SeBS Transversal Workshop

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The Fundamentals of SeBS

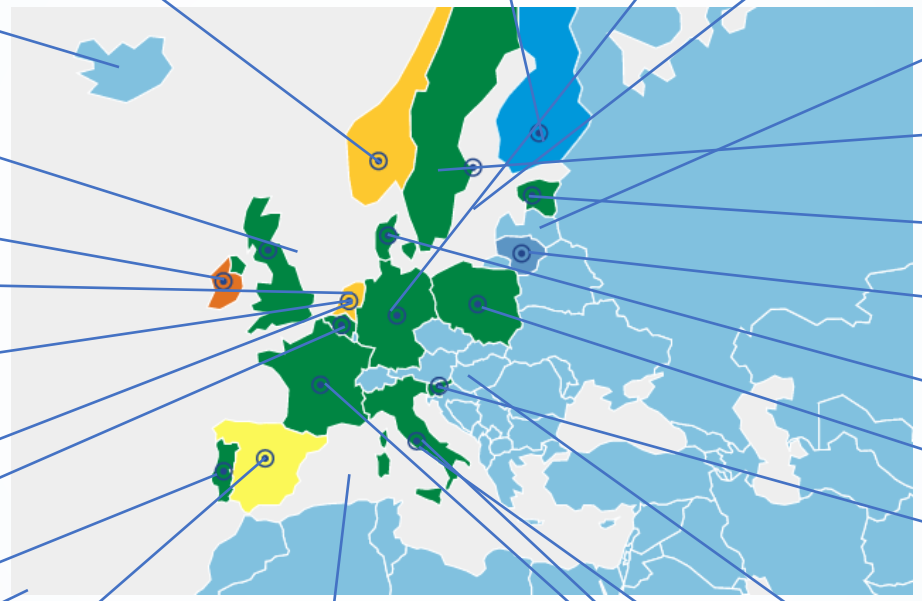
1. SeBS uses a bottom-up approach - analysis of benefits from using Sentinel data developed as an alternative to wide-ranging, top-down cost-benefit studies.

2. Developed over 30 selected cases being sufficiently mature for a sound analysis with committed support throughout the user's organisation (whether public or private).

3. Development of a sound methodology for measuring the value of EO and a rich portfolio of cases where the evaluation of the benefits has moved beyond "just" economics to include also benefits that cannot be easily monetized (environmental, regulatory etc).

4. Cross-cutting analyses, leveraging on understandings developed within each case, leads to a rich set of further insights regarding organisation's adoption of the technology.

A rich portfolio of cases



Ground Motion Monitoring (No)

Water Quality (D)

Winter Navigation (Baltic)

Water Quality Fi)

Irrigation (Austria)

Ice Navigation (Greenland)

CleanAir (Lv)

Peatland Management (UK)

Forestry Management (Sw)

Flood Management (Ir)

Grassland Monitoring for CAP (Est)

Water Quality (Nl)

Illegal Wild Boars Activity (Li)

Infrastructure Monitoring (Nl)

Farm Management (Dk)

Farm Management (Po)

Assessing Geese Damage (Nl)

Insurance & Risk Monitoring (Sk)

Growing Potatoes (Be)

Dredging (Maldives)

Forest Monitoring (P)

Aquifer Management (Es)

Global Oil Industry Activity Monitoring

Ground Motion Monitoring (Romania)

Deforestation Monitoring for Palm Oil Production

CleanSeas in the Mediterranean

Golf Course Monitoring (It)

Highways Management(It)

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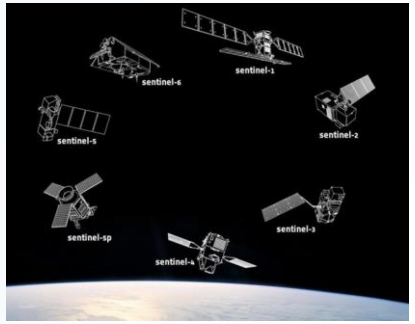
Sentinel Benefits Study: Our Methodology

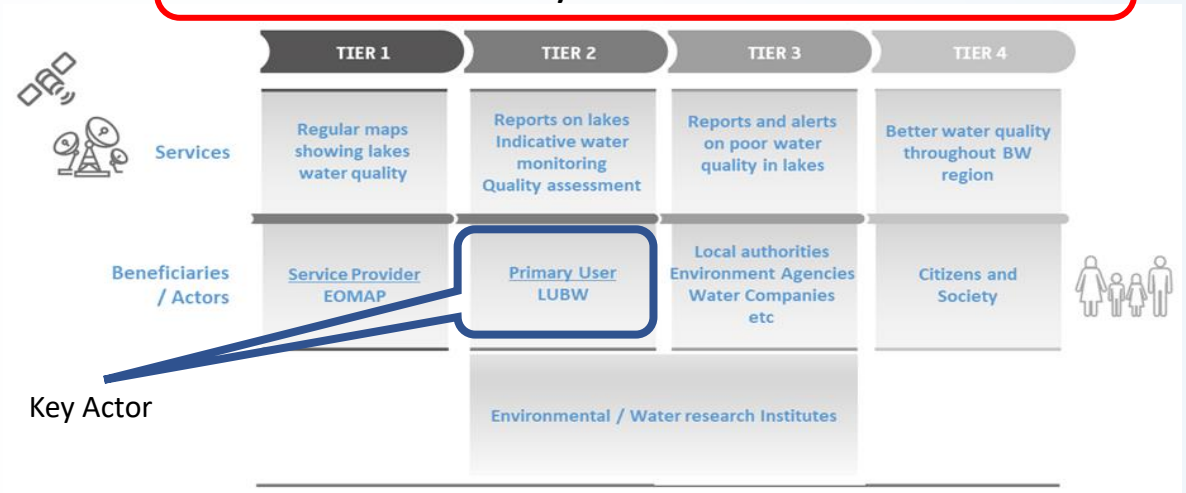
Robust, tested methodology

https://earsc.org/sebs/wp-content/uploads/2020/12/SeBS-Methodology-2020.pdf

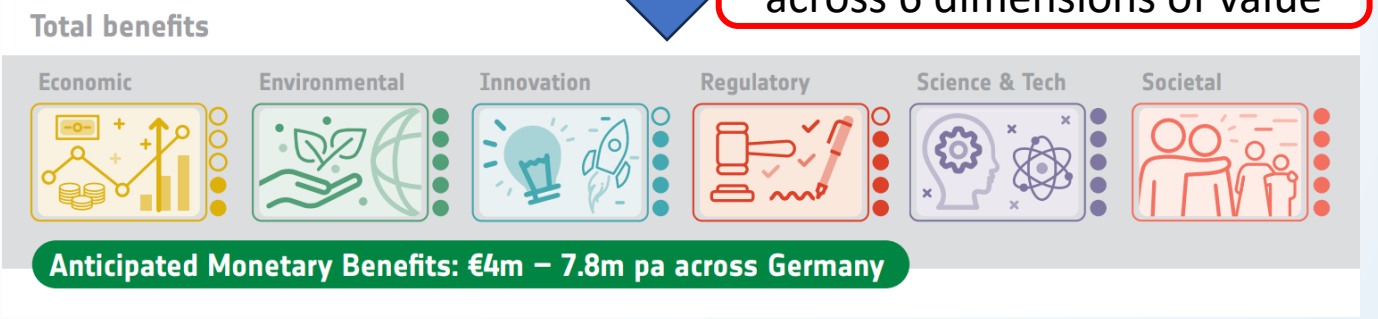


Operational use of Sentinel data by a primary user.

Value chain of actors in 4 tiers from supplier to citizens and society.



Benefits for each tier analysed across 6 dimensions of value



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6 Dimensions of Value

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.

ENVIRONMENTAL

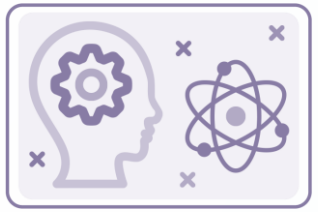
Impacts related to the state and health of the environment, particularly as regards the ecosystem services on which human societies depend.

REGULATORY

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

INNOVATION AND ENTREPRENEURSHIP

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



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.

SOCIETAL

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

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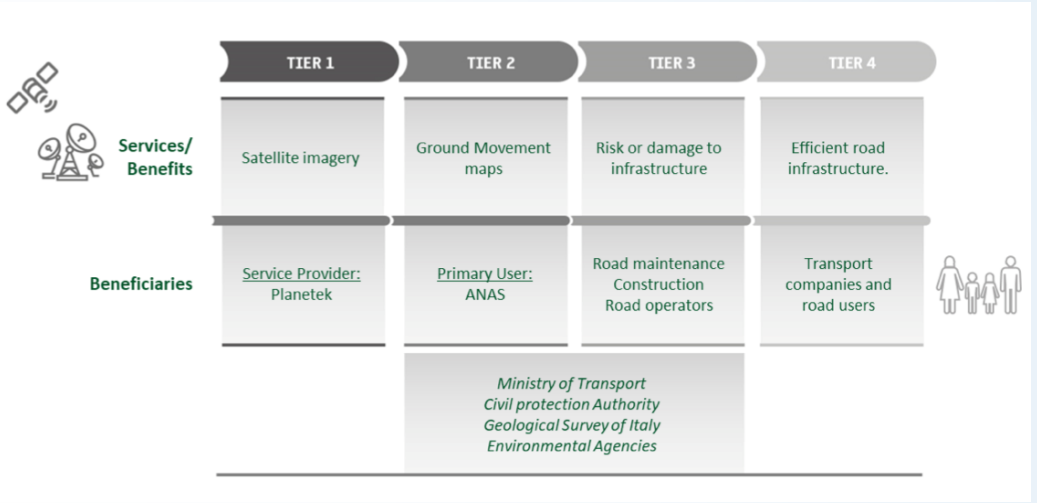
What does a SeBS “full” case look like?

- 70-pages report
- Rich contextual analysis
- Explicit assumptions validated with key stakeholders
- Extrapolation at country level as meaningful
- Full value chain analysis
- Quantitative assessment of economic outputs
- Qualitative assessment of impacts in 6 dimensions of value
- An easy-to-read flyer



	Minimum	Maximum
Tier 1 – Service Provider (Planetek)	n/a	n/a
Tier 2 – Primary User (ANAS)	€3.8m	€8.6m
Tier 3 – Construction Companies & Highway operators	€1.0m	€2.0m
Tier 4 – Citizens and Society	€0.8m	€3.0m
Total	€5.6m	€13.6m

Economic	Environmental	Societal	Regulatory	Innovation & Enterprise	Scientific & Technological
★★★★		★★	★	★★★	★★★

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Richness of the Cases bring new insights

Consistent framework for the analysis of more and more cases allows transversal analyses yielding highly valuable conclusions – some examples are:

Working together

In **Ireland**, flood mapping with shared information helps services co-ordinate their activities better through a common operating picture

In **Belgium**, having a common picture helps to bring together many different stakeholders across the potato industry, cutting across political and administrative lines.

Strategic Picture

In **Sweden**, families can plan their future as a result of knowing better the evolution of their woodland and when it may be harvested.

In **Greenland**, knowing where the ice has formed and when supply ships can pass, allows whole communities, living in isolated areas, to plan their lives better and to develop the strategic value of the island.

Better Regulation

In **Norway,** liabilities for co-lateral damage coming from road works are more easily managed by knowing <u>when</u> movement took place as well as the precise location. Allows better definition in regulations; ie 20 years limits rather than 5 years.

Basis for Transversal Analysis

Cross-cutting analyses contribute to strengthening the cases and the methodology as well as providing additional insights

Roads Infrastructure Management

[Highways Management in Italy](#)

[Ground motion monitoring in Norway](#)

Roads Management in Portugal (in progress)

Forests Management

[Forestry Management in Sweden](#)

[Forest Monitoring in Portugal](#)

Lake Water Quality Management

[Water Quality in Germany](#)

[Water Quality in Finland](#)

[Water Quality in the Netherlands](#)

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Common Indicators of Benefits

Economic Benefits e.g. cost savings, efficiency gains…

Examples are: Sweden/Forests (EO data helps save money) and Germany/water quality (improves performance).

Environmental Benefits e.g. reduced pollution, mitigating impacts…

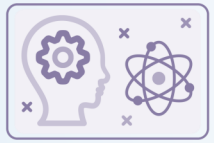
Examples are: Finland/water quality (reducing pollution) and Portugal/forests (mitigate pollution impact).

Regulatory Benefits e.g. better regulation, better policing, compliancy promotion…

Examples are: Sweden/forests (helping to design better legislation), Netherland/water quality (monitoring implementation).

Innovation or Entrepreneurship e.g. trigger for innovative processes or for creating business

Examples are: Italy/highways (driving innovation in public bodies), Netherlands/water quality (enabling new business in private companies)



Research and Science e.g. enabling new research…

Examples are: Germany/water quality and Norway/highways (providing information which is unobtainable by other means).

Societal Benefits: improving citizens lives and enabling better societies

Examples are: Italy/highways (directly benefit citizens e.g open roads), Sweden/forest (geopolitical factor i.e. increased forest inventory)

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How “Common” are the Benefits?

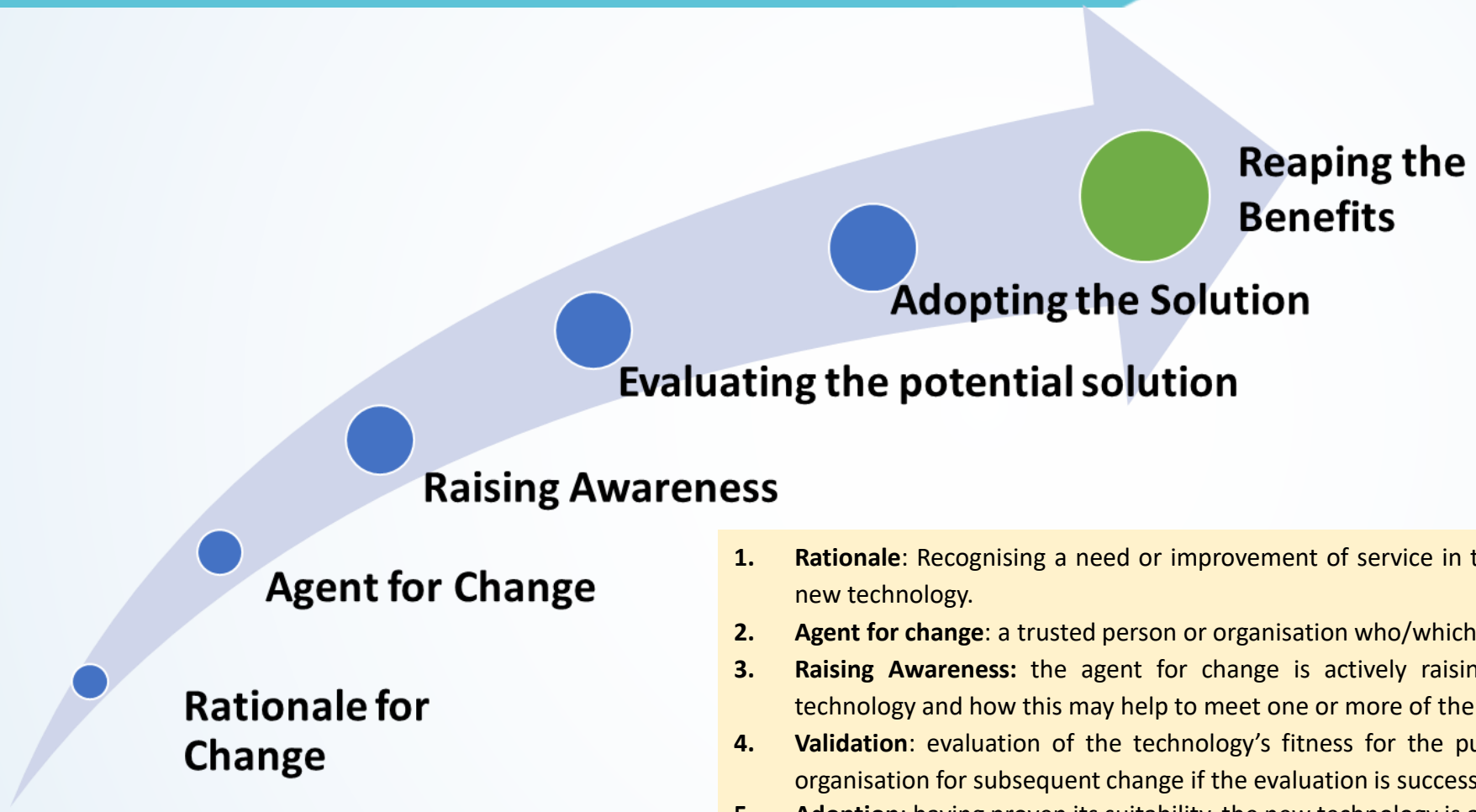
*OECD Observatory on Public Sector Innovation, Copernicus4Regions webinar on innovating public policies

What factors influence the uptake/adoption of services by public authorities and the related accruable benefits?

Benefits are specific to each case (even if the application is the same) ➔ The extrapolation of benefits from one case to another cannot be directly applied without due consideration of all boundary conditions.

Main factors that influence adoption of services by public bodies, and accruable benefits	
Geography	Geography dictates the scale of the benefit whether quantitative or qualitative. For instance: the extent of the areas to be monitored (e.g. sqkm of forest, stable/unstable geology, number of lakes to be monitored) provides a key trigger for the interest in effective monitoring methods.
Governance or Administrations	The way the public body is structured and the decisions are taken (national/regional/local authorities) and the degree of autonomy/budgets... ⁻ also addressed by OECD and Nereus*.
Culture	A general culture open to innovation and proactive problem-solving can also play a role. Absence of willingness and possibilities to innovate can bring general reticence to do so in public bodies
Legal Framework	Whether there a legal requirement to use the technology to measure/monitor there is a clear trigger. This was visible with the new CAP. Absence of legislative requirement undermines the investment case needed to establish a funded process. This is visible through the water framework directive. The legal basis often differs between countries if there is no European legislation.
Space awareness	Knowledge can “demystify space”. We have seen that sometimes space-based solutions are perceived as complex and costly by administrations who have poor awareness.
Industrial presence	The presence of a strong and proactive EO downstream industrial sector is key to ensure uptake especially in the absence of expert public providers (e.g. cartographic institutes or universities…). Companies wishing to do business help demonstrate the benefits.
“EO champions” within the organisation.	The “human factor” is often key: we found that an internal “champion” is almost always necessary unless use is required through the hierarchy. Changing roles and responsibilities undermines continuity and greatly weakens any commitment to the introduction of new processes. The process and EO use must become institutionalised.

The path to adoption



Stages of adoption of new services

1. **Rationale**: Recognising a need or improvement of service in the organisation which may be addressed using the new technology.
2. **Agent for change**: a trusted person or organisation who/which drives the change.
3. **Raising Awareness:** the agent for change is actively raising awareness in the organisation about the new technology and how this may help to meet one or more of the organisation's needs.
4. **Validation**: evaluation of the technology's fitness for the purpose of the organization and preparation of the organisation for subsequent change if the evaluation is successful.
5. **Adoption**: having proven its suitability, the new technology is adopted and implemented into the internal processes of the organisation.

Conclusions and recommendations

- The benefits derived from the use of Sentinel-based services are very specifically determined by a number of contextual factors ➔➔ When extrapolating the benefits from one case to another, due consideration shall be taken of the relevant boundary conditions.

- The level of uptake of Sentinel-based solutions by public administrations in Europe was found to be surprisingly divergent. Successful adoption in one administration is not matched in others. This led to the question why this is the case and an analysis of the pathway to the uptake ➔ ➔ Benefits and challenges largely depend on the adoption level of the organization so this should be taken in due account in every analysis

- The use of Sentinel-based services by different public organisations is often customized to fit their specific need, leading to peculiar practices and experiences that can be of great interest for benchmarking and cross-fertilization. Agencies can benefit by exposing their needs and practices through dedicated networks of peers. ➔ ➔ Build (or leverage existing) international networks of peers to exchange experience and views and develop understanding of how and why benefits can arise.

Transversal Findings

Day 1: Session on Roads Management

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Roads Management

How satellites can help?

- Measuring the risk of ground movement and consequent road construction / maintenance costs.
- Ground settlement after laying ballast or embankment construction
- Monitor risk of landslides due to rockfalls or to heavy rains.
- Detecting stress in bridges & tunnels.

Where satellites are helping:

- In active use in: Italy (core case), Norway (core case), Portugal (for maintenance prioritization), Sweden (monitoring projects).
- Under assessment in Austria (assessment of the use for bridge monitoring), Czech republic, Germany, Poland, Romania.

The Benefits of using Satellites:

- Reduced risk of increased costs through more effective surveying
- Reduced rework caused by unforeseen ground movement
- Improved legal and regulatory environment through diagnosis of movements
- Reduced social costs through avoided road closures.

Roads Management

Insights:

- Satellite InSAR measurements provide a unique tool for monitoring ground stability and detecting where there is a risk to roads or other infrastructure.
- Ground instability, which depends on the underlying geology, is a greater problem in some countries but all countries suffer to different degrees and hence it is widely applicable.
- InSAR provides the only method of surveying large areas for ground movement; e.g. moraines in Norway, or tunnels in Italy.
- Agencies dealing with roads are generally public and the organisation structure can be a barrier to implementation.
- Successful introductions have involved a champion and have set backs when the champion was no longer in the post.
- An outside trusted agent was present in the Norway space office and the Geological Institute which initiated the programme. The presence of an industrial company able to support and demonstrate the practicalities was important to the adoption in Italy.

Transversal Findings

Day 1: Session on Forests Management

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Forest Management

How satellites can help?

- Monitoring of clear cuts for adherence to permits.
- Detection of diseases
- Mapping of access into the forests
- Monitoring of fire damage.
- Replanting and sustainable development.

Where satellites are helping:

- In active use in: Sweden (core case), Portugal (core case), global tropical forests for ESG.
- Under assessment in Austria, Cyprus, France, Germany, Norway, Poland, Romania, Spain, mostly for disease detection and burnt area mapping.

The Benefits of using Satellites:

- Reduced costs of implementation of regulations
- Increased timber volume and reserves
- Improved forest ecosystem and biodiversity
- Better protection against threat of fire and emergency management
- Improved leisure facility for citizens

Forest Management

Insights:

- There is wide-awareness of the possible use of satellite data and uptake depends on the local forest conditions and legislation. In Sweden clearcut notification is set at 0,5ha whilst in some countries eg Czech Republic the limit size is smaller so making Sentinel use unattractive whilst commercial data may be too costly.
- Responsibility is devolved to local/regional administrations in many countries whereas the capability must be championed and introduced by a central (national) agency which becomes the trusted agent.
- Knowledge of the forests is important meaning that the service is often in-sourced through an administrative, remote-sensing or GIS department.
- The introduction of much more timely data (in Sweden) has made the monitoring product more attractive for other users and the use has increased in both public and private organisations.
- No platforms exist for the exchange of best practices but would be of interest to practitioners (in Sweden) particularly for knowledge of different processing techniques and data use (for example Sentinel 1 radar data).

Transversal Findings

Day 1: Session on Water Quality Monitoring

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Water Quality Monitoring

How satellites can help?

- Provide ability to measure water quality in many more lakes (all over 0,5ha) more frequently and with better spatial coverage (ie more measurement points in v large lakes).
- Give earlier warning of degrading water quality.
- Supports evaluation of the impact of regulations on land-use and agricultural practices on the water quality

Where satellites are helping:

- In active use in: Germany (core case), Finland (core case), Netherlands (core case).
- Under assessment in Austria, Belgium, France, Italy, Norway, Spain, but not yet in operational use.
- Some differences in use between regions with deep lakes and those with shallow ones where the temperature rises more quickly, agriculture is more intense and run-off a greater problem.

The Benefits of using Satellites:

- Improved links between measurements and implementation of regulation (can be further improved with reference in the Water Framework Directive)
- Avoidance of costs of making in-situ measurements in many more lakes.
- Earlier detection of problems
- Improved bathing water quality information for citizens

Water Quality Monitoring

Insights:

- Satellite data provides the capability to monitor lake water quality over large areas and any number of lakes which is not possible using conventional means.
- Introduction so far is determined by local use since national reporting under the WFD is not required. As a result, investments and operational budgets are not granted.
- Only where local expertise and champions have promoted the use of satellite data has this become systematic (ie in Finland).
- Local conditions influence strongly the risk and the need for monitoring. In the Netherlands, the shallow waters heat more rapidly and intense agriculture leads to high chemical pollution, whilst in Finland the enormous number of lakes drives monitoring needs.
- Trusted agents have been instrumental in driving adoption. The environmental institute in Finland has been key whilst industrial actors have demonstrated the capability in Germany and the Netherlands.