Introduction to Geographic Information Systems (GIS)

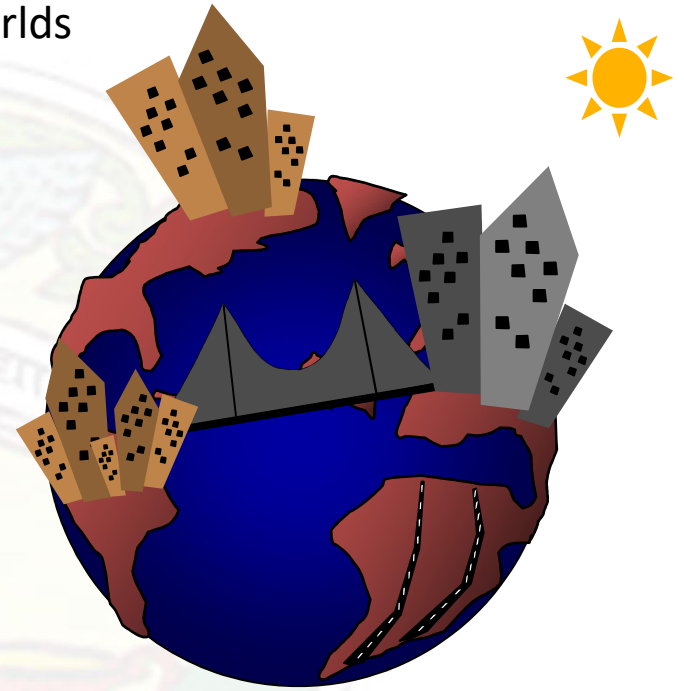
Outlines

- Introduction
- Who use GIS? & what can we do with GIS
- How does GIS work?
- Geography database & types of data
- Features of GIS
- SDI
- summary

Natural World

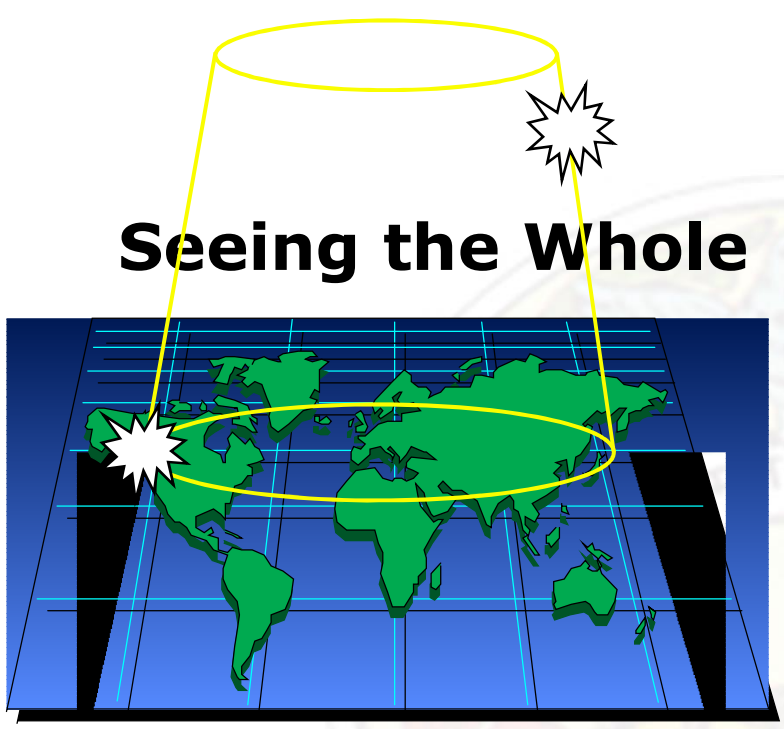
We Live in Two Worlds

Constructed World



. . . These Are Increasingly In Conflict

Context and Content



- Patterns
- Linkages
- Trends

- Watersheds
- Communities
- Neighborhoods
- Districts

- Geographic Information System (GIS) is a computer-based system including software, hardware, people, and geographic information

- A GIS can:

  create, edit, query, analyze, and display map information on the computer

Geographic Information System

- Geographic – 80% of government data collected is associated with some location in space
- Information - attributes, or the characteristics (data), can be used to symbolize and provide further insight into a given location
- System – a seamless operation linking the information to the geography – which requires hardware, networks, software, data, and operational procedures

…not just software!

…not just for making maps!

Who uses GIS?

- International organizations
  - UN HABITAT, The World Bank, UNEP, FAO, WHO, etc.
- Private industry
  - Transport, Real Estate, Insurance, etc.
- Government
  - Ministries of Environment, Housing, Agriculture, etc.
  - Local Authorities, Cities, Municipalities, etc.
  - Provincial Agencies for Planning, Parks, Transportation, etc.
- Non-profit organizations/NGO's
  - World Resources Institute, ICMA, etc.
- Academic and Research Institutions
  - Smithsonian Institution, CIESIN, etc.

What can you do with a GIS?

- The possibilities are unlimited…
  - Environmental impact assessment
  - Resource management
  - Land use planning
  - Tax Mapping
  - Water and Sanitation Mapping
  - Transportation routing
  - and more ...

How does a GIS work?

- GIS data has a spatial/geographic reference
  - This might be a reference that describes a feature on the earth using:
    - a latitude & longitude
    - a national coordinate system
    - an address
    - a district
    - a wetland identifier
    - a road name

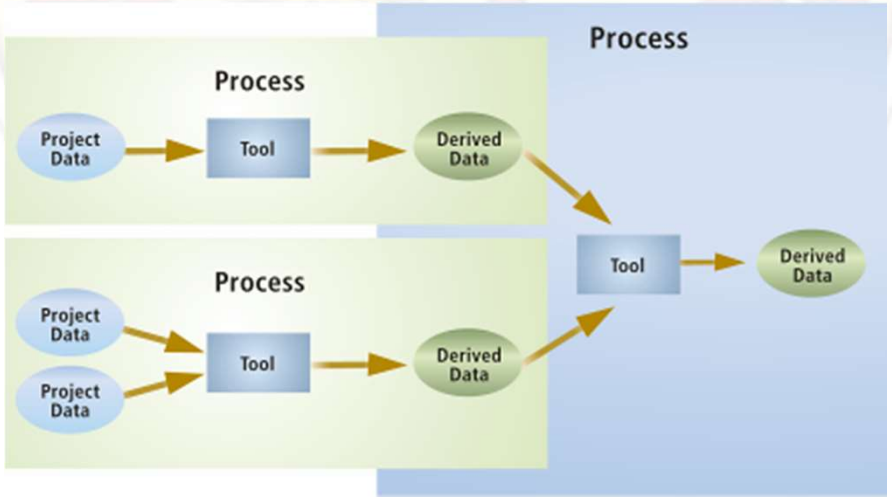
Two fundamental types of data

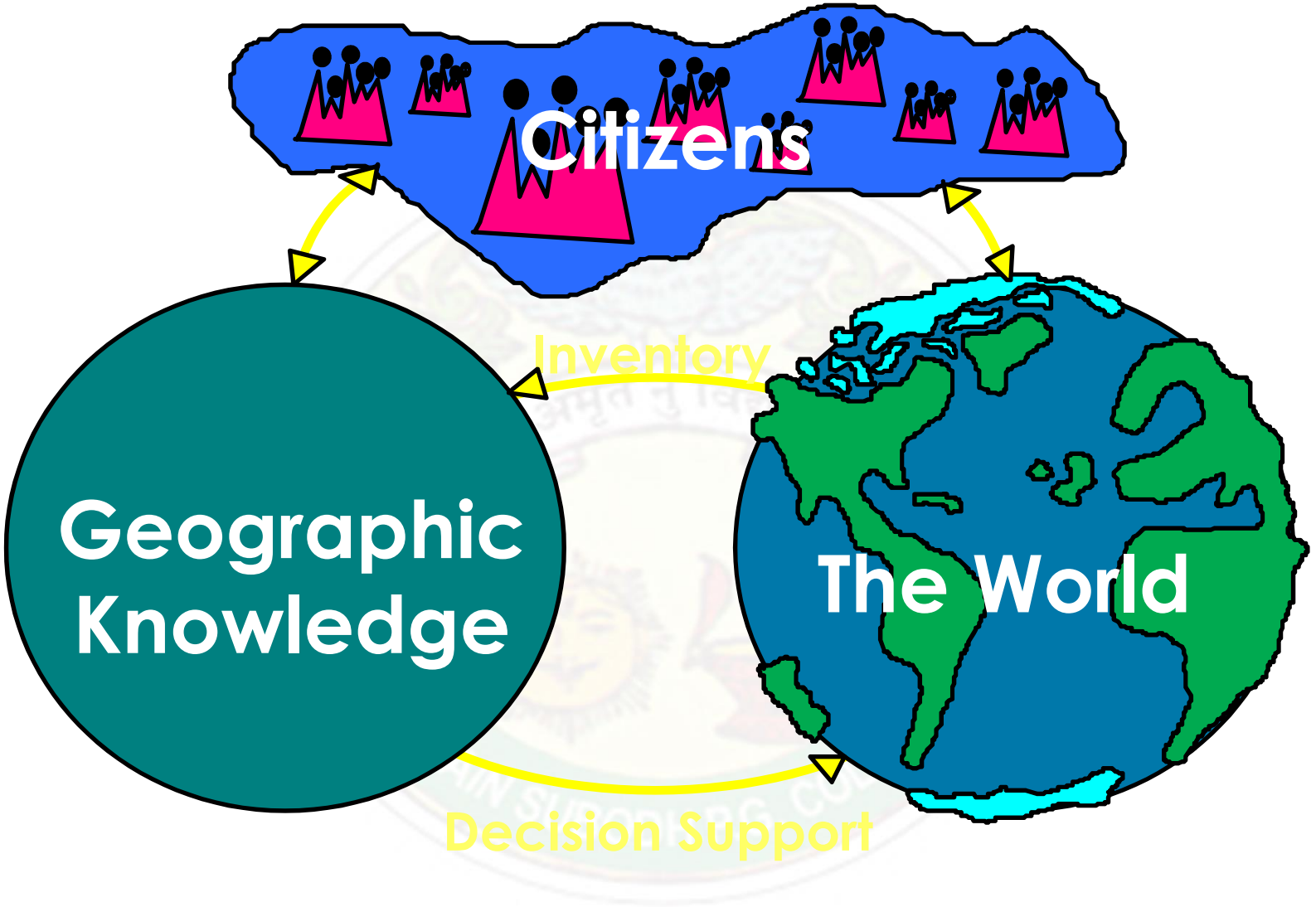
- Vector
  - A series of x,y coordinates
  - For discrete data represented as points, lines, polygons
- Raster
  - Grid and cells
  - For continuous data such as elevation, slope, surfaces

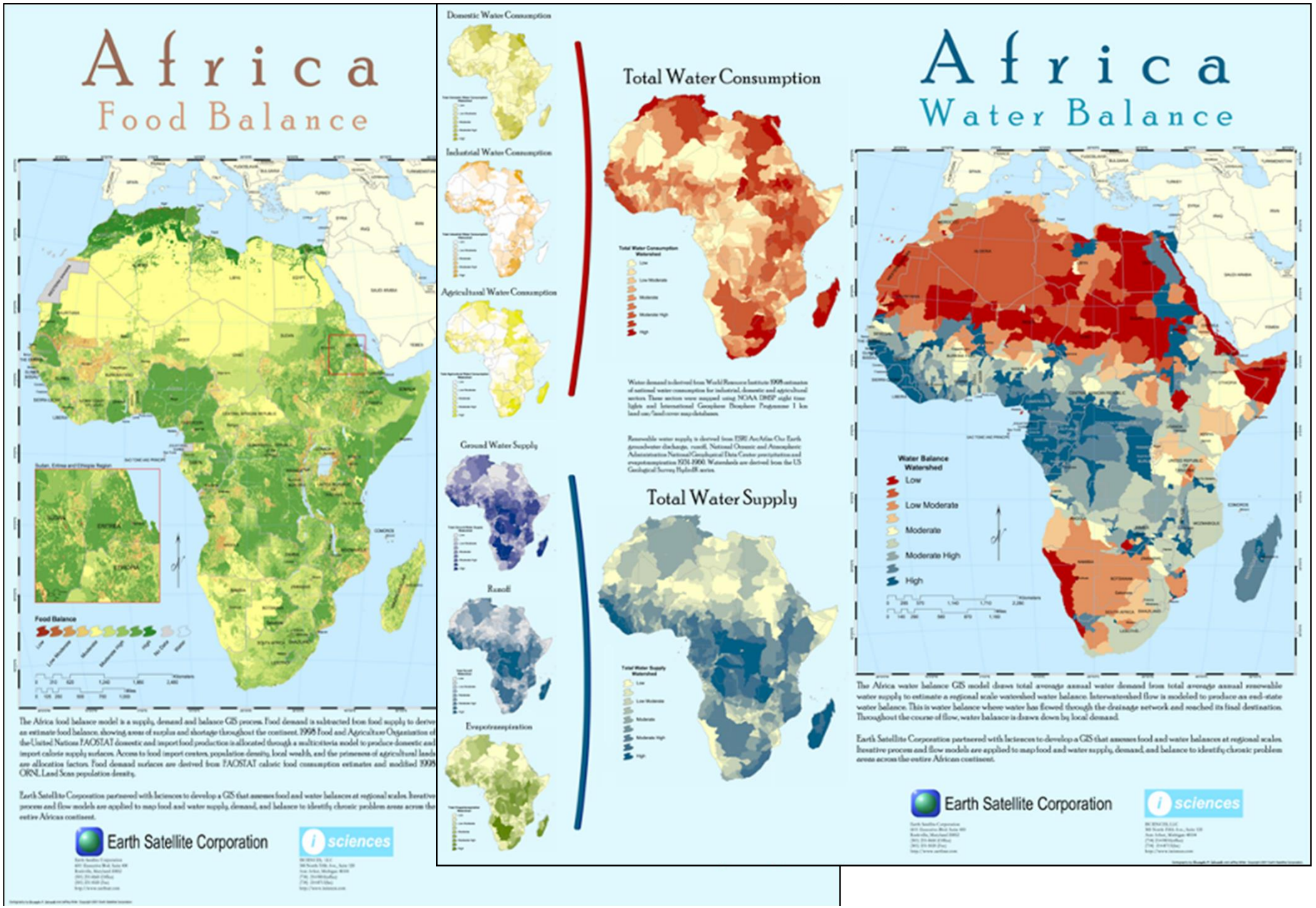
- A Desktop GIS should be able to handle both types of data effectively!

features of a GIS

- Produce good cartographic products (translation = maps)
- Generate and maintain metadata
- Use and share geoprocessing models
- Managing data in a geodatabase using data models for each sector




Citizens
Inventory
Geographic Knowledge
The World
Decision Support


Africa
Food Balance
Food Balance
The Africa food balance model is a supply, demand and balance GIS process. Food demand is subtracted from food supply to derive an estimate food balance, showing areas of surplus and shortage throughout the continent. 1998 Food and Agriculture Organization of the United Nations FAOSTAT domestic and import food production is allocated through a multicriteria model to produce domestic and import calorie supply surfaces. Access to food import centers, population density, local wealth, and the primeness of agricultural lands are allocation factors. Food demand surfaces are derived from FAOSTAT caloric food consumption estimates and modified 1998 ORNL Land Scan population density.
Earth Satellite Corporation partnered with Iscences to develop a GIS that assesses food and water balances at regional scales. Iterative process and flow models are applied to map food and water supply, demand, and balance to identify chronic problem areas across the entire Africas continent.
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Domestic Water Consumption
Industrial Water Consumption
Agricultural Water Consumption
Ground Water Supply
Runoff
Evapotranspiration
Total Water Consumption
Water demand is derived from World Resource Institute 1998 estimates of national water consumption for industrial, domestic and agricultural sectors. These sectors were mapped using NOAA DMSP night time lights and International Geosphere Biosphere Programme 1 km land use/land cover map databases.
Renewable water supply is derived from ESRI ArcAtlas Our Earth groundwater discharge, runoff, National Oceanic and Atmospheric Administration National Geophysical Data Center precipitation and evapotranspiration 1951-1980. Watersheds are derived from the US Geological Survey HydroSR series.
Total Water Supply
Africa
Water Balance
Water Balance Watershed
Low
Low Moderate
Moderate
Moderate High
High
The Africa water balance GIS model draws total average annual water demand from total average annual renewable water supply to estimate a regional scale watershed water balance. Interwatershed flow is modeled to produce an end-state water balance. This is water balance where water has flowed through the drainage network and reached its final destination. Throughout the course of flow, water balance is drawn down by local demand.
Earth Satellite Corporation partnered with Iscences to develop a GIS that assesses food and water balances at regional scales. Iterative process and flow models are applied to map food and water supply, demand, and balance to identify chronic problem areas across the entire African continent.
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Thank You!