

# EPA Soils and Land Use & Land Cover Research

This document is a Discussion document which will be presented, discussed and commented on at the EPA Soils and Land Use & Land Cover Research Planning Workshop on the 10<sup>th</sup> September 2013.

Once finalised, it will be incorporated into the EPA Sustainable Environment Research Pillar Strategic Position Paper. This will inform the future EPA Research Strategy over the period 2014-2020

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## 1. Background

Strong evidence-based scientific knowledge is **key** to informed and positive policy-making. Research and innovation play a pivotal role in environmental protection – providing assessments of the current state of the environment; increasing understanding of processes and related complex interactions, generating analysis of trends and projections; and developing new tools for environmental management. The funded research delivers a high-quality evidence-base which informs policy, identifies environmental pressures and develops solutions to them while, at the same time, encouraging the active dissemination of the research findings. In particular, the research has significantly contributed to meeting and addressing Ireland's international obligations at EU and UN levels and in supporting national policy development and implementation.

The EPA Strategy for environmental research in the period 2007-2013 (STRIVE, 2007) addressed key environmental management issues and priorities in Ireland and employed a systematic and strategic approach for environmental research (some projects under which are still in process).

The EPA Strategic Plan 2013-2015<sup>1</sup> reflects these principles through a number of strategic priorities with research playing a pivotal role in delivering a good, sustainable and healthy environment supporting all sectors of society and the economy.

The success of the STRIVE programme, has encouraged the EPA to progress towards planning the EPA Research Programme (2014-2020), which will aim at maintaining a vibrant and relevant environmental research programme. The research programme will be focused on addressing the major environmental challenges of Climate Change, Water and a Sustainable Environment. This document represents a thought starter in relation to considering the future research priorities in the Soils and Land Use & Land Cover research areas, which are included under the **Sustainable Environment Research Pillar**.

### 1.1. Context

Soil is a biologically active, complex mixture of weathered minerals (conventionally fractionated into sand, silt and clay), organic matter, organisms, solutes, air and water that provides the foundation for life in terrestrial ecosystems. It forms and evolves slowly over very long periods of time and is thus not readily replaced during several human lifespans. Land is subject to many competing demands. We rely on our land resource for food, energy (increasingly), agriculture and forestry, recreational opportunities and cultural amenities and, overall, for a good living environment. Moreover, there are indirect but critical environmental benefits and services provided by soils. For example, most of our drinking water at some stage is in contact with the soil horizon through run-off or infiltration. Soils play a role in carbon sequestering and contribute to ecosystem services. The rate and nature of land use changes indicate where future environmental pressures are likely to arise. The soil of Ireland is a valuable but finite national resource, which can be damaged and lost. An added policy stress in this area is that soils are a public good that, for the most part, are in private ownership.

The Ireland's Environment report (EPA, 2012<sup>2</sup>) indicated that generally, Ireland's soils are considered to be in good condition, with the exception of peat areas, which are particularly vulnerable to external pressures. However, the information available on land use, land cover and soil condition is limited and this prevents robust analysis of the status of both. In the 2012 EU report on the

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<sup>1</sup> <http://www.epa.ie/pubs/reports/other/corporate/epastrategicplan2013to2015.html>




<sup>2</sup> <http://www.epa.ie/pubs/reports/indicators/irelandsenvironment2012.html>

Implementation of the Soil Thematic Strategy<sup>3</sup> (see below), soil organic matter (e.g. in relation to climate change and soil fertility), soil erosion (elaboration of better soil erosion models), wind erosion, contaminated sites (including data on brownfield regeneration and budgets spent), and land take were identified as areas where additional data were required to support policy.

At present, there is no single authority charged with the protection of soils in Ireland. The EPA undertakes a range of activities which contribute towards the overall goal of “Protecting our Soils”. Several agencies and government bodies have roles and responsibilities relating to soils. These include, but are not limited to: the Department of Agriculture and the Marine (e.g. Common Agriculture Policy, Research, Food Harvest 2020), the Department of the Environment, Community & Local Government (DECLG) the Geological Survey of Ireland, which is the National Earth Science Agency, responsible for providing geological advice and information; the Department of Arts, Heritage and the Gaeltacht (e.g. Ireland's Built and Natural Heritage), the Heritage Council; and Teagasc which is the agriculture and food development authority in Ireland.

The EPA is the competent authority in the implementation of a number of EU regulations that cover certain aspects of soil protection. One of the most recent regulations is the Environmental Liabilities Directive. Others include the enforcement and licensing of both IPPC and Waste facilities, the Water Framework Directive and the integration of Strategic Environmental Assessments. An integrated approach to environmental protection implies that the monitoring of soil is required in conjunction with the monitoring of sediments, groundwater and surface waters. **Integration is the key to successful sustainable development and the delivery of soils resilience.**

In 2006, the European Commission published a Thematic Strategy for Soil Protection (COM(2006)231 final) and a proposal for a directive establishing a framework for the protection of soil (COM(2006)232). The overall objective of the strategy is the protection and sustainable use of soil, based on the guiding principles of preserving soil functions, preventing further degradation and restoring degraded soils to a level of functionality consistent with current and intended use. Despite the efforts of several Presidencies, the Council has so far been unable to reach a consensus on this legislative proposal. The 2012 EU report on the Implementation of the Soil Thematic Strategy<sup>4</sup>, indicated that both in the EU and worldwide, soil degradation has increased in the past decade. This trend is likely to continue unless several factors are addressed:

-  **Land use.** The growth in world population, urbanisation, soil sealing, the rising consumption of meat and dairy products, and the increased use of biomass for energy and other industrial purposes, may lead to increased global land use change and potential soil degradation. **Climate change** is likely to exacerbate and compound these potentially adverse impacts on soils. Policy needs to be developed to mitigate the potential effects of these pressures.
-  **Preservation and enhancement of soil organic matter.** Intensive and continuous arable production leads to a decline of soil organic matter. Peatlands provide important ecosystem services, especially in relation to biodiversity and water quality, and contain very significant carbon stocks. Historically, these soils have been undervalued and traditional management options have led to widespread degradation of peatlands. Maintenance and restoration of these services is essential, as is the cessation of any further large-scale loss of peatland carbon (largely as carbon dioxide), and thereby integral to the fulfillment of present and future greenhouse gas emission reduction commitments of the EU.
-  **Efficient Resources Use.** Agriculture and horticulture are highly dependent on the good management of soils for their long-term viability. Although the interaction of soil factors and plant growth is complex, the basics are: a good supply of nutrients (often cycled to the plant via reactions with soil organic matter), an adequate supply of soil water, and the avoidance

<sup>3</sup> [http://ec.europa.eu/environment/soil/three\\_en.htm](http://ec.europa.eu/environment/soil/three_en.htm)

<sup>4</sup> [http://ec.europa.eu/environment/soil/three\\_en.htm](http://ec.europa.eu/environment/soil/three_en.htm)

of excessive soil compaction (e.g. through the inappropriate use of machinery). It is also often true that the best and/or most productive soils (level, well-drained) make attractive sites for the built environment. Soils may also be the recipients of manures, biowastes and sewage sludge. These are produced every year in large amounts, and are sometimes disposed or otherwise mismanaged despite the fact that they contain nutrients and organic matter that could, in some cases, benefit soils. Phosphate fertilisers are a limited resource with concerns about their long-term availability; thus the appropriate targeting of such a resource to soils is likely to become of increasing importance.

Other EU policies (for instance on water, waste, chemicals, industrial pollution prevention, nature protection, pesticides, agriculture, climate) are contributing to soil protection, insofar as their objectives assume the ecosystem services provided by soils as a prerequisite. But as these policies have other aims and other scopes of action, they may not be sufficient to ensure an adequate level of protection for all soil in Europe. In Ireland, national legislation indirectly covers aspects of soil protection. A number of regulations include soil in their context, but these are fragmented and may not be adequate to ensure sustainable soil function on a long term basis.

European economies depend on natural resources, including raw materials and space (land resources). Thus the EU Thematic Strategy on the Sustainable Use of Natural Resources<sup>5</sup> includes such space as a resource. The Strategy applies to areas of land and maritime space that are needed for production purposes (e.g. minerals, timber, food) and for various socio-economic activities. These interests are often competing for the same territorial resource. Land-use planning and management decisions are usually made at the local or regional level; often by conflicting or competing bodies, dependent on the issues. However, the European Commission has a role to play in action being taken to ensure Member States take environmental concerns into account in their land-use development plans by:

- ✚ Integrating environmental considerations into planning decisions relating to land use so that there are made more sustainable;
- ✚ Enhancing the integration of land use aspects into coordinated decision-making involving all relevant levels of government, supported by the adoption of targets on soil and on land as a resource, and land planning objectives;
- ✚ Improving the geographic information flow about land-use issues. Continuous investment is therefore needed to ensure that credible, comparable and quality-assured data and indicators are available and accessible to those involved in defining and implementing policy;
- ✚ Taking integrated approach to urban and spatial planning, in which long-term environmental considerations are fully take into account;
- ✚ In the context of ongoing EU initiatives and networks, developing and promoting a common understanding of how to contribute to better urban environments by focusing on integration of urban planning with objectives related to resource efficiency, an innovative safe and sustainable low-carbon economy, sustainable urban land-use, sustainable urban mobility, urban biodiversity management and conservation, ecosystem resilience, water management, human health, public participation in decision making and environmental education and awareness; and
- ✚ Improving the planning, management and sustainable use of Europe's coastal zones.

Efforts to modify land-use practices to reduce diffuse source pollution of air and water include integrated river basin management and, in particular, the Nitrates Directive. Flooding caused by the construction of impervious surfaces (e.g. buildings and roads) and provoked by extreme weather events is addressed by a new European Floods Directive. The cross-cutting nature of land use is also

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<sup>5</sup> <http://ec.europa.eu/environment/natres/index.htm>

emphasised by the EU rural development and regional policies. The UNFCCC<sup>6</sup> and its Kyoto Protocol promote *inter alia* practices that reduce emissions of methane and nitrous oxide from agricultural land and the enhancement of carbon sequestration within biomass and soils across all land uses. A recent decision at EU level (Decision No 529/2013/EU<sup>7</sup>) will see all Member States reporting changes in greenhouse gas emissions and removals associated with all carbon pools within Cropland Management and Grazing Land Management during the second commitment period of the Kyoto Protocol. This is in addition to those within Afforestation, Reforestation and Deforestation, and Forest Management which are already mandatory for reporting during this period. EU policies on climate change adaptation are directly relevant to current and future land-use practices and economic sectors depending on those uses.

The European Landscape Convention, adopted in 2000, emphasises the need to seek the right balance between land use and protection of a landscape. Ireland's National Landscape Strategy Steering Group was established by the Department of Arts, Heritage and the Gaeltacht (DAHG) during 2011 in order to develop a National Landscape Strategy with the aim of sustainable management of change that affects landscape. Land-use planning and management are essential to better reconcile land use with environmental concerns. It is a challenge that involves various policy levels and different sectors. Monitoring and mediating the negative environmental consequences of land use while sustaining the production of essential goods and services, is a major priority of policy-makers around the world.

The Commission launched, on 12 March 2013, a new joint initiative (in the form of a Draft Directive) which aims to establish a framework for integrated coastal management and maritime spatial planning in EU Member States with a view to promoting the sustainable growth of maritime and coastal activities and the sustainable use of coastal and marine resources.

The United Nations Conference on Sustainable Development - or Rio+20 - took place in Rio de Janeiro, Brazil on 20-22 June 2012. The resulting Outcome document<sup>8</sup> contains clear and practical measures for implementing sustainable development, including the need for urgent action to reverse land degradation "*We will strive to achieve a land-degradation neutral world in the context of sustainable development.*" This is supported by the 7<sup>th</sup> EU Environment Action Programme<sup>9</sup>.

Urban sprawl is a pressing issue as it results in loss of soil ecosystem services and biodiversity, and limits future food production by using up agricultural land – effectively irreversibly. The Commission Communication on a Roadmap to A Resource-Efficient Europe<sup>10</sup> includes as milestones that: "by 2020, EU policies take into account their direct and indirect impact on land use in the EU and globally, and the rate of land take is on track with an aim to achieve no net land take by 2050; soil erosion is reduced and the soil organic matter increased, with remedial work on contaminated sites well underway". The 7<sup>th</sup> Environment Action Programme and the Rio+20 Summit promote an integrated approach to planning, building and managing sustainable cities and urban settlements. Sustainable land use policies and practices means finding the right balance between the needs of urban and rural areas. Government at all levels is becoming increasingly aware of the importance of having access to accurate, up-to-date land cover and land use information of sufficient detail. National land cover and land use data requirements are driven by policy, operational, and research information needs.

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<sup>6</sup> United Nations Framework Convention on Climate Change

<sup>7</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:165:0080:0097:EN:PDF>

<sup>8</sup> <http://sustainabledevelopment.un.org/index.php?menu=1298>

<sup>9</sup> <http://ec.europa.eu/environment/newprg/index.htm>

<sup>10</sup> [http://ec.europa.eu/environment/resource\\_efficiency/pdf/com2011\\_571.pdf](http://ec.europa.eu/environment/resource_efficiency/pdf/com2011_571.pdf)

In December 2012, the Food & Agriculture Organization of the United Nations (FAO) Council approved the Terms of Reference of the **Global Soil Partnership (GSP)**<sup>11</sup> and recommended its immediate implementation. The mandate of the GSP is to improve governance of the limited soil resources of the planet in order to guarantee healthy and productive soils for a food secure world, as well as support other essential ecosystem services, in accordance with the sovereign right of each State over its natural resources. In addition, the **Intergovernmental Technical Panel on Soils (ITPS)**<sup>12</sup> was launched in June 2013. The **International Year of Soils 2015**<sup>13</sup> will serve as a platform for raising awareness on the importance of sustainable soil management as the basis for food systems, fuel and fibre production, essential ecosystem functions and better adaptation to climate change for present and future generations.

### *Other Relevant Policy Context*

In 2010, the Department of Agriculture, Fisheries & Food (now the Department of Agriculture, Food & the Marine) published **“Food Harvest 2020”**<sup>14</sup> which sets the scene for Irish agri-food, drinks, fisheries and forestry sectors for the next decade. The report captures the considerable complexity of this sector; underlines its unique and special position within the Irish economy, and illustrates the potential which exists for this sector to grow even further. This strategy could potentially have long term implication for Ireland’s environment.

In 2012, the Department of the Environment, Community & Local Government (DECLG) published **“Our Sustainable Future”**<sup>15</sup>, which sets out a medium to long-term framework for advancing sustainable development and the green economy in Ireland. It takes account of developments at international and EU level designed to deliver an effective transition to an innovative, low carbon and resource efficient future.

In 2013, **Healthy Ireland** was launched by the Department of Health. It is a new national framework for action to improve the health and wellbeing of our country over 2013-2025. It reflects the international experience of a new commitment to public health with a considerable emphasis on prevention, while at the same time advocating stronger health systems. It provides for new arrangements to ensure effective co-operation between the health sector and other areas of Government and public services, concerned with social protection, children, business, food safety, education, housing, transport and the environment.

The Irish National Platform for Biodiversity Research (NPBR) is a forum for scientists, policy makers and other interested stakeholders involved in the field of biodiversity research. The platform is run under the auspices of the National Parks and Wildlife Service and the Environmental Protection Agency and administered by a secretariat (BEC Consultants Ltd). It forms part of a wider network of biodiversity platforms across Europe that link into European initiatives through the European Platform for Biodiversity Research Strategy (EPBRS). The NPBR (<http://www.biodiversityresearch.ie>) has identified priority areas essential to implement legislative requirements and to meet the challenge of halting the loss of national biodiversity. In particular, it made recommendations on agriculture, grassland and soil biodiversity research needs<sup>16</sup>.

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<sup>11</sup> [http://www.fao.org/fileadmin/user\\_upload/GSP/docs/tor/Aproved\\_GSP\\_ToRs\\_.pdf](http://www.fao.org/fileadmin/user_upload/GSP/docs/tor/Aproved_GSP_ToRs_.pdf)

<sup>12</sup> <http://www.fao.org/globalsoilpartnership/intergovernmental-technical-panel-on-soils/en/>

<sup>13</sup> [http://www.fao.org/fileadmin/user\\_upload/GSP/docs/Soil\\_2015/CL\\_146\\_7\\_A\\_IYSoils\\_final.pdf](http://www.fao.org/fileadmin/user_upload/GSP/docs/Soil_2015/CL_146_7_A_IYSoils_final.pdf)

<sup>14</sup> <http://www.agriculture.gov.ie/media/migration/agri-foodindustry/foodharvest2020/2020FoodHarvestEng240810.pdf>

<sup>15</sup> <http://www.environ.ie/en/Publications/Environment/Miscellaneous/FileDownload,30452,en.pdf>

<sup>16</sup> [http://www.biodiversityresearch.ie/Thematic%20recommendations\\_Agriculture\\_grasslands\\_Soil.pdf](http://www.biodiversityresearch.ie/Thematic%20recommendations_Agriculture_grasslands_Soil.pdf)



## 1.2. Research

Against the initiatives outlined above, it is vital to improve the evidence base that is required to accurately assess and protect soil resources and, thereby, their essential ecosystem services, and to provide information and guidance to policy and decision makers. The sustainable management of both land use and soils requires an **integrated approach**. The 7<sup>th</sup> Environment Action Programme urges the EU and Member States to reflect on how soil quality issues could be addressed using a targeted and proportionate risk-based approach within a binding legal framework. Ultimately, a national landscape strategy and a national soil protection strategy for Ireland will need to be prepared and fully implemented. Further, while Ireland has fewer contaminated land problems than most other industrialised countries, an overall policy framework for the identification, mapping, management and remediation of contaminated land in Ireland is needed.

Policy, funding and management are under the responsibility of different organisations and operate on various levels (e.g. local vs. national vs. EU-level research; basic vs. applied research). Only by improved exchange of information and involvement of both research providers and those in need of research results, can the research gaps be clearly identified and validated.

The capacity-building aspect of research is also vital for building Ireland's Intellectual expertise, as well as for increasing Irish researchers' participation in competitive, international programmes (e.g. FP7, Horizon2020, LIFE+, etc.).

The revival of a national effort on soils has been supported by significant investment since 2000 by the EPA Research Programme. Research in this area is intended to provide scientific knowledge to underpin the protection and sustainable use of soil. Between 2007-2012, the EPA STRIVE Programme has funded 17 Research Projects<sup>17</sup> (projects with a budget over €10,000) related to Soils and Land Use & Land Cover with a total commitment from the EPA of approximately € 6.48m. The range of projects funded includes desk-studies, scholarships, fellowships and large-scale multi-annual and multi-partner awards.

Some of the key achievements of the EPA Research Programme include to-date:

- ✚ The BOGLAND project developed a protocol for the sustainable management of peatlands in Ireland. Recommendations from this project have already been incorporated into the new birds and habitats regulations and will inform development of national peatland and wetland strategies.
- ✚ As part of a wide-ranging project on sustainable planning and development, Green City Guidelines were published which provide practical ways for local authorities, planners and property developers to protect and enhance biodiversity.
- ✚ Co-funded with Teagasc the development of a digital indicative soil map of Ireland which combines cutting-edge mapping technology and field assessment techniques that will, for the first time ever, be applied at national scale (ISIS project).
- ✚ The Soil H project (*Interactions of soil Hydrology, land use and climate change and their impact on soil quality*) which aims at identifying and assessing the interactions between soil hydrology, land use and climate change for different soil types representative of Irish conditions and to assess their impacts on soil quality.

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<sup>17</sup> <http://www.epa.ie/pubs/reports/research/ssr/scienceandsustainabilityresearch-basedknowledgeforenvironmentalprotection.html>

## 2. Overall Aim

*Strong evidence-based scientific knowledge is key to informed and positive policy-making. The EPA Strategic Plan 2013-2015<sup>18</sup> reflects these principles through a number of strategic priorities with research playing a pivotal role in delivering a good, sustainable and healthy environment supporting all sectors of society and the economy.*

Valuing and protecting our natural environment by ensuring that there is recognition that Ireland's environment has an intrinsic value in its own right has been highlighted as one of the Challenges and Opportunities of environmental protection by the EPA Strategic Plan 2013-2015<sup>19</sup>. The environment should be placed at the center of our decision making by ensuring that the value of science and environmental research to support evidence-based policy and decision making is recognised.

Sustainable soil management can mitigate environmental problems such as greenhouse gas emissions, poor water quality, water scarcity and stream sedimentation. Soils can be both a source and a sink of greenhouse gases (CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O). Soils research priorities are driven by the need to enhance food security, agricultural and forest productivity and other ecosystem services while adapting to climate change and improving environmental management. Soils research should underpin land use policies to balance the increased competition for land and soil resources to meet food, timber, fiber and energy needs and to accommodate expanding urban populations, including risks associated with soil sealing, soil compaction and indirect impacts of land use change, as well as flood management and the critical role of soils in hydrological systems. Research into soil ecological processes will establish sustainable soil management practices to restore and maintain soil fertility and prevent land degradation.

The EPA Research Programme 2014-2020 in the Soils and Land Use & Land Cover areas will support the ***development of sustainable soils and land-use policies***. The overall aim of these research areas are to: ***“help to protect and ensure a sustainable use of soil by getting a better understanding of soil and its functions and by preventing the threats to soil and mitigating their effects. Research activities will aim at supporting sustainable urban and land-use policies.”***

A key indicator of success for these areas will be evidence of support provided towards the development of sustainable soils & land use policies (with measurable uptake of research findings in policy documents); increased research capability & capacity building in these areas, successful participation in European & international projects, enhanced dissemination and maximised synergies and collaboration with the various funding bodies in the Soils and Land Use & Land Cover research areas.

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<sup>18</sup> <http://www.epa.ie/pubs/reports/other/corporate/epastrategicplan2013to2015.html>

<sup>19</sup> <http://www.epa.ie/pubs/reports/other/corporate/epastrategicplan2013to2015.html>



### 3. Our Approach for the Period 2014-2020

It is proposed that over the period 2014-2020, the core areas of research carried out by the EPA Research Programme in the areas of Soils and Land Use & Land Cover (under the *Sustainable Environment* Research Pillar) will be:

- Soils Research
  - *Governance & Policy support;*
  - *Identifying, Preventing and Mitigating Threats to Soil Quality & Biodiversity;*
  - *Maintaining and Restoring Soil Functions*
- Land Use & Land Cover Research
  - *Development of a National Land Use & Land Cover Information System;*
  - *Urbanisation;*
  - *Environmental Impacts of Land Use & Land Cover Changes.*

### 3.1. Soils Research

#### *Governance & Policy Support*

Research in this area will focus on providing *support for developing new environmental policy* and implementing current policies. Emerging issues will also be included.

An example of Research Gaps identified in this area include but is not limited to developing a key set of indicators for soil monitoring and a new soil monitoring network and baseline measurements. In addition, research is needed on awareness raising and education targeting a range of sectors

#### *Identifying, Preventing and Mitigating Threats to Soil Quality & Biodiversity*

Research in this area will *focus on developing our understanding of the spatial extent and impacts of potentially significant soil degradation threats*. It is our objective to manage the extent of our soil resource in ways which ensure we can meet our present and future land-use needs. The volume of soil in Ireland is being lost in three ways, sealing, erosion and extraction. Soil is lost through the development for housing, industry and infrastructure. This soil sealing is almost irreversible in terms of blocking geochemical and water cycles within that area of soil, as well as the obvious loss of productivity. The quantification of erosion in agricultural soils is unknown in Ireland. The exposure of bare (uncultivated) arable soils for part of the year means potentially great losses of productive topsoils due to runoff during heavy rainfall. Erosion loss is also experienced in the uplands on peatlands and along our coasts. Mineral, peat and topsoil extraction all contribute to loss of soil.

Examples of Research Gaps identified in this area include but are not limited to:

#### **Sealing<sup>20</sup>**

- ✚ Estimating accurately the amount of land lost to sealing
- ✚ Investigation of the effects and threats from sealing on soil qualities and soil functions, to health, human environment and nature;
- ✚ Monitoring and assessment methods for sealing;
- ✚ Assess the benefits and negative impacts of land use planning on sealing.

#### **Erosion**

- ✚ Expanding the knowledge on soil erosion processes and modeling, especially regarding different spatial and temporal scales;
- ✚ Monitoring and assessment methods for erosion;
- ✚ Effect of changes in climate and land use on erosion potential;
- ✚ Economic losses due to erosion.

#### **Compaction**

- ✚ Better models for predicting effects of compaction on soil processes and productivity;
- ✚ Monitoring and assessment methods for compaction;
- ✚ Development of strategies to reduce compaction, including technical measures and decision support systems.

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<sup>20</sup> Research in this area should further the findings presented in the 2012 EU report on Soil Sealing ([http://ec.europa.eu/environment/soil/pdf/sealing/Soil%20Sealing%20In-depth%20Report%20March%20version\\_final.pdf](http://ec.europa.eu/environment/soil/pdf/sealing/Soil%20Sealing%20In-depth%20Report%20March%20version_final.pdf) and <http://ec.europa.eu/environment/soil/sealing.htm>)

## Landslides

- ✚ Understanding the relationship between climate and landslides;
- ✚ Monitoring and assessment methods for landslide;
- ✚ Short-term prediction of landslide activity, including the use of models and GIS;
- ✚ Assessment of changing landslide potential under climate change, extreme events etc. and land use change

*The diversity of soils should be managed, concentrating particularly on our most valued soils*, so that the right balance of soil types is available to meet current and future needs for soil to support our ecosystems, landscape, agriculture and cultural functions. Ireland has a diverse range of soils, supporting a wide variety of ecological, landscape, agricultural and cultural functions. There is a variety of different measures to ensure that we maintain this high level of diversity. This area is of international importance with respect to soils research. The key measures already in place are:

- ✚ Legislation for designating and protecting valuable ecosystems, sites and landscapes; and
- ✚ Planning controls to protect archaeological sites.

In addition, recommendations from the National Platform for Biodiversity Research on Agriculture, grassland and soil biodiversity research needs will be taken into account.

Examples of Research Gaps identified in this area include but are not limited to:

- ✚ Role of soil management and protection in SACs, NHAs and SPAs;
- ✚ Develop robust indicators and soil management guidelines to monitor and maintain functional biodiversity in soils;
- ✚ Supporting research projects, particularly in the areas of landslides, soil sealing, soil functions and their link to biodiversity, the soil carbon and nitrogen cycles (with a focus on peatland restoration), soil fertility, and nutrients recycling in agriculture;
- ✚ Research on how soil degradation can affect the soil's ability to support vital ecosystem services such as flood mitigation, carbon storage and nutrient cycling.
- ✚ Recommendation towards the best way to integrate soil protection across Government bodies and agencies at all levels

## Maintaining and Restoring Soils Functions

Research in this area will focus on developing our understanding of how land management practices affect fundamental soil functions & soil quality and thus the delivery of ecosystem goods and services. It will focus on best practices to prevent & remediate soil degradation; as well as developing an evidence base on the impact of climate change on soils. It is an objective of the EPA “to *maintain and improve the quality of our soils* in ways which ensure we can meet our current and future social, environmental and economic needs”. This area will focus on *best practices to prevent and remediate soil degradation*; as well as developing our evidence-base on the impact of climate change in soils.

Examples of Research Gaps identified in this area include but are not limited to:

- ✚ Strategy to assess the potential effects of soils degradation;
- ✚ Best practices to protect and enhance levels of soil organic matter;
- ✚ Contribution of soil management to flood mitigation;
- ✚ Contribution of soil management to the mitigation of greenhouse gas emissions
- ✚ Ecosystem services – Value of soils to the Irish economy;
- ✚ Practices which have the potential to increase soil organic matter without increasing greenhouse gas emissions or having other negative environmental impacts;

- ✚ Impacts of climate change on soils & habitats (particularly peatland);
- ✚ Contaminated land in Ireland:
  - Estimating accurately the amount of contaminated land
  - What are the drivers for remediation? Environmental Vs. Economic;
- ✚ Improve our understanding of the risks to human health and the environment from soil pollution;
- ✚ Links between pollutants concentrations and impacts on soil quality;
- ✚ Understanding of the impact of atmospheric deposition of pollutants on biodiversity and ecosystems and the potential for recover;
- ✚ The role of soils in carbon sequestering;
- ✚ Remediation techniques and their impact on the environment.

Possible research topics under this area will be identified and discussed at the EPA Soils and Land Use & Land Cover Research Planning Workshop on the 10<sup>th</sup> September 2013.

### 3.2. Land Use & Land Cover Research Needs

Datasets relating to different aspects of land use and land cover in Ireland have been produced and maintained by various agencies, institutions and individuals. A significant research effort is required to *bring these data together to form a consistent picture of changing land use and land cover* in Ireland within a robust methodology that addresses data quality control.

Research Gaps identified in this area include but is not limited to:

#### *Development of a National Land Use & Land Cover Information System*

- ✚ Temporal and spatial distributions of landcover and land use at local, regional and national scales;
- ✚ Development of baseline dataset in Land Use & Land Cover.

#### *Urbanisation*

- ✚ Urban Development in a changing global environment (vulnerability of various urban areas, different urban populations and goods, enhancement of the resilience against natural hazards, overheating of urban areas and the role of land use & land cover and urban green spaces, modification of urban biodiversity, role of policies and governance in coping with climate risks)
- ✚ Develop new integrative concepts for Urban Development, taking into account global change, the need for sustainable use of resources, including construction resources and energy, the relationships between urban, peri-urban and peripheral areas in view of maximising human welfare, minimising resource and energy use and vulnerability against hazards.
- ✚ Concept of Green cities: green technologies, showcase the new generation of buildings and alternative means of transport.

#### *Environmental Impacts of Land use & Land cover changes*

- ✚ How may changes in land use, management and land cover affect local, regional and national environmental and socio economic conditions?
- ✚ Development of adaptive land-use management support systems;
- ✚ Recommendations towards the integration of environmental impacts considerations in Land-use planning and management;
- ✚ Ecosystem service value of soils in land cover assessments.

Possible research topics under this area will be identified and discussed at the EPA Soils and Land Use & Land Cover Research Planning Workshop on the 10<sup>th</sup> September 2013.