



Services Supporting the UNFCCC and Kyoto Protocol

Reporting on Land Use, Land-Use Change and Forestry

THE CHALLENGE

Introduction

Since 1997, the label 'Kyoto' has become synonymous with controversy, political and scientific debates, growing public awareness as well as fear and hope for the future.

Over time, the threats posed by global climate change have gained political and public recognition.

Today, there is near universal acceptance that the stakes are extremely high and maintaining the 'status quo' is no longer an option. The hard-won ratification of the Kyoto Protocol signals a watershed and while debates will continue – the time for global action has arrived.

The Challenge of Kyoto

Amongst its provisions, the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) commits signatories to limit emissions of greenhouse gases and applies a reference year (1990) as the benchmark for reductions.

For carbon dioxide emissions, the Kyoto Protocol allows the compensation of gas emission reductions through the sequestration of carbon within carbon stocks or 'sinks'.

A major resource for carbon sequestration is the world's forests.

The Kyoto Protocol encourages activities that increase the terrestrial carbon stock (forests) but also demands the reporting of changes using credible measurements and estimations. The reporting of **Land Use, Land-Use Change and Forestry (LULUCF)** is an essential aspect of Kyoto compliance. This poses a monitoring challenge to (governmental) agencies responsible for reporting on national level.

The regular **monitoring** of forests including **Afforestation, Reforestation and Deforestation (ARD)** activities and changes in carbon stock presents significant technical and management obstacles. Monitoring demands are geographically variable and complex with political, financial and legal ramifications as well as socio-economic impacts as nations strive to comply with the Kyoto Protocol while utilising various revenue-generating mechanisms.

For nations to successfully plan, implement and/or assess activities and impacts related to the UNFCCC and Kyoto Protocol the implementation of sustained monitoring capabilities is essential – and Earth Observation (EO) offers some valuable options.



THE SOLUTION

Earth Observation and Ground Measurement– Practical Options for Monitoring

The global requirement for consistent reporting and monitoring imposed by the UNFCCC and Kyoto Protocol demand technical solutions that have global relevance and universal applicability. Over recent years, professionals and policy makers have gradually embraced the usefulness of applied Earth Observation (imagery), especially when integrated with ground measurements and spatial analysis techniques – such as GIS.

The growing acceptance of applied EO has further been empowered by policy-driven initiatives including **GMES (Global Monitoring for Environment and Security)** and **GEO (Global Earth Observation)**, which strive to coordinate international (EO) capacities towards issues of global urgency. Mitigating the adverse consequences of climate change while meeting the monitoring requirements of the Kyoto Protocol presents unique opportunities for practical and sustainable EO-based solutions.



Forest fires, detected by satellite observations



Introducing....

An Innovative Monitoring Service for the UNFCCC and Kyoto Protocol

The European Space Agency (ESA) and European Union (EU) have supported the development of monitoring capabilities for policy makers and end-users responsible for reporting under the UNFCCC and Kyoto Protocol:



- **GSE Forest Monitoring (GSE FM)** is a distinct service element of the GMES Joint Initiative.

It delivers comprehensive monitoring services under a portfolio that supplies accurate, standardised and quality information to support policy makers and practitioners. One of the core services – Greenhouse Gas (GHG) reporting – offers outputs that meet the strict demands of the UNFCCC and Kyoto Protocol with respect to complete forest monitoring.



- **The Kyoto Inventory (KYOTO INV)** is a component of the ESA Data User Programme (DUP). It defines and develops key inputs required for UNFCCC and Kyoto reporting including area assessments and classifications for forests and country-specific land use, and the detection of ARD activities.

These complimentary activities have stimulated wide interest from users across a diversity of agencies, locations and sectors. The combined expertise and best practices are now available as an integrated **Monitoring Service for the UNFCCC and Kyoto Protocol**.

THE SERVICE



What are the main features of the Service?

National Greenhouse Gas (GHG) reporting is an essential component of the UNFCCC and the Kyoto Protocol.

It demands information that cannot be totally derived from National Forest Inventories or traditional sources, and also requires accurate, spatial information on forests for the Kyoto Protocol reference year (1990) and successive years.

In-situ measurements e.g. tree diameter, height and species provide valuable inputs for models that calculate biomass and carbon estimates. However, such ground data are labour intensive and costly to collect and not universally available in many locations with technical, logistical or access constraints. The Service addresses this requirement by integrating Earth Observation data with in-situ observations using combinations that optimise the final results.

For example, optical imagery combined with appropriate in-situ measurements produces spatially explicit and optimal results for GHG reporting. In cloudy regions that cover vast tracts of tropical forests, Synthetic Aperture Radar (SAR) sensors together with ground measurements deliver credible results. In extreme conditions of high cloudiness, poor access and/or a lack of ground measurements, SAR can be combined with default models to produce reasonable monitoring estimates.

Consequently, the integration of Earth Observation and in-situ data allows reporting to the highest possible confidence levels while maximising accuracy and minimising reporting costs – thereby meeting user requirements and the demands of the UNFCCC and Kyoto Protocol.

The Monitoring Service for the UNFCCC and Kyoto Protocol delivers the following results:

- **Enhanced mapping of forest and land use/cover areas.**
- **National summary statistics on totals and changes regarding biomass and carbon stock.**
- **Forest cover and change maps with statistical data.**
- **Other customised statistics and/or maps required by users.**

The outputs meet the Good Practice Guidance requirements for LULUCF and can be framed within the overall policy context of the target country providing decision makers with a range of pragmatic responses or policy options.

Radar and optical EO data:
Both support the services





What are the strengths of the Service?

The Service possesses unique characteristics and strengths:

- **Policy oriented:** Designed specifically to address the reporting requirements of the UNFCCC and Kyoto Protocol and highlight the policy implications of results.
- **User Driven:** Users have been intimately involved in the design and development of the service providing feedback from service cases (see inlays), leading to continual enhancements.
- **Standards:** Documented and accepted standards are applied throughout service delivery and reflected in validated outputs.
- **Quality:** Quality assurance procedures are implemented during data collection; pre-processing, integration, analysis and interpretation thereby validating the procedures and results.
- **Comparable:** The outputs are comparable over time, between locations and end-users.
- **Customisable:** The Service is flexible and customisable to meet unique reporting requirements and situational limitations confronted by the client.
- **Replicable:** The Service is transferable and replicable between locations and user situations.
- **Proven:** Based on extensive science and technical research, the Service has been field-proven through actual service-cases that fulfil user requirements (see inlays).

Can the Service address complex monitoring requirements?

Yes. The value and utility of the service has been proven through actual service cases described in the inlays. They highlight how the service has overcome implementation challenges and delivered outputs that meet or exceed client expectations.


Do the outputs comply with the UNFCCC and Kyoto Protocol and meet the needs of decision makers?

Yes. The Service has been designed specifically to address the reporting requirements of both the UNFCCC and Kyoto Protocol. It is based on sound science, leading-edge technologies and best practices while remaining policy-focused to support decision makers within various administrative settings.

Is the service accessible and practical for users?

The Service is both accessible and practical with clear procedures to access the service and optimise the benefits. While advanced technologies support the service – it is user responsive and 'friendly.' For example, the service is being applied in developing nations in Southern Africa under challenging conditions for local users and beneficiaries. The outputs not only support compliance and reporting but also sustainable development initiatives.



An aerial satellite-style map of a river system, likely the Amazon basin, showing a complex network of blue and black waterways winding through a landscape of red, orange, and brown terrain. A prominent white diagonal line runs from the top left towards the bottom right, partially obscuring the map. The map shows various land use patterns, including agricultural fields and natural vegetation.

What is the delivery mechanism and how quickly are results available?

The service is delivered through a Service Level Agreement (SLA) negotiated and executed between the end-user(s) and authorised service provider who has ultimate responsibility for service delivery in accordance with the technical specifications, schedule and budget outlined in the SLA. Results can be delivered incrementally depending on the size and priority given to areas covered – average project cycles take weeks or months depending on conditions and requirements.

What are the service costs?

Service cost depends upon variable factors including the user location and market conditions impacting the local service provider(s), availability of essential input data and necessary field work, actual user requirements including the desired reporting detail, and the size of the area covered. Costs are itemised by task and deliverable and can be estimated per square kilometre. The procedures and standards behind the service constantly strive to reduce costs.

Will the services be available in the future and meet new requirements?

Definitely. GMES represents a global and long term commitment to supporting sustainable monitoring practices. The service is a core component of GMES, which aims to develop a large and ultimately self-sustaining user and service provider network worldwide. This GMES community will over time, fully embrace the Service and promote enhancements at the service provider and users levels.