Communicating Climate Change to Communities: A GIS-based Framework to Support Local Decision-Making

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Agenda

- Introduction
- Background
- Objectives
- Methodology
- Anticipated Results
- Timeline
- Project Presentation

Introduction & Background

- The way we are communicating climate change is changing
- The path to climate resiliency has shifted towards local governments and communities
- Climate change resiliency in local communities lies within their ability of understanding the impacts of climate change on a local level

Supporting Local Actions

- We need to support local community driven frameworks to address and create achievable climate solutions
- Local Climate Action Plans
  - Pennsylvania has developed a Local Climate Action Plan Program
  - 53 cities, townships, boroughs, counties, and regional organizations in Pennsylvania have created their own plans

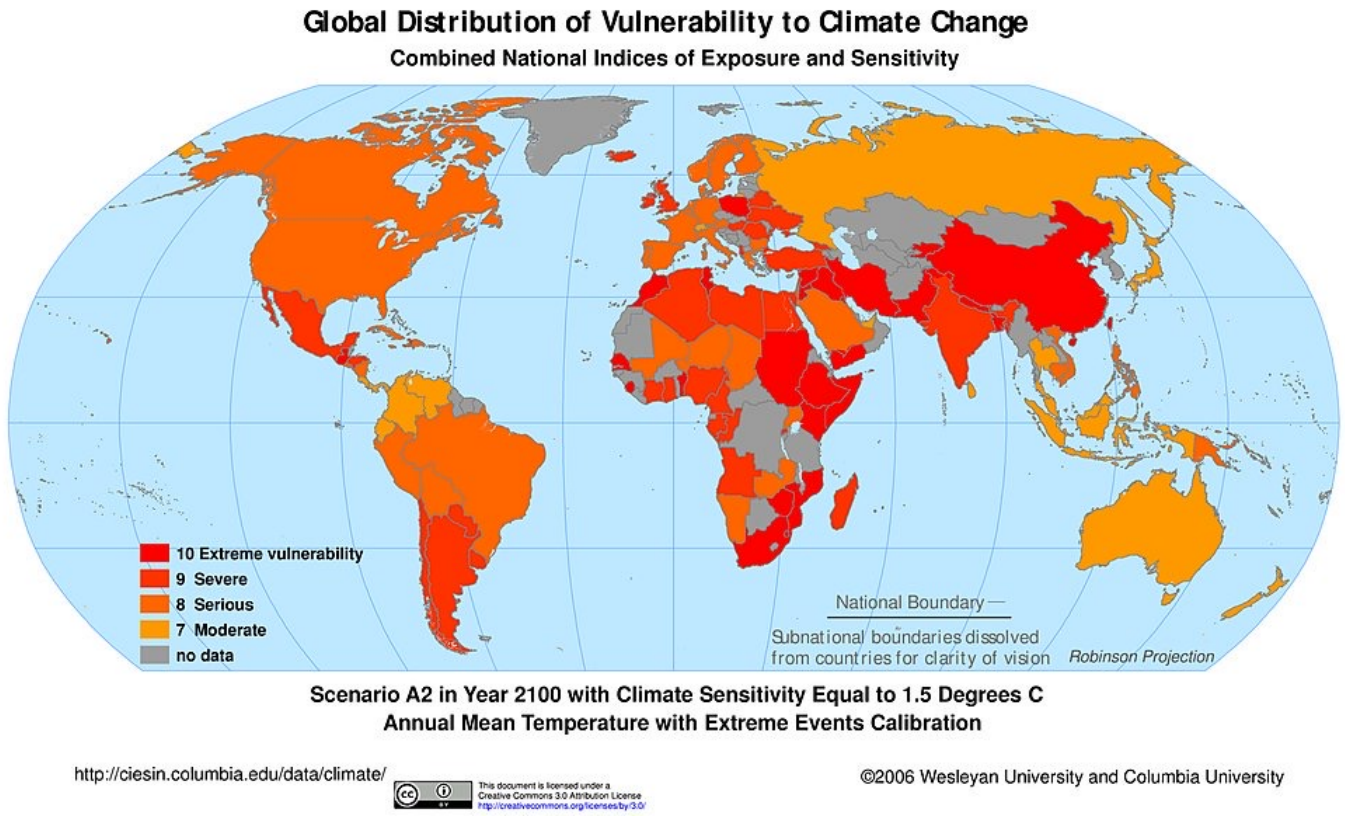
Local Climate Action Program

Having state and local governments lead by example on climate action is a key component of mitigating climate change in Pennsylvania and one of the strategies recommended in the Pennsylvania Climate Action Plan.

The DEP Local Climate Action Program provides free technical and personnel assistance to local governments that want to reduce greenhouse gas emissions and address climate change.

PA DEP (2022)

Utilizing GIS for Local Decision Making



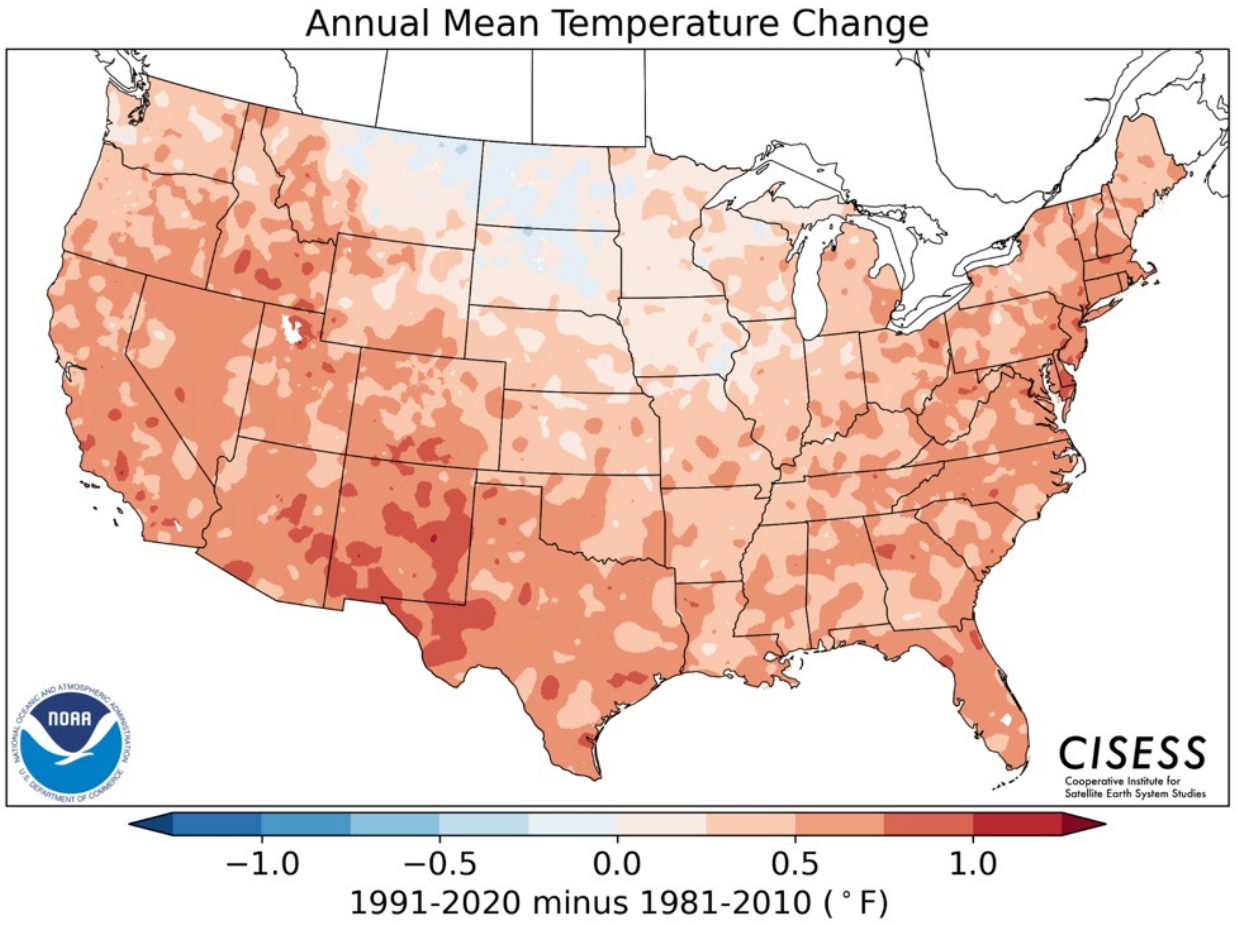
- GIS is extremely helpful tool for decision making
- Due to the geographic nature of climate change, maps are an important piece of visual representations of climate change (Fish, 2020b).
- However, we need more localized community climate change maps

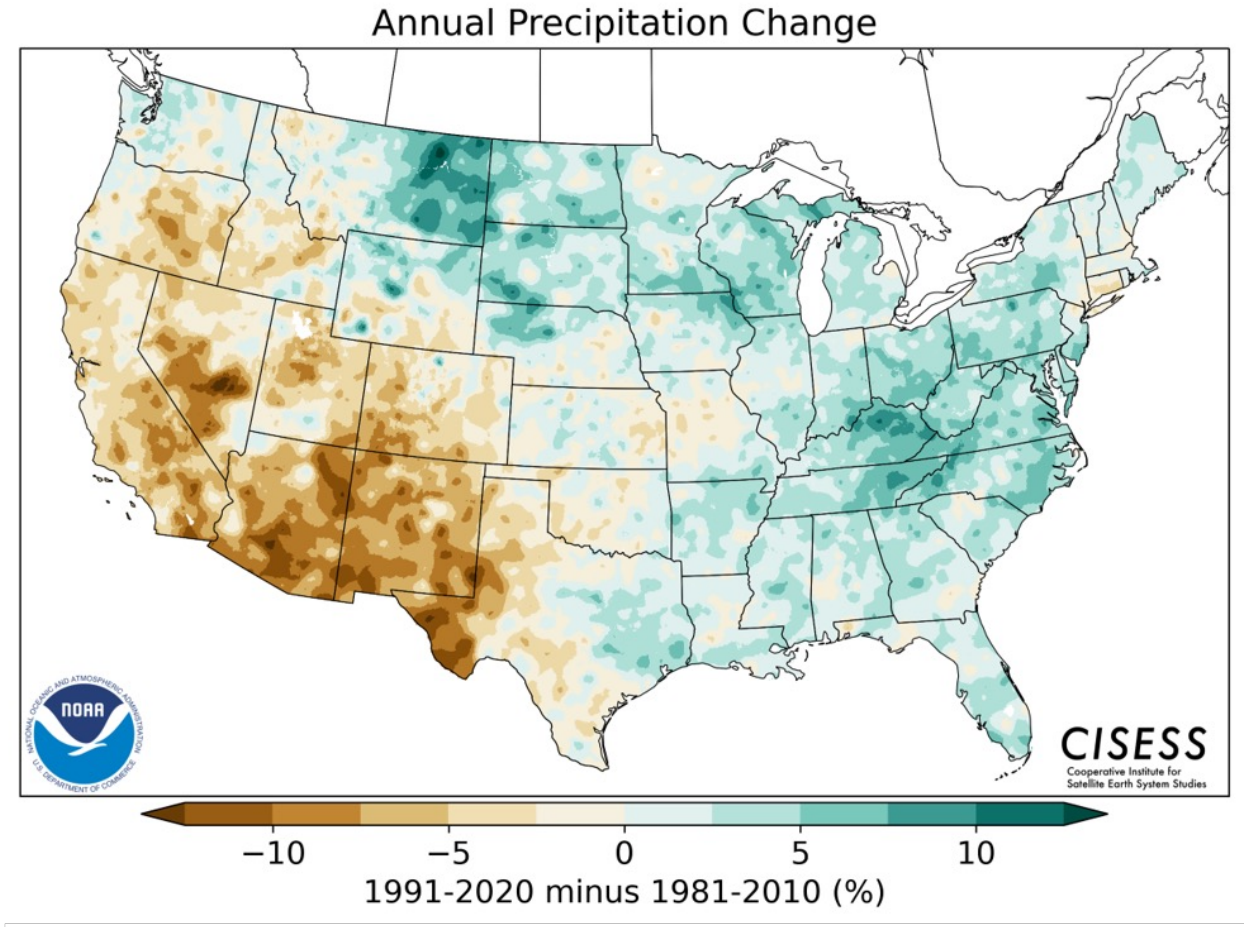
Communicating Climate Change with the Community in Mind

- Create personal connections to climate change through individual interests and shared values
- Storytelling is an effective medium to create personal connections
- Storytelling allows scientists to effectively communicate data using visualizations and narratives (Cote, 2021)
- Use user engagement tools to better evaluate community members and local decision makers

Objectives

- Address climate change data and the perception of climate data from a local community aspect.
- Investigate how climate change data is distributed, communicated, and displayed to the community using GIS tools and products.
- Conduct a risk and vulnerability assessment using ArcGIS to identify the most vulnerable communities in Allegheny County.
- Use ArcGIS Experience Builder to create a Web App to communicate findings with local decision-makers and local communities

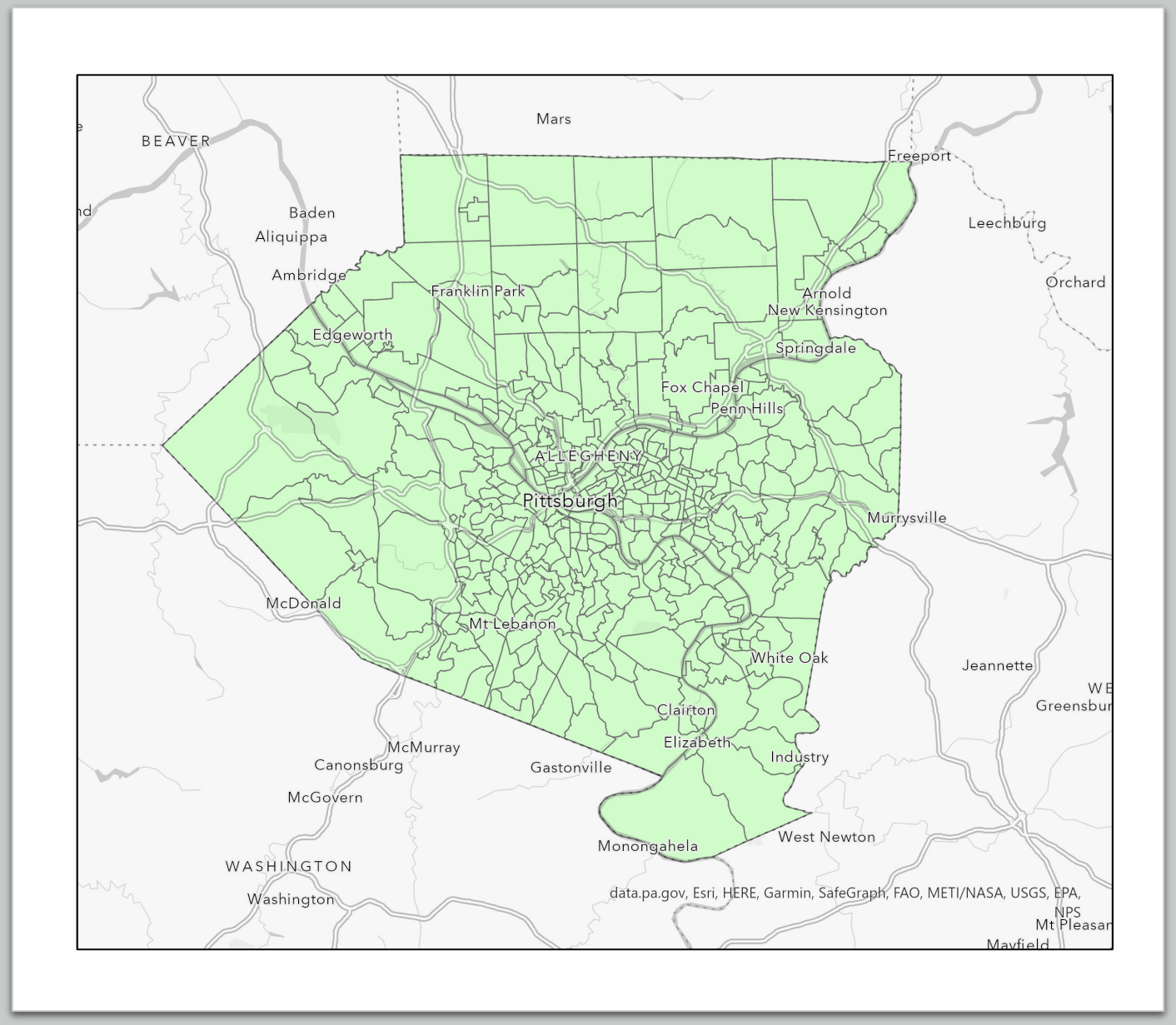




Methodology

Identify the Community

- Study Area: Allegheny County, Pennsylvania
- Largest City: Pittsburgh, PA
- Area: 745 sq mi (1,930 km2)
- Population: 1,250,578 (2020)
- Known for: Heavy Industry (specifically Steel), Technology, Medicine, and Home of Multiple Universities



Developing Climate Indices

- Need to identify:
  - Local Climate Action Goals
  - Potential Hazards & Vulnerabilities
  - Risk Areas of Concern
  - Sustainability Efforts

*Equation found via IPCC (2022) and Weis et. al (2016)

Local Climate Action Goals

Public health	Saving Money and Promoting Jobs	Enhance Resource Security	Foster Social Equality
• Reduction in disease and air pollutants • Increase in Public Safety • Trees and green infrastructure	• Energy Savings • Increase in property values by creating green spaces and energy savings • More clean industry jobs	• Preserves natural spaces • Protects our waters • Reduces dependencies	• Reduces energy burdens • Expanding transit to target disconnected communities • Changing zoning to provide greater opportunities

Identifying Potential Hazards

Areas of Concern for this Study

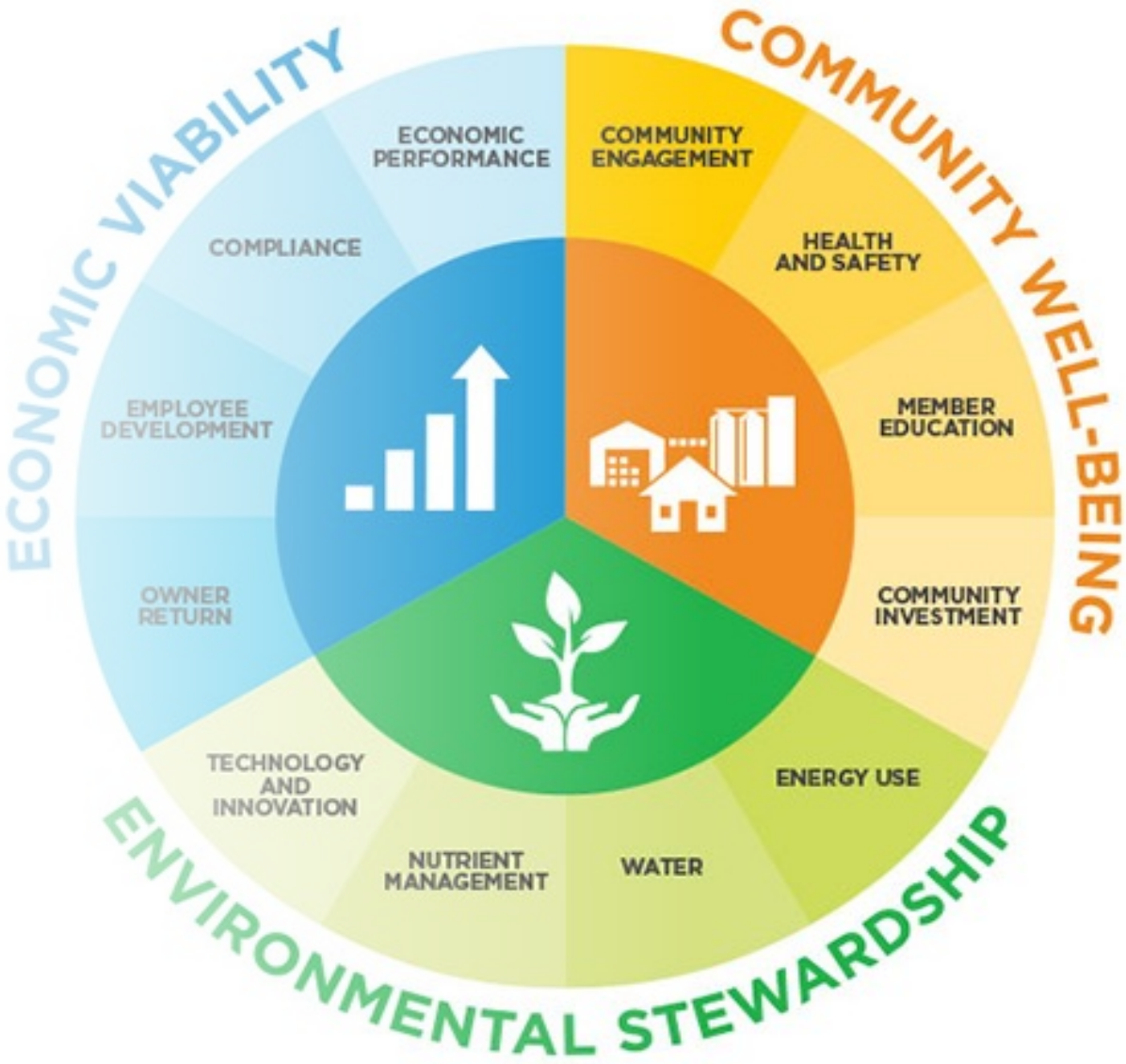
- Air Quality
- Flooding
- Landslide
- Heat Health
- Social Vulnerability
- Land Use

Potential Hazard	Level of Risk*	Level of Community Concern***
Air Quality	High	High
Cold Wave	High	Medium
Drought**	Medium	Medium
Flooding	High	High
Heat Wave	Medium	High
Ice Storm	Low	Low
Landslide	High	High
Lightning	Low	Low
Strong Wind	Medium	Low
Tornado	High	Low
Water and Stormwater	High	High
Winter Weather	Medium	Medium

Note: *Level of Risk determined from The National Risks Index for Allegheny County
**Drought level determined from U.S. Drought Monitor
***Level of Community Concern was determined based upon Local Climate Action Plans in Allegheny County

Sustainability Assessment

- Identifies positive climate resiliency actions already being done in the community
- Identify efforts from local community's climate action plans
- We will look at positive sustainability efforts:
  - Walkability
  - Greenspaces/Parks
  - Urban Tree Canopy
  - Bike Trails



Data Collection

Name of Data	Source	File Format
Allegheny County Boundary	Allegheny County – GIS Open Data	Shapefile
Allegheny County Census Tracts 2016	Allegheny County – GIS Open Data	Shapefile
Allegheny County Hydrology Areas	Allegheny County – GIS Open Data	Shapefile
Allegheny County Land Cover Areas	Allegheny County – GIS Open Data	Shapefile
USA Flood Hazard Areas	ArcGIS Living Atlas Created by: Esri_Landscape 2	Shapefile
Heat Health Census Tracts	ArcGIS Living Atlas Created by: mgilbert_climatesolutions	Shapefile
National Risk Index Census Tracts	ArcGIS Living Atlas Created by: FEMA_NationalRiskIndex	Shapefile
Particulate Matter 2.5 (2014)	CACES	CSV
Ozone (O3) 2014	CACES	CSV
2020 Green House Gas Emissions from Large Facilities	EPA Flight	CSV
Allegheny County Greenways	Western PA Regional Data Center	Shapefile
Sidewalk to Street "Walkability" Ratio	Western PA Regional Data Center	CSV
Urban Tree Canopy	Pennsylvania Spatial Data Access	Raster
Trail and Bicycle Network	Southwestern Pennsylvania Commission	Shapefile

Calculating Indices

- For each variable, determine the risk level on a scale from 1 (low risk) to 5 (high risk)

- Example for Land Use:

Land Use	Risk Level
Water	4
Transportation	2
Forest, Grasslands, Agriculture	1
Residential	2
Commercial, Malls	3
Industrial, Strip Mine	5
Non-Vegetative	3

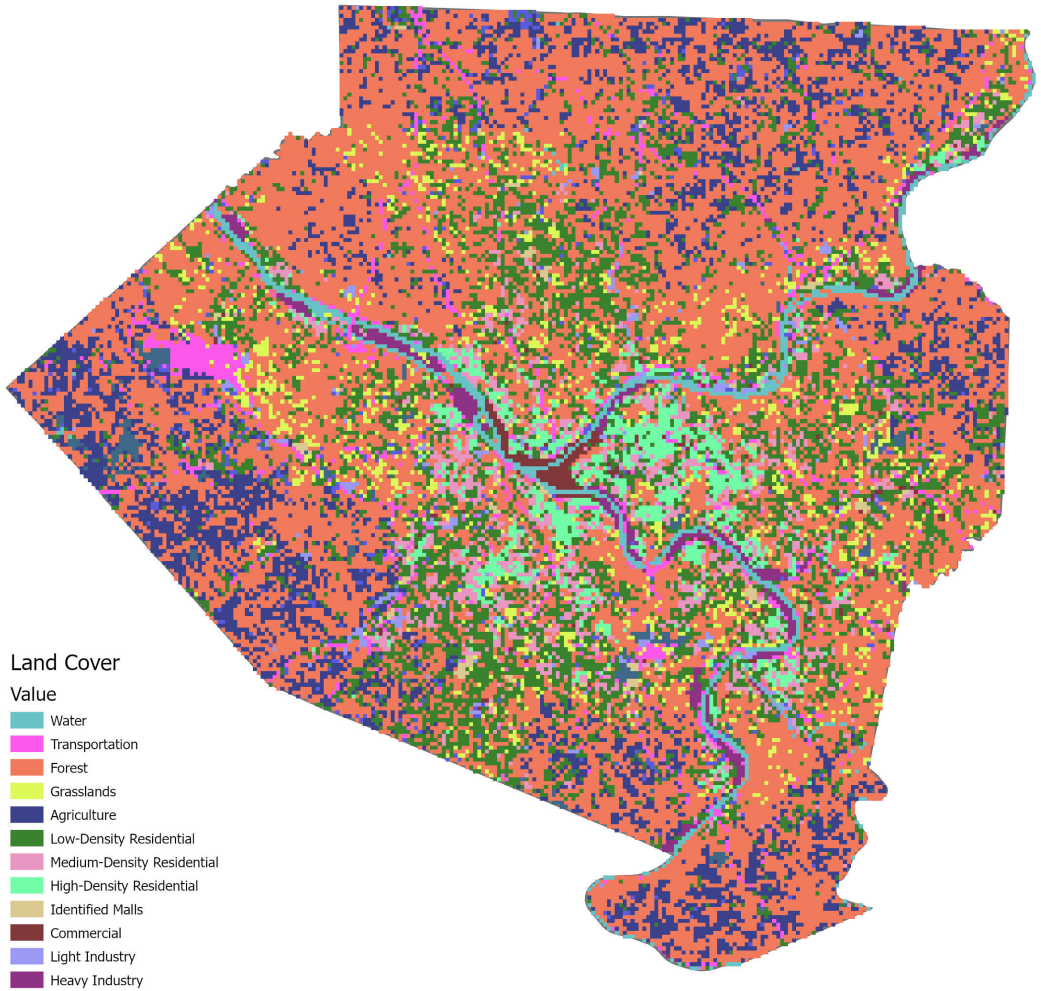
- Reclassify each variable based upon the determined risk level

- For individual risk analysis: Use Summarize Within to find the standard deviation of the risk level.
  - The higher the standard deviation, the higher the risk.
  - The lower the standard deviation, the lower the risk.

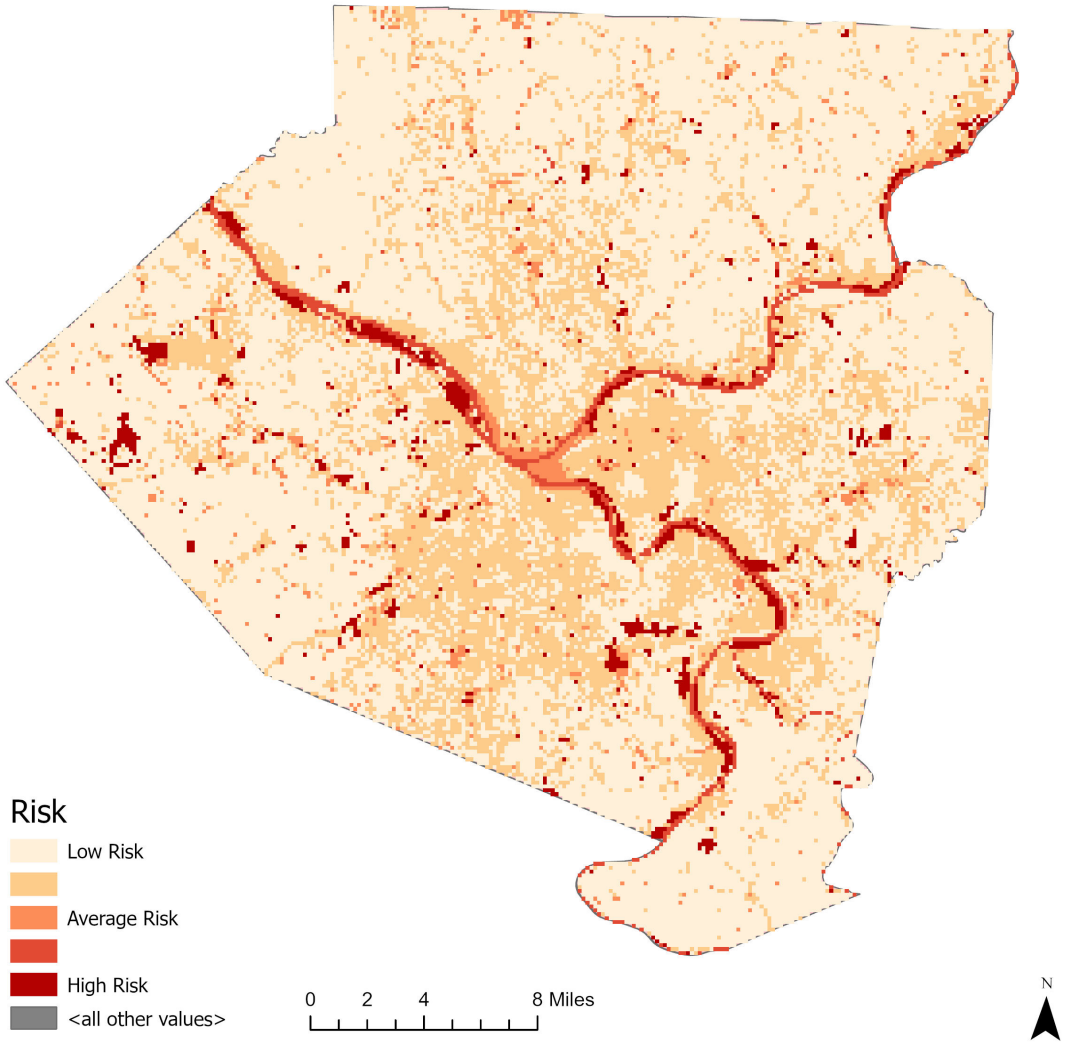
- Once all of the variables have been individually analyzed based of risk level, then we will use map algebra or raster calculator to add all of the variables together.

Type	Grid Code	New Value
Water	1	4
Transportation	2	2
Forest	3	1
Grasslands	4	1
Agriculture	5	1
Low-Density Residential	6	2
Medium-Density Residential	7	2
High-Density Residential	8	2
Identified Malls	9	3
Commercial	10	3
Light Industry	11	5
Heavy Industrial	12	5
Strip Mine	13	5
Non-Veg	14	3

Land Cover Type

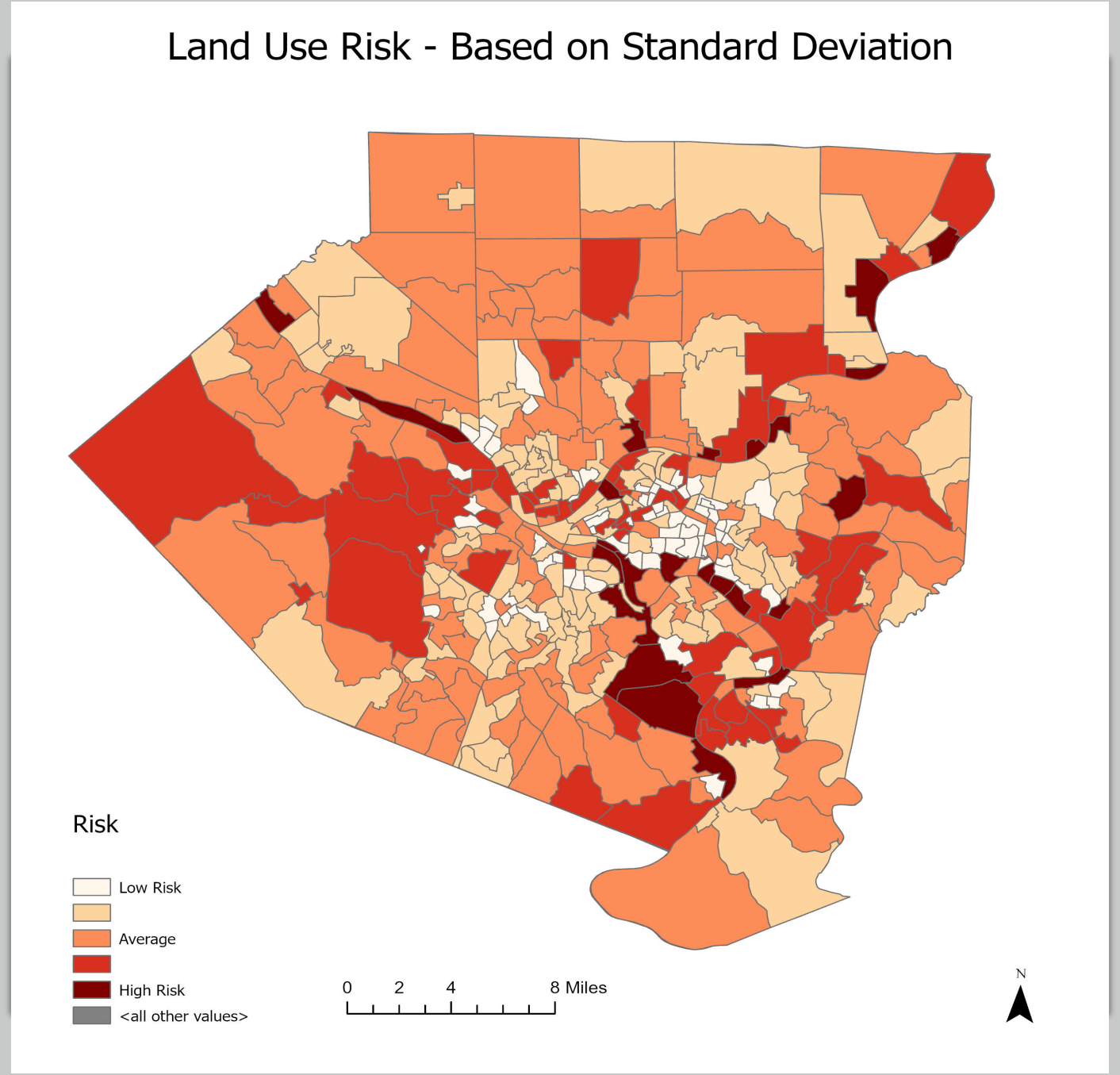


Land Use Risk - Based on Reclassifying



Anticipated Results

- Individualized Maps of Each Risk Variable
- Combined map displaying the risk level from low to high for the census tracts in Allegheny County

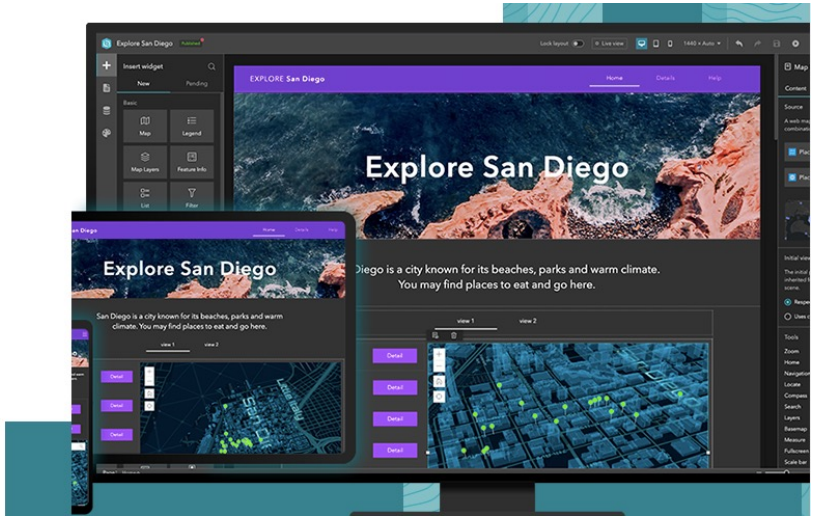


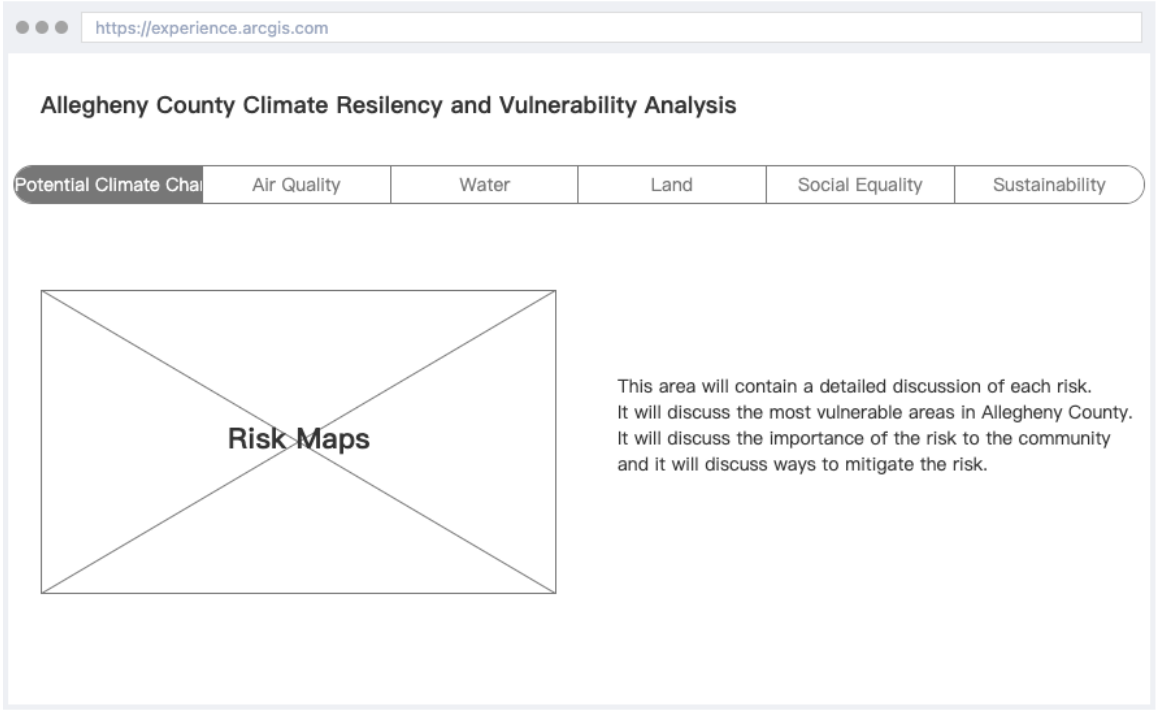
Developing a Web App

- A web app will be developed using ArcGIS Experience Builder
- This app will include the risk maps created in the analysis
- The app is broken into 6 sections:
  - Overall Potential Climate Change
  - Air Quality
  - Water
  - Land
  - Social Equity
  - Sustainability

ArcGIS Experience Builder

A new way of building web apps



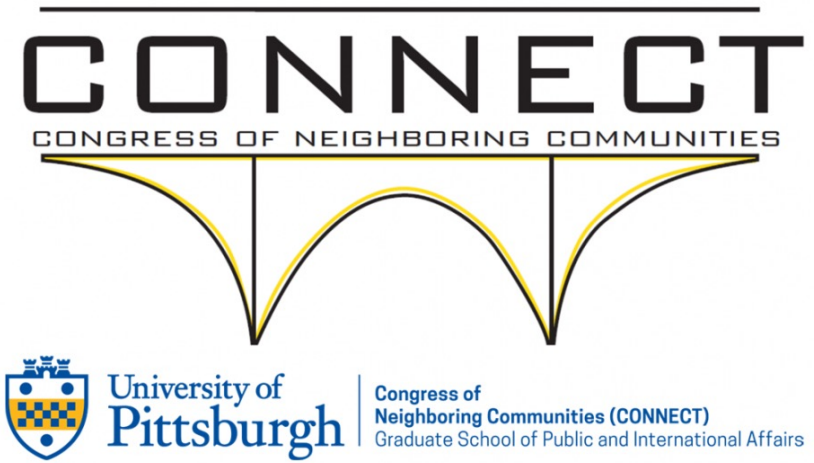


Timeline

Date	Tasks
October 2022 – November 2022	- Finalize Data Collection and Testing - Start Risk Analysis
November 2022 – December 2022	- Complete Risk Analysis - Begin Creating Web App
December 2022 – January 2023	- Continue to Work on Web App - Continue to work on Final Report
January 2023 – February 2023	- Finalize Web App
February 2023 – March 2023	- Finish Final Report - Create Final Project Presentation
March 2023 – April 2023	- Present Project

Project Presentation

- Working to set up a presentation locally in Allegheny County with various community stakeholders
- Talked to the Congress of Neighboring Communities (CONNECT) Team from the University of Pittsburgh about presenting to their group in Spring 2023
- Local Climate Action Program (LCAP) Participants in Allegheny County:
  - Etna
  - Munhall
  - Millvale
  - Forest Hills
  - Carnegie
  - Sharpsburg
  - West Homestead Boroughs
  - Elizabeth Township
  - Ben Avon
  - Swissvale




Questions?
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