

Satellite Imagery: Assessing Climate Impacts in Saarland in the Past Decade

Research Question:

How has vegetation health in Saarland changed over the past decade, and what does this indicate about the impact of climate change?

Methodology:

1. Data Acquisition:

Google Earth Engine (GEE) was used to obtain Sentinel-2 satellite imagery for two time periods: **2016 and 2023**. The region of interest (Saarland, Germany) was defined as an Area of Interest (AOI) in GEE.

2. Data Preprocessing:

Cloud masking was applied using the QA60 band to remove interference. NDVI (Normalized Difference Vegetation Index) was calculated to assess vegetation health. NDVI difference maps were generated to visualize vegetation changes over time.

3. Analysis & Visualization:

NDVI Maps (2016 & 2023): Show vegetation health at both time points.

NDVI Change Detection: Difference calculation (NDVI 2023 - NDVI 2016) to identify areas of vegetation loss and gain.

Statistical Analysis: NDVI means, and percentage changes were calculated.

Interactive Dashboard: Implemented using **Streamlit** to visualize NDVI trends dynamically.

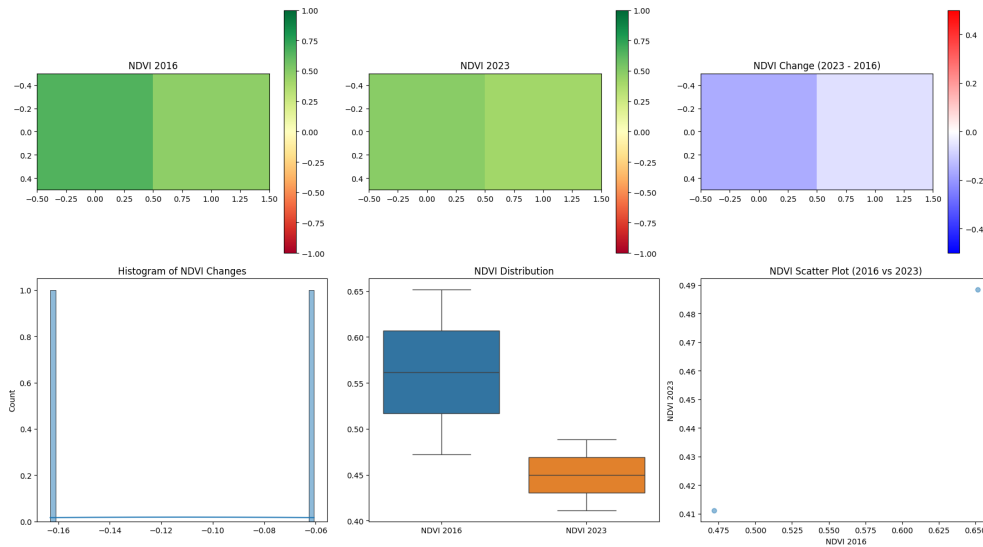
2. Results, Visualizations, and Interpretations

Key Findings:

- **Vegetation Loss Areas:** NDVI decrease was observed in some regions, indicating deforestation or urbanization.
- **Vegetation Gain Areas:** Some parts of Saarland showed an increase in NDVI, suggesting afforestation or improved land conditions.
- **Stable Areas:** Certain regions showed little to no change in NDVI, suggesting environmental stability.

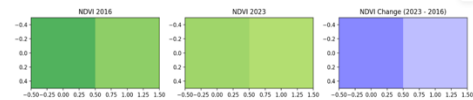
Visualizations:

- **NDVI Maps (2016 & 2023):** Show spatial distribution of vegetation health.
- **NDVI Change Map:** Highlights regions with significant vegetation loss or gain.
- **Histogram of NDVI Changes:** Shows distribution of NDVI variations.
- **Box Plot Comparison:** NDVI differences between 2016 and 2023.
- **Time-Series Analysis:** Mean NDVI trend over time.

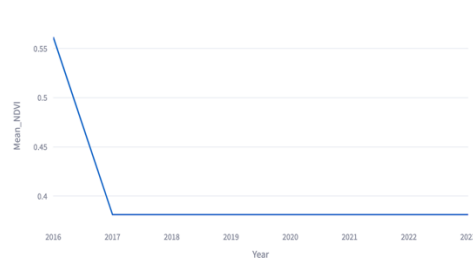


Saarland Vegetation Change Analysis

NDVI Change Map

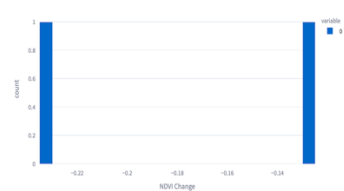


Mean NDVI Over Time



Distribution of NDVI Changes

NDVI Change Distribution



NDVI Comparison - 2016 vs 2023

NDVI Box Plot Comparison



3. Challenges Encountered

- Google Earth Engine Authentication Issues:** Resolved by manually authenticating in Colab.
- Cloud Cover in Satellite Images:** Applied cloud masking to ensure accurate NDVI analysis.
- Running Streamlit in Colab:** Since Colab doesn't support local servers, an alternative approach was required (e.g., running locally or using tunnels).
- Data Size Constraints:** Processing high-resolution images required careful handling of computational resources.

Conclusion

The analysis provided insights into climate impact trends in Saarland over the past decade. Future improvements include: Expanding the dataset for a full time-series analysis. Implementing advanced ML models for land classification. Deploying the Streamlit dashboard online for wider accessibility.