



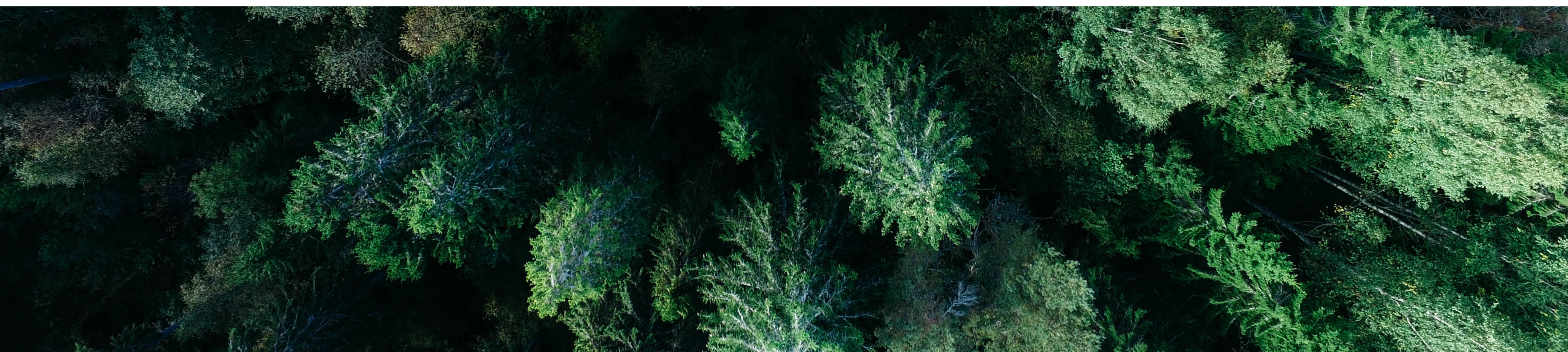
— SWEDEN —

SWEDEN

Sweden has been at the forefront of environmental protection and sustainability and was the first country to pass an environmental protection act in 1967. Since that time, Sweden has continued to push for the reduction of carbon emissions, pollution, and environmental sustainability, which in recent years, has brought about increases in the use of Earth observations (EO) data.

The majority of EO data produced by the Swedish government is focused on forest mapping, ice breaker services, meteorology, and disaster mitigation. However, water quality assessment, land cover mapping, agricultural monitoring, and ground motion services all remain important priorities. As a result of the importance of EO applications, the Swedish National Space Agency, has initiated work with an Open Data Cube to promote EO data for governmental use and development in Sweden. The data cube is part of the Swedish National Space Data Lab, an initiative to promote the use of EO together with artificial intelligence (AI) methods. This development will be made available as open-source and contribute to the global knowledge and capacity development for big EO data analysis.

Sweden has for a long time been committed to GEO and has provided financial support to the GEO Secretariat Trust Fund, for this phase of GEO with 110 000 Swiss Franc.

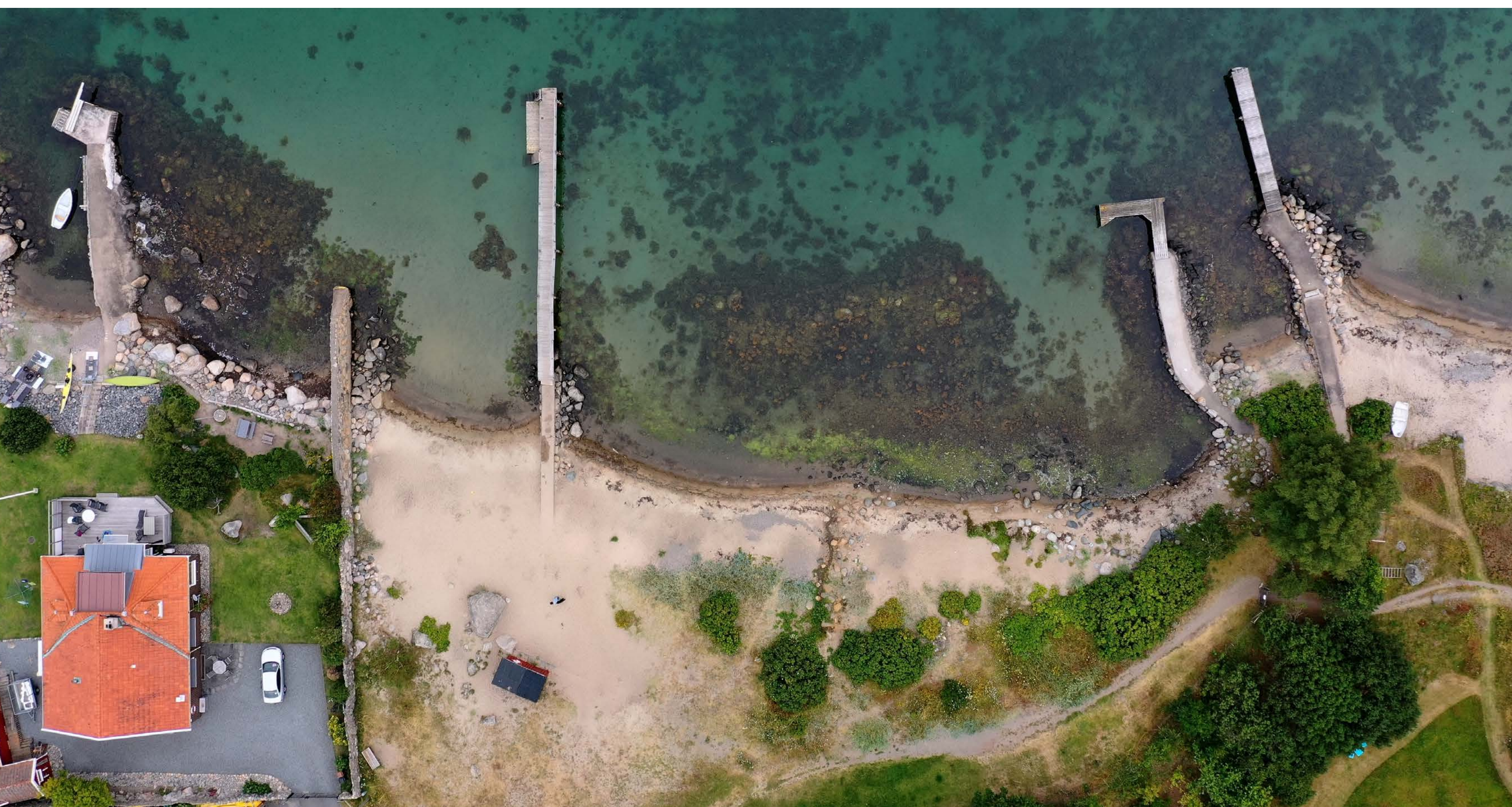


Gävle, Sweden. Photo: Geran de Klerk, Unsplash

COVID-19

In 2020-2021 many significant global challenges were presented to us related to the COVID-19 pandemic. GEO Work Programme activities, GEO Members, Participating Organizations and Associates are using EO to support response and recovery actions related to the COVID-19 pandemic.

EO data offers extensive historical and near real-time information to advance scientific inquiry, inform decision making and enhance policy interventions. Both the European Copernicus Programme and the European Space Agency have been working to provide services to monitor the environment and participate in the global efforts to fight the COVID-19 disease.

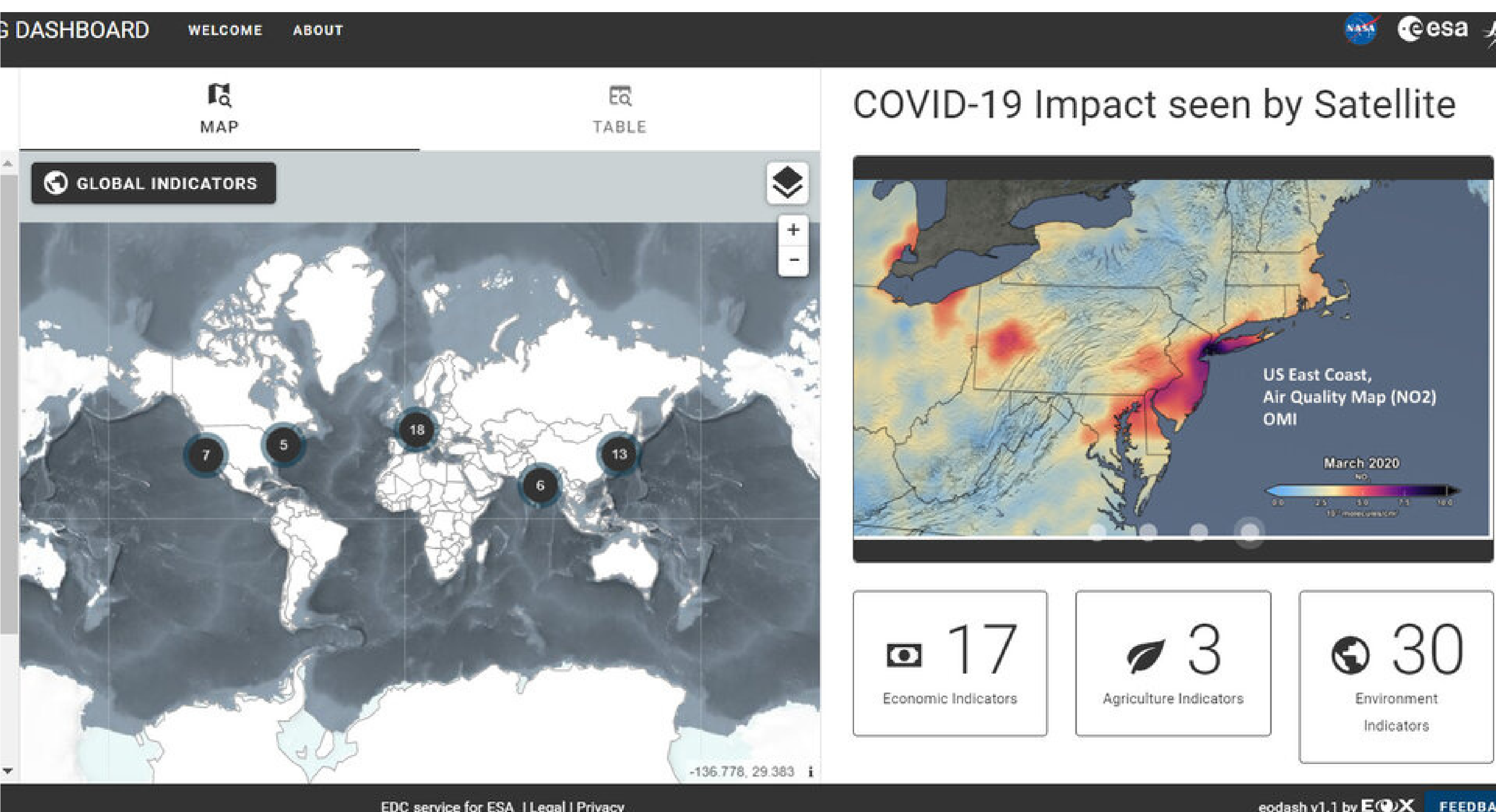


Onsala, Sweden. Photo: Sebastian Långström, Unsplash

The Copernicus Programme has provided vital information that has helped to advance COVID-19 research and sparked widespread interest in up-to-date information relating to the climate and the atmosphere. From measuring water transparency in Venice, Italy, to using Copernicus data to help solve the COVID-19 crisis, the Copernicus Programme and its services have contributed to the better understanding of how the virus spreads and monitoring of the environmental impacts of this pandemic.

In a recent report from the World Food Programme, forecasts indicate that the pandemic will continue to cause numerous problems and uncertainties along the food supply chain. The use of EO satellites will therefore continue to provide crucial information for monitoring crop growth and harvesting. It is also the reason for the jointly developed 'COVID-19 Earth Observation Dashboard,' created by NASA, ESA and the Japanese Aerospace Exploration Agency (JAXA).

This dashboard allows users to track real-time changes in climate change, air and water quality, economic activity, and agriculture, and has been examining the impact of regional lockdowns and social distancing on the Earth's air, land and water.



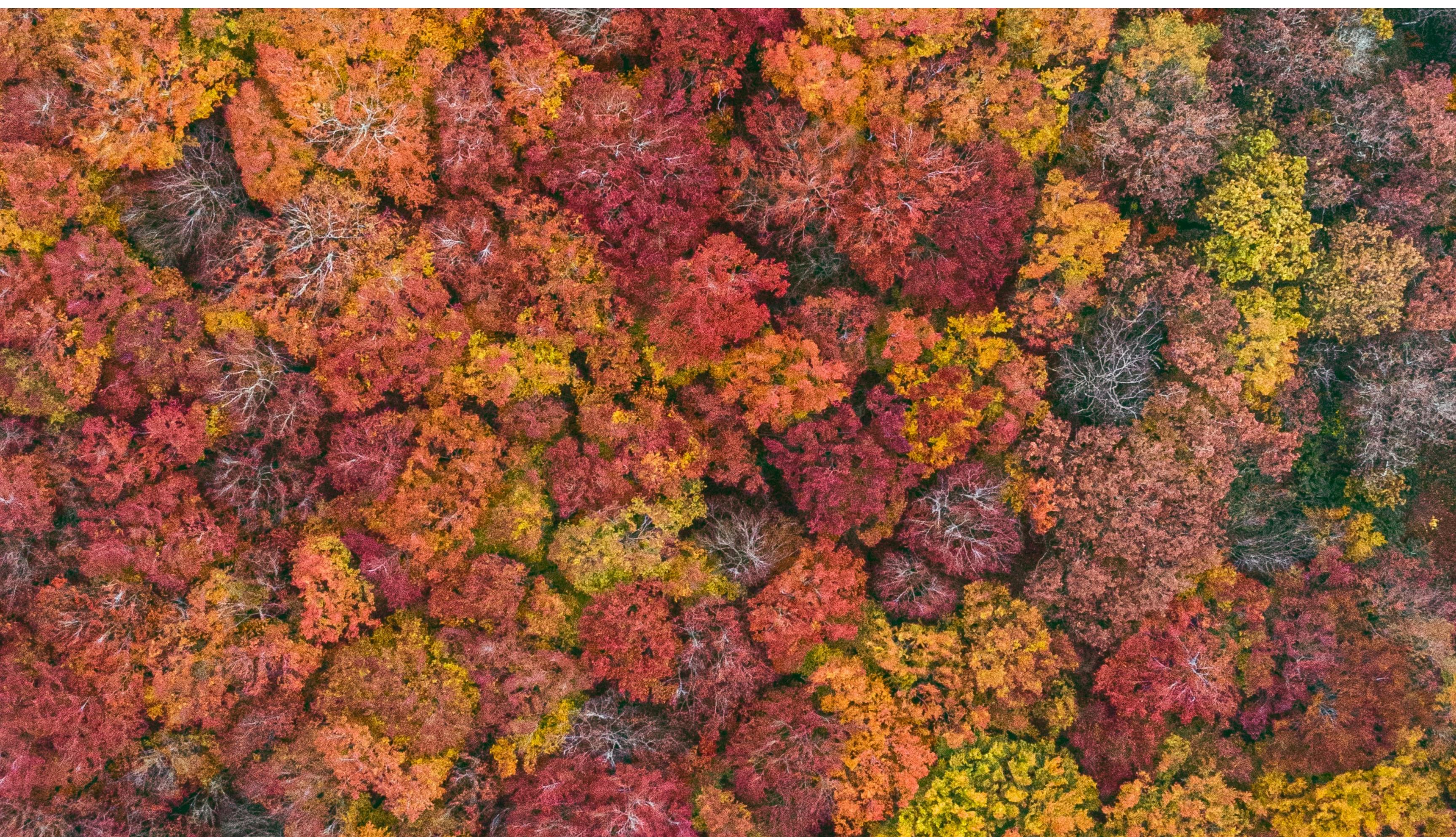
Air quality on the COVID-19 Earth Observation Dashboard

Overall, access to EO data has helped researchers, policymakers, and citizens alike with quality-assured data and tools. Also in Sweden, the Swedish Meteorological and Hydrological Institute (SMHI) is heavily involved in the Copernicus Atmosphere Monitoring Service (CAMS), the Copernicus Climate Change Service (C3S), as well as in the Copernicus Marine Environment Monitoring Service (CMEMS) and the Copernicus Emergency Management Service (CEMS).

THE SWEDISH CIVIL CONTINGENCIES AGENCY & THE GEO DISASTER RISK REDUCTION (DRR) WORKING GROUP

The newly established GEO DRR Working Group brings together two types of stakeholders - the geotechnical and geodata experts, and risk management professionals.

Subgroup 2 of the Working Group, with the assistance of the United Nations Office for DRR (UNDRR), will promote the use of EO data to show vulnerability, exposure, future risk trends, and contribute to disaster risk reduction strategies. The Swedish Civil Contingencies Agency (MSB) has long supported the use of EO data for the prevention of disasters. Also, the Stockholm Environment Institute (SEI) is part of the GEO DRR Working Group.

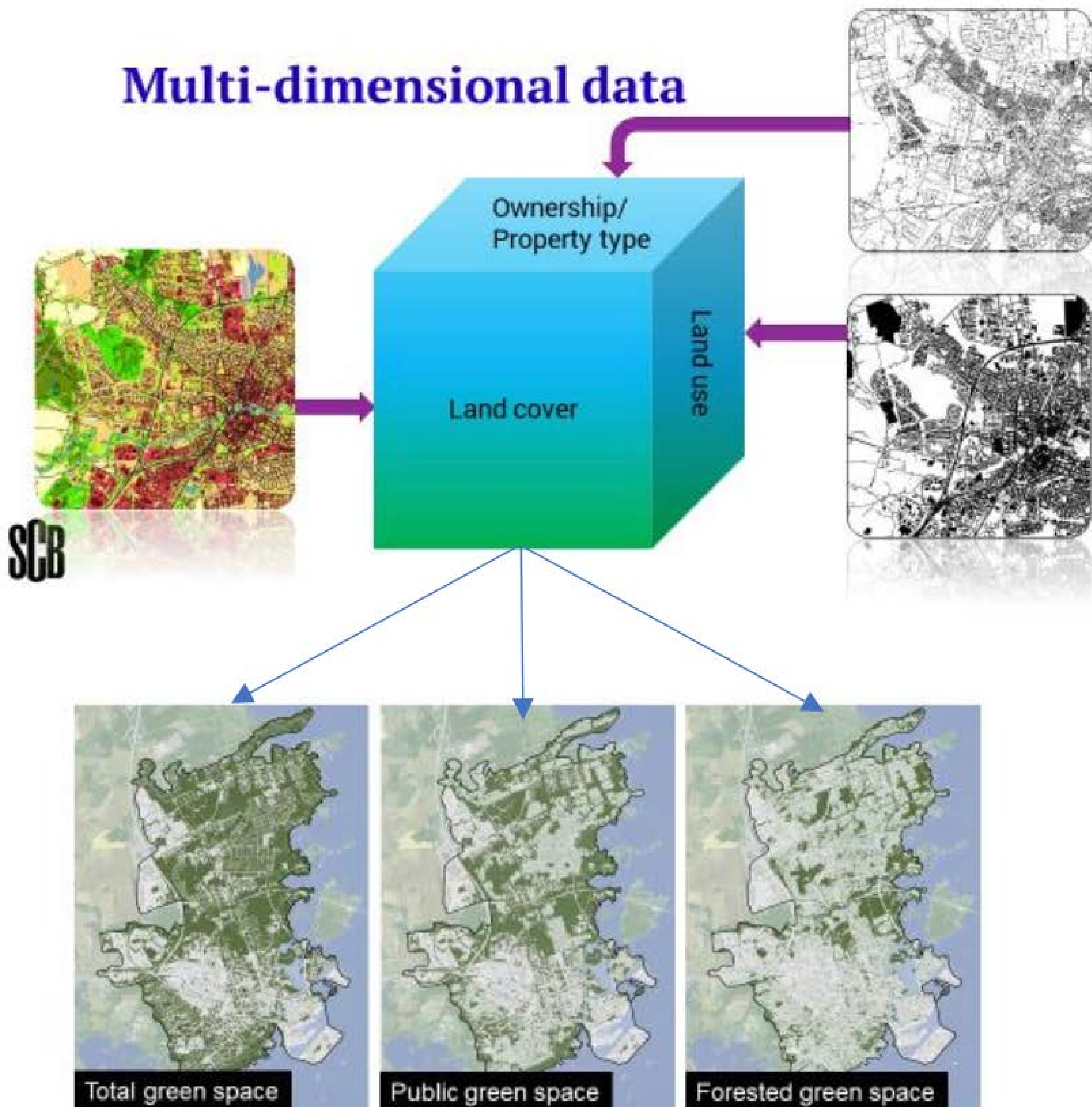


MSB, along with five other national authorities and one university, participated in a major project using EO data. The purpose of the project was to determine fire-prone levels in forests. The project, called National Land Cover Data, mapped the entire country of Sweden with 10m resolution using Sentinel data. The project has been further developed to identify areas with high and low fire susceptibility, which shows vulnerability.

More information about the project can be found on this link:
<https://www.naturvardsverket.se/upload/sa-mar-miljon/kartor/nationella-marktackedata.pdf>

MAPPING LAND COVER

In a use case from Sweden, analyzing public green spaces and overall land use, raw data from Copernicus services (Sentinel-2) was processed together with LIDAR data and other ancillary data in a joint national initiative for a national land cover database.



The combination of data sources formed a data cube where land cover types were linked with different types of ownership or land use, and brought together the following key points and recommendations for both national monitoring and European coordination:

NATIONAL MONITORING



Partnerships - key to harness the potential of EO data



For an NSI with limited infrastructure and know-how to pre-process large amount of EO data, the collaboration on the national land cover data has been paramount



Need to re-think around tools and methods to deal with large data volumes



Open data cubes with analysis-ready (EO) data can provide additional opportunities

EUROPEAN COORDINATION

The outcomes and findings of the coordinated analysis carried out on the SDG indicators by the 'UN-GGIM: Europe Working Group on Data Integration' according to the Work Plan 2017-2019 have allowed to agree on the following set of recommendations to enhance the contribution of geospatial data analysis and its integration with statistical data to address the SDG indicators:

1. Harmonize relevant geospatial data themes
2. Implement Cadastral and Land Cover data as key national authoritative data
3. Use geospatial layers generated from Earth Observation data
4. Create capacity building initiatives for NSI to take full advantage of EO based data
5. Define and implement NSDIs having in mind the requirements for statistical production
6. Implement consistent and stable sub-national spatial units
7. Develop and use population grids and other grid-based statistics
8. Adopt harmonised and comparable concepts, definitions and classifications and build consensus among Geospatial Agencies and National Statistical Institutes
9. Ensure availability and accessibility of processing workflows, including open formats of programming codes
10. Develop initiatives that promote availability, accessibility and usability of geospatial data
11. Increase the collaboration with researchers and data providers
12. Increase cooperation between National Statistical Institutes and Geospatial Agencies

STATISTICS SWEDEN

Statistics Sweden considers EO data, and EO data derivatives, as an increasingly important data source for official statistics nationally and internationally. Therefore, we are actively participating in the Swedish National Land Cover data consortium to safeguard access to high quality land cover data for land use and urban statistics.



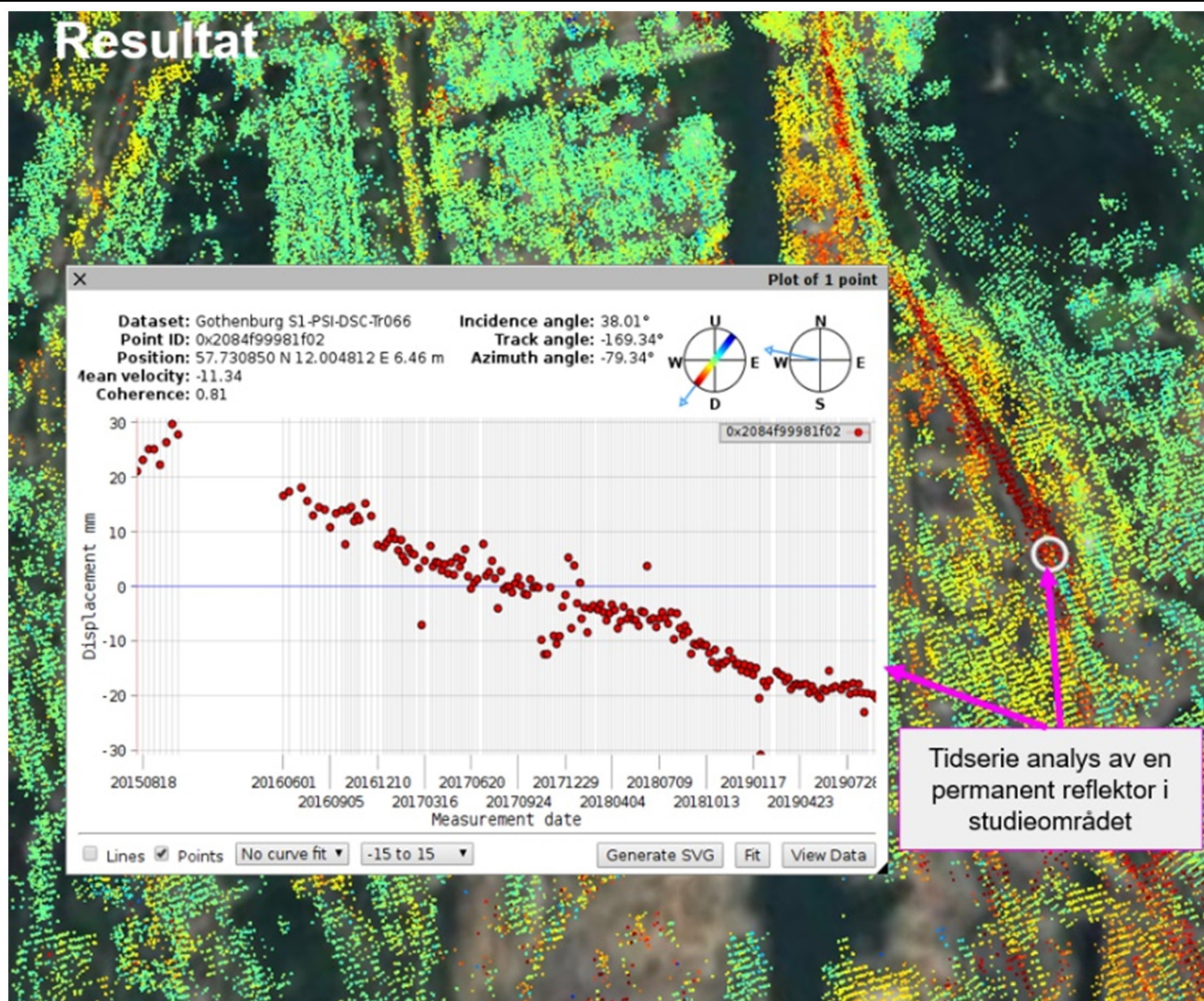
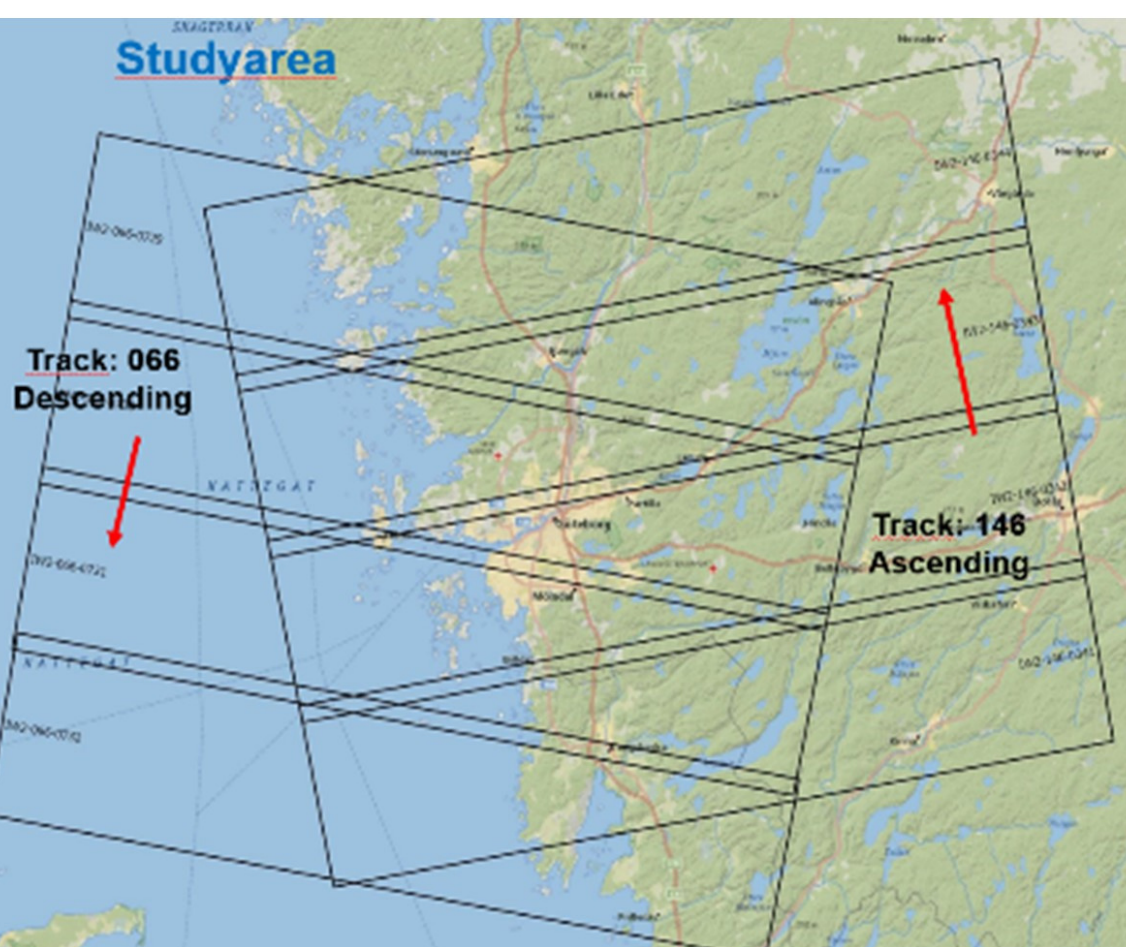
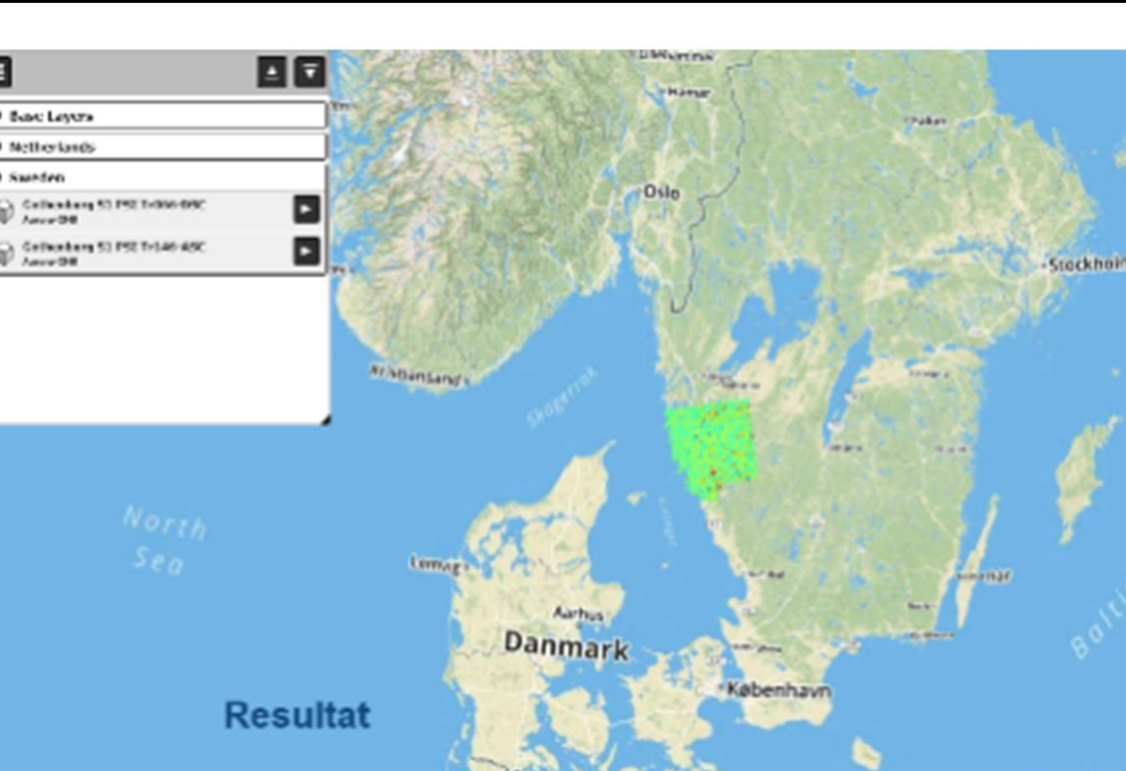
SCB, Sweden

We use pan-European Copernicus services (high-resolution layers) to calculate SDG indicators. We also welcome coordinated and sustained initiatives on analysis-ready data (e.g. open data cubes), which we believe will increase the uptake and use of EO data in public administration.

INSAR (INTERFEROMETRIC SYNTHETIC APERTURE RADAR)

The Swedish Geotechnical Institute (SGI) has conducted a pilot project with satellite imagery from the Copernicus Programme.

The project aimed to analyse ground stability by detecting vertical and horizontal deformations of static objects and develop cartography of sinking and rising areas. The technology used was InSAR (Interferometric Synthetic Aperture Radar) using coherence measurements from Sentinel 1A and Sentinel 1B.



SGI, Sweden

This can help our geotechnical engineers to discover where further investigations can be conducted. The pilot project focused on scenes covering the Western Götaland County, and it will lead to a nationwide service with an updating period of one year or more if necessary.