RECARE

Preventing and Remediating degradation of soils in Europe through Land Care

RECARE Project: Useful resources on soil threats

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Aim:

Finding and sharing solutions

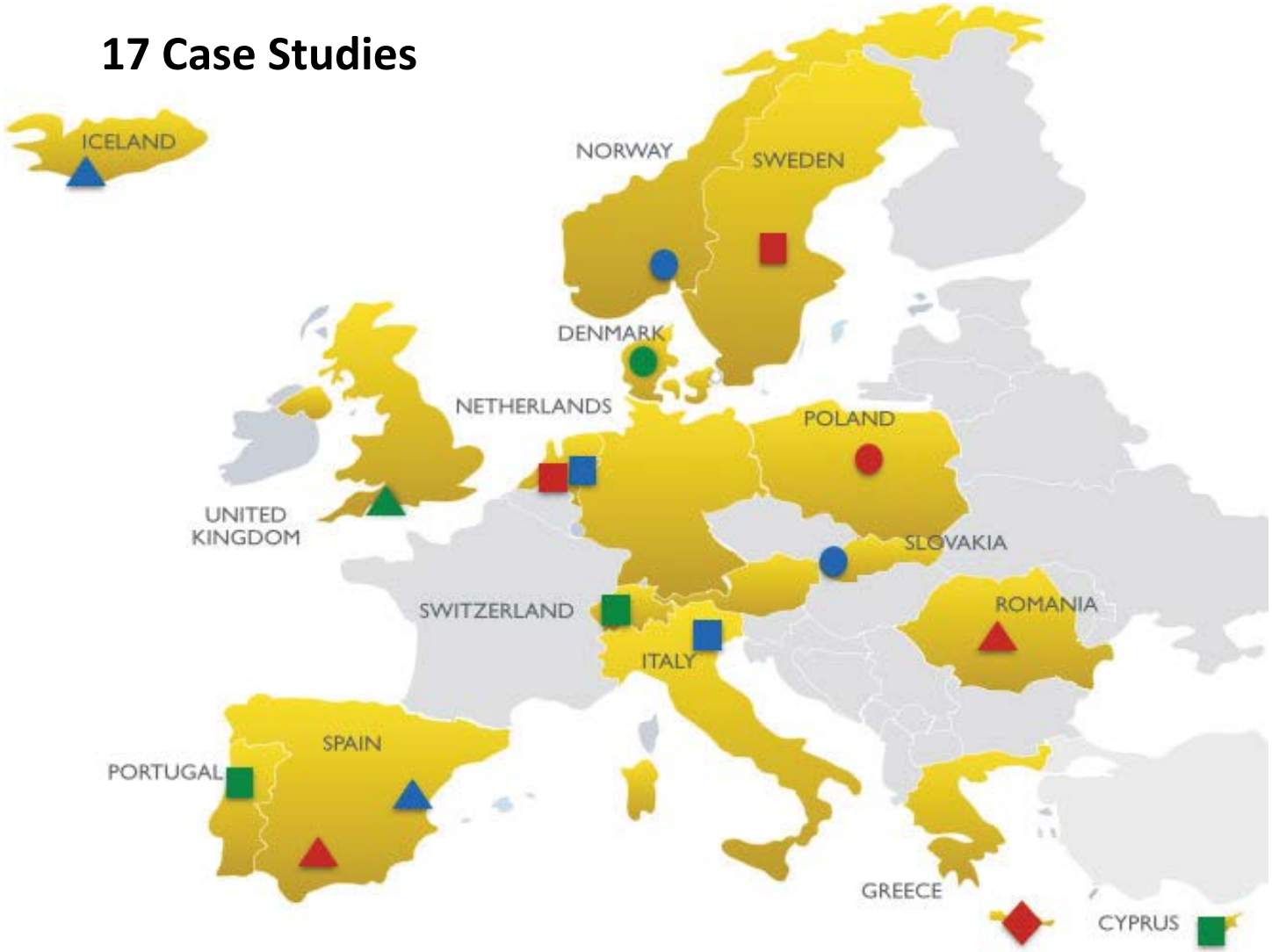
to soil degradation problems

across Europe

EU-funded FP7 project

5 year project - finished in October 2018

17 Case Studies










Soil Threat Icons

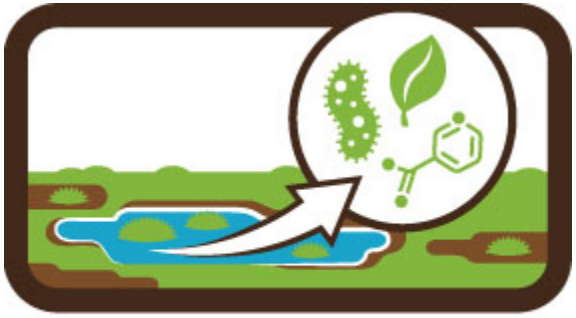
Soil Erosion

Soil Salinization

Soil Sealing

Desertification

Loss of organic matter in mineral soils



Loss of organic matter in peat soils

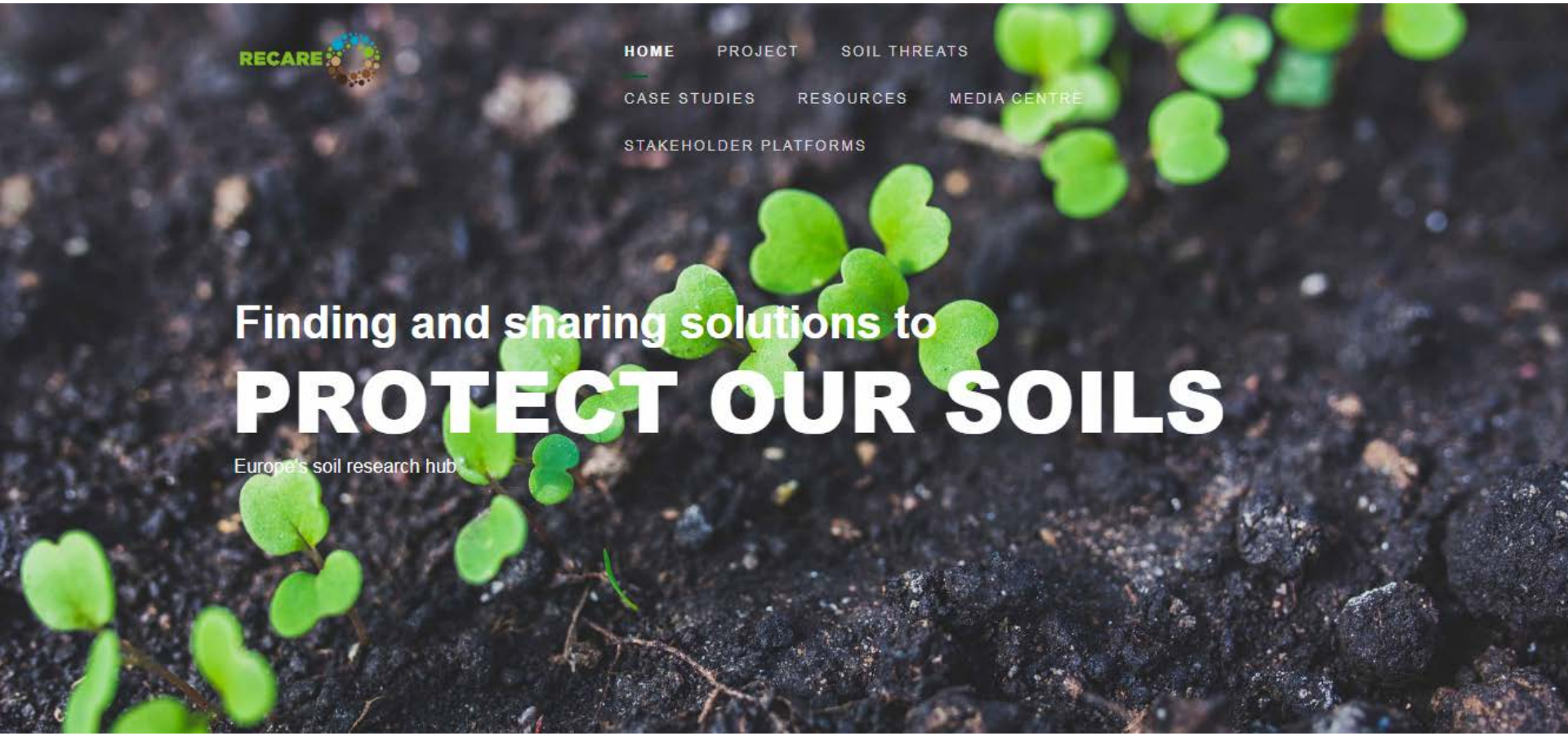
Soil Compaction

Floods & Landslides

Soil Contamination

Loss of soil biodiversity

RECARE Hub



www.recare-hub.eu

RECARE

HOME PROJECT SOIL THREATS

CASE STUDIES RESOURCES MEDIA CENTRE

STAKEHOLDER PLATFORMS

WHO IS RECARE-HUB FOR?

FARMERS & FORESTRY

RECARE-Hub contains the latest information on preventing soil threats, and cost-benefit analysis on proven remediation techniques.

INDUSTRY

Discover innovative sustainable land management measures that can combat threats to key soil functions.

POLICY MAKERS

Find out more about land care strategies relevant to your region and our integrated assessment of existing soil related policy.

RESEARCHERS

Access a wealth of European research data on soil threats and the efficacy of land care strategies.

TEACHERS & ENVIRONMENTALISTS

Whether you're a teacher or a concerned environmentalist, find out why Europe's soils are under threat and what researchers are doing to help combat the problems.

RECARE Experiments

RECARE FACT SHEET
CASE STUDY EXPERIMENTS
EFFECT OF THE DYKER ON
INFILTRATION, SOIL EROSION, A
WATERLOGGING

THE PROBLEM

About one-third of arable land in Switzerland is prone to soil erosion. Tubers and
typical elements of the crop rotation system widely practiced in the Swiss Plateau bu
vulnerable to soil erosion by water, resulting in recurrent soil loss and considerable o
Our case study in Friensberg region, Switzerland considers how to improve cultivati
counteract and mitigate the erosion risk.

THE PROPOSED SOLUTION

In this experiment, we evaluated the effectiveness
of a device called a 'Dyker', which local farmers
trialled during two cropping seasons. The
Dyker consists of a set of wheels with inclined
shovels. It is attached to the rear end of a potato
planting machine and digs holes every 80 cm
into the bottom of the furrows between potato
ridges. The holes are intended to improve water
infiltration and help retain water near the plants,
while minimising surface runoff and soil erosion,
and preventing waterlogging in depressions.

AIMS, OBJECTIVES AND E
DESIGN

The aim of the experiment was to
Dyker's effectiveness in reduci
and increasing water infiltration
planted with an all-in-one machi
rows with and without Dyker trea
dye tracer experiments on treate
test plots to study water movem
soil layers during infiltration a
subsoil infiltration behaviour. By
geometry and cross-sections
untreated furrows we were able
erosion and soil accumulation
with different slope, shape and fu

THE STAKEHOLDERS INVOLVED

The project actively involved stakeholders,
such as farmers, local authorities, water
and soil scientists, agricultural advisors,
the cantonal soil protection agency, farm
contractors, and representatives of the Federal
Office for Agriculture, and the Federal Office
for the Environment. They all contributed to
discussions and assessments of different pre-
existing and potential measures to reduce soil
erosion. We found that the potential measures
all had positive effects and most of them are
already applied in the study site region, and
enough research is available. The Dyker was
selected for testing as it was found to be the
most innovative measure in terms of novelty.

In addition, we used aeria
from drones to identify and
accumulation, waterlogging
resulting crop failure on the diffe

The Dyker in use with a Grimme GL 4

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RECARE FACT SHEET
USE OF CHIPPED PRUNED BRA
TO PREVENT SOIL EROSION IN
APRICOT ORCHARDS

THE PROBLEM

Fruit (apricot) production in the Mediterranean was a traditional crop and
product that requires intensive managements: pesticides, fertilizers and h
branches are burnt and the soils are intensively plough or herbicides are app
results in bare soils and then in high erosion rates that are non-sustainable.

PROPOSED SOLUTION

Each mature apricot tree is pruned in winter and
an average of 34.3 Kg of branches are removed.
We propose chipping these branches (instead
of burning them) and using them as a mulch to
reduce water and soil losses.

Chipping pruned branches in apricot orchard

AIMS, OBJECTIVES
DESIGN

We aim to determine if ch
can be a useful mulch
sustainable soil erosion
vineyards and orchards.

Each season, a simulate
was applied in a 0.25 m²
and sediment concentrati
this data the soil erosion
compared a control plot
chipped pruned branches
experimental station.

Chipped pruned branches used as a mulch in apricot orchards

STAKEHOLDERS INVOLVED

RECARE contacted the landowners and workers
to inform them about the benefit of using
chipped pruned branches to control the soil
losses. We applied this technique in a 20-years
old apricot farm in the Municipality of Molxent.
The experiment lasted from 2013 till 2016.

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RECARE FACTSHEET
CASE STUDY EXPERIMENTS
POST-FIRE MULCHING TO
REDUCE SOIL EROSION

THE PROBLEM

The experiment in the Caramulo area of Portugal addresses the problems of soil erosion by
water and the associated organic matter losses in forest areas recently burnt by wildfire – in this
case, in a eucalyptus plantation.

THE PROPOSED SOLUTION

We designed this field experiment to discover
whether applying eucalyptus logging residues
(typically referred to as 'mulching') immediately
after a wildfire would minimise post-fire
sediment and organic matter losses. Specifically,
the team wanted to know if reducing the amount
of applied residues by two-thirds, compared to
previous field experiments, would substantially
reduce this effectiveness.

AIMS, OBJECTIVES AND EXPERIMENT
DESIGN

The field experiment aims
and organic matter losses

- Doing nothing;
- Applying eucalyptus
rates of 8.0 Mg ha⁻¹ (
previous field trials in
- Applying eucalyptus l
of 2.5 Mg ha⁻¹ (reduce

To this end, we installed ni
wide by 8 m long in a euca
during the summer of 201
these plots over the next t
two years, we collected
to 4-weekly intervals (dep
analysed them in the labor
organic matter content.

THE STAKEHOLDERS INVOLVED

A wide range of individual forest owners and
managers were involved in the selection of
mulching for field testing, along with stakeholders
from the private sector, as well as representatives
from local, regional and national governmental and
nongovernmental organisations with an interest
in post-fire land management. The stakeholders'
lack of familiarity with mulching was one of the
main reason for selecting the practice.

Stakeholder workshop

Mulching e

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RECARE FACTSHEET
CASE STUDY EXPERIMENTS
EFFECTS OF DIFFERENT CROPS ON
SURFACE RUNOFF

THE PROBLEM

Floods and the corresponding erosion processes are among the principal soil threats causing
significant losses of arable land from the Mýjava river basin hillslopes. The destruction of the natural
landscape, which took place in the second half of the 20th century caused the area to have the highest
density of permanent gullies in Slovakia. The transition from the natural to agricultural landscape
brought new problems related to the quick occurrence of surface runoff even during rainfall events
where no runoff had occurred in the past.

THE PROPOSED SOLUTION

Surface runoff is the primary factor responsible
for increased soil loss from the area of interest.
A rainfall runoff experiment was proposed to
investigate the characteristics of the generated
surface runoff under different conditions
represented by: various crops and their growth
stages, and the types and state of soil cover.

As a result of the field experiments using various
crops and under different soil conditions (initial soil
moisture, stage of surface), other variables of the
surface runoff processes on the plots have been
developed, i.e., the critical rainfall intensities, the
soil moisture content for the runoff generation,
the dependence of the surface runoff on the
intensity of rainfall, the steepness of the slope
and the initial soil moisture content. The volumes
of the surface runoff and values of the time to
runoff have been applied in the parameterisation
and validation of the "slope scale" physically-
based hydrological model SMODERP.

THE STAKEHOLDERS INVOLVED

The extent of soil erosion in the Mýjava river
basin is a problem affecting a large number of
individuals and organisations. Because of this,
many stakeholders expressed an interest in the
formulation and evaluation of the experiments.
The stakeholders were local farmers, individuals
affected by soil and gully erosions, representatives
from local and regional authorities, and the water
managers dealing with high sediment loads
transported by the rivers.

AIMS, OBJECTIVES AND EXPERIMENT
DESIGN

The primary objective of the proposed
experiment was to investigate the characteristics
of the generated surface runoff, which occurred
as a result of artificial rainfalls of various durations
and intensities. Within the trials a particular focus
was placed on the estimation of:

- the volume of surface runoff,
- the mass of the transported sediments,
- the time to runoff.

Measuring surface runoff in an oilseed rape field

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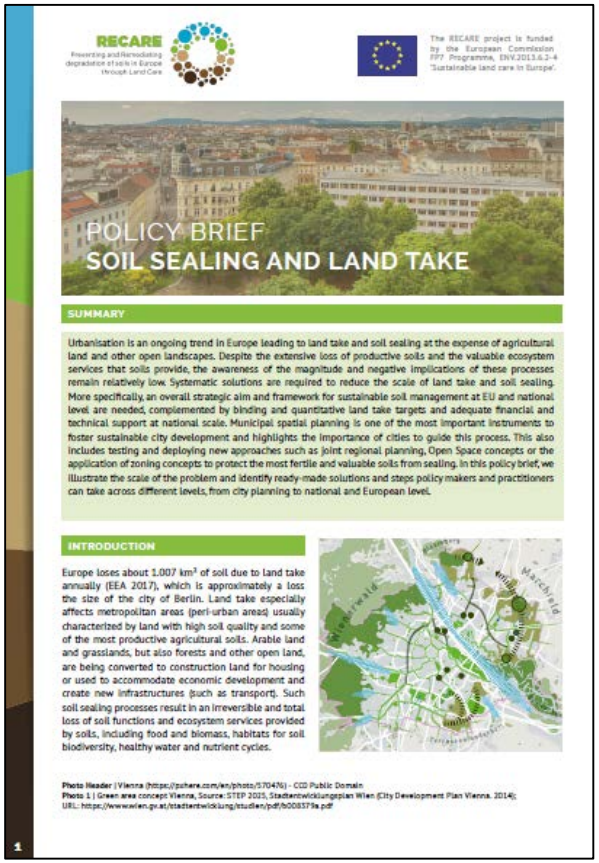
Soil Threat Fact Sheets

1. Soil Erosion by Water – (*En, Pt*)
2. Soil Erosion by Wind (*En*)
3. Soil Salinization (*En, Gr*)
4. Soil Compaction (*En*)
5. Floods and Landslides (*En*)
6. Soil Sealing (*En*)
7. Desertification (*En*)
8. Loss of Organic Matter in peat soils (*En, Nl, Se)*
9. Loss of Organic Matter in mineral soil (*En, It, Nl*)
10. Soil contamination (*En*)
11. Loss of Soil Biodiversity (*En*)

Policy Briefs



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POLICY BRIEF
SOIL SEALING AND LAND TAKE

SUMMARY

Urbanisation is an ongoing trend in Europe leading to land take and soil sealing at the expense of agricultural land and other open landscapes. Despite the extensive loss of productive soils and the valuable ecosystem services that soils provide, the awareness of the magnitude and negative implications of these processes remain relatively low. Systematic solutions are required to reduce the scale of land take and soil sealing. More specifically, an overall strategic aim and framework for sustainable soil management at EU and national level are needed, complemented by binding and quantitative land take targets and adequate financial and technical support at national scale. Municipal spatial planning is one of the most important instruments to foster sustainable city development and highlights the importance of cities to guide this process. This also includes testing and deploying new approaches such as joint regional planning, Open Space concepts or the application of zoning concepts to protect the most fertile and valuable soils from sealing. In this policy brief, we illustrate the scale of the problem and identify ready-made solutions and steps policy makers and practitioners can take across different levels, from city planning to national and European level.

INTRODUCTION

Europe loses about 1.007 km² of soil due to land take annually (EEA 2017), which is approximately a loss the size of the city of Berlin. Land take especially affects metropolitan areas (peri-urban areas) usually characterized by land with high soil quality and some of the most productive agricultural soils. Arable land and grasslands, but also forests and other open land, are being converted to construction land for housing or used to accommodate economic development and create new infrastructures (such as transport). Such soil sealing processes result in an irreversible and total loss of soil functions and ecosystem services provided by soils, including food and biomass, habitats for soil biodiversity, healthy water and nutrient cycles.

Photo Header | Vienna (https://pxhere.com/en/photo/570476) - CC0 Public Domain
Photo 1 | Green area concept Vienna, Source: STEP 2025, Stadtentwicklungsplan Wien (City Development Plan Vienna. 2014); URL: https://www.wien.gv.at/stadtentwicklung/studien/pdf/b008379a.pdf

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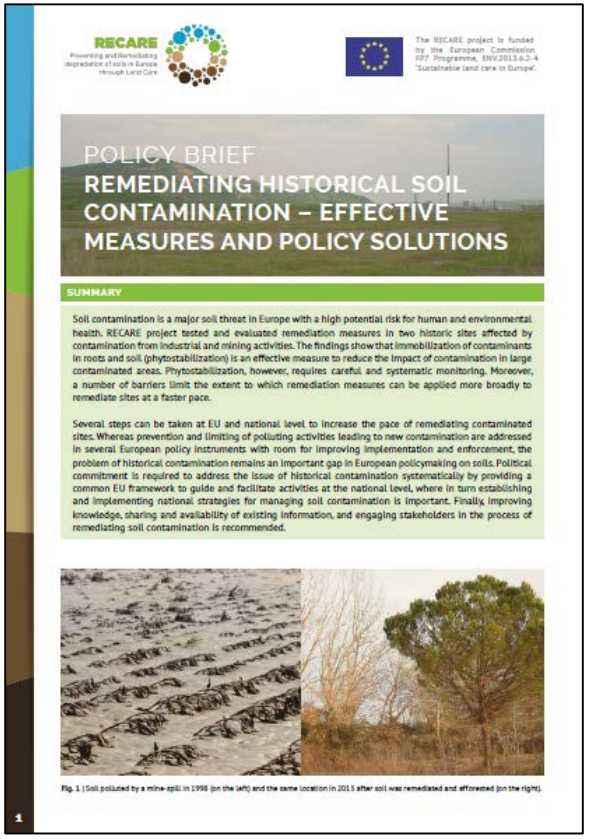

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POLICY BRIEF
REMEDIATING HISTORICAL SOIL CONTAMINATION – EFFECTIVE MEASURES AND POLICY SOLUTIONS

SUMMARY

Soil contamination is a major soil threat in Europe with a high potential risk for human and environmental health. RECARE project tested and evaluated remediation measures in two historic sites affected by contamination from industrial and mining activities. The findings show that immobilization of contaminants in roots and soil (phytostabilization) is an effective measure to reduce the impact of contamination in large contaminated areas. Phytostabilization, however, requires careful and systematic monitoring. Moreover, a number of barriers limit the extent to which remediation measures can be applied more broadly to remediate sites at a faster pace.

Several steps can be taken at EU and national level to increase the pace of remediating contaminated sites. Whereas prevention and limiting of polluting activities leading to new contamination are addressed in several European policy instruments with room for improving implementation and enforcement, the problem of historical contamination remains an important gap in European policymaking on soils. Political commitment is required to address the issue of historical contamination systematically by providing a common EU framework to guide and facilitate activities at the national level, where in turn establishing and implementing national strategies for managing soil contamination is important. Finally, improving knowledge, sharing and availability of existing information, and engaging stakeholders in the process of remediating soil contamination is recommended.

Fig. 1 | Soil polluted by a mine-spill in 1998 (on the left) and the same location in 2015 after soil was remediated and afforested (on the right).

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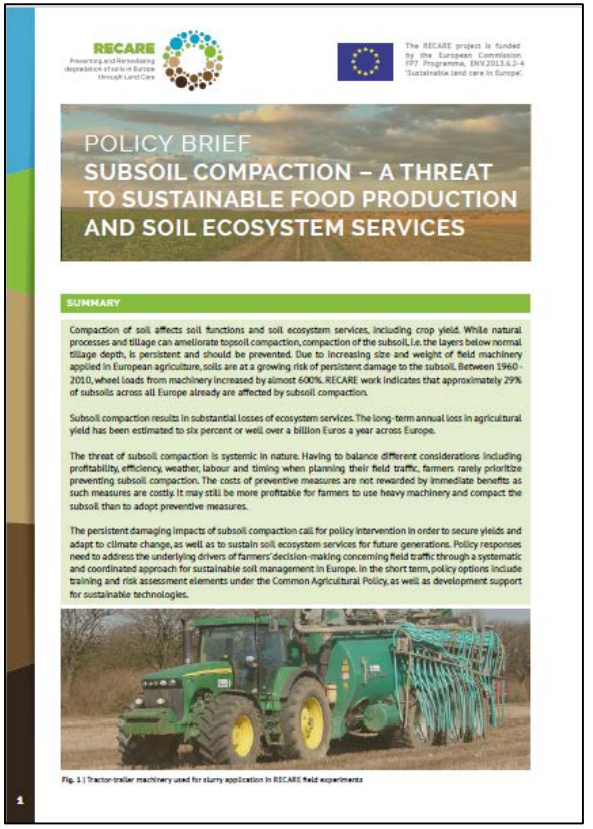

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POLICY BRIEF
SUBSOIL COMPACTION – A THREAT TO SUSTAINABLE FOOD PRODUCTION AND SOIL ECOSYSTEM SERVICES

SUMMARY

Compaction of soil affects soil functions and soil ecosystem services, including crop yield. While natural processes and tillage can ameliorate topsoil compaction, compaction of the subsoil, i.e. the layers below normal tillage depth, is persistent and should be prevented. Due to increasing size and weight of field machinery applied in European agriculture, soils are at a growing risk of persistent damage to the subsoil. Between 1960 - 2010, wheel loads from machinery increased by almost 600%. RECARE work indicates that approximately 29% of subsoils across all Europe already are affected by subsoil compaction.

Subsoil compaction results in substantial losses of ecosystem services. The long-term annual loss in agricultural yield has been estimated to six percent or well over a billion Euros a year across Europe.

The threat of subsoil compaction is systemic in nature. Having to balance different considerations including profitability, efficiency, weather, labour and timing when planning their field traffic, farmers rarely prioritize preventing subsoil compaction. The costs of preventive measures are not rewarded by immediate benefits as such measures are costly. It may still be more profitable for farmers to use heavy machinery and compact the subsoil than to adopt preventive measures.

The persistent damaging impacts of subsoil compaction call for policy intervention in order to secure yields and adapt to climate change, as well as to sustain soil ecosystem services for future generations. Policy responses need to address the underlying drivers of farmers' decision-making concerning field traffic through a systematic and coordinated approach for sustainable soil management in Europe. In the short term, policy options include training and risk assessment elements under the Common Agricultural Policy, as well as development support for sustainable technologies.

Fig. 1 | Tractor-trailer machinery used for slurry application in RECARE field experiments

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Videos

- Soil sealing in Italy
- Flooding in Norway
- Soil contamination in Romania
- Soil erosion in Spain

Resources for Schools

Resources for Schools

Below is a list of educational resources providing information about different soil threats. Links are provided to websites and details provided of the soil threat covered and a summary of the resources available. This list will be regularly updated.

Further information on education materials currently available at the European Soil Data Centre (ESDAC) can be found here

Existing Educational Resources

Website	Soil Threats Covered	Resources Available
Soil Net - UK	• Erosion • Desertification • Acid rain • Fertilisers • Pollutants • Deforestation • Impacts on biodiversity • Climate change • Salinisation	**Online:** Ages 7 - 11 – interactive explanations and games about soil in general Ages 12 - 16 – definition of threats, causes, consequences, mitigation, short quizzes Eco-lifestyle quiz. Interactive 'Terrain Builder' to show effect of erosion. Photo library. **Print:** Activity sheets (general) Fact sheets (soil components and types) Work sheets

譯文標題：實地研究：探索土壤的構造

(Field research: discovering the structure of soil)

論文出處	Barbara Birli et al. (2017) Field research: discovering the structure of soil. Science in School 42: 29–35. http://www.scienceinschool.org/content/field-research-discovering-structure-soil
內文翻譯授權	依照 Science in School 文章授權的版權資訊處理。
圖片授權	
翻譯者	國立臺灣師範大學物理學系 許文彥 先生
審查者	
適用年齡	11-14, 14-16

審查者序

審查者序:

土壤是不可再生的重要自然資源，可以說沒有土壤就不會有生命。這篇文章驗透過兩個簡單的土壤構造實驗，來闡述土壤在農業與生態上的重要性。所謂土壤構造，是礦物顆粒(砂粒、坋粒與粘粒)因為膠結而自然排列在一起的團粒，團粒的穩定性愈強，表示是愈健康的土壤，不僅農業生產力高，也比較能夠抵抗沖蝕作用。至於讓這些礦物顆粒能夠團聚的主要膠結劑，就是有機質。有機質不僅讓土壤構造的穩定性提高，也可以提供植物養分，而當土壤能免於沖破壞時，有機質也才不會加速分解為二氧化碳，因而加劇溫室效應。所以，第一個實驗是為了觀察土壤構造的穩定性而設計，可增加學生關於有機質在土壤中的重要性，以及不同土地利用對土壤構造與有機質的影響；第二個實驗則是讓學生觀察土壤的砂粒、坋粒與粘粒比例不同的時候，所代表不同土壤類型的意義，而這些意義書量都是日常生活容易理解的。

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RECARE
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RECARE Hub Legacy

- Further development of Resources for Schools

- RECARE Hub will continue for another 4 years – but then what?

Thank You!

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