Geographic information systems

Working with raster layers

(Lesson 5)

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- raster data model
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- styling (color ramps, color models, multiband images)
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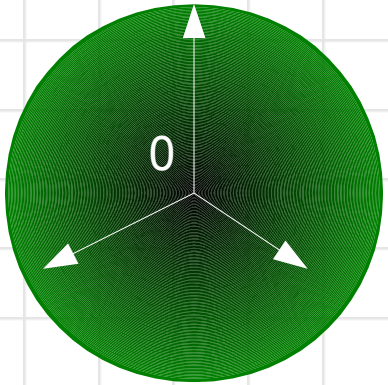
Map projections



- geographic coordinate system
- degrees (lat, long)
- e.g. WGS 84

- projected coordinate system
- meters
- e.g. UTM

Raster format

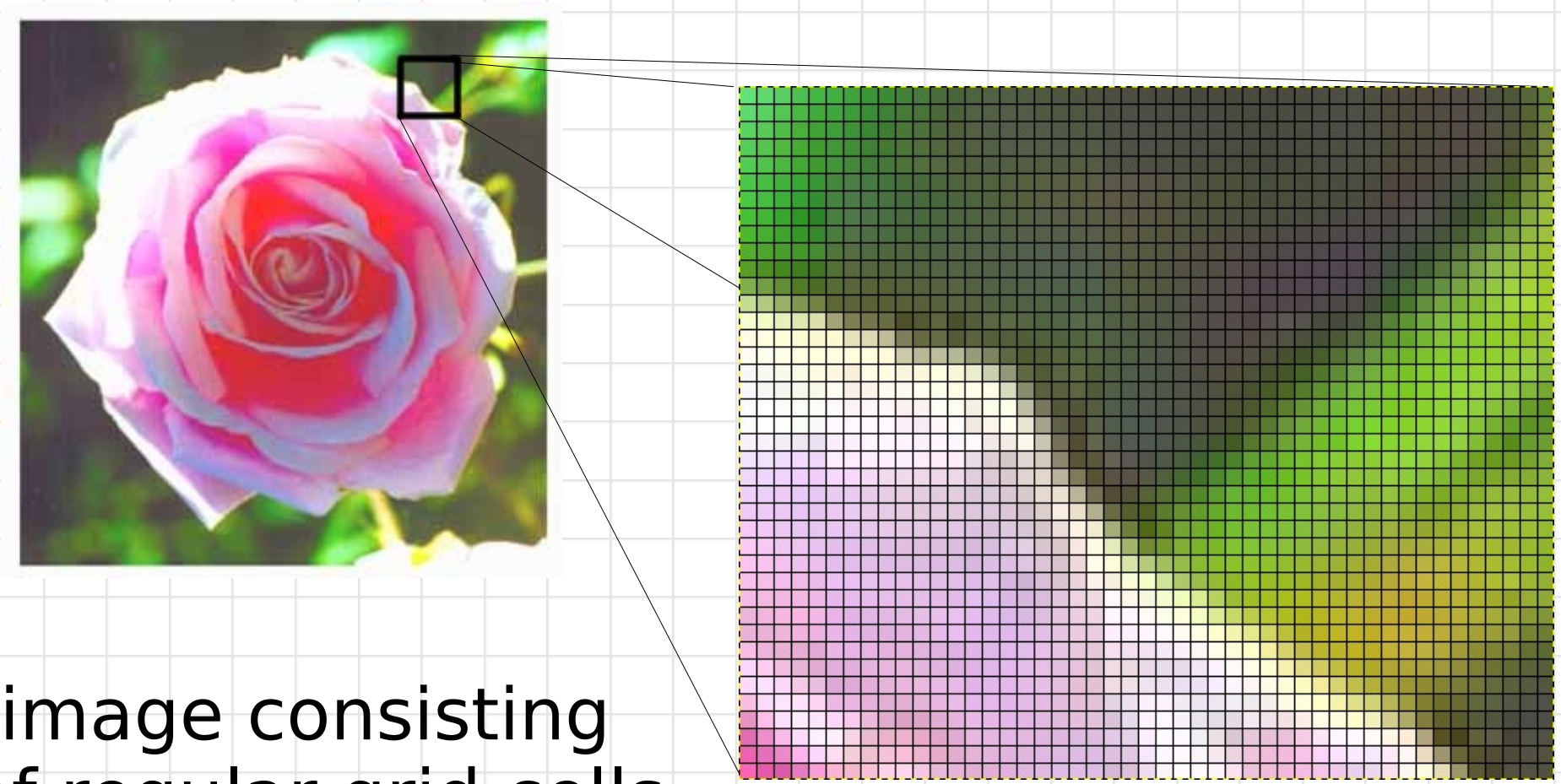
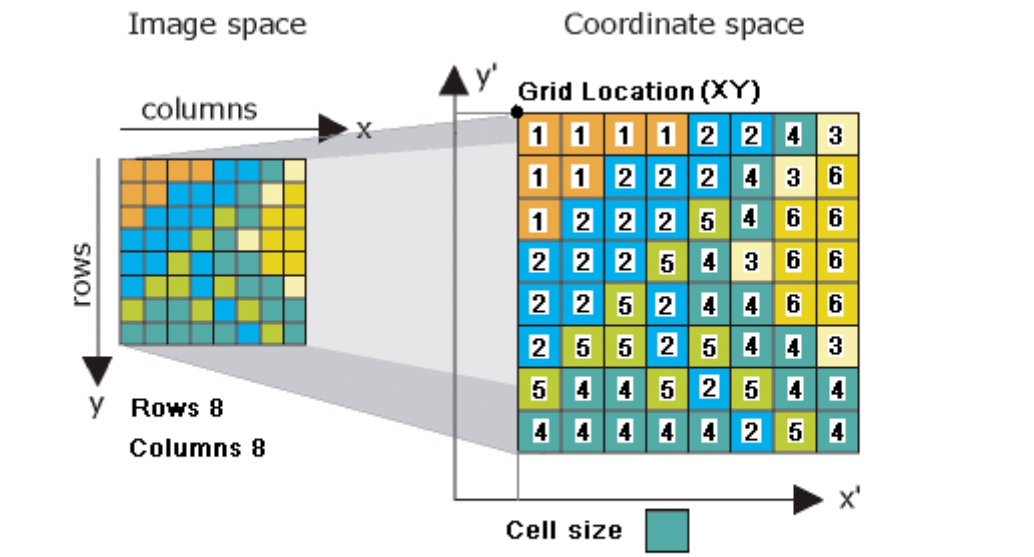


image consisting
of regular grid cells
(pixels)

Raster



Source: ESRI WebHelp

Raster parameters

- **resolution** (pixel size)
- **dimensions** (number of rows, columns)
- **spatial extent** (area)
- **domain** (allowed value range, allowed values)
- *raster with pixel size 10 m covering area 1 x 1 km – how many row and columns will have?*

Pixel values

What type of values can be stored in raster?

- texts (strings) - NO
- numbers - YES
- 1-bit (2^1=2 – binary raster, 0 – 1)
- 8-bit (2^8=256, 0 to 255)
- ...atd'.
- decimal numbers (*float*)
- with or without sign (*signed*, *unsigned*)

Raster file formats

- **(Geo)TIFF**
  - pixel from 1 to 32 bits (2 to 4294967296)
- **JPEG**
  - compression format (lossy compression)
- **IMG**
  - ERDAS Imagine – satellite images
- and many others:
  - BIL, HDF, HDR, MrSID, DEM, DDF, ...

Raster types and styling

Layer properties → Style

- singleband (greyscale)
- multiband (aerial, satellite images)
  - RGB color model
- pseudocolor singleband (color ramps)
- paletted (color tables)

- pixel value identification 

Metadata

- data about data
  - describe:
    - file format
    - path to source file
    - number of bands
    - raster dimensions and coordinates of origin (upper left corner)
    - spatial extent and resolution (pixel size)
    - spatial reference system
    - band statistics (min, max, mean, stdev)
- in QGIS:

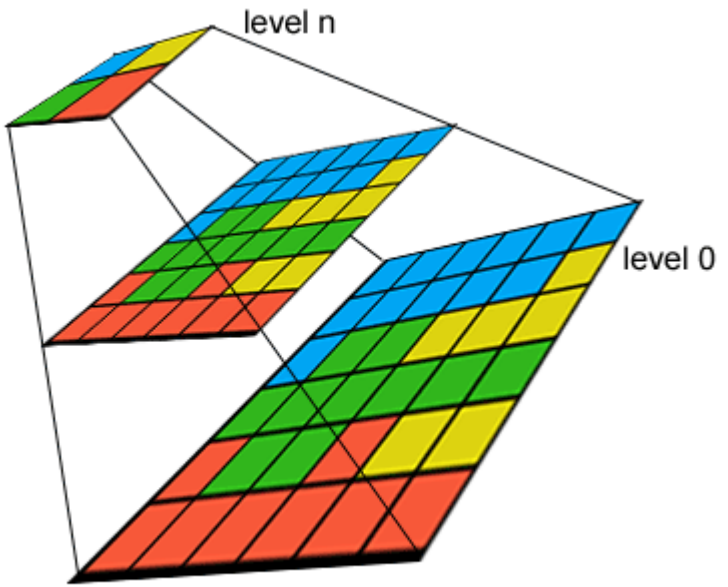
  Layer properties → Metadata

Overviews (image pyramids)

- improve navigation performance (zoom, pan) for high resolution raster layers
- lower resolution copies of the data
- in QGIS:

  Layer properties

  → Pyramids



3 levels of a pyramid

Georeferencing

- the process of associating a raster image (scanned map, aerial or satellite image) with spatial (geographical) locations – based on points with known coordinates (Ground Control Points, GCPs)
- relating internal coordinate system of an image to ground coordinate system
- georeferencing in QGIS:

  Raster → Georeferencer 

Georeferencing

- workflow:
  - identify at least three clearly visible points on raster image and on map canvas
  - identify the points on raster image and enter the coordinates from map canvas
  - set the transformation type and resampling method
  - specify the output raster and run the transformation

Georeferencing

- transformation type:

  Settings → Transformation Settings
- Linear
- Helmert
- Polynomial (1st, 2nd, 3rd order)
- Thin Plate Spline
- Projective
- there is a minimal number of points for each type of transformation (e.g. 3 points for linear, 4 points for projective etc.)

Georeferencing

- positional information are stored in:
- **raster header** – readable for GIS software
- **world file** – a six line plain text sidecar file (.tfw, .jgw or .wld)
- world file is created by linear transformation, the original raster file remains unchanged
- other transformation methods resample the original raster file to a new coordinate system, location will be stored in the header of the new file

The End

Thank you for attention!