CROP MONITORING

SEPTEMBER 16, 2019

CHANGE DETECTION WITH SATELLITE TIME-SERIES DATA

For all players of the modern agricultural market (regar
farmers, ag traders or insurers) not only is the
land productivity genuinely urgent, but so is constant m
efficient use.

Farmers can improve yields through tracking growth dy
developing healthy field trends based on abnormal case
conduct a more effective assessment of land conditions
the course of a long period of time using
able to schedule logistic spending plans
accurately. Lastly, scientists can monitor the biosphere
phenological crop distribution, observe global warming,

TIME SERIES ANALYSIS – WH ABOUT AND WHY IS IT SO EFFECTIVE?

Such a kind of monitoring is carried out so as to detect

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Say, for example, you were to build a time series graph using historical data at the beginning of the growing season. In this scenario you suddenly find that this year you have an extremely low yield among one of your fields compared with the performance within the same period of time for a number of years. If caught early you will have ample time and opportunity to identify and eliminate the root of the problem, therefore preventing potentially catastrophic crop losses in the future.

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However, sorting out tons of images taken over several years, applying the necessary vegetation indices to each of them, and identifying trends from this massive pile of data is not an easy task – so why not entrust this with a specially trained tool? Time series analysis (TSA) can handle this grind for you!

NDVI, NDWI AND NDSI – THE PERFECT WAY TO VISUALIZE YOUR DATA

To achieve this level of monitoring, various spectral indices are applied to satellite data. For TSA we have:

- **NDVI.** It is a basic indicator of plant health. Building time series with NDVI allows you, for instance, to increase the accuracy of the N-fertilizers distribution or based on the state of the leaf canopy from year to year, get at hand precise crop statistics, which can help predict yields for the current year. Moreover, it helps to identify and eliminate the root causes of an anomaly for preventing its occurrence in the future. It is very important to detect an abnormal drop of NDVI at the beginning of the season. This can be achieved through a comparison of the present field performance with the same data but for previous years. If such a kind of drawdown happens, immediately set the task

Cognition

Satellite Monitoring Of Forest Fires And Deforestation In the Brazilian Amazon

Detecting Changes, Trends And Seasonality With Satellite Time-Series Data

Using Historical Satellite Images To Get Insights From The Past

Smart Urban Planning With Remote Sensing Techniques

Satellite Data: What Spatial Resolution Is Enough For You?

numerous countries snow is perceived to be one of the most devastating natural disasters and have a huge negative impact on agriculture. Snow cover assessment also plays a major role in weather forecasting, hydrological assessment, research related to melting glaciers, and climate change. Snow cover is a lateral water supply in agriculture, that is a big necessity for plants, as well as protection against freezing in winter months for perennials and many other crops.

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- **NDWI** serves to detect the amount of water in soil or canopy. TSA created with the use of NDWI index will show the water content in soil and plants and the fluctuations over long intervals of time. The accumulation of such data will help identify areas that need additional irrigation as well as early detection of water shortages that can prevent plant wilting, drought, and other negative consequences.

In addition, with the use and assistance of these indices you can create maps that will simplify land assessment and solve a wide range of problems. Not only can agricultural issues be assessed, but also deforestation or pre-assessment of damages caused by natural and man-made disasters, weather forecasting, drought prevention, etc.

TIME-SERIES APPROACHES CURRENTLY AVAILABLE IN GIS TOOLS

TIMESAT Software Package

TIMESAT is a software package for analyzing time-series of satellite sensor data. TIMESAT is developed to investigate the seasonality of satellite time-series data and their relationship with the dynamic

- Free of charge

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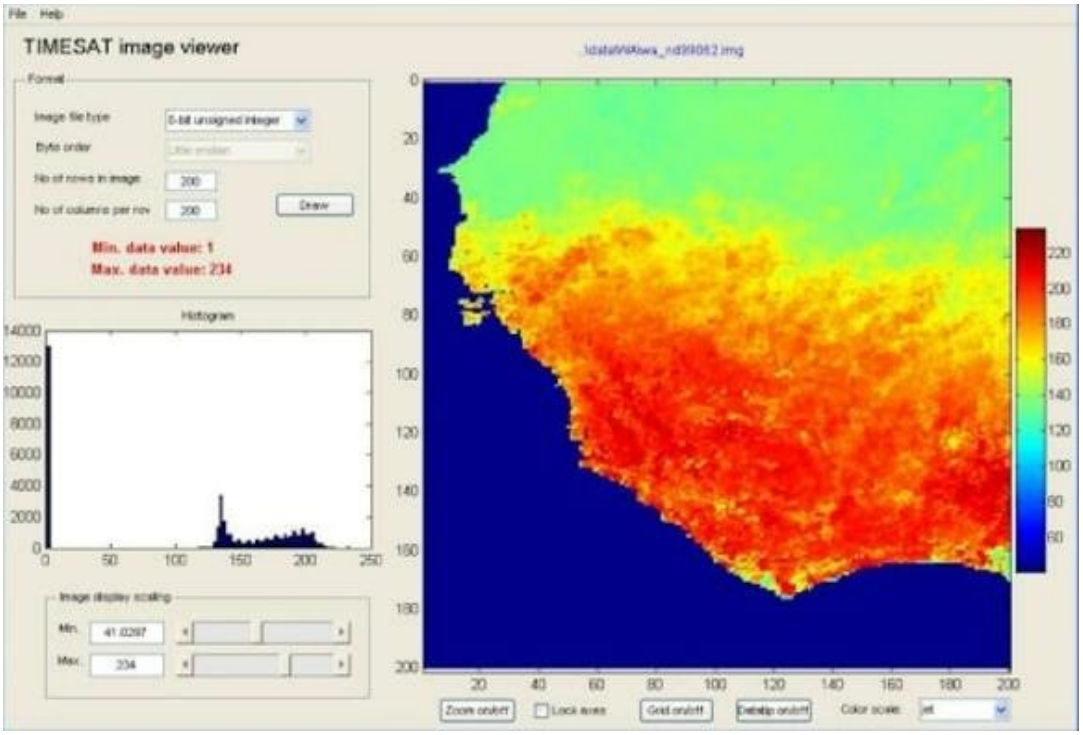
Cons:

- The Desktop app, installation issues, downloading, etc.
- Works with MODIS, low-resolution imagery only
- Works with AVHRR NDVI data only

TIMESAT software package screen.



ASAP

Pros:

- User-friendly interface, easy-to-use

- Only NIRSWIRR or NDVI indices may be used

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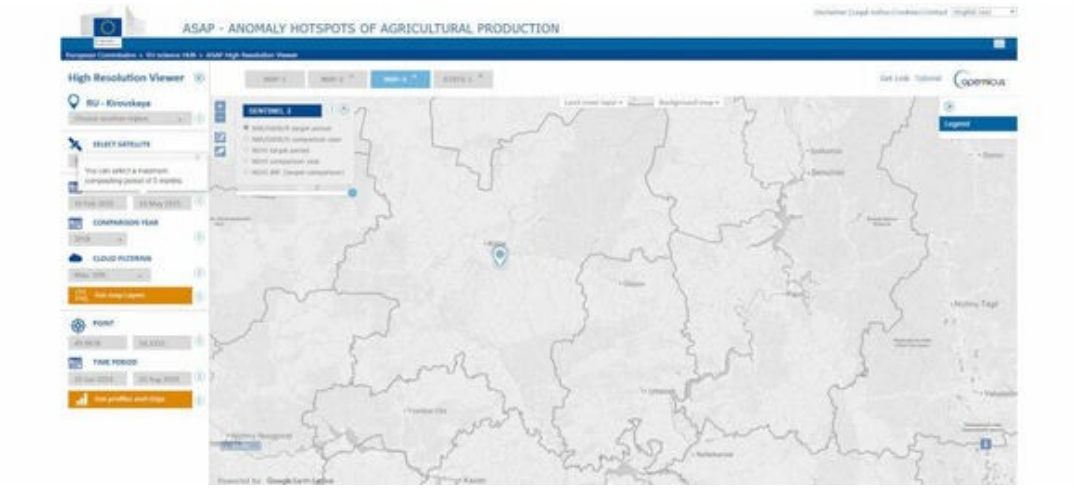
- The ability to receive data starting from 2012 only

ASAP system screen.



Remote Pixel NDVI Series

This project was built to test the capacity of AWS Lambda to do some fast and simple image processing using python and satellite images. A simple tool for building time series analysis using the NDVI spectral index.

Pros:

- Large AOIs for creating time series – 1000 sq. km
- Free of charge

Cons:

- NDVI only

The project remained at the demo level.

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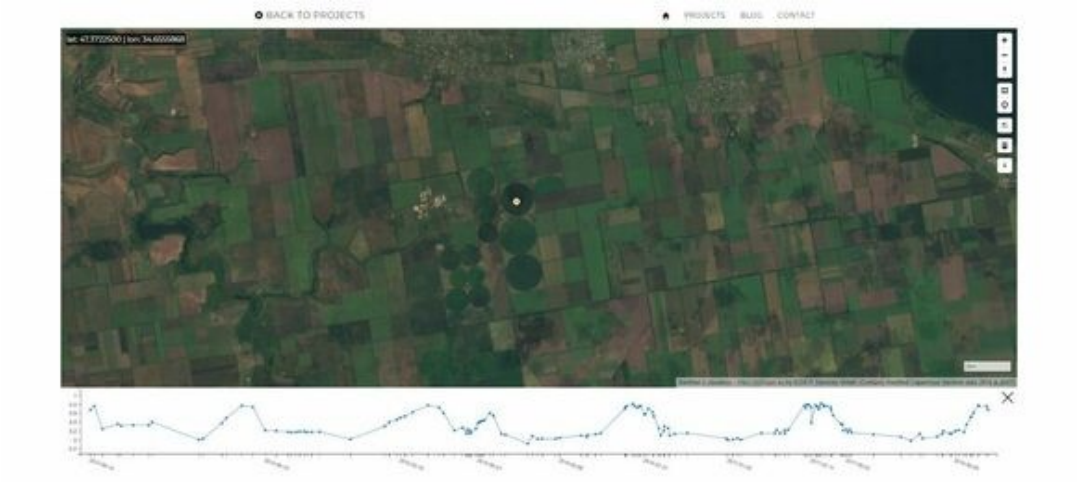
Remote pixel tool screen.



LANDVIEWER – ON THE CUTTING EDGE OF TIME-SAVING

To visualize historical data in dynamics and detect changes we developed the Time series analysis feature – an easy-to-use tool that allows the user to build the spatiotemporal graphs with specific indices applied within set AOI. This visualization is based on the data we acquire from each of the seven satellites individually or from all of them simultaneously.

The feature offers the possibility to monitor the dynamics of crop growth within your area of interest easily and without any additional tools, as well as to monitor the effectiveness of land and water resources usage, track environmental changes, study biodiversity within the selected AOIs, forecast weather, pre-assess damages caused by natural disasters, all right from your browser.

NB: *your max AOI for time series analysis is limited to 200 sq. km*

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Creating Time Series

The tool offers three indices to choose from: NDVI, NDWI, and NDSI. As seen in the image above, each index allows you to fulfil a specific range of tasks. Graphs can be created for any time intervals from one month and up to ten years by default. In case they do not suit your needs you are able to set custom time periods using the calendar. In addition to the spectral index and the time period, you can also select the data source, but the icing on the cake is the ability to build the graphs using all of the sensors simultaneously!

Currently, data obtained from such satellites as Sentinel-2, Landsat 8, CBERS-4 WFI, CBERS-4 MUX, CBERS-4 PAN10, Landsat 4-5 TM, and Landsat 4-5 MSS is available for TSA. Once all of the parameters are set, apply them to get the detailed analysis of your AOI for any time interval.

Creating Time Series Graph

When a drawdown of any index appears on the graph, you can visualize this plot on the map and check the analytics to find the reason of such index behavior. An equally important point is that the creation of graphs and analytics takes place using only declouded images.

Splitting By Years

In order to visualize field performance for the same period, but for different years, the Splitting by years option is provided. Divided up by years, the curve lets you easily compare index values across 3 to 10 years on the same graph. Compare values based on previous experience to know whether they are in the normal ranges or not. With this new visualization of Time series analysis you will never miss a trend or anomaly.

Split By Years

You can download the results in the form of a graph or table.

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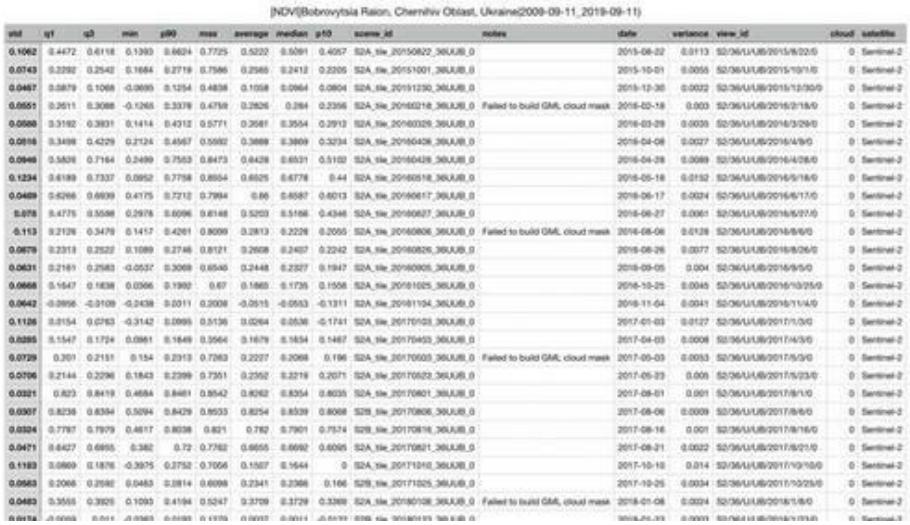
The download in the form of a graph will provide you with a .png file that displays the minimum, maximum, and average values, as well as the standard deviation for the selected spectral index.

Graph downloading

You can download a .csv file, where all of the necessary data will be presented in the form of a table.

Table downloading



Illegal deforestation monitoring

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In recent years the problem of illegal logging has become especially relevant for the Ukrainian Carpathians. Let's conduct a small private investigation. By simply scrolling the map, find the place where the consequences of deforestation are visible to the naked eye and set the area of interest (AOI) within it.

Use case 1. Setting AOI

Using the Time Series Analysis tool (TSA), create the graph using the NDVI vegetation index. This index will display the amount of biomass present in this area for a number of years. The graph allows defining time intervals when major drops of the index occurred. By disabling the smooth curves with no drawdowns, we can determine the year when there was an extreme decrease. Select this year and the next one to be displayed on the graph.

Use case 1. Creating time series

The graph shows that the amount of biomass sharply decreased in 2004 and remained low throughout 2005, but then increased again. This increase was due to the fact that the trampled and cut part of the forest had since ran wild. With a couple of simple steps, one can easily determine the exact time of illegal logging.

Use Case 2

Using Time series analysis in agriculture

Let's examine the case of creating time-series for a specific field. At this point, we create time series for those years when the same crops grew on the field. Using NDVI we can form certain trends in the development of this crop. Let's focus on 2017 and 2019. Consider 2017 as a reference year, as this year we had a historically high crop. Note the increasing of the vegetation index in March, April, and May. This is due to the emergence of shoots and the active crop growth in this period.

In the current year we can also observe an increase of NDVI; however, in early July there is a major drawdown. This NDVI drawdown was caused by abnormally high temperatures and serves as a clear alarm. By comparing the pace of crop development over different years, you can promptly spot anomalies, and thus take action. As can be seen from the graph, the farmer managed to rectify the situation using time series analysis and comparing the current NDVI with the one from the years when the yield was great.

Use case 2. Time series of a problem field

This screen shows the NDVI drawdown in 2019 compared to 2017.

Use Case 3

The following use-case considers not only your fields, but neighboring ones. Your fields are seeded with corn. Field monitoring is carried out through the use of satellite NDVI maps. Using these maps, we discovered plots with disparate NDVI values throughout the field.

Use case 3. NDVI map of a problem field

But how can we understand whether such values are the standard ones or these are deviations? And if these are deviations, how major they are? To answer these questions, we can use the Time series analysis tool.

within your district, you can easily save them in the form of a table.

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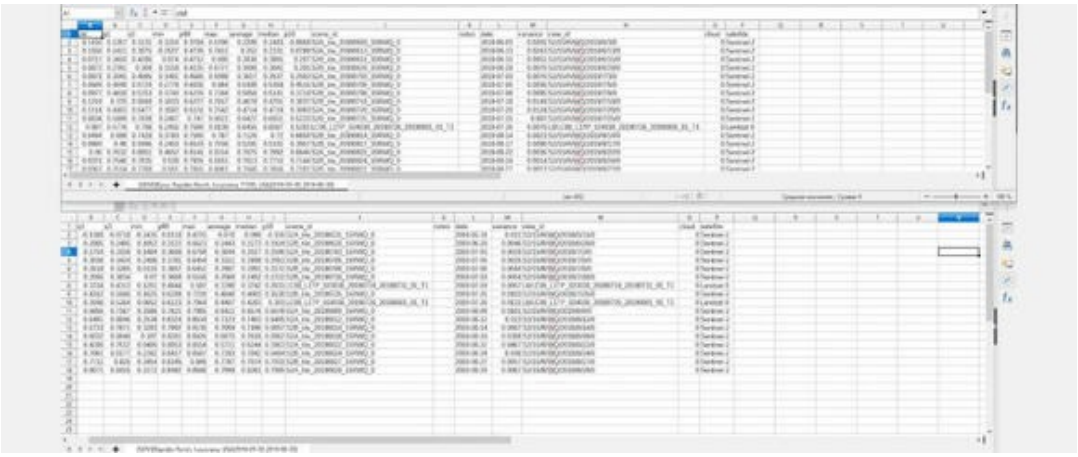
The performance of the field can be conveniently compared with others since this data is in a tabular form. As a result, you can gain insight on whether the NDVI performance of your fields falls under the relative norm or is completely different from district-wide trends.

Use case 3. Comparing results on two fields



BOOST YOUR ANALYTICS WITH TIME-SERIES ANALYSIS

In summary, this tool provides you with the exceptional ability to carry out constant monitoring of your area of interest so as to accumulate various data and make its further analysis much more accurate. This will allow you determine trends, derive patterns, and identify deviations within your fields. With our new feature, predicting yields will be easier than ever.

For detailed information on Time-series analysis, check LandViewer's user-guide or email us at support@eos.com

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