

GSA-5859

SISTEMAS DE INFORMAÇÃO GEOGRÁFICA EM SOFTWARE LIVRE

CARLOS HENRIQUE GROHMANN

INSTITUTO DE ENERGIA E AMBIENTE - USP

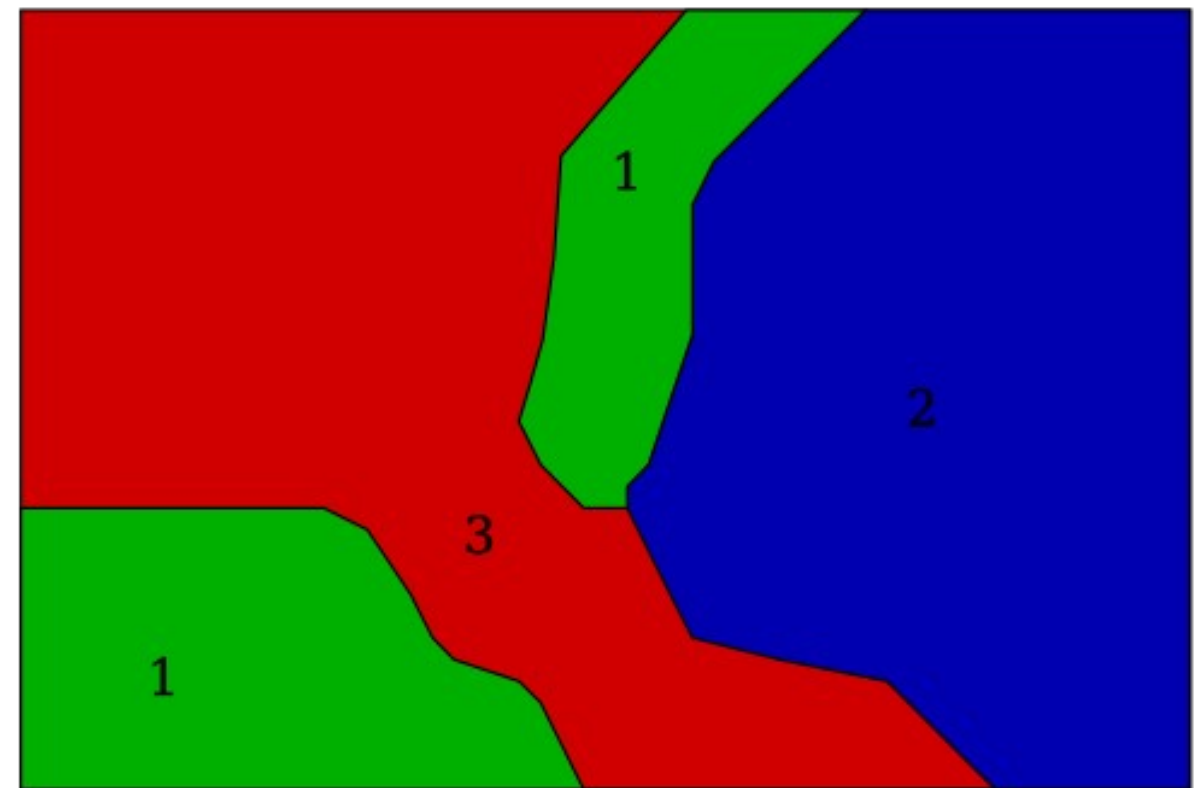
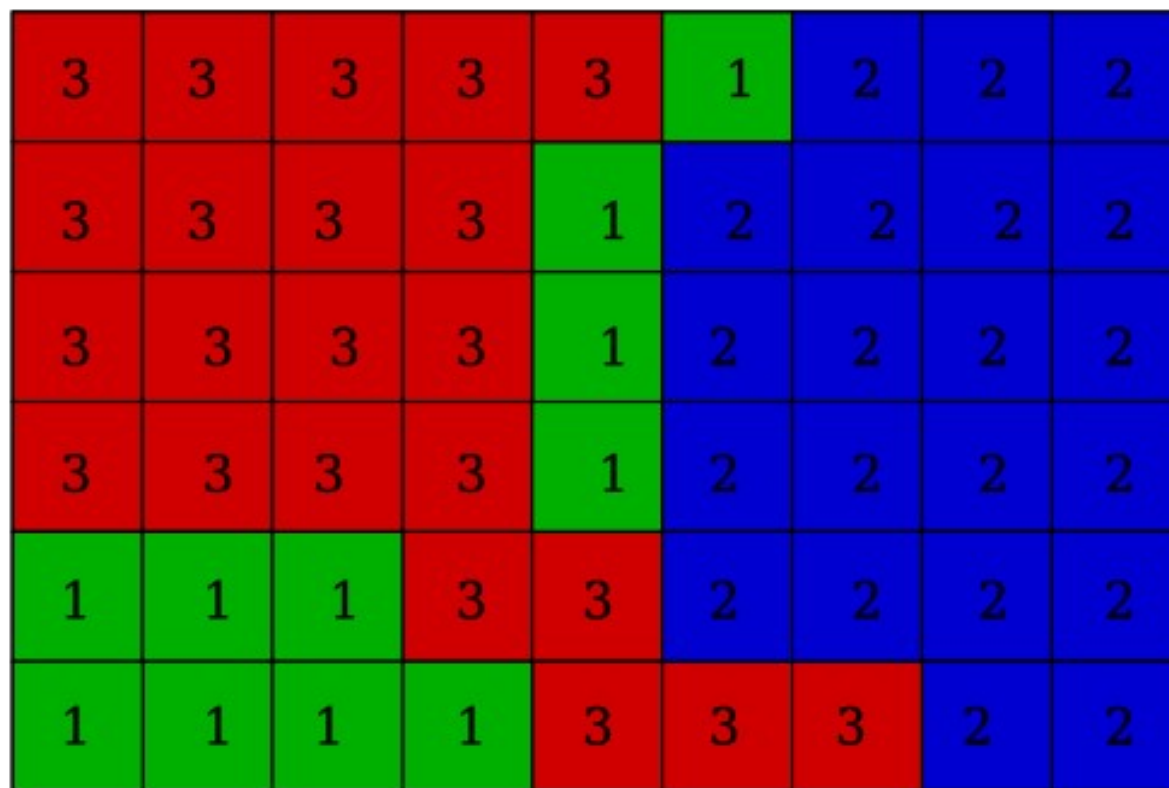
Dados raster (matriciais)

TIPOS DE 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

TIPOS DE DADOS

Representações Raster e Vetorial dos mesmos objetos em SIG

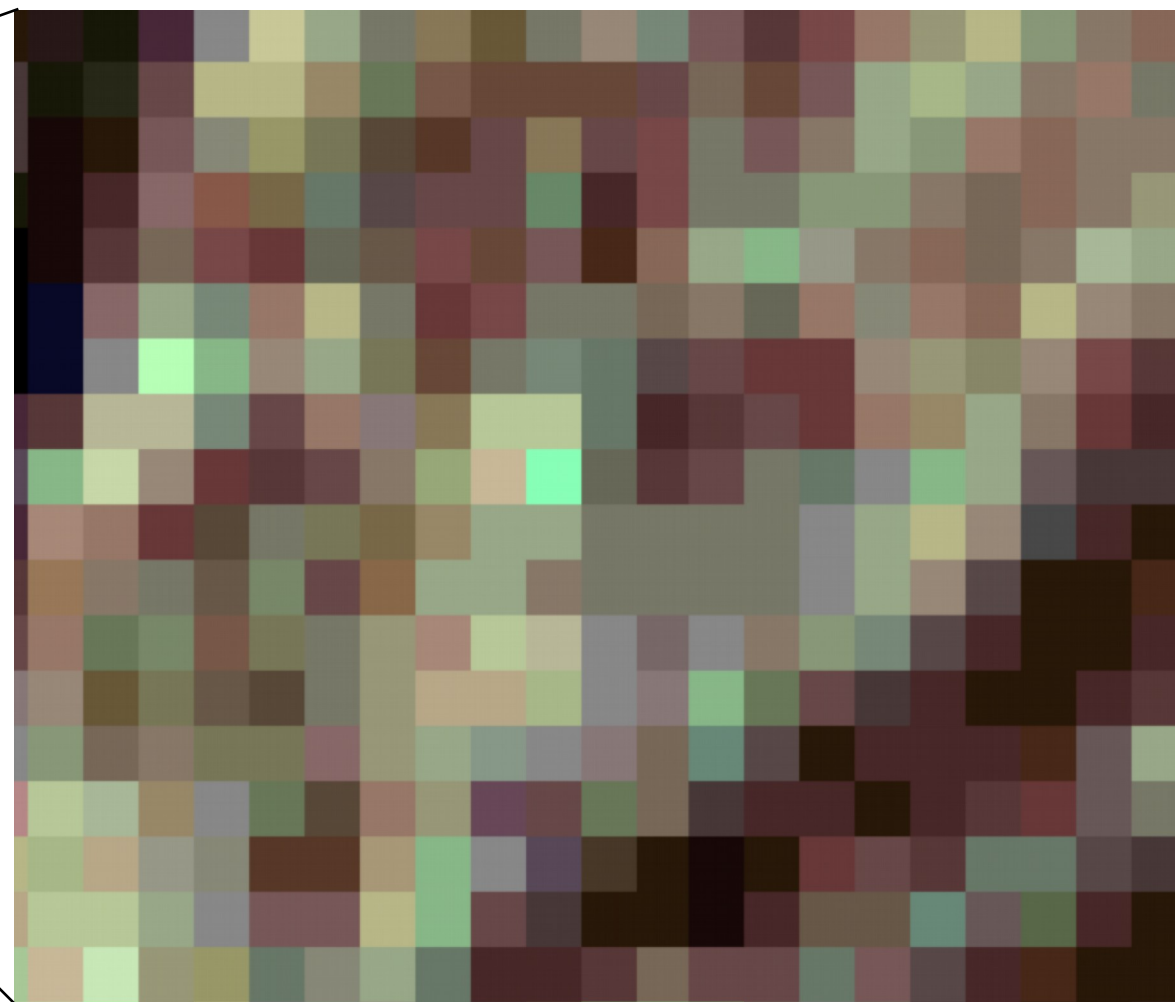
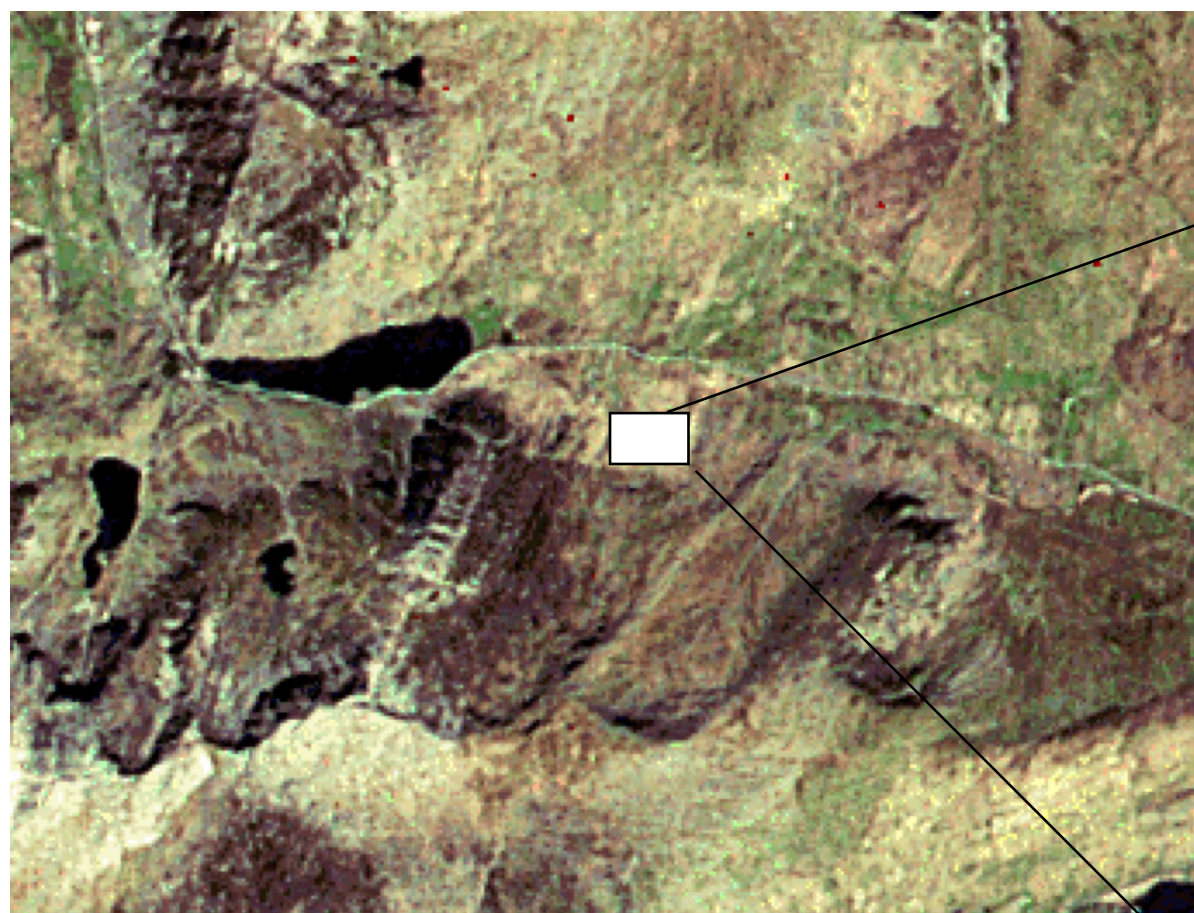


1 = área vegetada

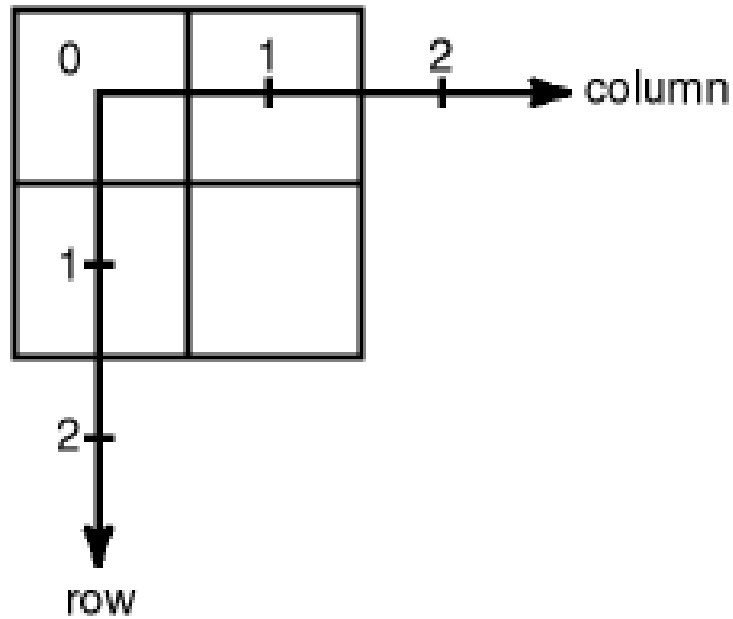
2 = água

3 = área urbana

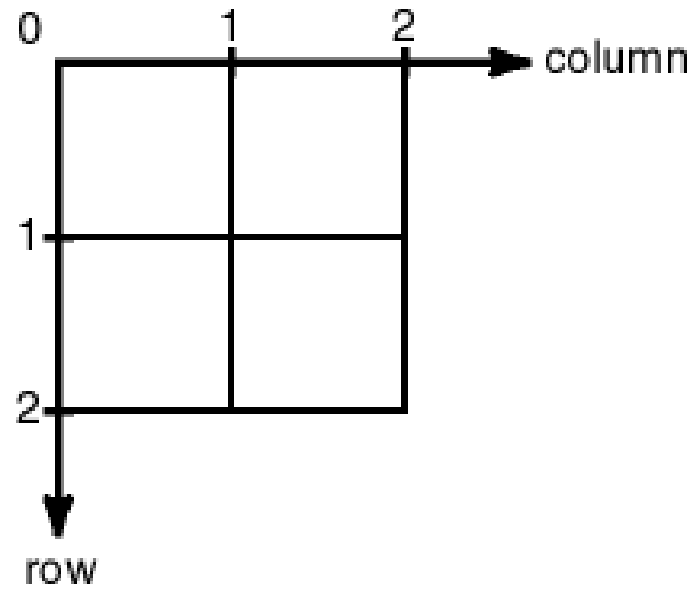
DADOS RASTER



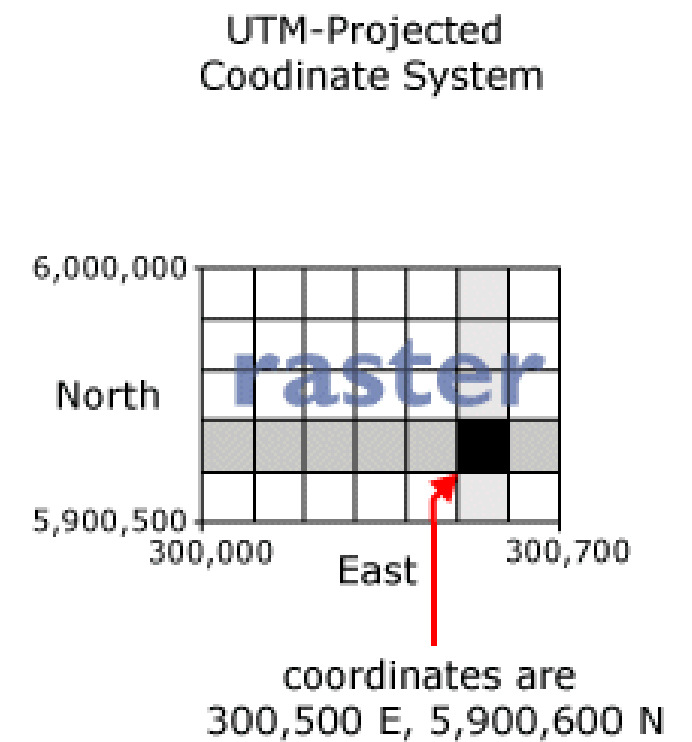
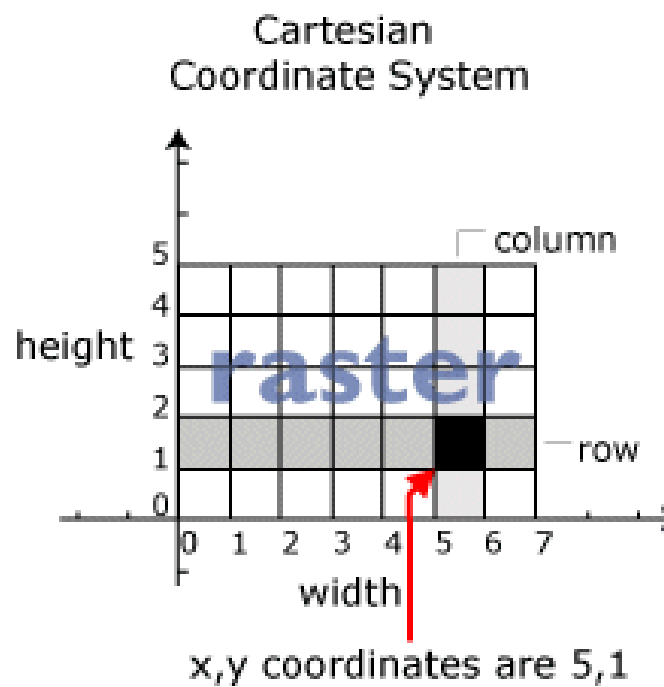
DADOS RASTER



Center-Based



Upperleft-Based

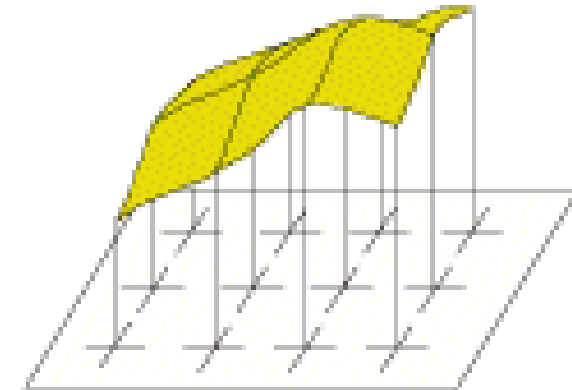


DADOS RASTER

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

+ 316	+ 319	+ 321	+ 323
+ 317	+ 323	+ 320	+ 326
+ 313	+ 318	+ 325	+ 323



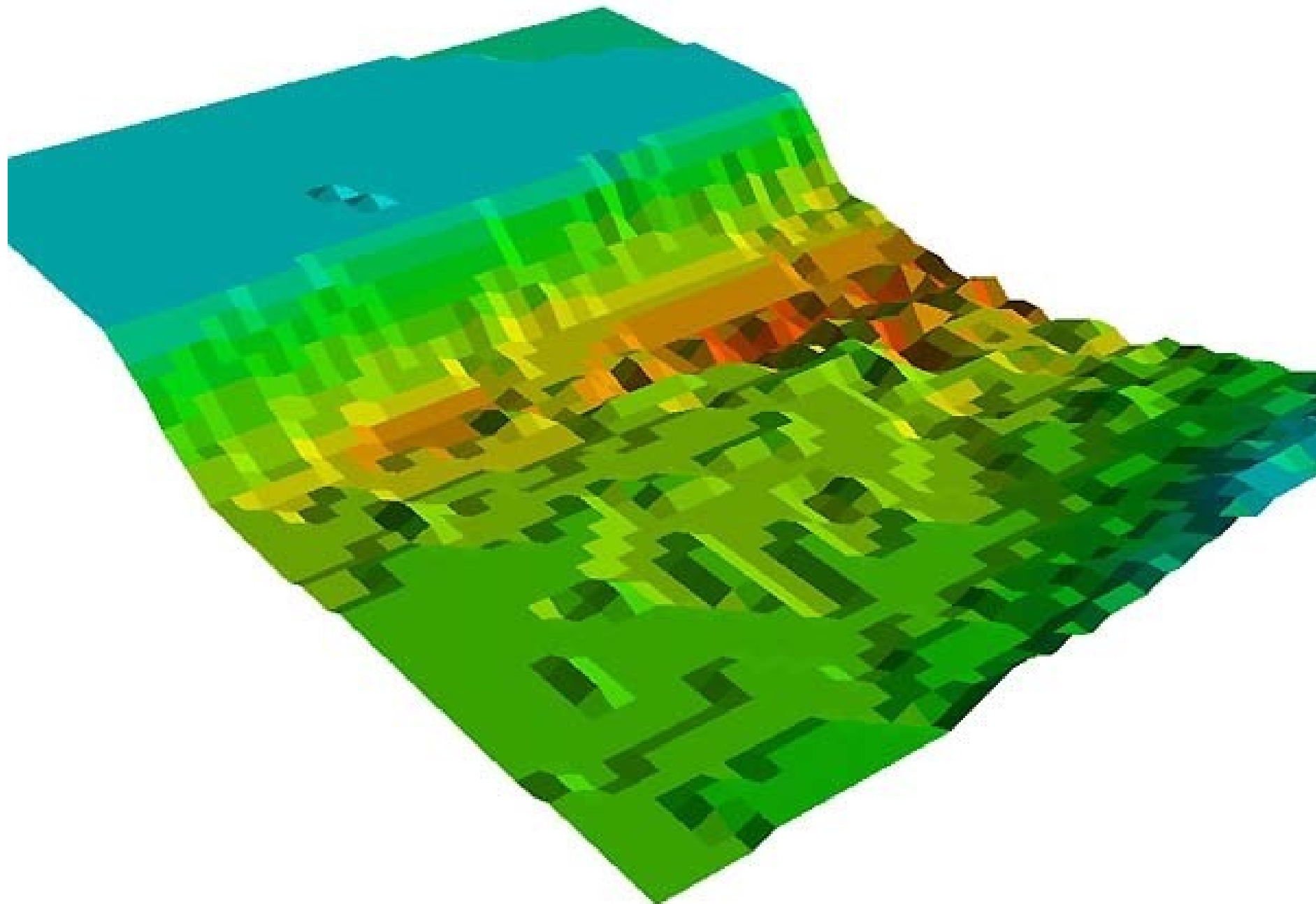
Value applies to the whole area of the cell

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

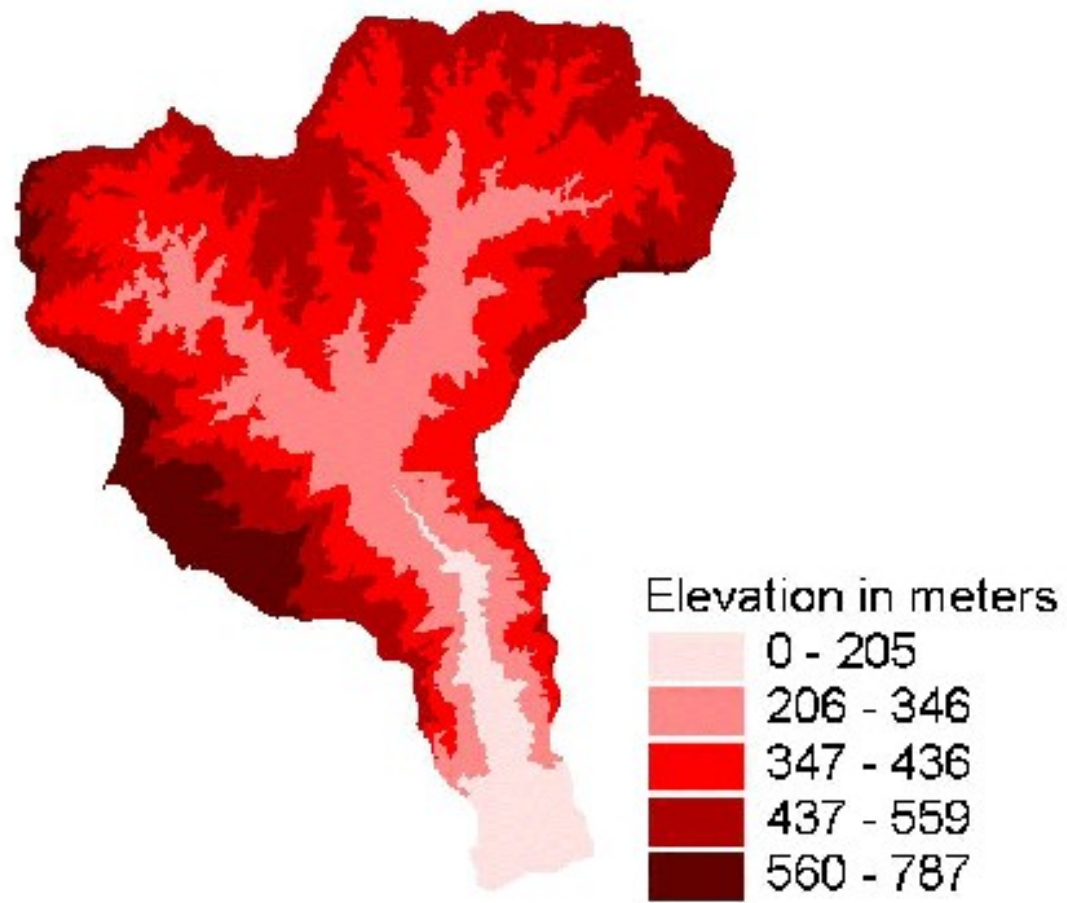
50	45	40	35
35	40	35	25
20	25	30	20



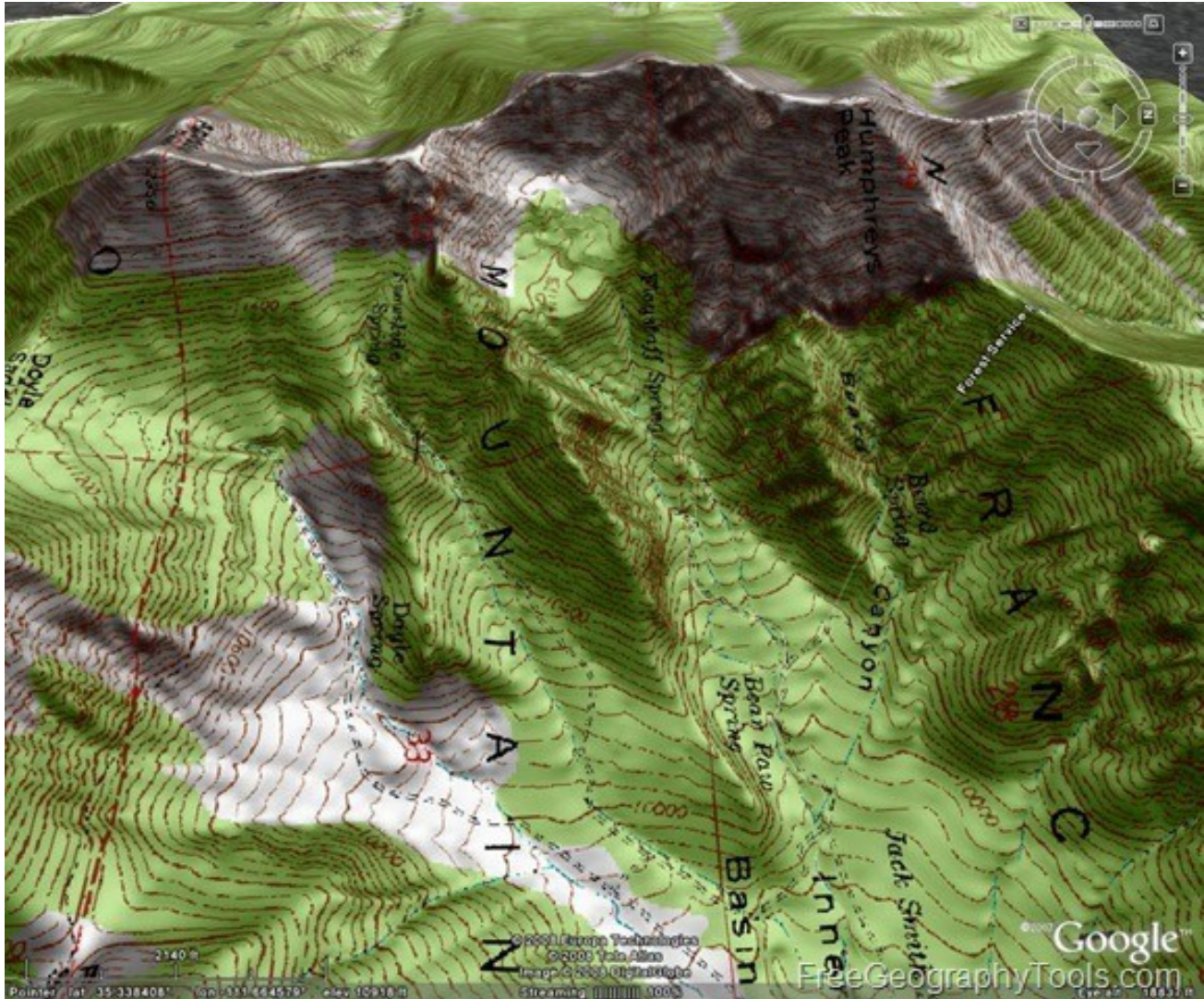
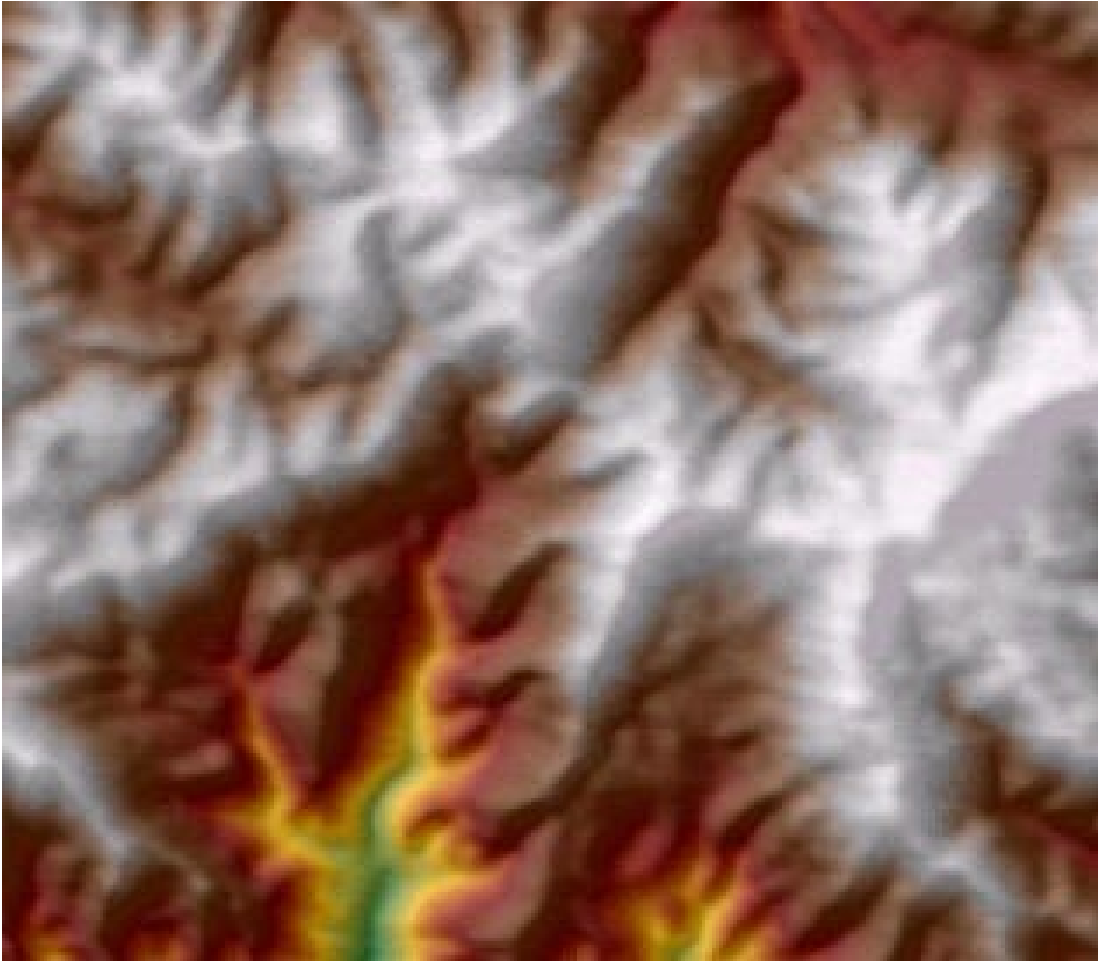
DADOS RASTER



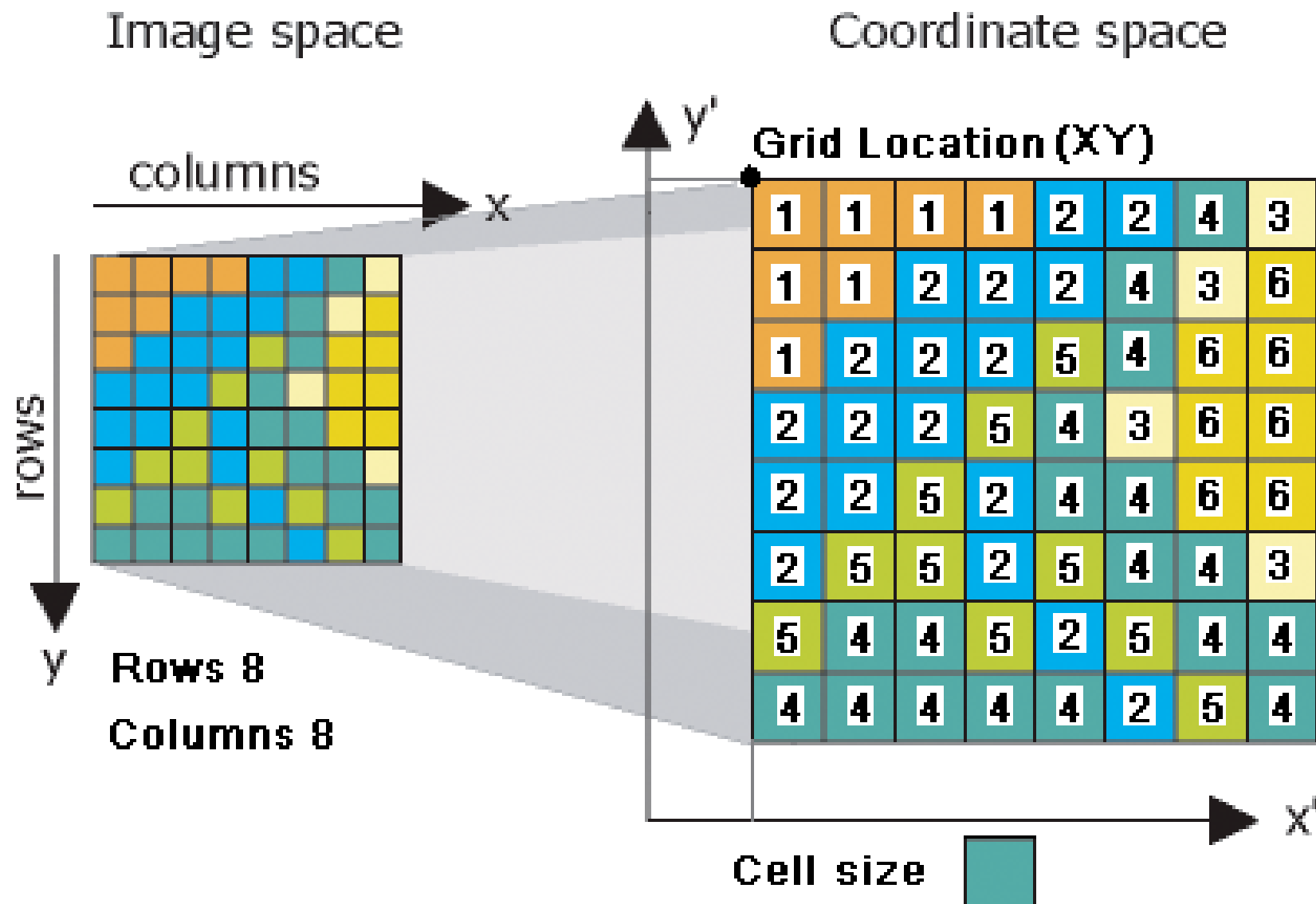
DADOS RASTER



DADOS RASTER



DADOS RASTER – TAMANHO DE ARQUIVOS



List of cell values

[111122431122243612225466222543662252446625525443544525444444254]

BITS & BYTES

- ▶ 1 bit – menor unidade de informação armazenada
- ▶ 1 byte (1B) – 8 bits
- ▶ 1 kB (kilobyte) = 2^{10} bytes = 1024 bytes
- ▶ 1 MB (megabyte) = 2^{20} bytes
- ▶ 1 GB (gigabyte) = 2^{30} bytes

BITS & BYTES

- ▶ imagem 8 bits = $2^8 = 1$ byte = 256 (valores por pixel)
 - ▶ 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

BITS & BYTES

- ▶ 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 (termal): $4414 \times 3904 \times 1\text{byte} = 17.232.256 \text{ B}$

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 – COMPRESSÃO

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

RASTER – COMPRESSÃO

- ▶ Run-Lenght Encoding
- ▶ Raster chain
- ▶ Block codes
- ▶ Quadrees

RASTER – COMPRESSÃO – 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

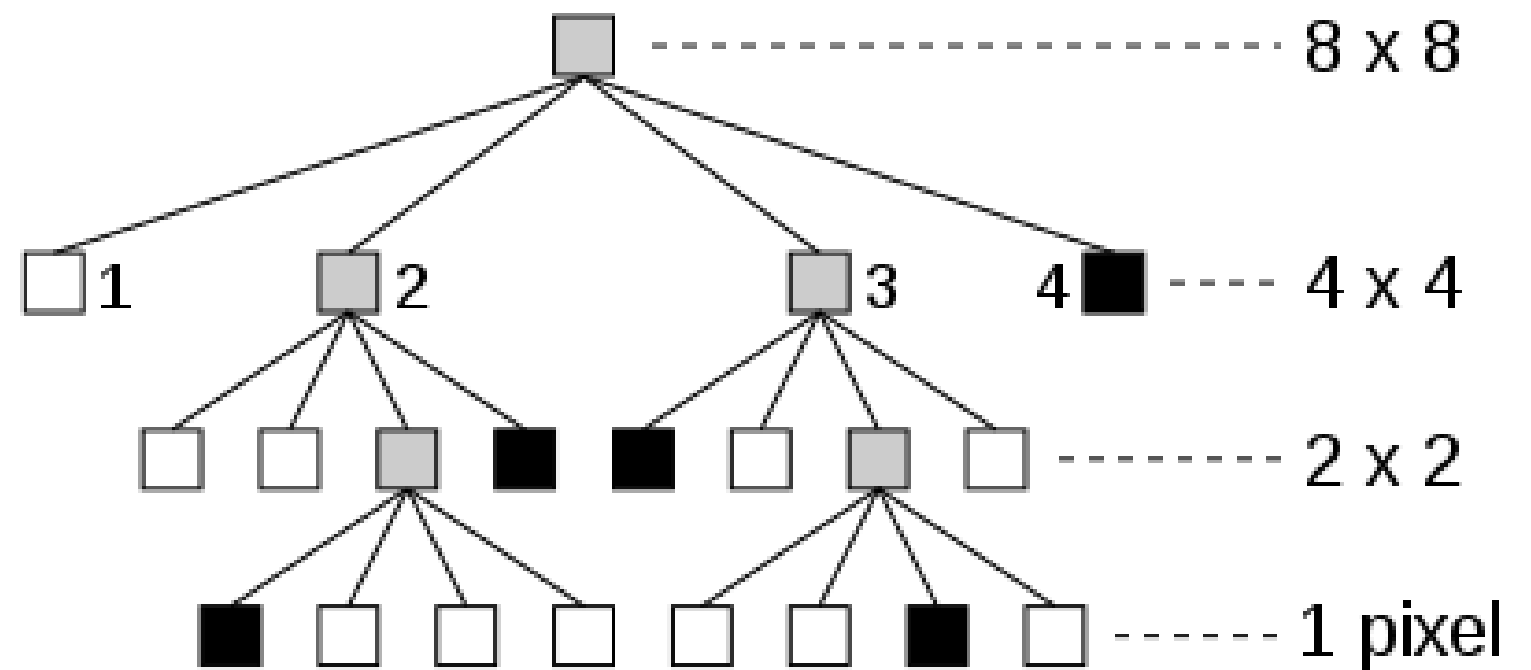
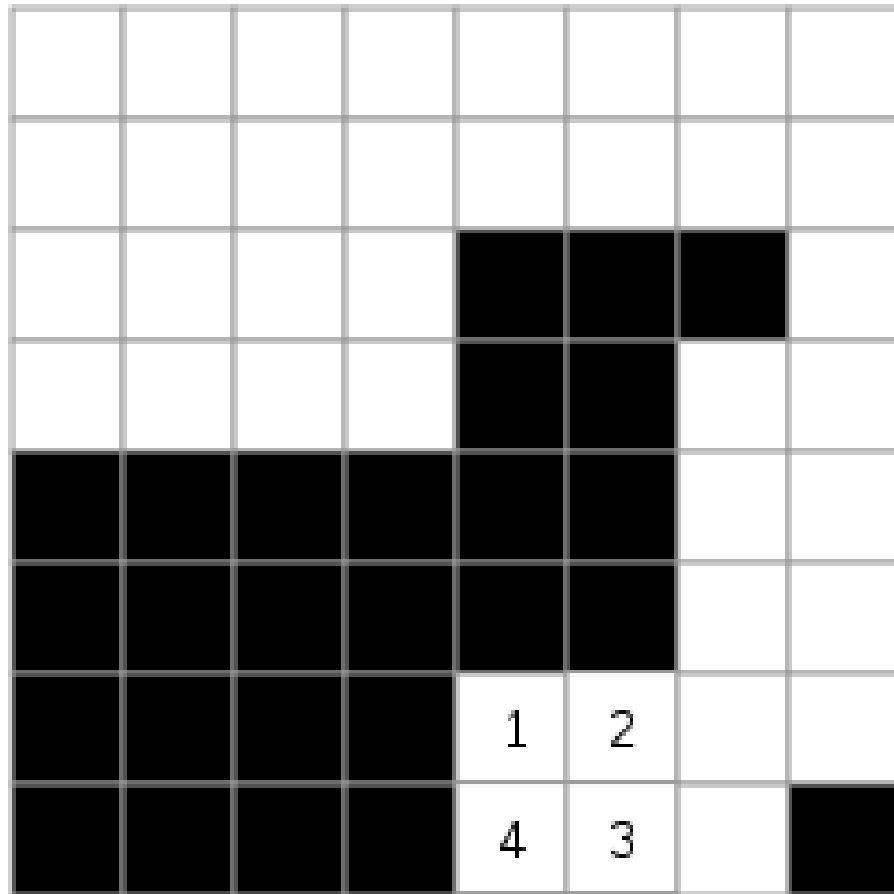
RASTER - COMPRESSÃO - RUN-LENGTH ENCODING

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

A,	4	0,	8				
A,	5	0,	8				
A,	4	0,	5	B,	6	0,	8
A,	4	0,	8				
A,	3	0,	6	C,	8		
0,	5	C,	6	0,	8		
C,	5	0,	8				
0,	8						

RASTER - COMPRESSÃO - QUADTREES



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.

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)