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CONCEPT NOTE

BE THE SOLUTION TO SOIL POLLUTION



GLOBAL SYMPOSIUM
ON SOIL
POLLUTION

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Concept Note

Global Symposium on Soil Pollution (GSOP18)

Co-organized by FAO, GSP/ITPS, UN Environment,
Basel, Rotterdam and Stockholm Conventions and WHO

2-4 May 2018

FAO Headquarters, Rome, Italy

Introduction

Soil pollution is one of the ten major soil threats identified in the 2015 *Status of the World's Soil Resources* report (FAO and ITPS, 2015a) and subsequently addressed in the *Voluntary Guidelines for Sustainable Soil Management* (VGSSM) of the FAO (FAO, 2016). Soil pollution is a chemical degradation process of soils caused by the presence of certain chemical elements or potentially harmful substances in amounts that exceed recommended levels for the health of humans, animals and plants or cause a detriment on soil normal functioning (Orgiazzi et al., 2016; Pierzynski et al., 2005). Soil pollutants include inorganic (e.g. metallic trace-elements, metalloids and radionuclides) and organic compounds (e.g. xenobiotic molecules, persistent organic pollutants (POPs) and antibiotics), some organic wastes (e.g. untreated biosolids and wastewaters) that can enhance the risk of spreading infectious diseases, and the so-called “chemicals of emerging concern” (CECs)¹ in amendments (e.g. antibiotics in manure) added to soils (e.g. manures) (FAO and ITPS, 2015a).

Soil pollution, whether local or diffuse, occurs from a wide range of sources, but those resulting from anthropogenic activities have become a widespread problem globally. Point source pollution occurs where intensive agricultural and industrial activities, inadequate solid, liquid and hazardous waste disposal, unbalanced or excessive organic and mineral fertilizer and pesticide applications, mining, military activities, or accidents introduce excessive amounts of pollutants to the local soil pool. Diffuse soil pollution, on the other hand, is the presence of a substance or agent in the soil because of human activities emitted from moving liquid or gaseous sources, covering a large area, or from multiple sources. Diffuse soil pollution is therefore caused by dispersed sources and occurs where emission, transformation and dilution of pollutants has occurred in other media prior to their transfer to soil. The three major pathways responsible for the introduction of diffuse pollutants into soil are (i) atmospheric deposition, (ii) agricultural inputs, and (iii) flood events. Causes of diffuse pollution tend to be dominated by the transport of pollutants by erosion processes (wind and water erosion and sedimentation), and excessive nutrient and pesticide applications, heavy metals, POPs and inorganic pollutants. As a result, the relationship between the pollutant sources and the level and spatial extent of soil pollution is indistinct (FAO and ITPS, 2015a).

¹CECs include, for example, nanoparticles, pharmaceuticals and personal care products, estrogen-like compounds, antibiotics and hormones, flame retardants, detergents, current-use pesticides, plastics and microplastics, heavy metals, perfluorinated alkyl substances and polycyclic aromatic hydrocarbons associated with electronic waste and some industrial chemicals additives, stabilizers and adjuvants.

While some soil degradation processes are directly observable in the field, others like soil pollution cannot be directly assessed or observed, making them insidiously hazardous. In the case of soil pollution, the uncertainties increase the challenges associated with its assessment and management. The diversity of pollutants, their different physicochemical properties, the possible interactions between pollutants, and the biological transformation of organic compounds in soil into diverse metabolites make these difficult to assess using soil surveys. However, the effects of soil pollution also depend on soil properties that are included in the soil survey and that have an impact on the mobility, bioavailability, residence time and storage of pollutants. Direct effects of pollutants may not be immediately revealed because of the capacity of soils to store and immobilize them, but can suddenly become evident after changes that may alter the environmental conditions (e.g. land use change) (FAO and ITPS, 2015a).

There is a direct link between the quality and safety of the food we eat and the level of soil pollutants. Soil pollution has also a direct impact on food security (FAO, 2006). Because some pollutants are taken up by plants through different pathways, they accumulate in the food chain, compromising the safety of the food consumed by both humans and animals (Tóth et al., 2016). Bioaccumulation in organisms and biomagnification along the food chain are causes of concern in particular for persistent organic pollutants. Ingestion of soil contaminated with POPs by poultry and cattle can result in the bioaccumulation of these chemicals in food such as eggs and milk (Weber et al., 2014, 2015). In order to address this problem, food safety policies should be harmonized with environmental regulations on soil, and water pollution (Lu et al., 2015). Additionally, soil pollution affects food availability by reducing crop yields due to toxic levels of pollutants that hamper crop growth and reduce soil biodiversity, thus increasing the problem of food security (Vargas et al., 2016). For example, the Ministry of Environmental Protection of China estimated that approximately one fifth of China's total farmland is polluted with cadmium, nickel, and arsenic, which may result in annual reductions of more than 10 million tons of food supplies (FAO and ITPS, 2015b).

Soil-borne human and animal health problems can develop through several mechanisms: 1) toxic levels of chemicals (e.g. trace elements and organic pollutants) that directly (vegetables and fruits) and indirectly (animal pathway) enter the food chain from the soil; 2) direct encounters with pathogenic organisms in soil; 3) production of nutrient-deficient crops from soils, thereby contributing to malnutrition, undernutrition and food insecurity; and 4) direct exposure to dust originating from soils, and contaminated water. In many countries, there is significant public concern about health problems from exposure to trace elements (often including heavy metals) and to organic pollutants in the soil. Increasing releases of potentially harmful trace elements (also known as heavy metals) to soil has led to a growing concern worldwide, particularly in rapidly developing countries such as China and India, where regulation, management and mitigation have struggled to keep pace with the rate of pollutant release to the environment. However, developed and developing nations are not immune to threats to soil function imposed by trace elements. The long legacy of improper hazardous waste disposal, emissions and releases from industrial activities and metal and POPs build-up in soils presents grave challenges for use and reclamation of polluted land (FAO and ITPS, 2015b).

In 2015, the Food and Agriculture Organization (FAO) of the United Nations and the Intergovernmental Technical Panel on Soils (ITPS) published the Status of the World's Soil Resource report including a regional assessment of the main soil threats, soil pollution being one of them. This report shows that in regions with mature industrial sectors and a well-developed regulatory framework such as Europe, North America, and parts of the Southwest Pacific, the primary issue is the identification and remediation of legacy sites of pollution. In these countries, increasingly stringent government regulation limits the spread of pollution

and specifies the level of remediation of existing polluted sites required. Hence, pollution is arguably a soil threat that responds directly to policy initiatives, at least in situations where the pollution can be readily linked to a specific pollution source and where significant public concern about pollution spurs policy development and implementation (FAO and ITPS, 2015a, b). The international community has established global regimes to minimize pollution from hazardous chemicals and wastes and to support countries in taking measures to achieve this objective. Three of the global instruments that have a significant impact on soil pollution are:

- The **Basel Convention** on the Control of Transboundary Movements of Hazardous Wastes and their Disposal that entered into force in 1992. Its fundamental aims are to reduce the transboundary movements (TBM) of hazardous and other wastes, prevent and minimize their generation and promote their environmentally sound management, with the purpose of protecting human health and the environment against their adverse effects (Basel Convention, 2011);
- The **Rotterdam Convention** on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade that entered into force in February 2004. Its overarching goals are: 1) promoting shared responsibility and cooperative efforts among parties in the international trade of certain hazardous chemicals, and 2) contributing to the environmentally sound use of those hazardous chemicals by facilitating information exchange about their characteristics, by providing for a national decision-making process on their import and export, and by disseminating these decisions to Parties (Rotterdam Convention, 2010); and
- The **Stockholm Convention** on Persistent Organic Pollutants (POPs) that has been in force since May 2004. It aims to protect human health and the environment from chemicals that possess toxic properties, remain intact in the environment for long periods and travel long distances, and accumulate in ecosystems with the risk of significant adverse effect on human health and the environment. The convention calls on parties to jointly work on eliminating or reducing the release of POPs into the environment (Stockholm Convention, 2008).

Attention was also given to long-range atmospheric pollution and the related atmospheric deposition of pollutants onto the soil surface. Therefore, the Convention on Long-Range Transboundary Air Pollution (LRTAP) was signed in 1979 in response to the detrimental impact of acid rain in Europe and entered into force in 1983. Over the past 30 years, the Convention on LRTAP has been extended by 8 protocols that target pollutants such as sulfur, nitrous oxides, persistent organic pollutants, volatile organic compounds, ammonia and heavy metals.

More recently, the Minamata Convention on Mercury was signed in 2013 with the purpose of protecting human health and the environment from the adverse effects of mercury (FAO and ITPS, 2015a), and the Sustainable Development Goals (SDGs) on soil protection and restoration were established in 2015. In this context, the international community recognized the role of soils in providing ecosystem services, enabling life on Earth and ensuring human well-being. In particular, the reduction of soil pollution and the restoration of polluted sites can contribute to achieving food security (SDG 2), increasing the provision of clean water (SDG 3 and 6), sustainable consumption and production (SDG 12), strengthening resilience and adaptive capacity to climate related hazards and natural disasters (SDG 13), preventing marine pollution from land-based activities, combating desertification, achieving a land degradation neutral

world, and halting biodiversity loss (SDG 15), and it is related to technology development and land use and urban planning (SDG 9 and 11) (United Nations, 2017).

Awareness on soil pollution is increasing around the world. The seventh actions by Governments defined in the revised World Soil Charter (FAO, 2015) establish the need for implementing regulations and limiting the accumulation of contaminants beyond established levels to guarantee human health and wellbeing, and facilitating remediation of contaminated soils that exceed these levels where they pose a threat to human health and the environment. The Third session of the United Nations Environmental Assembly (UNEA-3 2017) has adopted a resolution in which decisions called for accelerated actions and collaboration to address and manage soil pollution. The resolution commits to increasing research and development, targeting pollution through tailored actions, moving societies towards sustainable lifestyles based on a circular economy, strengthening and enforcing laws on soil pollution. The declaration aims to work towards a pollution-free world.

The ITPS, together with the Secretariats of the Basel, Rotterdam and Stockholm Conventions, UN Environment and World Health Organization (WHO), agreed to explore the option of a jointly organized Global Symposium on Soil Pollution during the first quarter of 2018 as a neutral platform to bring the best scientific information available on the status, trends and actions (both scientific and political) on soil pollution. The symposium is a bold action to implement the VGSSM and the UNEA3 resolution on soil pollution in terms of combating soil pollution and bringing scientific facts and evidences for launching global activities to reduce soil pollution and remediate polluted sites.

Aim and objectives

The Global Symposium on Soil Pollution is the first step in implementing the Voluntary Guidelines for Sustainable Soil Management in terms of preventing and reducing harmful substances in soils as a way to maintain healthy soils and food safety in accordance with the Sustainable Development Goals.

Specifically, the symposium's outcomes should provide scientific evidence to support actions and decisions to prevent and reduce soil pollution for increased food safety, food security and nutrition, ecosystem services, and promote the restoration of polluted sites.

The specific objectives of the symposium are to:

1. Examine the current scientific understanding of soil pollution and its effects on food production and safety, the environment and human health;
2. Critically reflect on the impact of land use decisions at the national level (e.g. related to mining, siting of waste disposal facilities and intensive agriculture and livestock production) on soil pollution and eventually, air and water where polluted soil or its pollutants can be transported by erosion processes or water runoff;
3. Identify limitations and prioritize key challenges related to restoring polluted sites;
4. Review existing international policies, agreements and frameworks addressing sources of pollution to agricultural land in order to assess their effectiveness and propose ways to improve them; and
5. Survey and review the use of soil thresholds globally, and explore additional research and policy needs.

6. Launch an agenda for action on soil pollution as a contribution to the implementation of the UNEA3 declaration on soil pollution.

Expected output

The symposium outcome document “Be the solution to soil pollution” will highlight the importance of addressing soil pollution from the food safety, environment and human health perspectives and will include a joint agenda for action based on scientific evidence to prevent it, mitigate it and remediate it where feasible.

Symposium structure

The Symposium will be a scientific meeting, held over three (3) days at the FAO headquarters in Rome, Italy from 2-4 May 2018 with 800-1000 participants representing all regions of the world.

The meeting will open with high level plenary addresses by representatives of the hosting organizations to present the policy context, the importance of soil pollution from various perspectives and the outcomes sought from the symposium.

Keynote presentations will be given by invited leading experts in relation to the following main themes (the themes are further elaborated under Item 6):

- Theme 1: Soil pollution on agricultural fields and other land uses
- Theme 2: The impact of soil pollution on food production and safety, the environment and overall human well-being
- Theme 3: Remediation of polluted sites
- Theme 4: Global status of soil pollution

PARALLEL SESSIONS

Parallel sessions will be held for Themes 1 to 3, to be organized by session conveners. The format of the parallel sessions will be determined by the conveners (in close collaboration with the organizing and scientific advisory committees) to ensure the themes are sufficiently presented and discussed to compile the key aspects needed for the outcome document. Theme 4 will be discussed collectively during plenary sessions.

ABSTRACTS AND PAPERS

Abstracts for key topics (as identified by the organizing and scientific advisory committees) will be invited to support the above themes and incorporate case studies from different countries. Guidelines for the preparation of abstracts and papers will be provided.

PARTICIPANTS

Participants will include representatives from FAO member states, UN Environment, Basel, Rotterdam and Stockholm Conventions and WHO country parties, presenters whose abstracts are accepted and scientists and practitioners working in related fields, representatives from NGOS, civil society and academia. Additionally, the symposium is expected to call the attention of the private sector working on agricultural

inputs production and distribution, pollutant management, and technology development for measuring and controlling soil pollution, and restoring polluted sites, such as the International Zinc Organization and the International Lead Organization.

Symposium Committees

The following Committees will be established:

ORGANIZING COMMITTEE

This committee will be comprised of representatives from each of the co-organizing bodies (FAO/GSP/ITPS, Basel, Rotterdam and Stockholm Conventions, UN Environment, and WHO). It will oversee the overall organization of the symposium, guide the formats of the parallel sessions, and oversee the finalization of the symposium outputs.

SCIENTIFIC COMMITTEE

Comprised of representatives from the co-organizing organizations, as well as additional leading experts in the five main themes, this committee will be responsible for evaluating submitted abstracts and papers, as well as ensuring the scientific quality of the parallel sessions and symposium outputs.

Symposium themes and key questions to be addressed

Based on the listed objectives, the symposium will focus on five themes to collate relevant information as elaborated below. In order to address the objectives, the main questions to be addressed during the symposium are listed under each theme.

THEME 1: SOIL POLLUTION ON AGRICULTURAL FIELDS AND OTHER LAND USES

Soil pollution is closely related to land use. On one hand, the local and neighboring land use determines the type and amount of pollutants in a given soil. On the other hand, land use on a given soil depends on its level of pollution. This theme is shaped around the direct and indirect sources of pollution of agricultural soils and the impacts that these soils can have on nearby ecosystems. It also links to the achievement of SDGs 3, 6, 9 and 11 on food security, the provision of clean water, the development of environmentally sound technologies, and sustainable urban planning, respectively.

SUB-THEME 1.1: DRIVERS OF SOIL POLLUTION IN AGRICULTURAL FIELDS

This sub-theme aims to discuss direct (e.g. pesticide application, use of organic and mineral fertilizers, use of polluted water, urban waste, releases from industrial production facilities, waste disposal facilities and landfills etc.) and indirect (e.g. atmospheric deposition from mining, smelting and waste incineration, surface runoff, water and wind erosion, etc.) sources of pollution of agricultural soils, the processes related to the transport and storage of pollutants in the soil and the role of land use planning in anticipating these processes. Two successful and valid movements - organic and urban agriculture - will also be discussed in relation to the use and safety of organic fertilizers, including sewage sludge, which may contain pollutants

such as heavy metals and POPs. In this context, the link between soil pollution and SDG targets 9.4², 11.3³ and 15.3⁴ is stressed in the framework of developing and adopting clean and environmentally sound technologies and industrial processes; enhancing inclusive and sustainable urbanization for participatory, integrated and sustainable human settlement planning and management; and combating erosive processes leading to soil degradation by pollution. Additionally, the economics of sound management and mismanagement of agricultural inputs (pesticides and organic and mineral fertilizers application) will be discussed in relation to food security, soil health and the economics of soil degradation, with a direct link to protecting soil, especially soils that are the most vulnerable (e.g. atoll soils) to pollution.

Core questions:

- Is there sufficient evidence based scientific information on soil pollution in agricultural fields?
- How does land use and urban and industrial planning influence the type and amount of pollutants in agricultural soils?
- How can the Code of Conduct on Pesticide Management contribute to prevent the risk of soil pollution on agricultural fields?
- How can soil pollution affect food production and safety?

SUB-THEME 1.2: DRIVERS OF SOIL POLLUTION IN OTHER LAND USES

This sub-theme explores the sources of pollutants from other land uses (mining, industrial activities, urban uses, etc.) and the impacts of soil pollution on other ecosystem compartments, such as air, surface water, groundwater, organisms. Therefore, it aims to discuss the impacts of soil pollution and to highlight the nexus between soil pollution, water quality, and biodiversity and habitat preservation. In this framework, it links directly to SDGs 3 and 6 on water quality (Targets 3.9⁵ and 6.3⁶) and the protection of water-related ecosystems including mountains, forests, wetlands, rivers, aquifers and lakes.

Attention is given to the mobility of mineral and organic pollutants such as fertilizers and antibiotics, heavy metals and micro-organisms in the environment. For example, changes in soil water condition by flooding (waterlogging) or draining can impact arsenic mobility, with arsenic becoming mobilized under flooded, anaerobic conditions. Arsenic can then be leached to pollute groundwater, resulting in human exposure to arsenic through well-water consumption. Arsenic causes many health problems in humans, including nervous system disorders, kidney and liver failure, as well as anemia and skin cancer. Over 130 million people worldwide routinely consume well-water with arsenic concentrations that exceed the World Health

²Target 9.4: By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.

³Target 11.3: By 2030, enhance inclusive and sustainable urbanization and capacities for participatory, integrated and sustainable human settlement planning and management in all countries.

⁴Target 15.3: By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world

⁵Target 3.9: By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water, and soil pollution and contamination.

⁶Target 6.3: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

Organization's recommended limits (FAO and ITPS, 2015a). Additionally, by involving isotope techniques, this sub-theme aims to discuss the half-life period and mobility (absorption, volatilization and leaching) of parent molecules, their metabolites, and additives in pesticides.

Core questions:

- What are the main drivers of soil pollution in non-agricultural land uses?
- Is there reliable information about the extent of soil pollution on other land uses?

THEME 2: THE IMPACT OF SOIL POLLUTION ON FOOD PRODUCTION AND SAFETY, THE ENVIRONMENT AND OVERALL HUMAN WELL-BEING

Soil pollution affects human well-being by compromising the ability of the soil to produce safe and nutritious food. In drylands especially, where water availability is a limiting factor to agriculture production, wastewater from treatment plants is used as an alternative source of water for irrigation to create resilience to climate change. Often, this water (and the solid waste it carries) lacks physical, chemical and sanitary quality, causing soil pollution and human health problems (Blume et al., 1982; Blume et al., 1980; Horn et al., 1980). In this context, Theme 2 links to the achievement of SDGs 2 and 3 on zero hunger and good health and well-being.

SUB-THEME 2.1: SOIL POLLUTION AND FOOD SAFETY

The susceptibility of a plant to pollutants and its rate of uptake varies with the plant species and the type of pollutants (Orita, 2012). For example, cadmium (Cd) is a chemical analogue of zinc (Zn) and plants may not be able to differentiate between the two ions. In this case, Cd is adsorbed and transported through the root system and can be bio-accumulated in plants (Yashim et al., 2014). In some cases, plants that take up soil pollutants are used to bio-remediate polluted soils via phytoextraction (Tangahu et al., 2011). In other situations, the uptake of pollutants such as antimicrobials, metals and POPs by plants, influences their safety and nutritional value and affects the food chain and ultimately human health, due to the bioaccumulation of pollutants at various stages (Ismail et al., 2005; Tasho and Cho, 2016).

It is the purpose of this sub-theme to assess the impact of soil pollution on the four dimensions of food security: availability, access, utilization and stability.

Core questions:

- How does soil pollution influence the quality and safety of the food we eat?
- How does soil pollution affect long-term food production, safety and nutrition (future scenarios)?
- Are there actions towards the prevention of soil pollution in the food chain?

SUB-THEME 2.2: RISK ASSESSMENT OF SOIL POLLUTION ON THE ENVIRONMENT AND HUMAN HEALTH

This subtheme aims to address the impacts soil pollution has on the environment and human health. Once the sources of pollution have been identified, it is time to analyze the mechanisms and pathways contaminants follow from soils into human body and other compartments of the environment, such as air, and water bodies. Soils have the ability of storing, immobilizing and degrading contaminants, what ensures

good quality of groundwater and a safe food production (Blum, 2005). However, they can act as a source of human health and eco-toxicological problems (Science Communication Unit, University of the West of England, 2013).

In many cases, solubility, mobility and bioavailability of pollutants depend on soil properties. Suspended pollutants are retained in soils, controlled by the soil porosity and the pore size distribution. Trace metals are adsorbed on the surface of colloidal particles in soils, principally humus, hydrous oxides of Fe, Mn and Al, alumino-silicate clays. Similar affinity has been observed between clay minerals and radionuclides (Ven der Graaf, Koomans, Limburg, & De Vries, 2007). Organic matter plays an important role not only in forming complexes, but also in retaining and transporting heavy metals in an exchangeable form (Yaron, Dror, & Berkowitz, 2012; Dragovic, Mihailovic, & Gajic, 2008). But when a change occurs in soil properties due to external pressures, solubility and bioavailability of pollutants may be affected, posing a risk to the environment and living organisms, including humans.

Generally, people can be exposed to contaminants in soil through ingestion (eating or drinking), dermal exposure (skin contact) or inhalation (breathing). The route of human exposure to a soil contaminant will vary with the contaminant and with the conditions and activities at a particular site (Shayler, McBride, & Harrison, 2017).

A clear example of the impact of soil pollution on the environment and human health is the use of manure, from animals treated with antimicrobials, as fertilizers. They contain residual concentrations of antimicrobial agents and antimicrobial resistant (AMR) bacteria. The application of biological soil amendments of animal origin not only loads the environment with AMR organisms, but also creates a selective pressure leading to the further development of drug resistance (O'Neill, 2015). The development of drug resistant bacteria and infections represents a serious threat to animal and human health globally, and needs to be addressed in a multi-disciplinary way. It is the purpose of this sub-theme to discuss the relevance of soil amendments in contributing to the ecology of AMR and transmission to humans and animals.

Core question:

- What is the impact of polluted soils on nearby or downstream ecosystems?
- How can the risk posed by polluted soils on the environment be assessed?
- What is the impact of antibiotic residues and AMR organisms in soil amendments and industrial waste on the microbial ecology in soils and soil-mediated ecosystem services?

THEME 3: REMEDIATION OF POLLUTED SITES

Waste disposal and treatment, agricultural inputs, industrial and commercial activities, chemicals, agrochemicals and fuel storage, transport spills on land, military operations, and nuclear operations are the key sources of local soil pollution. In developed countries, potentially contaminated sites are managed following surveys (searching for sites that are likely to be polluted), performing site investigations where the actual extent of pollution and its environmental impacts are defined, and implementing remedial and after care measures. However, this is not always true in developing countries, which often suffer from the lack of legislation and legal frameworks to support such actions, financial resources to conduct monitoring

and remediation activities, and access to technology. In addition to local pollution of the soil (which is easier to assess), diffuse soil pollution is in many instances not directly apparent, although it covers very large areas and represents a major threat to soil health (FAO and ITPS, 2015a).

In this framework, it is important to increase efforts to identify, assess, map, monitor and model soil pollution with the purpose of preventing human exposure to pollutants and restoring polluted sites, and ultimately ensuring the provision of sufficient, healthy and nutritious food. This session will address the achievement of SDG 15 on the protection, restoration and promotion of terrestrial ecosystems, with a focus on combating desertification, halting and reversing land degradation, and halting the loss of biodiversity (Targets 15.1, 15.3 and 15.5). Indeed, the impacts of soil pollution on biodiversity in general should not be overlooked.

SUB-THEME 3.1: MONITORING SOIL POLLUTION

National monitoring and reporting on the presence of pollutants in the soil is becoming increasingly important due to the scarcity of land for agriculture and other land uses, which is further exacerbated by population growth. This is especially true in developing countries where regulations on waste disposal and agrochemical applications are sometimes weak or inexistent. (Stalin et al., 2010; Bradon, 2013). However, the most developed countries are no strangers to this problem. Although they have implemented long-term soil surveys and have regulating instruments, they still lack a harmonized soil monitoring system and the real extent of local and diffuse soil pollution is not clearly known (FAO and ITPS, 2015a). It is the purpose of this sub-theme to (1) review the limitations related to mapping soil pollution, (2) draw future scenarios in the framework of producing healthy and nutritious food, and (3) review assessment, mapping, and monitoring tools currently available, with a focus on bio-indicators.

Core question:

- Are there agreed upon protocols for assessing, mapping and monitoring soil pollution at different levels?
- Is there a baseline of soil pollution at the global level?

SUB-THEME 3.2: STATE OF THE ART OF REMEDIATION TECHNIQUES OF POLLUTED SITES

Remediation of polluted soils is important to restore an affected site to a standard at which the current or proposed site use may proceed with minimal risk to humans and the environment (Bradon, 2013). Cleaning soil pollution is far from easy because site managers may often have little knowledge on how the pollutant is behaving beneath the surface. In the case of remediation of agricultural fields, this implies bringing polluted fields back to their original productive capacity. This is a topic of crucial importance nowadays, because of global human population growth and the recognition that there is limited availability of land suitable for agricultural production.

Numerous attempts are being made to decontaminate polluted soils, including an array of both in situ (on-site, in the soil) and off-site (removal of contaminated soil for treatment) techniques. None of these are ideal for remediating contaminated soils, and often, more than one of the techniques may be necessary to optimize the cleanup effort. Due to the huge costs associated with many clean-up procedures, the remedial actions in some countries are currently aimed at minimizing the risk of further spreading of contaminants.

The main question of this sub-theme is to identify the most commonly used remediation techniques and analyze their feasibility and efficiency. To work towards the identification of the best available techniques (BAT) for remediating polluted soils, considering them as the most effective, ecosystem-friendly and economically feasible way of reducing damage to the environment, must be a goal for the scientific and industrial communities. Regarding polluted agricultural soils, further discussion is needed on whether productivity can be restored in all polluted sites previously used for agriculture, considering to what extent the food produced on such land would be healthy and nutritious. Additionally, this sub-theme aims to discuss solutions to overcome limitations related to political settings, technology availability and the economic cost of remediating polluted sites, taking into consideration that remediation standards and procedures may differ or change depending on the country and the actual and future land use.

Core questions:

- What are the criteria that determine whether a polluted site can/must be remediated?
- Which tools/technologies can be used to increase the remediation of polluted sites?
- To what extent can polluted sites be restored for safe food production?

THEME 4: GLOBAL STATUS OF SOIL POLLUTION

The UNEA3 resolution invites member States to promote the reduction, mitigation, and remediation of pollution and to work on establishing legislative and regulatory frameworks. Governments should establish and implement regulations to limit the accumulation of contaminants beyond established levels to safeguard human health and well-being and facilitate remediation of contaminated soils that exceed these levels where they pose a threat to humans, plants, and animals. Furthermore, it requests the GSP and its Intergovernmental Technical Panel on Soil to prepare a report based on available scientific information and data, on the extent and future trends of soil pollution, considering both point source contamination and diffuse pollution. To achieve the mandate, further research and international discussion are needed.

SUB-THEME 4.1: DEVELOPING POLICIES AND SETTING THRESHOLDS FOR ADDRESSING SOIL POLLUTION

Legislation proved to have a direct impact on the extent of soil pollution and the incidence of remediation actions (FAO and ITPS, 2015a). Furthermore, the existence of legislation that ensures the liability for soil pollution and regulates new activities contributes to prevent new soil pollution. In this context, the number of remediated sites is expected to grow in countries with well-established legislation on polluted/contaminated land such as those belonging to the European Union, or having developed comprehensive contaminated land management (CLM) frameworks such as South Korea and Japan. The launch of national activities on soil pollution is promoted by the establishment of networks, international frameworks (i.e. the Thematic Strategy on Soil Protection (COM(2006)231 of the EU) and conventions (i.e. the Rotterdam, Stockholm and Basel Conventions).

This session aims to highlight the importance of policy in preventing and managing soil pollution by reviewing the existing international tools and frameworks, and outlining actions for filling the identified gaps.

At the same time, this session aims to respond to the request of many FAO member countries to establish thresholds for soil pollutants to be used as guidelines to prevent and monitor soil pollution and remediate polluted sites. Particularly, it is of interest to discuss the need for establishing such thresholds, for which

compounds, their scale of applicability (i.e. local, regional or global) and how these should be organized (i.e. by soil type, by pollutant, by land use, etc.). Recommendations made in this session will be reflected in the development of the thresholds by an open ended working group.

Core questions:

- What are the gaps in the existing international legal instruments and frameworks that have an impact on soil pollution and how can they be filled?
- What is the importance of setting thresholds for soil pollutants?
- Based on what criteria should thresholds be established?
- Is the setting of thresholds for soil pollutants a necessary part of policy development?

SUB-THEME 4.2: CASE STUDIES AT GLOBAL, NATIONAL AND REGIONAL SCALES

National attempts to estimate soil pollution extent and to remediate it have been done mainly in developed countries, but there is little data on the real extent of soil pollution in developing countries or at a global scale. However, the available data is alarming; soil pollution has been identified as the third main threat to soil for the European continent and the fourth main threat to the southern Mediterranean Basin (Montanarella, et al., 2016). Furthermore, soil pollution may facilitate and accelerate other degradation processes. This subtheme aims to gather the available information on the status of soil pollution around the world, to identify emerging pollutants, to discuss risk-assessment approaches and the best remediation techniques, to define which after-care measures must be adopted to ensure a safety environment and healthy food production and to present successful examples of remediation, as well as the estimated costs for remediating polluted.

Core questions:

- What is the extent of soil pollution in the world?
- What are the main knowledge gaps?
- Where will it be necessary to focus future efforts?

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