Estimating Forest Resilience Over the Major Forests in Sri Lanka Using Multisource Satellite Imagery

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Sri Lanka is one of the few countries in the world with extensive natural forest cover. However, most of the existing forests have been impacted by changing environmental conditions and increasing disturbances. To preserve our forest environment, investigating its temporal resilience is important. Forest resilience is the capacity of forests to recover from disturbances that lead to undesired shifts from their original state to available alternative stable states. This research study primarily focused on investigating the resilience of two major Sri Lankan forests: Wilpattu National Park and Kanneliya Rain Forest, over a period from 2017 to 2022 using Remote Sensing Techniques. The study involved analyzing a series of satellite images from Landsat 8/9 and Sentinel 1 and generating a Forest Resilience Index (FRI). Landsat 8/9 and Sentinel 1 satellite imagery were used to create layers representing various forest health indicators, such as NDVI (Normalized Difference Vegetation Index), LAI (Leaf Area Index), and RVI (Radar Vegetation Index). Subsequently, a time series analysis was conducted using the values of NDVI, LAI, and RVI, resulting in the generation of Forest Resilience Indices primarily using NDVI and RVI. The resulting FRIs for Wilpattu National Park and Kanneliya Rain Forest were determined as 0.7827 NDVI + 0.2173 RVI and 0.7853 NDVI + 0.2147 RVI, respectively. The validation was conducted with the generated FRI for the Upper Wilpattu area and was successful. Forests are essential for the well-being and health of the planet and its inhabitants. The concept of forest resilience has emerged as a crucial framework to identify how forests respond to disturbances or threats caused by human activities such as deforestation, forest degradation, and climatic changes. This analysis helped to assess the temporal variability, indicating the resilient dynamics of the Sri Lankan forests, such as Wilpattu National Park and Kanneliya Rain Forest.

Keywords: *Forest resilience index, LAI, NDVI, RVI, Time series analysis*