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THE RELEVANCE OF SOIL AND SOIL SCIENCE TOWARDS REALIZATION OF THE UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

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Co-Chair of the IPBES Land Degradation and Restoration Assessment (LDRA)

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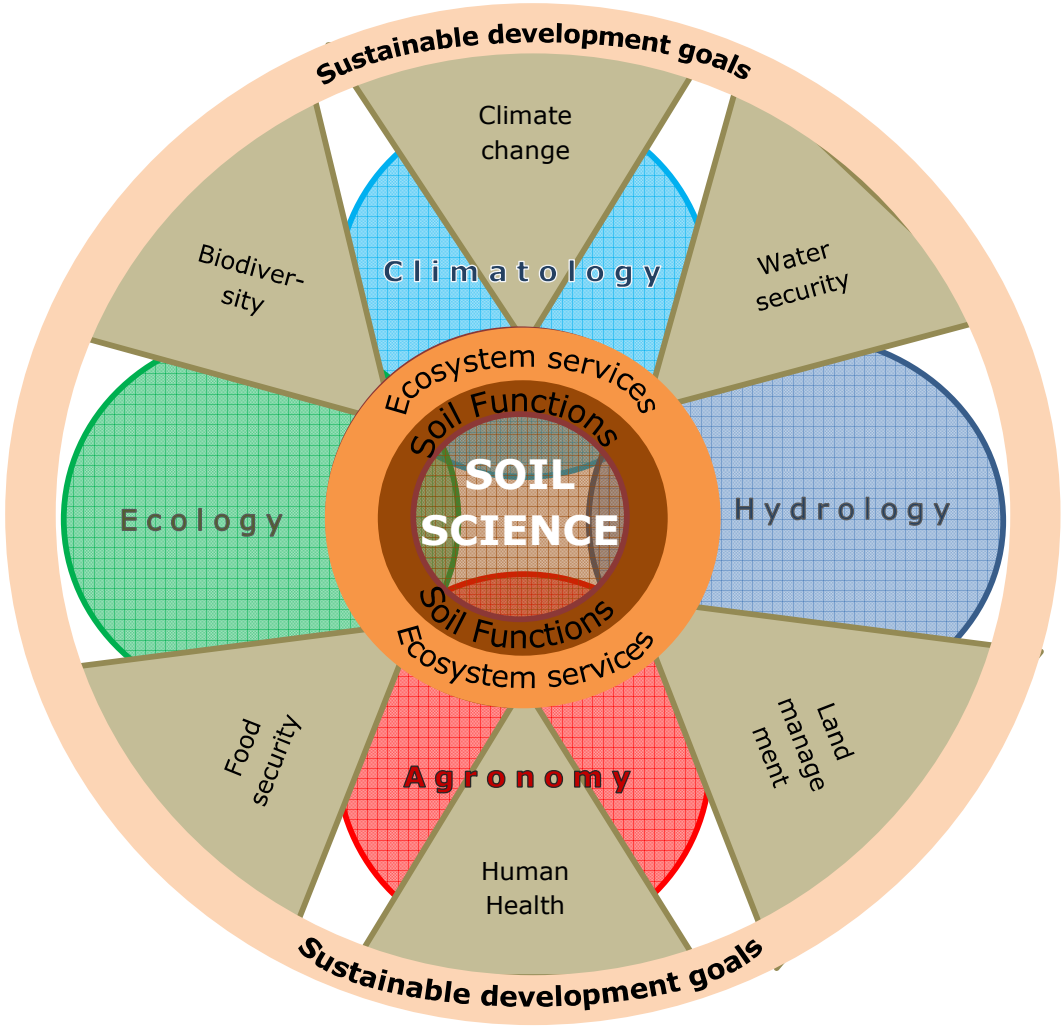
SUSTAINABLE DEVELOPMENT GOALS:

1 UNIVERSAL AGENDA, 17 GOALS

Relating soil science to soil functions, ecosystem services and sustainable development goals



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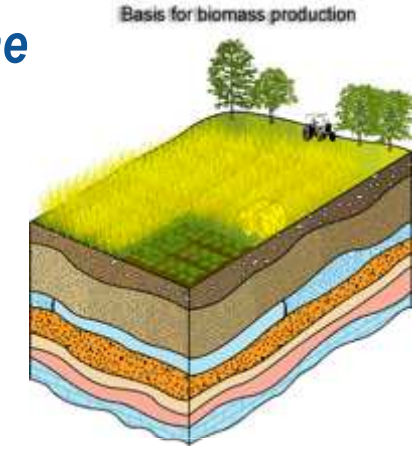
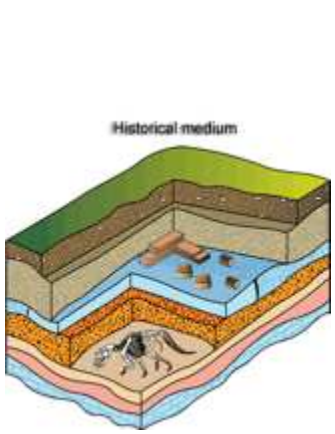
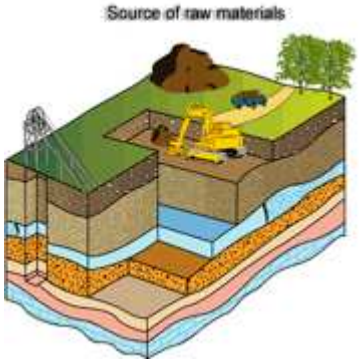
Soils deliver multiple services (soil functions as identified in the Soil Thematic Strategy COM(2006) 231):

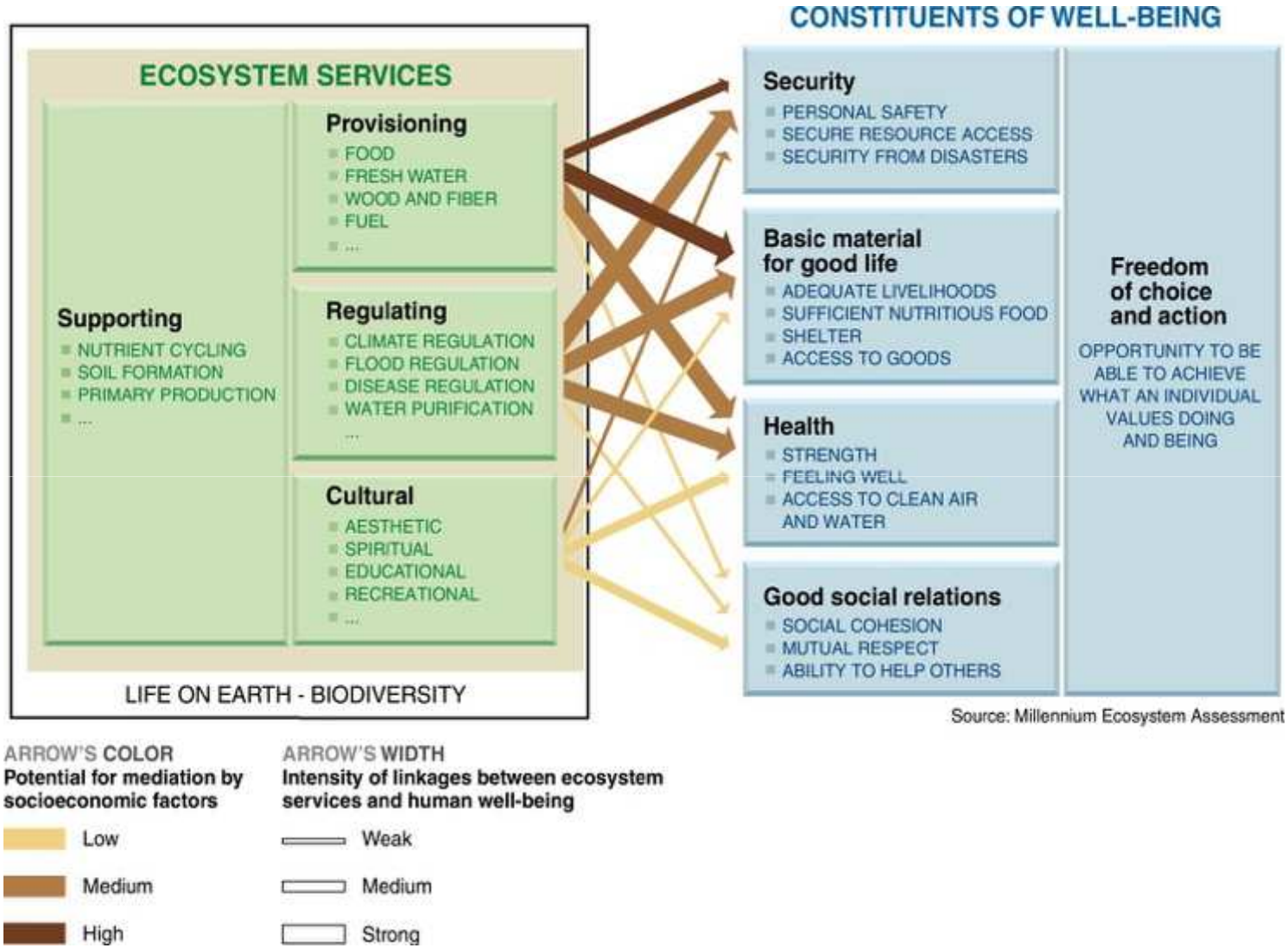
1. *Biomass production, including in agriculture and forestry;*
2. *Storing, filtering and transforming nutrients, substances and water;*
3. *Biodiversity pool, such as habitats, species and genes;*
4. *Physical and cultural environment for humans and human activities;*
5. *Source of raw materials;*
6. *Acting as carbon pool;*
7. *Archive of geological and archeological heritage.*







Ecosystem Services as defined in the MEA



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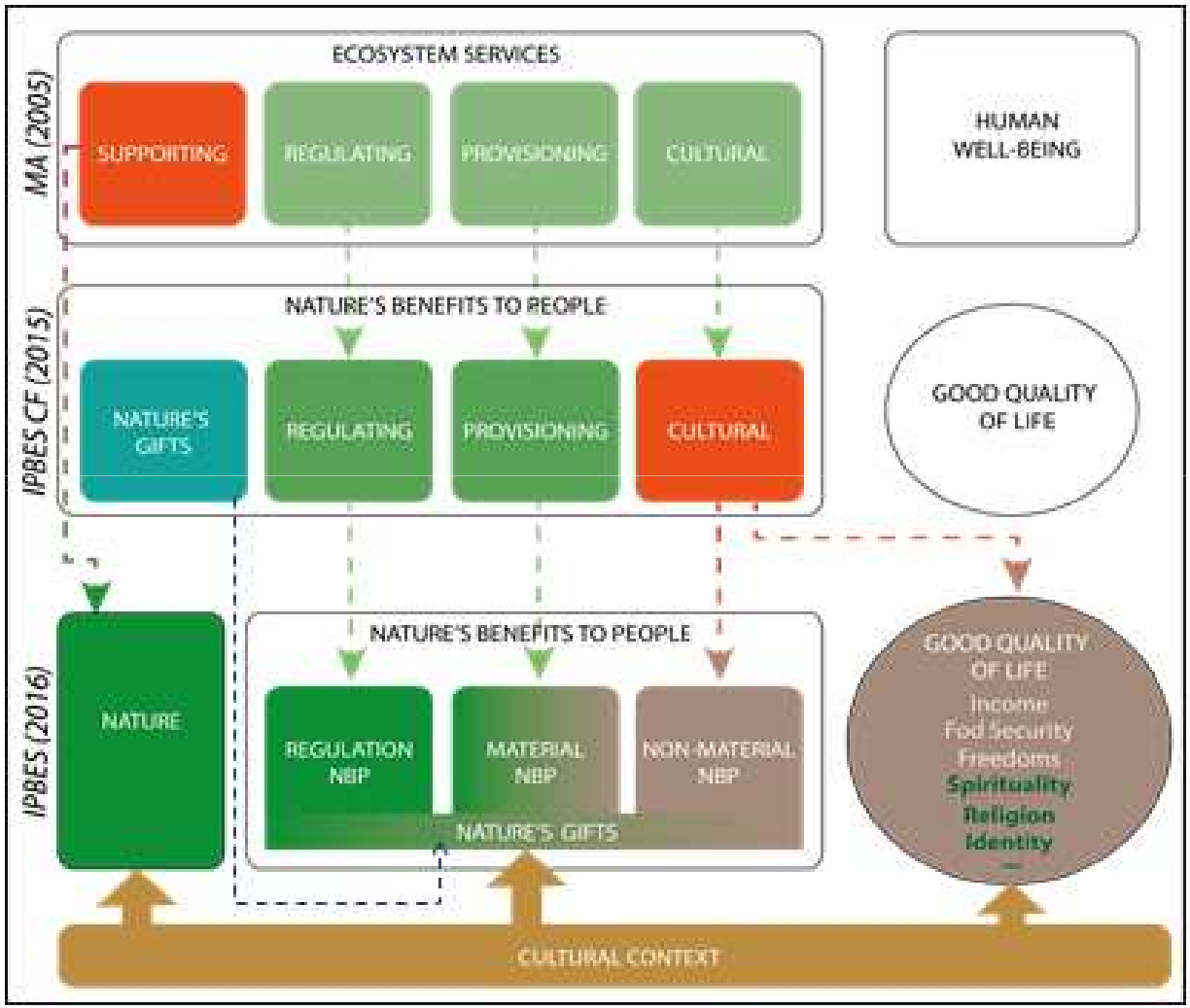
Evolving concepts of Ecosystem Services



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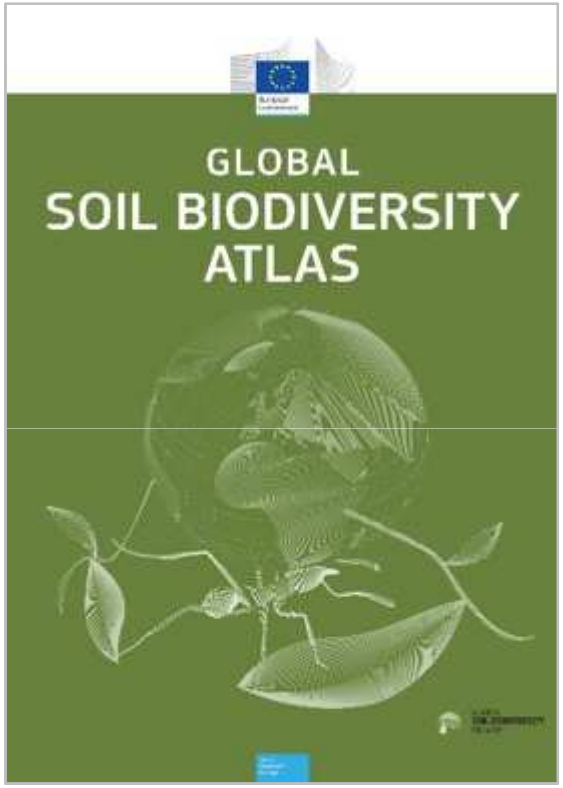
Relating ecosystem services to soils

ECOSYSTEM SERVICES	ECOSYSTEM FUNCTIONS	SOIL BIOTA
PROVISIONING Plant production (food) Biotechnology	Decomposition and carbon cycling	Macrofauna Mesofauna Microfauna Bacteria, fungi and archaea
REGULATING Climate regulation Atmospheric composition Hydrological services	Nutrient cycling	Microfauna Bacteria Mycorrhizal fungi Other microorganisms
SUPPORTING Habitat Biodiversity conservation	Soil structure and maintenance	Roots Earthworms Macroarthropods Fungi
CULTURAL Natural capital	Biological population regulation	Macrofauna Mesofauna Microfauna Bacteria and fungi



Soil-based ecosystem services, ecosystem functions and soil organisms that support them. The terms 'functions' and 'services' can be confusing. Usually, functions are considered as the biological processes underpinning and maintaining the ecosystem, while ecosystem services are defined as the direct and indirect contributions of an ecosystem to human well-being (derived from Brussaard, 2012). [119]

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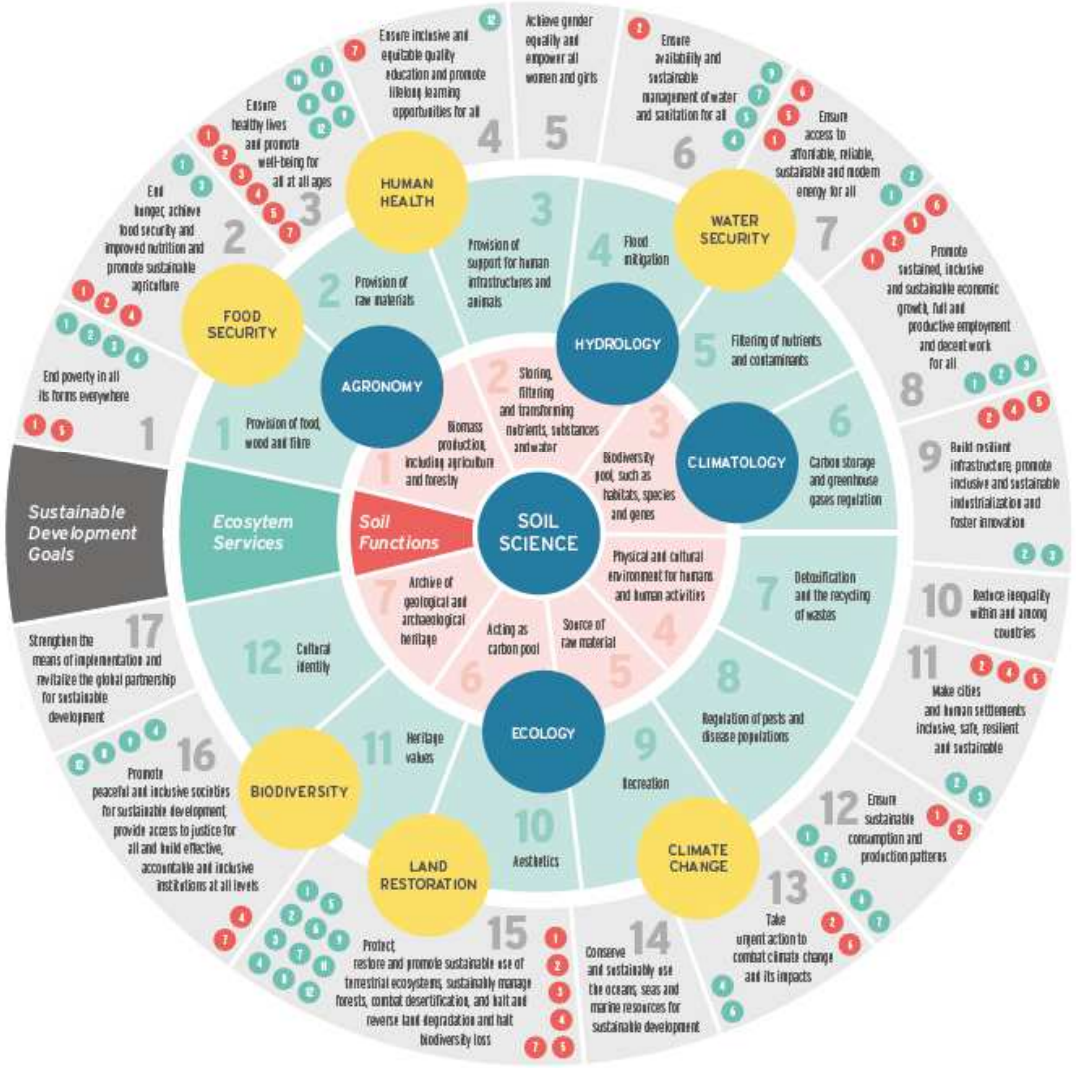
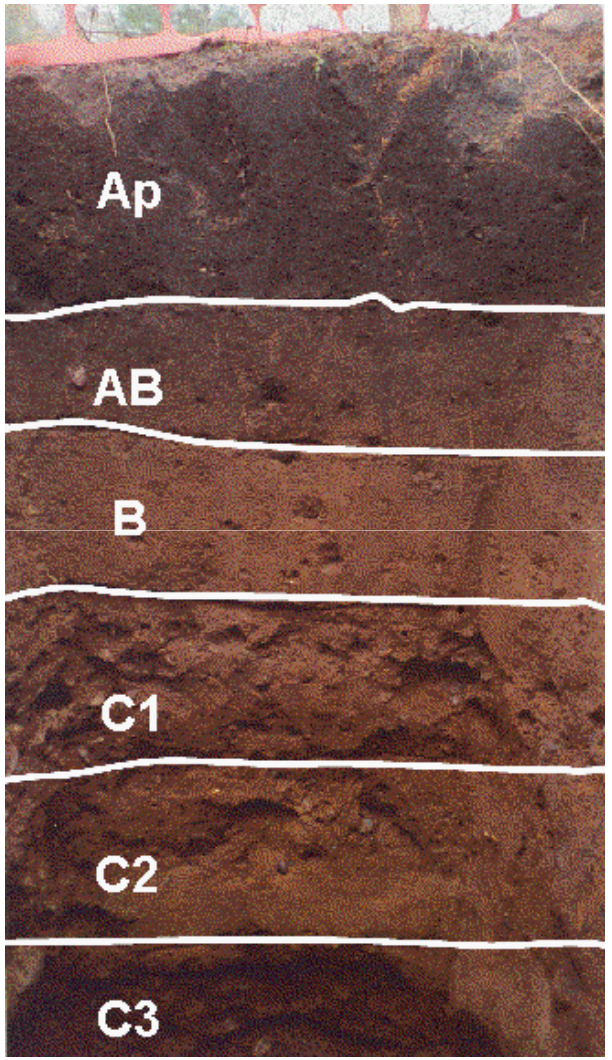
The significance of soils and soil science towards realization of the UN sustainable development goals

A GRAPHICAL ABSTRACT





FORUM paper: The significance of soils and soil science towards realization of the UN sustainable development goals (SDGs)
Keesstra, S.D., Bouma, J., Wallinga, J., Tittonell, P., Smith, P., Cerdà A., Montanarella, L., Quinton, J., Pachepsky, Y., van der Putten, W.H., Bardgett, R.D, Moolenaar, S., Mol, G., Fresco, L.O.

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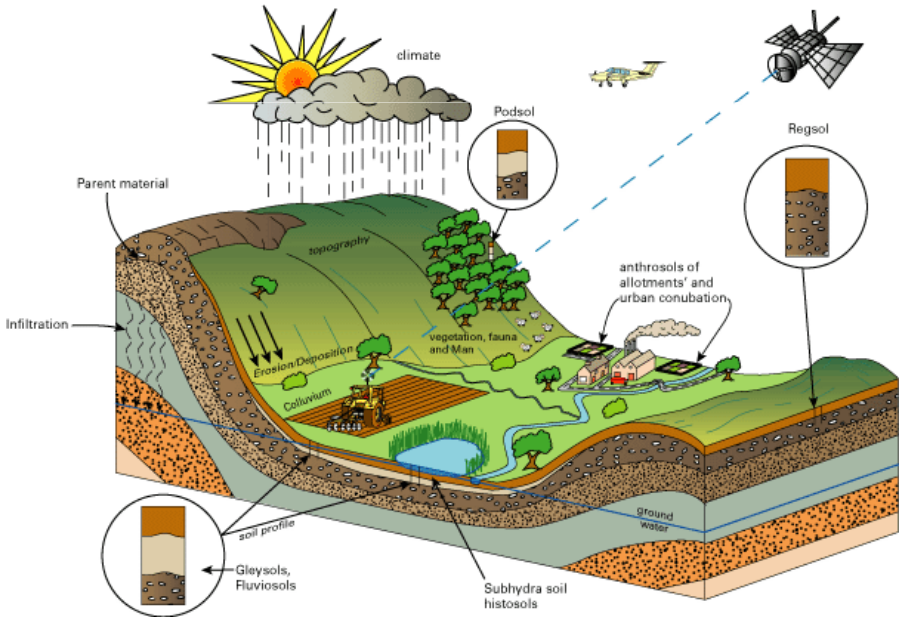
COMBAT DESERTIFICATION, HALT AND REVERSE LAND DEGRADATION, HALT BIODIVERSITY LOSS



- Conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems
- Sustainable management of all types of forests
- Achieve a land degradation-neutral world
- Conservation of mountain ecosystems
- Halt the loss of biodiversity
- Share the benefits arising from the utilization of genetic resources and promote appropriate access to such resources
- End poaching and trafficking of protected species
- Invasive alien species on land and water ecosystems
- Integrate ecosystem and biodiversity values into planning, development processes, poverty reduction strategies and accounts
- Financial resources for biodiversity and ecosystems
- Finance sustainable forest management
- Global support to combat poaching and trafficking of protected species

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Framework for Monitoring and Reporting on SDG Target 15.3

Land Productivity refers to the biological productive capacity of the land, the source of all the food, fiber, and fuel that sustains humans. Land productivity can be calculated across large areas from Earth observation data on net primary productivity (NPP). Estimates of NPP, using vegetation indices, are influenced in the short-term by crop phenology, rainfall, nutrient fertilization and other variables which must be corrected for to accurately interpret trends. National authorities are best able to determine whether declining levels of land productivity are considered land degradation by taking into account local circumstances.

National Data is envisaged to be primarily used, to the greatest extent possible, to derive the sub-indicators and other relevant indicators and information at the country level, covering bio-physical, governance and socio-economic conditions as well as the status of land resources. National Data can be collected through existing sources (maps, databases, reports), including participatory inventories on existing land management systems and their characteristics

Indicator 15.3.1
Proportion of land that is degraded over total land area

Sub-Indicators
UNCCD (CBD, UNFCCC)
Reporting Mechanisms

Data from multiple sources
FAO, GEF and other Reporting Mechanisms

Carbon Stocks (Above and Below Ground) give an indication of the amount of carbon in living and decomposing biomass above and below ground, including soil organic carbon. Carbon stocks are elementary to a wide range of ecosystem services and reflect land use and management practices. These stocks, including for soil organic carbon, can be estimated by applying carbon density values from ground-based measurements or national inventories in conjunction with land cover maps derived from Earth observation data. National authorities are best able to estimate trends in carbon stocks that indicate land degradation by taking into account local circumstances.

Land Cover and Land Cover Change, most often derived from Earth observation, is a fundamental parameter that assists with the interpretation and stratification of the other two sub-indicators. It is also essential for monitoring and reporting on multiple SDG targets focused on natural resource management, food and water security, environmental health and rural/urban planning for sustainable development. For global comparisons, countries are encouraged to use standardized land cover classification systems. National authorities are best able to determine whether land cover change is considered land degradation by taking into account local circumstances.

Convention on Biological Diversity

Food and Agriculture Organization of the United Nations

STAP

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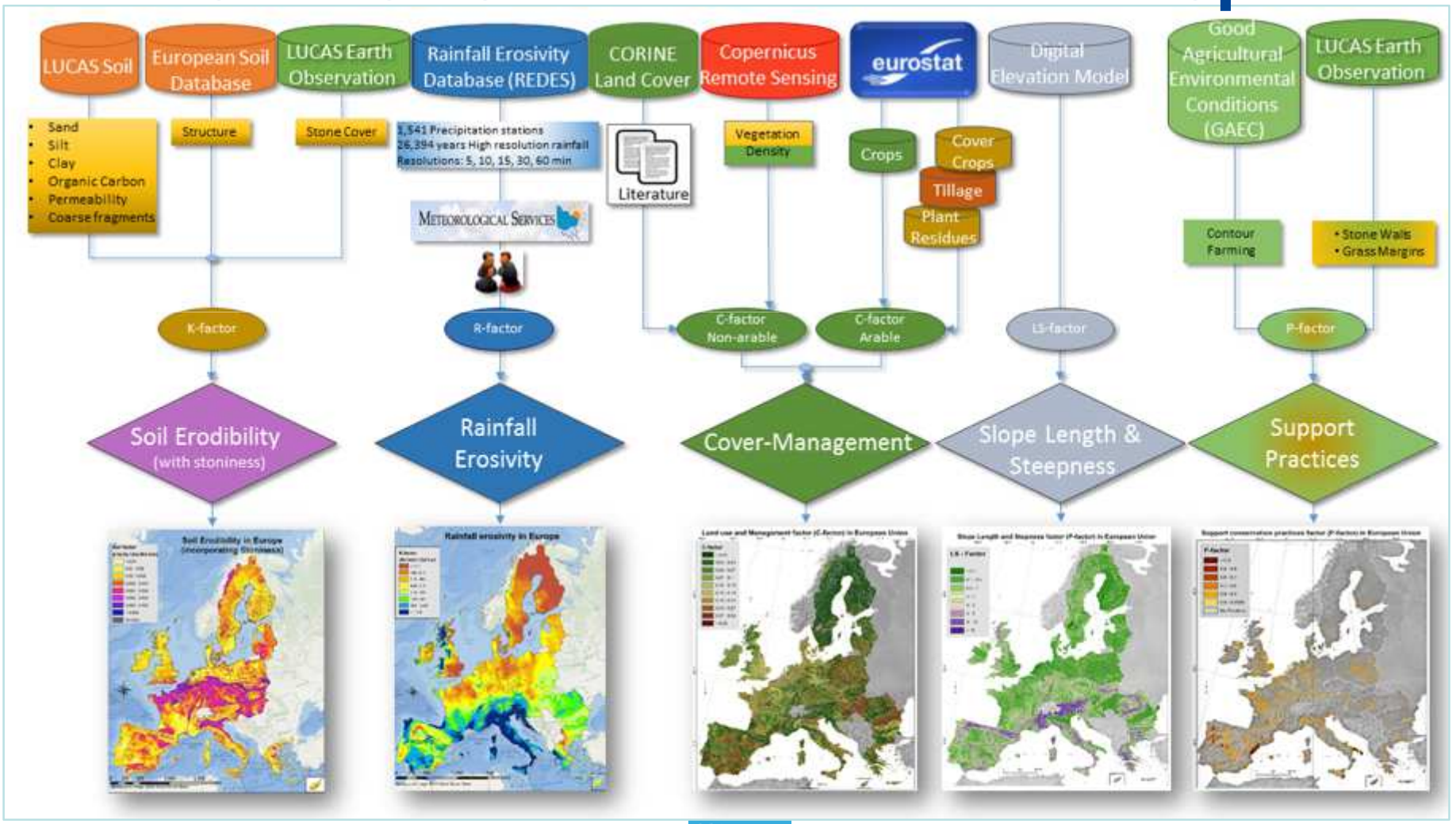
Soil erosion assessment in Europe



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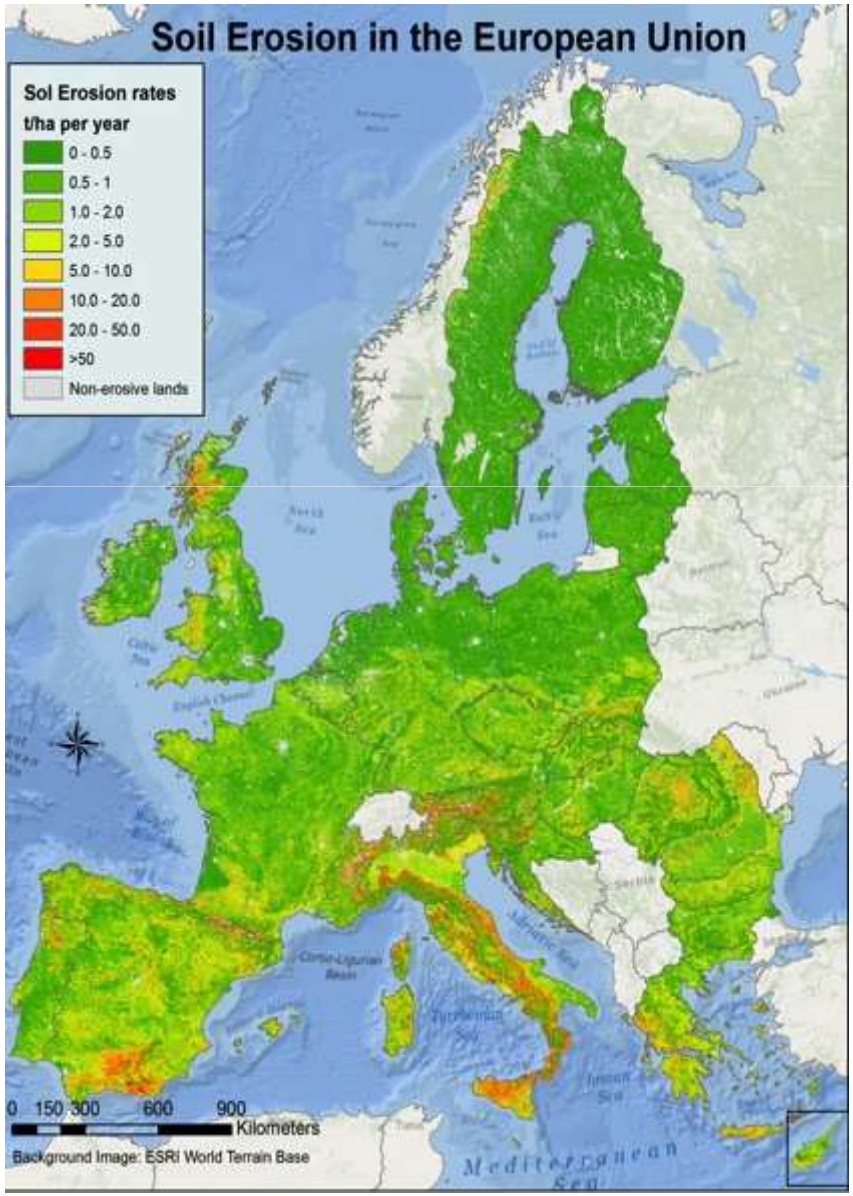

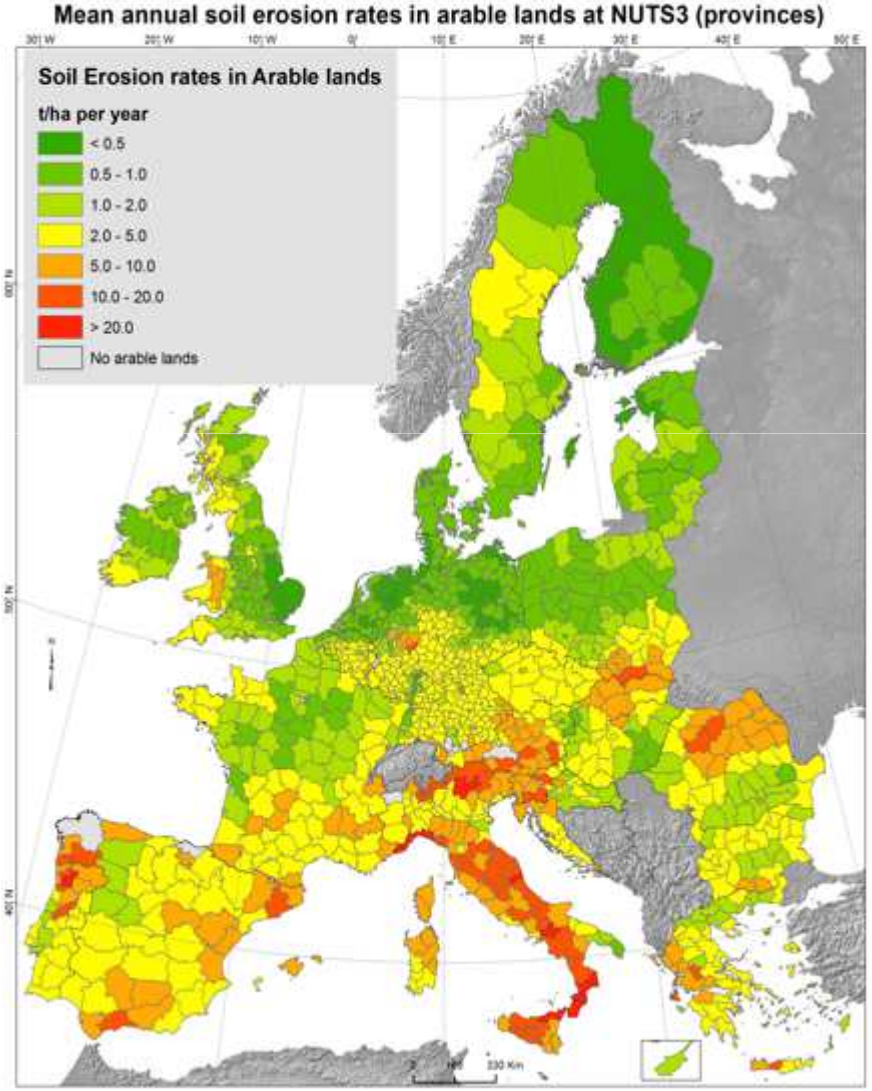

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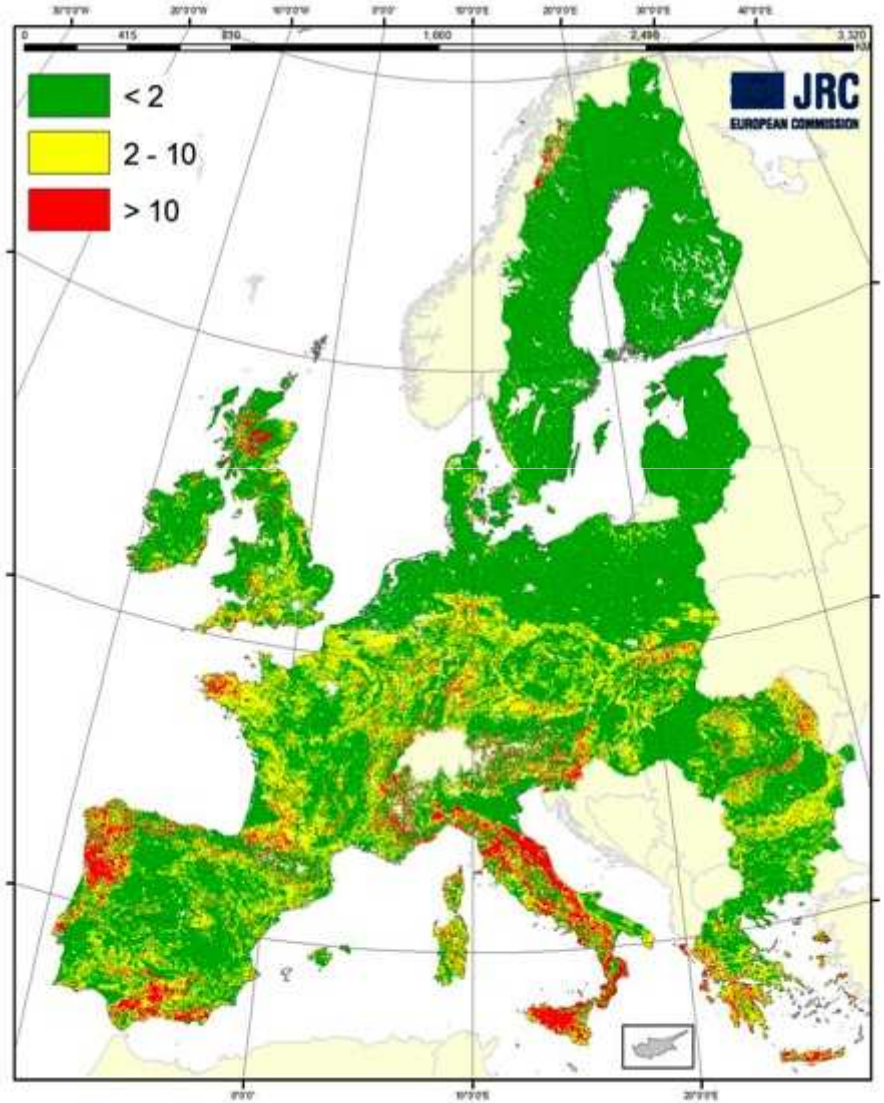
Soil erosion by water in the EU 27 (t/ha/y) based on the RUSLE



OECD countries reporting on erosion rates

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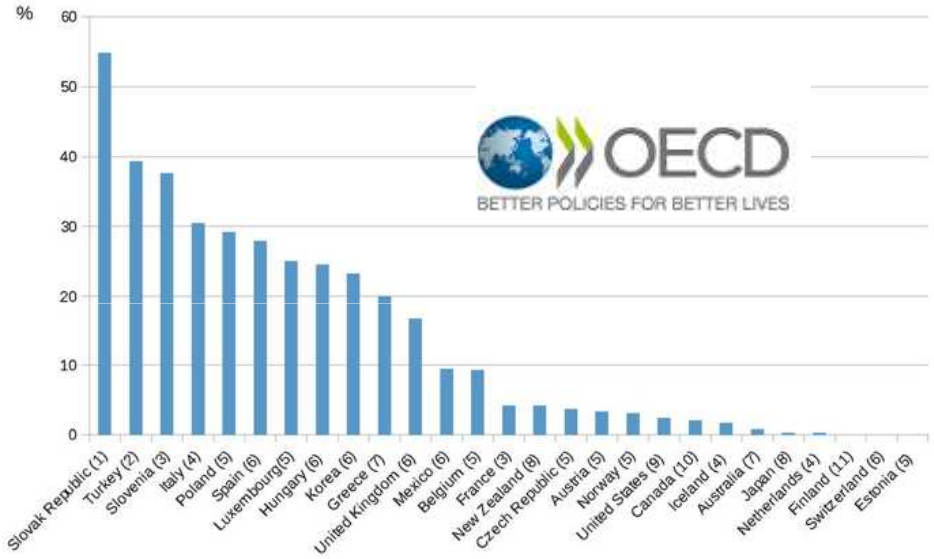
OECD Compendium of Agri-environmental Indicators - © OECD 2013

Chapter7 Figure 7.1. Agricultural land area classified as having moderate to severe water erosion risk, OECD countries: 1990-2010

Version 1 - Last updated: 07-Mar-2013

Figure 7.1. Agricultural land area classified as having moderate to severe water erosion risk, OECD countries: 1990-2010

Risk of water erosion greater than 11 tonnes/hectare/year of soil loss as a percentage share of total agricultural land area.



Countries are ranked in terms of highest to lowest % share of agricultural land at risk to water erosion.

1. Data for Slovak Republic refer to 2003-04.
2. Data for Turkey refer to 1990-94.
3. Data for France and Slovenia refer to 2006-07.
4. Data for Iceland, Italy and Netherlands refer to 1995-99.
5. Data for Austria, Belgium, Czech Republic, Estonia, Luxembourg, Norway and Poland refer to 2009-10.
6. Data for Hungary, Mexico, Spain, Switzerland and United Kingdom refer to 2000-02 and Korea refer to 2002.

Soil erosion data for Spain includes agriculture and forestry land. For Switzerland, the total agricultural area includes summer pastures (alpine pastures). For Mexico, the area of risk is the sum of moderate + severe + extreme erosion categories.

7. Data for Australia and Greece drawn from OECD (2008). Data for Greece covers all land, including agricultural land.
8. Data for Japan and New Zealand refer to 1985-89.
9. Data for United States refer to 2007-08.
10. Data for Canada refer to 2005-06, values for cultivated cropland.
11. Data for Finland refer to 2001.

Sources: OECD (2008), *Environmental Performance of Agriculture in OECD countries since 1990*, http://www.oecd.org/agriculture/; Joint Research Centre, European Union; Unpublished Estimates Pan-European RUSLE Model JRC, 2011; and national sources.

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Reduce death and illnesses from pollution (air, water, soil)

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18 April 2014 Last updated at 10:06

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Report: One fifth of China's soil contaminated

Rapid industrialisation has benefited many - but has had a huge impact on the environment

Almost a fifth of China's soil is contaminated, an official study released by the government has shown.

Conducted between 2005-2013, it found that 16.1% of China's soil and 19.4% of its arable land showed contamination.

The report, by the Environmental Protection Ministry, named cadmium, nickel and arsenic as top pollutants.

There is growing concern, both from the government and the public, that China's rapid industrialisation is causing irreparable damage to its environment.

The study took samples across an area of 6.3 million square kilometres, two-thirds of China's land area.

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Contaminated sites and health

Report of two WHO workshops:
Syracuse, Italy, 18 November 2011
Catania, Italy, 21–22 June 2012

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Science for Environment Policy

IN-DEPTH REPORT

Soil Contamination: Impacts on Human Health

September 2013
Issue 5

Review Article

Contaminated Sites in Europe: Review of the Current Situation Based on Data Collected through a European Network

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Under the European Union (EU) Thematic Strategy for Soil Protection, the European Commission has identified soil contamination as a priority for the collection of policy-relevant soil data at European scale. In order to support EU soil management policies, soil-related indicators need to be developed which requires appropriate data collection and establishment of harmonized datasets for the EU Member States. In 2011-12, the European Soil Data Centre of the European Commission conducted a project to collect data on contaminated sites from national institutions in Europe using the European Environment Information and Observation Network for soil (EIONET-SOIL). This paper presents the results obtained from analysing the soil contaminated sites data submitted by participating countries. According to the received data, the number of estimated potential contaminated sites is more than 2.5 million and the identified contaminated sites around 342 thousand. Municipal and industrial wastes contribute most to soil contamination (38%), followed by the industrial/commercial sector (34%). Mineral oil and heavy metals are the main contaminants contributing around 60% to soil contamination. In terms of budget, the management of contaminated sites is estimated to cost around 6 billion Euros (€) annually.

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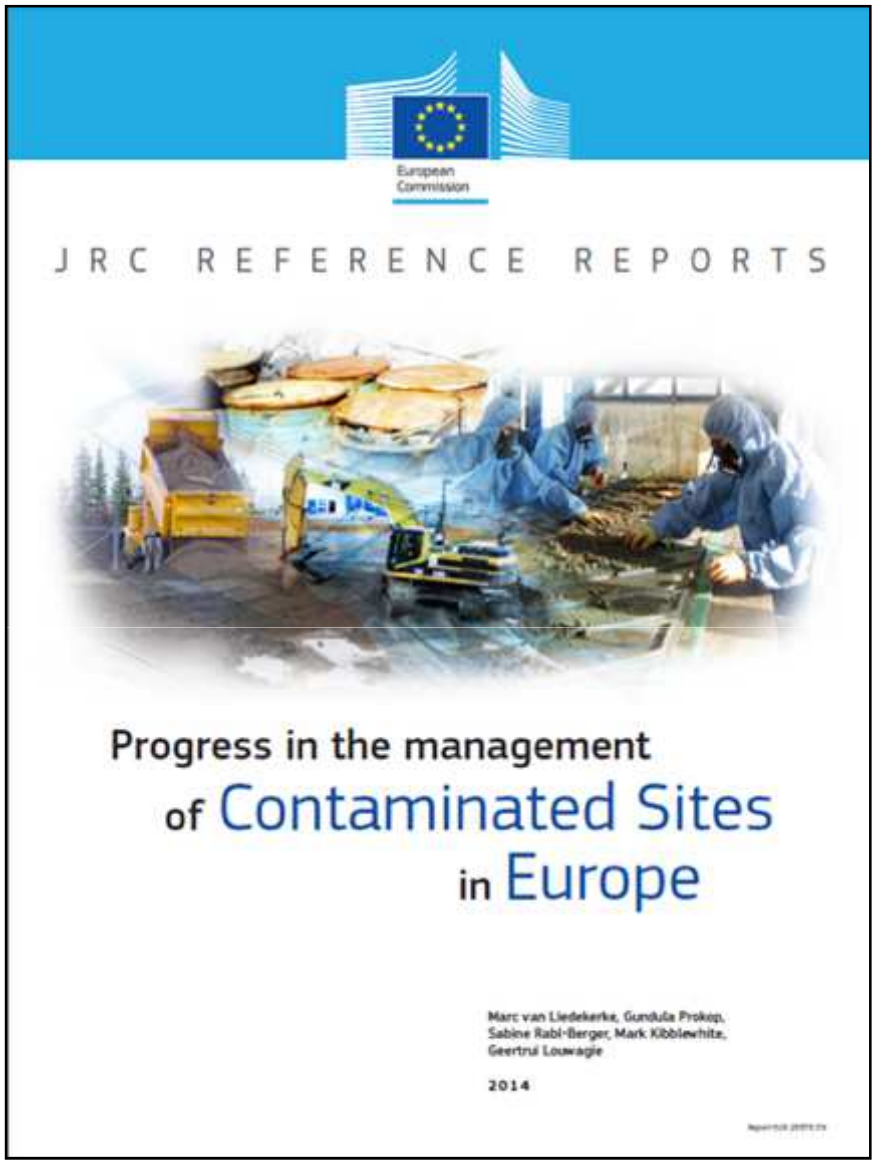

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Educational and Citizen Science in Slovakia

Enviróza (Envirosis) is a school programme and outdoor game designed to gather and spread information on contaminated sites in Slovakia. Intended for primary and secondary schools, the programme is implemented through the website www.enviroza.sk. The participants (teachers and pupils) seek out and identify contaminated sites, publish their data online and are awarded. Through accompanying competitions, they also inform the public about this issue.

Enviróza is categorised as a citizen science programme; its practical role is to update information about selected contaminated sites registered in the Information System of Contaminated Sites (ISCS) and to identify new sites (known as "school-identfied sites") that display signs of serious contamination.

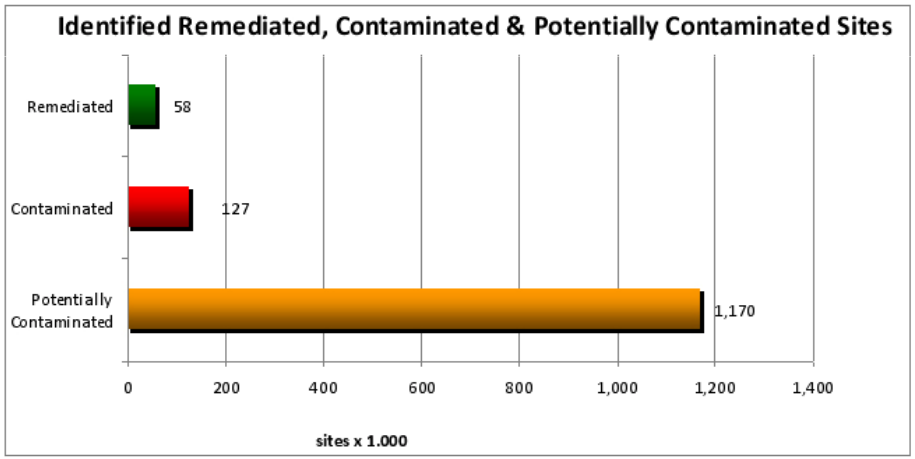
The information gathered by the participants is further processed by staff of the Slovak Environment Agency (SEA) and integrated into the ISCS thus making it available to state authorities, professionals and lay public.

The Enviróza school programme

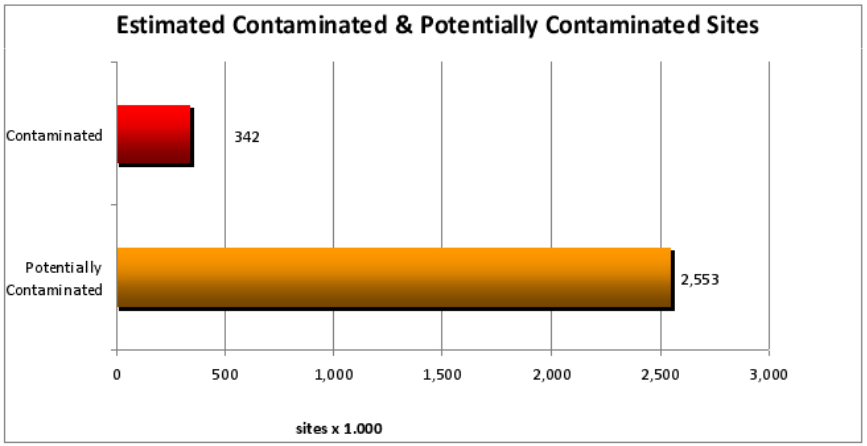
A total of 25 new sites were added by schools. After they were mapped, field inspection and evaluation of the school-identified sites for the purposes of their classification in the ISCS was carried out by Ing. Jaromír Helma, PhD. (SEA) in July and August 2014.

Soil Contamination (2011)

- Estimates show that the number of sites in Europe where potentially polluting activities are occurring, or have taken place in the past, now stands at about 2.500.000.
- it should be noted that around 340 000 sites may need urgent remediation



33 countries



39 countries

From: Panagos et al., 2013

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Thank you for your interest!

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