



# GSA-5859 / PCA-5017

## SIG em Software Livre

Dados Raster

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# Dados Raster (matriciais)

- São dados regularmente espaçados no espaço, em uma estrutura de matriz com células quadradas (normalmente) e de mesmo tamanho. Cada célula (pixel) recebe o valor de um atributo, que representa um fenômeno (por exemplo temperatura ou altitude). As células são organizadas em linhas e colunas, e seu valor pode ser acessado pelas coordenadas absolutas da matriz (linha/coluna) ou pelas coordenadas geográficas
- Tamanho do pixel = Resolução espacial

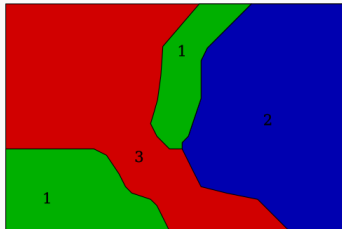
# Raster x Vetor

**Representações Raster e Vetorial dos mesmos objetos em SIG**

3	3	3	3	3	1	2	2	2
3	3	3	3	1	2	2	2	2
3	3	3	3	1	2	2	2	2
3	3	3	3	1	2	2	2	2
1	1	1	3	3	2	2	2	2
1	1	1	1	3	3	3	2	2

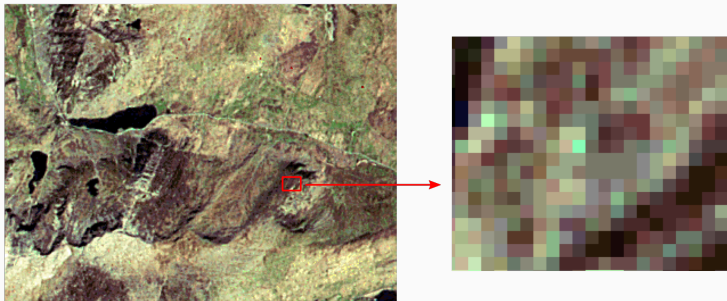
1 = área vegetada

2 = água



3 = área urbana

## Raster - pixels

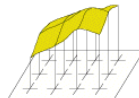


# Raster - valores e coordenadas

## Value applies to the center point of the cell

For certain types of data, the cell value represents a measured value at the center point of the cell. An example is a raster of elevation

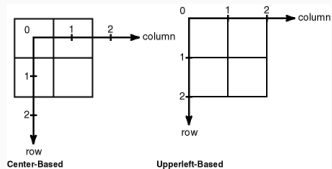
+ 315	+ 319	+ 321	+ 323
+ 317	+ 323	+ 320	+ 326
+ 313	+ 318	+ 325	+ 323



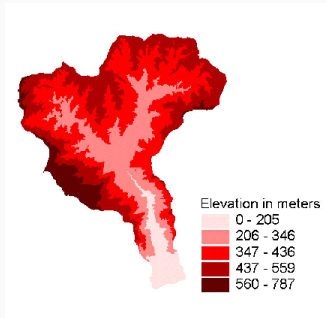
## Value applies to the whole area of the cell

For most data, the cell value represents a sampling of a phenomenon, and the value is presumed to represent the whole cell square.

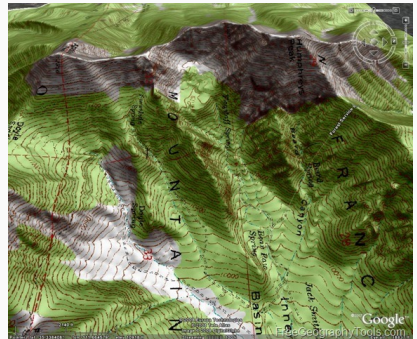
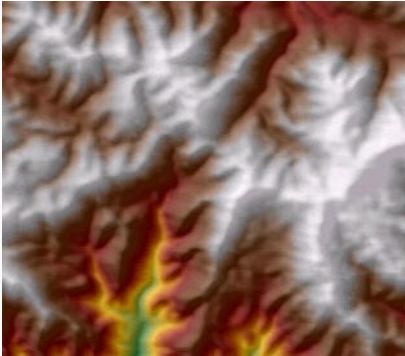
50	45	40	35
35	40	35	25
20	25	30	20



# Raster - pixel-is-area



# Raster - pixel-is-point(?)



## Bits & Bytes...

- 1 bit – menor unidade de informação armazenada
- 1 byte (1B) – 8 bits
- 1 kB (kilobyte) =  $2^{10}$  bytes = 1.024 bytes
- 1 MB (megabyte) =  $2^{20}$  bytes = 1.048.576 bytes
- 1 GB (gigabyte) =  $2^{30}$  bytes = 1.073.741.824 bytes



## Bits & Bytes...

- imagem 8 bits – 1 byte por pixel
- imagem 16 bits – 2 bytes por pixel
- imagem 32 bits – 4 bytes por pixel
  
- imagem 1000 linhas x 1000 col. x 1 banda x 1 byte = 1.000.000 bytes
  
- 1 byte =  $2^8 = 256$
- imagem 8 bits – cada pixel pode ter valores de 0 a 255

p220r079\_7x20000507.met

PRODUCT\_SAMPLES\_PAN = 17654

PRODUCT\_LINES\_PAN = 15614

PRODUCT\_SAMPLES\_REF = 8827

PRODUCT\_LINES\_REF = 7807

PRODUCT\_SAMPLES\_THM = 4414

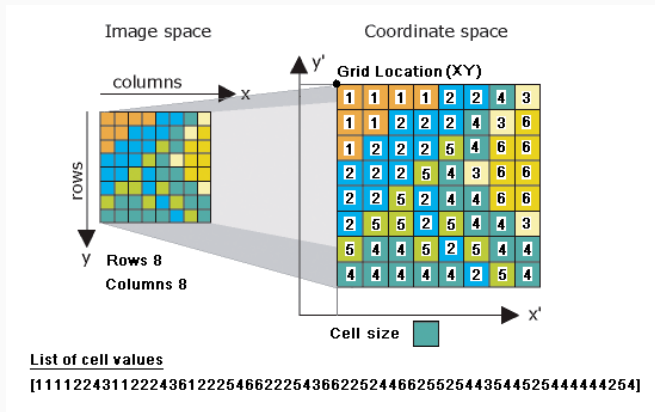
PRODUCT\_LINES\_THM = 3904

- Banda 8 (PAN):  $17654 \times 15614 \times 1\text{byte} = 275.649.556 \text{ B}$
- Bandas 1-5:  $8827 \times 7807 \times 1\text{byte} = 68.912.389 \text{ B}$
- Banda 6 (thermal):  $4414 \times 3904 \times 1\text{byte} = 17.232.256 \text{ B}$

# Bits & Bytes...

- 1\_BIT — A 1-bit unsigned integer. The values can be 0 or 1.
- 2\_BIT — A 2-bit unsigned integer. The values supported can be from 0 to 3.
- 4\_BIT — A 4-bit unsigned integer. The values supported can be from 0 to 15.
- 8\_BIT\_UNSIGNED — An 8-bit, unsigned data type. The values can range from 0 to 255. This is the default.
- 8\_BIT\_SIGNED — An 8-bit signed data type. The values can range from -128 to 127.
- 16\_BIT\_UNSIGNED — A 16-bit, unsigned data type. The values can range from 0 to 65,535.
- 16\_BIT\_SIGNED — A 16-bit signed data type. The values can range from -32,768 to 32,767.
- 32\_BIT\_UNSIGNED — A 32-bit unsigned data type. The values can range from 0 to 4,294,967,295.
- 32\_BIT\_SIGNED — A 32-bit signed data type supported by GRID. The values can range from -2,147,483,648 to 2,147,483,647.
- 32\_BIT\_FLOAT — A 32-bit data type supporting decimals.
- 64\_BIT — A 64-bit data type supporting decimals.

# Raster - Tamanho dos arquivos



# Raster - Compressão

- Diminuir o tamanho do arquivo (em bytes) para armazenagem e consulta
- Taxa de compressão depende do arquivo original
- Sem perda de informação (Lossless)
- Com perda de informação (Lossy)
- Uso de informação redundante
  - Ex.: 25.8888888888
  - lossless: 25.[9]8
  - lossy: 26

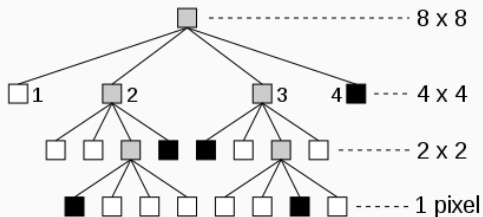
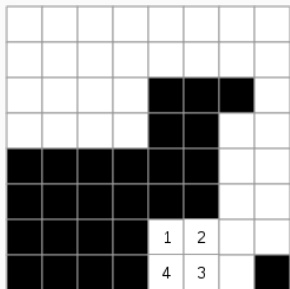
# Raster - Compressão por Run-length encoding

**raster representation**

A	A	A	A	0	0	0	0
A	A	A	A	A	0	0	0
A	A	A	A	0	B	0	0
A	A	A	A	0	0	0	0
A	A	A	0	0	0	C	C
0	0	0	0	0	C	0	0
C	C	C	C	C	0	0	0
0	0	0	0	0	0	0	0

pixel	value
1	A
2	A
3	A
4	A
5	0
6	0
7	0
8	0
9	A
10	A
11	A
12	A
13	A
14	0
15	0
16	0
.	.
.	.
.	.
62	0
63	0
64	0

# Raster - Compressão por Quadrees



# Raster - tipos de arquivo

- BIL - Band Interleaved by Line (image format linked with satellite derived imagery)
- Digital raster graphic (DRG) - digital scan of a paper USGS topographic map
- ECW - Enhanced Compressed Wavelet (from ERMapper). A compressed wavelet format, often lossy.
- ESRI grid - proprietary binary and metadataless ASCII raster formats used by ESRI
- GeoTIFF - TIFF variant enriched with GIS relevant metadata
- IMG - ERDAS IMAGINE image file format
- JPEG2000 - Open-source raster format. A compressed format, allows both lossy and lossless compression.
- MrSID - Multi-Resolution Seamless Image Database (by Lizardtech). A compressed wavelet format, often lossy.



# Raster - tipos de arquivo

- USGS DEM - The USGS' Digital Elevation Model
- DTED - National Geospatial-Intelligence Agency (NGA)'s Digital Terrain Elevation Data
- GTOPO30 - Large complete Earth elevation model at 30 arc seconds
- SDTS - The USGS' successor to DEM
- HGT - SRTM (NASA)