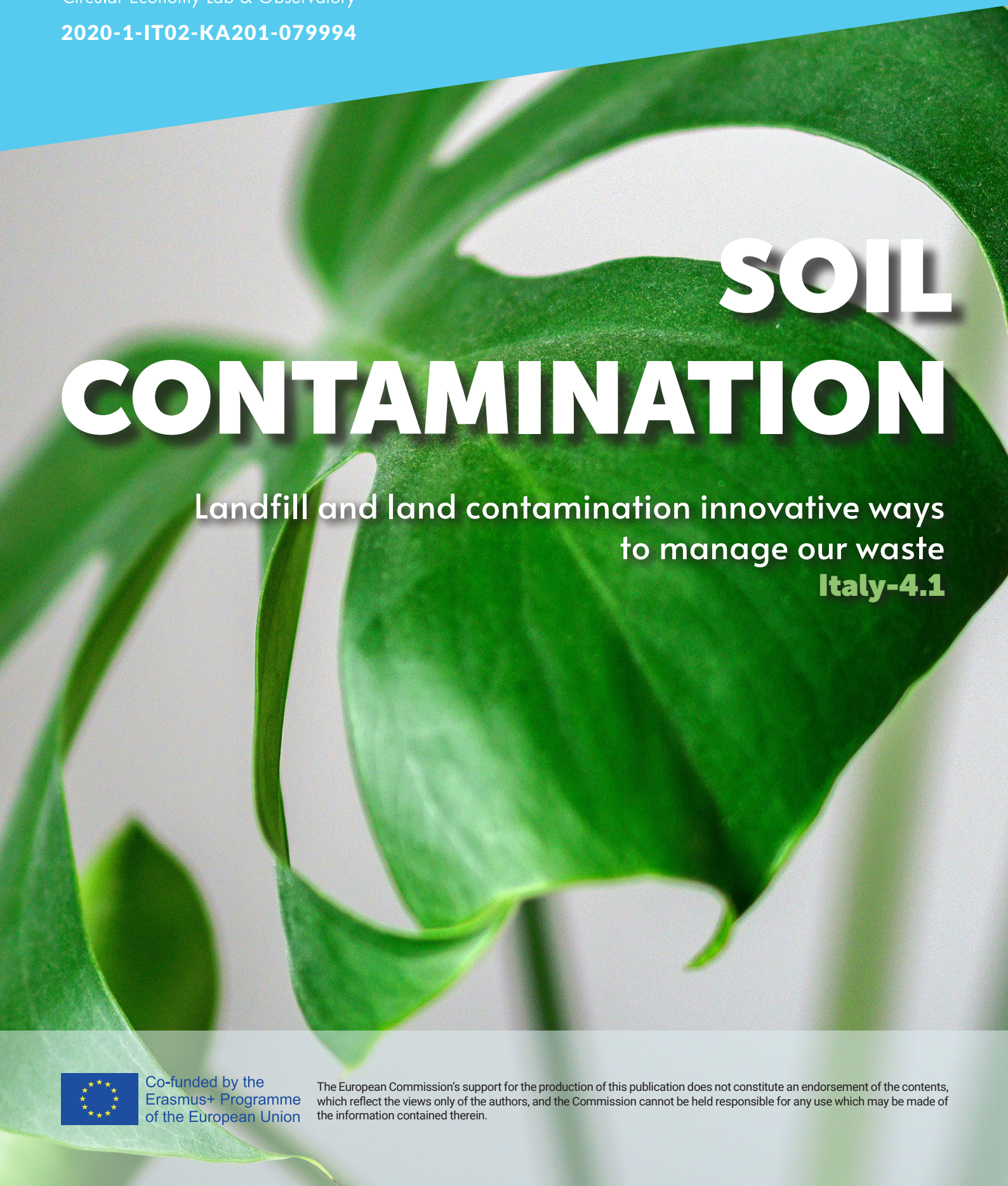
Circular Economy Lab & Observatory

2020-1-IT02-KA201-079994



SOIL CONTAMINATION

Landfill and land contamination innovative ways to manage our waste

Italy-4.1

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Landfills and land contamination caused by humans is having a drastic effect on the world. However, the damage is not only affecting the soil. Landfills are ugly and a major source of pollution.

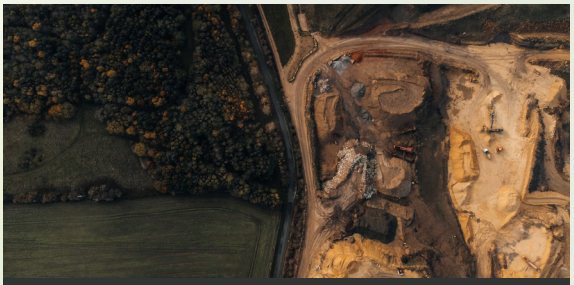

Figure 1: landfill view from above - England. Image from https://www.pexels.com/it-it/ Photo by : urtimud.89

Addressing the issue may require challenging decisions by individuals who have grown comfortable with their lifestyles and may be unaware of how their choices contribute to saving the environment. While it has been long convenient to ignore how small changes may have a compounding effect on slowing down land contamination, it is important to consider the extent to which measures are more effective.

Do you think you are contributing to the world's health?
Every piece of garbage or waste that is not reused or recycled has to go somewhere, where do you think it goes?
The so-called landfills are created when this event happens. Landfill sites are created purposely for burying waste, these sites exist all over the world, the sites can affect health and environment in multiple ways. Soil contamination refers to the destruction of land that could be used constructively by human activities, directly or indirectly. Contaminated lands contain substances in or under the earth that are actually or potentially dangerous to health or the environment, despite the numerous campaigns and struggles of environmental organisations.

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[1] Soil contamination or soil pollution is caused by the presence of chemicals (foreign to the human organism) or other changes in the natural soil environment.

It is typically caused by industrial activity, agricultural chemicals, or improper waste disposal.

Contamination is correlated with the degree of industrialization and intensity of chemical use.

Figure 2: landfill area near Crotone - Italy. Image from Google Earth

The tragic way in which episodes of soil contamination recorded in the last 30 years have marked the world, at the heavy cost of human lives. That involved families and workers settling on real cocktails of organic waste and industrial and chemical waste. The most concerning threat to humanity is in China, where more than half the population are exposed to toxic material. Soil pollution is one of China's biggest environmental challenges. [2]

A 2014 government survey showed nearly a half of the country's farmland was contaminated to all manners by chemical waste, pesticides, mining residues and heavy metals. China faces great challenges in protecting its soil from contamination caused by rapid industrialization and urbanisation over the last three decades. Comparisons with other regions of the world show that the current status of soil contamination, based on the total contaminant concentrations, is worse in China.

Soil pollution indicates the alteration of the chemical-physical and biological balance of the soil, as well as the predisposition to erosion, landslides and the entry of harmful substances even into the human food chain. Soil pollution is mainly due to these causes:
• solid, liquid, gaseous waste: solid waste is paper, glass, plastic, dead batteries, expired medicines and organic waste. Of these, the organic fraction is generally biodegradable, the rest are not biodegradable.

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The latter, to be disposed of, are sent to landfills. In some countries, like ours, there is also another type of disposal: separate collection; liquid waste includes insecticides, fertilisers, chemical fertilisers, mercury, expired liquid medicines, used battery liquids, which are very harmful to the environment as they reach underground aquifers and can damage their delicate balance; gaseous waste are those such as CFC, expelled from the cans at the time of use.

Figure 1: The image above shows an example of CFC greenhouse gas - Image from https://www.momscleanairforce.org/epa-murry-nomination/

Typical phenomena of pollution of the aquifers caused by leachate from uncontrolled solid waste landfills, and by abusive spills on the ground of industrial solvents very little absorbable by the geological formations of the subsoil.

Health risks are associated with illegal landfills, obsolete incineration plants, abandoned sites, uncontrolled burning of waste. controlled landfills of municipal solid waste do not pose a risk to the environment and to the health of the populations living near the plants.

In fact, waste can be disposed of in landfills, burned in incinerators or "waste-toenergy plants" (which are plants with different purposes), treated in composting or other specialised plants or recycled to be used again.

In Italy in 2018 there were about 310 controlled landfills, but there are also illegal landfills.

This forms an illegal waste management activity, planned and habitual, carried out by aware subjects and in agreement with each other, aimed at the disappearance of the waste produced through non-regulatory forms of disposal. [3]

In Italy, 2000 square metres of land occupied by waste were discovered in Empoli.

Figure 2: The image above shows the act of illegal landfills in Crotone, Italy - Image from https://www.csvcrotone.it/earth

The illegal landfill was found thanks to checks by the military at the Empoli forest police station. Various heaps of waste were found in the ground, indistinct by type from urban and special ones to dangerous and non-dangerous ones, deposited on the ground.

Mostly the waste consisted of parts of insulating materials such as glass wool, polystyrene and rock wool, plus black bags containing plastic and cardboard packaging, piles of spent bituminous paper, ferrous and wood waste as well as numerous buckets containing paints, thinners and glues, bags containing plaster and cement now unusable because hardened following exposure to the elements.

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Hazardous waste, on the other hand, were ceiling lights with neon tubes, batteries and exhausted gas cylinders, plastic containers of disinfectants with non-reclaimed hazardous substances, bags partially used and still containing the cold bituminous conglomerate.

The 3 major problems and consequences caused by waste disposal:
Toxins that end up in landfills caused by disposals contain harmful substances, one of which is mercury. It comes from fluorescent light bulbs and inhaling even a small quantity of it can harm our kidneys and even cause respiratory problems. There are products that end in landfills such as computers, televisions and even batteries which contain harmful substances like acid and arsenics that pose a major threat to human health.

Waters such as rain or groundwater filter through landfills and collect the components of decomposed waste (toxins) forming a liquid, called leachate, which contains chemicals such as methane, carbon dioxide, organic acids, alcohols...
Greenhouse gases it is a type of methane produced through the anaerobic decomposition process of organic materials and is the cause of many environmental problems, particularly climate problems such as melting glaciers and rising sea levels.[4]

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Figure 1: waste hierarchy, from https://environment.ec.europa.eu/topics/waste-and-recycling/waste-framework-directive_en

The health of the soil is worsening over time and the main cause is man and his self-centeredness, who thinks only of the direct benefits that the soil brings and neglects the consequences of his behaviours that will present problems to future generations and are undoubtedly killing the soil and the entire planet Earth!

Soil degradation is a complex problem that requires governments, institutions, communities and individuals to take indispensable measures.

A radical change in our habits as well as an eco-friendly style can limit soil pollution, so the first step is to correct some eco crimes that each of us commits every day to ensure healthy soils and counteract air pollution and of water. In terms of soil pollution and its possible solutions, prevention has always been the most profitable, economical and sustainable way.

But what are some eco-sustainable key points to respect in favour of soil well-being?

The European Union, in the 2018 Waste Framework Directive [5], states a 5 steps Waste hierarchy: Preventing waste is the preferred option, followed by reusing and resigning; recovery (also energy recovery) and disposal into landfill should be the last options. This is what may be easier to remember as the 4Rs: Reduce, Reuse, Recycle and Recover.

Figure 2: "I.T.I Guido Donegani Recycling system" Photo by: Waskar Lopez

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Reduce, the most favoured option, involves limiting the amount of waste we create, such as reducing plastic consumption. Reuse is second and includes using products more than once, which helps to save money, energy and resources. Third on the list is Recycling, which involves turning waste products into new items. Recover occurs after the reduce, reuse and recycle processes have been maximised.

The final option is disposal, however, this is the least favoured option and last resort. Preventing products and materials from becoming waste cannot be achieved if we do not rethink the production processes. That's why the European Commission adopted the new circular economy action plan [6], that is part of the European Green Deal.

Apart from reuse and recycle, many European cities have waste-to-energy plants (also called incinerators) to reduce the mass and the volume of waste (in fact the residues will go to the landfill), and at the same time to obtain energy from them.

Basically waste is burned at high temperatures (800-1400 celsius degrees), and, at least in modern plants, exhaust gas are treated to avoid bad consequences for the environment and the health of the citizens. There is a debate especially in Italy about the risks of these plants.

Some say that with high temperatures toxic compound like dioxins and particulate matter are easily released in the flue gases. An alternative treatment could be pyrolysis.

In this process, waste are treated at a lower temperature compared to incinerators (300-550 celsius degrees), in a low oxygen environment, to obtain gas and char which can be used in other processes. Some claim that Pyrolysis is a less likely to generate toxic compounds (dioxins, PM10, polycyclic aromatic hydrocarbons, furans or benzofurans), it has a lower cost and it is easier to manage. [9] There are also innovative and pioneering ways to treat waste.

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In particular, scientists from Purdue University, in Indiana (USA), have developed a process to obtain hydrogen from food waste in a much more efficient way, using yeast instead of bacteria. The process is above all much faster: it takes 18-24 hours instead of days to get hydrogen in the bioreactor where food waste is placed. [7]

Food waste left in a landfill generates methane during the process of decomposition, and in the best option not all the methane can be recovered (a powerful greenhouse gas: it is more than 25 times as potent as carbon dioxide at trapping heat in the atmosphere). Hydrogen, on the other hand, is the energy vector of the near future.

Unlike fossil fuels, combustion of hydrogen (in fuel cells) does not produce polluting gas, but just water vapour.

More importantly, hydrogen can be used to store the excess energy obtained from renewable sources (solar, wind), and reduce the need for batteries in the future. A similar research is being conducted in Europe, with the EU-funded HYTIME (Low temperature hydrogen production from second generation biomass) initiative. [8]

Figure 1: drawing of the consequences of man behaviour. Image from https://www.youtube.com/watch?v=WfGMYdalCIU

The fate of the world and the future of the next generations depends on the human species, "the only one in the world to have polluted the Earth and is the only one able to clean it up" (Dennis Weaver). It would have been useful to have those people who use the Earth as an ashtray and the soil as a drain for their waste go into space, perhaps by observing the natural and pure beauty that the planet offers us, man would be more sensitive to environmental problems such as pollution of the soil.

We are turning the planet into a landfill and the main pollutant is man himself! We need to save the world from ourselves and find an alternative, sustainable and better way to do what we want without destroying the environment.

Which is better: break down in research to find a solution to pollution or stop polluting? Right now we must find solutions to correct the mistakes of the past and in particular the impacts caused by the second industrial revolution, and at the same time reduce pollution and change our lifestyle in favour of saving the planet.

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This essay has argued that although the current situation is undeniably dangerous, there is still hope and ways to manage and possibly find a solution to the core problem. The study begins with the introduction of the main problems found in land contamination, then it follows with the dangers of China landfills. It is also very important to be aware of the consequences the Chinese population suffer each day, especially in urban areas.

Another point addressed are the specific problems and what we can do in the comfort of our home in order to annihilate the issue. It is clear that the only acceptable way of ensuring the safety of contamination is to follow the instructions on this academic paper, this paper would screen out those who are unlikely to behave against humanity, and would also eliminate the delays that currently characterise the urgency. Most important they would help prevent people from not managing their waste properly and also in not being aware of disposal management.

This paper would help protect human health.
Recently the secretary general of the United Nations gave a speech calling everyone to their responsibilities, the president said "in a few days the population of our planet will exceed a new threshold", we will reach 8 billion people. How will we respond when the "8 Billion baby" is big enough to ask, "What did you do for our world and for our Planet when you had the chance?" We are fighting for our life and we are losing it.

Figure 2: example of people following this academic paper behaviour. Image from https://www.pexels.com/it-it/8770251/ photo by Gustavo Fring

We are on a highway heading towards hell with our foot on the accelerator. It is the theme that distinguishes our age. It is the fundamental challenge of our century. It is unacceptable, shameful and self-defeating to put it on the back burner.

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