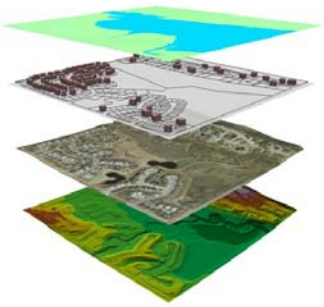
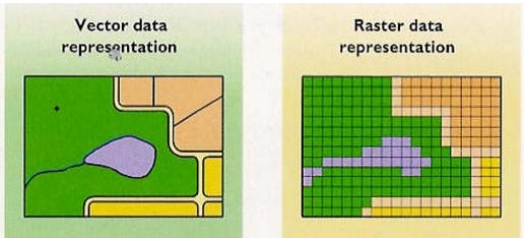
Introduction to Geographic Information Systems (GIS)

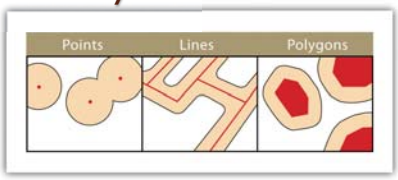


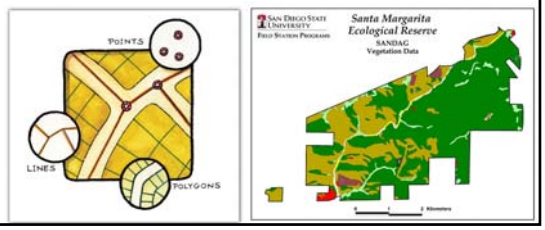
What is GIS?

- layers of data
- vector
- raster

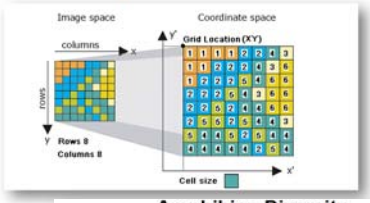


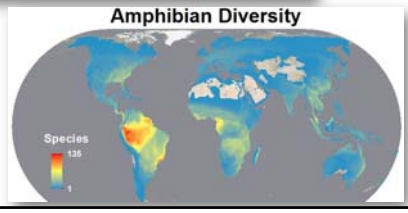
Vector Layers





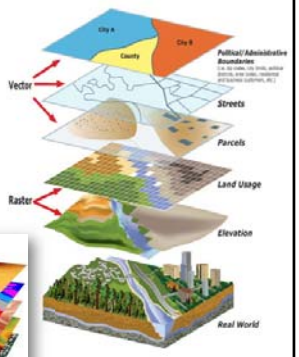
Raster Layers

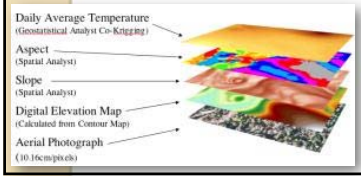




What is GIS?

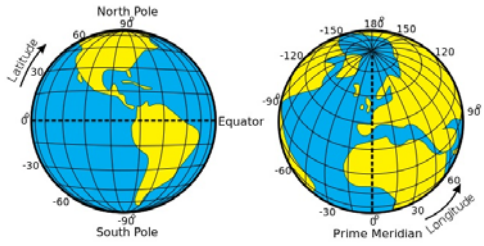
- X,Y data
- multi-layer
- spatial questions





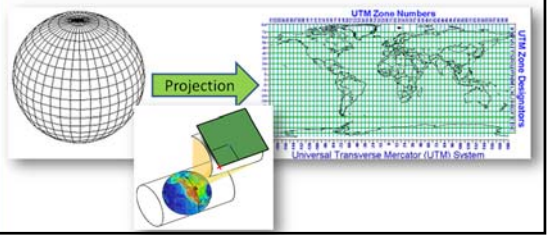
Coordinate Reference Systems

- Geographic CRS
  - spherical (3D)
  - 0° latitude = equator *(S = negative)*
  - 0° longitude = Greenwich *(W = negative)*



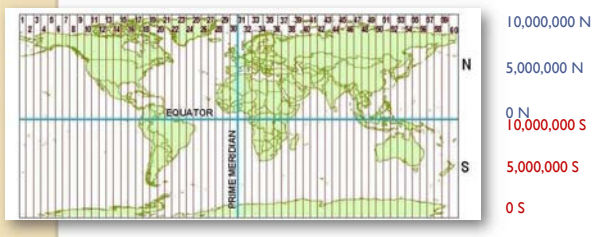
Coordinate Reference Systems

- Projected CRS
  - flattened (2D) -- *mathematical transformation*
  - "ellipsoid" & "datum" = spheroid shape fit to Earth
  - "projection" = convert 3D --> 2D
  - Universal Transverse Mercator (UTM)



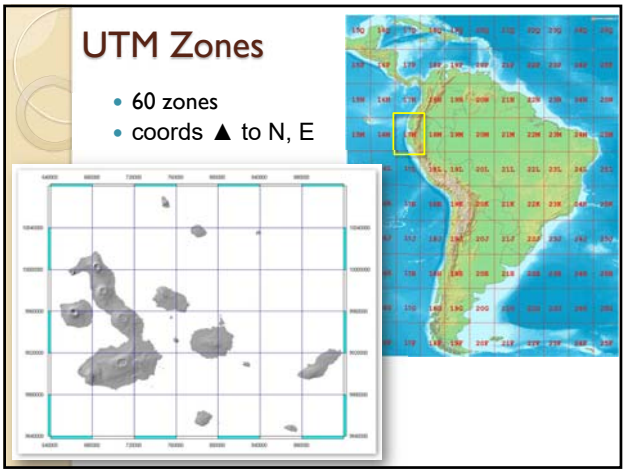
Universal Transverse Mercator (UTM)

- 1 meter = Equator-to-Pole / 10,000,000
  - "easting" from Greenwich (to E)
  - "northing" from Equator to North Pole
  - "southing" from South Pole to Equator



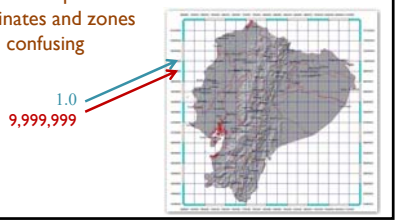
UTM Zones

- 60 zones
- coords ▲ to N, E



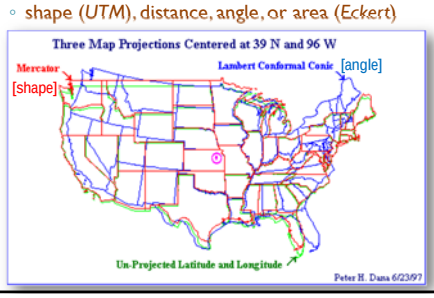
Compare Coordinate Systems

- Degrees Latitude - Longitude
  - (+) ease of understanding
  - (-) Longitude distance *changes* w/ Latitude
- UTM
  - (+) distances simple
  - (-) coordinates and zones can be confusing

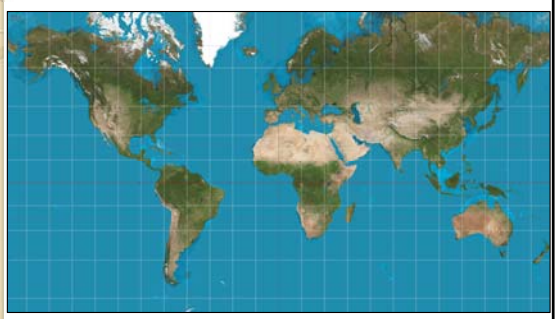


Compare Projections

- Earth *not* perfect spheroid
  - some ellipsoids fit better (we use WGS84)
- Projections can Conserve:
  - shape (*UTM*), distance, angle, or area (*Eckert*)

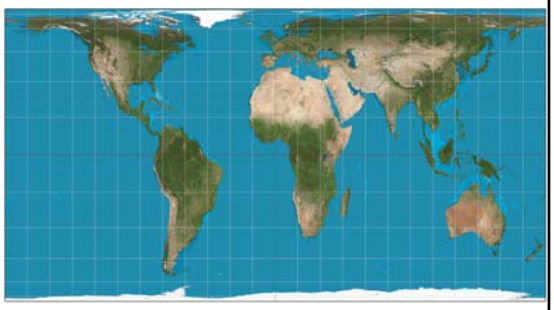


Mercator Projection



projection conserves "shape"

Cylindrical Equal-Area Projection



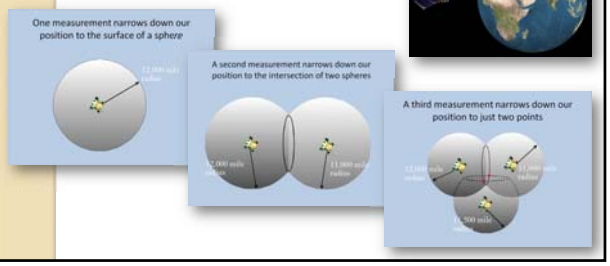
Recall "Area" hypothesis for tropical diversity: tropics are BIG

Global Positioning System (GPS)

- What Does it Do?
  - record waypoints & tracks
  - measure distances, calculate areas

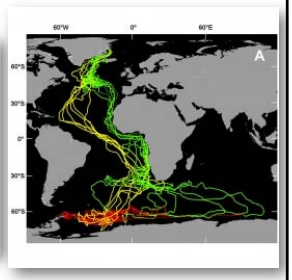
Global Positioning System (GPS)

- How Does it Work?
  - satellites send location, time
  - unit calculates position
  - *error estimates* (>3 satellites)



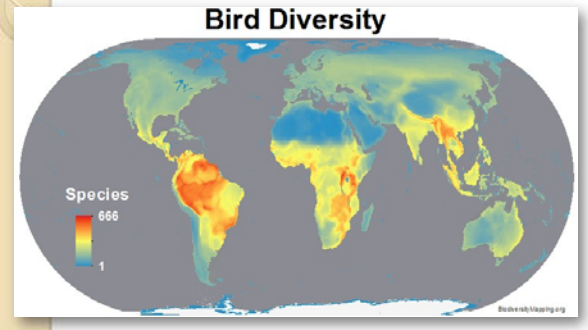
Uses of GIS - Display Data

- geographic data:
  - species locations
  - migration routes
  - *and much more!*



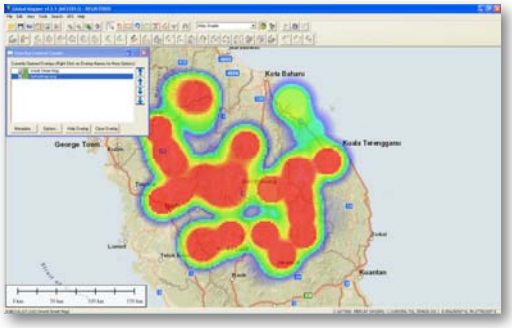
Uses of GIS - Create Maps

Uses of GIS - Data Visualizations

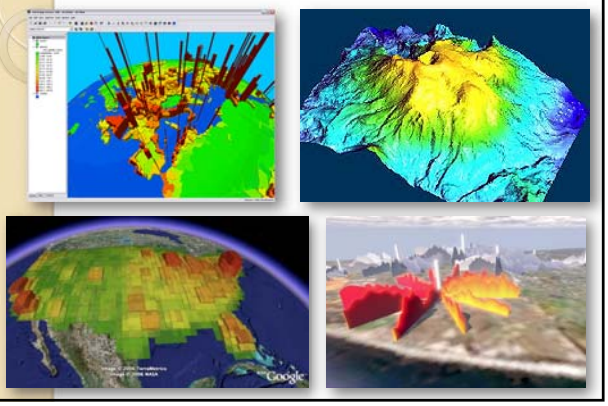


Uses of GIS - Data Visualizations

"Heat Map": proximity to landfills

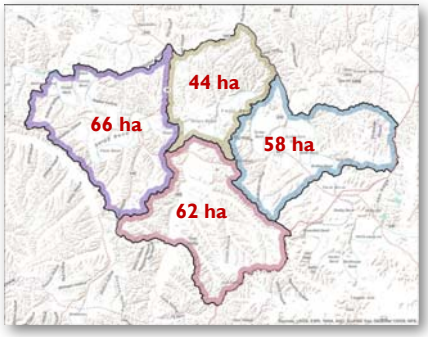


Uses of GIS - Advanced Visualizations



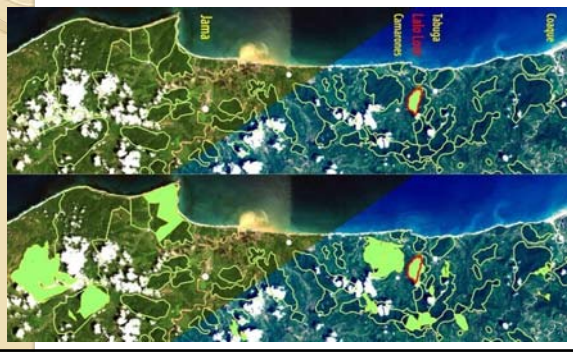
Uses of GIS - Spatial Analysis

- Distances & Areas



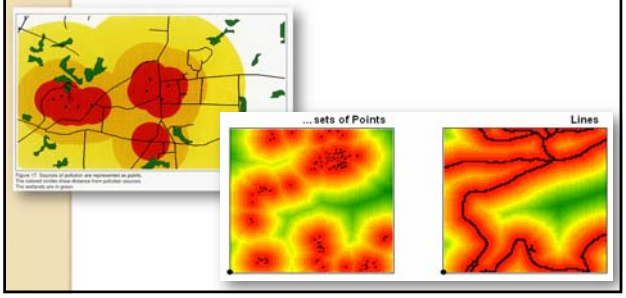
Uses of GIS - Spatial Analysis

- Manabí Biological Corridor



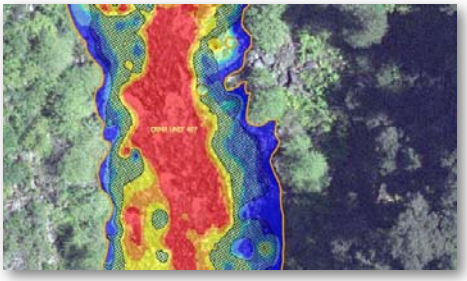
Uses of GIS - Spatial Analysis

- Proximity
  - pollution sources → wetlands
  - towns or roads → bird nests



Uses of GIS - Spatial Analysis

- Combine Data: reserve location
  - towns, slope, elevation, habitat, rainfall, etc.

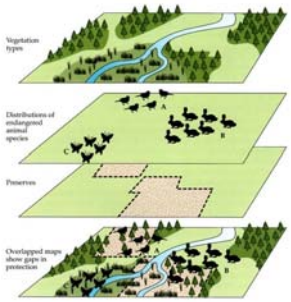


Uses of GIS - Advanced Analyses

- watersheds
- home range
- extract data for modelling

Ceiba GIS Projects

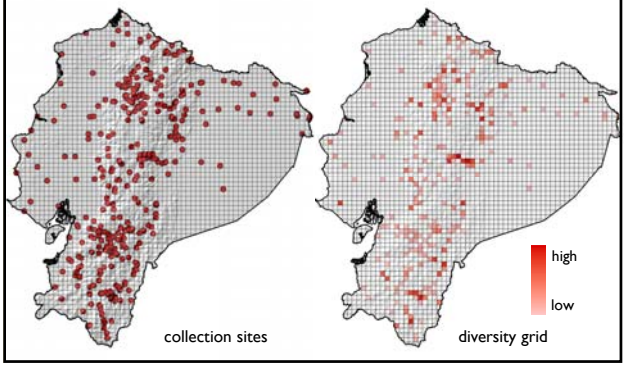
- Orchid Gap Analysis



METHOD

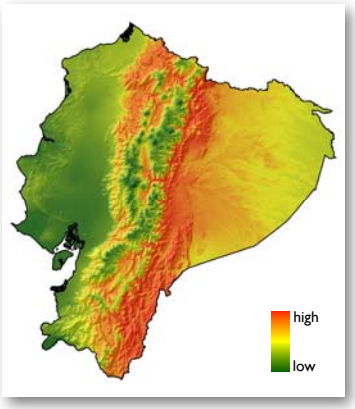
1) map species distributions
2) map reserve & protected areas
3) find unprotected areas ("gaps")
4) recommend new reserves

Ceiba Orchid Gap Analysis



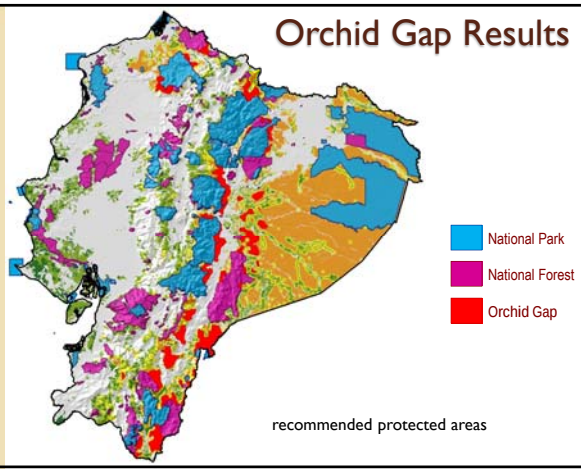
collection sites diversity grid

Ceiba Orchid Gap Analysis



predicted orchid diversity

Orchid Gap Results



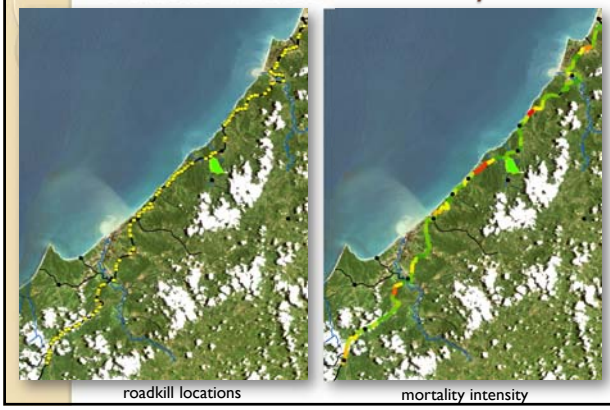
recommended protected areas

Ceiba GIS Projects

- Manabí Wildlife Mortality
  - weekly highway surveys
  - GPS all roadkill

roads

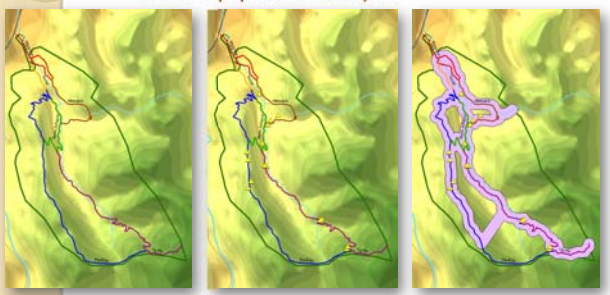
Manabí Wildlife Mortality



roadkill locations mortality intensity

Ceiba GIS Projects

- Mantled Howler Monkey Dynamics
  - map troop locations
  - estimate population density & size



trails troop locations surveyed area