UNLOCKING THE POTENTIAL OF CLOUD GIS IN FORESTRY USING NEW EOS PLATFORM

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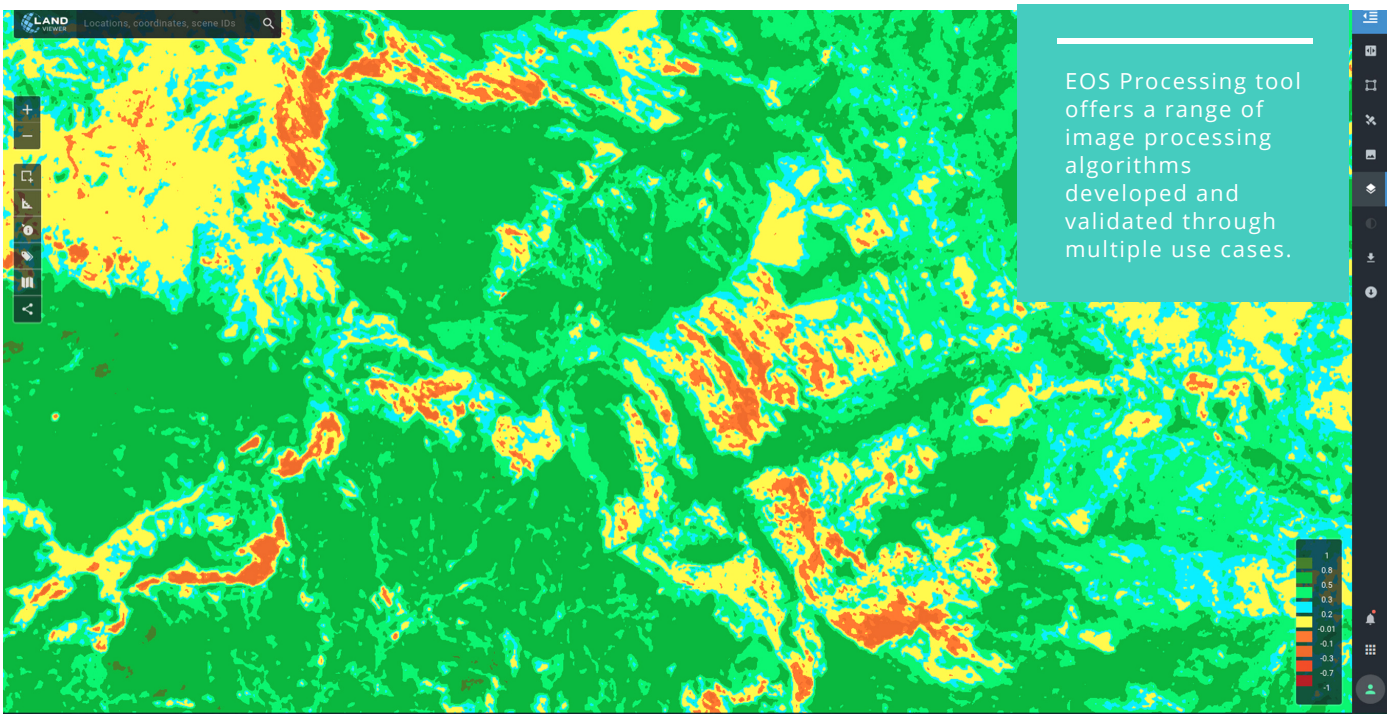
by Earth Observing System (EOS)



EOS Processing tool offers a range of image processing algorithms developed and validated through multiple use cases.

In the era of cloud computing, running a satellite imagery analysis online has become a reality. With cloud solutions like EOS Platform pioneering in the Earth observation market, ENVI and Erdas Imagine software are not the only options anymore.

EOS Data Analytics designed a new GIS platform for all geospatial-data related tasks, from basic remote sensing to cutting-edge image processing. It comprises 4 tools, which together allow for uninterrupted flow of analysis and support most remote sensor types and data formats:

- EOS LandViewer – quick search of low-, medium- and high-resolution imagery and remote sensing analysis;
- EOS Processing – a set of image processing algorithms for automatic feature extraction, change detection, etc.;
- EOS Storage – a cloud space for storing, sharing and distribution of geo-data;
- EOS Vision – a tool for mapping, data visualization and stylization.

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These tools offer solution for individuals and businesses across many industries, most often in agriculture, oil and gas, and forestry. To India, one of the world's most forested countries that is facing severe forest degradation and deforestation, EOS Platform can provide considerable aid in monitoring forest health and logging, tracking illegal forest clearing, and assessing fire damages.

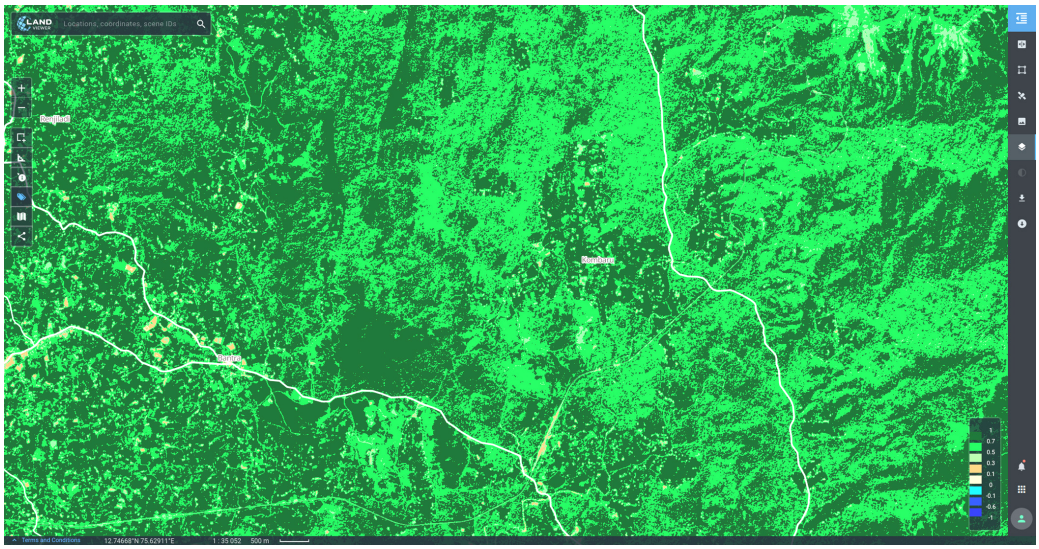

Figure 1. NDVI image of Bantra and Kombaru forest vegetation in 2015.

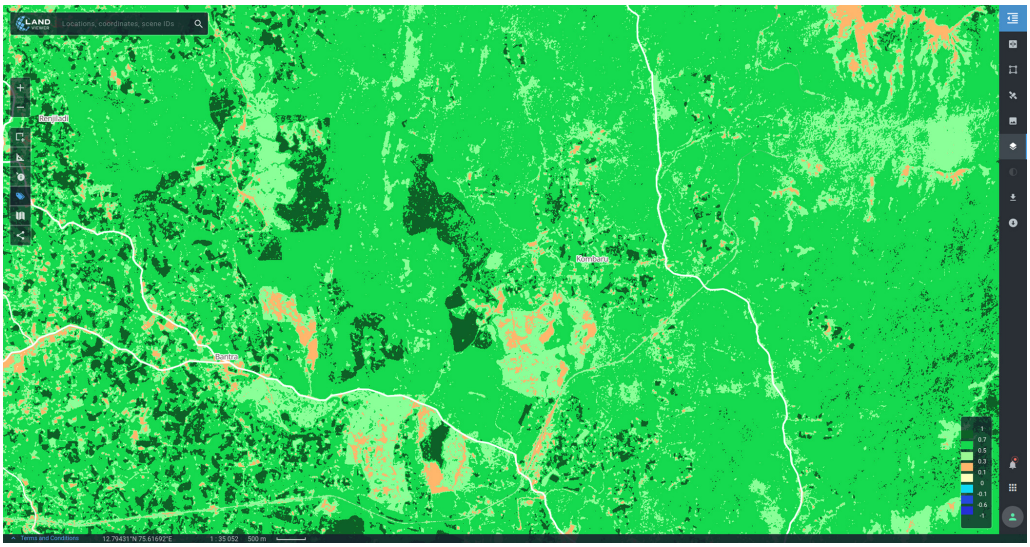

Figure 2. Areas of vegetation loss identified with NDVI analysis of 2018 image.

Monitoring Forest Health With Vegetation Indices

Forest degradation, which results in decrease or loss of forest cover and its productivity, is difficult to be identified from the ground. Satellites play the key role in providing a full picture of the current state of large forested areas, and remote sensing helps to identify vegetation suffering diseases, pest infestations, damaged by human activities.

A common case of GIS application is establishing the state of forest health by calculating the Normalized Difference Vegetation Index (NDVI). One of EOS Platform's tools, LandViewer, can be used to automatically create an online NDVI map. It has a list of instantly calculated indices for landscape, water, vegetation analysis, and gives free access to numerous land-observing satellite datasets (Landsat 7, 8, Sentinel-1, 2, MODIS, etc.). LandViewer also enables users to upload and work with their own satellite data: this can be imagery from Indian (Cartosat, ResourceSat and Indian Remote Sensing series) or other optical/radar satellites (SPOT, WorldView, etc.). Beginner analysts will easily master spectral analysis using LandViewer, as it doesn't require any particular GIS skills.

The growing demand for timber and farming land leads to massive forest clearing and degradation, which boomerangs on people, by causing floods and landslides. Deforestation is considered one of the main factors that triggered the catastrophic Kerala flooding in August, the worst in a century. With remote sensing, environmentalists can monitor the scale of damage caused and identify the forest areas, which need immediate protection.

These Sentinel-2 images show Kombaru and Bantra villages in Karnataka state. Over 80% of Kombaru's area is covered by forests, which looks believable on 2015's Sentinel-2 image, where the overall high NDVI values indicate a healthy forest cover. In 2018, the same area doesn't look same green anymore, demonstrating considerable forest loss in brown-colored areas.

To interpret NDVI values correctly, characteristics of the forest region and local species must be taken into account. According to many scientists, NDVI results' accuracy may also be affected by soil brightness and atmospheric noise. Therefore, skilled specialists may want to correct the analysis with additional VIs (Enhanced Vegetation Index, Wide Dynamic Range Vegetation Index, red edge NDVI, etc.) and validate the results against ground observations.

Experimentators looking for new

discoveries in forest analysis can use LandViewer to play around with spectral bands. The tool allows to apply a single band, create new band combination or an index, and visualize results in real time.

Forest Fire Monitoring

As global air temperatures rise, millions of forest acres are destroyed in severe fires caused by heat waves and humans. For India that has seen a 125% increase in forest fires in the last two years, it's essential to listen to the pulse of the planet and timely identify wildfires, assess damages, and monitor post-fire regeneration.

At national level, such services as ISRO's Indian Forest Fire Response and Assessment System (INFFRAS) enable efficient fire disaster response. Due to constant supply of images generated from MODIS and VIIRS sensors, INFFRAS detects active fires in near real-time, assesses damages and sends fire alerts to forest officers.

This March a severe forest fire outburst in Kurangani Hills, Tamil Nadu, destroying stretches of forest cover and taking 22 lives of trekkers trapped on the hill. To estimate the damage, we took a pair of Sentinel-2 images and calculated the Normalized Burn Ratio (NBR) in LandViewer.

Low NBR values (in dark orange to red) are a sign of recent burning; high values indicate areas of surviving vegetation. This data can be further used to create a burn severity map or measure the exact area using the drawing tool and AOI feature.

NBR-based post-fire analysis can also be performed with other satellite images containing the near-infrared (NIR) and shortwave-infrared (SWIR)

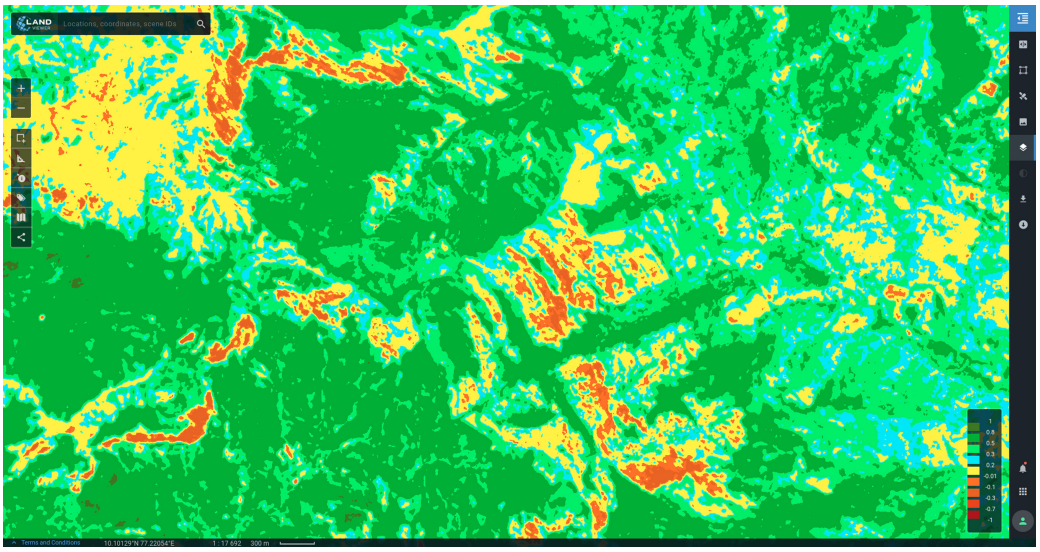

Figure 3. Sentinel-2 image of Kurangani Hills vegetation a week before the fire, with applied NBR.

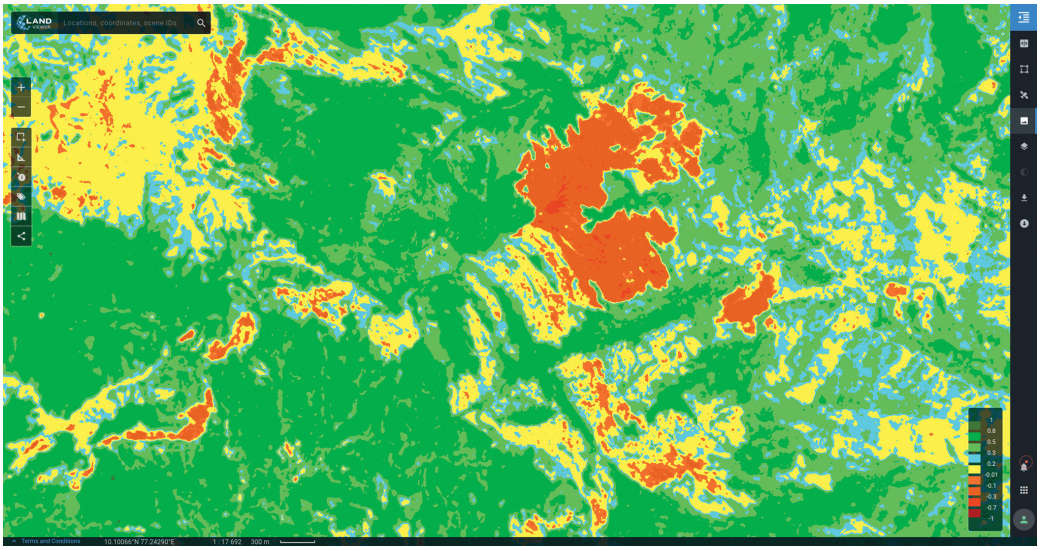

Figure 4. NBR map showing the extent of burn a week after the fire incident.

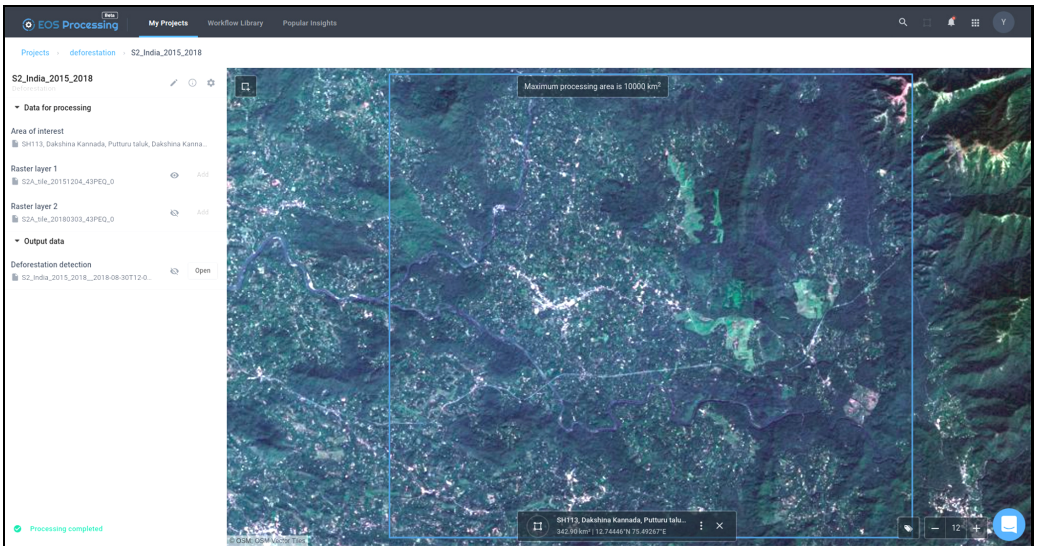

Figure 5. Forests of Dakshina Kannada district in December, 2015.

bands, such as Landsat 7, 8 (available in LandViewer), or IRS ResourceSat-1, 2 (can be uploaded for online analysis). To monitor vegetation recovery and estimate mortality, it's also important to repeat NBR analysis of an area during the next growing seasons.

Deforestation and Fire Damage Assessment

Global climate change is the most dangerous effect of deforestation, which can lead to complete rainforest disappearance in less than 100 years. Environmental organizations all over the world apply GIS techniques to create current maps of forest change and use, and take countermeasures to stop illegal forest clearing.

Forest loss trends can be best observed with multi-temporal analysis of satellite imagery, i.e. by comparing two images of same forest taken at different times. LandViewer's comparison slider can be useful in visualizing the differences between them and eyeball-estimating the scale of deforestation or any other damage.

However, to precisely map and assess forest damage caused by logging, fires or natural degradation, the automatic change detection should be used.

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These are Sentinel-2 images of Dakshina Kannada, which partly lies in the Western Ghats - one of the world's major plant diversity regions. The damage done in 2.5 years is clearly visible in natural color: once green, dense vegetation significantly decreased or completely disappeared (light green and brown areas). With the help of EOS' change detection algorithm that identifies changes from images in RGB and NIR spectrums, we received the third image (raster/vector layer) that highlights the exact areas of deforestation.

The entire analysis can be done in a short span of time, due to mutual integration of all EOS Platform tools: just find images in LandViewer and calculate the index, save them to EOS Storage and proceed directly to EOS Processing for extracting the analytics.

EOS Platform is available for free online use at *https://eos.com/platform*

Visit our website *https://eos.com* for more information.

For business inquiries, please contact us at *sales@eos.com*.

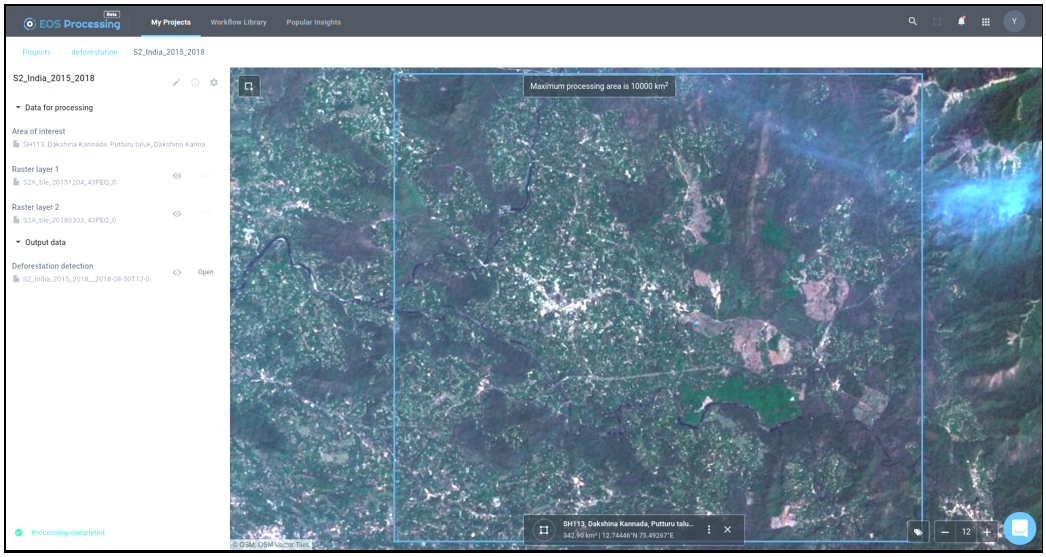

Figure 6. Same area as seen from Sentinel-2 satellite in March, 2018

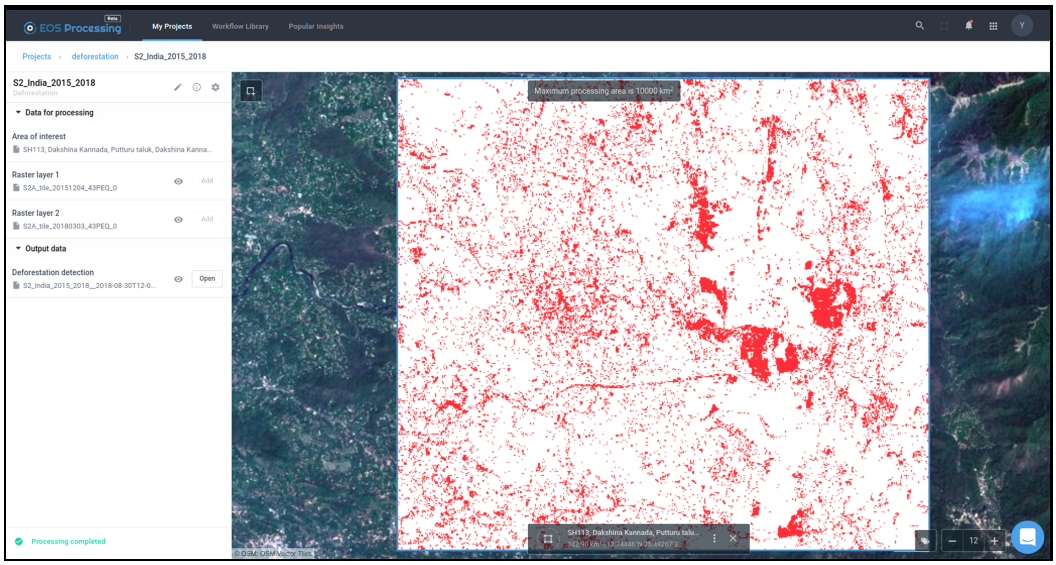

Figure 7. A map of forest cover changes that occured between 2015 and 2018, generated by EOS change detection algorithm.