

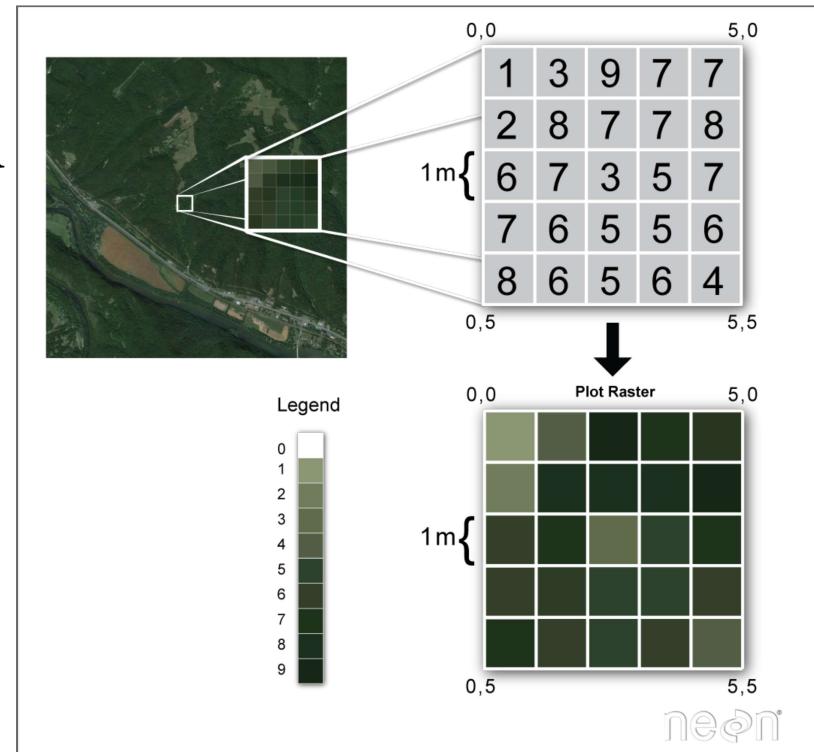
RASTER DATA

A simple, storage intensive format best suited for **continuous phenomena**.

RASTER DATA MODEL

Represents space **continuously**:

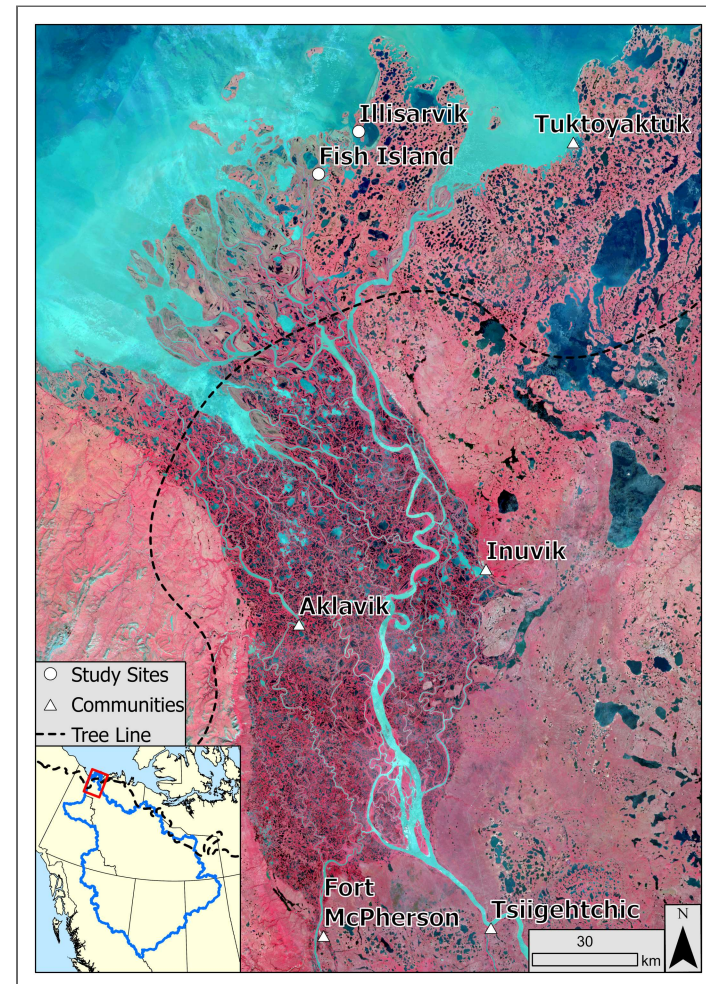
- Rectangular grid of equally sized cells
- Each cell only has **one value**



RASTER DATA MODEL

Multiple **bands** needed for multiple attributes

- Standard color photos have three bands:
 - Red, green, & blue
- LANDSAT8 has 11 bands:
 - Ultra blue to thermal infrared



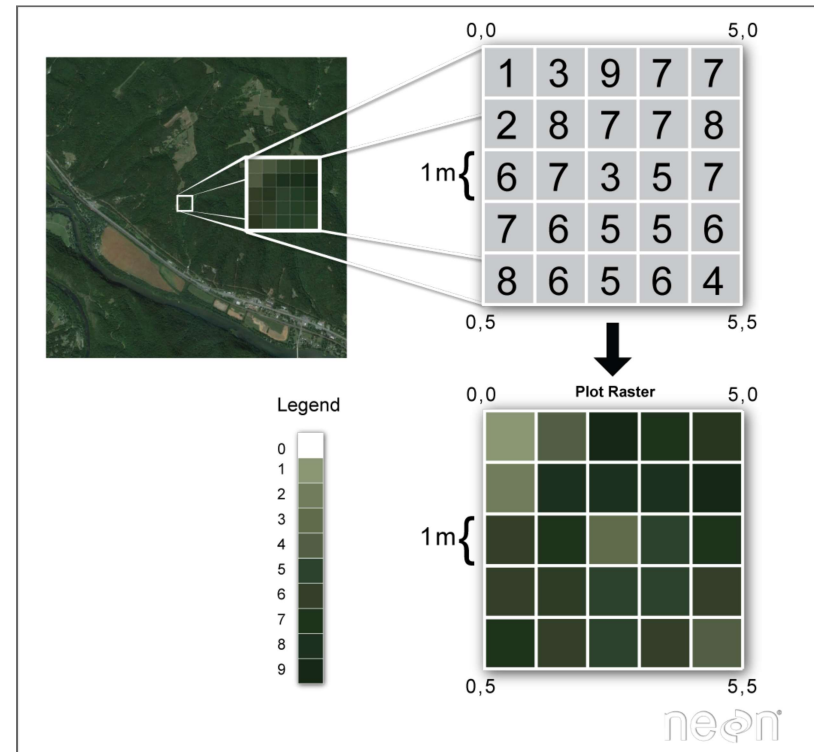
RESOLUTION & EXTENT

Resolution: cell size.

- $1 \text{ m} \times 1 \text{ m} = 1 \text{ m}^2$

Extent: depends on number of cells.

- 5 rows, 5 columns
- 1 m cell size
- Covers 5 m x 5 m



RESOLUTION & EXTENT

Resolution: 10 m cell size = 100 m²

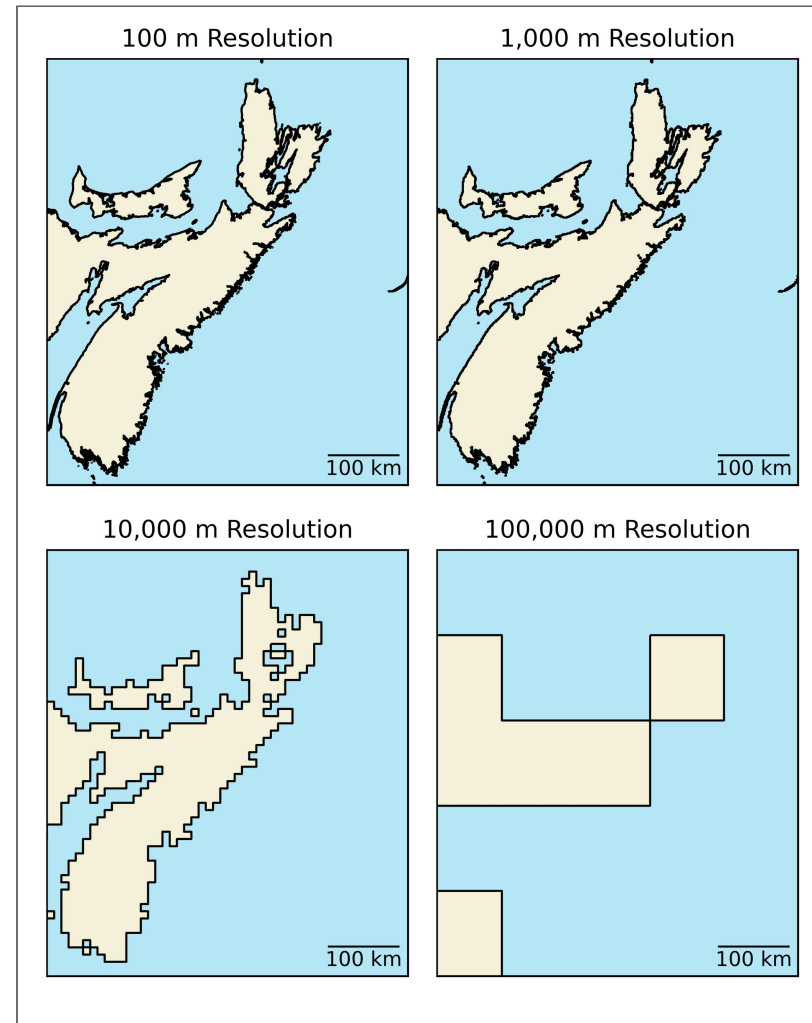
Extent: varies with number of cells.

Rows	Columns	Extent
5	5	50 m x 50 m
5	10	50 m x 100 m
100	100	1 km x 1 km

IMPLICATIONS

Loss of information during rasterization.

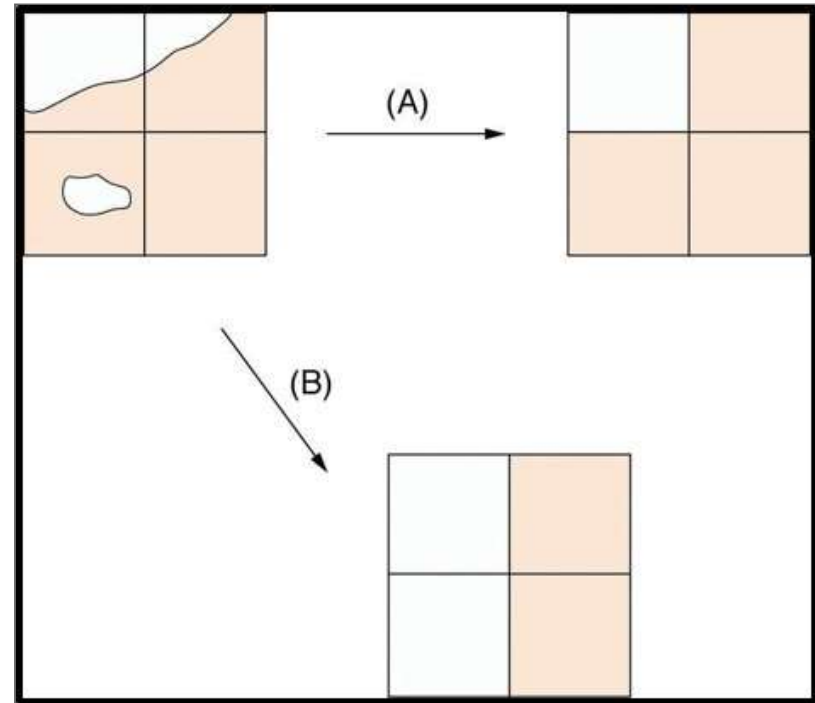
- A "bigger" issue for larger cells.
- At a certain point features become unrecognizable.
- Higher resolution = larger file for equivalent areas.



MIXED PIXEL PROBLEM

One cell: one value

- What if it covers multiple values?
 - A: Winner take all
 - B: Cell center
- Other options?



FILE SIZE

The number of cells per image dictates file size:

Cells = rows x columns x bands.

Extent	Bands	Cell Size	Cells
1 x 1 km	1	100 m	100 cells
1 x 1 km	1	1 m	1,000,000 cells
1 x 1 km	3	100 m	300 cells
1 x 1 km	3	1 m	3,000,000 cells

FILE SIZE

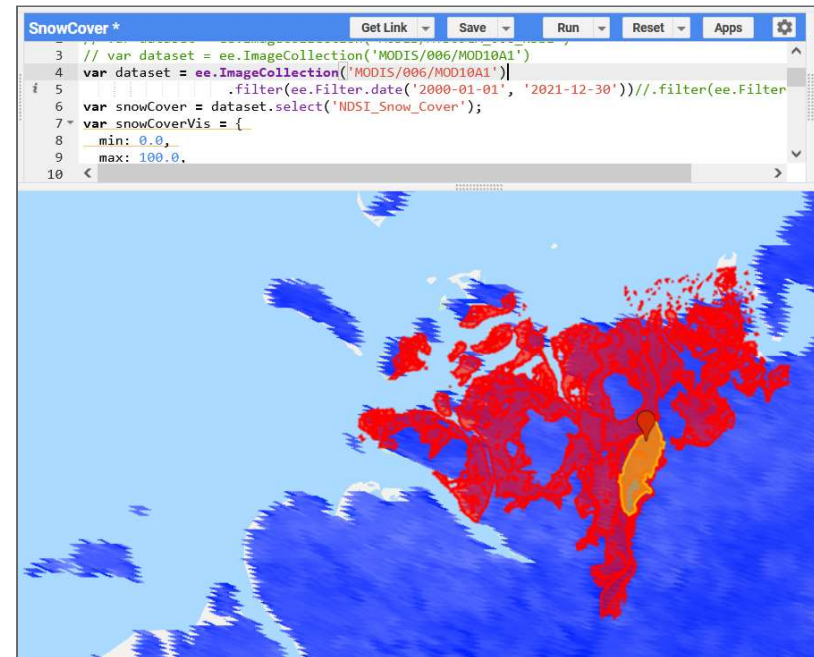
Increases **exponentially** with resolution and **linearly** with number of bands.

Extent	Bands	Cell Size	Cells
1 x 1 km	1	100 m	100 cells
1 x 1 km	1	1 m	1,000,000 cells
1 x 1 km	3	100 m	300 cells
1 x 1 km	3	1 m	3,000,000 cells

WHY DOES THIS MATTER?

Downloading a decade (87,600 bands) of snow cover data:

- 5 min for the red area
- 2 hrs for the orange area (17x larger)



METADATA IN ARCPRO



Layer Properties: Van_Greenest_ProjectRaster

General
Metadata
Source
Elevation
Display
Cache
Processing Templates
Joins
Relates

▼ Raster Information

Columns	3077
Rows	2624
Number of Bands	1
Cell Size X	24.3329742086692
Cell Size Y	24.332974208669
Uncompressed Size	30.80 MB
Format	FGDBR
Source Type	Generic
Pixel Type	floating point
Pixel Depth	32 Bit
NoData Value	
Colormap	absent
Pyramids	level: 5, resampling: Nearest Neighbor
Compression	LZ77
Mensuration Capabilities	Basic

► Band Metadata

► Statistics

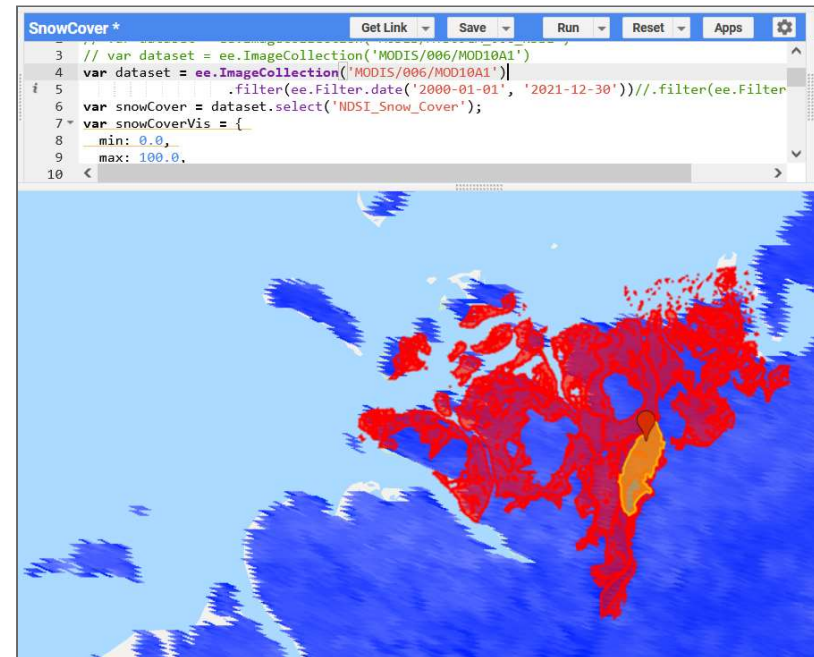
▼ Extent

Top	5,491,472.764337	m	
Bottom	5,427,623.040013	m	
Left	468,402.929592	m	
Right	543,275.491232	m	

WHY DOES THIS MATTER?

Processing times will increase as well:

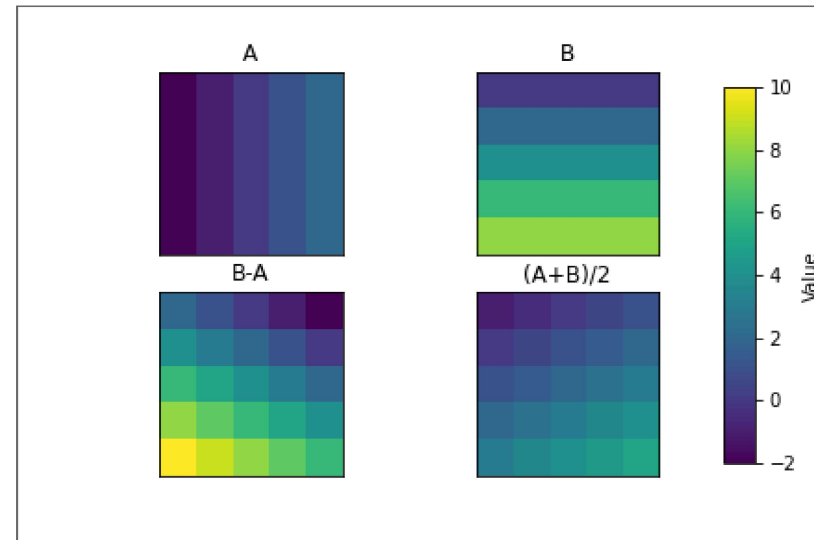
- Any manipulation or analysis of the red area will be much faster than the orange area



RASTER OVERLAY

A **key advantage** of raster data model is how algebraic expressions can be performed efficiently.

- A: Winter Temperature
- B: Summer Temperature
- Range: $B - A$
- Average: $(A + B) / 2$



KEY ADVANTAGES

- Well suited for continuous phenomena:
 - Continuous in **space** and **time**.
- Simple data structure makes overlay is easy and efficient.

GEOTIFF

One of the most common/functional raster formats, based of the Tag Image File Format (TIFF). A TIFF file stores metadata (data about the data) as tags. A GeoTIFF is a standard .tif image format plus additional tags spatial tags denoting spatial information including:

- Extent (minimum x,y and maximum x,y)
- Resolution (cell size)
- Projection, Coordinate system, and datum

OTHER FILE TYPES

Raster data can come in many different formats. You will likely encounter when working with raster data include:

- IMG - A proprietary image format commonly used by ESRI products
- JPEG2000 - A geospatial version of the common .jpg image type
- ASCII - An older human readable format (simple text file) with slower performance than the types listed above