10/10/2023

Assessment of NDVI and SMI for Kodaikanal & Environs

BY

Yuvashree D

9087512379

Yuvashreed2706@gmail.com

Table of Contents

INTRODUCTION:

Kodaikanal and its surrounding region, nestled in the southern Western Ghats of India, are characterized by their lush landscapes and diverse vegetation. This report aims to provide insights into the health of the vegetation and soil moisture conditions.

NDVI is a widely accepted metric for monitoring and quantifying the health and density of vegetation cover. Through this analysis, we aim to gain a better understanding of the variations in vegetation health over time, which can be crucial for agricultural planning, biodiversity monitoring, and environmental management.

Secondly, this report investigates soil moisture conditions in the Kodaikanal region using the Soil Moisture Index (SMI). SMI is a valuable indicator for assessing the moisture content in the soil, which has direct implications for agriculture, land use planning, and water resource management. By analyzing SMI data, we aim to provide insights into the variability of soil moisture levels, helping stakeholders make informed decisions regarding irrigation, land management.

Sentinel-2 Satellite Data:

The analysis presented in this report is based on Sentinel-2 satellite data, which is a part of the European Space Agency's Copernicus program. Sentinel-2 satellites capture high-resolution imagery of the Earth's surface, enabling us to monitor changes in vegetation and soil moisture with a level of detail and consistency that is invaluable for regional assessments. The data used in this analysis was obtained from the Sentinel Hub API, which provides access to a vast repository of Sentinel satellite imagery.

Through the combined use of NDVI and SMI analyses, we aim to contribute valuable insights that can aid in sustainable land use, agricultural planning, and conservation efforts in the Kodaikanal and surrounding areas. This report serves as a comprehensive assessment of the region's ecological health, with the goal of supporting informed decision-making.

Field Description:

Kodaikanal, often referred to as the "Princess of Hill Stations," is a captivating hill station located in the southern part of the Western Ghats in the state of Tamil Nadu, India. This report centers on Kodaikanal and its encompassing region, renowned for its mesmerizing natural beauty and unique ecological characteristics.

Geographical Location:

Kodaikanal is situated at approximately 10.2381° N latitude and 77.4892° E longitude. It is nestled within the Palani Hills of the Western Ghats, at an elevation of around 2,133 meters (6,998 feet) above sea level. The region is characterized by its picturesque landscapes, dense forests, and a network of meandering streams and lakes.

Size and Topography:

Kodaikanal and its surrounding area encompass a total land area of approximately [mention the approximate size, if available, or describe the general extent of the region]. The topography is defined by undulating hills, valleys, and plateaus, making it a prominent destination for nature enthusiasts and trekkers. Notable geographical features in the vicinity include the Palani Hills, Kodaikanal Lake, and numerous scenic viewpoints.

Vegetation and Land Cover:

The region is renowned for its rich biodiversity and diverse vegetation cover. Lush evergreen forests dominate the landscape, featuring a wide array of flora, including species like eucalyptus, pine, shola trees, and various indigenous plants. Additionally, Kodaikanal is known for its unique shola-grassland ecosystems, which are vital habitats for numerous endemic species.

Data Acquisition:

To conduct a comprehensive analysis of vegetation health and soil moisture in the Kodaikanal region and its surroundings, we utilized Sentinel-2 satellite data. The data acquisition process involved several key steps, including defining the area of interest, specifying the date range, and accessing data through the Sentinel Hub API.

Sentinel-2 Satellite Data:

Sentinel-2 is a part of the European Space Agency's Copernicus program, dedicated to providing open and high-resolution satellite imagery of the Earth's surface. It consists of twin satellites, Sentinel-2A and Sentinel-2B, which capture data across multiple spectral bands. These satellites offer invaluable insights into land use, vegetation health, and environmental conditions.

Cloud Cover Percentage Filter:

To ensure the quality and reliability of the satellite data, we applied a filter for cloud cover percentage. Only Sentinel-2 products with a cloud cover percentage of 3% or less were considered for analysis. This filtering process helped us obtain cloud-free and high-quality imagery, allowing for more accurate NDVI and SMI calculations.

Sentinel Hub API Credentials:

Access to Sentinel-2 satellite data was facilitated through the Sentinel Hub API. Our credentials, including the username and password, were used to authenticate and access the satellite data repository.

NDVI Calculation:

The Normalized Difference Vegetation Index (NDVI) is a widely accepted and valuable metric for assessing the health and density of vegetation cover. NDVI is calculated using specific spectral bands from satellite imagery, and its formula is designed to capture variations in vegetation reflectance properties.

Formula for NDVI:

The NDVI is computed using the following formula:

NDVI = (NIR – Red) / (NIR + Red)

Where:

NIR (Near-Infrared) is the spectral band that measures reflected light in the near-infrared range, typically represented by Sentinel-2 band 8.

Red is the spectral band that measures reflected red light, typically represented by Sentinel-2 band 4 or S2A_MSI_04 (Sentinel-2A)

NDVI Interpretation:

The NDVI values generated through this calculation provide a quantifiable measure of vegetation health within the study area. NDVI values typically range from -1 to 1, where:

NDVI values close to 1 indicate healthy and dense vegetation cover.

NDVI values close to 0 suggest non-vegetated or barren areas.

NDVI values below 0 indicate water bodies or man-made surfaces.

Understanding NDVI values and their spatial distribution in the Kodaikanal and surrounding region enables us to assess the vitality of the vegetation, monitor changes over time, and make informed decisions regarding land use, agriculture, and environmental management.

SMI Calculation:

The Soil Moisture Index (SMI) is a valuable metric for assessing soil moisture levels, which are critical for agriculture, land use planning, and water resource management. SMI is calculated using specific spectral bands from satellite imagery, with the Sentinel-2 satellite providing the necessary data for this analysis.

Formula for SMI:

The Soil Moisture Index (SMI) is calculated using the following formula:

SMI = (NIR - SWIR) / (NIR + SWIR)

NIR (Near-Infrared) is the spectral band that measures reflected light in the near-infrared range, typically represented by Sentinel-2 band 8.

SWIR (Short-Wave Infrared) is the spectral band that measures reflected light in the short-wave infrared range, typically represented by Sentinel-2 band 11.

Interpreting SMI Values:

SMI values generated through this calculation provide insights into the moisture content of the soil within the study area. SMI values typically range from -1 to 1, where:

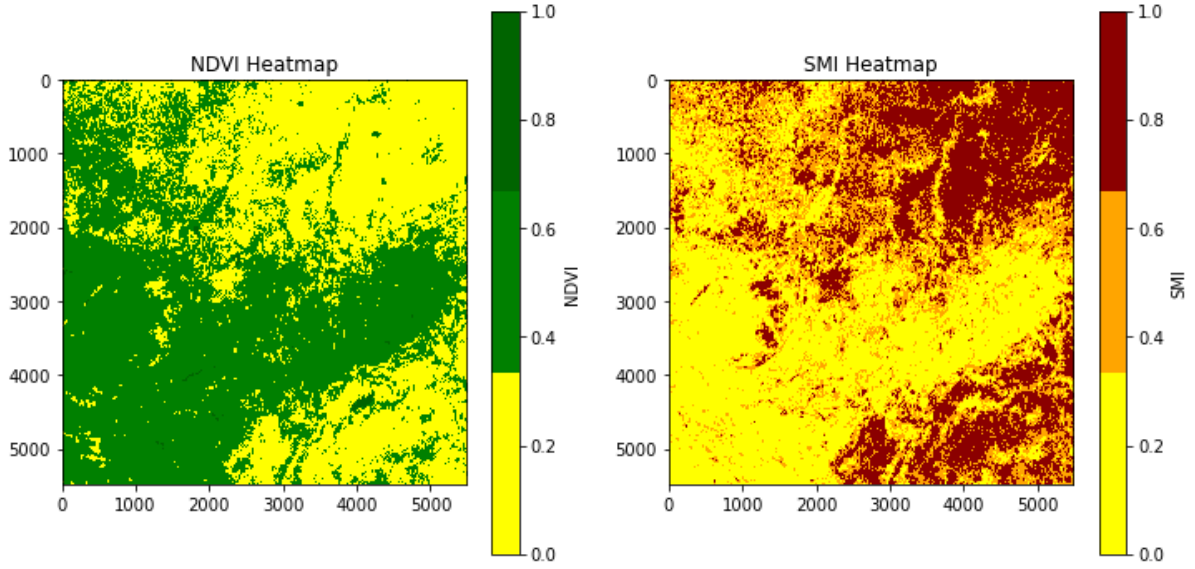
SMI values close to 1 indicate dry or arid soil conditions, suggesting low moisture content.

SMI values close to 0 represent soil conditions with moderate moisture content.

SMI values below 0 suggest wet or saturated soil, indicating high moisture content.

Understanding SMI values and their spatial distribution is crucial for evaluating soil moisture variability, identifying areas susceptible to drought or excessive moisture, and supporting informed decisions related to agriculture and land management.

Results and Findings:



Bar Graph created using Mean values of NDVI and SMI