Desertification in Europe

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Desertification in Europe?

A common misunderstanding is that desertification is linked to the presence of deserts. The truth is that desertification can and does occur far from any climatic desert, as the presence or absence of a nearby desert has no direct relation to desertification (Dregne, 1986). Desertification is the result of human induced land degradation which can be accelerated under severe drought conditions, and can occur under very diverse climatic conditions.
Desertification as the result of many different land degradation processes in Europe

Water erosion

Soil sealing

Wind erosion

OZ vom 11.04.1997
The impact of human activities on soil

- Diffuse input of contaminants as particulates
- Persistent substances
- Gradual disappearance of farms
- Sealing
- Blocking of soil functions important to the ecology of the landscape
- Destruction of soil
- Gradual destruction of soils
- Gradual destruction of soils
- Reduction in soil fertility
- Destruction of humus
- Changes in the structure of soils
- Reduction in soil fertility
- Acidification
- Contamination of soils and ground water with applied agrochemicals and atmospheric pollutants
- Changes in soil composition
- Adverse impacts on living organisms in the soil
- Adverse impacts on living organisms in the soil
- Salinisation
- release of toxic substances
- Destruction of soil
- Desertification!
Increasing drought in Europe

Daily soil moisture map of Europe

Date: 2005-09-18

http://natural-hazards.jrc.it
Increasing drought in Europe

Daily soil moisture anomaly map of Europe
- comparison to ERA40 simulation -

Date: 2005-09-18

http://natural-hazards.jrc.it
Weekly soil moisture trend for Europe

- daily trend of the development of soil moisture during the next seven days -

Increasing drought in Europe

Period: 2005-09-20 to 2005-09-27

http://natural-hazards.jrc.it
Affected countries in Europe according UNCCD

- Annex IV: Mediterranean Countries
  - Portugal
  - Spain
  - Italy
  - Greece
  - Malta
  - Turkey
  - ........
- Annex V: Central and Eastern European countries
  - Latvia
  - Belarus
  - Hungary
  - Romania
  - ...........
- European Community is party to the Convention and observer in both annexes but not an affected party by desertification within UNCCD
Actual Soil Erosion Map for Europe - 2000

Rate of soil loss (t/ha/yr)

Country boundary
Rivers (large)
Rivers (medium)
Lake (large)
Major water
Urban

The updated soil erosion map represents spatial distribution and current status of the soil erosion in Europe. It is a result of the CORINE land cover 2000 data for the years 1990-1995, updated with the CORINE land cover 2000 for the same date. The map was produced by the Institute for Environment and Sustainability, Joint Research Centre, Ispra, Italy.

MAP INFORMATION
Spatial coverage: Austria, Belgium, Czech republic, Denmark, Estonia, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Poland, Portugal, Slovakia, Slovenia, Spain, The Netherlands, United Kingdom.

Legend:
- 0 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 - 50
- >50

Country boundary
Rivers (large)
Rivers (medium)
Lake (large)
Major water
Urban

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Digital datasets can be downloaded from http://ec.europa.eu/energy/download_eu27_modular_eu27.zip

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Expected trends of erodibility of Luvisols in the European Union

Trends of erodibility
- Improved resistance
  - Fast decrease of erodibility
  - Decrease of erodibility (slow, low original erodibility)
  - Decrease of erodibility (slow, high original erodibility)
- Growing sensitivity
  - Steady conditions (low erodibility)
  - Steady conditions (high erodibility)
  - Increase of erodibility (slow, low original erodibility)
  - Increase of erodibility (slow, high original erodibility)
  - Fast increase of erodibility
Main human-induced driving forces

- Soil disturbance e.g. ploughing up-and-down slopes
- Removal of vegetative soil cover and/or hedgerows
- Increased field size (open fields)
- Abandonment of terraces
- Late sowing of winter cereals
- Overstocking
- Poor crop management
- Inappropriate use of heavy machinery, in agricultural and forestry practices, but also during construction works.
Consequences of erosion

• On-site effects
  • Loss of soil
  • Loss of soil fertility due to disrupted nutrient cycles
  • Restrictions on land use hindering future redevelopment and reducing the area of productive and valuable soil available for other activities (agricultural and forestry production, recreation etc.)
  • Land value depreciation

• Off-site effects
  • Damage to infrastructures due to excessive sediment load
  • Diffuse pollution of surface water
  • Negative effects on aquatic ecosystems and thereby biodiversity
  • Reduced water retention capacity, hence higher flood risk
  • Human health problems due to dust and particles in the air
The role of soils in the global carbon balance

Soil carbon and the global C budget

net C flow terrestrial -> atm (Gt/yr) 1997

1.6

120

2.0

3.5

Atmosphere (750 Gt)

6.5

fossil C

Vegetation (650 Gt)

Soils (1500 Gt)

Ocean

M. Robert, 2004
Soil Organic Carbon dynamics

- Terrestrial organic carbon pool
- Max. potential carbon stock at climax
- Max. potential carbon stock achievable through LULUCF measures
- Actual terrestrial carbon stock
- Hypothetical carbon stock build-up by LULUCF measures

Terrestrial carbon stock depletion by historical human induced LULUCF activities

Ca. 60,000 B.C. to 1000-1500 A.D Last “green” revolution

Present Future

ISC0 22/05/2008
Main land cover changes effects on soil C stocks

![Graph showing C stock change over duration for different land cover changes.]

- **Arable => forest**
- **Arable => grass**
- **Forest => arable**
- **Grass => arable**

Duration (years)

C stock change (T/ha)

Arrouays et al. 2002
Topsoil Organic Carbon Content (30cm)

Model output

Organic carbon content (%) in the surface horizon (0-30 cm) of soils

Organic matter decline

Aggregated results

National Soil Organic Carbon stocks (0-30cm) in Gt
Soil Organic Carbon and Erosion: Italy

![Map of Italy showing soil organic carbon and erosion rates](map.png)
Map of the soil’s natural susceptibility to compaction in the European Union

Legend:
- No soil
- Low
- Medium
- High
- Very high
- No evaluation

Houskova et al. 2008
Map of Saline and Sodic Soils in the EU: Status and Potentials

Legend
- Saline > 50% of the area
- Sodic > 50% of the area
- Saline < 50% of the area
- Sodic < 50% of the area
- Potentially salt affected soils

Tóth et al. 2008
Conclusions

• Extensive soil and land degradation processes are occurring in Europe leading to desertification.
• Observed degradation processes are mostly human induced.
• Extreme climatic events may further exacerbate the impact of the land degradation on local population.
• Local mitigation measures require an extensive assessment of the desertification processes covering the complete DPSIR framework.
• Constant monitoring and data collection allows for the evaluation of implemented measures and for regular updates of the status of desertification in Europe.