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Detecting stubble burning in agricultural fields in Serbia



STUBBLE BURNING IS A COMMON PRACTICE IN CULTIVATED FIELDS IN SERBIA, THREATENING THE HEALTH AND SAFETY OF THE TERRITORY.



WITH THE SUPPORT OF THE BIOSENSE INSTITUTE, UNDP SERBIA CREATED A WEB GIS PORTAL TO DETECT OPEN FIRES USING DATA FROM SENTINEL-2.



THE PORTAL ALLOWS THE GOVERNMENT TO DETECT STUBBLE BURNING AND TO UNDERTAKE EVIDENCE-BASED ACTIONS AGAINST THIS PRACTICE .

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COPERNICUS



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STUBBLE BURNING IS A COMMON PRACTICE IN CULTIVATED FIELDS IN SERBIA, THREATENING THE HEALTH AND SAFETY OF THE TERRITORY.

Farmers and landowners burn harvest residues in the open air to remove straw stubble that remains after grains have been harvested. This practice is illegal, as it deteriorates air quality and could result in uncontrolled extended fires.

IN 2019, AROUND 19.000 OPEN FIRES WERE RECORDED IN SERBIA. 14 PEOPLE DIED BECAUSE OF THEM AND 40 WERE INJURED [1].

Unauthorised stubble burning not only poses risks to people and properties, but it also damages the environment and agriculture activities. Indeed, fires threaten the habitat of wild plant and animal species, while also destroying beneficial microorganisms and reducing the fertility of the soil by deteriorating its humus content (100 years are needed for a centimetre of humus to form).

THE FIRES OF 2019 BURNED LOW VEGETATION, BUT ALSO DAMAGED FORESTS, MEADOWS, ORCHARDS, CEREALS, AND VINEYARDS [1].

In addition to threatening people, properties and natural environments, burning harvest remains also has negative effects on air quality.

According to a press release from UNEP of 2019, air pollution causes one of every five premature deaths in the Western Balkans [2], while Serbia ranks as the 5th most polluted country in Europe [3].





THE AUTONOMOUS PROVINCE OF VOJVODINA

Type of organisation: Public regional administration

Country: Serbia

Previous experience with Earth Observation data: No

With a multi-ethnic and multi-cultural population of about two million people, the Autonomous Province of Vojvodina occupies the northernmost part of Serbia. Novi Sad, its administrative centre, is the second largest city in the country.

While Novi Sad is heading towards recognition as a regional leader in the IT industry, Vojvodina's economy mainly relies on agriculture and agribusiness.

THE VOJVODINA PROVINCE IS PARTICULARLY AFFECTED BY THE PHENOMENON OF STUBBLE BURNING [4].

In 2019 alone, satellites spotted nearly 5.000 plots in which harvest residues had been set on fire [5].

TO DISCOURAGE FARMERS FROM BURNING THE REMAINS OF THEIR CROPS, THE PROVINCE'S PUBLIC AUTHORITIES NEED PRECISE AND RELIABLE INFORMATION ON THE LOCATION OF THIS PRACTICE.



**RECOGNISING THE THREATS
POSED BY STUBBLE
BURNING NOT ONLY TO
PUBLIC HEALTH BUT ALSO
TO AGRICULTURE AND THE
ENVIRONMENT, THE UNITED
NATIONS DEVELOPMENT
PROGRAMME IN SERBIA
(UNDP SERBIA) DECIDED TO
SUPPORT THE
DEVELOPMENT OF A WEB
PORTAL THAT PROVIDES
TIMELY AND ACCURATE
INFORMATION ON FIRES
OCCURRING IN
AGRICULTURAL FIELDS IN
SERBIA.**



The web portal was realised with the assistance of the BioSense Institute, a public research and development institute for IT in biosystems based in Novi Sad.

The BioSense Institute is a leading scientific institution in the region, it participates in numerous H2020 projects, and it performs research in numerous sectors, spanning from Earth observation and remote sensing to micro- and nano-electronics, sensor design, agriculture and biosystems, and AI and big-data analytics.

Within the scope of the ongoing ANTARES project, coordinated by the BioSense Institute and funded by the European Union's Horizon 2020 research and innovation programme, BioSense will become a centre of excellence for advanced technologies in sustainable agriculture and food security.

The Institute currently employs 126 people, including researchers (70% of the staff), administrative support personnel, programmers, and project managers.

Thanks to an agreement of cooperation signed in 2018 by the European Commission and the Ministry of Education, Science and Technological Development of the Republic of Serbia, the BioSense Institute has become a regional hub for the distribution of Copernicus satellite imagery [6, 7].

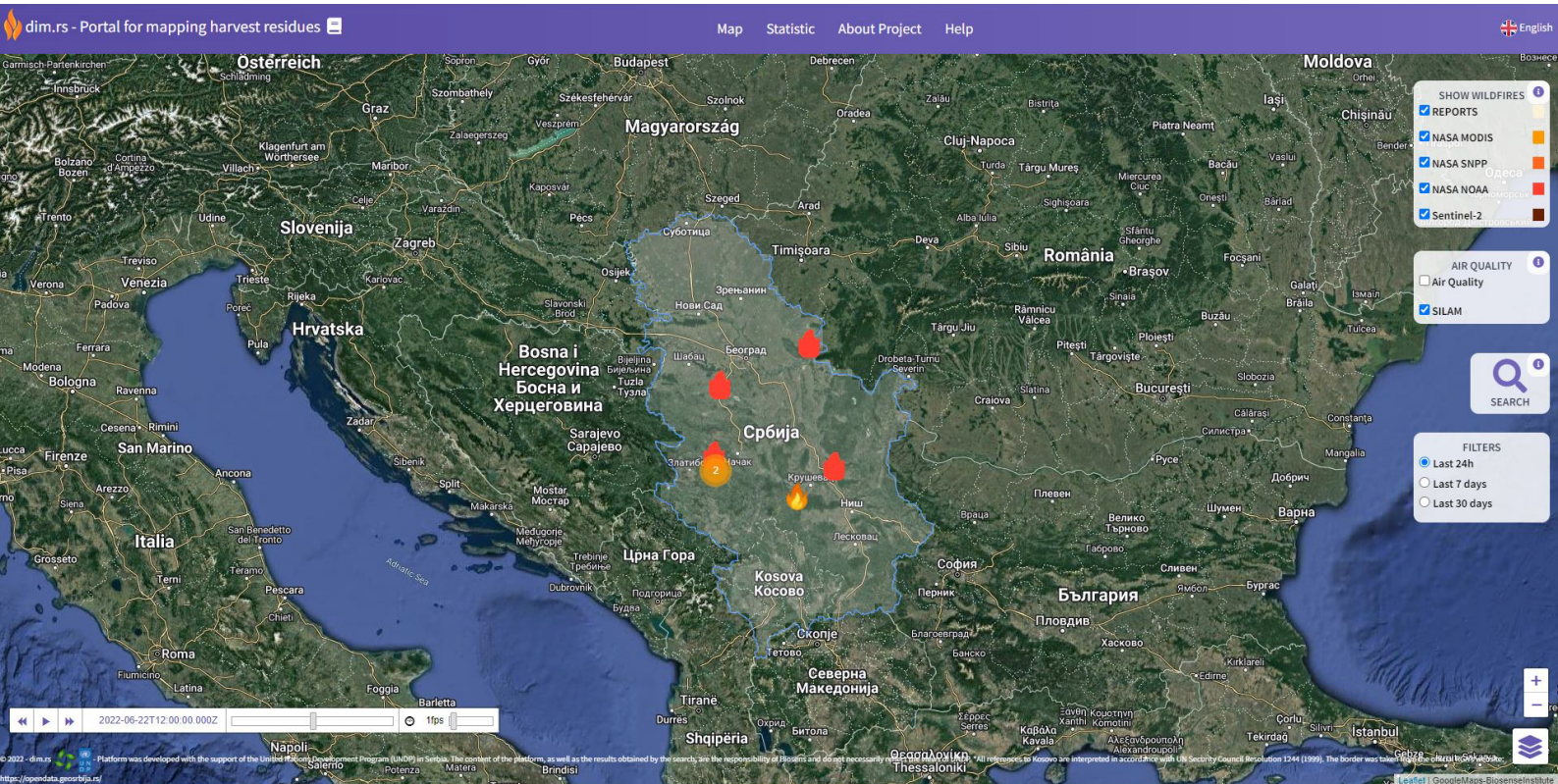
TO MAP STUBBLE BURNING, THE BIOSENSE INSTITUTE USED DATA FROM SENTINEL-2 SATELLITES.

The Copernicus Sentinel-2 mission is a constellation of two satellites (Sentinel-2A and Sentinel-2B) with a high spatial resolution (10 m to 60 m) and a Multi-Spectral Instrument (MSI) with 13 spectral bands that range from the visible range to the shortwave infrared (SWIR).

Short wave infrared bands with a spatial resolution of 20 m were particularly useful to the scientists of the BioSense Institute to map stubble burning in Serbia.



BY COMPARING TWO CONSECUTIVE SENTINEL-2 SATELLITE IMAGES, ONE BEFORE THE FIRE OCCURRENCE AND THE OTHER AFTER THE FIRE, AN ALGORITHM DETECTS THE AREAS WHERE FIRES HAPPENED AND THE POTENTIALLY BURNED AREAS. THESE SPOTS ARE VISUALISED ON AN INTERACTIVE WEB MAP THAT IS MADE OPENLY AND FREELY AVAILABLE TO THE PUBLIC.



The Web Geographic Information System Portal for mapping harvest residues: www.dim.rs

The Portal for Mapping Harvest Residues (www.dim.rs/#/dashboard) was funded by UNDP Serbia through the “Challenge call for innovative solutions to reduce air pollution in Serbia and improve air quality”.

The project aimed at raising the awareness of people, farmers in the first place, about the threats posed by stubble burning.

Moreover, it also aimed at capturing the attention of public authorities and at empowering them to take legal action against the farmers who would not retain this practice.

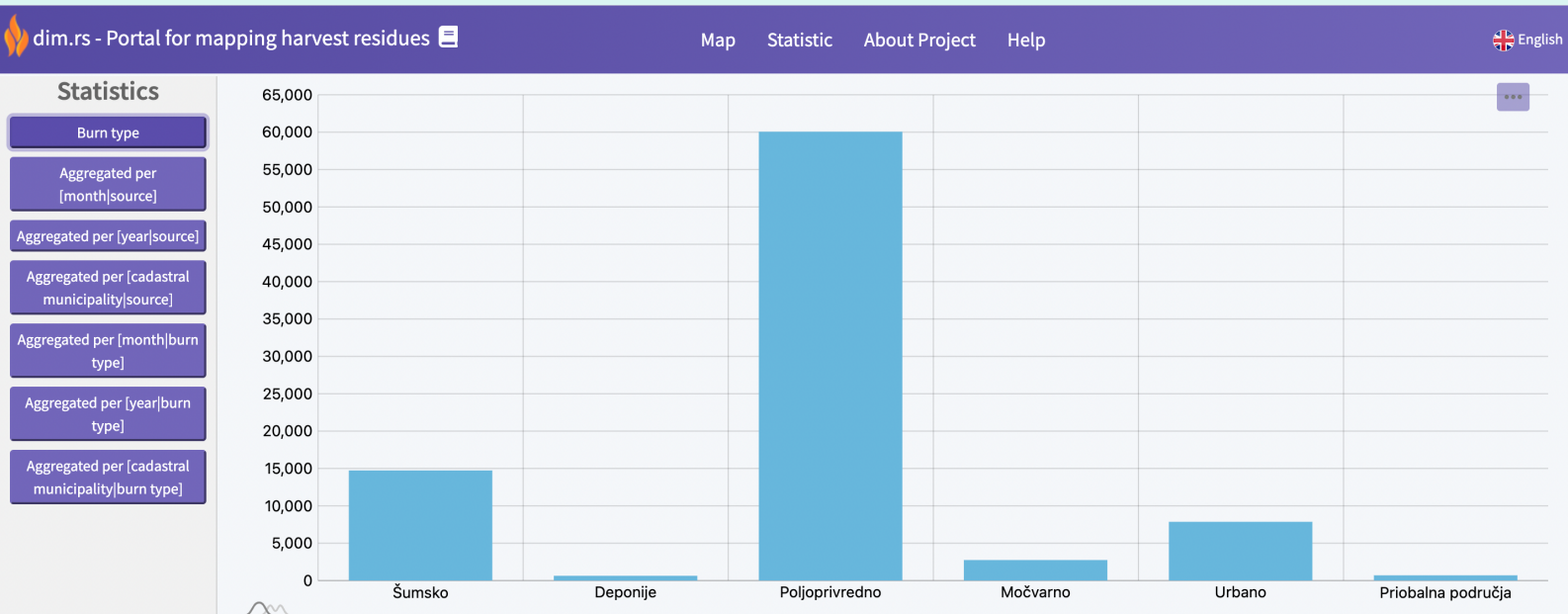
IN THE VOJVODINA PROVINCE, THE METHODOLOGY USED TO DEVELOP THE PORTAL WAS TESTED DURING THREE MONTHS (FROM SEPTEMBER TO NOVEMBER 2020), SPOTTING OVER 9.000 PARCELS THAT WERE SUBJECT TO CROP RESIDUE BURNING.

The BioSense's idea of the web portal dim.rs for mapping stubble burning has been recognised by the UNDP as one of the 14 best innovative solutions to improve air quality in Serbia in 2020 [8].

**THE PORTAL FOR
MAPPING HARVEST
RESIDUES PROVIDES
PUBLIC AUTHORITIES
IN SERBIA WITH
PRECISE
INFORMATION ON
THE LOCATION OF
STUBBLE BURNING,
THAT THEY CAN USE
TO RAISE
AWARENESS AND
DISCOURAGE
FARMERS FROM THIS
PRACTICE.**

On dim.rs, fires are classified according to the dates on which they occurred and cadastral information. The web-GIS portal also contains statistics on fire occurrence history that is available for download, and information for citizens on how to report illegal burnings.

Users can know which areas are the most affected by crop residue burning and in which periods of the year. Altogether, this information enables local administrations (such as police forces, firefighters and forest authorities, among others) to be better prepared to the occurrence of stubble burning, to target awareness raising campaigns, to better plan in-situ inspections, and to sustain law enforcement.



The statistics indicate fires in the agricultural field as the highest among other types of burns in the web GIS portal.
Source: www.dim.rs

The portal provides free data that are open to all public and private stakeholders in Serbia. At the national level, entities such as the Ministry of Internal Affairs and the Ministry of Agriculture, Forestry and Water Management of Serbia and the Republic Hydrometeorological Service of Serbia, can profit from the information on stubble burning in the portal.

At the provincial level, the portal on fires in agricultural fields targets the needs of several bodies of the Provincial Government of the Autonomous Province of Vojvodina, including the Provincial Secretariat for Agriculture, Water Management and Forestry, the Provincial Secretariat for Urban Planning and Environmental Protection, and the Institute for Nature Conservation of the Vojvodina Province.

In July 2022, UNDP Serbia is using the portal to emphasise the severity of the problem and to encourage other organisations and individuals to exploit the web-GIS platform and take part in a joint fight for a safer and healthier environment in Serbia.

**THANKS TO THE
COPERNICUS DATA, FOR
THE FIRST TIME
CITIZENS OF SERBIA
HAVE RELIABLE,
OBJECTIVE AND
COMPLETE
INFORMATION ON
STUBBLE BURNING OVER
THEIR TERRITORY.**

**AREAS THAT ARE MORE
PRONE TO STUBBLE
BURNING CAN NOW BE
EASILY IDENTIFIED AND
EVIDENCE-BASED
ACTIONS AGAINST SUCH
PRACTICE ARE WITHIN
REACH.**



LINKS

- Autonomous Province of Vojvodina: www.vojvodina.gov.rs
- Biosense Institute: www.biosens.rs
- Portal for mapping harvest residues: www.dim.rs
- United Nations Development programme in Serbia: www.undp.org/serbia
- United Nations Environment Programme: www.unep.org
- Discover our satellites, Copernicus website: www.copernicus.eu/en/about-copernicus/infrastructure/discover-our-satellites
- Actions on Air Quality: A Global Summary of Policies and Programmes to Reduce Air Pollution, United Nations Environment Programme, 7 September 2021. Consulted on 24 March 2022: www.unep.org/resources/report/actions-air-quality-global-summary-policies-and-programmes-reduce-air-pollution
- UNEP Clean Air Blue Skies initiative: www.cleanairblueskies.org

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www.undp.org/serbia/

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[2] Air pollution is responsible for up to one in five premature deaths in 19 Western Balkan cities, United Nations Environment Programme, 4 June 2019. Consulted on 23 March 2022.

[3] Serbia Air Quality Index. Consulted on 28 March 2022.

[4] Satellite Assisted Mapping of Environmental Pollutants: A Study on Burning Crop Residues, the Biosense Institute, 2021. Consulted on 28 March 2022.

[5] It's known exactly who's doing what in every field in Serbia: 4,913 images, draconian penalties, Telegraf, 24 October 2019. Consulted on 28 March 2022.

[6] BioSense Institute becomes regional center for distribution of satellite images of Copernicus Earth Observation Program, eKapija, 8 June 2018, Consulted on 12 July 2022.

[7] Copernicus Space Component Technical operating Arrangement ESA – BioSense Institute, Republic of Serbia, 25 January 2019, Consulted on 12 July 2022.

[8] UNDP Serbia, Clean air challenge: Calling for innovations to reduce air pollution in Serbia and improve air quality, 24 September 2020, Consulted on 3 April 2022.

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