Fostering Open Source GIS Support via a newly established university OSPO

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The University of Texas at Austin
Open Source Program Office

Engage faculty and students in an open source participation pathway advancing basic use of open source software through contribution, sharing, accepting external contributions, and ultimately developing an ecosystem of related open source projects.

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Open Source Participation Pathway

Sharing

Software from a team is made available using open source license/platform.

Accepting

An open source project receives contributions from outside the original research team.

Using

Researchers use appropriate open source software tools.

Advancing

An open source project supports outside contributions, but is part of a larger ecosystem of related projects with up/downstream dependencies.

Contributing

Research teams have a deeper understanding of an external software community, participate in identifying bugs, asking for new features.

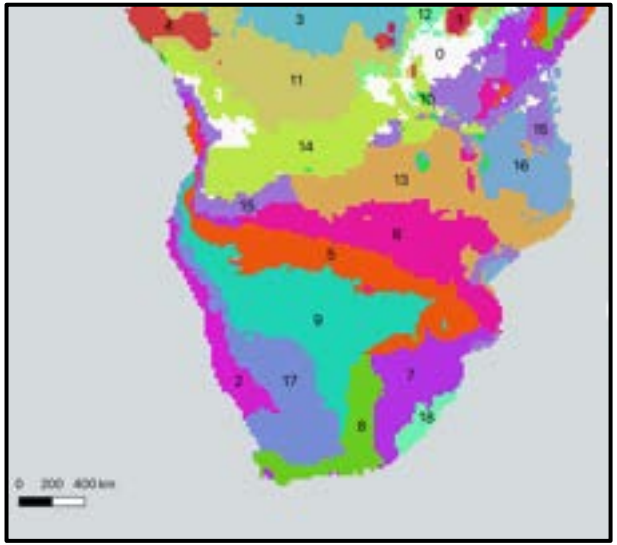
For more information reach out to the UT Open Source Program Office: ospo@utlists.utexas.edu

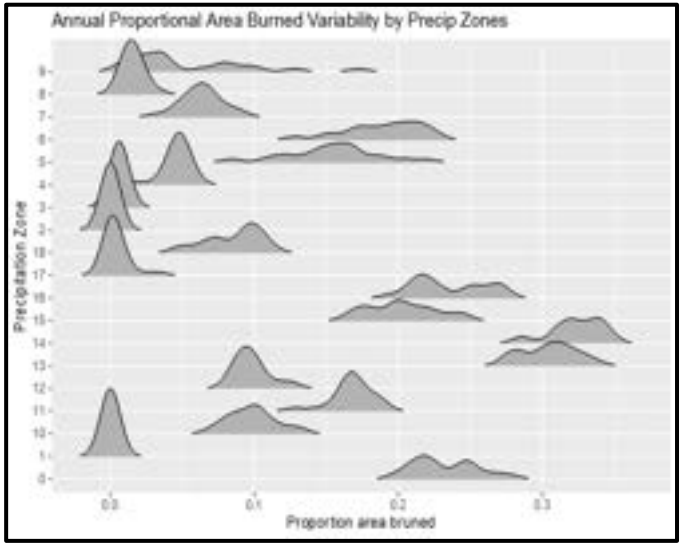
GIS is an interesting case

Majority of practitioners use ArcGIS Pro and Online

Why is open source important in an academic setting?

Collaboration





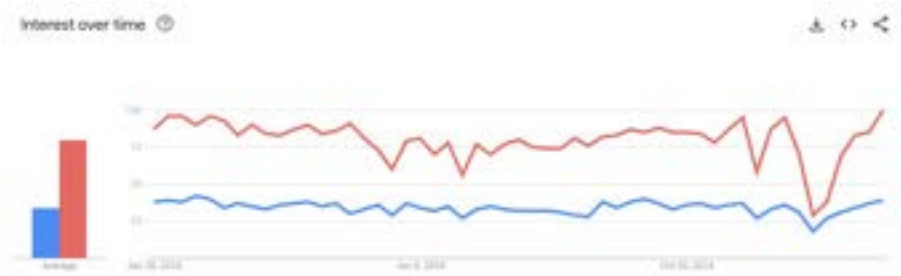
Collaboration

QGIS
Search term

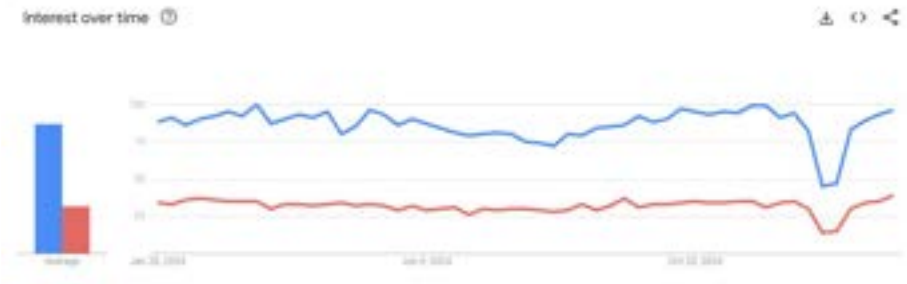
ArcGIS Pro
Search term

Google Trend Results 2024

U.S.



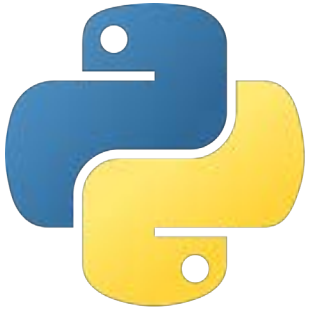
Global



Reproducibility

```
import geopandas
import pandas as pd
import folium
import matplotlib.pyplot as plt
import mapclassify
import shapely
from shapely.geometry import Point
import rasterio
import matplotlib
from matplotlib import pyplot
from rasterio.plot import show
from rasterio.plot import show_hist
```

```
# Import a shapefile
buildings = geopandas.read_file("/content/buildings.geojson")
buildings = buildings.to_crs(epsg=4326)  # Convert to WGS84
newgdf = buildings.to_file("test.geojson", driver='GeoJSON')
buildings.plot(markersize=0.5)
```



GitHub

Introduce GIS coding with Jupyter notebooks and OS packages

OSMNX

Folium

Post graduation

- Students lose proprietary software access when they graduate

- The ability to pick up different software options is key…

  but most GIS curriculum at UT focuses on proprietary software

GIS Training

Parallel workflows

In both QGIS and Python we will:

- Access and download GIS data
- Load and visualize the data
- Perform basic geoprocessing and analysis

Basic Functions

```python
# Define a function to calculate population density
# %%
def calculate_population_density(gdf: geopandas.GeoDataFrame) -> geopandas.GeoDataFrame:
    gdf_copy = gdf.copy()
    # Calculate area in sq km for the entire column
    area_sq_km = gdf_copy.geometry.area / 1_000_000
    # Calculate population density using vectorized operations
    gdf_copy['pop_density'] = gdf_copy['population'] / area_sq_km
    return gdf_copy
```

Raw Population

Population Density

Unpacking Concepts

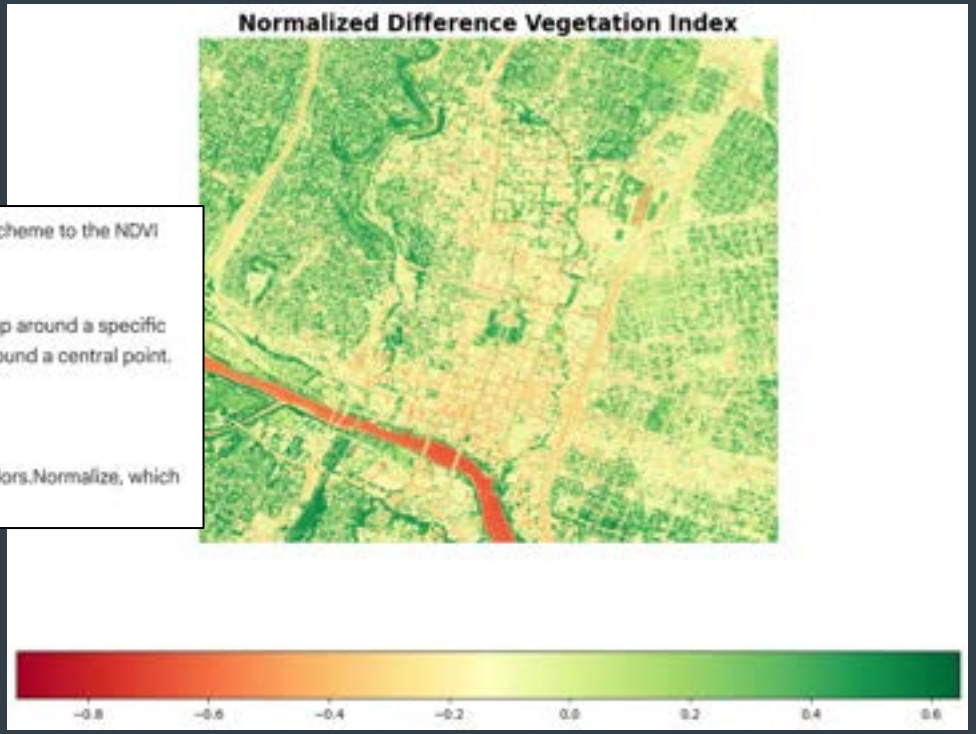
Now we are going to plot our NDVI data. The first step is choosing colors and matching the color scheme to the NDVI data

Here we are defining a custom normalization class called MidpointNormalize to center the colormap around a specific midpoint. This is useful for data like NDVI, where the most interesting values are often clustered around a central point.

Here's a breakdown:

Import: from matplotlib import colors imports the necessary module for working with colormaps.

Class Definition: class MidpointNormalize(colors.Normalize) defines a new class inheriting from colors.Normalize, which is the base class for normalization in Matplotlib.



Ultimate Goals

GIS students should graduate with:

A deep knowledge of GIScience fundamentals...not a software package

The knowledge to choose the best tool for the job

The ability to succeed with or without proprietary software access

Skills to generate reproducible workflows that are maintainable

Proprietary solutions are still essential

- Managed Cloud Infrastructure
- Integrated Apps Ecosystem
  - E.g., Story Maps, Scene Builder
- Solutions for sensitive data
- Commercially supported geodatabases

Any questions?

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