geoland

Integrated Project geoland

GMES products & services, integrating **EO** monitoring capacities
to support the implementation of European directives and policies
related to "**land** cover and vegetation"

Publishable
Final Period Activity Report 2004 - 2006

COO-0350-RP-0055

Issue 1.00

Project No. **SIP3-CT-2003-502871**

Period covered from 01/01/2004 to 31/12/2006

Date of preparation: 19/06/2007

Start date of project: 01/01/2004

Duration: 39 months

Project coordinator name: A. Kaptein

Project coordinator organisation name: Infoterra GmbH

TABLE OF CONTENTS

1 SUMMARY

Observatory Nature Protection (ONP)

ONP began with a more-or-less exclusive focus on regional users, but the work has evolved into a broader consideration of what should constitute a GMES Nature service, and how this should fit with regional, national, trans-national and European habitat monitoring scenarios. ONP has found that a product-only approach is not necessarily the only possible interface with the user community, and has accordingly proposed a three-tier service model which encompasses a generic data service (part of a future 'core' service?), an advisory service, and a product service. The specific ecosystem themes forming the practical demonstration work are a partial illustration of the product service. Product interoperability, indicator assessments, operational scenarios and recommending 'nature' content to European-level classification nomenclatures have served to illustrate an Advisory Service. Although still largely conceptual, a methodology framework has been defined for on-going work, with strong support for area frame sampling as the basis for a future harmonized EO-based monitoring programme, together with a holistic view of how a GMES Nature service might work, supporting both bottom-up reporting (via regional and national agencies), as well as top-down.

Observatory Water and Soil – Water (OWS-W)

OWS-W aims at developing stable, repetitive and quality-assured methods that integrate and optimise the use of EO derived information, i.e. land use / land cover data with customised thematic, spatial and temporal resolution, and ancillary geospatial data as input to catchment and surface water modelling, addressing the Water Framework Directive. Key focus have been Water pressure by irrigation practices, Water pollution and Source Apportionment modelling. All services consolidated within the frame of geoland have been or are going to be implemented and rolled out in ESAs GSE Land project in Sweden, Switzerland, Austria, Czech, Poland, Germany, Belgium, Luxemburg, Liechtenstein, Portugal, France, and Spain. Also, various national programmes or projects will further explore the services.

Observatory Water and Soil – Soil (OWS-S)

The Soil Observatory aimed at the development of pre-operational soil erosion risk assessment services which are in line with current EU policies such as the recently adopted by the Commission EU Thematic Strategy for Soil Protection. The developed services are based in the use of Earth Observation data, image analysis techniques and GIS modelling.

More specifically, the main objectives of the Soil Observatory were:

- To benchmark existing Soil Erosion models such as the USLE and PESERA in order to develop pre-operational high and low cost methodologies for the identification of high erosion risk areas.
- To investigate how the selected models are affected by the vegetation phenology and the way it changes over the year.

The developed services resulted in identifying areas of high potential soil erosion risk in a number of study areas in Greece and Italy. Such information is extremely important for erosion prevention, as it allows for the identification of the proper location and type of erosion prevention measures needed to be taken by the decision makers.

Observatory Spatial Planning (OSP)

Putting urban growth on the map

The objective of the Observatory Spatial Planning (OSP) has been to introduce innovative Earth Observation (EO) derived land cover products into spatial planning procedures and methods at European, national and sub-national level. The land cover products were combined with socio-economic information and integrated in GIS procedures and models. The actual results comprised maps, statistics, indicators, typologies and scenarios allowing for systematic and geospatial explicit territorial analysis.

Products and services have been developed in 9 European countries and toolsets have been installed for testing and benchmarking. With the project results, the Commission, the Member States and regions have significant information and tools for spatial planning at their disposal, enabling spatial planners to efficiently implement and assess actions.

Core Service Generic Land Cover (CSL)

The geoland Core Service Land Cover (CSL) is aimed at serving the needs of the European Commission and Member States on harmonized, topical and high quality basic information on Land Cover and its change. A large variety of different technical options have been analysed wrt. their scientific soundness, technical feasibility under different European environmental conditions, and economic viability. The consolidated portfolio comprises 21 classes, interoperable with CORINE; the minimum mapping unit is 1 ha in artificial areas and 5 ha in rural areas, respectively. The CSL Core Service concept has been accepted by EEA and its member states in July 2005 as the basis of the GMES Core Service Land Monitoring (CSLM). Its realisation for a wall-to-wall coverage of Europe is currently prepared by the GMES Implementation Group Land Monitoring, while the discussion on details is still ongoing.

Observatory Food Security and Crop Monitoring (OFM)

Geoland-OFM aimed at developing methods and tools for a future GMES Crop monitoring service for providing near-real time information on crop yield outlook and estimated cultivated areas at the scale of provinces and countries as basis for regional crop production estimates. The EC and FAO require such information on the major centres of production and in regions with food security problems, in particular for regions with high climatic risk of crop failures.

The current MARS-STAT and MARS-FOOD systems of JRC have been identified as the basis for a future GMES service.

Geoland-OFM has tested and cross-validated several alternative procedures under data rich conditions in European countries.

Three methods for estimating crop-specific acreage have been tested. They use LR or MR images and require different types input data sets due to differences in approach. All methods provide their acreage estimates some time after harvest. All methods gave good results in regions with homogeneous land cover: large fields, few crops, while results varied under mixed fragmented land use patterns. The available data, costs and type of region will determine the choice of best method.

Geoland-OFM work on yield estimation was organized as a contest between existing methods for generating yield indicators based remote sensing and modelling and combined methods. These yield indicators in the form of vegetation indices and modelled crop biomass are updated monthly and are used as predictor of the mean regional yield. The overall conclusion of the yield estimation contest was that the performance of the various methods varied over the regions and years. Validation requires long continuous time series of data, to which some remote sensing based methods could not comply. Early in the season none of the yield predictions based on any of the indicators is really better than the extrapolated trend. Later in the season the best predictions came from the modelled indicators of the existing MARS system. Remote sensing methods did better in Spain than more northern countries. In some cases these predictions can be improved by better model calibration.

In a second stage, the OFM methods have been applied in operational automated data processing chains to wheat and maize crops in the North China plain.

The key risk factors for the various OFM products are

- The availability of Earth Observation data on a long-term basis.
- Lack of uniform and consistent ancillary data
- The lack of suitable regression tools in yield forecasting
- The wide choice in products may be confusing for users,.
- The standard OFM-products designed for continent-wide crop monitoring may not address the information needs of the user for specific situations.

Observatory Global Land Cover & Forest Change (OLF)

OLF has been focusing on two priority areas identified in the GMES/EC action plan: Africa and Boreal Eurasia. Automated processing chains have been conceived, implemented and tested to generate a number of environmental indicators (seasonal variations of surface water, burned surfaces and fires, phenology of vegetation, land cover change) at a 10-day frequency. These products are currently delivered in near real time to African countries by the VGT4Africa specific support action. A software tool, “SPADA”, was developed to allow combination of these indicators as well as other space-based information and to identify areas with anomalies in terms of land cover change or conditions. Targeted users of the Observatory for Land Cover and Forest are public services of the EC, the EU member states and partner countries (Russia and African countries) and international institutions.

Observatory Natural Carbon Fluxes (ONC)

The objective of the land carbon component of GEOLAND is to develop a multimodel carbon accounting system accounting for weather and climate variability, coupled with a EO data assimilation system. This new tool will support Kyoto (and post-Kyoto) reporting activities.

The main achievement consisted in performing the greening of the land surface operational platforms of meteorological services (ECMWF and Météo-France). Namely, a CO2 responsive capability was introduced in the land surface models and the possibility to simulate the vegetation biomass and leaf area index. ECMWF is now ready to simulate the terrestrial carbon flux at a global scale with a spatial resolution of 25 km. The modelled carbon flux is fully consistent with the modelled water flux, soil moisture, vegetation biomass and leaf area index.

Demonstration products with a spatial resolution of 40 km can be found on http://www-lsceorchidee.cea.fr/.

A demonstration EO data assimilation system was implemented over southwestern France, and a simplified version was successfully applied at a global scale.

Future activities will focus on the representation of carbon storage and soil respiration in the modelling platforms of meteorological services, on the development of the operational use of EO data assimilation, on the improvement of the spatial resolution over Europe (1-10 km), and on linking the products with forest and soil carbon inventory activities in Europe.

Core Service Bio-physical Parameters (CSP)

The CSP aims at reaching a pre-operational production and validation of global bio-geophysical products, that is, vegetation variables (i.e., leaf area index, fraction of vegetation cover), radiation variables (i.e., surface temperature or albedo) and water variables (soil moisture, flooded areas) obtained at decadal time frequency and medium to low spatial resolution from EO data. For that, the complete information chain, algorithmic research – processing lines development – operational production – user services, has been set up and validated. The capability of operational production, and of product quality control is demonstrated with sound interfaces with both the upstream science community and the downstream user world.

Thanks to a dynamic spirit and a common strategy, the CSP teams have elaborated innovative algorithms, implemented the processing lines in a pre-operational environment, and delivered to users long time series of biogeophysical parameters, also available for the whole international community through the geoland-CSP website.

The CSP group dynamics, and the strong links established with the Global Observatories, have led to a common vision of what could be the global part of a future operational “Land Monitoring” service, integrating operational and R&D initiatives in Europe.

Operational Scenario (OS)

OS was designed as a cross-cutting activity of geoland. It provided a joint platform for all geoland Observatories & Core Services to develop the geoland scenarios for operational service provision and operational plans describing the requirements to achieve this in terms of service infrastructure, space and in-situ infrastructure, and demand & supply-side organisation.

The activities within the "Operational Scenario" worked through bottom-up and top-down approaches comprising Service Infrastructure analysis and Operational Service scenario development. Rationale of OS was to build on existing expertise and infrastructure elements, identify current bottlenecks and shortcomings, and find and propose solutions for upgrading to operational level of LC&V services. The OS reflected both, state-of-the-art as well as state-of-the-practise of geoland Observatories/Core Services. Designed as coordinating interface to parallel activities, the task OS aim was to collaborate with relevant initiatives and projects and GMES stakeholders in general (INSPIRE, IPs MERSEA & GEMS, SSA HALO & GOSIS, ESA GMES Service Elements (GSE), GEOSS). Key OS messages have been communicated to GMES stakeholders concerned. E.g. geoland requirements are well reflected in the ESA Sentinel Study.

2 GEOLAND – EUROPEAN AND GLOBAL LAND MONITORING

2.1 GEOLAND - SCOPE AND RESULTS

Motivation

Currently, 20% of all surface water sources in Europe are seriously threatened by pollution, 17% of the total land area is affected by soil erosion, 335 species are highly endangered, an intensified agriculture environmental stress, and growing urban settlements and transport networks lead to soil sealing and fragmentation of landscape.

Climate change is a fact already today. It makes long-term time series and land management based on previous experience not reliable any more. This is a key challenge not only for Europe's land management, but also to global crop monitoring, the sustainable development of Africa, or the reliable assessment of the global carbon and water cycles.

Policies & directives

A range of recent International and European policies and directives address these pan-European challenges. As a result, international, European, national and regional authorities face an increasing amount of spatially explicit monitoring and reporting obligations. The practical mitigation of short-term and mid-term climatic changes and man-made impact requires an up-grade of today's monitoring and management systems towards higher resolution in space and time.

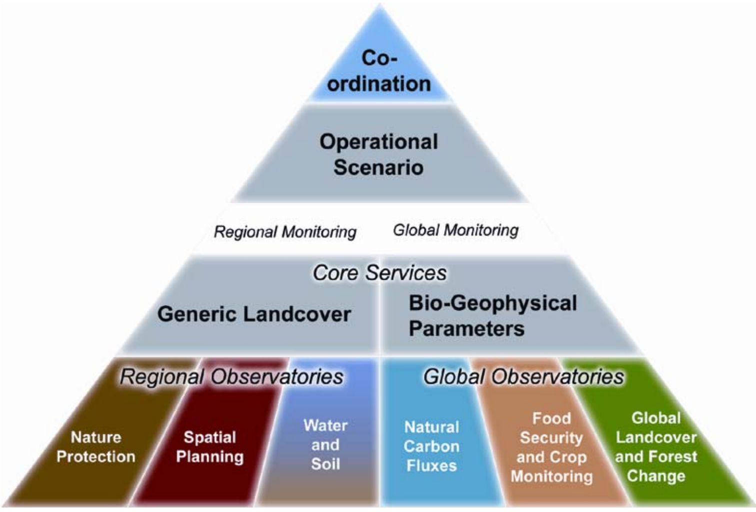
geoland Scope and Results

geoland is carried out in the context of GMES, a joint initiative of European Commission (EC) and European Space Agency (ESA), which aims to build up a European capacity for Global Monitoring of Environment and Security by the year 2008. The GMES initiative is considered a unique opportunity to integrate existing technology with innovative and scientifically sound elements into sustainable services.

geoland has been set-up to fundamentally support this initiative, focusing on the GMES priorities “Land Cover Change in Europe”, “Environmental Stress in Europe”, and “Global Vegetation Monitoring”. The ambition of the geoland stakeholders has been to develop and demonstrate a range of reliable, and affordable geo-information services – in close cooperation with more than 100 user organizations from 24 European member and accession states.

These services shall enable authorities and Europe's citizens to better cope with climate change and man-made impacts in order to support a sustainable use of natural resources, achieve an overall good quality of life, and fulfil concrete legal obligations in terms of spatial monitoring and land management.

95 products for the six application fields and two core services have been developed and thoroughly assessed for their maturity. 14 products failed and were deleted, 35 products were newly added responding to user needs and evolution of the service concept. Of the 81 "surviving products", final proof-of-concept including a user acceptance document was given for approx. 2/3 of the products (62). 1/3 of the products secured further demonstration / implementation funding. 1/6 – surprisingly enough- won first (small) operational budgets from public end-users.



The sub-task summaries present an overview of the tangible geoland results (see ch. 3, p. 30ff.). The last chapter introduces the exploitation steps in terms of operational implementation for mature products and services, and in terms of further R&D for promising candidates (see ch. 4, p. 64ff.).

Additional demonstration and R&D funding attracted beyond geoland

A range of geoland sub-tasks achieved to attract additional funding to achieve further steps in downstream service integration with user organisations (e.g. using local user funds), exploit synergies and added-value with further GMES services (e.g. Atmosphere, Ocean, Risk Management and communication links such as GeoNetCast[1]), and large-area demonstrations on selected European catchments / focus areas (through the European Space Agency's GMES Service Elements programme), China (through a European Development Bank project) and the Globe[2].

The European Commission's Integrated Project "Boss4GMES" will support the implementation definition and processing line integration for the European Fast Track Service Land Monitoring between end of 2006 until 2009.

Promising implementation steps

A transition phase addressing both CORINE Land Cover and first high-resolution layers has been initiated by EEA and its Member States as "Fast Track Service Precursor" (2006 – 2007).

geoland results will also contribute to the Joint Research Centre's Observatory for the sustainable development of Africa and the AMESD project from 2006 on.

The full Fast Track Service "European Land Monitoring Database" is expected be organised by DG ENTR together with matching operational funds user-DGs (2008 – 2013). The Global Observatories have initiated a meeting to pave the way towards a "Global Land Monitoring" services.

---

[1] European Commission Framework 5 Strategic Support Actions (SSAs) "HALO" and "Vegetation for Africa", European Space Agency, access to Eumetsat's PUMA infrastructure in Africa.

[2] ESA GMES Service Element (GSE) projects "SAGE" (Stage 1) www.gmes-sage.info , and "Land Information Services" (Stage 2) www.gmes-gseland.info , ESA's Data User Element (DUE) project GlobCover, and JRC's Global Daily Burnt Area project.

Pilot Services covering also downstream applications taking benefit from these core service are already starting-up now based on Regional initiatives, and European co-funding from existing programmes. Further European GMES funding is expected from 2010[3].

Stakeholder Platforms & Collaboration

geoland Consortium

During the course of the project, 59 consortium members willing to invest an approximate value of 10 M€ on top of the European Commission's grant of 10 M€ grew into one well structured team exploiting the benefits of a comprehensive expertise and complementary skills. The consortium represents a stakeholder group of public user organisations, researchers, and public and private service providers.

Public authorities collaborating directly with geoland

The growing user community currently involves more than 100 public authorities, defined as "legally mandated organisations" (LMOs) with a concrete operational obligation to implement specific policies and directives. These organisations range from international to local administrative levels to ensure comprehensive coverage of the reporting and decision making cascade.

20 public user organisations joined the geoland consortium as full members, all others have firmly committed their selves through formal collaboration agreements, defining both geoland and user-side deliverables and obligations.

Table 1: 53 User Organisations engaged in geoland

International User Organisations (9)	European User Organisations (11)
FAO – Food and Agriculture Organisation of the United Nations **GCP** – Global Carbon Project **IGBP** (via LSCE, F) **IGOS-P** Programme (via LSCE, F) **IKI** – Space Research Institute of the Russian Academy of Sciences **OECD – PUMA Task Force**, Public Management Committee, Organisation for Economic Co-operation and Development **UNEP-DEWA** – United Nations Environment Programme **UNIDO** – University of Trieste / International Centre for Science and High Technology, United Nations Industrial Development Organisation **WMO – GEWEX Programme**	**ECMWF** – European Centre for Medium-Range Weather Forecast **EUMETSAT-LandSAF** **DG REGIO** **DG AidCo** **DG RELEX** **ESPON** 3.3 – European Spatial Planning Observation Network, Co-ordination Unit **ETC-TE**, European Topic Centre Terrestrial Environment (EEA) **EUROCITIES** **JRC-AgriFish Unit** (linking to DG Agri, DG AidCo as end-users) **METRECS** – The Network of European Metropolitan Regions and Areas **EEA** -- European Environment Agency: *working links established between task managers and EEA project officers; EEA monitoring & guiding geoland progress as advisory board member*

3 COM(2005) 565 final – § 3.4 / p. 9 ff

National and Regional User Organisations (37)	
A – Austria Umweltbundesamt (UBA-A) State Government of Vorarlberg State Government of Upper Austria Austrian Institute of Spatial Planning (ÖIR) Austrian Conference on Spatial Planning (ÖROK) Forest Administration of Salzburg **CZ – Czech Republic** Czech Ministry of the Environment Czech Environmental Information Agency **D – Germany** Potsdam Institut für Klima- und Klimafolgenforschung (PIK) Umweltbundesamt (UBA-D) Bundesamt für Naturschutz (BfN) Ministerium für Landwirtschaft, Naturschutz und Umwelt Thüringen (TMLNU) Thüringer Landesanstalt für Umwelt und Geologie (TLUG) Thüringer Landesanstalt für Wald, Jagd und Fischerei (TLWJF) Landesamt für Land- und Forstwirtschaft, Thüringen (LWF) Landesamt für Natur und Umwelt Schleswig-Holstein (LANU) Forstliche Versuchs- und Forschungsanstalt Baden-Württemberg (FVA) **E – Spain** Confederacion Hydrografica de l'Ebro **F – France** Météo-France Agence de l'Eau Adour Garonne Institut Français de l'Environment (IFEN)	**GR – Greece** Ministry of Environment National Agricultural Research Foundation, Forest Research Institute (NAGREF – FRI) **I – Italy** Agenzia per la Protezione dell'ambiente e per i Servizi Tecnici (APAT) Forest Administration of South Tyrolia **N – Norway** Norwegian Water Resources and Energy Directorate Directorate for Nature Management Norwegian Institut for Land Inventory Statkraft **NL – The Netherlands** KNMI **S – Sweden** Swedish Enviromental Protection Agency (SEPA) County Administration Board of Dalarna (CAB) **UK – United Kingdom** Department for Environment, Food & Rural Affairs (DEFRA) Environment Agency for England & Wales Scottish Natural Heritage English Nature Countryside Council for Wales

GMES Land User Platform

To federate and coordinate the GMES vision among European users a self-governed, open GMES Land User Platform has been initiated. It is coordinated by the ETC-TE in order to motivate and support self-organised ad-hoc GMES user working groups (many of them already existing). Coordination and networking funding is provided by geoland (and the geoland+ task within IP Boss4GMES) and ESA's GSE Land.

Its goal is to establish a common understanding on service needs and implementation requirements across the user organisations of the policy sectors and vertical administrative levels addressed.

Table 2: User Organisations committed to geoland and GSE Land

Administrative Level	geoland		GSE Land *Baseline*[4]		Common User Base[5]	
	Users [6]	Nations	Users	Nations	Users	Nations
International	**9**	UN, OECD, IPCC	n.a.	n.a.	**9**	UN, OECD, IPCC
European	**11**	EUMETSAT, EU-25, EEA-32	**5**	EU-25, EEA-32[7]	**14**	EUMETSAT, EU-25, EEA-32
(Sub-) National, Local	**37**	11	**78**	20	**108**	24
Totals	**57**		**83**		**131**	

Certainly, much more needs to be achieved. geoland can only build the bottom-up user acceptance and awareness. Impact on agency decision making and policy making level needs top down GMES policy support. However, key European DGs and member state institutions have not really become full supporters of GMES on this level.

It remains a key that national or European agencies cannot build on sufficient operational budgets dedicated to GMES today to procure the geo-information they do need to fulfil the recent directives. While customers in commercial markets are rather quick in re-allocating budgets according to new needs and efficiency, the process of generating dedicated public budgets, associated with new coordination or procurements mechanisms has turned out to be a cumbersome and time-consuming procedure.

[4] More user organisations have already committed theirselves for GSE Land extension services; the implementation of these services is optional and depends on acceptance of these proposals by ESA.

[5] Taking into account common users: 2 European (ETC-TE, ESPON) and 5 national/sub-national bodies (from AT, DE, FR)

[6] 20 consortium members, 34 user associated through letters of commitment specifying the type of engagement, in-kind contributions and services received.

[7] EEA discussed a possible participation in the ESA GSEs in its management board June 22. The management board recommended to its members to participate in GSEs. EEA management will discuss this in the next step with ESA.

Direct links with official DG ENV and EEA working groups

Since 2004, a sound exchange with the 25 member state representatives of the DG ENV WISE working group looking into the practical implementation of the Water Framework Directive has been set-up by invitation of the responsible DG ENV desk officer.

The FTS Land Implementation Group has invited geoland stakeholders to provide consultancy to its activities since 2005.

The year 2006 saw a major step forward in direct communication with the 32 members state representatives of EEA's EIONET and the National Resource Centres (NRC) Spatial in the framework of discussing and defining the layout of a "Fast Track Service Pre-Cursor".

GMES, GEOSS and INSPIRE Collaboration

The geoland consortium has established excellent working links with parallel and follow-up GMES activities.

Collaboration continued with a range of GMES activities, including the SSAs HALO and RISE, the IP Boss4GMES, ESA's GSEs Land and Forest Monitoring, Sentinel-2 team, ESA's Heterogeneous Mission Access Study, and ESA's Service Evolution Study.

A GEOSS collaboration survey initiated by DG RESEARCH identifying the fields of potential geoland contributions to GEOSS working groups has not led to concrete results, yet. In the meantime the geoland Executive Board has strengthened its links with the GEO secretariat through one of its advisory (Michael Rast) and participation as an observer to the GEO-3 meeting in 2006, and the GOFC-GOLD standardisation activities. Further action is expected to follow in 2007.

INSPIRE collaboration has been rather indirect – with the DG ENV and DG EUROSTAT desk officers Hugo de Groof and Hans Dufurmont being involved as geoland Advisors and the GMES Land User Group. Contacts initiated by JRC at the 2005 ESA co-location and the 2006 geoland Forum 3 did not yet lead to major collaboration opportunities, except filling in some general INSPIRE surveys.

The consortium today has not achieved to set-up a general "geoland platform" to allow programmatic "European and Global Land Monitoring" coordination across the participating stakeholder groups and projects. Practically and informally, this apparent gap in coordination is expected to be closed by the on-going IP Boss4GMES (geoland+ activity) and the up-coming coordination of all stakeholders on new FP7 initiatives.

Next Steps

The GMES Land User Group and the GMES Land Service Provider Network will survive the geoland "project" as European stakeholder platforms. Research & Development and Implementation Plans have been prepared by the geoland stakeholders to propose a road-map for future activities.

The geoland consortium trusts in the success of a Fast Track Service Land Monitoring – and its evolution towards a more comprehensive service. The 2008 revision of the current EC budget framework may provide an opportunity to resource the necessary operational funds to implement a comprehensive Fast Track service.

In the mean-time, both the recently started IP Boss4GMES and the teaming for FP7 opportunities in early 2007 are expected to keep the wider European and Global geoland teaming and spirit alive

- and maintain the skills and know-how achieved through FP6 and FP7 funding, bridging the gap until operational funds become available.

2.2 BEYOND THE PROJECT – A LAND MONITORING VIEW ON GMES TODAY

As the pressure on Planet Earth grows, so does the effort in monitoring changes and impact on mankind and natural resources. Europe is contributing to these efforts through a number of international policies and European directives, the UN Framework Convention on Climate Change or the Water Framework Directive.

In order to successfully implement the related policies, the European Commission and the European Space Agency (ESA) have jointly established the European GMES initiative (*Global Monitoring for Environment and Security).*as a concerted effort. The scope is to establish operational services integrating Earth Observation data and in-situ measurement to support public decision makers – across a range of policy sectors, and from local management to European-level policy impact assessment.

Following a systematic cycle of service consolidation (proof of concept) and service implementation (large area demonstration) projects funded by EC's 6th Framework Programme and ESA's EarthWatch programme, GMES will now move towards operationality*. Three fast track services shall start by 2008 (land monitoring, marine information and emergency response). Other services will follow; several themes are already identified.

It is intended that through continued release of affordable, reliable and up-to-date core information a high rate of customised downstream services can be stimulated to public and private user organisations.

A successful implementation depends on reliable and long-term data availability. Europe currently depends heavily on Earth Observation satellites of non-European origin; meaning that – potentially – other countries know more about the European territory than the Europeans themselves, furthermore being able to cut Europe off from essential information streams. As the threatening European deficit in satellite navigation is overcome with GALILEO, the European Council has established GMES as the second technological flagship, designed to overcome the monitoring deficit alongside practical services to public organization..

Establishing this European self-sustainability in the implementation of its resources-related policies, and strengthening its position in this part of the information society sector will require a sustained support coming from RTD framework programmes as well as operational geo-information services procurement budgets of the European Commission DGs and MS bodies – bearing in mind that European public services are the key customers.

* See COM(2005)565 "GMES – from concept to reality" of November 2005 for a description of the latest status of development is described in. The website http://www.gmes.info/2.0.html is informing continuously.

European and Global Land Monitoring Services

Recent and upcoming European directives have lead to an increased demand by public decision makers for efficient and effective geo-information services at affordable costs. Therefore, the FP6 IP geoland was established as a European platform for all stakeholders (user organisations, researchers, service providers) to define, test, and accept GMES services. Alongside ESA consolidated service concepts, the GSE Land information Services project is implementing those European services over larger areas[8], that were identified as most mature in early 2005. Both lead projects of the Commission and ESA are working hand in hand. The geoland core service "European Land Monitoring" – supporting the downstream applications with common land use and land cover data, has been identified as one of the three European Fast Track Service candidates to be implemented from 2008. A Fast Track Service Pre-cursor will address the most urgent European reporting needs closing the gap between 2006 and 2008.

Following a stakeholder meeting initiated by the Global Land Monitoring team of geoland in early 2006, the "Implementation Group" on land has taken the custody for a "Global Component".

The Global Land Monitoring team has built a common vision of an extended "Land Monitoring" Service. Medias-France, the Institute of Meteorology of Portugal, VITO, and the Technical University of Vienna have teamed up to pursue key follow-up activities (research, processing line engineering development, production) towards operations.

In parallel to the "core service" discussion, the member states and regions of Europe have continued their local networking (e.g. Poland, Lithuania, Romania, Bulgaria). The Committee of the Regions has initiated a European wide collaboration, that shall be implemented from 2007 onwards.

The value of a GMES core service for both European DG applications and national downstream services has been demonstrated over large areas of Europe in 2006 through ESA's GMES Service Element "Land Information Services" (GSE Land).

A discussion on general GMES portfolio evolution steps has been initiated at the last geoland Advisory Board meeting, looking into requirements for the up-coming FP7 opportunities. The current findings indicate a need for a general European-wide seasonal monitoring scheme (e.g. crucial for soil erosion, agri-environment, water quality/quantity, crop forecasting).

The overall underlying assumption is that Climate Change will happen – and lead to increased variability of weather conditions. Therefore, average (multi-)annual mean values will become less and less important, statistics and "best-practice land use" building on the experience of the last decades and centuries already now is not any more sufficient. The key drivers for environmental change and sustainable use of resources will be more and more seasonal events.

Against this background, both a seasonal monitoring service and European-wide core applications may need to be implemented to enable early warning, yearly management, and a comprehensive overview on the impact of Climate Change on Europe's Environment and Quality of Life.

The service evolution discussion has been supported through inputs into the re-shaped "Boss4GMES" work-programme and ESA's service evolution study.

[8] www.gmes-geoland.info, www.gmes-gseland.info

Market implementation options and steps

Current understanding

The work-split between the European Commission and its Member States is governed by the principle of subsidiarity, when implementing European environmental, cohesion, and agricultural policies. In terms of geo-information services procurement, this is expected to translate into a European procurement of core services and down-stream applications. A “European Land Monitoring Database” has been identified as Fast Track GMES service of common interest for the so called “user-DGs” (DG Env, DG Agri, DG Regio), and the Member States[9]. The mandate to procure policy sector-specific downstream applications / services building on such a common “Land Monitoring Database” is with the Member State agencies at national, regional and local level, as well as user DGs.

Challenges

The European challenge is to agree on service standards to ensure interoperability between GMES services and with existing applications and national programmes. Synchronised funding schemes for core services and downstream applications still need to be established. Existing European programmes, such as DG Regio’s cohesion programmes still need to be activated to support the implementation of downstream services by Europe’s Regions. The LIFE programme of DG ENV is already now encouraging joint cross-border actions in support of existing directives. This discussion is expected to be led by INSPIRE on the technical level, and by the DG ENTR “GMES Land Monitoring Service Implementation Group” federating technical, organisational and funding aspects among the European Commission and Member State stakeholders.

Implementation Steps

European kick-start funding has already been achieved for a range of most mature services being demonstrated for a limited number of Regions under ESA funding. A transition phase addressing both CORINE Land Cover and first high-resolution layers has been initiated by EEA and its Member States as “Fast Track Service Precursor” (2006 – 2007). The full Fast Track Service “European Land Monitoring Database” will be funded by DG ENTR (FP7) together with matching operational funds, potentially from user-DGs (2008 – 2013). Pilot Services covering also downstream applications taking benefit from this core service are already starting-up now based on Regional initiatives, and European co-funding from existing programmes. Further European GMES funding is expected from 2010[10].

Towards a growing market – business environment and regulatory framework

Understanding

The GMES services have been specifically designed to meet the geo-information needs of public customers implementing International Policies and European Directives.

Public customers are expected to procure this geo-information in a open and competitive tender process. Private and public geo-information services providers will respond, accordingly. A visible trend in public administration is to focus public tasks on mandated duties, i.e. resourcing informa-

[9] COM(2005) 565 final – § 3.2 / p. 7 ff
[10] COM(2005) 565 final – § 3.4 / p. 9 ff

tion, evaluating it, taking decisions, and management of measures. For cost reasons, all other services might potentially be better outsourced to a competitive service market – provided that a trusted and proven offer is being established.

Challenges

To offer a trusted service portfolio based on commonly agreed service standards and accepted working practices is a key challenge for innovative services. Private and public services providers – in coordination with public user organisations - have just started to set-up an independent qualification audit process for GMES services and service providers to guarantee a trusted offer[11].

Market fragmentation needs to be overcome building on technical standards and a European procurement level, as the current geo-information services offer is already a pan-European one provided through service networks.

- **Standards**: A European-wide agreement on common geo-information standards is being promoted through the INSPIRE initiative. However, involvement of GMES services still needs to be increased raising awareness for the new or up-graded service needs. Here, a number of nations are already collaborating through the GMES network, recently established by a joint geoland and GSE Land initiative...
- **Common market**: nationally protected markets governed by local regulatory frameworks still prevail – especially in public procurement.
- **Coordinated procurement**: According to the subsidiarity principle funding and procurement of geo-information is located on regional level for a broad range of services. But this does not prevent collaboration across borders and administrative units, as the successful range of Interreg projects and the approach in GMES implementation demonstrates. However, both the European Commission's DGs and the Member State bodies still lack a coordinated procurement policy to stimulate the European public geo-information market sufficiently to become sustainable allowing for growing businesses able to further invest into its development (services, lobbying).

The establishment of operational budgets for GMES services is still a major concern. The EC discussion has just started, following the Fast Track Service communication. However, the awareness on what GMES could offer to comply with the growing reporting and management needs is still limited on Member State and Regional level.

Implementation Steps

The stakeholder process of customers and suppliers to set-up common standards and allow for trusted offers is on a promising way through INSPIRE and the GMES Land Service Provider Network / GMES Land User Group activities. To fully activate and include the Member States and Regions of Europe as key beneficiaries of land-related GMES services needs an additional political effort of the Commission and the Member States. It is anticipated that the up-coming GMES Bureau will actively support such a process. To overcome national market barriers still needs major policy efforts (see also the EC initiative on a "Services Directive" to achieve a genuine Internal Market).

[11] Action has been initiated by ESA (see GMES Service Elements, Stage 2 call). Qualification is being established by the GMES Land Service Provider Network in collaboration with the GMES Land User Group through the GSE Land project.

Role of the Regions in GMES and European Land Monitoring

Understanding

In the domain of Land Monitoring Services the European Regions are acting with two objectives:

- Following the subsidiarity principle, they are usually the mandated bodies to procure new information (i.e. principle customer also for GMES services). More than 100 of the 135 user organisations engaged in geoland and GSE Land are consequently on regional and local level. They are usually quite pragmatic and solution oriented, promoting transboundary European solutions to comply with recent/up-coming EC directives
- As local business developer developers they are engaged in the support of key innovative industries building the future knowledge society in Europe. -e.g. for example the French Technopole for ERA-STAR REGIONS (*espace européen de recherche – applications des technologies de l'espace et de la recherche pour les régions et les pays de taille moyenne*). set-up in the Region Midi-Pyrenees, or the German State of s, Brandenburg Initiatives to attract geo-information service providers and Earth Observation business.

Challenge

Today, the Regions of Europe are not well represented in the GMES process. Usually national representatives speak in decision making bodies, where pragmatic solutions accepted by the regions may be compromised against national interest in defending uni-lateral solutions.

Socio-economic benefits and funding schemes

Socio-economic benefits

- **Societal benefits**: Informed decision making through better and more timely available GMES geo-information enables better policy design and management decisions: for instance by ensuring compliance of agriculture incentives with drinking water quality targets by reducing diffuse pollution by nutrients and pesticides, or by reducing the impact of flash-floods on industry areas through improved spatial planning. In general, remediation measures (such as health costs, drinking water treatment, infrastructure damage) are substantially more expensive than any prevention measures.
- **Employment effects**: A limited impact on employment in the down-stream geo-information. However, GMES will lead to a sustainable business for a highly specialised community, which today is still very much depending on direct on indirect public support programmes (e.g. through FPs, ESA, national programmes). In addition, their knowledge on advanced geo-information technology will offer export opportunities, especially to less developed areas, increasing the competitiveness of Europe's high-tech industry and contributing to a better management of natural resources, worldwide. Besides that, a major effect on sustainable employment in space industry is anticipated through continuity of operational Earth Observation satellite programmes.

Funding schemes

- The procurement of geo-information by public customers for land monitoring, environment, agriculture, or spatial planning applications, is expected to be based on public budgets. Indirect cross-sales to commercial markets are expected to be quite limited due to the special information required by public bodies.

- PPP schemes for public geo-information services not seen as appropriate, as only a limited market beyond these European public players is expected. PPPs may be justifiable for EO data procurement or satellite business, where –beyond the European public market- a broad range of further applications and exports markets can be addressed.

Future Structure and Governance

- **Governance**: GMES Land activities, up to now, have been successful because they were embedded into a stakeholder process allowing for direct involvement of public bodies on all administrative levels (EC, MS, regions, local), science, and private/public suppliers.

  As the suppliers were asked to invest substantially (e.g. through the EC FP7 projects), this principle shall be maintained from their point of view. In the end, the GMES projects can only propose solutions that have been demonstrated, tested and accepted by user organisations.

  The final decision making process is exclusively a public mandate. Thus, without creating prior acceptance and awareness on the impact of decision alternatives (with respect to impacts on cost, quality, sustainability), investments made into GMES service development, are on risk to fail at this final step of formal adoption.

- **Structure and adequate governance mechanisms**: Mechanisms for procurement and operational budgets allocation currently are manifold. Coordination is needed.

  It is up to the mandated users to agree on synchronised procurement on European level and respective budgets. As such mechanisms are still lacking it is very important to initiate as soon as possible consolidated decisions on common procurement strategies and common service standards. Otherwise, the fragmented market situation will persist and possible synergies as well as economics of scale already demonstrated in the GMES projects will not materialise.

  From this point of view, a GMES Bureau acting as a "federator" and "enabler" may be a key idea to be tested for acceptance and effectiveness.

2.3 STRUCTURING AND INTEGRATING A FRAGMENTED SCENE – THE GEOLAND APPROACH

Within eight sub-projects (6 “observatories” addressing sector-specific end-user applications and 2 “core services” providing common up-stream geo-information inputs), the geoland partners develop products and services, utilizing available Earth Observation resources in combination with in-situ measurements, and integrating them with existing models into pre-operational geo-information services.

These will support international, European, national and regional authorities and institutions in fulfilling their increasing monitoring and reporting obligations – and help them to better manage natural resources.

Ten sub-tasks and their scope

geoland particularly addresses environmentally relevant issues such as water quality, nature protection, the Kyoto-process or food security issues. The project is structured into three regional and three global observatories, each of them supported by a core service providing basic geo-information inputs. An Operational Scenario is being established to define the geo-information infrastructure and satellite technology requirements to achieve a fully operational service.

The geoland products and services provide geo-information to support monitoring, management and decision making. The downstream service integration varies per observatory, ranging von mapping and change detection, through model assimilation, to integration into scenario tools and performing environmental assessments. Service providers along the value chain may be private or public, including technical departments of the user organisations.

Table 3: geoland sub-tasks and their scope

Regional Observatories *focus on implementation of newly established European directives*	
Observatory Nature Protection	Habitats and Bird Directive, Ramsar Convention, Convention on Biological Diversity
Observatory Water and Soil	Thematic Strategy for Soil Protection, Water Framework Directive
Observatory Spatial Planning	European Spatial Development Perspective, European Spatial Observatory Network

Global Observatories *address Global Change and Sustainable Development issues*	
Observatory Natural Carbon Fluxes	UN Framework Convention on Climate Change
Observatory Global Land Cover & Forest Change	UN Forum on Forest, Forest Development Communication of the EC
Observatory Food Security & Crop Monitoring	council regulations on Food Aid Policy, Environmental Measures in Developing Countries

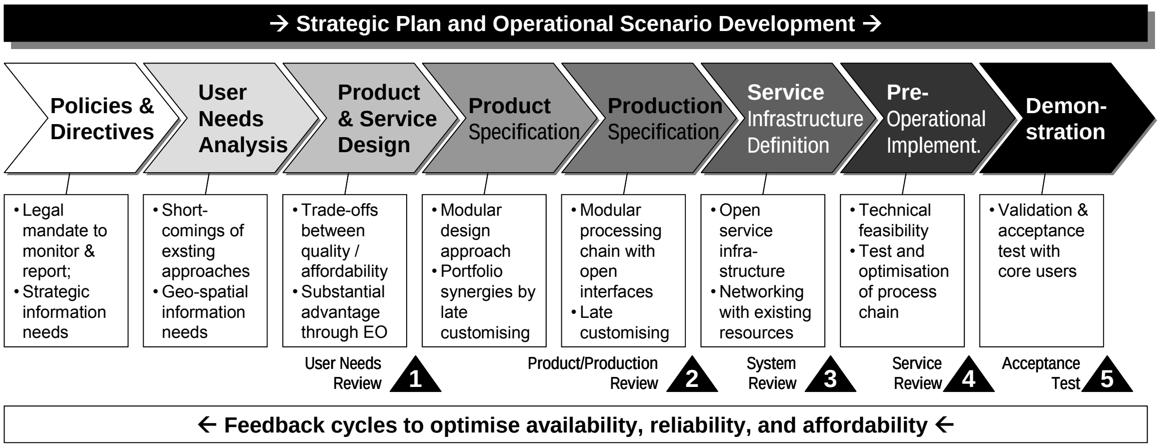
Core Services *support the observatories with cross-cutting issues*	
Core Service Generic Land cover	Support of the regional observatories with cross-cutting land cover and land cover change products
Core Service Bio-geophysical Parameters	Supports the global observatories with cross-cutting parameter products

Operational Scenario	Development of service infrastructure design for all sub-tasks

Systematic service health-checks

The geoland service development and demonstration logic is closely linked to user organisations driving and reviewing each step and finally accepting the results after integration into their own environment.

Table 4: User-driven, Step-wise Product & Service Development



The key technical scope of the geoland service development is to give proof-of-concept for mature geo-information services supporting recently established and evolving public end-user needs. The focus is the analysis of end-to-end service chains to make sure that better quality geo-information inputs do have an input, when being integrated into end-user applications.

The key questions are:

1. **Is it scientifically mature?** A range of models assimilating geo-information derived from Earth Observation alongside other information, such as in-situ measurements exists. But which of these algorithms and models are mature enough, do deliver stable and reliable results, to be built into an operational process chain? Are these algorithms and models fit to ingest geo-information at higher resolution? May other input parameters prove to be the limiting factors to a better end-result?
2. **Is it technically feasible?** This question was analysed against the background of the Earth Observation capacities and technologies available today – assuming that a first service capacity needs to be ready by 2008. At the same time, a number of algorithms are simply not practically feasible, e.g. not allowing for the necessary throughput to cover large areas or simply requesting too many input parameters not widely availably today.
3. **Is it economically viable?** Whatever a future funding of procurement setting for GMES services will be: the cost associated to each element of a service or service chain needs to be in a reasonable relation with the expected benefit, and existing/alternative approaches.
4. **Does it finally meet the end-user requirements (user acceptance)?** Practical demonstrations using the new GMES information within user-side monitoring, management, and reporting procedures were executed and critically evaluated by public user organisations to achieve the final proof-of-concept.

Two additional success levels were added, reflecting un-expected success in securing funding beyond geoland:

5. **Further demonstration / implementation funding secured?** Further funding from other research and operational funds enabling large area demonstrations or service transfer to new geographic areas.
6. **First operational end-user funding achieved?** Even if substantial budgets to procure new GMES-type geo-information do not yet exist, a number services were successful in acquiring first (limited) end-user funding.

The maturity assessment result by the end of the project in 2006 reads as follows:

Table 5: Cumulated product maturity rating

1 - Scientifically sound	2 - Technically feasible	3 - Economically viable	4 - User accepted	5 – further demonstration / implementation *	6 - first operational funding secured	Deleted	Total
81	**79**	**73**	**62**	**30**	**11**	**14**	**95**
85%	**83%**	**77%**	**65%**	**32%**	**12%**	**15%**	**100%**

* beyond geoland

The number of mature products taking best benefit of new Earth Observation resources integrated with existing systems quite well reflects the maturity of the user needs and the technology heritage.

The service maturity expectation (“ready for implementation”) after user acceptance (level 4) for all products is given in the following table.

Table 6: IP geoland – service consolidation status at project end

geoland Product Portfolio – Regional Observatories			
		Ready for implementation	**Remarks**
Observatory Nature Protection (ONP)			
ONP-F-1	Alpine Monitoring	2010	Validated at regional level
ONP-F-2	Protection Forests	2006	Ready for implementation
ONP-F-4	Habitats & Biotopes	2010	Validated at site/region level
ONP-F-5-1	Changes in Mountain Vegetation Cover	2010	Research topic, partly validated
ONP-F-5-2	Grazing quality of Mountainous Vegetation	2009	Research topic, partly validated
ONP-F-5-3	Monitoring Snow Cover Distribution Pattern	2010	Demonstrated, partly validated
ONP-F-5-4	Predicting Snow Wetness and Melt-onset in the Mountains	2007-8	Currently pre-operational
ONP-F-6	Ecotone Characterisation Map	2010	The application is still immature

geoland Product Portfolio – Regional Observatories			
		Ready for implementation	**Remarks**
Observatory Water & Soil – Water (OWS-W)			
OWS-F-1	Water Abstraction Pressure by Irrigation map *Set of GIS compatible* **maps** *reporting on the water abstraction pressure by irrigation*	2006	Validated & processing chain operational
OWS-F-2-1	High Resolution Water Pollution Map *Water Pollution Map Central Europe – Pesticides: Set of GIS compatible maps reporting on agricultural land use, respective pesticide loss and predicted environmental concentrations of pesticides in surface waters*	2006 2007	Validated processing chain operational ready for implementation
OWS-F-2-2	Medium Resolution Water pollution Map *Set of GIS maps reporting on the nutrient (nitrogen and phosphorus) surpluses in a whole catchment basin (50,000 – 100,000 km²)*	2006	Validated
OWS-F-3-2	Source Apportionment Map based on catchment based modelling of nutrient leakage (N and P).		
OWS-F-3-1a	Peatland classification as input to source apportionment modelling	2005	Validated
OWS-F-3-1b	Change detection (forest land)	2005	Ready for implementation
OWS-3-F-1c	Detection of spring / autumn tilling on arable land, i.e. bare soil or vegetation cover during winter season	2006	Validated, Processing line operational
OWS-F-3-3	Probabilistic classifiers: improved quality assessment and evaluation of remote sensing products –	2006	Validated
Observatory Water & Soil – Soil (OWS-S)			
OWS-F-4-1	USLE based Soil Erosion Risk Maps (scales:1:250.000, 1:100.000, 1:50.000) *The USLE (Universal Soil Loss Equation) is a well-known model, which is designed to estimate long-term erosion rates on agricultural fields and it has been used widely at different scales in Europe USLE based Soil Erosion Risk map*	2006 2008-2010 2010	Produced and accepted by the users R&D Operational
OWS-F-4-2	PESERA ((Pan-European Soil Erosion Risk Assessment) based Soil Erosion Risk Maps (1:50.000) *A physically based soil erosion model built around conceptual separation of precipitation into overland flow runoff generation and infiltration, with a runoff threshold depending primarily on soil and vegetation properties*	2006 2008-2010 2010	Crete test site, Greece: Produced and accepted by the users Test site Friuli, Italy (scale 1:100.000): Research topic R&D Operational

geoland Product Portfolio – Regional Observatories			
		Ready for implemen-tation	**Remarks**
OWS-F-4-3	RUSLE based Soil Erosion Risk Map *application of the Revised Universal Soil Loss Equation (RUSLE) approach Soil Erosion Risk Map based on the application of the Revised Universal Soil Loss Equation (RUSLE) approach RUSLE based Soil Erosion Risk Map*	2006	Cancelled
Observatory Spatial Planning (OSP)			
OSP-F-1	Spatial Indicators	2006	Processing chain operational
OSP-F-2	Urban Growth Scenarios *(local application)*	2006	Validated
		2007	Processing chain operational
		2010	Ready for implementation
OSP-F-3	Landscape Transformation Scenarios	2006	Validated
		2008	Ready for implementation
Core Service Generic Land Cover (CSL)			
CSL-I-1	General land cover	2005	Ready for implementation for Central European & boreal conditions
		2006	Validated and ready for implementation for Mediterranean conditions
Observatory Food Security and Crop Monitoring (OFM)			
OFM-I-1	Crop specific acreage estimates	2006	Processing chains operational. New regions require new data collection
OFM-I-1a	Crop Area/VITO: use of VGT-NDVI-S30 to create Area fraction Images through sub-pixel classification (unmixing) using neural network, calibrated with detailed land use maps	2006	Validated.
OFM-I-1b	Crop Area / Infoterra-France: using MERIS multitemporal for recognition of greening curve per crop group. Set of GIS compatible maps for reporting on food security and management of natural resources	2006	Validated (in favourable agricultural area condition) & processing chain operational
OFM-I-1c	Crop Area/JRC: MODIS-NDVI with crop specific thresholds	2006	Validated
OFM-I-2	Crop Yield / various indicators evaluated By intercomparison of performance	2006	Processing chains can be made operational within half a year. New regions and new crops will require data collection and calibration
OFM-I-2a	Crop Yield / CGMS-NoSat-4indicators	2006	Current operational MARS CGMS
OFM-I-2b	Crop Yield / CGMS-NoSat-Enh-4 indicators	2007	Implies update of CGMS crop data

geoland Product Portfolio – Regional Observatories			
		Ready for implemen-tation	**Remarks**
OFM-I-2c	Crop Yield / CGMS-Metsat-4 indicators	2007	Requires functional extent of CGMS
OFM-I-2d	Crop Yield / CGMS-Scat-4 indicators	2008	Depends on METOP scatterome-ter data
OFM-I-2e	Crop Yield / VGT-DMP-6 indicators	2007	Implies extent of current MARSOP service
OFM-I-2f	Crop Yield / VGT-NDVI-2 indicators	2007	Implies extent of current MARSOP service
OFM-I-2g	Crop Yield / VGT-VPI-2 indicators	2007	Implies extent of current MARSOP service
OFM-I-2h	Crop Yield / Metsat-EWBMS-3 indicators	2006	Operational by EARS
OFM-I-2i	Crop Yield / SPOTVGT-VCI-2 indicators	2006	Operational by IGiK in Poland
OFM-I-2j	Crop Yield / NOAA-VCI-1 indicator	2006	Operational by IGiK in Poland
OFM-I-2k	Crop Yield / Scatyield-1 indicator	2008	Depends on METOP scatterome-ter data
OFM-F-1	Regional production estimates (combination of OFM-I-1 and OFM-I-2)		Not tested in Geoland-OFM due to non-matching data sets
Observatory Global Land Cover & Forest Change (OLF)			
OLF-I-1	Seasonal & inter-seasonal change detec-tion	2006	Functional SPADA Prototype tool
OLF-I-2	Seasonal properties = phenology indicators	2005 2006	Prototype completed Operational processing chain up and running (VGT4Africa)
OLF-I-3	Map of sparse vegetation (<3% cover)	2006	Map produced. One-off operation
OLF-I-4	Ratio T/NDVI	2006 2008	Not implemented: missing ade-quate input Operational with METOP data
OLF-I-5 + OLF-I-6	Per land-cover class detection of changes in spectral properties / Spectral and contex-tual identification / classification	2006	Prototype chain tested for Boreal Eurasia. Ready for implementa-tion for that part of the world
OLF-I-7	Sum of occurrences of fires	2006	Research topic
OLF-I-8	Matheron index or equivalent Fire spatial pattern	2006	Research topic
OLF-I-9	Seasonal change detection in fire and burned surface seasonality	2006	Prototype completed Operational processing chain de-veloped (VGT4Africa)
OLF-I-10	Surface calibration with mod. Res.	2006	Research topic
OLF-I-11	Seasonal change detection in surface water availability	2005 2006	Prototype completed Operational processing chain up and running (VGT4Africa

geoland Product Portfolio – Regional Observatories			
		Ready for implemen-tation	**Remarks**
OLF-F-1	Annual vegetation growth patterns	2006	Functional SPADA Prototype tool
OLF-F-2	Annual patterns of growth stress	2006	Functional SPADA Prototype tool
OLF-F-3	Annual land cover update and disturbance	N/A	Lack of ad hoc input data
OLF-F-4	Annual fire patterns	2006	Functional SPADA Prototype tool
OLF-F-5	Annual synthesis of burnt surfaces	2006	Functional SPADA Prototype tool
OLF-F-6	Annual synthesis of small water bodies	2006	Functional SPADA Prototype tool
OLF-F-7	Environmental Assessment of Africa	2006	Functional SPADA Prototype tool
OLF-F-8	Environmental Assessment of Boreal Eurasia	2006	Functional SPADA Prototype tool
Observatory Natural Carbon Fluxes (ONC)			
ONC-F-1	Terrestrial biospheric CO_2 flux	2007	Ready for implementation ; R&D needed to address finer scales (1-10 km) over Europe
ONC-F-2	Water flux	2007	Ready for implementation
ONC-F-3	Vegetation Biomass	2007	Green biomass is ready for implementation (without EO data assimilation in a first stage) ; R&D needed to implement wood biomass in operational platforms.
ONC-F-4	Leaf Area Index	2007	Ready for implementation (without EO data assimilation in a first stage) ; R&D needed to address finer scales (1-10 km) over Europe
ONC-F-5	Root-zone Soil Moisture	2007	Ready for implementation (without EO data assimilation in a first stage)
ONC-F-6	Carbon Storage	2012	R&D needed to implement wood biomass in operational platforms.
Core Service Biogeophysical Parameters (CSP)			
CSP-F-1	LAI / fAPAR	2006	Operational in off-line mode at MEDIAS-France
		2007	Operational in NRT mode at VITO
CSP-F-2	FCover	2006	Operational in off-line mode at MEDIAS-France
		2007	Operational in NRT mode at VITO
CSP-F-3	Albedo	2006	Operational in off-line mode at MEDIAS-France
		2007	Operational in off-line mode at VITO

geoland Product Portfolio – Regional Observatories			
		Ready for implemen-tation	**Remarks**
CSP-F-4	Surface reflectance	2006	Operational in off-line mode at MEDIAS-France
		2007	Operational in NRT mode at VITO
CSP-F-5	SW radiation		Different method already opera-tional in SAF Land
CSP-F-6	LW radiation	2006	Already operational in NRT mode in SAF Land
CSP-F-7	Temperature	2006	Already operational in NRT mode in SAF Land
CSP-F-8	Burnt surface	2006	Already operational in off-line mode at VITO
CSP-F-9	Water bodies	2006	Already operational in off-line mode at VITO
		2007	Operational in NRT at VITO
CSP-F-10	Soil Moisture	2008	Operational at Eumetsat
CSP-F-11	Precipitation	2006	Already operational in off-line mode at GPCC

The stakeholder teaming - an achievement in itself

The main achievement of the coordination activity during the first year was to get the geoland Integrated project with its 10 sub-tasks, 59 contractors, user organisations, about 180 researchers and engineers up and running, producing results and delivering first service demonstrators widely recognised by user organisations and in the GMES environment. This demonstrated that the concept of an integrated project works and can be applied to the heterogeneous "land cover & vegetation" community - establishing close links across the sub-tasks leading to interoperable products and services to the benefit of all participants.

The further evolution of the GMES Land User Group and the GMES Land Service Provider Network demonstrates successful sub-group teaming beyond and across the limits of project-type activities.

geoland budget and return on investment

The total geoland project volume amounts to approx. 20 M€; 50 percent is funded by a European Commission (EC) grant within the FP6 programme, while the equivalent of further € 10 Mio are covered by the participating companies and institutions. This proves that the consortium members are convinced to be able to develop scientifically sound and equally valuable and sustainable services.

For large public research institutions the co-investment can be seen as an extension of their existing baseline research and development funding. This helps them translate their expertise into the new field of GMES and grow the perimeter of their activities. As a commercial return is not expected, long-term engagement and sustaining activities as “demonstrations” is feasible, while public operational funding is not yet existing.

Legally mandated user organisations typically do not foresee a research budget. For them, involvement of their operational staff and experts is a major effort. Their resources to commit to long-term projects and stakeholder platforms are limited.

Private and public service providers operate commercially. They need to achieve a “return on investment” within their business plans. The engagement into the 3-year research activity of geoland without a concrete public funding and procurement outlook already was a major risk. The current situation already today provided opportunities to exploit the geoland know-how in fully paid exercises, both within ESA demonstration activities (GSE) and a first precursor call by EEA expected for early 2007. However, these opportunities are not sufficient to fully recover the investment even within a mid-term (5 years) period. From this point of view, the necessary further FP7 investment to keep the know-how alive is a major economic challenge.

geoland consortium members

Agenzi per la Protezione dell´ ambiente e per i servizi tecnici, I
Alterra bv, NL
Amt der Vorarlberger Landesregierung, A
Austrian Research Centers GmbH, A
Commissariat à l´énergie atomique LSCE, F
Consiglio Nazionale delle Ricerche, IREA, I
County Administration Board of Dalarna, S
Delphi Informations-MusterManagement GmbH, D
European Centre for Medium-Range Weather Forecasts, GB
European Topic Centre on Terrestrial Environment, EU
Geoville Informationssysteme und Datenverarbeitung GmbH, A
German Aerospace Center DFD, D
HG Geo Data Solutions, D
Infoterra France SAS, F
Infoterra GmbH, D
Infoterra Ltd., UK
Ingenieursbureau voor Environmental Analysis and Remote Sensing bv, NL
Institut Cartogràfic de Catalunya, E
Institut Français de l´Énvironnement, F
Institut National de la Recherche Agronomique, F
Institut Français de l´Énvironnement, F
Institut National de la Recherche Agronomique, F
Institute of Geodesy and Cartography, PL
Inst. de Investigacao Científica Tropical, P
Instituto de Meteorolgia, E
JOANNEUM RESEARCH Forschungsges. M. b. H., A
Joint Research Centre of the European Community, EU
Landesamt für Natur und Umwelt Schleswig-Holstein, D
Leeds Metropolitan University, GB
MEDIAS-France, F
Mediterranean Agronomic Institute of Chania, GR
Météo-France Centre National de la Recherche Scientifique, F
Metria, S
National Agricultural Research Foundation – Forest Research Institute, GR
Natural Environment Research Council, GB
Netherlands Geomatics & Earth Observation B.V., NL
NOVELTIS, F
Norsk Regnesentral, N
Österreichisches Institut für Raumplanung, A
PUMA Task Team (EUMETSAT), INT
Pöyry Environment, F
Remote Sensing Solutions GmbH, D
Royal Netherlands Meteorological Institute, NL
Space Research Institute of Russian Academy of Science, RU
Spot Image SA, F
Swedish Environmental Protection Agency, S
Swedish University of Agricultural Sciences, S
Thuringian State Institute for Wood, Hunting and Fishing, D
Tragsatec Tecnologías y Servicios Agrarios S.A., E
TU Vienna, A
Umweltbundesamt (Fed. Env. Agency), A
UN Environment Programme, Division of Early Warning and Assessment, INT
University of Bonn, D
University catholique de Louvain, B
University of Trieste, I
University of Freiburg, D
University of Karlsruhe, D
University of Vienna, A
Vlaamse Instelling voor Technologisch Onderzoek VITO, B

Coordinator: Infoterra GmbH – Alexander Kaptein – alexander.kaptein@infoterra-global.com
Deputy Coordinator: Medias France – Marc Leroy – marc.leroy@medias.cnes.fr

For further Information, please contact

geoland Communications

Infoterra GmbH
Mareike Doepke

P : +49 7545 8 3924
F: + 49 7545 8 1337

E: mareike.doepke@infoterra-global.com

www.gmes-geoland.info

3 GEOLAND SUMMARIES PER APPLICATION FIELD / SUB-TASK

geoland has been structured into sub-tasks. End-user applications are addressed by six “observatories” taking benefit of two common up-stream core services. Cross-cutting issues of future operations, including Earth Observation sensor requirements, have been addressed by the “Operational Scenario” task. General programmatic steering by the Executive Board, overall communications, and operational management by the geoland office and the Coordinator are part of the “Coordination” sub-task.

A list of geoland demonstrations provided is given below. Please observe that for the European applications the focus was not on “large-area coverage”, but on “proof-of-concept” across a representative range of European ecozone conditions and national settings. “large-area coverage” demonstrations could be achieved through ESA’s GSE Land project for the most mature products.

Table 7: geoland demonstrations

OBS	Products	Sites [Countries]	Area Mapped [km²]	Scales, Resolution	Users served [Number]
ONP	Alpine Monitoring	Austria	ca. 5400 km^2 ca. 80 km^2	1:100.000 and 1:5.000	2
	Protection Forests	Austria / Italy	ca. 7500 km^2	1:25.000	1
	Generic Habitats & Biotopes	Germany (Schleswig Holstein)	ca. 2000 km² ca. 100 lm²	1:25000 1: 5000	1
		• Germany (Thuringia) • Germany (Rhine Valley)	650 km²	1:50,000 2.5m res. 1:25,000 1-2.5m res.	1
		• UK (Axe Valley) • UK (Langstone Harbour)	25 km^2 30 km^2	1:5000 1:5000	1 1
	Mountains	• Norway	• Scandinavia • Heimdalen • Venabygd	• >500 000 km² (1 km) • 300 km² (25m) • 160 km² (25m)	• 1 • 1 • 2
	Ecotones	• UK, Stonesdale Moor, Yorkshire Dales	1sq.km	2m res.	Non-specific
		• Austria, Hohe Tauern National Park	60 x 60km	10m res	Non-specific
		• Germany, Thuringia	110 x 110km	1:100,000 Extension of CSL mapping	Non-specific

OBS	Products	Sites [Countries]	Area Mapped [km²)	Scales, Resolution	Users served [Number]
OWS-W	F1: Water abstraction pressure by irrigation	France, Spain	France: 115 000 km^2 Spain: 11.500 km^2	Spatial units of analysis: average size 50 km^2, smaller size 1 km^2	France: 5 Spain: 2
	F1: Water abstraction pressure by irrigation	Spain	85.536 km^2	Spatial units of analysis: average size 50 km^2, smaller size 1 km^2	Delivery scheduled for end 2006
	F2-1: Water pollution, pesticides	Germany	6.500 km²	10 m resolution, 1: 25 000 - 1: 50 000	2
	F2-2: Water pollution	France	115 000 km^2	Spatial units of analysis: average size 50 km^2, smaller size 1 km^2	2
	F3: Source apportionment	Sweden	Selected sub-products: entire or smaller part of river basin, 29.000 km^2 Product F3-1b: 6.700 km^2 F3-1c: 8.375 km^2 Remaining products: 29.000 km^2	10-50 m resolution, scale 1:50 000-1:100 000	2
OWS-S	Soil Erosion Risk Maps (USLE – PESERA)	Northern Chalkidiki (Greece), Chania Crete (Greece), Friuli Venezia Giulia (Italy)	Northern Chalkidiki(~ 1600 km^2), Chania, Crete (~600 km^2), Friuli Venezia Giulia (depending on scale from 6000 to 780000 ha)	1:250.000 1:100.000, 1:50.000	3
OSP	Consolidated Spatial indicators and typologies	European test site (A/CZ/D/HU/IT/SL/SK) incl. national test site Vorarlberg (A) Budweis – Linz (CZ/A) Bratislava – Vienna (SK/A) Dublin (UK) Algarve (P) Dresden – Pargue (D/CZ)	410.000 km² 2,500 km² 1400 km² 1780km² 500 km² 500 km² 500 km²	1:250.000 / 1:100.000 1:25.000 1:25.000 1:25.000 1:25.000 1:25.000 1:25.000	8
	Urban / Regional simulation models	Dublin (UK) Vorarlberg (A)	500 km² 2500 km²	1:25.000 1:25.000	2
	Landscape Transformation Scenarios	European test site (A/CZ/D/HU/IT/SL/SK) Vorarlberg (A)	410.000 km² 2.500 km²	1:250.000 / 1:100.000 1:25.000	8 2

OBS	Products	Sites [Countries]	Area Mapped [km²)	Scales, Resolution	Users served [Number]
CSL	CSL-I-1	A, B, D, E, F, GR, I, LUX, NL,SE	278,000 *	1: 50,000	32
OFM	Crop Area by VITO using of VGT-NDVI-S30 through Area fraction Images and Neural Network unmixing	Belgium, Rostov (Russia), North China plain (China)	Belgium : 33.000 km² Russian : 100.000 km² North China plain: 1.200.000 km²	Spatial units of analysis: Pixel level (1 km²) Regional level: average size 1.100 km² (Belgian case) to 20.000 km² (Rostov, China)	1 (= JRC, who evaluated the results). The other users FAO and 2 users in China did not make evaluation of results
	Crop Area by Infoterra France using MERIS multitemporal and greening curve per crop group	Belgium, part of Poland, Rostov (Russia)	Belgium : 33000 km² Poland : 323.000 km² Russian : 100.000 km²	Spatial units of analysis: average size 1000 km² (Belgium) to 20000 km² (Poland and Russia). Res : 300x300 m	1 (JRC) and Belgium : 2 Poland : 1 Russian : 2
	Crop Area byJRC using MODIS-NDVI with crop specific thresholds	Rostov (Russia)	Russian : 100.000 km²	500x500 m	1
	Crop Yield/ CGMS-NoSat-4 indicators (Alterra)	Belgium, Poland, Spain, North China Plain	1 000 000	50x50 km meteo, 1x1 km crop mask	1
	Crop Yield/CGMS-NoSat-Enh-4 indicators (Alterra)	Belgium, Poland, Spain, North China Plain	1 000 000	50x50 km meteo, 1x1 km crop mask	1
OFM	Crop Yield/CGMS-Metsat-4 indicators (Alterra)	Belgium, Poland, Spain, North China Plain	1 000 000	50x50 km meteo, 1x1 km crop mask	1
	Crop Yield/CGMS-Scat-4 indicators (Alterra)	Belgium, Poland, Spain, North China Plain	1 000 000	50x50 km meteo, 1x1 km crop mask	1
	Crop Yield/VGT-DMP-6 indicators (VITO)	Belgium, Poland, Spain, North China Plain	1 000 000	1x1 km	1 (JRC) + users in China
	Crop Yield/VGT-NDVI-2 indicators (VITO)	Belgium, Poland, Spain, North China Plain	1 000 000	1x1 km	1 (JRC) + users in China
	Crop Yield/VGT-VPI-2 indicators (VITO)	Belgium, Poland, Spain, North China Plain	1 000 000	1x1 km	1 (JRC) + users in China
	Crop Yield/Metsat-EWBMS-3 indicators (EARS)	Belgium, Poland, Spain, North China Plain	1 000 000	5x5 km	1
	Crop Yield / SPOTVGT-VCI-2 indicators (IGiK)	Poland, Spain, North China Plain	1 000 000	1x1 km	1 (JRC) and 2 in Poland
	Crop Yield / NOAA-VCI-1 indicator (IGiK)	Poland, Spain, North China Plain	1 000 000	1x1 km	1 (JRC) and 2 in Poland
	Crop Yield / Scatyield-1 indicator (NEO)	Belgium, Poland, Spain, North China Plain	1 000 000	50x50 km	1

OBS	Products	Sites [Countries]	Area Mapped [km²]	Scales, Resolu-tion	Users served [Number]
OLF	Phenology (temporal change analysis) 10day products 20000311→20041221	Africa	80 Mkm²	Res 1 km²	50 Afric. Countries + ACP Obs
	Phenology (temporal change analysis) proto-type processing chain	Africa	80 Mkm²	Res 1 km²	50 Afric. Countries + ACP Obs
	Phenology (temporal change analysis) 10day products 20000101 →200020611	Boreal Eurasia	10 Mkm²	Res 1 km²	1 intermedi-ate user
	Water body seasonality 10 day products 19990711→20051221	Africa	80 Mkm²	Res 1 km²	50 Afric. Countries + ACP Obs
	Water body seasonality prototype processing chain	Africa	80 Mkm²	Res 1 km²	50 Afric. Countries + ACP Obs
	Burned surf. Seasonal-ity 10 day products 20020601 →20040321	Africa	80 Mkm²	Res 1 km²	50 Afric. Countries + ACP Obs
	Water body seasonality prototype processing chain	Africa	80 Mkm²	Res 1 km²	50 Afric. Countries + ACP Obs
	Forest cover change	Western par of Boreal Eurasia	15 Mkm²	Res 1/4 km²	2 ministries
	Sparse vegetation map	Sahara and neighbouring regions	20 Mkm²	Res. 1 km²	1
	Water body map	Western Africa	5 Mkm²	Res. 1 km²	50 Afric. Countries + ACP Obs
	SPADA prototype	N/A	N/A	N/A	50 Afric. Countries + ACP Obs
ONC	CO_2 flux, LAI, soil moisture: NRT demonstrator on http://www-lsceorchidee.cea.fr.	global	global	40 km	public

OBS	Products	Sites [Countries]	Area Mapped [km²)	Scales, Resolution	Users served [Number]
CSP	LAI & FAPAR & FCover (1999-2003)	globe		10-day, 1 km	Externals
	Surface Reflectance (1999-2003)	globe		10-day, 1 km	Externals
	Burnt Areas (1998-2003)	globe	-	Daily, 1 km	OLF + Externals
	Surface Albedo (1999-2003)	globe		10-day, 1 km	Externals
	Downwelling Longwave Radiation flux (DLR) (1999-2005)	Europe + Africa	-	6-hour, 50 km	ONC + Externals
	Land Surface Temperature (1999-2005)	Europe + Africa	-	1/2 hour, 0.05°	3 GO + Externals
	Soil Moisture (AMSR) (2003-2004)	globe	-	10-day, 0.5°	OFM + ONC + Externals
	Soil Moisture (ERS) (1992-2000)	globe		10-day, 50 km	ONC + OFM + Externals
	Precipitation (1997-2005)	globe	-	Daily, 1°	3 GO + Externals
	Small Water Bodies (1998-2004)	Africa	-	10-day, 1 km	OLF + Externals
	EWBMS products (1994-2004)	Europe + Asia	-	10-day, 0.04°	3 GO + Externals

geoland sub-task short names used: CSL – Core Service Land Cover, ONP – Observatory Nature Protection, OWS – Observatory Water (W) and Soil (S), OSP – Observatory Spatial Planning, CSP – Core Service Bio-physical parameters, OFM – Observatory Crop Monitoring and Food Security, OLF – Observatory Global Land Cover and Forest Change, ONC – Observatory Natural Carbon and Water Fluxes

3.1 OBSERVATORY NATURE PROTECTION (ONP)

3.1.1.1 Background

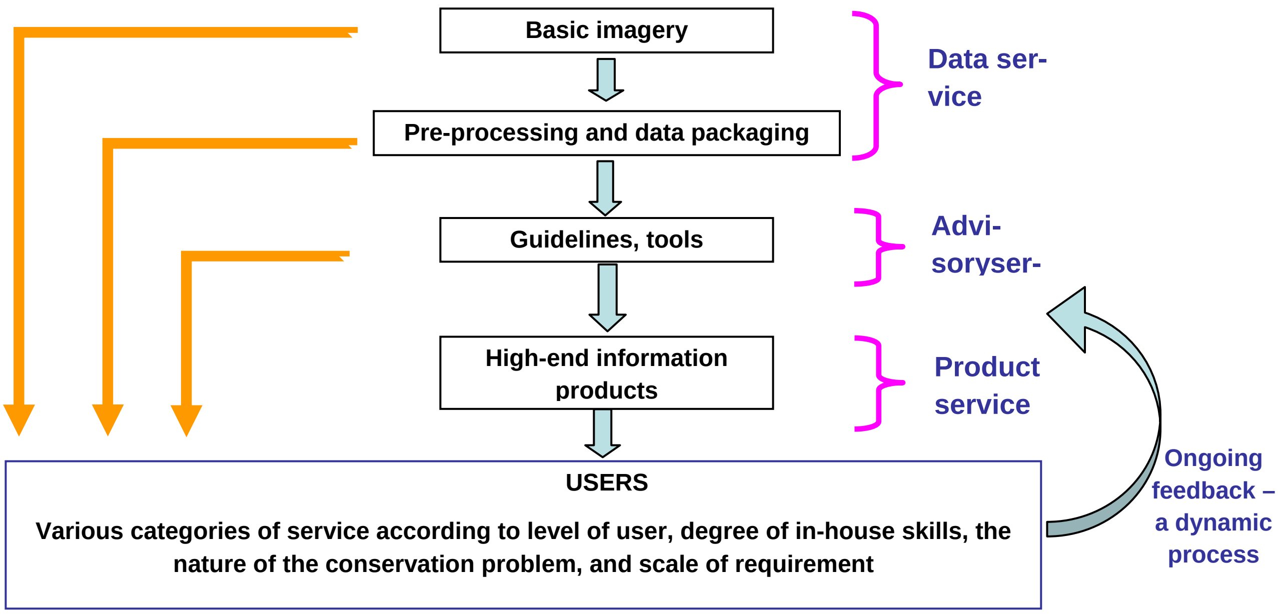
ONP's over-arching goal is to define the character of a future GMES service for 'Nature', and where the service should fit, with respect to ongoing Member State activities in defining/managing their response to policy drivers, as well as the need for pan-European summaries.

'Biodiversity' cannot be observed directly by EO, it can only be inferred from detailed land cover, field work and other ground data. Biodiversity assessments are in the hands of the national conservation agencies, who define priorities, protocols, and seek to discover an operational balance between field work, other in-situ data, together with airborne and spaceborne remote sensing support.

3.1.1.2 Service Model

The Nature Observatory started its work with the standard Geoland 'product' and 'production chain' philosophy though has found that this is not necessarily the only approach and possible interface with the user community, that a more flexible service offer was required. Furthermore, ONP began with a more-or-less exclusive focus on regional users, but the work has evolved into a broader consideration of what should constitute a GMES Nature service, and how this should fit with regional, national, trans-national and European habitat monitoring scenarios.

Accordingly, ONP has considered a 3-tier service model (as per the diagram below):



- A generic data service (probably part of a future Core Service)
    - procurement, archiving, pre-processing and data preparation, prior to thematic analysis

- An advisory service
  - data and methodology strategies, guidelines, tools
- A product service
  - specific thematic products for specific habitat mapping or monitoring tasks, for different categories of user.

What category of service is appropriate is therefore according to different users' in-house capacity to work with EO data.

Advisory Service

ONP has illustrated an Advisory Service through the following topics:

- A habitat interpretation database (HABID)
  - To provide real-world examples of different habitats, mapped by different sensors
  - Tools to translate a working set of classification nomenclatures (e.g. regional keys to a European standard, such as EUNIS), to encourage inter-operability
- Assessment for ensuring the 'nature' utility of a generic Land Cover classification nomenclature, for European wall-to-wall mapping (e.g. the CSL nomenclature)
- Assessing the EO-based mapping implications, implied by the high-level policy driver to locate and monitor High Nature Value farmland (HNV)
- Assessing the feasibility of EO support for assessment of specific Natura 2000 Annex 1 habitats
- Assessing the feasibility of EO support for the derivation of SEBI indicators, or the mapping of specific Annex-1 Habitats by the expected Image 2006 specification
- Recommendations for operational scenarios, at site, wider-area and European scale,

Product Service – Methodology Framework

A product service can be offered where there are no internal remote sensing skills, but where remote sensing has nevertheless achieved an operational role. Where 'product' is required, the methodology framework is designed to focus on:

- Habitat geographic extent and area.
- Habitat condition within class boundaries, as portrayed by EO sensors.
- Modelling the fuzziness of class boundaries

This Product Service has been partly illustrated by ONP, through practical work focused on three regional / ecosystem themes:

- ONP#1: Alpine Monitoring
- ONP#2: Protection Forests
- ONP#5: Mountains

and two generic habitat mapping and characterisation themes:

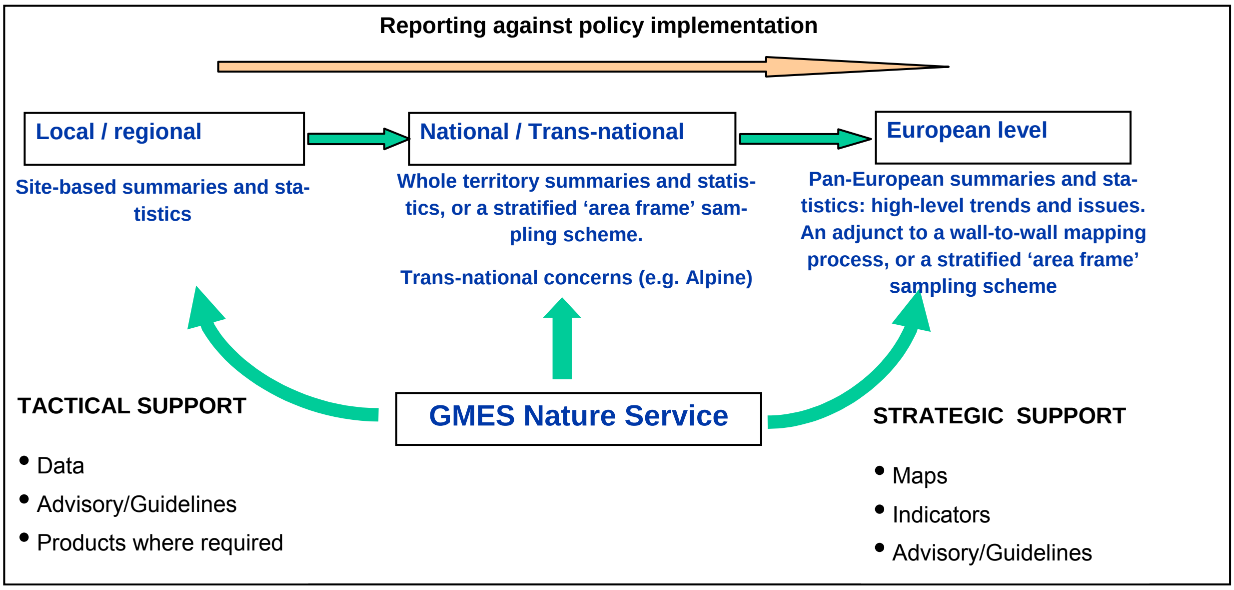
- ONP#4: Harmonized approaches for Generic Habitats and Biotopes, including wetlands (Albania and Aral See)
- ONP#6: Ecotone Characterisation Mapping

User Acceptance

Most of these products, through a mix of methodologies, can be considered pre-operational and validated, at least at regional level, and provide the methodology framework for ongoing service development. However, some user organizations are in the position of trying to understand the programmatics of GMES, rather than the detail of the product. Other users have directly been receiving product support and including it in their ongoing work, whereas others remain uncertain.

3.1.1.3 A future GMES Nature Service

The experience gained allows us to suggest a holistic view of how a GMES Nature service might work, supporting both bottom-up reporting (via regional and national agencies), as well as top-down:



The 'Strategic' support to EU-level users can be considered as a 'Core' Service for Biodiversity, whereas 'tactical' support at regional/national level could be considered as 'downstream'.

3.1.2 Remaining challenges & shortcomings (if any)

- During the project lifetime, the ONP team have not been able to illustrate ALL aspects of this service concept, for ALL bio-geographic zones. The overall framework, however, remains valid for ongoing work.
- The original selection of products and themes reflect the partner specialisms and interests, and those of related users, during the geoland proposal preparation and early phases of the project. The work has adapted from this starting point.
- The Biodiversity community is inherently a 'young' community, as compared with agriculture or forestry. There is a lot of science and field work between EO-based observation and an assessment of Biodiversity status – there are no simple variables which can be observed.
- Therefore, the potential for acceptance of a product portfolio will vary widely, according to in-house capability, existing working practices, mapping scales, priorities and conservation issues.
- With respect to EO technologies, there is a requirement for improved temporal resolutions to capture vegetation phenology at larger mapping scales than is possible with MR sensors, with specific mention of the Rapid Eye system or a functional equivalent. Current systems struggle to provide an adequate Time Series.
- Difficulties in scaling up a methodology for wider geographic coverage, e.g. SPOT-5 methodology difficult to apply across more than one scene, due to inadequate radiometric calibration of most current sensor systems.
- Seasonal limitations in mountainous regions (low light levels, shadows…)
- User-side data is only partly assured, access for service providers entirely depends on the user/owner, and its quality will vary from user to user

3.1.3 Way forward / outlook

- EO support for '**tactical**' mapping at regional (site-based) or national scale can (indirectly) achieve European value through the current bottom-up reporting lines, through ensuring 'good remote sensing' (airborne or spaceborne) and effective classification translation tools, though the pace and completeness of this process is in the hands of the Member States.
- However, an ONP conclusion is that the Natura2000 network does NOT form a easy basis for harmonised '**strategic**' EO-based monitoring, for a variety of conservation-related and logistical reasons.
- Therefore, an ONP recommendation is that an **area-frame stratified sampling** approach is the only realistic way of offering VHR/HR habitat/biodiversity monitoring, as a pan-European harmonised strategy for European assessments.
- It also supports bottom-up reporting as well as top-down.
- This builds on almost 30 years of heritage in the UK, other European countries, and recent European proposals (FP5 BIOPRESS/BIOHAB).

- This will support and be complementary to what the Member States do with Natura 2000.
- A stratified sampling scheme can offer the basis of a long-term monitoring network, with a vision for it to be a permanent EO-based network, linked with other European conservation networks (e.g. AlterNet is based on the LTER concept, ensuring linkage to global activities)
- Sites could be located according to a stratified sampling scheme, modified by specific EEA (or national) issues or concerns, which exploits the standard areal coverage of EO sensors, e.g. 60 km 'windows' could be selected to fit in with a sensible European stratification, NATURA 2000 and realistic national concerns.
- It can link with EO calibration/validation sites (e.g. UK, France, Germany, international) and offers a ready basis for benchmarking new sensors and methods

3.1.4 Recommendations & risks

ONP's recommendations for a future stratified area frame approach is considered low risk, in terms of Member State acceptance, as it is offers a new 'strategic' activity that is not possible without EO data, supporting national interests as well as European statistical summaries.

Future GMES services will expect budget support from the Member States, and must therefore be seen as supporting national/regional interests, as well as European-level requirements. This is a complex balance and still under discussion, with often contradictory and conflicting requirements, e.g. with respect to selection of Minimum Mapping Unit (MMU) and definition of thematic content.

For Nature GMES services a strong link with regional/national authorities and trans-boundary initiatives is necessary, (e.g. via upcoming INTERREG and LIFE projects), for the integration of a European area frame approach with similar national initiatives, to maximize synergies.

In the context of INSPIRE, to achieve "country profiles" of:

- Data existence and availability (including airborne and in-situ data)
- Existing and planned monitoring programmes

3.2 OBSERVATORY WATER AND SOIL – WATER (OWS-W)

3.2.1 Objectives, major Achievements & Results

The Observatory aims at developing stable, repetitive and quality-assured methods that integrate and optimise the use of EO derived information, i.e. land use / land cover data with customised thematic, spatial and temporal resolution, and ancillary geospatial data as input to catchment and surface water modelling, addressing the Water Framework Directive. This included methodology work and demonstration for and training of users.

The water observatory delivers reliable and interactive maps reporting on the water abstraction pressure due to irrigation at the regional and local scales. These tools, which can be easily combined to specific user tools provide to the environmental institutes, to water catchment authorities and to water suppliers the means to efficiently monitor and manage the water resources and to control pollution. The products have been generated on "Hydrographical zones". The irrigation service was successfully validated and has seen another year of service continuity for the Adour-Garonne basin (in 2006) through GSE Land; additional Spanish catchments will be addressed in GSE land 2007 and 2008: new year of Ebro catchment coverage and Tejo. The water observatory also provides tools for water pollution pressure (nutrient surpluses N and P) due to agriculture, urban and industrial activities at the regional scale. The Water pollution service of France are partly based on the same input data as the irrigation service, and within the GSE Land framework, a map of surplus, based on “Crops distribution maps” have been produced through the NOPOLU model.

The “Water Pollution Map Central Europe (Pesticides)”, combining high resolution Land Cover / Land Use information with dedicated GIS modelling is aimed to be integrated into on the one hand the reporting cycle for the WFD of regional customers in the first instance, but to a specific extend also national or international customers. For the purpose of modelling plant protection agents, with a focus on pesticides, the model DRIPS was introduced into the Observatory during 2005 and consolidated in 2006. A full set of products have been delivered to and evaluated by the user Thuringian Institute for Environment and Geology. The basic model DRIPS has been operationally applied within the frame of GSE Land project. Also developments resulting from geoland, especially the integration of high resolution Land Cover, has already been exploited in GSE Land.

The “Source Apportionment Map” addresses nitrogen and phosphorus in the river Dalälven drainage basin in Sweden. The actual work (sub-products) performed in Geoland all function as either new or improved datasets to obtain the final source apportionment map, or methods to improve the estimates of nitrogen and phosphorus leakage in the source apportionment model, primarily on regional level. For Source Apportionment mapping, the peatland and forest classification has been completed, using the probabilistic classification concept developed in geoland. Based on this data, type concentrations and FYRIS model adaptions have been made, particularly for N leakage from boreal areas. The change detection service for forest land was validated, and the results show that the medium resolution sensor AWiFS can fill the gap of spatial resolution and area coverage for other available EO data, without jeopardising the required quality of the output.

3.2.2 Remaining Challenges & Shortcomings

The information given by “Water Pollution Central Europe (Pesticides)”, especially on the localisation of hot spot areas prone to potentially high diffuse leakage of plant protection agents, is of very high importance for the users. Nevertheless, concerning the concentration of plant protection agents in the river stream some discrepancies have been detected between the modelled and measured concentrations. This is on the one hand due to differences in data used for this analysis. On the other hand a better calibration of the model by integrating concrete and actual in-situ concentration measurements would allow to better compare the modelled results with the concrete in-situ load measurements. This is a matter of further investigations to be done. This has already been discussed with the user.

For the tilling service, part of the Source Apportionment service, the transfer to new test sites of different ecotype, indicated that the product at current stage isn't sufficiently robust. Additional methodology work and validation is needed, which has been discussed and agreed by the user.

For the water abstraction product it is necessary to evaluate the performance of the "Arable acreage maps" when they are calculated with data acquired until the second half of July instead of the end of the crops development season (e,d October). The early availability of this information is a demand of users. Also there is a need to evaluate the impact of water management initiatives and measures on irrigation demands through time series of the product as well as an extension to back up sensors such as MODIS and AWIFS.

3.2.3 Way Forward / Outlook

All services consolidated within the frame of geoland have been or are going to be implemented and rolled out in ESAs GSE Land project in Sweden, Switzerland, Austria, Czech, Poland, Germany, Belgium, Luxemburg, Liechtenstein, Portugal, France, and Spain. This concerns both, the generic processing chains of water abstraction and pollution services and specific developments which have been validated within geoland.

In general the way forward will be to roll out to other regions of – not only – Europe. This can include Northern, Central, Southern but especially Eastern European regions. Additionally there is a high potential for the geoland OWS-W portfolio e.g. for Africa, where especially water abstraction is of major concern.

3.2.4 Recommendations & Risks

A key risk factor is the availability of EO data on a long-term basis. Many of the services require weekly – monthly – yearly monitoring over large areas, and this requires EO data with short repeating cycles and large area coverage.

A specific risk with the medium resolution Water abstraction products is with the users understanding and consequent acceptation of the product. The products usefulness is difficult to understand as compared to high resolution crops land cover maps that show explicitly the fields boundaries and the product generation process of the arable acreage maps is scientifically complex and the user may be reluctant to use what is felt as a black box result. For both issues, the risk is alleviated by extensive explanation of (i) complementarity of arable acreage maps and high resolution crops land cover maps, (ii) the process which is behind the production of arable acreage maps. This has been experienced with the Adour Garonne authority and was very successful.

3.3 OBSERVATORY WATER AND SOIL – SOIL (OWS-S)

3.3.1 Objectives, major achievements & results

Soil, the weathered material between the atmosphere at the Earth's surface and the bedrock below the surface, is a vital, largely non-renewable resource, which ensures a number of environmental, economical, social and cultural key functions. Soil erosion, a natural geological phenomenon resulting from the removal of soil particles by water and wind, affects both agriculture and the natural environment and is one of the most important (yet probably the least well-known) of today's environmental problems.

Given the importance of soil and in response to concerns about the degradation of soils in the EU the Commission has published a Communication "Towards a Thematic Strategy for Soil Protection". The prevention of soil erosion is a key point in the proposed strategy.

Soil erosion is a complex phenomenon caused by the interaction of numerous different factors such us climate, topography, vegetation cover and soil characteristics.

Since soil erosion processes by water are both varied and complex, several modelling approaches like USLE (Universal Soil Loss Equation) and PESERA (Pan-European Soil Erosion Risk Assessment) have been developed for a range of temporal and spatial scales.

The integration of existing soil erosion models, field data and data provided by remote sensing through the use of geographic information systems (GIS) appears to be an asset to exploit.

In this context, the Soil Observatory aimed at the development of such pre-operational soil erosion risk assessment services, which are in line with current EU policies and are based in the use of Earth Observation data, image analysis techniques and GIS models.

More specifically, the soil observatory (OWS-S) aimed at selecting appropriate soil erosion risk models and applying them within a GIS environment. Towards this end it used combined EO and auxiliary geocoded data in order to describe the spatial distribution of soil erosion and predict, with the highest possible accuracy, the location of high-risk areas.

The selected soil erosion models, namely USLE and PESERA, have been applied in a GIS environment and two methodologies for the prediction of the soil erosion risk have been developed. The USLE-based methodology, being the least data demanding, was considered to be a low cost solution, in contrast to the PESERA-based methodology, which is very data demanding and was regarded as a high cost alternative.

The Soil Observatory focused on assessing the risk of soil erosion within an area with the highest possible accuracy rather than calculating the values of soil loss. This resulted in locating areas of high potential soil erosion risk which is extremely important for erosion prevention, as it allows for the identification of the proper location and type of erosion prevention measures needed to be taken by the decision makers.

The results from the above applied methodologies are Soil Erosion Risk Maps at different scales and test sites:

Test Site	Model	Scale
Northern Chalkidiki, Greece	USLE	1:100.000, 1:50.000
Western Crete, Greece	PESERA	1:50.000
	USLE	
Friuli Venezia Giulia Region, Italy	USLE	1:250.000, 1:50.000

The above products were immature at the end of the first year of the project, as it was also mentioned in the EC reviewers' comments. After the GEOLAND forum in Toulouse the OWS-S objectives were redefined in cooperation with the OWS-S partners and users and the appropriate measures were taken.

Finally, at the end of the last year of the project, the OWS-S products and services have been produced and they have been accepted by the users via the last OWS-S internal Review Cycle.

Moreover, during the production period, the OWS-S has identified the gaps and the bottlenecks of the produced methodologies and also has defined the research requirements and the next working steps in order to improve them.

3.3.2 Remaining challenges & shortcomings (if any)

The main remaining challenges, as have been identified by the Soil Observatory, can be summarized as follows:

- Expansion of the test sites
- Investigation of the optimum time-step for monitoring seasonal vegetation density from EO data
- Development of a methodology for extracting the vegetation and bare soil patterns (estimation of soil fraction) using fine spatial resolution EO imagery
- Estimation of the management practices factor (P-factor) using fine spatial resolution EO imagery
- Development of a user friendly interface

Although the Soil Observatory focuses on incorporating EO data for the calculation of the soil erosion parameters, the need of ancillary data in the applied methodologies is still essential. The availability of this kind of data is considered to be a shortcoming for many EU countries.

3.3.3 Way forward / outlook

The outlook of the Soil observatory is to improve the provided services in order for them to become operational.

More specifically, the main target is to produce an accurate and valid service via a user friendly interface which will be able to predict and locate the areas of potentially high soil erosion risk by using EO data and by taking into account the vegetation seasonality. This kind of service would be extremely important for erosion prevention, as it allows for the identification of the proper location and type of erosion prevention measures needed to be taken by the decision makers.

3.3.4 Recommendations & risks

The use of spatial data is of crucial importance for all the proposed methodologies. As a result the development of a common infrastructure for the spatial data and the interoperability of spatial data for all EU countries would be a key issue for the applicability of the services at different scales and areas.

3.4 OBSERVATORY SPATIAL PLANNING (OSP)

3.4.1 Objective, Major Achievements & Results

Objective

The objective of the Observatory Spatial Planning has been to introduce innovative Earth Observation (EO) derived land cover / land use (LC/LU) products into spatial planning procedures and methods at European, national and sub-national level.

Policy drivers

At EU level, the Observatory Spatial Planning refers to the principles formulated in the European Spatial Development Perspective (ESDP) and implemented by the European Spatial Observatory Network (ESPON). The currently ongoing ESPON 3.3 project has served as a major reference for the geoland project. Further policy and high level guidance have been inferred from the INSPIRE initiative (Infrastructure for Spatial Information in Europe), the 6th Environmental Action Plan, the European Commission's "Communication on Planning and Environment – the Territorial Dimension" and the 2nd Cohesion Report. At national and sub-national level spatial planning directives such as the national Sustainability Strategy and spatial planning laws on state level have been addressed.

Service Portfolio

The Observatory Spatial Planning has generated products and services based on EO data, other geo-spatial as well as socioeconomic data contributing to the information needs of spatial planning. The products and services are generated on European, national and regional level and comprise:

- Indicators & spatial typologies (=DESCRIBE)
- Landscape transformation scenarios (=EXPLAIN)
- Urban / regional growth scenarios (=FORECAST)

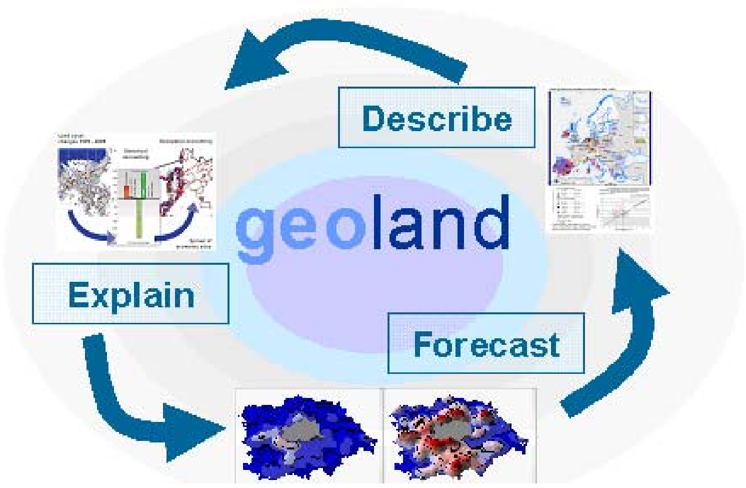


Figure 1: *„DESCRIBE, EXPLAIN, FORECAST" components related to products and services developed in geoland OSP*

Users and Testsites

The User and Observer group comprises organizations with a European (e.g. DG Regio, Eurocities, Metrex), national (e.g. Federal Environment Agencies of Austria, Czech Republic and Italy) as well as a regional dimension. Products and services have been developed in 9 European countries and toolsets have been installed at regional and national user premises for testing and benchmarking.

Achievements

A major achievement can be seen in the CLC based roll-out of the "DESCRIBE" component for all of Europe within an ESPON project. Furthermore a number of contracts on regional scale have been signed for partly implementing the CLC+ based regional "DESCRIBE" component. In addition, GSE Land implementation funding has been secured for production of the CLC+ based "DESCRIBE" component in 11 European countries. The "FORECAST" component is part of the new topic centre on terrestrial environment of the European Environment Agency and may through this activity be applied in selected sites.

Further success can be seen in the fact that OSP has played an important role in the definition of the core service "Urban Classes", which now serve as reference for the first Fast Track Invitation to Tender to be released at the end of 2006 by the EEA.

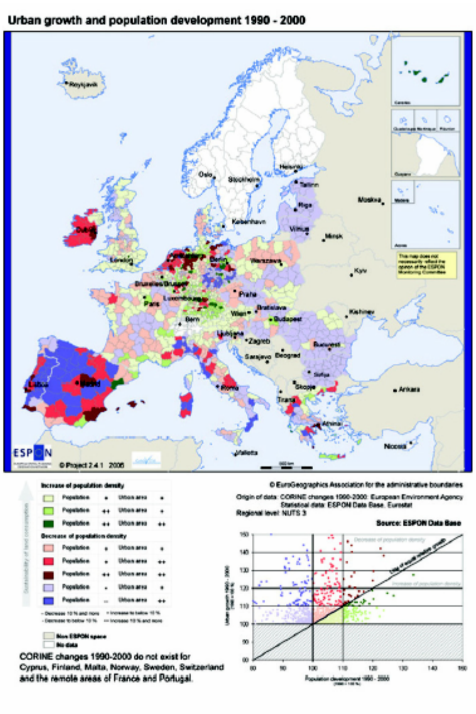


Figure 2: *Example of indicator roll-out via ESPON 2.4.1 project*

Results

The project results of the Observatory Spatial Planning are significant information and tools for spatial planning for the Commission, the Member States and regions. These tools are enabling spatial planners to efficiently implement and assess actions. The actual results are comprising cartographic illustrations, statistics, indicators, typologies and scenarios allowing for systematic and geospatial explicit territorial analysis. The latter can be seen as an important issue for reconciling social, economic and environmental issues in the sense of sustainability.

3.4.2 Remaining Challenges & Shortcomings

Remaining challenges focus on the operational implementation of the developed products. While the processing chain for spatial indicators is operational, the implementation of the urban growth model still requires refinements. This applies especially for the user interface and thus for the handling of the model, an issue of high importance when it comes to user acceptance. Although validated in terms of the basic methodology the landscape transformation scenarios are still in a development phase. The scenario design is somehow hampered by the fact that adequate prognosis data are missing on European level. Nevertheless such data sets are required as drivers for the different landscape transformation scenarios. An increased user acceptance combined with a "willingness-to-pay" for scenarios and modelling will largely depend on promotional activities as well as on operationalisation (i.e. from tools to software).

3.4.3 Way Forward / Outlook

Potential activities for a geoland 2 activity comprise enhancement of the "DESCRIBE, EXPLAIN, FORECAST" components and combining them into a truly integrated spatial planning portfolio serving user needs on regional, national and European level (Figure 3).

Out-reach activities of a potential geoland 2 comprise the below illustrated aspects:

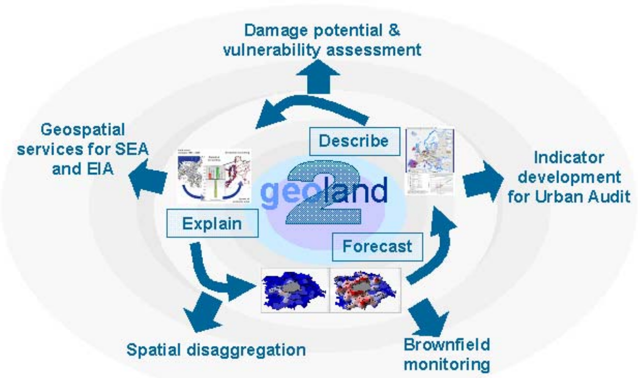


Figure 3: *Outcomes of a potential geoland 2 activity*

The outlined aspects have – asides from spatial disaggregation – important policy backgrounds and show a strong interlinkage between regional development and spatial planning. Implementation may be through an extended group of service providers taking into account partners from the new EU member states. Test sites shall be throughout Europe with a particular focus on regions receiving structural funds from EU.

3.4.4 Recommendations & Risks

Spatial indicators and landscape transformation scenarios on European level are limited in terms of input data quality. CLC data, as the only European wide source for land cover information, is likely to suppress relevant land use entities due to its MMU of 25 ha, leading to varying quality of products. Recommendations are given towards the use of an improved CLC+ (i.e. as defined by the Core Service) with a smaller MMU in particular for artificial surface areas. Availability, cost and accessibility of socio-economic data are adequate to a high degree. However, historic data might not be available in standardised form (or even not at all), in particular for the New Member States. Applying limited data sets might result in indicators and scenarios that are not comparable in space and time. Plausibility checks of input data and resulting products are therefore highly recommended.

3.5 CORE SERVICE GENERIC LAND COVER (CSL)

3.5.1 Objectives, Major Achievements & Results

The geoland Core Service Generic Land Cover (CSL) was primarily aimed at serving the geoland regional Observatories and a number of national user organisations with harmonized, topical and geometric correct basic information on Land Cover and its change. Key for all development phases of CSL have been the aspects of technical feasibility, affordability demonstrating a good cost / benefit ratio, and interoperability with Corine Land Cover (CLC) to assure continuity.

In its present version CSL comprises 21 thematic classes with a minimum mapping unit (MMU) of 1 ha (100 * 100 m^2). Compared to CLC this reduction of the total number of classes obviously is a disadvantage. However, our trade-off analysis has shown that the remaining classes of the Core Service are the most important ones driving the majority of today's environmental models. In addition, it has to be considered that increasing the MMU from 25 ha to 1 ha means an increase by factor 625! This has a severe impact on the total cost of the product as it implies a much more sophisticated data analysis process together with a more complex quality assurance approach. Hence, simply changing the MMU for all classes of CORINE towards 1 ha would be technically feasible but would lead to an explosion of costs. At the same time several CORINE classes not included are more oriented towards land use information and, thus, require a higher local knowledge. As the data base structure has been defined in a way that an extension towards more classes and higher information levels is foreseen, the geoland Observatories as well as the member states can easily extent the Core Service content towards their specific needs.

The thematic accuracy has been defined individually for each class taking into account that not all classes can be mapped with the same accuracy. It ranges between 80-90 % accuracy for most cases. The update frequency today depends mainly on EO data availability which permits a revision every 3-5 years, only.

The core service definition served as the starting point for land cover mapping services for ESA´s GSE Land project. It is aimed to demonstrate industrial capabilities to serve large areas in Europe with GMES services. All mapping products delivered by users have achieved very positive feedback with respect to topicality, quality and level of details included.

Its concept has been accepted by EEA and its member states in July 2005 as the basis of the GMES Core Service Land Monitoring (CSLM). Its realisation for a wall-to-wall coverage of Europe is currently prepared by the GMES Implementation Group Land Monitoring, while the discussion on details is still ongoing.

3.5.2 Remaining Challenges & Shortcomings

The on-going discussion among member states to improve European-wide harmonised land cover information has started with CORINE Land Cover. There is no doubt that this very successful approach as created many benefits to European customers from EEA and the DGs. Hence, there are reluctances among many member states to change a well established process when all the impacts of a higher resolution land cover data base are not well understood.

In addition, the introduction of a much higher MMU is related with a significant increase of cost per km2 which requires budget lines to be installed for a European wall-to-wall coverage.

3.5.3 Way Forward / Outlook

In October 2006 the EEA Advisory Board has officially accepted the GMES Fast Track approach and respective ITTs are expected until end of 2006. It comprises the update of CORINE with a change layer for the base year 2006 and two thematic layers, where a sealing layer is based on the CSL work and a forest layer based on JRC and GSE Forest Monitoring results. As funding for this core service precursor comes from EEA, DG Agri and ESA it can serve as a proxy for future operations which hopefully will lead to the GMES Land Cover Monitoring System (LCMS) as foreseen by the GMES Implementation Group Land, to be installed operationally from 2008 onwards.

geoland+ funded by the FP 6 IP BOSS4GMES has been set up to investigate the impact of a land cover service, as defined above and to review and define the full-scale European Land Monitoring Core Service (LMCS). The project will not only focus on a review of the thematic content (how many classes, what MMU, which frequency), but will investigate impacts on time series continuity, on existing applications, interoperability with existing data-sets and/or infrastructure, and last not least good value for money (budget needs, trade-offs). In addition, it will look into synergies with national expertise and mapping programmes and data access policies, establishing links to INSPIRE. Finally, issues regarding the organisation, such as funding, procurement mechanisms and transnational production will be looked at.

In FP 7 it is planned to submit a proposal which will hopefully allow continuing with R&D work identified already in geoland and the GSE projects. Open issues here are for example the establishment of processing chains for change detection identified as a cross-cutting issue for both, regional and global applications including means for sound product quality assurance. In addition, it is planned to exploit synergies from the availability of biophysical parameters and seasonal vegetation developments derived from high frequent medium-resolution imagery (e.g. MERIS, MODIS, VEGETATION) to be able to improve classification accuracies on difficult thematic classes such as pastures, wetland, Mediterranean shrubs etc. Another important issue is to reduce the production costs by more automated processing and/or to be able to offer more classes without increasing the production costs.

3.5.4 Recommendations & Risks

Besides possible improvements described in the previous chapter the core service is in a level of maturity which would allow European-wide roll-out. As FP 7 budget lines are not feasible for operations there remains the possibility of INTERREG and LIFE+ funds together with national budget. However, the lack of operational budget lines still prohibits European wall-to-wall mapping and, thus, the full benefits of CSLM for European citizens.

Therefore it is highly recommended that the GMES Bureau will seek for operational funds from 2008 onwards to fully implement the LMCS.

3.6 OBSERVATORY FOOD SECURITY AND CROP MONITORING (OFM)

3.6.1 Objectives, Major Achievements & Results

Geoland-OFM aimed at developing methods and tools to provide near-real time information on crop yield outlook and estimated cultivated areas at the scale of provinces and countries as basis for regional crop production estimates. National and international organizations dealing with food security an crop production assessment , require such information, notably the Food and Agriculture Organization of the United Nations (FAO) and the European Commission. Geoland-OFM's prime focus was to identify suitable methods and to provide new or improved components for the current JRC-MARS agricultural yield monitoring system, and a future regional crop acreage estimation system.

Achievements and results

Geoland-OFM has tested and cross-validated several alternative procedures under data rich conditions in European countries. In a second stage, these procedures have been applied to the North China plain.The methods are designed for application in operational automated data processing chains, producing reliable information at affordable costs.

Regional crop specific acreage estimation

Three methods for estimating crop-specific acreage from LR or MR imagery have been tested. One approach starts from the known shape of the green cover curves of the major crops over the season while the two other approaches start from a detailed map of crop fields on a small part of the area. The area estimate are provided some time after harvest. Each method works best for regions with homogeneous land cover: large fields, few crops. Under mixed fragmented land use the generic method using detailed land use maps and a neural network model gives the best results. The other methods may be as good and cheaper in case of relatively uniform cropped areas.

For two of the three tested methods operational production chains have been developed which can be applied easily to regions the size of France, provided that valid calibration data are available.

Regional yield estimation

The basic assumption in yield estimation is that the inter-annual differences in crop conditions are determined by the variation in biophysical growth factors and that such differences are reflected in so-called yield indicators. Geoland-OFM provides several kinds of so-called yield indicators in the form of 10-daily or monthly vegetation indices, output of crop models, and of combinations of remote sensing and models. These indicators can be used as yield predictors, alone or in combination. Geoland-OFM research on yield estimation was organized as a contest between existing methods.

The indicators of the existing operational MARS Crop Growth Monitoring System were taken as starting point and reference. The tests on accuracy of predicted wheat yields in Belgium, Poland and Spain included some 100 different indicators, of which 33 indicators were retained in the intercomparison study. The overall conclusion was that remote sensing based indicators did better in Spain than in the other two countries. Early in the season it is difficult to predict better than the extrapolated time trend in yield. In the second half of the season the best predictions came from the modelled indicators of the existing MARS system, but except for a few outliers, the differences between competing indicators were small.

Most yield indicators can be generated by automated production chains for continental scale applications, provided the input and calibration data are available (e.g. region specific crop calendars, shifts in sowing dates, meteo data, crop masks (regions of production), soil map).

Conformity to user needs

The end users of the OFM products are crop analysts who prefer to base their conclusions on convergence of evidence from independent sources. This must ensure the risks of false alarms and of not recognizing critical situations. It is therefore not a problem to maintain competing information products as long as they are independent. On the other hand, contradicting information can be very confusing, especially if they stem from artefacts, such as the use of different rainfall data sets in the same model. In order to serve the information needs of the end user/ the crop production analyst must condense the multitude of yield indicator information into simple summaries (tables, graphs, maps). Within geoland-OFM a prototype web-tool has been made showing condensed information on deviations in yield indicator values across regions, and their development during the cropping season.

Geoland-OFM has contributed to unifying and strengthening the existing European capabilities to support a global information service on regional agricultural production, including a formal recognition of JRC-Agrifish-MARS as the forerunner of a GMES service, improvements in existing data processing chains, data quality control, data exchange procedures and gains in knowledge and insight in the potentials and shortcomings of the applied methods, and possibilities for improvement.

3.6.2 Remaining Challenges & Shortcomings

Regional crop specific acreage estimation

A much wanted future application is the detection of annual crop area changes. This requires testing if the methods can be applied across years. Also the extension to other regions is an issue. Questions yet to be answered are: does it work in extreme years, to what degree is stratification needed and should calibration be carried out in each year? It should also be possible to estimate crop acreages halfway the cropping season.

Regional yield estimation.

The challenge is to identify among the many possible indicators the best predictor or the optimum combination of predictors for regional yield forecasting, taking into account data availability and agro-climatic conditions. However, the translation from indicator values to regional yield requires statistical analysis, for which the tools are not yet fully developed. Also, it is essential to have many years (e.g. seven years is better than five) of data for the calibration of yield indicators against regional yield statistics. In some cases the predictions can be improved by better model calibration. The cross validation tests should be applied to other crops as well, and a better insight should be obtained in the differences in performance of indicators across crops and regions, and stability in time during the season and over years.

3.6.3 Way Forward / Outlook

The way forward could follow several parallel tracks: to strengthen the current MARS system and to maintain the diversity of the alternative approaches, which can also serve other users. Besides the generation of standardized world-wide bulk information products special applications could be made for specific situations, and the use of the information products in regional crop production analysis should be supported. The development and quality of all products could benefit from their application in new agro-climatic environments and at different scales. It is essential that the information products are integrated in the analysis of the user organisations, and hence in the decision making on regional food security, and to expand the analysis to the global level to serve users with interest in monitoring crop production world-wide.

3.6.4 Recommendations & Risks

The key risk factors for the various OFM products are

- The availability of Earth Observation data on a long-term basis.
- Lack of uniform and consistent ancillary data
- The lack of consolidation of individual products.
- The wide choice in alternative products. For users this may be confusing , especially when the scientific basis for each product is complex and the product requires a high knowledge level for analysis and interpretation. In addition the standard OFM-products designed for continent-wide monitoring may not address the specific information needs of the user.

The recommendation related to these risks are

- To ensure continuity in satellites and to look for back up solutions
- To cooperate with other GMES components to share data and apply common standards
- To provide an explanation and guidance for the analysis and interpretation of each product shown to the users (analyst or end user)
- To carry out the research items listed under unresolved issues and remaining challenges. .
- Tailor information products for the specific needs of the provincial and national users, by zooming in and providing explanatory details, and to provide these products in semi-real time to the analysts working for the end users.

3.7 OBSERVATORY GLOBAL LAND COVER & FOREST CHANGE (OLF)

3.7.1 Objectives, Major Achievements & Results

Objectives

The initial objective was to serve two priority areas identified in the GMES/EC action plan: Africa and Boreal Eurasia. In an automated manner and at a frequency ranging between one week (actually every 10 day) and 3-months, information on environmental status would be provided pre-operationally. Products would be (1) a set of indicators of vegetation growth and vigour, and (2) indices of disturbances possibly leading to land degradation as well as indices of land cover conversion at continental scale. These indicators should then integrated into a higher level processing loop to identify (3) significant ecological processes and human activities at a yearly or seasonal time scale for priority ecosystem categories, such as boreal forest, tropical forest, tundra, woodland, rangeland, relevant large biodiversity sites or protected areas with legal status. The users of the Observatory initially identified are public services of the EC and EU member states, in particular those involved in the environmental dimension of foreign relationships, and UN environmental agencies with a mandate in the field of environmental management and monitoring.

Achievements

Three families of products ("indicators") could be fully developed, namely phenology / temporal change, burned surface / fire seasonal variations, and surface water seasonal variation (specifically in semi arid regions). These products are now generated in near real time and distributed to African users via the EUMETCAST network of EUMETSAT and the PUMA receiving stations installed with financial support from the European Development Fund. A demonstration data set was generated for these three products and is accessible via the geoland web site. This also includes phenology products for boreal Eurasia.

A land cover (mainly forest) change method was successfully tested for boreal Eurasia and a demonstration map was generated.

A workable prototype of a multi-criteria data analysis tool ("SPADA") was developed and distributed to African users. It is freely available via the geoland web site.

Four training sessions were organized to illustrate properties and explain the use of the products and of SPADA and activate data reception by users in Africa.

Of the two initially identified regions it became clear during the course of the project that an increased attention was given to Africa by European Authorities (EU and Member States). Moreover a number of key opportunities with good prospect came out, i. e. the AMESD project funding was decided and receives the support of the African Union, and African partners are taking steps to ensure the funding of a follow on under the gmes banner. Likewise it became clear that in this framework EC would remain a key player and source of funding, on one side for internal purpose (this resulted in the decision of developing the ACP observatory) and to support partners of development (see above, AMESD). This is in line with geoland project development, as the PUMA network, i.e. the precursor of AMESD is part of the consortium. In the mean time UN institutions have expressed interest at a purely technical level. Considering the priority set by EC authorities towards the core service (i.e. core products and applications directly relevant to EC sectoral policies, the focus was given to these initiatives.

3.7.2 Remaining Challenges & Shortcomings

- Environmental indicators need to be integrated as part of a core product portfolio, their algorithm will have to evolve so as to account for discontinuities in space segment properties (i. a. post VEGETATION missions with partially compatible data sets.
- Medium resolution change detection still needs consolidation, both in terms of data acquisition (MODIS? MERIS? Post MODIS/MERIS?) and method.
- Multi-criteria analysis needs further development with specific focus to thematic information relevant to decision makers. To get users involved in the process it is mandatory to access a sufficient number of data sets generated in near real time and to ensure sufficiently long data provision: the development phase must give a feeling to users of closeness to the real working conditions to get them involved. Work on “historical” data is of no use/interest for them.
- Involvement of African partners requires their participation right from the beginning to the development process and long-term training. The FP6 IP mechanisms were not appropriate. No solution is found yet.

3.7.3 Way Forward / Outlook

The way forward can be articulated along the following lines:

- Consolidation of standard environmental “indicators” in the gmes core service.
- Maintenance / upgrade of these products by adapting algorithms to a broadened range of data sources (i.e. other satellite data)
- Addition of a land cover change product based on high / medium resolution satellite data
- Development of end-user oriented information prototype product lines (5 to 10, TBC) in the ACP observatory and AMESD frameworks
- Consolidation of parts or totality these prototype lines in a SPADA2 freeware
- Look into ways to consolidate funding mechanisms (current per project approach is not appropriate / sustainable for long-term monitoring systems) .

3.7.4 Recommendations & Risks

- Increased development of synergisms:
    - with upstream production component (post CSP) (adequacy of standard products)
    - with food security component (commonality of products)
    - with European component (processing & exploitation of high & medium res. Sat data)
- Define a workable mechanism for partnership with African institutions (win-win operation re. technical content: access to ground information >< access to advanced methods)
- Major risk for future developments: lack of appropriate input data.

3.8 OBSERVATORY NATURAL CARBON FLUXES (ONC)

3.8.1 Objectives, Major Achievements & Results

The overall objectives of ONC are to:

- demonstrate the feasibility of monitoring vegetation-atmosphere CO_2 exchange at the global scale, on daily to seasonal and inter-annual time scales ;
- develop the 'greening' of the operational weather forecast model of ECMWF, where vegetation-atmosphere interactions must be better accounted for ;
- develop the use of in situ and different satellite remote sensing sources of information in global land surface models by implementing and using assimilation techniques ;
- propose a near-operational system at ECMWF analysing land biospheric CO_2 fluxes with a spatial resolution of about 50 km.

The major achievements / results are:

- the upgrade of the ECMWF land surface model TESSEL. A new version, called C-TESSEL (Carbon-TESSEL), was developed, based on the ISBA-A-gs approach of Météo-France (Calvet et al. 1998, Gibelin et al. 2006). It is able to simulate the CO_2 fluxes (photosynthesis and ecosystem respiration) ;
- the upgrade of the Météo-France land surface model ISBA. The ISBA-A-gs approach was implemented at a global scale. LAI simulations were compared with satellite estimates of LAI at a global scale (Gibelin et al. 2006) ;
- the upgrades of the ECMWF and Météo-France land surface models were validated by using in situ towerflux measurements (FLUXNET network) ;
- the upgrades of the ECMWF and Météo-France land surface models were implemented into operational modelling platforms (CY30R1 and SURFEX, respectively) ;
- C-TESSEL was tested in an offline configuration (with prescribed atmospheric forcings) at local and global scale. The model was compared to observations at local scale, and with other models at the global scale. C-TESSEL was run in offline mode using the GSWP forcing. This covers the globe for 1982-1995 at a resolution of 1 x 1 deg ;
- a NRT processing chain has been set up with the ORCHIDEE surface model. The output of the global simulation at horizontal resolution 40 km can be viewed at: http://www-lsceorchidee.cea.fr. A prototype data assimilation system has also been set up and will be further developed ;
- a prototype 2DVAR assimilation system able to assimilate jointly LAI estimates and near-surface soil moisture observations was implemented in ISBA-A-gs and in C-TESSEL and tested over southwestern France ;
- various types of EO data were used for validation or data assimilation: MODIS, AVHRR series, SPOT/VGT LAI products ; ERS-Scat soil moisture products ;
- the progress made by ONC is recognized by the research users / partners (e.g. CarboEurope).

3.8.2 Remaining Challenges & Shortcomings

Progress is needed towards Kyoto reporting issues:

- Active supra-national users should get involved in the land carbon component of GEOLAND ;
- The link with forest and soil carbon inventory players should be reinforced.

3.8.3 Way Forward / Outlook

In ONC, an extensive modelling / benchmarking work was performed. Carbon flux models were implemented into the operational platforms of Météo-France and ECMWF. Demo offline EO data assimilation algorithms were implemented at Météo-France and ECMWF. Next step is to go towards operations, namely start in 2008 with a simple operational system able to produce carbon fluxes at the global scale (ECMWF, 25 km resolution) and, gradually, refine the system.

A strong R&D component is needed in that field. In particular for data assimilation.

Future R&D activities should include a focus on medium resolution (1-10 km) in order to build operational tools able to provide specific products over Europe and link to the forestry community.

Fruitful interactions are expected with CarboEurope regarding the use of EO data into carbon models, the model validation using in situ flux measurements, model benchmarking and comparisons.

3.8.4 Recommendations & Risks

Scientific recommendations were made by the HALO project. They are summarized below.

Vegetation is a major factor of the land-atmosphere exchange of carbon dioxide and water vapour. Conversely, the vegetation is strongly influenced by the meteorological conditions. Because of this close interaction, the global vegetation model C-TESSEL at ECMWF has been developed as part of GEOLAND. It will provide the natural biosphere carbon dioxide flux to GEMS and water vapour flux to the Numerical Weather Prediction (NWP) system at ECMWF. C-TESSEL currently models the green biomass and can be constrained with satellite-based Earth observation (EO) products of the Leaf Area Index (LAI). In order to be able to model the carbon stocks, and consequently the carbon fluxes, with sufficient accuracy for climate studies C-TESSEL must be developed further to include soil organic matter and forest biomass. Furthermore, soil water products, including freezing and thawing, must be taken into account and further EO products like the fraction of absorbed photosynthetically active radiation (FAPAR) and meteorological data should be ingested. Therefore, it can be recommended to develop the existing low resolution (about 25 km) global vegetation model further in a close collaboration between the land and atmosphere monitoring communities. A global offline (decoupled from the atmosphere) system should be run in parallel to the online system for backup and testing. A number of fluxtower and soil moisture stations in Europe should provide their data near-real-time (at least before 30 days after they have been acquired), and the flux data should be continuously processed by a CAL/VAL process, ensuring the quality control of the ECMWF products over Europe. A strong collaboration with CarboEurope is needed.

Biomass burning is a major source of various atmospheric pollutants. Its emissions of aerosols and carbon monoxide frequently dominate their respective atmospheric abundances. Also, its contribution to atmospheric carbon dioxide is significant for source inversions. The currently established methods for modelling of BB emission with the help of EO fire products require the biomass, including forest biomass and soil organic matter, as key input. The existing EO fire products yield complementary information, none of which is sufficient alone. Therefore, a Global Fire Assimilation System (GFAS) is needed to create a global fire product with sufficient accuracy.

3.9 CORE SERVICE BIO-PHYSICAL PARAMETERS (CSP)

3.9.1 Objectives, Major Achievements & Results

The Core Service bio-geophysical Parameters has been built on existing operational efforts, at national (GeoSuccess in Belgium, POSTEL in France) and European (LSA SAF/EUMETSAT) levels, and on existing projects (FP5/CYCLOPES, ESA/GLOBCARBON, FP5/ELDAS). The CSP partners, including universities (IMK, Uni. Bonn, IPF, IMP), private companies (EARS, Noveltis), service providers (IM, VITO, MEDIAS-France), and research centres (Météo-France), are diverse with more or less experience about an operational service.

The first challenge was to create a dynamic spirit in the CSP team in order to set-up a common strategy aiming at demonstrating the ability of a pre-operational service. This has been successful with an appropriate development cycle. In 2004, innovative algorithms have been elaborated. Then, during the second project year, the processing lines have been implemented, and the first version of products delivered to users. Finally, in the last year, after the methodologies have been improved according to users feedbacks, processing lines have been run for long time series, and products are now available over multi-year periods.

The second objective was to promote the CSP activities and products in the world outside geoland. For that, CSP partners have actively participated in many scientific conferences and workshops, and have published their research results in scientific journals. However, the main profitable promotion tool is the geoland/CSP website which provides a free open access to CSP products for the whole international scientific community. In 10 months, about 65 external users have been registered, more than 40 % are from non-EU countries.

The third aim was to prepare the geoland follow-on. Thanks to the CSP group dynamic, to the strong links established with the Global Observatories, many discussions all along years 2005 and 2006 have led to a common vision of what could be the global part of a future operational "Land Monitoring" service in Europe.

With long time series of products available, an international promotional covering, and an ambitious strategy for the next years, the overall geoland/CSP results are positive and encouraging for the post-geoland era.

3.9.2 Remaining Challenges & Shortcomings

Two main shortcomings appeared in the geoland process.

The first one concerns the CSP portfolio. Because of a non accurate knowledge of the Observatories applications at the beginning of the project, the portfolio has been built with existing products, mainly. And it has appeared that this did not fit the Observatories needs as much as they should have. Consequently, some adaptations have been performed during the project life. Now, thanks to the strong links established between CSP and the Global Observatories, the definition of the Bio-geophysical Parameters portfolio in the geoland follow-on project will be strongly user-driven.

The second criticism is about the lack of product quality assessment, and of validation exercise. Very few validation actions have been foreseen in the initial CSP R&D plan due to limited resources. Furthermore, they have been performed by partners in charge of algorithmic development, and their results have not been directly provided to geoland users. However, the strong requirements for a product accuracy assessment expressed by Global Observatories, but also by external scientific users, have led to put the validation actions as a priority for the geoland follow-on project. This trend has been already initiated by the involvement in international intercomparison exercise of global LAI products led by NASA. Such exercise should be extended to other biogeophysical variables.

3.9.3 Way Forward / Outlook

Almost all CSP processing lines have run over multi-year Earth Observation data in off-line mode. However, in order to provide final user services, which generate bulletins dedicated to decision makers mainly, it is essential to retrieve the information from satellite data in near real time. That's why the next step consists in adapting the CSP processing lines for near real time processing, and integrating them in operational production centres. This is the main objective of the geoland follow-on project in order to set-up operational services in Land Monitoring.

3.9.4 Recommendations & Risks

All activities performed in the frame of geoland have been carried out with the objective to set-up an operational European service in Land Monitoring. The main criterium of such an operational service is the continuity. That means the continuity in Earth Observation acquisitions, mainly. This is secure for meteorological sensors onboard operational satellite series, but not for other Earth Observation sensors. Then, for all bio-geophysical products derived from non-meteorological sensors, it is essential to foresee a back-up solution in case of failure of the nominal sensor. In this perspective, the geoland follow-on project will foresee that all variables derived from VEGETATION will have a back-up derived from MODIS, and R&D work will be planned to guaranty their full consistency.

3.10 OPERATIONAL SCENARIO (OS)

3.10.1 Objectives, major Achievements & Results

The task “Operational Scenario” (OS) was designed as a cross-cutting activity of geoland. It provided a joint platform for all geoland Observatories & Core Services to develop the geoland scenarios for operational service provision and operational plans describing the requirements to achieve this in terms of service infrastructure, space and in-situ infrastructure, and demand & supply-side organisation.

The activities within the “Operational Scenario” worked through bottom-up and top-down approaches comprising Service Infrastructure analysis and Operational Service scenario development. Rationale of OS was to build on existing expertise and infrastructure elements, identify current bottlenecks and shortcomings, and find and propose solutions for upgrading to operational level of LC&V services.

The “Operational Scenario” work has been structured according to the following two levels of activities:

1. Scenario Development & Operational Plan

The “strategic and organisational level” of OS activities with its objective to develop operational scenarios for GMES LC&V services and a global implementation road-map (operational plans) considering functional, organizational & funding aspects.

2. Infrastructure requirements and framework definition

The “technical level” of OS activities comprising requirements assessment, identification of existing elements, gap analysis. It’s content were e.g. assessment of data resource EO and non-EO data with respect to GMES LC&V service requirements; EO coverage scenario analysis considering EO-data availability and sustainability; analysis of “Functional Architecture” per Observatory / Core Service.

The Operational Scenario task reflected both, state-of-the-art as well as state-of-the-practise of geoland Observatories / Core Services. Designed as coordinating interface to parallel activities, the task OS aim was to collaborate with relevant initiatives and projects and GMES stakeholders in general.

In three years of geoland project, the task Operational Scenario has achieved the following main results:

1. ***Operational Scenarios considering strategic & organisational aspects*** **of future operational provision of GMES LC&V services.**

   The Global as well as the Regional Observatories elaborated scenarios for future operations of geoland services considering:

   - Organisational structures enabling operational service provision at it’s best,
   - Today’s existing elements of service infrastructure,
   - Key bottlenecks of current service infrastructure and organisation,
   - Funding mechanisms enabling operations.

Many exchanges and meetings between **CSP and Global Observatories** Tasks Managers, and with representatives of national and European institutions, have been conducted to clarify what could be the global part of a future “Land Monitoring” Service. A common document “Service Infrastructure Scenario” has been presented and submitted to discuss the geoland vision of an implementation plan and to set up an operational GMES service for land surface monitoring at the global scale. These actions aimed to prepare the “post-geoland” era in the FP7 framework.

As a result of the GMES User Workshop on Land Monitoring, the **CSL and Regional Observatories** developed possible implementation road maps with respect to mid-term horizon (Fast Track Service) and long-term sustainability considering operational core services and follow-on activities to develop down-stream capacities.

2. *Assessment of geoland Earth Observation sensor requirements*

An assessment of geoland service requirements on Earth Observation (EO) sensors has been performed to identify EO sensor specifications which are mandatory for operational provision of GMES LC&V services. Data acquisition conditions and product specifications were accomplished for analysis purposes.

Key messages have been communicated to GMES stakeholders concerned. E.g. geoland requirements are well reflected in the ESA Sentinel Study.

3. *Analysis of “Functional Architectures”*

Besides the activities on “strategic & organisational level” the work packages on “technical level” performed analyses of “Functional Architecture”.

This activity aimed at a functional description of infrastructure – with respect to future operational provision of GMES LC&V services – to identify:

- What elements exist and are currently used?
- Which are the requirements on infrastructure with respect to operational service provision?
- What are current bottlenecks & gaps of service infrastructure?

Two analyses have been performed; one by the global Observatories, one by the regional Observatories. Both identify the key infrastructure components existing and/or needed for sustainable service provision under operational conditions.

4. *Inventory and description of space data resources and policies*

Building on geoland EO sensor requirements, an inventory of earth-observing systems that can be of relevance for regional and global land cover application has been performed.

In addition, the main drivers of data policies for access to earth observation data to be used for land cover and vegetation monitoring. Drivers to be taken into account are related to: data distribution organisation, IPR and licensing issues and pricing policies.

5. geoland Operational Plans

The objective of the geoland Operational Plan is assess: what will be beyond geoland project? Building on the various achievements of geoland service development activities, the Operational Plan provides per Observatory and service line (a) an assessment of achievements of observatories, of product maturity and marketability of products, (b) identification of needs for further R&D as well as (c) identification of implementation steps. Aiming at operational service provision, a (d) preliminary cost assessment depicts for mature services figures about implementation and production costs.

As the Operational Plan identifies implementation and R&D needs beyond geoland project, it is a valuable input for the definition of follow-on activities to achieve operational services in mid- and long-term.

6. Collaboration with parallel activities

geoland task Operational Scenario coordinated the collaboration with parallel activities. Dedicated links to parallel projects and initiatives, such as e.g. INSPIRE, IPs MERSEA & GEMS, SSA HALO & GOSIS, ESA GMES Service Elements (GSE), GEOSS embedded geoland into relevant geo-information communities and ensured to take new developments into account.

3.10.2 Remaining Challenges & Shortcomings

GMES is an ambitious and complex process and implementing operational GMES LC&V services remains challenging. The task Operational Scenario objective was to identify current shortcomings and propose solutions implementation of sustainable services.

Key challenge of this task identified remains still to get together all stakeholders – users, service provider and researches – as well as bridging of various communities – e.g. meteo community, environmental experts, geo-information specialists, and satellite engineers.

3.10.3 Way Forward / Outlook

Objective of the task OS was to depict a way forward by preparing Operational Scenarios and Operational Plans.

OS as a project task is seen as valuable instrument to achieve a common understanding and to harmonise approaches (at least at a minimum scale) for further GMES LC&V development and implementation activities.

3.10.4 Recommendations & Risks

To summarize, the key recommendations are:

- An organisational framework basing on the requirements and possibilities of all stakeholders for operational GMES LC&V services needs to be developed which can guarantee reliable and sustainable provision of services in long-term.
- Operational funding is not established today. Only few operational funding sources could be identified.

- All GMES LC&V services require reliable and sustainable earth observation as well as in-situ data sources.
- Data access and dissemination policies are seen as a key bottleneck of today's service provision.
- Building on consolidated user requirements, various topics of further R&D have been identified and should be considered for further development activities.
- Operational infrastructures are crucial for reliable service provision. Many elements do already exist and can be used. Upgrades and improvements are essential to provide services as best as possible.
- Linking with parallel activities in particular with existing and upcoming legislation (e.g. INSPIRE, Thematic Strategies) is seen as key to coordinate and embed GMES LC&V developments within the overall GMES stakeholder process.
- Further funding is clearly required to overcome today's shortcomings.

3.11 COORDINATION (COO)

geoland work-programme and activity coordination

In terms of programmatic coordination the collaboration of the Executive Board members worked surprisingly well and lead to a coordinated implementation of geoland work – exploiting synergies within the project, and using additional funding opportunities to the benefit of all participants where appropriate and possible.

A coordinated approach could be established for external communication with the various stakeholder groups and decision making bodies – each task manager taking responsibility for his / her own domain's stakeholders on behalf of all the consortium. The internal communication, decision making, and trouble shooting procedures, as laid down in the geoland Consortium Agreement, proved to work well.

Please see chapter 1 for a overview from the coordinator's and executive board's point of view on the geoland results and its contributions to GMES.

geoland reporting and EC interface

Specific administrative issues arising from the experience with contractual reporting and contract changes have been reported in the non-publishable section of the annual activity reports (management chapter). This information has been discussed in detail with DG ENTR project management and financial audit experts, the German NFP (national focal point) for the Framework Programme, and DG ENTR decision makers.

Through increased staffing at DG ENTR the project management with the Commission was significantly eased from 2005 onwards. However, the somewhat complex financial reporting procedures continue to lead to a long list of yearly clarification requests for many contractors. The coordinateor, the geoland secretary and his team are continuously doing a substantial effort in support all contractors in fulfilling their reporting obligations, and in answering the Commission's requests.

The geoland file is not expected to be closed before end of 2007 – taking into account reporting milestones, clarification answers, and lead-in times for review and acceptance of reports, and release of final payments.

4 PLAN FOR USING AND DISSEMINATING THE KNOWLEDGE

4.1 RESEARCH & IMPLEMENTATION STRATEGY, SUMMARY

The list in the table below provides an overview of GMES Land projects steps from "research and development" (consolidation phase) through large-area demonstration and the associated up-scaling of service capacities (implementation phase) towards operational services as seen today (end of 2006).

Table 8: GMES Land Monitoring Services – implementation steps

2004 – 2006	**Consolidation** (user consensus / acceptance; research, development, demonstration, validation)	**IP geoland** (EC FP6) Forest Monitoring, SAGE, Urban Services, Coast-Watch (ESA GSE)
2005 – 2008	**Implementation** (geographic roll-out &, operational production chains)	**GSE Forest Monitoring, Land Information Services** (ESA GSE Stage 2)
2006 – 2009	**Consolidation / Implementation II** (interoperability with existing non-GMES applications, synergies with national programmes)	**IP B4G** (geoland+) (Fast Track / Core Service Service Definition „European Land Monitoring")
2006 – 2008	***Operations - Transition Phase***	***Fast Track Service (Pre-Cursor) / CORINE Land Cover 2006***
2008 - 2011	***Consolidation / Implementation III*** *another „bridging phase" towards operational funds*	*FP7 opportunity, 1st call, 3rd call* *(service evolution, next service generation)*
2008 – 2013	***Operations – Downstream Service co-funding opportunities for MS***	***LIFE+ and INTERREG4 programmes***
2008+?	***Operational Core Services ?*** ***Downstream Services ?***	***Joint effort of user-DGs and MS expected!***

4.1.1 Research and Development Strategy

The geoland research and development (R&D) approach is looking into

- The **product maturity** assessment – geoland products and services show a range of maturity degrees (scientific maturity, technical feasibility, , user acceptance). Specific measures from basic research to engineering effort in integrating near-real time process chains are required – depending on the maturity level achieved.
- The **"marketability" (operationalisation) outlook** – not all geoland products are expected to find operational funding at the same time. Some do suffer from non-consolidated user require-

ments, some are depending on up-stream core services to be implemented first, others may depend on fixed reporting dates set by directives. This situation is reflected in the timing and order of R&D measures recommended.

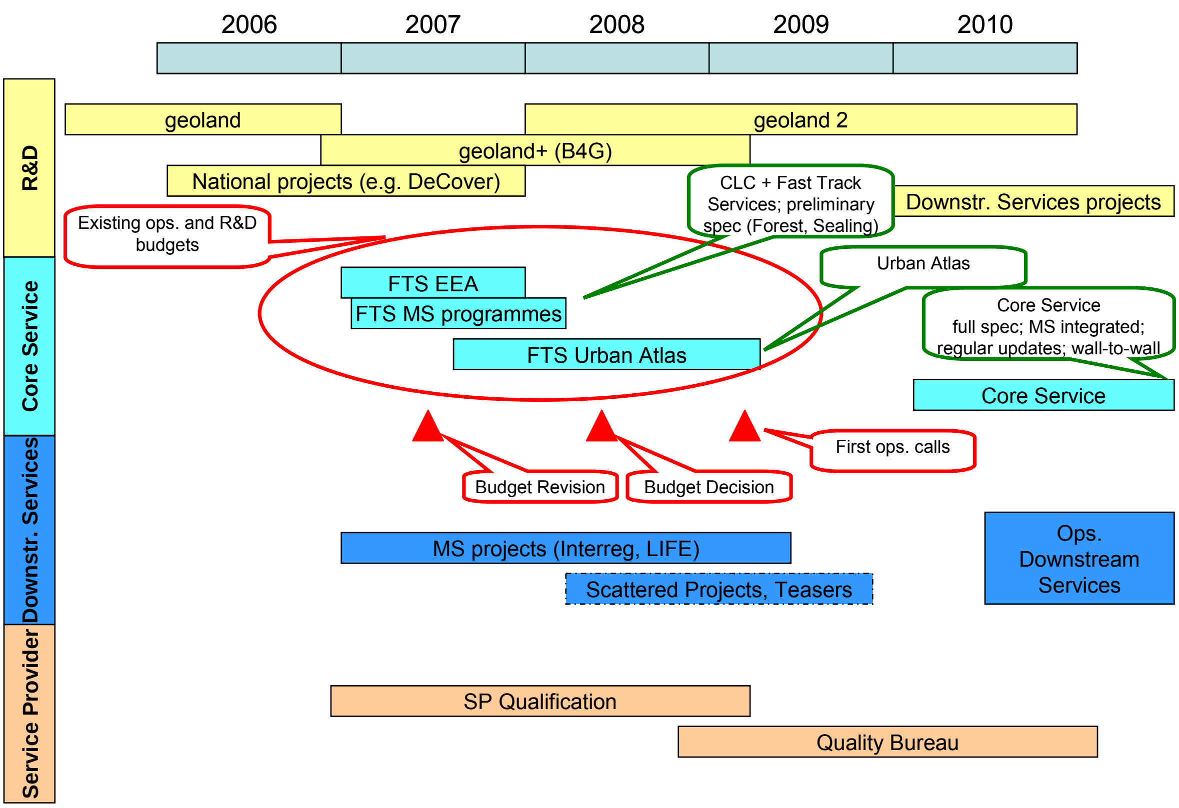
- The **R&D timeline -** Assuming likely availability of R&D funds, the product development timeline has been adjusted to reality (see also Figure 4, p. 66ff.). The year of "readiness for implementation" does reflect necessary lead-in times for R&D, provided that sufficient funding is available in the meantime (see Table 6, p. 22ff.).

A public geoland "R&D and Implementation Plan" document has been prepared by the "Operational Scenario Task" together with all sub-tasks. Key **R&D activities proposed** are highlighted below:

- **Seasonal monitoring requirements (mainly European Land Monitoring):** growing variability of weather conditions ("climate change impact") requires seasonally differentiated monitoring instead of average yearly modelling. This is especially true for phenomena driven or controlled by vegetation conditions and weather parameters (e.g. precipitation). While the Global Land Monitoring activities are traditionally based on seasonally available low resolution datasets (closely linked to the tradition and tools of meteorological modelling), the European Land Monitoring approaches build on three to five year "snapshots" due to lacking data availability and much higher costs incurred with growing resolution of data sets. Integration of at least medium-resolution seasonal information seems to be crucial for water applications (water quality/diffuse pollution, irrigation/water availability) across Europe. The same holds true for soil erosion estimates, largely dependent on actual vegetation coverage vs. actual precipitation events.
- **Near-real-time demonstration (Global Land Monitoring)**: the Global Land Monitoring products have been validated and demonstrated using historical off-line data and prototypes only. To provide prove of concept and achieve "implementation maturity", the process line needs to be fully integrated to enable "life" near-real time operations along all the value chain – from input parameters to the final result. This type of technical and logistical integration is a major step that requires substantial funds.
- **Up-grading and up-scaling of production infrastructure**: prototypes used for R&D purposes are far from the future throughput and capacity requirements of a full European coverage. The same holds true for the typical organisation of the process chains, largely characterised by today's small scale production, where each service provider does all steps of the value chain, in a less differentiated work-flow. The challenge is to establish sufficient production capacities throughout Europe, that be combined or chained leading to the same results for the same products. Such an approach requires both technology steps (work-flow management tools, data management, specialised production tools, collaborative tools) and organisation aspects (independent qualification / certification of providers and their process chains, independent QA of final results).
- **Model up-grades**: existing assimilation models (e.g. water quality, …) can only make limited use of spatially explicit information (e.g. some are based on rather statistical approaches). Higher resolution land monitoring information may not lead to better assimilation results, as other input parameters prove to be the limiting factors – but cannot be provided at higher resolution.

- **Comparability of results**: for European and Global Land Monitoring, a range of models exist – many of them well proven and accepted. Assuming that it will not be realistic to focus on just "one truth", the key issue for further R&D is the "comparability" of similar parameters produced by different models.
- **Transfer to different ecozones**: a number of models have been tested across a range of eco-zone conditions, other still need to undergo this cycle, now having been positively validated on a few sites in geoland.
- **Interoperability with national / existing data-sets**: Interoperability of newly introduced GMES services has been validated and proven for selected cases and European Member States. A formalisation of content and format standards still needs to be achieved (see INSPIRE process or WMO / EUMETSAT procedures). A systematic check throughout all EU / EEA members states concerning synergies of use with existing other national data-sets required for modelling (e.g. hydrological data, topographic data, socio-economic statistics) still needs to be done.
- **Continuity of support for existing applications**: For core mapping services, a crucial question is the continuity of support for existing applications outside the current GMES focus (such as the Water Framework Directive, the Soil Thematic Strategy, etc.). A range of European, national and regional applications have been using the CORINE Land Cover data-set since the 1990s. When introducing a new, high resolution solution through GMES, continuity of support needs to be checked. A change of results is to be expected (e.g. through under-/overrepresentation of specific land use classes as a function of scale), statistical correction factors may need to be applied.

Figure 4: Funding Sources Timeline



Potential R&D funding sources have been assessed to allow for concrete follow-up measures by the stakeholders involved. Major sources analysed currently include

- **ESA GMES Service Elements** (2003 – 2008) "Land Information Services" and "Forest Monitoring" include "Demonstration" activities (large area coverage for Europe and/or selected member states), and few dedicated "Research" activities to enable incremental "service evolution" (e.g. by improving throughput and/or quality of processes).
- **FP6 IP Sustainability (called "BOSS4GMES" or "B4G")** (2006 – 2009) focuses of collaborative up-grading / up-scaling of production infrastructure, interoperability with national data-sets, and continuity of support for existing applications (besides dedicated training/qualification measures for users and suppliers).
- **FP7** (project starts expected 2008, duration expected until 2015) is expected to address in the GMES section both "Core Service Evolution / Implementation" with a focus on European Land Monitoring (one of the "Fast Tracks") in the first call 2007, and "Downstream Service applications" in the third call 2010. The challenge will be to ensure a minimum continuity of activities to maintain the know-how and user-support built-up across the foreseeable gap in time, especially for "Global" and "Downstream" activities. However, FP7 research actions on "Environment" and "Global Change" should not at all be ignored, especially to solve fundamental issues of "model up-grades".
- National co-funding opportunities have been considered. Today, these may rather provide co-funding for selected specific issues.
- Further EUMETSAT, ECMWF, and ESA research activities may need to be further evaluated to assess their potential for specific research actions. Currently, a comprehensive and integrated support as by FP7 is not expected from these sources.

4.1.2 Implementation Strategy

The implementation of GMES consolidated services for "land" currently seems to be separating into three major activity streams:

- **European Land Monitoring Core Services**: The core mapping elements of geoland/GSE Land have selected as one "fast track" activity of the European Commission to be implemented by 2008. A fast track precursor with a limited scope will be implemented by EEA between 2006 and 2008. Selected nations perform national inventories at a quality better or equal to the future full-scale European Fast Track Service already today.
- **European Land Monitoring Downstream Services**: National or regional applications driven by European Land Monitoring database are part of these administrative bodies' responsibility (within the European principle of "subsidiarity"). Funding shall be provided by national / regional funds. European co-funding seems possible or even likely, providing MS with the necessary "cash" for external procurement of such services through programmes such as Interreg 4 or LIFE+.

  European-wide applications required by Europe's DGs have got a potential to become part of a "core service".

- **Global Land Monitoring Services**: While making use of common up-stream bio-physical parametres, the Global Land Monitoring services see the application of an integral part of the overall service. Not being part of the “Fast Track Services” today, a strong push is needed towards Eumetsat / ECMWF, key user DGs and other users to enable first implementation of mature results today. A discussion, how these Global Services could become an integral part of EC-funded GMES services still needs to be led. The current GMES Implementation Plan points out the target year of 2010 to launch another series of further applications.

European Land Monitoring

Fast Track Service Pre-cursor (EEA)

During a transition phase – building on a virtual pooling of operational funds – a “Fast Track Service Precursor” focussing on just two high resolution mapping elements (“sealing”, “forest”) and a parallel update of the CORINE Land Cover product will be implemented by EEA and its member states as “FTS/CLC2006” between 2006 and 2008 for EEA’s 10 mio. km² of Europe.

Selected member states already today implement or plan to implement national mapping programmes with a better or similar quality as the future EC Fast Track Service (e.g. Spain, UK, Sweden, Hungary, Finland, Germany).

Fast Track Service (EC)

The target is to establish a full “Fast Track Service” covering all Europe by 2010, based on budgets available by 2008. The products – according to the current core service findings of geoland/GSE Land- should include a “high resolution” European Land Cover map (20+ classes, 1 to 5 ha), and a European Urban Atlas (0.1 – 0.25 ha).

European Land Monitoring - Portfolio Evolution (full performance of core applications) (EC)

A further portfolio evolution, from the currently addressed “core mapping products” towards an additional “seasonal monitoring component” and “core applications” for Europe is recommended and needs discussion with the stakeholder groups. Core applications should enable the assimilation of land use/land cover data into meaningful information required by Europes DGs, such as Water Quality (WFD), Soil Erosion (STS), Spatial Impact of Europe’s Plans and Programmes (SEA), Agri-environmental subsidies need and impact (new CAP).

Downstream Services (MS, EC co-funding)

The EC programmes INTERREG (DG REGIO, cohesion funds), and LIFE+ (DG ENV) are expected to support MS in resourcing the necessary co-funding enabling them to externally procure selected downstream geo-information services developed within the GMES framework.

National programmes are expected to support a local implementation of regional core mapping services, similar to the ones defined by geoland, for UK, Sweden, Finland, and Spain. Also Germany is currently evaluation the potential funding for a national “Fast Track Service Pre-cursor”. Downstream application funding is generally scarce on national / regional level – whereas, generally, new reporting schemes would require external procurement of new information.

However, more than a scattered success is not expected, unless a broader political initiative supports this approach. Systematic implementation requires decisions on operational budget lines, agreement on implementation mechanisms of the associated directives.

Organisational layout – demand side (procurement) and supply side (service provision)

Procurement Approach

The preferred model for the procurement of geo-information services is a “competitive one”, where services are procured through public tenders. However, different degrees of in-sourcing / out-sourcing of activities need to be observed per application field / nation.

Different procurement options may serve the requirement of aquality-ensured long-term servicing capacity. Maybe a “transition” phase will be needed, until a stable public procurement budget can sustain a competitive scene of service providers.

- Framework contracts: are providing a mid-term commitment, enabling cost efficient service provision as the risk for securing necessary commercial investments is reduced. Benefit can be taken from volume discounts. A balanced work-load and limited investment risk can be achieved on the supply-side by setting-up European consortia during a transition phase - preparing the ground for a future competitive service provider scene.
- Single production tenders with full commercial competition on a case by case basis may be implemented.

Both approaches may work with or without

- pre-qualification – per tender, using reference and/or test production or
- qualification – using agreed auditing / certification schemes.

On the mid-term/long-term the economically preferred approach may with the pre-qualification / qualification to give an opportunity to those companies engaged in previous GMES activities to demonstrate their increased quality and competitiveness gained. The same approach should ensure trust and quality for the user organisations.

Framework contracts are economically preferable to both parties for reasons of cost efficiency (see above)

Procurement authority / entity

Procurement through contributing DGs may cause fragmented situation. Practice shows that – especially for core mapping services- a common interest exists across DGs. De-facto or virtual pooling of budgets and a resulting single tender per project or per procurement item will lead to a much better market offer due to volume and competitive access for a broad range of providers.

The entity in charge may be one of the key user organisations (such as EEA for the FTS/CLC2006) or DG REGIO for an Urban Atlas. On the other hand, efficiency in procurement and handling of contracts may be achieved by setting-up a common geo-information procurement entity for Europe.

Certification / Audits

Alternatively quality criteria may be agreed between user organisation and suppliers, and laid down through public standards and product/service specifications. Independent control can be implemented by existing and trusted technical audit organisations (e.g. TÜV, BVQI). If an additional EC Quality Bureau is required, as promoted by some stakeholders, seems still to be justified.

Quality control of results

End users are typically interested in the final service results, not in the mapping results as an intermediate step. However, quality approval of key inputs mapping parameters is critical for the overall result. Tests in geoland and GSE Land show, that such a QA role could be taken over by ETC-TE's European expert network for a European Land Monitoring Service. Alternatively, any other neutral consortium – not involved in the production of these GMES services or not eligible to bid for it – may be fit to perform this QA job.

4.2 EXPLOITABLE KNOWLEDGE AND ITS USE

The following table presents exploitable results, defined as knowledge having a potential for industrial or commercial application in research activities or for developing, creating or marketing a product or process or for creating or providing a service.

Table 9: Exploitable knowledge

Exploitable Knowledge (description)	**Exploitable product(s) or measure(s)**	**Sector(s)** of application	**Timetable** for "commercial"* use	**Patents or other IPR protection**	**Owner** & Other Partner(s) involved
ONP: Nothing to report					
OWS-W:					
1. Maps of arable land acreages (Crops distribution maps)	OWS-F-1-layer 1; OWS-F-2-2-layer 2	1 Environment 2 Agricultural censuses 3 Sustainable development 4 Management of the water quality and quantity	2007	See Annex B to geoland Consortium Agreement	Infoterra France SAS
2. Production line for mapping of period for ploughing and bare soil vs. vegetated fields	OWS-F-3	1 Environment 2. Management of the water quality	2007	See Annex B to geoland Consortium Agreement	Metria Miljöanalys
3. Production line for "Special Land Cover / Land Use" for Water Pollution	OWS-F-2.1a	1 Environment 2 Agricultural censuses 3 Sustainable development 4. Management of the water quality and quantity	2007	See Annex B to geoland Consortium Agreement	Infoterra GmbH

Exploitable Knowledge (description)	**Exploitable product(s) or measure(s)**	**Sector(s)** of application	**Timetable** for "commercial"* use	**Patents or other IPR protection**	**Owner** & Other Partner(s) involved
4. Processing line for pesticide input/load modelling	OWS-F-2.1b	1 Environment 2. Management of the water quality	2007	See Annex B to geoland Consortium Agreement	Infoterra GmbH / GBG e.V.
5. Processing line for N and P surplus mapping (NOPOLU)	OWS-F2-2	1 - Environment 2. Management of the water quality	2007	1 Environment 2. Management of the water quality	Poyry Environment
CSL:					
Processing chains ready for large area production of generic land cover for Europe	CSL-I-1 replacing CORINE and leading towards a GMES Land Monitoring Core Service (LMCS)	Environmental monitoring supporting reporting & management demanded by directives and policies	Ready for immediate start	Processing chains developed individually by each SP are protected under IPR;	Service providers owning proprietary processing chains; transfer of knowledge possible based on market prices
OFM					
1 CGMS Production line for yield indicators, based on agromet model: extendable operational version	Tools for calculation of yield indicators, storage in data base and creating maps (including source code). Alternative modes of introducing meteo data	1 Agricultural statistics, yield forecasts, regional production 2 Crop drought assessment 3. Environment: crop water use, carbon accumulation, soil cover 4. assessment of effects of climate change	2007		JRC-IPSC-Agrifish, Alterra
2 PyWOFOST based production line for scientific studies related to probabistic yield forecasting and data assimilation	Tool based on WOFOST crop model with similar functionality as CGMS	Methodololgy development and research in the field of crop modelling and yield forecasting, etc	-		Alterra
3 EWBMS production line for yield indicators, based on MeteoSat data and agromet model. Operational	Entirely based on Metesoat. Uses reported historic yield data for calibration	Idem (like 1, 2, 3 and 4 above)	2007		EARS
4 Production line for yield indicators, based on soil drought estimated from SWI (see next item). Pre-operational	Tools based on scatterometer derived SWI data, which combines rain and actual ET	Like 1 and 2 (above)	2007		NEO

Exploitable Knowledge (description)	**Exploitable product(s) or measure(s)**	**Sector(s)** of application	**Timetable** for "commercial"* use	**Patents or other IPR protection**	**Owner** & Other Partner(s) involved
5 Production line for soil moisture mapping through the soil water index (SWI). Operational	Tools based on scatterometer data (formerly ERS, now METOP)	Like 2 (above) and 5 Input describing surface wetness in simulation models for regional weather	2007		IPF-TUW
6 Production line for yield indicators, based on LR and MR data	Tools for calculation of vegetation indices (NDVI, VPI) and yield indices (DMP, using Monteith model) based on VGT, MODIS, AVHRR on for deriving yields based on these indicators	Like 1 (above)	Ready		VITO
7 Production lines for yield indicators derived from LR images (family of vegetation indices) for calculation of vegetation indices Operational	Tools in ERDAS environment using RS data (NOAA,VGT, Modis) for calculation of vegetation indices VCI and TCI	Like 1, 2 and 3 (above)	2007		IGiK
8 Production lines for area estimation by means of sub-pixel classification using neural networks	Tools for hard classifications and tools for sub-pixel classifications with neural networks using VGT and MODIS data	7 agricultural statistics (cropped area), early warning for food security	2007		VITO
9 Production line for mapping of arable land acreages (Crop distribution maps). Operational	Tools using MERIS data and phenological models to estimate green cover fraction characteristics	Like 7 and 8 (above) 9. Environment 10. Sustainable development 11. Food security	2007	See Annex B to geoland Consortium Agreement	Infoterra France
10 Production line for mapping of arable land acreages (Crop distribution maps). Operational	Method using phenological parameters and statistical approach, based on MODIS data, developed in ERDAS environment	7 Agricultural censuses: crop acreage survey, regional production	2007		JRC
OLF:					
Automated procedure for detection of environmentally significant dates from time profiles of seasonal indicators such as vegetation indices and equivalent	IDL Code	Environmental monitoring	End 2005	Agreement from OLF partners for free licensing for non commercial applications	JRC, UCL

Exploitable Knowledge (description)	**Exploitable product(s) or measure(s)**	**Sector(s)** of application	**Timetable** for "commercial"* use	**Patents or other IPR protection**	**Owner** & Other Partner(s) involved
Temporal curve reconstruction procedure	IDL code	Environmental monitoring	End 2005	Agreement from OLF partners for free licensing for non commercial applications	JRC
Automated procedure for retrieval of time information re. surface water	IDL code	Environmental monitoring	End 2005	Agreement from OLF partners for free licensing for non commercial applications	JRC
Automated procedure for retrieval of time information re. burned surfaces and active fires	IDL code	Environmental monitoring	End 2006	Agreement from OLF partners for free licensing for non commercial applications	JRC, IICT
SPADA Analysis tool for multi-parameter environmental evaluation "(working prototype")	Sw based on OS library	Environmental monitoring	End 2006	Agreement from OLF partners for free licensing for non commercial applications	JRC. CEH, CNR
1. Maps of arable land acreages (Crops distribution maps)	OWS-F-1-layer 1; OWS-F-2-2-layer 2	1 Environment 2 Agricultural censuses 3 Sustainable development 4. Management of the water quality and quantity	2007	See Annex B to geoland Consortium Agreement	Infoterra France SAS
CSP:					
	LAI / fAPAR	Environmental Services	2007		*MEDIAS-France*
	FCover	Environmental Services	2007		MEDIAS-France
	Albedo	Environmental Services	2007		MEDIAS-France
	Surface reflectance	Environmental Services	2007		MEDIAS-France
	LW radiation	Environmental Services	2006		IM
	Temperature	Environmental Services	2006		IM and IMK
	Burnt surface	Environmental Services	2006		VITO
	Water bodies	Environmental Services	2007		VITO
	Soil Moisture	Environmental Services	2008		IPF and Uni.Bonn
	Precipitation	Environmental Services	2006		IMP

* Comment: GMES Services provided to public bodies by public entities or Service Providers

Specific Remarks per Observatory

OWS-W:

1. Maps of arable land acreages (crops distribution maps)

- *What the exploitable result is (functionality, purpose, innovation etc.);*
  Maps providing the areas of annual crops at the regional scale inside the 'arable land' areas identified by a core service land cover product (CLC type). It can be generated each year at low cost. It can be used to make yearly agricultural inventories, and to monitor the impact of agricultural practices on the environment. In particular, these maps can be used as inputs for irrigation and pollution models to generate respectively maps of the water abstraction pressure by irrigation and maps of the nutrient surpluses
- *Partner(s) involved in the exploitation, role and activities*
  Infoterra France SAS
- *How the result might be exploited (products, processes) – directly (spin offs etc) or indirectly (licensing) – on an individual basis or as a consortium / group of partners;*
  Various possible exploitations : products sales, or in a longer term production software licensing
- *Further additional research and development work, including need for further collaboration and who they may be*
  The result is being improved and validated on various ecozones by INFOTERRA FRANCE
- *Intellectual Property Rights protection measures (patents, design rights, database rights, plant varieties, etc. – include references and details)*
  See the Annex B of the geoland Consortium Agreement
- *Any commercial contacts already taken, demonstrations given to potential licensees and/or investors and any comments received (market requirements, potential etc.); initial Services* -> GMES implementation; EDF

The result is at the basis of the products OWS-F-1 and OWS-F-2-2, which have been identified as potential initial services.

2. Production line for mapping of period for ploughing and bare soil vs. vegetated fields

- *What the exploitable result is (functionality, purpose, innovation etc.);*
  Processing line for mapping fields exposed to ploughing activities and/or fields with bare soil vs. vegetated fields. Defining period during which ploughing activities have been performed. The processing line is a fast and stable, semi-automated process keeping the operator effort to a minimum and not requiring and field measurements which is cost efficient.

  The process allows for EO data sources of various resolutions in the span of approximately 10-70 m. The possibility of using medium resolution data allows for fast repeating cycles, large area coverage and low cost per mapping unit. It can be generated during ploughing periods monthly and/or yearly and can be used to monitor the impact of agricultural practices of the environment. In particular, this data can be used as input to Source Apportionment models.
- *Partner(s) involved in the exploitation, role and activities*
  Metria Miljöanalys
- *How the result might be exploited (products, processes) - directly (spin offs etc) or indirectly (licensing) – on an individual basis or as a consortium / group of partners;*

Individual basis. Exploitation process not defined yet.

- *Further additional research and development work, including need for further collaboration and who they may be*
  The result is being improved and validated
- *Intellectual Property Rights protection measures (patents, design rights, database rights, plant varieties, etc. – include references and details)*
  See the Annex B of the geoland Consortium Agreement
- *Any commercial contacts already taken, demonstrations given to potential licensees and/or investors and any comments received (market requirements, potential etc.); initial Services -> GMES implementation; EDF*

Demonstration to user in 2006 after spring ploughing activities have been mapped.

3. Production line for “Special Land Cover / Land Use” for Water Pollution

- *What the exploitable result is (functionality, purpose, innovation etc.)*
  Processing line for the production of specialised Land Cover / Land Use information to specifically support establishing water management plans required by the Water Framework Directive. These maps, consisting on generic information on Land Cover / Land Use and specific classes for arable land (main crop types + information on inter-crops) allows for better estimation of (a) erosion resulting from agricultural practises and (b) where specific crops are grown which are prone to high application rates of pesticides and nutrients. The processing line s based on semi-automated steps and standard optical HR EO data. Additionally the product is designed to be integrated into models to estimate pressure and inputs of pesticides/nutrients onto/into the water cycle. Furthermore the product can directly be used to plan for measurements in the agricultural sector.
- *Partner(s) involved in the exploitation, role and activities*
  Infoterra GmbH
- *How the result might be exploited (products, processes) - directly (spin offs etc) or indirectly (licensing) – on an individual basis or as a consortium / group of partners;*
  Not defined yet
- *Further additional research and development work, including need for further collaboration and who they may be*
  After failure of LS 7 as one very helpful sensor, the value of MR EO data has to be evaluated for this HR product.
- *Intellectual Property Rights protection measures (patents, design rights, database rights, plant varieties, etc. – include references and details)*
  See the Annex B of the geoland Consortium Agreement
- *Any commercial contacts already taken, demonstrations given to potential licensees and/or investors and any comments received (market requirements, potential etc.); initial Services -> GMES implementation; EDF*
  The result is at the basis of the products OWS-F-2.1b and additionally will has been delivered to the end user within the frame of geoland project.

4. Processing line for pesticide input/load modelling

- *What the exploitable result is (functionality, purpose, innovation etc.)*

Processing line for the modelling of pesticide inputs into river systems by integrating HR Land Cover products derived from EO data, statistics and in-situ measurements into one GIS. The model approach DRIPS was developed as an easy-to-use expert system to aid decision makers with pesticide exposure / risk assessment tasks on a national or a river basin scale. While formerly based on ArcView 3.2 (and thus dependent on this product and its script language Avenue), it has now been recoded as a standalone application (programmed in DELPHI) operating with ASCII files created from grid maps.

- *Partner(s) involved in the exploitation, role and activities*
  GBG e.V., Infoterra GmbH
- *How the result might be exploited (products, processes) – directly (spin offs etc) or indirectly (licensing) – on an individual basis or as a consortium / group of partners;*
  Not defined yet
- *Further additional research and development work, including need for further collaboration and who they may be*
  As specific data sets are needed (especially pesticide application information), which probably show differences in different countries (due to specific agricultural practise), the processing line has probably to be adapted accordingly. Especially agricultural institutes dealing with this issue are needed for gathering this information throughout Europe.
- *Intellectual Property Rights protection measures (patents, design rights, database rights, plant varieties, etc. – include references and details)*
  See the Annex B of the geoland Consortium Agreement
- *Any commercial contacts already taken, demonstrations given to potential licensees and/or investors and any comments received (market requirements, potential etc.); initial Services -> GMES implementation; EDF*
  The basic process (without geoland refinements) has been implemented already in the frame of the GSE Land project and has been successfully run for the Moselle-Sarre supra-catchment.

5. Processing line for N and P surplus mapping

- *What the exploitable result is (functionality, purpose, innovation etc.);*
  Processing line for the modelling of N and P surplus into river systems and ground water, to be used for assessing agicultural pressure on water and by diffuse pollution transfer models.
- *Partner(s) involved in the exploitation, role and activities*
  Poyry Environment
- *How the result might be exploited (products, processes) – directly (spin offs etc) or indirectly (licensing) – on an individual basis or as a consortium / group of partners*
  Both exploitation are possible: products delivery and NOPOLU software licensing
- *Further additional research and development work, including need for further collaboration and who they may be*
  The coupling of NOPOLU with other diffuse pollution transfer models has been started in GSE land with MONERIS and PEGASE but further additional development work is needed in this direction.
- *Intellectual Property Rights protection measures (patents, design rights, database rights, plant varieties, etc. – include references and details)*
  See the Annex B of the geoland Consortium Agreement

- *Any commercial contacts already taken, demonstrations given to potential licensees and/or investors and any comments received (market requirements, potential etc.); initial Services -> GMES implementation; EDF*
  The basic process has been implemented already in the frame of the GSE Land project and has been successfully run for the Moselle-Sarre supra-catchment.

OFM

In the domain of crop yield estimates most OFM partners started with their own (pre)-operational system based on existing methods. During Geoland-OFM these systems have been tested, applied to the test regions, refined and improved. The partners in area estimates developed new methods (building on existing methods and tools), so that these tools carry a relatively stronger geoland-heritage. Nevertheless geoland has contributed to the continuity and quality of all applied tools, so that they can all boast to be from geoland descent to some degree.

Ad 1. CGMS Production line for yield indicators: extendable operational version

- *What the exploitable result is (functionality, purpose, innovation etc.);*
  Processing line for daily or 10-daily updating the simulated crop status over large areas. Suitable for application to large areas involving large data flows. Procedure for ingestion of RS data is known, but not yet applied in operational CGMS version.
- *Partner(s) involved in the exploitation, role and activities*
  JRC-Agrifish has outsourced the operational activities with CGMS to Alterra for application to Europe and Central-Asia, and also its thematic maintenance. Alterra has the knowledge to integrate RS data into CGMS.
- *How the result might be exploited (products, processes) – directly (spin offs etc) or indirectly (licensing) – on an individual basis or as a consortium / group of partners;*
  The usual mode of exploitation is through outsourcing via a competitive tender procedure, including a set phase preceding the operational phase.
- *Further additional research and development work, including need for further collaboration and who they may be*
  The research topics and partners will depend on the choice of RS data to be integrated, on the required spatial and temporal detail in the calculations, on the degree that the output of the system should be related to biophysical conditions (both environmental and agrotechnical), and on the required linkage to the statistical analysis for identifying the best yield forecasting procedure.
- *Intellectual Property Rights protection measures (patents, design rights, database rights, plant varieties, etc – include references and details)*
  The policy of JRC-Agrifish, owner of the -CGMS system, is that a free licence can be granted for non-commercial applications.
- *Any commercial contacts already taken, demonstrations given to potential licensees and/or investors and any comments received (market requirements, potential etc.); initial Services –> GMES implementation; EDF*
  The application has potential for commercial application, e.g for the large player on the world market in the trade in agricultural commodities, but this information-market has not been explored. OFM focuses public applications on public funding.

Ad 2. PyWOFOST based production line for scientific studies related to probabistic yield forecasting and data assimilation

- *What the exploitable result is (functionality, purpose, innovation etc.);*

A flexible variant of the CGMS processing line (described under ad 1) making use of Python scripts and My SQLor Access data base procedures, specially developed for Geoland work to build in different variants of the WOFOST crop model into CGMS. Suitable for development and testing CGMS functionality. Data base capacity is smaller than the operational CGMS Oracle data base.

- *Partner(s) involved in the exploitation, role and activities*
  Alterra.

- *How the result might be exploited (products, processes) – directly (spin offs etc) or indirectly (licensing) – on an individual basis or as a consortium / group of partners;*
  Research tool

- *Further additional research and development work, including need for further collaboration and who they may be*
  Can be re-used and adapted relatively easily

- *Intellectual Property Rights protection measures (patents, design rights, database rights, plant varieties, etc – include references and details)*

- *Any commercial contacts already taken, demonstrations given to potential licensees and/or investors and any comments received (market requirements, potential etc.); initial Services –> GMES implementation; EDF*
  Not applicable. Immediate use only in the context of improving MARS-CGMS system

Ad 3 EWBMS production line for yield indicators, based on MeteoSat data and agromet model. Operational

- *What the exploitable result is (functionality, purpose, innovation etc.);*
  Operational drought monitoring and crop yield forecasting system. Complete begin-to-end processing chain, i.e. from satellite data reception to delivery of end user products. Potential for low cost worldwide application within a few years.

- *Partner(s) involved in the exploitation, role and activities*
  EARS, partner institutes and companies, end users, in particular JRC, FAO, China National Academy of Sciences.

- *How the result might be exploited (products, processes) – directly (spin offs etc) or indirectly (licensing) – on an individual basis or as a consortium / group of partners;*
  (1) Purchase of services or (2) Implementation of complete system

- *Further additional research and development work, including need for further collaboration and who they may be*
  Will always be useful to further improve system and products, parrallel to operational use.

- *Intellectual Property Rights protection measures (patents, design rights, database rights, plant varieties, etc – include references and details)*

- *Any commercial contacts already taken, demonstrations given to potential licensees and/or investors and any comments received (market requirements, potential etc.); initial Services –> GMES implementation; EDF*

Ad 4 Production line for yield indicators, based on soil drought estimated from SWI (see next item). Pre-operational

- *What the exploitable result is (functionality, purpose, innovation etc.);*

DRYMON is a relatively new method for monitoring droughts. From scatterometer signals soil moisture is calculated. Especially with the use of ASCAT nboard the METOP satellite, covering the entire globe every day, enables DRYMON to identify droughts when they develop and to measure their intensity.
The monitoring of drought with DRYMON indices can be so precise that the soil moisture deficiency can be used to forecast crop yield. Of course this does not work in areas where crop yield is not limited by water availability (e.g. irrigated crops), but anywhere else the method works very well. For most alternatives in drought monitoring, the models available are very "data hungry". And it seems only logical to monitor a drought through what it is: a lack of soil moisture. With DRYMON it is possible to do this from a satellite. The advantages of doing this from a satellite are obvious:
- Global coverage;
- Frequent collection of data in the same repetitive manner;
- Once the satellite flies, the cost of running the system are extremely low;
- Now the first satellite of the METOP-series has been successfully launched, there is no real risk of large data gaps.

With the METOP-ASCAT instrument operational, the DRYMON indices are now further developed into a commercially exploited service.

- *Partner(s) involved in the exploitation, role and activities*

Geoland CSP core service provider IPF has been a partner in several SCAT-related projects. Also in Geoland, IPF has provided SWI data for the generation of DRYMON indices. Besides IPF several institutes like Alterra and some universities are involved in the development of DRYMON indices.

- *How the result might be exploited (products, processes) – directly (spin offs etc) or indirectly (licensing) – on an individual basis or as a consortium / group of partners;*

With the launch of the first satellite of the METOP-series the most important obstacle for the exploitation of SCAT-based NRT drought monitoring services has been removed. With several partners (from within and outside the Geoland consortium) such a service is now being made concrete.

- *Further additional research and development work, including need for further collaboration and who they may be*

METOP ASCAT will provide much better temporal coverage then the ERS scatterometer, as used within Geoland. This opens the possibility to improve the SWI method and its derived DRYMON indices and to potentially adapt the method to different climates, soil and crop types. Also, recent advances in observation and data assimilation techniques suggest that the combination of precipitation and soil moisture observations could provide higher-quality soil moisture information.

- *Intellectual Property Rights protection measures (patents, design rights, database rights, plant varieties, etc – include references and details)*

No such activities.

- *Any commercial contacts already taken, demonstrations given to potential licensees and/or investors and any comments received (market requirements, potential etc.); initial Services –> GMES implementation; EDF*

NEO has been involved in the development and application of SCAT-based services since 1998 and has been active in the development of the commercial exploitation of such a service since then. However, until a 'secured' data source was available, such a service was commercially not feasible. Now the development of the commercial exploitation has already started.

Ad 5 Production line for soil moisture mapping through the soil water index (SWI). Operational

- *What the exploitable result is (functionality, purpose, innovation etc.);*

  C-band scatterometers, like any other microwave remote sensing instruments, can only provide measurements of the moisture content in the soil surface layer (typically only a few centimetres) while agrometeorological models need information about the soil moisture in the root zone. Research dealing with the assimilation of remotely sensed surface soil moisture data in land surface models has advanced a lot in recent years, but has not yet reached an operational stage. For facilitating the use of scatterometer (ERS scatterometer, METOP ASCAT) derived soil moisture data, the IPF has produced Soil Water Index (SWI) data which have been derived from scatterometer surface soil moisture time series using a red-noise filter. Even though this method does not exploit the information content of the scatterometer data to the best possible extent, it was shown that it still has good skill in estimating the profile soil moisture content, in particular when the temporal sampling rate of the scatterometer is good. Also it can be applied worldwide and produces regularly gridded data, two important criteria for the exploitation of scatterometer derived soil moisture data in agrometeorological models. To summarize, despite SWI has some weaknesses, it is still widely used because it is much more easy to use than irregularly gridded surface soil moisture data and because of its reasonably accuracy.

- *Partner(s) involved in the exploitation, role and activities*

  The SWI and various derivative products such as SWI anomaly data has been produced by the IPF, who are also a partner of the CSP core service. IPF has already distributed SWI data to over 100 users worldwide (not just within the scope of geoland) and has interacted as close as possible with users to understand the strengths and weaknesses of the method. The SWI data have also been distributed and exploited by the commercial geoland partner NEO.

- *How the result might be exploited (products, processes) – directly (spin offs etc) or indirectly (licensing) – on an individual basis or as a consortium / group of partners;*

  METOP was launched in October 2006 and first ASCAT surface soil moisture data are expected to become available in the beginning of 2008. The data will be processed centrally at EUMETSAT and distributed over EUMETCast within 130 minutes after sensing. Since only few users will be able to assimilate these data directly (e.g. ECMWF, Meteo France), the provision of SWI data is very important for facilitating the use of these data in agrometeorological applications and, overall, to reach a much larger number of users. Since the METOP programme guarantees the availability of these data up to the year 2020, there is commercial potential in quality controlled, homogenized, NRT SWI data.

- *Further additional research and development work, including need for further collaboration and who they may be*

  METOP ACAT will provide much better temporal coverage compared to the ERS-1/2 scatterometer, as used within geoland. This opens the possibility to improve the SWI method and to potentially adapt the method to different climates, soil and crop types. Also, recent advances in observation and data assimilation techniques suggest that the combination of precipitation and soil moisture observations could provide higher-quality soil moisture information. Research partners experienced in data assimilation (e.g. Meteo France) could strengthen the current OFM team.

- *Intellectual Property Rights protection measures (patents, design rights, database rights, plant varieties, etc – include references and details)*

  All methods have been published in scientific journals. This effectively protects the OFM partners from IPR claims by third parties.

- *Any commercial contacts already taken, demonstrations given to potential licensees and/or investors and any comments received (market requirements, potential etc.); initial Services –> GMES implementation; EDF*

  No such activities have been undertaken.

Ad 6 Production line for yield indicators based on LR and MR data

- *What the exploitable result is (functionality, purpose, innovation etc.);*
  - Operational processing lines for the calculation of 10-daily vegetation and yield indicators, generation of colour maps and databases with regional unmixed means.
  - Semi-operational processing line for generating yields based on these vegetation and yield indicators.
  - Images, maps, databases with vegetation or yield indicators for vegetation and crop monitoring purposes.
  - Maps, tables with crop yield estimates and forecasts
- *Partner(s) involved in the exploitation, role and activities*

  VITO. Vegetation and yield indicators are created for JRC-Agrifish in the frame of the MARSOP-2 contract using parts of these processing lines.

- *How the result might be exploited (products, processes) – directly (spin offs etc) or indirectly (licensing) – on an individual basis or as a consortium / group of partners;*
  - via product sales
  - via service contract, as result of a competitive tender procedure

- *Further additional research and development work, including need for further collaboration and who they may be*

  Improvement of the method for deriving yield from RS indicators (statistically or by using improved modelling techniques)

- *Intellectual Property Rights protection measures (patents, design rights, database rights, plant varieties, etc – include references and details)*

  See Annex B of the Geoland Consortium Agreement.

  In case of:
  - product sales: VITO general conditions will be applied
  - service contract: VITO general conditions will be applied, unless specified otherwise.

- *Any commercial contacts already taken, demonstrations given to potential licensees and/or investors and any comments received (market requirements, potential etc.); initial Services –> GMES implementation; EDF*
  Public use: potential application in the context of ESA-GSE GMFS or EC-FP7 Geoland-2 (?). Potential for commercial use.

Ad 7 Production lines for yield indicators derived from LR images (family of vegetation indices) for calculation of vegetation indices Operational

- *What the exploitable result is (functionality, purpose, innovation etc.);*

Production line for deriving vegetation indices: Vegetation Condition Index (VCI), Temperature Condition Index (TCI) and PTVCI; VCIAVG; VTCIAVG from satellite low-resolution data: NOAA AVHRR, SPOT-VGT, MODIS, organized within ERDAS environment. Suitable for application for large areas.

- *Partner(s) involved in the exploitation, role and activities*

IGiK

- *How the result might be exploited (products, processes) – directly (spin offs etc) or indirectly (licensing) – on an individual basis or as a consortium / group of partners;*

The usual mode of exploitation is through outsourcing via a competitive tender procedure, including a set phase preceding the operational phase.

- *Further additional research and development work, including need for further collaboration and who they may be*

Further research and development work will be dependent on the level of spatial and temporal detail needed for deriving yield information, as well as on number and type of crops considered for operational crop yield assessment. It will also require close collaboration with statistical institutions producing crop estimates and with meteorological institutions, in order to prepare the most reliable crop yield forecasts based on remote sensing inputs supported with meteorological data.

- *Intellectual Property Rights protection measures (patents, design rights, database rights, plant varieties, etc – include references and details)*

- *Any commercial contacts already taken, demonstrations given to potential licensees and/or investors and any comments received (market requirements, potential etc.); initial Services –> GMES implementation; EDF*

The prepared technology could be operationally applied by institutions/ organizations which use information on crop yield for taking decisions on agricultural market, but so far that synergy has not been established. Activities related to GMES implementation in the near future form a platform for making the proposed RS based technology fully exploitable.

Ad 8 Production lines for generating crop area estimates by means of sub-pixel classification using neural networks

- *What the exploitable result is (functionality, purpose, innovation etc.);*

- Operational processing line for the generation of crop area estimates
- Maps, tables with crop area estimates (per pixel or aggregated per region)

- *Partner(s) involved in the exploitation, role and activities*
  VITO

- *How the result might be exploited (products, processes) – directly (spin offs etc) or indirectly (licensing) – on an individual basis or as a consortium / group of partners;*
  - via product sales
  - via service contract, as result of a competitive tender procedure

- *Further additional research and development work, including need for further collaboration and who they may be*
  Optimisation of the methodology for deriving area estimates early in the growing season, Further research is needed for determining the limits of extrapolation in time (application on subsequent years) and space (application on large regions).

- *Intellectual Property Rights protection measures (patents, design rights, database rights, plant varieties, etc – include references and details)*

  See Annex B of the Geoland Consortium Agreement.
  In case of:
  - product sales: VITO general conditions will be applied
  - service contract: VITO general conditions will be applied, unless specified otherwise.

- *Any commercial contacts already taken, demonstrations given to potential licensees and/or investors and any comments received (market requirements, potential etc.); initial Services –> GMES implementation; EDF*
  Public use: the method is currently being used in the frame of ESA-GSE GMFS (Senegal).
  Potentially also useful for EC-FP7 Geoland-2.
  Potential for commercial use.

Ad 9 Production line for mapping of arable land acreages (Crop distribution maps). Operational

- *What the exploitable result is (functionality, purpose, innovation etc.);*
  Maps providing the areas of crops at the regional scale inside the 'arable land' areas identified by a core service land cover product (CLC type). It can be generated each year with a low cost. It can be used to make the management of natural resources (food security), yearly agricultural inventories, and to monitor the impact of agricultural practices on the environment.

- *Partner(s) involved in the exploitation, role and activities*
  Infoterra France SAS

- *How the result might be exploited (products, processes) – directly (spin offs etc) or indirectly (licensing) – on an individual basis or as a consortium / group of partners;*

  Various possible exploitations : products sales, or in a longer term production software licensing

- *Further additional research and development work, including need for further collaboration and who they may be*
  The result is being improved and validated on various sites by Infoterra France

- *Intellectual Property Rights protection measures (patents, design rights, database rights, plant varieties, etc – include references and details)*
  See the Annex B of the geoland Consortium Agreement

- *Any commercial contacts already taken, demonstrations given to potential licensees and/or investors and any comments received (market requirements, potential etc.); initial Services –> GMES implementation; EDF*
  The result is at the basis of the product OFM-F-1-1b which has been identified as potential initial services.

Ad 10 Production line for mapping of arable land acreages (Crop distribution maps). Operational

- *What the exploitable result is (functionality, purpose, innovation etc.);*
  Methodology and processing line for crop acreage estimation and agriculture statistics production. Crop production estimates. Statistical approach using remote sensing.
- *Partner(s) involved in the exploitation, role and activities*
  Collaboration with Russian institutions for data collection and scientific exchange of methodologies

- *How the result might be exploited (products, processes) – directly (spin offs etc) or indirectly (licensing) – on an individual basis or as a consortium / group of partners;*
  In the framework of the JRC MARS activities in developing countries and national institutions in their context of agriculture statistics collection and acreage assessments

- *Further additional research and development work, including need for further collaboration and who they may be*
  Additional research needed in other environment (Africa) with different crops, collaboration with local institutions always needed

- *Intellectual Property Rights protection measures (patents, design rights, database rights, plant varieties, etc – include references and details)*
  The policy of JRC-Agrifish is a free use of the methodology developed

- *Any commercial contacts already taken, demonstrations given to potential licensees and/or investors and any comments received (market requirements, potential etc.); initial Services –> GMES implementation; EDF*
  No commercial contact or licensees. Application is mainly for public institutions

OLF

1) What the exploitable result is (functionality, purpose, innovation etc.);
   IDL codes are workable prototypes, but do not have the efficiency for mass processing. They serve as reference for ad hoc coding of processing chains. Each processing line is new.
   SPADA software is a prototype based on Open Source libraries, in particular GDAL, GD, VB and GNU.
2) Partner(s) involved in the exploitation, role and activities
   All the coding was done at JRC. Other OLF partners contributed at the level of algorithm identification / design

3) How the result might be exploited (products, processes) - directly (spin offs etc) or indirectly (licensing) – on an individual basis or as a consortium/group of partners;
IDL code have been exploited in the framework of the VGT4Africa project as the basis for algorithm and process coding in C/C++ using the COOL/VIP Toolbox library
4) Any technical and economic market considerations – commercial and technical thresholds etc.
The market for the products is entirely made of entities from public services. Due consideration has to be given to their funding mechanism.
5) Any obstacles identified which might prove to be barriers to commercialization
Real commercialization cannot be envisaged in the shirt term: confidence needs to be built among users: this exists only 1) if they are convinced of product quality and 2) they are given clear signal about long-term sustainability of products, which is not yet the case.
6) The existence or development of similar or competing technologies / solution elsewhere
Products generated by IDL codes are entirely new, but it can be expected that competitors will appear from US.
Most of SPADA functionalities can be carried out with industry standard software. Its comparative advantages are: functionalities streamlining and free availability
7) Third party rights (e.g. patents belonging to competitors), standards, …
All was developed in order to avoid any third party right
8) Analysis of any (potential) non-technical obstacles
N.A.
9) Any form of non-commercial use or impact, relating e.g. to the development of new standards or policies
Exploitation in the near future (min 5 years) MUST be on a non commercial basis, in order to fully convince the users. The period length is determined by the fact that what is looked at is seasonal behaviour, therefore several years of use are needed.
10) Further additional research and development work, including need for further collaboration and who they may be;
See Section 3.7.2
11) Intellectual Property Rights protection measures (patents, design rights, database rights, plant varieties, etc. – include references and details); registration with Annex B CA
There is variation w. r. to standards terms of the consortium agreement. It is necessary for product acceptance by users that methods and algorithms used are published.
12) Any commercial contacts already taken, demonstrations given to potential licensees and/or investors and any comments received (market requirements, potential etc.); initial Services -> GMES implementation; EDF
IDL code used to develop C/C++ /COOL/VIP Toolobox operational processing chain in the VGT4Africa project
13) Where possible, also include any other potential impact from the exploitation of the result (socio-economic impact).

4.3 DISSEMINATION OF KNOWLEDGE

Table 10: Dissemination activities

OBS	Planned/ actual Dates	Type	Type of audience	Countries addressed	Size of audi-ence	Partner responsi-ble / involved
ONP	7-8 Oct. 2004	Conference 1st Göttingen GIS & Remote Sensing Days	Scientific	D,A		14
	25-29 May 2004	23rd EARSeL symposium, Dubrovnik	Scientific	International		35
	9-10th March 2005	Conference: LANU Schleswig-Holstein and Sachsen-Anhalt, 'Re-mote sensing for nature con-servation'	Scientific	D	100	35,5,34
	12-20th February 2005	Exhibition: Contribution to Geoland presentation for the Brussels Space week.	International	International		5,14,35,36, 34,9,19
	2-3 April 2006 Thessaloniki	INTERREG MedWet work-shop	Scientific	Mediterra-nean	20	5, 35
		Web site: Initial version on-line	World Wide Web	International		5,14,35,36, 34,9,19
		DVD: ONP contribution to Geoland DVD	various	Various		5,14,35,36, 34,9,19
		Publications:				
		Bock M, Xofis P, Mitchley J, Rossner G. Wissen M. (2005): Object Oriented Methods for Habitat Mapping at Multiple Scales. In: Jour-nal for Nature Conservation 13, 75-89				35
		Kleinod K, Bock M, Wissen M. (2005): Detecting vegeta-tion changes in a wetland area in Northern Germany using earth observation and geodata. In: Journal for Na-ture Conservation 13, 115-125.				35
		Evits, E; Lamb A D; Langar F; and Koch B. (2005), 'Or-thogonal transformations of SPOT5 images: seasonal and geographical depend-ence of Tasselled Cap im-ages'. Submitted to Photo-grammetric Engineering & Remote Sensing				36,5
		Hill, R.A., Granica, K., Smith, G.M. & Schardt, M. (2005) Characterization of alpine treeline ecotones: an opera-				34,14

OBS	Planned/ actual Dates	Type	Type of audience	Countries addressed	Size of audi-ence	Partner responsi-ble / involved
		tional approach ? Proceedings of *ForestSAT 2005: Operational Tools in Forestry Using Remote Sensing Techniques*. May 31-June 1 (Borås, Sweden).				
		Mander, Mitchley, Keramitsoglou, Bock & Xofis (2005). - Earth observation methods for habitat mapping and spatial indicators for nature conservation in Europe. Journal for Nature Conservation, 13, 69-73.				35
		Hill, R.A., Granica, K., Smith, G.M. & Schardt, M. (2006) Representation of an alpine treeline ecotone in SPOT HRG data. Submitted to Remote Sensing of Environment.				34,14
		Bock, Rossner, Wissen, Remm, Langake, Lang, Klug, Blaschke and Borut Vrščai, 2005, 'Spatial Indicators for Nature Conservation, from European to Local Scale', Ecological Indicators 5, Issue 4, 322-338				35
		Smith G.M. & Hill, R.A. (2005) Wetland monitoring within the GEOLAND project. In Proceedings of the Remote Sensing Workshop. Peterborough, UK: 30 September 2004. (English Nature, Peterborough).				34
		Schardt, M., Granica, K., Hirschmugl, M., Luckel, W. & Klaushofer, F. (2005): Satellitenbildbasierte Waldklassifikation für Salzburg (KLEO). Strobl/Blaschke/Griesebner (Hrsg.): Angewandte Geoinformatik 2005. Proc. of 17th AGIT Symposium (06. – 08. 07. 2005), Salzburg. Verlag Wichmann, Heidelberg, pp. 621 – 628.				14
		R. Wack, H. Stelzl, 2005, Assessment of Forest Stand Parameters from Laserscanner Data in Mixed Forests, Proceedings of the FORESTSAT workshop Boras , Sweden				14
		Dees, M., Volk, H., Straub, C. Langar, P. Koch , B. Ramminger, G. (2006): Remote sensing based concepts utilising SPOT 5 and				

OBS	Planned/ actual Dates	Type	Type of audience	Countries addressed	Size of audi-ence	Partner responsi-ble / involved
		LIDAR for forest habitat mapping and monitoring under the EU Habitat Directive. Remote Sensing of Environment, (submitted 11/2006). Ivits, E., Langar, F., Hemphill S. & Koch, B (2006): Advantages and Disadvantages of Pixel- and Object-Based Classification Methods Based on the Spot 5 Sensor. Berichte Freiburger Forstliche Forschung (in print). Langar, F., Ivits E. & Koch B. (2006): Objektbasierte Klassifikation von Hauptbaumarten in Spot 5 Satellitendaten. Grundlage für Kartierung und Monitoring von FFH Gebieten in Thüringen. Online proceedings, AGIT Konferenz, Salzburg, 4.-6. Juli 2006. http://www.agit.at/myAGIT/papers/2006/6067.pdf. Langar, F., Ivits E. & Koch B. (2006): Modelling FFH areas in forests using object based classifications of remote sensing data and GIS in Thuringia. Online proceedings, International Conference on Object-based Image Analysis (OBIA 2006). Salzburg, 5-7. July 2006. Volume No. XXXVI – 4/C42, ISSN – 1682-1777. http://www.commission4.isprs.org/obia06/papers.htm				
OSW-W	2005-2006	Project web-site	General public	Europe	NA	OWS-W partners
	2005-2006	Direct e-mailing	Users and SP's addressing WFD	Europe	NA	OWS-W partners (co-ordinated by Metria)
	13.12.2004 initiated cont. 2005-2006	OWS-W Flyer	General public	Europe	NA	OWS-W partners
	10.-11.02.2004	Conference / seminar	Swedish remote sensing users / industry / researchers	Sweden	App. 100	Metria, SEPA; CAB
	01.04.2004	Conference	GIS users / administrative users / researchers	France	100	EADS Astrium SAS
	11.06.2004; 02.12.2004	User meetings; promotion and training	National, regional and lo-	France	20	EADS Astrium

OBS	Planned/ actual Dates	Type	Type of audience	Countries addressed	Size of audi-ence	Partner responsi-ble / involved
	2005-2006		cal users			SAS
	27.01.2005	Conference	National, re-gional authori-ties, industry, scientists	Sweden	App. 50	SLU
	17.02.2005	User meeting	Regional authority	Sweden		SLU, Metria, CAB
	24.03.2005	CNES GMES user Work-shop	National user organisations and service pro-viders	European	App. 50	Metria, Infoterra
	21-23.09.2005	XI National Remote Sensing Congress	National, re-gional and local users.	Spain	200	Tragsatec
	25.10.2005	EWA Conference "European River Basin Management"	National users	Belgium	App. 100	ITD
	22.11.2005	WISE EC Workshop	EC, JRC, ETC-Water, Member State represen-tatives	EU 25+	45	ITD, speech
	29.11.2005	Seminar – Implementation of WFD in European countries	European, Na-tional, regional and local users, in charge of re-porting to WFD	Sweden, Finland, Norway, Denmark, England, France, Estonia	100	Metria, SLU, SEPA
	Jan 2006	Workshop (German Working Group on Water – LAWA)	German water managers	Germany	120	ITD
	Mar 2006	WISE EC Workshop	EC, JRC, ETC-Water, Member State repre-sentatives	EU 25+	45	ITD
	Q2-2006	Lesson / conference	Students higher education	South America	12	Tragsatec
	Sep 2006	Seminar, Conference (Elbe Conference)	EC, intern. nat., reg. administrat-ions, NGOs, SP	Elbe/Labe countries, EU	500	ITD
	Sept 2006	National GIS and RS Con-gress	Academic, re-search and SME	Spain	200	Tragsatec
	18/09/2006	Presentation of products OWS-F1 and OWS-F-2	F Ministry of En-vironment and the 6 French Water district authorities, rep-resentatives of the Diffuse pol-lutions working group	France	15	Infoterra France
	19 – 22 Sept 2006	XII National Congress on Geographic Information Technology	Academic, re-search and SME	Spain	200	Tragsatec
	27.09.2006	EARSEL Conference	Research	International	ca. 200	GBG, ITD
	Oct 2006	User Workshop	SP, users	Germany	12	ITD
	Nov 2006	EWA, 2nd Brussels Confer-ence	NGOs, EC	EU ++	100	ITD

OBS	Planned/ actual Dates	Type	Type of audience	Countries addressed	Size of audi-ence	Partner responsi-ble / involved
	30.11.2006-01.12.2006	Seminar/workshop	Research / user / SP	Sweden	Ca 40	Metria, SLU, CAB, SEPA
OWS-S	February 2005	Workshop regarding Pesera model (training)	OWS-S partners and users	Greece, Italy, Spain	15 partici-pants	MAICh-AUTh
	25-28 May 2006	International Conference: Remote Sensing and Spatial Analysis Tools for Erosion Processes (Samos, Greece): OWS-S poster presentation / dissemination of geoland material: geoland DVD, OWS-S leaflet	Soil researchers of Europe	European countries		Konstanti-nos Ntouros (MAICh-AUTh)
	6-8 Novem-ber 2006	21st European Conference for ESRI Users, Greece: OWS-S poster presentation	GIS users from Europe	European countries		
	May 2006	Dissemination of the GEOLAND DVD	Greek National Services	Greece		
	Feb 2007	Updated OWS-S Web site	Researchers – Organisations with an interest in soil erosion		World-wide	MAICh-AUTh, Univ. of Trieste
	Feb 2007	OWS-S leaflet updated ver-sion	Researchers – Organisations with an interest in soil erosion		Europe	MAICh-AUTh, Univ. of Trieste
OSP	24.04.2005	Workshop European soil pro-tection strategy	Decision makers	EU	100	GeoVille
	22.-25.02.2005	CORP Competence Center of Urban and Regional Plan-ning	Spatial planners, Researchers, political decision makers	EU and in-ternat.	400	ARCS, GeoVille
	06.-08.07.2005	AGIT Symposium,	Research, GI-Experts, Spatial planners	EU, mainly German speaking	1100	JR, ARCS, GeoVille
	13.-17.07.2005	Association of European Schools of Planning Con-gress	Universities / uni departments that research in urban and reg. planning.	EU	Several hundred	GeoVille, ARCS, Leeds Met-ropolitan University
	23.-27.08.2005	45th Congress of the Euro-pean Regional Science As-sociation (ERSA 2005):"Land Use and Water Management in a Sustainable Network Society"	Spatial planners, Water mgmt ex-perts, decision makers, re-searchers	EU and internat.	Several hundred	ARC sys-tems re-search, Joint re-search Centre
All	Dec 2005	3rd geoland forum	Consortium, po-litical, research	European	~100	All
OSP	19. - 20.04.06	GMES Graz ’06 – “A market for GMES in Europe and its regions – the Graz dialogue” (Graz, Austria)	Spatial planners, decision mak-ers, researchers	EU and internat.		GeoVille
	27. – 28.06.06	CLC2006 workshop – Corine Land Cover, GMES (Copen-hagen, Norway)	Spatial planners, decision mak-ers, researchers	EU and internat.		GeoVille
	06.07.2006	Workshop GSE Land (Barcelona, Spain)	Spatial planners, decision mak-	EU and internat.		GeoVille

OBS	Planned/ actual Dates	Type	Type of audience	Countries addressed	Size of audi-ence	Partner responsi-ble / involved
			ers, researchers			
CSL	07.-10.02.2006	geoland forum	geoland team	Europe	160	all
	28.02.-01.03.2006	Technical meeting to repre-sent FTS team & assure link to geoland	IP Sustainability	Europe	30	1, 2
	09.03.2006	GMES and the regions	European re-gions, member states represen-tatives	Europe	80	1
	11.04.2006	Internal review	DG ENTR, re-viewers	Europe	25	all TMs
	18.-20.04.2006	Graz – A market for GMES in Europe and its Regions	Member states	Europe	200	1
	08.-11.05.2006	ISPRS Symposium, techn. meeting	International	Global	400	1
	12.05.2006	Techn. Meeting B4G; representing CSL	IP Sustainability	Europe	20	1
	17.05.2006	Techn. Meeting B4G	B4G review & hearing	Europe	15	1
	22.05.2006	Consultancy	IG Land Moni-toring	Europe	6	1
	23.05.2006	Coordination of parallel ac-tivities & discussion of joint actions	JRC experts	Europe	12	1
	08.-09-06.2006	TM meeting	TMs	Europe	20	TMs
	27.-28.06.2006	EEA FTS meeting with NRCs in Copenhagen	NRCs, EEA	Europe	45	1, 8, 15
	07.-10.02.2006	geoland forum	geoland team	Europe	160	all
	28.02.-01.03.2006	Technical meeting to repre-sent FTS team & assure link to geoland	IP Sustainability	Europe	30	1, 2
	09.03.2006	GMES and the regions	European re-gions, member states represen-tatives	Europe	80	1
	11.04.2006	Internal review	DG ENTR, re-viewers	Europe	25	all TMs
	18.-20.04.2006	Graz – A market for GMES in Europe and its Regions	Member states	Europe	200	1
	08.-11.05.2006	ISPRS Symposium, techn. meeting	International	Global	400	1
	12.05.2006	Techn. meeting B4G; repre-senting CSL	IP Sustainability	Europe	20	1
	17.05.2006	Techn. meeting B4G	B4G review & hearing	Europe	15	1
	22.05.2006	Consultancy	IG Land Moni-toring	Europe	6	1
	23.05.2006	Coordination of parallel ac-tivities & discussion of joint actions	JRC experts	Europe	12	1
	08.-09-06.2006	TM meeting	TMs	Europe	20	TMs
	27.-	EEA FTS meeting with	NRCs, EEA	Europe	45	1, 8, 15

OBS	Planned/ actual Dates	Type	Type of audience	Countries addressed	Size of audi-ence	Partner responsi-ble / involved
	28.06.2006	NRCs in Copenhagen				
	04.-05.07.2006	GMES user meeting organ-ised by GSE Land	GMES users	Europe	14	8
	17.08.2006	Consultancy for DG ENTR, IG Land monitoring	DG ENTR, IG	Europe	6	1
	27.-30.09.2006	EARSeL-workshop Land use & land cover	MS, scientists	Europe	160	1
	04.10.2006	RISE meeting Brussels; geo-land link & CSL presentation	RISE partici-pants, Humboldt representative	Europe	25	1
	17.-18.10.2006	GMES presentation at Ger-man Ministries	national decision makers	Germany	50	1
	15.11.2006	AGRUM meeting	Regional plan-ner	Germany	25	1
	01.12.2006	Technical meeting with DG Regio on Urban Audit	DG Regio, DG ENTR	Europe	4	1, 15
OFM	2004-2006	OFM Flyer	General public	Europe	NA	Alterra
	2005-2006	Project web-site with Promo-tion material on www.gmes-geoland.info/OS/OFM	General public, end users	Europe	NA	Alterra,
	2006	Observatory web-site www.marsop.info/geoland followed by http://www.geoland-food.info	General public, and end users	Europe, China	NA	Alterra, OFM part-ners
	20-22 March 2006 in Mol, Belgium	Combined meeting of Hua-bei-CGMS-China Asia ITC Action and Geoland-OFM	research	Europe, China	30	VITO, Alterra, IGiK, NEO
	23-25 Oct 2006, Arlon, Bel-gium	III CGMS Expert meeting	Research, ana-lysts, users	Europe, Central Asia, China	70	JRC, Alterra, VITO, IGiK, NEO
	15-17 Nov 2006 Beijing, China	OFM training session and combined meeting of Hua-bei-CGMS-China Asia ITC Action and Geoland-OFM ,	Research, ana-lysts	China	30	VITO, Alterra, IGiK, NEO
	30.11-01.12.2006 Stresa, Italy	ISPRS workshop on Remote Sensing Support to Crop Yield Forecast and Area es-timates, including OFM train-ing session	Research, ana-lysts, users	world	60	JRC, Al-terra, VITO, IGiK, EARS, NEO, ITF, TUWien
	23.01.2006 Roma, Italy	OFM training session at WFP and FAO	Research, ana-lysts, users	Developing world	20	JRC, Alterra, VITO, IGiK, EARS, NEO, TUWien
OLF	07-11.02.2005	Training session	Scientific and technical staff of met service, env. ministry, health ministry and water re-	Rep. Congo, Dem. Rep Congo	25	OLF-JRC

OBS	Planned/ actual Dates	Type	Type of audience	Countries addressed	Size of audi-ence	Partner responsi-ble / involved
			source ministry			
	15-22.11.2005	Training session	Scientific and technical staff of met service, env. ministry, health ministry and water re-source ministry	CILSS countries (Mauritania, Senegal, Gambia, Guinea Bissau, Mali, Burkina Faso, Niger, Chad)	12	OLF-JRC
	18-28/07/2006	Training session	Scientific and technical staff of met service, env. ministry, and water re-source ministry + SADC/RRSU	Botswana + SADC	24	OLF-JRC
	23-26/10/2006	Training session	Scientific and technical staff of met service, env. ministry, and agric minis-try	Mozambique	6	OLF-JRC
	12-14/09/2004	Remote Sensing and Photo-grammetry Society – Edinburgh, Annual Symposium 2004	Scientists, stu-dents, private companies	UK	300	CEH
	21-22.09.2004	GLCN – Firenze Land cover mapping and change as-sessment	Scientists	Africa, Italy, USA	100	JRC
OLF & CSP	26.09-01.10.04	6th EUMETSAT user forum in Africa – Brazzaville use of low EO data for weather, climate and env. monitoring	Directors & key staff nat. Met services	Africa	150	JRC, ME-DIAS
OLF	8-10 June 2005	SIBERIA-2 – Vienna final in-ternal consortium meeting	Scientists	Europe, N. Eurasia	30	CEH
	21-24 June 2005	GEO4 expert meeting Nai-robi Preparation of the Global Env. Outlook (UNEP	Scientists	worldwide	150	JRC
	07-09/2005	Int. Conference on Remote Sensing and Geoinformation Processing in the Assess-ment and Monitoring of Land Degradation and desertifica-tion	Scientists	Europe, Africa	150	CNR
	24-25/04/2006	Madrid International Sympo-sium Earth Observation and Global Change	Scientists	international	100	UCL
	8-10/08/2006	Missoula, USA Global Vege-tation Workshop 2006 : Long term global monitoring of vegetation variables using moderate resolution satel-lites,	Scientists	International	150	UCL, JRC
	30/08-1/09/2006	Rome International work-shop on reducing emissions from deforestation in devel-oping countries, Subsidiary Body for Scientific and	Scientists	International	50	UCL

OBS	Planned/ actual Dates	Type	Type of audience	Countries addressed	Size of audi-ence	Partner responsi-ble / involved
		Technological Advice (SBSTA) of the UNFCCC, FAO				
	16-20/10/2006	7th EUMETSAT forum of African users	National dir. of met, delegates of international org	Africa	150	JRC
	8-10/11/2006	Stanford, USA International conference "Imaging Environment: Maps, Models, Metaphors"	Scientists	US	200	UCL
	15-16/11/2006	Moscow Regional GOFC-GOLD workshop for Northern Eurasia Regional Information Network (NERIN)	Scientists	Russia + International	50	JRC
	12-17/11/2006	San Diego USA3rd International Conference on Fire Ecology and Management	SCIENTISTS	International	200	IICT
ONC	2004	5 conferences	Research, Space agencies, Industry.	International	50 to 3000	METE
	2005	*7 conferences*	Research, Space agencies, Operational meteorology.	International	20 to 3000	METE, ECM, CEA/CNRS, KNMI
	2006	*RAQRS symposium*	Research, GEO secretariat	International	*About 300*	METE, ECM, CEA/CNRS, ALT
CSP	24-26 March 2004	VEGETATION Users Conference	Research	International		MEDIAS
	25-30 April 2004	EGU Conference	Research	International		IPF
	24-28 May 2004	BALTEX Conference	Research	International		IMP
	31 May -04 June 2004	EUMETSAT Conference	Research	International		IPF
	12-23 July 2004	ISPRS Congress	Research	International		MEDIAS
		CSP Website	Scientific community + decision makers	International		MEDIAS
	December 2004	CSP Flyer	Scientific community + decision makers	International		MEDIAS
	24-29 April 2005	EGU Conference	Research	International		All partners
	August 2005	DVD	Scientific community + decision makers	European		Medias
	17-19 October 2005	ISPRS Symposium	Research	International		IPF
	24 January 2006	SIRTA Workshop	Research	International		CNRM
	30 January-1 February	Ateliers	Research	France		CNRM

OBS	Planned/ actual Dates	Type	Type of audience	Countries addressed	Size of audi-ence	Partner responsi-ble / involved
	2006					
	8-10 March 2006	LSA SAF Users Workshop	Research	European		IPF
	7-10 August 2006	GLVM Workshop	Research	International		MEDIAS
	25-29 Sep-tember 2006	RAQRS Symposium	Research	International		MEDIAS
	9-11 October 2006	Conference	Research	Germany		IMK
OS	07.-10.02.2006	geoland forum	geoland team	Europe	160	All
	28.02.-01.03.2006	Ttechnical meeting to repre-sent geoland OS team & as-sure link to geoland	IP Sustainability	Europe	30	1, 2
	11.04.2006	Internal review	DG ENTR, reviewers	Europe	25	all TMs
	04.10.2006	RISE meeting Brussels; geo-land link	RISE partici-pants, Humboldt representative	Europe	25	1
COO		geoland Forum 1, 2, 3, 4	Public	Europe		All
		Parliament News articles 1, 2, 3	Public	Europe		Infoterra
		geoland web-site	Public	Europe		All
		geoland CD	Public	Europe		All
		geoland sub-task 2-pagers	Public	Europe		All
		geoland press releases 1, 2, 3, 4	Public	Europe		Infoterra
		Selected articles 2004 / 2005 on geoland		Europe		Infoterra
		Position papers Inter alia Graz	Graz GMES conference (Austrian EC presidency)	All EC MS	Approx. 250	all geoland TMs

CSL-5 Service Portfolio

Agreement among all CSL partners that this document should be released to all interested parties as a basis for discussion on generic GMES land cover services (i.e. as a starting point for ESA GSE stage 2 projects) and for possible CORINE improvements.

OLF

Brivio P.A., M. Boschetti, P. Carrara, D. Stroppiana, G. Bordogna, 2006. A fuzzy anomaly indicator for environmental status assessment based on EO data: preliminary results for Africa. 1st Int. Conf. on Remote sensing and geoinformation processing in the assessment and moni-toring of land degradation and desertification, Trier (Germany) 7-9 September 2005, pp. 383-390.

Brivio P.A., G. Bordogna, M. Boschetti, P. Carrara, D. Stroppiana, 2005. Valutazione dello stato della copertura vegetale in Africa: la prospettiva del progetto europeo GeoLand. 9a Conf. Naz. ASITA “Geomatica. Standardizzazione, interoperabilità e nuove tecnologie”, Catania, 15-18 Nov. 2005, Vol. I, pp. 493-498.

Mota, B., J.M.C. Pereira, D. Oom, M.J.P. Vasconcelos, M. Simon, O. Arino, and M. Schultz (2004) Screening the ESA ATSR-2 World Fire Atlas (1997-2001). Atmospheric Chemistry and Physics

Manuel de l'utilisateur VGT4Africa - Première Edition // VGT4Africa user manual - First Edition Baret, F., Bartholomé, E., Bicheron, P., Borstlap, G., Bydekerke, L., Combal, B., Derwae, J., Geiger, G., Gontier, E., Grégoire, J-M., Hagolle, O., Jacobs, T., Leroy, M., Piccard, I., Samain, O. et Van Roey, T., 2006, Luxembourg: Office for Official Publication of the European Communities, EUR 22344 EN - EUR 22344 FR, E. Bartholomé (éditeur).

Observation Requirements for Global Biomass Burning Emission Monitoring Kaiser, J.W., Schultz, M.G., Grégoire, J-M., Bartholomé, E., Leroy, M., Engelen, R., Simmons, A. and Hollingsworth, A., 2006, proceedings of the EUMETSAT Meteorological Satellite Conference – Session: Global Environmental Monitoring, Helsinki, Finland, 12–16 June 2006

Recommendations for a Global Fire Assimilation System (GFAS) as part of GMES Kaiser, J.W., Schultz, M.G., Textor, C., Grégoire, J-M., Sofiev, M., Boucher, O., Heil, A., Serrar, S., Engelen, R. and Hollingsworth, A., 2006, 2nd Workshop on Geostationary Fire Monitoring and Applications, EUMETSAT, Darmstadt, Germany, December 4-6, 2006

SPADA user manual - First edition // Manuel de l'utilisateur SPADA première edition. Edited by Andrew Nelson1 Authors: Andrew Nelson1, Etienne Bartholomé1, Mauro Michielon1, Bruno Combal1, Pietro Alessandro Brivio2, Mirko Boschetti2, Paola Carrara2, Daniela Stroppiana2 and Heiko Balzter3. 2006, Luxembourg: Office for Official Publication of the European Communities, EUR XXXXX EN - EUR XXXXX FR

A MAP OF TEMPORARY WATER BODIES IN WESTERN AFRICA Haas E. (1), Combal B. (1), Bartholomé E(1).Proceedings of GLOBWETLAND SYMPOSIUM: “Looking at wetlands from Space”, Frascati 19-20 Oct 2006, in press

Submitted

Brivio P.A., M. Boschetti, P. Carrara, D. Stroppiana and G. Bordogna 2006 Fuzzy integration of satellite data for detecting environmental anomalies across Africa. In Advances in Remote Sensing and Geoinformation Processing for Land Degradation Assessment. (Hill J. and A. Roeder, Eds), Taylor & Francis (submitted).

Stroppiana, D., Boschetti, M., Carrara, P., Bordogna, G., & Brivio, P.A. 2006. Continental monitoring of vegetation cover status with a fuzzy anomaly indicator: an example for Africa. Remote Sensing of Environment (submitted).

Carrara, P., Bordogna, G., Boschetti, M., Stroppiana, D. & Brivio, P.A. 2006. A flexible multi-source spatial data fusion system for environmental status assessment at continental scale. Int. J. of Geographic Information Science (submitted).

Andreas Langner, Etienne Bartholome, Florian Siegert: The use of low and medium resolution satellite data for monitoring forest cover changes in tropical Africa” in preparation

Balzter, H., Gerard, F., Weedon, G., Grey, W., Combal, B., Bartholome, E., Bartalev, S. and Los, S., submitted, Coupling of vegetation growing season anomalies with hemispheric and regional scale climate patterns in Central and East Siberia, Journal of Climate, submitted

CSP

Conferences:

- 24-26 March 2004, Second International VEGETATION users conference, An introduction to the Biogeophysical Parameter Core Service of the geoland project by Leroy, M. and the CSP Partners.
- 25-30 April 2004, EGU conference: Presentation of validation results of Soil moisture products derived from ERS by IPF.
- 24-28 May 2004, Fourth Study conference on BALTEX: Presentation of precipitation products and clarification of IPR by IMP.
- 31 May – 4 June 2004, EUMETSAT Conference 2004: "Global Soil Moisture Data and its Potential for Climatological and Meteorological Applications" by IPF.
- 12-23 July 2004, XXth Congress of ISPRS, Towards an European service center for monitoring land surfaces at global and regional scales : the geoland / CSP project by Leroy, M. and the CSP partners.
- 24-29 April 2005, EGU Conference: CSP presentation in the session « Remote Sensing observation of Biogeochemical cycles » + Scientific presentations by CSP partners
    - Elias, T., and J. L. Roujean, The geoland algorithm to estimate the solar radiation at surface level from geostationary sensors: Method, case studies and influence of the atmospheric composition.
    - Kottek, M., P. Skomorowski, K. Brugger and F. Rubel, Merging satellite precipitation and bias-corrected rain gauge measurements on a daily base.
    - Leroy, M. and the CSP partners, geoland - Core Service biogeophysical Parameter.
    - Libonati, R., I. F. Trigo, J. Silva and C.C. DaCamara; Assessment of fire weather index forecasts in Continental Portugal.
    - Paredes, D.; Trigo, R. M.; Garcia-Herrera, R.; Trigo, I. F, Precipitation changes over Western Europe in early spring and its modulation by large-scale atmospheric circulation variability.
    - Scipal, K., Accuracy of global soil moisture data from microwave scatterometers.
    - Trigo, I.F, Climatology and interannual variability of storm-tracks in the Euro-Atlantic sector: a comparison between ERA-40 and NCEP/NCAR reanalyses.
    - Wilker, H., Drush, M., Seuffert, G.; Simmer, C., Effects of the near-surface soil moisture profile on the assimilation of L-band microwave brightness temperature.
- 17th –19th October 2005, International Symposium on Physical Measurements and Signatures in Remote Sensing, Beijing, China, Azimuthal signatures of scatterometer measurements over different land cover types in China by Bartalis Z., K. Scipal, W. Wagner.
- 24th January 2006, *SIRTA workshop*, Experimental estimation of the aerosol radiative forcing at the continental surface level and at a hourly-basis temporal resolution with METEOSAT-7 by Elias, T., J.L. Roujean, C. Henry, and R. Lacaze.
- 30th January- 1st February 2006, *Ateliers Expérimentation et Instrumentation,* Experimental estimation of the aerosol radiative forcing at the continental surface level and at a hourly-basis temporal resolution with METEOSAT-7 by Elias, T., J.L. Roujean, R. Lacaze, and C. Henry.
- 8-10 March 2006, *LSA SAF user training workshop*, Soil moisture from thermal infrared satellite data: envisaged synergies with METOP ASCAT data by W. Wagner, and C. Kuenzer.
- 7-10th August 2006, *Global Land Vegetation Monitoring Workshop,* The CEOS Leaf Area Index Inter-comparison as a prototype activity by Garrigues, S., R. Lacaze, J. Morissette, F. Baret, M. Weiss, R. Fernandes, J. Nickeson, S. Plummer, W. Yang, and R. Myneni.

- 25-29th September 2006, *Second Symposium on Recent Advances on Quantitative Remote Sensing,* The CEOS Leaf Area Index Inter-comparison as a prototype activity by Garrigues, S., R. Lacaze, J. Morissette, F. Baret, M. Weiss, R. Fernades, J. Nickeson, S. Plummer, W. Yang, and R. Myneni.

Website: http://www.gmes-geoland.info/cs/csp/index.php

Flyer: general presentation of CSP (organisation, partners and portfolio) distributed during the Open Day of the Second **geo**land Forum at Toulouse, updated on November 2006 to be distributed during the last geoland Forum in Berlin.

4.4 PUBLISHABLE RESULTS

As a general rule geoland results are "non-public"; investing into a shared-cost action the partners have reserved their rights to exploit the results in order to achieve an adequate return of investment.

However, each observatory is free to publish any results or make available any product/service (maybe under general public license conditions), if the partners agree. Some observatories have taken advantage of this opportunity; other have decided to restrict the exchange of information to dedicated projects under collaboration agreements implementing the geoland Consortium Agreement's rules for publication and exploitation of IPR.

During the first reporting period a number of documents were produced, that are subject to the IPR of the consortium, but have been recommended to be made available publicly or subject to collaboration agreements: These are the: Key User-Segments Profiles, User requirements documents, Service Portfolio.

4.4.1 Observatory Nature Protection (ONP)

ONP considers the Key User-Segments Profiles, User requirements documents, Service Portfolio, and Training Report Annexes (with examples of the ONP Advisory Service), to be publishable results. Where users have contributed to documentation then they should be allowed to use the eventual report, as it may influence ongoing national discussions with respect to GMES.

4.4.2 Observatory Water and Soil – Water (OWS-W)

- Key User Segment Profiles
- User Requirements document
- Service Portfolio
- Promotion Plan
- Promotion package

4.4.3 Observatory Water and Soil – Soil (OWS-S)

OWS-S	2010	SOIL EROSION RISK ASSESS-MENT USING MULTITEMPORAL SATELLITE IMAGES AND GIS	Publication	Researchers and practitioners from European countries
OWS-S	2010	Results from the use of EO data and land Cover information for the calculation of the USLE –C factor	Publication	Researchers and practitioners from European countries

4.4.4 Observatory Spatial Planning (OSP)

OBS	Planned / actual dates	Media	Type	Countries addressed	Partner responsible / involved
OSP	Summer 2005	Town and Country Planning	Article	UK	Leeds Metropolitan University, GeoVille
OSP	2. Half 2005	RAUM	Publica-tion	AT	UBA, ÖIR, Land Vor-arlberg, GeoVille
OSP	2. Half 2005	PlaNet CenSE (Interreg IIIB CADSES project) WT: European Spatial Planning Gateway WT: Metropolitan Net-works WT: North-South Corridors	Publica-tion	EU	UBA, ÖIR, Land Vorarlberg
OSP	2006	Planning practice and re-search journal	Journal	International	University of Leeds
OSP	2006	European planning studies	Book	International	University of Leeds
OSP	2006	Contribution to land use modeling book	Journal	International	ArcSys
OSP	2006	RAUM journal	Journal	International	OIR

Beside this publication publishable results comprise as well the products provided in the table be-low:

Type	Product	Potential Customers
1. Indicators	Processing Chains	Policy Decision Makers, Governmental
2. Urban Growth Models	MOLAND	Policy Decision Makers, Governmental
3. Urban Growth Models	Polycentric peri-urban settlement development model	Policy Decision Makers, Governmental
4. Land Transformation Scenarios	Land Accounting Tool	Policy Decision Makers, Governmental

The use of the products is restricted. The products will be exploited individually by each partner.

4.4.5 Core Service Generic Land Cover (CSL)

Document	Description
CSL-5 Service Portfolio; CSL-0350-RP-0005; Issue 4	Basis for discussion on generic GMES land cover services (i.e. as a starting point for ESA GSE stage 2 projects) and for possible CORINE improvements.
CSL – Regional Service Portfolio	Summary of all the products developed by the different regional observatories and the Core Service Land Cover (CSL).
CSL - Discussion paper on CORINE Land Cover Update; CSL-0350-TN-0003; Issue 1.00	To steer the discussion among MS on FTS definition and release
Annual Change Detection Monitoring of Europe; geoland / GlobCover / GOFC-GOLD Findings – June 2006	Issued by geoland Task Managers, GOFC-GOLD, GlobCover and FOREMMS Representatives This paper summarises the findings from the on-going discussion on annual monitoring of land use / land cover changes within Europe based on several expert meetings carried out between 2004 and 2006.
Topographic Normalisation – Best practice guide; CSL-0350-RP-0008; Issue 01.00	The document describes and compares different methods for topographic normalisation in order to give a best practice guideline for topographic normalisation.
CSL Findings: Multi-sensor, multi-scale and multi-temporal classification approaches; CSL-0350-RP-0012, Issue 1.00	These geoland CSL findings summarise in a methods review the state of the art of multi-sensor, multi-scale and multitemporal classification approaches
CSL Findings - Validation and Quality Assurance Guidelines – CSL-0350-TN-01; I1.01	This document describes the findings of the geoland Core Service Land Cover team on general rules for service validation and quality assessment applicable for Land Cover / Land Use (LC/LU) mapping from regional to European level.
CSL Findings: Rationale for the geoland Core Service Land Cover; CSL-0350-TN-05; I1.00	This document describes the rationale of the process chosen by the geoland Core Service Land Cover team and describes the approach taken towards its present status.

4.4.6 Observatory Food Security and Crop Monitoring (OFM)

In principle, all OFM-documents will be public, after the final version has been delivered and approved by involved partners (end December 2006). Of scientific interest are especially the Method Compendium and the Reports on the inter-comparison studies:

- Isabelle Piccard (Editor), OFM- 8 Methods Compendium. Report OFM-0350-RP-0008 Draft 1.12, Sept 2006
- M. Bettio, S. Fritz, G. Genovese and with contributions from all the OFM partners, REPORT ON YIELD INTER-COMPARISON STUDY. Geoland-OFM Report without Number. Joint Research Centre. Institute for the Protection and Security of the Citizen. AGRIFISH Unit, Ispra
- The REPORT ON CROP ACREAGE INTER-COMPARISON STUDY by S. Fritz et al is expected for Feb 2007

Geoland-OFM has taken the initiative of preparing a special issue of the International Journal of Applied remote sensing and Geo-information (JAG) on “Crop yield forecasting and crop area estimation”. Two Geoland project staff members act as guest editors, Allard de Wit (Alterra) and

Katarzyna Dabrowska-Zielinska (IGiK). A number of leading scientists from all over the world have been invited to submit papers, and while the geoland partners have also submitted papers, of which the following have been selected for publication:

- Satellite derived indices for operational crop yield forecasting. by IGiK team Katarzyna Dabrowska - Zielinska, Krystyna Stankiewicz, Wanda Kowalik, Alexandre Guerra, Maria Gruszczynska, Jedrzej Bojanowski
- Sub-pixel classification of SPOT-VEGETATION time series for the assessment of regional crop areas in Belgium. By VITO team Sara Verbeiren. Herman Eerens, Ides Bauwens, Isabelle, Piccard, Jos Van Orshoven
- The Use of MODIS data to derive acreage estimations for larger fields: a case study in the South-Western Rostov Region of Russia, by JRC's Steffen Martin Fritz
- Crop Growth Modelling And Crop Yield Forecasting Using Satellite-Derived Meteorological Input By Alterra team Allard de Wit and Kees van Diepen
- Comparison Of Remote Sensing Based Approaches For Yield Forecasting In Europe From The Geoland Project by JRC's team Manola Bettio, Giampiero Genovese, Steffen Fritz

At the ISPRS Workshop on Remote Sensing support to crop yield forecast and area estimates held in Stresa, 30th November - 1st December 2006, two sessions were devoted to the presentation of the geoland-OFM results:

Session 2 - GEOLAND RESULTS FOR CROP YIELD FORECAST, Alternative and complementary approaches to estimate regional crop yields

- GENOVESE Giampiero (JRC-MARS): Inter-comparison of results of various yield estimation methods in three European countries and outlook for strengthening the role of remote sensing
- De WIT Allard (Alterra) Use of Meteosat and ERS data as input for CGMS crop model
- ROSEMA Andries (EARS) Meteosat based agrometeorological monitoring and crop yield forecasting using the energy and water balance monitoring system
- VERBEIREN Sara (VITO) Comparison of different unmixing methods for yield estimation
- DABROWSKA-ZIELINSKA Katarzyna (IGiK), Use of Spot-VGT and NOAA-AVHRR to derive yield indicators
- WAGNER Wolfgang (UNIV. VIENNA) and Rob Beck (NEO) Use of Scatterometer-data to estimate soil moisture and yield indicators

Session 4 - GEOLAND RESULTS FOR CROP AREA ESTIMATES

- EERENS Herman (VITO) Wide scale land use mapping and regional crop area estimation via sub-pixel classification of low resolution images
- CAYROL Pascale (INFOTERRA France) The use of MERIS data in Belgium and Poland for crop area estimates
- FRITZ Steffen (JRC) Acreage estimates in Southern Russia and intercomparison of results from GEOLAND

4.4.7 Observatory Global Land Cover & Forest Change (OLF)

Brivio P.A., M. Boschetti, P. Carrara, D. Stroppiana, G. Bordogna, 2006. A fuzzy anomaly indicator for environmental status assessment based on EO data: preliminary results for Africa. 1st Int. Conf. on Remote sensing and geoinformation processing in the assessment and monitoring of land degradation and desertification, Trier (Germany) 7-9 September 2005, pp. 383-390.

Brivio P.A., G. Bordogna, M. Boschetti, P. Carrara, D. Stroppiana, 2005. Valutazione dello stato della copertura vegetale in Africa: la prospettiva del progetto europeo GeoLand. 9a Conf. Naz. ASITA "Geomatica. Standardizzazione, interoperabilità e nuove tecnologie", Catania, 15-18 Nov. 2005, Vol. I, pp. 493-498.

Mota, B., J.M.C. Pereira, D. Oom, M.J.P. Vasconcelos, M. Simon, O. Arino, and M. Schultz (2004) Screening the ESA ATSR-2 World Fire Atlas (1997-2001). Atmospheric Chemistry and Physics

Manuel de l'utilisateur VGT4Africa - Première Edition // VGT4Africa user manual - First Edition Baret, F., Bartholomé, E., Bicheron, P., Borstlap, G., Bydekerke, L., Combal, B., Derwae, J., Geiger, G., Gontier, E., Grégoire, J-M., Hagolle, O., Jacobs, T., Leroy, M., Piccard, I., Samain, O. et Van Roey, T., 2006, Luxembourg: Office for Official Publication of the European Communities, EUR 22344 EN - EUR 22344 FR, E. Bartholomé (éditeur).

Observation Requirements for Global Biomass Burning Emission Monitoring Kaiser, J.W., Schultz, M.G., Grégoire, J-M., Bartholomé, E., Leroy, M., Engelen, R., Simmons, A. and Hollingsworth, A., 2006, proceedings of the EUMETSAT Meteorological Satellite Conference – Session: Global Environmental Monitoring, Helsinki, Finland, 12–16 June 2006

Recommendations for a Global Fire Assimilation System (GFAS) as part of GMES Kaiser, J.W., Schultz, M.G., Textor, C., Grégoire, J-M., Sofiev, M., Boucher, O., Heil, A., Serrar, S., Engelen, R. and Hollingsworth, A., 2006, 2nd Workshop on Geostationary Fire Monitoring and Applications, EUMETSAT, Darmstadt, Germany, December 4-6, 2006

SPADA user manual - First edition // Manuel de l'utilisateur SPADA première edition. Edited by Andrew Nelson1 Authors: Andrew Nelson1, Etienne Bartholomé1, Mauro Michielon1, Bruno Combal1, Pietro Alessandro Brivio2, Mirko Boschetti2, Paola Carrara2, Daniela Stroppiana2 and Heiko Balzter3. 2006, Luxembourg: Office for Official Publication of the European Communities, EUR XXXXX EN - EUR XXXXX FR

A MAP OF TEMPORARY WATER BODIES IN WESTERN AFRICA Haas E. (1), Combal B. (1), Bartholomé E(1).Proceedings of GLOBWETLAND SYMPOSIUM: "Looking at wetlands from Space", Frascati 19-20 Oct 2006, in press

Submitted

Brivio P.A., M. Boschetti, P. Carrara, D. Stroppiana and G. Bordogna 2006 Fuzzy integration of satellite data for detecting environmental anomalies across Africa. In Advances in Remote Sensing and Geoinformation Processing for Land Degradation Assessment. (Hill J. and A. Roeder, Eds), Taylor & Francis (submitted).

Stroppiana, D., Boschetti, M., Carrara, P., Bordogna, G., & Brivio, P.A. 2006. Continental monitoring of vegetation cover status with a fuzzy anomaly indicator: an example for Africa. Remote Sensing of Environment (submitted).

Carrara, P., Bordogna, G., Boschetti, M., Stroppiana, D. & Brivio, P.A. 2006. A flexible multi-source spatial data fusion system for environmental status assessment at continental scale. Int. J. of Geographic Information Science (submitted).

Andreas Langner, Etienne Bartholome, Florian Siegert: The use of low and medium resolution satellite data for monitoring forest cover changes in tropical Africa" in preparation

Balzter, H., Gerard, F., Weedon, G., Grey, W., Combal, B., Bartholome, E., Bartalev, S. and Los, S., submitted, Coupling of vegetation growing season anomalies with hemispheric and regional scale climate patterns in Central and East Siberia, Journal of Climate, submitted

4.4.8 Observatory Natural Carbon Fluxes (ONC)

Calvet, J.-C., A. L. Gibelin, J. Muñoz Sabater, C. Rüdiger, A. Brut, A. Beljaars, S. Lafont, L. Jarlan, A. Friend, B. van den Hurk, E. J. Moors : Towards near-operational global and regional monitoring of carbon fluxes over land using EO data, Recent Advances in Quantitative Remote Sensing, Valencia, september 2006.

Gibelin, A.-L., Calvet, J.-C., Roujean, J.-L., Jarlan, L., Los, S., "Ability of the land surface model ISBA-A-gs to simulate leaf area index at the global scale: comparison with satellites products", *J. Geophys. Res.*, Vol. 111, D18102, doi:10.1029/2005JD006691, 2006.

Muñoz Sabater, J., Jarlan, L., Calvet, J.-C., Bouyssel, F., De Rosnay, P., "From near-surface to root-zone soil moisture using different assimilation techniques", *J. Hydrometeorol*., in press, 2006.

Pellarin, T., Calvet, J.-C., Wagner, W., "Evaluation of ERS Scatterometer soil moisture products over a half-degree region in Southwestern France", *Geophys. Res. Lett*., Vol. 33, L17401, doi:10.1029/2006GL027231, 2006.

4.4.9 Core Service Bio-physical Parameters (CSP)

Bartalis Z., K. Scipal, W. Wagner, Azimuthal Anisotropy of Scatterometer Measurements over Land, *IEEE Transactions on Geoscience and Remote Sensing*, vol 44, Issue 8, 2083-2092, August 2006.

Ceballos, A., K. Scipal, W. Wagner, J. Martinez-Fernandez, Validation and downscaling of ERS Scatterometer derived soil moisture data over the central part of the Duero Basin, Spain, *Hydrological Processes, vol. 19, pp. 1549-1566,* 2005.

Kottek, M., J. Grieser, C. Beck, B. Rudolf, and F. Rubel, World Map of Köppen-Geiger Climate Classification Updated, *Meteorol. Z., 15, 259-363*, 2006.

Kottek, M., and F. Rubel, Global Daily Precipitation Fields from Bias-Corrected Rain Gauge and Satellite Observations. Part I: Design and Development. *Meteorol. Z*., in process. 2007.

Leroy, M., and the CSP Partners, An introduction to the Biogeophysical Parameter Core Service of the geoland project, *Proceedings of the Second International VEGETATION users conference*, 24-26 March 2004.

Leroy, M., and the CSP partners, Towards an European service center for monitoring land surfaces at global and regional scales : the geoland / CSP project, *Proceedings of the XXth Congress of ISPRS*, 12-23 July 2004.

Rubel, F., and M. Kottek, Global Daily Precipitation Fields from Bias-Corrected Rain Gauge and Satellite Observations. Part II: Verification Results. *Meteorol. Z.,* in process, 2007.

Scipal, K., C. Scheffler, W. Wagner, Soil Moisture Runoff Relation at the Catchment Scale as Observed with Coarse Resolution Microwave Remote Sensing, *Hydrology and Earth System Sciences Discussions, Vol2, Number 2, pp 417- 448*, 2005.

Wagner, W., V. Naeimi, K. Scipal, R. DeJeu, J. Martinez-Fernandez. Soil Moisture from Operational Meteorological Satellites*, Hydrogeology Journal, in press*, 2006.

4.4.10 Operational Scenario (OS)

Document		**Description**			
CSL-5 Service Portfolio; CSL-0350-RP-0005; Issue 4		Basis for discussion on generic GMES land cover services (i.e. as a starting point for ESA GSE stage 2 projects) and for possible CORINE improvements.			
Feb 05	*Memorandum*	*GPO; ESA*	*EU*		*ITD*

Title: GEOLAND - A MULTIPLE SCALED APPROACH UTILISING LAND COVER AND VEGETATION INFORMATION TO ACHIEVE OPERATIONAL GMES SERVICES -RECOMMENDATIONS FOR AN OPERATIONAL SERVICE ORGANISATION

GMES User Workshop “Land Monitoring (20-21 October 2005): contribution to preparatory activities by providing OS material and findings.

Global Strategic Plan: Implementing a Global Land Monitoring Service by 2008, V 1.2, January 2006

April 2006 Position paper prepared for the course of the Conference “a Market for GMES in Europe and its regions” – the Graz dialogue”.

4.4.11 Coordination (COO)

See table 4.