Fundamentals of GIS

Aleksey Sheshukov
Darci Paull
Will Boyer
Sue Brown

KCARE
Kansas Center for Agricultural Resources and the Environment

K-STATE
Research and Extension

What is GIS?

- Geographic Information System
  - GIS is a system that captures, stores, analyzes, manages, and presents data that are linked to a location
  - GIS is a system that includes a form of a mapping software

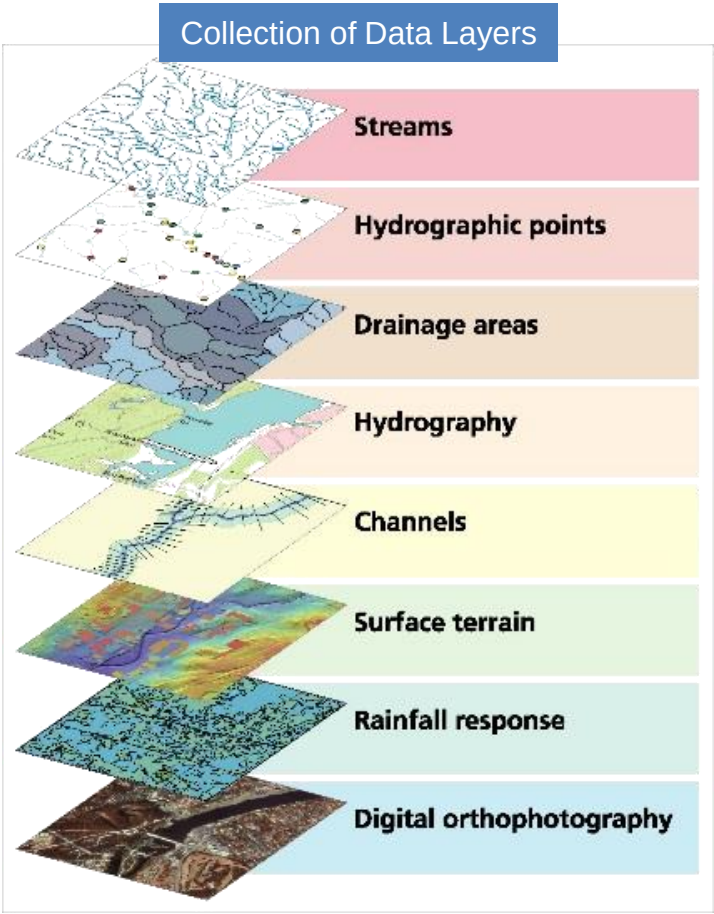
- Geographic implies of the surface of the earth
  - Information implies knowledge of or collection of some form of data
    - A system implies some form of organization, arrangement, etc.. Perhaps a framework?

KCARE
Kansas Center for Agricultural Resources and the Environment

K-STATE Research and Extension

GIS for Water Resources

- GIS is a powerful tool for developing solutions for water resources
- Hydrologists use GIS technology to integrate various data and applications into one, manageable system
- ArcGIS Pro tools:
  - Spatial analyst toolbox
  - ArcHydro package
  - TauDEM package
  - Etc.

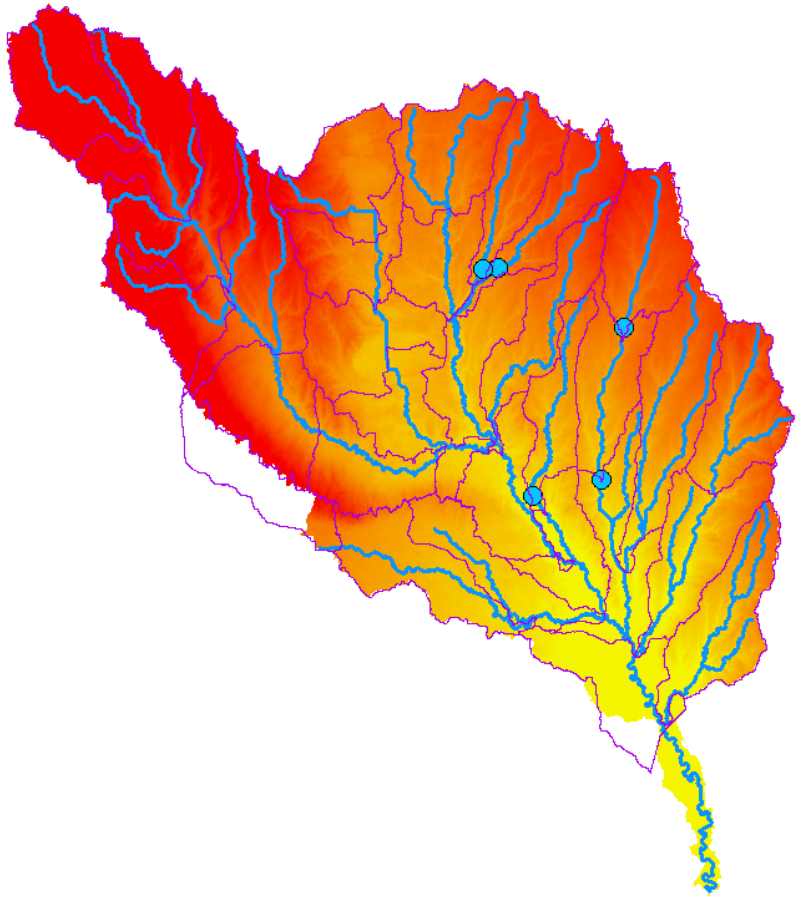


KCARE
Kansas Center for Agricultural Resources and the Environment

K-STATE Research and Extension

Integrated Water Geodatabase

- Digital Elevation Model
- Watersheds
- Streams
- Water bodies
- Land use / Land cover
- Soils
- Water monitoring stations
- Meteorological stations
- Etc…

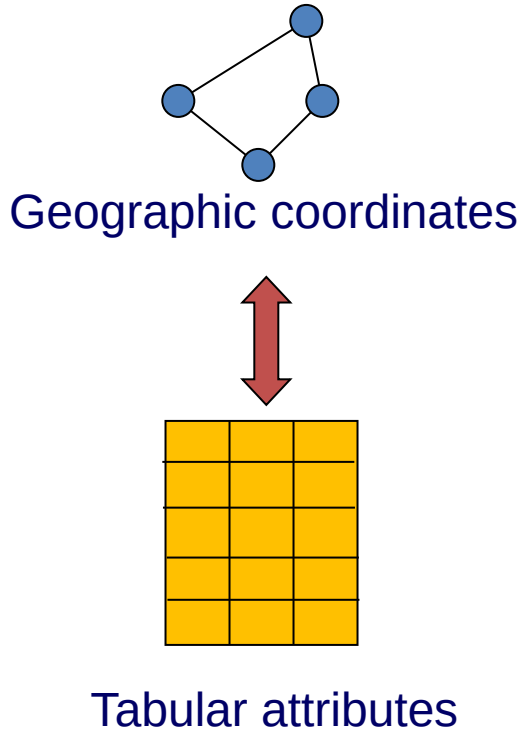


KCARE
Kansas Center for Agricultural Resources and the Environment

K-STATE Research and Extension

Geographic Data Models

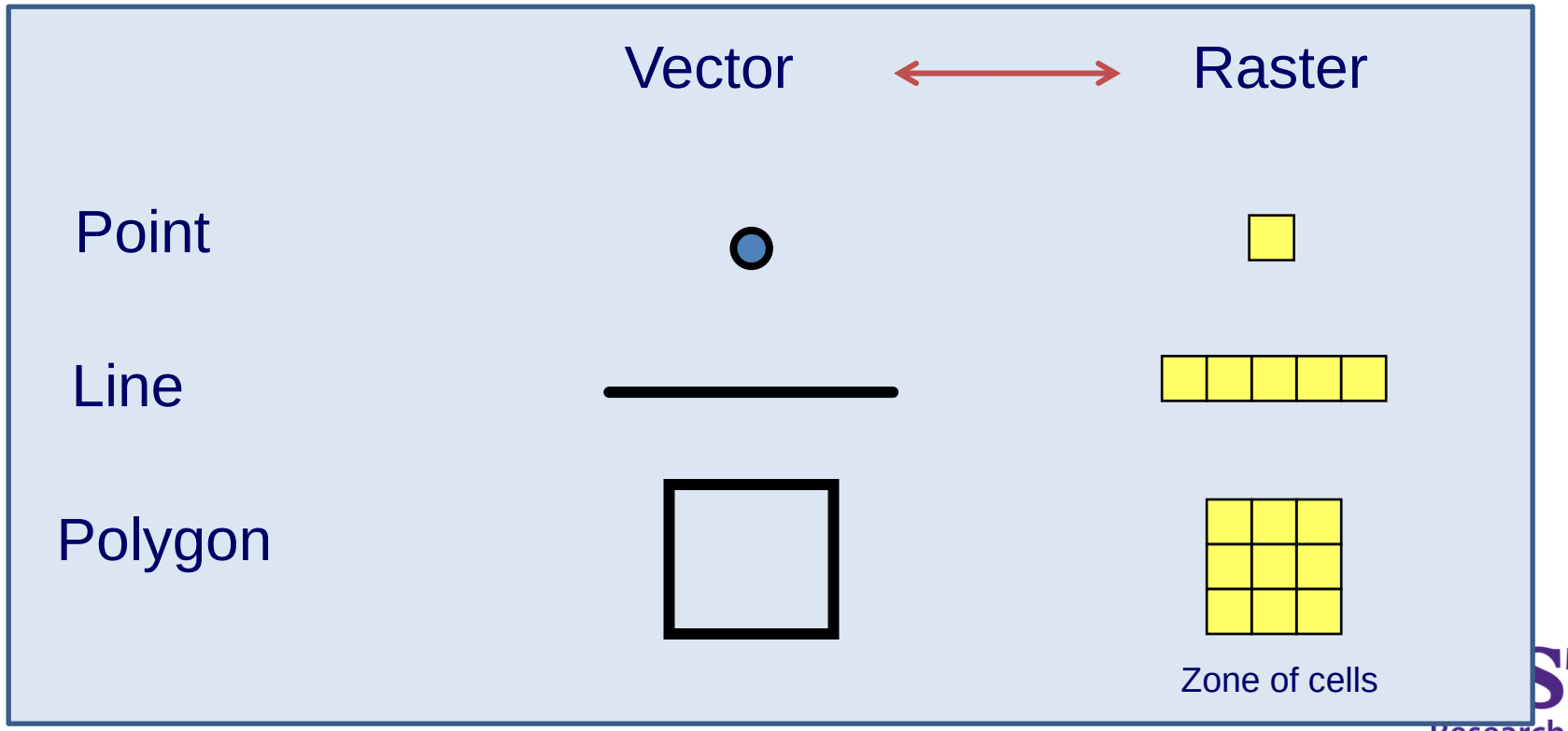
- A geographic data model is a structure for organizing geospatial data so that it can be easily stored and retrieved
- Geographic coordinates and attributes are stored in separate but linked files
- Shapefiles
  - Developed for ArcView ~ 1993
  - Attributes in dBase (.dbf) tables



KCARE
Kansas Center for Agricultural Resources and the Environment
K-STATE
Research and Extension

Raster and Vector Datasets

- Vector datasets are defined spatially
- Raster datasets are described by a grid, one value per grid-cell



KCARE
Kansas Center for Agricultural Resources and the Environment

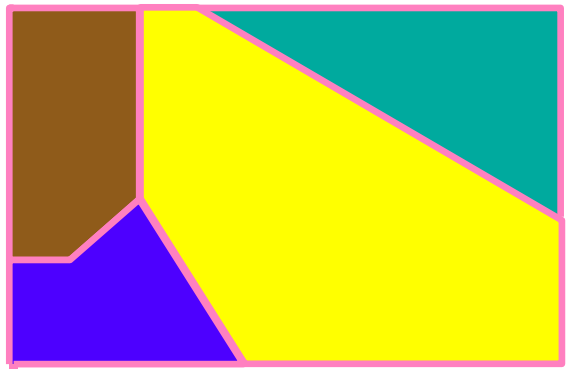
STATE
Research and Extension

Raster and Vector

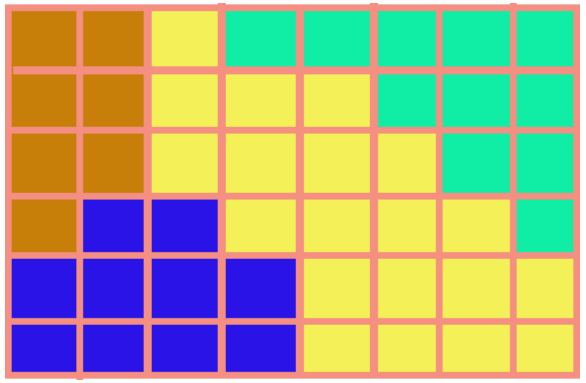
Two methods of representing geographic data in GIS

- Both represent different ways to encode and generalize geographic phenomena
- Both can be used to identify both fields and discrete objects
- In practice, a strong association between raster and fields and vector and discrete objects

Vector



Raster

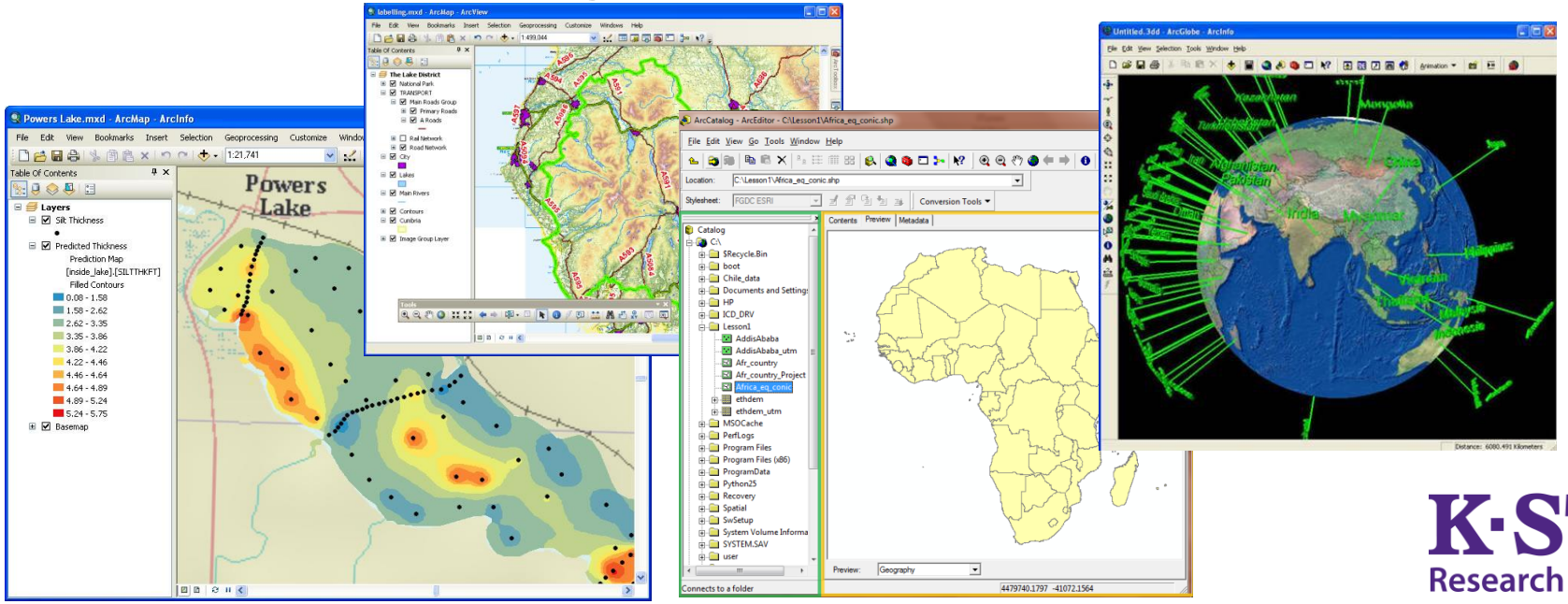


KCARE
Kansas Center for Agricultural Resources and the Environment

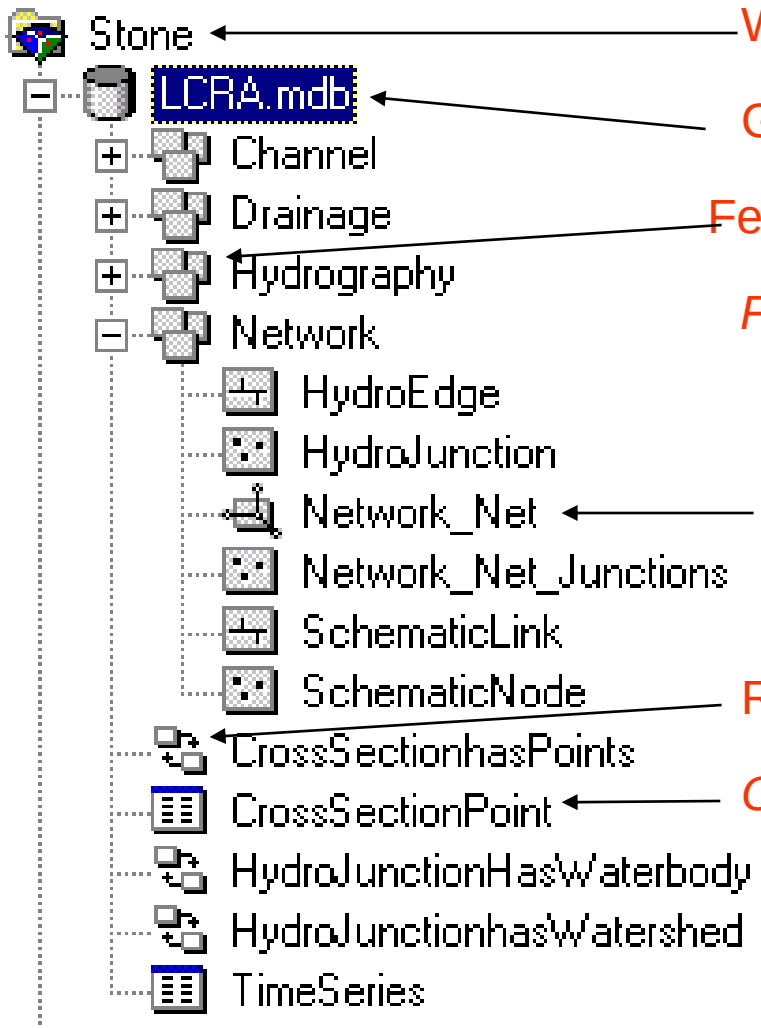
K-STATE
Research and Extension

ESRI ArcGIS

- A platform for designing and managing solutions through the application of geographic knowledge.
  - ArcGIS Pro, ArcGIS Online, …
  - ArcMap, ArcCatalog, ArcGlobe, ArcScene



ArcGIS Geodatabase

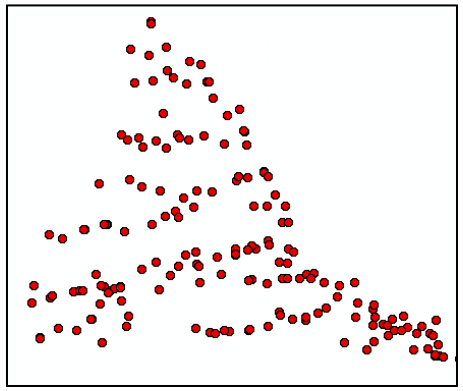


Workspace

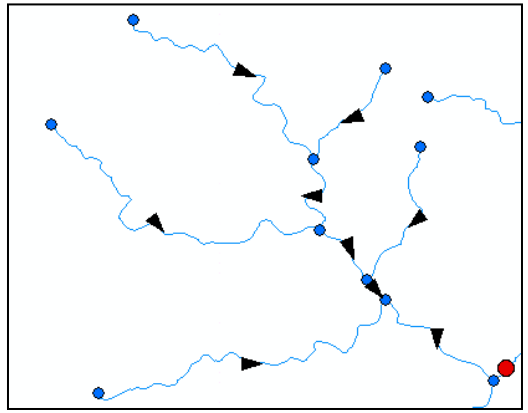
Geodatabase

Feature Dataset

Feature Class



Geometric Network



Relationship

Object Class

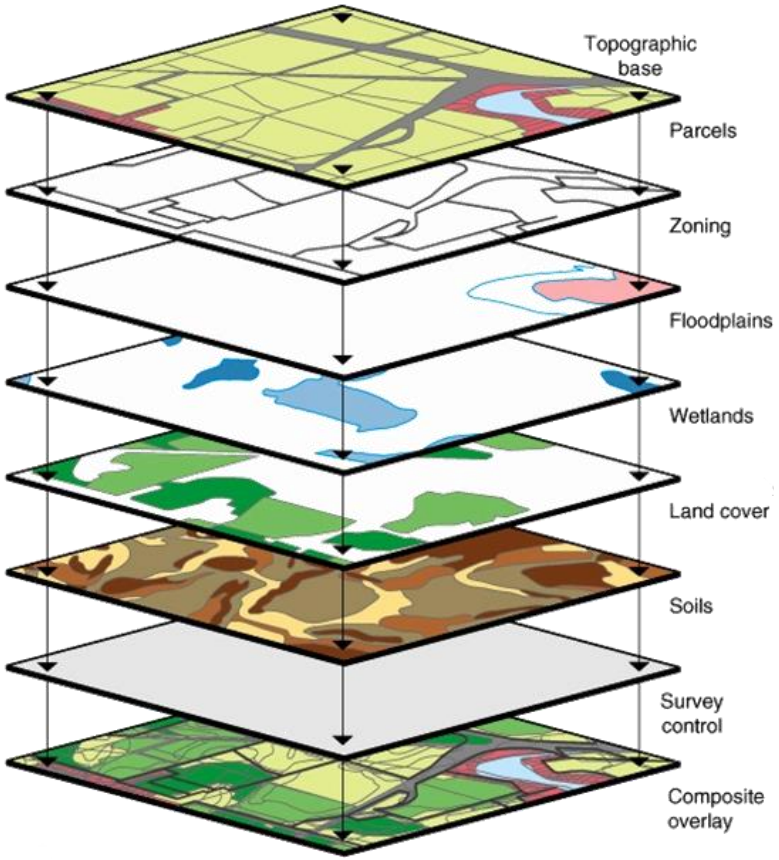
OBJECTID*	CrossSectionID*	CrossSectionM	Elevation
3931	Colorado/Lbj Middle 06	3464	801
3932	Colorado/Lbj Middle 06	3482	800
3933	Colorado/Lbj Middle 06	3495	800
3934	Colorado/Lbj Middle 06	3511	799
3935	Colorado/Lbj Middle 06	3527	799

KCARE
Kansas Center for Agricultural Resources and the Environment

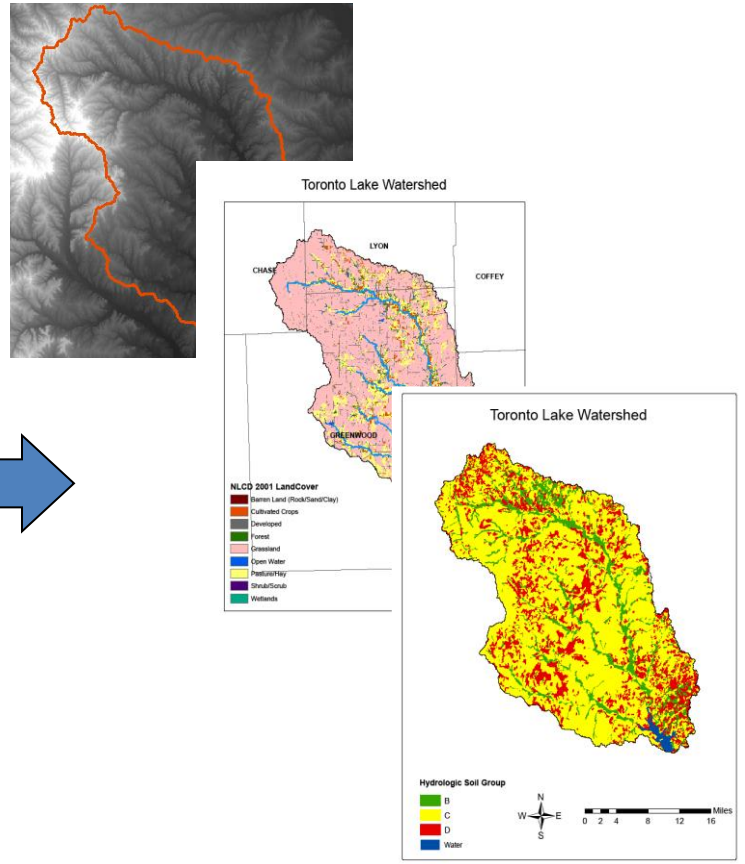
TATE
and Extension

GIS Input Data

Collection of Data Layers



Composite Characteristics



KCARE
Kansas Center for Agricultural Resources and the Environment

K-STATE Research and Extension