

Exploring Urban Development and Wildfire Vulnerability in Austin



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Understanding the Wildland-Urban Interface (WUI)

What is the Wildland Urban Interface?

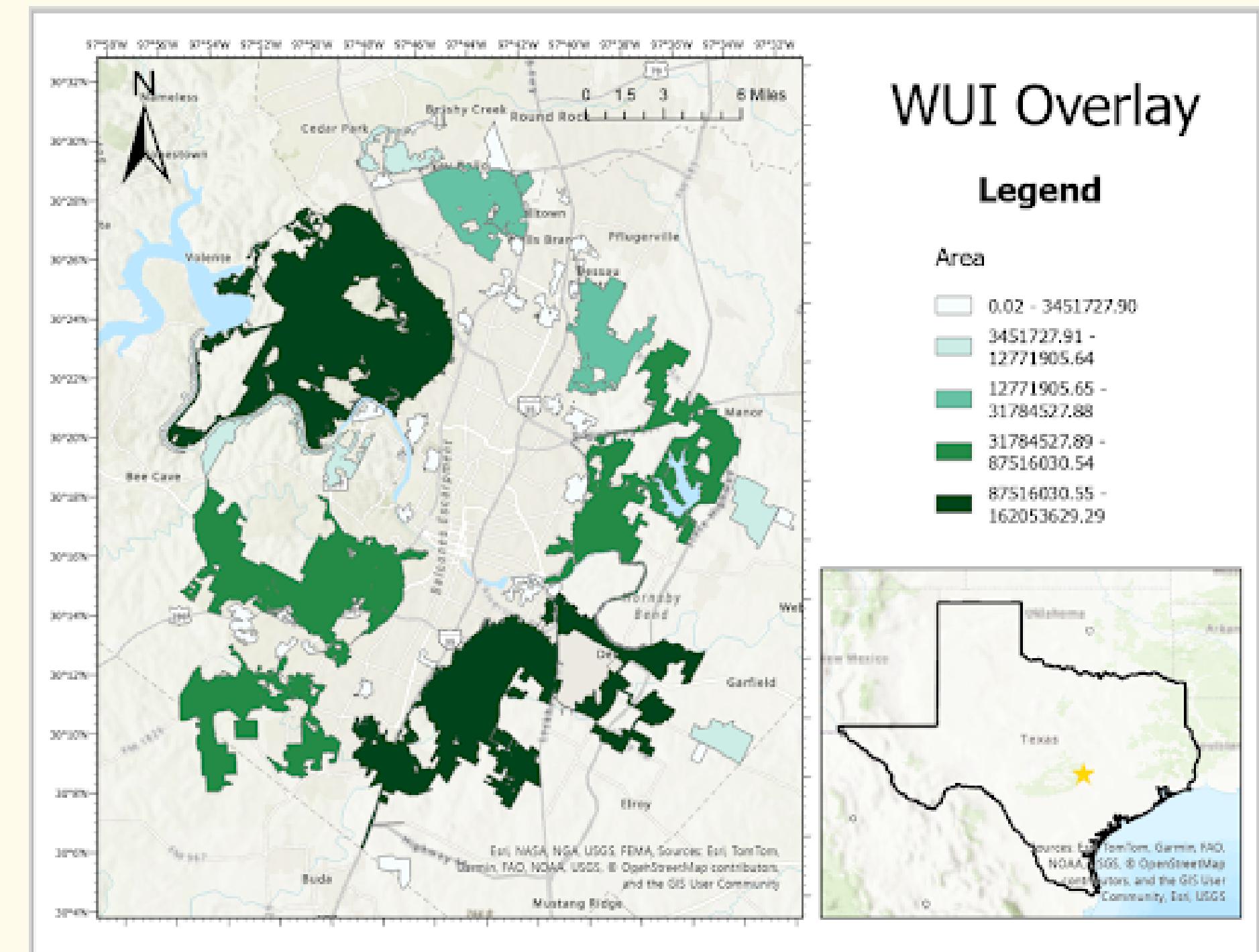
Area where human development and underdeveloped wildland meet

Area for Human-Environmental Conflicts

- Wildfires (which we will be focusing on)
- Invasive species
- Habitat Fragmentation
- Biodiversity Decline

Why is the WUI so dangerous?

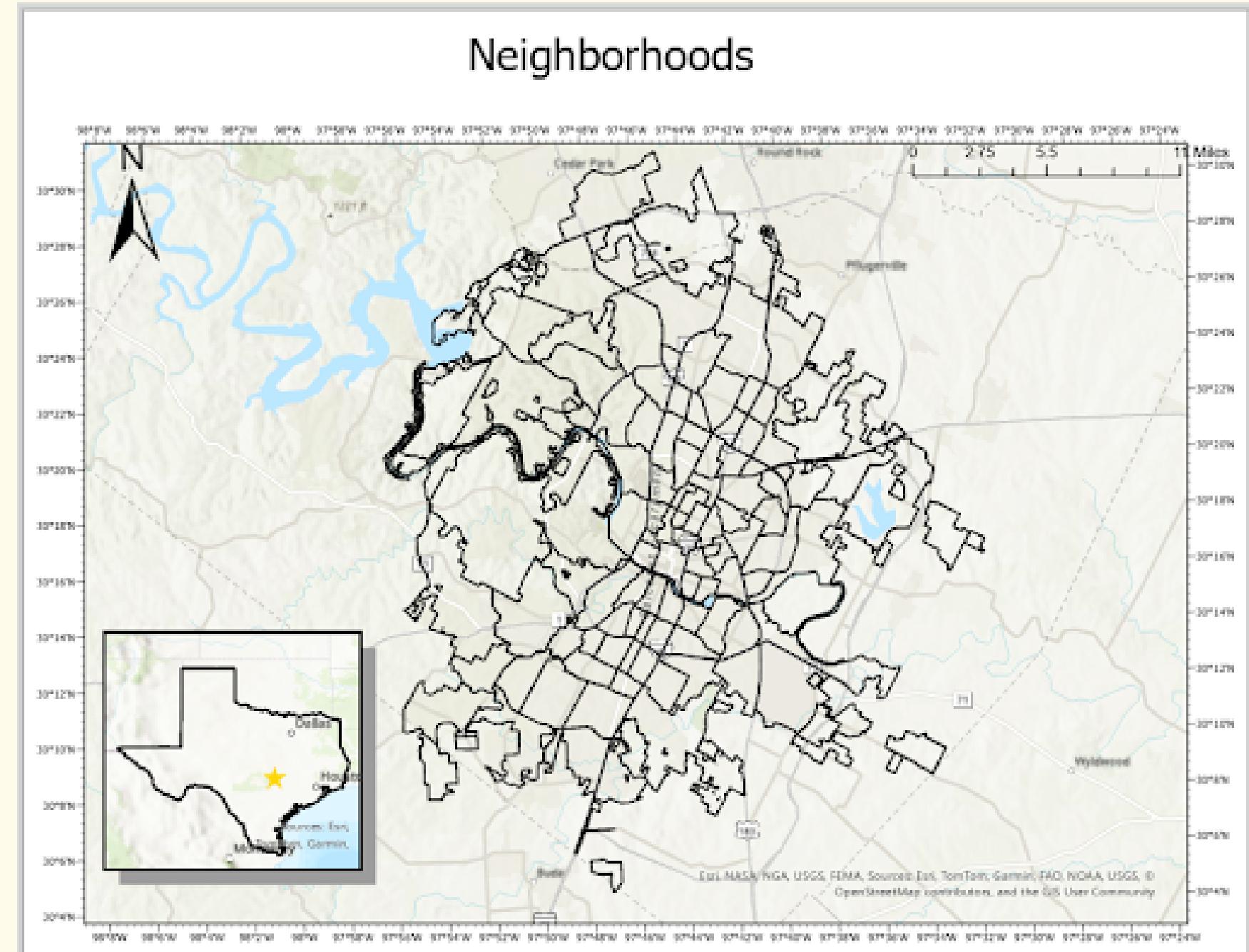
- About 86% of wildfires in Texas occur within two miles of a community
- Over 14,500 communities in Texas are at risk of wildfires



Objective

Do higher populated areas near undeveloped wildland areas increase the likelihood of wildfires?

- We are also exploring how the proximity of human development to wildfires can impact a community's vulnerability.
- What makes a population vulnerable?
 - Proximity
 - Densely populated areas tend to have more urban development which increases the amount of WUI zones
- Where we pulled our data from
 - Austin Wildland Urban Interface code zones
 - Austin Neighborhood dataset
 - Austin and Travis County Wildland Urban Interface
 - Travis County Wildfire Hazards



Code & Methods

```
#Obtain a list of the feature classes displayed on our map
shpList = arcpy.ListFeatureClasses()
shpList

['Austin.shp',
'FINAL_PROJECT_MAP.shp',
'Neighborhoods.shp',
'Neighborhoods_line.shp',
'Neighborhood_Populations.shp',
'POP_SQMI.shp',
'POP_SQMI_Clipped.shp',
'Travis_County_Boundary.shp',
'Travis_County_Neighborhoods.shp',
'Vulnerable_Pops.shp',
'Vulnerable_Pops_Clipped.shp',
'WUI_Code_Overlay.shp',
'WUI_Code_Overlay_Clipped.shp']
```

```
target_features = 'Austin_Neighborhoods'
join_features = 'Vulnerable_Pops_Clipped'
out_feature_class = 'VulnerablePops_Neighborhoods'

arcpy.analysis.SpatialJoin(target_features, join_features, out_feature_class, join_type="KEEP_ALL")
```

```
target_features = 'Austin_Neighborhoods'
join_features = 'POP_SQMI_Clipped'
out_feature_class = 'Neighborhood_Populations'

arcpy.analysis.SpatialJoin(target_features, join_features, out_feature_class, join_type="KEEP_ALL")
```

```
out_dataset = 'FINAL_PROJECT_MAP.shp'
out_spatial_ref = arcpy.SpatialReference(4326)
arcpy.management.Project(shpList[0], out_dataset, out_spatial_ref)
arcpy.management.Project(shpList[1], out_dataset, out_spatial_ref)
arcpy.management.Project(shpList[2], out_dataset, out_spatial_ref)
arcpy.management.Project(shpList[3], out_dataset, out_spatial_ref)
arcpy.management.Project(shpList[4], out_dataset, out_spatial_ref)
arcpy.management.Project(shpList[5], out_dataset, out_spatial_ref)
arcpy.management.Project(shpList[6], out_dataset, out_spatial_ref)
arcpy.management.Project(shpList[7], out_dataset, out_spatial_ref)
```

```
in_features = 'POP_SQMI.shp'
clip_features = 'Austin_Neighborhoods.shp'
out_feature_class = 'POP_SQMI_Clipped.shp'

arcpy.analysis.Clip(in_features, clip_features, out_feature_class)
```

```
in_features = 'Austin_Neighborhoods.shp'
out_feature_class = 'Austin_Neighborhoods_line.shp'
arcpy.management.PolygonToLine(in_features, out_feature_class)
```

```
in_table = 'Neighborhood_Populations'
field_name = 'Population'
field_type = 'DOUBLE'

arcpy.management.AddField(in_table, field_name, field_type)
```

```
cursor = arcpy.da.SearchCursor(outint, ["neighname", "sqmiles"])
df = pd.DataFrame(data = [row for row in cursor])
df.columns = ["neighname", "sqmiles"]
del cursor
df
```

```
df.sort_values(by=["sqmiles"], ascending = False, inplace = True)
```

```
outint = "Neighborhood_Populations.shp"
fields = arcpy.ListFields(outint)
for f in fields:
    print(f"Field name: {f.name}")

Field name: FID
Field name: Shape
Field name: Join_Count
Field name: TARGET_FID
Field name: fid_1
Field name: target_f_1
Field name: neighname
Field name: sqmiles
Field name: shape_leng
Field name: shape_area
Field name: shape_le_2
Field name: POP
Field name: POP10_SQMI
Field name: POP10_SQ_1
Field name: TRACT
Field name: FIPS
Field name: POP10_SQ_2
Field name: SQMI
Field name: Shape_Are
Field name: Shape_Len
Field name: TOT_POP
Field name: POP_DEN
Field name: Population
```

	neighname	sqmiles
0	MLK	1.545283
1	EAST CESAR CHAVEZ	0.681529
2	NORTH LAMAR	0.986354
3	HOLLY	0.712029
4	WEST CONGRESS	0.586179
...
98	SOUTH MANCHACA	1.389067
99	WINDSOR HILLS	1.244682
100	UNIVERSITY HILLS	1.134856
101	POND SPRINGS	3.118958
102	DITTMAR--SLAUGHTER	3.916488

103 rows × 2 columns

	neighname	sqmiles
20	MANSFIELD--RIVER PLACE	16.473853
52	BLUFF SPRINGS	12.104283
81	WEST OAK HILL	11.501983
8	ROBINSON RANCH	10.777298
41	DECKER LAKE	9.637395
...
51	DAWSON	0.495535
79	TRIANGLE STATE	0.454327
30	NORTH UNIVERSITY	0.366984
68	OLD ENFIELD	0.328503
23	CHESTNUT	0.283444

103 rows × 2 columns

	neighname	FIRECAT
97	SWEETBRIAR	Elevated Potential Zone
11	UNIVERSITY HILLS	Elevated Potential Zone
13	JESTER	Elevated Potential Zone
14	CIRCLE C SOUTH	Elevated Potential Zone
15	WESTGATE	Elevated Potential Zone
...
7	OLD WEST AUSTIN	Potential Zone
18	HYDE PARK	Potential Zone
16	GALINDO	Potential Zone
53	WEST CONGRESS	Potential Zone
83	CENTRAL EAST AUSTIN	Potential Zone

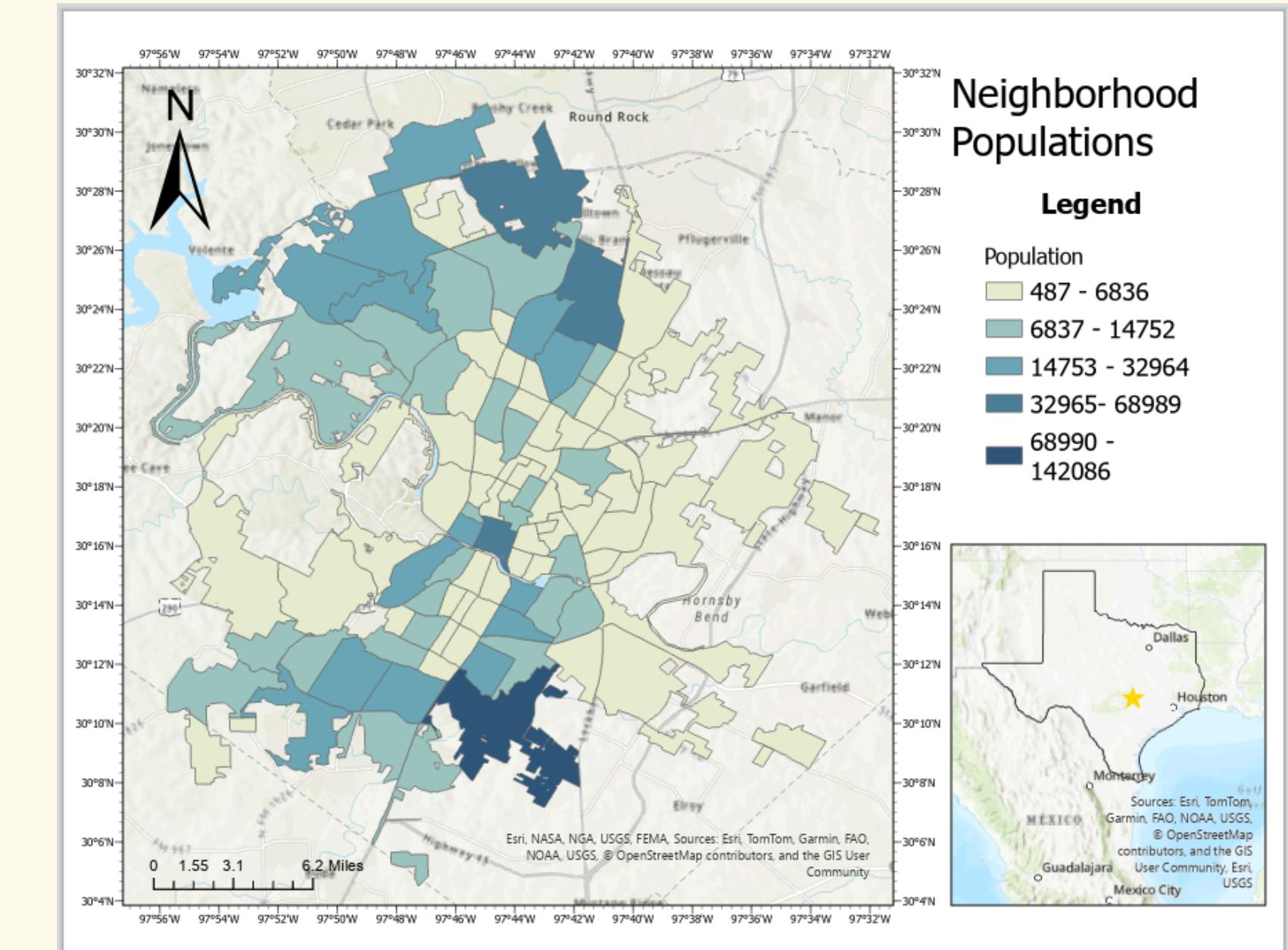
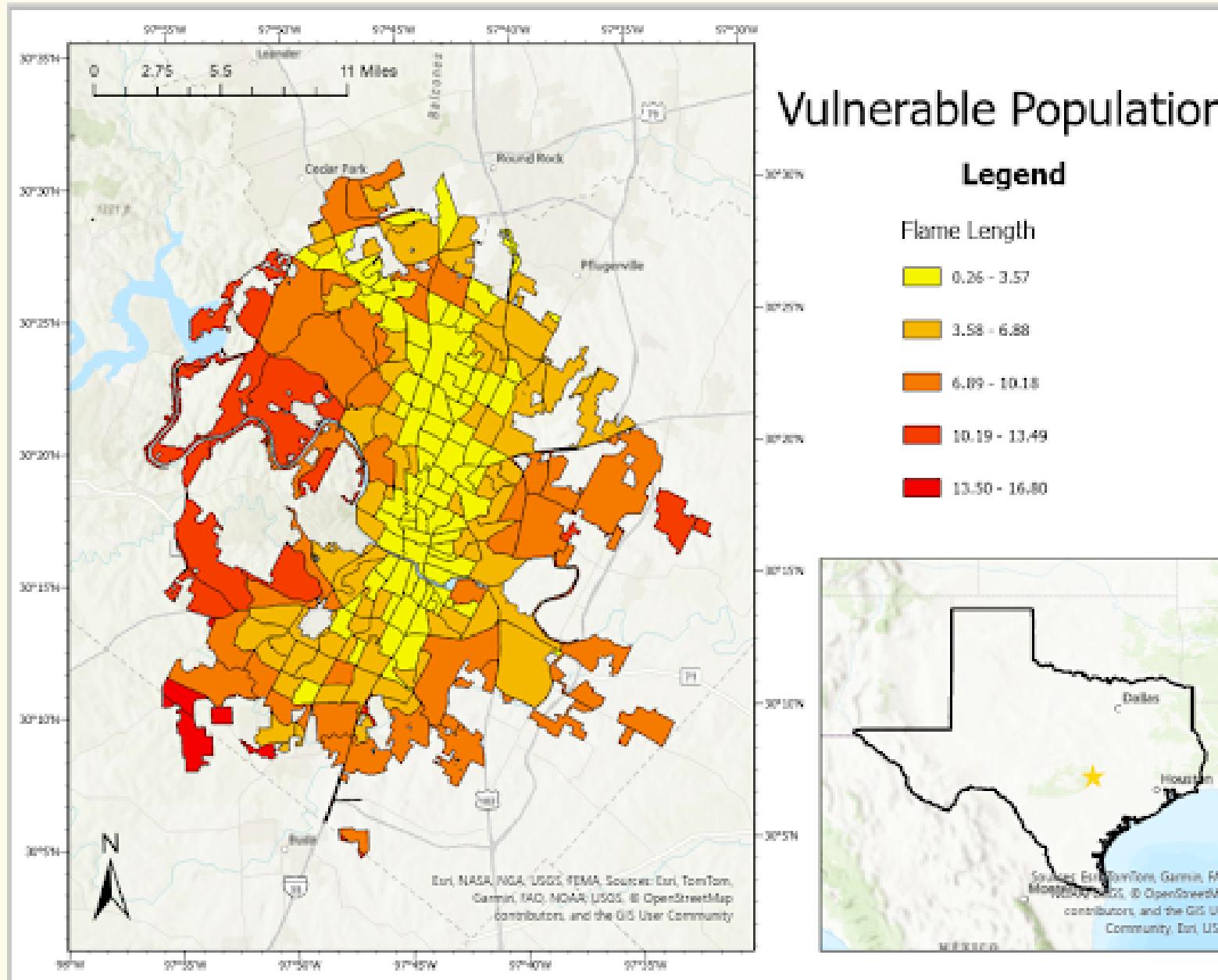
103 rows × 2 columns

Main Code Flow

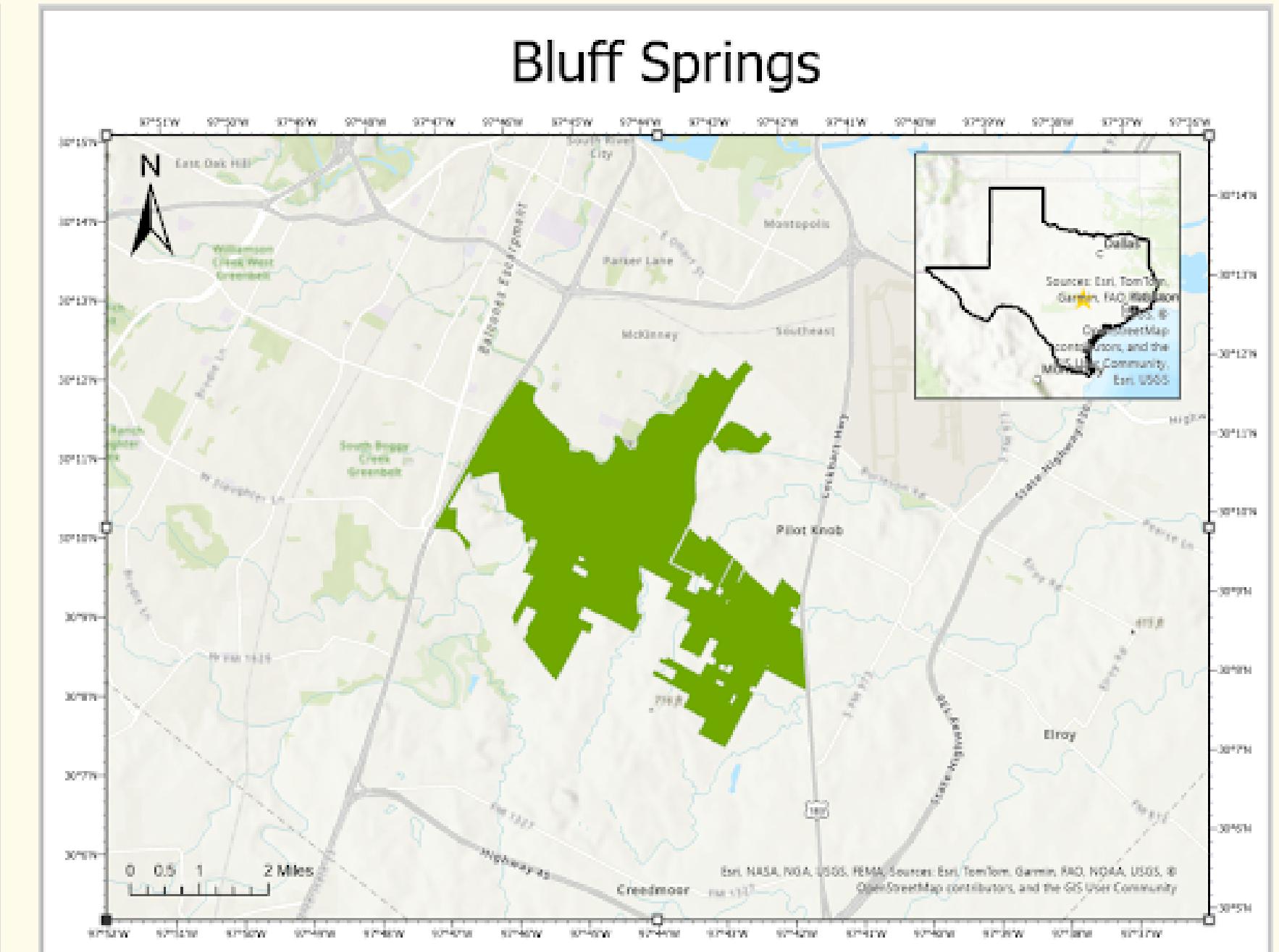
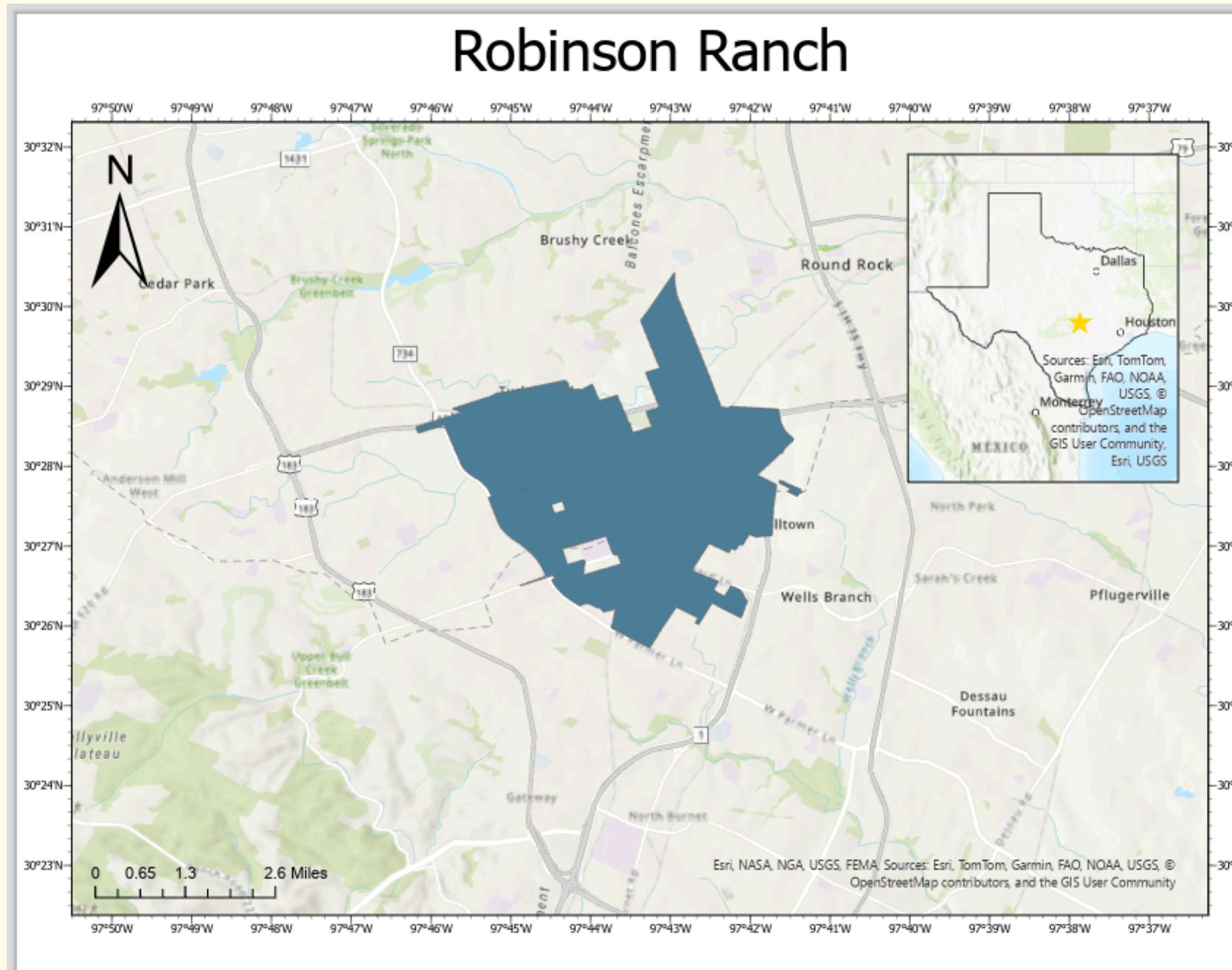
Chart

Import packages > ListFeatureClasses > Set Spatial Reference > Clip features to Austin Neighborhoods > Spatial joins between Austin neighborhoods and population density > Add Population Field > multiply area by population density in new field > Search cursor/columns > sort values

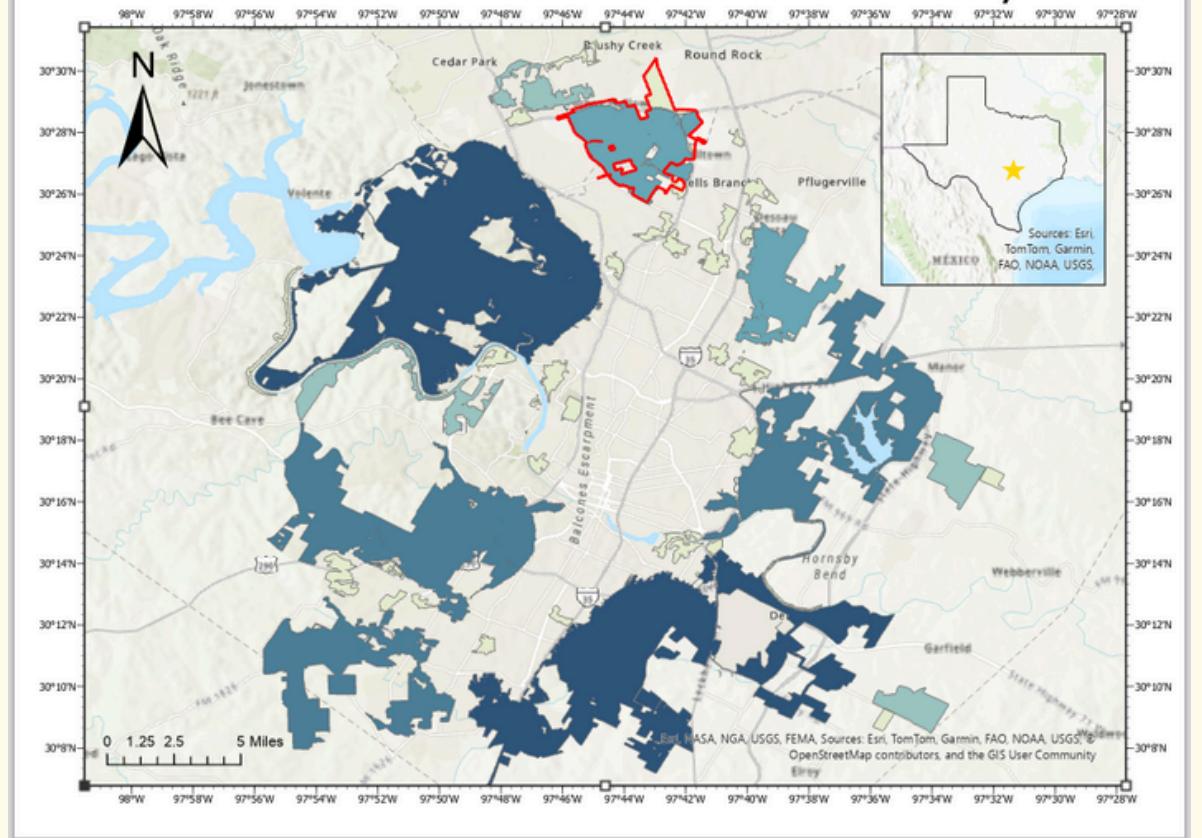
Visualizing Risk: Maps and Insights



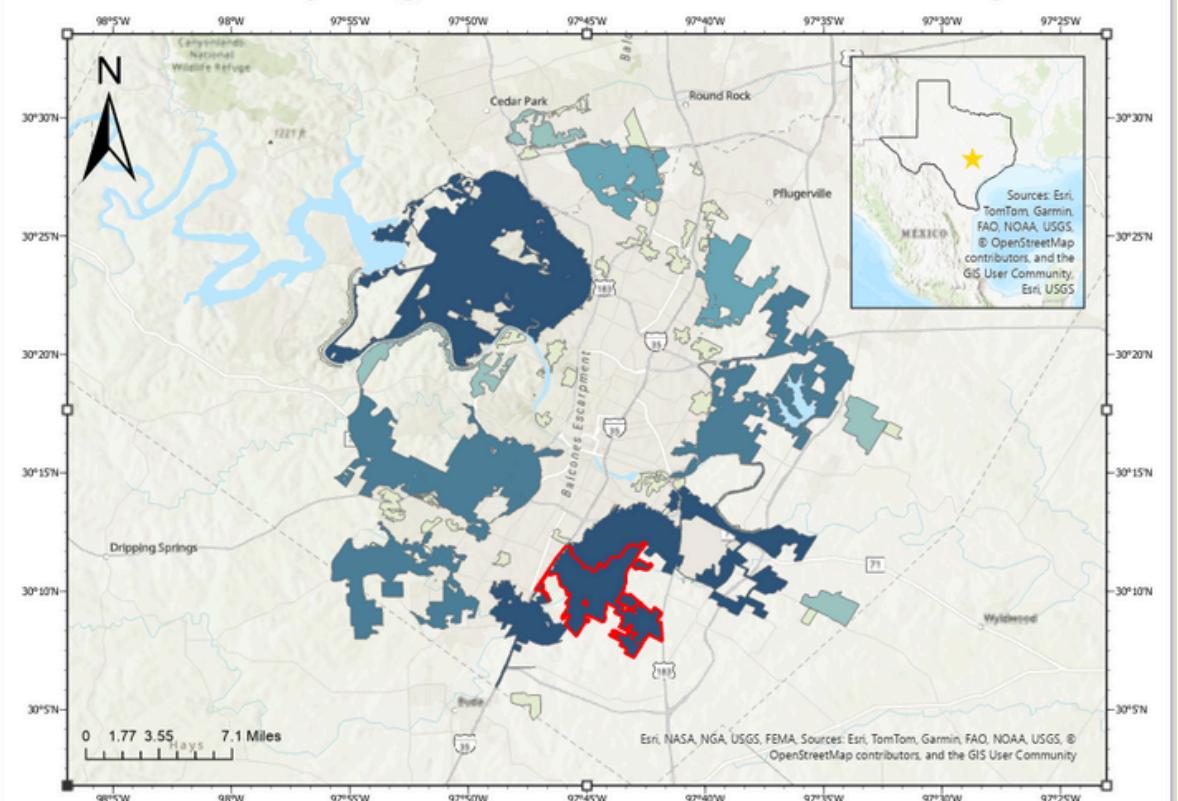
Visualizing Risk: Maps and Insights



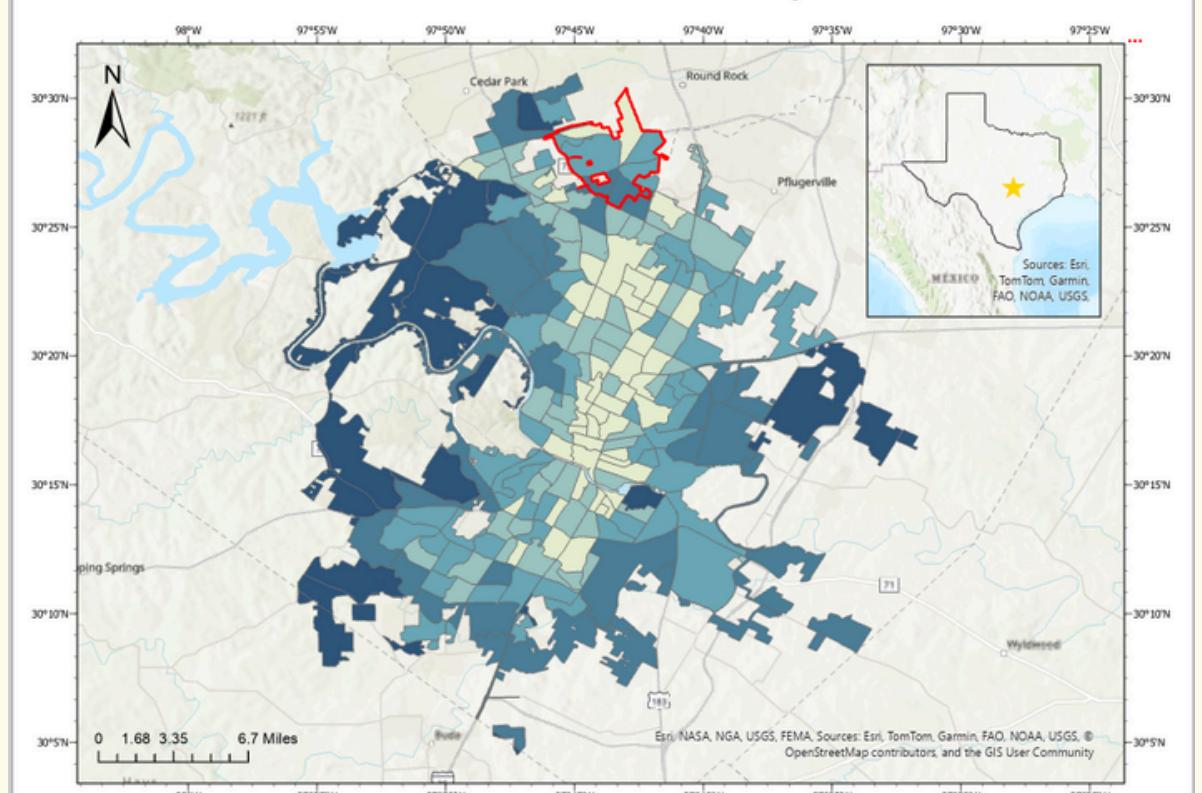
Robinson Ranch over the WUI Code Overlay



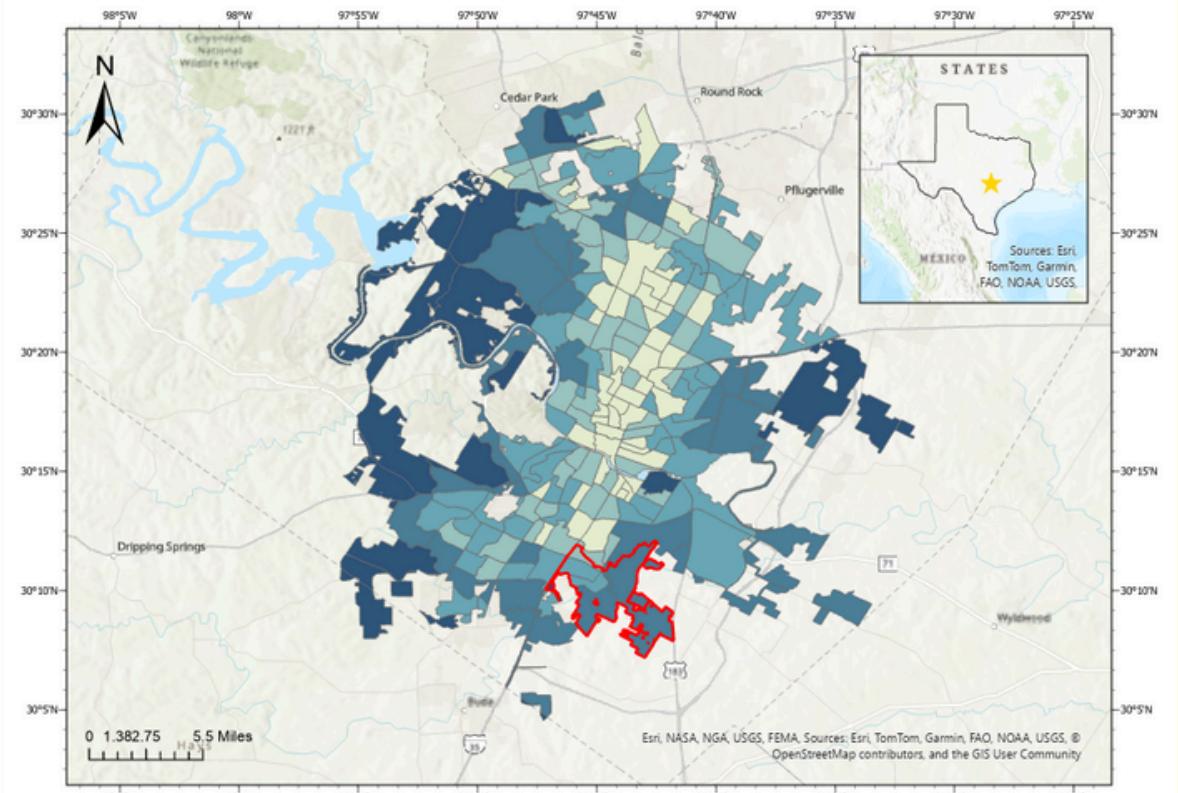
Bluff Springs over WUI Code Overlay



Robinson Ranch over Vulnerable Populations



Bluff Springs Over Vulnerable Populations



Limitations and Implications

- Due to limited time as this research can and should be done over a long period of time there were factors that were not accounted for such as:
 - Fire education/preparedness
 - Socio-economic status of communities
 - Topography
 - Climatology of the area
 - Engineering of urban development
- Accessibility to data
- When downloading data into ArcGIS the fields were inputted backwards from the original format so we had to redo and switch it manually
- ArcGIS locks on certain data details such as the Schema lock

Conclusion

- Robinson Ranch and Bluff Springs are the largest (in terms of population) suburban neighborhoods in Travis County that are also closest to a high risk zone for wildfires, and the WUI.
- This means that in the event of a wildfire, Robinson Ranch and Bluff Springs could potentially be the most affected.
- The more urban development near the WUI and areas more vulnerable to wildfires also puts a strain on firefighters, who now not only have to focus on putting fires out in forests but also human developments as well.
- Though our data it answers the question, but it could be null because we only focused on population size and neighborhood size.

Sources

Wildland-Urban Interface Code | AustinTexas.gov. (2024). Austintexas.gov.

<https://www.austintexas.gov/department/wildland-urban-interface-code>

Neighborhoods. (2020, September 25). Austintexas.gov. https://data.austintexas.gov/Locations-and-Maps/Neighborhoods/a7ap-j2yt/data_preview

Austin Fire Department Wildfire Division. (2020). *Austin and Travis County Wildland Urban Interface.* Esri. <https://austin.maps.arcgis.com/apps/View/index.html?appid=bd2a9d1475c64951a4e64b47d24fe3eb>

Esri. (n.d.). *Travis County Wildfire Hazards.* <https://austin.maps.arcgis.com/apps/View/index.html?appid=ac1072648f9a407c8170a6c254bc540d>

Thank You

We will now open the floor for questions.