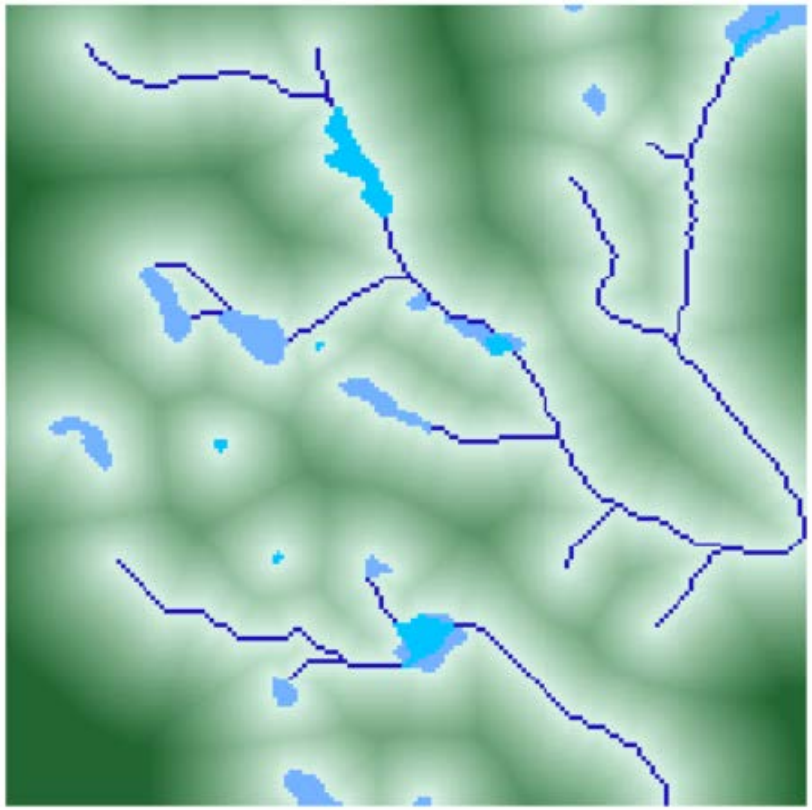
Even if it's displayed in colors other than gray!

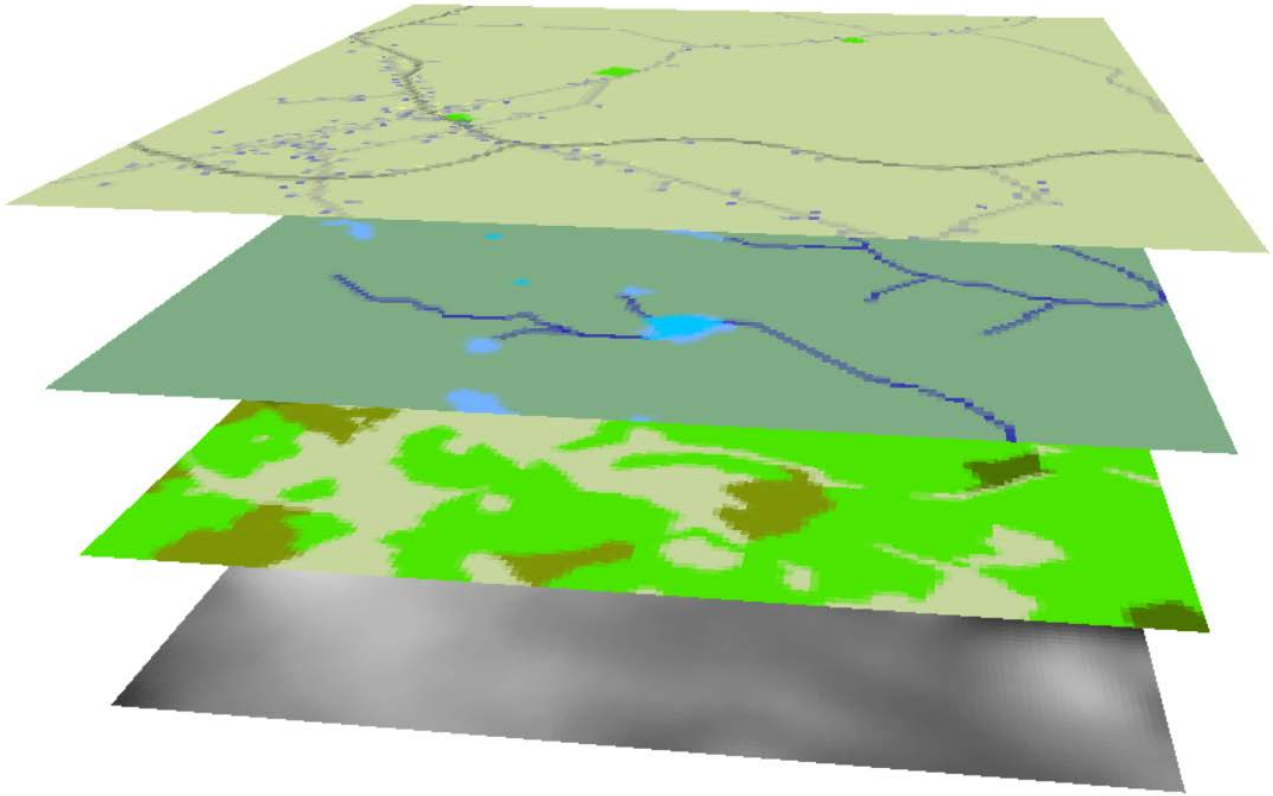
One of the most common grayscale rasters is a DEM – Digital Elevation Model.

Each pixel has a value for elevation above sea level.

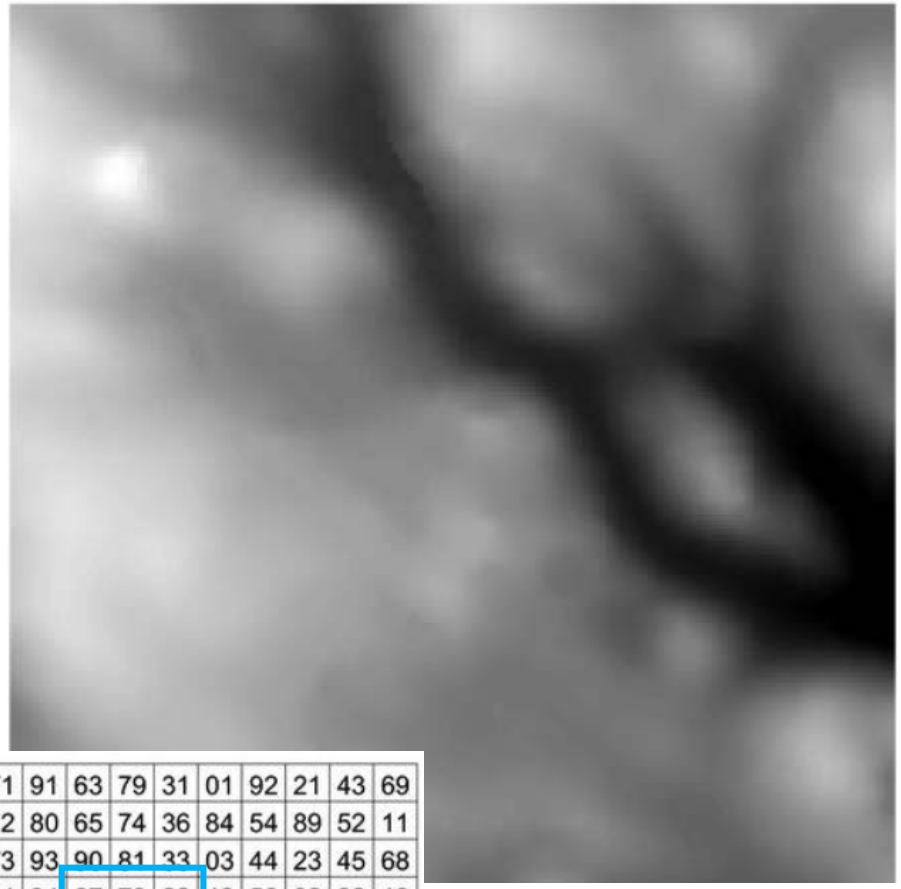


Like vector-based spatial analysis, raster analysis can also take place in two different dimensions. Some processes analyze the surface of a single raster; others match up the same pixel location across several raster layers.

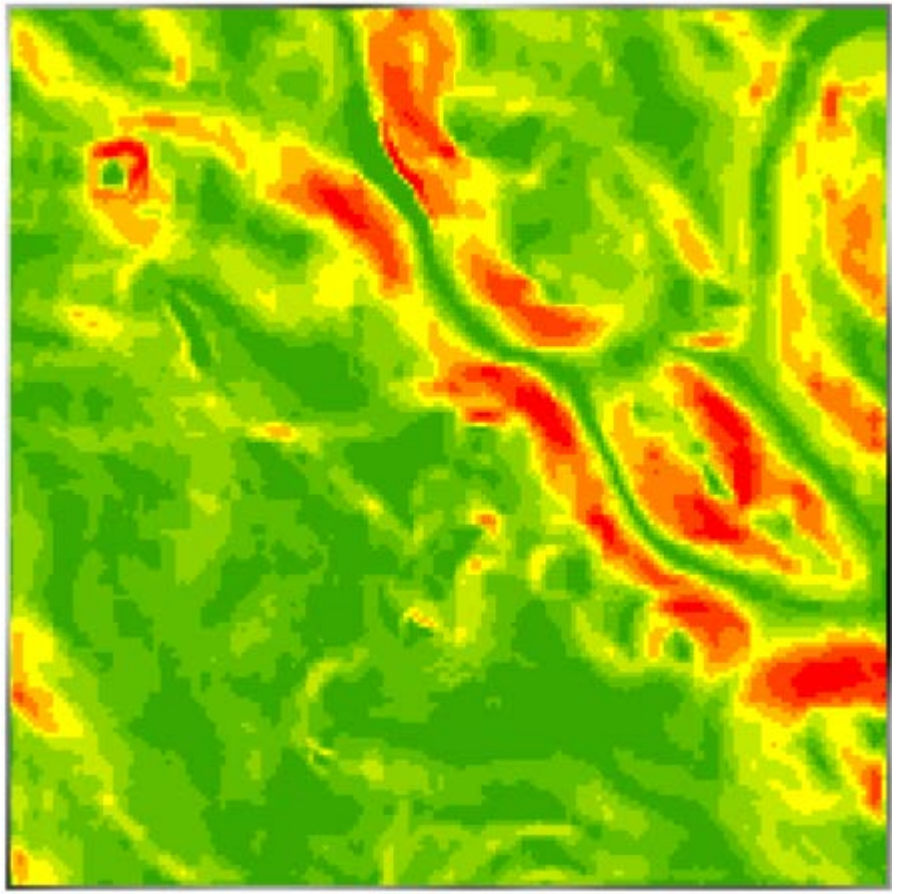




Example of surface-level analysis: slope from an elevation raster

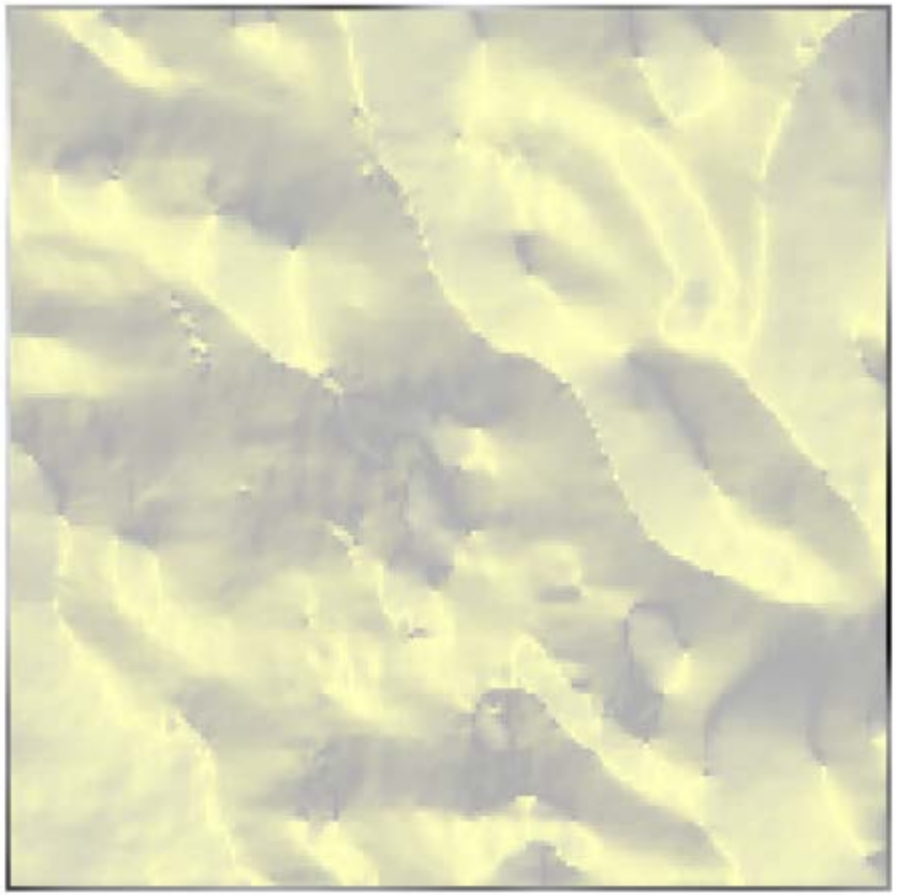


71	91	63	79	31	01	92	21	43	69
12	80	65	74	36	84	54	89	52	11
73	93	90	81	33	03	44	23	45	68
04	34	67	70	22	48	56	02	32	13
75	95	46	83	35	05	82	25	47	57
94	06	98	24	14	64	58	53	72	15
77	97	26	85	37	07	16	27	49	61
28	50	00	30	20	62	60	55	66	17
10	40	59	87	39	09	96	29	51	41
08	18	42	38	76	99	88	78	86	19



Each pixel in the new raster is filled with a value computed from the corresponding cell in the old raster and its neighbors.

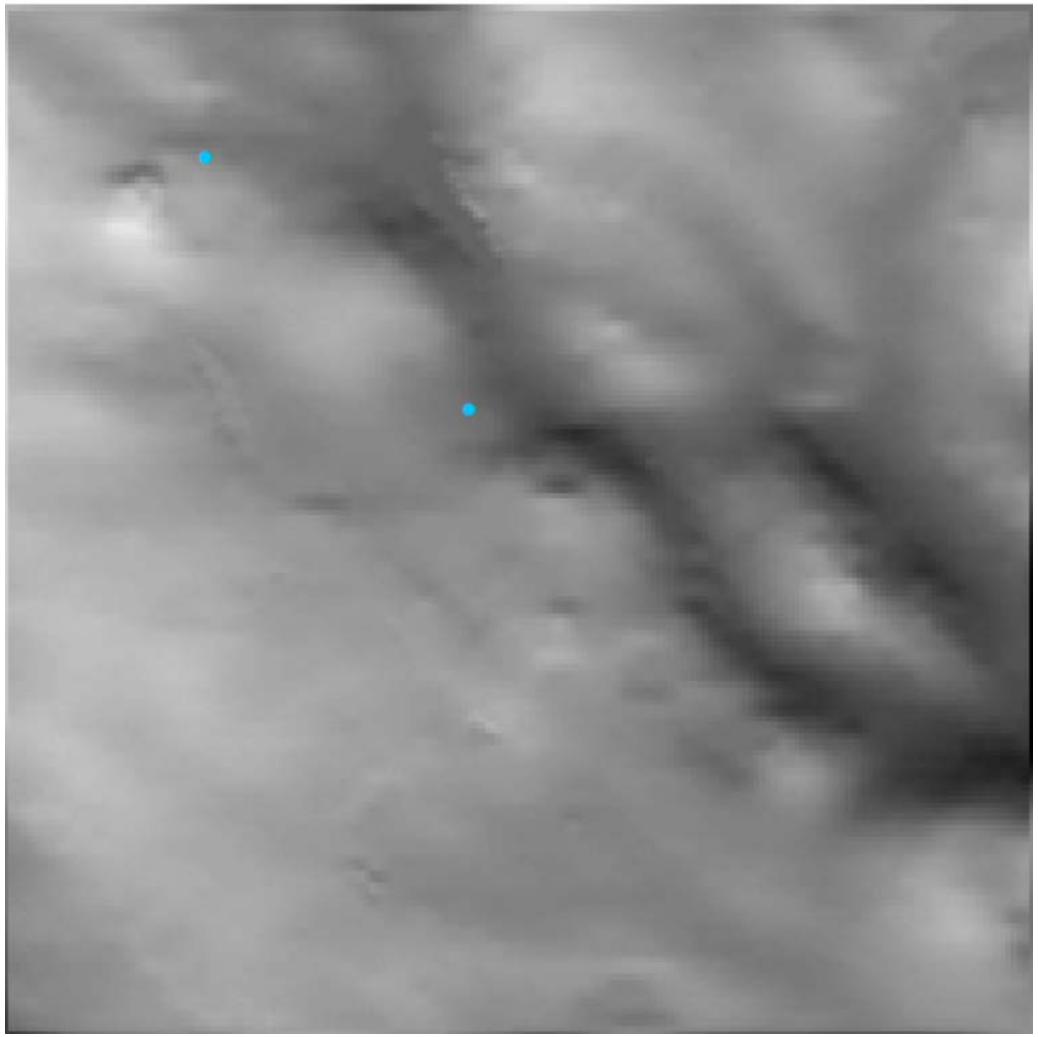
Example of surface-level analysis: aspect from an elevation raster

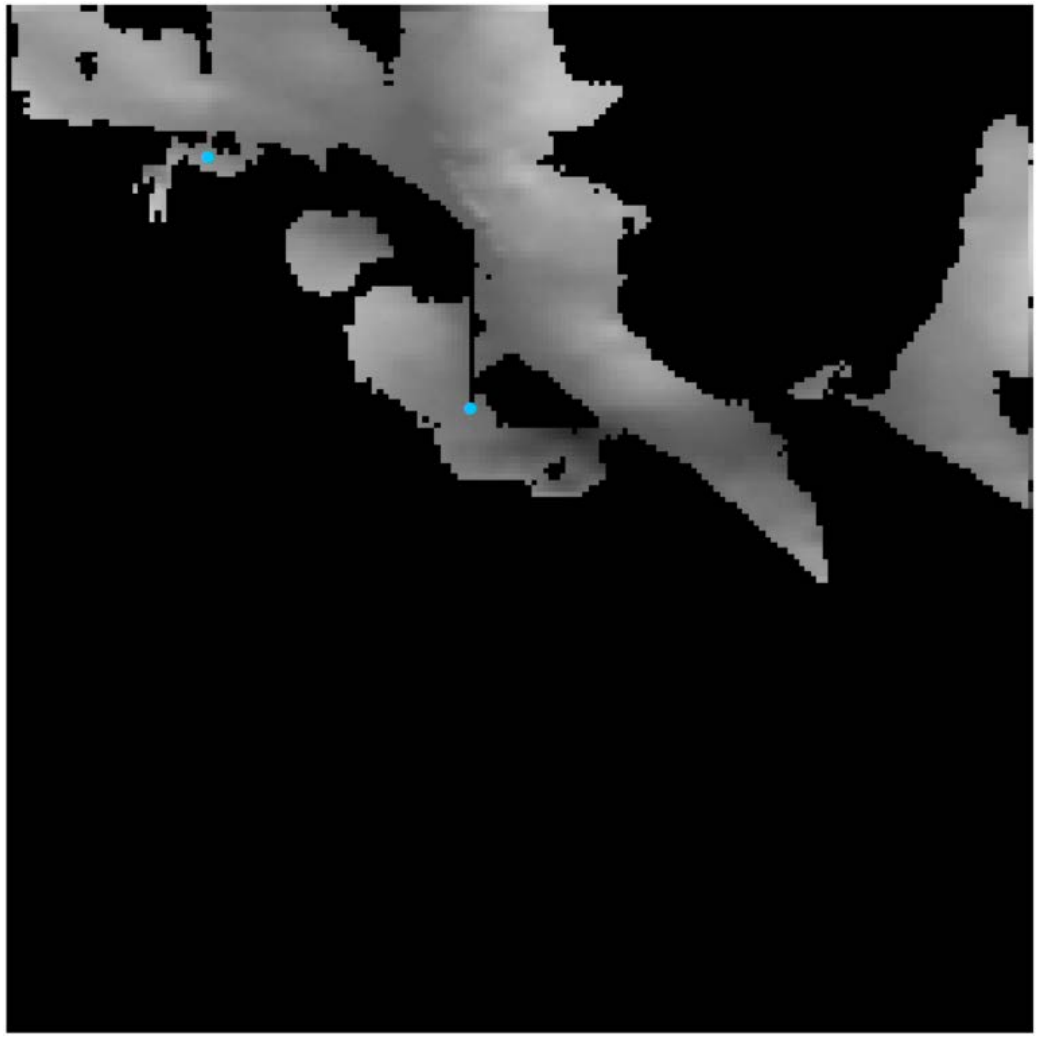


Each pixel in the new raster is filled with a value computed from the corresponding cell in the old raster, 1 – 360º representing which compass direction that pixel faces.

(North is both 1 and 360 . . . 0 is completely flat.)

Example of surface-level analysis: viewshed from an elevation raster

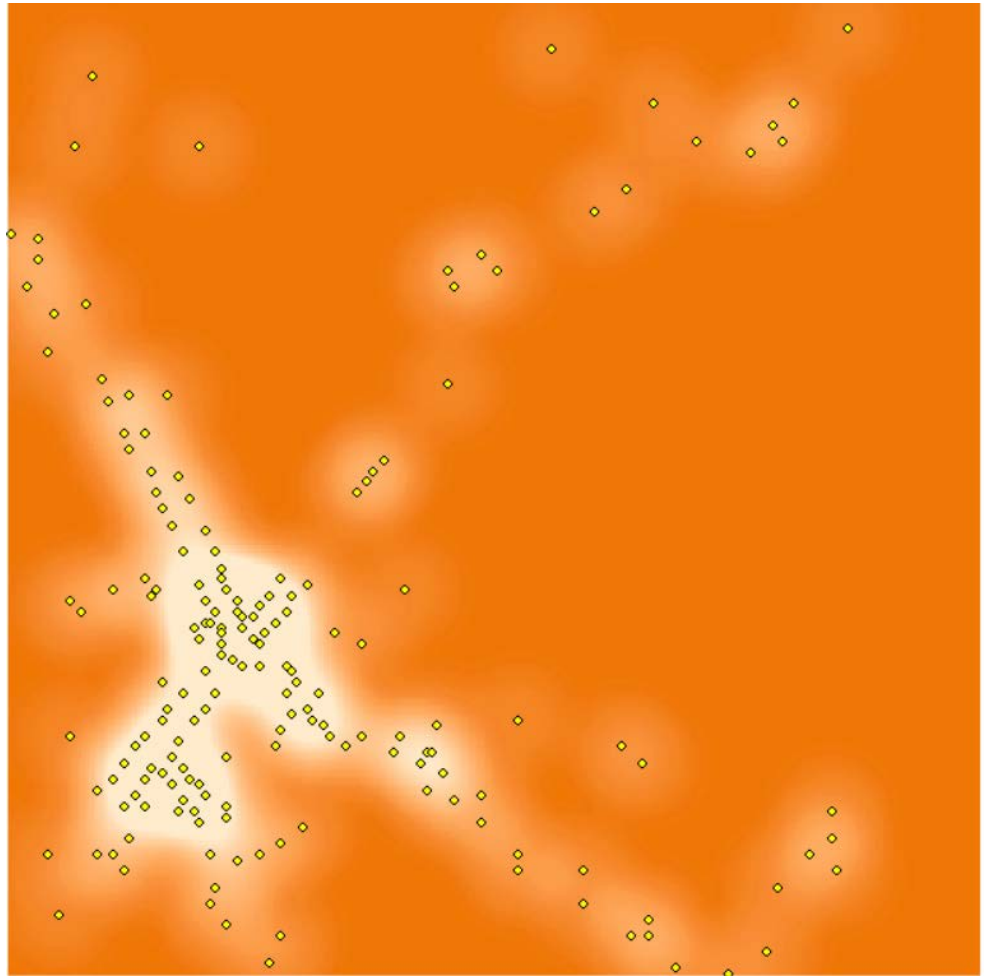


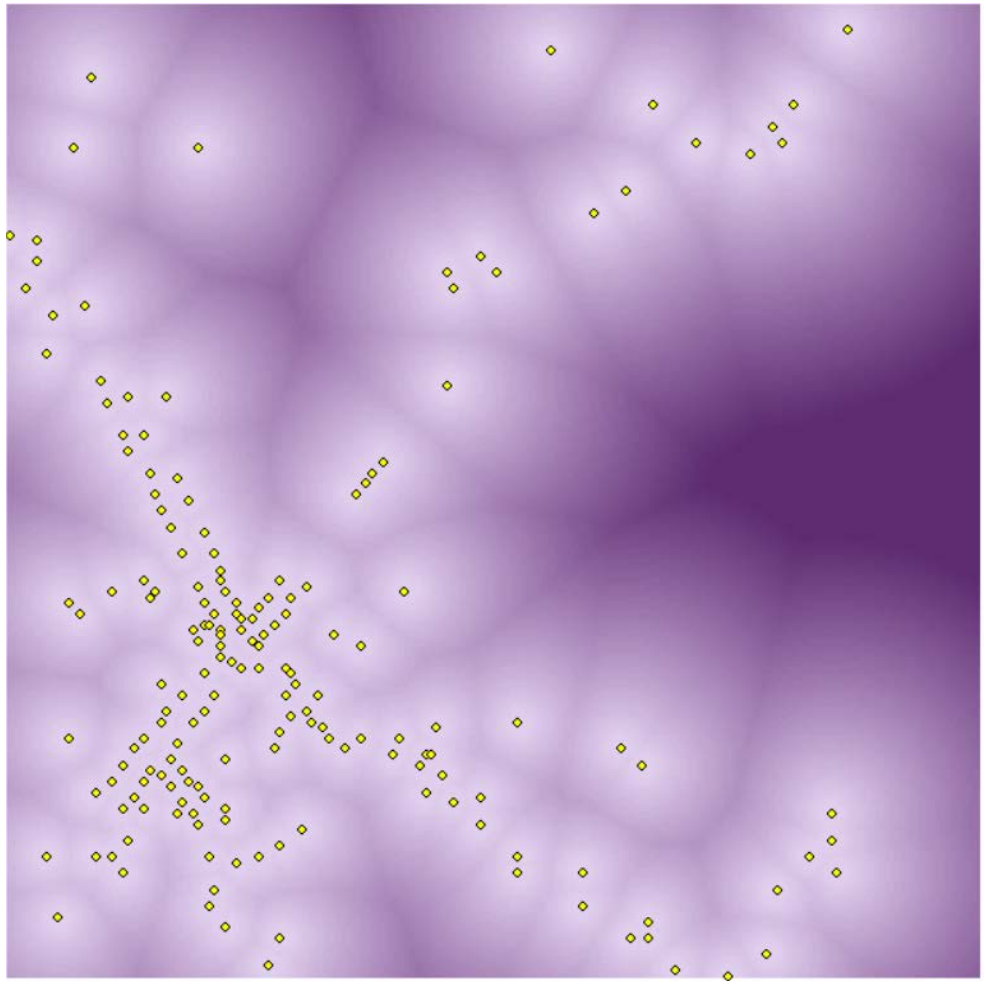


Cells in new raster contain **1** or **0**, visible or not visible. Viewshed uses both raster and vector inputs.

Example of surface-level analysis: Density and Distance

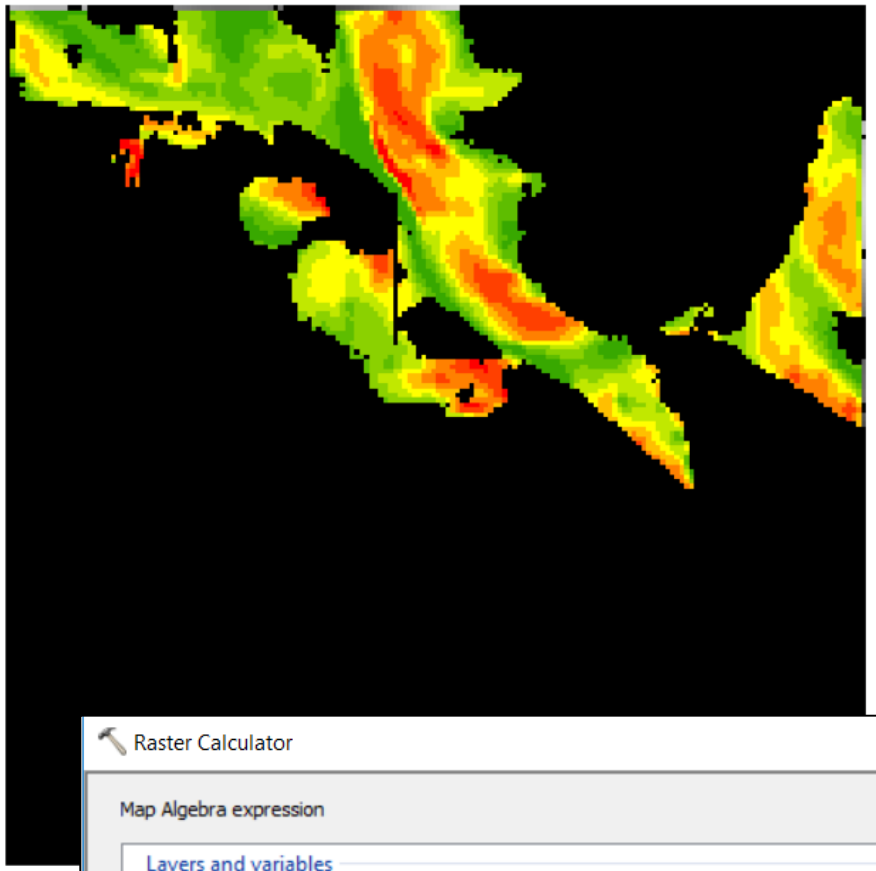
Each cell holds the local density of points or distance from nearest point.

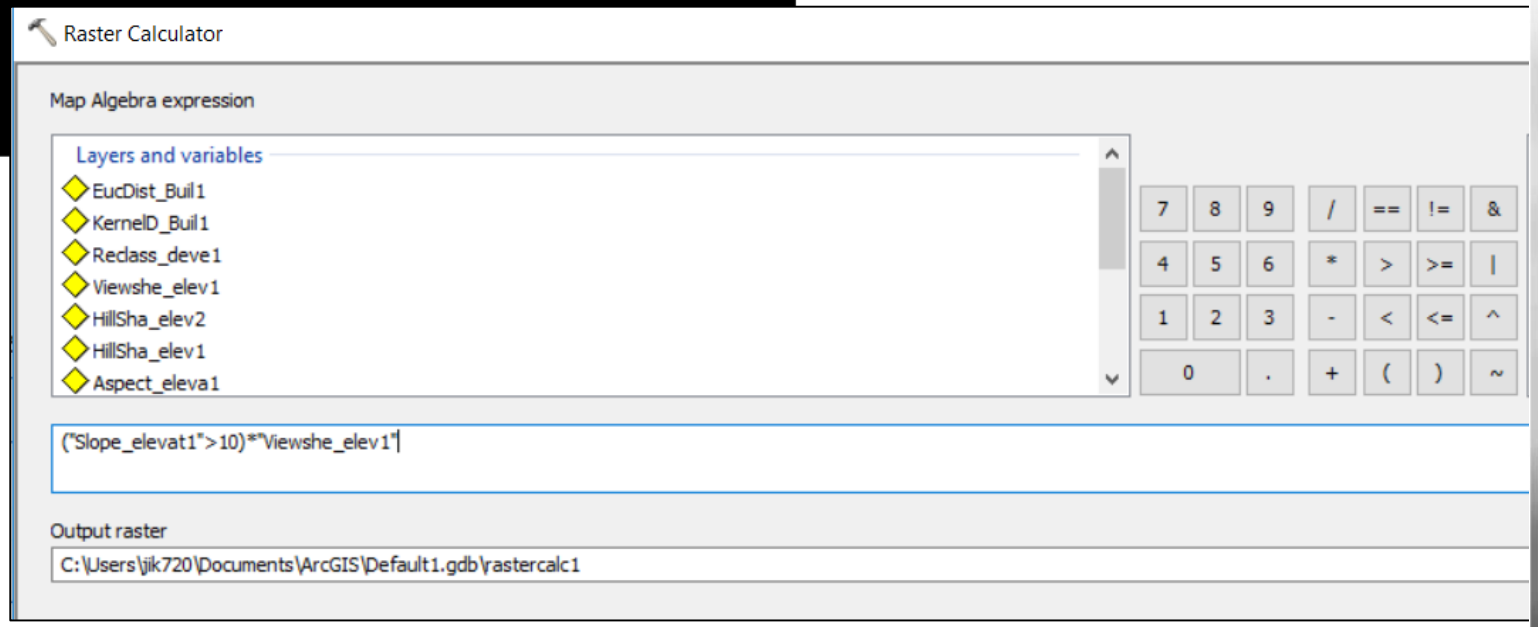


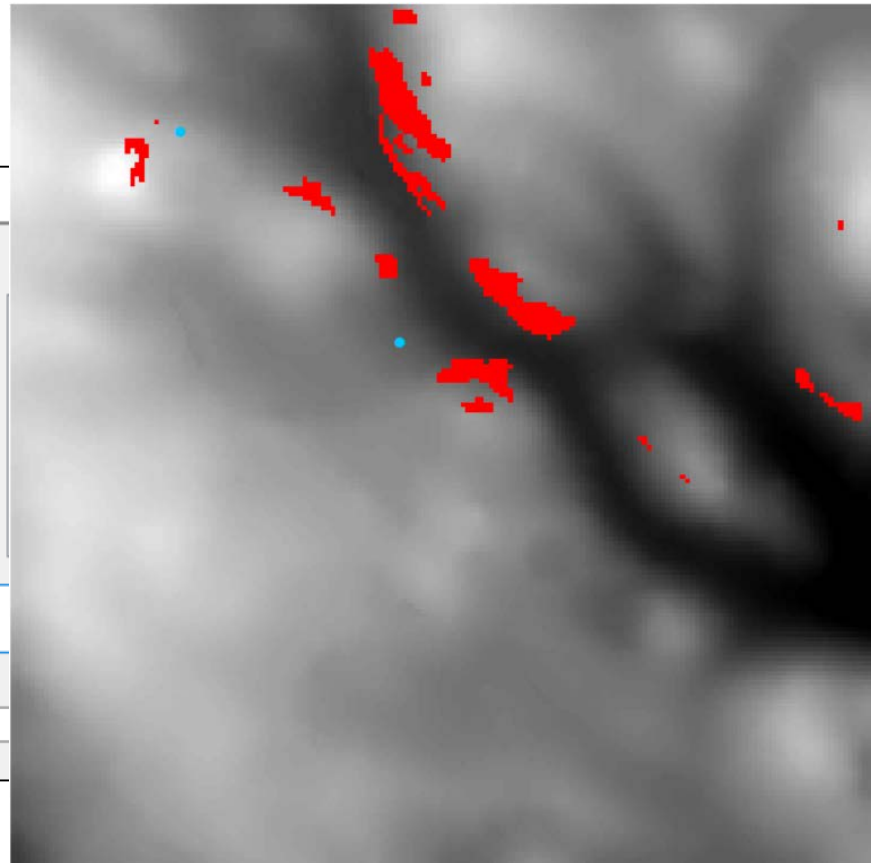


Example of overlay analysis: Map Algebra

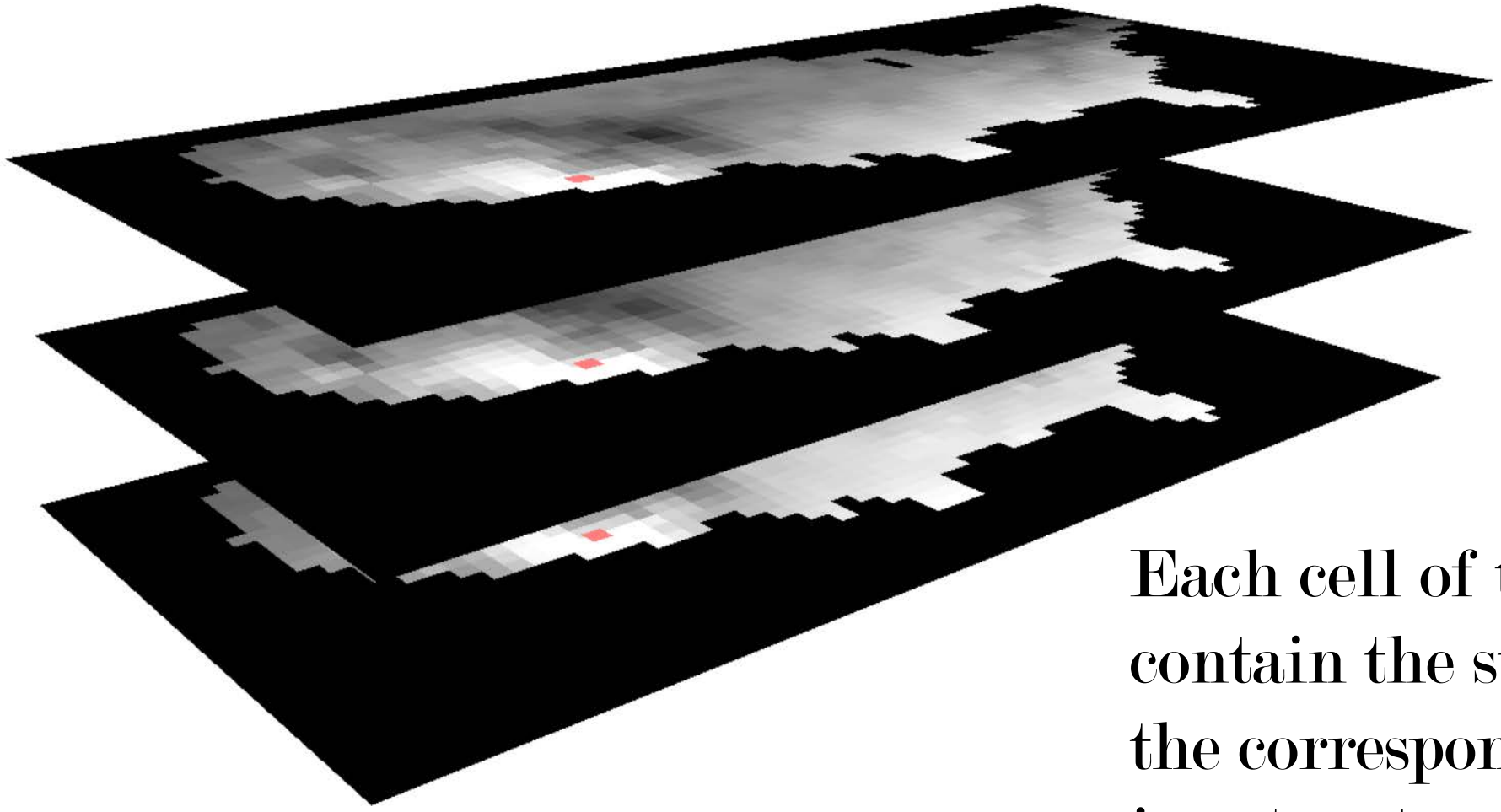
Pixel by pixel, layers are combined in mathematical equations and logical operators. The cells in the output raster will each contain the "answer."







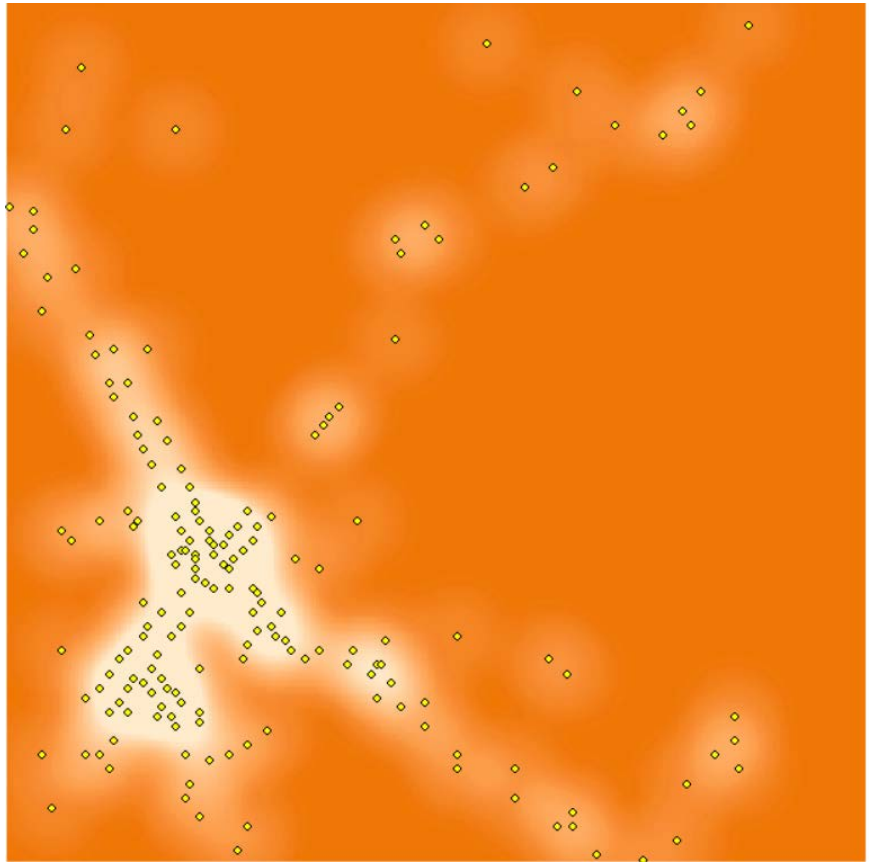
Example of overlay analysis: Local Statistics

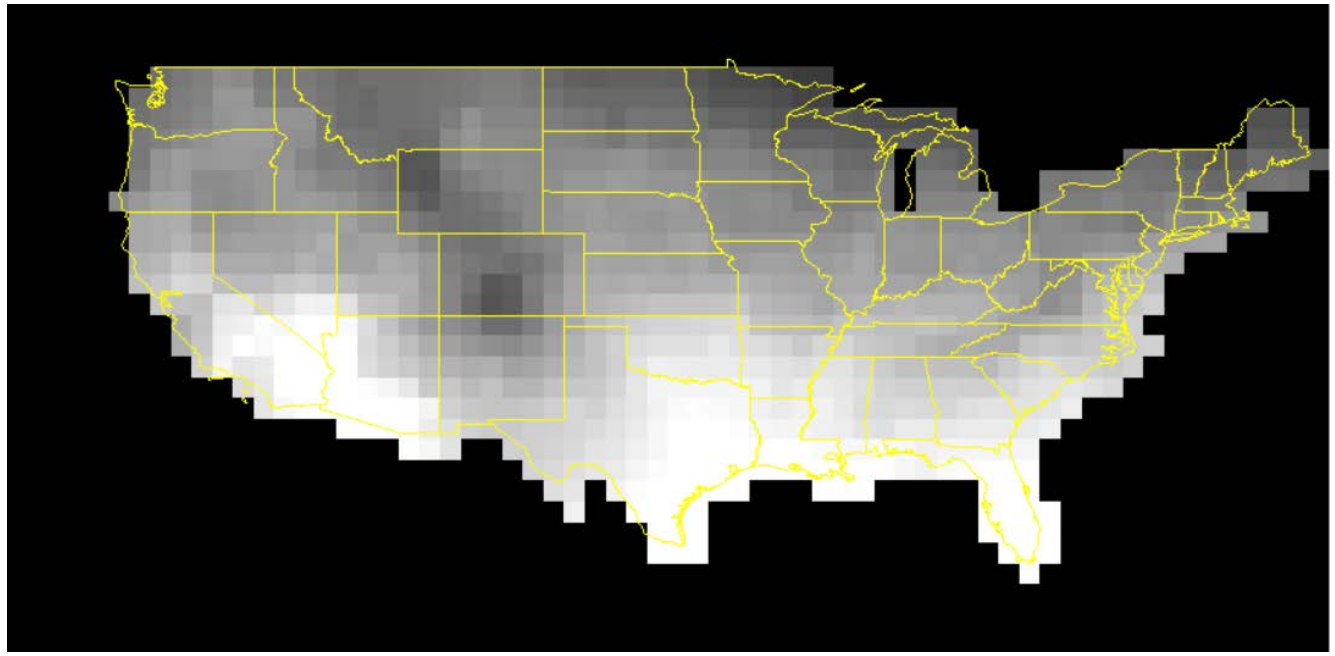


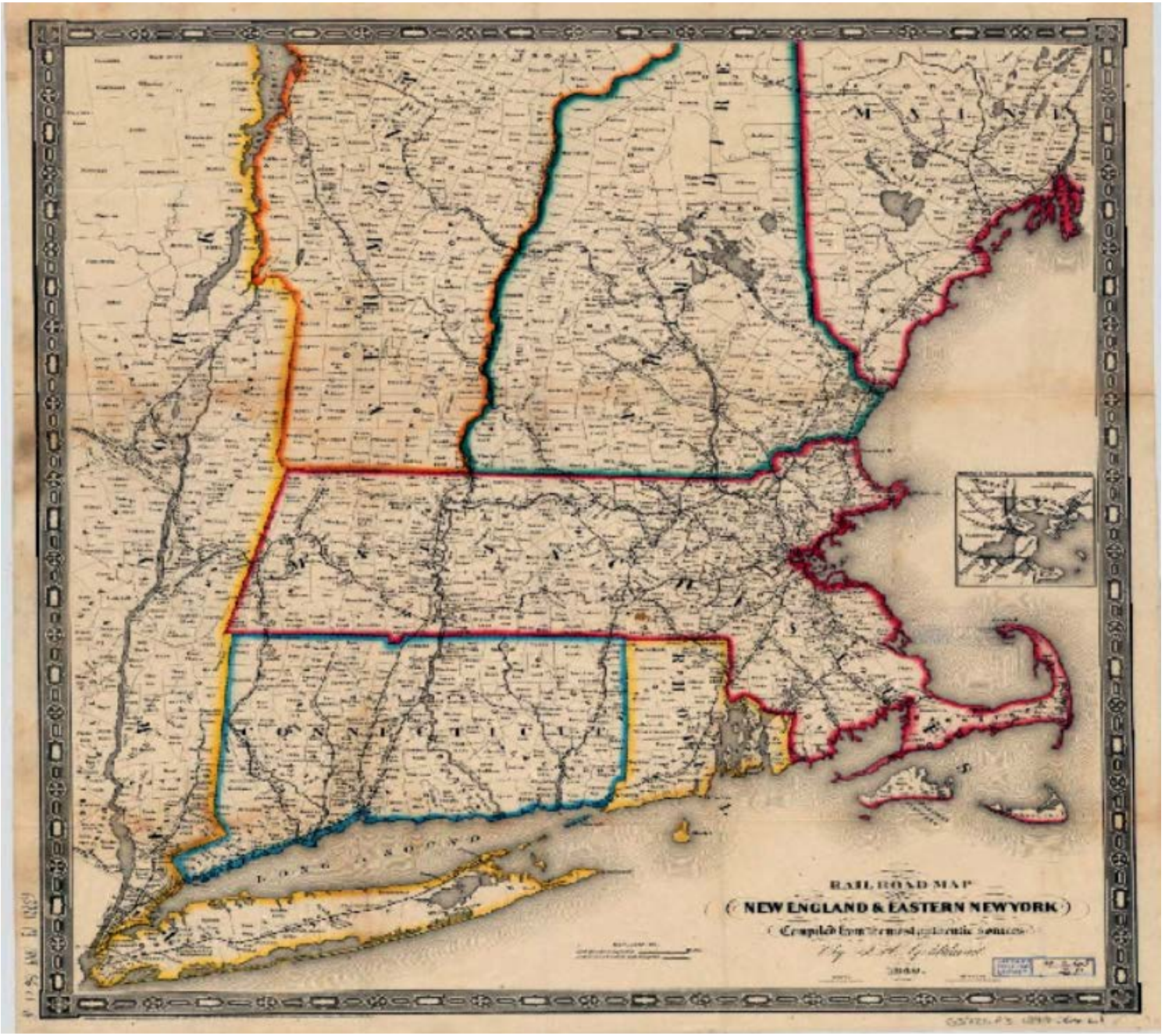
Mean
Majority
Maximum
Median
Minimum
Minority
Range
Standard Deviation
Variety

Each cell of the output will contain the statistic computed on the corresponding cell in all the input rasters.

Sampling Raster Data to Features:
Extract Values to Points
Zonal Statistics



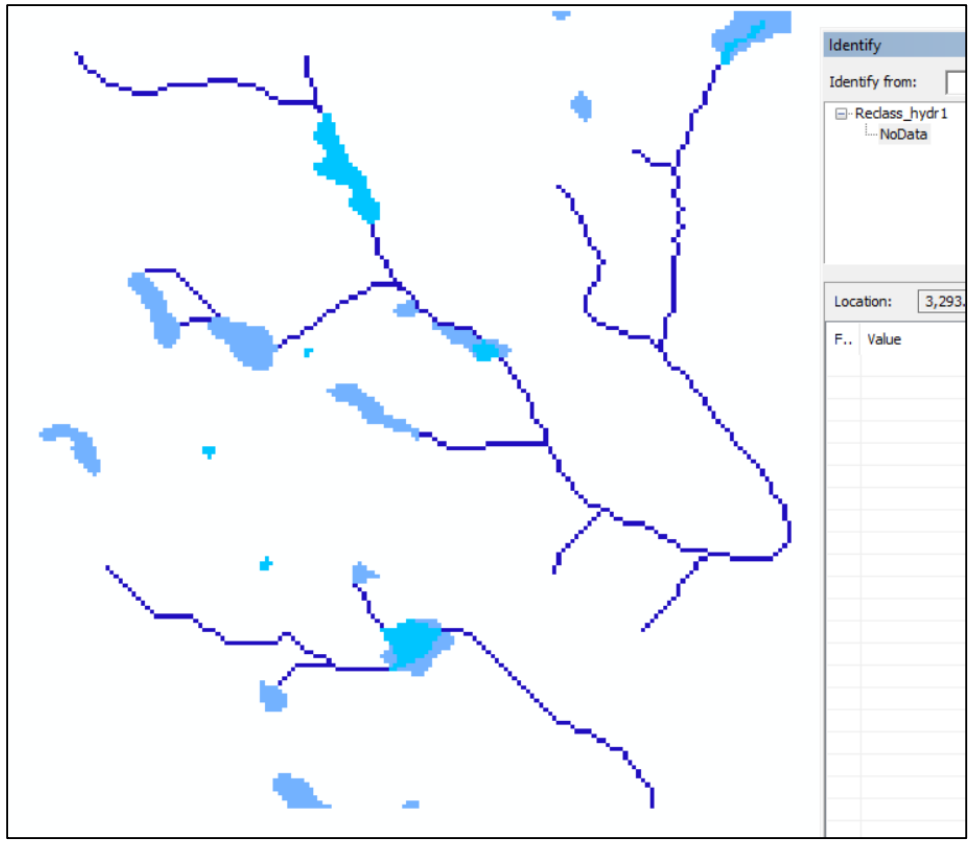




Odds & Ends:

Raster Clip

Odds & Ends: NoData vs. Zero



Odds & Ends: Make Permanent or Export Raster