



**TERRA•EYE**

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# Capabilities of TerraEye System

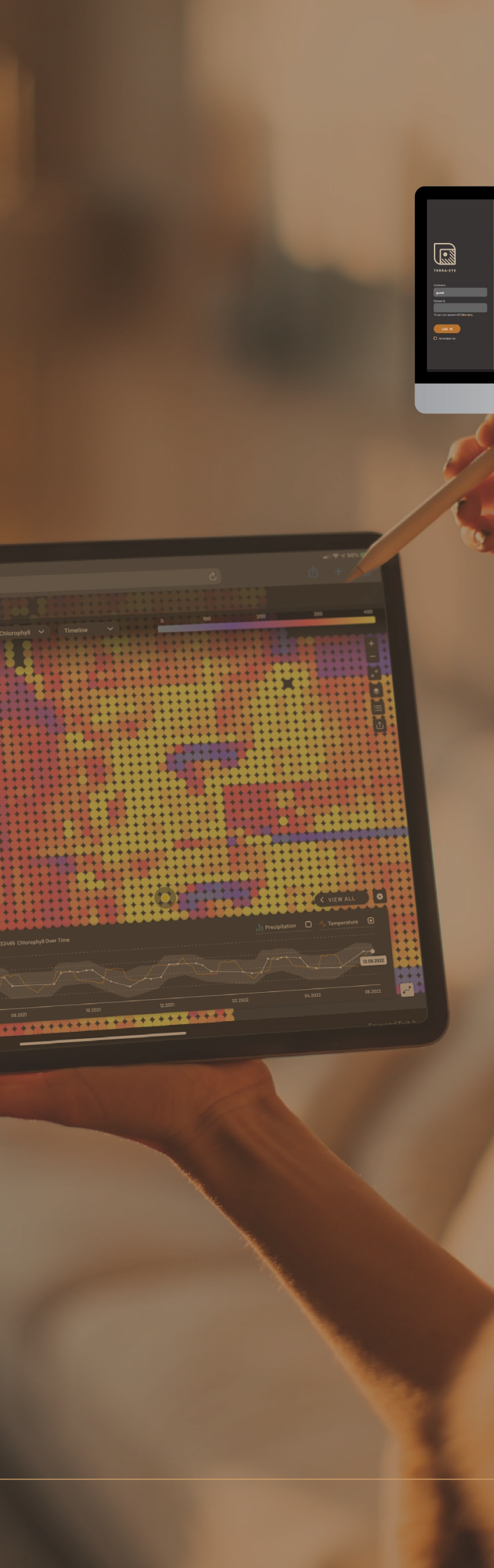
Sustainable Development Reporting  
with the Help of TerraEye System



REMOTE SENSING  
BUSINESS  
SOLUTIONS

Maximizing efficiency and accuracy  
with AI-powered satellite data processing





## TERRA-EYE

TerraEye is a tool, dedicated to the opencast mining industry, among other things, monitor the environmental impacts of opencast mines. The functionalities we are developing are based on satellite data analysis, with the support of artificial intelligence and machine learning. In this article, we present selected functionalities relating to environmental impacts, using several Russian open-pit mines as examples.

The idea behind the TerraEye system is automated monitoring of both mining areas and surrounding areas affected by mining activities. Monitoring of areas affected by mining activities is centered around the environmental impacts of open-pit mining. In an era of increasing social and environmental awareness, effective monitoring and reporting of these impacts is becoming mandatory in most countries.

## GENERAL OVERVIEW OF ESG

Corporate sustainability reporting refers to informing employees and local communities about an entity's activities. Sharing information regarding the integration between environmental and social factors in business operations fosters transparency and credibility for the company (GOV, 2022).

**In light of the new obligations imposed by EFRAG, individuals should arm themselves with the right tools to monitor environmental impacts.**

**The European Financial Reporting Advisory Group (EFRAG) in April 2022 issued a series of drafts of the Uniform Sustainability Reporting Standards (ESRS), which are designed to standardize sustainable development reporting standards to enable comparability of data in reports produced by companies.**

The standards impose sustainable development reporting obligations on all large companies and major capital groups from Jan. 1, 2024, which means that individuals will have to submit a report for 2023. For SMEs (except micro-enterprises), the report will be mandatory starting January 1, 2026 (Szewc, 2022).

The standards relate to three main topics, which are:

1. **Environment (E)**
2. **People and society (S)**
3. **Corporate Governance (G)**

The standards thematically related to the environment highlight issues such as climate change, pollution, water, and marine resources, biodiversity and ecosystems, and the closed-loop economy (Biernacki, 2022).

Considering the draft sustainability reporting standard treating biodiversity and ecosystems (ESRS E4), its provisions require an entity to, among other things, disclose information on how the company affects biodiversity and ecosystems, noting both the negative and positive impacts of operations. The company should also disclose any measures that have been taken and the results of those actions, the purpose of which has been to inhibit, mitigate or remediate the negative effects of the activity and to protect and restore biodiversity.

**In order to meet the imposed disclosure requirements, it is necessary to monitor areas that are both directly and indirectly affected by the entity.**

**In ESRS E4, The European Financial Reporting Advisory Group recommends satellite imagery as one of the methods of collecting data and mixing the company's impact on biodiversity and ecosystems (EFRAG, 2022).**

In ESRS E4, the European Financial Reporting Advisory Group recommends satellite imagery as one method of collecting data and measuring a company's impact on biodiversity and ecosystems (EFRAG, 2022).

Satellite data has many qualities. They are acquired in a non-invasive manner, additionally carrying spatial information. Data recording can take place every few days or even daily, depending on the temporal resolution of the remote sensing sensor. Also, a great advantage is the availability of archival data (satellite monitoring has been carried out since the 1970s). The measurement method, frequency of data recording, spatial coverage, and access to archival data make satellite imagery a valuable source of information for companies whose responsibility will be to report on biodiversity and ecosystems.

## TERRA-EYE SYSTEM - REPORT INPUT

In light of the new obligations imposed by EFRAG, individuals should arm themselves with the right tools to monitor environmental impacts. The TerraEye system was developed in response to the needs of businesses. Its task is to provide interpretable data based on satellite imagery, which can serve as input to the analyses presented in the sustainable development report. The usefulness of the TerraEye system is justified by the ESRS E4 records cited below, their corresponding functionalities, and their use.

In addition, the TerraEye system helps companies meet **Sustainable Development Goals (SDG)**. Examples of the goals that the TerraEye system helps meet through regular satellite monitoring are:

- Clean water and sanitation
- Life underwater
- Life on land



Developed water detection functionality allows the user to monitor both the changing surface of water bodies and selected water quality indicators.

### Paragraph 55.

Paragraph 55 requires the preparer to disclose information on its impact on species and ecosystems. In the case of aquatic ecosystems, the TerraEye system provides data carrying information on changes in water surface area and changes in the trend of remote sensing indicators over a given period. This allows an entity to assess its impact on aquatic ecosystems and indirectly on the species there.

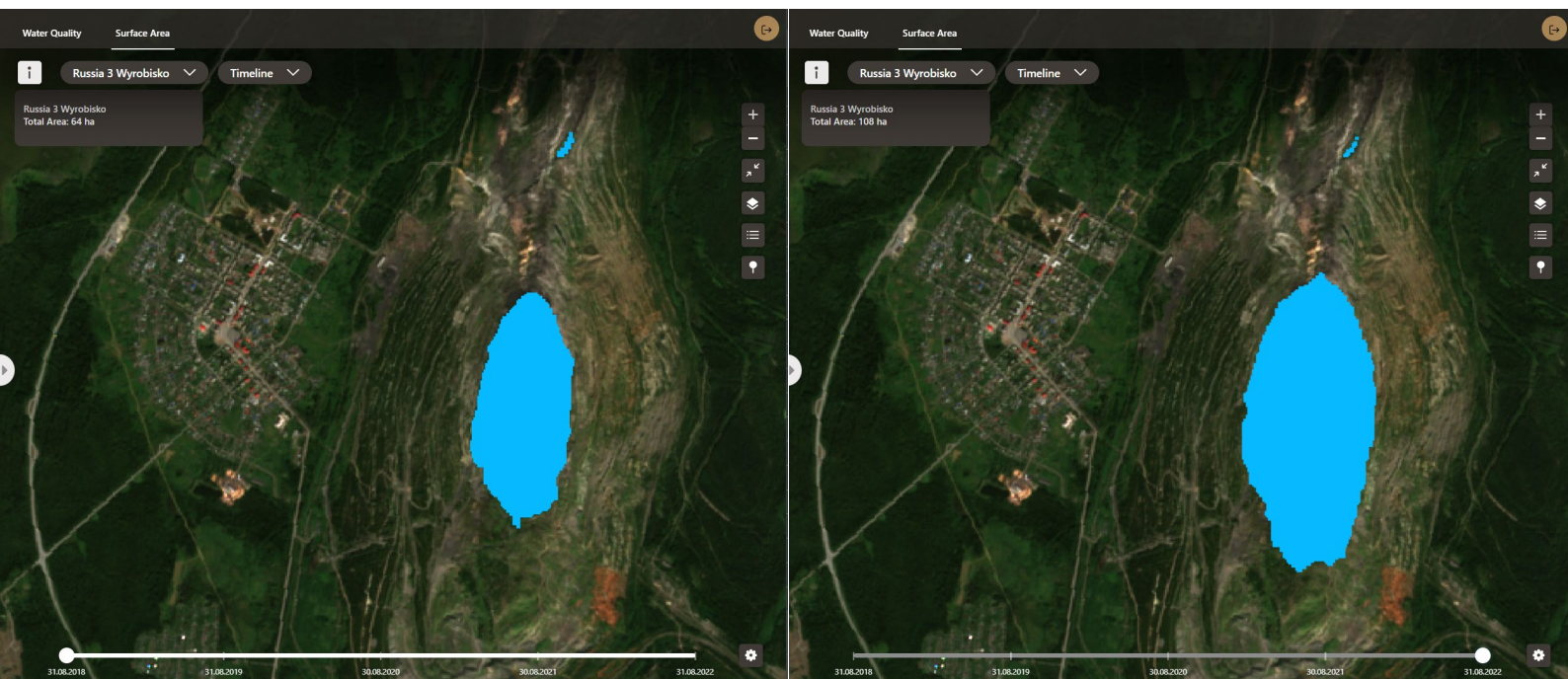


Fig. 1. Changes in the surface of the water table in the final pit after lignite mining. View from the TerraEye application.

**AG 69.**

According to AG 69. (annotation/advice on requirement), a company is required to disclose information on the risk of global extinction of species. EFRAG indicates that the change in a species' area of habitat (AoH) can be used as a proxy for the change in a species' population size.

Information on the change in the area of the water surface provided by the TerraEye system allows the company to interpret the data received and assess how its activities affect the extinction risk of a given species living in aquatic ecosystems.

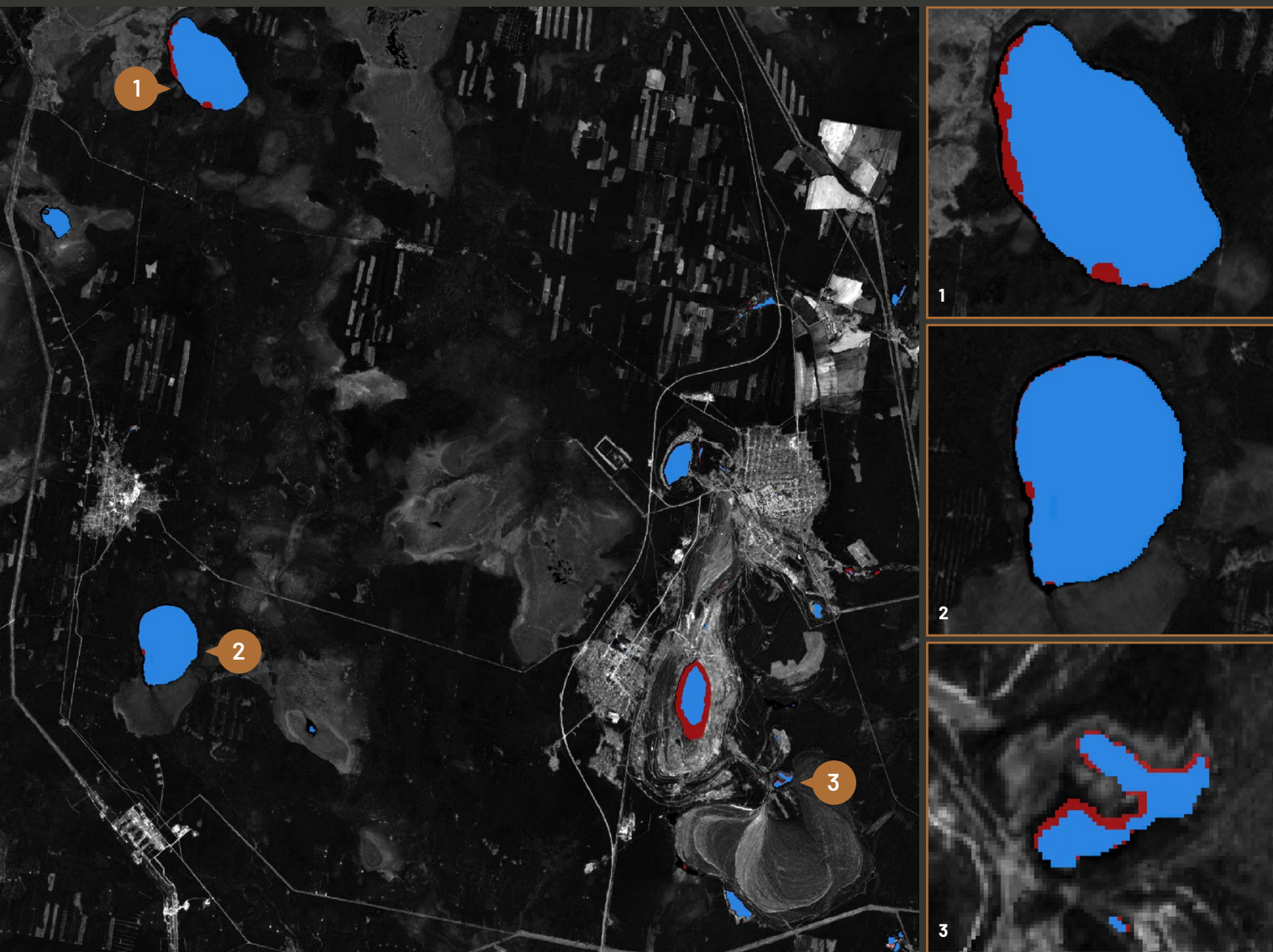


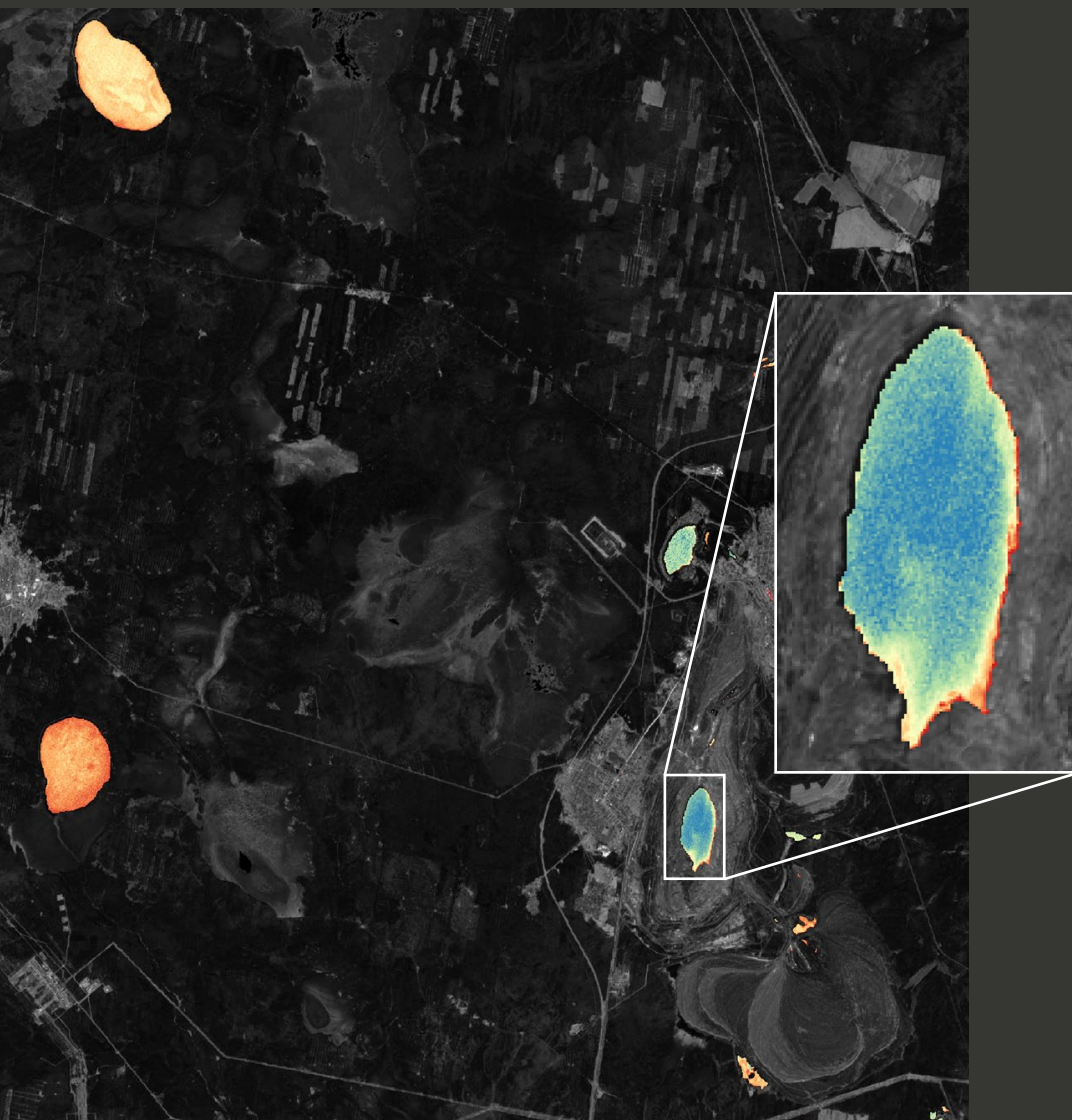
Fig. 2. Changes in water surface area in lakes.



### Paragraph 46.

Paragraph 46. requires an entity to disclose information about the impact of its activities on biodiversity, ecosystem services, and parent ecosystems. These include, but are not limited to, land use change, habitat change, or pollution. The TerraEye system, by calculating remote sensing indicators, can provide

the preparer of the report with the information necessary to analyze the possible presence of contaminants in the water. Also, the indication of hot and cold spots can help an individual locate a potential source of pollution.



The figure on the left shows an example of analytical results for dissolved organic carbon (DOC) in 2019 at location Decommissioned Open Pit Lignite Mine and surrounding natural reservoirs. It should be noted that the amount of dissolved organic carbon in anthropogenic post-mining reservoirs that fill with water is at a much lower level than in natural lakes.

Fig. 3. Comparison of dissolved organic carbon (DOC) content in the final pit and surrounding lakes in 2019; on the approximation - map of DOC indicator hot-spots in the end pit.

The developed greenery detection functionality is used to inventory the vegetation cover in the area affected by mining activities by indicating the extent of each vegetation cover class.

### AG 64.

According to AG 64., land cover is a type variable that can be assessed using satellite data. As part of the AG 62. notation, a company can disclose information on land cover changes that are the result of anthropogenic factors.

Examples of such disclosures are the size of forest areas converted to agricultural land or as a result of urbanization. The green detection functionality allows the enterprise to obtain quantitative land cover data that can help it prepare a report.

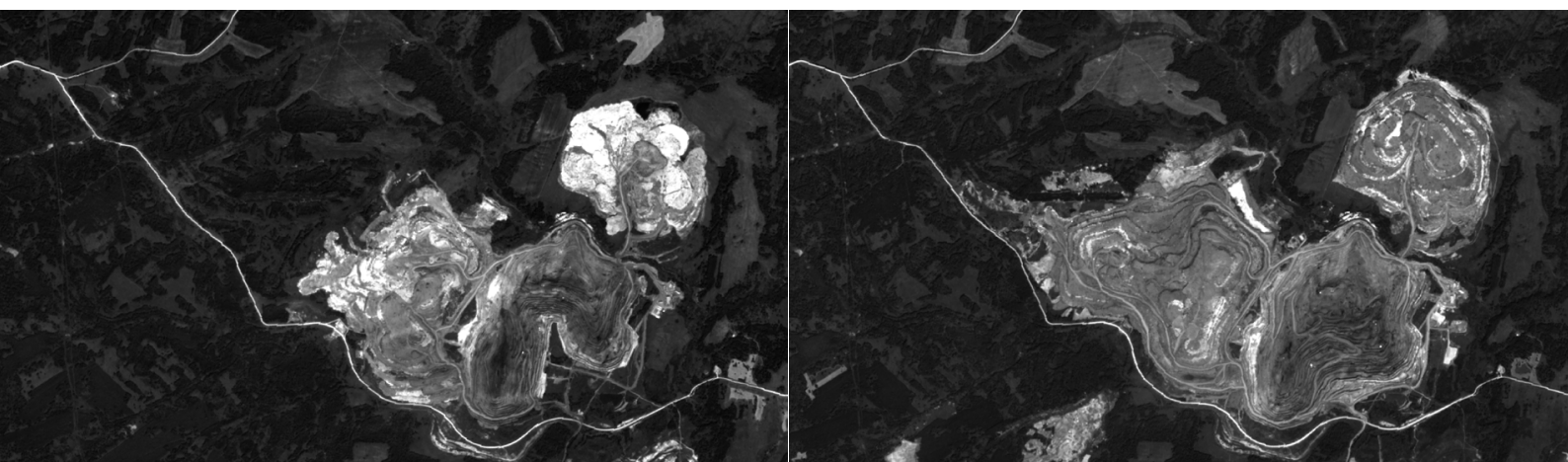
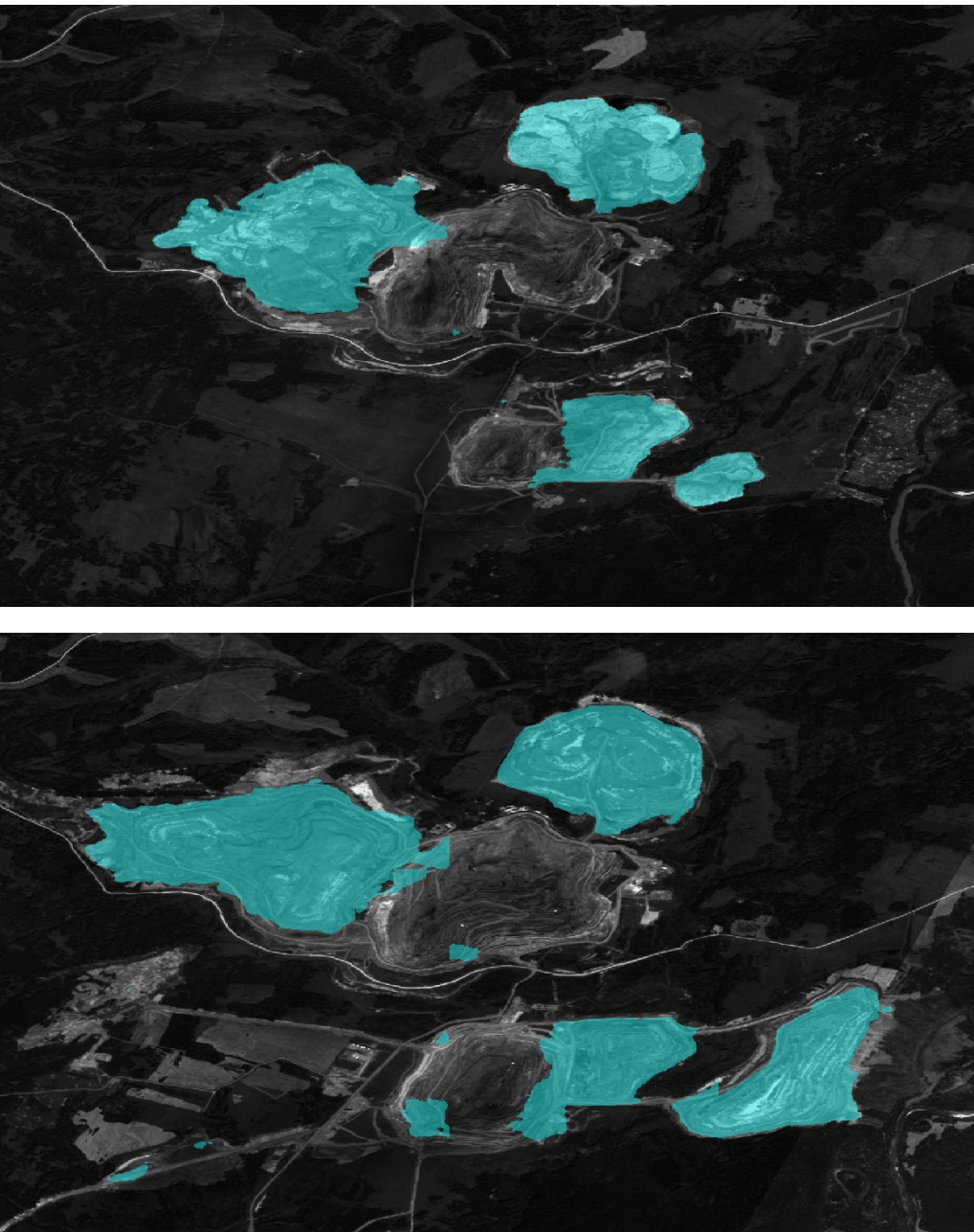


Fig. 4. Changes in the area of the excavations from 2017 to 2021.





## AG 10.

It is clear from the AG 10. a provision that the process of identifying and assessing the impacts, risks, and opportunities of the company related to biodiversity, among other things, includes:

- impacts related to biodiversity and ecosystems,
- short-, medium- and long-term dependencies.

The archival data offered by the TerraEye system can help the enterprise draw correct conclusions in the above identification process.

In the exposed mining area, there is a significant increase in size of pits and dumps. The TerraEye system has provided information that, because of the progress of external dumping, the total area of the 4 existing external dumps has increased from nearly 900 to more than 1,378 hectares between 2018 and 2022. As a result, about 417 hectares of land have been taken out of use for waste rock placement alone. The heap in the eastern part of the mining area increased most significantly, increasing its area by more than 200 hectares.

Similar analyses of area changes were made for other predicted classes of mining area elements. The effectiveness of the prediction systematically increases as the amount of input data for the machine learning models increases.

Fig. 5. Changes in the area of dumps in 2018-2022.

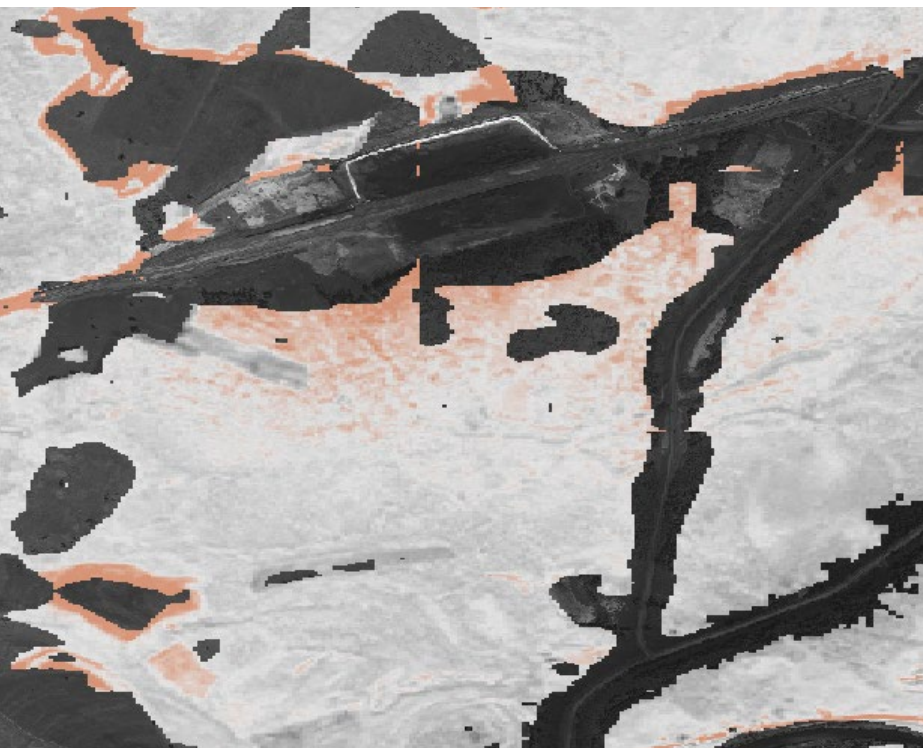
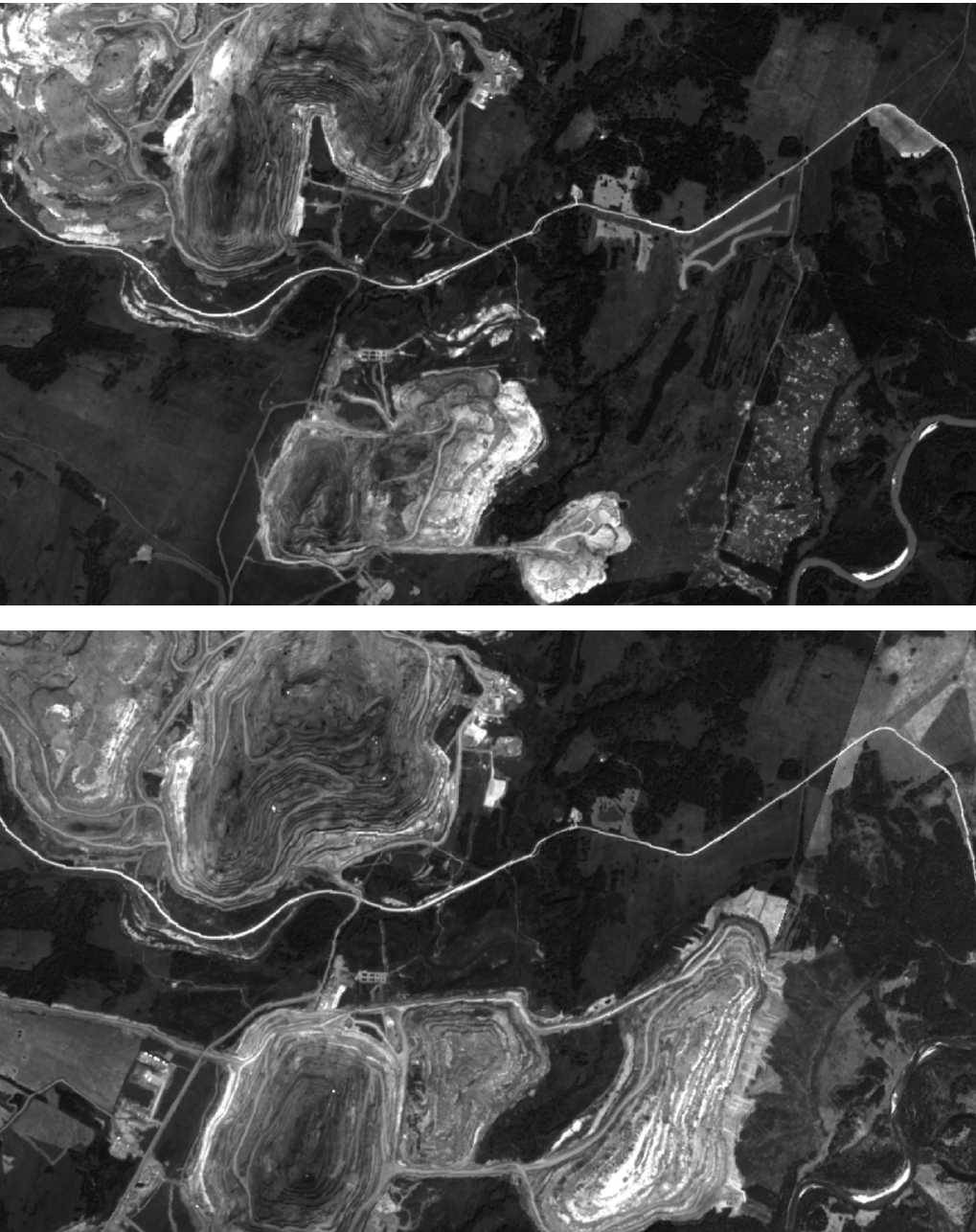


Fig. 6. Excerpt of the area showing the newly transformed area in 2021 (top); comparison of NDVI values between 2017 and 2022 (bottom).

## AG 19.

The provision of AG 19. requires the entity to disclose information about significant threats to biodiversity and ecosystems under physical risks, which may be the process of desertification of the land surface or fragmentation of forests. Regular provision of data by the TerraEye system on land cover and values of remote sensing indicators can enable the enterprise to identify such risks early.





## Paragraph 47.

Paragraph 47. obliges entities to report information on land use that has been assessed as a significant factor affecting the loss of biodiversity and ecosystem services. In addition, the wording of the requirement indicates that such activities may be mining activities. The functionality of the TerraEye system - segmentation of elements provides information on the magnitude of changes caused by the activities of the mine, as shown in the example, the TerraEye system allows the acquisition of data on land use changes.

Fig. 7. Photo showing changes in land use as a result of mine operations.



## SUMMARY

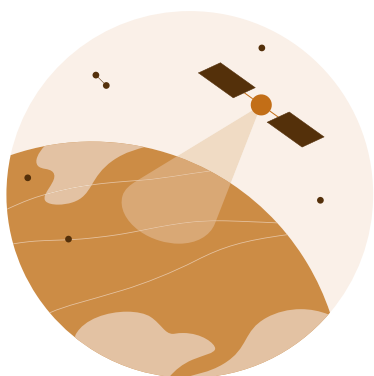
**The obligation to prepare sustainable development reports as of January 1, 2024 forces companies to start collecting data on their environmental impact as early as 2023.**

The use of the TerraEye system will enable companies to easily access interpretable data (including archived data), which, as indicated above, is an important input to the analyses required in preparing a sustainable development report. An additional advantage of the TerraEye system is the ability to present information in graphical form. The illustrations make the report much clearer to the report user.



# Our concept for critical sites monitoring

With a wide range of customers we understand the need for data in different ranges and different detail. To provide those types of information we aim to integrate with all types of technologies for data gathering.



## THE BIG PICTURE

**Satellite imagery provides the most diverse and up to date information:**

- Every 2-3 days new multispectral images are available;
- Every 12 days new radar data is acquired for ground displacement information;
- Access to hyperspectral imagery data allows for more complex analysis.



## A CLOSER LOOK

**Drones (UAV) can be deployed to further supplement satellite data and to get more specific information about a region or a site:**

- When better resolution is needed;
- When clouds obscure specific location;
- In case validation of sat data is needed.



## IN-SITU DETAILS

**Accessing granular information via additional sensors and physical sample gathering.**

- Used to create and confirm analysis results.
- Gathering samples in specific locations in case of specific events or to acquire more insight for a planned future project.



## PARTNERSHIP

To achieve the highest quality of presented information and constantly improve our machine learning algorithms, we cooperate with the experts:

- Working on data from optical constellations (including Pléiades Neo, Pléiades, SPOT DMC Constellation, Vision-1) through cooperation with Airbus, SentinelHub, ESRIC, Maxar, SatRev, Pixxel and SkyWatch.
- Cooperating with Prometheus S.A. as part of the implementation of drone flights and data acquisition.
- Cooperating with the Faculty of Geology of the University of Warsaw and the Wrocław University of Science and Technology to improve our algorithms.
- Supporting by Microsoft, PWC and ESA in developing our system.
- Receiving funding from the National Centre for Research and Development.

**AIRBUS**

**MAXAR**

**esric**

**sentinelhub**

**pixxel**

**SATREV**

**Microsoft**

**PROMETHEUS**

**pwc**

**esa**

**UNIwersYTET  
WARSAWSKI**

**Politechnika Wroclawska**

**SKYWATCH**

**NCBR**  
Narodowe Centrum Badań i Rozwoju



## ABOUT US

Our mission is to reduce the environmental impact of opencast mines by means of new technological innovations. Helping mining professionals make smarter decisions with data, satellite imaging and analytics.

There is no tool on the market that in easy and simple way can assess environmental impact, production bottlenecks and monitor productivity.



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## Contact

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