

## WebGIS platform of multi-annual cropland maps from Hungary based on Sentinel-1 data

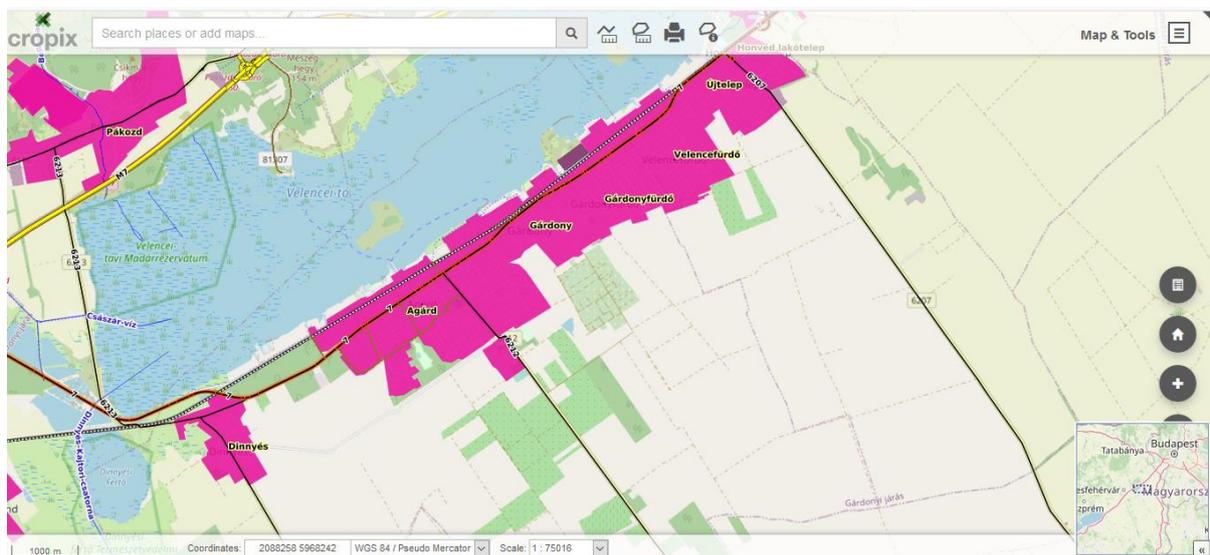
Together with sarmap and the developers of Sourcepole, a customized WebGIS platform - <https://t1p.de/skuh> - has been developed to visualize multi-annual cropland maps of Hungary.

The WebGIS has three conceptual clusters:

1. Spatial cluster
2. Temporal cluster
3. Thematic cluster

1. The WebGIS for Hungary shows data from Sentinel-1 SAR satellite, which is operated by the European Space Agency. We use data from the ascending mode, which covers the entire country of approximately 100.000 km<sup>2</sup> in three stripes: West (A073), Center (A175) and East (A102).

When you enter the WebGIS, the map shows an area with an open-street-map somewhere in Hungary. There is an overview map, which can be opened with the double arrows in the lower right-hand corner. The square within the overview map shows you the current extent of the map-viewer.



There are two background maps. Open-street-map is integrated as a web-map-service (WMS) as well as the Bing aerial map. You can switch between the layers using this button, which is also in the lower right-hand corner.

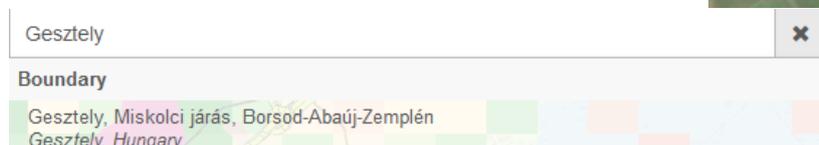


There are some more buttons to jump back to the initial view and to zoom in and zoom out (you can also use the scroll wheel of your mouse for this).

If you hold one button of the mouse and pan, the map shifts within the map canvas.

In the top menu bar are two tools for measuring distance and area.

Last but not least, we have a search field for spatial searches. You can search for places anywhere in the world, but the map products in this application are for Hungary only.



2. The temporal cluster applies to the time-series.

We organized the map products in folders and subfolders. In the lowest subfolder we find the different dates of acquisition for each map product and each orbit of Sentinel-1.

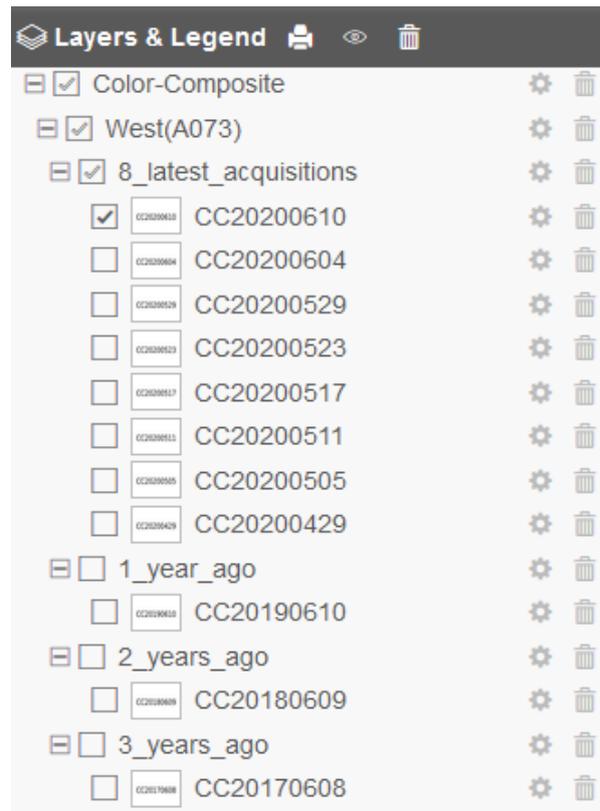
Here you see the western stripe, which is orbit A073, where you find the 8 latest acquisitions.

Beside the abbreviation of the map product you see the date indicated in the format YYYYMMDD.

The map product is only visible if all check-boxes are active through the whole folder structure.

The data is acquired with a 6 day repetition rate. We update accordingly with a delay of normally less than two days.

We found the last 8 acquisitions are most relevant and added the acquisitions of the current date as well as those from 1, 2 and 3 years earlier.



This should help to compare the current year to previous years.

3. The thematic cluster addresses the different map products.

In the menu "Map & Tools" you find the submenu "Theme". If you open it, you can select predefined themes.

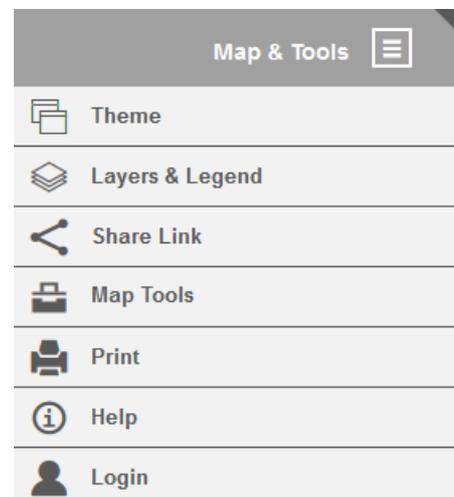
Themes are arrangements of different layers. They are organized according to our map products.

This is still a work in progress and more themes could be added over time.

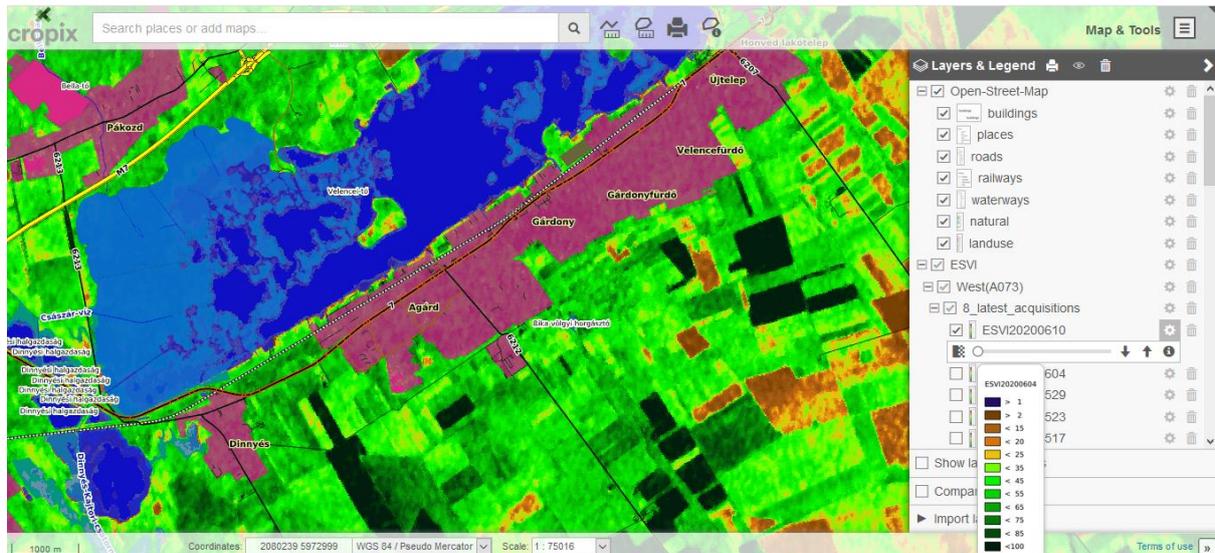
Each theme has, as a top layer, the open-street-map as vector data, which appears on top of the map.

With open-street-maps in front of the satellite image, users can better locate places of interest.

Below you see the map products organized on one hand in orbits and on the other hand over the time-series.



There are a few additional features in the application I would like to mention. In the image below you see a slider bar below each single layer, which allows you to adjust the transparency of the layer.



Right beside the check box of the layer you can open the legend definition of each layer. Shown here is the color coding of the ESVI (enhanced SAR vegetation index, see below). The values of ESVI range in a relative scale from 0 – 100.

### The map products

The ESVI shows the fresh biomass. This map product can also be seen as a proxy for LAI (leaf area index). Low values up to 20 show bare soil or vegetation which is not covering the soil or fully matured. In green we see grown up vegetation, with humidity in the different parts of the plants. This can be in the leaves, stem and grain or seeds. SAR satellites measure the structure and humidity. If the plant has reached the peak of season and starts to mature the values will drop. This means that the water content in the plants reduces.

CC stands for Color Composite. This map product is derived from single date SAR data and can be seen as a pseudo true color image with a high spectral contrast. We see more details within single plots than we see in the ESVI. The user can monitor single plots or areas and identify spots with abnormalities or uncommon behavior.

The third map product in this application is the SWI (SAR water index). It shows the relative humidity content in the field crops and the top soil of cropland. This index correlates very well with optical NDWI and is useful for drought monitoring.

The map product cultivation units is derived from ESVI over several years. The background for this product is, that single plots can be cultivated in one year with one crop and in the following year it can be divided into parcels. We also see neighboring plots, which are cultivated with the same crop in one year, but in the next year, the plots are cultivated with different crops. We wanted to generate a map product which shows the cultivation units derived from remote sensing data. The map product may help perhaps underwriters of crop insurances to better identify the insured risk.

We have an external map product in the WebGIS, which shows different layers for soil nutrients at a resolution of 500 m. The source is the European Soil Data Centre ([esdac.jrc.ec.europa.eu](http://esdac.jrc.ec.europa.eu)).

We will soon have a log-in function, where you can register for free if you want to use the application. In case you find bugs or have some comments, please don't hesitate to contact us.