AGRICULTURAL DAMAGE MAPPING IN HUNGARY

Earth Observation based damage maps have been integrated into a central framework and have been used in an operational manner for several years now, leading to substantial cost reductions for authorities and clients alike.

The challenge

The agriculture of Hungary – as numerous cases of the last five years have demonstrated – is facing an increasing number of extreme weather conditions. The increasing rate and length of these events often result in substantial damage and loss in the Hungarian agricultural sector. Increasing risk factors, their implications on the area-based agricultural subsidies, and the large extent of agricultural territories affected all give reason for continuous monitoring via remote sensing techniques, measuring the damages in both space and time.

The space based solution

In the period February-March 2016, extreme precipitation events took place, which resulted in the appearance of inland excess water as well as water logging in several Hungarian counties.

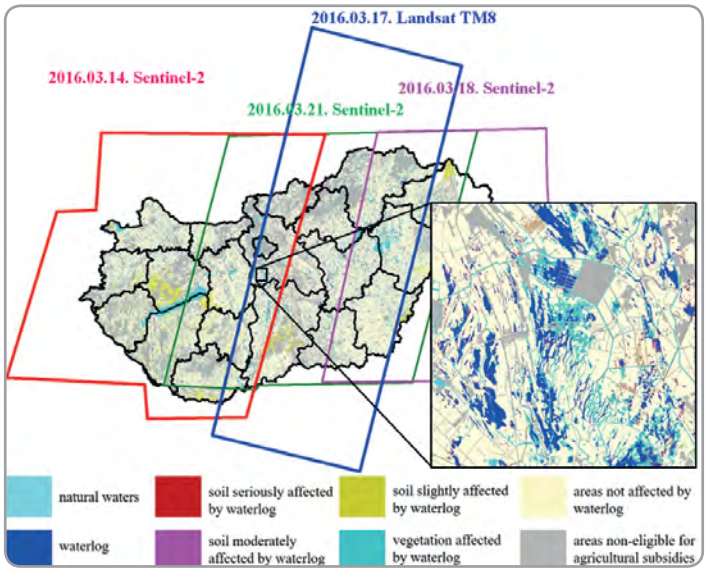
Surveying the extent of water-affected surfaces was carried out by the use of optical satellite imagery from Sentinel-2 and Landsat. The map in Figure 1 shows the results of our analysis: altogether 131,245 hectares of water-affected areas were detected countrywide.

With free and easy access to Sentinel-1 SAR data and to the open-source Sentinel toolboxes, users can now benefit from this technology. Thus, operative inland water mapping by radar imagery becomes possible. Hence, a survey of the whole country was successfully done in a few days based on Sentinel-1 imagery for the period from 01–04 March 2016. Open inland excess water surfaces (see an example on Figure 2) were detected with high accuracies, leading to a result of 88 960 hectares as a lower estimate.

Benefits to Citizens

Countrywide appearance of inland excess water, waterlogging, spring-frost damages and summer drought events collectively can affect 30-40,000 farmers in Hungary. Obviously, it is impossible to provide operational real-time ground-based observations for the assessment of loss compensation claims. Thanks to the good spatial and temporal resolution of Sentinel satellite images not only does the affected territory becomes measureable, but the temporal evolution of the events can be monitored as well.

The Government Office of the Capital City Budapest, Department of Geodesy, Remote Sensing and Land Offices, Remote Sensing Unit produces thematic maps of land surfaces affected by extreme water conditions and drought, derived from satellite products. The final maps are uploaded to the database of the so-called Agricultural Risk Management System. Via this framework, the maps of the affected territories are available to all members of



Inland excess water map of Hungary based on Sentinel-2 and Landsat-8 optical images between 14/03/2016 and 21/03/2016.

Thematic Area: AGRICULTURE, FOOD, FORESTRY AND FISHERIES

Region of Application: NORTHERN HUNGARY

Sentinel mission used: S1, S2

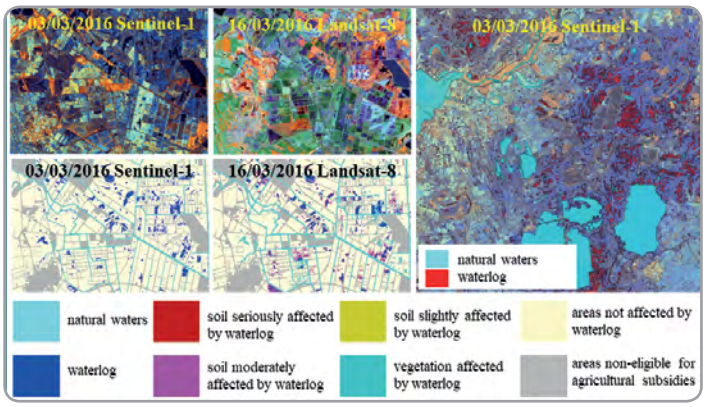
Copernicus Service used: –

Usage Maturity Level: 3

the project: the Hungarian Paying Agency, the Research Institute of Agricultural Economics, the Hungarian Meteorological Service, the General Directorate of Water Management, and the Ministry of Rural Development. Thus, the need for on-the-spot controls decreases, official administration is reduced, and procedure deadlines are shortened.

Outlook to the future

The success of the current system provides a solid basis for its further extensions. On the one hand, damage mapping is planned to be extended to storm and hailstorm effects, with preliminary studies already being carried out. Furthermore, measures are being taken to integrate yield loss estimations into the systems of risk management and loss compensation. In addition, the possibility of including grasslands is under consideration. Nevertheless, these topics require further investigations in order to establish robust methodologies for the estimation of crop yields and grassland productivity, in which remote sensing is likely to play a major role.



Map of water-affected land surfaces around Lake Tisza on radar composite (VV, VH, VV/VH) (right). Optical (NIR, SWIR, RED) and radar (VV, VH, VV/VH) composites (left upper) and the derived waterlog maps (left down).

> "Damage maps can substitute a large number of on-the-spot checks, leading to substantial cost reductions for authorities and clients likewise."
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> ***Hungarian Paying Agency***

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ABOUT COPERNICUS4REGIONS

This Copernicus User Story is extracted from the publication "**The Ever Growing use of Copernicus across Europe's Regions: a selection of 99 user stories by local and regional authorities**", 2018, Edited by NEREUS, the European Space Agency and the European Commission.
The model cases focus on local and regional authorities who successfully applied Copernicus data in 8 major public policy domains.

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