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Soil and Sustainable Land Use Management

Research and Innovation

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Land under pressure

Competition for land in Europe is increasing, due to a growing population and increasing demands, especially in cities. Housing, a growing infrastructure, industry, agriculture and leisure are not easy to accommodate.

Building and unsustainable agricultural methods will lead to a decline in soil quality that provides humanity with essential services. One-quarter of all living species are found in soil, and people depend on it for, among other things, food, clothing, building materials, medicines, and the regulation of clean water and air. In short, soil is vital to survival.

Climate change too is having an impact. It has contributed to the growing frequency of natural disasters that erode soil quality in Europe, including flooding in northern countries and desertification in the south. Yet soil is an important carbon sink, capturing about 20% of man-made CO_2 emissions. Its loss further accelerates climate change, creating the risk of a vicious circle of environmental damage.

Research priorities

Without a whole new approach to land use, we are at risk of destroying our natural heritage and making life increasingly unpleasant for ourselves and our children. That means finding innovative ways of reconciling conflicts of interest and demand for land.

Over half of the global population live in urban areas and with this figure expected to rise **urban development** must become sustainable.

Urban sprawl can be a challenge, exploiting land and resources, and generating more greenhouse gas emissions in inner cities. Europe needs forward-looking, environmentally friendly approaches to **soil and land management**.

In order to preserve, improve or restore soil systems, policy-makers must understand their importance and how they are influenced by human activities. Research should pave the way for the development of innovative and effective ways to mitigate damage and combat **desertification** worldwide as well as in Europe.

Research at European level is the best way to learn more about problems that occur in more than one country, and to pool good practice and disseminate tools and technologies to local players who can apply them. Policy-makers must take account of economic, social and environmental issues in order to achieve sustainable land use. Modelling and simulation software, accounting frameworks and codes of practice are among the instruments that can help them select the most appropriate package of measures for local needs. Thanks to EU-funded research projects, local authorities all over Europe now have a wide range of cost-effective and socially responsible options available to them.

Urban development

European cities occupy a relatively small proportion of land. But their impact on surrounding environments is huge. They consume resources such as water and energy, and generate massive quantities of waste. 70% of global emissions stem from cities. Planners need high-quality research in order to build sustainable cities.

Cities are crucial to land use, because up to 80% of Europeans live in them or are affected by them. Although they set some of today's toughest environmental challenges, they are also economic growth hubs and knowledge centres, fostering innovative solutions.

The growth of urban living is an ongoing trend. But the pattern of growth can be designed better, so as to optimise resource use, facilitate mobility, halt urban sprawl and guarantee a better quality of life to city dwellers.

Getting involved

More and more, people want to have a say in how their communities develop. Projects that allow for public participation from day one are most likely to find solutions that work, and achieve more sustainable patterns of behaviour. Strategies need to be flexible and widely applicable on a practical level, integrating scientific innovation and social progress.

The aim of the **TURaS** project is to develop tools to help cities deal with three of the most urgent challenges: climate change, shortage of natural resources, and unsustainable urban growth. It is doing this by bringing together urban communities with local authorities and planners, academics, and small and medium-sized enterprises (SMEs).

URBAN-NEXUS adopts a similar approach, using social media, dialogue cafés and events to build awareness and foster partnerships between policy-makers, researchers and local stakeholders, to help to reduce the urban ecological footprint. The project aims to establish long-term partnerships that will continue to work together in the future.

Innovative solutions for better European cities: SUME

To help growing European cities become more resource-efficient and less wasteful, a ground-breaking EU-funded research project is investigating the principles of 'urban metabolism'.

*The **SUME** project – Sustainable Urban Metabolism for Europe – helps city officials to get an overview of flows of resources and energy. This bio-physical analysis aims to reduce cities' consumption as they expand, and break the link between urban development and CO_2 emissions.*

The SUME project, like other EU research activities in this field, encourages local governments across Europe to co-operate with each other. It also brings together different aspects of urban planning such as transport, energy, waste and housing. By coordinating their efforts, European cities can exchange knowledge and good practice, making it easier to find sustainable solutions.

Soil and land use management

Far from being dead and inert, soil is a constantly evolving, living medium made up of minerals, residues from plants and animals, water, air and living organisms. Soil is crucial to human life, and Europe has over 10 000 different types.

Nature needs up to 1 000 years to produce 2.5 cm of topsoil, so soil recovery is a long process. Yet, due to unsustainable land-use practices such as mining, deforestation, urban development and industrial pollution, current soil loss in Europe is estimated to be taking place 100 times faster than soil formation. The alarming fact is that it has become a finite resource.

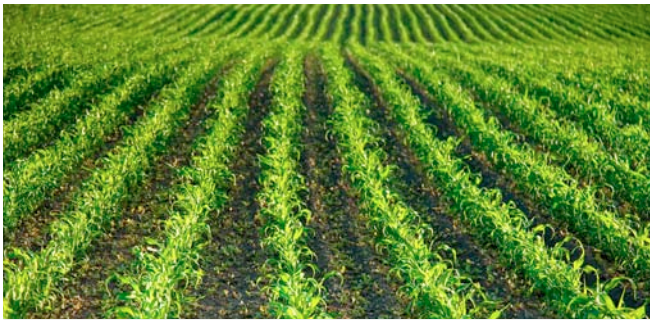
Soil protection is not just an environmental priority but also an economic and social one. Land management has a major impact on soil health: the way farmers, industries, builders and developers treat soil is relevant to everyone.

Crossing disciplines

Recent EU research projects aim to build on existing results from previous studies and use them in innovative ways that will make an impact on soil protection and land management – moving from assessment to application. This entails selecting projects that involve stakeholders from the start, including civic planners, NGOs and SMEs. The **DESIRE** project is a good example where this principle has been successfully worked out and developed further. This project proved that an interdisciplinary approach is essential, and that it can be extremely effective.

Visions on future land use – a major challenge for Europe

The **VOLANTE** project – Visions of Land-use Transitions in Europe – brings together the different disciplines that make up land-system science and involves decision-makers and stakeholders in planning a Roadmap for Future Land Resources Management in Europe. The current global developments in food and energy production inevitably lead to huge changes in European land use, and in the ecosystem services land resources can provide. VOLANTE employs intensive stakeholder interaction to develop informed visions for future land resources management. The resulting roadmap allows policy-makers to proactively identify pathways for a better future, while taking into account the trade-offs connected with them.



Down-to-earth research: EcoFINDERS

*Understanding of the biodiversity of soil is still quite limited, partly due to the tiny size of soil-borne organisms and the difficult task of isolating them. However, recent scientific advances have made it easier for researchers to explore its complexity. The **EcoFINDERS** project aims to design cost-effective indicators for monitoring soil diversity, which will inform policy-making.*

At the scientific level, it will increase knowledge of different soils and their contribution to ecosystem services: the natural processes that sustain human life. The project will also have an economic aspect, looking at the value of soil ecosystems and the costs of maintaining them.

EcoFINDERS will help to define a policy for the sustainable management of soils, contributing to a future Soil Framework Directive.

Desertification

Desertification is the advanced stage of land degradation, and means that the soil has lost its ability to provide important ecosystem services and, consequently, to support human activities and socio-economic welfare. As a result, populations may migrate in search of alternative livelihood options. The cost of food and food insecurity increase, as do socio-economic inequalities.

Land degradation and desertification may be due to drought, over-exploitation of water resources, salinisation or severe loss of soil organic matter, land, use change, inappropriate land, management practices, forest fires, etc. It is a major economic, social and environmental threat around the world. It affects one-third of the Earth's surface, and over 2 billion people in more than 150 countries.

Desertification is also a growing problem in Europe: more than 15% of the total surface area is significantly affected. Portugal, Spain, Greece, southern France, Malta, Cyprus, and southern Italy are most at risk, but parts of Bulgaria, Hungary, Latvia, Romania, Slovakia and Slovenia are also threatened.

Bridging the gap between research and action: PRACTICE

*Key to the **PRACTICE** project is the use of innovative ways to involve researchers, stakeholders, and end-users, linking science to society in order to share best practices to combat desertification.*

The project has been collecting examples of long-term land-restoration projects in different countries, including EU-funded research, since the 1980s. It is developing an integrated evaluation method to assess their cost effectiveness.

With the participation of stakeholders at all levels, from farmers and local organisations to national and international bodies, PRACTICE will develop an integrated protocol on combating desertification. This will combine ground-based and remote-sensing approaches for evaluating soils and landscapes, and take account of socio-economic conditions. Training, education and knowledge-sharing are important elements.

Surveillance systems

The EU highlights the risk of desertification in its Soil Thematic Strategy, and the European Commission actively participates in the work of the UN Convention to Combat Desertification (UNCCD).

Europe needs to develop assessment, mitigation and restoration practices to counter desertification. Recent advances in research have provided valuable models, assessment tools and surveillance systems, giving rise to more knowledge about the drivers, processes and impacts of the problem. However, integrated evaluation and data on cost effectiveness are still lacking.

Combatting desertification: engaging stakeholders

Experience from the **DESIRE** project suggests that by engaging affected communities, it is possible to derive a number of important benefits that could help combat desertification. The project tried to develop alternative land-use and management conservation strategies in 18 degraded and desertification hot spots around the world. Among the key requirements which emerged from the project, a close collaboration between scientists, stakeholders and policy-makers is deemed essential.

Project List

AMAZALERT – Raising the alert about critical feedbacks between climate and long-term land use change in the Amazon
http://www.eu-amazalert.org/home

CASCADE – Catastrophic shifts in drylands: how can we prevent ecosystem degradation?
http://www.cascade-project.eu/

DESIRE – Development of a system of indicators for a resource efficient Europe
www.desire-project.eu

DIGISOIL – Integrated system of data collection technologies for mapping soil properties
http://www2.ufz.de/index.php?en=19452

EcoFINDERS – Ecological function and biodiversity indicators in European soils
http://ecofinders.dmu.dk/

GHG Europe – Greenhouse gas management in European land use systems
http://www.ghg-europe.eu/

INBIOSOIL – Innovative biological products for soil pest control
http://inbiosoil.uni-goettingen.de/index.php?id=2

iSOIL – Interactions between soil related sciences - Linking geophysics, soil science and digital soil mapping
http://www.isoil.ufz.de/

Iso-Soil – Contaminant-specific isotope analyses as sharp environmental-forensics tools for site characterisation, monitoring and source apportionment of pollutants in soil
http://isosoil.eu/Default.aspx

LEDDRA – Land and ecosystem degradation and desertification: assessing the fit of responses
http://leddra.aegean.gr/allabout.html

ModelPROBE – Model driven soil probing, site assessment and evaluation
http://www.modelprobe.ufz.de/index.php?en=18269

PRACTICE – Prevention and restoration actions to combat desertification. An integrated assessment
http://80.24.165.149/drupal/

REDD-ALERT – Reducing emissions from deforestation and degradation through alternative land uses in rainforests of the tropics
http://www.redd-alert.eu/

SoilCAM – Soil Contamination: Advanced integrated characterisation and time-lapse monitoring
http://www.bioforsk.no/ikbViewer/page/prosjekt/forside?p_menu_id=19572&p_sub_id=19565&p_dimension_id=19564&p_dim2=19565

SOILSERVICE – Conflicting demands of land use, soil biodiversity and the sustainable delivery of ecosystem goods and services in Europe
http://www.lu.se/o.o.i.s/26761

SoilTrEC – Soil transformations in European catchments
http://www.soiltrec.eu/

SUME – Sustainable Urban Metabolism for Europe
www.sume.at

TURaS – Transitioning towards urban resilience and sustainability
www.turas-cities.eu

UMBRELLA – Using microbes for the regulation of heavy metal mobility at ecosystem and landscape scale: an integrative approach for soil remediation by geobiological processes
http://www.umbrella.uni-jena.de/cms/index.php

UPSOIL – Sustainable soil upgrading by developing cost-effective, biogeochemical remediation approaches
http://www.upsoil.eu/

URBAN-NEXUS
www.urban-nexus.eu

VOLANTE – Visions of Land-use Transitions in Europe
http://www.volante-project.eu/

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Competition for land in Europe is increasing, due to a growing population and increasing demands, especially in cities. Housing, a growing infrastructure, industry, agriculture and leisure are not easy to accommodate. The EU's Seventh Framework Programme supports research and innovation based solutions at transnational and international level.

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