
ESCI 545 GIS Workshop



RICE

Fondren Library
GIS/Data Center

Remote course logistics

1. Software should already be downloaded
2. Slides, wiki, recording available
3. Unmute yourself to ask a question
4. Type questions into chat

Objectives

1. Know where to go for further assistance
2. Refresh on GIS terms and concepts
3. Familiar with ArcGIS Pro interface
4. Employ GIS tools for geoscience objectives

Road map

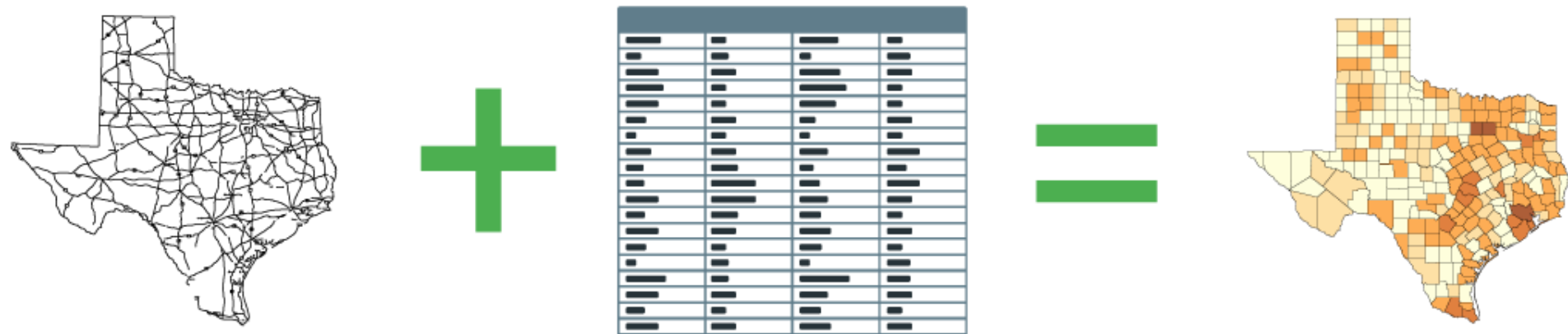
GDC → GIS overview → Examples of GIS → **Hands-on workshop**

GIS/Data Center

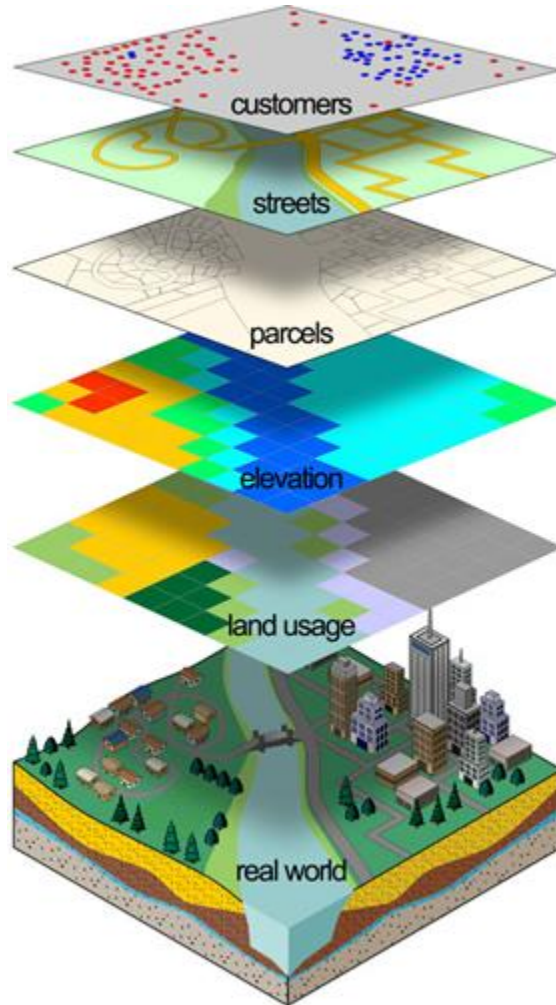
GIS overview

What is GIS?

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



What is GIS?



GIS data

Components → Types → Formats

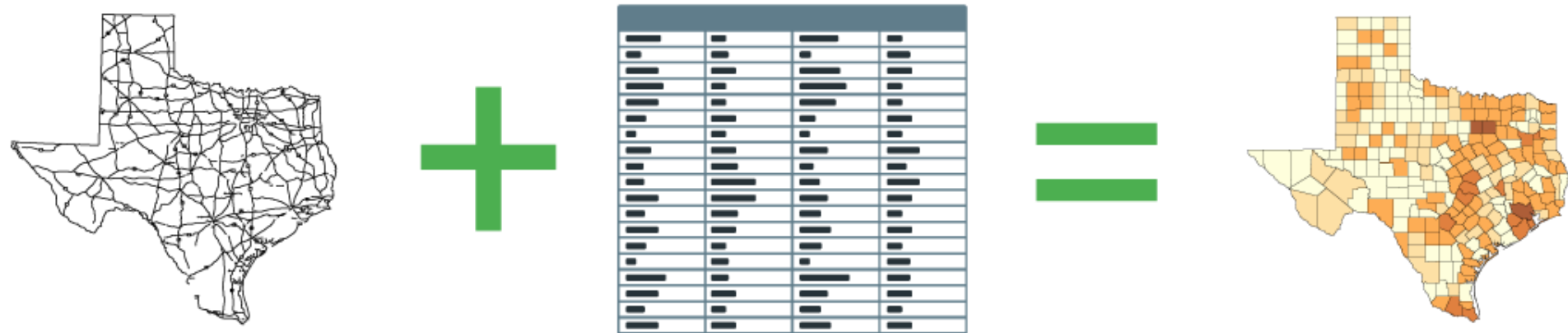
GIS data components

Features

- Graphic spatial representation of real-world physical features

Attributes

- Non-spatial data describing the features



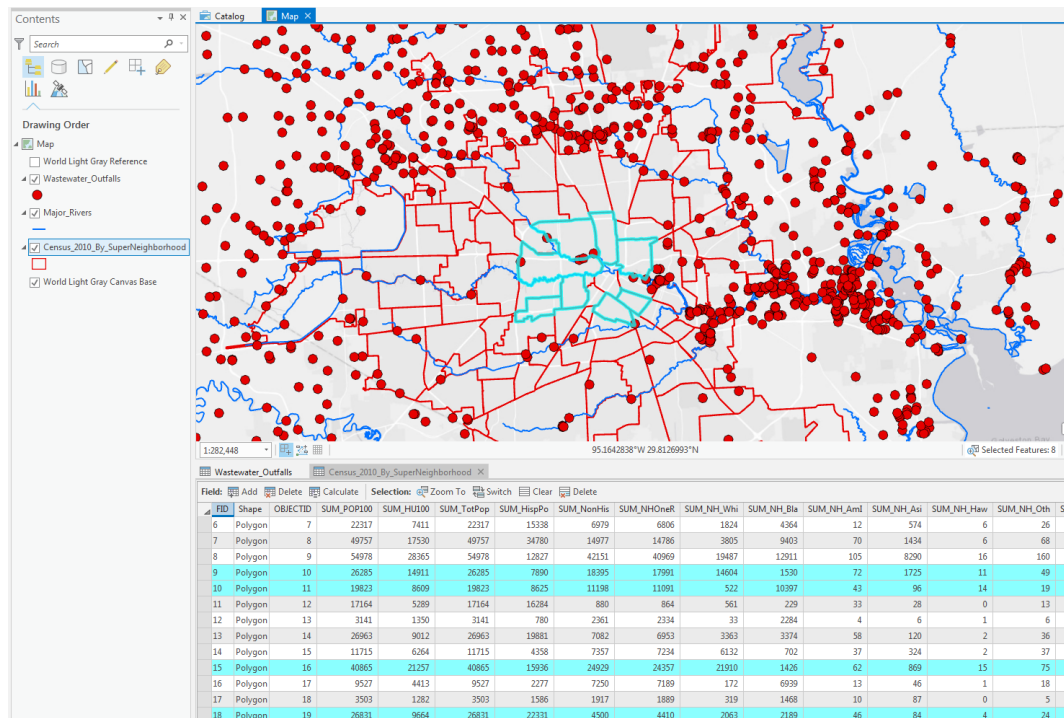
GIS data components

Features

- Graphic spatial representation of real-world physical features

Attributes

- Non-spatial data describing the features



Symbolize data by attributes

The screenshot displays a GIS application interface. The main map shows a city area with superneighborhoods color-coded based on total population. The Symbology pane on the right is configured for the layer 'Census_2010_By_SuperNeighborhood' using a 'Graduated Colors' style. The field 'SUM_TotPop' is selected, with a 'Natural Breaks (Jenks)' method and 5 classes. The color scheme ranges from light yellow to dark red.

The Contents pane on the left shows the layer 'Census_2010_By_SuperNeighborhood' with a legend for 'SUM_TotPop / Shapearea':

- ≤0.00004675
- ≤0.0001205
- ≤0.0001943
- ≤0.0002848
- ≤0.0005566

The data table at the bottom shows the following columns: FID, Shape, OBJECTID, SUM_POP100, SUM_HU100, SUM_TotPop, SUM_HispPo, SUM_NonHis, SUM_NHOneR, SUM_NHWhi, SUM_NH_Bla, SUM_NH_Aml, SUM_NH_Asi, SUM_NH_Haw, and SUM_NH_Oth.

FID	Shape	OBJECTID	SUM_POP100	SUM_HU100	SUM_TotPop	SUM_HispPo	SUM_NonHis	SUM_NHOneR	SUM_NHWhi	SUM_NH_Bla	SUM_NH_Aml	SUM_NH_Asi	SUM_NH_Haw	SUM_NH_Oth
0	Polygon	1	3881	2104	3881	711	3170	3091	1353	1396	11	321	1	9
1	Polygon	2	13471	5120	13471	10603	2868	2798	1063	1623	21	78	2	11
2	Polygon	3	16716	3664	16716	3266	13450	13347	6092	6562	29	355	1	308
3	Polygon	4	2497	1133	2497	603	1894	1880	15	1853	5	6	0	1
4	Polygon	5	49277	31563	49277	7311	41966	41129	34063	2291	69	4551	11	144
5	Polygon	6	33973	15192	33973	15914	18059	17769	4920	12080	80	638	5	46
6	Polygon	7	22317	7411	22317	15338	6979	6806	1824	4364	12	574	6	26
7	Polygon	8	49757	17530	49757	34780	14977	14786	3805	9403	70	1434	6	68
8	Polygon	9	54978	28365	54978	12827	42151	40969	19487	12911	105	8290	16	160
9	Polygon	10	26285	14911	26285	7890	18395	17991	14604	1530	72	1725	11	49
10	Polygon	11	19823	8609	19823	8625	11198	11091	522	10397	43	96	14	19
11	Polygon	12	17164	5289	17164	16284	880	864	561	229	33	28	0	13
12	Polygon	13	3141	1350	3141	780	2361	2334	33	2284	4	6	1	6

Select data by attributes

Contents

- Map
- World Light Gray Reference
- Wastewater_Outfalls
- Major_Rivers
- Census_2010_By_SuperNeighborhood**
 - SUM_TotPop / Shapearea
 - ≤0.00004675
 - ≤0.0001205
 - ≤0.0001943
 - ≤0.0002848
 - ≤0.0005566
- World Light Gray Canvas Base

Geoprocessing

Select Layer By Attribute

Parameters | Environments

Layer Name or Table View
Census_2010_By_SuperNeighborhood

Selection type
New selection

Expression
SUM_TotPop is Greater Than 60000

✓ The SQL expression is valid.

Add Clause

Invert Where Clause

Run

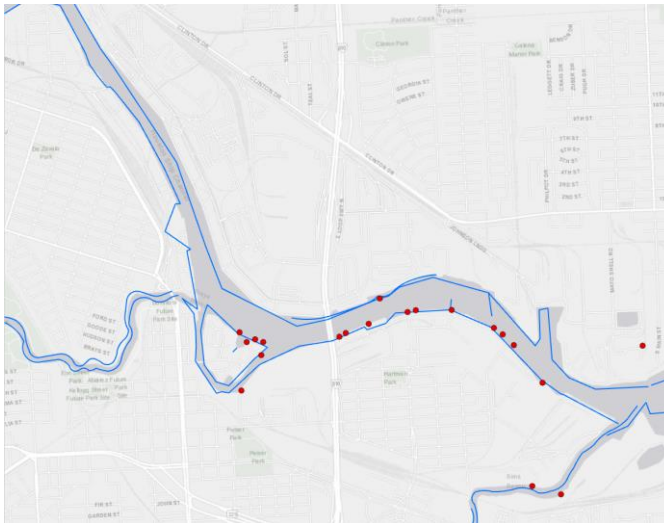
Table View

FID	Shape	OBJECTID	SUM_POP100	SUM_HU100	SUM_TotPop	SUM_HispPo	SUM_NonHis	SUM_NHOneR	SUM_NHWhi	SUM_NH_Bla	SUM_NH_Aml	SUM_NH_Asi	SUM_NH_Haw	SUM_NH_Oth
43	Polygon	44	75724	30285	75724	43244	32480	31627	9838	10280	105	11208	40	156
50	Polygon	51	60857	19004	60857	31148	29709	29328	2139	26146	76	892	3	72
52	Polygon	53	102235	35498	102235	47966	54269	52936	8596	25589	163	18348	30	210

Data types

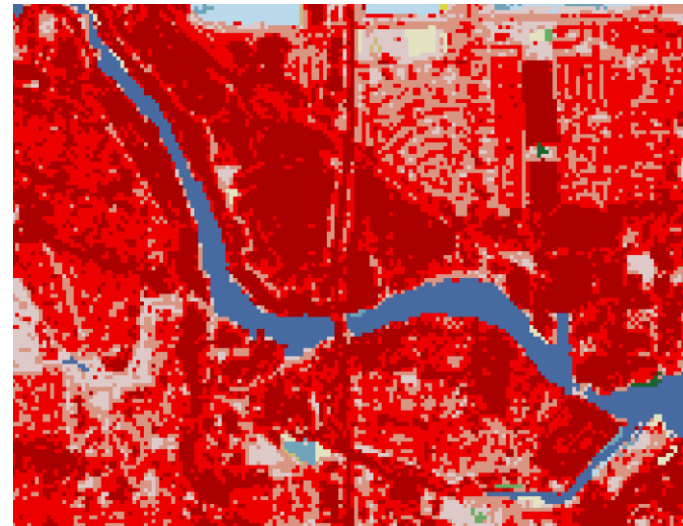
Vector

- 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

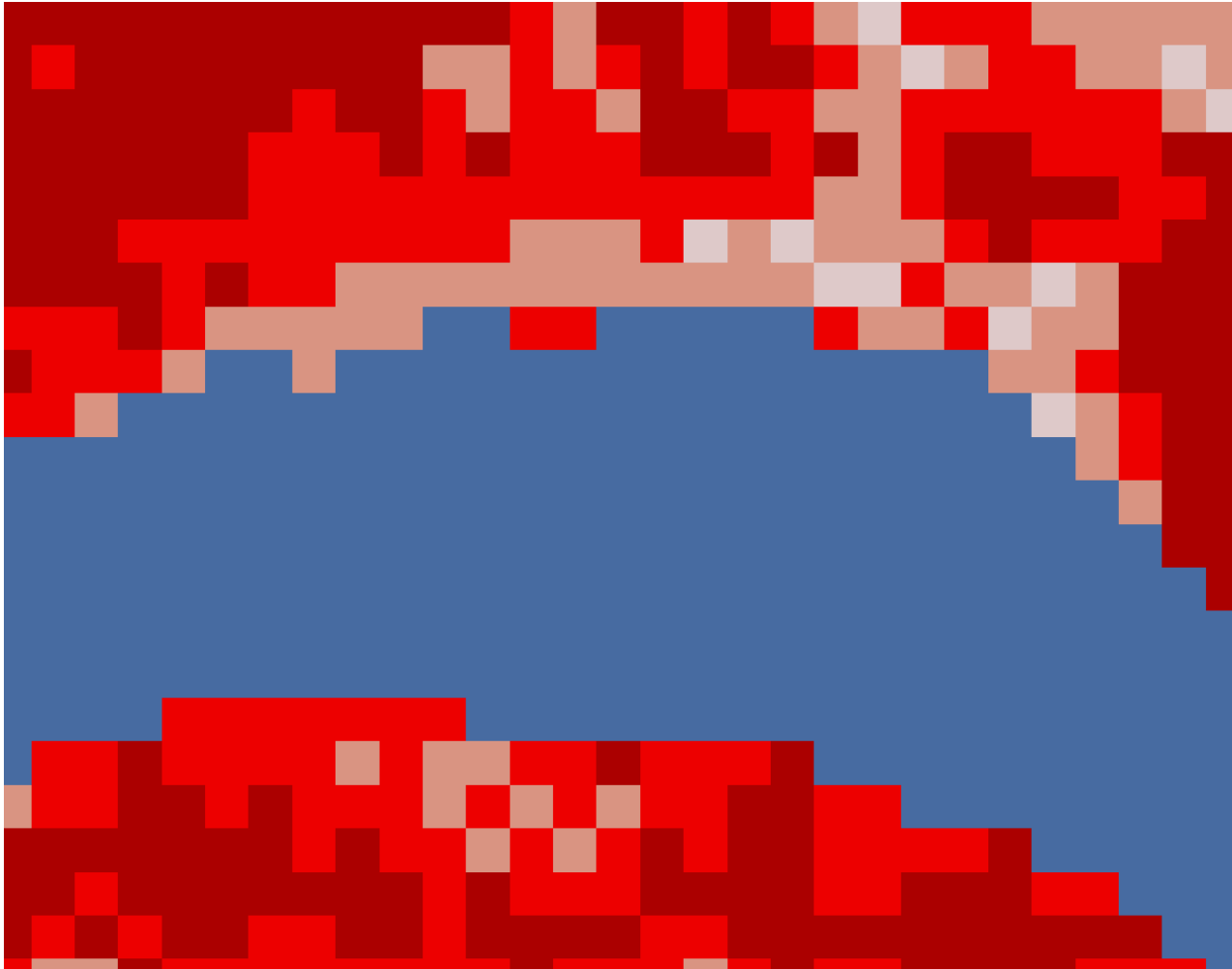


Raster

- 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



Raster data



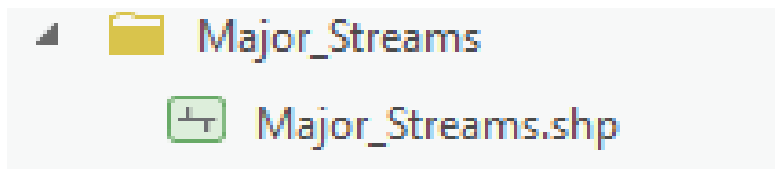
Data formats

Feature class

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

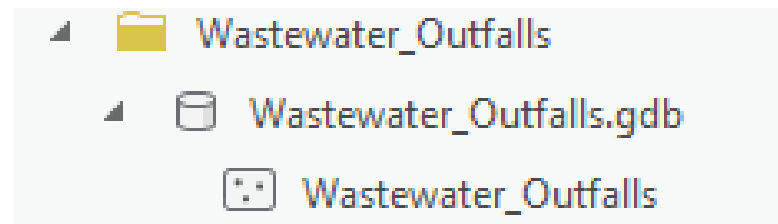
Shapefile feature class

- Open source



Geodatabase feature class

- Esri, proprietary

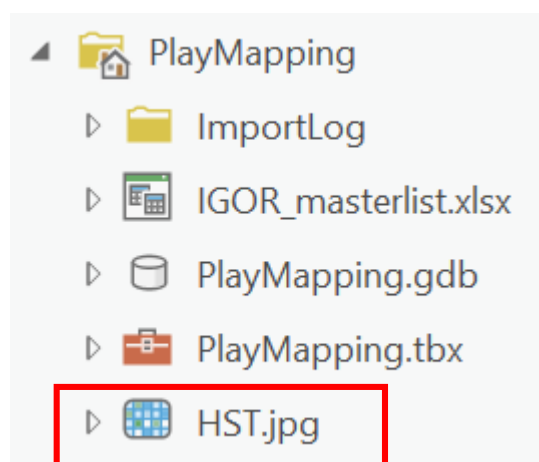


Data formats

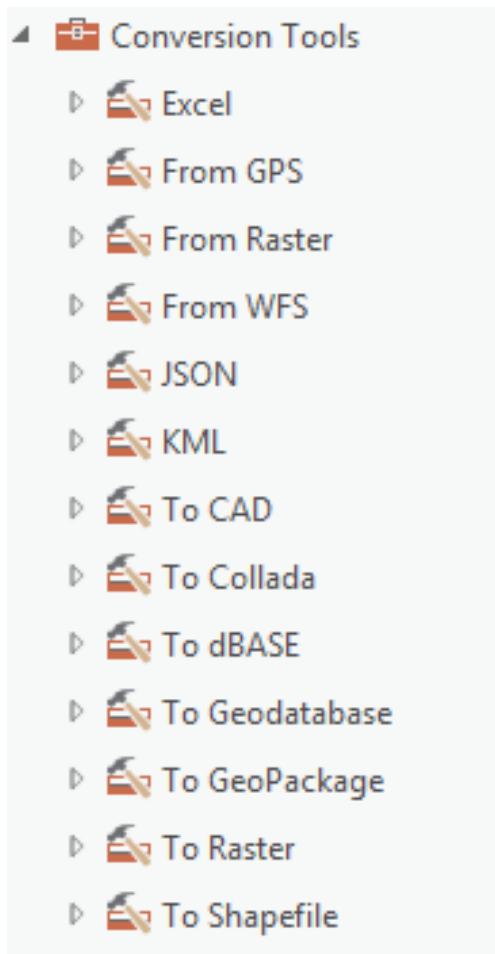
Raster

- Matrix of cells organized into rows and columns where each cell contains a value representing information.

- *MrSID*
- *Esri GRID*
- *JPEG*
- *TIFF*
- *GeoTIFF*
- *PNG*



Data formats



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



GIS in practice

Environmental Impacts

Sea Level Rise and Storm Surge Effects on Energy Assets



- Introduction
- Baltimore MSA
- Boston MSA
- Houston MSA
- Los Angeles MSA
- Miami MSA
- Mobile MSA
- New Orleans MSA
- New York MSA
- Norfolk MSA
- Philadelphia MSA
- Bibliography

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

Sea Level Rise and Storm Surge Inundation

OE 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

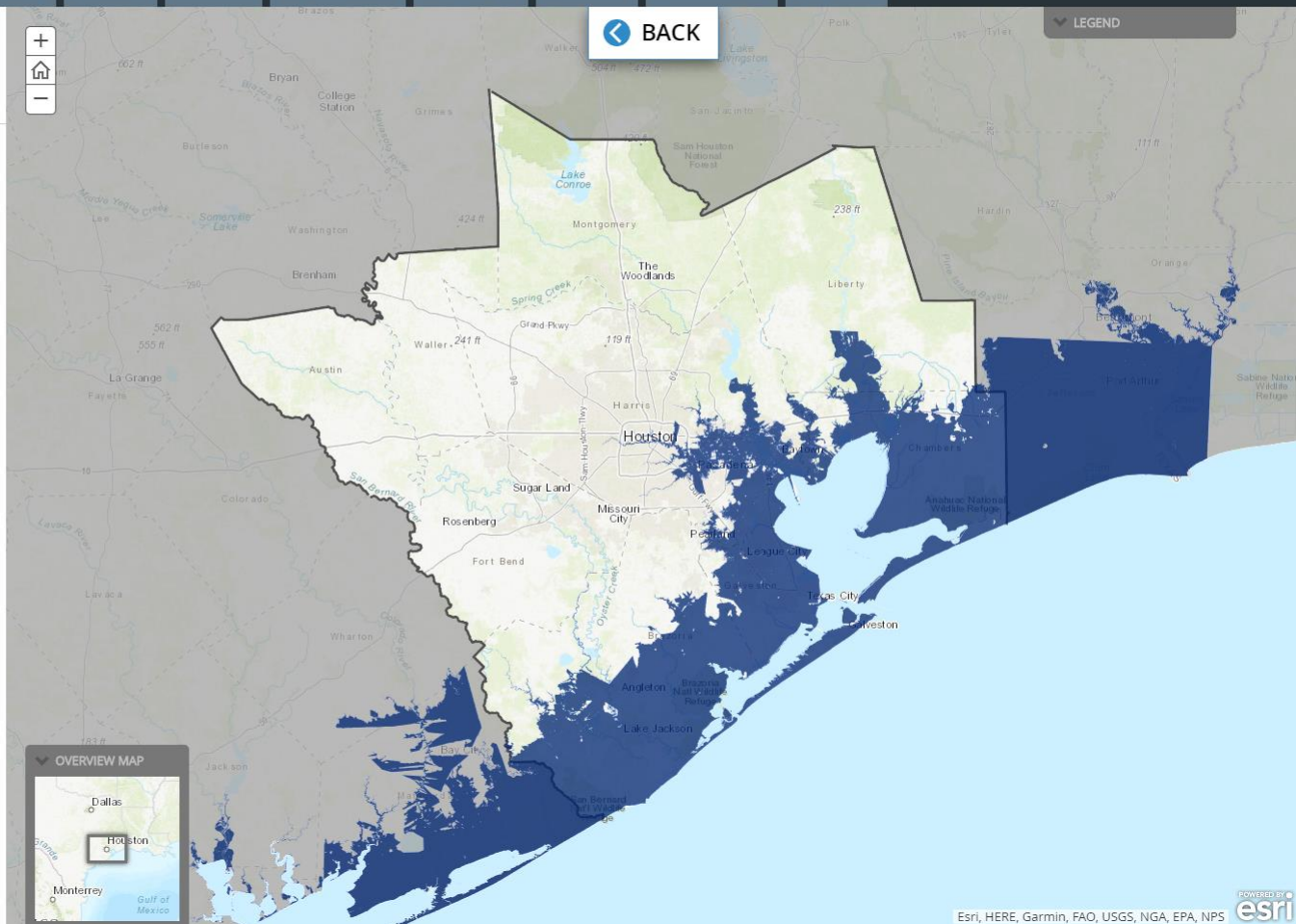
Category 5 Storm Surge

- 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:



POWERED BY Esri, HERE, Garmin, FAO, USGS, NGA, EPA, NPS

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

Environmental Impacts

Summarizing Hurricane Harvey's Environmental Impacts

- Intro
- Water
- Air**
- Health and Safety
- Built Environment and People
- Electricity and Energy
- About

Air

- Ozone**
- Toxics

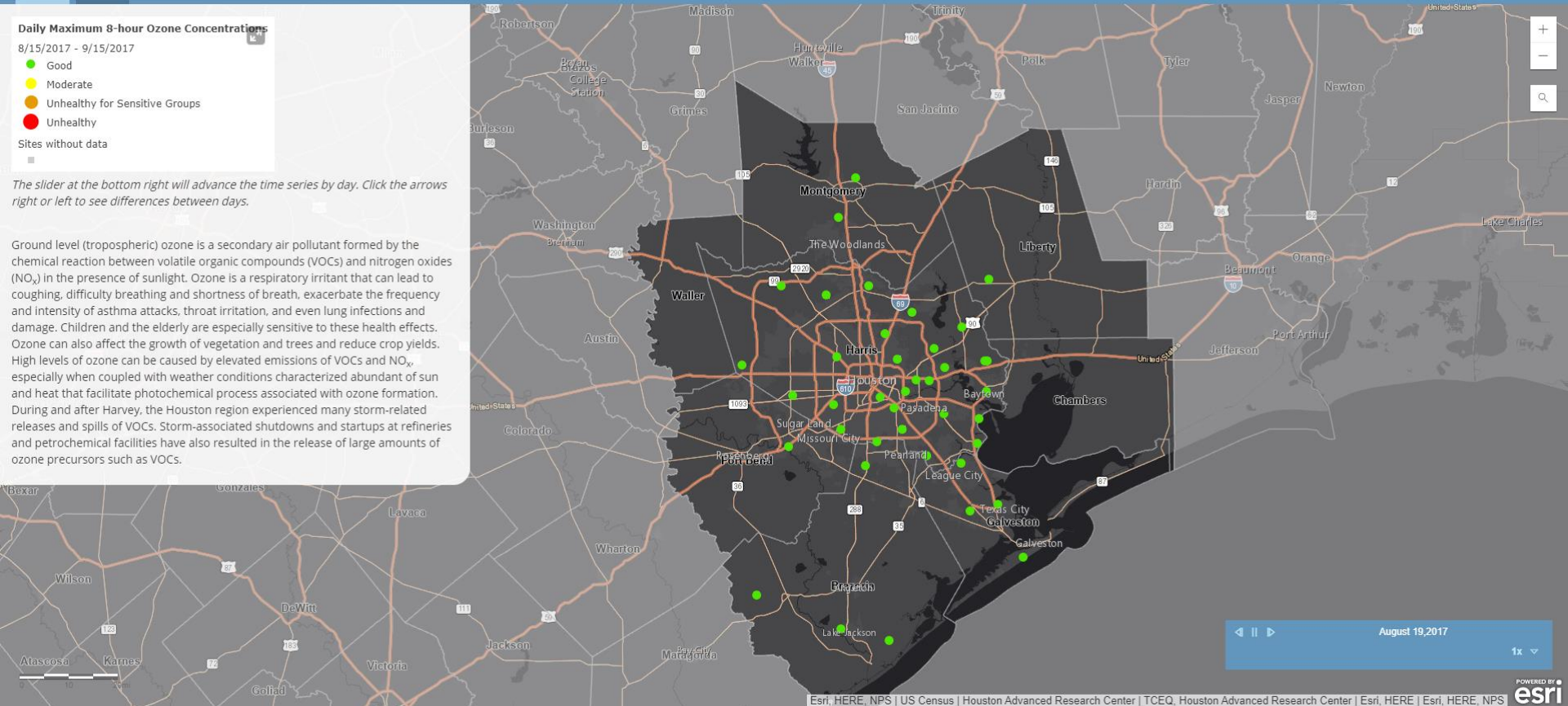
Daily Maximum 8-hour Ozone Concentrations
8/15/2017 - 9/15/2017

- 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 (NO_x) 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 NO_x, 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://harresearch.maps.arcgis.com/apps/MapSeries/index.html?appid=d6b0a3d762ec46ef8ea676f1008f7028/>

Hands-on workshop

Recording available.

Slides available.

Wiki tutorial available online.

Summary

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