

### **Project Summary**

Land cover and land use change analysis in central Colorado. Utilizing NLCD and Landsat to classify and identify changes of land use. Identifying regions of human development, forest removal, agricultural changes, water body changes. Upon identifying the regions of major change, a study will be conducted into the causes of these changes and seeing if the changes match what is seen in the image analysis.

The landsat program is a long-running satellite imagery collection started by NASA and the USGS with the launch of their first satellite in 1972. Since then, there have been 8 more Landsat cameras launched, each with improved technology throughout the years. These satellites gave us high resolution imagery of the Earth's surface that have many uses. These uses range from government mapping, to agricultural monitoring, wildfire detection, land use changes, flood mapping, forest health monitoring, or snow and glacial monitoring.

Satellite imagery gives scientists many tools for gathering information about the uses, health, and development of the Earth's surface. With a history of imagery from satellites like the landsat program, we can begin to understand how the uses of the surface are naturally changing, follow regions of human development, and identify regions where future development might be possible. Many tools that can provide this insight are already existing, such as the USGS's National Land Cover Database (NLCD) and the Multi-Resolution Land Characteristics Consortium (MRLC). These groups and databases provide classified landsat imagery that identifies regions of different land uses including, developed, barren, forest, shrubs, planted regions, with each category containing subcategories within. The NLCD dataset is updated approximately every 2-3 years, dating back to 2001.

### **Objective**

The goal for this project is to focus on the classification of landsat data for land use. By classifying two different time periods, the time periods can be summarized to see how and where changes to land use are occurring.

### **Area of Study**

This study will focus in the central area of Colorado, in the south suburbs of Denver. This stretch is approximately 20 kilometers between the cities of Denver and Castle Rock with a growing amount of suburban development in between.

### **Data to use**

1. The two collections of NLCD data, 2016 and 2019. These datasets are available at a 30 meter resolution.
2. The landsat 8 data. This information is available back to 2013 and also at a 30 meter resolution for the bands we will most likely be using (2,3,4,5). This will allow for the use of true color, NIR, as well as NDVI.

**Procedure flowchart** (Underlined is completed, <https://github.com/Sigmanaj/S2023RemoteSensing>)  
(No partner identified for code yet, was out sick this last week)

- Load the NLCD data into python
- Clip to study area
- Compare and reduce categories depending on complexity

- Determine average % of each category for each year
- Determine regions of major change, forest to developed, water to not-water, etc
- Load Landsat data to do a classification of land use
- Clip to study area
- Use the different bands to classify the land use for multiple different years (incl. 2016 and 2019)
  - Using tools from lab 5
- Compare classification to NLCD for years to see effectiveness of classification
- Determine average % of each category for each selected year
- Determine regions of major change

## Challenges

- With only a 3 year difference in NLCD data, the information might not be the most telling so we'll have to go into Landsat to get a few more years of data, but will have to classify the data.
- The resolution of data might affect the classification. Regions of mixed use might be difficult to classify.
- Still learning tools and best practices for geemap
  - Reduction in classification for NLCD dataset is something I don't have experience with in geemap
  - Comparing two different datasets
    - I know one can do raster math to get information, but comparing classified data will be interesting
    - Possible time differences in imagery datasets may affect resulting comparison (to reduce this, I chose time periods both in summer)
- Due to computation limitations (hydroshare resource struggling to run), the area has been limited to a circular area with a radius of 15 kilometers.