SOIL RESOURCE

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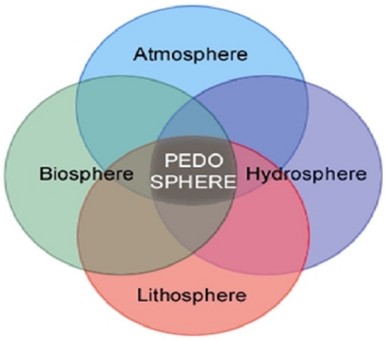
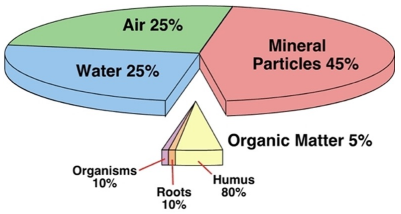


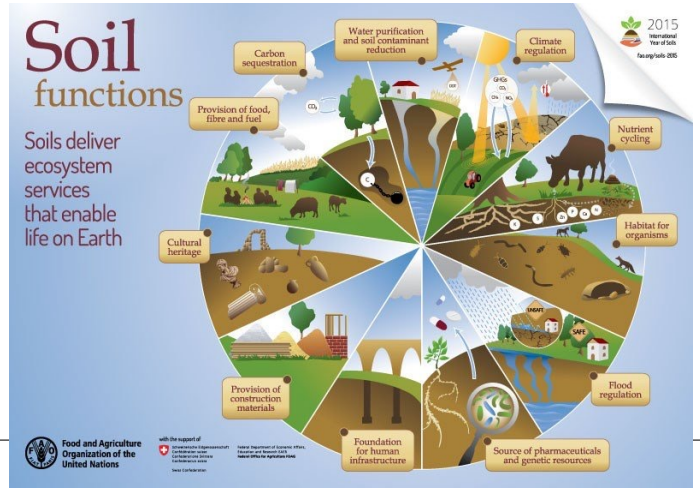
SOIL IS A NATURAL, ALIVE AND DYNAMIC RESOURCE

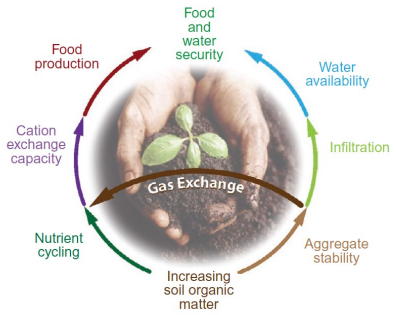
Composed by 3 phases:

- **SOLID PHASE** (mineral matter and organic matter)
- **LIQUID PHASE** (soil solution)
- **GASEOUS PHASE** (soil atmosfere)

Approximate composition of topsoil (% by volume)



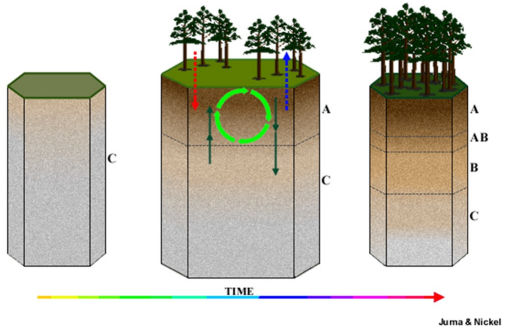


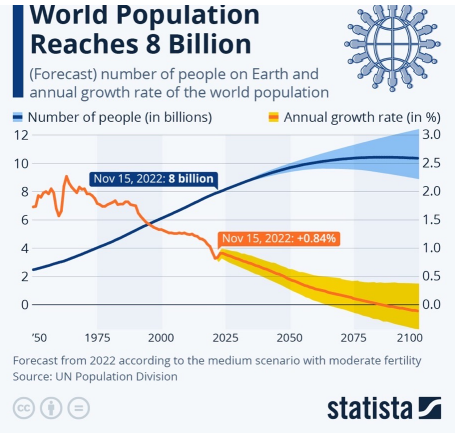


Soil has unique physical, chemical and biological properties that determine its greater or lesser vulnerability to external pressures, such as actions of anthropic origin

Some soil profiles of Europe (source: Europe's Environ: The Dobris Assessment, 1995)

Formation of 30 cm layer of soil takes between 1000 and 10000 years
At Human scale, **SOIL is considered as a NON-RENEWABLE resource**





Growth up to

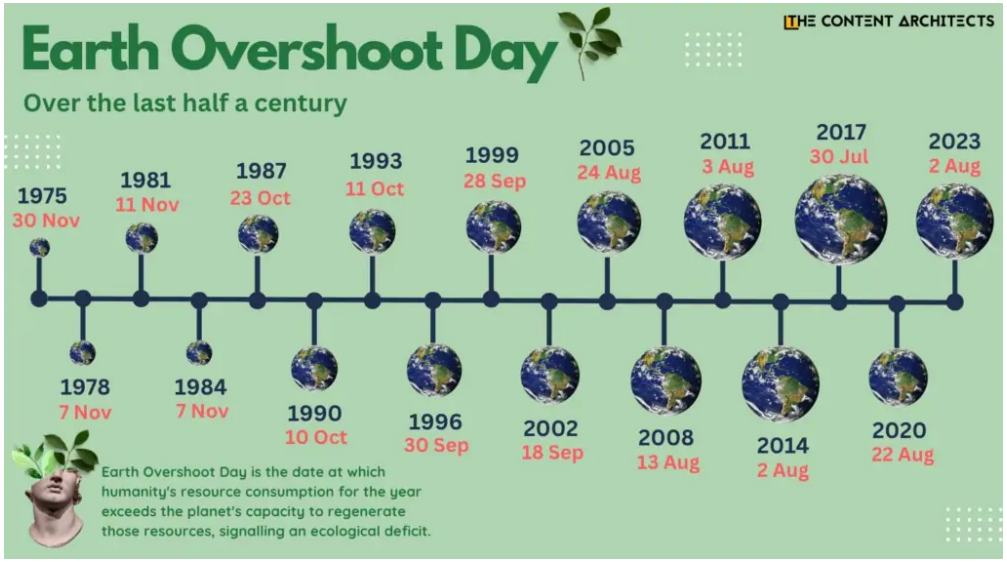
10 billion by 2050

2050

OVERCONSUMPTION

Our use of the world´s natural resources

(Gijum et al., 2009)



SOIL IS A FINITE RESOURCE SUBMITTED TO DEGRADATION PROCESSES

Erosion

Compaction

Soil sealing

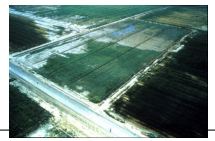
Organic matter decline

Contamination

Biodiversity decline

Landslides

Salinisation



EU SOIL STRATEGY FOR 2030
(COM(2021) 699 FINAL – 17.11.2021)

- Soils are essential ecosystems that deliver valuable services such as the provision of food, energy and raw materials, carbon sequestration, water purification and infiltration, nutrient regulation, pest control and recreation.
- Therefore, soil is crucial for fighting climate change, protecting human health, safeguarding biodiversity and ecosystems and ensuring food security.
- Healthy soils are a key enabler to achieve the objectives of the European Green Deal such as climate neutrality, biodiversity restoration, zero pollution, healthy and sustainable food systems and a resilient environment.

Panagos et al., 2022, https://doi.org/10.1016/j.geodrs.2022.e00510

ZERO POLLUTION ACTION PLAN

A significant policy development has been the adoption of the EU Action Plan: "Towards a Zero Pollution for Air, Water and Soil". This Action Plan **recognizes that soil pollution harms human, soil and environmental health, as well as being one of the main reasons for the loss of biodiversity and the ability of ecosystems to provide services such as carbon sequestration**. The Action Plan contains a number of measures specifically targeting soils, including a framework to regularly assess the status of EU soils with regards to pollutants.

The Zero Pollution Action Plan sets out the vision that by 2050, air, water and soil pollution is reduced to levels no longer considered harmful to health and natural ecosystems.

The development of a priority watch list for soil contaminants as well as guidance for the safe, sustainable and circular use of excavated soils is expected.

Panagos et al., 2022, https://doi.org/10.1016/j.geodrs.2022.e00510

MISSION 'A SOIL DEAL FOR EUROPE'

In September 2021, the European Commission adopted five Research and Innovation Missions to bring concrete solutions in response to major societal challenges.

The Mission **"A Soil Deal for Europe" will support the EU's ambition to manage land in more sustainable ways, thereby meeting global commitments such as the Sustainable Development Goals (SDGs)**

and

contributing to a number of **European Green Deal targets** on sustainable farming and forestry, climate resilience, biodiversity, zero-pollution and resilient rural areas.

Panagos et al., 2022, https://doi.org/10.1016/j.geodrs.2022.e00510

EU BIODIVERSITY STRATEGY FOR 2030

Biodiversity Strategy for 2030: Bringing nature back into our lives (2020/2273(INI))

Stated that it is essential to step up efforts to **protect soil fertility, reduce soil erosion and increase soil organic matter by adopting sustainable soil management practices**. It also stated that significant progress is needed to **identify contaminated sites, restore degraded soils, define the conditions for good ecological status, set restoration objectives, and improve the monitoring of soil health**.

THE 8TH ENVIRONMENT ACTION PROGRAMME

Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a General Union Environment Action Programme to 2030 (OJ L 114, 12.4.2022, p.22).

Set the priority objective that by 2050 at the latest, people live well, within planetary boundaries in a well-being economy where nothing is wasted, growth is regenerative, the EU has achieved climate neutrality and has significantly reduced inequalities. Some of the **enabling conditions needed to meet that objective include tackling soil degradation and ensuring the protection and sustainable use of soil, including by a dedicated legislative proposal on soil health**.

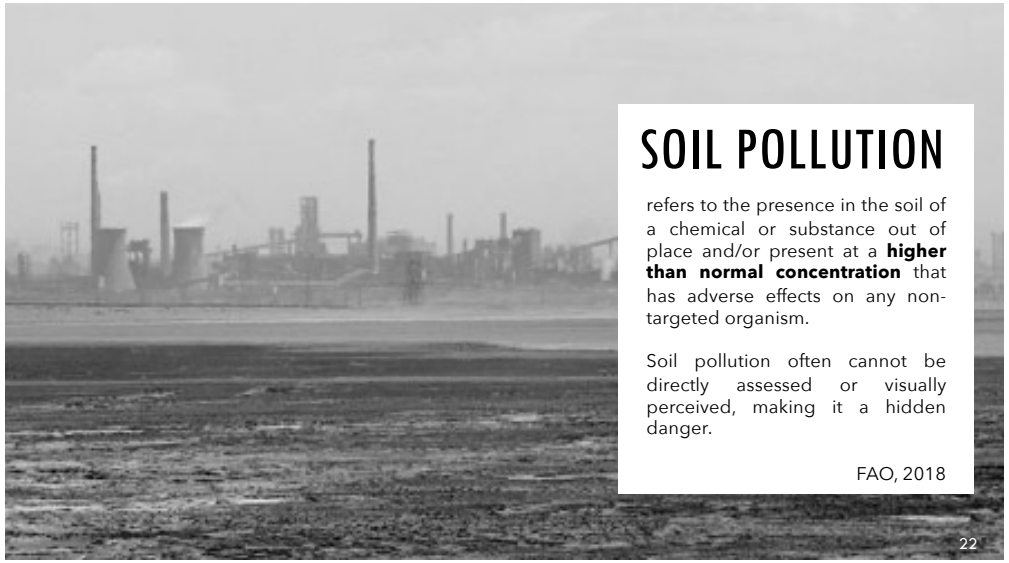
EU SOIL MONITORING LAW COM(2023) 416 FINAL

Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Soil Monitoring and Resilience

The objective of the Directive is to **put in place a solid and coherent soil monitoring framework for all soils across the EU and to continuously improve soil health in the Union with the view to achieve healthy soils by 2050 and maintain soils in healthy condition**, so that they can supply multiple ecosystem services at a scale sufficient to meet environmental, societal and economic needs, prevent and mitigate the impacts of climate change and biodiversity loss, increase the resilience against natural disasters and for food security and that soil contamination is reduced to levels no longer considered harmful to human health and the environment.

This Directive lays down measures on:
(a) monitoring and assessment of soil health;
(b) sustainable soil management;
(c) contaminated sites

This Directive applies to all soils in the territory of Member States



SOIL POLLUTION

refers to the presence in the soil of a chemical or substance out of place and/or present at a **higher than normal concentration** that has adverse effects on any non-targeted organism.

Soil pollution often cannot be directly assessed or visually perceived, making it a hidden danger.

FAO, 2018

EEA-39
3M potentially polluted sites
(European Economic Area & cooperating countries in the West Balkans)

USA
1 300 polluted or contaminated sites are included on the Superfund National Priorities List

CHINA
16% of all soils & 19% of its agricultural soils categorized as polluted

AUSTRALIA
80 000 estimated contaminated sites

These numbers are informative in helping to understand the effects of certain activities on soils, they do not reflect the complete extent of soil pollution around the world

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EU25: 3 - 3.5 million potentially contaminated sites

Total anual costs ~ 17 billion €

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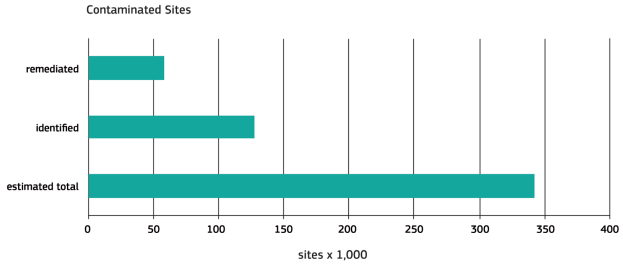
SOIL CONTAMINATION IN EUROPE

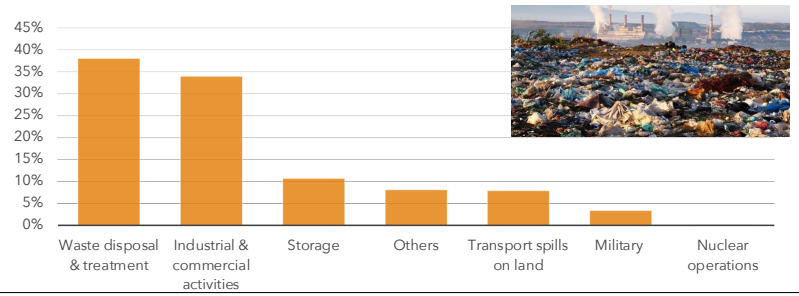


- Affects 231 million people
- Represents a market value of 57 billion €

Suorce: van Liedekerke et al., 2014, https://doi.org/10.2788/4658

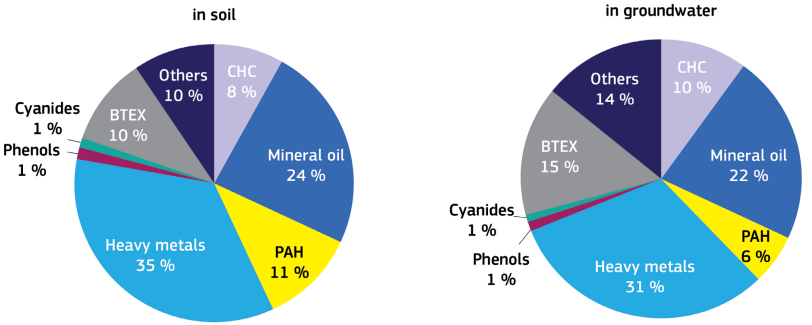
SOURCES OF SOIL POLLUTION

Breakdown of the main sources causing soil contamination in Europe as % of sources over the total number of sources identified. European shares have been calculated as average over 22 EEA countries/regions.



Report EUR 26376 EN - Progress in the management of Contaminated Sites in Europe, 2014

SOIL CONTAMINATION IN EUROPE



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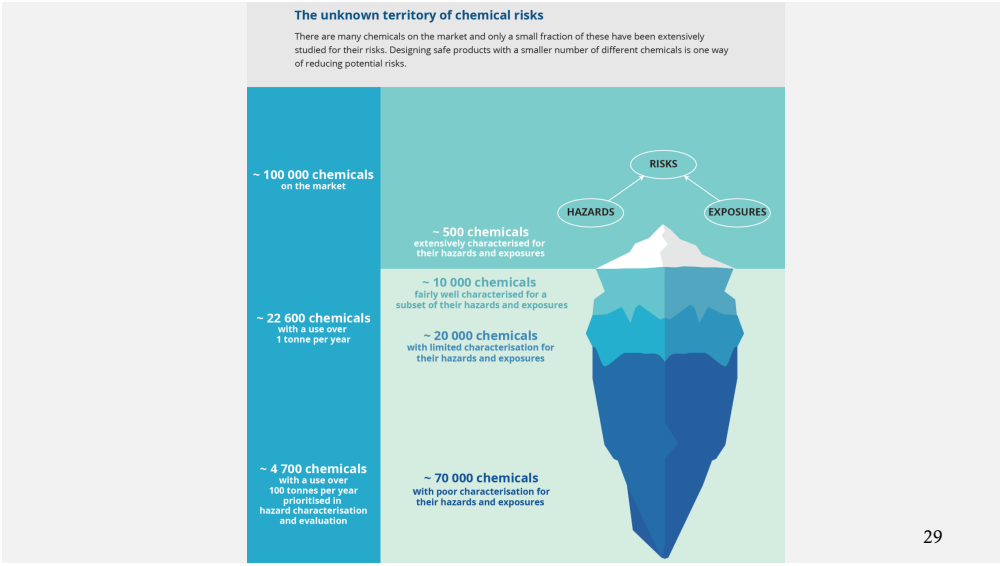


NOVA SCHOOL OF SCIENCE & TECHNOLOGY · CENSE center for environmental and sustainability research · RESOLUTIONLAB

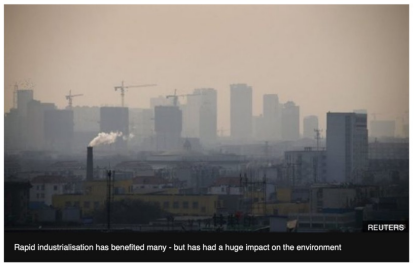
NEWS ON SOIL CONTAMINATION

Público 18/11/2005

NOVA SCHOOL OF SCIENCE & TECHNOLOGY · CENSE center for environmental and sustainability research · RESOLUTIONLAB

Report: One fifth of China's soil contaminated

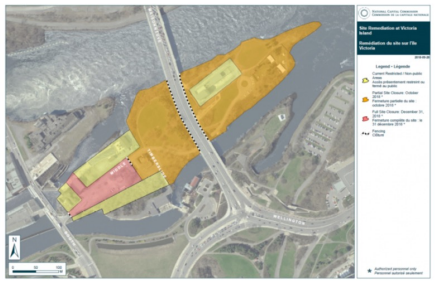
18 April 2014 Share



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

NCC closing Victoria Island for 7 years to clean up contaminated soil

BY BEATRICE BRITNEFF · GLOBAL NEWS
Posted October 2, 2018 3:20 pm
Updated October 2, 2018 4:07 pm



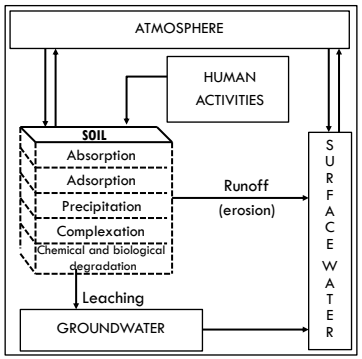
— Decades of industrial and commercial activities on Victoria Island left the soil, groundwater and surface water on the site polluted with metals, ashes, lead, zinc and fuel oil, among other contaminants. . *National Capital Commission*

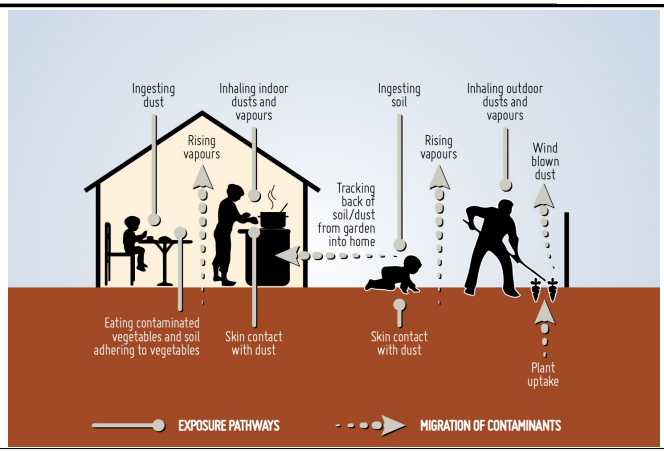
Soil pollution 'jeopardizing' life on Earth, UN agency warns on World Day

FAO/Hkun Lat | A girl runs through a dried field in Mynmar's Sagaing region. Once a fertile farmland, the soil has degraded and may not sustain crops for many years to come.

CONSEQUENCES OF SOIL CONTAMINATION

- Decrease in soil fertility
- Decrease in biodiversity
- Lower water retention capacity
- Interruption of the gas cycle and nutrient cycle
- Reduced degradation of contaminants
- Direct impact on water and air quality
- It harms the health of populations
- Threatens food safety





Source: EA, 2008

HUMAN HEALTH IMPACT

- *"Reports confirm heavy metal contamination and cancer risk at Terceira Island"*

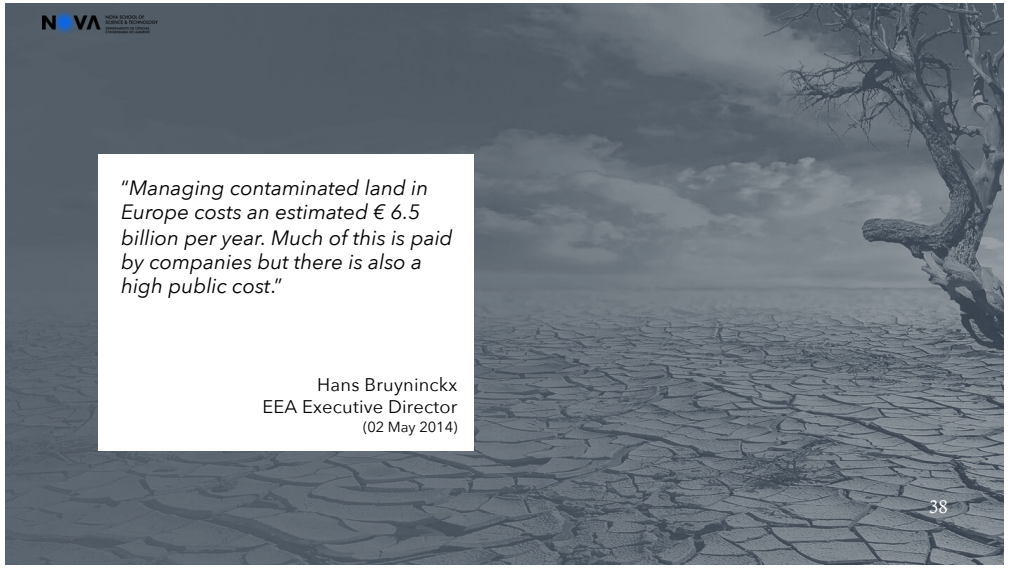
SOCIEDADE

Relatórios confirmam contaminação com metais pesados e risco de cancro na ilha Terceira [a reportagem do Expresso que venceu o Gazeta]

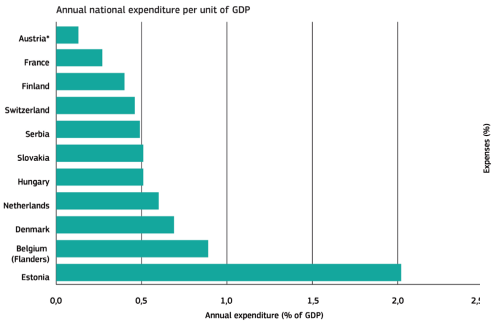
01.07.2019 às 22h02

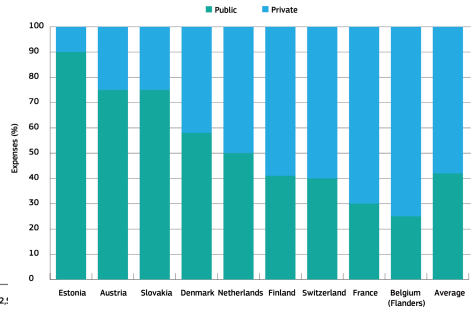
Maria Gomes e os pais, José Gomes e Ana Soares: uma das muitas famílias que vivem na Estrada 25 de Abril e que foram atingidas pelo cancro. Do lado esquerdo vê-se um dos tanques de combustível de avião das Lajes
NUNO BOTELHO

https://expresso.pt/sociedade/2019-07-01-Relatorios-confirmam-contaminacao-com-metais-pesados-e-risco-de-cancro-na-ilha-Terceira-a-reportagem-do-Expresso-que-venceu-o-Gazeta



MANAGEMENT EXPENSES OF CONTAMINATED SITES





Suorce: van Liedekerke et al., 2014, https://doi.org/10.2788/4658

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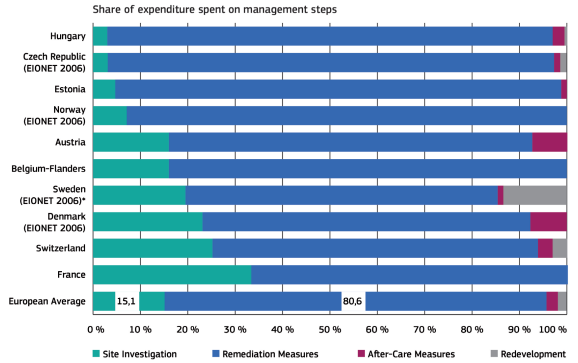

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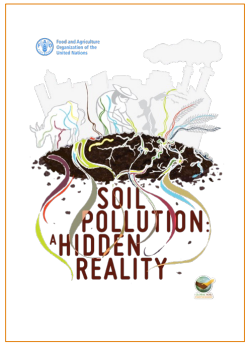
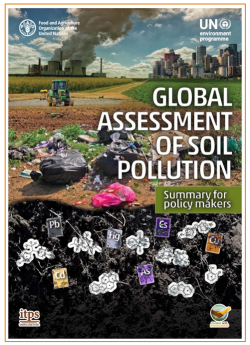
SOME DOCUMENTS ON SOIL POLLUTION





SOME REFERENCES

- COM(2006)231 final. Estratégia Temática de Proteção do Solo. Comunicação da Comissão ao Conselho, ao Parlamento Europeu, ao Comité Económico e Social e ao Comité das Regiões. Comissão das Comunidades Europeias, Bruxelas, 12 pp.
- COM(2021) 699 final EU Soil Strategy for 2030
- EIONET priority data flows. www.eionet.europa.eu/dataflows/ (acedido em 2023-05-11).
- Jones, A.; Panagos, P. *et al.* (2012). The State of Soil in Europe. EEA and JRC, EUR 25186 EN, doi:10.2788/77361 (online)
- Panagos, P.; Montanella, L.; Barbero; M.; Schneegans, A.; Aguglia, L.; Jones, A. (2022). Soil priorities in the European Union. Geoderma Regional, 29, e00510, https://doi.org/10.1016/j.geodrs.2022.e00510
- van Liedekerke, M.; Prokop, G.; Rabl-Berger, S.; Kibblewhite, M.; Louwagie, G. (2014). Progress in the Management of Contaminated Sites in Europe. EUR 26376 – Joint Research Centre – Institute for Environment and Sustainability, doi:10.2788/4658
- Vegter & Kasamas, 2011. *In*: Frank A. Swartjes (Ed.) Dealing with Contaminated Sites, From Theory towards Practical Application, pp. 1017-1053, DOI 10.1007/978-90-481-9757-6_23, Springer Netherlands.

SOME REFERENCES

- Giljum, S. *et al.* (2009). Overconsumption? Our use of the world´s natural resources. SERI and GLOBAL 2000 (Austria).
- Ribeiro A. B.; Mateus, E.P.; Couto, N. (Editors) (2016). Electrokinetics across disciplines and continents - New strategies for sustainable development. Springer International Publishing, ISBN: 978-3-319-20178-8 (Print) 978-3-319-20179-5 (Online), 427 pp., https://doi.org/10.1007/978-3-319-20179-5
- Ribeiro A.B.; Prasad, M.N.V. (Editors) (2021). Electrokinetic remediation for environmental security and sustainability. John Wiley & Sons, Ltd. ISBN: 978-1-119-67011-7, 668 pp., https://onlinelibrary.wiley.com/doi/book/10.1002/9781119670186
- http://vimeo.com/iasspotsdam/letstalkaboutsoil-english