Introduction to ArcGIS Pro
Objectives

1. Familiar with GIS terms and concepts
2. Navigate ArcGIS Pro software
3. Know where to go for further assistance
Road map

GDC → GIS overview → Examples of GIS → **Hands-on workshop**
GIS/Data Center
Fundamentals
What is GIS?

A geographic information system (GIS) is a system designed to create, store, manipulate, analyze, manage, and visualize spatial data.

Photo source: https://mangomap.com/what-is-gis
What is GIS?
GIS components

Software
- Esri ArcGIS, QGIS, ERDAS IMAGINE, ENVI

Hardware
- Desktops, servers, smartphones, tablets, GPS devices

Data
- Publicly available, purchased, created

People
- GIS professional, data providers, and audiences

Methods
- Workflows; plans and rules for how technology is applied
GIS functions

**Visualization**
- Getting information by looking at a map

**Geospatial analysis**
- Performing detailed analysis regarding the spatial relationships between and within datasets

**Geospatial data management**
- Organizing and updating spatial information
GIS data

Components → Types → Formats → Coordinate systems
GIS data components

**Features**
- Graphic spatial representation of real-world physical features

**Attributes**
- Non-spatial data describing the features

Photo source: https://mangomap.com/what-is-gis
GIS data components

Features
- Graphic spatial representation of real-world physical features

Attributes
- Non-spatial data describing the features
Symbolize data by attributes
Select data by attributes
# Data types

**Vector**

- Uses points, lines, and polygons to represent real features on the earth’s surface. Ideal for discrete themes with definite boundaries.
- Examples: light poles, roads, buildings

**Raster**

- Composed of a continuous grid of cells that represent a value for a portion of the earth’s surface. Ideal for continuous themes of change.
- Examples: elevation, rainfall
Vector data - points
Vector data - lines
Vector data - polygons
Raster data
Raster data
Data formats

**Feature class**
- Vector storage data format; points, lines, polygons
- Homogenous collection of common features

**Shapefile feature class**
- Open source

**Geodatabase feature class**
- Esri, proprietary

![Major Streams](image1.png)
![Wastewater Outfalls](image2.png)
Data formats

Conversion Tools
- Excel
- From GPS
- From Raster
- From WFS
- JSON
- KML
- To CAD
- To Collada
- To dBASE
- To Geodatabase
- To GeoPackage
- To Raster
- To Shapefile
 Coordinate systems

**Geographic (3D)**
- A method of representing points in a space of given dimensions using spherical measures of lat/long
- Measured in degrees

**Projected (2D)**
- A method of representing the earth’s 3D surface as a 2D surface
- Measured in feet/meters

Geographic coordinate systems

Photo source:
Projected coordinate systems

Map Projection Families

Photo source: https://docs.qgis.org/2.8/en/docs/gentle_gis_introduction/coordinate_reference_systems.html
Projected coordinate systems
Esri ArcGIS software
ArcGIS products

**Desktop GIS**
- ArcGIS Pro, ArcMap, ArcCatalog

**Web-based GIS**
- ArcGIS Online (AGOL): web maps, web apps

**Mobile GIS**
- Collector for ArcGIS
- Survey123 for ArcGIS
ArcGIS software @ Rice

On campus access
- GIS/Data Center
- Fondren Library 1st Floor Rice Computers
- Mudd Lab
- Various Department Labs (ARCH, CEVE, ESCI)

Personal use
- Request a 1-year student trial by e-mailing gisdata@rice.edu
- Windows only
GIS in practice
Nature and Conservation

Sea Level Rise and Storm Surge Effects on Energy Assets: Houston

Sea Level Rise and Storm Surge Inundation

GCE generated several inundation surfaces to account for the range of possibilities of both future SLR and storm surge. Using the NCA Intermediate-High scenario in conjunction with NOAA data, the Houston area is projected to experience 2 feet of SLR by around 2050, and 5 feet of SLR by around 2100.

The following layers were created to show projected inundations. Click to view.

- No Storm Surge
  - 2 Foot of Sea Level Rise
  - 5 Feet of Sea Level Rise

- Category 1 Storm Surge
  - 2 Foot of Sea Level Rise
  - 5 Feet of Sea Level Rise

- Category 5 Storm Surge
  - 2 Foot of Sea Level Rise
  - 5 Feet of Sea Level Rise

Assets

The Houston MSA includes more than 1,455 energy assets, which consists of electricity, petroleum and natural gas assets. For the purposes of this analysis, additional focus is placed on larger, more important assets.

Assets that were examined included:

https://icfgeospatial.maps.arcgis.com/apps/MapSeries/index.html?appid=58f90c5a5b5f4f94aaff93211c45e4ec
Environmental Impacts

Summarizing Hurricane Harvey’s Environmental Impacts

Air

Daily Maximum 8-hour Ozone Concentrations
9/15/2017 - 9/15/2017

- Good
- Moderate
- Unhealthy for Sensitive Groups
- Unhealthy
- Sites without data

The slider at the bottom right will advance the time series by day. Click the arrows right or left to see differences between days.

Ground level (tropospheric) ozone is a secondary air pollutant formed by the chemical reaction between volatile organic compounds (VOCs) and nitrogen oxides (NOx) in the presence of sunlight. Ozone is a respiratory irritant that can lead to coughing, difficulty breathing and shortness of breath, exacerbate the frequency and intensity of asthma attacks, throat irritation, and even lung infections and damage. Children and the elderly are especially sensitive to these health effects. Ozone can also affect the growth of vegetation and trees and reduce crop yields. High levels of ozone can be caused by elevated emissions of VOCs and NOx, especially when coupled with weather conditions characterized abundant of sun and heat that facilitate photochemical process associated with ozone formation. During and after Harvey, the Houston region experienced many storm-related releases and spills of VOCs. Storm-associated shutdowns and startups at refineries and petrochemical facilities have also resulted in the release of large amounts of ozone precursors such as VOCs.

https://harcresearch.maps.arcgis.com/apps/MapSeries/index.html?appid=d6b0a3d762ec46ef8ea676f100817028/
Business and Economics

Optimizing Home Delivery with Location Services

Blending Deliveries for All Customers

If the service strategies were simply combined by giving all the unassigned deliveries to a second vehicle at any of the DCs, there would be 83 hours of work but only approximately 8 hours allocated to DC5.

A strategy to minimize vehicles but ensure all DCs are used is not optimal because the second vehicle is often driving long distances to start deliveries. DC5 could serve some of those customers while more vehicles at some DCs might reduce time and distance.

<table>
<thead>
<tr>
<th>DC</th>
<th>Stops</th>
<th>Work Hours</th>
<th>Minutes Driving</th>
<th>Miles Driven</th>
<th>Start Time</th>
<th>End Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC1</td>
<td>67</td>
<td>14:56</td>
<td>225.97</td>
<td>77.84</td>
<td>9:00 AM</td>
<td>4:55 PM</td>
</tr>
<tr>
<td>DC2</td>
<td>53</td>
<td>11:56</td>
<td>186.22</td>
<td>57.11</td>
<td>9:00 AM</td>
<td>4:53 PM</td>
</tr>
<tr>
<td>DC3</td>
<td>63</td>
<td>13:05</td>
<td>154.59</td>
<td>41.13</td>
<td>9:00 AM</td>
<td>4:56 PM</td>
</tr>
<tr>
<td>DC4</td>
<td>71</td>
<td>15:30</td>
<td>220.91</td>
<td>65.98</td>
<td>9:00 AM</td>
<td>4:53 PM</td>
</tr>
<tr>
<td>DC5</td>
<td>35</td>
<td>7:51</td>
<td>121.32</td>
<td>54.77</td>
<td>9:00 AM</td>
<td>4:51 PM</td>
</tr>
</tbody>
</table>

| Totals | 289 | 63:18 | 909.01 | 296.82 |

Servicing All Customer Deliveries from Existing DCs (Blend)

https://esribizteam.maps.arcgis.com/apps/MapJournal/index.html?appid=c81dfbf908d84eb89ec52351415c4dea
Hands-on workshop

Wiki tutorial print-outs in the back of room!
Summary

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2. Navigate ArcGIS Pro software
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