



GIS WORKSHOP FOR VACCINE



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Agenda

- GIS Introduction
- Spatial Analysis
- Geodatabase
- Web GIS
- Resources on Campus

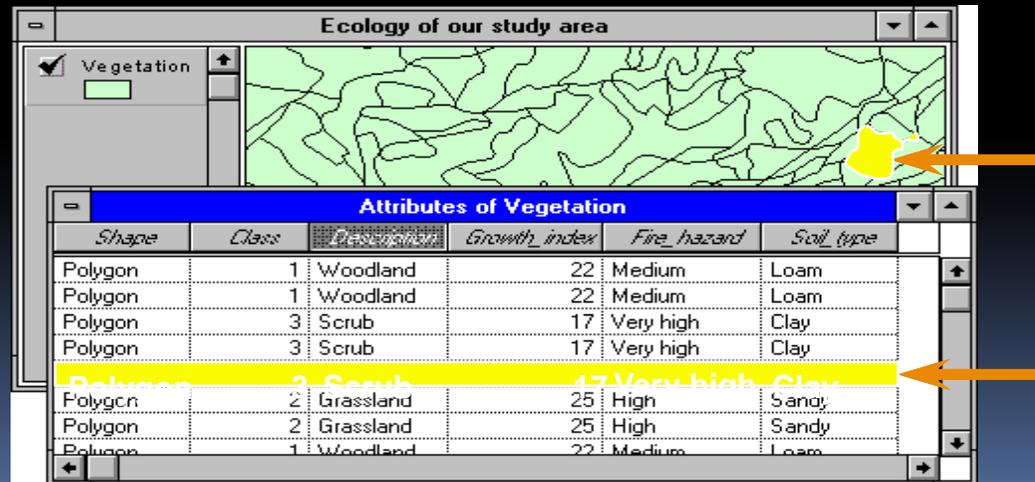
Agenda

- **GIS Introduction**
- Spatial Analysis
- Geodatabase
- Web GIS
- Resources on Campus

GIS Introduction - Concept

GIS stores information about the world as a collection of thematic layers that can be linked together by geography.

Map + Information



GIS Introduction – Data Types

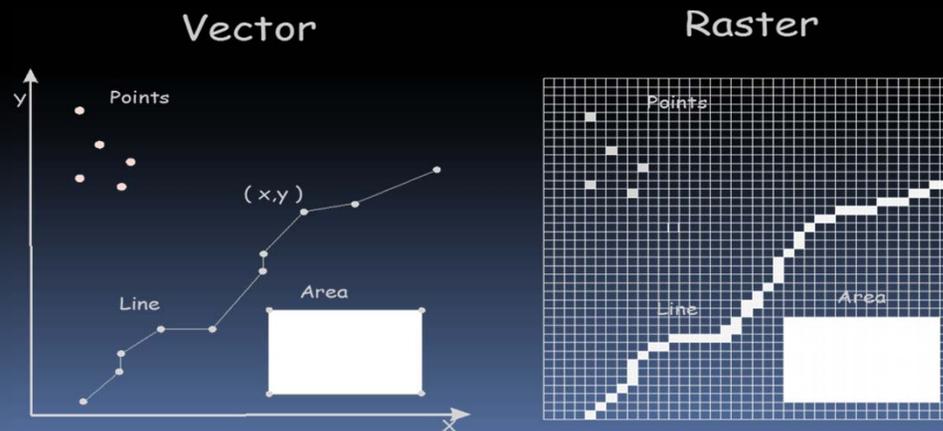
Two fundamental types of data

❑ **Vector**

- A series of x,y coordinates
- For discrete data represented as points, lines, polygons

❑ **Raster**

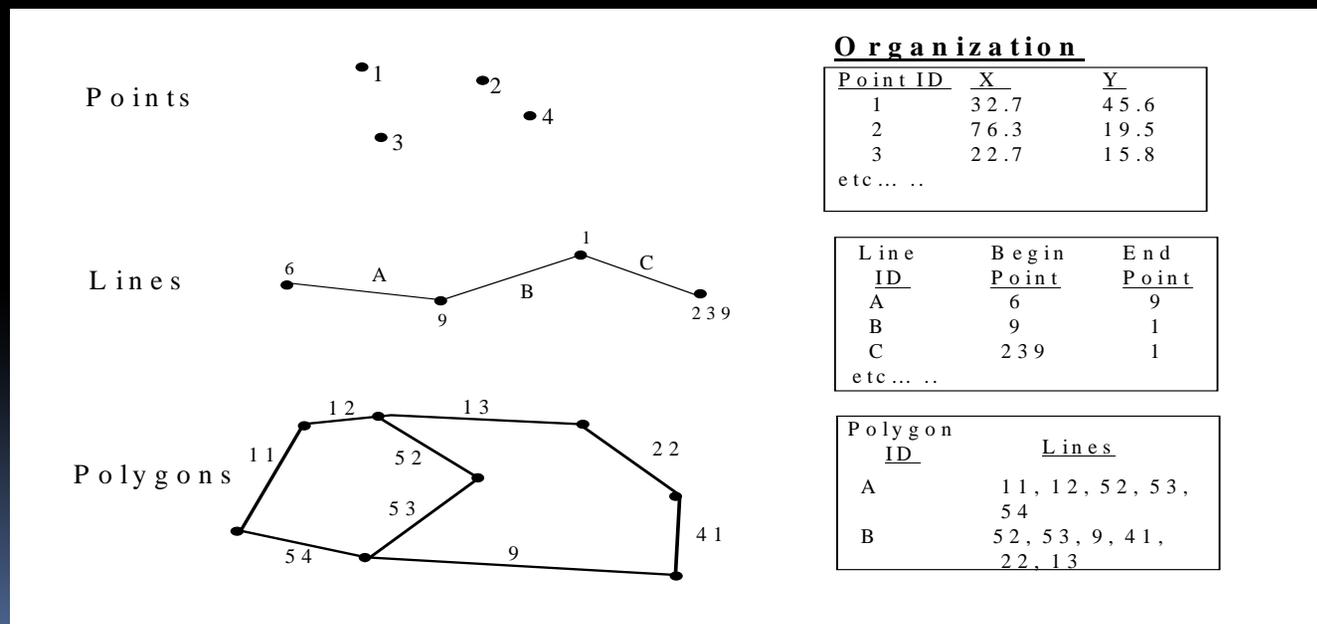
- Grid and cells
- For continuous data such as elevation, slope, surfaces



GIS Introduction – Data Type

Vector data model:

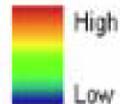
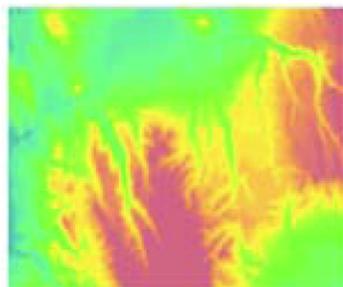
Best for representing discrete objects with defined shapes and boundaries.



GIS Introduction – Data Type

Raster data model:

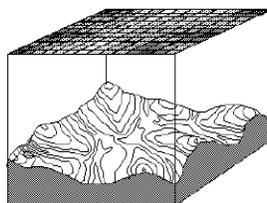
Continuous data



Categorical data

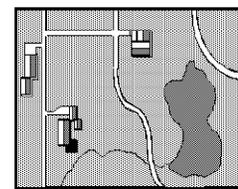


Surface data



(DEM: Digital Elevation Model)

Thematic data



(Land use/Land cover)

GIS Introduction – File Format

Common GIS file format:

❑ Vector:

- ❑ ESRI Shapefiles (*.shp, *.dbf, *.prj, *.sbn, *.sbx, *.shp.xml).
- ❑ Geodatabase (feature class).
- ❑ Kml (kmz) file.
- ❑ Spread sheet with lat/long.

❑ Raster:

- ❑ Geotiff, geodatabase, mosaic dataset, dem, etc.

Open file format: Open Geospatial Consortium (OGC) standard.

DEMO: File format conversion

GIS Introduction - Software

- ❑ **ArcGIS (ESRI Inc.):**
 - ❑ ArcMap Desktop application + Extension
 - ❑ ArcGIS for Office
- ❑ **QGIS:**
- ❑ **Google Earth:**
- ❑ **Web GIS:**
 - ❑ ArcGIS Server.
 - ❑ Google map API.
 - ❑ Open Layers.
 - ❑ Leaflet.
 - ❑ GeoCommons.

GIS Introduction – Basic functions

- ❑ Create a map
- ❑ Attribute table, table manipulation
- ❑ Map customization (symbolology)
- ❑ Selection
- ❑ Data editing
- ❑ Export map

DEMO

GIS Introduction – Advanced Topics

- ❑ Adding address data, or XY coordinates
- ❑ Time Animation
- ❑ 3D visualization
- ❑ Development based on ArcObject

DEMO

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- **Spatial Analysis**
- Geodatabase
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GIS Introduction – Spatial Analysis

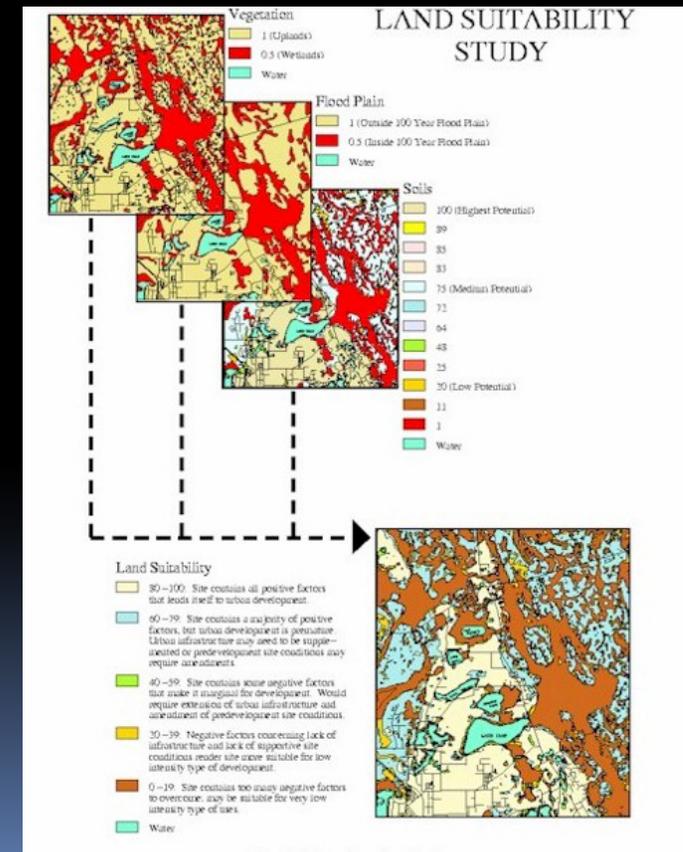
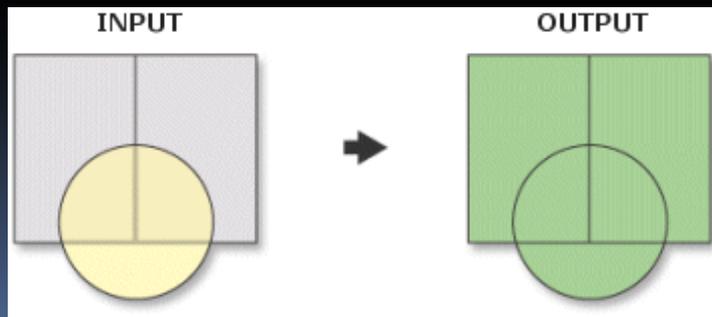
- ❑ Overlay
- ❑ Buffer Analysis
- ❑ Dissolve
- ❑ Network Analysis
- ❑ Spatial Regression
- ❑ Spatial Interpolation
- ❑ Spatial Statistics
- ❑ Model Builder and Python Scripting

GIS Introduction – Overlay

1. Spatial Overlay:

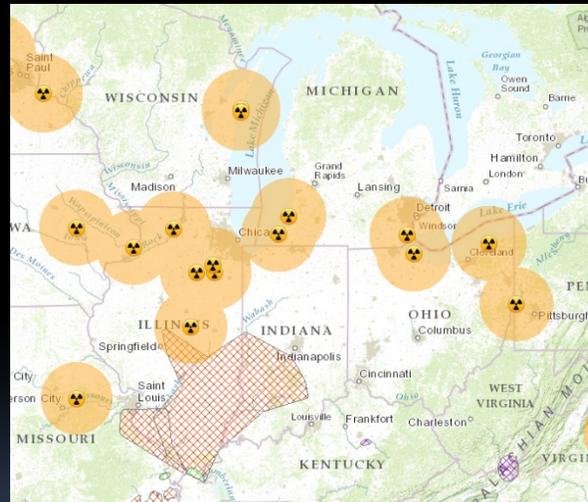
Spatial overlay is accomplished by joining and viewing together separate data sets that share all or part of the same area.

The result of this combination is a new data set that identifies the spatial relationships.



GIS Introduction – Buffer Analysis

2. Buffer analysis: identifying areas surrounding geographic features



50 miles 10 miles
10 and 50 mile derived evacuation zones surrounding nuclear plants. 10 and 50 miles represent official evacuation distances used in the United States.

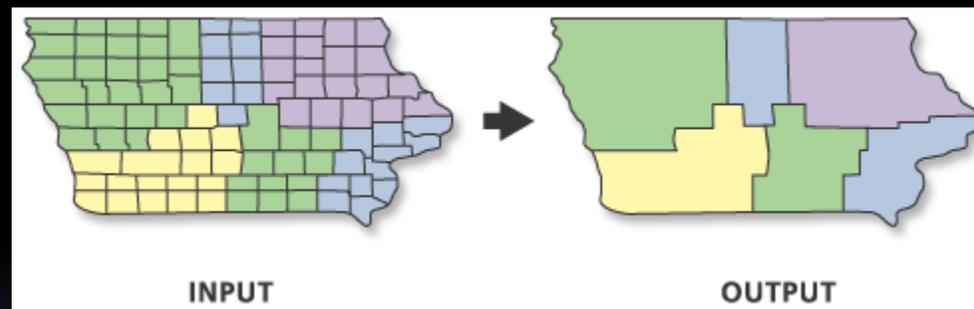
Driving distance buffer:

http://developers.arcgis.com/javascript/samples/fl_selection/

GIS Introduction – Spatial Analysis

3. Dissolve

Aggregates features based on specified attributes.



GIS Introduction – Network Analysis

4. Network Analysis

Major features:

- Routing to multiple stops
- Finding closest facilities
- Service area analysis
- Origin Destination (OD) cost matrix

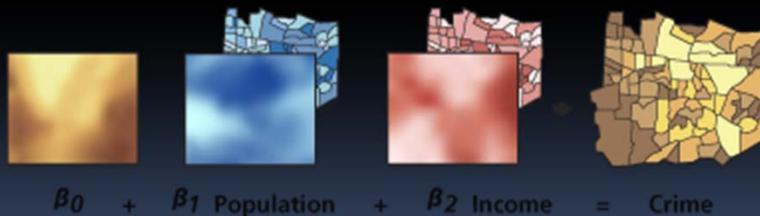
DEMO

GIS Introduction – Spatial Relationship

5. Spatial Regression

- Geographically Weighted Regression (GWR)

A local form of linear regression used to model spatially varying relationships.



Exploratory Regression



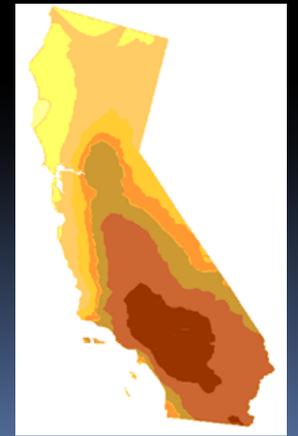
GIS Introduction – Spatial Interpolation

6. Spatial Interpolation

- Use those sample points to predict values of variable of interest at all other unsampled locations.

Interpolation Method:

- Inverse Distance Weighted
- Trend Surface
- Natural Sampling
- Splines
- Kriging



GIS Introduction – Spatial Statistics

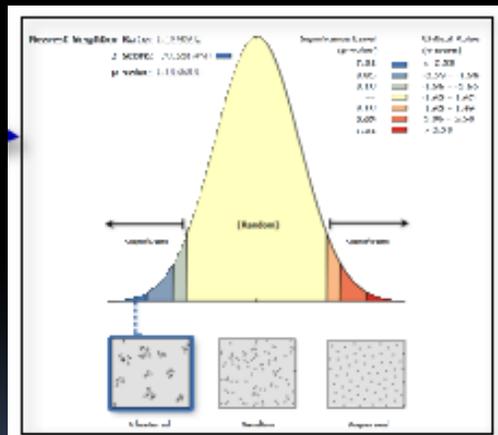
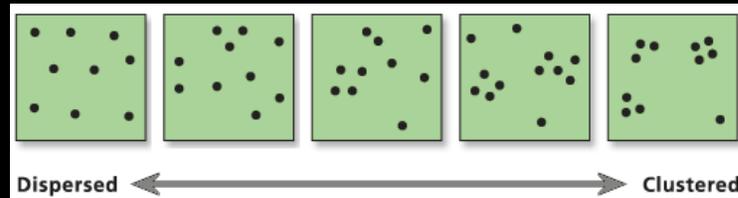
7. Spatial Statistics: analyzing spatial distributions, patterns, processes

Sample questions:

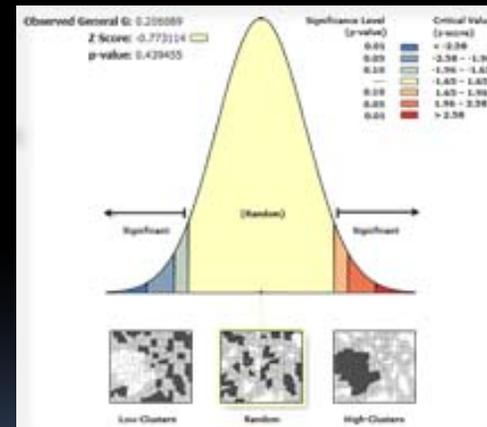
- Is there spatial clusters?
– **Analyze patterns**
- Where are the clusters?/Where are the outliers?
-- **Mapping clusters**
- Which features are most alike?
-- **Grouping analysis**
- Access overall spatial pattern
--**Spatial auto-correlation**

GIS Introduction – Spatial Statistics

Is there any spatial cluster?



Clustered vs. Dispersed
(Average Nearest Neighbor)



Low cluster vs. High cluster
(High/Low Clustering)

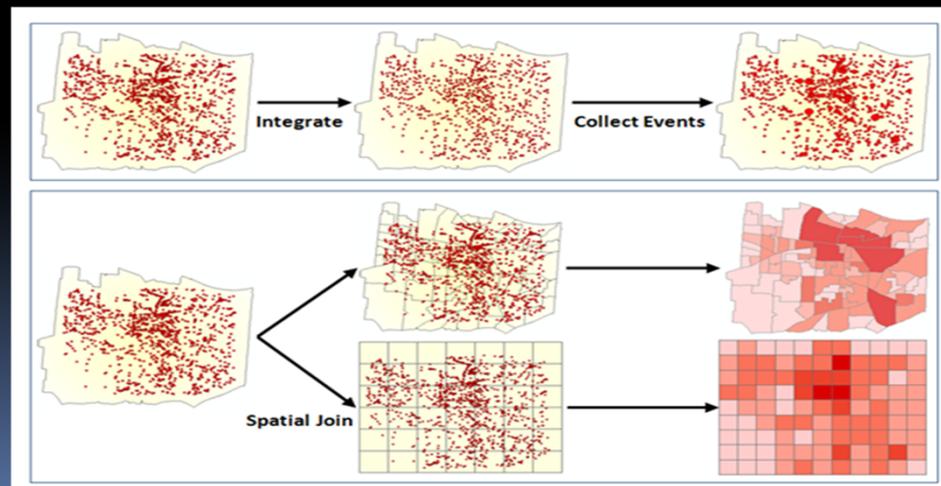
GIS Introduction – Spatial Statistics

Where are the clusters?

Hotspot analysis
(Getis-Ord G_i^*)



Input fields

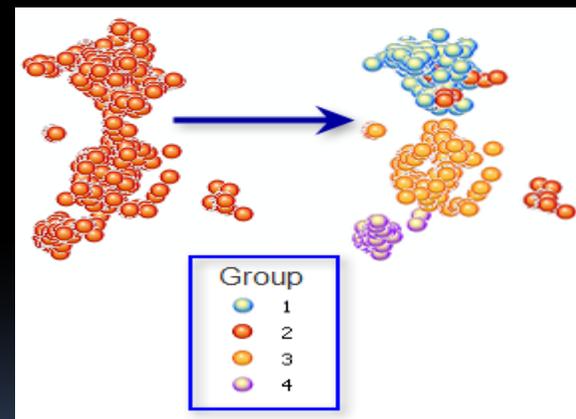


GIS Introduction – Spatial Statistics

Which features are most alike?

Grouping features based on feature attributes and optional spatial/temporal constraints.

Maximize both within-group similarities and between-group differences by trying every combination of features.

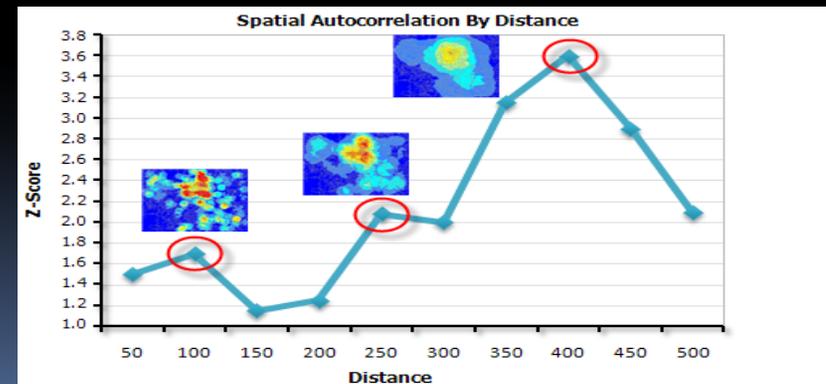


GIS Introduction – Spatial Statistics

Access overall spatial pattern

Incremental Spatial Auto-correlation:

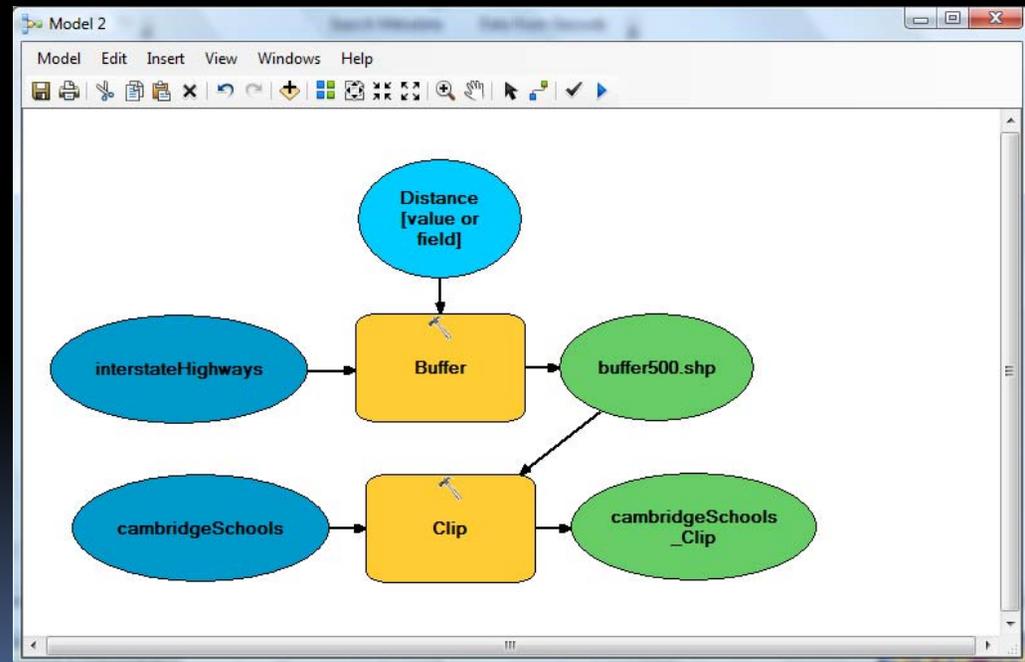
- Measures spatial autocorrelation for a series of distances.
- Z-scores reflect the intensity of spatial clustering.
- Statistically significant peak z-scores indicate the spatial scale promoting clustering are most pronounced.



GIS Introduction – Model Builder & Python Scripting

Model Builder:

DEMO



GIS Introduction –

Model Builder & Python Scripting

Python Basics:

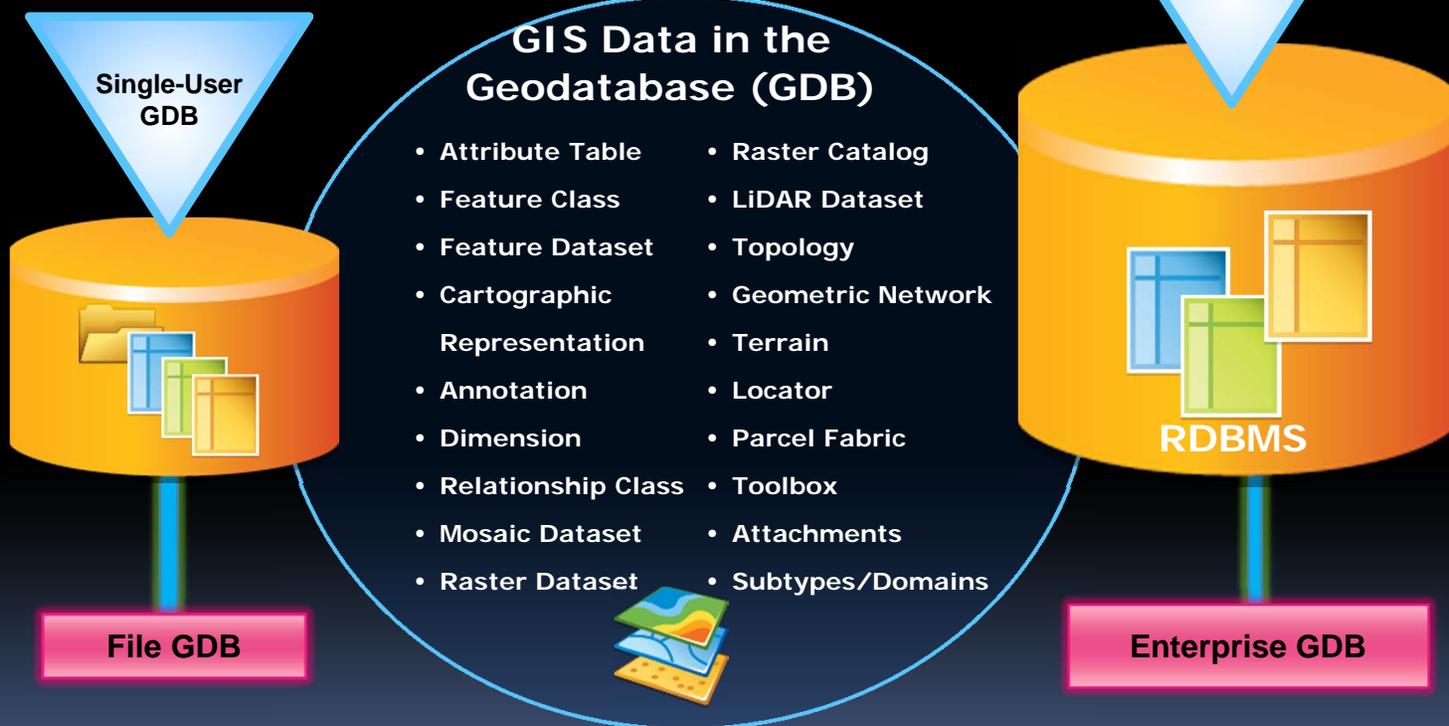
- Platform: ArcGIS Python Window, IDE (Integrated development environment) such as PythonWin, with debugging tools.
- Can be run either in command line or as individual module.
- Help: User ArcGIS help system to find usage, command syntax and scripting examples.
- ArcPy

DEMO

Agenda

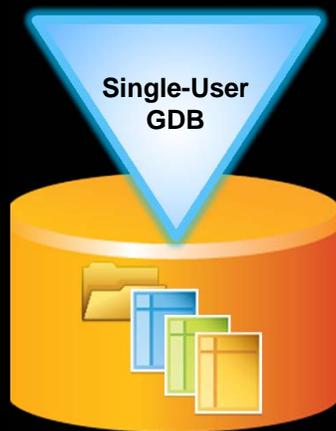
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Geodatabase Basics

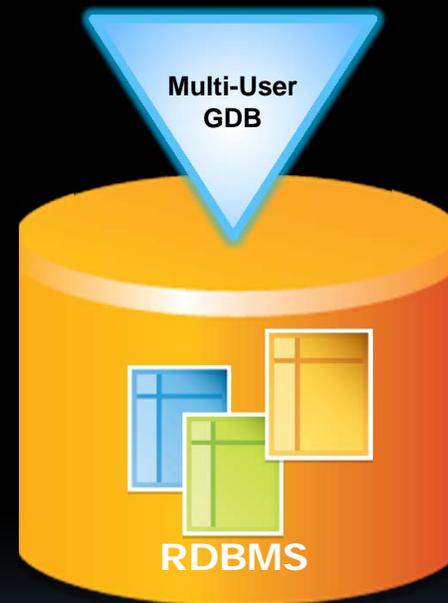


ArcGIS for Server & Databases

File Geodatabase or SDE...?



- No DBA
- Static Data
- Read Only applications
- Map Caching
- Can participate in 1 way replication



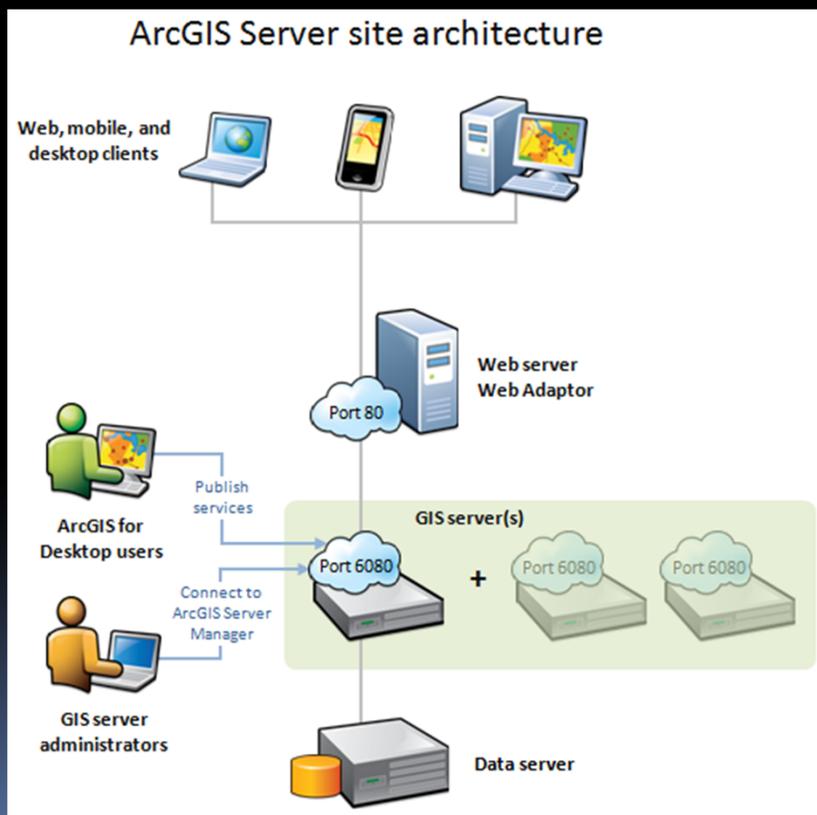
- DBA manages data
- Require Versioning
- Web Editing required
- 2 Way Replication workflows

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Web GIS - ArcGIS Server

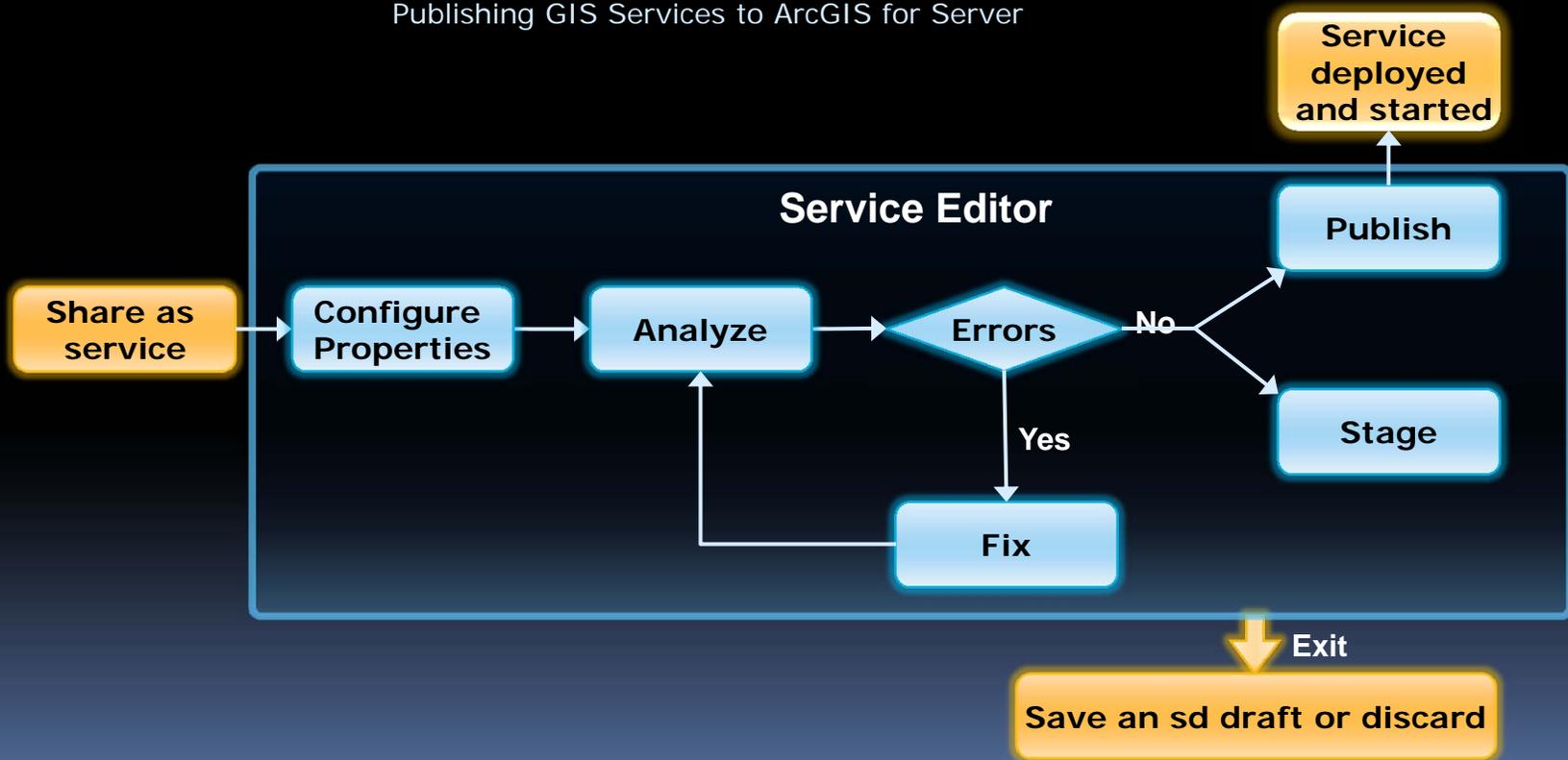
Implemented as capabilities of ArcGIS Server services



- **Map Service**
 - WMS, WCS, WFS, KML, WMTS (10.1)
- **Image Service**
 - WMS, WCS, KML
- **GeoData Service**
 - WCS, WFS, KML
- **Geoprocessing Service**
 - WPS (10.1)

Service publishing workflow

Publishing GIS Services to ArcGIS for Server



Common service capabilities

- **Mapping**

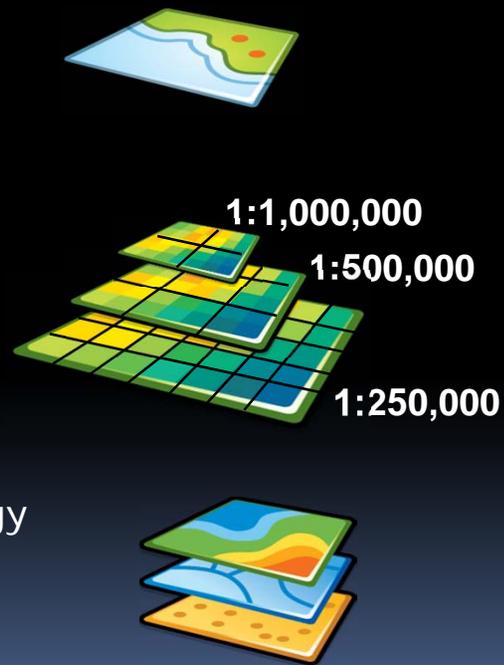
- Dynamic
 - Server needs to retrieve data
- Option to cache

- **Tiled Mapping (cached)**

- Pre-rendered tiles at different scales
- Improved performance

- **Feature Access**

- Serve feature geometry and symbology
- Allows for editing and querying



Web GIS - ArcGIS Server APIs

Workflow:

Data collection/compilation -> Creating map/geoprocessing in desktop
-> Publish via ArcGIS Server -> Web APIs or Mobile SDKs

ArcGIS Server Rest Service Endpoint

Three flavors:

- [Javascript](#)
- [Flex](#)
- [Silverlight](#)

Web GIS – ArcGIS Server APIs

- Javascript API Web App development (Mashup)
 - Client side web app:
HTML + JavaScript + CSS
 - Framework:
Dojo
 - ArcGIS API for JavaScript

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Resources on Campus - Learning

- ❑ GIS classes offered at Purdue:
- ❑ ESRI virtual campus classes: <http://www.esri.com/training/>
Contact Nicole Kong (kongn@purdue.edu) for course code.
- ❑ [ESRI Live Training Seminars](#) :
- ❑ Libraries Book Collection:
- ❑ Library Support: geohelp@purdue.edu, or kongn@purdue.edu
- ❑ GIS community at Purdue:
(<https://engineering.purdue.edu/ECN/mailman/listinfo/purduegis>)
- ❑ ESRI forum:

Resources on Campus - Software

- ❑ **ESRI educational license:**

ArcGIS Desktop, all extensions (including spatial analysis, 3D analysis, geostatistics, etc.), ArcGIS Server, ArcSDE database, ArcPad, CityEngine, etc.

- ❑ **ESRI free student 1 year license:**

Contact Nicole Kong (kongn@purdue.edu) for license.

- ❑ **ArcGIS Online, geocoding, ArcGIS for office:**

- ❑ **Free products: QGIS, Google Earth.**

- ❑ **Google Earth Pro.**

- ❑ **GeoServer.**

Resources on Campus - Data

- ❑ **GIS data [LibGuide](#):**

 - Data by Theme

 - Data by State

- ❑ **Databases:**

 - SimplyMap

 - Proquest Statistical Dataset

 - Reference USA

- ❑ **Geodata Portal:**

 - Geodata @ Purdue (in construction)

Resources on Campus - **Library**

- ❑ Technical support:
- ❑ Data access:
- ❑ Data sharing:
- ❑ Data collection strategies:
- ❑ Project planning:
- ❑ Web GIS and mobile GIS development:



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Exercise

- Demo
- Exercise document
- Survey

<http://mapsdev.lib.purdue.edu/WS/>