Digital data for GIS and RS

Open the bash terminal and run

```
cd $HOME
rm -fr $HOME/SE_data
git clone  https://github.com/selvaje/SE_data.git
```

Digital data for GIS and RS

- Digital data
  - Simplification of the real world
  - Constrain the reality in bit information
  - Can be “single data” and can have table associate to it
  - Different format
  - Can be open by different software
  - Small (few line) or large size (million of pixel)

File Format vs File extension

- A **file format** is a standard way that information is encoded for storage in a computer file. It specifies how bits are used to encode information in a digital storage medium. File formats may be either proprietary or free and may be either unpublished or open.

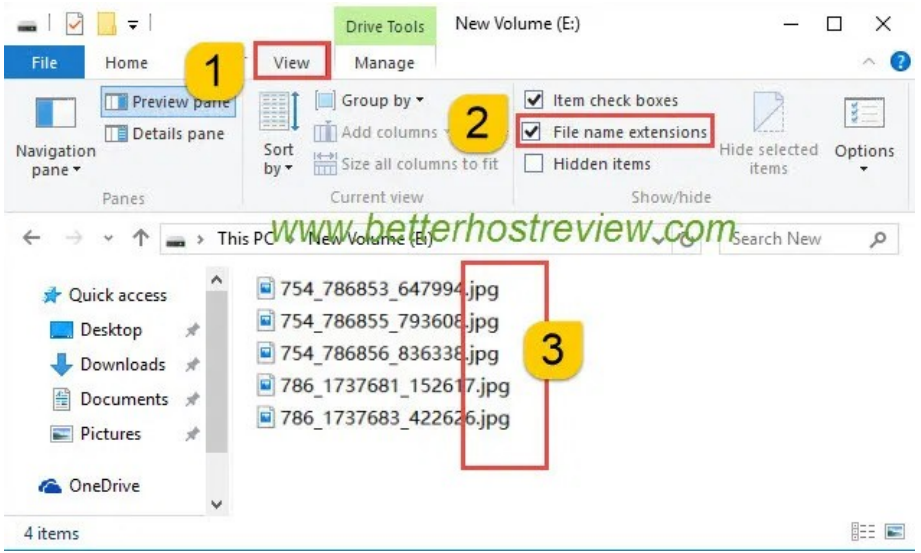
  (source https://en.wikipedia.org/wiki/File_format)

- A **file extension** or filename extension is a suffix at the end of a filename. It is used to show the type of a computer file.

  (source https://simple.wikipedia.org/wiki/File_extension)

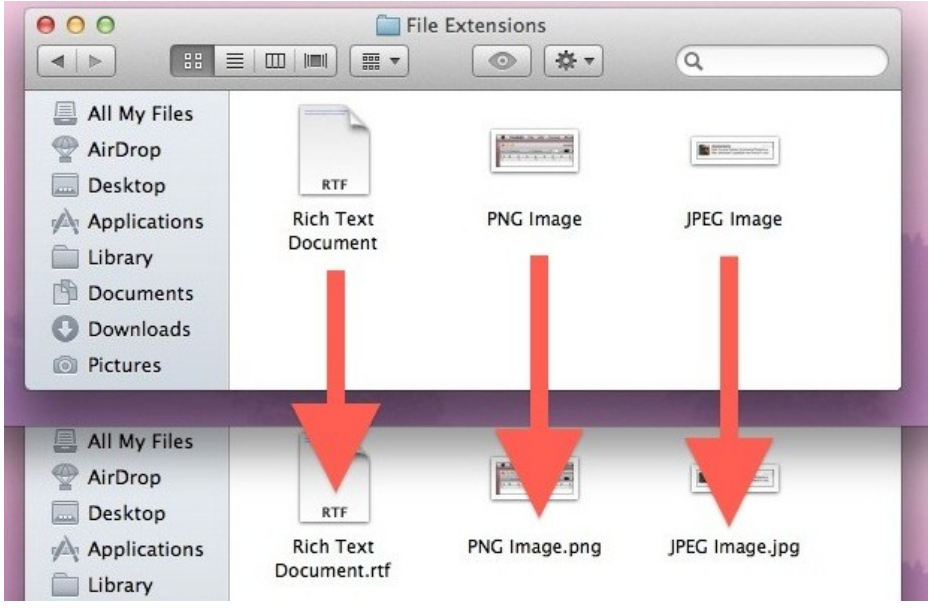
Hidden filename extensions on windows:

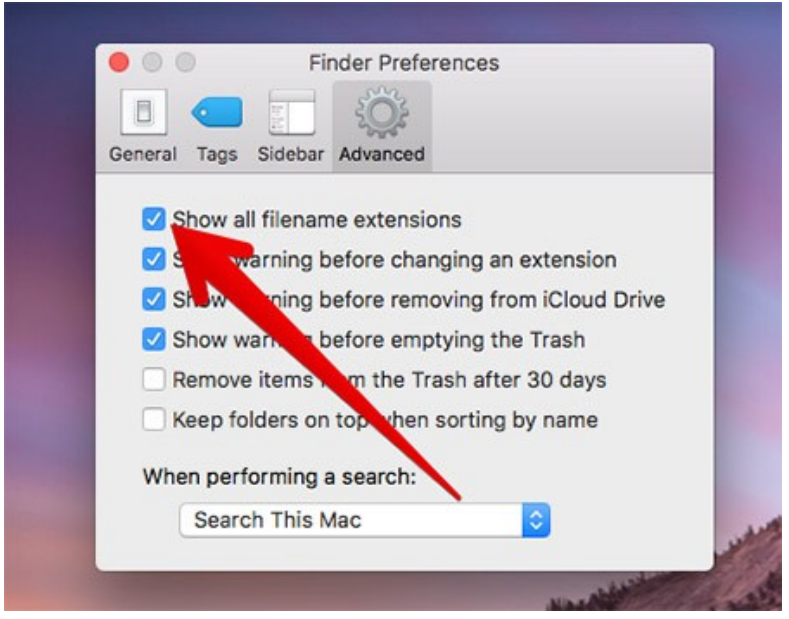
https://knowledge.autodesk.com/search-result/caas/sfdcarticles/sfdcarticles/How-to-enable-hidden-file-extensions-in-Windows.html



Hidden filename extensions on MAC OS:

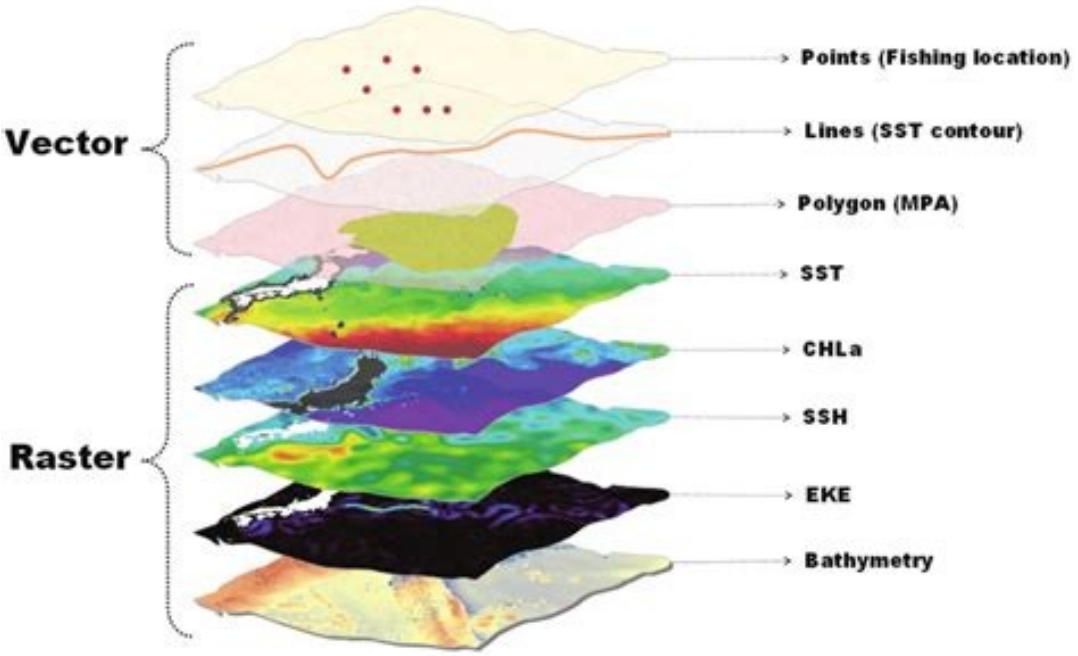
https://support.apple.com/guide/mac-help/show-or-hide-filename-extensions-on-mac-mchlp2304/mac

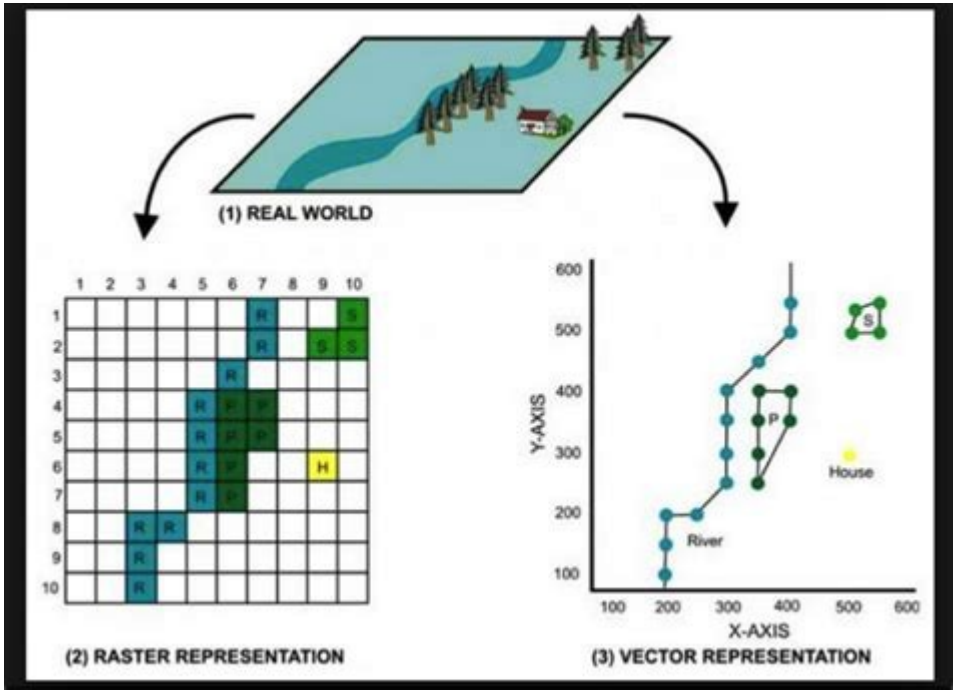




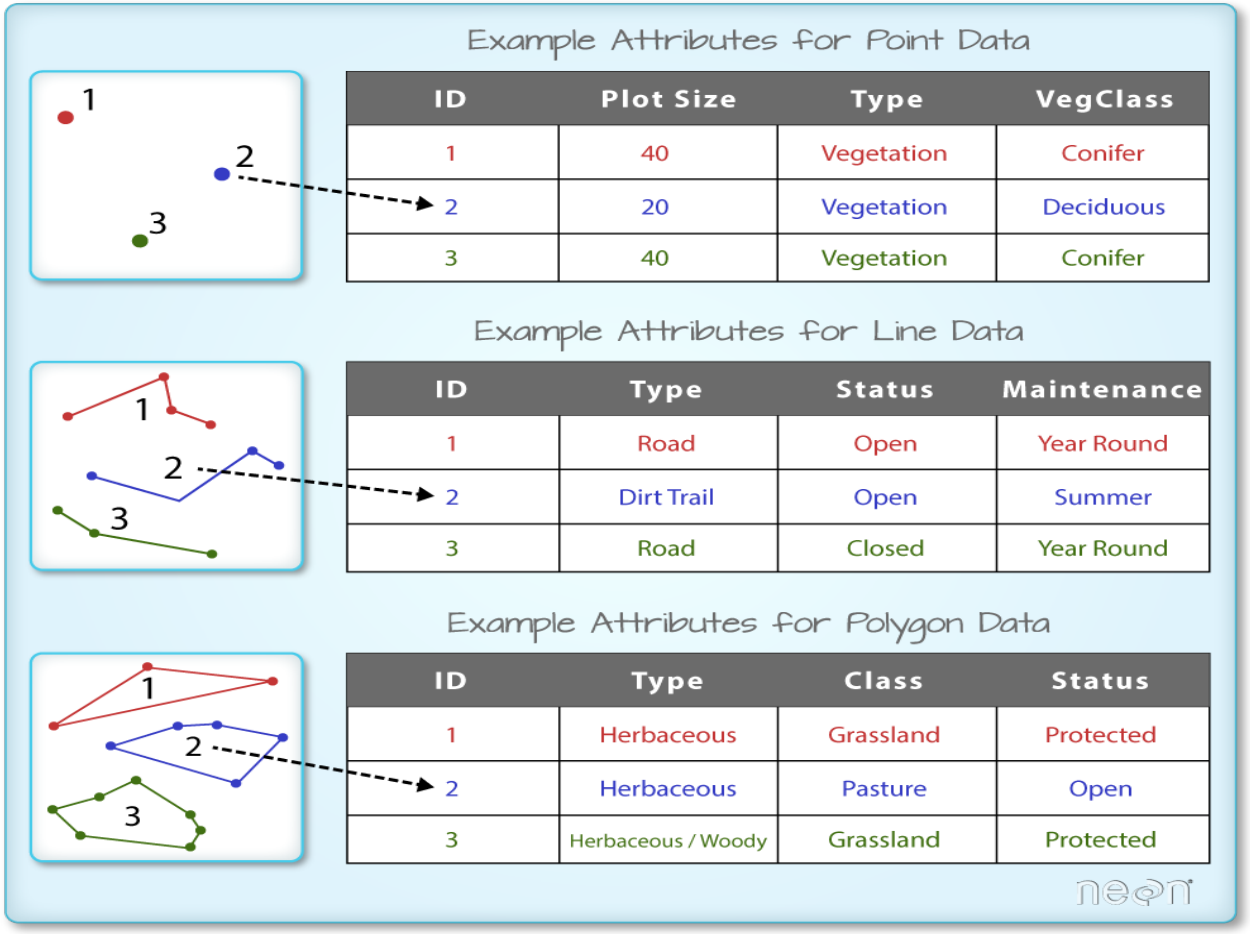
Geographic layers representation

Single layer





Vector Data



ID	Plot Size	Type	VegClass
1	40	Vegetation	Conifer
2	20	Vegetation	Deciduous
3	40	Vegetation	Conifer

ID	Type	Status	Maintenance
1	Road	Open	Year Round
2	Dirt Trail	Open	Summer
3	Road	Closed	Year Round

ID	Type	Class	Status
1	Herbaceous	Grassland	Protected
2	Herbaceous	Pasture	Open
3	Herbaceous / Woody	Grassland	Protected

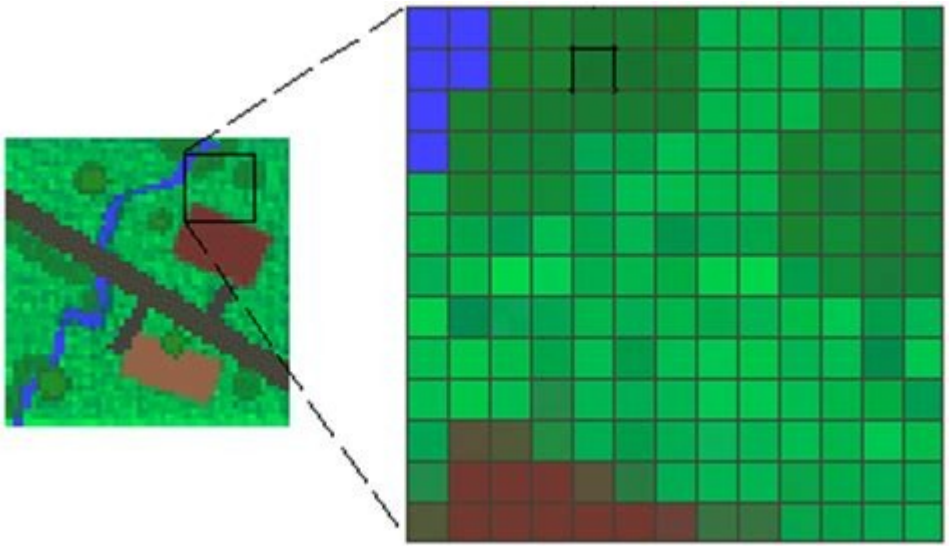
Formats
ogrinfo --formats

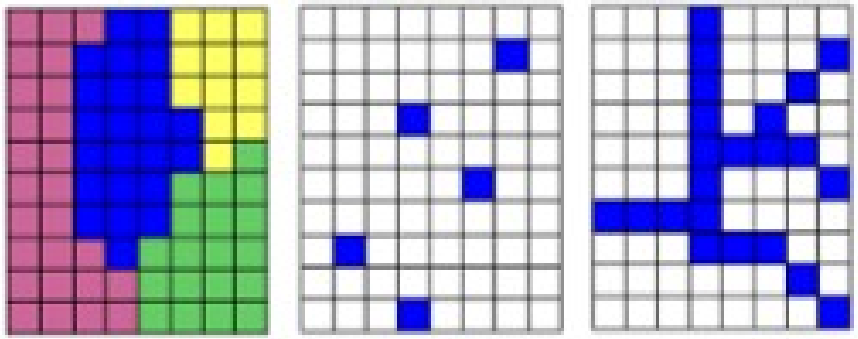
ESRI Shapefile -vector- (rw+v): ESRI Shapefile
GeoJSON -vector- (rw+v): GeoJSON
GPX -vector- (rw+v): GPX
GPKG -raster,vector- (rw+vs): GeoPackage
SQLite -vector- (rw+v): SQLite / Spatialite
KML -vector- (rw+v): Keyhole Markup Language (KML)
CSV -vector- (rw+v): Comma Separated Value (.csv)

Landscape Features

Roads, trails → lines
animal/plant presence absence → points
Land cover → polygons
Cadastral data → polygons, lines, points
Forest map → polygons

Raster Data



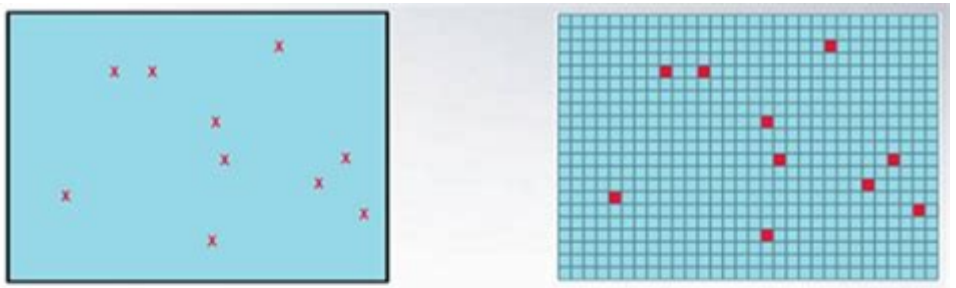


Formats
gdalnfo --formats

GTiff -raster- (rw+vs): GeoTIFF
AAIGrid -raster- (rwv): Arc/Info ASCII Grid
PNG -raster- (rwv): Portable Network Graphics
netCDF -raster,multidimensional raster,vector- (rw+s): Network Common Data Format
HDF5 -raster,multidimensional raster- (rovs): Hierarchical Data Format Release 5
HFA -raster- (rw+v): Erdas Imagine Images (.img)

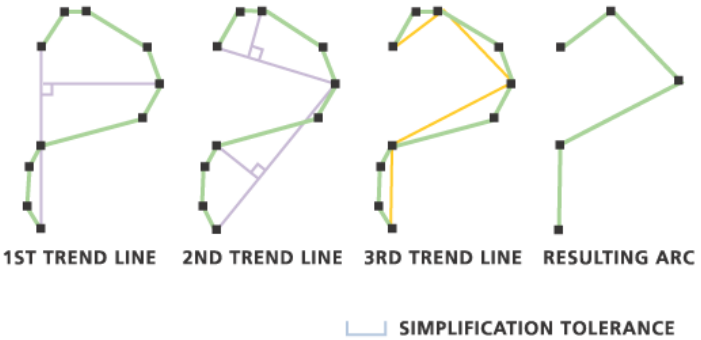
Landscape Features

Roads, trails → pixel lines
animal/plant presence absence → pixel points
Land cover → pixel/area polygons
Forest map → pixel/area polygons



Vector Features

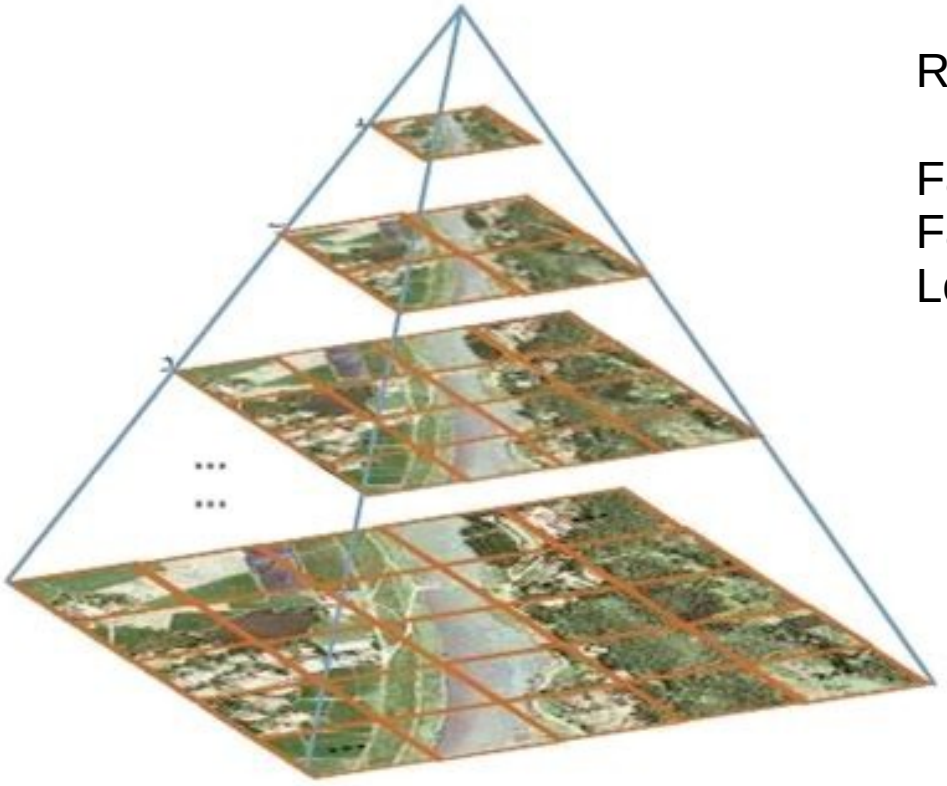
Metadata (projection, other info, author)
Vector geographic extension
Attribute table
Point accuracy,
Line accuracy



Raster Features

Metadata (projection, other info, author)
Pixel dimension
Raster geographic extension
Number of bands or layers
Pyramids and internal overview
Compression
No-data
Data type

Pyramids / internal overview /tiling



Raster features

Fast rendering for online application
Fast zoom in zoom out
Low bandwidth for large are

Raster data type

Understanding data type

	Ranges of GDAL data types		**Image Size**
GDAL data type	Minimum	Maximum	
Byte	0	255	39M
UInt16	0	65,535	78M
Int16, CInt16	-32,768	32,767	78M
UInt32	0	4,294,967,295	155M
Int32, CInt32	-2,147,483,648	2,147,483,647	155M
Float32, CFloat32	-3.4E38	3.4E38	155M
Float64, CFloat64	-1.79E308	1.79E308	309M

Raster and Vector Visualization

Open the bash terminal and run

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```

Raster Data Visualization

- Digital elevation model
  - One band → elevation value
- Satellite images
  - Multi bands Image: spectral value and QC value

Open the bash terminal and run

qgis /home/user/SE_data/exercise/geodata_small/dem.tif

Vector Data Visualization

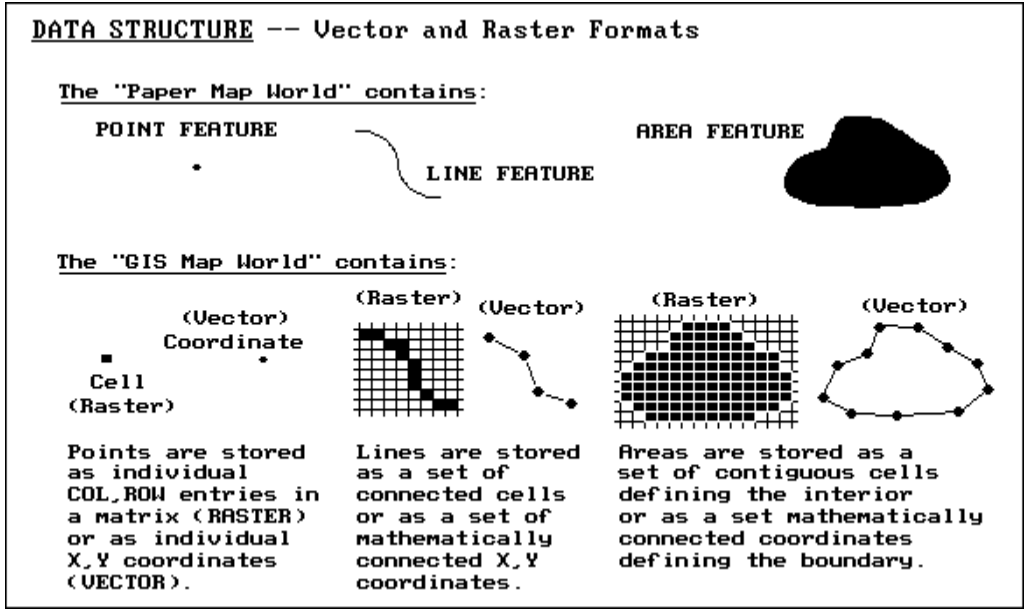
Country Border

Polygons and Vector Attribute

Open the bash terminal and run

qgis /home/user/SE_data/exercise/geodata/shp/TM_WORLD_BORDERS.shp

Conversion
from vector to raster
from raster to vector



A vector feature → can cover less then a pixel
A vector feature → can cover more then a pixel

Coarse Vector → Coarse Raster
Country border → 1km resolution raster
Municipality border → 100 m resolution raster

Raster → processing flow, modeling
Vector → final product, web visualization, attribute query