Annex I - “Description of Work”

Project acronym: *(e-SOTER)*
Project full title: *Regional pilot platform as EU contribution to a Global Soil Observing System*
Grant agreement no.: 211578
Date of preparation of Annex I: 19 July 2008
Date of approval of Annex I by Commission: *(to be completed by Commission)*

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PART A

A1. Budget breakdown and project summary

A.1 Overall budget breakdown for the project

A3.2:
What it costs

Project Number 1	211578	Project Acronym 2	e-SOTER

One Form per Project

Participant number in this project 3	Participant short name	Estimated eligible costs (whole duration of the project)					Total receipts	Requested EC contribution
		RTD / Innovation (A)	Demonstration (B)	Management (C)	Other (D)	Total A+B+C+D		
1	ISRIC	148,733.68	0.00	197,115.08	125,457.66	471,306.42	0.00	425,498.34
2	University of Miskol	252,684.80	0.00	3,230.40	27,000.00	282,915.20	0.00	212,994.00
3	BGR	417,200.00	0.00	6,660.00	11,000.00	434,860.00	0.00	327,810.00
4	JRC	335,040.00	0.00	7,518.00	42,000.00	384,558.00	0.00	290,298.00
5	Cranfield University	277,120.00	0.00	7,356.00	20,500.00	304,976.00	0.00	230,571.00
6	Alterra	278,108.00	0.00	8,314.00	24,000.00	310,422.00	0.00	234,895.00
7	Szent Istvan Univers	137,000.00	0.00	3,280.00	12,000.00	152,280.00	0.00	115,030.00
8	SciLands	152,320.00	0.00	5,060.00	11,000.00	168,380.00	0.00	127,550.00
9	INRA	113,052.80	0.00	5,840.80	11,000.00	129,893.60	0.00	98,880.40
10	UNOTT	81,475.20	0.00	6,120.80	12,250.00	99,846.00	0.00	76,415.20
11	Czech University of	60,240.00	0.00	5,200.00	11,000.00	76,440.00	0.00	58,630.00
12	ISSCAS	68,640.00	0.00	2,460.00	24,500.00	95,600.00	0.00	72,315.00
13	ENA	95,200.00	0.00	3,676.00	23,500.00	122,376.00	0.00	92,701.00
14	WU	273,169.00	0.00	9,699.00	29,000.00	311,868.00	0.00	236,325.75
TOTAL		2,689,983.48	0.00	271,530.08	384,207.66	3,345,721.22	0.00	2,599,913.69

A.2 Project summary

A1:
Our project

Project Number 1	211578	Project Acronym 2	e-SOTER

ONE FORM PER PROJECT

GENERAL INFORMATION			
Project title 3	Regional pilot platform as EU contribution to a Global Soil Observing System		
Starting date 4	The first day of the month after the signature by the Commission		
Duration in months 5	42		
Call (part) identifier 6	FP7-ENV-2007-1		
Activity code(s) most relevant to your topic 7	ENV-2007-4.1.3-03: Development of a Global Soil Observing System		
Free keywords 8		Soil and Terrain database, remote sensing, applications, web portal	

Abstract 9 (max. 2000 char.)

Soil and land information is needed for a wide range of applications but available data are often inaccessible, incomplete, or out of date. GEOSS plans a global Earth Observation System and, within this framework, the e-SOTER project addresses the felt need for a global soil and terrain database. As the European contribution to a Global Soil Observing System, it will deliver a web-based regional pilot platform with data, methodology, and applications, using remote sensing to validate, augment and extend existing data.
Technical barriers that have to be overcome include: quantitative mapping of landforms; soil parent material and soil attribute characterization and pattern recognition by remote sensing; standardization of methods and measures of soil attributes to convert legacy data. Two major research thrusts involve: 1) improvement of the current SOTER methodology at scale 1:1 million in four windows in Europe, China and Morocco. Moderate-resolution optical remote sensing will be combined existing parent material/geology and soil information, making use of advanced statistical procedures; 2) within 1:250 000-scale pilot areas, advanced remote sensing applications will be developed - geomorphic landscape analysis, geological re-classified remote sensing, and remote sensing of soil attributes.
Advances beyond the state of the art include: transformation of pre-existing data and addition of new information with remote sensing and DEM; interpretations of the e-SOTER database that address threats defined in the EU Soil Thematic Strategy and comparing the results with current assessments; and delivery through a web service of a data portal.
e-SOTER will deliver a Pilot Platform and a portal that provides open access to: 1) a methodology to create 1:1 million-scale SOTER databases, and an enhanced soil and terrain database at scale 1:1 million for the four windows; 2) an artifact-free 90m digital elevation model; 3) methodologies to create 1:250 000-scale enhanced SOTER databases, and the databases themselves for four pilots; 4) advanced remote sensing techniques to obtain soil attribute data; 5) validation and uncertainty propagation analysis; 6) dedicated applications related to major threats to soil quality and performance.

A.3 List of beneficiaries

List of Beneficiaries

Beneficiary Number	Beneficiary name	Beneficiary short name	Country	Date enter project	Date exit project
1 coordinator	International Soil Reference and Information Centre	ISRIC	NL	month 1	month 42
2	Physical Geography and Environmental Sciences - University of Miskolc	UniMis	H	month 1	month 42
3	Spatial Information in Soil and Environmental Protection - Federal Institute for Geosciences and Natural Resources	BGR	D	month 1	month 42
4	European Commission, DG JRC, IES, Land Management & Natural Hazards Unit	JRC	I	month 1	month 42
5	National Soil Resources Institute - Cranfield University	CU	UK	month 1	month 42
6	Alterra – Green World Research	Alterra	NL	month 1	month 42
7	Department of Soil Science and Agricultural Chemistry - Szent Istvan University	SIU	H	month 1	month 42
8	Scientific Landscapes	Scilands	D	month 1	month 42
9	Science du Sol - Institut National de Recherche Agronomique	INRA	F	month 1	month 42
10	Centre for Geospatial Science – University of Nottingham	UNOTT	UK	month 1	month 42
11	Czech University of Life Sciences	CULS	CZ	month 1	month 42
12	Institute of Soil Science – Chinese Academy of Sciences	ISSCAS	China	month 1	month 42
13	Ecole Nationale d’Agriculture de Meknès	ENA	Morocco	month 1	month 42
14	Laboratory for Geo-information Science and Remote Sensing – Wageningen University	WU	NL	month 1	month 42

PART B

B.1 Concept and objectives, progress beyond the state-of-the-art, S/T methodology and work plan

B.1.1 Concept and project objectives

Soil and land information is needed for policy-making, hands-on management of land resources, and monitoring of the environmental impact of development. Lack of comprehensive information about land resources - globally, nationally or locally - means uninformed policies, continuing degradation of land and water resources, unnecessary carbon emissions to the atmosphere, and no likelihood of achieving the Millennium Development Goals. The viability and cost of vital infrastructure is affected just as much as food and water security and response to environmental change. In the case of the European Soil Thematic Strategy, the operational measures laid down in the Framework Directive and Impact Assessment are hamstrung by lack of accessible, easy-to-use, consistent, harmonized and relevant soil data.

Present situation

The only harmonized global soil information is the FAO-Unesco *Soil map of the world* at scale 1:5 million (FAO-Unesco 1974-1981); for Europe, the 1986 *Soil map of the European Communities* at scale 1:1 million (CEC 1985) is supported by the *Soil geographical database for Eurasia and the Mediterranean* (Lambert *et al.* 2002). A much-improved methodology for a World Soil and Terrain database (SOTER) incorporates quantitative information on both soils and terrain (van Engelen and Wen 1995). Figure 1 depicts the present status of SOTER compilation, which includes for Eastern and Central Europe SOTER database at scale 1:2.5 million. Figure 2 illustrates the SOTER attribute data model that can contain up to 118 unique attributes of a soil and terrain unit.

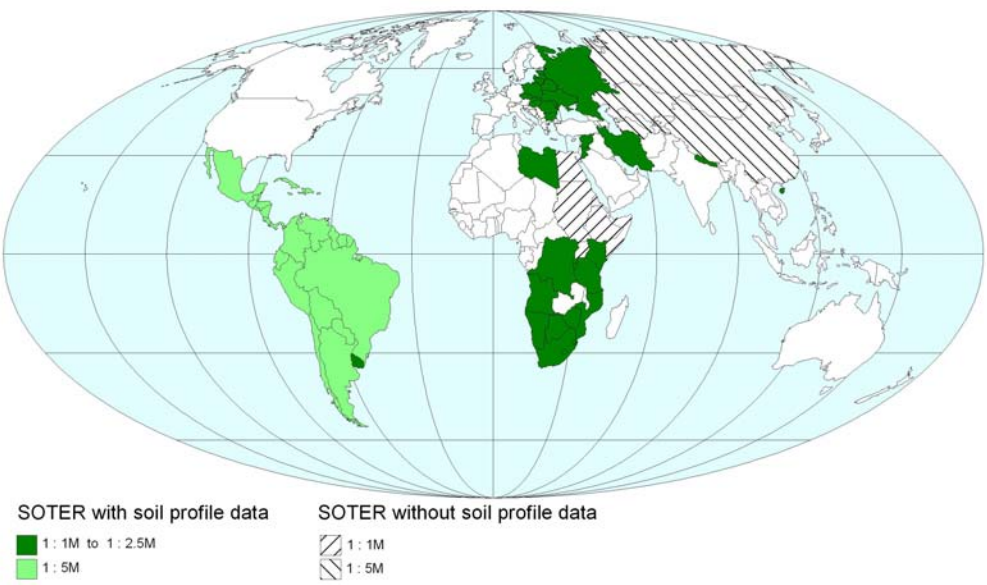

Figure 1: Status of World SOTER databases, 2007

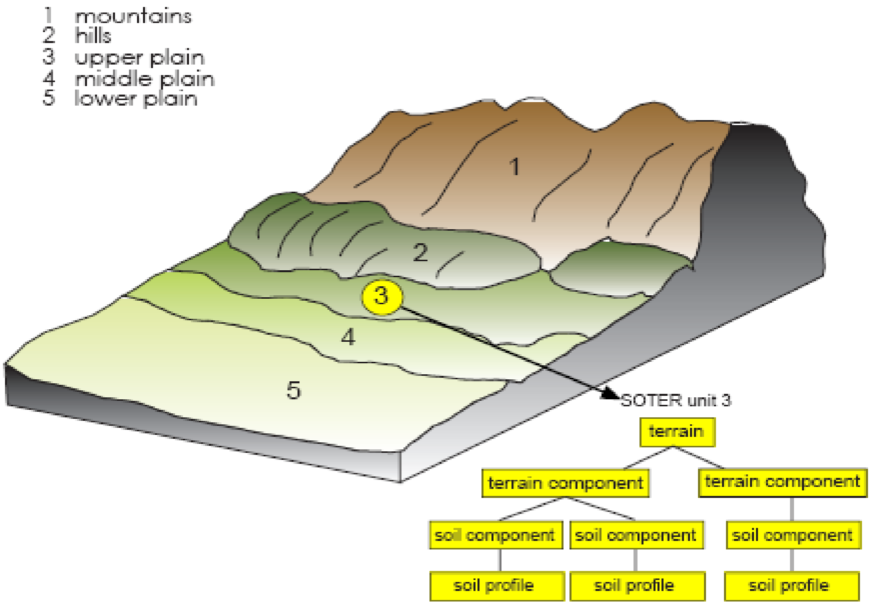

Figure 2: SOTER attribute data model

In a comprehensive soil observing system, five components may be distinguished: 1) data collection, 2) transformation, 3) data management, 4) interpretations and 5) delivery. In the current SOTER, these may be characterized as follows:

Data collection: Soil and terrain data have been collected by national organizations at various scales and using their own standards and methods. There are many data gaps, and the absence of standardization in survey techniques and in the analysis of samples has created geometric and semantic mismatches at national boundaries.

Transformation: At present, soil survey data are converted manually to a SOTER-compatible format, then generalised to the operational scale. Mismatches at national boundaries and data gaps are carried forwards into the SOTER product. Attribute data are held only for complex mapping units; a further phase of data selection and interpretation, or modeling, is necessary to generate specific attribute data for particular places, or seamless data surfaces for individual attributes.

Data management: The database is not accessible for on-line queries and cannot satisfy users' requirements for either seamless data surfaces or disaggregated attribute data.

Interpretations: Applications can be made only for limited areas and are further constrained by data gaps, lack of standardization and mismatches at national boundaries.

Delivery: The current SOTER uses a database that is only accessible off-line, not providing capabilities of on-line queries and therefore cannot satisfy the user community.

In short, the present system cannot fulfill the requirement for immediately accessible, interoperable, digital information on specific soil and terrain attributes, and global coverage is incomplete. *e-SOTER* will meet the demand by developing a combination of methods and technologies that can deliver global soil and terrain data at scale 1:1 million.

European contribution to a global soil observing system

GEOSS plans a global Earth Observation System to meet the need for land resources information, and a global soil and terrain database is identified as a component of an agricultural monitoring system (AG-07-03 in the GEO work plan for 2007-9). ISRIC, as coordinator of *e-SOTER*, has recently been added by the GEO Secretariat as a contributor on GEO Agriculture Task AG-07-03: Operational Agricultural Monitoring System. The Task supports a global soil and terrain database at the scale of 1:1,000,000.

e-SOTER (Figure 3) is proposed as the European contribution to a Global Soil Observing System, overcoming the present shortcomings of SOTER and providing a Regional Pilot Platform that can be extended worldwide, for example under the proposed Gates Foundation initiative GlobalSoilMap.net. *e-SOTER* adds value by: 1) using remotely-sensed data both to validate and correct existing survey data; 2) to generate new data surfaces; 3) improving the quality of results of applications previously based on legacy data alone; and 4) providing a freely accessible web service that delivers both selected data in an easy-to-use format and procedures to compile *e-SOTER* databases locally and upload these data to the European database if they meet prescribed quality standards.

e-SOTER makes use of detailed digital elevation models (DEMs), recent advances in remote sensing, and new analytical tools for landform analysis, parent material detection and soil pattern recognition - both to extend the legacy soil data and to build a framework for new data acquisition. Remote sensing cannot generate, in itself, the same kind of soil pattern as mapped in SOTER – for instance remote sensing is limited in the number of classes it can identify (of the order of 20 compared with the several hundred of soil associations occurring in global maps) (Clevers *et al.* 2007; Harsanyi and Chang 1994) and only a few remote-sensing techniques can penetrate deep below the ground surface - but the patterns detected by remote sensing are real and meaningful and lend invaluable support to soil survey.

The collaborative project addresses four major barriers to a comprehensive soil observing system:

- Morphometric descriptions - enabling quantitative mapping of landforms as opposed to crude slope categories. This will build upon EU- initiated DEM landform classification procedures (Dobos *et al.* 2005);
- Soil parent material characterization and pattern recognition by remote sensing - enabling separation of soil processes within the landscape;
- Soil pattern recognition by remote sensing;
- Standardization of methods and measures of soil attributes to convert legacy data already held in the European Geographical Soil Database and various national databases to a common standard - so that they may be applied, e.g. in predictive and descriptive models of soil behavior.

The project objectives that contribute to the lifting of the four major barriers described above are:

1. Morphometric descriptions of the landforms both in an enhanced SOTER DEM methodology as well in newly developed DEM analysis using natural breaks. The existing DEM that will form the basis for the morphometric analysis will be filtered and enhanced to obtain an artifact-free product. The end product will be a landform layer in the window and pilot areas, achieved in month 18 for the 1:1 M scale and in month 31 for the 1:250 000 scale.
2. Soil parent material characterization using RS and legacy data will generate a parent material classification relevant for soil development, and parent material pattern within the window and pilot areas, achieved in month 18 for the 1:1 M scale in month 31 for the 1:250 000 scale

3. Soil pattern recognition will use existing data and converting these into a standardized SOTER format. Using RS will generate additional predictors of soil properties. End products will be a soil layer in the window and pilot areas with standardized soil attributes. achieved in month 24 for the 1:1 M scale in month 31 for the 1:250 000 scale

Additional project objectives will be:
- Quality assessment of *e-SOTER*. This will be achieved by a validation and uncertainty analysis to be completed in month 40.
- Applications of the newly acquired *e-SOTER* in the field of major soil threats and comparisons with applications based on earlier datasets. To be achieved in month 40.
- Dissemination of the results of the project through stake-holder conferences (month 24 and 41) and through web-based services (month 42).

The end product will be a *regional pilot platform* with methodologies, concepts and applications that, together, will facilitate:

- An enhanced SOTER database methodology at scale 1:1 million for Europe and the world;
- Ways of generating finer-scale maps of specific soil and terrain attributes, and digital data, based on legacy soil survey data and remote sensing;
- A framework for new, cost-effective field survey and monitoring programs.

JRC and ISRIC – World Soil Information intend to service this output as web-based European and Global Soil Data Portals, respectively.

B.1.2 Progress beyond the state of the art

The Framework Program 7 calls for an operational system, which will deliver soil information that can be used directly by policy makers and managers. The *e-SOTER* research project has two major research thrusts differing in scale and methodology:

1. Improvement of the current SOTER methodology at scale 1:1 million by using moderate-resolution optical remote sensing systems to delineate *geo-botanical* units and to associate them statistically with existing parent material/geology and soil information
2. Advanced methodologies applied at scale 1:250 000 using geomorphic landscape analysis, geological re-classified remote sensing, and a remote sensing approach of soil attributes

Advances of *e-SOTER* beyond the state of the art (Figure 3) may be described under the five system components already defined:

- ***Data collection***
  e-SOTER will use legacy data on soil and terrain and, mainly, optical medium-resolution remote sensing imagery, augmented by spectrometry and gamma radiometrics.

- ***Transformation***
  Until now, the procedure has been simply to translate existing soil survey data into the SOTER format, manually creating mapping units that combine terrain and soil parent material. *e-SOTER* will transform the pre-existing data and bring new information with remote sensing interpretation and DEM analysis to enhance all three components of the SOTER database: landform, parent material and soil information:

<u>*Landform*</u>*:* At the 1:1 million scale, landform units will be derived from analysis of the Space Shuttle Topographic Mission (SRTM) 90m DEM. The morphometric analysis will elaborate the SOTER landform definitions introduced by Dobos *et al. (2005)*.

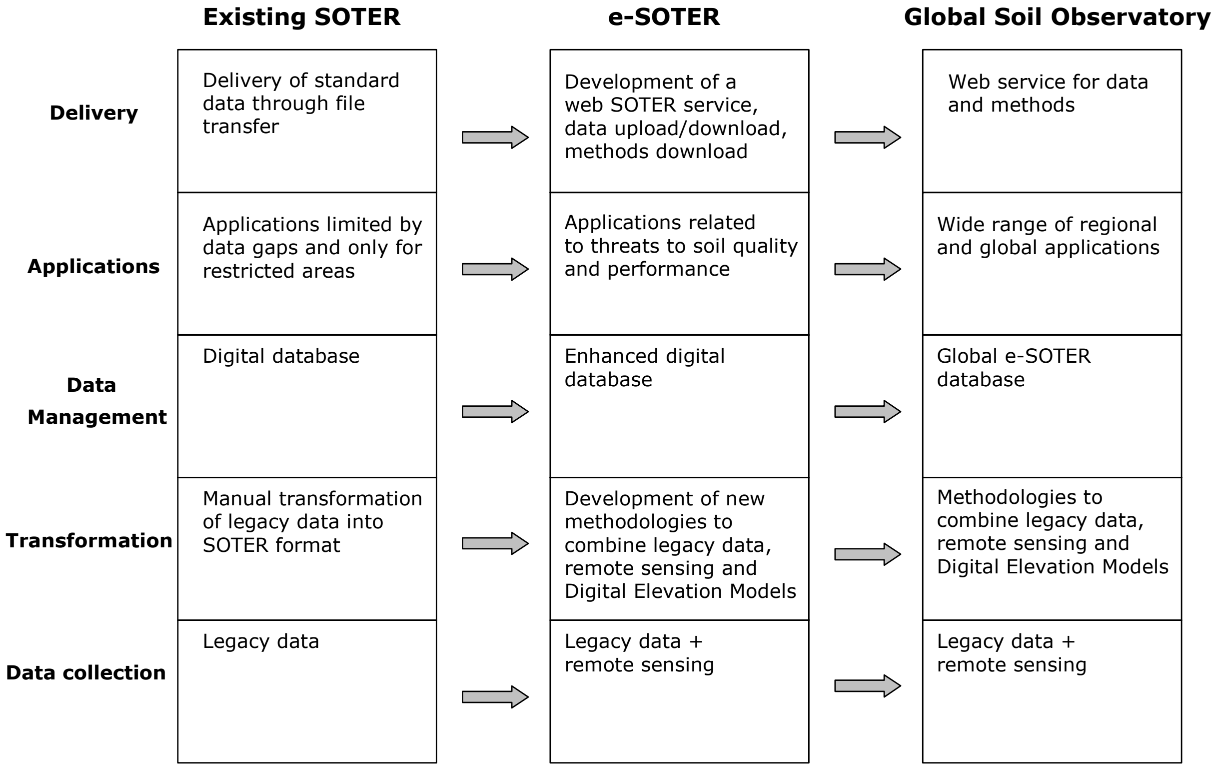

Figure 3: *e-SOTER* contribution to the Global Soil Observatory

At the 1:250 000 scale, alternative methods to derive terrain parameters will be explored, in particular the comparative advantages of applying rule-based (MacMillan *et al.* 2000) and object-based segmentation techniques to the natural continuum; and fixed definitions as opposed to flexible definitions related to individual landscapes.

<u>*Soil parent material*</u>*:* At the 1:1 million scale, delineation of parent material units will employ optical, medium-resolution satellite imagery, constrained by landform and anchored to available geological data.
At the 1:250 000 scale, soil parent material will be determined from remote sensing data.

<u>*Soil characterization*</u>*:* For soil characterization at the 1:1 million scale, research will follow a pragmatic approach: 1) spatial patterns using available, optical medium-resolution satellite data, trained with existing soil mapping; 2) attribute data using the World Reference Base taxonomic units (FAO 2006a) as carriers of information from documented to unknown sites, and harmonizing national datasets to create a common reference point.

At the 1:250 000 scale, advanced remote sensing methods like airborne radiometrics and image spectrometry, airborne medium-resolution remote sensing, and low-resolution satellite data will be used to develop predictors for soil properties using two approaches: 1) classification and regression-tree analysis, and 2) evidential reasoning.

- ***Data management***
  Data from *e-SOTER* will be stored in a database structure based on the current SOTER enhanced following FAO (2006b).

- ***Interpretations***
  e-SOTER data will be used to run models that address threats defined in the EU Soil Thematic Strategy. Comparison will be made with runs made with the existing European Soil Database (European Soil Bureau Network 2004).

- ***Delivery***
  The results of *e-SOTER* will be available through a web service of a data portal, providing the basis for a Global Soil Observatory. Linkage with the GEOSS architectural principles and interoperability arrangements will be sought.

Baseline description of the research indicators

The current status of terrain and soil information has several shortcomings which the *e-SOTER* project aims to solve. The descriptions of the baseline and the related research indicators are as follows:

- There is no operational system for deriving landform units from DEM. e-SOTER will create such a system for application at scale 1:1 M and 1:250 000.
- The existing DEM available for Europe has several shortcomings: gaps, thermal noise. The project will create an artifact-free DEM.
- Spatial information on soil parent material is incomplete: e-SOTER will derive the spatial pattern from low-resolution RS and legacy data.
- Existing soil parent material classification is incomplete and non-standardized. The project will create a classification of soil parent material relevant for soil development.
- Soil pattern information in Europe is based on the data of (national) soil survey campaigns, without standardization. The project will combine this information with RS data to improve this information both at the 1:1 M and 1:250 000 scales
- Quality assessment of existing soil and terrain information is generally poor. The project will deliver a quantitative assessment of the results.
- Interpretation of existing soil and terrain data suffers from the inherent deficiencies. The project will investigate whether use of the *e-SOTER* database will improve evaluation of soil threats compared with using existing data.
- Soil and terrain data, methodologies for their creation and interpretation are not easily accessible. *e-SOTER* plans a data dissemination portal based on INSPIRE principles.

B.1.3 S/T Methodology and associated work plan

B.1.3.1 Overall strategy of the work plan

The research will be organized in a sequence of data collection, transformation, data management, interpretations and delivery (Figure 5). Under transformation there are two parallel thrusts that differ in scale, methodology and tools:

1. Improvement of the current SOTER methodology at scale 1:1 million;
2. Developing advanced methodologies at scale 1:250 000.

Activities:

- ***Data collection:*** This is not a research activity *per se* but involves harmonisation of heterogeneous pre-existing (legacy) data, based on transfer rules developed in earlier or ongoing projects like ENVASSO (FP6), and the acquisition of up-to-date remote sensing data.

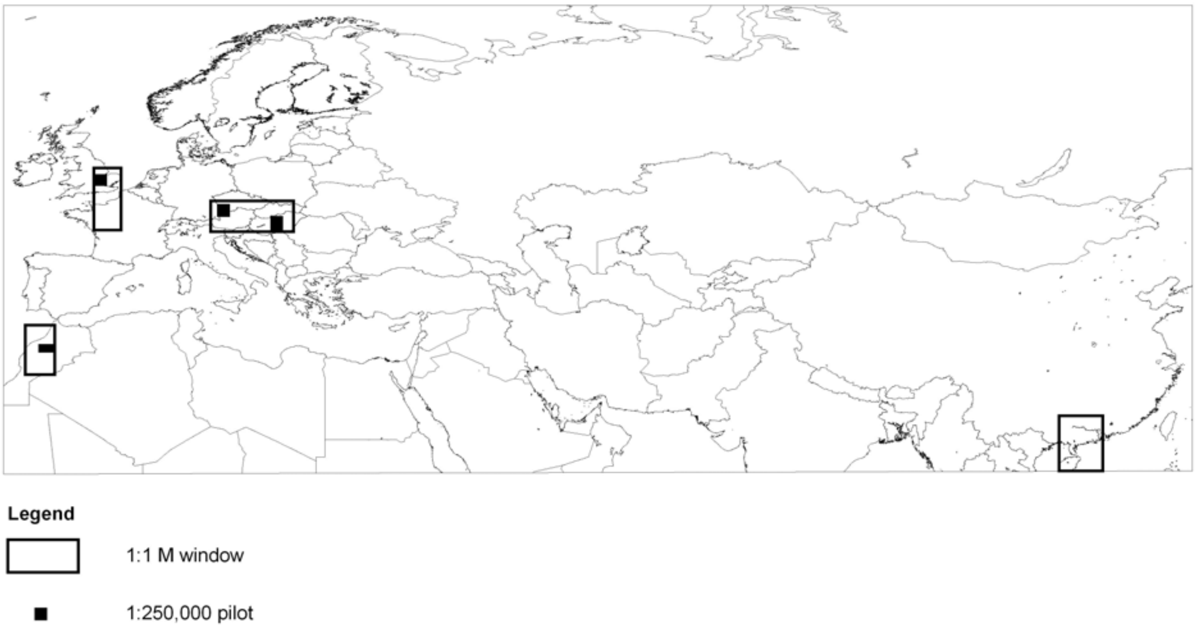

Figure 4: Location of *e-SOTER* 1:1 million windows and 1:250 000 pilots

- ***Transformation:***

  1. A combination of remote sensing and legacy data will be used to create an enhanced SOTER in four, selected windows at scale 1:1 million: two in European consortium partner countries and, also, two in International Cooperation Partner Countries – Morocco and China (Figure 4). In each window, complete SOTER coverage will be accomplished. The European windows are selected to be representative of continental landform and land cover; the Moroccan window, representing the Mediterranean environment, is supported by previous involvement of the partner in the EU-Mediterranean soil database and in regional SOTER activities; the Chinese partner has also been involved in earlier SOTER compilations and the window represents a sub-tropical environment. Both ICPC countries figure as co-chairs in GEO, offering potentials for implementing national soil observatories.

  2. All possible approaches in remote sensing will be explored to contribute to a much-enhanced view of soils. Within the already-defined windows, four pilot areas at scale 1:250 000 are selected according to the availability of advanced remote sensing imagery and substantial legacy data on parent materials and soils.

  Research under (1) will use existing soil, geological and other relevant information along with low-resolution remote sensing imagery; Work Package 1 will undertake research on landform and parent materials, and Work Package 2 on soils. Landform characterization will be based on analysis of SRTM 90 m DEM. DEMs derived from synthetic aperture radar measurements and processed by interferometry suffer from thermal noise - which will be reduced using procedures developed by Selige *et al* (2006). Land cover data will be used to correct the apparent land surface produced by the vegetation canopy. Repeating patterns of landform and individual landform elements are keys to detailed soil patterns; research will focus on recognizing and delineating them according to their shape and position. Delineation of parent material units will employ optical, medium-resolution satellite imagery (MODIS, AVHRR, SPOT and Landsat TM) constrained by landform and anchored to available geological data. Finally, generalization procedures will be developed to downscale high-resolution data to the 1:1 million scale.

Research under (2) will use data from (1) and, also, innovative approaches to obtain landform, parent material and soil information though various segmentation techniques applied to DEM for landform analysis, spectral feature enhanced multispectral image processing in combination with available lithological information from geological maps, and advanced remote sensing techniques for the assessment of soil properties. This is part of Work Package 3 and will be carried out in smaller pilot areas within the windows of Work Packages 1 and 2.

- ***Data management:*** Methods, concepts and technologies developed under Data Collection and Transformation will be validated and uncertainty propagation will be analyzed.

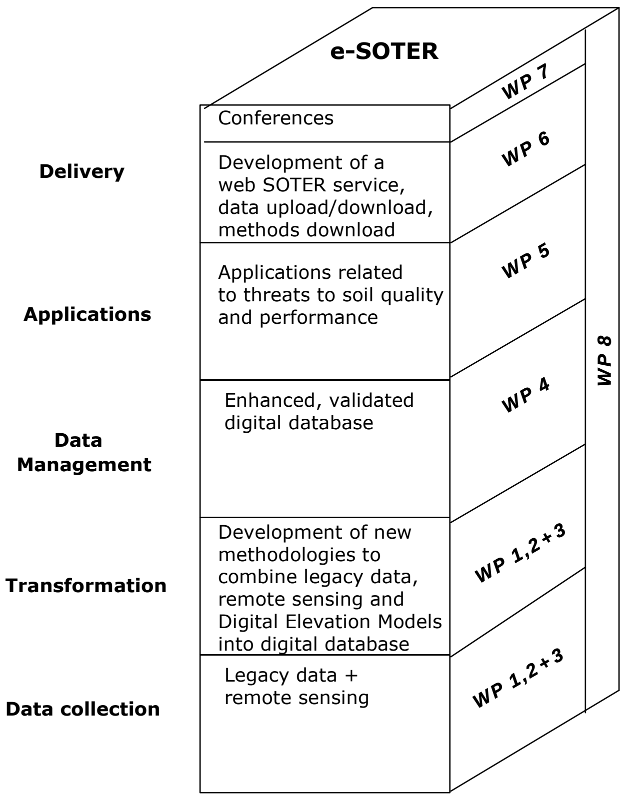

Figure 5: Sequence of activities in *e-SOTER*

- ***Interpretations:*** Various applications like soil erosion risk (Le Bissonnais *et al.* 2001) relevant to the EU Soil Thematic Strategy (Eckelmann *et al.* 2006) will be developed to demonstrate the improvement of the *e-SOTER* database relative to existing databases.

- ***Delivery:*** The regional pilot platform and all the underpinning materials developed in *e-SOTER* will be disseminated through a web service as contribution to a global soil observation system based on INSPIRE principles. Data specification and exchange rules will be based on SoTerML as an extension of GeoSciML. The new system will be launched at two stakeholder-conferences.

Identified **risks** of the project could be related to:
- Organizational problems
- ICPC partners
- Finances
- Data

The **contingency plan** assumes that organizational problems will be negligible as the consortium partners are experienced organizations with a long track record in research in the project's field of interest in joint activities or in EU related research.

The project coordinator has an established research relation on SOTER with the partners from China (ISSCAS) and Morocco (ENA). The latter has also cooperated with the European Soil Bureau Network on the soil database on the Mediterranean.

Most partners are national research institutes or higher education establishments and get their core funding from governments. The only SME in the project has a well established working relation with several federal and state organizations in Germany.

Data needed for the project are owned by public bodies and will either be available free of charge or can be purchased through sub-contracting. In case of non-delivery of these data the project can always fall back on data available at European level at JRC.

B.1.3.2 Timing of work packages and their components

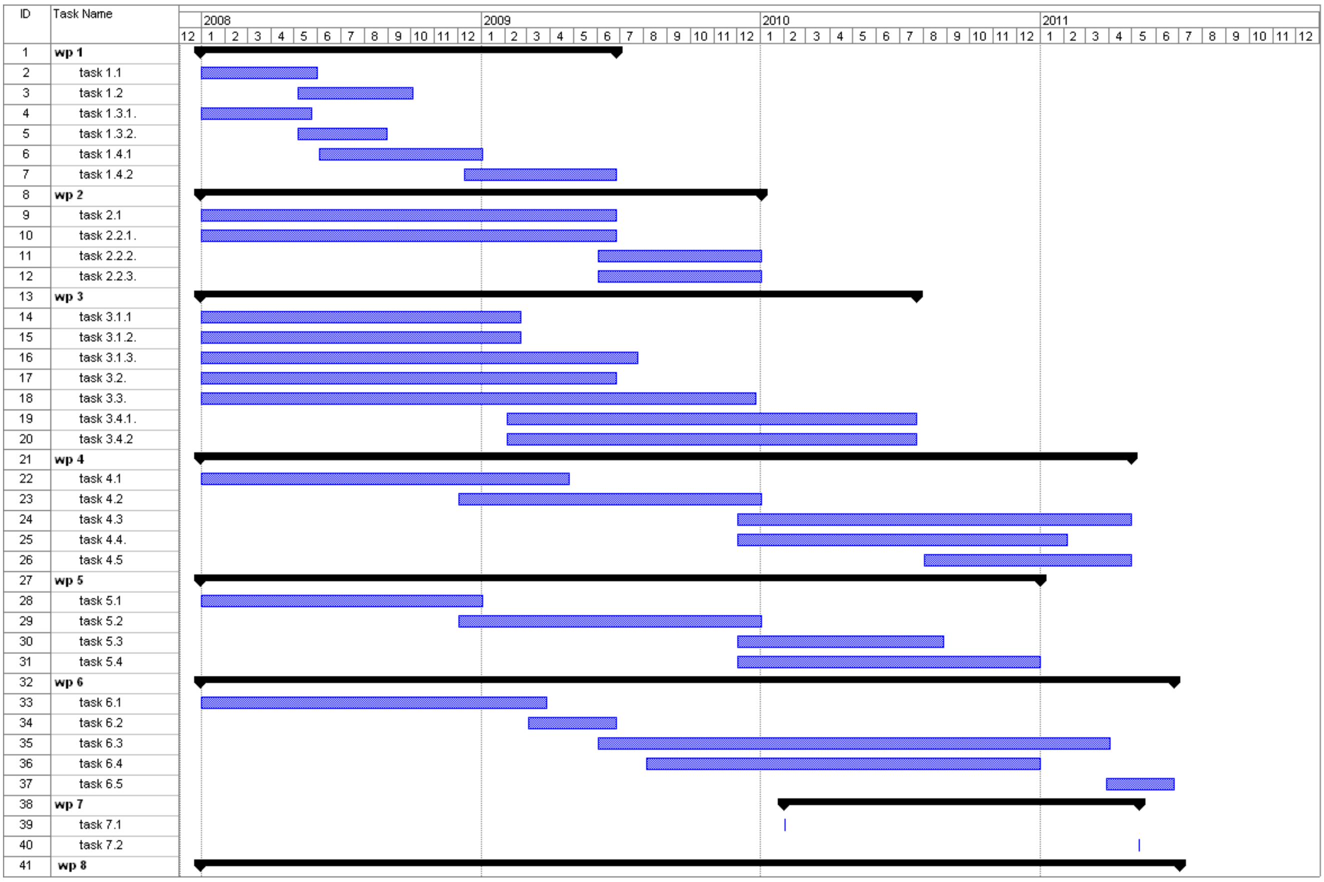

Figure 6: Detailed planning of the e-SOTER project

B.1.3.3 Work package list

Work package No	Work package title	Type of activity	Lead beneficiary No	Person-months	Start month	End month
1	Development of a landform and parent material platform methodology	RTD	2	90	1	18
2	Development of a methodology to integrate soil data from legacy and RS sources	RTD	7	102	1	24
3	Improvement of SOTER spatial and attribute data	RTD	5	94	1	31
4	Accuracy assessment of terrain and soil platforms	RTD	6	21	1	40
5	Applications	RTD	6	32	1	40
6	Development of an e-SOTER dissemination platform	RTD	4	46	1	42
7	Stakeholder conferences	OTHER	1	1	19	41
8	Project management	MGT	1	25	1	42
	TOTAL			410		

B.1.3.4 Deliverables list

Del. No.	Deliverable name	WP no.	Lead bene-ficiary	Estimated indicative person-months	Nature	Dissemi-nation level	Delivery date (proj. month)
D1	D8.1 Project website	8	1	0.5	O	PU	4
D2	Dissemination plan	8	1	1	R	CO	6
D3	D1.1 1:1 M scale SOTER geometric databases of the terrain units (landform and parent material) for the windows in Europe, Morocco and S-China	1	2	90	P	PU	18
D4	D8.2 18-monthly report on progress and finances	8	1	1	R	CO	18
D5	D2.1 SOTER soil units for the four 1:1 M scale windows with harmonized soil classification and analytical soil data	2	7	102	P	PU	24
D6	D8.2 Interim progress report	8	1	1	R	CO	24
D7	D7.1 Mid-term stakeholders conference	7	1	0.5	O	PU	25
D8	D3.1 Integrated high-resolution e-SOTER database for 1:250 000 scale pilots	3	5	94	R	PU	31
D9	D8.2 18-monthly report on progress and finances	8	1	1	R	CO	36
D10	D4.1 e-SOTER validation and accuracy assessment	4	6	21	R	PU	40
D11	D5.1 Applications of *e-SOTER* related to major threats	5	16	32	R	PU	40
D12	D7.1 Wrap-up stakeholders conference	8	1	0.5	O	PU	41
D13	D6.1 *e-SOTER* operational Web services and relational DBMS	6	4	46	P	PU	42
D14	D8.3 Final report	8	1	2	R	PU	42
			TOTAL	392			

Note: Not all person-months for Management are included in TOTAL

B.1.3.5 Work package descriptions

The *e-SOTER* project consists of a sequence of activities grouped around the five components that make up a SOTER system (Figure 5). Work Packages (WPs) 1 and 2 investigate ways to delineate and characterize soil and terrain units at a 1:1 million scale. WP3 researches new approaches to obtain SOTER databases at scale 1:250 000. WP4 validates the results of WPs 1, 2 and 3. WP5 demonstrates the improvement of the *e-SOTER* database compared with existing databases by running various interpretations relevant to the EU Soil Thematic Strategy. Dissemination of *e-SOTER* is achieved through a web service developed in WP6 and, in WP7, through stakeholder conferences. WP 8 deals with overall project management.

WP 1's objective is to develop a ***methodology for a global platform for terrain and soil parent data at a scale of 1:1 million*** and conforming to SOTER criteria. The objective of the first task **(T1.1)** is the development of an artifact-free DEM. DEMs derived from SRTM synthetic aperture radar measurements processed by interferometry suffer from *thermal noise.* This will be reduced using enhanced filter techniques developed by Selige *et al* (2006). Reflection of the radar signal by the vegetation canopy also produces a false surface; corrections will be applied using Europe-wide land cover data. The objectives of the second task **(T1.2)** will be: the morphometric characterization of landforms, based on the existing SOTER landform criteria using elevation, slope, relief intensity and dissection parameters, and further developing the digital, SRTM-based procedure of Dobos *et al* (Dobos *et al.* 2005); and the creation of landform units. The objectives of the third task are **(T1.3.1)** the determination of soil parent material within these landform units, based on low-resolution satellite imagery (AVHRR, MODIS, SPOT Vegetation) and DEM data in combination with legacy soil parent material data using a **(T1.3.2)** classification of parent materials relevant for soil development and based on the system developed by BGR (2005). The objective of the fourth task **(T1.4)** is the creation of terrain units by combining landform and soil parent material units. Research will focus on the generalization and aggregation processes and on methods of cleaning and structuring the geometric data sets for the four 1:1 million-scale windows.

(D1.1) WP 1 will deliver: a 1:1 million-scale SOTER geometric databases of the terrain units for the four windows: combining landform and parent material derived from 1) a quantitative, DEM-based algorithm for landform classification applied on a complete, artifact-free digital elevation model for Europe South of 60 degrees, for Morocco and for South China, and 2) methods to derive parent material classes and delineations using RS and legacy data and a simplified soil parent material classification relevant to soil development and performance.

WP 2 will ***integrate legacy data with new data from remote sensing.*** The first task is to generate spatial soil information for the four 1:1 million-scale windows. The second task is compilation of a harmonised soil data base for the 1:1 million-scale windows.

In **T2.1**, legacy soil data from two representative windows in Europe, one in Morocco, and one China will be used to compile soil mapping units within the WP1 terrain units. Soil patterns will be enhanced using optical, medium-resolution remote sensing imagery.

In **T2.2.1**, the SOTER soil component data structure will be revised to allow inclusion of new soil attributes. In **T2.2.2**, soil attribute data derived from existing national (and some international) databases will be translated into defined standards before importation into the *e-SOTER* database. Translation algorithms will be developed, based on the results of the ongoing FP6 ENVASSO project; where applicable, pedotransfer rules will be used to generate missing information from available parameters. Subcontracting national organizations for the delivery of such relevant data in the needed format and structure will be necessary. In **T2.2.3**, algorithms developed in T2.2.2 will be used to will the soil attribute database.

WP 2 will deliver: **(D2.1)** a complete coverage of the SOTER soil units for the four 1:1 million-scale windows with harmonized soil classification and analytical soil data in a revised SOTER soil component data structure.

WP 3 will ***improve the SOTER spatial and attribute data.*** This involves: landform classification, soil parent material and soil attribute data. The working scale will be 1:250 000.

The first task **(T3.1)** will reform analysis of DEM data by using natural breaks. Two approaches will be investigated: **T3.1.1** will use hierarchical classification of landform types (MacMillan *et al.* 2000) through a combination of dendogram analysis and area statistics, followed by a more detailed subdivision based on classification of landform elements using slope-break analysis. **T3.1.2** will use the bottom-up approach of identifying natural breaks using local self-adjusting thresholds and up-scaling. T3.1.1 and T3.1.2 will finally create independent landform datasets.

The second task **(T3.2)** will derive parent materials by using feature-enhanced, multispectral image processing to MODIS and Landsat-TM data - with edge and texture filtering and visual interpretation, making use of geological maps. There will be a link with the global 1:1 million geological mapping program. Especially in the non-European windows, spectral-mixture modelling will be applied to landscape-unit analysis in combination with DEM variables. The landscape will be divided according to lithology and vegetation. Then parent material classes will be further analyzed following input from T1.3.

The third task **(T3.3)** is to develop Europe-wide additional predictors of soil properties at various spatial, spectral and temporal scales. The multi-scale approach will have two baselines and a collaborative component: **T3.3.1** will focus on classification and regression-tree analysis using ancillary data to predict refined attribute classes of e-SOTER; **T3.3.2** will use evidential reasoning to either constrain or assimilate ancillary remote sensing data at European scale. The combination of constraint, regression and assimilation analysis involves a risk of over-fitting which may cause uncertainty. Therefore, in **T3.3.3,** an expert panel will evaluate variable and parameter dependencies that may affect spatial and attribute outputs for e-SOTER.

The first component will compile attribute data previously not used to constrain e-SOTER attributes (e.g. advanced land use/cover products, partly from the FP6 ECOCHANGE project), productivity and vegetative change including phenology indicators, the Soil Water Index (SWI) being a measure of the profile soil moisture content obtained by filtering the surface soil moisture time series with an exponential function, and the relation between soil groups to MODIS-derived surface albedo). These data will be used in a classification and regression-tree (CART) analysis.

The second component will use the same data refine the derivation of e-SOTER attributes spatially.

The last component will assess potential contradictions in the derived data, and specify the required additional information, complementary to WP1 and WP2 outputs. This will require field survey data from the pilot areas. An iterative feedback loop to WP4 is established in this task.

The fourth task **(T3.4)** will integrate the products of the first 3 tasks of this WP for the 4 pilot windows resulting in 1:250 000 enhanced SOTER databases that will be evaluated by local experts.

WP 3 will deliver **(D3.1)** an integrated high-resolution e-SOTER database for 1:250 000 scale pilots.

WP 4's objective is ***validation and uncertainty analysis*** by comparing the *e-SOTER* output with independent validation data for both 1:1 million-scale windows in Europe and for two 1:250 000-scale pilot areas. The first task **(T4.1)** is to design a validation strategy based on statistical sampling and inference methods. Basic design principles include precise definition of the objective, specification of the quality measure (width of confidence intervals, accuracy of bias estimate, power in hypothesis testing), inventory of constraints and prior information, assessment of anticipated operational costs and set-up of a detailed field and lab protocol. The validation strategy must be able to incorporate various types of existing data. The second task **(T4.2)** is to collect independent validation data for both 1:1 million-scale test windows in Europe and for two of the four 1:250 000-scale pilots using the generic sampling design procedure worked out in T4.1. The third task **(T4.3)** will compare the e-SOTER data with the independent validation data. A comparison will be made between the accuracy obtained with products of WP1/2 with that of WP3. The fourth task **(T4.4)** is to identify those input data that have large uncertainties and for which the SOTER methodologies are sensitive. The uncertainty in these inputs is assessed and quantified by probability distribution functions. The assessment is done by identifying the sources of uncertainty and consulting e.g. instrument precision specifications, GIS meta-information on data-quality, replication measurements, expert elicitation, purity indices for large and small-scale soil maps, quantified spatial interpolation errors. The input uncertainty assessment must also consider cross-correlations and spatial autocorrelation. The fifth task **(T4.5)** is to analyse uncertainty propagation by applying Monte Carlo simulation for selected test windows (minimum two). The contribution of individual uncertain inputs to the final uncertainty is also assessed, thus identifying the weakest links in the SOTER modeling chain. The propagated uncertainty in the SOTER products is also compared to the uncertainty that resulted from the validation analysis (Task 4.3), thus providing insight to the contribution of model structural and parameter errors.

WP 4 will deliver: **(D4.1)** a validation strategy and accuracy assessment of e-SOTER products at scale 1:1 M and 1:250 000.

WP 5's objectives are ***applications of the e-SOTER database***. It will investigate whether use of the *e-SOTER* database will improve evaluation of threats to soil quality and performance compared with using data from previous soil maps and databases. The examples will focus on threats identified by the EU Soil Thematic Strategy: erosion, compaction, flooding, landslides, loss of organic matter, salinization and sealing. Appropriate models that can measure the threats at the relevant scales will be selected, and run with *e-SOTER* data and any additional data required. The objective of the first task **(T5.1)** is the identification of the most important threat to soil quality and performance in each window area. In the second **(T5.2)** data for the models will be collected. The third **(T5.3)** will compare threats assessment based on *e-SOTER* and on pre-existing data sources considering both spatial patterns and at statistical trends. The fourth task **(T5.4)** will make a comparison between existing data on threats and the results obtained from the 1:1 million and 1:250 000-scale windows by running models for the most important threats determined in T5.1.

WP 5 will deliver: **(D5.1)** applications of *e-SOTER* related to major threats in three 1:1 million-scale windows (W-Europe, C-Europe and Morocco) and two 1:250 000-scale pilot areas (D/CZ and Morocco) and a comparison with existing data on threats.

WP 6's objective is ***development of an e-SOTER dissemination platform***. It will develop a data dissemination portal for *e-SOTER* based on INSPIRE principles. Links with existing or emerging international soil platforms will be explored. Research in the first task **(T6.1)** will focus on the analysis of data specification and exchange rules (XML) and will prepare the SoTerML, closely linked with GeoSciML. The second task **(T6.2)** will be profile and analytical data management. The third task **(T6.3)** will be to create a global/European *e-SOTER* Portal, including RDBMS structures, algorithm database and data dissemination services. Underpinning the system is a spatially-enabled relational database management system (RDBMS) which will hold and manipulate the variety of data types, scales and sources required by *e-SOTER*. The fourth task **(T6.4)** is research on implementation on different algorithms applied on *e-SOTER*. The final task **(T6.5)** will be to publish the gathered products in various formats.

WP6 will deliver **(D6.1)** *e-SOTER* operational Web services and relational DBMS including an algorithm database containing methods developed in WP1-6.

WP 7's objective is ***stakeholder conferences***, presenting the results of the finalized Work Packages at the conclusion of WP1, 2 and 3, and at the end of the project. The conferences will enable dialogue between project team members and user groups from:

- GEOSS group:
  - data management (Task DA-06-01: GEOSS Data Sharing Principles)
  - interoperability
  - capacity building (Task CB-07-01d: Building National and Regional Capacity)
  - agriculture (Task AG-07-03: Operational Agricultural Monitoring System)
- Global soil platforms (existing and emerging):
  - GlobalSoilMap initiative (CIESIN, Earth Institute Columbia University, NRCS-USDA, CSIRO, CGIAR, JRC, ISRIC)
  - FAO
  - UNEP, GRID
- Soil and natural resources institutes of EU member countries, Mediterranean and Near East countries not represented in the *e-SOTER* Consortium.

The presented *e-SOTER* results and planned products will be assessed by the conference participants. Suggested modifications will be considered for implementation in the application and dissemination WPs.

WP 7 will deliver **(D7.1)**: 2 conferences (mid-term and wrap-up).

WP 8 will be the ***project management***, ensuring effective delivery of the project, on time and within budget, by transparent and accountable procedures. Oversight is vested in a Steering Committee comprising representatives of the partners and meeting annually. Day-to-day management is the responsibility of the Executive Board consisting of the 8 work package coordinators.

WP 8 will deliver: **(D8.1)** project website on project results, regularly updated throughout the project duration; **(D8.2)** 18-monthly reports on progress and finances; **(D8.3)** final report. The final report will include the plan for the use and dissemination of foreground and a report on awareness and wider societal implications.
Short management reports will be produced every 6 months within the 18-months reporting cycle.

WP no.	**1**	**Start date or starting event: month 1**											
Title	**Development of a landform and parent material platform methodology**												
Activity type	**RTD**												
Participant number	**2**	1	3	4	5	7	8	9	12	13			
Person-months per participant	39	6	7	5	1	4	9	10	7	2			

Objectives

Development of a quantitative methodology to delineate SOTER terrain units (landform and soil parent material) using digital data sources like satellite imagery and digital terrain models in combination with legacy data. To be validated in WP4

Description of work

Task 1.1: To develop a complete, artifact-cleaned digital elevation model based on available DEM data

Partners involved: 4, 8

Activities:

- Development of a complete, artifact-removed digital elevation model based on available DEM data
- The algorithm generated in this WP will be stored in the Algorithm DB of WP6 and executed for the region

Task 1.2: Landform classification according to the SOTER criteria and the development of terrain units

Partners involved: 2, 3, 4, 9

Activities:

- Research and refinement, focused on the applicability of the Dobos-Daroussin procedure to translate the SOTER landform classification theory into a digital, SRTM–based procedure
- Procedure to generalise high-resolution data to the 1:1 M scale

Task 1.3: Delineation of soil parent material units

Partners involved: 2, 3, 4, 5, 7, 12, 13

Activities:

- Assessment of data sources (to include gamma-radiometrics, thermal remote sensing and radar imagery)
- Definition of parent material classes relevant to the soil development and soil attributes
- Development of methods to estimate and predict spatial variation of soil parent

materials
- Harmonization of parent material information within the 1:1 M windows
- Gap-filling, testing methods (based on RS and legacy data from quaternary geological information) and training data of different origin and type to derive parent material classes

Task 1.4: Combination of landform and soil parent material units into terrain units

Partners involved: 1, 2, 4, 9

Activities:
- To combine the landform and soil parent material units into terrain units
- To develop a method for cleaning and structuring the geometric datasets

Deliverables

D1.1	A 1:1 million-scale SOTER geometric databases of the terrain units for the four windows: combining landform and parent material derived from 1) a quantitative, DEM-based algorithm for landform classification applied on a complete, artifact-free digital elevation model for Europe South of 60 degrees, for Morocco and for South China, and 2) methods to derive parent material classes and delineations using RS and legacy data and a simplified soil parent material classification relevant to soil development and performance.	Month 18

WP no.	2	Start date or starting event: month 1											
WP title	**Development of a methodology to integrate soil data from legacy and RS sources**												
Activity type	**RTD**												
Participant number	**7**	1	2	3	4	5	9	11	12	13			
Person-months per participant	36	6	14	3	5	1	1	5	24	8			

Objectives

Delineation and characterization of the soil attribute information of SOTER terrain units of WP1 using legacy soil data and remote sensing in four windows (two in Europe, one in Morocco and one China). To be validated in WP4.

Description of work

Task 2.1: Generating spatial soil information for the 1:1 million-scale windows

Partners involved: 1, 2, 3, 4, 5, 7, 9, 11, 12, 13

Activities: Definition and collection of the primary soil variables for the soil characterization based on the SOTER data requirement (defined in the SOTER soil data structure, see later), availability of soil data, and availability of pedotransfer rules for missing or difficult to derive soil data

- Collection of the available soil information of appropriate scale and format for the four windows
- Application of pedotransfer rules for missing or hard-to-derive soils
- Harmonization of data of various origins within the pilot window and the development of a training dataset for the selected soil and parent material variables
- Development of a RS dataset representing the spatial variability of soil variables in question at scale 1:1 M scale
- Selection and development of digital soil mapping tools to derive primary soil attribute layers
- Development of the secondary (derived) soil property layers using pedotransfer rules and the primary soil dataset
- Overlay the soil property data layers with the SOTER Units developed in WP1

Task 2.2: Compilation of the soil data base for the 1:1M-scale windows

Partners involved: 1, 2, 3, 4, 5, 7, 9, 11, 12, 13

Activities:

- Development of the soil component data structure - updating and improving the current SOTER soil component data structure according to and harmonized by recent standards, and assigning the available data. Terms, definitions and coding of soil profile and horizon descriptions will follow the FAO *Guidelines for Soil description* (2006), the *World Reference Base for soil resources* (2006)
- Collection and import of soil information with appropriate scale and format for the

four pilot windows. Data sources: geo-referenced profiles from international projects and data bases (Spade, BioSol) and relevant national databases • Development of methods to translate and harmonize archived soil information to SOTER terminology and to generating missing soil information

Deliverables

D2.1	A complete coverage of the SOTER soil units for the four 1:1 million-scale windows with harmonized soil classification and analytical soil data in a revised SOTER soil component data structure.	Month 24

WP no.	3	Start date or starting event: month 1											
Title	**Improvement of SOTER spatial and attribute data**												
Activity type	**RTD**												
Participant number	**5**	2	3	4	7	8	11	13	14				
Person-months per participant	21	8	12	9	2	15	5	3	19				

Objectives

To investigate new technologies to derive digital equivalents of SOTER units

Description of work

Task 3.1: Research on improved analysis of DEM data using natural breaks

Partners involved: 5, 8, 11

Activities:

3.1.1 Activities (top-down approach):
- Hierarchical classification of higher landform types through a combination of dendogram analysis and area statistics;
- Classification of landform elements using slope-break analysis.

3.1.2 Activities (bottom-up approach):
- development of new and enhanced morphometric terrain parameters;
- development advanced classification methods;
- development of a generalization procedure for up-scaling.

3.1.3 Activities
- Creation of scale independent landform classification parameter datasets

Task 3.2: Research on remote sensing analysis for soil parent materials

Partners involved: 3, 4, 5, 11

Activities:
- Interpretation and derivation of parent material classes following (if necessary, refining) the nomenclature developed in WP1. Starting from stratigraphic mapping units, regional lithological properties (texture, mineralogy) are compiled by expert judgment;
- Identification of lithological units using RS and re-classified digital geological information for mapping soil landscapes;
- Use of RS for the further refinement of better defined lithological strata (compared to WP1) providing, if possibly, some information on key mineralogical features;
- Classifying parent material from geological map units (requires knowledge of periglacial processes

Task 3.3: Research on remote sensing for soil attribute data

Partners involved: 14, 4, 5, 8

Activities:

- 3.3.1 Compilation of attribute data to be used in a classification and regression tree analysis. Evaluation of the predictive capability of the attribute data used.
- 3.3.2 Refinement of the above attribute data supporting the derivation of e-SOTER attributes spatially using evidential reasoning.
- 3.3.3 Evaluation panel activities deciding on dependent and independent variables to be used. Coordination partner 14.

Task 3.4 Integration

Partners involved: 2, 3, 5, 7, 13

Activities:

- Integration of geomorphic terrain units, parent material and semantic soil information for each pilot area;
- Evaluation by local experts.

Deliverables

D3.1	Integrated high-resolution e-SOTER database for 1:250 000 scale pilots	Month 31

WP no.	**4**	**Start date or starting event: month 1**											
Title	**Accuracy Assessment of Terrain and Soil Platforms**												
Activity type	**RTD**												
Participant number	**6**	3	5	11									
Person-months per participant	13	1	2	5									

Objectives

1. To assess and quantify the accuracy of the results of the new platforms by comparison of the resulting maps of Work Packages 1 to 3 with independent validation data
2. To identify the weak links in the e-SOTER modeling chain using Monte Carlo uncertainty propagation methods

Description of work

Task 4.1: Design of validation strategy

Partners involved: 6, 11

Activities:

- Development of a generic procedure to derive the optimal validation sampling design and inference method for varying cases of target universe, target variable, statistical power, confidence interval width, sampling costs, measurement error and level of prior information
- Development of a sampling design and statistical inference method for the case where existing data on the target variable are obtained with convenience and purposive sampling
- Design of a validation strategy that can incorporate both *hard* and *soft* validation data
- Design of generic field protocol for data collection and analysis

Task 4.2: Collection of independent validation data

Partners involved: 3, 5, 6, 11

Activities:

- Inventory of existing independent validation data for the UK and D/CZ 1:250 000 test windows, to be stored in a common database
- Application of the generic sampling design procedure to validation test windows, yielding tailored sampling design strategies
- Planning of fieldwork and laboratory analysis for test windows, including detailed field protocol
- Fieldwork and laboratory analysis for test windows, store results and meta-data in database

Task 4.3: Validation of SOTER outputs for test windows

Partner involved: 6

Activities:
- Obtain relevant data from both the 1:250 000 and 1:1 M *e-SOTER* outputs for the validation test windows in UK and D/CZ and store in validation database
- Apply appropriate statistical inference method to compare *e-SOTER* output with validation data; compute validation measures (e.g. bias, root mean squared error, coefficient of determination, confusion matrices, kappa statistics), taking account of the uncertainty in the validation data
- Compare validation results for *e-SOTER* methods at 1:250 000 and 1:1 M to determine whether the higher resolution *e-SOTER* methodology yields a significantly more accurate representation of reality

Task 4.4: Quantification of uncertainty about the SOTER inputs

Partners involved: 3, 5, 6, 11

Activities:
- Identification of a limited number of *e-SOTER* inputs to be treated as main sources of uncertainty in *e-SOTER* methodology for both test windows
- Quantification of input uncertainties for selected test windows, yielding multi-point probability distribution functions (pdfs) that can be cross- and auto correlated
- Store pdfs of uncertain input variables in the Data Uncertainty Engine

Task 4.5: Application of uncertainty propagation analysis

Partner involved: 6

Activities:
- Generate possible realities of uncertain *e-SOTER* inputs with the Data Uncertainty Engine
- Use Monte Carlo simulation to analyse how uncertainties in the SOTER methodology propagate (using simple random sampling or Latin hypercube sampling)
- Assess contribution of uncertain inputs to *e-SOTER* output uncertainty using regression-based and other methods
- Compare uncertainty propagation results with validation results and, for selected test windows, identify the weakest links in the *e-SOTER* modelling chain

Deliverables

D4.1	Validation strategy and accuracy assessment of *e-SOTER* products at scale 1:1 M and 1:250 000	Month 40

WP no.	**5**	**Start date or starting event: month 1**											
Title	**Applications**												
Activity type	**RTD**												
Participant number	**6**	3	4	9	11	13							
Person-months per participant	10	3	8	3	3	5							

Objectives

Demonstration of the applications of *e-SOTER* and assessment of improvements in the evaluation of threats to soil quality and performance compared with usage of pre-existing data. The results at scales of 1:1 M and 1: 250 000 will also be compared. The examples will focus on threats identified by the EU Soil Thematic Strategy. Specific objectives:

1. To provide examples of how *e-SOTER* can be used to evaluate threats to soils
2. To evaluate whether *e-SOTER* performs better than previous soil maps and databases
3. To evaluate optimum scale for *e-SOTER* applications

Description of work

Task 5.1: Identifying the major threat in each pilot area

Partners involved: 3, 6, 9, 11, 13

Activities:

- Identify the most important threat to soil quality and performance
- Determine how to evaluate these threats using SOTER
- Determine which data are needed for such evaluation, which will depend on the threat and method in question

Task 5.2: Assembly of data for model input and for evaluation of results

Partners involved: 3, 6, 9, 11, 13

Activities:

- Assemble data needed to run models selected in task 1. Many of these data have been collected in WP2
- Assemble independent data about the status of the most important threats in the windows and pilot areas - to evaluate results of SOTER-based assessment

Task 5.3: Compare threats assessment based on *e-SOTER* and pre-existing data sources

Partners involved: 4, 6, 9

Activities:

- Run models for the most important threat in the windows at scale 1:1 M in W-Europe, C-Europe and Morocco

- Compare results with existing data on threats, looking both at spatial patterns and at statistical trends
- Compare results of using pre-existing soil maps / databases and *e-SOTER*

Task 5.4: Comparison of different scales of SOTER

Partners involved: 4, 6, 9

Activities:

- Run models for the most important threat in 2 pilot areas, at scale 1:250 000
- Compare results with assessment using pre-existing data and with assessment using with SOTER at scale 1:1M

Deliverables

D5.1	Applications of *e-SOTER* related to major threats in three 1:1 million-scale windows (W-Europe, C-Europe and Morocco) and two 1:250 000-scale pilot areas (D/CZ and Morocco) and a comparison with existing data on threats	Month 40

WP no.	**6**	**Start date or starting event: month 1**											
Title	**Development of an e-SOTER dissemination platform**												
Activity type	**RTD**												
Participant number	**4**	1	3	5	10								
Person-months per participant	13	2	10	12	9								

Objectives

Development and operation of a data portal for the *e-SOTER* products - as a contribution to a global soil observation system

Description of work

Task 6.1: Analysis of data specification and exchange rules (XML) and development of concept rules for SoTerML (OGC)

Partners involved: 3, 4, 5, 10

Activities:
- Preparation of the SoTerML, including data dictionary for nomenclatures and various data sources (metadata)
- Development of WRB 2006 XML exchange format
- Development of a SoTerML, as an extension of GeoSciML, for SOTER model compliant with ISO/TC190/SC 1 N140 *Recording and Exchange of Soil-Related Data*

Task 6.2: Soil profile and analytical data management (Global Pedon Database; semantic map data base)

Partners involved: 1, 3, 4, 5

Activities:
- Transfer pre-existing and new soil data into a relational database
- Flag soil data with their respective level of uncertainty

Task 6.3: Development, setup and implementation of a global/ European *e-SOTER* portal

Partners involved: 1, 3, 4, 5

Activities:
- Creation of a global/European *e-SOTER* Portal, including RDBMS structures, algorithm database and data dissemination services
- Testing of methods for data dissemination to global *e-SOTER*

Task 6.4: Transfer of methods developed by WP1-3 into Algorithm Database and Incorporation into *e-SOTER* Portal

Partners involved: 3, 4, 5

Activities:
- Research on implementation of different algorithms into *e-SOTER*

Task 6.5: Publication of European Dataset as DVD or Publication as a EUR-Report

Partner involved: 4

Activities:
- Assembly of information gathered by other WPs, creation of User Interface

Deliverables

D6.1	Freely accessible *e-SOTER* operational Web services and relational DBMS including an algorithm database containing methods developed in WP1-6	Month 40

WP no.	**7**	**Start date or starting event: month 19**											
Title	**Stakeholder conferences**												
Activity type	**Other**												
Participant number	**1**												
Person-months per participant	1												

Objectives

To communicate and share views and opinions on the project and its outcomes with scientific and user groups

Description of work

General tasks of conferences:
Present results of the WP's finalized
Dialogue between project teams and user groups: related EU projects/programs, policy makers, SMEs; recommendations and follow-up

Specific tasks
Conference 1: Prepare and host conference presenting outcomes of WPs 1 and 2

Conference 2: Prepare and host conference launching the data portals and handing over project outcomes

Partner involved: 1

Activities:
- Plenary and parallel sessions
- Publicity: covering key moments of the Conference
- Regular meeting of Executive Board
- Support activities: secretariat, logistics

Deliverables

D7.1 Mid-term and wrap-up conferences	Month 25 and 41

WP no.	8	Start date or starting event: month 1												
Title	**Project management**													
Activity type	**Management**													
Participant number	**1**	2	3	4	5	6	7	8	9	10	11	12	13	14
Person-months per participant	19	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4

Objectives

Effective project deliver, on time and within budget, by transparent and accountable procedures

Description of work

Task 1: Management and coordination of all activities within the project
Oversight is vested in a General Assembly comprising representatives of the partners, meeting at least annually. Day-to-day management is the responsibility of the Executive Board, reporting to the General Assembly

Activities:
- Programming
- Coordination of the management structure
- Planning
- Budgeting
- Decision making
- Leadership
- Conflict management
- Reporting to EU
- Dissemination plan

Task 2: Administration, reporting and liaison with the EU, in compliance with EU procedures.

Activities:
- Project website
- Financial accounts
- Reporting on progress and finances: short (every 6 months) interim (every 18 months) and final (accounts will be maintained by Wageningen University and Research Centre and independently audited)

Deliverables

D8.1	Project website on project results	Month 4
D8.2	Dissemination plan	Month 6
D8.3	18-monthly reports on progress and finances	Month 18 and 36
D8.4	Final report	Month 42

B.1.3.6 Efforts for the full duration of the project

Table 1. Indicative efforts per beneficiary per WP

Project number (acronym): 211578 (e-SOTER)

Work package	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	TOTAL per Beneficiary
ISRIC	6	6	-	-	-	2	1	19.4	34
UniMis	39	14	8	-	-	-	-	0.4	61
BGR	7	2.5	12	1	3	10	-	0.4	36
JRC	5	5	9	-	8	13	-	0.4	40
CU	1	1	21	2	-	12	-	0.4	37
Alterra	-	-	-	13	10	-	-	0.4	23
SIU	4	36	2	-	-	-	-	0.4	42
Scilands	9	-	15	-	-	-	-	0.4	24
INRA	10	1	-	-	3	-	-	0.4	14
UNOTT	-	-	-	-	-	9	-	0.4	9
CULS	-	5	5	5	3	-	-	0.4	18
ISSCAS	7	24	-	-	-	-	-	0.4	31
ENA	2	8	3	-	5	-	-	0.4	18
WU	-	-	19	-	-	-	-	0.4	19

Table 2. Indicative efforts per activity type per beneficiary

Project number (acronym): 211578 (e-SOTER)

Activity Type	ISRIC	UniMis	BGR	JRC	CU	Alterra	SIU	Sci lands	INRA	UNOT T	CULS	ISS CAS	ENA	WU	Total of Activities
RTD/Innovation activities															
WP1	6	39	7	5	1	-	4	9	10	-	-	7	2	-	90
WP2	6	14	2.5	5	1	-	36	-	1	-	5	24	8	-	102
WP3	-	8	12	9	21	-	2	15	-	-	5	-	3	19	94
WP4	-	-	1	-	2	13	-	-	-	-	5	-	-	-	21
WP5	-	-	3	8	-	10	-	-	3	-	3	-	5	-	32
WP6	2	-	10	13	12	-	-	-	-	9	-	-	-	-	46
Total ‘research’	14	61	36	40	35	23	4	15	14	9	18	31	18	19	385
Total ‘demonstration’	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Consortium management activities															
WP8															
Total ‘management’	19.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	24
Other activities															
WP7	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Total ‘other’	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
TOTAL BENFICIAIRIES	34	61	36	40	37	23	42	24	14	9	18	31	18	19	410

B.1.3.7 List of milestones and planning of reviews

The deliverables of WPs 1, 2 and 3 are essential for the project as they mark the transition between (1) the Data Collection and Transformation phase and (2) the Data Management, Application and Delivery phase of the project. It marks the completion of the *e-SOTER* spatial database. The output of WP 1 and 2 - the 1:1 million-scale SOTER databases of the windows - and of WP3 – the pilot studies at scale 1:250 000 – should provide the data input to WP 4, 5 and 6. Although the latter WPs need these results, they can already start their research earlier on tasks that do not depend on the deliverables from the phase 1, for example: identifying the threats, design of the applications, independent validation data, design of web services, etc.

The deliverables of WPs 1, 2 and 3, D3, D5 and D8 respectively, are three milestones, while the deliverable of WP6 (D13) forms the last milestone.

Reviews are planned parallel to reporting periods: months 18, 36 and 42. Although dates of milestones 2 and 3 do not coincide with the review dates, this milestone will be reviewed at the next successive review. The presented milestone dates are necessary so that WPs that depend on them can proceed on schedule.

List and schedule of milestones

Mile-stone no.	Milestone name	WPs no's.	Lead benefici-ary	Delivery date from Annex I	*Comments*
1	1:1 M scale SOTER geometric databases of the terrain units	1	2	18	Database and report accepted by Executive Board
2	SOTER soil units for the four 1:1 M scale windows	2	7	24	Database and report accepted by Executive Board
3	Integrated high-resolution e-SOTER database for 1:250 000 scale pilots	3	5	31	Database and report accepted by Executive Board
4	*e-SOTER* operational Web services and relational DBMS	6	4	42	Hand-over deliverables of *e-SOTER* to European/ Global Soil Portal

Tentative schedule of project reviews

Review no.	Tentative timing, i.e. after month X = end of a reporting period	*planned venue of review*	*Comments , if any*
1	After project month 18	Wageningen, The Netherlands	
2	After project month 36	Wageningen, The Netherlands	
3	After project month 42	Ispra, Italy	

B.2 Implementation

B.2.1 Management structure and procedures

As current observing/monitoring systems are lacking or need to be significantly completed, this *e-SOTER* Collaborative Project is to develop a regional pilot platform to be a major component of a future Global Soil Observing System for GEOSS.

The *e-SOTER* consortium

- Builds on cutting edge experience and reputation of both individual experts and their organizations
- Focuses on the development of methodologies, solutions and applications that serves the EU soil thematic strategy.
- Stems from soil and terrain observation institutes in Europe, Africa and Asia and so reflects its ambition to contribute to a global soil and terrain observing system.
- will seek active dialogue with user groups (policy makers, service providers, spatial planning officers, scientific researchers, SMEs, etc.) to ensure that the project will deliver added value for them.

In short; the *e-SOTER* consortium fits in well with ambitions of the EU to contribute, in a demand driven approach, to the completion of a World Soil Observing System.

B.2.1.1 Work package structure

The project is broken down in 7 work packages and one WP for project management. WP 1-3 refer to the data collection and transformation tasks; WP 4 concentrates on the data management; WP 5 on applications of the outcome of WP 1-3; WP 6 is designed for delivery *e-SOTER* through web services; WP7 disseminates the results through stakeholder conferences to user groups and wider communities; WP 8 concerns project management.

	WP nr	Heading	Tasks
RTD	1	**Development of a landform and parent material platform methodology**	1. To develop a complete, artifact-cleaned digital elevation model based on available DEM data 2. Landform classification according to the SOTER criteria and the development of terrain units. 3. Delineation of soil parent material units 4. The combination landform and soil parent material units into terrain units
	2	**Development of a methodology to integrate soil data from legacy and RS sources**	1. Generating spatial soil information for the four 1:1 M Windows 2. Compilation of the soil data base for the 1.1M windows: Collection, harmonization and import of the semantic soil information
	3	**Improvement of SOTER spatial and attribute data**	1. Research on improved analysis of DEM applying natural breaks 2. Research on RS analysis for parent material 3. Research on RS for semantic soil data

	WP nr	Heading	Tasks
RTD	4	**Accuracy assessment of terrain and soil platforms**	1. Design of validation strategy: 2. Collection of independent validation data 3. Validation of SOTER outputs for test windows 4. Quantification of uncertainty about the inputs to the SOTER methodology 5. Application of uncertainty propagation analysis
RTD	5	**Applications**	1. Identifying the major threats in each pilot area 2. Gathering data (both input for models, and for evaluation of results) 3. Comparing original soil map/database and SOTER 4. Comparing different scales of SOTER
RTD	6	**Development of an e-SOTER dissemination platform**	1. Research on analysis of data specification and exchange rules (XML) and development of concept rules for SoTerML (OGC) 2. Soil profile and analytical data management (Global Pedon Database; semantic map data base) 3. Development, setup and implementation of a global/ European *e-SOTER* portal 4. Transfer of methods developed by WP1-3 into Algorithm Database and Incorporation into *e-SOTER* Portal 5. Publication of European Dataset as DVD or Publication as a EUR-Report
Other	7	**Conferences**	1. Conference to present outcome of WP 1 and 2 2. Wrap up and hand-over conference
Manage ment	8	**Project management**	1. Management and coordination of all activities within the project 2. Administration, reporting to and liaise with the EU.

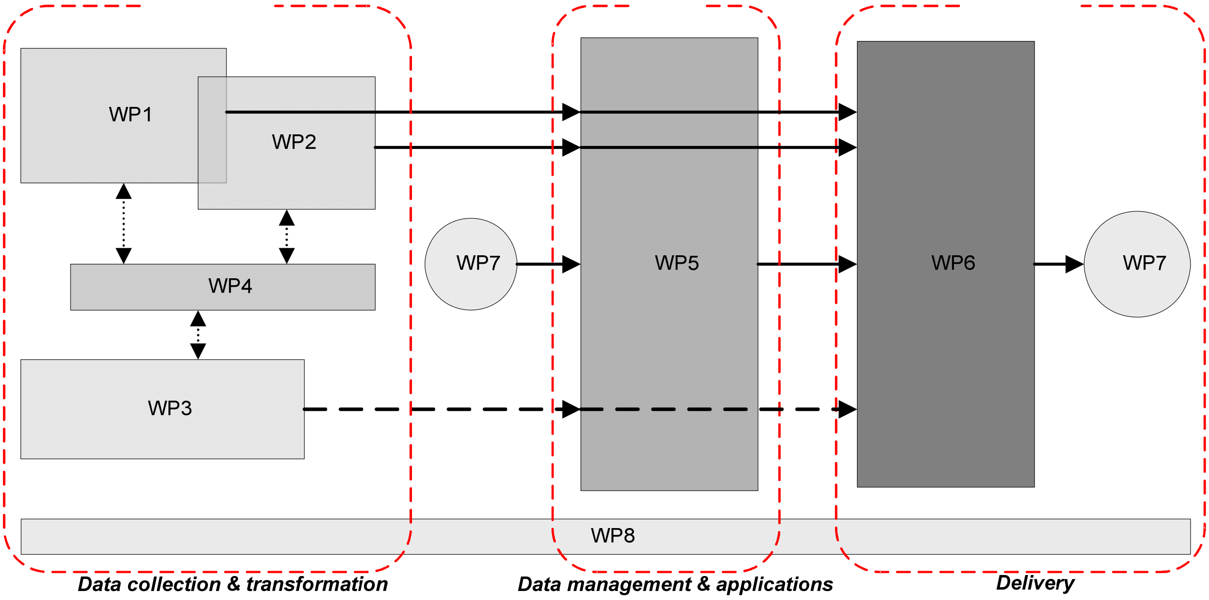

Figure 7: Workflow of *e-SOTER*

B.2.1.2 Management principles

Preconditions for the Collaborative Project to be effective and inspiring include:

- Clear goals
- Joint efforts and ownership
- Realistic time frame
- Sufficient slack to tackle hick ups in the project planning
- Contingency planning elements to handle unforeseen complications
- Good communication between all parties

Due to the project's multi-disciplinary characteristics, the following management principles will be leading throughout the project:

- Network-mindset: Partners in the network should really feel and experience the added value of sharing and working together within the *e-SOTER project.* The Executive Board and project manager are well aware that this process needs permanent attention and stimuli.

- Cost efficient: The *e-SOTER* project will be keen to minimize redundancies and travel schedules of participants.

- Demand driven: Partners see it as essential to develop methodologies and applications that fit societal needs. Given the different standards and lacking data sound scientific solutions should be developed to accommodate the wish of the EU to contribute to a global soil observing system that has real added value because of its prediction and scenario analysis capacity.

- Respect and reciprocity: The input/output ratio in the project is balanced over the partners. Work will be done on issues most close to the experience, expertise and local presence of the partners.

- Consensus: All consortium partners will all have a seat in the General Assembly. This will provide the central guidance of the project and decide on issues in principal on a consensus basis. The Executive Board has clear cut output to deliver. They will in principal adopt consensus to be their basis for decision making. If this proves to be impossible, the General Assembly will decide.

- Coherence: Within the work packages, tasks and objectives are collected to build critical mass and avoid unnecessary overlap and recurrence. Hence communication lines are short and complicating tuning and dependencies are avoided.

- Contingency planning: To plan this Collaborative Project means that all levels of action should be dovetailed carefully. In this project we will use some contingency tools:

    - Incremental planning by the PMT
    - Slack in planning and budget allocation
    - Periodic reporting and risk identification
    - Self steering teams

B.2.1.3 Management procedures

Strict procedures to cover decision making, reporting and administrative issues, are adhered to in order to structure the tasks and activities within this Collaborative Project.

A. Stratified responsibilities and decision making: The decision making structure in the *e-SOTER* project is basically top down over 3 levels, i.e.

Level 1: The General Assembly

The Consortium partners will appoint a General Assembly of representatives with a mandate to steer the project.

The General Assembly

- Adopts the approved project proposal and EU-contract as leading documents that set out the overall ambition of the project, its deliverables, timeframes and the available budgets.
- Meets once a year to discharge the project manager on his progress and financial report.
- Will approve the annual (updated) planning documents prepared and presented by the project coordinator.
- Decide on major changes in the planning/budgeting of the project (all in accordance with the rules of conduct agreed with the Commission)
- Decide on matters that concern the partner structure of the consortium.
- Decide on all matters that are tabled for decision making by the Executive Board.
- Liaise with the partners executive officers.

Level 2: Executive Board and project coordinator

The Executive Board consists of the 8 work package coordinators. The project coordinator (=WP 8) is chairman of the Executive Board. He is in charge of the overall and day-to-day project management. He has a small staff of administrative and project assistants. He will focus primarily on the project to deliver the results within time and budget constraints.
The Executive Board will provide executive leadership necessary to run a successful and sound Project.
ISRIC (Mr Vincent van Engelen) is appointed as project coordinator.

The project coordinator is in charge of

- communication vis-à-vis the EU Commission Project Officer in charge
- coordination of the technical activities of the project
- the overall legal, contractual, ethical, financial and administrative management
- coordination of knowledge management and other innovation-related activities
- overseeing the promotion of gender equality in the project
- overseeing science and society issues related to the research activities conducted within the project
- opening and maintaining the dialogue with the observers and user groups

The project coordinator shall

- ensure that the tasks identified regarding accession to the Grant Agreement are carried out in a timely manner;
- be the intermediary for communication between the beneficiaries and the Commission
- receive all payments made by the Commission to the consortium and administer the Community contribution regarding its allocation between beneficiaries and activities
- ensure that all the appropriate payments are made to beneficiaries without unjustified delay;
- keep accounts making it possible to determine at any time what portion of the Community funds has been paid to each beneficiaries for the purposes of the project.
- inform the Commission of the distribution of the funds and the date of transfers to the beneficiaries.

The Executive Board has a collective responsibility to

- Ensure optimal scientific integration of the work packages by keeping in close contact will all participants.
- Ensure that the research in the project is carried out within the financial budget and time frames agreed.
- Ensure that all project deliverables and milestones are reached at the indicated time points.
- Ensure appropriate exploitation and dissemination of knowledge, coordinating all innovation-related activities of the consortium, fostering the dissemination, exploitation and take-up/use of all knowledge arising form the Project.

Level 3: Work package

The WP-coordinators - as principal scientific experts on the subsequent areas of research - will produce the expected deliverables within allocated time and budget. As self-steering teams, they will have to tackle the scientific dilemmas and barriers as they come along and will address problems and issues that encompass their WP to the WP-coordination level. Any major diversion of the initial project plan is to be reported to the executive board for further handling.

The work packages nr. 1, 2, 3, 4, 5 and 6 all have a strong scientific research bearing. As the WP's are interlinked and consecutive, the WP-coordinators have a specific scientific coordination group to ensure that the interfaces will be carefully watched and matched.

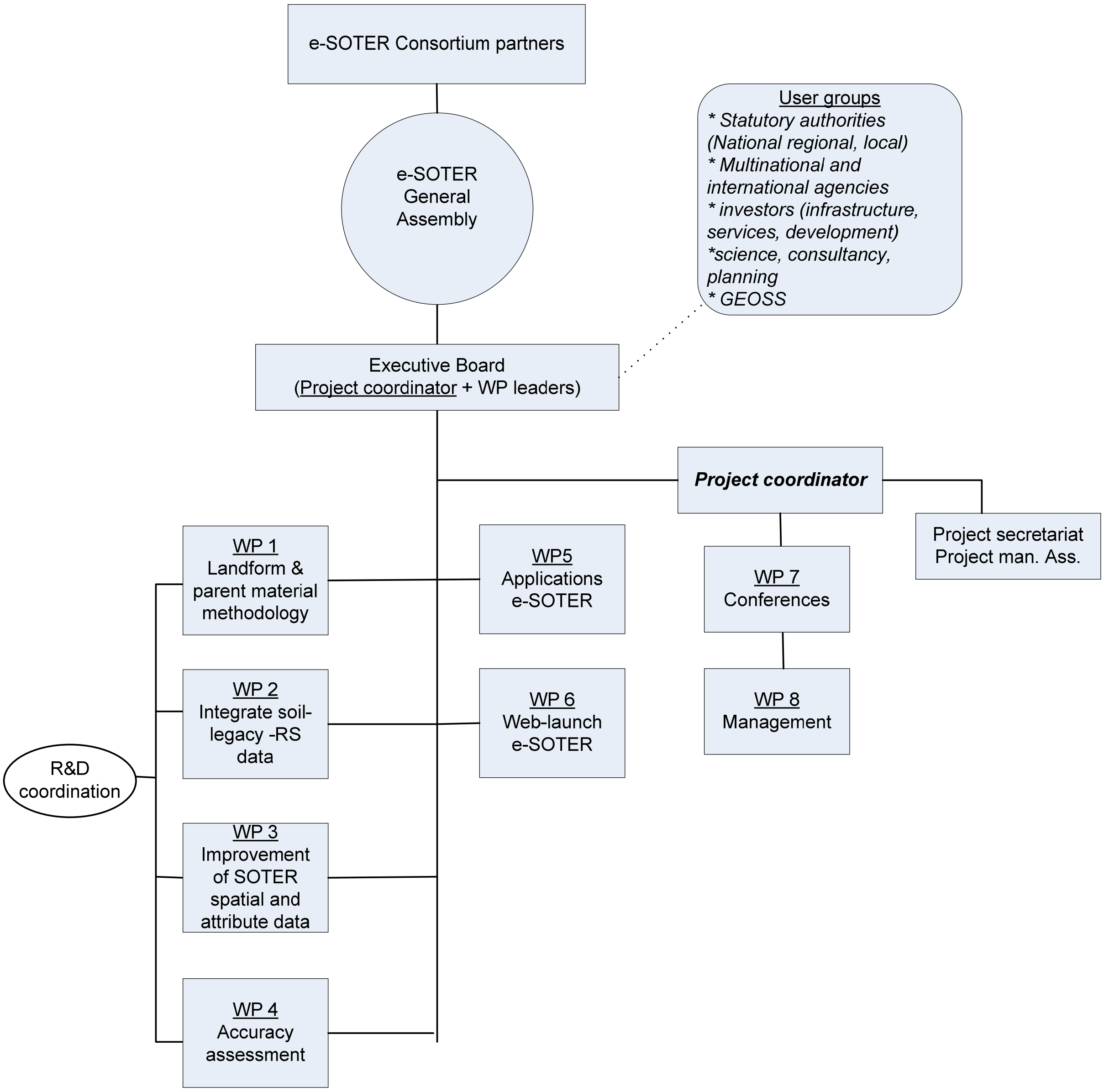

Figure 8: Management structure of *e-SOTER*

B. Adequate and timely reporting

The Executive Board will produce detailed WP-templates for the WP-coordinators to organize their work and to periodically report to the Executive board. The reporting format includes the WP-coordinators observations on risks and diversions experienced and foreseen for the Executive Board to accommodate.

C. Sound and transparent administration
The Executive Board will hand out templates for administrative and financial purposes. All templates are in accordance with EU-regulations and obligations stemming from the EU-contract, the consortium agreement and accounting rules.

D. Management of knowledge
All knowledge that is to be developed and used by the project partners to bring about the *e-SOTER* deliverables, is to be collected, systemized and accessible to researchers and the wider public as part of the WP 6 under the guidance of the JRC.

E. Management of Intellectual property
See B.3.2.

B.2.1.4 Management Tools

The *e-SOTER Project* is multi-disciplinary; soil and terrain, remote sensing and IT-sciences and technologies will contribute equally. *e-SOTER* is also multi-institutional and multi-cultural. The selection of the partners and their role and input in the project, reflects our understanding of the issues and best ways to advance from the state of the art to a new integrated Soil and Terrain observing system (*e-SOTER*).

Management tools
- The stratified management structure of the project ensures effective management and decision making
- Regular meetings of the executive board ensures efficient coordination between he work packages
- A specific R&D coordination level ensures experts to discuss scientific issues between them, so as to alleviate the scientific coordination on the executive board level.
- A dedicated *e-SOTER*-web portal will be used to support the project management with windows to planning, reporting, management, communication, etc.

B.2.2 Individual participants

Partner 1: ISRIC – World Soil Information, Wageningen, The Netherlands
ISRIC's role in *e-SOTER* will be coordinator of the project and leader of WP8 management of the project. There will also contributions to a number of Work Packages, notably WP1, WP2, WP6 and especially WP7. **Scientist in charge:** Drs Vincent van Engelen ISRIC - World Soil Information is an independent foundation with a global mandate, funded by the Netherlands Government, and with a strategic association with Wageningen University and Research Centre. It is the World Data Centre for Soils of the International Council of Sciences (ICSU) and an institute for applied research. The mission of ISRIC – World Soil Information is to support cooperative research in the field of land resources. ISRIC has a cooperative agreement with FAO and UNEP for the establishment of the World Soils and Terrain Database (SOTER) and has extensive experience in developing such soil databases at national and continental scale. The European Community, represented by the Institute for Environment and

Sustainability of the Joint Research Centre (JRC-IES), and ISRIC have a Collaboration Agreement to co-operate in the field of soil and land resources databases, documentation, reference collections, and their application to policy and management, and to work jointly in projects of common interest.

Personnel involved:

Drs **Vincent W.P van Engelen**, Leader Research and Development (Physical geography, soil information systems). Drs van Engelen, has more than 25 years' experience in soil survey, land evaluation and land use planning, working for national governments and international organizations – including long residence or assignments in East and West Africa. At ISRIC since 1988, he has been principally responsible for the ongoing development of the global Soil and Terrain Database (SOTER), regional surveys and professional training worldwide and managing various SOTER-related projects.

Dr **David Dent**, Director (Soil survey, land evaluation and land use planning), has more than 30 years' experience in soil survey, land evaluation and land use planning with national governments, international agencies and commercial organizations; and as a university teacher in environmental sciences. He has special expertise in acid sulphate soils, environmental geophysics mapping of salinity and water resources salinity, and the interface between science and policy.

Selected publications:

1. **Dent DL** 2007. Environmental geophysics mapping salinity and water resources. *International Journal of Applied Earth Observation and Geoinformation* **9**, 130-136
2. Schaepman ME, Clevers JGPW and **Dent DL** 2007. Advances in airborne electromagnetics and remote sensing of agro-ecosystems. *International Journal of Applied Earth Observation and Geoinformation* **9**, 89-224
3. **Van Engelen VWP** 1999. SOTER - The World Soils and Terrain Database. In: M.E. Summner (Ed.), *Handbook of Soil Science*. CRC Press, Boca Raton, pp A1-H-89
4. **Van Engelen VWP** and Huting JRM 2004. The use of DEMs in SOTER: a tool for delineation of landform for soil and terrain databases. In: Eswaran H, P Vijarnsorn, T Vearasilp and E Oadmanabhan (Eds), *Innovative techniques in soil survey*. Land Development Division, Chattuchak, Bangkok, pp 153-159
5. **Van Engelen VWP** and Wen TT 1995. Global and National Soils and Terrain Digital Databases (SOTER). Procedures Manual (revised edition), FAO, ISSS, ISRIC, Wageningen, 125 p

Partner 2: Physical Geography and Environmental Sciences, University of Miskolc, Hungary

UniMis is the leader of WP1. It will contribute to a number of Work Packages, notably WP 1 and 2: contribution to the classification of landform using DEM and the identification of soil pattern through RS.

Scientist in charge: Dr Endre Dobos

The University of Miskolc is one of the biggest Hungarian universities; it provides a working space for 15,000 students, 800 lecturers and 1,200 other staff. It consists of 7 faculties and several institutions located in two major campuses. The oldest faculty, founded in 1735, is the Faculty of Earth Science and Engineering where a wide range of basic and applied geosciences are present, providing a significant potential support for the project.
The Department of Physical Geography and Environmental Sciences is the leading body for the BSc, MSc and PhD training in Geography and takes a significant part in the environmental engineer and geo-informatics education. It offers courses in physical geography (soil sciences, biogeography, ecology, geomorphology, climatology, regional physical geography) and in geo-informatics, like GIS, remote sensing, geostatistics and traditional and digital surveying techniques. The research activities of the department cover a broad spectrum, starting from soil science, digital soil mapping and surveying, landscape analysis and land use planning, geomorphology, and surveying of natural resources.
The department is well established within Europe. There is an active, joint work with the European Commission, Joint Research Centre, Institute of Environment and Sustainability (JRC-IEC), in the field of digital mapping of natural resources and database development. The department staff holds the chair position of the Digital Soil Mapping Working group of the European Soil Bureau Network, incorporated into the JRC as a scientific support body. The department has participated in a

successfully completed FP5 research project on regional and rural development, and participates in an FP6-project on environmental and soil monitoring for Europe (ENVASSO). The department has been leading or participating as partner in numerous cross border projects (Phare Credo, CBC, Interreg) on rural development, sustainable development, surveying and analysing the human and natural resources for regional developmental plans. The department is part of a strong national cooperation network as well, cooperating with Universities and other scientific and education institutions.

Personnel involved:

Dr Endre Dobos is Associate Professor, Head of the Department of Physical Geography and Environmental Sciences within the Institute of Environmental Management, Faculty of Earth Science and Engineering, University of Miskolc. His field of research covers soil science, digital soil mapping, GIS and remote sensing. He has been a visiting scientist in the Joint Research Centre of the EC, and also in the US, at USGS data centre and at Purdue University. He was actively involved into the digital procedure development of the SOTER manual and also in the development of the SOTER database for the EU. He is a chairman of the Digital Soil Mapping Working Group of the European Soil Bureau.

Prof. Dr Attila Hevesi, DSc., is Professor, Department head of the Dept. of Physical Geography and Environmental Sciences. He has 40 years of research experiences in geography. He is an expert in the geography of Europe, geomorphology, geology and biogeography and climatology. He is the head of the BAZ county Geographic Society.

Dr Tamás Madarász, is Assistant professor at the Department of Hydrogeology and Engineering Geology. Role in project: senior researcher in the field of Human-health and Environmental Risk Assessment, member of the NICOLE network; has been involved in more than a dozen risk assessment tasks related to national soil remediation projects, in his current field of research is integrated risk assessment methodology for environmental and geotechnical risks, especially landslide risks.

Prof. Dr Károly Kocsis, DSc., is Institute head, professor in Geography; Geographer.

Dr Tibor Elekes is Associate professor at the Department of Physical Geography and Environmental Sciences; Geographer.

András Hegedűs, MSc. is a third year PhD student and an employed research fellow at the Dept. of Physical Geography and Environmental Sciences, doing research on digital terrain modelling for geomorphologic surveys. He is involved into numerous research projects focusing and digital data development and environmental sciences.

János Vágó, MSc., is a second year PhD student and an employed research fellow at the Dept. of Physical Geography and Environmental Sciences, doing research on digital terrain modelling for geomorphologic surveys. He is involved into numerous research projects focusing and digital data development and environmental sciences.

Péter Holndonner, MSc., is a first year PhD student at the Dept. of Physical Geography and Environmental Sciences, doing research on digital terrain modelling for flash-flood modelling. He is involved into numerous research projects focusing and digital data development and environmental sciences.

Anna Seres, MSc., is potential post doctoral colleague, who is about to finish her PhD on ‘on the risk assessment of snow avalanches based on digital terrain modelling and RS tools’.

Éva Hudák, MSc, is specialized on project management and European studies, and will assist in the project management and administration.

Selected publications:

1. **Dobos E**, Daroussin J and Montanarella L 2005. An SRTM based procedure to delineate SOTER Terrain units on the 1:1 and 1:5 million scales. EUR 21571 EN, Office for Official Publications of the European Communities, Luxemburg, 55 p
2. **Dobos E** and Montanarella L 2006. The development of a quantitative procedure for soilscape delineation using digital elevation data for Europe. In: Lagacherie P. McBratney AB and Voltz M (Eds), *Digital soil mapping: An introductory perspective*. Development in Soil Science, Vol. 31, Elsevier B.V., Amsterdam, p. 107-117

3. **Dobos E**, Micheli E and Montanarella L 2006. The population of a 500-m resolution soil organic matter spatial information system for Hungary. In: Lagacherie P, McBratney AB and Voltz M (Eds), *Digital soil mapping: An introductory perspective*, Development in Soil Science, Vol 31. Elsevier B.V., Amsterdam, p. 477-485
4. **Dobos E**, Carre F, Hengl T, Reuter H and Tóth G (Eds) 2006. Digital Soil mapping as a support to production of functional maps. EUR 22123 EN. Office of Official Publications of the European Commission, Luxemburg, 68 p
5. **Dobos E**, Micheli E, Baumgardner MF, Biehl L and Helt T 2000. Use of combined digital elevation model and satellite radiometric data for regional soil mapping. *Geoderma* **97**, 367-391

Partner 3: Spatial Information in Soil and Environmental Protection - Federal Institute for Geosciences and Natural Resources (BGR)

BGR will be involved in the parent material classification and mapping in WP 1 and WP 3, and the development of web services in WP 6.

Scientist in charge: Dr Rainer Baritz

The Federal Institute for Geosciences and Natural Resources (BGR) is the central German geoscientific institution and subordinate to the Federal Ministry of Economics and Technology (BMWA). The Institute is responsible for Soil Information Systems in Geology, Hydrogeology and Soils. BGR develops national and international maps at various scales, particularly 1:200,000 to 1:5,000,000 scale. BGR is connected to various European and international institutions: European Soil Bureau Network; EuroGeoSurveys, BGR also holds Vice-Presidency in the Commission for the Geological Map of the World (CGMW), and is president of the Thematic Subcommission Hydrogeological maps. BGR recently participated in geological mapping in Madagascar, Guinea and Ghana.

Personnel involved:

Dr. **R. Baritz**, soil scientist (soil inventories, soil information systems). Dr. **K. Asch**, Head International Mapping and GIS (geological survey). **M. Toloczyki**, geologist (geological cartography), **E. Eberhardt**, soil Scientist (data base design, soil evaluation methods).

Selected publications:

1. **Asch, K.**, (2003): The 1:5 Million International Geological Map of Europe and Adjacent Areas: Development and Implementation of a GIS-enabled Concept; Geologisches Jahrbuch; SA 3, BGR, Hannover (ed.); Schweitzerbart (Stuttgart), 190 p., 45 fig., 46 tab.
2. Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) (2005). Soil Regions of the European Union and Adjacent Countries 1:5,000,000 (version 2.0). – Hannover. EU catalogue number S.P.I.05.134.
3. **Eberhardt, E.**, Dickoré, W. B., Miehe, G., 2006: Vegetation of the Hunza Valley: Diversity, altitudinal distribution and human impact. Kreutzmann, H. (ed.): Karakoram in transition - the Hunza Valley. Oxford University Press, Pakistan, (in press), Karachi. p. 109-122
4. Eckelmann, W., **R. Baritz**, S. Bialousz, P. Bielek, F. Carre, B. Houskova, R.J.A. Jones, M. Kibblewhite, J. Kozak, C. Le Bas, G. Tóth, T. Tóth, G. Várallyay, M. Yli Halla and M. Zupan (2006). Common Criteria for Risk Area Identification according to Soil Threats. Soil Information Working Group (SIWG) European Soil Bureau Network (ESBN). EUR 22185 EN, Office for Official Publications of the European Communities, Luxembourg.
5. Hartwich, R., **R. Baritz**, M. Fuchs, D. Krug and S. Thiele (2006). Soil Regions of the European Union and Adjacent Countries 1:5,000,000 (version 2.0) - Explanatory Notes. Arbeitshefte Boden. (submitted and accepted)

Partner 4: European Commission, DG JRC, IES, Land Management & Natural Hazards Unit

JRC is the leader of WP6. Its work will also involve the creation of an artifact-free DEM for Europe in WP 1 in close cooperation with Scilands and application of the landform algorithm to the DEM in WP 1 and WP 3; use of RS for determination of soil parent material in WP 1 in close collaboration with BGR; running applications in WP 5; the development of web services in WP 6.

Scientist in charge: Dr Hannes Isaak Reuter

The mission of the Institute for Environment and Sustainability (IES) is to provide scientific-technical support to the European Union's Policies for the protection and sustainable development of the European and global environment. Our prime objectives:

- to investigate the level and fate of contaminants in the air, water and soil;
- to assess the effects of these contaminants upon the environment and individuals; and
- to promote a sustainable energy supply.

IES's integrated approach combines expertise in the fields of experimental sciences, modelling, geomatics and remote sensing. The combination of such complementary expertise puts IES at the forefront of European environmental research for the achievement of a sustainable environment.

Scientists involved:

Dr Hannes Isaak Reuter graduated in 1999 as a geoecologist from University of Potsdam in Germany. Afterwards he joined the Leibniz Centre for Agricultural Landscape Research (ZALF) while working on precision farming topics. He finished his PhD studies in 2004 with a degree in soil science from the University of Hannover. Before joining LMNH Unit he was employed as researcher at the ZALF in the DEKLIM-project where he was looking in the simulation of dust emissions from agricultural soils. His interests are in relief analysis at different scales, spatial and temporal dynamics of soil and plant properties, water and wind erosion estimation using models and based on measurements across different scales. Hannes develops methods for the European Soil Database. More recently he has been involved in further developing SOTER procedures and in the construction of an up-dated pan-European soil erosion risk assessment.

Dr Luca Montanarella studied from 1978-1984 Agriculture Sciences at the University of Perugia, graduated in agricultural engineering at the Faculty of Agriculture, University of Perugia, Italy; 1984-1985 post-doctoral study at the Centre for Biopharmaceutical Sciences, University of Leiden, The Netherlands, 1986 Visiting Scientist at the Faculty of Pharmacy, University of Groningen, The Netherlands; 1986-1991 Mass Spectrometry and Chromatography Specialist at Varian Associates, Palo Alto, USA. 1991-1992 principal administrator at the Italian Ministry of Agriculture. Since 1992 scientific officer at the Commission of the European Communities, Joint Research Centre (JRC), Ispra, Italy; 1992-1995 working as Head of the Organic Reference Laboratory, Environment Institute, JRC; 1995-2000 Head of the European Soil Bureau project, Space Applications Institute, MARS unit; 2001-2003 Head of the European Soil Bureau project, Institute for Environment and Sustainability, Soil and Waste unit, JRC. Since 2003 he is the head of the new JRC action "Monitoring the State of European Soils" (MOSES), since 2007 renamed JRC action SOIL. Numerous scientific publications. Main interests are: Soil Databases, GIS, soil protection, land degradation. Luca is Member of the Committee for Science and Technology of the UNCCD, actively promoting soil protection at European and Global scale.

Panagos Panos studied Informatics in the homonymous Department of Economics & Business, Athens University from 1989-1993. He is currently undertaking a Masters in Business Administration (MBA) in University of Patras (Greece). From 1993 to 1997 he worked as a software developer in the private sector in Greece, moving then to Brussels, Belgium. During the period 1997-2000 he has acted as an IT consultant for the European Commission in relation to the project Euro Info Centres (DG Enterprise), after which he returned to Greece to become the Head of the Information Systems Department at the private company INTRAMET. He joined the European Commission - Joint Research Centre in 2001 with duties in database administration and development of GIS and Web applications. Panos participated in the projects EUROHARP, PECOMINES and EWCZ-EuWASP of the Soil and Waste Unit and in the LMNH unit in the projects ECALP, DanubeSIS and MEUSIS. His role in the SOIL action is to develop and maintain the European Soil Portal for the development of the Applications on and the implementation of Web Mapping Services (WMS) in the Soil Portal and in the development of the

"European Soil Database (distribution version 2)" disseminated on CD-ROM.

Stefan Sommer has a background in Geology (M.Sc. University of Munich 1985) with a specialisation in remote sensing. Since 1986 he has endorsed a professional career in the field of remote sensing applications. From 1989 to 1991 he participated in the organisation of joint ESA/JRC Imaging Spectrometry Airborne Campaigns (EISAC '89, MAC Europe '91) on behalf of the Institute for Remote Sensing Applications of the JRC and later on in the deployment of Hymap in Europe, which laid grounds for the JRC studies on remote sensing and chemometric methods to assess the Aznacollar mining accident. From 1996 to 2000 he was leading the Mediterranean Ecosystem Monitoring sector of the JRC-SAI EGEO Unit and was responsible JRC scientist in a number of EU funded land degradation projects such as MEDALUS III, GeoRange, Desertlinks and recently IP Desurvey.
Since 2001, he is working with the RWER Unit (before named Soil&Waste) of the Institute for Environment and Sustainability (IES), where he is responsible for remote sensing applications regarding the monitoring and assessment of land degradation processes and environmental impact of mining wastes, coordinating the GIS and remote sensing aspects in PECOMINES. In WP3 he will supervise JRC contribution to remote sensing delineation and spectral characterization of lithological units.

Selected publications:

1. Dobos E, **Montanarella L**, Negre T and Micheli E 2001. A Regional Scale Soil Mapping Approach using Integrated AVHRR and DEM Data. *International Journal of Applied Earth Observation and Geoinformation* **3**, 30-42
2. Giannetti F, **Montanarella L**, Negre T and Salandin R 2001. Integrated Use of Satellite Images, DEM's, Soil and Substrate Data in Studying Mountainous Lands. *International Journal of Applied Earth Observation and Geoinformation* **3**, 25-29
3. Jones A, **Montanarella L** and Jones RJA (Eds.) 2005. *Soil Atlas of Europe*, European Soil Bureau Network, European Commission, Office for Official Publications of the European Communities, L-2995 Luxembourg, 128 pp
4. Jones RJA, Hiederer R, Rusco E, and **Montanarella L** 2005. Estimating organic carbon in the soils of Europe for policy support. *European Journal of Soil Science* **56**, 655-671
5. Van Rompaey AJJ, Bazzoffi P, Jones ,RJA and **Montanarella L** 2005. Modeling sediment yields in Italian catchments. *Geomorphology* **65**, 157-169

Partner 5: Cranfield University's National Soil Resources Institute (NSRI)

CU is leading WP3 and it activities extend across a number of other Work Packages, notably in WP2. WP3 and WP4 and especially WP6.

Scientist in charge: Dr Stephen Hallet

Cranfield University's National Soil Resources Institute (NSRI) is one of Europe's leading centres of research, consultancy and postgraduate education specialising in soil and land resources with a focus on profitable and sustainable forms of land management. NSRI's staff provides expertise in the assessment of soil, land and water quality, evaluation and control of environmental pollution, environmentally friendly solutions to land degradation, and the impacts of climatic and land use change. We advise governments, government agencies, NGOs and private companies on environmental management and environmental impacts of proposed land use change. We are also involved in several committees to help inform European policies on soils and the environment.

NSRI is a leading European centre for soil survey and soil information systems development. We are the sole supplier of national soil survey publications and digital soil data that are used by policy, research, regulatory and commercial organisations to assist them in achieving land and water management objectives.

NSRI is responsible for the LandIS (Land Information System) environmental data base for soils and related information in England and Wales (www.landis.org.uk). NSRI have developed a range of web-based services to reveal and disseminate the contents of LandIS to a variety of stakeholder groups. The SoilScapes Viewer tool for instance provides public access to a simplified soil map and database for

England and Wales (www.landis.org.uk/soilscapes). This uses a Macromedia Flash application to present soil maps and associated data in real time for given Postcodes across the countries.

Personnel involved:

Dr S.H. Hallet has a long-standing expertise in the application of spatial computer-based methodologies and GIS to the environmental sciences with particular reference to soil and natural environmental systems. Acting as Group manager of the Cranfield University National Soil Resources Institute's Soil Resources Group, he holds the overall responsibility for Cranfield's national Land Information System (LandIS), containing comprehensive soil and related near-earth environmental information for England and Wales (www.landis.org.uk). Dr Hallett has extensive experience in project management, Internet development, systems analysis, design and development of spatial environmental information systems, environmental risk and geo-hazard assessment and decision support systems for land, water and toxic chemicals management. Dr Hallett teaches Systems Analysis, Spatial Data management and Internet mapping at postgraduate level and has supervised Doctoral studies.

Dr Thomas Mayr is a Principal Research Scientist at the Integrated Earth System Sciences Institute of Cranfield University. Thomas has extensive experience in project work relating to digital soil mapping, soil function mapping and environmental impact assessments. He has a long interest in terrain parameterization and classification.

Andrew Rayner, MSc, graduated from the University of South Africa in 2000 with a BSc majoring in Computer Science and Geography. After graduating with an MSc in Geographical Information Management at Cranfield University Andrew went on to join the National Soil Resources Institute (NSRI) in 2004 to work on developing a public interface to the Land Information System (LandIS) for England and Wales.

Andrew has established the web-based mapping facility of NSRI. The facility is an implementation of multi-layered client-server based technologies which serves as a foundation for developing online GIS applications and offers fast and user friendly remote access to the NSRI spatial data holdings. He has also developed the flagship application for this facility, the Soilscapes Viewer (www.landis.org.uk/soilscapes). This is an interactive map based interface used to showcase the LandIS data holdings in particular. His specific areas of expertise include:
- Geographical information systems design and development including GPS;
- Web based applications design and development;
- Spatial database design and development;
- Geographical information management.

Ann Holden, MSc
Ann Holden gained a BSc honours degree in Geography and Maths at Keele University, with a distinction in computing, working then over the following 12 years within commercial computing companies on software development projects, with roles ranging from programmer to systems analyst. Areas included international banking, finance, back office sales systems, COSHH system and an interface to a change management system. In 2001 Ann returned to university to study for an MSc in Geographical Information Management at Cranfield University, followed by joining Cranfield as a member of the GIS and Internet programming staff, using Visual Basic, Java, C++ and XHTML.

Since joining Cranfield Ann has worked on a wide range of projects, for both NSRI and more recently Cranfield's Institute of Environment and Health. Project have included: Converting a Catchment Information System from Unix to PC-Windows using Visual Basic and Esri's ArcObjects; Creating a soil survey data entry system on Pocket PC using ArcPad; Creating user help systems and a graphical front end to the Aquatic Ecosystem Database; Completing a software Tool for investigating strategic water resource management scenarios, in Mapobjects Java in the Aquadapt programme (EVK1-CT-2001-00104); Creating utilities to automate the running of specific models, such as Genstat and Century; linking spatial soils data to Internet delivery applications.

Selected publications:

1. **Hallett SH** and Bullock P and Baillie I 2006. Towards a World Soil Survey Archive and Catalogue. *Soil Use And Management* **22**, 227-228
2. **Hallett SH**, Jones RJA and Keay CA 1996. Environmental Information Systems Developments for

planning sustainable land use. *Int. J. Geographical Information Systems* **10,** 47-64
3. King JA, Dampney PMR, Lark RM, Wheeler HC, Bradley RI and **Mayr TR** 2005. Mapping Potential Crop Management Zones within Fields: Use of Yield-map Series and Patterns of Soil Physical Properties Identified by Electromagnetic Induction Sensing. *Precision Agriculture* **6**, 167-181
4. **Mayr TR** and Palmer R 2007. Digital Soil Mapping: An England and Wales perspective. In: Lagacherie P, McBratney AB and Voltz M (Eds.), *Digital Soil Mapping: An Introductory Perspective*. Developments in Soil Science, Volume 31, Elsevier BV, Amsterdam, p. 365-375
5. **Mayr T**, Black H, Towers W, Palmer R, Cooke H, Freeman M, Wood C, Wright S, Lilly A, Jones M, DeGroote J and Hornung M 2006. Novel methods for spatial prediction of soil functions within landscapes. Final Report to the Department for the Environment, Food and Rural Affairs (DEFRA) and the Scottish Executive Environment and Rural Affairs Department (SEERAD)

Partner 6: Alterra – Green World Research

Alterra is leading WP4 - the spatial uncertainty analysis of *e-SOTER* – as well as WP5: the identification of major soil threats and models to predict these using *e-SOTER* and older data and compare the results.

Scientist in charge: Prof. Coen J. Ritsema

Alterra is the main Dutch centre of expertise on rural areas. It combines expertise on rural areas and their sustainable use, including aspects as water, wildlife, forests, the environment, soils, landscape, climate and recreation, and various other aspects in the development and management of the environment. Alterra engages in strategic and applied research to support policy making and management at local, national and international level. During the past decades, simulation models like SWAP, PESTLA, INTEGRATOR and LISEM have been developed. Alterra is in charge of several national and international databases on soil, groundwater, land use, landscape and recreation, including the national soil database of the Netherlands. The institute is co-ordinator of the national Environmental and Nature Assessment Offices. Alterra is part of Wageningen University and Research Centre (Wageningen UR).

Personnel involved:

Prof. Coen J. Ritsema has more than 20 years of experience in fundamental and applied research in the area of land use management and hydrology, and in coordinating large (inter)national multidisciplinary research projects and programs. His interest has been focused on land-hydrology interactions at different spatial and temporal scales, with special attention to soil physical and chemical processes like erosion, water repellence, oxidation, and pollution. He has published around 125 research papers in refereed international scientific journals, and is currently Vice-President of the Soil Science Division of the European Geosciences Union.

Dr Gerard B.M. Heuvelink holds an MSc in Applied Mathematics (1987) and a PhD in Environmental Science (1993). He has worked as assistant professor in Geostatistics and Stochastic Simulation with the University of Amsterdam. He moved to Wageningen in 2003, where he works as senior research scientist in Geostatistics with Alterra and as associate professor in Pedometrics with the Department of Environmental Sciences of Wageningen University. Gerard has written around 100 scientific publications on geostatistics, spatial uncertainty analysis and pedometrics, about 30 of which appeared in peer-reviewed international journals. Gerard was work package leader and partner in several EU projects. He is worldwide recognised as a leading scientist in pedometrics and spatial uncertainty analysis, mainly through his publications and his active involvement in conferences and meetings. Gerard chaired the Pedometrics Commission of the *International Union of Soil Sciences* and is editorial board member of *Geoderma*, *Transactions in GIS* and of *Environmental and Ecological Statistics*. He is also the president of the *Dutch Soil Science Society*.

Dr Dick J. Brus is a physical geographer. He started as a geomorphologist and worked on the systematic mapping of the geomorphology of the Netherlands at scale 1:50 000. He then switched to soil science, and worked on a revision of the Dutch System for Soil Classification. After this he switched to pedometrics, with emphasis on sampling and geostatistics. He has published 27 publications on pedometrics in peer reviewed journals, and recently a handbook on Sampling for Natural Resource Monitoring (published by Springer Verlag, New York).

Dr Rudi Hessel is a physical geographer, and specializes in modelling hydrology and soil erosion at different scales. He is also interested in simulating the effect of different scenarios on hydrology and erosion, and in the design and execution of the fieldwork needed to be able to run models, and to evaluate their results. He has published about 10 research papers about these subjects in refereed international scientific journals.

Selected publications

1. Brown JD and **Heuvelink GBM** 2007. The Data Uncertainty Engine (DUE): a software tool for assessing and simulating uncertain environmental variables. *Computers & Geosciences* **33**, 172-190
2. De Gruijter JJ, **Brus DJ**, Bierkens MFP and Knotters M 2006. *Sampling for Natural Resource Monitoring*. Springer, Berlin, Heidelberg, New York
3. **Heuvelink GBM** 2006. Accuracy assessment of Digital Soil Maps. In: Dobos E, Carré F, Hengl T, Reuter HI and Tóth G (Eds), *Digital Soil Mapping as a Support to Production of Functional Maps*. EUR 22123 EN, Office for Official Publications of the European Communities, Luxemburg, p 29-33
4. **Ritsema CJ** (Ed.) 2003. Special Issue `Soil Erosion and Participatory Land Use Planning on the Loess Plateau in China'. *Catena* **54**, 330 pp
5. Stolte J, **Ritsema CJ** and Bouma J 2005. Developing interactive land use scenario's on the Loess Plateau in China, presenting risk analyses and economic impacts. *Agriculture, Ecosystems & Environment* **105**, 387-399

Partner 7: Department of Soil Science and Agricultural Chemistry, Szent Istvan University (SIU)

SIU is the leader of WP2. Its major task will be the compilation of a spatial soil database. Other work will be in WP1 and WP3.

Scientist in charge: Prof. Erika Michéli

The Szent István University plays a dominant role in Hungarian research and higher education in the field of agricultural and environmental sciences. The faculty members perform high level research in the area of basic and applied soil sciences. Soil classification, mapping, and general soil characterization is strengths of the group. SIU has extensive experience in national and international co operation and projects in soil characterization, soil survey and soil monitoring (INDEX FP6-project, ENVASSO FP6-project, WRB).

Personnel involved:

Prof. Erika Micheli M.Sc. (Gödöllő Agr. Univ.) Ph.D. and D.Sc. (Hungarian Academy of Sci.) is a professor and deputy head of the Department of Soil Science and Agricultural Chemistry. She has been on the faculty of SIU for 20 years. She is the major lecturer of Soil Science and the leader of soils related research in the department. She served as chair of the Working Group of the World Soil Reference Base for Soil Resources (WRB), and is the current vice chair of the Commission Soil Classification of the International Union of Soil Sciences; she is member of the Steering Committee of the European Soil Bureau Network. She contributed to the development of Hun-SOTER and in the development of the Hungarian window of the 1:1 M Soil Digital Data Base of Europe.

Dr. Barbara Simon, M.Sc. (Purdue Univ., USA), Ph.D. (SIU) is a postdoctoral research fellow in the Department. Her PhD thesis was and her expertise are related to soil monitoring.

Tamás Szegi, M.Sc. (SIU) is a research associate performing research related to soil survey and soil conservation, classification. He contributed to development national and international data bases.

Other key participants of the *e-SOTER* team will be 2 PhD students, **István Waltner and Márta Fuchs.** Both have participated in the European Summer Schools on Soil Survey and have strong training in soil classification, GIS and digital soil mapping.

Selected publications:

1. IUSS Working Group WRB (**Michéli E**, Schad P , Spaargaren O, Nachtergaele FO and Dent DL (Eds) 2006. *World reference base for soil resources 2006* (2nd ed.). World Soil Resources Reports No. 103. FAO, Rome. (ISBN 92-5-105511-4)
2. **Micheli E**, Nachtergaele FO, Jones RJA and Montanarella L (Eds) 2002. Soil Classification 2001. European Soil Bureau. EUR 20398 EN, Office for Official Publications of the European Communities, Luxembourg, 248 pp
3. Tóth T, Csillag F, Biehl LL and **Micheli E** 1991. Characterization of semi-vegetated salt-affected soils by means of remote sensing. *Journal Remote Sensing of the Environment* **37**, 167-180
4. Várallyay G, **Micheli E,** Szabó J and Pásztor L. 1996. Soil and Terrain Digital Database (SOTER) and its multipurpose application in Hungary. Publications of University of Agricultural Sciences, Gödöllő, *(HU ISSN 0237-8930)* Vol/II, 9-19.)

Partner 8: Scilands GmbH

Scilands' work will be in WP1 where it will contribute to the creation of an artifact-free DEM and in WP3 where it will assist in the identification of landform through analysis of DEM.

Scientist in charge: Dipl. Geogr. Michael Bock

Scilands GmbH is a SME according to the definitions of the European Commission. In 1997 Scilands GmbH was established by former employees of the Department of Geography of the University of Göttingen. The main focus of the Scilands GmbH is on the development and production of advanced digital geo data. Looking back to experiences with digital terrain models (DTM) since 1987 one emphasis is on the production, evaluation and correction of DTM and high quality derivations from DTM for applications in geo-sciences. For this purpose the software package SARA (System for Automated Terrain Analysis) has been developed. Currently the development of software and methodology is embedded in SAGA (**S**ystem for **A**utomated **G**eoecological **A**nalysis), a scientific GIS for terrain analysis, remote sensing, modelling of climatological and geomorphological processes and soil regionalisation, developed in close cooperation with the Department of Geography of the University of Hamburg. In the last years Scilands GmbH had orders from several Mapping agencies in Germany as the Federal Institute for Geosciences and Natural Resources.

Personnel involved:

Dipl. Geogr. Michael Bock, Managing director, studies of geography, botany and soil sciences in Bamberg and Göttingen. From 1996 to 1999 he worked for different employers as a engineer in GIS. In late 1999 he was employed by Göttingen and then Munich University as a part of GeoS, the validation team for SRTM DEM. 2000 he changed to Scilands GmbH where he was involved in several projects to analyze DEM for soil mapping agencies. In 2006 he became partner and managing director of Scilands GmbH.

Dipl. Geogr. Rüdiger Köthe, Managing director, studies of geography, geology and cartography at the University of Hannover (diploma in 1988). From 1988 to 1998 scientific assistant at the Department of Physical Geography at the University of Göttingen. During this time (besides teaching) principally involved in research projects focussed on digital terrain analysis for soil information systems funded by the *German Research Foundation* (DFG) and the *Federal Institute of Geo-sciences and Natural Resources of Germany* (BGR). Experiences in software engineering, digital terrain analysis, geomorphology, geo-ecology, geology, hydrology, soil mapping and geo information systems. Since 1997 one of the owners and managing directors of the Scilands GmbH.

Dipl. Phys. Andre Ringeler, studies of physics and meteorology at University of Göttingen. Since 2000 member of AG Geosystem Analysis with head Prof. Böhner, University of Hamburg. His focus beside GIS programming and software engineering is developing algorithms in image segmentation.

Selected publications:

1. **Bock M**, Bohner J, Conrad O, Kothe R and **Ringeler A** 2007. Methods for creating Functional Soil

Databases and applying Digital Soil Mapping with SAGA GIS. In: Hengl, Panagos, Jones and Toth T (Eds.). *Status and prospect of soil information in south-eastern Europe: soil databases, projects and applications*. EUR 22646 EN, Office for Official Publications of the European Communities, L-2995 Luxembourg, p 157-174
2. Selige T, Bohner J and **Ringeler A** 2006. Processing of SRTM X-SAR Data to Correct Interferometric Elevation Models for Land Surface Applications. In: Bohner, McCloy and Strobl (Eds), SAGA – Analyses and Modelling Applications. *Göttinger Geographische Abhandlungen* **115**, 97-104, 127-128
3. **Bock M** and **Kothe R** 2004. New concepts and methods for creating scale independent, functional soil data base. Paper for EUROSOIL 2004 (download: http://kuk.uni-freiburg.de/hosted/eurosoil2004/full_papers/id617_Bock_full.pdf)
4. Bohner J, **Kothe R** and Selige T 2004. Geographical Information Systems: Applications to Soils. In: Hillel D, Rosenzweig C, Powlson D, Scow K, Singer M and Sparks D (Eds), *Encyclopedia of Soils in the Environment*, Elsevier, Oxford, pp. 121-129
5. Selige T, **Ringeler A,** Bohner J, Conrad O and **Kothe R** 2001. Validation of Grid-Based Surface Reconstruction Techniques Applied to Digital Elevation Models Including the Shuttle Radar Topographic Mission. *Proceedings of the International Geoscience and Remote Sensing Symposium*, Vol. VII: 3135-3137, IEEE Publication, Piscataway, NY, USA

Partner 9: Science du Sol - Institut National de la Recherche Agronomique

INRA will be involved in WP1: classification of landform from DEM in close collaboration with UniMis; in WP2 and WP5 it will contribute to the compilation of the soil database and the applications of soil erosion models respecively.

Scientist in charge: Dr Guy Richard

The Soil Science laboratory which will contribute to this project is located in Orléans. It is one of the 35 laboratories spread across France which are part of the department of "Environment and Agronomy" which in turn is one of 14 departments of the Institut National de la Recherche Agronomique (INRA). The role of INRA is to contribute to the integrated study of the functioning of natural and cultivated ecosystems through its research between plant production and the environment. The missions of INRA combine both the acquisition of new scientific knowledge and its application via the definition of durable crop and forest-management systems. INRA develops research projects with a dual focus: the achievement of production objectives with respect to quantity and quality as well as the maintenance and/or restoration of the quality of the environment, based on the known impact of agriculture on soil, water and the atmosphere.

Personnel involved:

Dr Guy Richard is Senior Soil Scientist at the Institut National de la Recherche Agronomique (Soil Science laboratory - Orléans). His research interests are soil compaction, soil tillage, soil physical conditions, crop establishment, carbon sequestration, N_2O emissions and erosion. His research activities cover field experimentation, laboratory estimation of soil parameters, modelling of compaction, heat and water transfer. He was the leader of a team "Soil Management" in the INRA laboratory of Laon in Northern France from 1998 to 2004. Currently he leads research programs for INRA and Cemagref about precision agriculture and soil tillage, for the French Ministry of Environment about French soil sensitivity to compaction and leads a research unit of Soil Science. Dr Richard is the author of 55 papers in refereed scientific publications and has published more than 100 other scientific publications. He is associate editor of the *Canadian Journal of Soil Science* and member of the editorial advisory board of the *Soil & Tillage Research* Journal and on the French journal "*Etude et Gestion des sols*".

Joël Daroussin is a Research Engineer at the Institut National de la Recherche Agronomique (Soil Science laboratory - Orléans). His field of work is geographical information systems (GIS) applied to soil science. He was strongly involved in the development of the Soil Geographical Database of Eurasia at scale 1: 1 million (SGDBE1M), the Soil Erosion Risk Assessment in Europe project, the Pan-European Soil Erosion Risk Assessment (PESERA) project, and the development of an SRTM-based procedure to delineate SOTER Terrain Units on 1:1 and 1:5 million scales.

Selected publications

1. **Daroussin J**, King D, Le Bas C, Vršaj B, Dobos E, Montanarella L 2007. The Soil Geographical Database of Eurasia at scale 1:1,000,000: history and perspective in digital soil mapping. In: Lagacherie P, McBratney AB and Voltz M (Eds), Digital Soil Mapping: An Introductory Perspective. Developments in Soil Science, Volume 31, Elsevier BV, Amsterdam, p. 55-65
2. Dobos E, **Daroussin J** and Montanarella 2005. An SRTM based procedure to delineate SOTER Terrain units on the 1:1 and 1:5 million scales. EUR 21571 EN, Office for Official publications of the European Communities, Luxemburg, 55 p
3. Le Bissonnais Y, Cerdan O, Léonard J and **Daroussin J** 2006. Pan-European soil erodibility assessment. In: Boardman J and Poesen J (Eds). Soil Erosion in Europe. Wiley, p. 685-694
4. Le Bissonnais Y, **Daroussin J**, Jamagne M, Lambert J-J, Le Bas C, King D, Cerdan O, Léonard J, Bresson L-M and Jones RJA 2005. Pan-European soil crusting and erodibility assessment from the European Soil Geographical Database using pedotransfer rules. *Advances in Environmental Monitoring and Modelling* **2**, 1-15
5. Pereira J, Défossez P and **Richard G** 2007. Soil susceptibility to compaction by wheeling as a function of some properties of a silty soil as affected by the tillage system. *European Journal of Soil Science* **58**, 34-44

Partner 10: Centre for Geospatial Science – University of Nottingham

UNOTT will contribute to WP6 in the field of interoperability and XML.

Scientist in charge: Dr Didier Leibovici

The University of Nottingham's Centre for Geospatial Science (CGS) is dedicated to research and development issues associated with geospatial interoperability. CGS has been active in the development of GEOSS demonstrators as part of the involvement of the Open Geospatial Consortium (OGC) in the GEOSS Architecture and Data Committee. It provides expertise in the area of geospatial standards: Prof. Jackson is a Main Board Director of the Open Geospatial Consortium (OGC) and the Centre is a full voting member of the OGC technical committee ; Dr Jinsoo You, a Special Lecturer is an active member of ISO TC211. CGS is a leading research centre for geospatial interoperability and the development of persistent test-bed facilities to provide knowledge transfer and services to the user community as well as a continuing research platform, whether this is at the global level (e.g. GEOSS, UNSDI) or European (e.g. INSPIRE).

Examples of recent European programmes where members of CGS have taken part, concern Spatial Data Infrastructure development MOTIIVE (FP6), environmental modelling research DeSurvey (FP6) and GMES project CYCLOPS.

Research staff at CGS has a background in geomatics, computer science and mathematical / statistical modelling. The Centre has its own powerful computing facilities and a wide range of commercial and free and open source (FOSS) software as well as the usual access to the University's central facilities.

Personnel involved:

Dr Didier Leibovici has a PhD in Applied Mathematics from the University of Montpellier II and worked for some years as a Statistician Researcher in epidemiological and medical imaging. Dr Leibovici also has a Masters degree in Information Technology from the University of Montpellier II and his previous post was in geomatic modelling for landscape changes at the IRD (Institute of Research for Development) in France. Dr Leibovici has expertise data modelling and GIS application modelling and as such took part (whilst holding a project leader position in an IRD research unit) in a still ongoing FP6 program on Desertification (DeSurvey). His recent position at the Centre for Geospatial Science confirms his interests in interoperability of systems using OGC standards and issues associated to developing decision modelling tools.

Dr Kristin Stock has a PhD in Surveying & Engineering (Built Environment and Landscape Planning).

She has worked on a range of national (Australian) and international projects on data modelling and more recently worked the MOTIIVE FP6 project on designing of registries/catalogues for spatial data infrastructures that include semantic information to assist in intelligent querying, service composition and automated interpretation of web services and data resources. Dr Stock focuses her research on the use of semantics to assist in the interpretation and application of geospatial information, specifically addressing the development of methods for semantically-aware data analysis and mining.

Dr Jerry Swan has a PhD in Pure Mathematics (computational group theory) at Nottingham in which most of his software engineering and in graph theory are expressed. He has nearly 20 years experience in industry as a software engineer and OOA\D architect and has worked in application areas as diverse as logistics and generative music. In the 1990s, he ran a software development company employing more than 20 people. Dr Swan acts as a project leader for the CGS interoperability test-bed computing facility and his research's interests include optimization, graph theory, symbolic computation, knowledge representation, machine learning, and semantics.

A post-doc recruited for the project during two years would have competence in geospatial modelling with some knowledge in soil and/or geomorphology sciences. He will be supervised by the other CGS participant members (Unot) beneficiating from their combined expertise and input for the project.

Selected publications:

1. Desconnets J-C, Loireau M, **Leibovici D**, Moyroud N and D'Herbès J-M 2004. Data infrastructure and geographic information system for desertification survey in Africa circum-Saharian zone : ROSELT program. In: Morell, M. al (Eds.). *Conference on water observation and information system for decisio*n. Balwois : Colloque, 2004/05/25-29, Ohri, p. 381-382
2. Loireau M, **Leibovici D**, Desconnets J-C and D'Herbès J-M 2005. LEIS, a Tool for Diagnosis and Prevision of Antropogene Pressure on Natural Vegetation. *RGLDD (Remote Sensing and Geoinformation Processing.* In: the Assessment and Monitoring of Land Degradation and Desertification, Trier
3. **Stock K** and Pullar D 1999. Identifying Semantically Similar Elements in Heterogeneous Spatial Databases using Predicate Logic Expressions. In: Vckovski A, Brassel KE and Schek HJ (Eds). *Interoperating Geographic Information Systems: Second International Conference.*, INTEROP '99, Zurich, Switzerland (Lecture Notes in Computer Science 1580, Springer, Berlin)
4. **Stock K** 2006. Spatio-Temporal Data Management Using Object Lifecycles: A Case Study of the Australian Capital Territory Spatial Data Management System. *Journal of Spatial Sciences* **51,** 43-58

Partner 11: Czech University of Life Sciences

CULS wll be involved in various WPs: in WP2 and WP3 it will contribute to the compilation of the soil database; in WP4 it will contribute to the uncertainty analysis.

Scientist in charge: Prof. Josef Kozak

Research of the Department of Soil Science and Geology, Czech University of Life Sciences is aimed mainly on digital soil mapping, preparation of new digital versions of soil characteristics databases, classification of soils and soil associations, modelling of transport processes, soil organomineral complexes, application of geostatistics, toxic forms of Al in forest soils including development of analytical procedures, transport and degradation of pesticides in the soil, stability of soil structure in anthropogenic soils, application of pedotransfer functions, and modelling of soil water retention. As an important achievement of the Department could be considered digital form of the Taxonomic Soil Classification System of Czech soils, available on web pages of the Department, and also on Soil Portal of JRC EU in Ispra. Department was contributing organization for projects like 1 : 1 000 000 soil database of Europe, SOVEUR, Soil Atlas of Europe. Workers of Department prepared soil digital maps 1:250 000 also using SOTER techniques.

Scientists involved:

Prof. Josef Kozak's research is focused on soil mapping, digital soil mapping, building of soil databases, and the application of pedotransfer functions and rules. He was co-responsible for Czech Republic contribution to Soil database at scale 1:1 million and a co-author of the Digital soil map of Czech Republic at scale 1:250 000 using the SOTER methodology as well as of Czech part of the FAO-project on Soil Vulnerability Mapping in Central and Eastern Europe (SOVEUR), coordinated by ISRIC – World Soil Information. He was a member of the Advisory Forum during the EU Soil Directive.

Prof. Luboš Borůvka has 15 years of experience in soil research. His interest is focused on application of quantitative methods (multivariate statistics, geostatistics, fuzzy classification, artificial neural networks, etc.) on soil data, especially for the assessment of soil chemical degradation like acidification and pollution with potentially toxic elements. Recently, assessment of forest soil acidification and consequent release of toxic aluminium forms makes his major focus. Pedometrical methods are used to reveal major factors influencing these degradation processes and to describe spatial distribution of soil acidification. He also tested application of pedometrical methods on legacy soil data. He is a member of the commission 1.5 Pedometrics of the International Union of Soil Sciences (IUSS) and worked in the working group on Digital Soil Mapping of the JRC Ispra, Italy. He has coordinated several research projects supported by the Czech Science Foundation, Czech Ministry of Agriculture and other providers; he is president of the subcommittee on Ecology, Forestry and Soil Science of the Czech Science Foundation. He is also a member of scientific board of Faculty of Science, Charles University in Prague. He has research experience from abroad; 3 months in France (ENSAIA Nancy) and one year in the U.S.A. (University of Florida, Gainesville, FL). He published over 30 papers in scientific journals and has also contributed to several books on digital soil mapping.

Dr Vit Penizek is focused on research of soil and soil forming factors relationship (mainly relief) by using advanced pedometric methods in GIS environment. He specialized in delineation of alluvial soils in last years. Currently he works as a research assistant at University of Life Sciences Prague. He participates on various projects supported by national and EU foundations. Some of the results were published in refereed journals (Plant, Soil and Environment, Soil and Tillage Research, Geoderma) and on national and international conferences. He contributes to books on digital soil mapping (Digital Soil Mapping as a support to production of functional maps and Digital Soil Mapping with Limited Data. Elsevier). Part of his work is teaching of new methods in soil mapping and applied cartography. He is a member of Czech Society of Soil Science and IUSS.

Selected publications:

1. **Boruvka L**, Donatova H and Nemecek K 2002. Spatial distribution and correlation of soil properties in a field: a case study. *Rostlinna Vyroba* **48**, 425-432
2. **Boruvka L**, **Kozak J**, Nemecek J and **Penizek V** 2002. New approaches to the exploitation of former soil survey data. *Proceedings 17th Congress of Soil Science*, Bangkok
3. **Boruvka L**, Mladkova L and Drabek O 2005. Factors controlling spatial distribution of soil acidification and Al forms in forest soils. *Journal of Inorganic Biochemistry* **99**, 1796-1806
4. **Boruvka L**, Mladkova L, Drabek O and Vasat R 2005. Factors of spatial distribution of forest floor properties in the Jizera Mountains. *Plant, Soil and Environment* **51**, 447-455
5. **Kozak J** 2006. Proposed Strategy of European Commission to protect Soils. *Soil and Water Research* **4**, 164-165

Partner 12: Institute of Soil Science – Chinese Academy of Sciences

ISSCAS' work will be focused on the compilation of SOTER databases in WP 1 and 2 in the window in China.

Scientist in charge: Prof. Dr Gan-Lin Zhang

The institute's research focuses on solutions to vital problems in agricultural development, ecological and environmental protection, and development of soil sciences. In soil resource sector, the major expertise includes (1) soil resource inventory by soil classification and mapping, soil information system construction of various scales; (2) land use change and its effect on soil resources; (3) soil degradation, including assessment and control measures; and (4) soil quality changes and assessment under different cropping systems.

Personnel involved:

Dr Gan-Lin Zhang is Professor and Leader Research in Soil Classification, Cartography and soil information systems.

Selected publications:

1. Mantel S, Zhang Xuelei and **Zhang Ganlin** 2003, Identification of potential for Banana in Hainan Island, China. *Pedosphere* **13,** 147-155
2. **Zhang Ganlin**, Gong Zitong, Zhang Xuelei, Zhao Yuguo, Mantel S and Van Engelen VWP 2002. Application of small-scale and large-scale SOTER databases in Hainan, China. *Transactions of 17th World Congress of Soil Science*, Symposium 44, Paper No.655
3. Zhao Yuguo, **Zhang Ganlin** and Gong Zitong 2003. SOTER-based soil water erosion simulation in Hainan Island. *Pedosphere***13,** 139-146
4. Zhang Xuelei, Chen Jie, **Zhang Ganlin**, Tan Manzhi and Ibanez JJ, 2003. Pedodiversity analysis in Hainan Island based on SOTER database. *Journal of Geographical Sciences* **13**, 181-186

Partner 13: Ecole Nationale d'Agriculture de Meknes

ENA' s work will be focused on the compilation of SOTER databases in WP 1 and 2, data supply for WP3 and WP5 applications of *e-SOTER* in Morocco.

Scientist in charge: Dr Rachid Bouabid

ENA-Meknes is one of the leading academic and research institutions in agriculture in Morocco. The educational system is a five-year program that culminates with a Master's in Science degree. The research activities focuses mainly on applied and development research. ENA is organized in ten departments with multidisciplinary team consisting of faculty members trained at PhD level in the fields of agronomy, soil science, animal science, plant protection, agricultural economics and extension, at leading universities in USA and Europe. ENA has developed good collaborative linkages with the international scientific community through various projects and exchange programs. ENA offers also continuing education programs an expertise in different fields. The soils department hosts a soil testing lab and has been involved in several soil research activities.

Researcher involved:

Dr. Rachid Bouabid (PhD) is a faculty at the Soil Science Department of the National School of Agriculture (ENA-Meknes) for 16 years. Along with the teaching activities on soil pedology, he conducts research and development work related to soil management and conservation aspects. He has participated to several projects dealing with soil and water resource sustainability. He was involved in the Moroccan SOTER database, and contributed to the organization in Morocco of 2 workshops on SOTER database for North African countries lead by FAO. He has good experience with participatory approach for rural appraisals and implementation measures in watershed management project. He is the SG of the Moroccan Association of Soil Science.

Selected publications:

- Badraoui M., **R. Bouabid** & R. Pavloviç. 2002. Les Bases de Données SOTER dans les Pays de l'Union du Maghreb Arabe. Bulletin de la FAO, 2002.
- Badraoui M., **Bouabid R.**, Ljouad L., Rouchdi M., 2002. Base de données digitales SOTER pour le Maroc. In Badraoui, Bouabid & Pavlovic Eds. Proceedings de l'atelier « bases de données SOTER pour les pays de l'Union du Maghreb Arabe ». 12-16 novembre 2001, Rabat, Maroc. Bulletin de la FAO, 2002. p. 63-76.
- Badraoui M., **Bouabid R**., Ljouad L. 2000. SOTER : Base de données sur le sol et le terrain au 1/5000000 du Maroc. Rapport et carte. Programme SOTER/FRA. Direction des Aménagements Fonciers, Ministère de l'Agriculture, du Développement Rural et des Pêches Maritimes. Rabat, Maroc.
- Badraoui M., **Bouabid R**., Rachidi F., Ljouad L. 2003. Land degradation and conservation in the

agro-ecosystems of Morocco. P. Zdruli éd., Ecosystem-based assessment of soil degradation to facilitate land users' and land owners' prompt actions. Proceeding of the MEDCOSTLAND Thematic Network project workshop, Adana, Turkey, 2-7 June 2003. p 247-258. IAM Bari, Italy.

- **Bouabid R.** Rachid F. & M. Kerby. 2003. Participatory Approach to integrated Soil Conservation: A pilot project in Nakhla Watershed in Northwestern Morocco. *In Proceedings of the Medcoastland-Thematic Network Project. Adana, Turkey, 2-7 June 2003. Ed. P. Zdruli, CIHEAM, Bari, Italy.*

Partner 14: Laboratory for Geo-information Science and Remote Sensing, Wageningen University

WU's work in WP3 will be focused on the development of additional predictors of soil properties using RS.

Scientist in charge: Prof. Dr sc. nat. Michael Schaepman

The Centre for Geo-Information (CGI) located at Wageningen University and Research Centre specializes in the domain of quantitative, physical and statistical based retrieval of land surface parameters relevant for Earth System Science with special focus on Earth observation related imaging spectroscopy. Particular attention is paid to the use of radiative transfer models, support vector machines, data assimilation, and linking soil-vegetation-atmosphere transfer models to state space estimation algorithms. This is complemented by a strong link using ecological process models, with emphasis on species composition of the vegetation at ecosystem level. Soil properties are assessed by using advanced methods for estimation of litter fraction, soil organic carbonates, and photosynthetic vs. non-photosynthetic vegetation with state-of-the-art spectrometers and methods. The Centre is well equipped for biochemical and biophysical parameter measurements, as well as photon-vegetation interaction measurement equipment ranging from directional mineral, soil, and leaf optical properties measurements to flux measurements at landscape scale.

Staff members of the group have already participated in various EU, ESA, NASA projects, including the design of the ESA APEX instrument, the participation in the Surface Process and Ecosystem Changes Through Response Analysis (SPECTRA) and FLEX (Fluorescence EXplorer) missions. The group provides representatives in ESA/EU GMES, CEN, CEOS, ISLCIP (LandFLUX) communities and supported the writing of the ESA science plan ('The Changing Earth'). The particular contribution will be focusing on the expertise in scaling reflectance measurements from microscopy scale to landscape scale, including the modeling of soil directional behaviour, as well as assessing relevant soil properties (clay/sand fraction, mineral composition, soil moisture, soil texture, fractional abundances of vegetation and non-vegetation, as well as process modeling serving as indirect measures for soil properties assessment. Additional expertise is present in the domain of spatial data infrastructures (global inventory of clearinghouses), crop yield forecasting (e.g., CGMS, MARS), National, European and global scale land use mapping (e.g., LGN4, GLC2000, PELCOM), directional thermal and reflective measurements, as well as water and energy balance modeling, among others.

Personnel involved:

Prof. Dr sc. nat. **Michael Schaepman**, Scientific manager (spectrodirectional imaging, quantitative, physical based remote sensing, dynamic process modeling, GEO participant, ISPRS WGVII.1 chair); Prof. Dr ir **Arnold Bregt** (Spatial Data Infrastructures (SDI), Clearinghouses, CEN member,), Dr **Jan Clevers**, Associate professor (imaging spectroscopy and multispectral imaging, vegetation indices); Dr **Lammert Kooistra**, Assistant professor (integration of remote sensing in ecological modelling, quantitative, statistical based remote sensing); Dr **Sytze de Bruin**, Assistant professor (spatial data quality, spatial uncertainty analysis); Drs **Harm Bartholomeus**, lecturer (imaging spectroscopy, soil spectroscopy, soil optical properties); Post-Doc and/or PhD students, to be appointed.

Selected publications:

1. Acerbi-Junior FW, **Clevers JGPW** and **Schaepman ME** 2006. The assessment of multi-sensor image fusion using wavelet transforms for mapping the Brazilian Savanna. *International Journal of*

Applied Earth Observation and Geoinformation **8**, 278-288

2. **Bartholomeus H**, Epema G and **Schaepman ME** 2007. Determining iron content in Mediterranean soils in partly vegetated areas, using spectral reflectance and imaging spectroscopy. *International Journal of Applied Earth Observation and Geoinformation* **9**, 194-203

3. **Clevers J**, **Schaepman ME**, Mücher CA, De Wit AJW, Zurita Milla R and **Bartholomeus H** 2007. Using MERIS on ENVISAT for Land Cover Mapping in The Netherlands. *International Journal of Remote Sensing* **28**, 637-652

4. **Schaepman ME** 2007. Spectrodirectional Remote Sensing: From Pixels to Processes. *International Journal of Applied Earth Observation and Geoinformation* **9**, 204-223

5. Schaepman-Strub G, **Schaepman ME**, Painter TH, Dangel S and Martonchik JV 2006. Reflectance quantities in optical remote sensing – definitions and case studies. *Remote Sensing of Environment* **103**, 27-42

B.2.3 Composition of the e-SOTER consortium

The *e-SOTER* consortium comprises major scientific institutes with highly respectable track record in soil and remote sensing related sciences. Most of hem have worked together successfully in other projects within EU framework programs and others. The expertise given in the table below illustrates the capacities of the consortium on all project domains (data collection, transformation, data management, applications and delivery). Access to data is guaranteed by the participation of national institutes.

Nr	Abbr	country	Expertise	Participate in WP
1	ISRIC	NL	Development of SOTER methodology, data distribution as World Data Centre Soils	1, 2, 6, 7, 8
2	UniMis	H	Digital procedure development of the SOTER manual and in the development of the SOTER database	1, 2, 3, 8
3	BGR	D	Soil inventories, soil information systems, geological survey, data base design	1, 2, 3, 4, 6, 8
4	JRC	It	Environmental research in experimental sciences, modelling, geomatics and remote sensing	1, 2, 3, 4, 6, 8
5	CU	UK	Assessment of soil, land and water quality, evaluation and control of environmental pollution, and the impacts of climatic and land use change.	1, 2, 3, 4, 6, 8
6	Alterra	NL	Fundamental and applied research in the area of land use management and hydrology	4, 5, 8
7	SIU	H	Research in the field of agricultural and environmental sciences	1, 2, 3, 8

Nr	Abbr	country	Expertise	Participate in WP
8	Scilands	D	Enhancing Digital Terrain Models (DTM), analyzing DTM	1, 3, 8
9	INRA	F	Integrated studies of the functioning of natural and cultivated ecosystems	1, 2, 5, 8
10	UNOTT	UK	Research and development issues associated with geospatial interoperability	6, 8
11	CULS	CZ	Resource inventory, soil information system construction	2, 3, 4, 5, 8
12	ISSCAS	China	Soil resource inventory, soil information systems, soil degradation research	1, 2, 8
13	ENA	Morocco	Natural resources surveys	1, 2, 3, 5, 8
14	WU	NL	Quantitative, physical and statistical based retrieval of land surface parameters relevant for Earth System Science with special focus on Earth observation related imaging spectroscopy	3, 8

Sub-contracting

Sub-contracting is foreseen for data delivery on soil parent material and soils. Such data are normally held by national or regional organizations and have to be purchased in a format that is usable by the project.

The following data are to be purchased:

- Parent material data for the 1:1 M windows and 1:250 000 pilots for WP1 and 3. This is part of the work of BGR and UniMis. An estimation of the costs is € 48,000 and € 65,000 respectively.
- Soil data for the 1:1 M windows and 1:250 000 pilots for WP2 and 3. This is part of the work of SIU (WP2). Estimated costs: € 25,000.

Consortium partners do not have access to data outside their national area, or are not allowed to collect them. Therefore sub-contracts with national or regional survey organizations will be made. Selection of sub-contractors is guided by availability of suitable candidates – mostly national/regional organizations with a mandate in the window or pilot area.

Sub-contracting for audited accounts of partners will take place during and at the end of the project. Estimated costs: € 32,000.

Third parties

Not applicable.

Funding for beneficiaries from third countries

Not applicable.

Additional beneficiaries

Not applicable.

B.2.4 Resources to be committed

The *e-SOTER* collaborative project comprises focused R&D and applications for web based delivery. The table highlights the various resources to be committed to the work within each WP.

	National & regional Data	Global data	Survey devices	Dedicated software	High performance computing	RS applications
WP 1	X	X		X		X
WP 2	X	X		X		X
WP 3	X		X	X	X	X
WP 4				X	X	
WP 5	X	X		X	X	
WP 6	X	X		X	X	
WP 7						
WP 8				X		

Personnel: The *e-SOTER* collaborative project will produce new methods and concepts to deliver aggregate mapping data as an EU contribution to a world soil and terrain database. The core of the work to be done is R&D in nature and to be performed by experts in every relevant field of research. I.e. 70% of the total budget is to be consumed by personnel and overhead costs (= on average €40 per hour).
The project management costs are calculated to be 7.1% of the total budget, which is well within international standards.

Data: The new methods and concepts are geared to provide a 'by-pass' to the existing legacy soil date in member countries. These legacy data are essential for the delivery of SOTER-based parameters. Traditionally the legacy data rest within (national and regional) public bodies of the member states and are either provided for free or should be procured.
In the total budget, 7.5% is set aside to subcontract these bodies to deliver the data needed and to provide additional services if necessary.

Computing hard- & software: To process the legacy data, using the new concepts and methods developed in *e-SOTER*, robust and high performance hard- and software are essential. As all partners have strong footings in soil research, this computer infrastructure will be available for the *e-SOTER* project. As only the Moroccan partner ENA does not have the necessary tools to work with, they made a consumable provision in their budget. All other partners recover the costs of these infrastructures from the overhead charges in their budgets.

Remote sensing applications: To collect remote sensing data, JRC, BGR and WU, will use their in house equipment. The costs thereof will be recovered from the overhead charges in their budgets.

Co-financing the EU-contribution: The total costs of the *e-SOTER* project are calculated to be €3.3 million. With an estimated EU contribution of €2.6 million, partners will have to swallow difference of circa €750,000.
The co-financing ratio is more or less the same for all partners, except for the coordinator who is in charge of a large part of the project management tasks (financed with a 100% EU contribution).

Partner	Total costs	EU contribution	Co-financing	%
ISRIC	471,306	425,498	45,808	9.7
UniMis	282,916	212,994	69,992	24.7
BGR	434,860	327,810	107,050	24.6
JRC	384,558	290,298	94,260	24.5
CU	304,975	230,570	74,405	24.4
Alterra	310,422	234,895	75,527	24.3
SIU	152,280	115,030	37,250	24.5
Scilands	168,380	127,550	40,830	24.2
INRA	129,893	98,880	31,013	24.0
UNOTT	99,846	76,415	23,431	23.5
CULS	76,440	58,630	17,810	23.3
ISSCAS	95,600	72,315	23,285	24.4
ENA	122,376	92,701	29,675	24.2
WU	311,868	236,326	75,542	24.2
TOTAL	**3,345,720**	**2,599,911**	**745,809**	

All partners have the resources to swallow the co-financing obligations as a consequence of participating in this *e-SOTER* project. The national scientific research institutes see it as a consequence of their national and international mandate on soil research and a privilege to participate in the e-*SOTER* team of scientific excellence. For the other partners, the financial security for staff allocated and subsequent projects and contracts expected to follow from this high international profile position, makes the e-*SOTER* participation and co-financing a worthwhile investment,

B.3 Impact

B.3.1 Expected impacts listed in the work program

The *e-SOTER* consortium is dedicated and apt to clear the grounds for a new global Soil Observing System. The concrete deliverables ad up to produce scientifically sound methods and concepts to produce a European Soil Observing System as a major component of a Global Soil Observing System to come.

The few applications of *e-SOTER* that can be demonstrated within the budget, limit the impact on potential user groups. Expansion of *e-SOTER* to a full European coverage will depend on the willingness of national institutes on natural resources to invest funds in feeding the created system. Risks are further elaborated in B1.3.1.

Confronted with the expected impacts listed in the FP7 ENV-work program we have listed the *e-SOTER* expected contributions.

Source	FP7-ENV objectives	RELEVANCE OF *e-SOTER* Collaborative Project
FP7 Work program ENV	To promote sustainable management of the environment and its resources through advancing our knowledge on the interactions between the climate, biosphere, ecosystems and human activities, and developing new technologies, tools and services, in order to address in an integrated way global environmental issues	*e-SOTER* is a new generation of soil and terrain mapping and database management technology - with vastly improved applications to support environmental policies, impact assessment and management at regional and global levels.
	Furthermore, wider international cooperation is necessary for the completion of knowledge and the promotion of better management at a global level	*e-SOTER* will be made operational from JRC and ISRIC, ensuring transparent availability to the public and private sectors and the general public.
	Earth Observation, which has gained recent international importance through the GEOSS initiative (Global Earth Observation System of Systems), intends to make the existing observing/monitoring systems more convergent at global level as described in the GEO 10 year implementation plan. The nature of environmental research is such that Earth Observation data and activities are needed in most of the topics of the environment Theme, which means that many of the environment topics supported through FP7 could be relevant to the Group on Earth Observation (GEO), Global Monitoring for Environment and Security (GMES) and Infrastructure for Spatial Information in Europe (INSPIRE) initiatives.	*e-SOTER* responds directly to the GEOSS proposal for agricultural monitoring system but goes well beyond the agricultural sphere – embracing global monitoring of environment and security and support for investments in urban and industrial infrastructure. *e-SOTER* fully complies with OGC standards and INSPIRE rules.

FP7-ENV-Act. 6.1	Furthermore a multi-risk approach combined with spatial planning, mapping and modelling are needed for the development of prevention and mitigation strategies. Multidisciplinary/interdisciplinary research aiming to better understand the underlying processes should be pursued to improve detection, prediction and forecasting methods.	*e-SOTER* will contribute to a better understanding of soil and terrain resources; it contributes essential data and procedures to detection, prediction and forecasting methods.
FP7-ENV Act. 6.4	Research activities will be focussed on the development and integration of the Global Earth Observation System of Systems (GEOSS) within which GMES (Global Monitoring for Environment and Security) is complementary for environment and sustainable development in the context of the GEO (Group on the Earth Observation) initiative (including support to the GEO secretariat). Interoperability between observation systems, information management and data sharing, and optimisation of information for understanding, modelling and predicting environment phenomena will be addressed A strong emphasis is put on the need to integrate the European Earth Observation related research activities into the global picture.	In following the interoperability standards by OGC, *e-SOTER* will allow data sharing, information management and optimization of information between observation systems within Europe and worldwide.
Call FP7-ENV 4.1.3.3	Conduct research activities needed for the European contribution to the completion of the World Soil and terrain database (SOTER) in view of developing the emerging global soil observatory. The project should build on already existing European contribution towards the above objectives in particular in view of filling the gaps occurring from different countries (e.g. developing countries). It should also include elaborating methods to analyse, quantify and record soil status with respect to the multiple pressures affecting soil ecosystems. The project should contribute integrating the European efforts in providing a regional pilot platform which would be linked to the World Soil and terrain database and other GEO relevant initiatives in involving the adequate international partnership, and in compliance with the objectives of the EU Soil Thematic Strategy. ***Expected impact****: Development of European Earth Observation systems and related activities as a major component of a future Global Soil Observing System for GEOSS where observing/monitoring systems are lacking or need to be significantly completed.*	*e-SOTER* is a web-based Pilot Platform contributing to a European and Global Soil Observing System. The *e-SOTER* portal will give open access to: • An enhanced soil and terrain database for four 1:1 million-scale • Methodologies to create SOTER databases • Methods to derive landform units from DEMs • Methods to obtain parent material and soil information by combining remote sensing and legacy data • An artifact-free digital elevation model • Enhanced SOTER databases at scale 1:250 000, compiled using advanced techniques in remote sensing and DEM analysis and methodologies such databases • Advanced remote sensing techniques to obtain soil attributes • Dedicated applications related to major threats to soils

The *e-SOTER* web services will be hosted by JRC and ISRIC, acting as the European Soil Data Centre and as the World Data Centre for Soils of ICSU respectively. The continued existence of both institutes in guaranteed. One of the deliverables of the project is a tool to enable people to populate the database. Procedures are in place for data quality control. It is the policy of JRC and ISRIC to encourage data custodians of national and regional data to contribute these to the SOTER database.

B.3.2 Dissemination and management of intellectual property

B.3.2.1 Dissemination

The *e-SOTER* project aims to deliver new methods, concepts and proven applications to as a contribution to a World Soil observing system that tackles the gaps within the current systems (FAO and SOTER).

In order to bring about this Global Soil Observing System, it is vital that countries, multi-national bodies, scientific communities etc. are well informed about the outcome and results of the *e-SOTER* collaborative project. Only when these communities adopt the solutions developed in their systems and applications, a World Soil Observing system can emerge.

The *e-SOTER* project therefore makes it immanent to have an encompassing dissemination plan under the responsibility of the project manager. The project manager will develop this dissemination plan in the first 6 months of the project for approval by the Steering Committee. Although the Project manager will have to work out its own plans in sufficient detail, the following elements will be included:

The *e-SOTER* dissemination plan will include

- Reports for internal circulation within the project to plan and document the work (to be) done.
-
- A final wrap-up workshop for all parties within the project to discuss findings, experiences and follow up.
- One workshop in that allows for a more contextual discussion of results and feedback from stakeholders (scientific researchers, users groups/communities (policy makers, planning, etc.)
- Sharing the project results and experiences with partners outside EU
- Presentations at relevant conferences to stimulate interest in the project results.
- Internet-site hosted by JRC for the Soil and terrain research community with information on the project, related R&D activities, etc.

The General Assembly has a particular responsibility to liaise with and sensibilize the executive officers of the leading institutions and bodies outside the EU.

All participants have agreed to actively disseminate information to (inter)national organizations and societies. In addition specific conferences and embedded workshops, similar to those in other EU-funded Consortia, will be organized, to share the technologies, new scientific knowledge and insights from within the *e-SOTER* project to outside interest groups and organizations.

The Consortium will stimulate swift publication of results. The scientific results will be disseminated as manuscripts submitted for publication in major journals. By publishing papers in these journals the partners of this Consortium agree to make freely available to colleagues in academic research any of the material that were used in the research reported and that are not available from commercial suppliers.

B.3.2.2 Management of intellectual property

This chapter handles the access right to foreground for policy purposes and transfer of ownership of *groun*d (specific to environment research) as defined in Special Clause 29 of the Grant Agreement.

a) The *e-SOTER* project data collection and storage protocols will be in line with the Community Data Policy as defined in the **INSPIRE Directive** (European Parliament 2007):

   1) Creation of metadata: they will be part of all data sets collected during the project life-time, in particular in WP 1, 2 and 3 but also in WP 4 and 5 as far as applicable
   2) Application of rules for interoperability of data sets and services: this will be implemented in WP 6 in the task 6.1
   3) Application of data sharing: data collected within the project will be made available through an *e-SOTER* portal, established at JRC and ISRIC – task 6.3 of WP 6.

   and with the **GEOSS Data Sharing Principles** (Group on Earth Observations 2005):

   1) Full and open exchange of data, metadata, and products shared within GEOSS, recognizing relevant international instruments and national policies and legislation: through the *e-SOTER* portal.
   2) All shared data, metadata, and products will be made available with minimum time delay and at minimum cost: through the public *e-SOTER* portal.
   3) All shared data, metadata, and products free of charge or no more than cost of reproduction will be encouraged for research and education: through the public *e-SOTER* portal.

   Mapping, integration and sharing of data will be ensured by the project, being the core of WP 1, 2, 3, 5 and 6. Maintenance of the data after the closure of the project will be in the hands of all contributing beneficiaries who can upload newer data into the continuing product of WP 6: the *e-SOTER* web portal operated at JRC and ISRIC, as the European Soil Data Centre and as the World Soil Data Centre of ICSU, respectively.

b) The *Community* Institutions and Bodies shall enjoy access rights to *foreground* for the purpose of developing, implementing and monitoring environmental policies. Such access rights shall be granted by the all beneficiaries concerned on a royalty-free basis.

c) Where *foreground* will no longer be used by the beneficiaries nor transferred, the *beneficiary* concerned will inform the *Commission*. In such case, the *Commission* may request the transfer of ownership of such *foreground* to the *Community*. Such transfer shall be made free of charge and without restrictions on use and dissemination. As all *foreground* will be accessible through the *e-SOTER* portal at JRC, this provision will be automatically fulfilled.

All *e-SOTER* participants endorse the need to properly manage all the intellectual assets and innovation generated by the Project. All such activities will be coordinated by the Knowledge manager as part of WP 6.

All partners agree to have no prior reservations to inputs of resources, tools and know-how needed to accomplish the tasks and produce the deliverables.

It is the firm intention of the partners not to claim or restrict the use of new knowledge, methods, concepts or products. However, when issues of this kind emerge, they will be put before the Steering Committee to determine the appropriate course of action.

B.4 Ethical issues

e-SOTER will provide a regional pilot platform for Soil observation as a contribution to a world soil observing system. As far as we can see and to the best of our knowledge, no ethical issues of any kind are related to this project.

	yes	Page
Informed consent		
• Does the proposal involve children?		
• Does the proposal involve patients or persons • not able to give consent?		
• Does the proposal involve adult healthy • volunteers?		
• Does the proposal involve Human Genetic • Material?		
• Does the proposal involve Human biological • samples?		
• Does the proposal involve Human data • collection?		
Research on Human embryo/foetus		
• Does the proposal involve Human Embryos?		
• Does the proposal involve Human Foetal • Tissue / Cells?		
• Does the proposal involve Human Embryonic • Stem Cells?		
Privacy		
• Does the proposal involve processing of • genetic information or personal data (e.g. • health, sexual lifestyle, ethnicity, political • opinion, religious or philosophical conviction)		
• Does the proposal involve tracking the • location or observation of people?		
Research on Animals		
• Does the proposal involve research on • animals?		
• Are those animals transgenic small laboratory • animals?		
• Are those animals transgenic farm animals?		
• Are those animals cloning farm animals?		
• Are those animals non-human primates?		
Research Involving Developing Countries		
• Use of local resources (genetic, animal, plant • etc)		
• Benefit to local community (capacity building • i.e. access to healthcare, education etc)		
Dual Use		
• Research having potential military / terrorist • application		
I CONFIRM THAT NONE OF THE ABOVE ISSUES		

B.5 Consideration of gender aspects

B.5.1 Areas of research

Not applicable.

B.5.2 Gender balance in the consortium

Traditionally soil science, in particular field-based activities, has been limited to men. However, the consortium is pleased to include, on merit, Dr Erika Micheli as a female WP leader and, in that capacity, member of the Executive Board.

B.5.3 Gender balance in the dissemination

Not applicable.

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