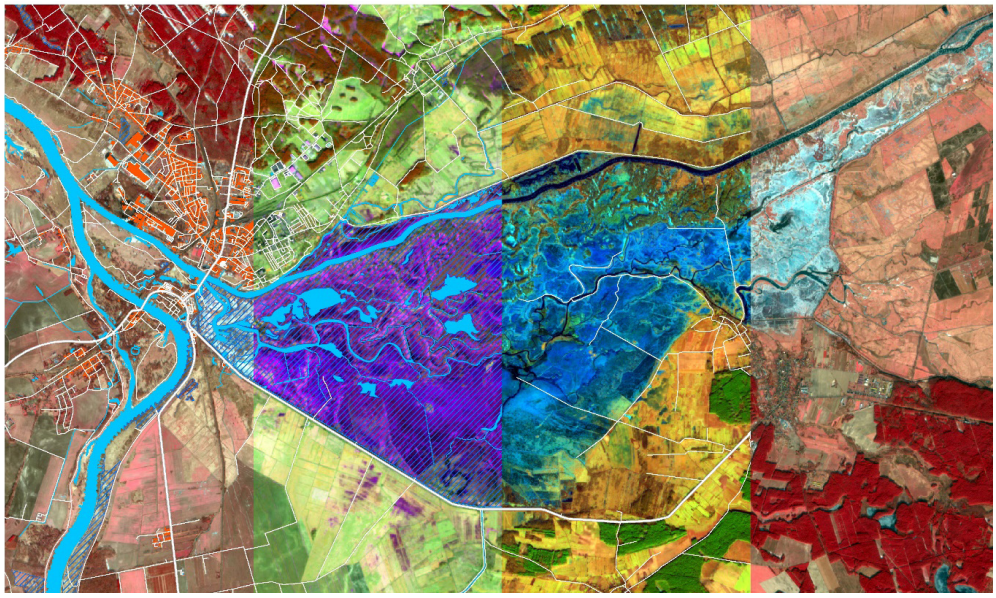
INNOVATION IN DISASTER PREVENTION

Geoinformation for crisis management



Guidelines and examples

2023

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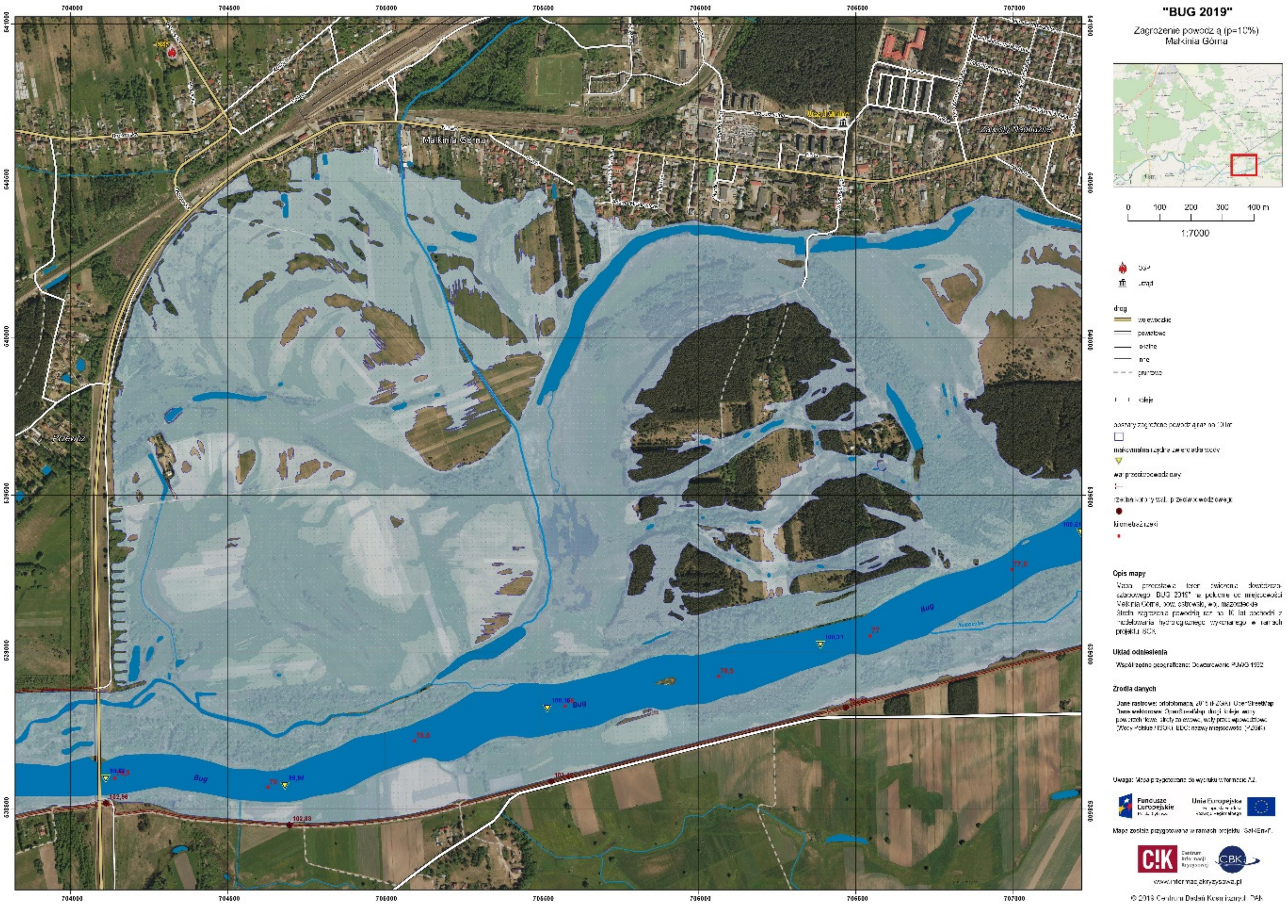
GEOINFORMATION FOR CRISIS MANAGEMENT

Geoinformation means information that describes the location and characteristics of phenomena, natural or human made, related to the Earth's surface. It is used in almost all aspects of social and economic activities, however it can bring particular benefits in all phases of crisis management cycle.

It has to be underlined that according to joint ICSU Geo-Unions, JBGIS and UNOOSA report „since 1970, total damages caused by all hazards combined accumulate to over $2,300 billion (in 2008 US dollars), equivalent to 0.23 percent of the cumulative world output. A gradual but clear upward trend can be observed, which is likely to continue into the future due to the impacts of climate change and population growth in areas exposed to natural hazards.'' This results in significant loss of human lives, damages to property and infrastructure and negative impacts on the environment, which might be reduced by improved risk assessment, early warning, and disaster detection and monitoring. The best way of achieving that is by taking advantages of the technologies for processing, storing, analysing and visualising geospatial data which have advanced greatly in recent years, enabling building national and global Spatial Data Infrastructures (SDI). These new developments can contribute to improving prediction and monitoring of hazards, risk reduction and emergency response.



Flood risk map provided by CIK for Bug 2019 exercise.

Geoinformation enables identification of threats and hazards in the spatial dimension, modelling of their extent and possible evolution, predicting their impacts and elaborating different crisis event scenarios. It can provide detailed maps and 3D models of areas of interest, risk and vulnerability assessments, crisis situation monitoring, evacuation plans, damage assesments, recovery

plans and many other useful information products. Geoinformation is based on many different data sources – satellite imagery, aerial photos, data obtained from drones with various sensors, geodetic databases, satellite navigation, meteorological data, LIDAR and radar measurements, in-situ sensors, even social media information.

For the end-users, geoinformation may bring enormous benefits, but like all advanced technological solutions it requires investments both in terms of necessary equipment and personel competences. They need to have the necessary facilities, hardware, or software to access and subsequently process the available data sources, extract the data that could be useful for them and to apply it to their specific situation and information requirements. Fortunately, nowadays there is an ever-growing number of available ready-made solutions and geoinformation services (some of them described in the next sections of this report), even with guidelines and recommendations facilitating their practical use and absorption by the end users. Moreover, the amount of archived data combined with new AI and high-performance computing capabilities enables the long-term monitoring, change detection and analysis of evolutionary trends for a given area and multiple hazards. This is a real shift of paradigm – instead of users waiting for information during emergency situation we can nowadays have information waiting for the users. There are monitoring services, risk assesments and geoinformation products available on a permanent basis – everyone who is interested and needs them can have access to them at any given moment and their operational interfaces are becoming more and more "user friendly" and no longer require a very specialistic GIS knowledge.

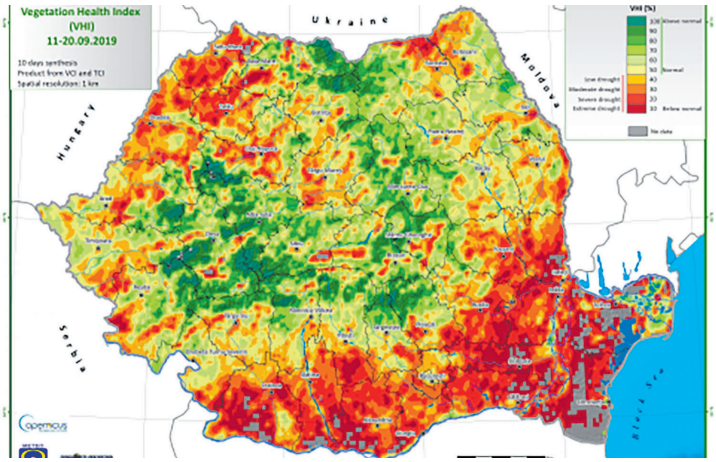
As briefly described above, geoinformation solutions based on innovative technologies play a significantly growing role in improving disaster prevention and thus reducing negative consequences of different crisis events. However, simply having access to a new tool or a technological solution is not enough – one has to learn how to properly use it to take full advantage of the capabilities it offers and eliminate any possible disadvantages. It is very important to properly assess the potential impact of a change brought by a new solution on the socio-technical setup of a crisis management organisation. Investments in new innovative solutions (including geoinformation products), which are not properly adapted to the needs of a given user, his mode of operation, rules and procedures not only generate significant costs, but may also have a negative impact on the operational efficiency of crisis management services.

It is also crucial to remember that the "geoinformation needs" do vary depending on the crisis management stakeholders involved and even for the same entity they may change in the different phases of disaster management cycle. For prevention and preparedness, risk and vulnerability assessments, risk management and contingency planning generally the more information layers are available the better – the relevant institutions will know more about possible threats and will be better prepared to mitigate them. However, once a disaster does occur, it is important to adapt the amount of information available to the appropriate level of operation. For instance local level first responder units need to have practical, "actionable" information: they need to know what roads are passable and what population needs to be evacuated as a priority in their area of responsibility, but not necessarily what are the long-term crisis evolution scenarios or what additional resources have to be deployed and where they will come from – this knowledge is useful for the strategic command. Having too little information about current crisis event will certainly hinder a disaster relief operation, but having too much information will also have a negative impact on efficiency of crisis management activities. It is therefore important to try and find a "golden mean", using both already publicly available data sources and solutions as well as tailor-made GIS tools.

COPERNICUS SYSTEM - A WEALTH OF DATA AND GEOINFORMATION SERVICES

Copernicus is one of the flagship programmes of European space policy, celebrating its 25th anniversary in 2023. It is an Earth monitoring programme based on data from Earth Observation satellites (dedicated Sentinel constellation and so-called contributing missions, both public and commercial) and in-situ observations from sensors on the ground, at sea or in the air. Copernicus is an international initiative managed by the European Commission and implemented in partnership with the Member States, the European Space Agency (ESA), the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), the European Centre for Medium-Range Weather Forecasts (ECMWF), EU Agencies and Mercator Océan.

Copernicus has been specifically designed to meet user requirements and is based on a free and open data access policy. It continously delivers near-real-time data on a global level which can also be used for local and regional needs. However, Copernicus offers much more than just „raw" satellite and in-situ data – it provides a set of value-added information services by processing and analysing the available data. Datasets stretching back for years (sometimes even decades) are made comparable and searchable, thus ensuring the monitoring of changes; patterns are examined and used to create better forecasts, for example, of the ocean and the atmosphere. Maps are created from imagery, features and anomalies are identified and statistical information is extracted.

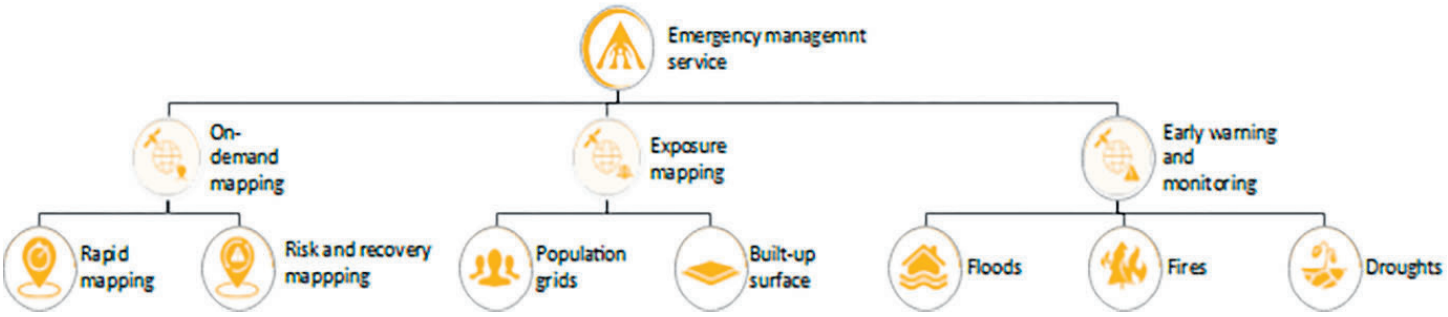


Drought monitoring in Romania, source: https://www.copernicus.eu/

These value-adding activities are divided into six thematic streams of Copernicus services: Marine, Atmosphere, Land, Climate Change, Security, Emergency. There is also a Copernicus service catalogue – a comprehensive list of information products relevant to the various Copernicus services (searchable by filters or keywords).

The information provided by the Copernicus services can be used by end users (usually public authorities at all levels, but also commercial companies and even individual persons) for a wide range of applications in a variety of areas. These include urban area management, sustainable development and nature protection, regional and local planning, agriculture, forestry and fisheries, health, civil protection, infrastructure, transport and mobility, as well as tourism.

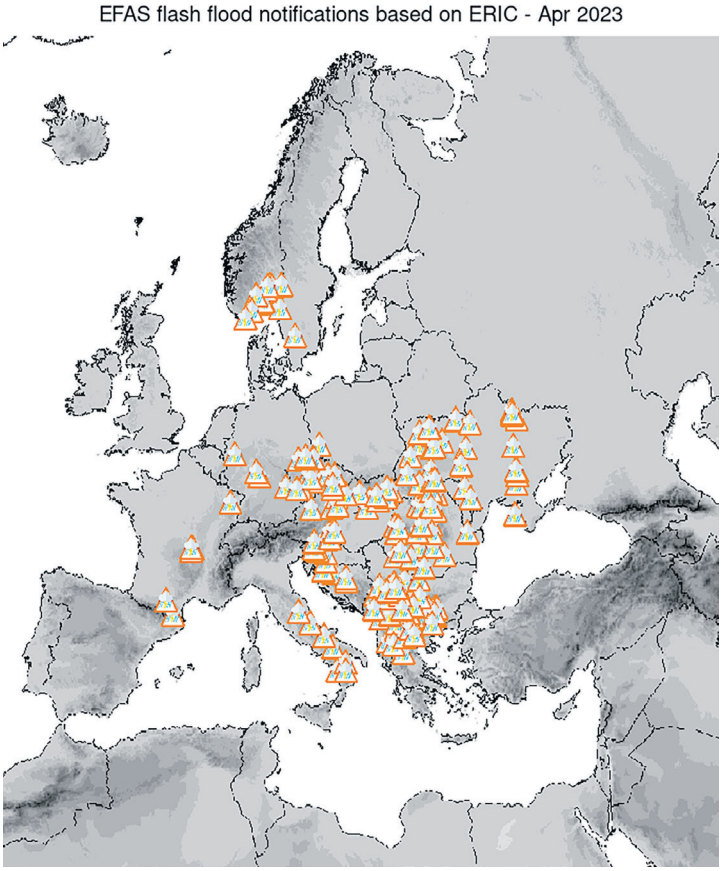
The Copernicus Emergency Management Service (Copernicus EMS) can support all phases of the emergency management cycle: preparedness, prevention, disaster risk reduction, emergency response and recovery. It provides all actors involved in the crisis management, rescue and humanitarian aid with mapping products and analyzes based on geo-spatial information derived from satellite remote sensing and completed by available in situ or open data sources.
This action helps increase the effectiveness of rescue operations and crisis management activities, leading to improved safety of the population and preventing material losses before, during and after disasters and other crisis events by providing information, e.g. on the type and scale of the threat, the extent of the flooded area, the spread of a fire and helps in disaster risk reduction as well as in planning and monitoring the progress of reconstruction. In this way, CEMS contributes significantly to achieving the priorities of the Sendai Framework for Disaster Risk Reduction.



Copernicus Emergency Management Service structure.

Copernicus Emergency Service has been operational since April 2012. It works in the 24/7/365 mode under the management of Emergency Response Coordination Centre (ERCC) in Directorate-General for European Civil Protection and Humanitarian Aid Operations (DG ECHO). Technical support, mapping and early warning services are the responsibility of Directorate-General Joint Research Centre (DG JRC).

The On-demand mapping service is provided free of charge to all users either in rush mode, for emergency management activities which require immediate response (minimum 24 hours, maximum 5 days) and/or non-rush mode, to support emergency disaster management activities not related to immediate response, analysing pre-disaster risk assessment and population and asset vulnerability or post-disaster recovery and reconstruction. It can be activated only by designated authorised users. Over the last 10 years it has been activated mostly in conjunction with floodings, wildfires, windstorms, and humanitarian crises.



All the maps and information products delivered by CEMS are publicly available on the programme website and dedicated geoportals for each subservice. It is important to underline that the products generated by the service can be either used as supplied (e.g. as digital or printed map outputs) ot they may also be combined with other data sources (e.g. as digital feature sets in a geographic information system) to support geospatial analysis and decision making processes of emergency managers.

Source/Learn more:
https://emergency.copernicus.eu/

„SOLUTION ENABLERS" - SUPPORTING ORGANIZATIONS AND STRUCTURES

ESA - EUROPEAN SPACE AGENCY

ESA in an independent international organization, established in 1975, with 22 full Member States, 5 associate members and 3 European Cooperating States today. Its general objective is to support peaceful exploration and expolitation of outer space. ESA's activities are divided into 2 categories – mandatory (space science, technology research, education and training) and optional (Earth observation, navigation, telecommunication, space transportation, exploration, space safety). The overall yearly budget of ESA (including institutional programmes) is 7 billion € in 2023.

In recent years, more and more focus in placed on supporting the development of different space-based applications and supporting the commercialization of innovative technological solutions. Earth observation, navigation and so-called ,,integrated applications'' programme are the main ,,source'' of projects and initiatives relevant to crisis management and disaster prevention in ESA's portfolio of activities.

In 2022 ESA decided to adopt a new approach and establish three accelerators: Space for a Green Future, a Rapid and Resilient Crisis Response, and the Protection of Space Assets. Accelerators are ,,action-based partnerships between space and user stakeholders, fostering synergies between them around shared goals to solve global challenges''. They aim at the identification of new use cases, the development and demonstration of new (space) solutions, and the scaling of these solutions to new sectors and regions. Two of them will address the crisis management challenges, albeit in different phases – Green Future mainly in mitigation and preparedness, and Rapid and Resilient Crisis Response in response and recovery. The expected beneficiaries of these initiative are not only directly the governments of Member States involved, but also civil protection organisations, environmental agencies, first responders, commercial businesses, critical infrastructure stakeholders (e.g. oil and gas companies, electric grid operators) and individual citizens.

Source/Learn more:
https://www.esa.int/

EUSPA - EUROPEAN UNION AGENCY FOR THE SPACE PROGRAMME

EUSPA was formally established in May 2021, building upon previous structures and experience of European GNSS Agency (dating back to 2004). According to its mission statement, EUSPA leads the implementation of the EU Space Programme, promotes space-based scientific and technical progress and supports competitiveness and innovation in the European space industry, with a particular focus on SMEs (Small and Medium Enterprises) and start-ups. EUSPA is responsible for providing operational services based on the European space flagship programmes Galileo (and EGNOS) and Copernicus, as well as newer, still under development initiatives like Govsatcom, SST (Space Surveillance and Tracking) and IRIS (Infrastructure for Resilience, Interconnectivity and Security by Satellite). It is focused also on supporting the use of satellite data across different sectors and facilitating the development of value-added downstream

services. According to EUSPA's analyses, the global GNSS downstream market revenues (both devices and services) will grow from 199 billion € in 2021 to 492 billion € in 2031 and the global market for EO data and services will reach over 5,5 billion € in 2031 (80% of 2021 EO revenues of 2,8 billion € come from value-added services).

EUSPA (together with ESA) provides 3 key elements for improving efficiency of crisis management – Earth observation imagery, serving as a basis for mapping the affected areas and analysing both short- and long-term evolution trends, precise positioning of infrastructure, affected population and operational resources deployed during the crisis (including so-called Public Regulated Service – PRS – restricted to government authorised users for sensitive applications requiring a high-level service continuity) and reliable and secure satellite communication coverage even in remote places (or places with destroyed terrestrial communication infrastructure). EUSPA offers market support and technical know-how to academia, innovators, SMEs and start-ups. It has a significant budget from Horizon Europe, other EU funding and innovative procurement mechanisms.

Source/Learn more:
http://www.euspa.europa.eu/

eurisy
ACTING COLLECTIVELY TO BRIDGE SPACE AND SOCIETY

EURISY

Eurisy is a non-profit association gathering space agencies, international organisations, research institutions, and private businesses involved or interested in space-related activities across Europe. It was established in 1989.

Eurisy identifies success stories of use of satellite applications in the public and private sectors and invites user organisations to share their experiences within workshops, conferences and projects.

Eurisy strives to promote the use of satellite solutions for the benefit of professional communities in numerous sectors through a unique bottom-up approach, putting at the centre the end users, understanding their needs and challenges, providing relevant fora to share experiences and expertise by tapping into its repository of success stories. Over the years this work has resulted in Europe's largest database of users' testimonials on operational satellite services.

Eurisy also hosts the Space Service Hub: a one-stop-shop 3D platform to showcase European champions' satellite based solutions in different areas from smart cities to rural and coastal areas.

Source/Learn more:
https://www.eurisy.eu/

UN-SPIDER

The „United Nations Platform for Space-based Information for Disaster Management and Emergency Response – UN-SPIDER" was established as a new United Nations programme in December 2006 in order to „ensure that all countries and international and regional organizations have access to and develop the capacity to use all types of space-based information to support the full disaster management cycle".

UN-SPIDER provides the Member States with Technical Advisory Support in 3 forms: Advisory Missions (in-depth analyses and discussions with key national crisis management stakeholders resulting in guidelines and recommendations), Emergency Support (making space-based data, services and derived products, such as maps, available to countries affected by a disaster) and Capacity Building (training activities, remote technical advisory support, recommended practices, examples of practical uses of maps, products and services that have been developed and implemented by the space and geospatial communities to contribute to disaster risk reduction, preparedness, response and recovery efforts).

Source/Learn more:
https://www.un-spider.org/

EXAMPLES OF READY-MADE SOLUTIONS

EU DISASTER RISK MANAGEMENT KNOWLEDGE CENTRE RISK DATA HUB

The official mission of the Commission Disaster Risk Management Knowledge Centre is to integrate existing scientific multi-disciplinary knowledge and co-develop innovative solutions for existing needs. Activities of the EC DRMKC support the translation of complex scientific data and analyses into usable information and provide science-based advice for DRM policies.

The DRMKC Risk Data Hub (RDH) is a GIS web platform providing access to data and methods for Risk and Impact assessment in a multi-hazard context. Risk Data Hub adopts the comprehensive administrative frameworks and policies (Union Civil Protection Mechanism, Sendai Framework for DRR), data sharing initiatives (OpenDRI) and spatial data infrastructures (INSPIRE) with the purpose of setting the bases for knowledge for DRM at local, national, regional and EU-wide level.

The Risk Data Hub is developed as a decision support system that integrates spatial data (usually based on Copernicus services) along with statistical analysis. This helps decision makers have an indication for time and spatial coverage of economic damages and human losses across Europe from hazardous events, upon which consistent decisions can be made. Offering access to data, methodology and implementation showcase, the DRMKC Risk Data addresses the needs at national level regarding disaster risk management related actions (e.g. national risk assessment, loss data collection, Sendai indicators reporting, and Solidarity Fund request) improving risk management capabilities.

RDH consists of 3 main areas: risk analysis, disaster loss data, facts and figures. It covers 8 classes of hazards: geophysical, hydrological, meteorological, climatological, technological, biological, transportation and malicious and their impact on 4 categories of assets: population, buildings, critical services and environment. Authorised users can create their private ,,User corner'' to upload their own data to run customised assessments.

Source/Learn more:
https://drmkc.jrc.ec.europa.eu/risk-data-hub/#/

EO TOOLKIT FOR SUSTAINABLE CITIES AND HUMAN SETTLEMENTS

This is a joint initiative of UN HABITAT, GEO (Group on Earth Observations) and EO4SDG, aiming to support local communities, cities and countries in understanding the value and usefulness of Earth observations for achieving Sustainable Development Goal 11 (SDG 11 make cities and human settlements inclusive, safe, resilient and sustainable) and to provide practical guidance and examples of EO data, tools, and use cases in support of sustainable urbanization and resilience.

Earth observations (EO), acquired remotely by space-borne, airborne and ground-based observations represent reliable, timely and continuous sources of information for Goal 11 and related urban issues. Many national and local level governments and organizations, however, are unfamiliar with or lack the skills and capacity required to apply Earth observations in support of urban policy, planning, monitoring, reporting and operational decision making.

The Earth Observations Toolkit for Sustainable Cities and Human Settlements is an online knowledge resource, which can serve as a first step for countries and cities interested in applying EO to support their SDG 11 monitoring and urban policy planning and implementation needs. It contains more than a dozen examples of complete set of tools available for download, with necessary documentation, user guide, links to relevant EOdata sets, training materials and several use cases. They are divided into 4 main categories: housing, open spaces, urbanization and transport.

There are also one-pager guidelines that detail how various resources contained in the toolkit can help audiences measure impact against indicators associated with SDG 11.

Source/Learn more:
https://eotoolkit.unhabitat.org/

GIS SUCCESS STORIES

GIS IN SUPPORT OF GOVERNMENT ADMINISTRATION IN CRISIS MANAGEMENT ACTIVITIES

INTRODUCTION

In 2020, at the beginning of the COVID-19 epidemic, Government Centre for Security in Poland, together with the Chancellery of the Prime Minister, created the GISCOVID-19 system, the platform which integrated epidemic data using ArcGIS family software.

The system was designed to support crisis management units involved in fighting against SARS-CoV-2 and provided decision-makers with data on the epidemiological situation, as well as the public with an up-to-date map of coronavirus infections and areas with new safety rules or other useful information., e.g. on vaccination, published on the government website.

The system, previously known as GISCOVID-19, was renamed to GISBN (GIS National Security) in 2022, and its purpose evolved to building situational awareness through monitoring and analyzing selected threats relevant to national security, including those related to the war in Ukraine, as well as collecting data on natural and man-made disasters. The system is designed to evolve continuously according to users' needs, and its primary purpose is to provide decision-makers with the necessary data to support crisis management and improve national security.

GISCOVID-19 ORIGINS

The geoinformation system GISCOVID-19 is an example of a successful implementation of Esri's Disaster Response Program, where GIS technology supports disaster response efforts and expertise. The system was delivered very quickly, where Esri Poland provided software, data, configurable applications, and technical experts.

The GisCOVID-19 system, that was managed by the Government Centre for Security, was the result of cooperation among many governmental entities, the private sector and the world of science, which had taken up a joint fight to prevent the spread of the coronavirus epidemic. The representatives of, among others, the following entities participated in the works on its creation: the Chancellery of the Prime Minister, the Ministry of Health, the Ministry of Digitization, the National Headquarters of the State Fire Service of Poland, the Police Headquarters, the Territorial Defence Forces, the Crisis Information Centre from the Space Research Centre of the Polish Academy of Sciences, the Mathematical and Computer Modelling Centre of the University of Warsaw, the National Centre for Cyber Security, the Head of Geospatial Reconnaissance and the Image Reconnaissance Centre.

The system was dedicated to decision-makers, analysts and on-call services from ministries, voivodship offices and institutions, carrying out tasks for crisis management in connection with the COVID-19 epidemic threat. Over 50 institutions had access to the system. The aim was to present the situation in the country broken down by voivodships on the basis of data from the Ministry of Health in relation to selected indicators: new cases, recoveries, cumulative number of illnesses, availability of beds in hospitals, people in quarantine or deaths. This information enabled an analysis of the development of the situation and was the basis for creating reports for decision-makers. Overall, the GISCOVID-19 system has been an important tool in Poland's response to the COVID-19 pandemic. It has helped to build situational awareness, improve decision-making, and respond more effectively to the crisis (Fig. 1 and Fig.2).

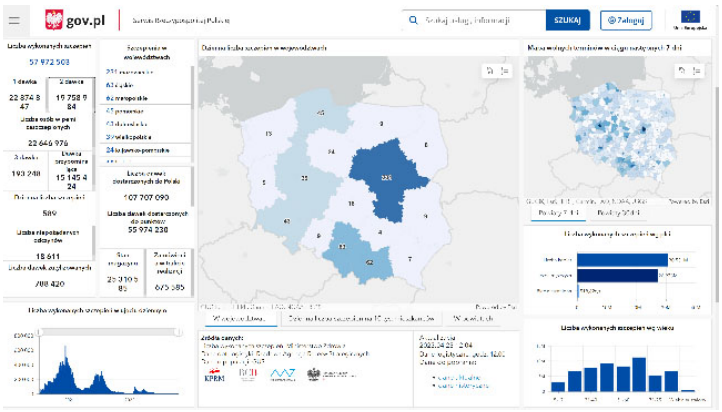


Figure 1. COVID-19 vaccination report (https://www.gov.pl/web/szczepimysie/raport-szczepien-przeciwko-covid-19)

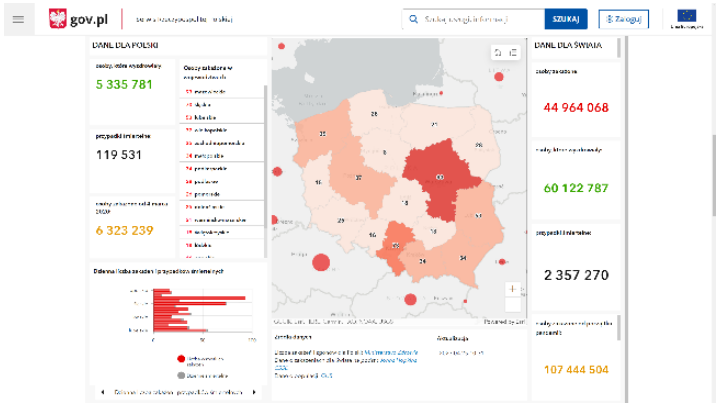


Figure 2. COVID-19 infection report (https://www.gov.pl/web/koronawirus/wykaz-zarazen-koronawirusem-sars-cov-2

GENERAL INFORMATION

The fight against the COVID–19 epidemic crisis is one of the many areas where the Government Center for Security plays a major role in building situational awareness, and the geoinformation system proved its usefulness not only for spatial analysis.

The newest functionality of the GISBN National Security system increases the possibility to monitor and build situational awareness by mapping, monitoring, and providing risk assessment, in order to achieve the following goals:

- create epidemic threat maps for different diseases (Fig. 3);
- create a disease spread prognosis map (Fig. 4);
- identify sensitive and vulnerable areas (Fig. 5);
- build situational awareness and operational map of the region and the country and neighbouring countries (Fig. 6);
- monitor and analyse of selected threats relevant to national secuirty (Fig. 7);
- coordinate the process of collecting data.

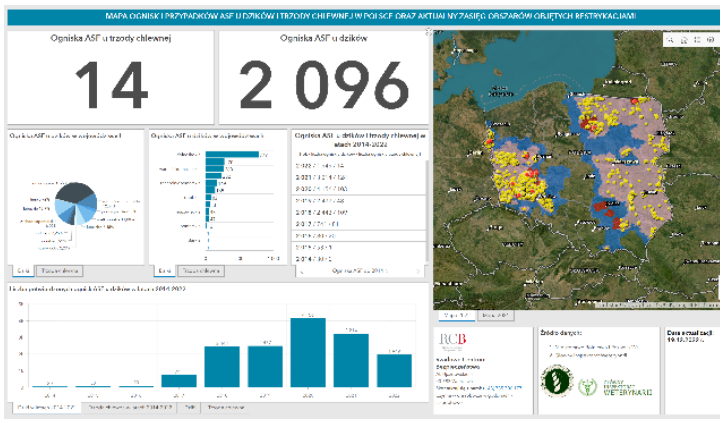


Figure 3. ASF outbreaks

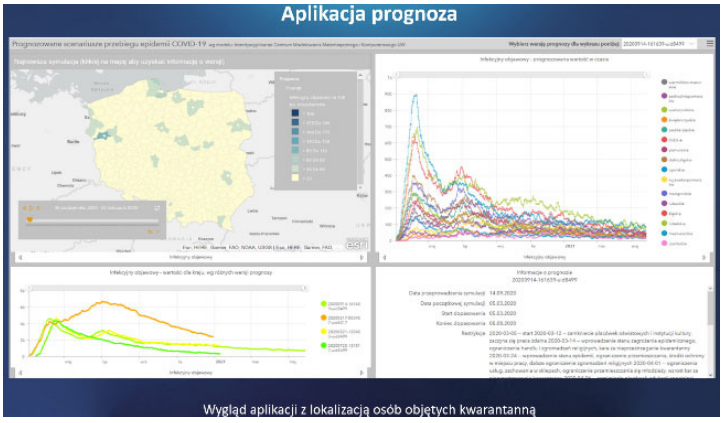


Figure 4. Application to prognose the possible pandemic spread scenarios

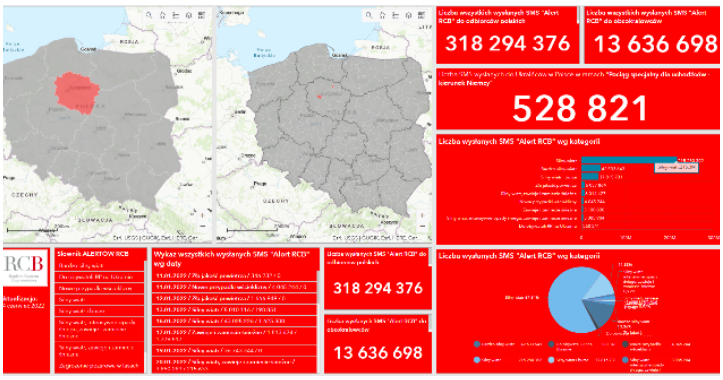


Figure 5. Sensitive and vulnerable areas

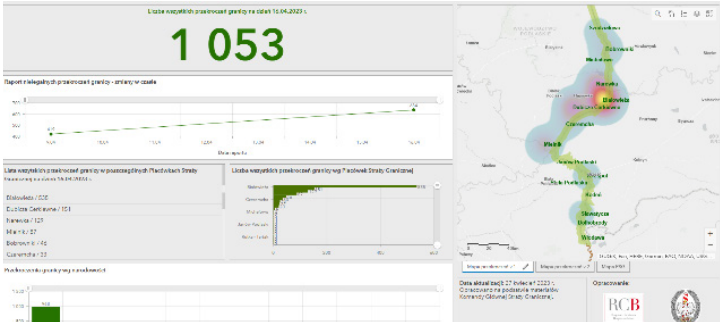


Figure 6. Situational awareness

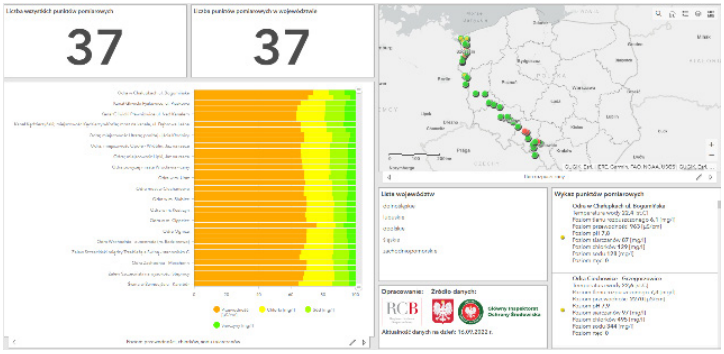


Figure 7. Monitoring Odra river

GISBN National Security is an example of good practice in Poland from 2015 to 2022, which demonstrates a more structured and institutionalized collaboration between science and public administration. In cooperation with scientists, the Government implemented a data integration platform using Geographic Information Systems software (GIS National Security) for the crisis management system. The purpose of developing GIS National Security is to create a database of losses caused by disasters to fulfill the implementation of the Sendai Framework for Disaster Risk Reduction 2015 – 2030 and to assess and manage risks at the local level.

The Government collaborated with the Mathematical and Computer Modelling Centre of the University of Warsaw to develop prognostic models of coronavirus spread in Poland. The models were integrated into the GIS National Security system, which allowed the government personnel to share the data with research and development entities and generate analyses, forecasts, and scenarios modeled by the use of AI.

The Government (including the Government Centre for Security) cooperates with the Space Research Centre of the Polish Academy of Sciences to build a platform integrating different services in one place – satellite imagery, data collected by drones, and other map tools – to improve our early warning system and build situational awareness among decision-makers.

IMPLEMENTED SOLUTIONS

The system's logical architecture is divided into two subsystems: one for informing the public, which is available on the website and implemented in the cloud solutions of ArcGIS Online; and another dedicated to a specific and defined group of users, e.g. decision-makers and representatives of institutions, ministries, and public services. This second component of the system has been installed on the IT infrastructure of the Cyberspace Defense Forces.

The main objective of the component for the public is to provide aggregated and current information on the epidemiological situation in the country. The solution uses the ArcGIS HUB application, which was used to configure the relevant websites and operational panels (ArcGIS Dashboards). After entering the website, the user receives access to the Map of coronavirus infections (SARS-CoV-2) and detailed information relating to the vaccination process.

Access to this part of the system is limited to indicated users from over 50 public administration institutions, ministries and services (police, fire brigade, border guards) performing tasks for national security. Authorised users have various rights, ranging from viewing shared applications and resources, to managing these resources, modifying and creating new layers and applications, using system analytical tools, and administering resources. The entire component runs on Portal for ArcGIS. Through the portal, authorized users can access dedicated applications and operating panels that present various issues.

EXAMPLES OF APPLICATIONS SUPPORTING THE COORDINATION OF HUMANITARIAN AID FOR UKRAINE

In 2022, a significant part of the effort was directed towards organizing and supporting help for refugees from Ukraine. After the ecological disaster on the Odra River in 2022, the system is being used to monitor the threat associated with the pollution of rivers by golden algae. The geoinformation system GISBN National Security is an effective tool to prepare and analyse all sorts of data and make basic applications with dedicated functionality.

1) Situational awareness map (Fig. 9)
2) Migration from Ukraine (Fig. 10)
3) Optimization of the humanitarian aid for refugees from Ukraine (Fig. 11)
4) Looking for help in Poland (Fig. 12)
5) Logistic effort (Fig. 13)

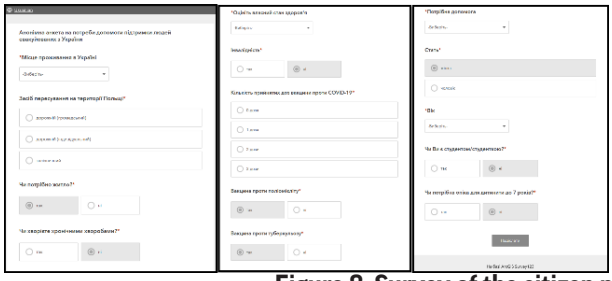


Figure 8. Survey of the citizen needs

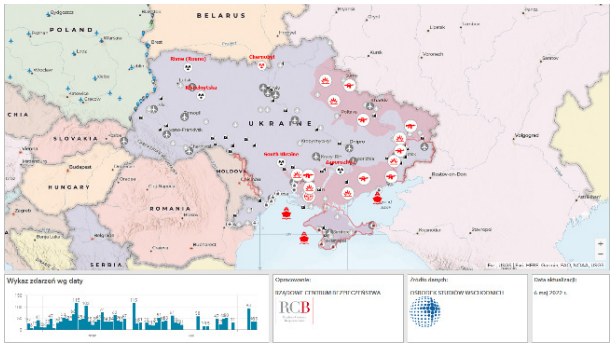


Figure 9. Operational map of Ukraine

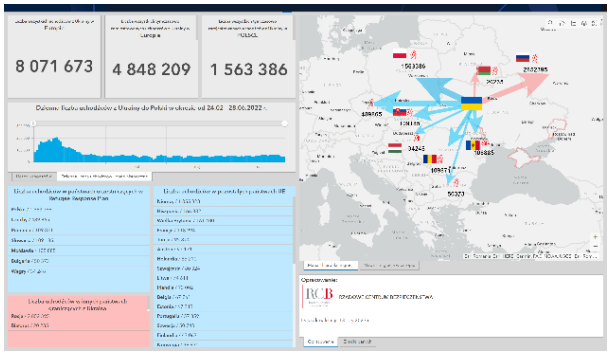


Figure 10. Main direction of migration from Ukraine

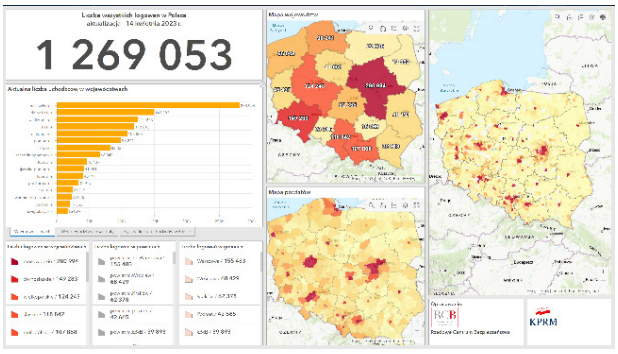


Figure 11. Localization of the Ukrainian refugees in Poland

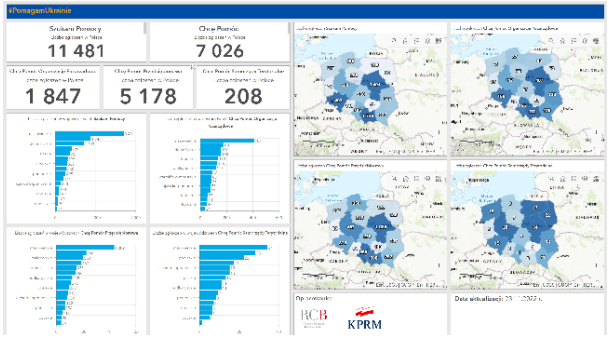


Figure 12. Involvement of the Polish society in organizing aid

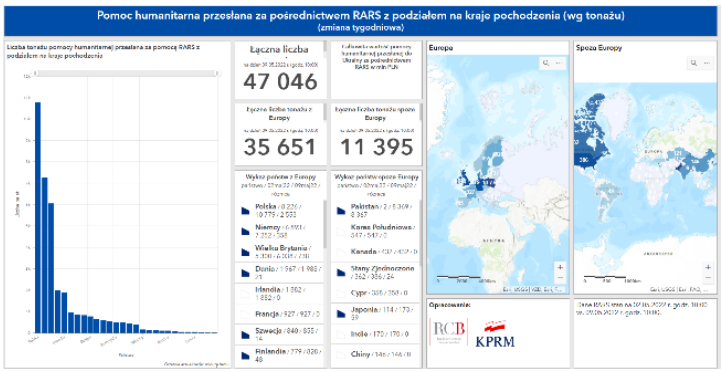


Figure 13. Humanitarian help for Ukraine from other countries

CURRENT DEVELOPMENT PLANS FOR THE SYSTEM

GISBN system has proven to be extremely useful in crisis management and emergency response. One of the main advantages of GIS technology is that it allows for the creation of a comprehensive, real-time situational awareness map that displays relevant information on a single screen. This can assist emergency responders in prompt and effective coordination of their efforts, as well as in allocating resources where, as well as in allocating resources to where they are most required. One of the key features of the GISBN system is its ability to provide data in real-time. This means that the system is able to quickly update and share information on the status of each crisis situation.

Current development plans for the system include:

- Creation of a classified data component in collaboration with the Ministry of National Defense.
- Integration of the system with the TAK system (Team Awareness Kit/Tactical Assault Kit), implemented by the Cyber Space Action Team of the Armed Forces Operational Command.
- Developing ,,ODRA'' dashboard for monitoring the threat of golden algae development, in collaboration with the Chief Inspectorate of Environmental Protection.
- ,,National Radiological Safety'' dashboard, in collaboration with the Polish Atomic Agency.
- Creation of a platform integrating data from drones and satellite imagery in cooperation with the Crisis Information Centre in the Space Research Centre of the Polish Academy of Sciences.
- Creation of a dashboard for monitoring disinformation.

The system is also a tool for collecting data on losses from disasters for reporting to the Sendai Framework Monitor.

The Government Centre for Security uses the system to create a database of capabilities and resources of crisis management entities in case of emergency situations, as it is their legal responsibility. The database collects information gathered by ministries, central offices, and voivodeships.

The GISBN systems will also be used for risk management and creating spatial analyses of risk-prone areas. By integrating different types of data sources and analytical tools, the systems can provide decision-makers with a comprehensive view of the risks and vulnerabilities within a given area. This information can be used to identify areas that require greater attention, prioritize resources and efforts, and develop more effective risk management strategies. The collected information can be utilized to identify high-risk areas, prioritize resources and efforts, and create more efficient strategies for risk management.

The GISCOVID-19 and GISBN National Security system helps to better understand the situation, make better decisions, and respond more effectively during a crisis. The geoinformation system is is an effective tool not only in the context of pandemics. It is useful for counteracting various hazards at all phases of the crisis management. The main goal is to build situational awareness by monitoring and analysing the most important threats to national security, including those related to the war in Ukraine. The Government Center for Security has created a tool that allows for sharing data with research institutions, providing analyses and scenario modeling through artificial intelligence. Those products are shared with entities responsible for crisis management and civil protection, scientists, services and decision makers. The system providesthe means to integrate different services in one place, including geospatial data such as satellite imagery, UAV images, raster and vector data from various databases, and other mapping tools. This improves Poland's early warning system and builds threat awareness amongst decision makers.

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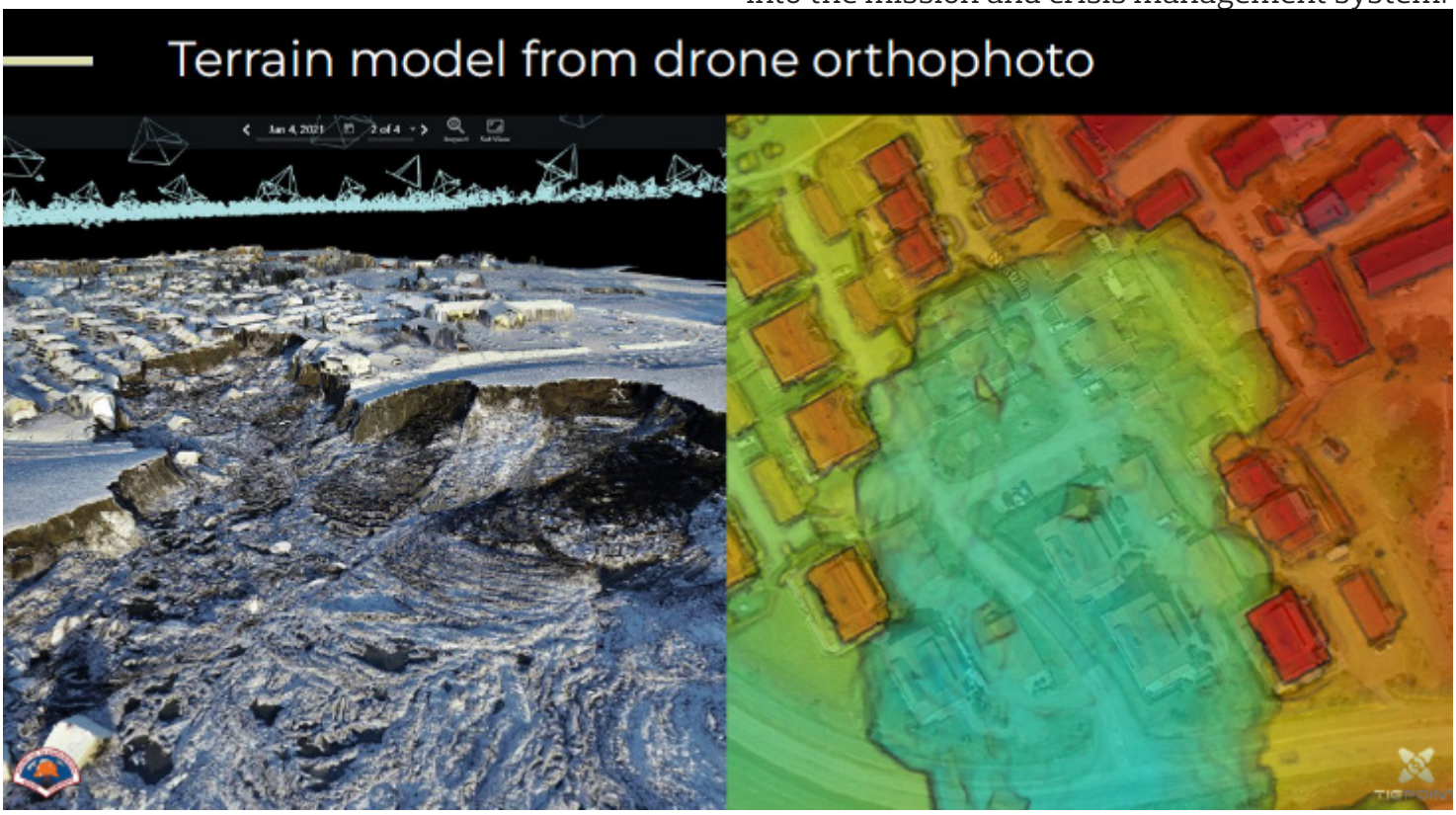
GIS SUCCESS STORIES

INTEGRATION OF UAV MAPPING WITHIN NORWEGIAN 110 CENTRES (112 CENTRES)

GENERAL AIMS AND BACKGROUND CONTEXT

The initiative aims to enhance situational awareness in crisis management by utilizing UAV mapping and 3D modeling. The project addresses the challenge of providing accurate and up-to-date mapping data to first responders and crisis management centers during emergency situations. The responsible authorities is the National Municipal cooperation for the 110 centrals. Solution providers are Locus, Bliksund, and Geodata, for the implementation of a mission and crisis management system for all 110 centers in Norway. The initiative involves the integration of videostream, 2D and 3D map data acquired from UAVs into the crisis management system. The map data will be distributed to the operational leadership and field workers' tablets from the crisis management system. The transboundary coordination has not yet been pursued as the initiative is focused on improving crisis management within Norway.

The initiative was prompted by the landslide in Gjerdrum, which highlighted the need for efficient mapping solutions for crisis management. Within 18 hours of the landslide, the first 3D map collected by UAV was made available on a cloud platform. However, the map was not integrated into the applicable map solutions used by first responders, resulting in inaccuracies and inefficiencies. Nevertheless, it was a valuable asset in decision making, intelligence gathering, and ensuring safety. The initiative will require additional resources and training in order to implement mapping data from UAV seamlessly into the mission and crisis management system.



Gjerdrum Quick Clay Landslide, December 2020. Source: Tiepoint AS (Nicholas Newhouse)

CHALLENGES AND LESSONS LEARNT

One of the challenges in implementing the initiative is the lack of standardization and knowledge regarding UAV mapping, especially amongst crisis management. It is essential to determine what kind of map is necessary for a particular crisis situation and the required accuracy level. This may vary from a high-resolution picture covering the entire area of interest to a detailed LIDAR mapping. Crisis management needs to understand the different types of data that can be acquired and their respective value, such as high-resolution pictures for immediate delivery, LIDAR maps for quick processing but poor 3D visualization, and RGB maps that rely on time consuming and powerful data processing, but offer excellent situational awareness data. It is also important to understand the data that can be valuable at a later stage.

Another challenge is the georeferencing of the maps and their transferability among different types of geodetic references. The collected 2D/3D map data needs to be distributed among various map solutions used by different first responders, requiring a standardised and easily transferable format. Improving this part will ensure that all relevant personnel have access to the same mapping data, improving the overall effectiveness of crisis management.

THE EXPECTED BENEFITS AND WAY FORWARD

The implementation of the initiative will result in significant benefits in crisis management. The updated and accurate map, combined with geolocation data on first responders, body cameras, and streaming, will improve situational awareness, enabling better decision-making and ensuring the safety of workers. This provides leaders and decision-makers with a comprehensive platform for the execution of operations, resulting in a more effective response to crises. Overall, the use of UAV mapping and 3D modeling proves to be a valuable asset in managing crises and has improved the

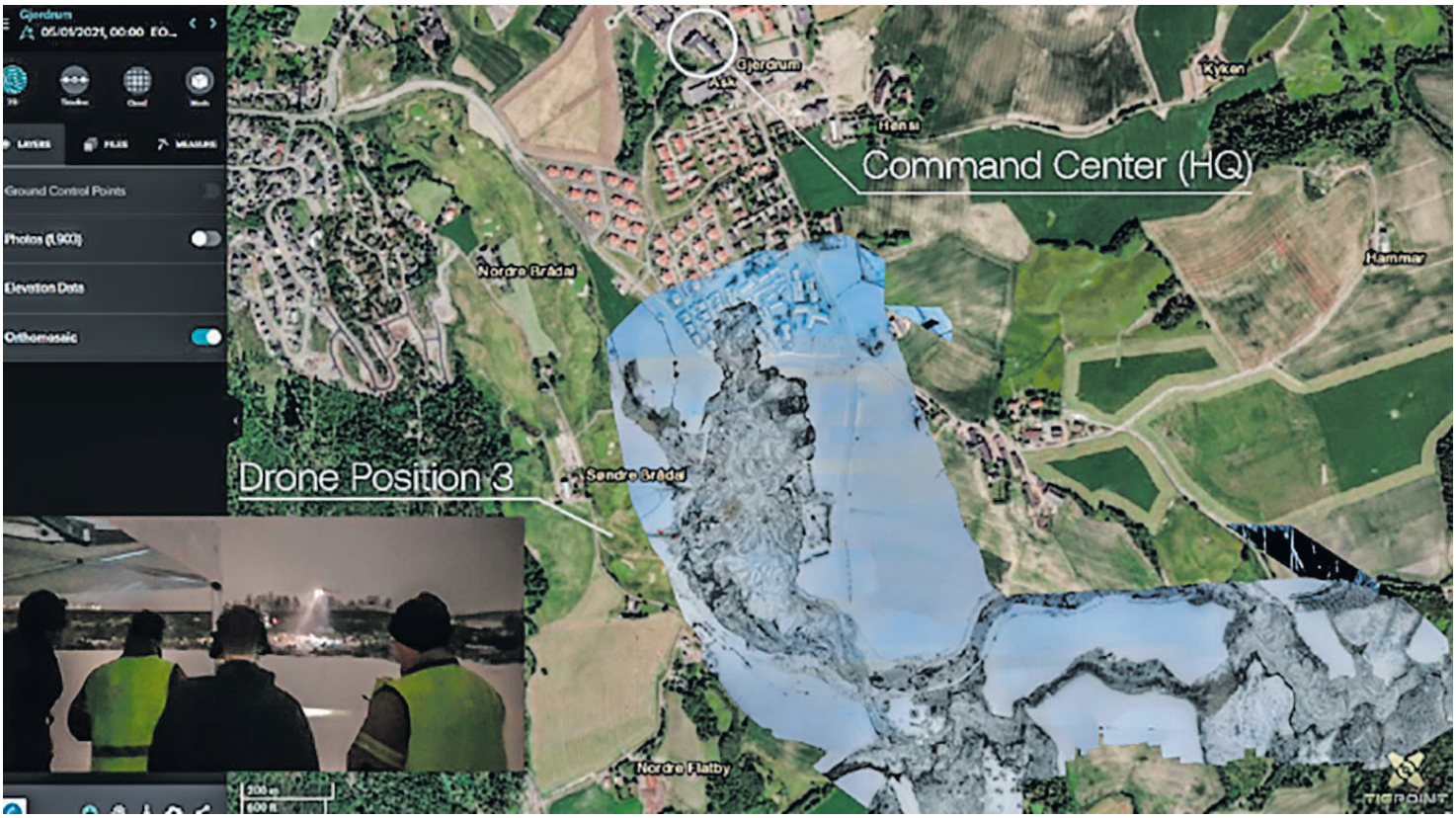
Gjerdrum Quick Clay Landslide, December 2020. Source: Tiepoint AS (Nicholas Newhouse)

efficiency and effectiveness of crisis management operations.

The implementation of this initiative is in progress but is already highlighting the importance of providing crisis management with the necessary knowledge and competence to order the right mapping data by UAV at the right time. It is essential to understand what kind of mapping data that can be delivered within a given time frame, which will enable crisis management to make informed decisions and respond effectively to crises.

It has become evident that UAVs are a valuable tool in crisis management, and it is crucial to establish guidelines to ensure that the right data is obtained and utilized effectively. Moreover, the current lessons learned from this initiative emphasize the need for ongoing training and education for crisis management personnel to maximize the potential of UAV mapping and 3D modeling in crisis situations.

Learn more:
https://tiepoint.no/emergency/



Gjerdrum Quick Clay Landslide, December 2020. Source: Tiepoint AS (Nicholas Newhouse)

GIS SUCCESS STORIES

CZECH REPUBLIC: FIGHTING CLIMATE CHANGE

A NEW CHALLENGE IN EUROPE

In response to the impact of climate change across the continent, the European Union has implemented a wave of green regulations with the goal of becoming climate neutral by 2050. Public and private organizations alike will need to conform to these new standards, an expectation that can appear daunting to those with few available resources.

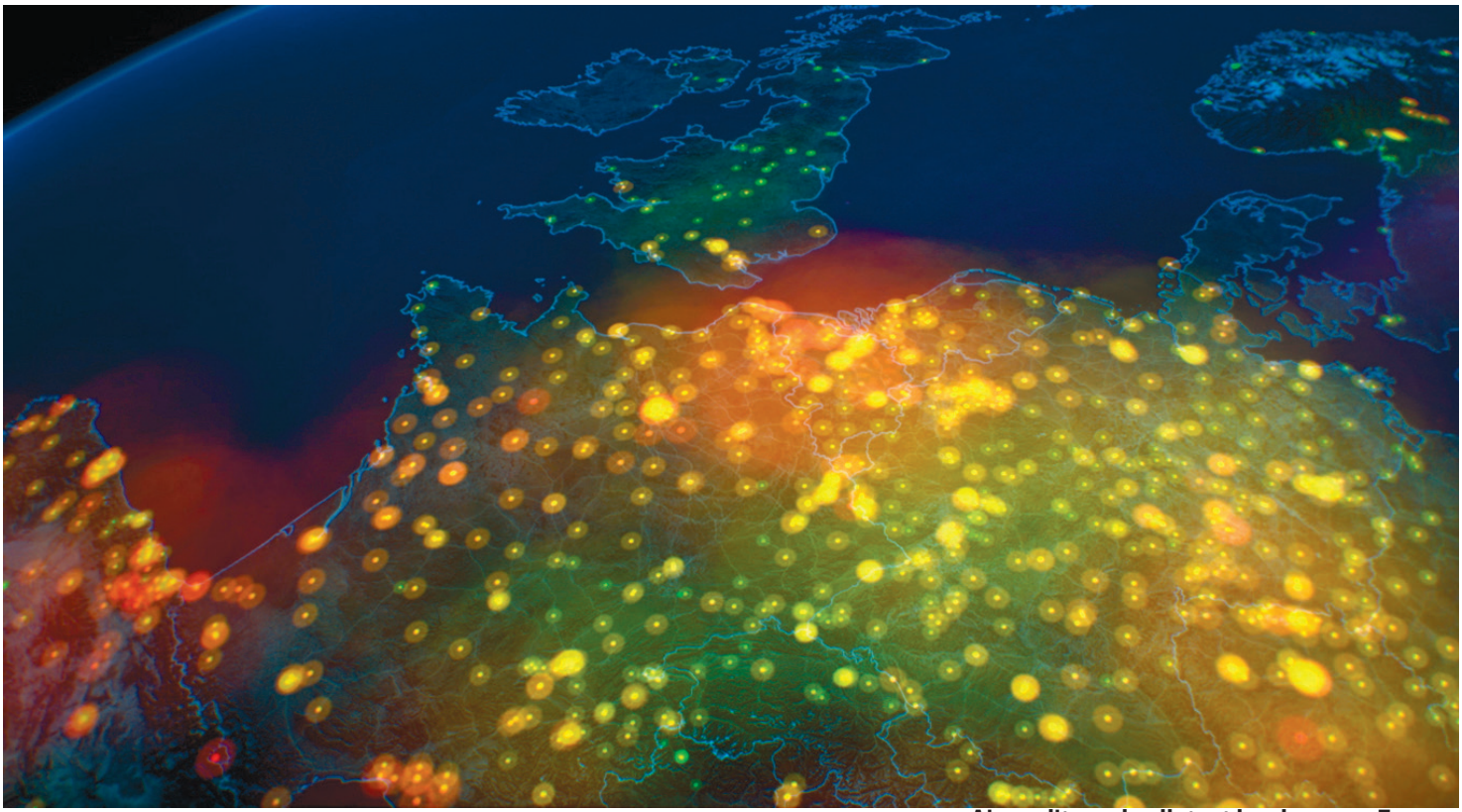
That was the case for Jiří Čtyroký and the Prague Institute of Planning and Development (IPR Prague). They were mandated by the city to ,,enhance long-term resilience and reduce vulnerability to climate change. ''With such a broad directive, Čtyroký and his team were not sure where to begin. Then, they turned to geographic information system (GIS) technology.

COMBINING LAYERS TO DISCOVER SOLUTIONS

IPR Prague combined three layers of geospatial data onto a single map to help understand the challenge from a new point of view.

The first layer used satellite imaging to identify heat islands, areas with lots of pavement and industrial infrastructure that are especially prone to temperature increases. With heat waves killing grass and trees throughout Prague and rising temperatures leading to an increase in heart attacks among the elderly, IPR Prague had identified an imminent threat to the city and its residents.

The second layer contained precise data on the city's population density, allowing planners to quickly visualize where changes to the landscape could occur that would positively impact the largest number of people.



Air quality and pollutant levels across Europe.

Finally, IPR Prague added a layer representing municipal regulations with which it needed to comply, outlining the borders in which it could legally operate.

Combining these three layers gave IPR Prague a comprehensive understanding of its problem and solutions and directed it toward the best places to concentrate resources. The team began planting new vegetation and installing water features on rooftops, beneath train tracks, and in other places with great potential to cool down hot spots—locations that never would have been considered without layered spatial analysis.

PLANNERS AND CITIZENS ON THE SAME PAGE

While it was critical for IPR Prague to understand the impact of climate change on the city, it was equally important to generate public support for the project by sharing its findings with the people impacted by climate change.

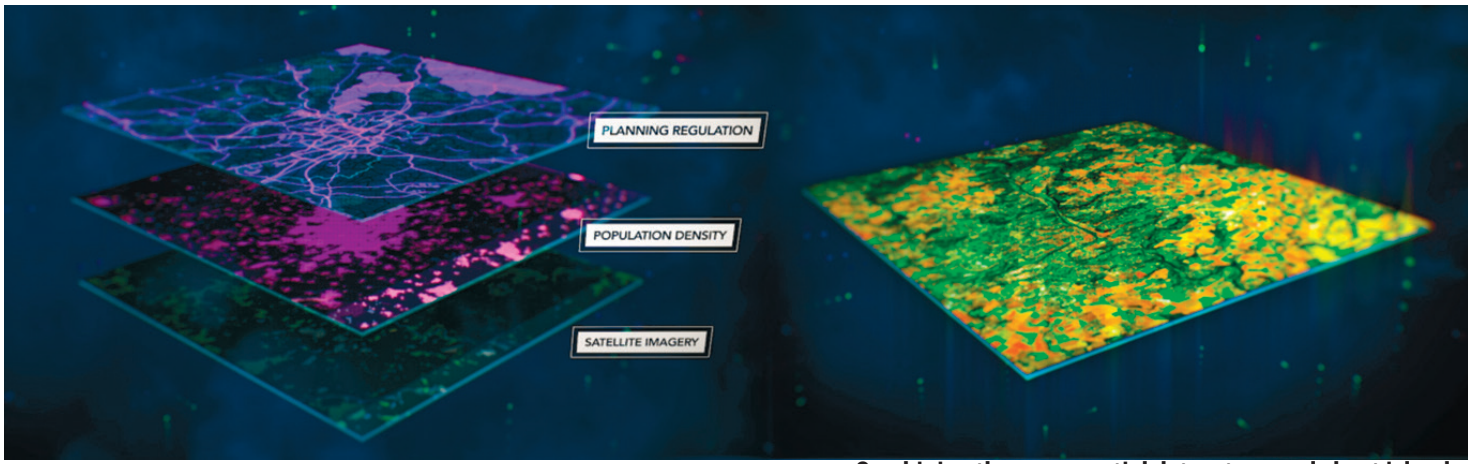
Maps were a great way to do this. At the Center for Architecture and Metropolitan Planning (CAMP), IPR Prague's maps were exhibited to the general public, who could walk through the demonstration center and see both the problems facing their city and how those problems were being addressed.

Attendees were especially impressed by the satellite images, showing the places they live and inhabit layered with clear evidence of healthier vegetation and a drop in temperatures during the summer.

Citizens see results at the Center for Architecture and Metropolitan Planning.

For Čtyroký, the data and maps projected onto the walls at CAMP were confirmation of what he had already seen when walking the streets: that he and his team were making Prague a better place to live.

Learn more:
https://www.esri.com/en-us/about/about-esri/europe/case-studies/czech-republic-case-studyvcdcc



Combining three geospatial datasets reveals heat islands.

GIS SUCCESS STORIES

PORTUGAL: ACCELERATING DISASTER RESPONSE

Portugal is a country with relatively high forest coverage in comparison to the other EU countries: forest area (as % of land area) was reported at 36.15 % in 2020, according to the World Bank collection of development indicators, compiled from officially recognized sources.

Due to the increasingly dry climate, these forest are more and more threatened by wildfires. In Portugal the peak fire season typically begins in late June and lasts around 14 weeks.

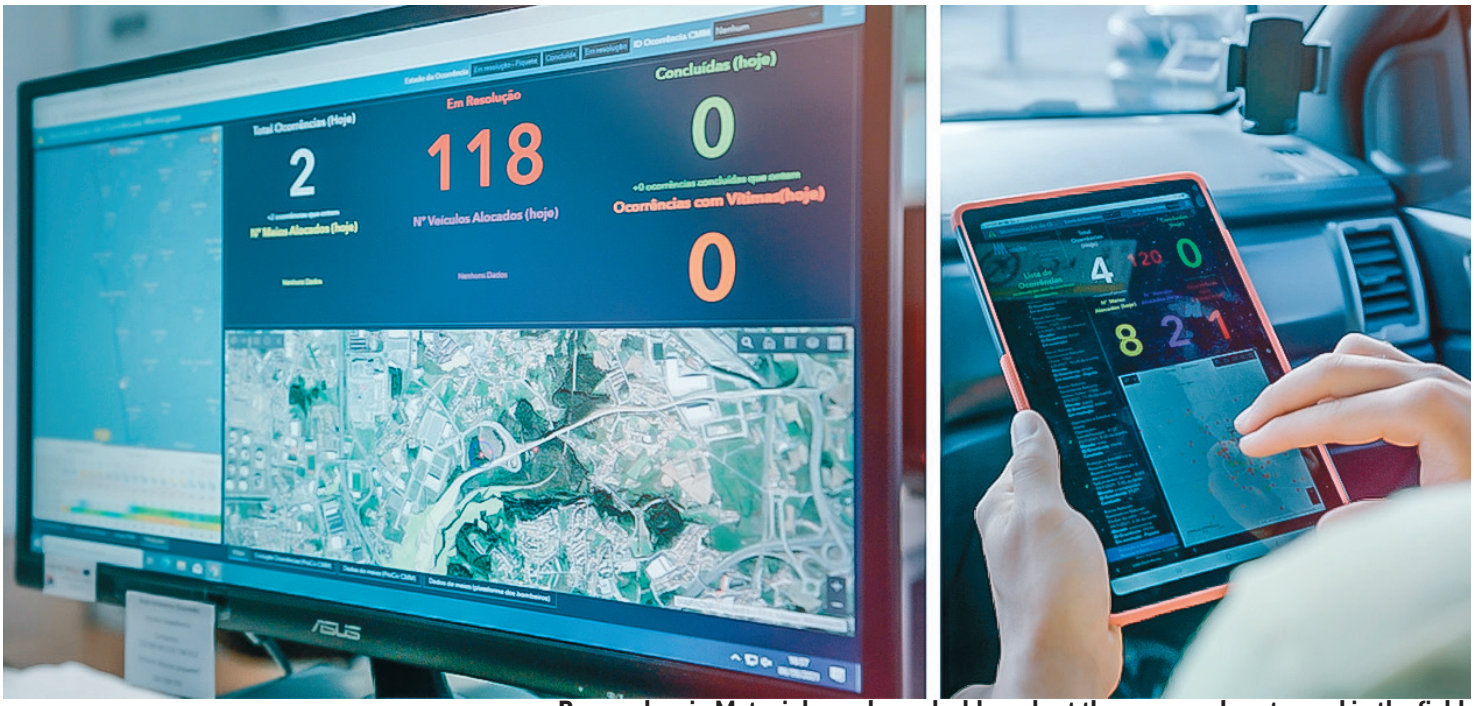
From 2001 to 2021, Portugal lost 388k ha of tree cover from fires and 738k ha from all other drivers of loss. The year with the most tree cover loss due to fires during this period was 2017 with 131k ha lost to fires – 75% of all tree cover loss for that year. It was also the year with the highest number of human victims – 66 people were killed and 204 injured in the wildfire in June 2017, and four month later in October 2017 another wildifre caused 45 deaths in Portugal and four in Spain, for a total of 115 deaths (111 in Portugal, 4 in Spain) between the two incidents.

CHALLENGES IDENTIFIED

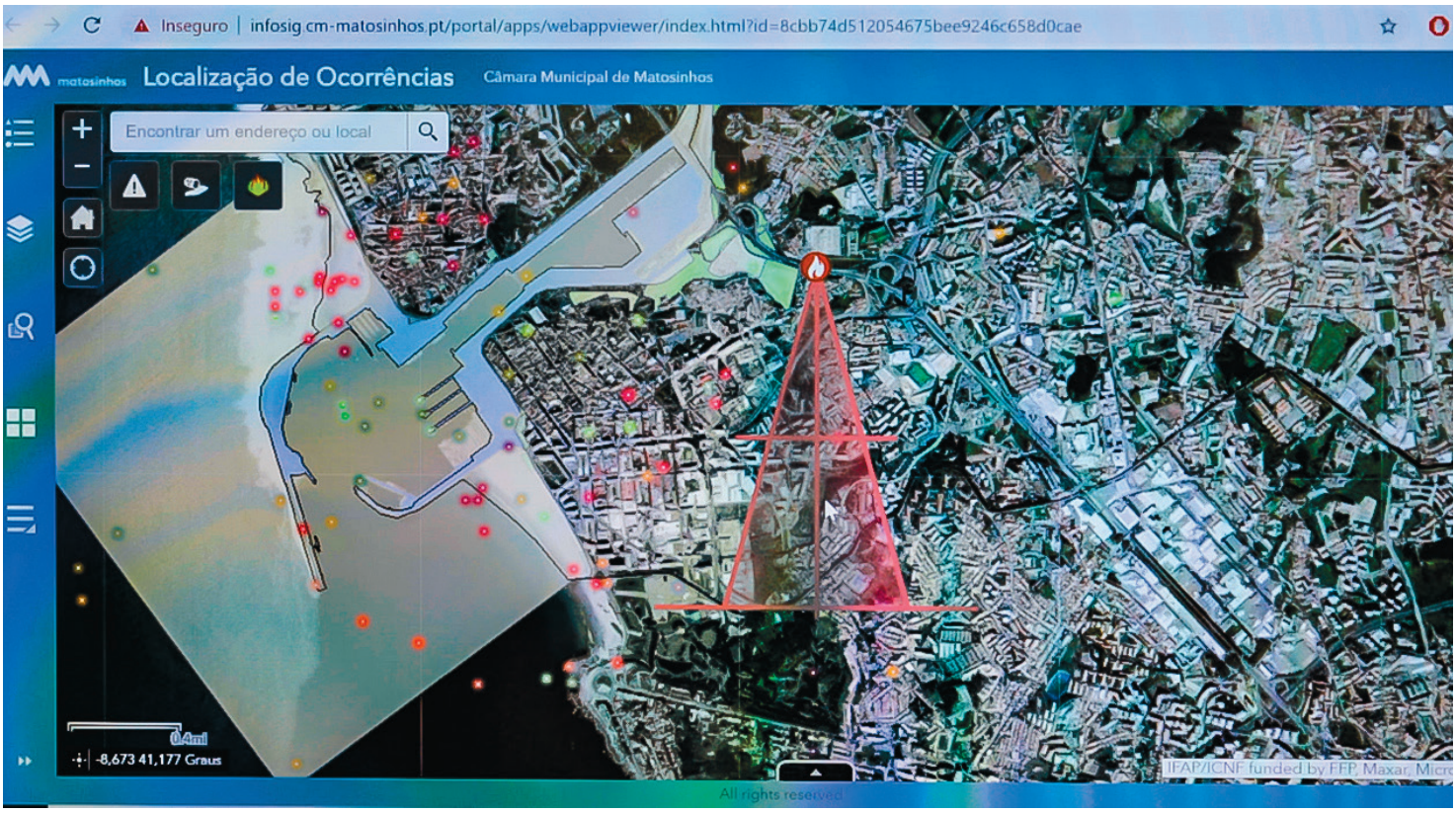
As climate change intensifies, disasters in Europe are becoming more frequent and extreme. Emergency response teams need to find new ways to keep up with these growing threats.

In many European cities, several entities deal with disasters, creating the potential for fatal lapses in communication. When seconds are precious, coordination can mean the difference between life and death.

Matosinhos, a Portuguese city threatened by wildfires, floods, and the potential for industrial disaster at the city's large chemical plant, recognized the need for a unified response. The city now relies on geographic information system (GIS) technology to make sure that all members of every disaster response team are always on the same page. What the city learned can help any organization run more efficiently.



Responders in Matosinhos rely on dashboards at the command center and in the field.



Matosinhos uses GIS to simulate a fire's path through the city under certain conditions.

PROPOSED SOLUTIONS

Nothing gets everyone on the same page faster than having the lay of the land summarized with maps, graphs, and charts—updated in real time—that fit on a single screen. For this, the Matosinhos team used dashboards created with ArcGIS Dashboards. This allowed everyone to understand vital, complex data at a glance. These dashboards are customized to meet each team's needs. They can be updated quickly as needs change and accessed simultaneously in command centers and the field. This is why ArcGIS Dashboards is used by emergency responders the world over.

WHAT-IF MAPPING SCENARIOS

One vital GIS capability for emergency responders is to run scenarios for better decision-making. For a firefighter, this can mean seeing how a fire may spread or which areas to evacuate first under certain conditions. For a mayor, it can mean understanding how an investment in a new fire station will impact community safety.

The reason GIS works so well for scenario planning is that it combines robust data handling and visualization. Decision-makers can instantly see the consequences of changing variables on a map. Thus it is used to explore questions as varied as how to respond to a supply chain bottleneck, what the best option is for a franchise location, or how legislation will affect the price of real estate in a given area.

Learn more:
https://www.esri.com/en-us/about/about-esri/europe/case-studies/portugal-case-study

GIS SUCCESS STORIES

AREA-BASED RISK ASSESSMENT FOR DONETSK OBLAST - MARIUPOLSKYI RAION

AREAS OF INTEREST

IMPACT Initiatives has been conducting hazard analysis in humanitarian settings since 2019, where simple methods of geospatial investigation were used, and the biggest part of the assessment was dedicated to the hazards impact and consequences rather than to hazard risks. But already in 2020, IMPACT piloted Area-Based Risk Assessments (ABRA) in five communities in eastern Ukraine, affected by conflict since 2014. In addition to the armed conflict and COVID-19-pandemic, communities in eastern Ukraine, living along the Line of Contact, continued to face natural hazards common to the region – wildfires, drought spells, and water safety issues – that are exacerbated by the conflict, while the State's strategy remains largely focused on emergency response, rather than preparedness and resilience of the communities most exposed to these risks. The main objectives of the ABRA was to assist communities, local government and industries with a granular and comprehensive risk data to better predict, prepare for and respond to current and future risks in the city. The assessment was also intended to support implementation of risk reduction programmes, resilience-building activities and help to inform local-level disaster risk reduction planning. ABRA was conducted under the 3P Consortium framework, led by ACTED and including IMPACT Initiatives, the Danish Red Cross, Ukrainian Red Cross Society and Right to Protection.

CHALLENGES IDENTIFIED

There were three main information gaps identified on the way to inform decision-making process for localized disaster risk reduction activities:

1) localization and extend of the main natural and anthropogenic hazards in the targeted areas of Eastern Ukraine,

2) the level of exposure of populations to such hazards, and

3) the extent to which certain populations would be more vulnerable or resilient to hazards.

Apart from the data gaps, institutional settings also posed a challenge, as there was still no functional platform for open geospatial data access and most of relevant vulnerability data were dispersed among various stakeholders on different levels.

PROPOSED SOLUTIONS

The Area-Based Risk Assessment aimed to fill this gap by collecting, processing, and utilizing existing openly available geospatial data on hazard exposure, and statistical data on vulnerability, and capacity in order to assess disaster risks in the target areas. All five assessments were conducted on the sub-regional level in order to provide information that is usable by local and sub-regional authorities in their disaster mitigation and response planning process. The most comprehensive and granular output among these five was the Area-Based Risk Assessment for Mariupolskyi raion, with the case study dedicated to the urban multi-hazard risk analysis for Mariupol city – the second largest city in Donetsk Oblast and main industrial port in the Sea of Azov. Mariupol city is a highly industrialized city that poses its population at risk from multiple hazards such as air pollution, exposure to hazardous facilities, illegal landfills, flooding, landslides and urban heat islands. The city is highly prone to air pollution (Fig 1.) and is responsible for 15% of Ukraine's total emissions deriving from stationary pollution sources, such as industrial plants and power stations. Additionally, over 7700 buildings lie in the zone of potential groundwater flooding and the majority of recorded illegal landfills in the city are located within or close to this zone. Mariupol also highly exposed to additional hazards posed by conflict, being located less then 10 km from the front line.

Although global geospatial datasets, like Google Earth Engine, USGS Earth Explorer, could be used for risk analysis in a country level, however, due to the lack of granularity, they are insufficient for a sub-regional risk analysis like for Mariupol ABRA. For example, one image from MODIS Terra satellite (extensively used for global level extreme weather events analysis) covers area around 5.5 million sq km, and territory of Mariupol city is only around 166 sq km. Considering such level of granularity, it was only possible to use global geospatial datasets that possess resolution of 1 km and less, like images from the Sentinel-5P data on air pollution, Landsat 8 for urban heat islands effect, etc. Such granular hazard maps enabled to highlight areas within the city, the most prone to such hazards as urban flood, coastal landslides (Fig 2.), and heat island effects (Fig 3.), and potential radius of chemical pollution in case of industrial site damage. For exposure anaylsis, global exposure datasets, like LandScan or World Population raster, and crowdsourcing map geodata services like OpenStreetMap were used to map exposed population and infrustructure. Developed city-level hazard-exposure maps were aimed to be used by local municipalities to prioritize hazard hotspot areas for structural risk mitigation measures and emergency preparedness activities.

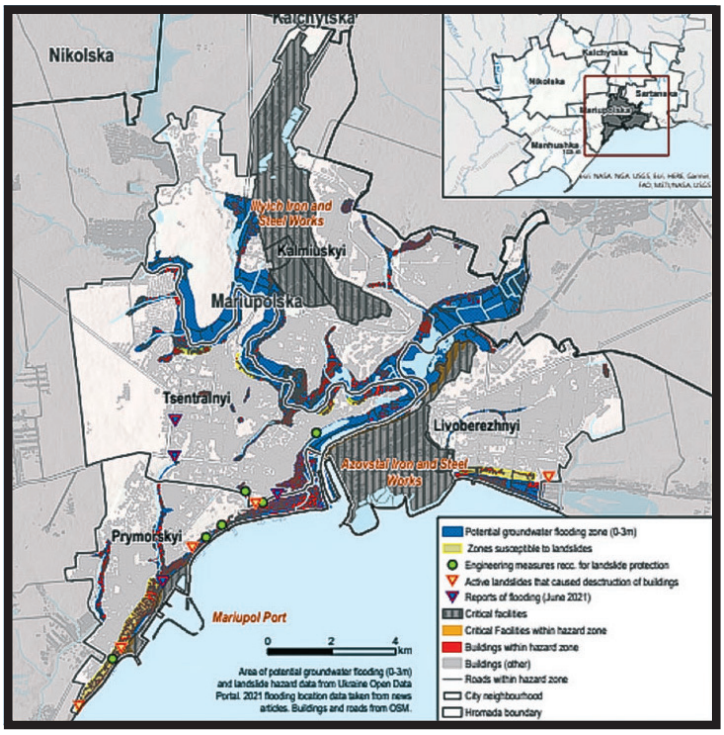


Figure 2. Floods and landslide exposure

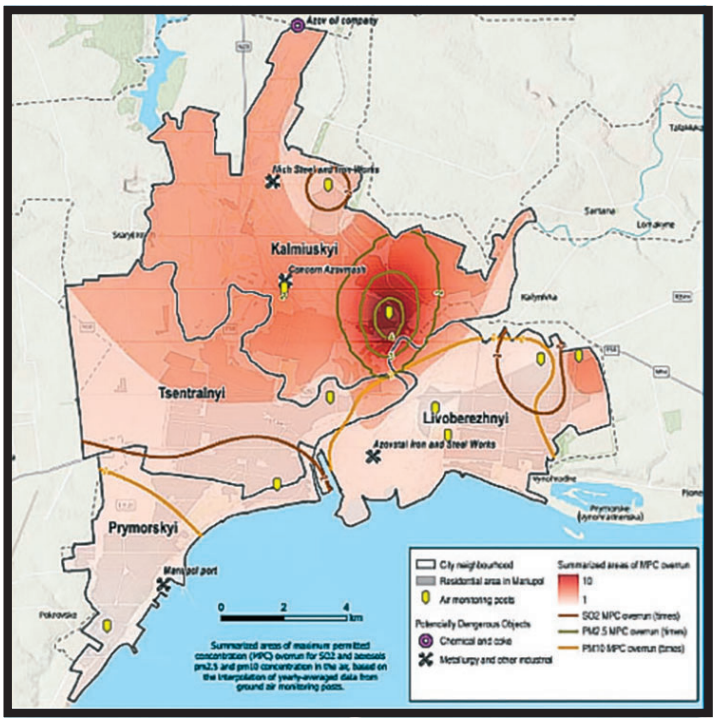


Figure 1. Air pollution

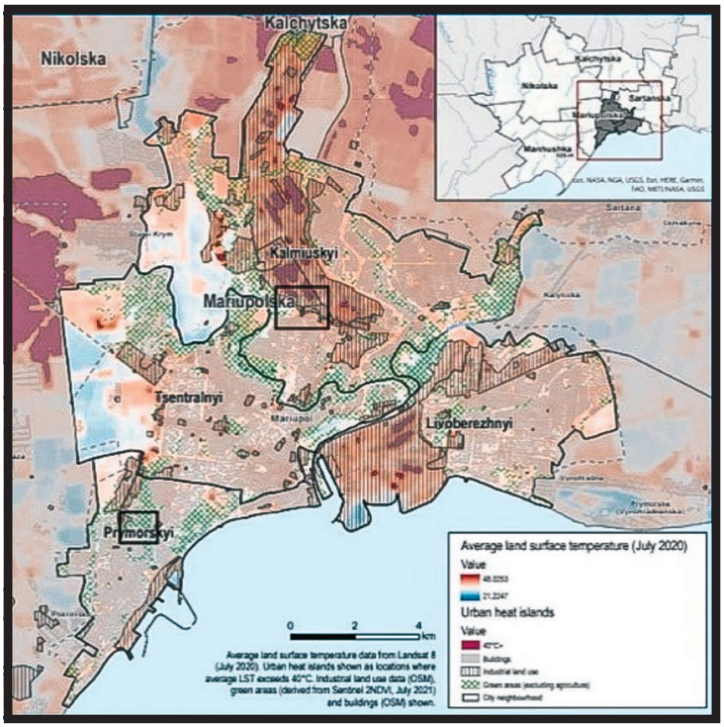


Figure 3. Urban heat islands, 2020

Vulnerability dimension for ABRA was comprised of three components that interact with each other; susceptibility, coping capacity, and adaptive capacity. For each vulnerability component, a set of indicators was identified on neighbourhood level (data were given by local authorities on request), weighted, and summarized into vulnerability index, which after combination with hazard exposure data resulted into a neighbourhood-level risk index. This helped to identify which neighbourhood in Mariupol city accommodates the biggest proportion of vulnerable groups, considered to be impacted the most in case of hazardous events. These groups consist of people who are dependent on others, due to their age or physical conditions: children, elderly people, people with disabilities, and IDPs. Lack of coping capacity was identified in neighbourhoods where health facilities were lacking human or technical capacity and when big amount of people might need medical care in case of emergency. Also were identified neighbourhoods with a deficit of emergency-related protection facilities (shelters), which are necessary in case of technological hazards. Considering the presence of climate-related hazards, like flood and heat island effect, neighbourhoods with the smaller proportion of green space were considered lacking adaptive capacity to absorb heat shocks or retain flood water.

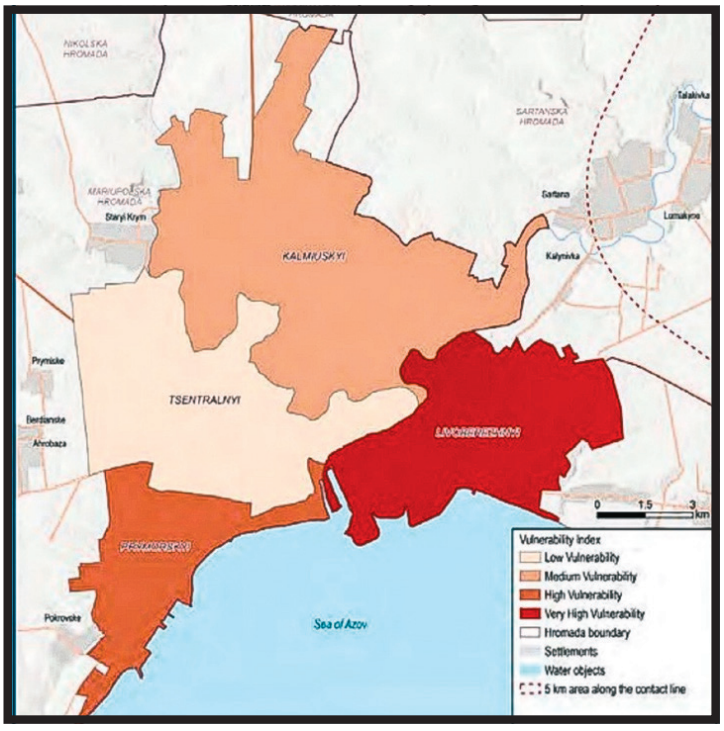


Figure 4. Vulnerability profile by district

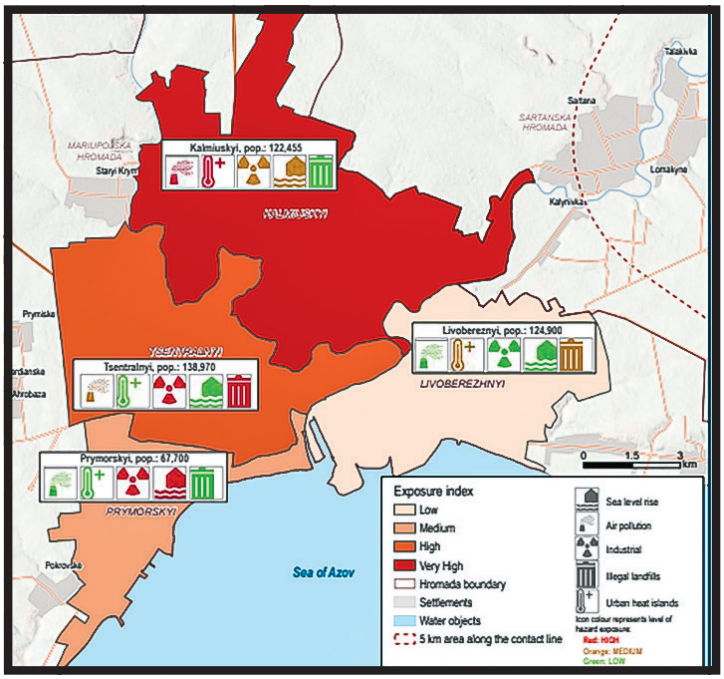


Figure 5. Multi-hazard exposure by district

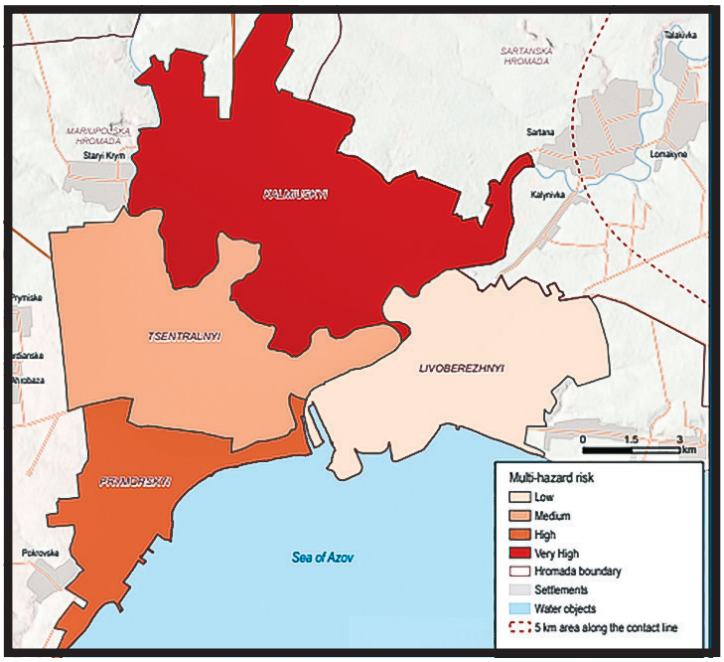


Figure 6. Multi-hazard risk by district

After overlaying all these factors, Livobezerhnyi district (Figure 4.) was defined as the most vulnerable, which needs specific attention from local authorities during the DRR planning and interventions. The final stage of the assessment was identification of the neighbourhood the most at risk for the selected five hazards, meaning where the highest number of people exposed to the multiple hazards overlay with highest proportion of vulnerable people living in neighbourhood.

DISSEMINATION OF RESULTS AND LESSONS LEARNT

After the successful completion of risk assessment, IMPACT, with a support of the UNDRR, organized 2-days City Resilience workshop for Mariupol municipalities, academia, and local NGOs, where resilience gaps and actions plan were identified in a participatory manner using Disaster Resilience Scorecard for Cities. An important lesson learned was that with geospatial analysis it is possible to identify hazards that are not obvious for the local population. Even though local municipalities compose the emergency response and coordination group in the city, they weren't aware of the heat island effect and considered it as a ''normal'' phenomenon during the summertime. Also, the extent of groundwater flooding was underestimated, and local actors did not consider it may cause damage in the future. Also, important knowledge is that local actors do not consider different scenarios of response in case of the intense hazardous event and, during the workshop, IMPACT facilitated the identification of the different scenarios of emergency that local municipality should be prepared for.

The biggest barrier that IMPACT have encountered while conducting ABRA in Mariupol is availability of the statistical data required for vulnerability index. There were at first around 30 indicators identified to measure socio-economic and institutional vulnerability, yet, only 15 of them remained, as not all required data is collected on a neighborhood level. The opportunity here is to collect primary vulnerability data by IMPACT in a separate assessment to ensure up-to-date, relevant and representative data for risk analysis.

Nataliia Makaruk

IMPACT highly advocate for utilizing local-level risk assessments for disaster risk management, anticipatory actions and conventional humanitarian response programming, especially in conflict and fragile settings, with utilization of granular geospatial datasets and locally collected vulnerability data to ensure evidence-based disaster risk planning is available in „the most at risk" and „the least prepared" areas.

Climate Watch:
Data on Climate-Related Risks in Vulnerable Contexts | Impact (impact-initiatives.org)

GIS SUCCESS STORIES

TACKLING STUBBLE BURNING: TOWARDS A SAFER AND HEALTHIER ENVIRONMENT IN SERBIA

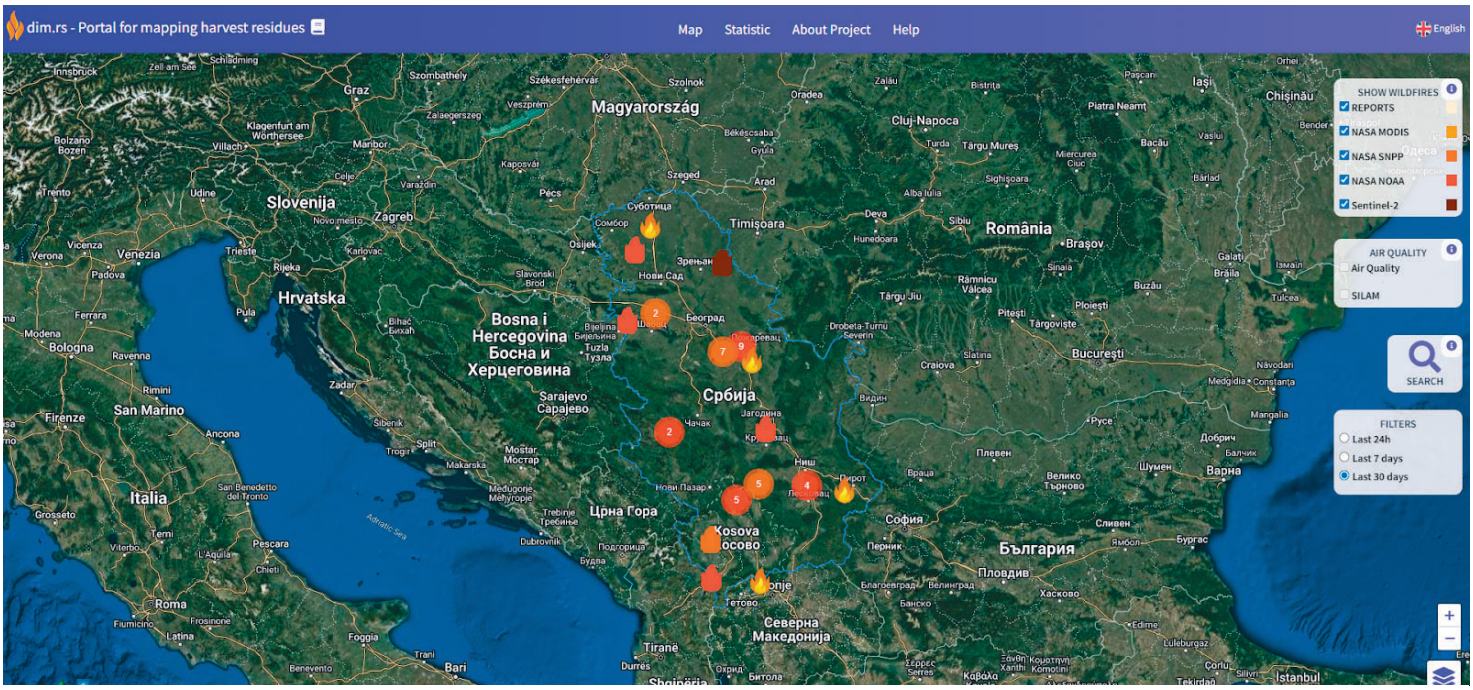
CHALLENGES IDENTIFIED

Stubble burning in Serbia and other parts of the world remains a major problem, despite being banned by law. Farmers often resort to this harmful practice as they see no financially viable alternatives. But the consequences are dire – from jeopardizing air quality and soil microbiology, to causing accidents on highways and even fatalities. Sadly, local authorities have failed to keep track of the fire incidents, missing an opportunity to address this burning issue.

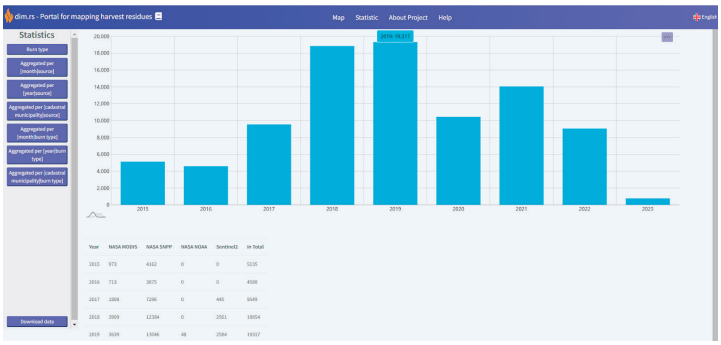
PROPOSED SOLUTIONS

The BioSense Institute in Serbia has created the dim.rs web GIS portal, which is the first of its kind to provide reliable and unbiased information on this issue in a continuous manner, free of charge for all individuals and organizations in the country. Thanks to the financial support of the United Nations Development Program in Serbia (UNDP Serbia) through ''Challenge call for innovative solutions to reduce air pollution in Serbia and improve air quality'', this platform was established to increase public awareness of the harmful impacts of stubble burning and to provide decision-makers with accurate data. By providing precise location information on burnings, the portal is helping authorities to discourage farmers from continuing this damaging practice.

Dim.rs web GIS portal displays data coming from several satellite sources for the territory of the Republic of Serbia, namely MODIS, SNPP, NOAA and Sentinel-2. The first three satellites have high temporal and moderate spatial resolution, and this data is retrieved from the Fire Information for Resource Management System (FIRMS) that distributes Near Real-Time (NRT) active fire information. On the other hand, Sentinel-2 images are characterized with high



Homepage of dim.rs portal displaying open fire locations for the past 30 days.



Statistical information on open fires. Decreasing trend is visible since 2019, when initial steps towards GIS portal creation were taken. Data prior to 2019 may not be complete.

spatial resolution of 10 m and temporal resolution of 5 days, and are processed using in-house algorithm to detect burned areas using a change detection approach based on consecutive satellite acquisitions and short-wave infrared bands. The web GIS portal dim.rs allows users to explore fire records through various filtering options. Users can select a specific time period, municipality, and burn type of interest. The homepage displays fires that occurred within the past 24 hours, but users can easily view fires from the past week or month by selecting the corresponding radio button. The portal also provides information on air quality, including a 5-day forecast of fine smoke particles from land fires and an air quality assessment based on hourly concentrations of PM10 and PM2.5 from the Serbian Environmental Protection Agency's network of automatic stations.

The dim.rs web GIS portal not only tracks current fires through satellite data, but also enables the identification of trends and areas more susceptible to burning. This allows for targeted efforts to address the issue in specific municipalities. The portal provides statistics on open fires categorized by attributes such as burn type, months, satellite sources, years, and cadastral municipalities. Users can download the data in various formats including images (png, jpg, pdf) and tabular data (csv, xlsx, json, pdf, html). Additionally, a mobile application encourages individuals to contribute auxiliary data for future updates and promotes the solution.

LESSONS LEARNT AND OUTLOOK TO THE FUTURE

Some non-official estimates state that about 19.000 open fires occurred in Serbia in 2019 (verified later with the number detected by dim.rs portal), of which many were related to burning low vegetation, damaging

Pop-up window showing Senitnel-2 image of the burned area, with information on time and location.

forest, meadows, orchards, vineyards and other crops. Dim.rs portal also precisely detected locations for over 2.000 burning crop residue spots in a period of only three months in 2020. These pieces of information were alarms that made public officials announce on television their ability and readiness to cope with this problem. However, due to long pandemic period, plans were postponed for future but even the very establishment of a portal that keeps the track of stubble burning, available at a fingertip, already made farmers think twice before burning harvest residues and thus resulted in the reduced number of open fires as seen in the figure starting from year 2019 when initial steps towards building the web GIS portal were taken. In 2022, UNDP Serbia utilized the portal to draw attention to the gravity of the issue and inspire collective efforts towards a safer and healthier environment in Serbia.

Stubble burning remains a major problem, despite being banned by law. Its consequences are dire – from jeopardizing air quality and soil microbiology, to causing accidents on highways and even fatalities. Even the very establishment of a portal that keeps the track of stubble burning, available at a fingertip, already made farmers think twice before burning harvest residues and thus resulted in the reduced number of open fires.

Learn more:
https://dim.rs/#/dashboard
Contact:
office@biosense.rs

GIS SUCCESS STORIES

REDUCING FLOOD RISK THROUGH GIS: THE RESULTS OF THE DANUBE FLOODPLAIN PROJECT

CHALLENGES IDENTIFIED

The Danube is the second longest European river (2850 km), its basin in 19 countries, and affecting the lives of 81 million people. It has a 801,500 km^2 catchment area and has lost 80% of its wetlands and floodplains since the end of the 19th century. The loss of its floodplains has cost us a huge water purification capacity.

The Danube Floodplain Project aims to reduce flood risk through floodplain restoration along the Danube River and its tributaries. The project brought together experts from 10 countries and 22 organisations, co-funded by the European Union (ERDF, IPA funds). The main goal is improvement of transnational water management and flood risk prevention while maximising the benefits for biodiversity conservation.

PROPOSED SOLUTIONS

The expected change is in the improved knowledge about water management which integrates benefits for the ecosystems, society, economy and flood protection throughout the Danube Basin. The outcomes are a Danube Basin Wide Floodplain Restoration and Preservation Manual, addressed mainly to practitioners; a Danube River Basin Sustainable Floodplain Management Strategic Guidance summarizing the key findings of the manual, but targeting a wider audience; and a Danube River Basin Floodplain Restoration Roadmap. The pilot areas were Hodonín – Holíč in Slovakia and Czech Republic, Kostanjevica na Krki in Slovenia, Middle Tisza in Hungary, Begečka Jama in Serbia and Bistreț in Romania.

DANUBE FLOODPLAIN GIS

As part of the Danube Floodplain project, the Danube Floodplain Geographic Information System (DFGIS) was developed. It is a spatial database storing all results of the project. Via a public web-based interface, the data is available in the form of interactive maps. The results of the Floodplain Evaluation Matrix (FEM) modelling for active and potential floodplains of the Danube and tributary rivers can be visualized and downloaded. The FEM results can also be accessed in textual form as the Danube Floodplain Inventory (DFInv). The evaluation of ecosystem services and habitat provision for different pilot areas is also available via the Danube Floodplain GIS.

The results of the ecosystem services (ESS) and biodiversity analysis of the pilot areas were integrated in the DFGIS and DFInv. Second, the extended parameters (water level dynamics and extended CBA) of the upgraded FEM-Tool have been added. Third, the FEM evaluation results of the extended pilot areas are incorporated.

The FEM-Tool (Floodplain Evaluation Matrix – Tool) was further developed, improving the usability and the speed of the assessment. The tool was developed in the open-source QGIS environment as a plugin and can evaluate floodplains and assess restoration projects/measures. It can use input data from hydraulic modelling, ecosystem services (ESS) analysis, ecological assessments, habitat modelling, stakeholder and extended cost-benefit analysis to determine if a restoration project is recommended or not. The tool allows identifying hydraulically active floodplains, determining the need for preservation and restoration demand of them based on the results of the FEM. This method uses hydrological, hydraulic, ecological and socio-economics parameters to assess the effects of the floodplain on flood risk reduction, ecology and socio-economics.

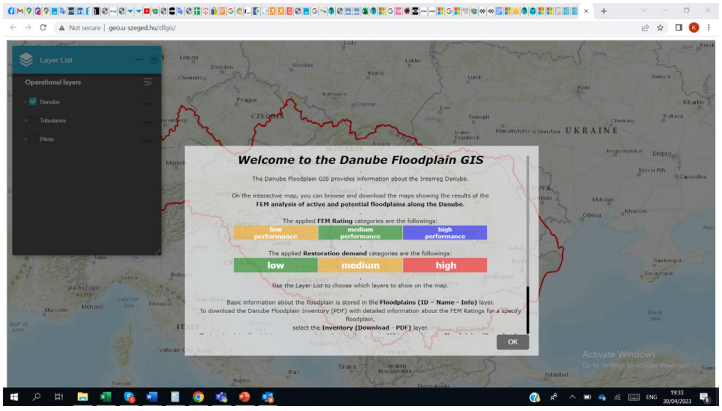
The FEM-Tool supports the application of the FEM and allows storing the results. After identifying the floodplains, the current state (status quo) of a hydraulically active floodplain is evaluated with a minimum set of parameters, including at least one parameter of each category (hydrology, hydraulics, ecology, socio-economics). Additional parameters can also be assessed, but it is not mandatory. After evaluating the current state, planned restoration projects can be assessed, starting with a stakeholder analysis followed by assessing the project and its effects. Therefore, the FEM method is applied again, but a more detailed analysis is conducted, including three mandatory additional parameters. This more in-depth analysis assumes that the restoration project is implemented and the FEM parameters are recalculated. The results are compared with the FEM results of the current state. If the FEM evaluation is improving after the restoration project and the additional analysis (stakeholder analysis, additional parameters, ecosystem services, habitat modelling) favors the project, it is recommended to implement it.

ADDED VALUE OF FLOODPLAINS

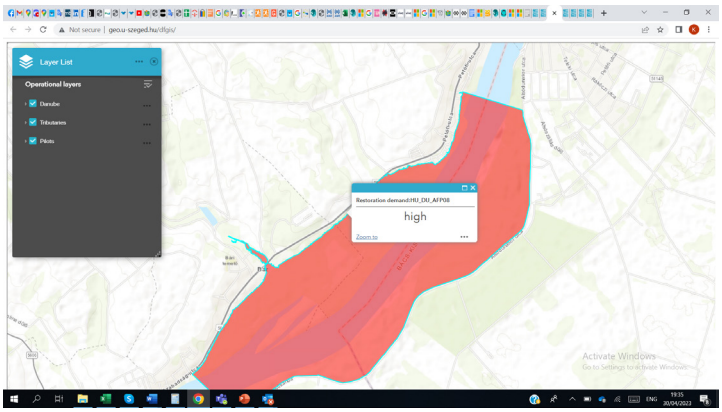
Floodplains play an important role in controlling floods by storing, and thereby dissipating the energy of high water discharges. With floods becoming more serious and frequent due to climate change, their negative impacts in Europe are expected to increase considerably in the future. The climatic shifts will leave society even more vulnerable to these increasingly common incidents. During 1980–2016, the total reported economic losses caused by weather and climate-related extremes in the European Economic Area (EEA) amounted to approximately EUR 436 billion (in 2016 Euro values) (EEA Report, 2017). Several studies have already shown that a natural management of floodplains provides greater human and ecosystem benefits if compared to arable farming and intensive agriculture. More sustainable, nature-based solutions are needed to reduce the impact of floods and preserve dynamic water ecosystems.

Learn more:
www.interreg-danube.eu/danube-floodplain

Catchment-wide natural water retention solutions enable us to mitigate the impacts of both floods and droughts. Water retention not only reduces flood risk but ensures an improved water supply which is good for vegetation and groundwater recharge, as well as for human uses such as extensive agriculture production.



Danube Floodplain screenshot



Danube Floodplain screenshot

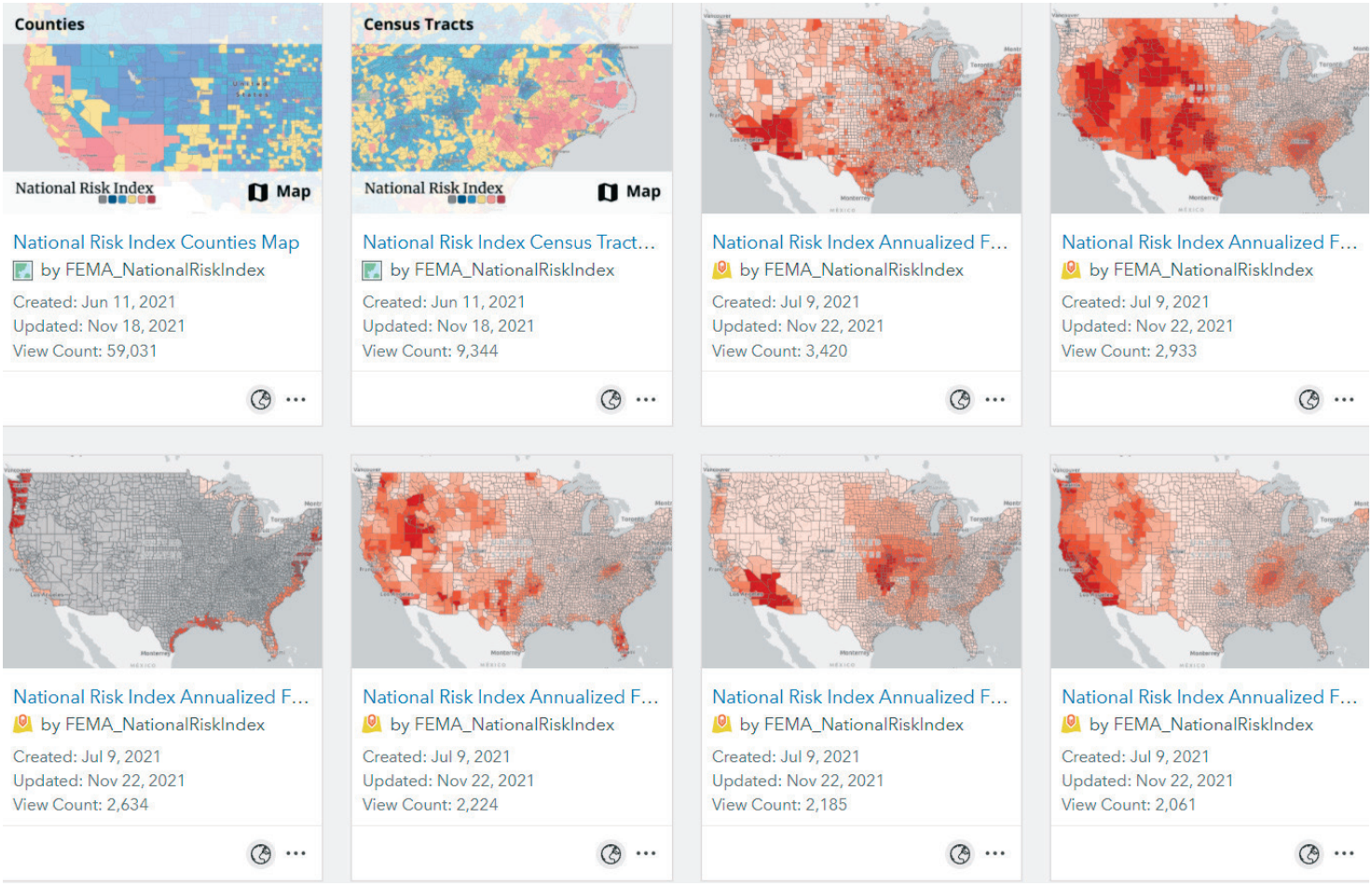
GIS SUCCESS STORIES

EVALUATE NATURAL HAZARD RISK WITH FEMA'S NATIONAL RISK INDEX

Natural hazards have been getting more devastating and more frequent in the past 50 years. According to the World Meteorologica Organization, the number of disasters has increased by a factor of five. Natural hazards can cause millions of dollars in damages to buildings and agriculture, but more gravely they can cause injuries and fatalities. Depending on where you are located in the U.S., the severity of your risk as well as the type of hazard vastly differs.

If you have ever wondered how at risk your community is to natural hazards, the recently released National Risk Index (NRI) from the Federal Emergency Management Agency (FEMA) has got you covered. The National Risk Index is an online mapping application that visualizes natural hazard risk metrics based on 18 natural hazards, expected annual losses from natural hazards, social vulnerability, and community resilience. With this tool, you can discover a holistic view of community risk to natural hazards.

Newly released layers include: National Risk Index Counties, National Risk Index Census Tracts, National Risk Index States Expected Annual Loss.



National Risk Index information layers - screenshot.

These newly released layers are an excellent source for any map maker trying to determine what kind of natural hazard risk are prevalent in their community, what kind of natural hazards are prominent, and what the kind of losses would be expected for people, buildings, and agriculture.

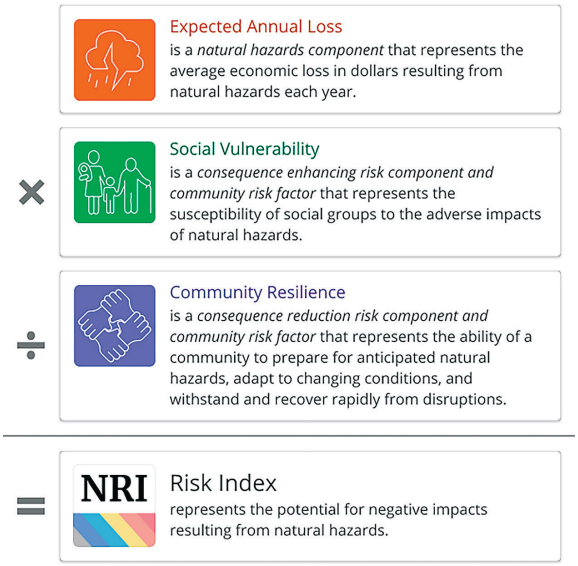
These layers enable users to analyze their own data in conjunction with the NRI data, as well as being able to create captivating maps that showcase natural risk in their communities.

UNDERSTANDING THE NATIONAL RISK INDEX

In the National Risk Index, risk is defined as the potential for negative impacts as a result of a natural hazard.

The risk equation behind the Risk Index includes three components: Expected Annual Loss, Social Vulnerability, Community Resilience.

The datasets supporting the natural hazards and consequence reduction components have been standardized using a min-max normalization approach. The dataset supporting the consequence enhancing component was acquired in a normalized format, allowing for easy incorporation into the National Risk Index risk calculation. Using these three components, a composite Risk Index score and hazard type Risk Index scores are calculated for each community (county and Census tract) included in the Index.



Each community has a composite Risk Index score and up to 18 hazard type Risk Index scores (e.g., Tornado Risk Index score). A composite Risk Index score measures the relative risk of a community based on all 18 natural hazards included in the Index, while a hazard type Risk Index score measures the relative risk of a community for a specific hazard type.

HOW THE NATIONAL RISK INDEX CAN HELP

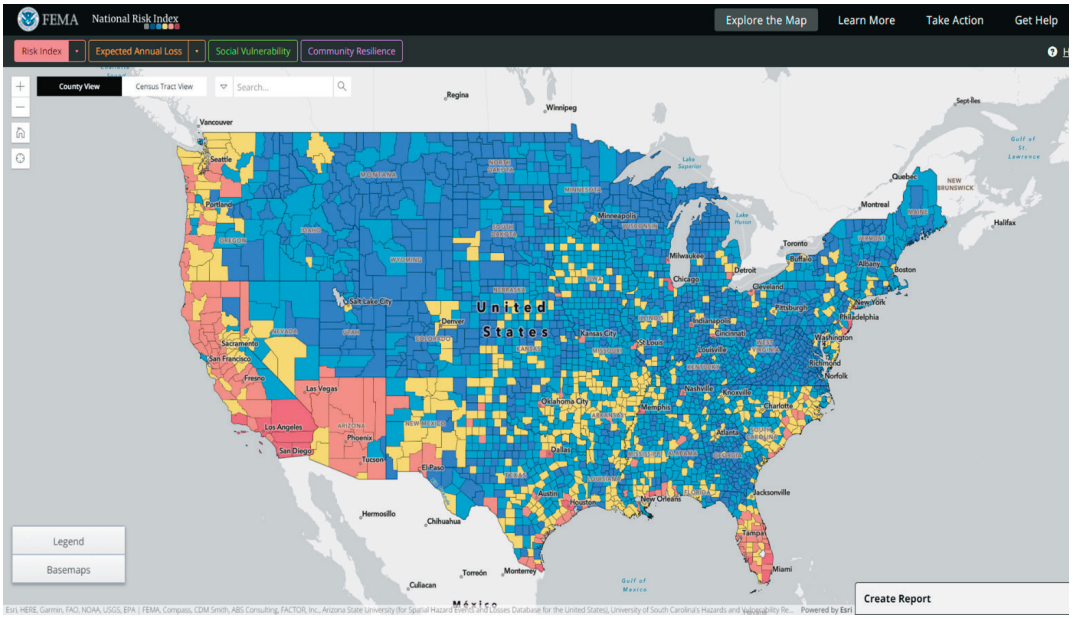
- Updating emergency operations plans
- Enhancing hazard mitigation plans
- Prioritizing and allocating resources
- Identifying the need for more refined risk assessments
- Encouraging community-level risk communication and engagement
- Educating homeowners and renters
- Supporting the development and adoption of enhanced codes and standards
- Informing long-term community recovery

THE NATIONAL RISK INDEX AUDIENCE

The Index is accessible to anyone interested in mitigation or understanding a community's natural hazard risk, including:

- Public employees
- Local officials
- Research institutions
- Property owners
- Community planners
- Real estate professionals
- Academia
- Insurance community
- Homeowners and renters

ratings of each of the 18 individual hazard types.



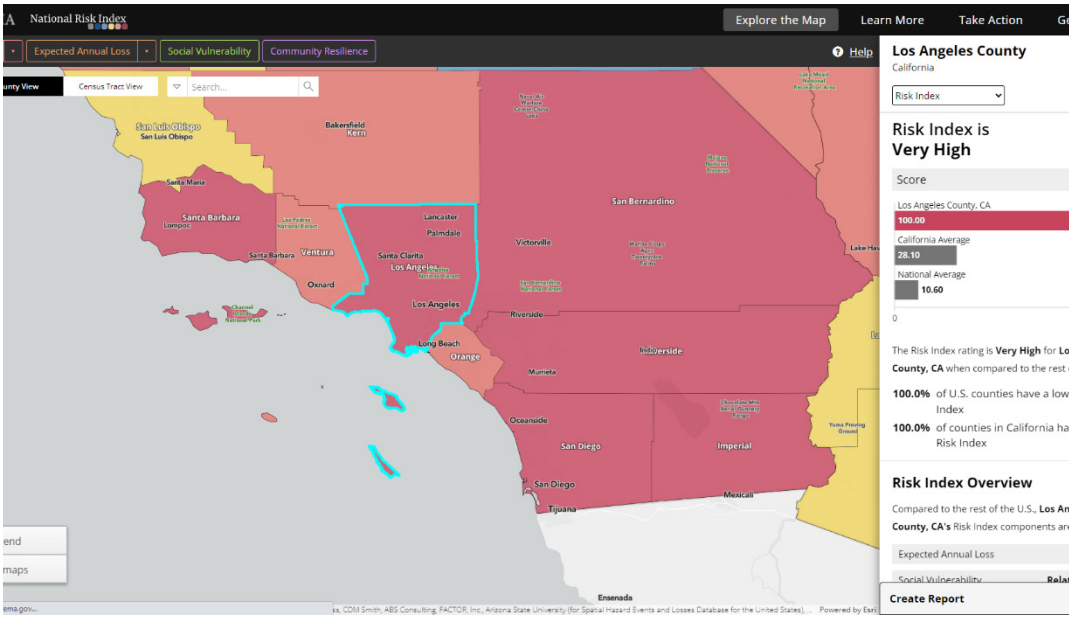
FEMA NATIONAL RISK INDEX WEB APP

FEMA National Risk Index Web App - screenshot.

This app created by FEMA allows you to explore the NRI throughout the United States. Explore the overall risk index, the Expected Annual Loss, Social Vulnerability, or Community Resilience factors at either the county or tract level. This ready-to-use app requires no set up, so it is perfect for getting right into the data and seeing how natural hazard risks affect your community. FEMA has created a robust pop-up in the web app that shows a plethora of information, such as ranking the hazard scores of your selected area to its state and nation, as well as all of the scores/

Additionally, FEMA's NRI web app also incorporates a Create Report function, that creates a neatly designed, yet detailed report of your selected geography, full of charts, maps, and tables.

Learn more:
https://www.fema.gov/flood-maps/products-tools/national-risk-index
For any NRI related questions, please email
FEMA-NRI@fema.dhs.gov



An example of report for Los Angeles County, California – screenshot.

GIS SUCCESS STORIES

SATELLITE-BASED MONITORING OF WATER RESOURCES - AN ODRA RIVER CASE

INTRODUCTION

Several hundred tons of dead fish were collected from the water surface in the summer of 2022 on the German and Polish side of the Odra River.

Scientists, research institutes and a group of experts led by the Federal Environment Agency in cooperation with the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV), as well as the German-Polish Environmental Council have prioritized defining the cause of the emergency and respective countermeasures.

Earth observation data from Planet paired with research from the Helmholtz Centre for Environmental Research (UFZ) in cooperation with EOMAP were able to deliver valuable insights to government stakeholders.

INVESTIGATING THE CAUSE WITH REMOTE SENSING SOLUTIONS

False assumptions have been made initially and attributed the emergency to river pollutants such as mesitylene or mercury, yet the most likely cause of mortality was high salinity in the water. Salinity has a negative effect on organisms and can lead to damage of cell structures or dehydration and, ultimately to the proliferation of the microalgae Prymnesium parvum.

Sentinel data combined with near-daily imagery from Planet's SuperDove satellites and paired with insights from EOMAP and UFZ researchers made such detailed water analysis possible.

Researchers were able to show the presence of an algal bloom in the Odra River. The image series indicates a connection between a salt discharge initiated near Opole/Poland and the increased algae development, leading ultimately to the emergency alongside the river. The flow time from Opole in Poland to Frankfurt in Germany was 11 days.

Regular water monitoring with the help of remote sensing and subsequent early warning systems could have prevented the disaster.

The image shows the inflow of the Warta (right) at August 3 2022, carrying markedly higher algae concentrations increasing the algal level in the Odra below significantly. c/ EOMAP / Planet
https://www.eomap.com/press-release-satellite-data-reveals-details-of-oder-river-disaster/

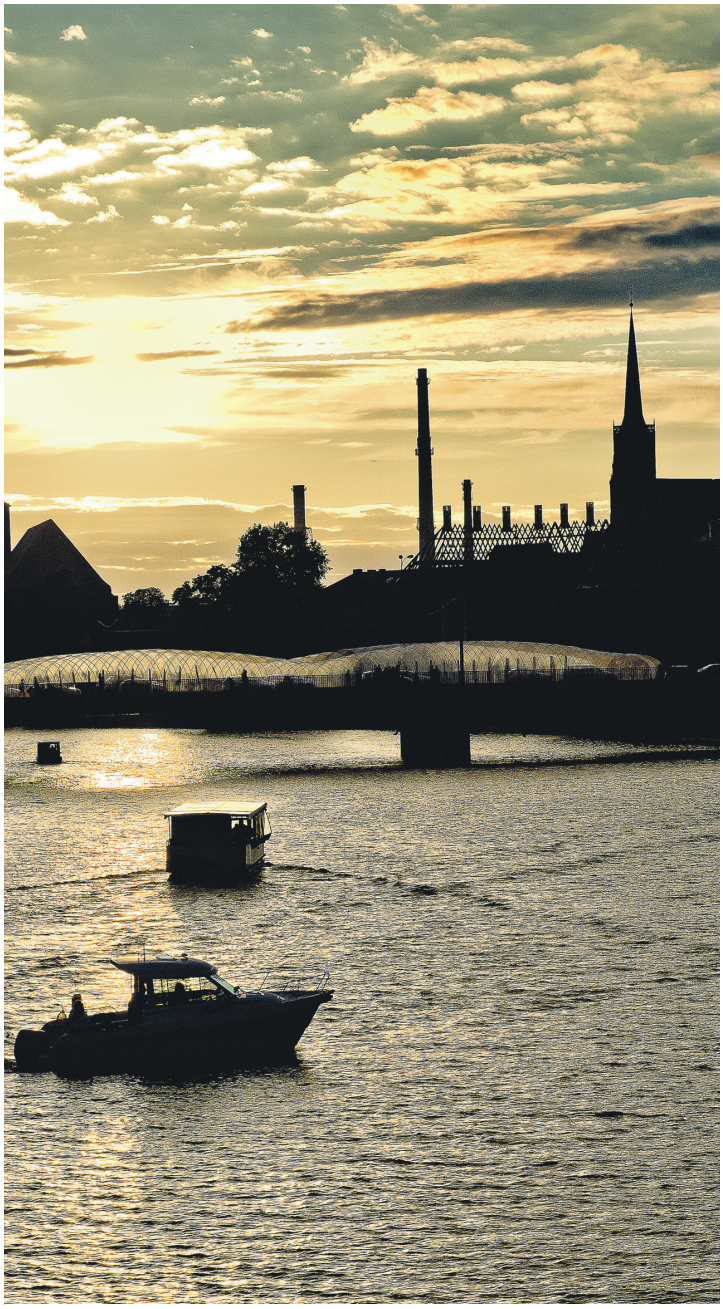
REMOTE SENSING IS KEY FOR BOTH PREVENTION AND RESPONSE TO DISASTERS

The key to successful water management is to understand and mitigate risks before they occur, make a more robust forecast and informed allocation of resources during the recovery phase. Continuous monitoring of water resources is time consuming and expensive due to the manual collection of water samples. In addition, manual sampling provides very limited spatial and temporal information, additionally retrospective analysis is not possible.

It is difficult to predict the exact time, location, and severity of contamination, yet satellite imagery along with appropriate analytical tools can help derive conclusions for all phases of emergency management. Planet's high-resolution monitoring made it possible to reconstruct the chronology of the Odra disaster without the need for a costly manual sampling process. However, in order to have as complete and precise information about a given crisis situation as possible, it is useful to combine data from satellite imagery (properly calibrated and validated) with in-situ observations and measurements.

The Odra disaster will not remain an isolated incident as climate change can pose similar hazardous situations in the future. It is critical to gain the right situational awareness and coordinate quick responses and next steps with the support of digital analyses and imagery data before, during and after the disaster.

Learn more:
https://www.planet.com/markets/emergency-management/



View of Odra rivershot.

GIS SUCCESS STORIES

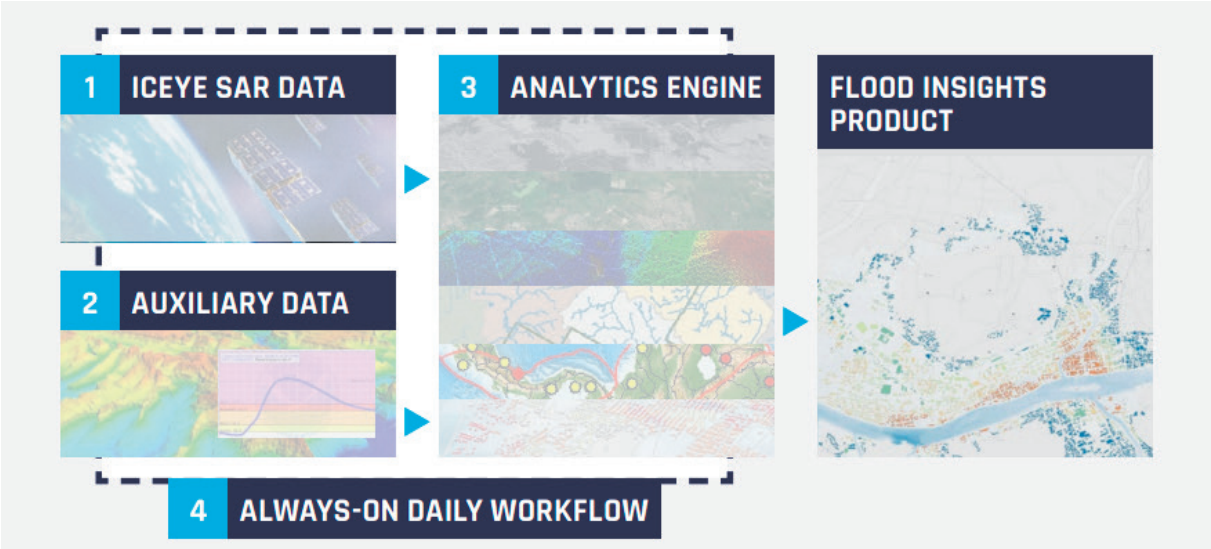
ACTIONABLE NATURAL CATASTROPHES INTELLIGENCE TO TRANSFORM GOVERNMENT RESPONSE, RECOVERY & RESILIENCE

There is no doubt that climate change is impacting the frequency and severity of natural disasters worldwide. Extreme weather events of 2022, such as Hurricane Ian in Florida, the disastrous floods in eastern Australia, or the wildfires in California, were a reminder of the growing challenge for humankind in responding more effectively to natural catastrophes. Extreme weather events such as the above often have catastrophic effects on human lives. Research has shown that 4.4 billion people globally have left injured, homeless, displaced or in need of emergency assistance, and nearly 1.3 million people have died due to extreme weather events between 1998 and 2017. Additionally, the impact of hazards on national economics in that same period have totaled over 2.908 billion US dollars, 2,245 billion of this was due to climate related disasters (United Nations International Strategy for Disaster Reduction – UNISDR 2018). With projections indicating further increases in extreme weather events, more economic losses and human lives are expected if we do not take significant steps to avert and adapt to them. Globally governments recurring impacts of natural disasters. Earth observation technology cannot solve the climate crisis on its own, but it does offer hope. For the first time in history, we are now able to persistently monitor any location on the planet, understand the environment we are living in, and better respond to the consequences we now all face as a result of climate change.

PROPOSED SOLUTIONS

Globally available, high-resolution datasets are vital in managing systemic risks better. Owning the world's largest synthetic-aperture radar (SAR) constellation and combining Earth observation with advanced data analytics, ICEYE offers insights into which properties are most exposed to a given peril and which buildings are more likely to be affected than others. ICEYE's Flood Insights Product is the world's first consistent, near-real-time source for flood observation data.

ICEYE's Flood Insights Product combines observations of flooding from ICEYE SAR satellite



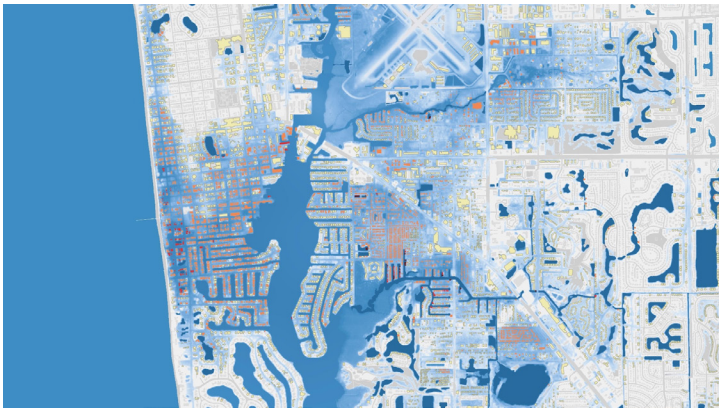
The Flood Insights Product is created by combining four key pillars:

can see through clouds, at night, and everywhere on earth multiple times a day, and auxiliary data collected from multiple sources, such as river gauges and images sourced from social media and the news. The flood insights product includes (1) flood monitoring service to inform customers what events ICEYE is expecting, observing, or analyzing and (2) data layers and summary reports about flood events it analyzes.

SUCCESS STORY: FEMA, NLT AND ICEYE

During the 2022 Atlantic hurricane season, ICEYE delivered near real-time geospatial flood impact data to FEMA for major US flood events, collaborating with New Light Technologies (NLT) and other contractors. As intense flooding was hitting the state of Kentucky in July 2022, there was an immediate need for quick, high-resolution flood data to identify the impacted communities and facilitate response and recovery activities. In an area where such undertakings could be hampered by complex terrain, relative remoteness of affected communities, and lack of reliable communication means, ICEYE was able to step in as the primary observation-driven source for flood information. Just a few months later, devastating floods struck the US again – first with the remnants of a typhoon in Alaska bringing the strongest storm in decades to the coastline, then with Hurricane Fiona dumping a feet of water over Puerto Rico, and finally with Hurricane Ian causing catastrophic storm surge and historic freshwater flooding through Florida and the Southeast Coast.

Each disaster carried its own issues with traditional data gathering. In Alaska, the remoteness of the communities made it hard to immediately understand what the impact was. In Puerto Rico, the nature of a disaster on an island compounded by gray skies for days after the event meant boots on the ground or even aerial imagery collection plans would be difficult. And in Florida, the scope and scale of the disaster made it hard to get a full picture of who was impacted and where resources would need to be prioritized.



Hurricane Ian captured over Naples, Florida, in September 2022.

In collaboration with NLT, ICEYE was able to step in and deliver its initial flood insights to FEMA in fewer than 24 hours from the peak of each flood. That flood data was analyzed with TEMPO (Tool for Emergency Management and Prioritizing Operations) —a tool developed by NLT for FEMA to support response and recovery activities during major disasters through combining demographic and critical infrastructure information with hazard data —providing FEMA and the disaster management community with critical information that was used widely across the regions.

The solution offered FEMA unparalleled situational awareness of the catastrophic floods and provided the agency with the ability to prioritize immediate response and rescue activities, such as the tasking of urban search and rescue forces, expediting of preliminary damage assessments, organization of collection plans for airborne imagery and assembling of on-ground high-water-marks positions. This allowed FEMA to make critical decisions on the allocations of resources and application of relief money in days rather than weeks.

There is a clear need to deliver a comprehensive suite of insight solutions related to a wide range of natural catastrophe events that enable government agencies and insurance industry customers to achieve substantially better outcomes for their stakeholders.

Learn more:
https://www.iceye.com/solutions.
Contact: solutions@iceye.com

GIS SUCCESS STORIES

ROCK THE ALPS - MONITORING ROCKFALL RISK AND PROTECTION FOREST MAPPING

CHALLENGES IDENTIFIED

Forests cover 40% of the Alpine Space. In natural hazard management and disaster risk reduction worldwide, but especially in the Alpine Space, forests are increasingly considered equal to technical or civil engineering measures. Forests can, e.g. lead to increase slope stability and reduce the risk to an acceptable level in many locations.

Where forests are present, the implementations of technical measures for risk reduction are often redundant or cheaper. Beautiful examples are the numerous forests throughout the Alps that prevent the release of snow avalanches instead of expensive snow racks and the large-scale afforestation in the late 19th century that nowadays prevent upslope erosion and sedimentation problems in the lower parts of the Alpine catchments. The preservation and enhancement of the protective role of forests against natural risks are key to an efficient strategy for strengthening the livability of the AS. The 6 Pan-European Ministerial Conferences on the Protection of Forest held since 1990, have all stressed the need for a common approach to value Forest Ecosystem Services (FES) as a basis for developing a Sustainable Forest Management. Prioritisation of FES has to be done on the basis of societal needs. Although it is widely recognized that reduction of natural hazard risks is one of these, there are still critical needs in terms of:

- a common definition of risk, protection forest/issues,
- harmonized methodology/indicators for mapping this FES,
- harmonized tools/indicators for assessing the forest mitigation efficiency according to the specificities of each forest stand and forest cover.

PROPOSED SOLUTION

Within this context, the Interreg Alpine Space project ROCKtheALPS (Harmonized ROCKfall natural risk and protection forest mapping in the ALPine Space) has capitalized the knowledge gained in previous EU projects to provide the first AS regional rockfall risk zoning tool, as well as the first AS wide harmonized map of rockfall risk and protection forests.

These outputs are supporting local/regional/national/EU governance authorities in risk prevention/forest management. An interdisciplinary/transnational partnership has been set up with a 1.86 M€ ERDF budget.

ROCKTheALPS project made the first step towards integrating forests in local protection policies. During the project, researchers gathered data of 10.620 rock falls in the Alps and beyond, calculated a rock fall and a protection model and used them to map protection forests across the 400.000 km^2 of the Alps. Now, this knowledge is accessible for anyone involved in rock fall protection policy-making, thanks to the ROCKTheALPS webgis and toolbox.

This web GIS offers the access to two webmaps:

1) The rockfall past events map and database via the link

https://www.arcgis.com/apps/webappviewer/index.html?id=f0908d087e4f483c8c4b705c4ed4dd51&extent=295667.0461%2C5396100.6221%2C2142385.6495%2C6008819.8409%2C102100

This webmap represents the locations of past rockfall events recorded in the Alpine Space. Events are separated into locations of rockfall release areas and rockfall deposits (related to particular rockfall release area). The download section of the map

gives access to the ,,.CSV'' database. More on the additional attributes of this data is available in the statistics section of the map. Additionally, in the download section of the map, more profiles of past rockfall paths are available in the .CSV database. Larger portion of these profiles is not georeferenced and shown on the map therefore the number of events between these databases differentiates.

A specific application for surveying and mapping rockfall past events has been developed by one project's partners (University of Lujblajna)

https://leica-geosystems.com/en-IN/about-us/news-room/customer-magazine/reporter-81/mappigng-the-rockfall-source-and-deposit-areas-in-the-alps

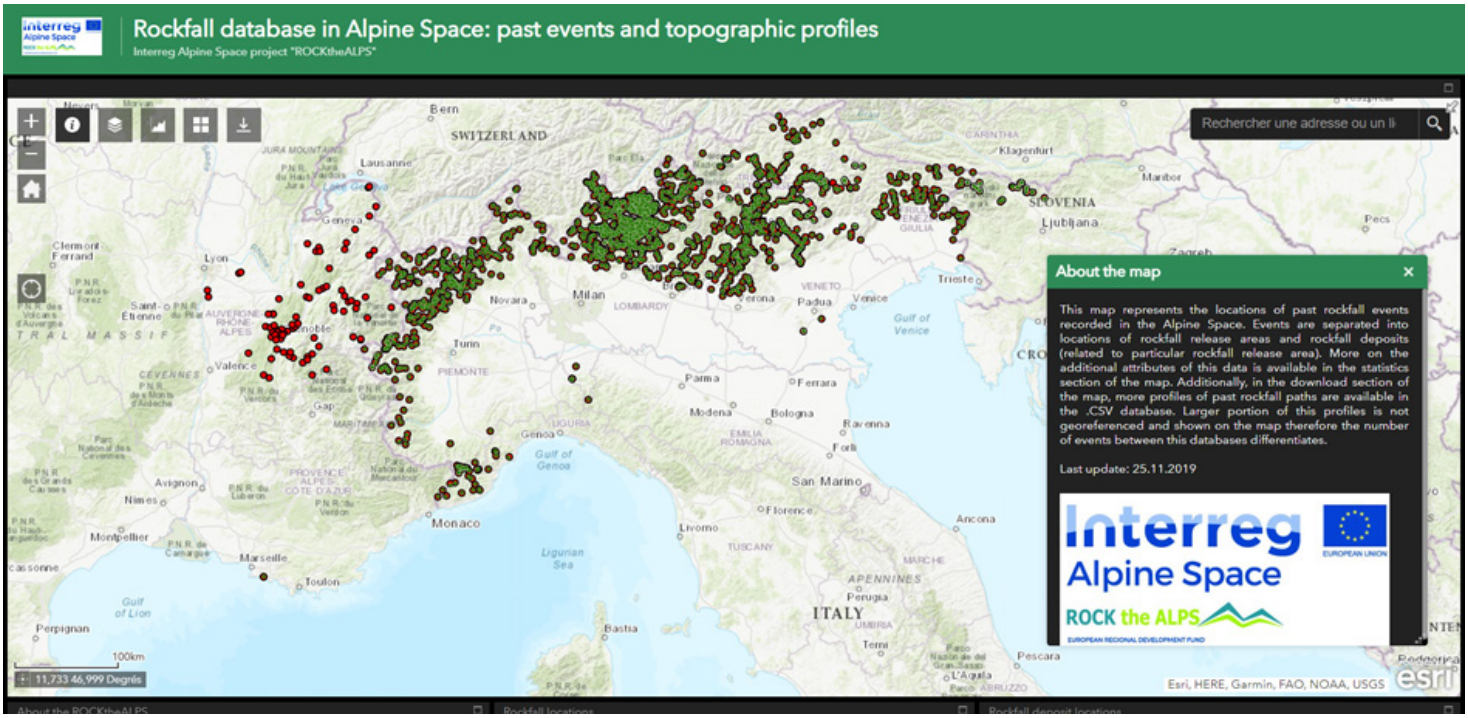


Fig 1: The webmap associated to the Rockfall past events database of the project ROCKtheALPS (©Berger-RTA -2023)

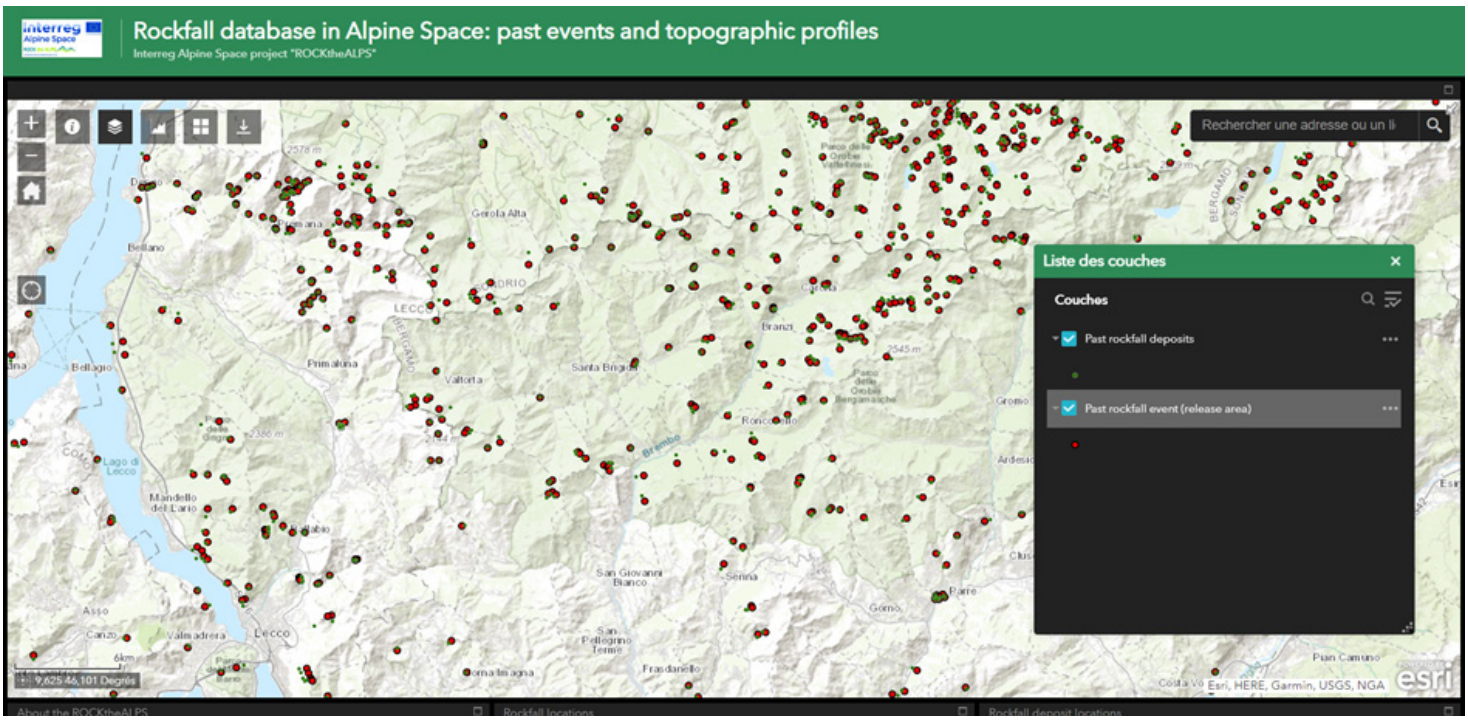


Fig 2: Extract of the Rockfall past events webmap of the project ROCKtheALPS (©Berger-RTA -2023)

2) The first Alpine Space harmonized rockfall risk and protection forest webmap.

https://www.arcgis.com/apps/webappviewer/index.html?id=f14a6b5eeba0456a80685fe594c7dcc9&extent=--527838.6723%2C5161855.6642%2C3165598.5344%2C6387294.1017%2C102100

The map is showing the results of an innovative rockfall assessment methodology called ROCK-EU using harmonized criteria and objective data, and past rockfall events recorded in Alpine Space. It represents the first Alpine Space wide harmonized webmap of rockfall risk and protection forest. The download section gives access to the different GIS layers displayed in the webmap.

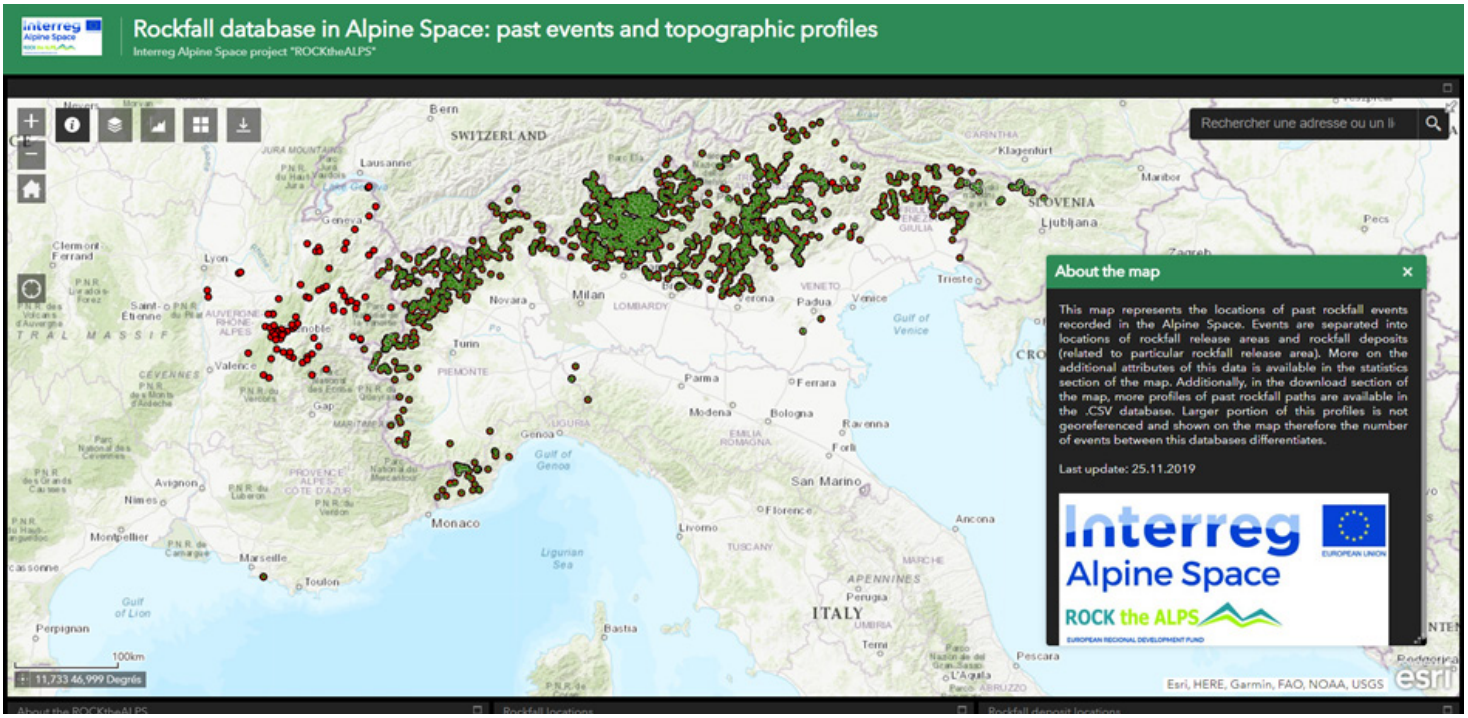


Fig 3: A zoom in of the first Alpine Space harmonized rockfall risk and protection forest webmap (©Berger-RTA -2023)

LESSONS LEARNT AND OUTLOOK TO THE FUTURE

The maps of the protective forests against rockfall risks at the entire Alpine Space provided by the project identify zones where forest-based solutions are potentially usable for rockfall risk mitigation. These maps have been used for providing the first factual info for the Alpine Space and the Alpine Convention territory. There are two key findings:

14.0% of the forests of the Alpine Space have a protective role against rockfall risks. This represents 21.5% of the forest cover of the Alpine Convention territory.

Country	Total area [km^2]	Forest area [km^2]	Proportion of protection forest
Austria	83950	37280 (44.4%)	12.3%
Switzerland	41290	12650 (30.6%)	26.1%
Germany	46100	16410 (35.6%)	3.3%
France	101440	42765 (42.2%)	8.6%
Italy	97020	35165 (36.2%)	24.7%
Liechtenstein	160	75 (46.9%)	27.8%
Slovenia	20270	11810 (58.3%)	8.4%
Total	**390230**	**156155 (40.0%)**	**14.0%**

Tab 1: The distribution of protective forest against rockfall risk per Alpine Space countries (©Berger-RTA -2023).

The collected database of past events is now being used to develop a new innovative rockfall propagation model ROCKAVELA (for more info visit the site of the scientific association ecorisQ: https://www.ecorisq.org).This model has been developed using the ROCKtheALPSpast events data base that is updated on a yearly basis. Now this database contains 21118 topographic profiles from past events, and is now interationalised with data coming from countries all over the word (EU, USA, Canada, Japan, New Zealand, Australia, Pakistan, Nepal...)

If you are interested in these challenges and ready for sharing your data, please contact us via **frederic.berger@inrae.fr**

Learn more:
https://www.alpine-space.eu/project/rockthealps/

The maps of the protective forests against rockfall risks in the entire Alpine Space identify zones where forest-based solutions are potentially usable for rockfall risk mitigation. In order to improve and further develop harmonized rockfall models, there is still a need for international cooperation in building an international database on past events.

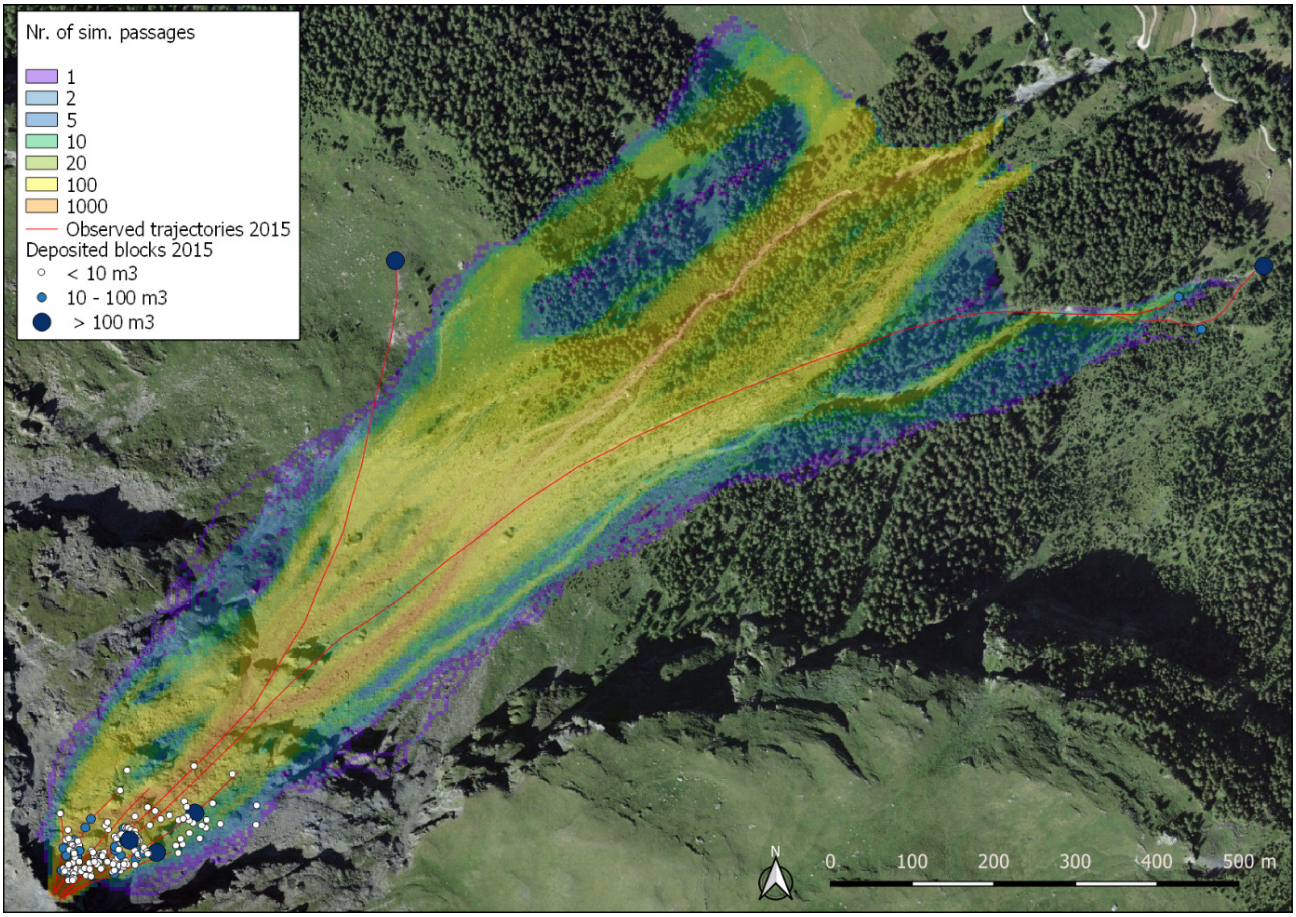


Fig.4: An example of the results obtained with the model ROCKAVELA and past events deposit points of the database (©Dorren-EcorisQ -2023). This model is freely available via https://www.ecorisq.org/ecorisq-tools

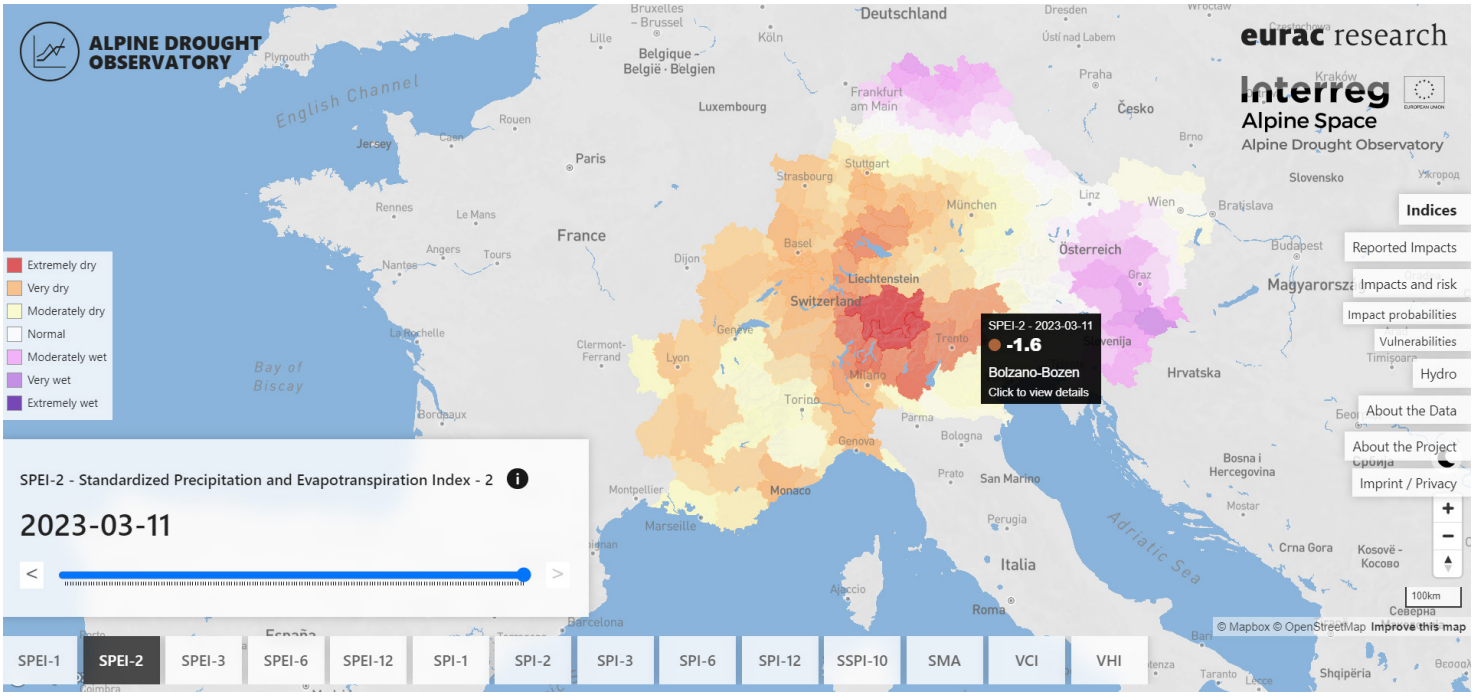
GIS SUCCESS STORIES

THE ALPINE DROUGHT OBSERVATORY

Droughts are becoming an increasing concern in the Alps and in the lowland areas that receive Alpine water. The Alpine Drought Observatory (ADO) provides a tool for a quick and easy overview of the current drought situation in the Alpine region and past drought situations in the last 6 months as maps and the last 40 years as timeseries. ADO is integrating data from climate models, satellite data observations and ground station data from all Alpine countries as well as historical entries. The data is harmonized with all Alpine countries and continuously updated daily or every two weeks depending on the observation index. All data is offered on open access under the CC-BY 4.0 license. ADO provides the following data for the entire alpine space on political and hydrological relevant boundaries:

- Meteorological indicators such as SPI (precipitation), SPEI (evaporation), and SSPI (snow conditions).
- Satellite based vegetation indicators VHI, VCI
- Hydrological data from monitoring stations along most rivers in the Alps
- Historical database on drought impacts from scientific articles and media reports
- Vulnerability analysis and relevant data for its assessment

The user can select between different drought indices and can move back in time by shifting the time slider. By clicking on the map, the user can retrieve detailed information including a graph with a time series for the specific location (Eurac Research, 2022).



The ADO webplatform. Showing the SPEI-2 at 2023-03-11. It becomes directly visible that the most parts of the Alps are in drought conditions.

CHALLENGES IDENTIFIED

As climate change intensifies, droughts become more frequent. The last two years have been challenging in terms of water availability in the alpine region. Hydrological offices across the Alps have to deal with severe drought conditions. This makes the management of water resources an essential task. Decisions have to be taken that concern hydro power generartion, irrigation for agricultural production, tourism and the availability of drinking water.

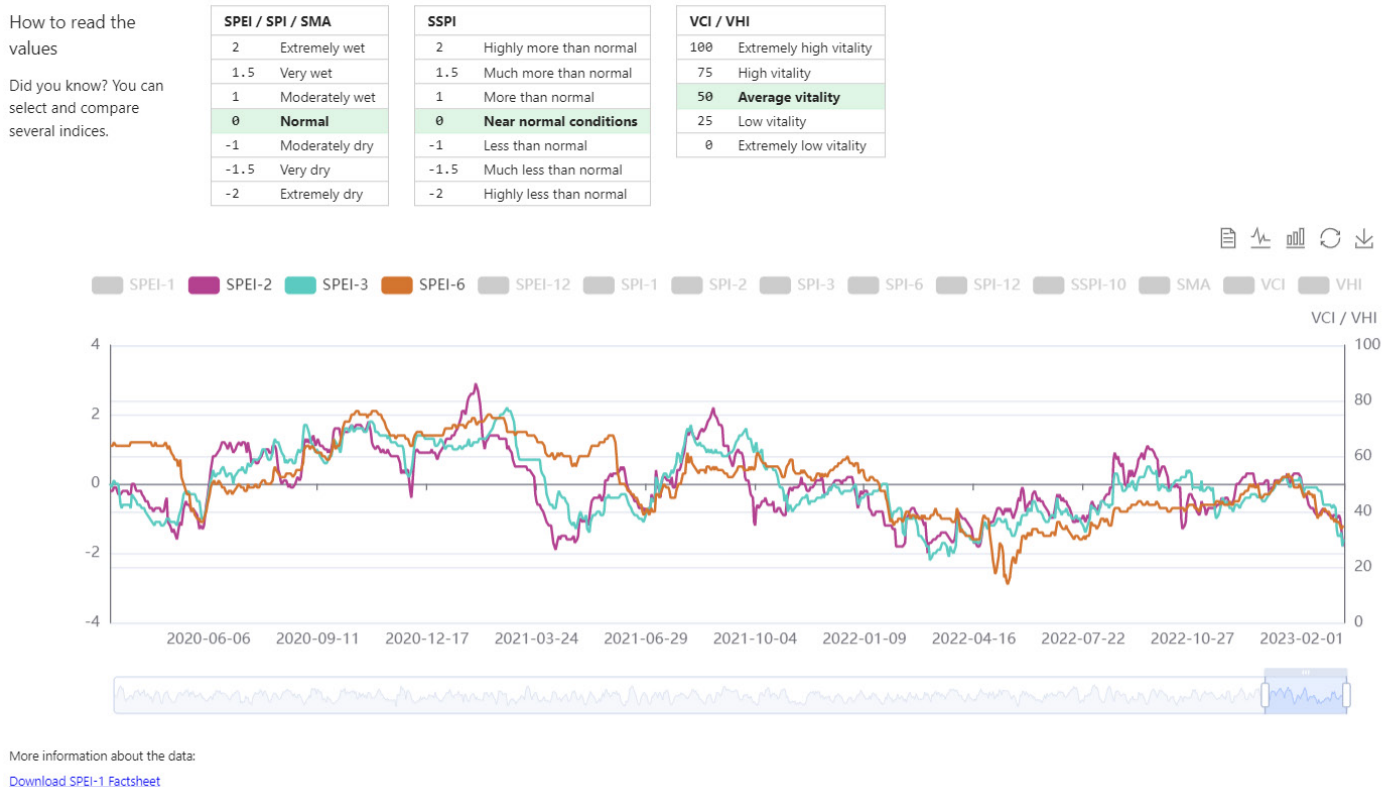
This is why frequently updated, spatially consistent and scientifically proven information on drought is needed to take informed decisions.

PROPOSED SOLUTIONS

The interdisicplenary ADO consortium, ranging from researchers to hydrological officers, have jointly agreed upon which characteristics the presented drought information must have. The ADO platform makes the drought indices operationally and openly accessible for everybody. All indices have their own fact sheet that explains concisely and understandable what the index represents and how it is to be interpreted. The spatially consistent presentation (in opposite to sparse and diverse point measurements) allows to compare different regions. The up-to-date information allow for relevant and quick planning measures, since the preparation of data does not take time away from the decision makers anymore. The long time series, ranging back to 1980, also foster learning from the past. Being able to know about the severity of past droughts and their impacts help to classify current situations and to plan accordingly.

UPTAKE

The ADO platform has already proven useful for different use cases and is thus an impactful tool. A scientific publication tracing the snow line altitute in the alps for the last 30 years has been carried out by incorporating data produced by the ADO platform (Koehler et al., 2022). It shows that the snow line altitude in 2022 is several hundred meters above the long term average. The platform serves as a blueprint for other drought platforms and webgis visualizations, e.g. planned integration into Green Transition Information Factory Austria (European Space Agency, 2023). This is easily feasible and encoureged by adhering to open source and open data standards. Journalists use the easily accesible in-

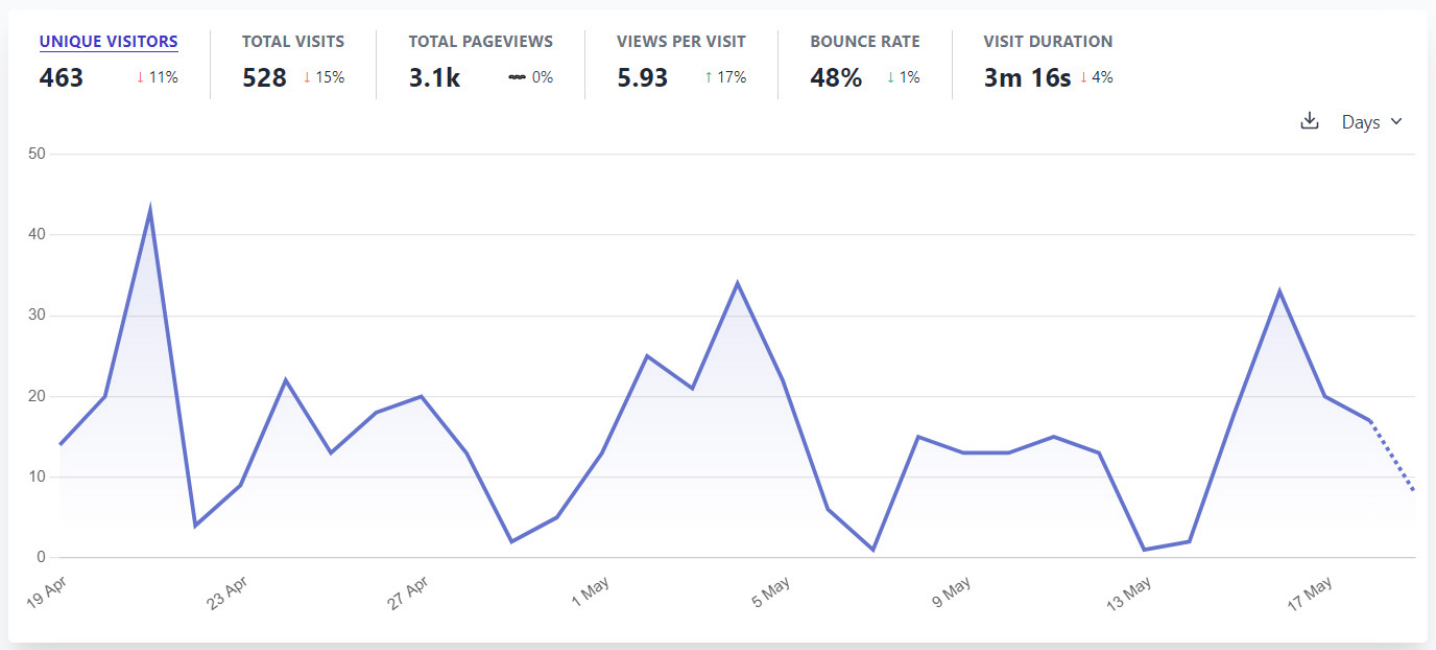


The time series view of selected NUTS-Region. All indices can be compared. Time can be selected back to 1980.

formation to underline their articles with data (Der Standard, 2023, Süddeutsche Zeitung, 2023). And the Hydrological Office of the Regione Piedmonte have published a video, „La Siccità" on how the ADO platform helps them in their water management process (Regione Piedmonte, 2022). The diverse uptake and the high user numbers show the impact and success of the ADO platform that stems from interdisciplinary collaboration, adhering to open science and focussing on the needs of the users.

Water scarcity is becoming a concern in the Alps and in the lowland areas that receive Alpine water. The ADO online platform facilitates access to unified and relevant drought information by visualizing a combination of meteorological and hydrological drought indicators. The platform is updated daily, easily understandable, and openly accessible for everybody. Alpine, local, and regional actors benefit from the ADO web platform, as they improve the efficiency of their drought management and ability to face related risks.

Learn more:
https://ado.eurac.edu/



The user numbers for the last 30 days - there have been more than 500 visits. Since the platform has gone online in June 2022, there have been more than 3500 visits.

USEFUL LINKS

RCB Rządowe Centrum Bezpieczeństwa

rcb.gov.pl

CBK PAN

www. cbkpan.pl

dsb

www.dsb.no

https://emergency.copernicus.eu/

https://vision.esa.int/rapid-and-resilient-crisis-response/

https://www.eurisy.eu/

https://drmkc.jrc.ec.europa.eu/risk-data-hub/#/

https://www.earthobservations.org/

https://www.earthobservations.org/geo_wp_23_25.php

https://eotoolkit.unhabitat.org/

https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030

https://www.un-spider.org/

https://earsc.org/

https://eeagrants.org/