Justification for Chosen Method

One of the most common methods for identifying the amount of vegetation and green space in a given area is with a metric called NDVI, or the Normalized Difference Vegetation Index. This metric is calculated mathematically from the visible and near-infrared light reflected by vegetation as given by the following equation:

$$NDVI = (NIR - RED) / (NIR + RED)$$

Where NDVI, as stated previously, is the Normalized Difference Vegetation Index. NIR is the near-infrared light and RED is the visible red light. It measures the ratio of (the reflective difference in the red and the near-infrared light) to (the sum of red and near-infrared reflectance). This metric is useful because green vegetation reflects near-infrared light, while absorbs red light (Hafen, 2021). Thus, if there were lots of green vegetation in an area, we would expect the perfect outcome of NDVI to be:

$$NDVI = (NIR - RED) / (NIR + RED) = (1 - 0)/(1 + 0) = 1$$

The results of this calculation range from -1 to +1. The scale is interpreted as follows:

- Anything below 0 signifies no vegetation
- Anything close to 0 signifies there are no green leaves
- Anything close to 1 (0.8-0.9) signifies the highest possible density of green leaves.

We selected this metric as our method to calculate the change of greenspace in a city largely because of the industry standard in using this, “nearly all satellite Vegetation Indices employ this difference formula to quantify the density of plant growth on the Earth” according to NASA (Levy and Przyborski, 2000).

Alternate Methods

An alternate method to measuring vegetation via satellite imagery is the EVI, Enhanced Vegetation Index. This is an adjusted version of NDVI but is designed to function better in conditions with dense canopy, such as rainforests. As we are interested in analyzing the change in green space over time in a city, which is unlikely to have a dense vegetation canopy, the NDVI is more appropriate. Alternatively, there is NDRE, Normalized Difference Red Edge, but which is also more well suited for agricultural/nature purposes and is designed for dense crops.

References

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