

*Dear Members of the Land Data User Community,*

Welcome to the second edition of the GMES Land User Newsletter. After we gave you an overview of some of the main services of the GSE Land project in the first issue of this Newsletter, we would like to focus this issue on GMES history –**How are some of the projects linked to where we stand now?**– and on some of the big challenges that GMES has to face: **How to ensure service quality in a cost efficient and transparent manner?** and **What is the long-term vision of land monitoring in the timeframe 2008 to 2013 and how to get there from where we are now?**

Based on the feedback received to our first edition, we have added a glossary so that you can see at a glance the topics of this Newsletter. As we are nearing the end of another (GMES) year, I would like to take the opportunity to wish you a Merry Christmas and a prosperous and successful year 2007.

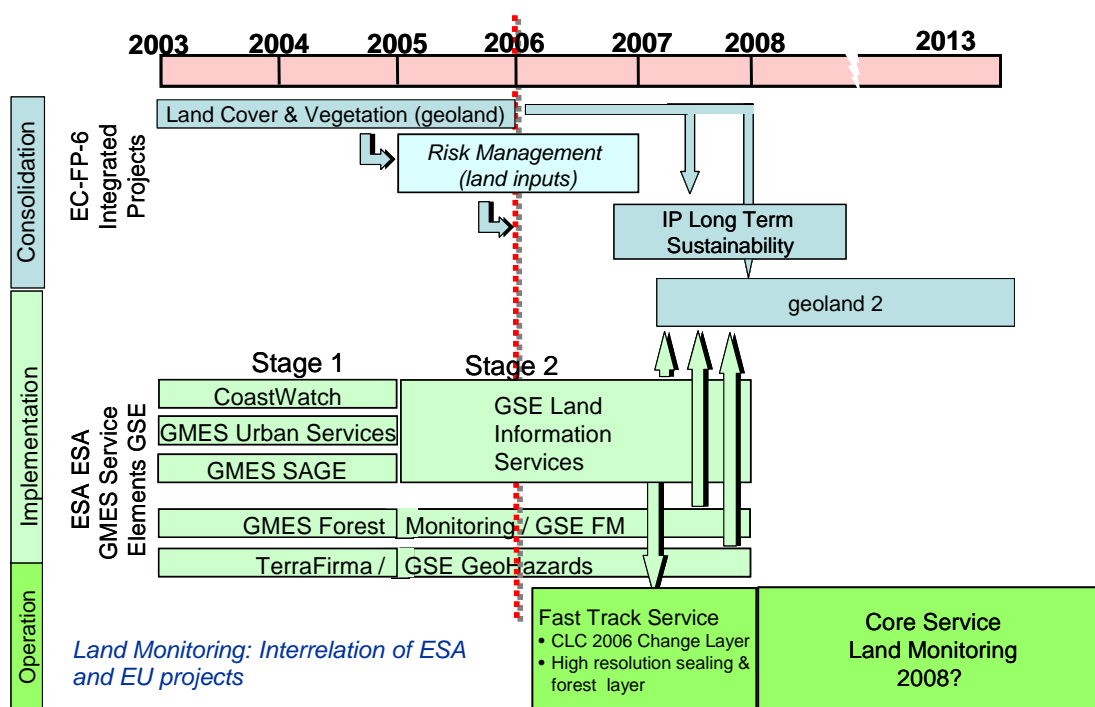
*Stefan Kleeschulte, ETC/TE Manager*

**GMES History 2002+**

After a period of 4 years of discussion between future stakeholders of GMES the European Commission established from 2001 onwards the so-called Outline GMES EC Action Plans for an Initial Period from 2001 to 2003 <sup>1</sup> and a European Earth Observation capacity by 2008 <sup>2</sup> with the overall objective of establishing a future operational GMES Programme.

The activities initiated through these Communications during the Initial Period led to a new Communication “From concept to Reality” <sup>3</sup> outlining the strategic dimension, the support of a variety of EU policies and implementation measures including as well, short term activities like gradual introduction through Pilot Operational Services (so-called Core Services) of Governance Aspects. In this context Land Monitoring was identified as one of the most promising candidate services for fast track introduction fulfilling basic prerequisites such as maturity, uptake by the user community and long-term sustainability of demand and supply.

The success of “Land Monitoring” selected as a Core Services is based on different projects funded by the ESA through its GMES Service Element and the EC through FP-6 and the Integrated Project geoland as it is expressed by the following image.



<sup>1</sup> Global Monitoring for Environment and Security (GMES): Outline GMES EC Action Plan (Initial Period: 2001 – 2003) COM(2001) 609 final

<sup>2</sup> Global Monitoring for environment and Security (GMES): Establishing a GMES Action Plan 2004 – 2008, COM(2004) 65 Final

<sup>3</sup> Global Monitoring for Environment and Security (GMES): From Concept to Reality COM(2005) 565 final

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GMES land related services will produce a number of thematic mapping products derived from remote sensing data which build the basis for the so-called downstream products, such as model results addressing water quality, land consumption, quality of life etc. Hence, it is of great importance that these mapping products can be trusted.

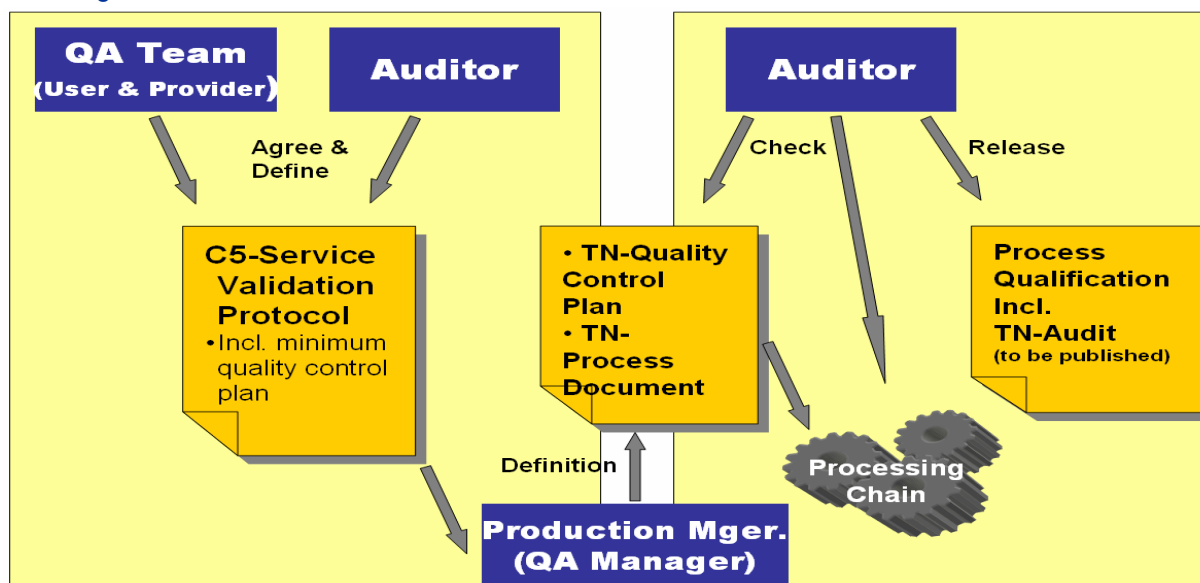
In the framework of ESA's project "GMES Service Element Land – GSE Land" a new QA approach has been set up during the first phase (Oct 2005 – Sept 2006) which was intensively tested and discussed among service providers and users. However, in order to address a wider community of stakeholders, ie the whole land user community and to motivate and intensify discussion on this important issue towards a European standard in land information quality the concept is briefly described as follows.

## I GMES Land Quality Assurance

The main goal of any quality assurance (QA) concept is to validate and ensure an agreed quality for a product by comparing it to independent, up-to-date information of higher detail (e.g. comparing satellite image derived data to aerial photographs). This implies as well that it is important to produce reproducible and traceable results. In this sense, quality assurance not only guarantees quality, but also helps to streamline production (reduction of cost) and provide comparable products across different production sites and service regions. Otherwise users may be forced to repeat validation campaigns with substantial efforts of their own over and over again.

The quality assurance approach of GSE Land Information Services builds on three pillars:

- **product and service standards** jointly set-up and agreed among user organisations and formalised with service providers. This includes standardised product descriptions and interpretation guidelines applicable to all European conditions.
- a **qualification scheme** accepted by users organisations and service providers, defined by scientific experts representing demand and supply including scientific and engineering know-how.



Quality Assurance: Technical Implementation Scheme

- an **implementation scheme** for the qualification elements performed by independent auditors and supervisors:
  - The TÜV Süddeutschland (a German independent industrial auditor) for independent service chain audits and training of internal auditor's (audit philosophy and method)
  - A trusted European expert on land cover / land use mapping acting as supervisor for chief interpreters in the production units
  - An independent central technical reference team led by the ETC-TE (comparable to CLC 2000 core team established at the ETC-TE or MARS team established at JRC AgriFish Unit) who is responsible for the **quality assurance process** and the **quality control** of the final land cover products.

The first two pillars require a general consensus of all GMES stakeholders and a broad discussion on related details. In GSE Land an implementation scheme has been set up and is currently being tested and evaluated. The following aims to explain the approach to a broader audience in order to stimulate discussions towards a European-wide acceptance.

In the first months of the project the QA team (consisting of independent scientific and technical experts) has agreed and defined the so-called **Service Validation Protocol**, a document which describes in detail the technical approach. After definition of the QA approach, and prior to starting the production, each service provider must define its **internal quality assurance/ quality control plan**, integrated into their processing chain. The production chain and the adherence to the internal QA/QC approach is checked on-site by the independent auditor (TÜV).

The second main component of the quality assurance approach is the quality assessment of the product. It includes three main components:

- A **qualitative verification** by the QA technical team in which some intermediate results of the service provider interpretation are commented on by the QA team and potential deviations from the specifications are highlighted. The verification is done during the course of production and is meant to increase and harmonised data quality.
- A **quantitative validation**: The QA team performs an independent external technical quality control after the finalisation of the mapping product to check whether the products reached the desired quality. The validation is carried out in a "blind"

approach by experienced interpreters without knowing the interpretation done by the service provider. Then, this information is compared to the mapping results from the service providers and statistical indicators are computed such as overall accuracy, user and producer accuracy and Kappa coefficients based on the error matrices produced.

- **Specifications validation**: the user will validate the product if it fulfils the needs that the user themselves have included in the product requisites.

The final independent quantitative product evaluation is based on a sampling scheme that takes care of statistical representativeness of the samples together with an acceptable cost ratio with regard to the required independent reference data in a European-wide context.

In a user workshop (Barcelona, July 2006) the QA method was presented and intensively discussed. A general agreement on this new QA approach was reached. Moreover, it was also decided to compare the results obtained applying this new approach with the ones obtained applying the previous approach based on point sampling. It was agreed that this new QA approach needs a communication initiative to introduce it to a broader audience and to provide guidelines and examples. This discussion should include lessons learnt from within the project and also from other GSE projects.

Consequently, this article is intended to be a first step towards this initiative, as it needs a broad agreement among the GMES stakeholders first, and among all the interested stakeholders afterwards, based on an in-depth discussion of the pros and cons. The authors would appreciate intensive feedback on this issue in order to optimize and test the approach in the two remaining phases of GSE Land. Hence, any contribution on this issue will be greatly appreciated.

More information on the QA approach agreed under the GSE Land project can be downloaded at [http://eea.eionet.europa.eu/Public/irc/eionet-circle/user\\_group\\_on\\_land\\_monitoring/library](http://eea.eionet.europa.eu/Public/irc/eionet-circle/user_group_on_land_monitoring/library)

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## II Towards a Land Monitoring Fast Track Service 2008+

Since the launch of GMES in 2001 by the European Commission (Global Monitoring for Environment and Security (GMES) - Outline GMES EC Action Plan (Initial Period: 2001 – 2003) COM(2001) 609 final ) and other stakeholders, land monitoring has crystallised as one of the more successful and mature services supporting the development of a European capacity for Earth Observation. As a consequence FTS2006 was launched as an operational service in order to provide by 2008 the following information:

- A set of multi-temporal individual and mosaicked ortho-corrected satellite images for the reference year 2006, as basis for the land monitoring service;
- Land cover and land cover change mapping at European scale (CLC2006) for implementation, review and monitoring of EU policies (eg water framework directive, biodiversity strategy, common agricultural, regional policies) and also for reporting obligations under international treaties (eg the Kyoto Protocol), in line with national land-cover / land-use inventories in the Member States;
- High-resolution layers for mapping at local scale, for example city planning, construction, noise modelling, mining, monitoring "hot spots" where rapid changes are occurring – starting with two layers on forest types and built-up areas.

### What is the FTS?

The objective of the Global Monitoring for Environment and Security (GMES) initiative is to provide on a sustained basis reliable and timely services related to environment and security issues in support of policy needs and to provide an operational and autonomous European capability for GMES by 2008.

GMES will be developed in steps as an EU-led initiative through the introduction of pilot phase services, starting with the three most mature "fast track services" (land monitoring, marine, and emergency response) by 2008.

These services should support EU environmental and security policy development, monitoring and implementation from the local, regional and EU level to the global level. The beneficiaries of the services will be EU institutions and bodies, as well as local, regional to global institutions involved in research, monitoring and implementation.

Looking at the FTS2006, it is clear that this service will only be a first step towards a Fast Track Service 2008+. The period 2008 to 2013 will be a transition period that will identify a land monitoring core service with most probably a range of products.

In addition, to such a long-term vision we need short-term priorities – defined in collaboration with the user community – on what to do first. To reach this goal we propose to provide you with statements from the countries how they see the future from their national perspective and documents from European and national projects with options and proposals. From these experiences, we think that the basis for discussion is substantially mature, ie needs, limitations and feasibility have been widely debated for a long time. What is needed now is to share all this information in an organised way in order to develop a shared vision within the land community and to prioritise.

To deepen this discussion, we would like to invite you to a workshop in the framework of the geoland final meeting in Berlin at the beginning of February 2007.

If you would like to present your opinion here, please contact the ETC/TE: [etcte@uab.es](mailto:etcte@uab.es).

<http://www.gmes.info/166.0.html>

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## III GMES Land Success Stories

### *geoland Achievements*

**October 2005:** The EEA Management Board proposed to its member states to accept the land cover service concept of geoland / GSE Land as the basis for a European-wide GMES Fast Track Service (FTS). This was agreed by the majority of the member states.

**February 2006:** the FP6 IP geoland and GSE consortia agreed to establish a common self-governed GMES user community for land applications organised by ETC-TE. This user community was inaugurated in February at the geoland Forum in Vienna. An impressive number of users from key member states e.g. Austria, Germany, Greece, France, Poland, Spain, Sweden, United Kingdom have already indicated their interest to participate. In order to have more influence on GMES process several national users now seek an official national mandate.

**March 2006:** LIFE+ and Interreg regulations now accept GMES services to be eligible for funding.

This will hopefully support the established service provider network to survive the gap from 2008 onwards, until European budget lines have been established.

**June 2006:** The service provider network (comprising GSE Land and FP 6 IP geoland partners) has actively collaborated in defining the Terms of Reference (ToR) for the European Fast Track Service Land (FTS). At the KO meeting organised by EEA on 27th/ 28th June in Copenhagen, with DGs and MS representatives, broad support for the sealing service developed and consolidated by geoland/GSE Land was demonstrated. EEA and GSE Land user organisations for the first time supported this service in public and committed themselves to its development.

**September 2006:** DG Regio are now actively involved in the definition of the European Urban Atlas product. In a joint effort experts have completely revised the Urban Atlas product. This progress has motivated DG Regio to seek for budgets to set-up a fast track service Urban Atlas covering all European cities identified in the Urban Audit.

**October 2006:** The GMES Fast Track Service was approved Oct. 10th by the EEA Advisory Board. Release of Specification of Work (SoW) was expected at end of October, and the ITT for high resolution layers is expected for December 2006.

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### **Management of Water Resources**

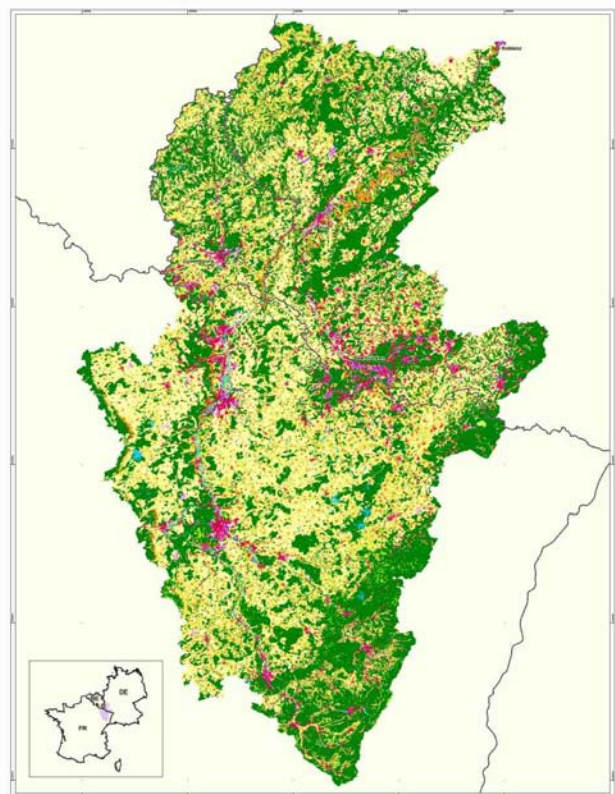
As one main element of European environmental legislation the Water Framework Directive (WFD) becomes more and more important for all levels of water and environmental administrations. Reporting on and managing water resources on a river basin scale rather than on administrative level is one of the main challenges within this Directive.

Within GMES Land a set of water quality services have been developed and implemented. These are especially focused on the identification and management of nutrient and pesticide inputs into the water cycle resulting from diffuse sources. The methodologies/tools applied within GMES Land vary in the specific implementation sites, taking into account the differences in both the ecological/environmental conditions throughout

Europe, and in national/regional methodologies and tools for the implementation of the WFD.

Focus has been put on the realisation of services at a catchment level, ie beyond administrative borders. Besides the river basins Weser (DE), Jucar (ES) and Ljusnan (SE), one of these catchments has been the Moselle-Sarre supra-national catchment, integrating areas of Luxembourg, Belgium, France and Germany. Within the Moselle-Sarre catchment a large set of services has been produced in phase 1 of the ESA funded GSE Land project, combining information on actual high and medium resolution Land Cover / Land Use information with in-situ information into specific water quality models. These models have been proven eg in the EUs' IP geoland, to be scientifically sound, user accepted and in principle can be applied throughout Europe.

The GSE Land set of products comprises general high resolution Land Cover information, represented by the product "Regional Land Cover" (see separate chapter in this newsletter), and specific medium resolution Land Cover information on up-to-date agricultural usage, represented by the product "Arable Acreages Maps".



*Water Quality Services: Regional Landcover Product for cross-border Sarre-Mosel catchment (D, F, LUX)*



Furthermore the water quality models NOPOLU, NPP Service, PEGASE and DRIPS were applied, to entire catchment areas. The model NOPOLU delivers information on the surplus of nutrients resulting from agricultural practice. This is an input, in addition to the information on Land Cover, to the models NPP Service (based on MONERIS algorithms) and PEGASE, which deliver information on the leakage of nutrients into and the respective concentrations in surface water bodies. The model DRIPS provides information on the leakage of pesticides into and the corresponding concentration in surface water bodies. Besides giving information on the actual pressure on and status of water bodies concerning nutrients and pesticides, these models allow for the analysis of measures to be undertaken to cope with specific problems related to the status of water bodies.

All these different products are already or at least will be integrated in the near future into the work flow of the different national / regional water administrations representing the International Commission for the Protection of the Moselle-Sarre (IKSMS/CIPMS).

**User Statement:**

The International Commission for the Protection of the Moselle-Sarre has a long tradition in trans-national cooperation lasting more than 45 years. With the implementation of the WFD this cooperation has become more and more important. The services delivered within the frame of the GSE Land project provides us with information which is consistent over the whole catchment area and which is of better quality to that available so far. This allows us to more efficiently implement the WFD. Besides the harmonisation of specific basic data sets used by the different delegations, the harmonised methodological approach applied is also of great importance for our daily work.

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***Irrigated Arable Crops and Water Extraction***

The products presented here provide information on surfaces of irrigated arable crops and on volumes of water applied for irrigation. Both products allow reporting on the water abstraction pressure by irrigation. An innovative remote sensing technique based on Medium resolution and large coverage sensor (MERIS imagery) has been developed to obtain information on the acreages covered by various types of arable crops and grasslands, and in particular of irrigated arable crops. It is able to discriminate the various groups of annual crops for one year on a regional scale.

The product "Irrigated volumes" provides users with estimates of the volume of water needed for optimal growth of irrigated crops. This information is provided at a resolution requested by the users. This resolution defines a unit which must be homogeneous with respect to the problems of the users (communes, hydrological unit). The product "Irrigated volumes" can be provided on a week, month or by yearly basis. Otherwise, these maps are available in vector format and are compatible with any GIS software. These products can be provided in any projections requested by users.

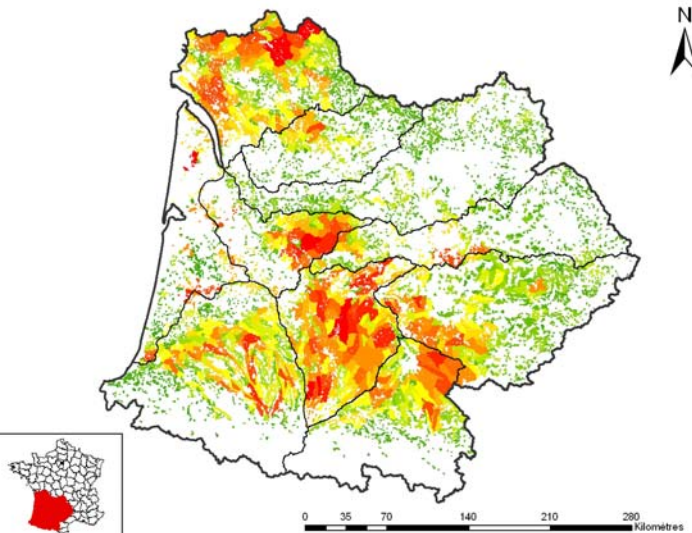
The product Irrigated arable crops ("Irrigated surfaces") map is produced for the whole Adour-Garonne district corresponding to about 116.000km<sup>2</sup> in 2005 (figure 1). The product "Irrigated volumes" (figure 2) has been produced on the Midi-Pyrénées region (45.000 km<sup>2</sup>), which is included in the Adour-Garonne district. The results on "Irrigated surfaces" have been evaluated by comparing them to the RGA (Recensement Général Agricole) which is the Agricultural statistics data base of the French Ministry of Agriculture, obtained by a general census of agriculture (2000). The results obtained are highly satisfactory (relative error is 7%). The product is generated by a fully semi-automatic chain which guarantees the reproducibility of the results. The product "Irrigated volumes" is validated with farmers' volume declarations available since November 2006. The production of this product for the remaining area of the Adour-Garonne district will be realized in 2007.

Both "Irrigated surfaces" and "irrigated volumes" products have been provided to the French water agency user, (Agence de l'eau Adour Garonne, Toulouse) for review and acceptance. These products, were presented at a users' meeting in July 2006 together with a training session, in

order to better understand and evaluate them. The first users' feedback on the both products is positive. These products will be used for streamlining the decision making process for water quantity. They should help to assess agricultural pressures and impacts according to Water Framework Directive. The main advantage of these products is the reliable supply of yearly updated maps and analysis that will support the work of the administration.

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Map of irrigated crops in the French Adour Garonne district

### **GSE Forest Monitoring**

The GSE Forest Monitoring (GSE FM) consortium was set up to address the policy related demands for securing the ecological functions in the forestry and land use sector. The first stage (2003-2004) consolidated services related to the information needs of environmental policies such as the United Nations Framework Convention on Climate Change-UNFCCC. The consolidation stage has been successfully completed and therefore the GSE FM is currently implementing a fully operational system from 2005-2008 for an expanded user community, with a related geographical service area in a sustainable manner. The overall objectives for GSE FM implementation are:

- Demonstrate progress towards long-term sustainability for a set of GMES services.
- Deliver services and benefits to users on progressively larger scales.
- Establish a durable, open, distributed GMES Service Provision Network.
- Establish standards and working practices for GMES Services.

The key policies that the GSE FM addresses are the UNFCCC and Kyoto Protocol (KP), the UN Convention on Biological Diversity (UNCBD), the Ministerial Conference on the Protection of Forests in Europe (MCPFE) and related criteria and indicator processes, the United Nations Forum on Forests and National Forest Programmes.

The GSE FM currently brings together 25 user organisations and 18 operational service providers. Overall benefits as noted by the users in the first Phase of implementation include:

- improved spatial coverage
- improved spatial resolution
- improved temporal resolution
- improved accuracy
- development and support of standards and processes
- more efficient forest management

Several users made statements that the GSE FM service really helped the user towards improved reporting capacity, as their respective services offered data that were simply not available before. Some users reported an increased time and cost-effectiveness as well as a more targeted forest management thanks to the implementation of the service.

These aspects are demonstrated in the following user statements from Sweden and Austria:

#### **Clear Cut Mapping and Monitoring Service for the Värmland/Örebro region in Sweden**

With the information provided by clear-cut mapping we can focus our efforts on those objects that need our attention. The expensive field visits can therefore be made where they actually are needed. With the monitoring service we get data that is



more strategic, and we get information that indicates the failures of the forest-regenerations and use that information to pin-point the causes. Knowing the cause for the failures we can improve or change our working practice.

Similar services are developed for the Forest Service in Irkutsk and for a group of users in the French administrative région of Limousin and French "département" of Haute-Vienne.

**Support to Environmental Monitoring - CORINE spatial refinement in Western Austria for the Austrian Environment Agency**

The GSE-FM service for CORINE Spatial Refinement enables reporting obligations according to the UNECE/FAO definition of "forest" and on several related forest indicators, such as for the Ministerial Conference on the Protection of Forests in Europe and for the Alpine Convention. For several of these indicators, data could not so far be provided via in-situ measurements and hence the service provides very much needed information in a novel way.

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## IV Events

**North American Land Cover Summit (Washington DC)**

The North American Land Cover Summit, organised by the U.S. Geological Survey (USGS) took place on 20 – 22 September 2006 in Washington, DC. The summit is a forum for Canada, the United States and Mexico to discuss and exchange ideas about land cover mapping on the North American continent.

This year's topic dealt with the need for a common North American land cover database (covering all 3 nations). Representatives from Australia (Michele Barson, CSIRO) and Europe (Stefan Kleeschulte, ETC/TE) were invited to present experiences with large-area land cover programmes. The European presentation addressed the Corine Land Cover experience of Europe and current activities of the GMES Fast Track Service on Land Monitoring. The participants were especially interested in the organisational set-up and the shared responsibilities among EEA, ESA and the European Commission, which could also serve as a model for North America.

A conclusion from the summit is that Europe is rather advanced in land cover mapping as compared with North America: with the exception of Mexico, none of these countries has yet produced a land cover change database (no second inventory), current land cover change mapping programmes address the reference year 2000 and thus are not affected by the failure of Landsat 7.

In a similar manner to Europe, the participants expressed a shift from technology driven solutions to user driven demands in Earth Observation projects.

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**TANGO Kick-off**

In November 2006 the TANGO project led by Astrium and gathering 23 complementary partners was selected for co-funding by the European Commission in the 3rd Call for proposals of the Aeronautics and Space priority of the Sixth Framework Programme (FP6).

The TANGO "Telecommunications Advanced Networks for GMES Operations" project is the first project under FP6 bringing satellite telecommunications to serve the needs of the whole GMES community. The project addresses key environment and security applications in domains such as marine services and emergency response including risk and crisis management and humanitarian aid.

The project will mobilise key GMES players (GMES service providers, GMES data providers and end-users representatives) as well as Satellite Communication's leading expertise in the area with an overall budget of 8.9 M€, of which 5 M€ will be funded by the European Commission.

Through this project, Astrium and its associated research and industrial partners aim to develop and provide operational telecommunications solutions to the immediate GMES services needs, as well as prepare the definition of optimised satellite telecommunications infrastructures to expand future GMES services.

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## V Upcoming Activities and Links

### ***EURISY Conference: Future Challenges for Local and Regional Authorities: How can Space Technology help? 16 - 17 April 2007 – Barcelona***

Local and regional authorities are confronted with new challenges which require careful planning and effective use of new technologies: monitoring of the natural environment, sea and coastal pollution, land use, agriculture and forestry, mapping, dynamic route guidance with real-time traffic information, spatial planning natural disaster management, etc.

These and other areas are often the responsibility of local or regional authorities. However, they are by nature of concern simultaneously at local, global, and inter-local levels. To address these issues, the authorities are required to consider both micro and macro phenomena, and coordinate with other regional, national or European actors. Space technology applications have led to the development of numerous tools and services that can bring breakthrough solutions to address the challenges of local and regional authorities.

This is in particular true through European programmes such as the Global Monitoring for Environment and Security (GMES) and Galileo, which provide a number of new services of interest for local and regional authorities. However, these services are seldom known, or still in a development stage which makes their utilisation difficult or not fully operational.

This conference brings to Barcelona professionals from the authorities and from the space technology and service sectors. The two-day programme is designed to encourage discussion and effective information exchange on the challenges ahead from the user perspective, and also to present possible solutions provided by existing and planned space infrastructure and applications in the areas of earth observation, positioning navigation and timing, and telecommunications.

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### ***Final geoland Forum; Parallel Meeting FTS 2008***

The final geoland meeting will be a good opportunity to review the outcome of several Land related GMES projects eg IP geoland, ESA GSE stage I and stage II (i.e. SAGE, GUS, Forest Monitoring) that have helped to shape the Fast Track Service 2006. Moreover, we expect that these results will stimulate the interchange of ideas related to one of the great challenges of GMES: the long-term vision of land monitoring in the timeframe 2008 to 2013 and how to get there from where we are now. The information provided in this Newsletter is a starting point for reflection. During the final geoland meeting, a 3 hour workshop is planned to communicate these ideas as a necessary step to develop a shared vision. Short presentations providing statements of the countries are welcome. For further information, please contact Stefan Kleeschulte or Jaume Fons at the ETC/TE.

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***[www.gmes-geoland.info/forum](http://www.gmes-geoland.info/forum)***

### ***GMES Network of Users (GNU)***

The Coordinated Action GNU is a project of more than 20 user organisations – led by the Austrian Federal Environment Agency (UBA) which intends to initiate a structuring of the GMES demand side by setting up an independent platform that will become the focal point and mouthpiece of European GMES user needs, and, likewise will foster a systematic dialogue between the stakeholder communities. The Coordinated Action is closely linked to already existing networks of users of environmental data, including EEA Eionet, the GEO User Interface Committee and the User Group on Land Monitoring supported by geoland and GSE Land.

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