e-SOTER

Regional pilot platform as EU contribution to a Global Soil Observing System

FP7 project # 211758

ISRIC World Soil Information

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The FP7 setting

European Commission involved in initiatives which are developing and improving the access of Europe to Earth observation capacities:

- Global Earth Observation System of Systems (GEOSS)
- Global Monitoring for Environment and Security (GMES)
- Infrastructure for SPatial InfoRmation in Europe (INSPIRE)

Specific research activities for GEOSS for environment and sustainable development with a soils link:

- Supporting sustainable agriculture and combating desertification
- Supporting a global soils and terrain database at scale 1:1 M

Earth Observations in FP7

Development of a Global Soil Observing System:

- Research for the European contribution to the completion of the World SOTER database
- Build on existing EU contribution to SOTER
- Filling gaps (e.g. developing countries)
- Methods to analyse, quantify an record soil status with respect to pressures affecting soils (threats)
- EU effort to provide regional pilot platform for SOTER and GEOSS
- Follow objectives of EU Soil Thematic Strategy

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Figures:

- Duration: 3.5 years
- Starting date: September 1st 2008
- Budget: € 3.3 M
- EU-funding: € 2.6 M
- Total labour effort: 410 person months
- Partners: 14
- Coordinator: ISRIC (34 person months of which 20 for management)

e-SOTER consortium

- ISRIC - World Soil Information (coordinator)
- Dept of Phys. Geogr. and Environm. Sc. - University of Miskolc
- Federal Institute for Geosciences and Natural Resources (BGR)
- Institute of Environment and Sustainability - Joint Research Centre
- National Soil Resources Institute - Cranfield University
- Alterra
- Dept. of Soil Sc. and Agric. Chemistry - Szent Istvan University
- Scientific Landscapes (SciLands)
- Institut National de la Recherche Agronomique- Orléans
- Centre for Geospatial Sciences - University of Nottingham
- Czech University of Life Sciences
- Institute of Soil Science – Chinese Academy of Sciences
- Ecole Nationale d'Agriculture de Meknès
- CGI - Wageningen University

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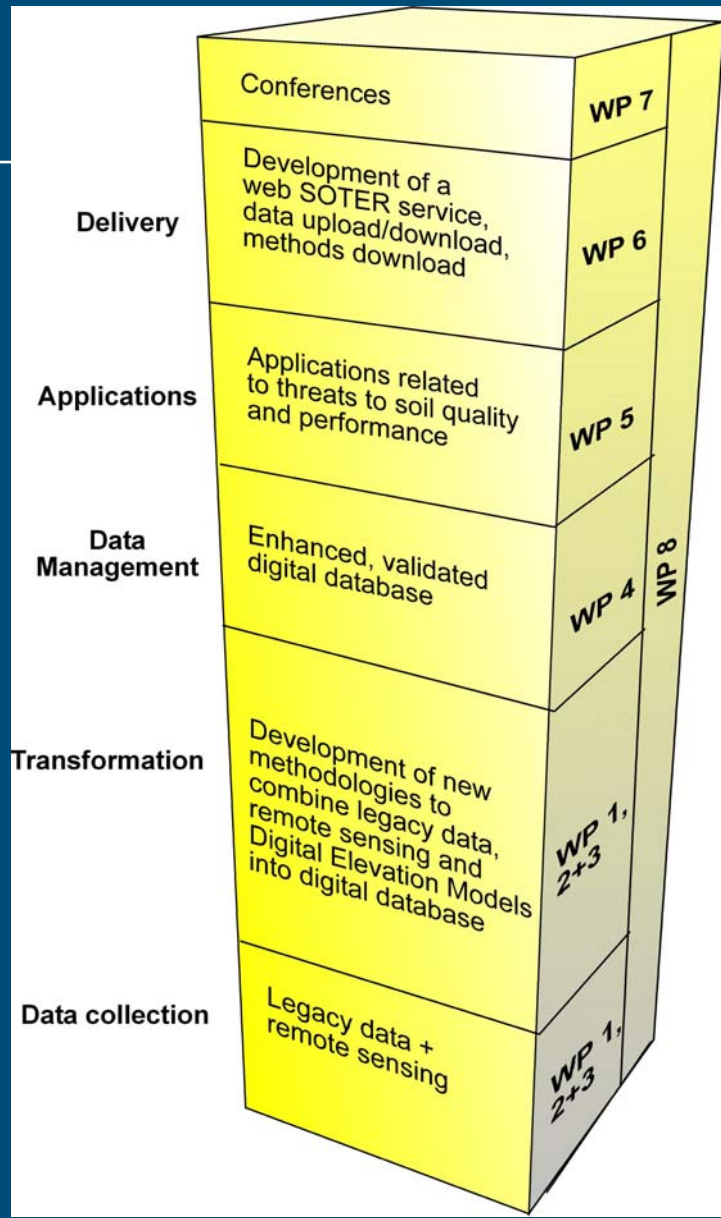
Components of a comprehensive soil observing system:

- data collection
- transformation
- data management
- interpretations
- delivery



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e-SOTER will overcome the current shortcomings of SOTER and form a platform that can be extended world-wide by:

- Using RS data for validation and correction of existing survey data
- Generating new data surfaces
- Improving the quality of applications
- Providing a freely accessible web service

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e-SOTER 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.

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Project objectives in detail:

- 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 for the 1:1 M scale and for the 1:250 000 scale.

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Project objectives in detail:

- 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, for the 1:1 M scale and for the 1:250 000 scale

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Project objectives in detail:

- 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 for the 1:1 M scale and for the 1:250 000 scale

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Additional project objectives:

- Quality assessment through validation and uncertainty analysis
- Applications in the field of major soil threats and comparisons with applications based on earlier datasets
- Dissemination through stake-holder conferences and through web-based services

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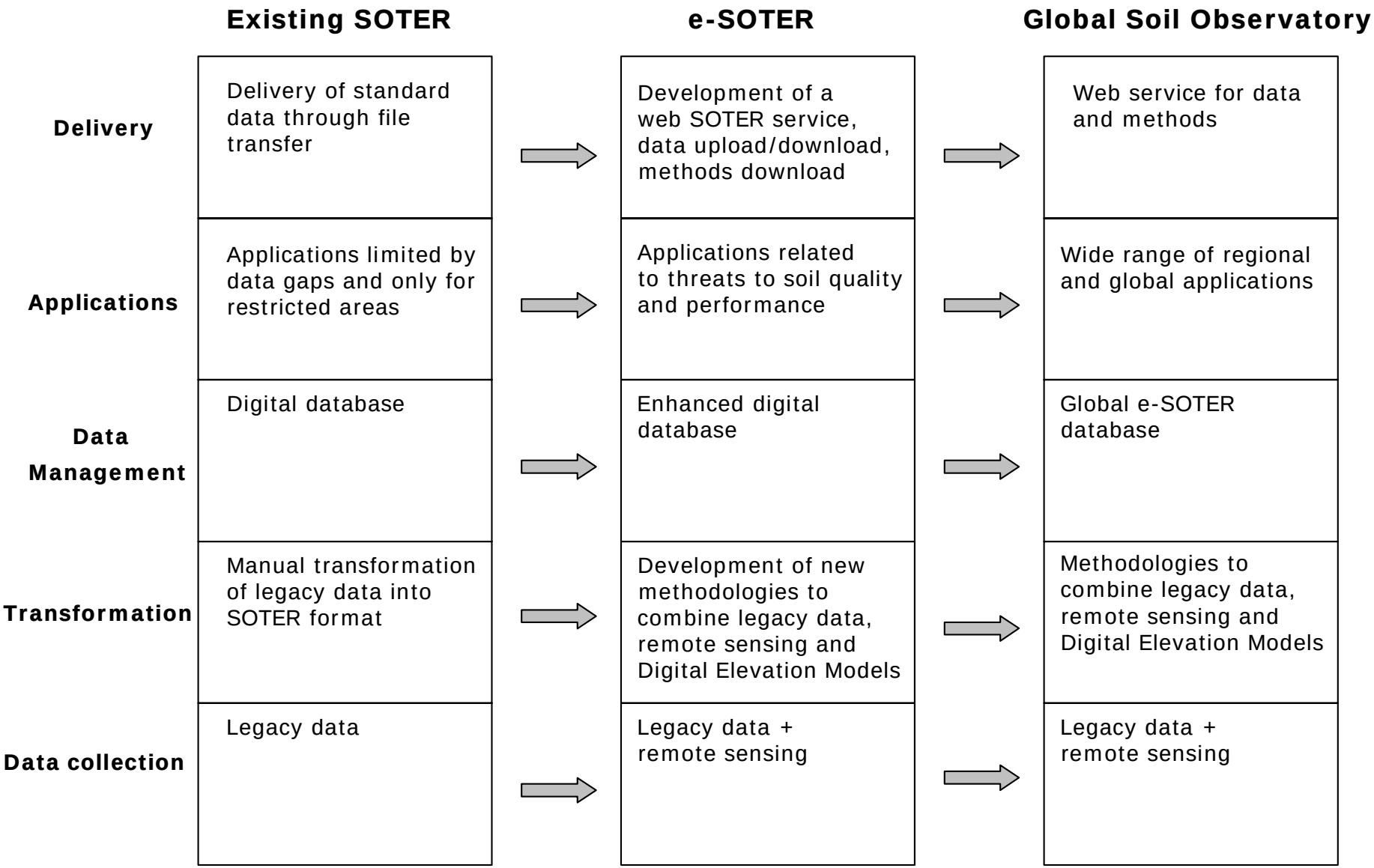
Two major research thrusts:

- 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
- Advanced methodologies applied at scale 1:250 000 using geomorphic landscape analysis, geological re-classified remote sensing, and a remote sensing approach of soil


Existing SOTER
e-SOTER
Global Soil Observatory
Delivery
Delivery of standard data through file transfer
Development of a web SOTER service, data upload/download, methods download
Web service for data and methods
Applications
Applications limited by data gaps and only for restricted areas
Applications related to threats to soil quality and performance
Wide range of regional and global applications
Data Management
Digital database
Enhanced digital database
Global e-SOTER database
Transformation
Manual transformation of legacy data into SOTER format
Development of new methodologies to combine legacy data, remote sensing and Digital Elevation Models
Methodologies to combine legacy data, remote sensing and Digital Elevation Models
Data collection
Legacy data
Legacy data + remote sensing
Legacy data + remote sensing

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Advances in:

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.

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Advances in:

Transformation

- 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:

- *Landform:* At the 1:1 million scale, landform units will be derived from analysis of the SRTM 90m DEM. The morphometric analysis will elaborate the SOTER landform definitions introduced by Dobos *et al. (2005)*.

  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 (Köthe and Bock 2006); and fixed definitions as opposed to flexible definitions related to individual landscapes.

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Advances in:

Transformation (continued)

- *Soil parent material:* 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.

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Advances in:

Transformation (continued)

- *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 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.

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Advances in:

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

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Advances in:

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

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Windows and pilots

Legend

1:1 M window

1:250,000 pilot

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