Utilizing Google Earth Engine to measure landcover and land use change of Trivandrum, a coastal city in India

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Introduction

Coastal plains cities often face unique environmental threats, which can also be exacerbated by urbanization through alteration of land-atmosphere interaction processes. While such urbanization effects occur in all geographical settings, it has been hypothesized the associated atmospheric impacts are amplified in the coastal zones. This is because regularly occurring sea and land breeze phenomenon can cause the atmospheric impacts of urbanization to manifest in a consistent fashion. Land cover change over years has an impact on urban heat and other microclimatic phenomena.

Importance of Urban Land Cover: what happens to urban areas

Urbanization typically
- Increase urban heat
- Increase storage heat
- Increases anthropogenic heat

Urbanization
- increases
  - increases runoff (r)
  - decreases storage (S)
  - decreases evapotranspiration (E)

Effects of urban growth

- Urban heat effect - urban areas that are significantly warmer than its surrounding rural areas due to high storage concrete and human activities
- Increase in pollution (cars, industries, etc.)
- Change in urban climate (precipitation)
- Health, water and sanitation problems
- Environmental refugees - (moving inland from coastal cities)
- Mental health issues, stresses, and insecurities

Methodology

- Google Earth Engine
  - Large geospatial database
  - Google Collaboration
- Python Script
- R Studio (Machine Learning)
- Time Series
- Linear Regression Models

Study Area – Trivandrum, India

Results

MODIS dataset
- Left column is 2000-2009 average
- Right column is 2010-2019 average
- First row is daytime LST
- Second row is night LST
- Third row is vegetation
- Intensive increase in LST distinctly seen in the daytime of 2010-2019 range
- Decrease in vegetation (NDVI)

- In the previous image, two weather stations are shown using a triangle and circle.
- This graph shows maximum temperatures from the circle weather station in (a).
- In (b), seasonality is removed to show the trend increase from 2000 onwards.
- In (c), residuals also show an increase as well from 2000-2019.

Summary

- In conclusion, Trivandrum, a Tier 2 (medium-sized) city that has seen a lot of urban growth and removal of vegetation, especially in the last 10 years.
- Effects on its micro-climate - temperature increase, vegetation decrease, and increase in runoff which could lead to flooding.
- This will lead to uncomfortable living conditions for the people of Trivandrum.
- This study remains in progress. Further analysis of various criteria are yet to be reviewed and interpreted.

References will be provided on request.