



Project acronym	e-SOTER
Project full title	Regional pilot platform as EU contribution to a Global Soil Observing System
Project No	211578

**Deliverable  
D13**

**Report on the final  
Stakeholders Conference**

April 2012



## Document Information

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Deliverable number	D13
Deliverable title	Final stakeholder conference
Period covered	n.a.
Due date of deliverable	02/2012
Actual date of deliverable	26/04/2012
Author(s)	Vincent van Engelen (ISRIC)
Participants	All WPs
Work package	7
Work package title	Stakeholder conferences
Dissemination level	PU
Version	1.0

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### History of Versions

Version	Date	Status	Author	Approval level
1.0	26/04/2012		Van Engelen	

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## 1 Summary

On March 20-23, 2012 the Food and Agriculture Organization of the United Nations - FAO and the e-SOTER project organized a large Global Soil Partnership workshop: 'Towards Global Soil Information: activities within the GEO Task Global Soil Data'. The workshop was attended by 80 persons from a wide range of soil data producing and using organizations. One day of the workshop was dedicated to e-SOTER and this report limits itself to that day.

Several presentations on e-SOTER, its aims and products, were given by consortium partners, followed by discussions with the audience.

The e-SOTER methodology was endorsed by the Executive Committee of the European Soil Bureau Network and recommended as the methodology to update the 1:1 million scale European soil database.

## 2 Background

FAO, with the support of the European Commission has launched the **Global Soil Partnership - GSP** in September 2011 to raise awareness of decision makers on the vital role of soil resources for achieving food security, adapt to and mitigate climate change and guarantee provision of environmental services. The improvement of soil information and its use in developing sound soil policies and improved decision making for soil protection and management are the main aims of the GSP. In that regard, the GSP will address five main pillars of action:

1. harmonization and establishment of guidelines and standards of methods, measurements and indicators;
2. strengthening of soil data and information;
3. promoting targeted soil research and development;
4. promoting sustainable management of soil resources; and
5. encouraging investment, policy and technical cooperation in soils.

The **e-SOTER** project funded by the European Commission FP7 research program and coordinated by ISRIC – World Soil Information has developed in the past 3.5 years a *Regional pilot platform as EU contribution to a Global Soil Observing System*. The Group on Earth Observations (GEO) 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.

FAO and the e-SOTER project considered a joint workshop that would address (1) the GSP-pillar *Strengthening of soil data and information* and (2) the research results of the e-SOTER project would be a good venue for the global soil community.

## 3 Presentations

There were 13 presentations on e-SOTER project and one of the Global Soil Data task of GEOSS:

**e-SOTER as a contribution to a Global Soil Observing System:** Vincent van Engelen (ISRIC) reported on the Global Soil Data task of GEOSS in which the e-SOTER project participated. The task has two major thrusts: area-class soil maps and soil property surfaces. Currently the Harmonized World Soil Database in which existing SOTER products have been incorporated is the first product that will become available through the GEO portal.

**Overview e-SOTER:** Vincent van Engelen (ISRIC) reported upon the set-up and achievements of the project and mentioned that good progress was notably made in morphometric descriptions, soil parent material characterization, pattern recognition by remote sensing, standardization of procedures, quality assessments and uncertainty analysis. Moreover, applications of the database and validation and uncertainty analysis were also made. The project also developed a web service.

**Development of terrain and parent material platform at scale 1:1 million:** This issue was reported upon by Endre Dobos (University of Miskolc) who concluded that a quantitative methodology to delineate SOTER terrain units using digital data sources like satellite imagery and digital terrain models in combination with legacy data has been developed. However, there should not be attempts to reproduce the "traditional" datasets with the new tools, but rather to convert and save all the information from the legacy datasets using the new tools in a novel dataset design.

**Developing the soil component of e-SOTER** was discussed by Erica Micheli (Szent Istvan University) who drew the attention to the fact that the unavailability, and limited access and quality of soil data remain a major limitation. Expert knowledge and better guidelines for soil observation need to be improved/harmonized while further developing distance methods and other numerical approaches which are promising.

**Enhancing the Terrain component in the e-SOTER database** was presented by Joanna Zawadska (Cranfield University) who tested two different approaches and concluded that both methods give different but not dissimilar results Bayesian Networks favour approaches based on homogenous objects while Cramer's V statistic finds more value in approaches based on physical entities.

**A new system of terrain classification** was presented by Rüdiger Köthe (Scilands GmbH) who concluded that terrain analysis and classification on the base of DTM can deliver a valuable contribution to create or enhance soil maps. Particularly in regions with poor data availability terrain analysis on the base of SRTM data in the form of geomorphographic maps can help to create soil maps.

**A new classification of soil parent material** was discussed by Ulrich Schuler (BGR) who emphasized the advantage of a revised classification of parent material (FAO, 2006) for the derivation of soil properties. This could serve to develop a global parent material layer for SOTER. Advantages and disadvantages of gamma spectrometry were also discussed.

**Integration of terrain, parent material and soil information in e-SOTER at 1:250 000 scale** was presented by Michael Bock (Scilands GmbH). The procedure consistently implements the site factors relief and parent material Pre-stratification of the landscape

according to soil regions is required for larger mapping projects. The validity to serve as a conceptual soil map is promising, but it needs further investigation by soil surveyors.

**e-SOTER web services: status and way ahead to a Global Soil Information Service** was discussed by Yusuf Yigini (JRC- European Commission). The web portal designed for disseminating the results of e-SOTER was illustrated. It made also use of the metadata of GeoNetwork. It is expected that the portal will go live in April 2012.

**Enhanced e-SOTER database for a study area in the UK** was discussed by Joanna Zawadzka (Cranfield University). She concluded that both presented approaches added value to the SOTER database. Inclusion of terrain component based on physical entities appropriate for 1:250 000 scale mapping while the Terrain component based on homogenous objects is appropriate for small scale maps (1:1 – 1:5 M). The accuracy of the database in terms of provision of soil information is affected by the accuracy of parent material data and soil observations.

**Application of the e-SOTER approach in Morocco: opportunities and constraints** was presented by Rachid Moussadek (INRA-Maroc) who concluded that the e-SOTER approach remains good approach as a first step framework for a soil mapping program of the unstudied areas of Morocco. This approach is also a great opportunity to build local capacity and establish a Moroccan Soil Database to be used in studies for mitigating climate change and soil erosion, while enhancing soil fertility and land suitability.

**Validation and uncertainty analysis** was presented by Gerard Heuvelink (Alterra) who concluded that important error sources in the UK e-SOTER soil map are the over-representation of Histosols and Podzols and the absence of Leptosols as a dominant soil group. Important error sources in the G/CZ e-SOTER soil map are the under-representation of Chernozems and Podzols and the confusion between Hydromorphic soils, Cambisols and Luvisols. DEM uncertainty has the largest effect on slope class. Uncertainty about the prevailing landform attribute, quantified by the entropy, is generally small.

**Applications of the e-SOTER database using some models to simulate soil threats** was discussed by Simone Verzandvoort (Alterra) who stated that there was a large deviation of model outputs compared to expert responses. Model outputs based on the e-SOTER database are not always better according to the experts than those based on legacy databases.

**Standard and services for soil and terrain data exchange: SoTerML** were discussed by Steve Hallett (Cranfield University) who proposed that data should be available over the internet in a standard format (OGC WFS) while merging legacy and new data across domains.

Presentations can be downloaded from <http://www.esoter.net>.

**Table 1.** Presentations given by e-SOTER partners

Presentation	Author	Partner
Overview e-SOTER	Vincent van Engelen	ISRIC
Development of a terrain and parent material platform at scale 1:1 million	Endre Dobos	UniMis
Developing the soil component of e-SOTER	Erika Micheli	SIU

Enhancing the terrain component in SOTER database	Joanna Zawadzka	CU
A new system of terrain classification	Rüdiger Köthe	Scilands
A new classification of soil parent material	Ulrich Schuler	BGR
Integration of terrain, parent material and soil information in e-SOTER at scale 1:250.000	Michael Bock	Scilands
Enhanced SOTER database for a study area in the UK	Joanna Zawadzka	CU
Application of e-SOTER approach in Morocco: opportunities and constraints	Rachid Moussadek	INRA-Maroc
Validation and Uncertainty Analysis of e-SOTER products	Gerard Heuvelink	Alterra
Applications of e-SOTER related to major soil threats	Simone Verzandvoort	Alterra
e-SOTER Web Services	Yusuf Yigini	JRC
Standards and services for Soil and Terrain Data Exchange: SoTerML	Daniel Simms	CU

## 4 Discussion and conclusions

The e-SOTER presentations were followed by a two hour debate chaired by Jon Hempel (USDA-NRCS) of which the highlights are summarized here.

Eddy De Pauw (ICARDA) kicked off the discussion by asking if the terrain analysis was a single track or if this could follow several tracks. Jon Hempel concluded that on the basis of the interventions it appears indeed that several tracks are possible depending on the availability and quality of the data (in particular geology).

The advantages and disadvantages of polygon based mapping versus pixel based mapping were discussed by Vincent van Engelen (ISRIC), Endre Dobos (Univ. Miskolc), Rainer Baritz (BGR) and Eddy de Pauw (ICARDA), in particular how to devise ways to distribute soil profile information within the polygon.

Another discussion launched by Luca Montanarella (EC-JRC) questioned the future of e-SOTER as his expectations had been at the onset of the project that it would result in a full SOTER update of Europe at 1:1 M scale. Vincent van Engelen as coordinator of e-SOTER pointed out that the project document did only specify research on tools and methods to do so and to refine the methodology at 1:250 000 scale in specific windows for future national applications. Both these objectives were achieved. Erica Michele (Szent Istvan University) stated that although the e-SOTER update for Europe at 1:1 million scale was started, there were problems with soil profile information access from several countries. Given the present economic and financial crisis collecting new soil information is not a priority for countries in the EU. Luca Montanarella concluded that although a global SOTER remained a long term goal it would be better to concentrate on the 1:1 million scale update for Europe only, which could feed in the HWSO product.

The decision to continue the effort to produce a 1:1 million SOTER for Europe was later confirmed in a parallel meeting of the executive committee of the European Soil Bureau Network.

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