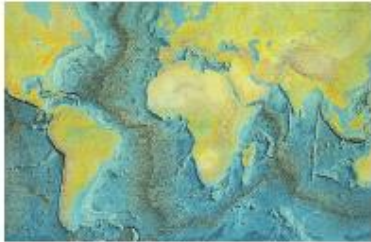


# Geography 1000

## Introduction to Physical Geography




Dr. Derek R. Peddle  
Professor of Geography  
derek.peddle@uleth.ca

D.Peddle - Geography 1000

1

## Today's Class ...

- The Earth's Size and Shape: Geoid 
- Position on Earth: Latitude and Longitude
- Direction and Navigation: Great Circles
- Maps: Scale and Projections
- GIS: Geographical Information Systems

→ Book: p 13-18; 21-25; 28-30.

D.Peddle - Geography 1000

2

## Earth Shape: A Sphere... ~ Almost...



D.Peddle - Geography 1000

3

## Earth Shape

Isaac Newton:

Theory of Gravity ...



Earth's rotation → Greater centrifugal force at equator;

Slight equatorial bulge...

Polar flattening - *oblateness*

**Newton:** Earth is an Oblate Ellipsoid, not a Sphere...

Later: Further Refined – Shape: GEOID

D.Peddle - Geography 1000

4

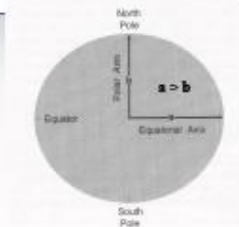
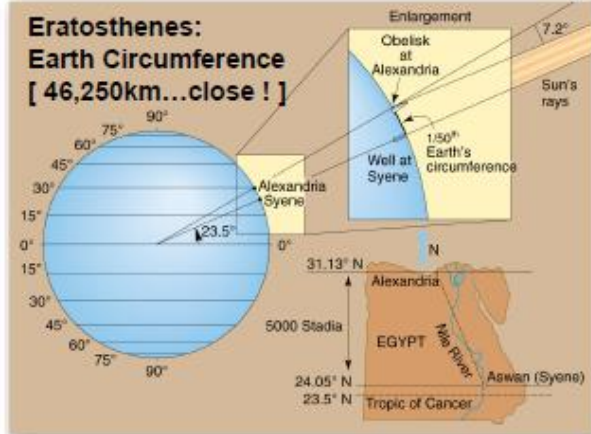


Figure 4.2 The shape of an oblate spheroid is determined by the relative length of the equatorial (meridional) axis (a) and the polar (oblateness) axis (b). The actual amount of flattening is greatly exaggerated in this diagram.

## Earth Size: 247 B.C.

### Eratosthenes: Earth Circumference [ 46,250km...close ! ]



D.Peddie - Geography 1000

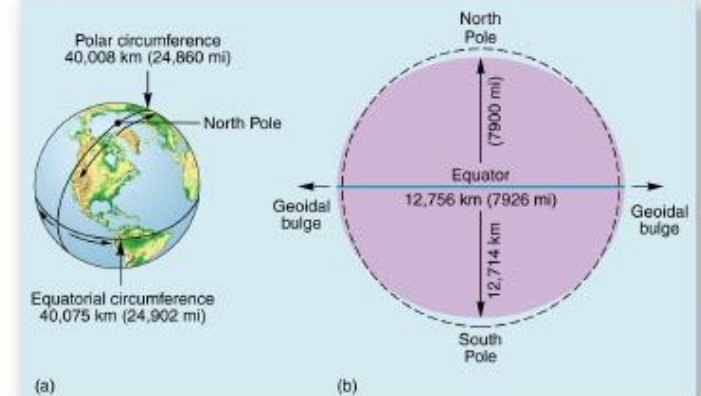
5

Christopherson, *Elemental Geosystems*

Copyright © Pearson Education, Inc.

## Earth's Size and Shape ... Today:

### Geoid



D.Peddie - Geography 1000

6

Christopherson, *Elemental Geosystems*

Copyright © Pearson Education, Inc.



D.Peddie - Geography 1000

7

## Location and Time on Earth

- Latitude
  - Latitudinal Geographic Zones
- Longitude
  - Prime Meridian and Standard Time
- Great Circles and Small Circles

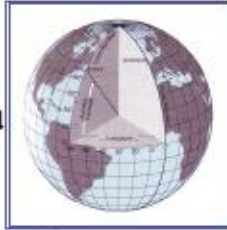
D.Peddie - Geography 1000

8

## Latitude and Longitude ~ Position

**Latitude** of a given position on Earth:

Angle north or south of the equator, measured from the center of the Earth

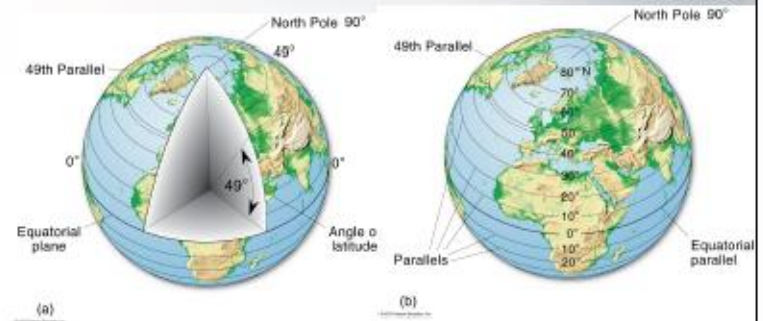


**Parallel**

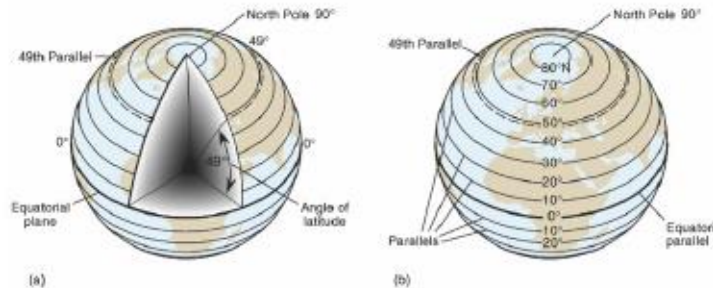
A line connecting all points along the same latitude

e.g. Arctic/Antarctic Circle, Equator, Tropic of Cancer/Capricorn

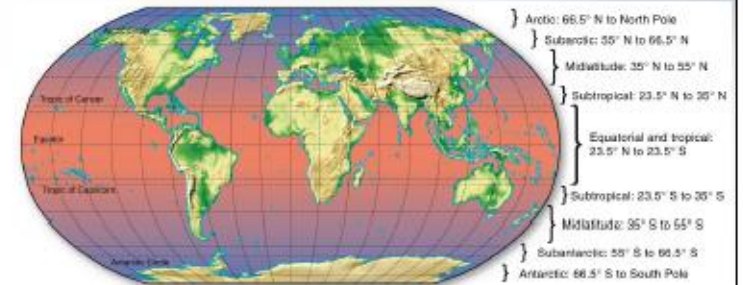
## Latitude



**Latitude** (same as last slide, just different view...)



## Latitudinal Geographic Zones

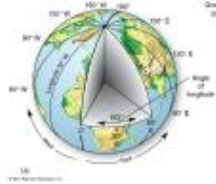




## Longitude

*Longitude* of a given position on Earth:

Angle east or west from the *Prime Meridian*, measured from the center of the Earth



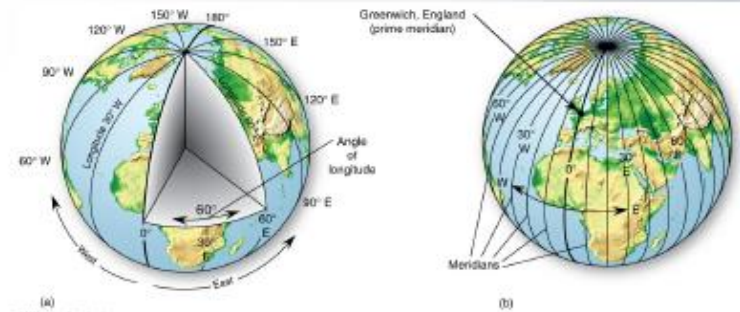
Prime Meridian ( $0^\circ$  longitude) - goes from north pole to south pole, through Greenwich, England

### Meridian

A line connecting all points along the same longitude

*Today:* Global Positioning Systems (GPS) used to determine latitude and longitude. (GPS: next week in class)

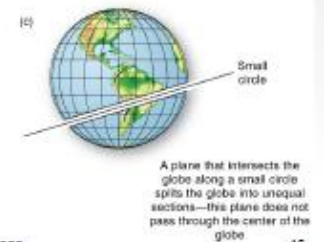
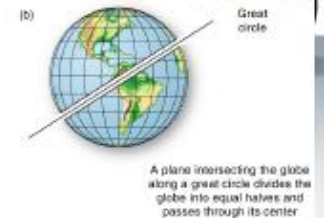
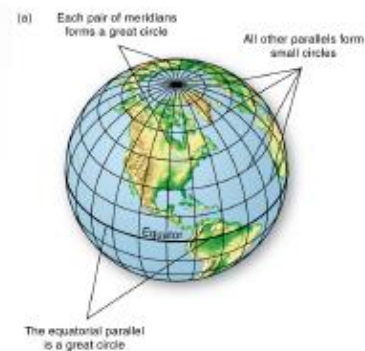
## Longitude



## Longitude and Time Zones



## Great Circles and Small Circles



## Mapping



- Maps are used every day
- Many geographical analyses involve a map...
- Information: features, attributes, spatial analysis

## Map Scale and Projections

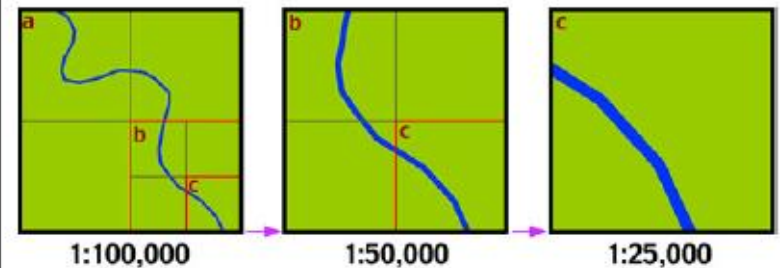
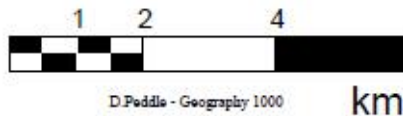


- Map Scale
  - Definition
  - Different ways
- Projections
  - Properties
  - Different types (classes) of projections

## Map scale

Ratio of distance on map to actual distance on the ground.

1. Verbal 1 cm equals 50,000 cm  
(1 cm equals 500m)
2. Representative Fraction (RF) 1 : 50,000
3. Graphic / bar scale:



## Map scale

small 1:1,000,000



large 1:50,000

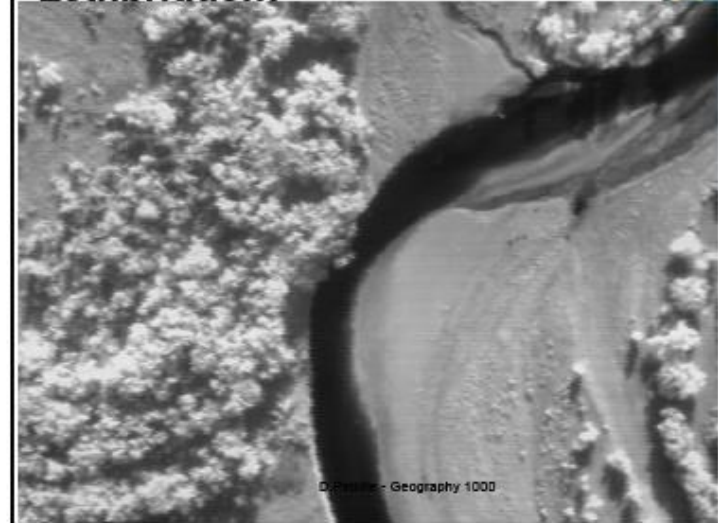


medium

1:250,000



## Lethbridae...



D.Peddie - Geography 1000

22

## Map Projections



- Earth is **3-D**. A Volume.
- But we use maps on a **2-D** Flat Surface
  - Computer screen, mobile device
  - Paper map / Book, Atlas
- **Projections** ~ Δ Dimension (D)
  - Transformation: **3-D → 2-D**

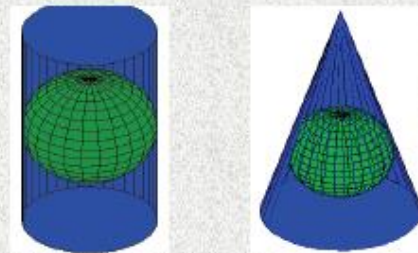
D.Peddie - Geography 1000

23

Earth, globe: 3-D (e.g. sphere)

Map: 2-D (flat paper, computer screen).

Is it possible to perfectly represent the globe in two dimensions ? **No!**



others...

**CYLINDRICAL PROJECTION**      **CONICAL PROJECTION**

D.Peddie - Geography 1000

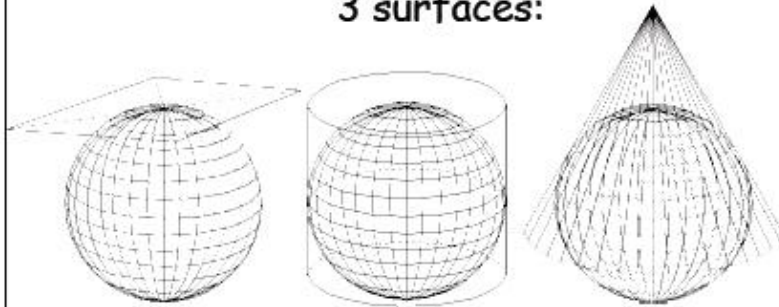
24



## Map projections

- mapping the sphere (3-D) onto the plane (2-D)

3 surfaces:



planar

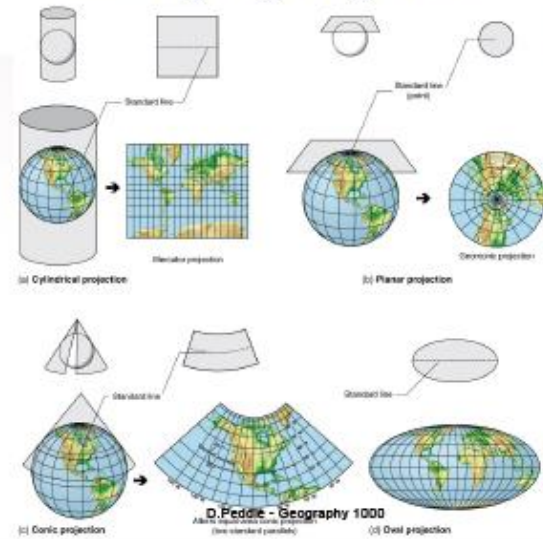
cylindrical

conical

D.Peddie - Geography 1000

25

## Classes of Map Projections



26

## Map projections

Distortion... something has to give!

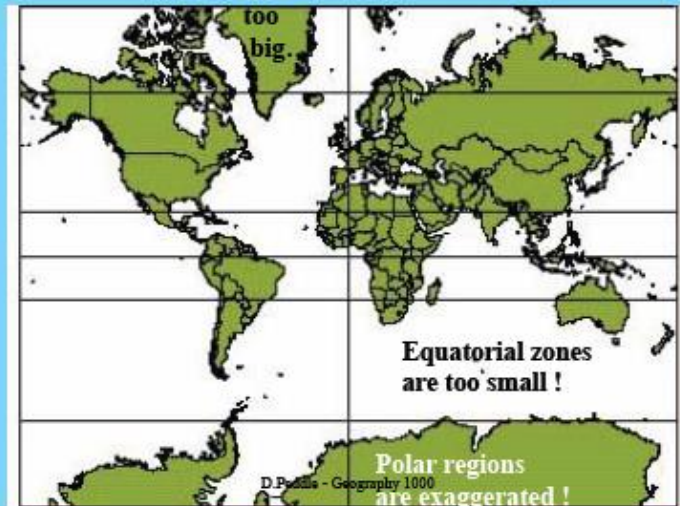
- a) Distance - equidistant
- b) Area - equal area
- c) Angles (Direction) - conformal
- d) Shape

Cannot preserve all properties...

D.Peddie - Geography 1000

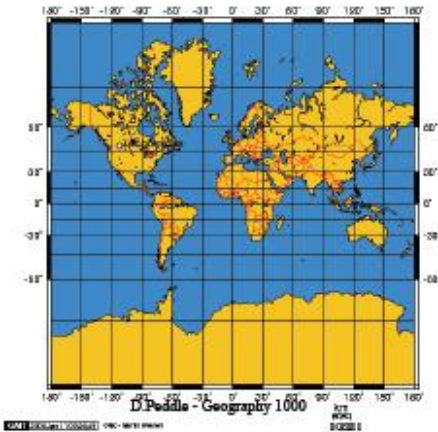
27

## Mercator Projection (a "direction-accurate" map)



# Mercators projection (1569)

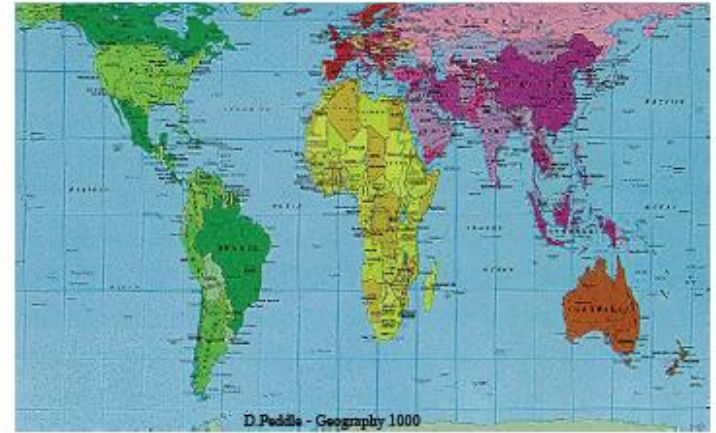
Cylindrical conformal projection.  
Good navigation map (angles, direction preserved)



29

# Peters projection (1974)

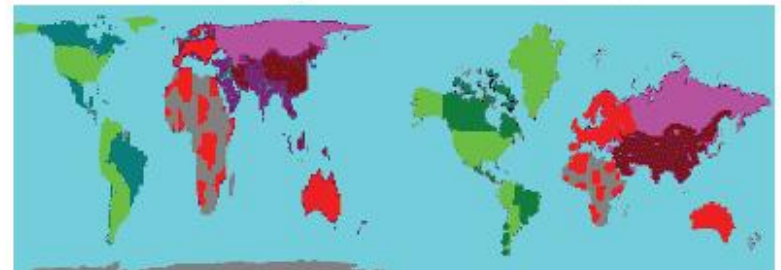
Equal area



**Who says north is up?**  
**It's just a convention....**



**Comparison Peters and Mercator**



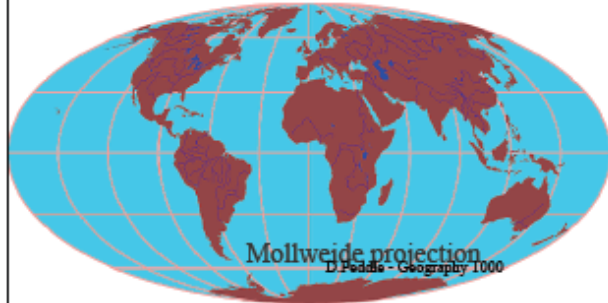
D. Peddle - Geography 1000

32



## Oval and Sinusoidal Projections

Used to show entire globe



Some distortion of all spatial elements

33

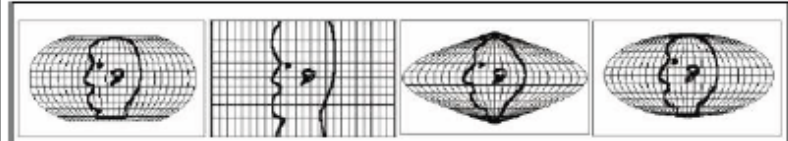
## A HEAD DRAWN ON THE ROBINSON PROJECTION TRANSFERRED TO 3 OTHER PROJECTIONS

Robinson

Mercator

Sinusoidal

Mollweide



A head drawn on one projection (Robinson's) has been transferred to the Mercator (center left) and a sinusoidal (center right) and finally to a Mollweide (far right). The 'natural' profile could have been drawn on any of these and then plotted on the others. This is just a way of getting a sense of what different projections do.

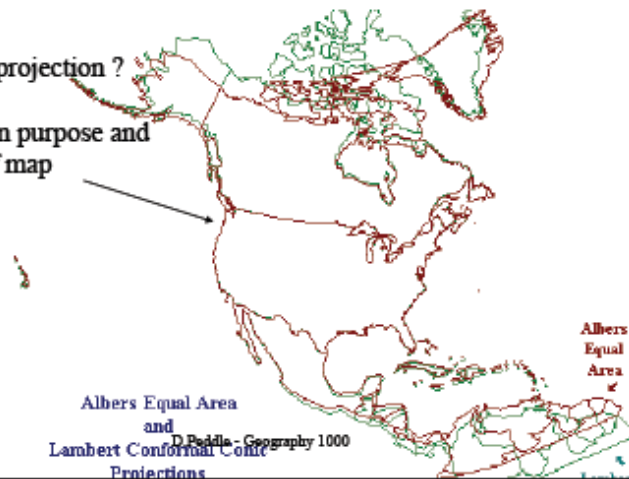
D.Peddie - Geography 1000

34

## Two Different Projections of North America

Choice of projection ?

Depends on purpose and location of map



## Spatial Sciences

- Remote Sensing
- Imaging Science
- Geographical Information Systems (GIS)
- Global Navigation Satellite System (GNSS)
  - e.g., Global Positioning System (GPS)
- Geodesy
- Surveying
- Digital Cartography, Computer Mapping
- Spatial Modeling
- Others...
- KEYS:
  1. Linkages
  2. New technologies

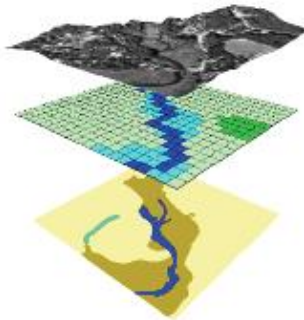


D.Peddie - Geography 1000

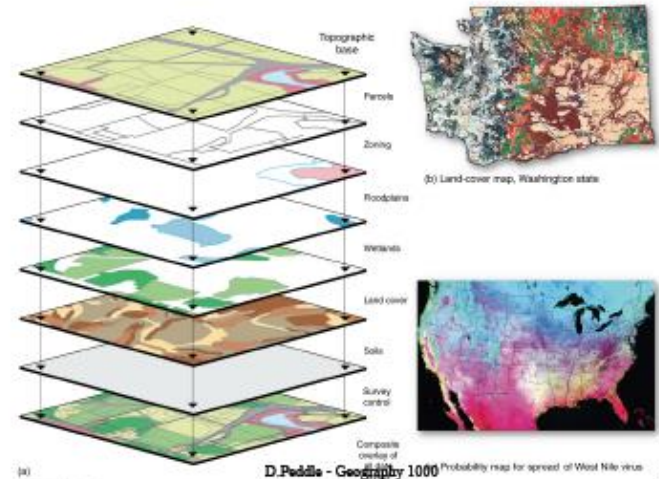
Page 36

# Geographical Information System

A computer-based information system to capture, manage, update, analyse, display, and output spatial data and information for use in a decision making context



# GIS: Combining and Analysing Data "Layers"



# GIS Data Sources



Maps



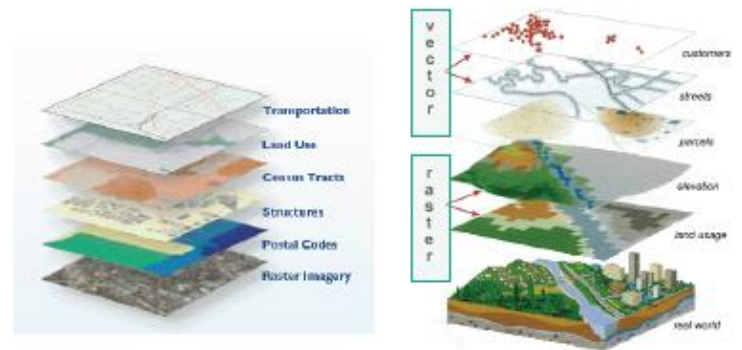
Databases

~ spatial data base management system (DBMS)  
positions <-> attributes



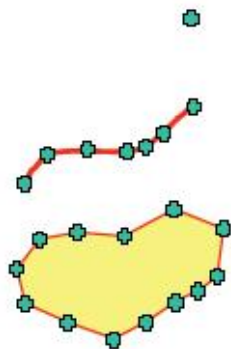
Images

# GIS Data Sources



# Vector Data

X,Y coordinates record map feature locations:

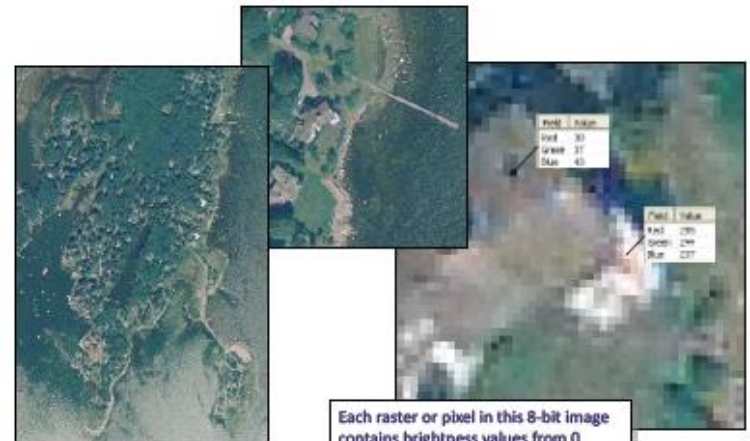


**Points**  
(fire hydrant, water well, utility pole...)

**Lines**  
(power line, road centerline, stream...)

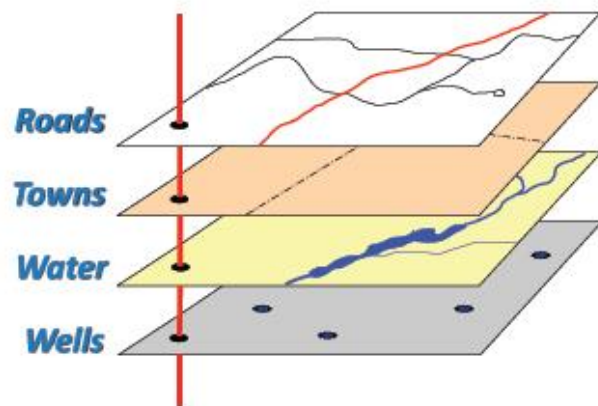
**Polygons**  
(land parcels, wetlands, flood zone...)

# Raster Data



Each raster or pixel in this 8-bit image contains brightness values from 0 (dark) to 255 (bright) for red, green and blue colours.

# Registered Data Layers



# Geography 1000

Introduction to  
Physical Geography

Questions ?...

