FP7 Project nr 226487 Project start date: 01 May 2009
Acronym: EuroGEOSS
Project title: EuroGEOSS, a European approach to GEOSS
Theme: FP7-ENV-2008-1: Environment (including climate change)
Theme title: ENV.2008.4.1.1.1: European Environment Earth Observation system supporting INSPIRE and compatible with GEOSS (Global Earth Observation System of Systems)
Web site: www.eurogeoss.eu

D.2.1.1. Report on requirements for multidisciplinary interoperability

Title	D.2.1.1. Report on requirements for multidisciplinary interoperability
Creator	L. Vaccari
Creation date	11/02/2010
Date of last revision	13/10/2010
Subject	Interoperability, User Requirements, Initial Operating Capacity
Status	☐ Draft ☒ Final
Publisher	EuroGEOSS, WP2
Type	Text
Description	
Contributor	S. Nativi, M. Santoro
Format	Doc
Source	
Rights	☐ Restricted ☒ Public
Identifier	EuroGEOSS_D_2_1_1_requirements_multidisciplinary_interoperability.doc
Language	En
Relation	WP2
Coverage	Not applicable

These are Dublin Core metadata elements. See for more details and examples http://www.dublincore.org/

TABLE OF CONTENTS

FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

Abbreviation	Name
AOC	Advanced Operating Capacity
APAAT	African Protected Areas Assessment Tool
APM	Area Production Model
CEN	European Committee for Standardization
CHE	Ebro River Basin Authority
CIFOR	Center for International Forestry Research
CNIG	Centro Nacional de Información Geográfica
CSW	Catalog Service for the Web
DCMSEE	Center for drought management in Southeastern Europe
DOPA	Digital Observatory of Protected Areas
EDISOFT	Empresa de Serviços e Desenvolvimento de Software, S.A. – Portugal
EDO	European Drought Observatory
EFDAC	European Forest Data Centre
EFFIS	European Forest Fire Information System
EFICP	European Forest Information and Communication Platform
ENM	Ecological Niche Model
EU	European Union
FAO	Food and Agriculture Organization
FGUA	Fundacion General de la Universidad de Alcala
FP7	Seventh Framework Programme
GBIF	Global Biodiversity Information Facility
GEO	Group on Earth Observations
GeoRM	Geo Rights Management
GeoRSS	Geospatially-enabled RSS and Atom feeds
GEOSS	Global Earth Observation System of Systems
GMES	Global Monitoring for Environment and Security

GSCB	Ground Segment Coordination Body
IBA	Important Bird Area
IDEE	Spanish Spatial Data Infrastructure, Infraestructura de Datos Espaciales de España
INSPIRE	Infrastructure for Spatial Information in Europe
IOC	Initial Operating Capacity
IR	Implementing Rules
IUCN	International Union for Conservation of Nature
ISO	International Organization for Standardization
JRC	Joint Research Centre
LUCC	Land Use and Cover Change
MARM	Ministerio de Medio ambiente Y Medio Rural Y Marino
MCPFE	Ministerial Conference on the Protection of Forests in Europe
MS	Member State
NDVI	Normalize Difference Vegetative Index
NFI	National Forest Inventory
NGO	Non-Governmental Organization
NSDI	National Spatial Data Infrastructure
O&M	Observation and Measurement
OFAC	Observatory for the Forests of Central Africa
OGC	Open Geospatial Consortium
OSE	Observatorio de la Sostenibilidad en España
OWS	OGC Web Services
RSPB	Royal Society for the Protection of Birds
SAIH	Automated Hydrology Information System
SEIS	Shared Environmental Information System
SIA	Integrated Water Information System of Spain
TREES	United Nations Environment Programme
ULBF	University of Ljubljana Biotechnical Faculty

UNEP	United Nations Environment Programme
WBDB	World Biodiversity DataBase
WCMC	World Conservation Monitoring Centre
WCS	Web Coverage Service
WCS-T	Web Coverage Service, Transactional
WDPA	World Database on Protected Areas
WFS	Web Feature Service
WFS-T	Web Feature Service, Transactional
WMS	Web Map Service
WPS	Web Processing Service
WP	Work Package

1 INTRODUCTION

The goal of WP2 is to enable multidisciplinary interoperability and validation between three different thematic areas (Forestry, Biodiversity, and Drought - WPs 3-5). This document analyses and summarized the requirements from the EuroGEOSS thematic themes (D3.1, D4.1, D5.1). Moreover, the document reports a comparative analysis of the common interoperability issues (D6.1) and summarizes the technological common architecture (D2.2.2) required to enable multidisciplinary interoperability between different areas.

In what follows, Section 2 reports, for each theme, a brief outline of the existing situation and user scenarios proposed for the EuroGEOSS project. Moreover, section 3 presents cross thematic interoperability issues analysis performed in the deliverable D6.1, and section 4 presents a common set of technological use cases to support multi-disciplinary interoperability. Finally, section 5 presents some conclusions and future work.

2 REQUIREMENTS FROM THE EUROGEOSS THEMES

2.1 Forestry

The EuroGEOSS deliverable D3.1, provides an overview of the existing situation and of the basic requirements in respect to the systems and datasets at European and Local / Regional / National levels, which include:

- the European Forest Data Center (EFDAC) framework at JRC: it has been established within the JRC to constitute the primary focal point for information on forest related issues. It is based on a metadata catalogue, a customized web map service, The European Forest Information System (EFFIS), the related datasets derived from National Forest Inventories (NFI) and international forest data sources (for instance: MCPFE, FAO), the tree species distribution/ suitability maps, the European Forest Information and Communication Platform (EFICP)
- the TREES-3 (and FOREST) project(s) of the JRC. These projects aim at estimating tree cover changes at continental and regional levels for the Tropical belt and European continent for the periods 1990-2000-2005 based on a systematic sample of medium resolution satellite imagery
- the Spanish Spatial Data Infrastructure (IDEE): it is supported mainly by the National and Regional Spanish governments and contains more than 80 nodes publishing more than 500 Web services and 6,000 layers of data available covering all themes in INSPIRE Annexes I and II.

The JRC identified the main user requirements to be a common Map Viewer which collects data from available forest systems (TREES, EFDAC components, etc.) and to make EFDAC metadata catalogue as the central point accessing and harvesting metadata from other systems.

Specifically for the TREES-3 project it is identified as a general requirement to make the TREES database accessible through an interface to the outside, i.e. OWS services, eventually with a user front-end application.

Moreover, the Forest Fire use scenario and the Forest changing Mapping scenario are outlined, from which high level Functional Requirements are derived.

Forest Fire scenario,

Table 1: Forest Fires Scenario Description

Brief Summary
Extreme forest fire disasters are increasingly frequent events around the globe. The growing severity of fire disasters are a consequence of increased vulnerability of the natural environment and societies. The social, economic and environmental costs of forest fires are very high, often leaving many thousands of people homeless and displaced, without income due to loss of local livelihood by the fire, and in many cases millions of people affected by negative long-term health impacts caused by fire emissions. Forest fires are very complex phenomena which can rapidly devastate large forest areas and cause the loss of biodiversity. There is also widespread awareness that the risk may increase as a result of climate change. Forest fires analysis and strategic planning in combating the forest fires require the development of information systems, datasets and services which could interact and communicate with each other considering the large number of existing data on local, national, regional and global level. The use of applications and available computer tools combining different sources can improve the quality of the analysis and predict the spread of forest fires in an attempt to prevent or reduce major loss as well as damage to the environment. Although forest fire information and early warning systems exist at global, European as well as national scale, it is difficult to combine datasets and information from different sources in order to have the clear, detailed and coordinate picture about forest fires. The main purpose is the improvement and establishment of inter-connection among the systems and data structure about forest fires as well as identification of options and interfaces in order to take benefit from data and products **available at global, regional and national levels.**
Community Objectives
EuroGEOSS demonstrates the added value to the scientific community and society of making existing systems and applications interoperable and used within the GEOSS and INSPIRE frameworks. EuroGEOSS therefore focuses primarily on the application areas, and the multi-disciplinary interoperability aspects to opening them up, linking them, and making them GEOSS components. EuroGEOSS will demonstrate that this process increases access to new forms of data and services in forestry area, and as a result allows scientists to address new scientific questions, or address old questions in new and better ways. Experts on forest fires from the Commission and the competent national authorities are steadily in contact to exchange the lessons learnt from previous fires and to contribute to the European Forest Fire Information System EFFIS managed by the Joint Research Centre, which has become the most efficient forecasting and assessment tool in the field of disasters. Together, the

European Commission and the Member States continue looking for suitable and efficient ways to avoid unnecessary fire impacts.

The European Forest Fire Information System (EFFIS) can contribute to GEOSS initiative on Wildland Fire Warning System providing fire danger forecasts and analyses of forest fire damages for the pan-European area and GMES projects in the area of emergency response.

Implementation of interoperability with global, regional and local datasets and services related to forest fires could increase the effectiveness of the European Forest Fire Information System (EFFIS) and could contribute to the reaching the Community goals in preventing and informing the public on forest fires danger, forest fires as well as supply the Commission services with robust and broader data on forest fires.

Actors

Global Earth Observation System of Systems (GEOSS).

The Joint Research Centre. The Land Management and Natural Hazard (LMNH) Unit in particular its action related to monitoring the state of European forests (FOREST) and responsible for European Forest Fire Information System (EFFIS).

Universitat Jaume I de Castellon – Spain. The Centre for Interactive Visualization (CeVI) is a research centre of the Department of Information Systems at University Jaume I.

Centro Nacional de Información Geográfica (CNIG) - Spain. Assigned to Ministry of Public Works and Transports through National Geographic Institute of Spain, which coordinates the Spatial Data Infrastructure of Spain (IDEE), a collective project with more than 80 nodes publishing and integrating more than 500 Web services and 6,000 layers of data and metadata covering all themes in INSPIRE Annexes I and II, following OGC specifications, ISO standards and INSPIRE principles. This initiative allows users to locate, identify and access geospatial information produced in Spain on the Internet.

Empresa de Serviços e Desenvolvimento de Software, S.A. – Portugal (EDISOFT). Specialized Portuguese company that offers technologically advanced software solutions and highly qualified IT consulting services

End – users. Forest fires experts, forest managers, forest and environmental researchers and modelers, educational users, individual personal users.

Context and pre-conditions

The GEOSS initiative on Wildland Fire Warning System is planned to operate as a coordinated network of regional systems using existing remotely-sensed and ground-based data networks, and new forecasting and fire danger risk models to provide improved prediction capabilities, analysis tools, and response support. The system will operate from global to local level, with rapid information dissemination via dedicated networks.

In order to ensure the provision of robust data and information on the state of the environment for the development of related policies at European Union level, the European Commission Directorate-General Environment (ENV), Joint Research Center (JRC) and Eurostat, with the European Environment Agency (EEA), all together called “Group of four” (Go4), have agreed at the end of 2005 the establishment of “Environmental Data Centres”. The EFDAC hosted by the Joint Research Center (JRC) of the European Commission has been established to supply European Union decision-makers with processed, quality checked and timely policy relevant forest data and information within the EU.

The recently established EFDAC provides a gateway to data holdings and information on forest resources in Europe. In addition, the EFDAC supports the generation of value-added forest indicators on sustainable forest management on the basis of data collected by the Member States. The EFDAC is built on the basis of existing systems, such as the European Forest Fire Information System (EFFIS), the Forest Focus database, the European Forest Information and Communication Platform (EFICP) as well as integrates tools and applications developed by JRC (EFDAC MapViewer, EFDAC Metadata Catalogue and its management system).

The European Forest Fire Information System (EFFIS) has been established by the Joint Research Centre (JRC) and the Directorate General for Environment (DG ENV) of the European Commission (EC) to support the services in charge of the protection of forests against fires in the EU and neighbouring countries, and also to provide the EC services and the European Parliament with information on forest fires in Europe. EFFIS addresses forest fires in Europe in a comprehensive way, providing EU level assessments from pre-fire to post-fire phases, thus supporting fire prevention, preparedness, fire fighting and post-fire evaluations. The core of EFFIS consists of a scientific and technical infrastructure at the JRC doing research on forest fires and operating a web based platform. In addition EFFIS is supported by a network of Experts on Forest Fires from 22 EU countries that meet regularly with the EC services. Other than the on-line web based system, a huge EU fire database is maintained within EFFIS; furthermore, reports on forest fires in Europe are produced yearly.

The current warming climate trend in the Mediterranean region makes it vulnerable to forest fires and reduces the capability of Mediterranean forests to accommodate the fires as well as further aggravates the risk of forest fires. As a result of the intensification of forest fires, the capacity of the Mediterranean ecosystems to naturally regenerate in many areas has been reduced, while extensive areas are being affected by biodiversity loss, soil erosion and water scarcity. Portugal and Spain are among the Mediterranean countries the most affected by forest fires, therefore in order to test inter-connectivity and interoperability of the forest related datasets and services the datasets and services available in Portugal and Spain are being considered for testing purposes. There are many datasets, services and other forest information available in Portugal and Spain on local, regional and national level, which could be accessible through web services.

The following web services and datasets from Portugal and Spain (national, regional and local level) could be used and others could be identified later:

National / Spain

- OTALEX (Observatorio Territorial Alentejo-Extremadura)
- CORINE Land Cover
- National Airborne Orthophotography Plan

Regional / Spain

- Landscapes Map of Andalucía.
- Ecological and Forestry Inventory of Catalonia
- Rioja Spatial Data Infrastructure WMS

Local / Spain

- Forest Cartography of La Palma
- Forest Cartography of Tenerife

Other available datasets, web services on forest fires from Spain and Portugal will be identified at later stages.

Scenario Events

(use cases are derived from scenario steps described below)

step	description
1	National forest fire expert (for instance from Spain) or GEOSS user through WMS services searches and accesses forest fire maps and layers available in European Forest Fire Information System (EFFIS), for instance: information on forest fire danger forecast, results of analyses of forest fire damages for the pan-European area, maps of burned biomass and atmospheric emissions in EU, fuel map of Europe, etc.
2	The user of European Forest Fire Information System (EFFIS) through WMS services accesses selects and visualizes geographical and forest fires thematic information from national, regional and local level in Spain / Portugal as well as other general and thematic resources from GEOSS initiative on Wildland Fire Warning System, Fire Information for Resource Management System (FIRMS).
3	Using web services (WMS/WFS) the end – user through a catalogue selects the forest fires data from different systems (WFWS, FIRMS, EFFIS, and Portuguese / Spanish systems) and combine them (within the common Map Viewer) with different forestry thematic layers and forest inventory statistics.
4	Forest fire expert searches (CSW/WMS/WFS) and selects through a catalogue the forest fire thematic layers and within the common Map Viewer uses them for various analysis and research purposes, for instance: calculation of burnt area, fire danger in area of interest (for instance certain regions in Spain / Portugal); evaluation of accuracy of the results according to different data sources. In addition the combination of forest fire layers with other forestry thematic layers could be used to evaluate and analyze the impact of forest fires to biodiversity, protected areas, tree species distribution.
5	The end–user combining the forest fire thematic layers from different sources produces the additional layers and exports /saves them locally.

Post-Conditions

N/A

Special Requirements

N/A

References
http://www.idee.es http://www.ideotalex.eu/ http://efdac.jrc.ec.europa.eu/ http://effis.jrc.ec.europa.eu/index.php http://forest.jrc.ec.europa.eu/ http://www.edisoft.pt

Forest Change Mapping Scenario

Table 2: Forest Change Mapping Scenario Description

Brief Summary
Development, implementation, monitoring and further improvement of environmental policies depend crucially on the availability of robust data on the state of the environment, pressures, impacts and responses. Forest data and other related information play a very important role in making decisions and defining environmental policies. Forest sector becomes the cross-cutting issue related to other themes like climate change, energy, biodiversity, deforestation and land management, etc. Therefore the forest data contribute to the development of other cross - sectorial policies as well as to the development of various analysis, models, and scenarios related to environment. Hence it is not enough to have robust and available forest data and information at local (national) level but it is more crucial to have them at regional as well as global levels which allow the decision makers to have the clear picture about environmental processes, causes, tendencies and possible solutions. Consequently the forest related information becomes essential for policy makers and from local to global organizations. However, information on forest resources is often scattered, incomplete and unreliable. Most of these deficiencies are due to the lack of inter-connection among the systems and data structures established at the local, regional and global levels. Forest change is of great concern for land use decision makers and conservation communities. Quantitative and spatial forest change information is critical for addressing many pressing issues, including global climate change, carbon budgets, biodiversity, protected areas and sustainability. The main goal of this scenario is to improve present knowledge of the extent of and change in tropical and boreal forest cover on continental / European / national scale and reduce uncertainties in global estimates of forest cover change. The improvement and establishment of inter-connection among the systems and data structures at the local, regional and global levels will give the possibility to have the forest cover and forest cover change data and combine them with existing forest maps, layers and forest data on local, regional and global levels using them for various models, analysis and research.
Community Objectives

EuroGEOSS demonstrates the added value to the scientific community and society of making existing systems and applications interoperable and used within the GEOSS and INSPIRE frameworks. EuroGEOSS therefore focuses primarily on the application areas, and the multi-disciplinary interoperability aspects to opening them up, linking them, and making them GEOSS components. EuroGEOSS will demonstrate that this process increases access to new forms of data and services in forestry area, and as a result allows scientists to address new scientific questions, or address old questions in new and better ways.

Forests cover over 30% of the territory of the 27 Member States of the European Union. The maintenance and enhancement of the forest ecosystem is widely recognized as one of the main goals in preserving Europe's environment. The community goal is to improve present knowledge of the extent of and change in European forest cover within global context and to provide information to European Commission services in support to the definition of policies and other decision making on forestry and environmental issues.

Information of the spatial distribution of European forests is needed for forest protection and conservation, forest resource analysis, climate change research and other forest related applications. There are several efforts of mapping forests at different, from regional to pan-European, scales. The regional efforts vary also in level of detail, sources of information, forest definition and target groups. Therefore, their use on global/ regional/ national levels for various scientific, policy and reporting purposes is a crucial issue.

Actors

The Joint Research Centre. The Land Management and Natural Hazard (LMNH) Unit in particular its action related to monitoring the state of European forests (FOREST) and responsible for European Forest Data Center (EFDAC) as well as The Global Environment Monitoring (GEM) Unit in particular its action monitoring terrestrial ecosystems in EU development-assistance priority areas (TREES-3 project).

Universitat Jaume I de Castellon – Spain. The Centre for Interactive Visualization (CeVI) is a research centre of the Department of Information Systems at University Jaume I.

Centro Nacional de Información Geográfica (CNIG) - Spain. Assigned to Ministry of Public Works and Transports through National Geographic Institute of Spain, which coordinates the Spatial Data Infrastructure of Spain (IDEE), a collective project with more than 80 nodes publishing and integrating more than 500 Web services and 6,000 layers of data and metadata covering all themes in INSPIRE Annexes I and II, following OGC specifications, ISO standards and INSPIRE principles. This initiative allows users to locate, identify and access geospatial information produced in Spain on the Internet.

Empresa de Serviços e Desenvolvimento de Software, S.A. – Portugal (EDISOFT). Specialized Portuguese company that offers technologically advanced software solutions and highly qualified IT consulting services

End – users. Forest managers, experts, forest and environmental researchers and modelers, educational users, individual personal users.

Context and pre-conditions

Several initiatives have dealt with the collection of forestry information, from the global level of FAO reports, through the more detailed TBRFA (Temperate and Boreal Forest Resources Assessment), to the European, national, regional and local levels. These existing global datasets (FAO, CIFOR, WCMC, FIRMS, etc.) in combination of satellite images could bring the added value in interpreting and validating the forest cover. However, at the moment, most of the mentioned global datasets are not available or accessible through information systems or internet tools / applications.

Research groups at the Joint Research Centre (JRC) are developing methods for monitoring forest cover resources from a global perspective. The TREES-3 and FOREST projects of the JRC aim at estimating tree cover changes at continental and regional levels for the Tropical belt and European continent for the periods 1990-2000-2005 based on a systematic sample of medium resolution satellite imagery. The project is carried out in a collaborative partnership with FAO and is intended to support Remote Sensing Survey of the FRA 2010. An operational system is being developed by JRC for the processing and tree cover change assessment of a large set of multi-temporal medium resolution imagery covering the Tropical and Europe (e.g. about 4 000 sample sites of 20x20 km size for the tropics and about 2 000 sample sites of 10x10 km size for European continent).

In order to ensure the provision of robust data and information on the state of the environment for the development of environmental policies at European Union level, the European Commission Directorate-General Environment (ENV), Joint Research Center (JRC) and Eurostat, with the European Environment Agency (EEA), all together called “Group of four” (Go4), have agreed at the end of 2005 the establishment of “Environmental Data Centres”. The EFDAC hosted by the Joint Research Center (JRC) of the European Commission has been established to supply European Union decision-makers with processed, quality checked and timely policy relevant forest data and information within the EU.

The recently established EFDAC provides a gateway to data holdings and information on forest resources in Europe. In addition, the EFDAC supports the generation of value-added forest indicators on sustainable forest management on the basis of data collected by the Member States. The EFDAC technical platform is targeted to be interoperable with external nodes for the exchange of metadata and data. The framework for such interoperability is set by the INSPIRE Directive. The EFDAC is built on the basis of existing systems, such as the European Forest Fire Information System (EFFIS), the Forest Focus database, the European Forest Information and Communication Platform (EFICP) as well as integrates tools and applications developed by JRC (EFDAC MapViewer, EFDAC Metadata Catalogue and it’s management system).

In order to assess inter-connectivity and interoperability of the forest related datasets and services the datasets and services available in Spain are being considered for testing purposes. There are many datasets, services and other forest information available in Spain on local, regional and national level, which could be accessible through web services.

Web services and datasets suggested using from Spain (national, regional and local level)

National / Spain

- CORINE Land Cover
- EUROPARC-Spain
- National Airborne Orthophotography Plan

Regional / Spain

- Landscapes Map of Andalucía.
- Biodiversity Map of Andalucía
- Vegetation Map of Andalucía
- Ecological and Forestry Inventory of Catalonia
- Web Map Server of Biodiversity data bank of Catalonia
- Bioatlas of Balearic Islands
- Rioja Spatial Data Infrastructure WMS
- Vegetation Map of Canarias

Local / Spain

- Forest Cartography of La Palma
- Forest Cartography of Tenerife
- Digital Cartography for the National Park of Doñana Monitoring

For Continental / Tropic level the following dataset are being considered

- Forest change maps 1990-2000-2005 (Tropics / Africa)
- Land cover change around and within the protected area (Tropics / Africa)
- FAO, CIFOR, WCMC, FIRMS datasets

For European level the following datasets are being considered to use. Some of them are under construction and will be available 2010:

Europe

- European forest map *(1990 - 2000 - 2006)*, forest cover change in Europe (*forest maps 1990, 2006 are under construction or final development and will be available 2010*)
- European forest type map *(2006) (under construction, should be available 2010)*

- Dominant tree species distribution / habitats suitability maps in Europe

The following maps are being developed within Framework Contract launched by JRC for the provision of data and services awarded to a consortium of 9 partners on the basis of specific contracts (SC) based on requests issued by the JRC. It is foreseen to develop these maps in 2010:

- Species richness in Europe on 1x1km INSPIRE grid (number of different tree species per grid)
- Tree Stand Global Composition in Europe on 1x1km INSPIRE grid (majority of coniferous and broadleaves)
- Occurrence / presence of main tree species in Europe on 1x1km INSPIRE grid

Scenario Events
(use cases are derived from scenario steps described below)

step	description
1	National forest experts through the web interface query (WMS/WFS) the TREES database of images and other global or regional forestry-related data sets (in –situ forest measurements FAO, CIFOR) and validate TREES database (database of forest change maps) using the query results. National forest experts correct and update the forest change maps and make the results accessible through the web services (through WMS).
2	Forest/vegetation experts through the web interface query (WMS/WFS) other global data sets (WCMC, OFAC, FIRMS) and update the protected areas database (vegetation maps) in conjunction with the query results. Forest experts analyze, correct and update maps of land cover around and within the protected area in database.
3	Using the web services (WMS/WFS) end-users search and access through a catalogue a geographical and forestry thematic information from national, regional and local level in Spain.
4	End-users through a catalogue (CSW/WMS/WFS) select and access a forest cover maps throughout the specific regions (for instance: Tropic, Africa, Europe) and time period (1990 – 2000- 2005).
5	Using web services (CSW/WMS/WFS) end–users search and select the forest cover maps and combine them with available forestry thematic layers and forest inventory statistics in the common web interface (Map Viewer), for instance: forest type, species richness, number of different tree species, tree stand global composition, occurrence / presence of tree species, tree species distribution / habitats suitability maps, protected areas, biodiversity, forest indicators, etc.
6	The end–users combining the different forestry thematic layers produce the additional layers and export/save them locally.
7	The end–users through a catalogue search (CSW/WMS/WFS) and select the available forest maps and thematic layers desired to compute the different models. The selected maps and layers through the common web interface (Map Viewer) are used for various analysis and models, for instance: providing estimates of the rates of forest cover change on global / continental and regional scale, evaluating the impact of forest change on protected areas, biodiversity, and tree species distribution as well as for various Area Production Models (APM), LUCC models.
Post-Conditions	
N/A	
Special Requirements	
N/A	
References	
http://www.idee.es http://www.ideotalex.eu/ http://www.europarc-es.org/	

http://efdac.jrc.ec.europa.eu/
http://effis.jrc.ec.europa.eu/index.php
http://forest.jrc.ec.europa.eu/
http://www.edisoft.pt

Requirements

This part identifies the initial EuroGEOSS Forest Capacity functional requirements. These are derived from the steps (basic flow) highlighted in the Use Scenarios described in the previous Section.

Table 3: Forestry Functional Requirements

UFR	Description	Related Scenario & Use Case
1	Metadata requirements	-
1.1	Resources shall be described via metadata records stored in a common catalogue.	
1.2	Metadata records shall be used to discover resources via catalogue search mechanisms.	
2	Discovering Services requirements	-
2.1	Users shall be able to query the Metadata catalogue in order to discover (registered) resources (e.g.: datasets, services, etc)	
2.2	Users shall be able to build search criteria (i.e. using a filter) in order to query metadata catalogue on available forest resources (data).	
2.3	Expert Users shall be able to publish WMS services with the results of the validation of TREES database.	
2.4	Users shall be able to search the metadata catalogue for resources that belong to local, regional, national and global data levels.	
2.5	Expert Users shall be able to publish forestry related WMS and WFS Services.	
3	Access Services requirements	-
3.1	Users shall be able to access a WMS entry point via a Map Viewer interface.	
3.2	Users shall be able to access a WFS entry point via a Map Viewer interface.	
3.3	Users shall be able to access a metadata catalogue CSW entry point using a portal front-end. (see reqs. 2.1 & 2.2)	
4	Querying and Viewing Data requirements	-

UFR	Description	Related Scenario & Use Case
4.1	Users shall be able to build search criteria in order to query available forest data.	
4.2	Users shall be able to select the datasets (layers) available as the result of the query (see reqs. 2.2 & 4.1) and see them on the Map Viewer.	
4.3	Users shall be able to combine data from different WMS/WFS forest available services at local (country), regional (European) and global (world) levels.	
4.4	Users shall be able to save the map context for later use.	
4.7	Users shall be able to create additional layers using a combination of different datasets from different services (see req. 4.3).	
4.6	Users shall be able to download/export a combined dataset (data from several services – see req. 4.7) with forest data and save it locally.	
5	Data Management	
5.1	Experts Users shall be able to update and validate the (internal) TREES database using forest related WMS and/or WFS services.	
5.2	Experts Users shall be able to update the land cover maps from protected areas database using forest related WMS and/or WFS services.	
6	Data Quality requirements	-
6.1	TBD	

These initial requirements will be taken into account in the development of the IOC of EuroGEOSS.

2.2 Biodiversity

The EuroGEOSS deliverable D4.1 provides an overview of the existing situation and of the basic requirements in respect to the systems and datasets at International and European level, which include:

- The MONDE action of the Institute for Environment and Sustainability (IES) of the **Joint Research Centre** (JRC) has developed the **African Protected Areas Assessment Tool** (APAAT), which is an on-line WEB GIS information system and can be considered as the first consistent, continent-wide assessment of the state of protected areas (PAs) in Africa. The APAAT largely relies on data provided by third parties.
  The main user requirements for JRC-MONDE within the projects include: automated assessment of PAs; interactive tools for assessing biodiversity, habitats, and threats to habitats in unprotected areas; extension of the geographic coverage to the whole globe; improve the indicators by collecting ground truth validated data; and provide a habitat modelling service coupled with climate change models.
- The **Global Biodiversity Information Facility** (GBIF) is an intergovernmental organisation tasked with helping to build a global informatics infrastructure through promoting participation and working through partners, mobilising biodiversity data, promoting data exchange standards, building an informatics architecture, promoting capacity building, and catalysing the development of analytical tools. It provides a dynamic index of data published via the GBIF network by GBIF participants.
  The GBIF data portal (http://data.gbif.org) provides unified access to the data published on the network.

  Several initiatives were identified as vital contributions to a strategic road map for Biodiversity Informatics, including the creation of global registries, completing the construction of a solid taxonomic infrastructure, creating ontologies for biodiversity data, and developing an approach to the citation of published data and information services.

  Moreover, GBIF has identifies the need of some tools (viewer, data discovery system), services (on line editing and certification of species distribution maps, feedback tools, services for Alien Species and to support reporting requirements of the parties to the Convention on Biological Diversity) and additional data (quality metadata, scalability of computing capacity, Integration of GBIF data with environmental and IUCN red List data)
- The **UNEP-WCMC** is the biodiversity monitoring arm of the United Nations Environment Programme and is responsible for a range of biodiversity-related services that support conservation decision-makers. UNEP-WCMC collates and manages a wide range of biodiversity datasets including species distributions and trade, ecosystem extent and state, climate and climate change and world protected areas. The **World Database on Protected Areas** (WDPA), as it is known, is a joint project of UNEP and IUCN that brings together protected area data from national governments, non-governmental organizations, academic institutions, international biodiversity convention secretariats and many others. Current systems include a spatial database, a set of validation tools, a set of standards, a public facing website, and a WFS.
  The main user requirements for the WDPA are to improve the coverage, completeness, quality and assessment of the datasets; and to create new content new content showing land cover change and ecosystem/biodiversity degradation within protected areas, supporting time-series analysis and modelling
- **BirdLife** is an international NGO representing a Partnership of over 110 conservation organisations globally, using birds as the unifying focus of work. BirdLife strives to conserve

birds, their habitats and global biodiversity, working with people towards sustainability in the use of natural resources. The main applications are the World Biodiversity Database (WBDB), the World Bird Database, and the Data Zone software. The main user requirements are: to maintain systems for storing information and making it available to the Partnership; to complete the species range polygon dataset and the IBA inventory dataset; to enable improved analyses; to present BirdLife data to the public in a variety of formats; to provide a consolidated global view of the conservation status of birds.

- The **Royal Society for the Protection of Birds** (RSPB) is an environmental charity, and the UK partner of BirdLife International. RSPB speaks out for birds and wildlife, tackling the problems that threaten the environment. It relies upon memberships and donations to fund its work, with over 1 million members, a staff of 1,300 people and 13,000 volunteers, and more than 200 nature reserves in the UK and abroad. The main RSPB application relevant to the EuroGEOSS project is **WorldBirds**.
  The main requirements include: the collation of all public observations into a single database to enable delivery to the Avian Knowledge Network, and from there into the Global Biodiversity Information Facility (GBIF) and other applications and the development of enhanced uses of the data, including incorporation of other datasets to enrich the bird data held.

Moreover, the outcome gathered in the previous analysis are used to identify and describe with detail relevant use scenarios and requirements that shall be used by the EuroGEOSS Biodiversity Capacity system(s).

Table 4: Digital Observatory of Protected Areas use scenario

Brief Summary
Develop a Digital Observatory of Protected Areas (DOPA), an interoperable environmental information service, to enable improved assessment of areas of high ecological value, typically Protected Areas.
Community Objectives
The use of protected areas to help preserve the planet's biodiversity is a well established practice. However, biodiversity loss does occur in protected areas. Habitat degradation and climate change are the primary contributing factors to loss, yet their impacts are difficult to monitor accurately and forecast. The purpose of the Biodiversity Operating Capacity planned in the framework of EuroGEOSS is to develop an interoperable environmental information service for enabling improved assessments of areas of high ecological value, typically PAs. This service will become a Digital Observatory for Protected Areas which will mainly rely on its own habitat characterization and modelling tools for ecological assessments and forecasting and on the project partners' information on species distributions for assessing biodiversity. The experience in developing indicators at the continental level for protected areas in Africa will be ported to other continents. As an interoperable web service generating biodiversity related indicators for selected areas, the DOPA can become a useful decision-making tool in a web processing chain assessing environmental changes due to anthropogenic activities, including climate change. In particular, the development of a habitat modelling web service within the DOPA will allow the community to assess possible consequences to our environment, an issue requiring inter-disciplinary interoperability and advanced modelling from multi-scale heterogeneous data sources.

Actors
The primary actors are the representatives of the partner institutions of EuroGEOSS Work Package 4 who will contribute data and web services to the DOPA, and Work Package 2 partners who will develop multi-disciplinary interoperability and ensure compliance of the EuroGEOSS operating capacity with the principles of GEOSS, INSPIRE, SEIS and GMES. - EC-JRC – Gregoire Dubois - UNEP-WCMC – Andrew Cottam - BirdLife International – Ian May - Royal Society for the Protection of Birds – Ian Fisher - Global Biodiversity Information Facility – Éamonn Ó Tuama - CNR – Stefano Nativi - Other: scientists/research biologists (species/habitat modelling); climate data modeller; end users of DOPA – policy/decision makers.
Context and pre-conditions
To assess the state of protected areas, the JRC MONDE activities have focused on monitoring habitats at the continental scale using remote sensing techniques, mainly, and on gathering information on species richness. By assessing the uniqueness of habitats and the level of threat to species, priorities in conservation strategies can be defined in the light of anthropogenic pressures like agricultural activities or climate change. The African Protected Areas Assessment Tool (APAAT), developed by MONDE, is an online information system based on a Geographic Information System (GIS) and satellite-derived data developed to aid decision makers assess the state and pressure of 741 protected areas (PAs) in Africa. It can be considered as the first consistent, continent-wide assessment of the state of protected areas in Africa. More information can be found at http://bioval.jrc.ec.europa.eu/PA/ and in Hartley et al. (2007). PAs are characterized according to indicators of their irreplaceability in terms of species composition and uniqueness of habitat, and exposure to pressure from anthropogenic sources. In contrast to regular surveys of fauna and flora that can be expensive to conduct, monitoring habitats can benefit from well established earth observation systems and techniques that can capture most of the environmental parameters that characterise habitats. However, the APAAT largely relies on data provided by third parties collected through the internet using standard downloads and/or on written requests made to the data providers. Much of the data preparation and analysis is carried out within a GIS (Nelson & Hartley, 2008) but, because the effectiveness of conservation practices can only be assessed through regular assessments, the whole process of discovery, collecting and processing data needs to be automated as much as possible and exposed through metadata catalogues and web services. The whole value of the APAAT is derived from the collection and the merging of a very large variety of data covering very different themes, ranging from species distribution maps to socio-economical indicators. These datasets include: base GIS layers, Species distributions/occurrences layers, and environmental data. For each assessed protected area, the APAAT provides a radar plot to indicate the species richness of the area and the value of associated habitat using some indicators on the uniqueness of these species and habitats, as well as the pressure on the protected area considering agricultural activities and distance from populated areas (see page x). However, impacts on PAs are difficult to accurately monitor and forecast within the current architecture of the APAAT. Moreover, the current structure of the APAAT has provided few opportunities to end-users to assess indicators as these are only

available through reports in a graphical form.

The Digital Observatory for Protected Areas aims to become a real time assessment tool relying as much as possible on web services to exchange and process data automatically. The DOPA will also improve the interaction between data providers and data users by allowing users to validate, correct and add to existing repositories of species data, protected area boundaries, threat and habitat information, basic GIS layers, etc.

The APAAT is providing assessments for protected areas in the light of other protected areas of the continent and of the other protected areas of the country. The DOPA is aiming to further extend the use of protected areas to Important Bird Areas (IBAs) as well as to provide the tools and means to obtain an assessment based on biodiversity and threats to any area end-users might be interested in.

Threats to protected areas are mainly assessed in the APAAT through the use of information on population density and agricultural activity. The DOPA will adopt a simplified version of the IUCN's Threats Classification Scheme Version 3.0 which should, ideally, be made available through web services to allow for an automatic threat assessment.

The APAAT also provides reports (country profiles) for each country based on existing country level datasets that are downloaded and reformatted. The DOPA will revise the current approach of preparing country profiles as the amount of information currently made available is far too detailed. Shorter profiles using possibly other more suitable indicators will have to be considered although it is acknowledged that such profiles are necessary to provide a context to the current state of PAs.

Scenario Events	
(use cases are derived from scenario steps described below)	
step	**description**

Step	Description: The Digital Observatory for Protected Areas - Simulation of new park
01	**Scientist access EuroGEOSS GEO Portal**
01.1	Scientist access EuroGEOSS Portal and searches for “Biodiversity Applications”
01.2	Scientist selects Digital Observatory for Protected Areas (DOPA) client application
01.3	Scientist accesses Digital Observatory for Protected Areas (DOPA) client application
02	**DOPA Client: data discovery and visualisation**
02.1	Scientist uses a catalogue to discover, for a particular region, datasets of interest and their service access points.
02.2	In the DOPA GIS client, the scientist views a world map and selects layers of interest, e.g., protected areas of the world and Important Bird Areas (IBAs)
02.3	Scientist views the indicators (SRI, HRI) for a selected number of PAs. The Indicators are generated automatically in the background as new versions of these datasets become available.
02.4	Scientist selects map layers representing species richness (mammals, amphibians and birds).
02.5	Scientist selects the category of the protected area to be displayed.
02.6	Scientist selects map layers representing species densities (raster overlay of maps of number of mammals, birds, and/or amphibians).
02.7	Scientist selects the vulnerability levels (least concerned, near threatened, vulnerable, endangered, critically endangered) of the species to display to identify critical areas.
02.8	Scientist requests statistics for species densities and level of vulnerability for each protected area.
02.9	Scientist selects a PA on the basis of classes of values of indicators.
03	**DOPA Client: defining a new area**
03.1	Scientist loads/draws a polygon of a **new area of interest** (guided possibly by maps of species densities) (Figure 3).
03.2	Scientist selects modelling service that recalculates the indicators of all PAs in the associated country and in the ecoregion for the newly added polygon(s) as well as for all the other areas. The indicators for all the other protected areas in the same ecoregion and country are recalculated (Figure 4).
03.3	Scientist submits request to modelling service.
03.4	Scientist views modelling service outputs (updated indicators for area of interest).
03.5	Scientist requests printed report on new area of interest.
Step	**Description: Using E-Habitat in the Digital Observatory for Protected Areas**
01	**Scientist access EuroGEOSS GEO Portal**
01.1	Scientist access EuroGEOSS Portal and searches for “Biodiversity Applications”
01.2	Scientist selects Digital Observatory for Protected Areas (DOPA) client application

01.3	Scientist accesses Digital Observatory for Protected Areas (DOPA) client application
02	**DOPA Client: data discovery and visualisation**
02.1	Scientist uses a catalogue to discover, for a particular region, datasets required to compute the habitat, and their service access points.
02.2	In the DOPA GIS client, the scientist views a world map and selects layers of interest.
02.3	Scientist selects one or more protected areas in a region of interest.
02.4	Scientist submits a request to the Habitat Irreplaceability Indicator modelling service for PAs of interest using the new thematic layers/datasets as inputs.
02.5	Scientist views the outputs of the Habitat Irreplaceability Indicator modelling service.
02.6	Biodiversity Indicators of PAs are compared among themselves for the various habitats scenarios
Step	**Description: E-Habitat, Ecological Niche Modelling and Climate Change Modelling in the Digital Observatory for Protected Areas**
01	**Scientist access EuroGEOSS GEO Portal**
01.1	Scientist access EuroGEOSS Portal and searches for “Biodiversity Applications”
01.2	Scientist selects Digital Observatory for Protected Areas (DOPA) client application
01.3	Scientist accesses Digital Observatory for Protected Areas (DOPA) client application
02	**Scientist selects species of interest**
02.1	Scientist submits query to brokering service to discover suitable presence datasets for a particular species
02.2	The Broker mediates the request, forwarding it to the OGC WFS that is used to publish the data.
02.3	Scientist selects one or more datasets returned by the query.
02.4	Scientist receives the selected datasets via the Broker which passes the request to the WFS.
03	**Scientist selects environmental datasets (actual)**
03.1	Scientist submits query to brokering service to discover suitable environmental datasets
03.2	The Broker mediates the request, forwarding it to the OGC WCS that is used to publish the data.
03.3	Scientist selects one or more datasets returned by the query.
03.4	Scientist receives the selected datasets via the Broker which passes the request to the WCS.
04	**Scientist selects environmental datasets (projected)**
04.1	Scientist submits query to brokering service to discover suitable projected environmental datasets derived from Climate Change modelling
04.2	The Broker mediates the request, forwarding it to the OGC WCS that is used to publish the data.

04.3	Scientist selects one or more datasets returned by the query.
04.4	Scientist receives the selected datasets via the Broker which passes the request to the WCS.
05	**Scientist generates Ecological Niche Model (ENM)**
05.1	Scientist uses the ENM client application to submit selected species and environmental datasets to the ENM Server
05.2	Scientist uses the ENM client application to select an algorithm for the model and to set the algorithm parameters.
05.3	The ENM client sends a request to the WPS Server to generate the ENM.
06	**Scientist generates projection of the Ecological Niche Model**
06.1	Scientist uses the ENM client application to submit the projected environmental datasets to the ENM Server
06.2	Scientist uses the ENM client application to select the particular ecological niche model to be projected.
06.3	The ENM client application sends a request to the WPS Server to project the ENM.
06.4	The ENM client submits a transaction request to the WCS-T to publish the generated projection.
06.4	Scientist uses the ENM client application to retrieve the generated projection.
06.5	The Broker mediates the request, forwarding it to the OGC WCS-T that is used to publish the projection.
06.6	Scientist selects the generated projection from the datasets returned by the query.
06.7	Scientist receives the selected projection via the Broker which passes the request to the WCS-T.
Post-Conditions	
The Climate Change Modelling scenario can be validated by splitting a species presence dataset into two regions, generating the ENM from one region and checking how well it predicts the distribution of the species in the second region. Based on the effect of Climate Change on the habitat of the species in question, a new Protected Area can be designated taking into account corridors that would allow migration from the old to the new area.	
Special Requirements	
References	

Figure 1: Hand drawn/uploaded polygon and request for biodiversity (species) indicators

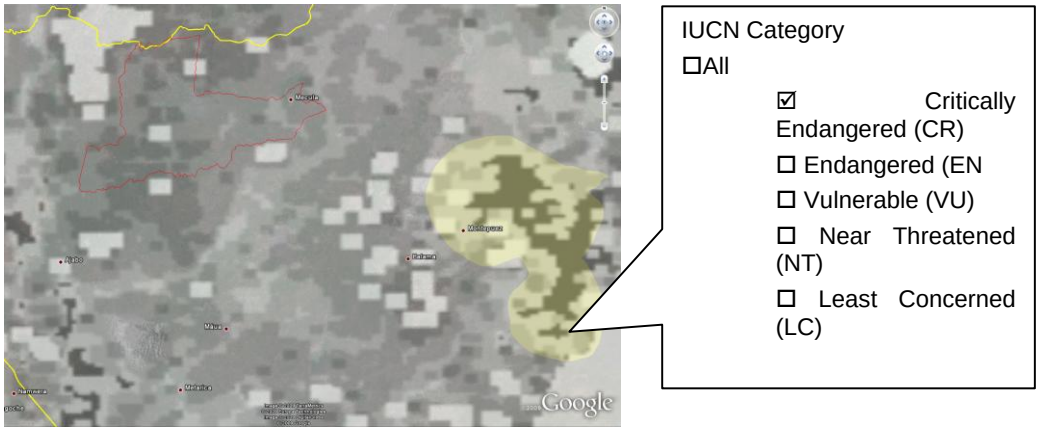
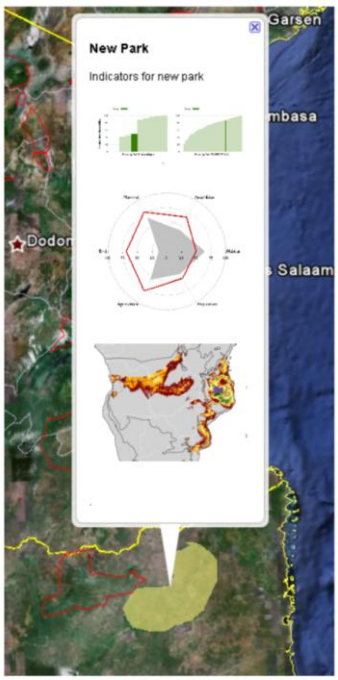


Figure 2: Hand drawn/uploaded polygon and automatic computation of biodiversity indicators (habitat irreplaceability, species richness relative to other PAs, etc)



Requirements

This part identifies the initial EuroGEOSS Biodiversity initial capacity requirements. These are derived from the steps (basic flow) highlighted in the Use Scenarios described previously:

- Metadata: metadata, conforming to INSPIRE guidelines, should accompany all biodiversity datasets delivered through the EuroGEOSS geo portal. However, different metadata standards, and not just ISO 19115, must be accommodated to serve the needs of particular communities, e.g., Ecological Metadata Language.
- Discovery services: there is a need for a central biodiversity metadata catalogue system that harvests metadata from other distributed catalogues and provides a virtual view of all

metadata on the network. The central metadata catalogue should provide search/browsing functions and must, in turn, interface to the EuroGEOSS portal clearinghouse to enable inter-disciplinary search across Forestry, Drought and Biodiversity resources, and provide access points for data and associated services.

- Access services: data access should be provided through use of standards-based web services and support the full chain of collecting, processing and sharing data/products.
- Data quality: to establish fitness for purpose when considering prospective use of data, data quality statements should be included in metadata, in particular for geospatial, taxonomic and temporal coverage. For example, accuracy and precision should be noted for geo-location measurements, and sampling techniques and protocols should be described. In addition, adoption of community-agreed controlled vocabularies and ontologies will help to provide more accurate descriptions of the data.

2.3 Drought

Work Package 5 involves partners that deploy services for drought monitoring and forecasting on regional, national, and continental scales. Other partners conduct research on drought indices (ULBF) and have extensive expertise in the development of OGC web services. UNIZAR established the services running at CHE and CNIG among other (cf. http://iaaa.cps.unizar.es/showContent.do?cid=geoportales.EN). The EuroGEOSS deliverable D5.1 provides an overview of the existing situation and of the basic requirements in respect to the systems and datasets at International, European and Local / Regional / National levels, which include:

- **CHE** is the Ebro River Basin Authority dealing with the compilation and analysis of drought related data (http://www.chebro.es/). Their service integrates real-time data from an automated hydrology information system (SAIH). The CHE uses data provided by the SAIH (Automated Hydrology Information System) in real-time for providing data on droughts. The systems maintained by CHE include SITEbro and IDE-EBRO. The **SITEbro system** (http://iber.chebro.es/sitebro/sitebro.aspx) is one of the systems maintained by CHE. It's the geographic service for the Ebro river basin. It includes several drought related resources together with other type of resources, and it will incorporate the drought monitoring indicators and indices. Own and external WMS and WFS services are incorporated in the system. The **IDE-EBRO system** is another system maintained by CHE. It is the Spatial Data Infrastructure for Ebro river basin.
- The **national Spanish Spatial Data Infrastructure** (**Infraestructura de Datos Espaciales de España, IDEE**) can be considered as a collective framework embracing a set of harmonised and standardized SDI at national, regional and local level in Spain. The national Geoportal (www.idee.es) opened in 2004, is managed by CNIG as organization responsible for the coordination of National SDI and it has been designed from the very beginning as the main point of access to all the available geoservices in Spain, as well as to all the Regional SDIs operational in Spain. Among the existing clients in this Geoportal, the **IDEE viewer** allows access to more than 700 web map services with more than 14,000 layers from more than 400 different nodes, covering all themes in INSPIRE Annexes I and II and some of the themes from Annex III. IDEE offers some analysis applications in addition to the services listed below.
- The Spanish institution **OSE** has the task to link observatories related to sustainability issues and similar on a national scale (http://www.sostenibilidad-es.org/). The **IDE-OSE** system is described in the questionnaire of D5.1. IDE-OSE includes the cartography of different sustainability indicators about economic, social, environmental, global, cultural, and governance dimensions. Through the IDE-OSE, the cartography of these indicators is represented for the Autonomous Community, for national scale analysis, or by European countries, when the analysis is made for this scale (broader comparison). This project allows the user to visualize all the Indicators of the Annual Reports of Sustainability in Spain in a way that the data covers all the territory, even though it is managed by specific communities. It is a good way of compiling the information that exists about a concrete subject. Also, it presents the possibility of comparing the results among different European countries.
- **SIA** is the integrated water information system in Spain maintained by MARM (FGUA-OSE); this system was developed according to INSPIRE and WISE Technical Guidelines from the European Environment Agency. In addition, they are planning to start using Workflow tools in the course of 2010. The SIA system does not yet support exporting SIA information in the format of OGC Web Services. This are to be implemented in 2010.

- **DCMSEE** is the center for drought management in Southeastern Europe represented by the University of Ljubljana in the project (http://www.dmcsee.org/). This center provides access to data on droughts of Southeastern European countries.
- **EDO** is the European Drought Observatory that is developed by the Land Management and Natural Hazards Unit of the EC-JRC (http://ies.jrc.ec.europa.eu/land-management-and-natural-hazards-unit). Currently EDO provides data on droughts on a continental level. These data are derived from data collected by drought observatories throughout Europe and from satellite data. The EDO service is based on the University of Minnesota MapServer (UMN MapServer), which implements OWS specifications. The service is, however, not accessible as a WMS or WFS through the Internet.

The main tasks of almost all of the above mentioned institutions involved in data collection are the generation of data and indices for monitoring and analyzing droughts. Drought indices are derived from different data sources and provide information on precipitation, vegetation density, and hydrology in a region. Data required for calculating the drought indices are regularly provided by meteorological stations on different scales, by satellite sensors and as outputs from climate models or models of land surface processes. The generation of drought indices, therefore, requires the **processing of data** from different sources and possibly of data of different scales. The **analysis** of droughts requires that specific drought events can be accessed in the system for analysis. State organizations like CHE (IDE-EBRO, SITEbro), OSE (IDE-OSE), and MARM (SIA) need to **communicate information** on the drought situation to the public.

Using the EuroGEOSS system for drought management requires that data published in the services are accessible and restrictions on the use of data are known. For analysis purposes, specific drought events should be accessible, as said above.

An important aspect in the EuroGEOSS project is the inter-comparison of selected drought indices across scales (i.e., continental, national, regional scales). This implies an identification of common drought indices for all scales and hydrological systems as starting point for multi-scale comparison.

Long-term objectives that exceed the scope of the EuroGEOSS project, but are of interest to the drought community, are:

- the use of web processing services for the automatic generation of drought indices,
- the derivation of drought hazard and risk maps,
- the analysis of drought impacts on aspects like economy and similar.

Based on the description of the user requirements in the section before and in accordance with the objectives of the EuroGEOSS project, specific scenarios will be defined and implemented during the course of the project.

Scenario – Comparison and Validation of Multi-Scale Drought Information

Table 5: Using interoperable services of drought information

Brief Summary
The basis of the first generic scenario is the availability of multi-scale drought information. Accessing this information allows to compare and validate the representation of droughts by different drought indices. This scenario, identified within WP5, will exploit the up- and downscaling capabilities that will be

enabled through an established interoperability between the European Drought Observatory and national and regional drought resources provided by WP5 partners. Up- and downscaling refers to the accessing and visualization of drought information on different spatial scale levels.

Community Objectives

The objective of the drought community is to improve the monitoring and detection of drought events.

The European Drought Observatory under development at JRC provides consistent continental-scale drought information. This type of information is appropriate to acquire a fast overview on the hydric state of the environment in Europe. Due to limitations in data availability and spatial resolution, however, the level of detail of this type of information is restricted. On the other hand, national and regional information systems such as the Spanish National Drought Observatory or the operational water information systems of the Ebro Catchment Authority can provide drought information in higher spatial detail, and complement the picture with local observations not available at the continental scale.

The interoperability between drought information systems at continental, national, and regional level will allow for a direct comparison and validation of various drought indicators and indices produced by the systems. An expert user gains the opportunity to compare drought indices and to depict a comprehensive picture of a drought event in a region. A non-expert user, e.g. at the policy level of the European Commission, receives a rapid overview in the entire continent, and at the same time more detailed information where required.

Since droughts are not bound to administrative and political boundaries, in case of a drought event, a close collaboration and cross-border information exchange between neighboring regional or national users in affected European Union Member States can enhance the efficiency of mitigation measures.

Actors

Drought data user: Users of drought data can be experts in this field or non-experts. Expert users focus on the detailed analysis of drought events. These experts users are called EuroGEOSS users, because they use the EuroGEOSS broker as starting point of the acquisition of drought data.

Non-experts or administrative users require a general assessment of the drought situation in a region; these users are referred to as EDO users, because their point of access to drought information is EDO.

Portal of the European Drought Observatory (EDO): EDO provides drought information at continental level for all of Europe. The provided drought data contain data on precipitation, vegetation density, and soil moisture.

Drought data providers offering drought data through web services: national and regional data providers supply drought information on more detailed scales than the EDO system.

Drought Metadata Catalogue: The data resources coming from EDO and national and regional data providers are registered in the metadata catalogue of WP5.

Context and pre-conditions	
Data providers supply drought data at continental, national, and regional level. These data and services for data provision are registered in the WP5 metadata catalogue.	
Scenario Events	
step	**description**
Assessment of the drought situation in Europe	
1.	The user looks for drought data in Europe and accesses the EDO portal. Her objective is to get an overview of the drought situation in Europe.
2.	The user goes to the EDO map server.
2.1	The user investigates maps of drought indices and zooms to a region affected by a drought.
3.	The metadata catalogue is queried implicitly and searched for drought data from regional data providers.
3.1	In case detailed data are available they are displayed in the EDO map server.
Analysis of drought data through a drought expert	
1.	A drought expert user wants to find out what drought-related datasets exist for her drought study with defined spatio-temporal context.
1.1	The user accesses directly the EuroGEOSS broker and looks for metadata of drought or related data of interest to her.
1.2	The broker provides the user with results from the search of the metadata catalogue.
2	In a next step the user wants to get access to the drought data: for this purpose there is a button for the search of services providing access to the identified data.
2.1	The user selects a list of layers to be displayed.
2.2	Subsequently the layers are shown in a map viewer client (i.e., EDO map server). In the EDO map server the user can zoom in to regions of interest.
Post-Conditions	
The user is provided with data on droughts on different scale levels. Drought data for Europe provide her with an overview of the drought situation; national and regional drought data allow a	

more detailed assessment on the drought situation in a certain region.
Special Requirements
Data providers need to provide at least one drought index that is suitable for assessing the drought situation in their region of interest; the drought data need to be available through standard web services.
References
The data and services available for the drought thematic area can be found in the WP5 metadata catalogue: http://eurogeoss.unizar.es/Search/Search.html.

Requirements

The requirements of users in the EuroGEOSS project are related to four issues: metadata, discovery services, access services, and data quality.

Metadata

Metadata provide descriptions of data sets and services of the drought community. The metadata need to contain the INSPIRE metadata elements. Metadata are used for searching data in the metadata catalogue; they are, therefore, most useful when they are up-to-date. A summary of metadata fields of interest is given below.

Human-generated textual description:

- unique identifier (definition of the topic and used keywords on the basis of controlled thesauri (In the Slovenian central register for spatial data at the moment the CEN/TC287 standard is used);
- business name of the agency or responsible party associated with the dataset;
- organization in which the person in charge of the dataset is working;
- description of the data (abstract including the following subheadings: purpose, dataset file content, data content, projection);
- extent of geographic coverage of the dataset;
- geographic bounding box;
- temporal context of spatial data (beginning and ending date of time series);
- spatial context of data representation (continental, national, regional);
- quality and validity of the dataset;
- search words (words likely to be used by a non-expert to find the dataset);
- access constraints.

Machine-generated data useful for software applications:

- stored data format (the most used formats for spatial data in Slovenia are ESRI formats);
- available data format;
- methods used for collecting, processing, and transforming data;
- standards used for the datasets;
- geo-referenced system with measurements and resolution.

Discovery services in relation to metadata

The metadata catalogue should be predictable and reliable in both form and content. This is the only way for potential users to find information and to use it. Discovery services should deliver the

minimum amount of information that needs to be provided to convey to the inquirer the nature and content of the data resource.

This falls into broad categories to answer the “what, why, when, who, where and how” questions about geospatial data. These questions led to the European implementing regulations for discovery services.

What: title and description of the data set.
Why: abstract detailing reasons for the data collection and its uses.
When: when the data set was created and the update cycles, if any.
Who: originator, data supplier, and possibly intended audience.
Where: the geographical extent based on latitude, longitude, co-ordinates, geographical names or administrative areas.
How: how it was built and how to access the data.

The discovery services should provide the key information to allow the researcher to decide if the dataset is potentially useful.

The level of metadata detail that will be documented depends on the type of data held and the methods used for accessing and applying the data. Different types of data (e.g. vector, raster, textual, imagery, thematic, boundary, polygon, attribute, point, etc.) will require different levels and forms of metadata to be collected. However, there is still a high degree of compatibility between most of the metadata elements required.

Access services

Access constraint: Any restrictions or legal prerequisites that may apply to the access and use of the dataset including licensing, liability and copyright. The regulations to be applied are documented in the European Commission regulation.

Where possible, access services should be organized and completed with the following subheadings:

- type of license: The type of license that the dataset is available under.
- download (only if applicable): It is very important that date are reachable in different forms in tables and maps or graphs.

Data quality

The function of data quality is “fitness to purpose”, which means that the user of a dataset has to decide if a dataset can be used for a certain task. The user, therefore, needs the following pieces of information regarding the data quality of a dataset:

- Lineage: brief history of the source and processing steps used to produce the dataset;
- Positional accuracy: brief assessment of the closeness of the location of spatial objects in the dataset in relation to their true position of the Earth.

Where possible, data quality should be organized and completed with the following subheadings:

- Scale/resolution: scale or resolution of the dataset. This can also include the scale/resolution of the source data used to create the dataset.

- Planimetric accuracy: horizontal accuracy assessment against their real world features (e.g. +/- 100m;
- Attribute accuracy: brief assessment of the reliability assigned to features in the dataset in relation to their real world values. This can include an assessment of how well the significant attributes have been populated, and any limitation on the data's use as a source for attribution.
- Logical consistency: brief assessment of the degree of adherence of logical rules of data structure, attribution and relationships;
- Completeness: brief assessment of the extent and range in regard to the completeness of coverage, classification and verification. Where possible, completeness should be organized and completed with the following subheadings:
- Spatial completeness: assessment of the spatial coverage of the dataset;
- Attribute completeness: assessment of the completeness of significant attributes fields.

3 CROSS-THEMATIC INTEROPERABILITY ISSUES

In the framework of the cost-benefit considerations and analyses required by the WP6 of EuroGEOSS, a survey was prepared in order to investigate the requirements, needs and suggestions stemming from the three Thematic Areas of EuroGEOSS. The survey was illustrated in the D6.1 of the project EuroGEOSS which contains the analysis of the results.

In particular, the survey was useful to identify main common problems with Spatial data of the three different thematic areas, which can be used to define common requirements.

3.1 Overview of the problems

The most common problem, that responding partners currently face when using spatial data, relates to the integration among data (20%). This is followed by finding the data, converting it and its quality (all at 17%).

The reuse of data and its cost are not major issues for the partners of the EuroGEOSS project, as they were respectively selected only by 9% and 6% of respondents.

Respondents who selected as problems 'finding' and/or 'accessing' spatial data (overall more than 30%) were asked to comment about such issues more in detail. In particular, for 'finding' the aim was to understand if the type of problem experienced was mainly due to a lack of communication or to an unknown source, for example. As to 'accessing', partners had to indicate whether the problems experienced relate to technical or to institutional issues (e.g. copyright issues, unwillingness to share data, etc.). Table 6 reports an overview of the received answers.

Table 6: Overview of problems related to 'Finding' and 'Accessing' data

Organisation-	Finding	Accessing

GBIF	There is a need for comprehensive catalogues to enable discovery of biodiversity resources; there are many national/international initiatives but these need to be integrated into a single clearing-house mechanism.	Technical issues: there is a need for more widespread adoption of standards-based web services for accessing biodiversity data (especially for geospatial web) and for development of standardised ontologies and vocabularies for biodiversity data; Data quality is a major concern for the GBIF network: several checks are made when indexing data and we are promoting development of web services that provide quality checking before data is published to the network.
RSPB		Mainly copyright and financial issues for base layers such as Ordnance Survey, and for up-to-date infrastructure layers (e.g. roads, rail).
UNEP-WCMC	Communication and unknown source	Technical rather than institutional. Nearly all national authorities are happy to contribute data to the WDPA, but none of their data is easily accessible as it is not on the internet.
JRC-MONDE Action	Finding the most suitable thematic maps, we are currently using for Africa, for other regions will be an issue, especially because a number of variables require careful processing (NDVI, % Water Bodies, %Forest cover..)	We have privileged access to remote sensing data over Africa but not for other regions. Obstacles are to be expected.
BirdLife International	Communication, language, unknown source	Some issues occur with getting data from non-birdlife institutions such as national and regional mapping or environmental agencies.
CHE	Communication problems (for instance, with Autonomous Communities first you have to find the suitable public servant), problems locating the data about a specific subject (for example, pressures on the bodies of water) and the date of their last updating, their format and structures. There's a lack of created standard metadata catalogues.	Technical: servers down, restricted access. Institutional: we have to insist continuously to be granted the access to data. There is no automatic data updating.

CSIC	In general, no problems are found with spatial data for our research and applications. Given the research and national character of the CSIC we have a general open access to national environmental datasets.	No problems
FGUA-OSE	Our data are mainly statistical, and then we have problems with availability of data with high level of spatial resolution, for example local data or regional data. The problem is to found it and the update of this data.	

3.2 Information/data, models and services expected to be available from EUROGEOSS implementation

In the context of the proposed projects as the current situation, partners were asked to comment on what information/data, models and services they would expect to be available from the implementation of EuroGEOSS. Table 7 reports an overview of the answers received. It is clear that the desired evolution of the current situation would lead to:

- increased access of data,
- greater interoperability and
- better integration of data.

Table 7: Data models and services expected to be available through EuroGEOSS

Organisation	Data, models and services expected to be available from the implementation of EuroGEOSS
GBIF	Metadata catalogue services; access to protected area data via standard web services; enriched GIS clients that can consume the web services; prototypes of workflows that demo how services around biodiversity data can be automated – the challenge here will be developing models and ontologies.
RSPB	RSPB is mainly a data provider in the context of EuroGEOSS, although easy access to infrastructure, administrative, satellite etc. data would be welcomed. Dependent on availability, certain datasets would be useful for analysis, such as land cover, to look at bird distribution and abundance, and increase the accuracy and availability of remote sensing.

UNEP-WCMC	We would like to be able to undertake analysis across sectors on the protected areas data, including looking at other datasets on forestry, drought, economics, remote sensing etc. Also, it will be very useful to be able to access data from the other partners in WP4 for analyses.
JRC-MONDE Action	The biodiversity WP is expecting to have access via web services to thematic layers produced in other WPs. Inside the biodiversity WP, JRC will have access to new web services describing protected areas and important bird areas. Benefits for the biodiversity WP are numerous, among which the possibility to perform real-time automated updates of our maps of protected areas and of habitats through the use of web services. It should become also possible to assess unprotected areas with higher biodiversity values. The development of the e-Habitat WPS should allow end users to test the best means to describe an ecosystem , to correlate the habitat models with biodiversity and better assess climate change impact on habitats (and so on biodiversity) through the linking with climate change models.
BirdLife International	We would like to have improved access to Protected Areas information, so that it can be integrated on the fly and improved engagement with GBIF to access their data
CHE	- Interoperability with other systems. - Query and public access to the geo-referenced information from the new Ebro Basin Hydrological Plan. - Catalogue of data so there's more availability and knowledge of the available data. - Analysis related to the monitoring program of the Ebro Basin Hydrological Plan could be done.
CSIC	Drought data at continental level would be useful for different research purposes, including hydrological modelling at a large scale. Some of the products of the European drought observer (e.g., soil moisture estimations and models) can be very useful to complement other data and to be included in the hydrological modelling from local to regional scales.
FGUA-OSE	We would like: - To have access to environmental (forestry and biodiversity) data at European scale to complete our indicators with the better information existent. - To improve our finding of data. - To create a catalogue of metadata. We develop our metadata based on ISO 19115 but we have any problems because our data are mainly statistical not spatial. - And also it would be very interesting to have services for the creation of indicators on line based on data of different sources and disciplines (forestry, drought, etc.)
FGUA-OSE MARM-SIA	Design of a single data model to facilitate interoperability between systems and creating a catalogue of metadata based on existing international standards.

CNIG	As provider of data and services via web at national level, we expect to achieve more information and experience about interoperability, standards and international SDI as well as obtaining added value (advanced applications or analysis applied to our data) according to INSPIRE Directive.
JRC- LMNH Unit	Global, regional and local datasets and services on forest cover, forest cover change maps as well as other forestry thematic layers are available through web services within EuroGEOSS project. This will give the possibility to make estimates of the rates of forest cover change on global / continental and regional scale, to use it for various Area Production Models (APM), LUCC models as well as combining forest cover and forest cover change maps with other thematic layers and evaluating the impact of forest change rate on protected areas, biodiversity, tree species distribution, etc.

3.3 Main envisaged benefits

The main benefits that partners expect from EuroGEOSS relate to increased data accessibility and to the possibility to integrate European systems into a global framework (both chosen by 16% of respondents), followed by increased interoperability (both thematic and multi-disciplinary) and by data sharing (14%). The option 'Other' has been selected by the JRC – Action MONDE, which expects ideally a reduction in the biodiversity loss.

This topic will be carefully monitored at the end of the project in order to assess if the expected benefits have actually materialized and achieved.

4 COMMON FUNCTIONALITIES UNDERPINNING INTEROPERABILITY

To provide functional requirements for EuroGEOSS multidisciplinary interoperability infrastructure, a set of common technological use cases are recognized from the collection of thematic requirements discussed in this document. These common use cases will be implemented by the EuroGEOSS Initial Operating Capacity. A second set of advanced use cases will be recognized and implemented in the second phase of project: the Advanced Operating Capacity.

The following use cases have been identified for the EuroGEOSS Initial Operating Capacity:

Resource Management

[UC-1] Register Service in the EuroGEOSS Operating Capacity;

Discovery & Evaluation

[UC-2] Harvesting via the EuroGEOSS Discovery Broker.

[UC-3] Distributed Query (aka Search of Metadata).

[UC-4] Resource Browsing (aka Presentation of Available Services).

[UC-5] Semantic Enabled Distributed Query (aka Semantics Enabled Search of Metadata).

Access and Use

[UC-6] Download (aka Interact with Access Services).

[UC-7] Data Access on "common grid".

They were selected considering also a necessary consistency with the GEOSS Architecture Implementation Pilot use cases (http://www.ogcnetwork.net/AIP). The following tables describe each use case.

Table 8: [UC-1] "Register Service in the EuroGEOS Operating Capacity"

Overview	
Title	Register Service in the EuroGEOSS Operating Capacity
Description	This use case describes the conditions and steps to register services in the EuroGEOSS Operating Capacity.
Actors and Interfaces	
Initial Status and Preconditions	- The Service Provider has a service of interest for EuroGEOSS Operating Capacity; - The Service Provider owns the appropriate credentials to register a service in the EuroGEOSS Brokering framework –e.g. register catalog services in the EuroGEOSS discovery broker, register processing/transformation services in the EuroGEOSS access broker, register access services in the EuroGEOSS Thematic Area catalogs.
Basic Flow	
Step 1: EuroGEOSS Forestry Catalogue service queries Forestry Catalogues for registered components and services. **Step 1**: Service Provider configures the service of interest for serving data according to some dataset schemas and some data encodings supported to the EuroGEOSS Operating Capacity (see D.2.2.2). **Step 2**: Service Provider configures –or validates- all the information about its Service interface (i.e. service metadata) as provided in the service Capabilities document: - Service Type, Version, Title and Abstract, Supported languages; - Contact information (service provider PoC); - Supported service operations request and response encoding; - Contents : Layers Names (normalized terms for M2M processing) and Titles (human readable); - Domains of validity : dimensions, units, range, scales, reference systems. **Step 3**: Service Provider publishes its service to the EuroGEOSS discovery Broker; for this task , he/she can use the user-friendly configuration tool which is published by the EuroGEOSS brokers. Doing that: - Metadata about the Service (encode in ISO 19139) is generated automatically by the EuroGEOSS brokers; - additional information (e.g. metadata not found in the getCapabilities) can be added when registering the service.	
Post Condition	

Table 9: [UC-2] "Harvesting via the EuroGEOSS Discovery Broker"

Overview	
Title	Harvesting via the EuroGEOSS Discovery Broker
Description	Discovery and Evaluation: Harvesting via the EuroGEOSS Discovery Broker. This use case describes the steps for the harvesting via the EuroGEOSS discovery broker.
Actors and Interfaces	
Initial Status and Preconditions	- The Service Provider has a service of interest for EuroGEOSS Operating Capacity; - The Service Provider owns the appropriate credentials to register a service in the EuroGEOSS Brokering framework –e.g. register catalog services in the EuroGEOSS discovery broker, register processing/transformation services in the EuroGEOSS access broker, register access services in the EuroGEOSS Thematic Area catalogs.
Basic Flow	
Step 1: EuroGEOSS discovery Broker extracts the harvest policies and online metadata service links for its registered resources. **Step 2**: For resources which are catalog services –or inventory services; EuroGEOSS discovery Broker harvests all or part of the available metadata holdings: - EuroGEOSS Thematic Area catalog permits harvesting and holds less than 100,000 records. EuroGEOSS discovery Broker harvests all of the holdings and periodically updates them according to the registered frequency of change. - EuroGEOSS Thematic Area catalog does not permit bulk harvesting and/or holds more than 100,000 records. EuroGEOSS discovery Broker harvests collection records (aggregate summary) as criteria for dynamically cascading queries to the EuroGEOSS discovery Broker from users to the service. **Step 3**: For resources which are other than catalog services, EuroGEOSS discovery Broker harvests the service *getCapabilities* –or equivalent resource description- and any additional metadata references provided therein. The Broker assembles as complete as possible a set of discovery metadata records from this information according to its familiarity with that particular service type. **Step 4**: (optional) Service Provider issues a manual request to the EuroGEOSS discovery Broker to re-harvest and update metadata sooner than indicated by its registered harvest policy.	
Post Condition	

Table 10: [UC-3] ”Search of Metadata”

Overview	
Title	Search of Metadata, Distributed Query
Description	This use case describes the conditions and steps for portals and application clients to support EuroGEOSS user in searching for resources of interest via the EuroGEOSS discovery Broker and/or the EuroGEOSS Thematic Area Catalog(s).
Actors and Interfaces	
Initial Status and Preconditions	Resources metadata has been successfully registered in the EuroGEOSS Thematic Area catalog(s), which are available either directly or via the EuroGEOSS discovery Broker.
Basic Flow	

Step 1: Client Application requests capabilities of catalogs of interest (i.e. the EuroGEOSS discovery Broker and/or the Thematic Area Catalogs) to determine the protocol needed to search for resources (e.g. CSW 2.0.2 core interface, CSW/ISO,CSW/ebRIM-EO, OpenSearch, etc.) and the queryable elements of each as needed (D2.2.2 describes the interfaces published by the EuroGEOSS discovery Broker).

Alternatively, the Client Application knows a-priori the protocol needed to interact with catalog(s) of interest;

Step 2: Client Application presents the user with search criteria based on queryable properties of selected catalogs; the following configurations are suggested:

- Simple keyword search and area of interest/bbox search;
- Advanced search parameters such as organization, catalogs to be searched, thematic area, resource type, etc.
- More specific earth-observation criteria such as sensor row/path, collection, subsetting/ordering and/or delivery mechanisms, etc
- Value-added and/or domain/community specific search capabilities such as thesaurus matching, cluster matching, etc.

Step 3:

(a) [EUROGEOSS Thematic Area Catalog sub-case]: Based on user selections, Client Application constructs query to each selected catalog and the *ResultSet* is returned and presented to the user with application-specific options (such as total number of results, basic information about each result, grouping of results, etc);

(b) [EUROGEOSS discovery broker sub-case]

- Based on user selections, Client Application constructs a unique query to the EuroGEOSS discovery broker;
- the broker distributes the query to each selected catalog implementing the necessary transformation (i.e. mediation and adaptation) functionalities;
- the broker collects the *ResultSet* returned by each queried catalog and generates a unique and consistent *ResulSet* implementing the necessary transformation (i.e. mediation and adaptation) functionalities;
- the broker returns the *ResulSet* to the Client Application;
- the Client Application presents to the user the query result with application-specific options

(such as total number of results, basic information about each result, grouping of results, etc); **Step 4**: User selects resources of interest for evaluation and/or use.
Post Condition

Table 11: [UC-4] "Browsing (aka Presentation of Available Services)"

Overview	
Title	Browsing (aka Presentation of Available Services)
Description	This use case describes the conditions and steps for portals and application clients to present to the EuroGEOSS user the reachable services discovered by searching the EuroGEOSS discovery Broker and/or the EuroGEOSS Thematic Area Catalogs.
Actors and Interfaces	
Initial Status and Preconditions	- The user has discovered and/or selected services or alerts of interest. - The user run a Client application which is able to interact with the EuroGEOSS discovery broker –or one of the EuroGEOSS Thematic Area Catalog. - EuroGEOSS Discovery Broker –or Thematic Area Catalog- has established reachability of discovered registered services or alerts (e.g. the broker or Thematic Area Catalog application has established that the services of interest are running and responding to requests); - The Client application can support the presentation of the selected services or alerts of interest –e.g. are GEO-portal, GI-go, GeoNetwork client, ArcGIS/ArcExplorer, WorldWind, etc.
Basic Flow	
Step 1: EuroGEOSS Discovery Broker –or Thematic Area Catalog- issues GetCapabilities request to receive further metadata about the capabilities provided by the service. **Step 2**: Depending on the type of service, the broker returns to the Client more information on the service offerings such as layers, features, coverages, sensor parameters, portrayal rules, etc served by the selected service. The Client presents the user with such information. **Step 3**: The user can choose to get additional information about each offering (e.g. if available via OWS *DescribeFeature*, *DescribeCoverage*, *DescribeSensor*, etc.). **Step 4**: EuroGEOSS Discovery Broker –or Thematic Area Catalog- allows the Client application to provide options for: - displaying/portrayal of maps (in time and in space) - zooming in to results, - adding results to the viewing map, - saving current view/selections as GeoRSS, HTML, KML, context document, etc. **Step 5**: For each selected resource, EuroGEOSS Discovery Broker –or Thematic Area Catalog- allows the Client application to provide options for:	

- downloading/exploring resource in case of files, documents, web sites; - displaying alerts in case of alert services; - viewing resource in case of OGC Web Service –or other services which return well-known encoding formats –e.g. GeoTIFF, PNG, GML, SHP, KML, etc. **Step 6**: EuroGEOSS Discovery Broker –or Thematic Area Catalog formulates the appropriate request and sends it to the resource access server.
Post Condition

Table 12: [UC-5] Semantics Enabled Distributed Query (aka Semantics Enabled Search of Metadata)

Overview	
Title	Semantics Enabled Distributed Query (aka Semantics Enabled Search of Metadata)
Description	This use case describes the conditions and steps for portals and application clients to support EuroGEOSS user in searching for resources of interest via a combined use of the EuroGEOSS discovery broker (or Thematic Area Catalogs) and Ontology Engines.
Actors and Interfaces	
Initial Status and Preconditions	- Ontology Engine(s) is/are available to be queried and publish(es) query interfaces supported by the EuroGEOSS augmented discovery framework (see D.2.2.2 phase-2). - A Discovery Augmentation Component was successfully registered in the EuroGEOSS discovery broker and is available to extend the broker functionalities by supporting semantic-enabled queries. - The Discovery Augmentation Component is able to interact with the published Ontology Engine(s). - A Client Application has been developed, is available for use, and is able to interact with the EuroGEOSS augmented discovery framework (i.e. the EuroGEOSS discovery broker + the Discovery Augmentation Component .
Basic Flow	
Step 1: The Client Application requests capabilities of Discovery Augmentation Component to determine the protocol needed to search for resources and the queryable elements of each as needed. [Alternatively, the Client Application knows a-priori the protocol needed to interact with the component]. **Step 2**: The Client Application presents EuroGEOSS user with search criteria based on the discovered queryable properties: - “Typical” distributed query queryable properties (see the “Distributed Query” use case) + Semantic relation (e.g. SKOS relation). **Step 3**: Based on user selections, the Client Application constructs a query and submit it to the Discovery Augmentation Component. **Step 4**: The Discovery Augmentation Component “expands” the keyword clause by retrieving “semantically related” terms interacting with the published Ontology Engines –this is	

accomplished in either an automatic way or based on user-driver criteria. **Step 5**: The Discovery Augmentation Component generates a set of "structured" queries based on the previous extension. **Step 6**: The Discovery Augmentation Component submit the structured query to the EuroGEOSS Discovery Broker. **Step 7**: The Discovery Augmentation Component collects the *ResultSets* clusters them and sends them to the client. **Step 8**: The Client Application presents the clustered *ResultSets* in a "smart" way. **Step 9**: EuroGEOSS User selects resources of interest for evaluation and/or use.
Post Condition

Table 13: [UC-6] Download (aka Interact with Access Services)

Overview	
Title	Download (aka Interact with Access Services)
Description	This use case describes the conditions and steps to interact with an Access Service interface within EuroGEOSS IOC.
Actors and Interfaces	
Initial Status and Preconditions	- A resource access server is registered to the EuroGEOSS discovery broker. - The resource access server is deployed and configured for serving data according to some standardized dataset schemas and some data encodings, supported to the EuroGEOSS Operating Capacity (see D.2.2.2). - The EuroGEOSS discovery Broker has retrieved the metadata about the service operations and the resources provided by the server.
Basic Flow	
Step 1: The EuroGEOSS discovery broker receives a *Describe*(resource) request **Step 2**: The EuroGEOSS discovery broker sends a response describing the content offerings of each queried resource. **Step 3**: The EuroGEOSS discovery broker receives a *Get*(resource) request with parameters set by the client from the content offerings response. **Step 4**: The EuroGEOSS discovery broker sends a response with the resource content matching the selected content offering.	
Post Condition	

Table 14: [UC-7] Download (aka Interact with Access Services)

Overview	
Title	Data Access on “common grid”
Description	This use case describes the conditions and steps for accessing datasets on a “common grid” in the EuroGEOSS Operating Capacity.
Actors and Interfaces	
Initial Status and Preconditions	- A Client Application is available for use. It is able to interact with the EuroGEOSS discovery broker. - A EuroGEOSS “access broker” is available. - The EuroGEOSS discovery broker is able to interact with the EuroGEOSS “access broker”. - The user has discovered and selected a set of resources of interest via the EuroGEOSS discovery broker; - The selected resources are accessible through standard access services (see D2.2.2)
Basic Flow	
Step 1: Client Application presents the user with a set of options for accessing the resources - CRS; - Spatial resolution; - Temporal resolution; - Data Format; - Bounding Box; - Etc. **Step 2**: The User fills all (or part of) the fields according to her/his needs. **Step 3**: The Client Application sends the appropriate request to the EuroGEOSS discovery Broker. **Step 4**: For each of the requested resources, the EuroGEOSS discovery broker pass the request to the EuroGEOSS access broker which computes the needed transformations. **Step 5**: For each of the requested resources, the access broker executes (calling the appropriate external –or internal- transformation service) the needed transformations. **Step 6**: The access broker returns all the requested resources on the requested grid –e.g. a common grid for all the retrieved resources.	
Post Condition	

5 CONCLUSIONS AND NEXT STEPS

This document presented a collection of requirements of the partners of the EuroGEOSS project. The first part of the document (section 3) reported the requirements for each EuroGEOSS theme separately. The second part of the document (section 4) reported a comparative analysis of the common interoperability issues and recognized a common set of technological use cases to support multi-disciplinary interoperability.

In this first version of the deliverable, we reported the requirements from various work packages useful to build the initial operating capacity of the project. These requirements will serve for validating the developed solutions at the end of each cycle of the project. The key points we identified for the requirements of multidisciplinary interoperability are:

- As obtained from the survey of WP6, the main problems raised from the partners are related to the discovery and access to spatial data. The creation of IOC components and interfaces for each theme (in particular the creation of a catalogue service) contributing to EuroGEOSS will collect services and datasets from each thematic partner and provide, at least, catalogue, download and view services. (D3.1, D4.1, D5.1, D6.1).
- Cross thematic interoperability is also essential to find, combine and create new datasets, indexes, models, based on datasets and services of each single area. Within the EuroGEOSS project, cross thematic interoperability is implemented by the EuroGEOSS brokering framework. This framework shall be composed of a set of brokering components each addressing a required functionality (e.g. discovery, access, semantics, etc).
- There is a need for more widespread adoption of standard-based web services which is guaranteed if the partners will adopt minimum requirements from international initiatives such as INSPIRE and GEOSS (D2.2.1).

Next steps will be toward the following directions:

- Brokering Framework: At this stage the EuroGEOSS brokering framework provides the discovery broker which federates well-accepted catalogue, inventory and access standard services. As for International standards, OGC CS-W, WCS, WMS and WFS are supported (D2.2.2). Next steps will concern the development of an access broker and of a semantic broker sorting out the heterogeneity which characterizes access and semantics functionalities across the different Communities.
- Data and Services integration: Integration tests among three thematic areas starting from the available and published services and datasets. The outcomes of the tests will be used to define a minimum set of common interoperability rules to publish datasets and services.
- Common use scenario: identification of a basic common use scenario, to test the IOC architecture whose main components are represented by the EuroGEOSS brokers and SDIs of the three EuroGEOSS themes.
- Workflow testing use case: use of BPMN as a workflow modelling environment, to test single thematic workflows and models and to build cross thematic workflows.
- Automatic creation of WPS based on existing datasets and services.
- Integration of existing or development of new ontologies and vocabularies for biodiversity, forestry and drought data.

A next release of this document will capture and discuss the multidisciplinary interoperability requirements for the Advanced Operating Capacity of EuroGEOSS.