Investigating the value brought by the use of Copernicus Sentinels data in European Public Administrations

Examples from two ESA-lead initiatives

Dr. Alessandra Tassa | European Space Agency
With contributions from
- Roya Ayazi | NEREUS aisbl | Belgium
- Geoff Sawyer | EARSC (European Association of Remote Sensing Companies) | Belgium

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Preamble

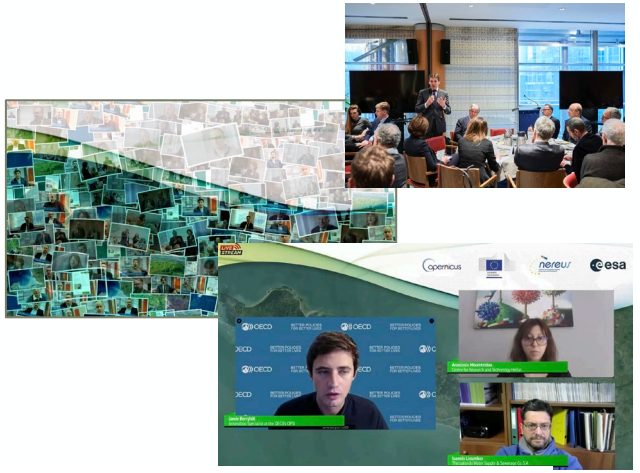
“European public authorities can leverage Copernicus as an effective tool to make informed decisions, enforce environmental policies and build more sustainable and resilient lifestyles for European citizens.”

..not as obvious as it may seem…

Copernicus4regions

Investigating the ever-growing use of Copernicus across Europe's regions

- Managed by the Network of European Regions using Space Technologies (NEREUS)
- Funded by the EU and ESA
- Intensive and multi-faceted capacity building activity at high political level
- An effective "bridge" between service providers, service users and politicians



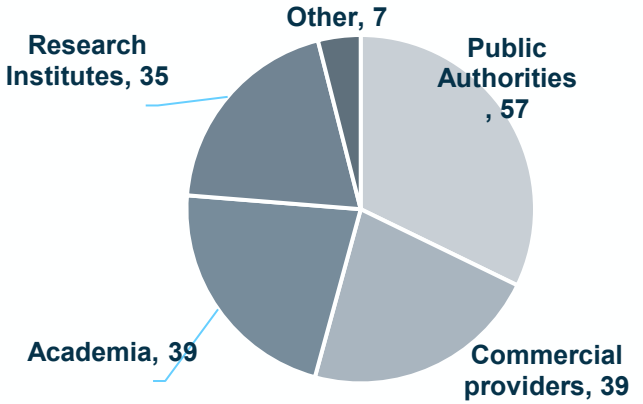
MEMBERS OF THE EUROPEAN PARLIAMENT

LOCAL AND REGIONAL POLITICIANS

Visit http://www.nereus-regions.eu/copernicus4regions/

Want to know more?
Follow Roya Ayazi at the LPS22!
Copernicus4regions - How interregional best-practice and knowledge sharing contributes to space capacity building
Thursday 26@10:40 E1.04.1

Copernicus4regions publication



99 peer-reviewed user stories, 177 co-authoring entities of which 57 PAs

Source | [The ever growing use of Copernicus across Europe's regions]

Use of Sentinels data from European LRAs: examples

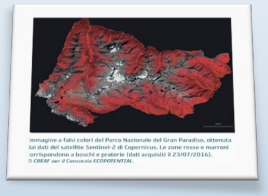
ThuringenForst Institute

UML

Operational Afforestation Monitoring, p.96

Gran Paradiso National Park

UML



MONITORARE LE PRATERIE DI ALTA QUOTA PER PROTEGGERE GLI UNGULATI SELVATICI

Lemvig Utility

UML

Don't pour the money down the drain: fix it!

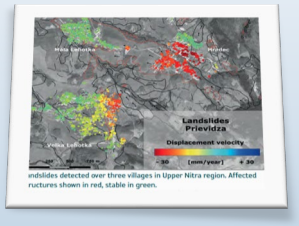
Latvia Rural Support Service

SENTINELS FOR FLOOD AND YIELD LOSS MAPPING

Public Service of Wallonia

CHANGE DETECTION ANALYSIS ON WALLOON BROWNFIELD SITES, p.184

Slovakia State Geological Institute



SENTINEL-1 MONITORS GEOHAZARDS TO SECURE CITIZENS HOMES

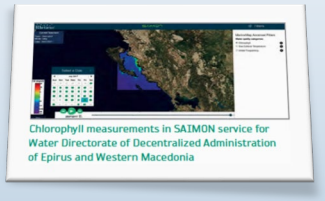
Intermunicipal Community of Coimbra Region

COPERNICUS HELPING CIVIL PROTECTION

National Land Survey of Iceland

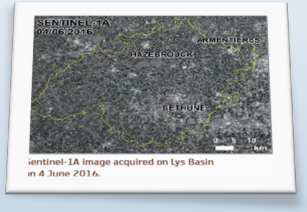
KEEPING TRACK OF RETREATING GLACIERS IN ICELAND

Decentralized Administration of Epirus and Western Macedonia



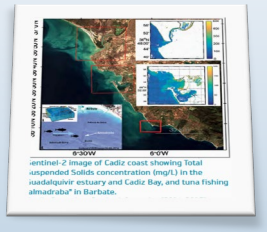
MONITORING COASTAL WATERS IN NEAR REAL TIME

Basin authority of the Lys river



COPERNICUS FOR LYS BASIN WATER MANAGEMENT

National Coastal Office in Cadiz

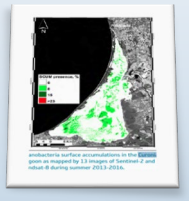


SENTINEL-2 SUPPORTS COASTAL MANAGEMENT FOR OPTIMISED DECISION MAKING

Norwegian Avalanche Warning Service

IMPROVING SNOW AVALANCHE FORECASTING

Lithuania Environment Protection Agency



Tracking algal blooms in the Curonian lagoon

Geological Survey Ireland

MONITORING GROUNDWATER FLOODING IN IRELAND USING SENTINEL-1 SAR

Metropolitane Milanesi SpA

MONITORAGGIO DELLO STATO DI SALUTE DELLE RETI IDRICHE E FOGNARIE, p.246

Use of Sentinels data from European LRAs: quotes

ThuringenForst Institute

*The successfully implemented monitoring system is a **timesaving tool** for foresters*

Operational Afforestation Monitoring, p.96

Gran Paradiso National Park

*The use of Sentinels data **has improved** the control and management of high-altitude grasslands providing plenty of information for remote areas*

MONITORARE LE PRATERIE DI ALTA QUOTA PER PROTEGGERE GLI UNGULATI SELVATICI

Lemvig Utility

*The use of EO data is becoming mainstreamed into our **long-term strategic planning** leading to a **more cost-efficient** water sector to the financial benefit of all citizens."*

Don't pour the money down the drain: fix it!

Latvia Rural Support Service

*Using Sentinels to check damaged fields lets us finish **compensation payments in less than** two months from the first drop of rain."*

SENTINELS FOR FLOOD AND YIELD LOSS MAPPING

Public Service of Wallonia

*This application, based on Sentinel data, **will save time and reduce the costs** of updating brownfield inventory."*

CHANGE DETECTION ANALYSIS ON WALLOON BROWNFIELD SITES, p.184

Slovakia State Geological Institute

*Thanks to Sentinel-1 we can monitor landslides threatening citizens' homes **more reliably and with unprecedented detail**."*

SENTINEL-1 MONITORS GEOHAZARDS TO SECURE CITIZENS HOMES

Intermunicipal Community of Coimbra Region

*Copernicus **aids daily decision-making activities**, minimising the implications of environmental threats."*

COPERNICUS HELPING CIVIL PROTECTION

National Land Survey of Iceland

*Using the Sentinel images to update our map database has not only improved our data but also our **productivity**."*

KEEPING TRACK OF RETREATING GLACIERS IN ICELAND

Decentralized Administration of Epirus and Western Macedonia

*Thanks to the SAIMON, we are able **to provide to our citizens accurate and reliable information about the Eutrophication risk** in our regions coastal area on a daily basis."*

MONITORING COASTAL WATERS IN NEAR REAL TIME

Basin authority of the Lys river

*These maps provide us with **reliable data** on rural areas, which in time will **allow us to focus the manpower** to help with crisis management and feedback."*

COPERNICUS FOR LYS BASIN WATER MANAGEMENT

National Coastal Office in Cadiz

*Sentinel-2 will definitely help us to **solve the challenging** water quality monitoring along the coast of Cadiz, bringing new perspectives of applications into focus such as dredging-induced turbidity monitoring."*

SENTINEL-2 SUPPORTS COASTAL MANAGEMENT FOR OPTIMISED DECISION MAKING

Norwegian Avalanche Warning Service

*Avalanche detections from radar satellite data **decrease the uncertainty** of our avalanche forecasts."*

IMPROVING SNOW AVALANCHE FORECASTING

Environment Protection Agency Lithuania

*The implementation of the WFD was always challenging, relying only on insitu monitoring. We believe satellites will provide us with **regular additional information** about status of our lagoons*

Tracking algal blooms in the Curonian lagoon

Geological Survey Ireland

*Sentinel 1 data **has transformed** the way we monitor groundwater flooding in Ireland. It **provides a practical method to monitor a complex problem**."*

MONITORING GROUNDWATER FLOODING IN IRELAND USING SENTINEL-1 SAR

Metropolitane Milanesi SpA

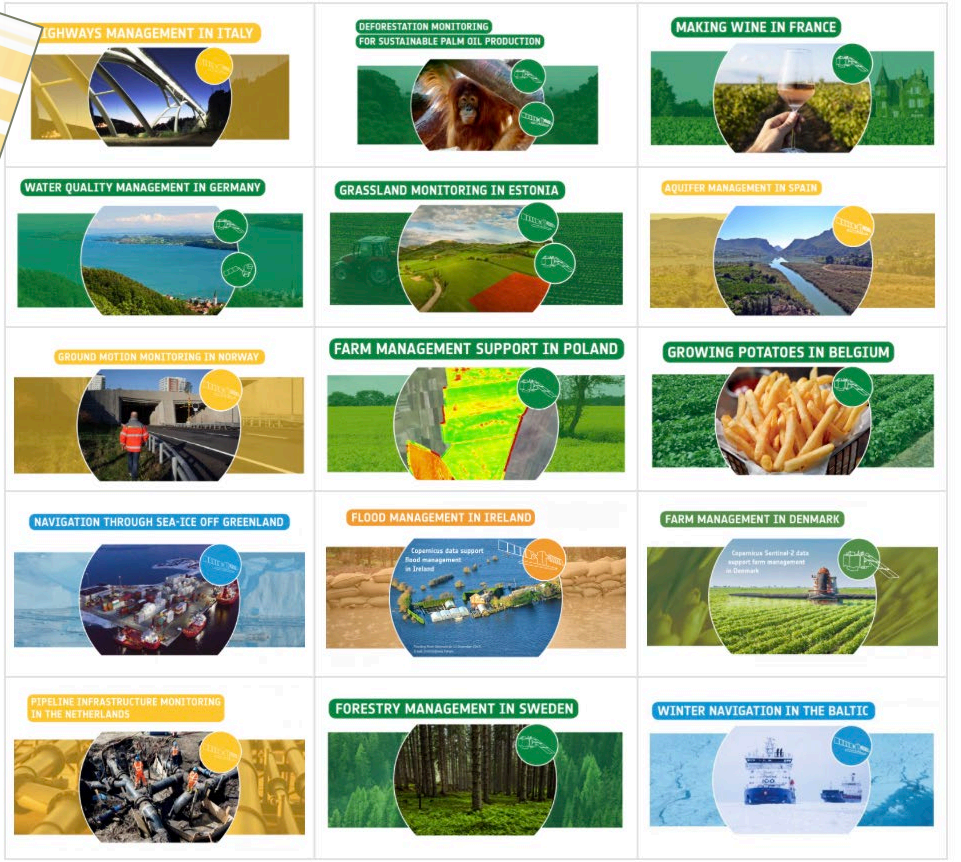
*We found satellite radar interferometry **the most accurate and affordable survey method** to prevent and detect potential sewer and water network failures."*

MONITORAGGIO DELLO STATO DI SALUTE DELLE RETI IDRICHE E FOGNARIE, p.246

SeBS: the Sentinels Benefits Study

Showcasing the benefits derived from the use of Copernicus Sentinels through fully developed value chains

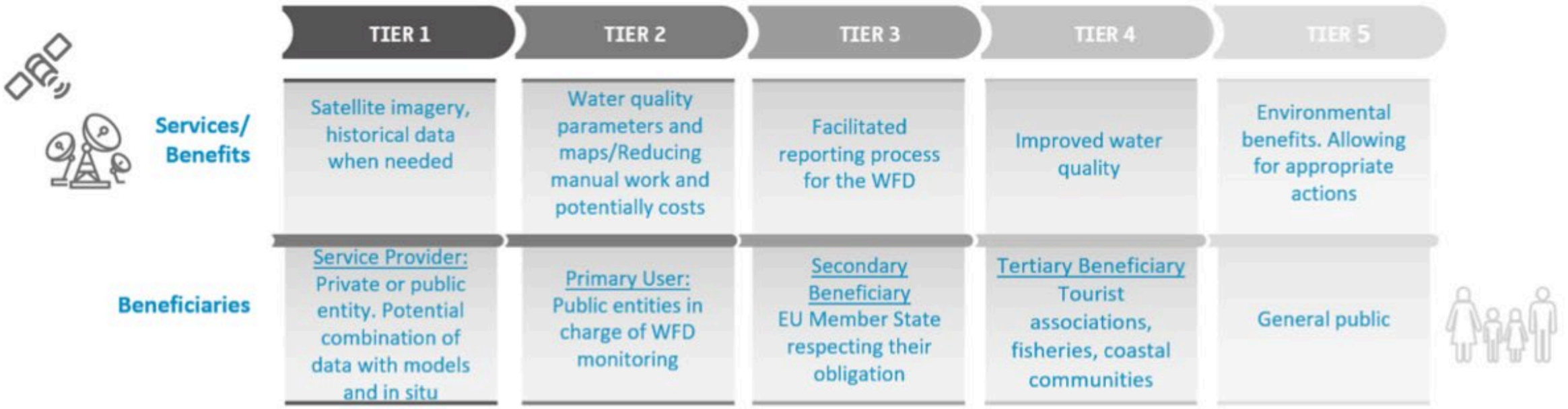
- Managed by the European Association of Remote Sensing companies (EARSC)
- Funded by the EU and ESA
- 15 long case + 8 short case reports
- Complementary cross-cutting analyses
- Fully fledged methodology available for practitioners



Visit http://earsc.org/sebs

SeBS Methodology: the value chain analysis

The analysis extends throughout the full set of consequential impacts, from data use to society



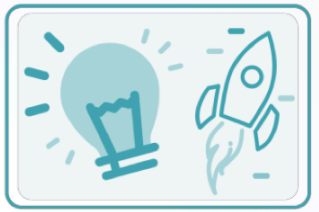
Use of EO data and beneficiaries in the case WFD-related water quality reporting

Source | SeBS Methodology: A practical Guide for Practitioners to evaluate the benefits brought from EO data

SeBS Methodology: 6 dimensions of value

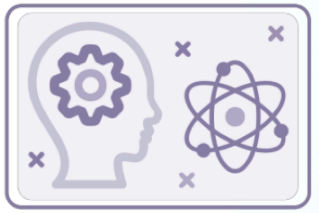
Benefits are assessed through six different dimensions

ECONOMIC
Impacts related to the production of goods or services, or impacts on monetary flow or volume, such as revenue, profit, capital and (indirectly, through turnover generation) employment.



INNOVATION AND ENTREPRENEURSHIP
Impacts linked to the development of new enterprises, business or jobs and/or the introduction of technological innovation into the market.

ENVIRONMENTAL
Impacts related to the state and health of the environment, particularly as regards the ecosystem services on which human societies depend.



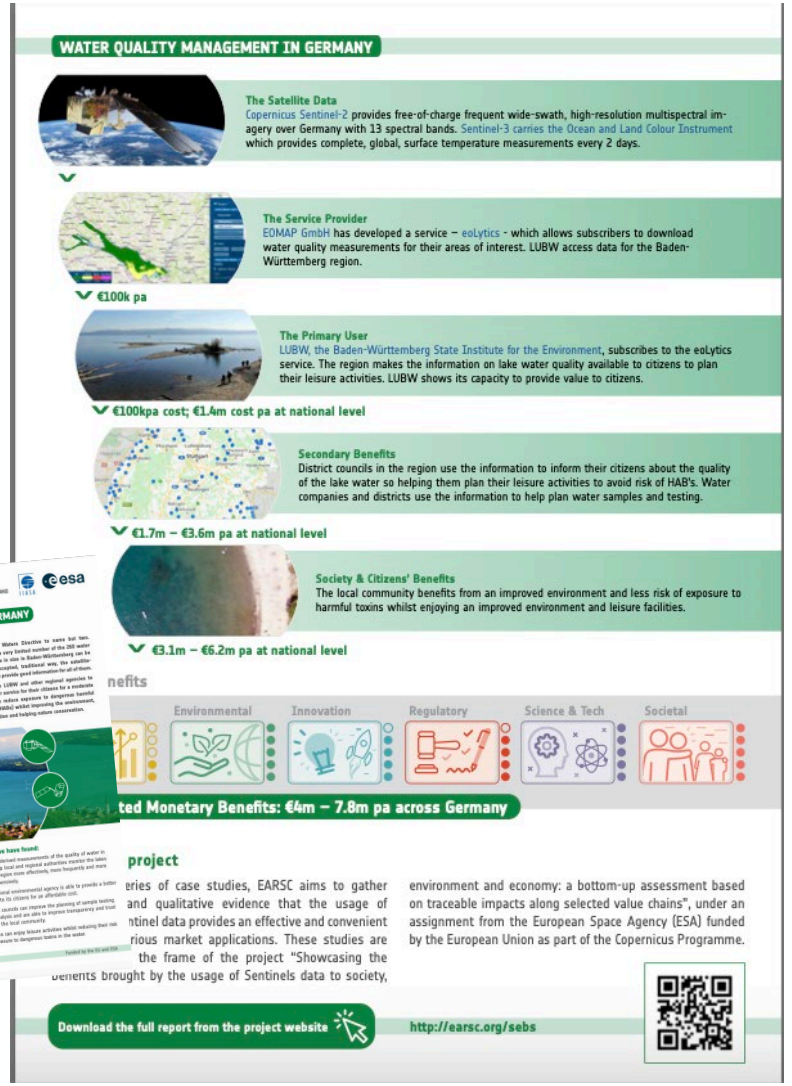
ADVANCEMENTS IN SCIENCE AND TECHNOLOGY
Impacts linked to academic, scientific or technological research and development, the advancement of the state of knowledge in a particular domain.

REGULATORY
Impacts linked to the development, enactment or enforcement of regulations, directives or other legal instruments by policy makers.

SOCIETAL
Impacts related to societal aspects such as increased trust in authorities, better public health or secured geostrategic position.

Source | SeBS Methodology: A practical Guide for Practitioners to evaluate the benefits brought from EO data

SeBS benefits evaluation framework



Source | SeBS case: Water Quality Management in Germany

- Increased revenue (tier 1)
- Cost savings from in-situ testing and less chemicals for water treatment (tier 3)
- Citizens saving time, better health, access to leisure amenities as well as nature (tier 4)

- Reduced pollution (less fertiliser run-off)
- Maintaining natural habitats and biodiversity (tier 4)
- Earlier detection of environmental threats – HAB's. (tier 3 & 4)

- Improving regulations on the water sector (use of fertiliser, chemicals, water)
- Improving controls and reporting on water quality
- Improving understanding of regulatory impacts leading to further improvements in policy design.

- Innovation driver within the supplier and the primary user as well as extended network (Tier 1&2)
- Changing "operational practices within the German environment agencies. (Tier 3)

- Wide-scale nature of the measurements possible with Sentinel data is enabling research projects into ecosystems services as well as impacts of water quality.

- Improved access to amenities linked to water bodies (swimming, fishing, sailing, etc
- Fewer health issues induced by poor water quality
- Better quality of life.

SeBS benefits for public administrations

Benefits for public administrations are diverse and specific, but recurring patterns have been observed

- Cost savings
- Efficiency gains
- …..

- Innovation in the internal processes of the administration
- …..

- Development of in-house competencies in EO domain
- …..

- Improvement of legislation
- Improved capabilities for policy enforcement
- …..

- Improved internal coordination and situational awareness
- Improved transparency with the public
- Improved services to citizens
- Improved trust from the public
- Sense of satisfaction for own work
- …..

SeBS Regulatory Benefits 1/2

Preparation & Design of Legislation
whereby, b*y offering new measurements, EO/Copernicus data allows the design of regulations to be improved to reflect existing or new policy needs*

Policy Evaluation
whereby EO/Copernicus data can be used to support systematic or ad-hoc monitoring of the adequacy of the policy and the efficiency of its implementation

Public Accountability
Whereby civil society can get independent evidence of policies implementation. Not a part of the policy cycle, but an important attribute linked to public authority performance and evaluation

Compliance Monitoring
whereby EO/Copernicus data are used by the relevant authorities to assess the level of alignment to the prescribed behaviour and/or its breaches

Compliance Reporting
Whereby EO/Copernicus data can help to improve the efficiency and effectiveness of agency reporting obligations

Follow-Up and Enforcement
EO/Copernicus data are used in enforcement- related proceedings and to provide courts with evidence of illegal activities (e.g., judiciary or audits)

Compliance Promotion
EO/Copernicus data support deterrence from non-compliances by raising awareness amongst potential offenders of the ability to detect non-compliance (and the possibility to enforce if necessary)

Source | SeBS Report: Showcasing examples of Regulatory Benefits

SeBS Regulatory Benefits 2/2

Preparation & Design of Legislation	Examples found where regulations have been changed (or are planned) as a result of the availability of Sentinel data	• Managing Forests in Sweden • Ground Motion Monitoring in Norway • Aquifer Monitoring in Spain
Compliance Monitoring	Examples found where compliance with existing regulations is monitored better through the use of Sentinel data	• Grassland in Estonia • Aquifer Monitoring in Spain • Water Quality in Germany
Compliance Reporting	Not many examples were found where both reporting is required and Sentinel data can or are allowed to support this.	• Grassland in Estonia • Water Quality in Finland
Follow-Up and Enforcement	Limited examples of the use of Satellite data in courts due to the difficulty to overcome practical and legal obstacles.	• Wild Boars in Lithuania • CleanSeas in the Mediterranean
Compliance Promotion	Numerous cases where communicating the capability to detect non-compliance coupled with public visibility of detections, plays a deterrent role vis-á-vis potential perpetrators.	• Dredging in the Maldives • Grasslands Monitoring in Estonia • Managing Forests in Sweden
Policy Evaluation	This aspect has not figured in our case analysis. From the interaction with users, it would seem possible but mostly, cases do not have a sufficiently long history…	
Public Accountability	Several examples found where the objectivity of EO data, and in particular the full, free and open access granted by Copernicus, contribute to the successful enacting of core principles such as transparency and accountability	• Grasslands in Estonia • Water Quality in Germany • Dredging in the Maldives • Global Forest Monitoring for Sustainable Palm Oil • Sand Dredging in Finland

Source | SeBS Presentation to Copernicus User Forum: Practical Lessons

SeBS Sectoral Workshops 2022

Workshops are addressing representatives of public agencies in charge of implementing public policies

Water quality monitoring and reporting	June 9 @10	• Lake water quality monitoring in Germany • Water quality monitoring in Finland
Forest Management	June TBD	• Forest Management in Sweden • Forest Management in Portugal
Road infrastructure management	September TBD	• Roads Infrastructure Management in Norway • Highways Management in Italy

Workshop on water quality management (VIRTUAL)
Open to representatives of public agencies in charge of lake water management
Thursday 9 June @10 ➔ email Geoff.Sawyer@earsc.org

Copernicus4regions stories: evolution analysis

Following the interest generated by the prototypes, further operationalised, the public administration (SPW) has funded a regional application of the LU and LC mapping, through a follow-up project named "Walous". After reference datasets were produced for 2018 by a consortium of ISSeP and two universities (ULB, UCLouvain), ***the SPW is now funding the update of the LC dataset by a private company*** *(Aerospacelab). This novel solution uses Artificial Intelligence algorithms.*

03_EO-FOR-SUSTAINABLE-URBAN-PLANNING_Evolution.pdf (nereus-regions.eu)

Primary User (Tier 2) of this solution recognises a marked increase in awareness and collaboration with public entities (national agencies, regional and municipal), and across sectors. Such fact is evaluated as ongoing driver for innovation. ***The solution will continue to be further developed and matured and set in a global, web-based work environment.*** *It now integrates vertical ground motion and geological and geotechnical properties, in a risk based approach to asset management and climate adaptation so as to improve societal resilience.*

91_DON-T-POUR-MONEY-DOWN-THE-DRAIN-FIX-IT_Evolution.pdf (nereus-regions.eu)

May 2022

CHANGE DETECTION ANALYSIS ON WALLOON BROWNFIELD SITES

A few years later

In the last few years, the prototyped application received strong amendments. The change detection processing chain now integrates Sentinel-1 data on top of Sentinel-2. The workflow exploits the capabilities offered by the Terrascope platform for the automatic processing of Copernicus data. It will be provided as a new service for the Administrative for the continuous monitoring of Walloon brownfields.

Eric Hallot, Institut Scientifique de Service Public (ISSeP) - Remote Sensing and Geodata Unit

	TIER 1: SERVICE PROVIDER	TIER 2 PRIMARY USER	TIER 3 SECONDARY USER	TIER 4 END USER BENEFICIARIES
BENEFICIARIES	Institut Scientifique de Service Public (ISSeP)	Wallonia Region, Operational Development Directorate; Expert operators for brownfield detection	Wallonia Region; Local decision-making administration	Citizens and society
SERVICES	Sentinel-1 Sentinel-2	Decision-making tool for a more efficient updating of the brownfields' inventory (NDVI and BI spectral indices, further correlated with ground-truth data)	Facilitated rehabilitation of brownfields	Limitation of urban sprawl; Job creation; Development of residential, industrial or recreational areas;

Value chain definition following SeBS Methodology - https://earsc.org/sebs

The space-based solution

This Copernicus-based solution was produced by a scientific entity for a Public Administration. In the past few years, there were significant performance and automation improvements of the solution.

The Usage Maturity Level

The solution has transitioned to a higher level of UML. The main reason to help this transition is identified as an increased recognition about the effectiveness of the solution at decision-making level, based on the achieved results and return-of-experience.

Thematic Area	Region of Application	Sentinel mission used	Copernicus Service used	Usage Maturity Level
TERRITORIAL MANAGEMENT AND URBAN PLANNING	WALLONIA	S1, S2	-	4

THE EVER GROWING USE OF COPERNICUS ACROSS EUROPE'S REGIONS: A selection of 99 user stories by local and regional authorities

CHANGE DETECTION ANALYSIS ON WALLOON BROWNFIELD SITES

How did the story evolve?

Overall benefits

ECONOMIC
- Cost savings of operating expenditure have been registered
- Efficiency gains have been registered

INNOVATION
- The solution has helped to introduce some innovation in the functioning of the public administration

ENVIRONMENTAL
- Reduced depletion of natural resources

SCIENCE
- The solution has enabled some technological advancement
- There was an increase in technical/scientific expertise related to Copernicus/EO within the PA
- There was an increase in technical/scientific expertise related to Copernicus/EO at the service provider
- There was an increase in the research budget share of the institutions involved in the solution

REGULATORY
- There were improvements in the policy monitoring capabilities of the PA in charge

SOCIETAL
- No noticeable additional modification/impact on the functioning of the public administration nor on the lives of the citizens since 2018.

Benefits classification following SeBS Methodology - https://earsc.org/sebs

Interesting facts...

In terms of technical imporvement, this solution now integrates Sentinel-1, in addition to the Sentinel-2 data. An automated processing chain for change detection has been implemented in the environment offered by the Terrascope platform. Additionally, further development of the application was funded by The Belgian Science Policy Office. The research was carried out by ISSeP in collaboration with the Royal Military Academy for the Service Public de Wallonie. The solution is now being implemented and will soon be integrated within the workflow of Department of Operational Planning.

Outlook to the future

For the future, a full implementation of the service is planned and further developments will be carried out on the complimentary use of Copernicus and local very-high-resolution aerial coverages. A scientific watch will be carried out in parallel to these new developments in order to identify new relevant sources of Earth observation data.

Acknowledgements

This project is funded by a grant from the Operational Development Directorate (DGO4 – SPW, Wallonia).

Contacts

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Find the original story at
www.nereus-regions.eu/copernicus4regions/user-stories-sheets
or Download the full publication
www.nereus-regions.eu/copernicus4regions/publication

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www.copernicus.eu
https://sentinels.copernicus.eu

Source | https://www.nereus-regions.eu/copernicus4regions/user-stories-sheets/

Conclusions

- Both the C4R and SeBS stimulated a useful reflection on the value of Copernicus Sentinels data for a variety of public users
- They pictured a vibrant multi-disciplinary user community initially difficult to engage but then enthusiastic and interested in sharing experiences
- Benefits analysis not only allows improvements in the description of benefits, but especially their perception and understanding, thereby supporting optimal data exploitation and further uptake

Conclusions

“European public authorities can leverage Copernicus as an effective tool to make informed decisions, enforce environmental policies and build more sustainable and resilient lifestyles for European citizens.”

q.e.d.