



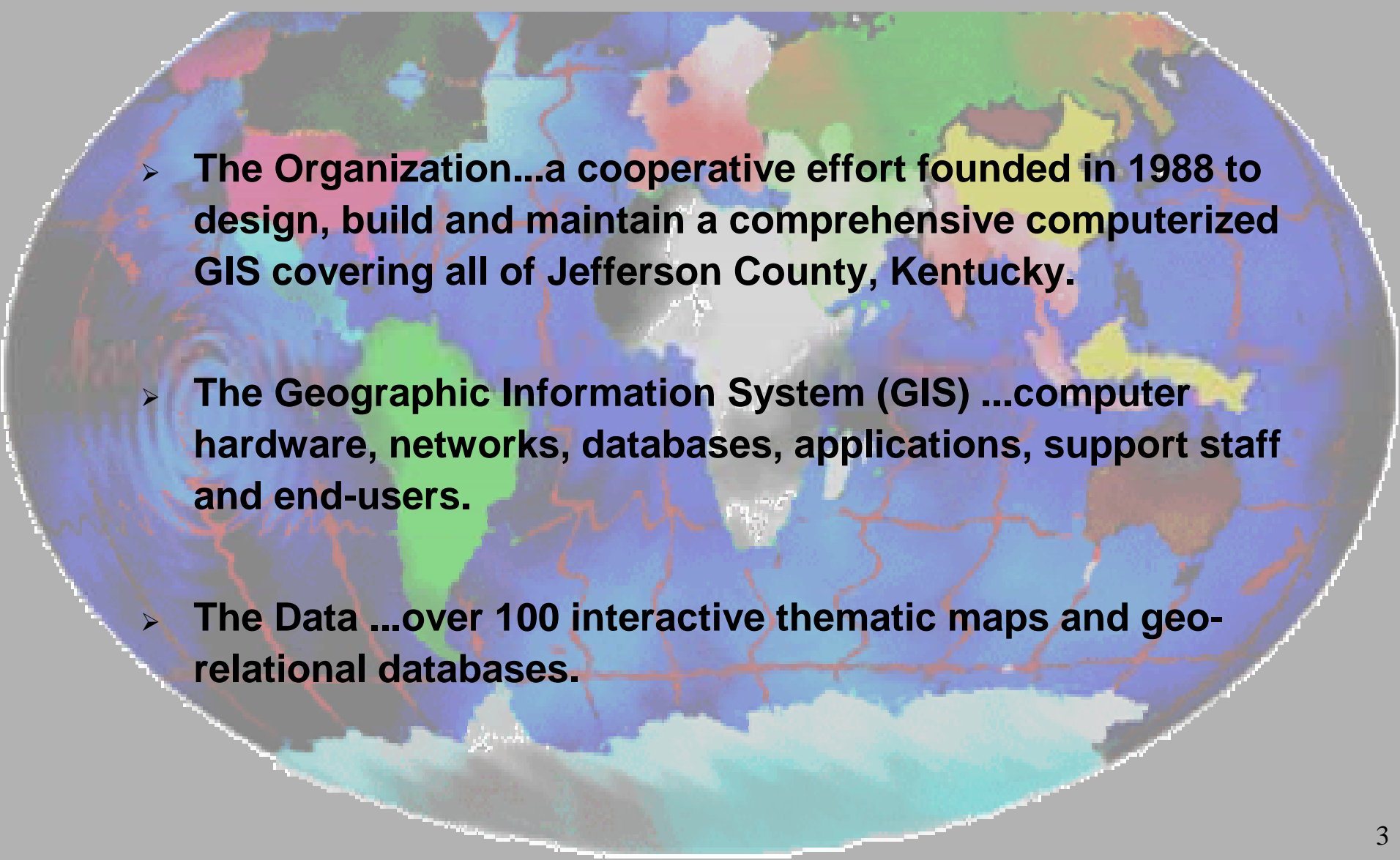
Introduction to the LOJIC GIS

www.lojic.org


Learning Objectives

- 
- **Basics of Geographic Information Systems**
 - **Fundamental Skills For Success:**
 - Computer basics*
 - Database design basics*
 - **Visualizing Your Data**
 - **GIS Data Sources**
 - **Resources**

What is LOJIC ?

- 
- **The Organization...a cooperative effort founded in 1988 to design, build and maintain a comprehensive computerized GIS covering all of Jefferson County, Kentucky.**
 - **The Geographic Information System (GIS) ...computer hardware, networks, databases, applications, support staff and end-users.**
 - **The Data ...over 100 interactive thematic maps and geo-relational databases.**

LOJIC GIS Partners

- 
- **Louisville & Jefferson County Metro Government**
 - **Property Valuation Administrator**
 - **Metropolitan Sewer District**
 - **Louisville Water Company**

What is GIS?

GIS: Geographic Information Systems.


What is it, where is it, why is it there, and what relationships exist?

*Watershed, Pollution,
Industrial runoff.*


*Beargrass Creek Water
Quality Monitoring Site*




What Makes A GIS?

- 
- **Computers, software, networks, scanners, digitizers, plotters...**
 - **Data, standards and quality control**
 - **Metadata, data dictionaries.**
 - **And most of all; communication, people and partnerships!**

Why GIS?

- 
- **Geography is everywhere!**
 - **Visual and interactive presentation of complex thematic data.**
 - **Easier to interpret than spreadsheets.**
 - **Promotes better decision making.**
 - **Empowers partnerships, interaction and public access.**

GIS, More Than A Thousand Words!

- 
- **More than a snapshot or a map, an interactive, visual & often real-time representation of geographic themes** (*populations, habitats, landuse, hydrology, watersheds, sampling sites, addresses, etc.*)
 - **Powerful research, analysis, presentation & teaching tool** (*enhances problem solving abilities, reveals complex and often hidden relationships, patterns and trends, strengthens critical thinking skills.*)
 - **Modeling, forecasting, planning** (*landuse planning, hydrologic modeling, wildfire management, preservation.*)

Thematic Map Features are Spatially Represented as:

- **Point Features** (*discrete spatial objects like; cities on a large scale map, water monitoring sites, trees, wells, power poles, manholes, site addresses, etc...*)

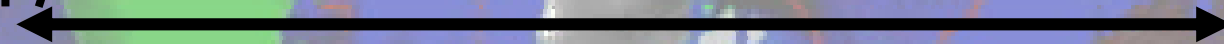


X,Y location

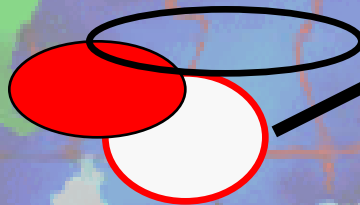


- **Line/Arc Features** (*linear spatial objects like; streets, contours, streams, sewers, power lines, etc...*)

Length, direction

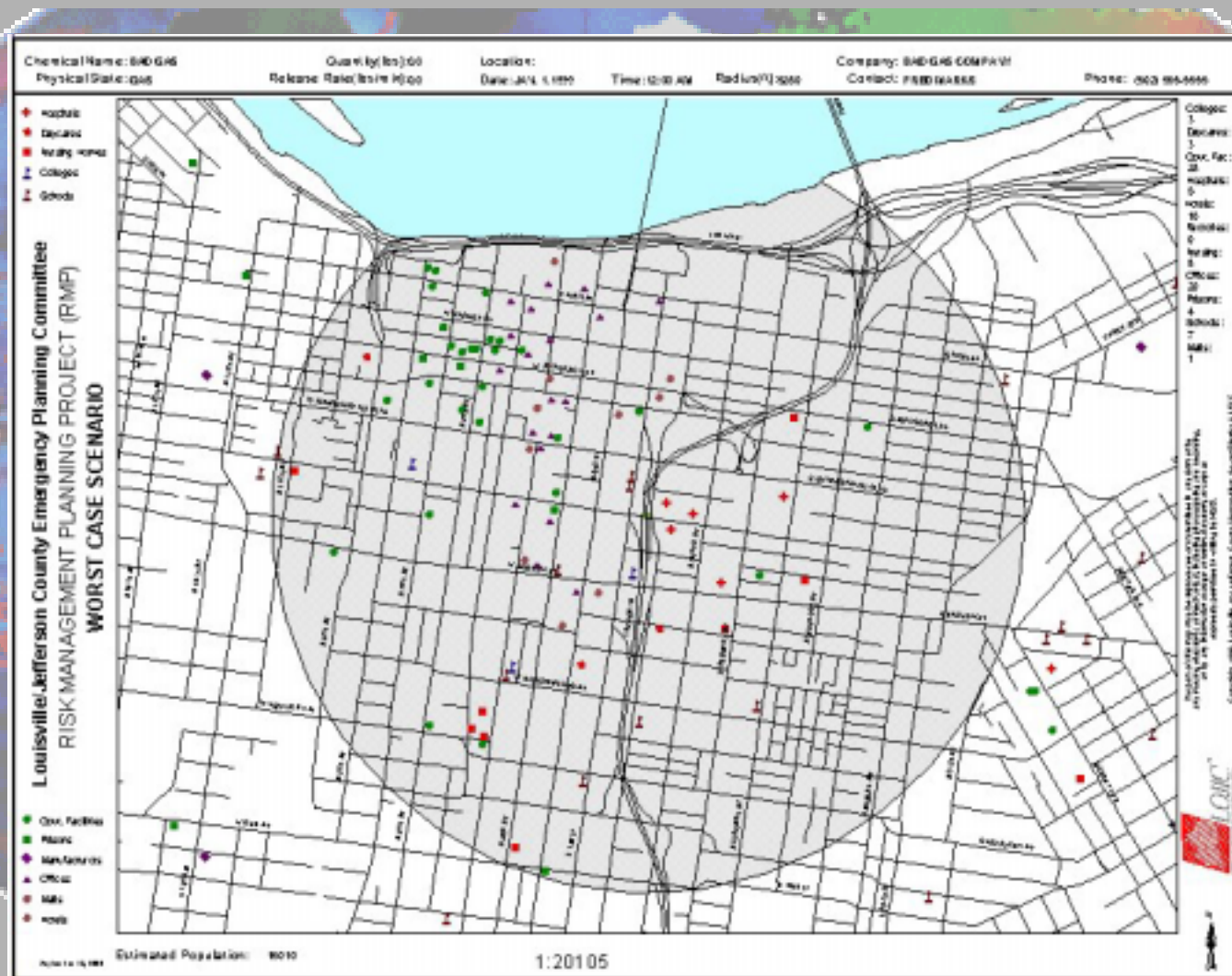


- **Polygon Features** (*areal spatial objects like; lakes, parcels, country's, islands, cultural and political boundaries, watersheds, etc...*)



Perimeter, area

These Thematic Map Features Can Be Overlaid for Spatial Analysis



Spatial Analysis Can Reveal, & Answer Questions About, Complex Relationships, Patterns & Trends

- **Adjacency - geographic features that share a common boundary:**

Example:

A golf course next to a stream or lake.

- **Containment - geographic features contained within area features:**

Example:

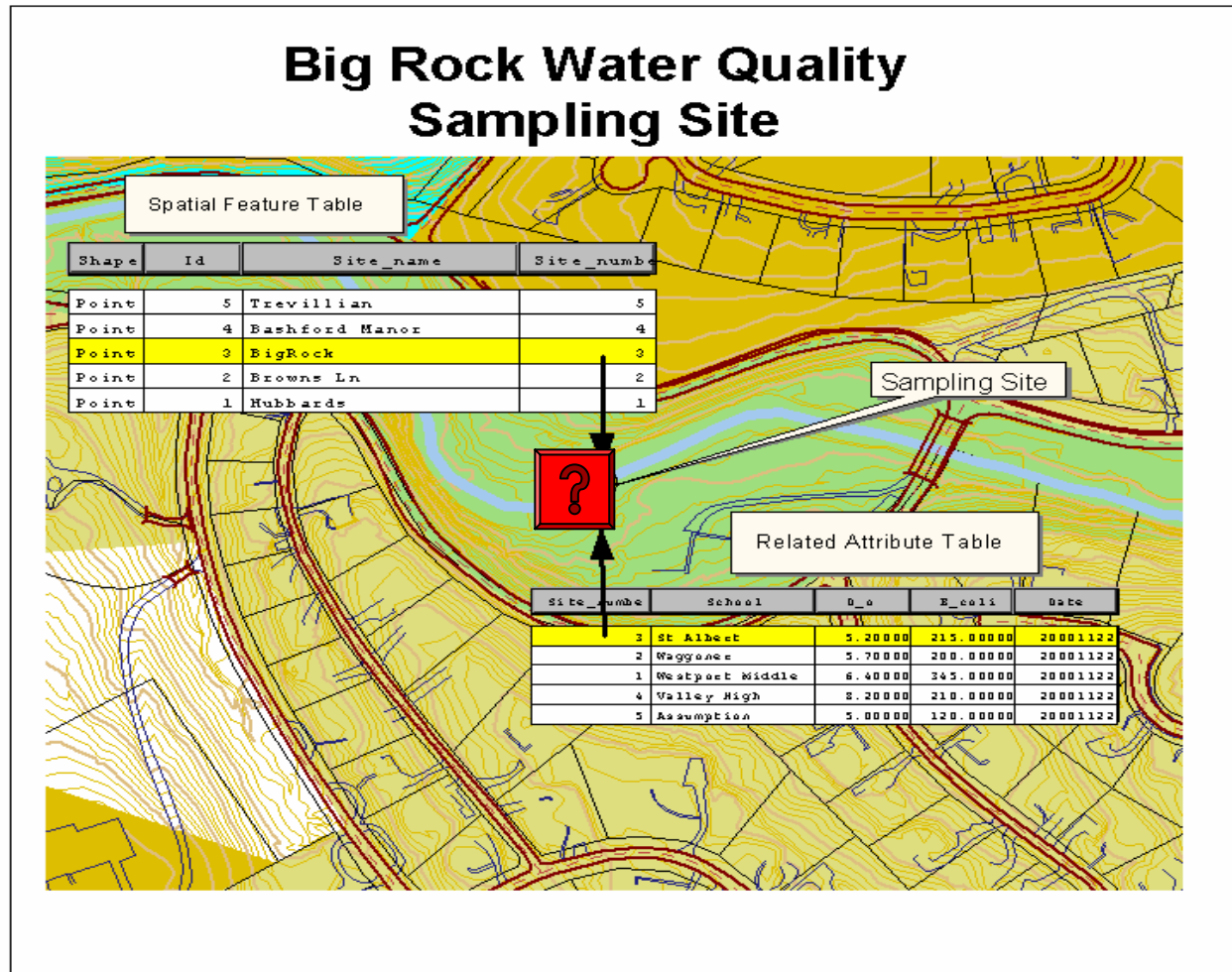
Industries within a watershed.

- **Intersects - geographic features intersected by other features:**

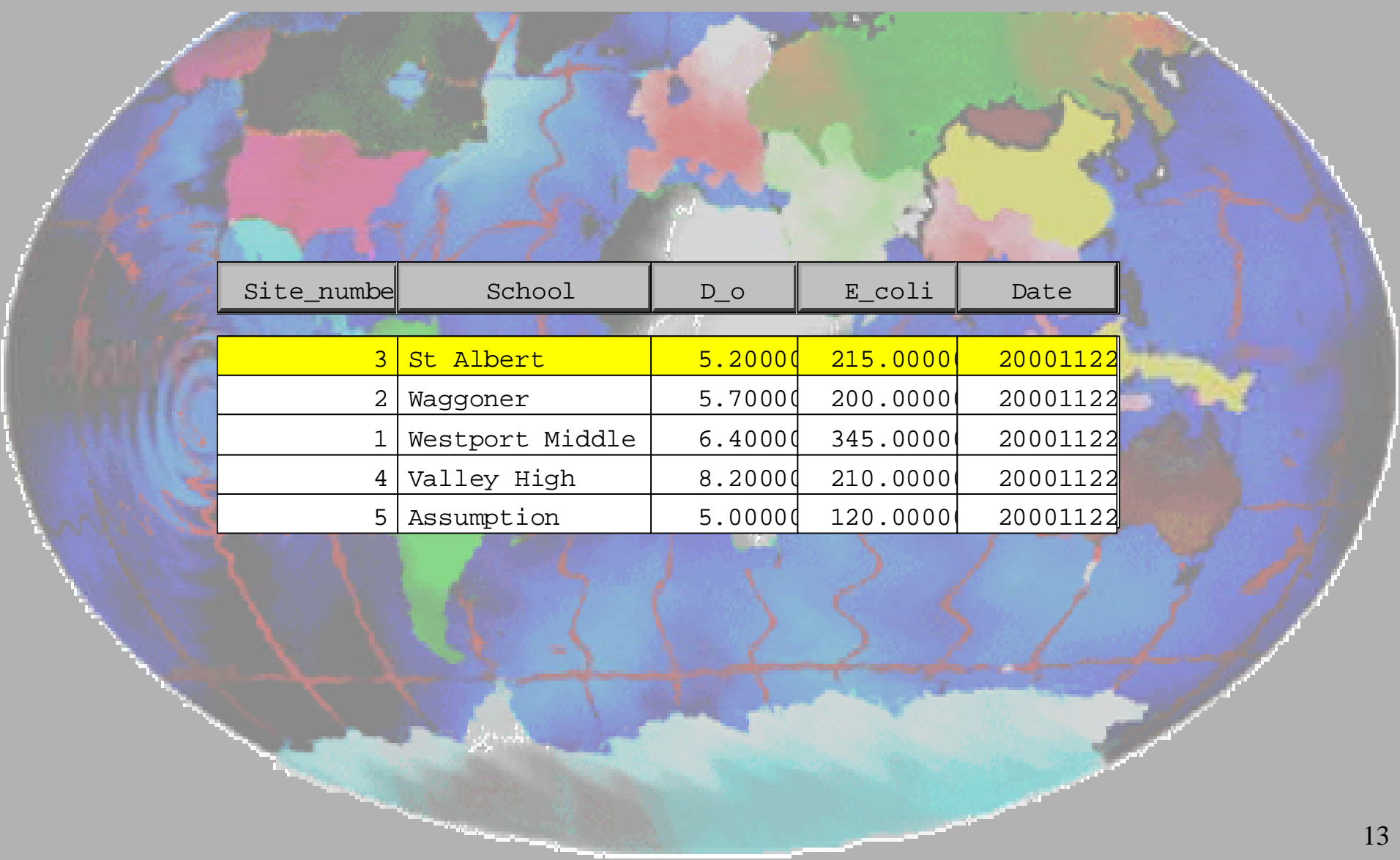
Example:

Streams intersected by transportation corridors.

GIS Maps Are Interactive & Dynamic



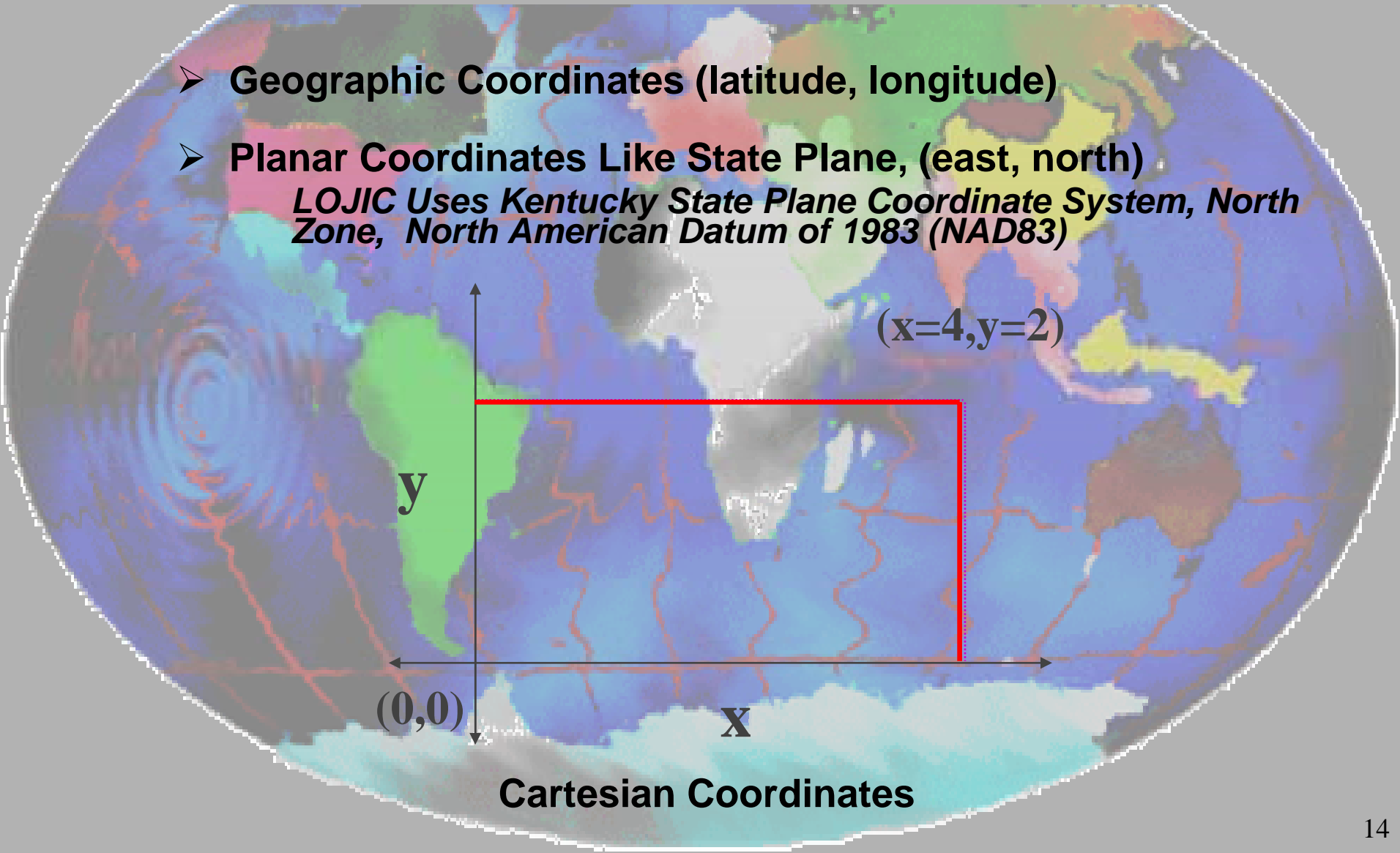
Beargrass Creek Water Quality Data



Site_numbe	School	D_o	E_coli	Date
3	St Albert	5.20000	215.0000	20001122
2	Waggoner	5.70000	200.0000	20001122
1	Westport Middle	6.40000	345.0000	20001122
4	Valley High	8.20000	210.0000	20001122
5	Assumption	5.00000	120.0000	20001122

The primary coordinate systems used to represent map features, (points, lines & polygons), are:

- **Geographic Coordinates (latitude, longitude)**
- **Planar Coordinates Like State Plane, (east, north)**
LOJIC Uses Kentucky State Plane Coordinate System, North Zone, North American Datum of 1983 (NAD83)



Coordinates Reference Map Features To True Ground Locations

Spatial data (map features) are stored in a GIS using coordinates to reference features to ground locations.

Points...single coordinate (x,y) pairs

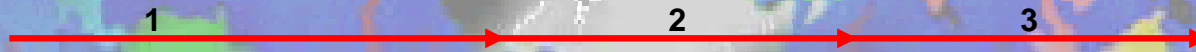
Lines...ordered sets of connected points

Areas...polygons defined by sets of lines

Topology!

Spatial Objects (map features) in a GIS have topology, defining geographic relationships between connecting or adjacent features;

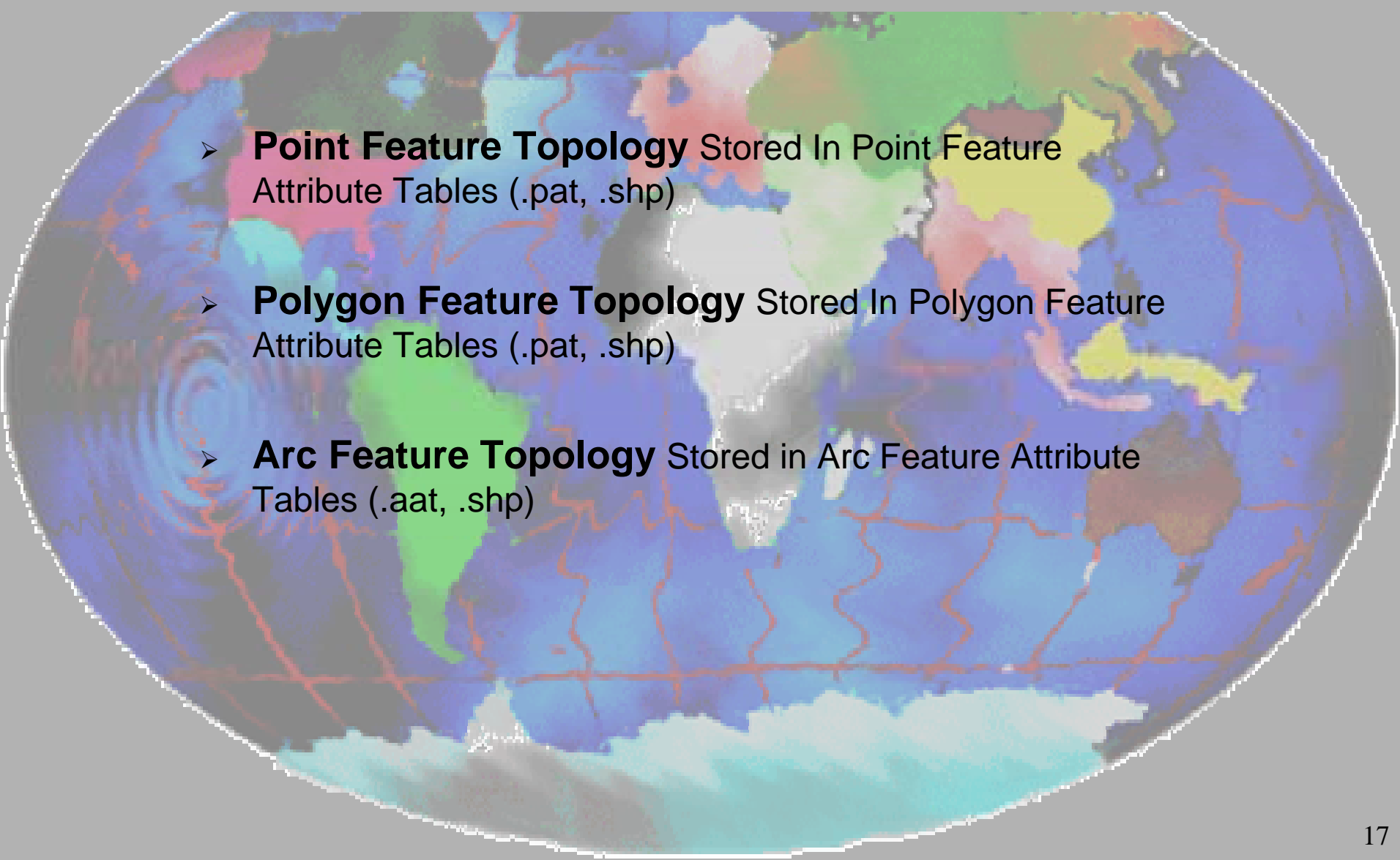
- **Connectivity** (*lines connected to other lines at nodes define from - to direction, segment length, form networks.*)



- **Adjacency** (*lines forming polygons and sharing boundaries with other polygons, perimeter, area, left - right.*)



These Topological Data Structures Are Stored In Tables Called Feature Attribute Tables

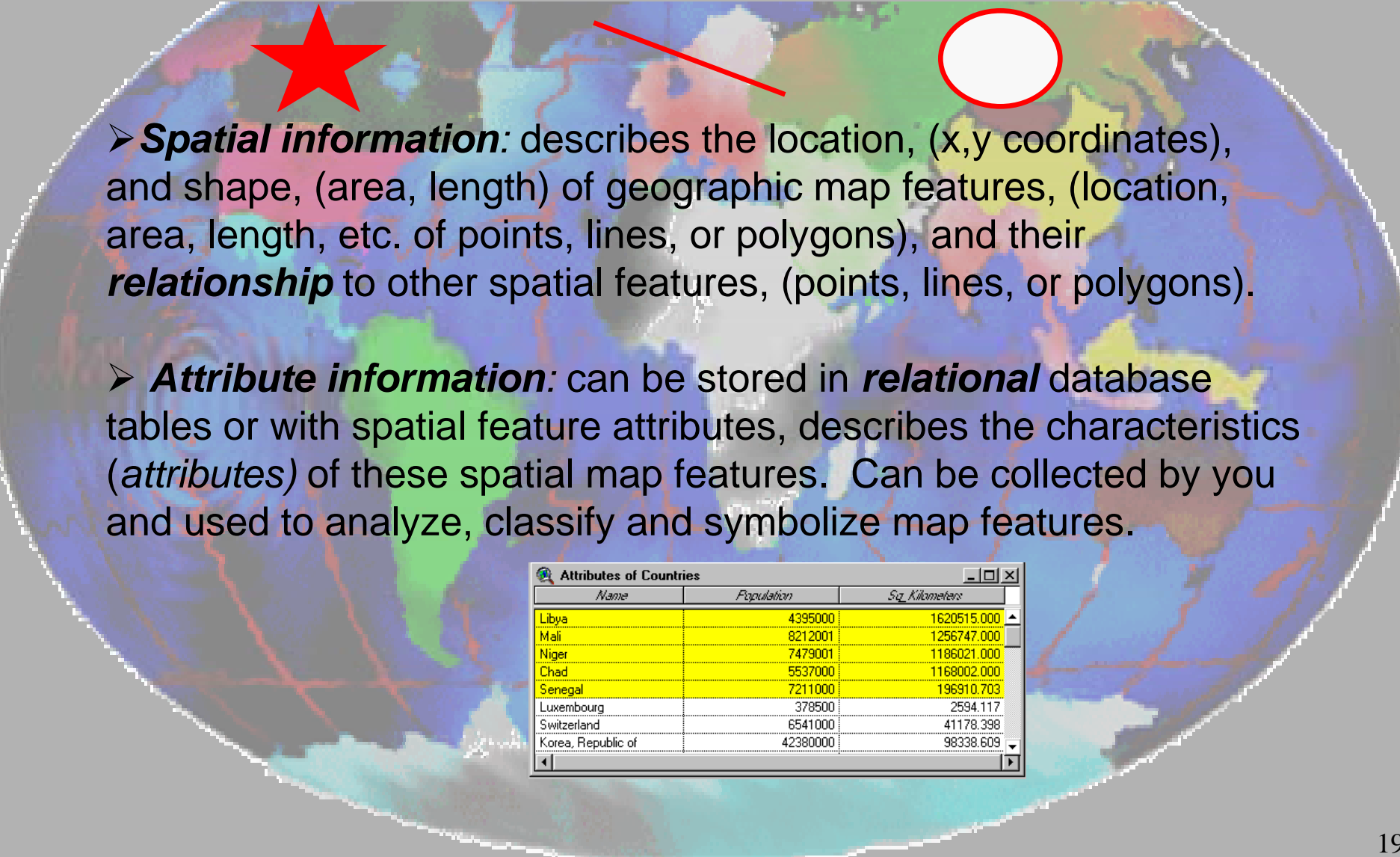
- 
- **Point Feature Topology** Stored In Point Feature Attribute Tables (.pat, .shp)
 - **Polygon Feature Topology** Stored In Polygon Feature Attribute Tables (.pat, .shp)
 - **Arc Feature Topology** Stored in Arc Feature Attribute Tables (.aat, .shp)

The Descriptive Attributes of These Map Features Can Be Stored With Their Spatial Attributes or Stored Separately in Relational Database Tables

- **GIS Native Spatial Attribute Tables**
(*ArcInfo, ArcView, Mapinfo, Etc.*)
- **Text Files**
- **dBase Files** (Excel, Access, Clarisworks, etc...)

Site_number	School	D_o	E_coli	Date
3	St Albert	5.2000	215.0000	20001122
2	Waggoner	5.7000	200.0000	20001122
1	Westport Middle	6.4000	345.0000	20001122
4	Valley High	8.2000	210.0000	20001122
5	Assumption	5.0000	120.0000	20001122

So, Map Features are Described in a GIS by Their Location, Topology, and Their Attributes!:

- 
- **Spatial information:** describes the location, (x,y coordinates), and shape, (area, length) of geographic map features, (location, area, length, etc. of points, lines, or polygons), and their **relationship** to other spatial features, (points, lines, or polygons).
 - **Attribute information:** can be stored in **relational** database tables or with spatial feature attributes, describes the characteristics (**attributes**) of these spatial map features. Can be collected by you and used to analyze, classify and symbolize map features.

Name	Population	Sq. Kilometers
Libya	4395000	1620515.000
Mali	8212001	1256747.000
Niger	7479001	1186021.000
Chad	5537000	1168002.000
Senegal	7211000	196910.703
Luxembourg	378500	2594.117
Switzerland	6541000	41178.398
Korea, Republic of	42380000	98338.609

Fundamental Skills For The Successful GIS User

➤ **Computer Skills**

Navigating Directories, Networks, Files

Relational Database Concepts

Data Formats & File Naming Conventions

Basic Statistics & Classification Methods

➤ **GIS Skills**

Thematic Mapping

Map Projections & Coordinate Systems

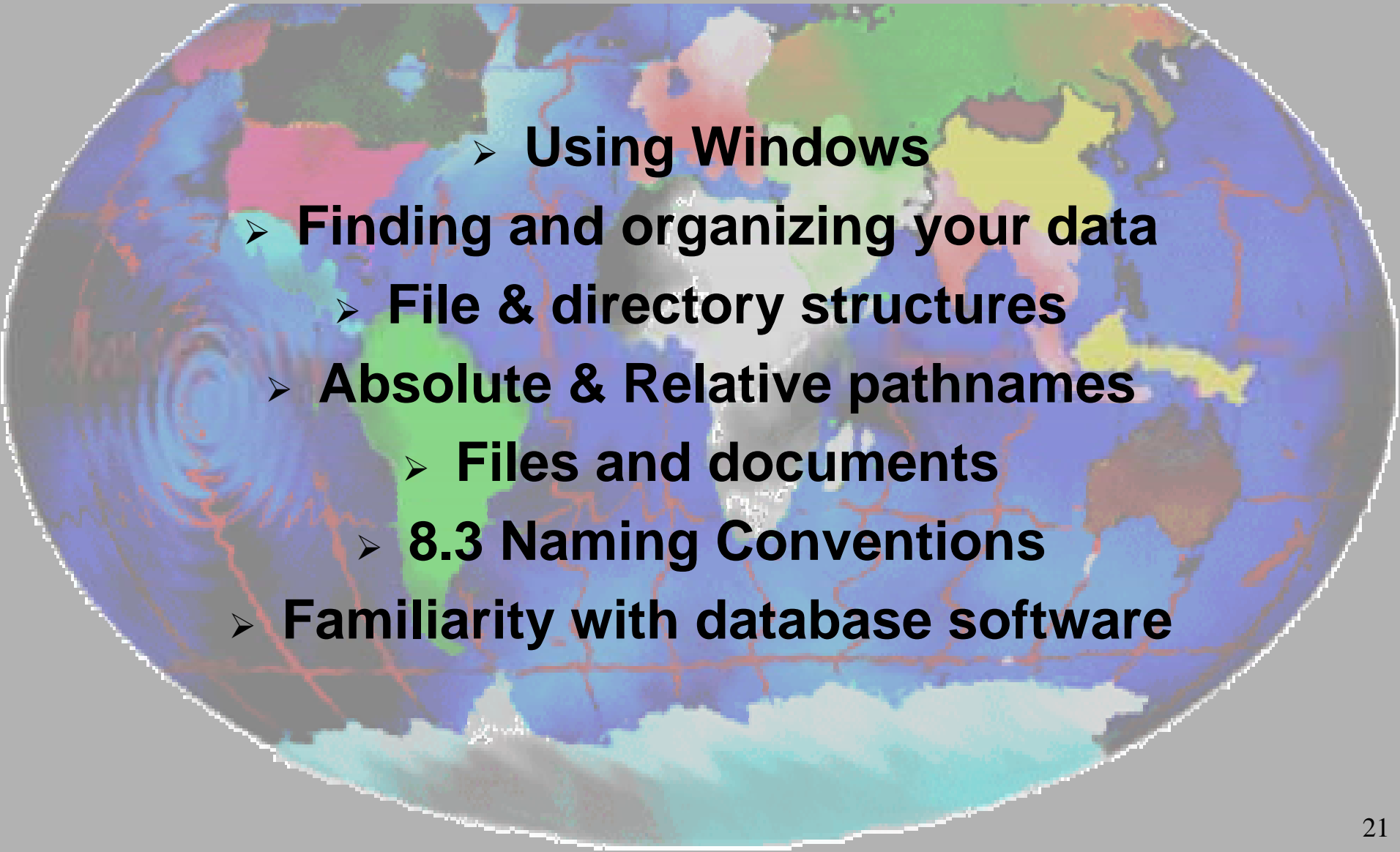
Cartographic Concepts

Scale, Accuracy, Quality Control

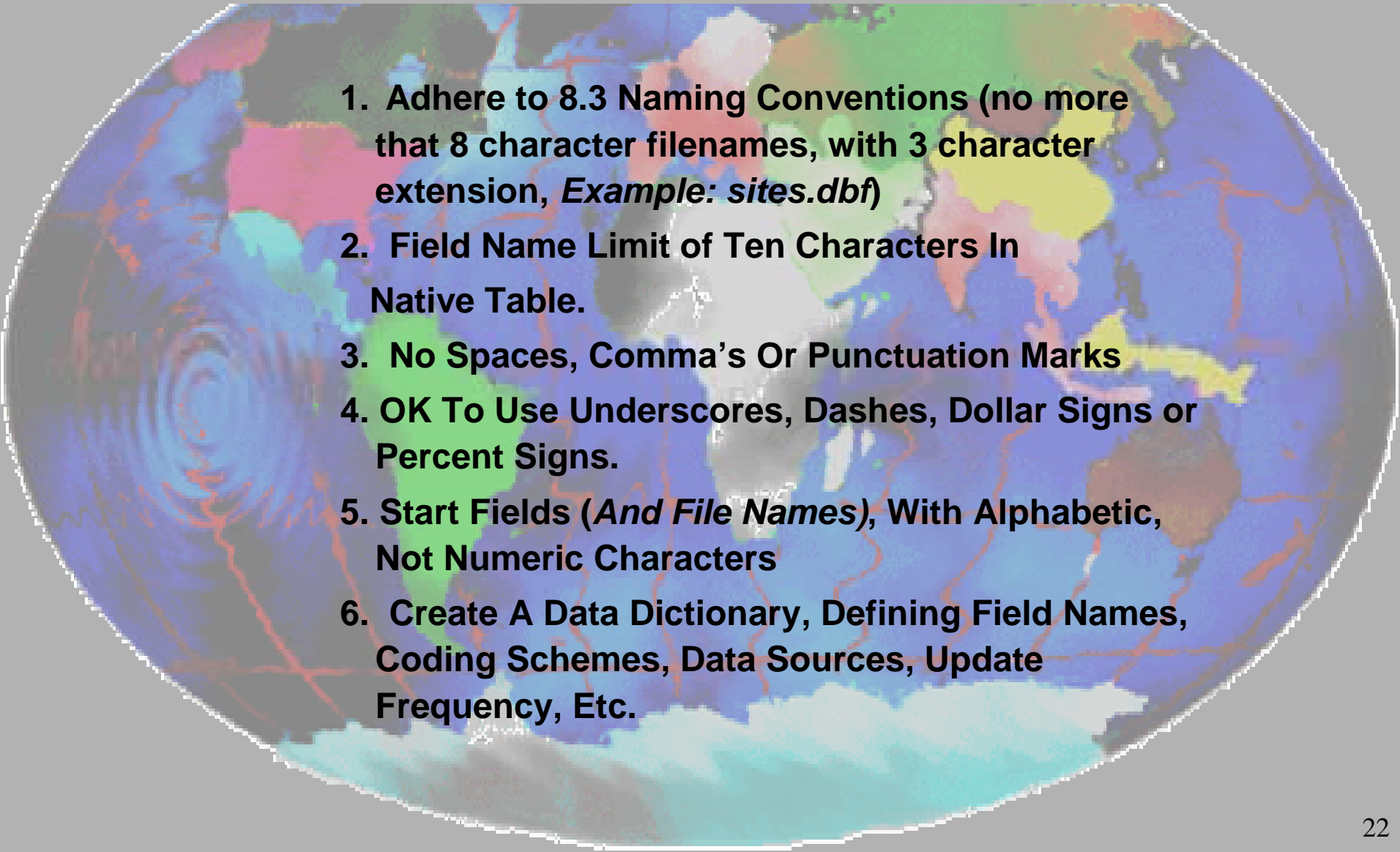
Metadata

(See ESRI's Inventory of Critical Skills handout)

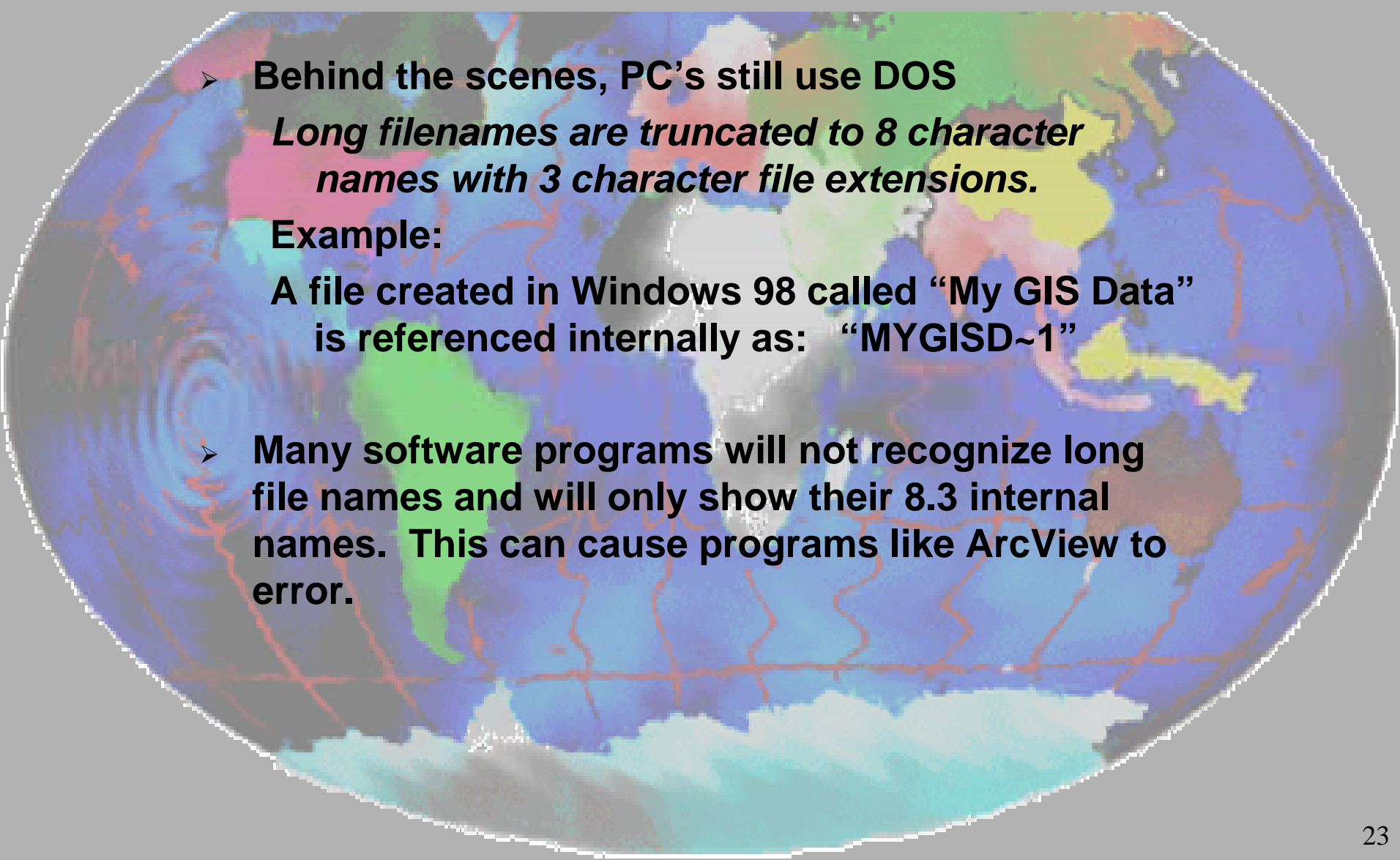
Basic Computer Skills

- 
- **Using Windows**
 - **Finding and organizing your data**
 - **File & directory structures**
 - **Absolute & Relative pathnames**
 - **Files and documents**
 - **8.3 Naming Conventions**
 - **Familiarity with database software**

GIS Database Naming Conventions, Table Format Restrictions And Metadata

- 
1. Adhere to 8.3 Naming Conventions (no more than 8 character filenames, with 3 character extension, *Example: sites.dbf*)
 2. Field Name Limit of Ten Characters In Native Table.
 3. No Spaces, Comma's Or Punctuation Marks
 4. OK To Use Underscores, Dashes, Dollar Signs or Percent Signs.
 5. Start Fields (*And File Names*), With Alphabetic, Not Numeric Characters
 6. Create A Data Dictionary, Defining Field Names, Coding Schemes, Data Sources, Update Frequency, Etc.

Why Use 8.3?

- 
- Behind the scenes, PC's still use DOS
 - Long filenames are truncated to 8 character names with 3 character file extensions.*
 - Example:**
 - A file created in Windows 98 called "My GIS Data" is referenced internally as: "MYGISD~1"
 - Many software programs will not recognize long file names and will only show their 8.3 internal names. This can cause programs like ArcView to error.

Designing Your Database for GIS

(See Handout "Creating Data For Use In ArcView")

- Differentiate Between Spatial Features and Descriptive Attribute Data

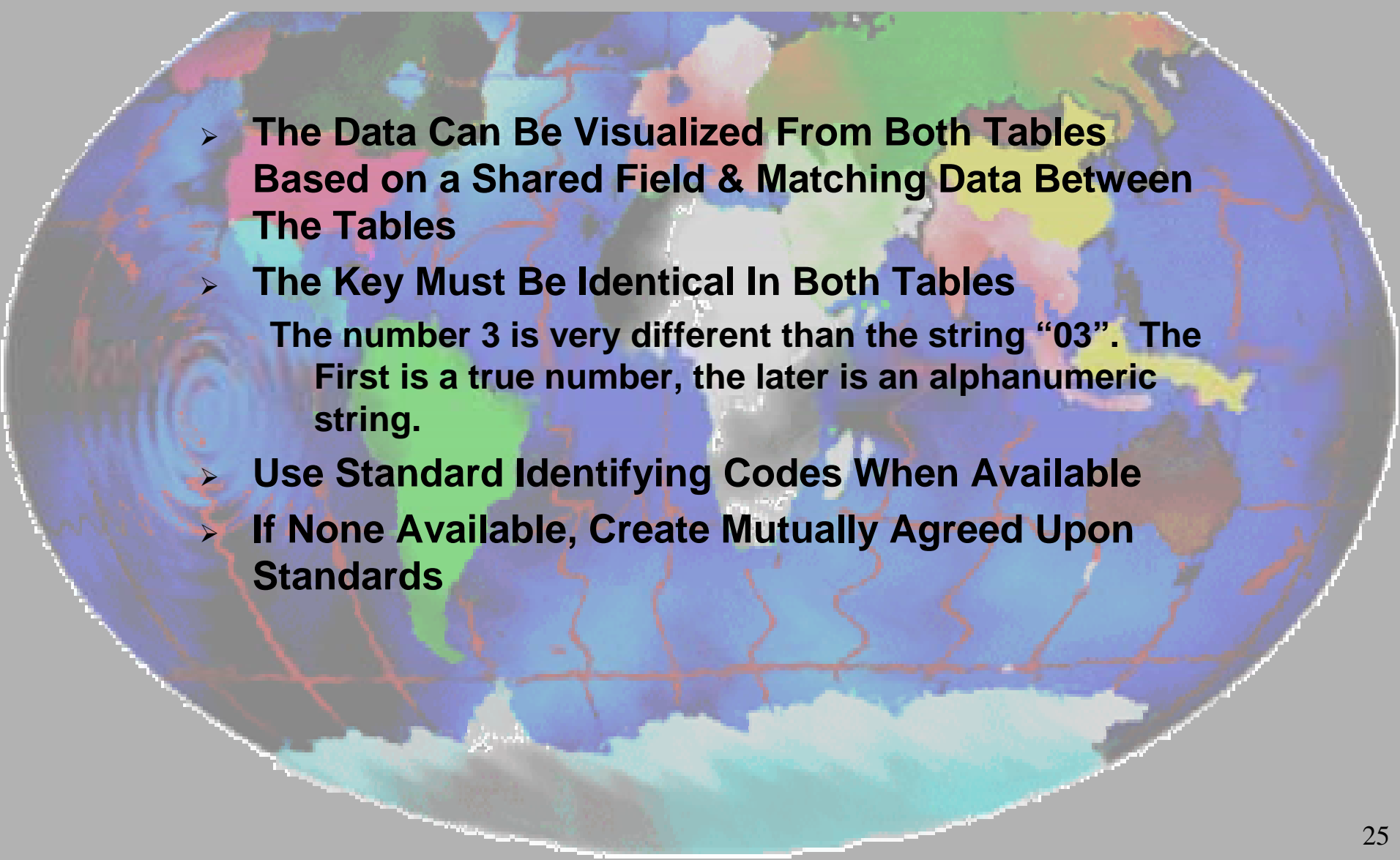
Does the data describe the location of the feature or characteristics of the feature?



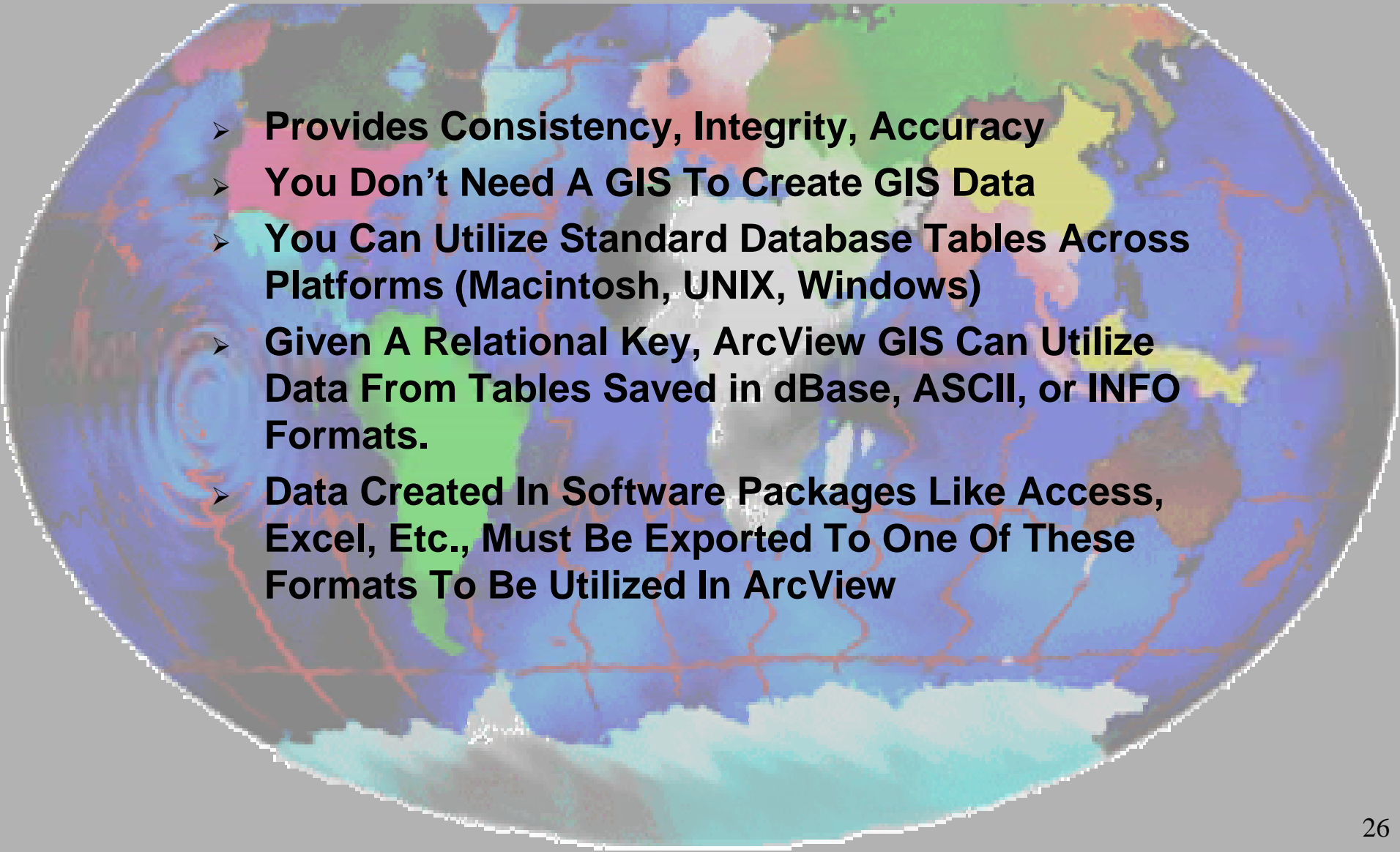
- Given A Relational Key Between Spatial & Descriptive Attribute Tables, ArcView can Join the Information

Site_numbe	School	D_o	E_coli	Date
3	St Albert	5.200000	215.000000	20001122
2	Waggoner	5.700000	200.000000	20001122
1	Westport Middle	6.400000	345.000000	20001122
4	Valley High	8.200000	210.000000	20001122
5	Assumption	5.000000	120.000000	20001122

Unique Identifiers are the Key!

- 
- **The Data Can Be Visualized From Both Tables Based on a Shared Field & Matching Data Between The Tables**
 - **The Key Must Be Identical In Both Tables**
 - The number 3 is very different than the string “03”. The First is a true number, the later is an alphanumeric string.
 - **Use Standard Identifying Codes When Available**
 - **If None Available, Create Mutually Agreed Upon Standards**

What Does This Mean To You?

- 
- **Provides Consistency, Integrity, Accuracy**
 - **You Don't Need A GIS To Create GIS Data**
 - **You Can Utilize Standard Database Tables Across Platforms (Macintosh, UNIX, Windows)**
 - **Given A Relational Key, ArcView GIS Can Utilize Data From Tables Saved in dBase, ASCII, or INFO Formats.**
 - **Data Created In Software Packages Like Access, Excel, Etc., Must Be Exported To One Of These Formats To Be Utilized In ArcView**

You Don't Always Have To Start From Scratch

- **Look For Existing Spatial Data Sources**
Someone Has Probably Already Mapped The Creek!

USGS, LOJIC, KYOGIS, ESRI, Etc...

Why: Saves Time & Money.

- **Look For Existing Attribute Data Standards & Protocols, and model your attribute data accordingly!**

Globe, EPA, LOJIC, Etc...

Why: Easier To Share Information.

Visualizing Your Data!

Given Topology
Map Features With Spatial Attributes

A Relational Key
Unique Identifier

Your Data Table
Describing Map Features

GIS Software
ArcView, ArcExplorer, MapInfo, Etc...

***Spatial Features Can Be Overlaid to Reveal
Complex, Often Hidden Relationships Between
Geographic Features***

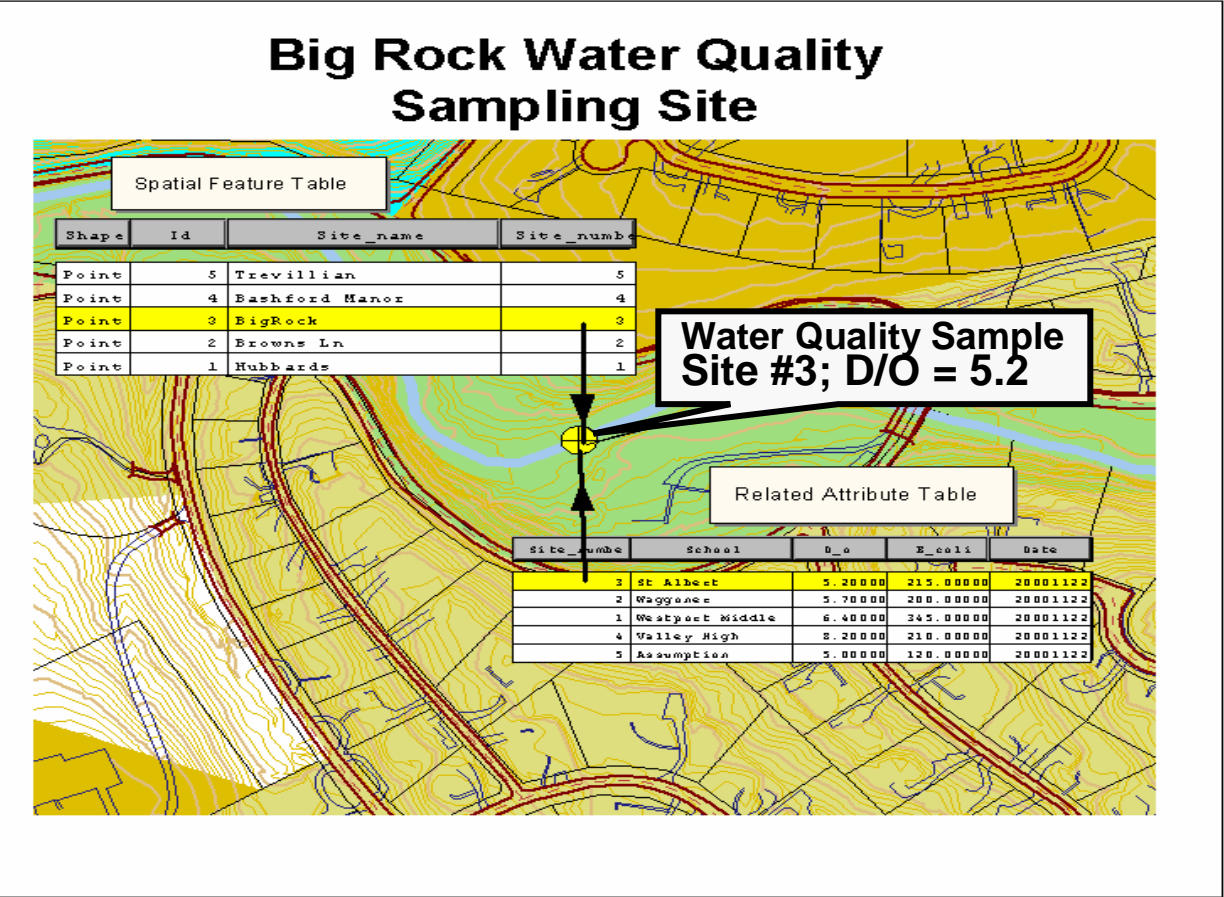
Spatial Overlays

Map layers can be overlaid for combined topological query and analysis

Answering Questions Like: *What landuse exists within a five mile radius of a sample site?*

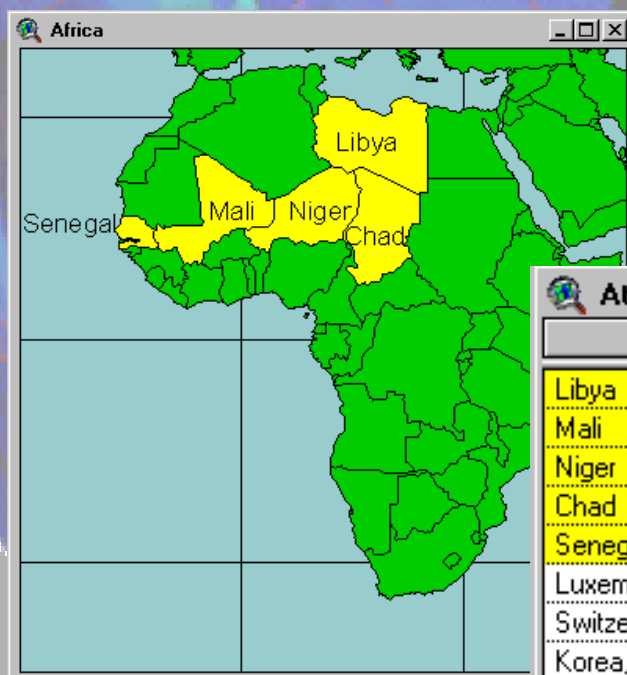


This Combination = GIS, An Interactive & Intelligent Visualization Tool



Map Features in a GIS Are Dynamic!


- Links *map features* to tables of *attributes*
- Accesses the attributes for any map feature
- Locates any feature from its attributes
- Manages sets of features and attributes as *themes*



A table window titled 'Attributes of Countries' with three columns: Name, Population, and Sq. Kilometers. The table contains data for several countries, with the first five rows highlighted in yellow.

Name	Population	Sq. Kilometers
Libya	4395000	1620515.000
Mali	8212001	1256747.000
Niger	7479001	1186021.000
Chad	5537000	1168002.000
Senegal	7211000	196910.703
Luxembourg	378500	2594.117
Switzerland	6541000	41178.398
Korea, Republic of	42380000	98338.609

GIS Data Sources

- 
- **LOJIC, (Louisville & Jefferson County Information Consortium)**
 - **ESRI, (Environmental Systems Research Institute)**
 - **KOGIS, (KY Office Of GIS)**
 - **Census**
 - **USGS**
 - **EPA**
 - **HUD**
 - **Private Vendors**
 - **And Many More**

GIS Resources

➤ **World Wide Web** (*Interactive Training, data, etc*)

www.esri.com, www.esri.com/industries/k-2/atlas/index.html

www.globe.gov

www.lojic.org

www.gis.com

➤ **Books**

“Peter Coffee Teaches PCs”

“An Introduction to Geographical Information Systems”,
Heywood, Cornelius. Carver

“Database Design for Mere Mortals”, Hernandez

“Getting Started With Geographic Information Systems”,
Clarke

“Getting to Know ArcView GIS”, ESRI Press

