

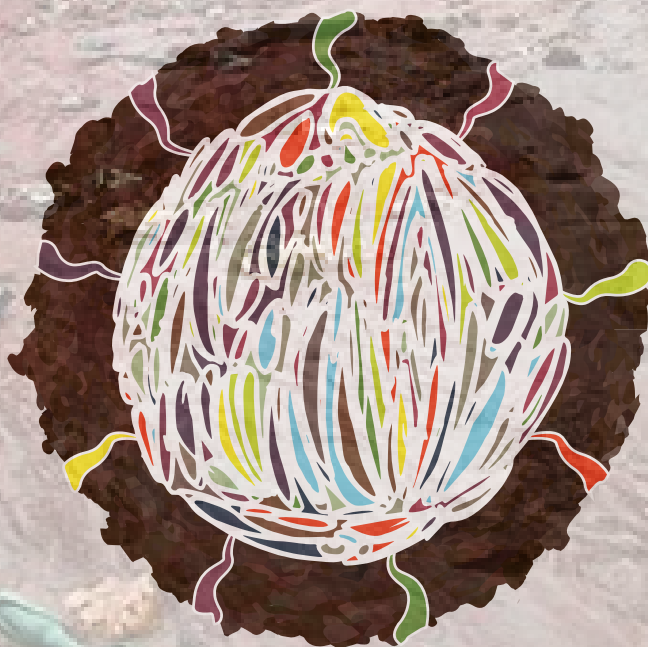


Food and Agriculture
Organization of the
United Nations

BE THE SOLUTION TO SOIL POLLUTION

GLOBAL SYMPOSIUM
ON SOIL
POLLUTION

OUTCOME
DOCUMENT



2 - 4 MAY 2018 | FAO - ROME, ITALY



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INTERGOVERNMENTAL
TECHNICAL PANEL ON SOILS



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GLOBAL SYMPOSIUM
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BE THE SOLUTION TO SOIL POLLUTION

OUTCOME DOCUMENT OF THE
GLOBAL SYMPOSIUM ON SOIL POLLUTION

2-4 MAY 2018 | FAO HEADQUARTERS | ROME, ITALY

An event co-organized by:

FAO | Food and Agriculture Organization of the United Nations

GSP | Global Soil Partnership

ITPS | Intergovernmental Technical Panel on Soils

BRS Conventions | Basel, Rotterdam and Stockholm Conventions Secretariat

UN Environment | United Nations Environment Programme

WHO | World Health Organization

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ABBREVIATIONS

AGAH	Animal Health Service of the Animal Production and Health Division, FAO
AGFF	Food Safety and Quality Unit, FAO
AGPM	Plant Production and Protection Division
AMR	Antimicrobial resistance
BRS Conventions	Basel, Rotterdam and Stockholm Conventions Secretariat
CBL	Land and Water Division, FAO
EC	European Commission
FAO	Food and Agriculture Organization of the United Nations
GIS	Geographical Information Systems
GSOP18	Global Symposium on Soil Pollution 2018
GSP	Global Soil Partnership
ITPS	Intergovernmental Technical Panel on Soils
JRC	Joint Research Centre of the European Commission
PAHs	Polycyclic aromatic hydrocarbons
PCBs	Polychlorinated biphenyls
PECs	Pollutants of emerging concern
POPs	Persistent organic pollutants
PPCPs	Pharmaceuticals and personal care products
SDGs	Sustainable Development Goals
SSM	Sustainable Soil Management
UN Environment	The United Nations Environment Programme
UNEA3	Third session of the United Nations Environment Assembly
Vis-NIR	Visible and near infrared spectroscopy
VGSSM	Voluntary Guidelines for Sustainable Soil Management
WHO	World Health Organization

SCIENTIFIC AND ORGANIZING COMMITTEES

This outcome document, “Be the solution to soil pollution”, was prepared and reviewed by members of the Scientific and the Co-organizing Committees (see below) but does not necessarily represent the views of those bodies or their member states. This document is also based on and complemented by a book of proceedings, which presents extended abstracts of the various sessions.

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SUMMARY

The Global Symposium on Soil Pollution (GSOP18) was jointly organized by the:

- Food and Agriculture Organization of the United Nations (FAO);
- Global Soil Partnership (GSP) and its Intergovernmental Technical Panel on Soils (ITPS);
- United Nations Environment Programme (UN Environment);
- Secretariat of the Basel, Rotterdam and Stockholm Conventions (BRS conventions); and
- World Health Organization (WHO).

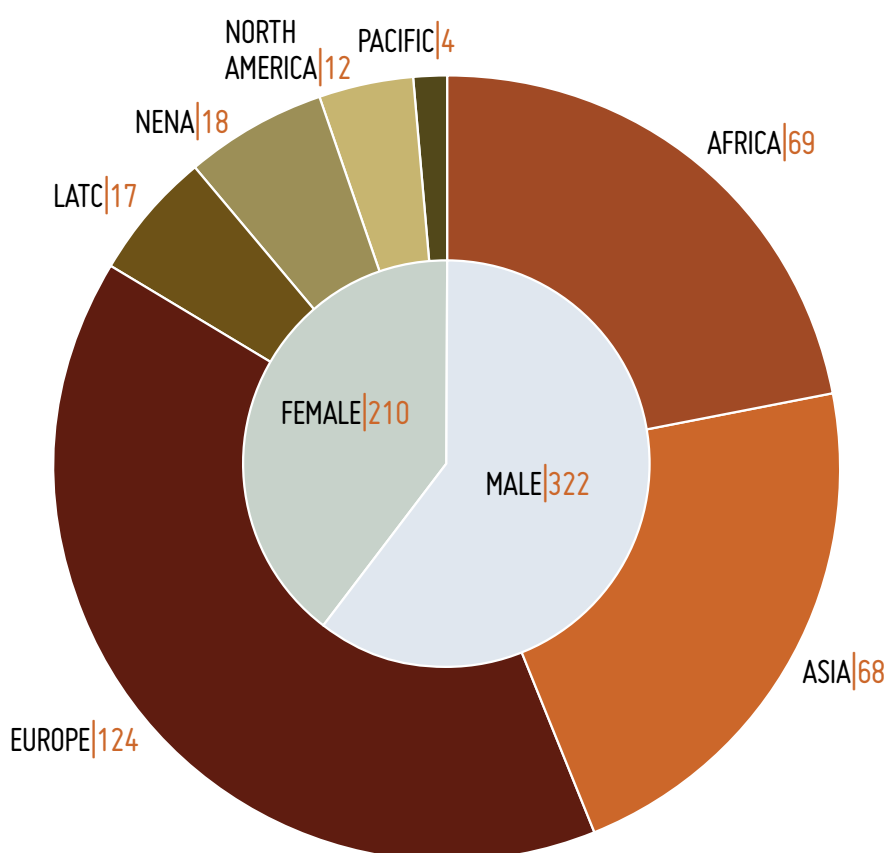
The symposium was held at FAO headquarters in Rome, Italy, on 2–4 May 2018 and attended by 525 participants (40 percent women, 60 percent men) from 100 countries, including representatives of FAO member states, organizing institutions, the academia, the private sector and civil society, as well as scientists and land users working on soil pollution and related fields.

The overall aim of the symposium was to gather available information and scientific knowledge on soil pollution with regards to: the sources; risks posed to food production and safety, human health and the environment; risk assessment approaches; and state-of-the-art techniques to remediate polluted sites.

The three-day symposium was structured around four main themes focusing on: 1) the identification of the main drivers of soil pollution in different land uses; 2) the assessment of negative impacts of soil pollution on food safety, the environment and human health; 3) methods for monitoring, assessing and remediate soil pollution; 4) the existence of national or regional policies and guidelines that include threshold values for different pollutants and the global status of soil pollution.

Participants from all the regions in the world engaged actively by presenting the results of studies demonstrating: that soil pollution is a global threat; the main sources of soil pollution in different countries and land uses; the challenges of monitoring, assessing and remediating soil pollution; and ultimately discussing and developing key messages that are reflected in this outcome document. The recommendations presented in this document aim to support the development of policies and actions to encourage the implementation of soil management and land use planning strategies that enhance the prevention, minimization and remediation of soil pollution when feasible, through the promotion of sustainable soil management (SSM).

GSOP18 | STATISTICS OF ATTENDANCE



BACKGROUND OF THE GLOBAL SYMPOSIUM ON SOIL POLLUTION

Soils are the most valuable ecosystem in the world (Pepper *et al.*, 2009). The roles of soils in food production and food quality, in climate regulation and in the provision of raw materials and services, such as fibers and natural antibiotics are widely recognized. Notwithstanding the enormous scientific progress made to date, protection and monitoring of soil condition at national and global levels still face complicated challenges impeding effective on-the-ground policy design and decision making.

The Status of the World's Soil Resources Report (FAO and ITPS, 2015) identified soil contamination and pollution as one of the main soil threats affecting global soils and the ecosystems services provided by them. Soil pollution is posing a serious risk to human health through direct contact (dermal exposure or inhalation of polluted soil particles) or indirectly, by consuming plants or animals that have accumulated large amounts of soil pollutants.

Human activities over thousands of years have left a legacy of polluted soils worldwide (Swartjes, 2011). Despite the identification efforts conducted in many regions of the world to estimate the extent of soil pollution, the lack of a global assessment presents an obstacle to the mobilization of economic resources to minimize soil pollution and to achieving public and private commitment to combating soil pollution. Stronger scientific evidence is required to support actions to prevent, control and remediate soil pollution.

At the third session of the United Nations Environmental Assembly (UNEA3), held in December 2017, countries adopted a resolution calling for accelerated actions and collaboration to address and manage soil pollution (United Nations Environment Programme, 2017a). The main request of the resolution is to undertake necessary measures at national and regional levels to understand the extent of soil pollution in their territories and to strengthen policies to prevent, reduce and manage soil pollution.

Remediation of polluted soils is essential, and research continues to develop novel, science-based remediation methods. Increasingly expensive physical remediation methods such as chemical inactivation or sequestration in landfills are being replaced by science-based biological methods such as enhanced microbial degradation or phytoremediation (Rodríguez-Eugenio, McLaughlin and Pennock, 2018). The maintenance of soil health and the prevention and reduction of soil pollution are possible through promoting SSM practices, environmentally friendly industrial processes, reduction of waste generation, recycling and reuse of goods, and sustainable waste storage.

The prevention of soil pollution could reduce soil degradation, increase food security, contribute substantially to the adaptation and mitigation of climate change, and contribute to the avoidance of conflict and migration. Therefore, by taking immediate actions against soil pollution we can contribute to the achievement of almost all the Sustainable Development Goals (SDGs), with a significant impact on goals 1, 2, 3, 6, 9, 11, 12, 13, 14, 15 and 17.

The overall aim of the symposium was to review the current state of scientific knowledge on soil pollution and its effects on food production and safety, the environment and human health. The symposium also aimed to build 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, in line with the SDGs.

Specifically, the aim was that the symposium outcome would provide crucial information that could contribute to:

1. Critical reflection on the impact of land use decisions at the national level on soil pollution (e.g. in relation to mining; the location of waste disposal facilities; intensive agriculture and livestock production; the proximity of agricultural fields to industrial areas or transport infrastructure; etc.) and eventually, air and water pollution where polluted soil or its pollutants can be transported by erosion processes or water runoff;
2. Identifying constraints and prioritizing key challenges related to the restoration or remediation of polluted sites;
3. Reviewing existing international policies, agreements and frameworks addressing sources of soil pollution in order to assess their effectiveness and propose ways to improve them;
4. Surveying and reviewing the use of soil contamination thresholds globally, and explore additional research and policy needs; and
5. Launching an agenda for action on soil pollution in response to the implementation of the declaration on soil pollution adopted during the UNEA3.

SYMPOSIUM THEMES, KEY QUESTIONS, AND DISCUSSION SUMMARY

THE SYMPOSIUM'S FOUR MAIN THEMES WERE DESIGNED TO FOCUS DISCUSSIONS ON:

1. the identification of the main drivers of soil pollution in different land uses;
2. the assessment of negative impacts of soil pollution on food safety, the environment and human health;
3. available methods for monitoring, assessing and remediating soil pollution;
4. the existence of national or regional policies and guidelines that include threshold values for different pollutants and the global status of soil pollution.

The aim of the interactive discussions was to develop conclusions and recommendations, based on the scientific evidence presented, on the way forward to prevent and minimize soil pollution. The identification of weaknesses in knowledge and regulations has led to the definition of the line of work for future approaches and the prioritization of the most urgent actions in a consensual manner. In the lead-up to the symposium, key questions were developed for each theme to stimulate discussion and help in identifying priority actions. Scientific presentations in parallel sessions set the scene for debating the thematic questions, and interactive discussions were held on the morning of the last day to develop answers to those questions. Due to the nature of the questions, concrete answers were not always possible based on a discussion alone. As a result, discussions mostly focused on the ultimate goals implied in each question and what needs to be considered in developing appropriate answers.

The GSOP18 themes and subthemes are listed below, with brief contextual summaries of their importance. This is followed by a summary of the main discussion points on each subtheme, as agreed through consensus by participants during the interactive discussion sessions.



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

Human activities are the main sources of soil pollution. On one hand, the local and neighbouring 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 was shaped around the direct and indirect sources of pollution of agricultural soils and in other land uses, 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

Agricultural soils are subjected to direct (e.g. pesticide application, use of improperly treated organic fertilizers and overuse of 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. The processes related to the transport and storage of pollutants in the soil and the role of land use planning in anticipating these processes are therefore important. The economics of sound management and mismanagement of agricultural inputs (application of pesticides and organic and mineral fertilizers) were discussed in relation to food security, soil health and the economics of soil degradation. A direct link was made especially to soil protection that are the most vulnerable to pollution. Agriculture and livestock production have been identified as one of the main sources of greenhouse gases. Enhancing SSM and the rational use of agrochemicals will contribute to prevent and minimize soil pollution, increasing the resilience of soil systems to climate-related hazards (SDG target 13.1).

Presenters identified the use of pesticides, low quality irrigation water, plastics greenhouses and the amendment of soils with manure and sewage sludge as potential sources of soil pollution in agricultural fields. They may contain high levels of heavy metals, antimicrobial resistant (AMR) bacteria, micro- and nanoplastics, pharmaceutical and personal care products (PPCPs) and other pollutants of emerging concern (PECs). It is clear that organic wastes have a great potential to increase soil organic matter and contribute to increase crop production, but participants stressed the need to develop and strengthen international regulations and guidelines on the use of organic fertilizers to ensure that contaminants are not released into the environment with their use. Participants highlighted the importance of long-term monitoring programmes (including monitoring of complex mixtures) to develop informed risk assessments to determine human and environmental exposure. More research related to the effects of pesticides on soil organisms, the interactions between different agrochemicals and their potential transfer to the food chain, is therefore needed.

Globally, soils are the major source of N_2O to the atmosphere. Agricultural emissions due to the use of N fertilizers and manures, together with emissions from natural soils, represent 56–70% of all global N_2O sources (Syakila and Kroeze, 2011). Participants highlighted the urgent need to monitor nutrients in soils, improve the efficiency in the use of fertilizers, and promote capacity development among farmers to control the misuse of agrochemicals.

Risk assessment approaches in agricultural systems should take into consideration the bioavailability of different contaminants and the pathways involved in their transfer to organisms and crops.

KEY QUESTIONS

- IS THERE SUFFICIENT SCIENTIFIC-BASED EVIDENCE 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?

DISCUSSION SUMMARY

The misuse of agrochemicals, such as excessive fertilization and uncontrolled pesticide application, were identified as the main sources of pollution in agricultural fields. International regulations could help control the commercialization and sustainable use of these products. Participants in this session agreed on the benefits and improvements achieved since the launch of the Code of Conduct on Pesticide Management, and supported the adoption of a similar tool to regulate the use of fertilizers.

In addition, the presenters and attendees of this session agreed on the importance of making farmers aware of the problems caused by the misuse of agrochemicals and involving them in the development of good practices for sustainable soil and crop management. In this regard, the idea of including measures to prevent and combat pollution in the Soil Doctors Programme of the GSP arose. Building capacities to prevent soil pollution that can be transmitted from farmer to farmer was identified as being the best way to involve all stakeholders.

Reversing soil degradation should take into consideration the prevention and reduction of soil pollution, even if it is a less obvious threat. Participants emphasized the need to implement the Voluntary Guidelines for Sustainable Soil Management (VGSSM) not only in developing countries but with a strong commitment also from developed regions. Encouraging crop rotation, intercropping of legumes in cereal based cropping system, and the circular economy within agricultural fields were some of the proposals that could reduce the use of agrochemicals and the resulting soil pollution.

Several interventions noted that agricultural soils are often not the culprit but the victim of pollution, mostly from surrounding activities. Land use planning should take into account legacy contaminated soils and design appropriate uses for them in accordance with current pollution levels, as well as the installation of potentially polluting activities in areas close to agricultural soils.

The discussion ended with a clear understanding that it is necessary to involve all stakeholders and to increase awareness of the risk posed by soil pollution. More transparent and participative initiatives are needed to engage citizens and other stakeholders in soil pollution prevention and control.

Three main conclusions emerged from discussions during this session. Firstly, the need to develop harmonized measuring and monitoring systems based on standards for healthy soils was stressed. A global monitoring system would allow the acknowledgement of countries that are actively tackling soil pollution and enable the sharing of relevant experiences and technologies. Secondly, participants proposed the establishment of a platform that connects existing networks to share knowledge and experiences and that allows permanent exchange between land users, scientists and policymakers to increase their awareness on soil pollution and to collectively design prevention measures. Lastly, there is a need to urge governments to apply the principles of prevention and precaution, which would allow timely action to be taken to protect the environment. International guidelines are essential to facilitate the development and implementation of national regulations that include the application of these two principles with respect to the marketing and use of agrochemicals. Furthermore, considering the costs and the impossibility of fully restoring or remedying large areas, these principles should be applied globally.

SUB-THEME 1.2: DRIVERS OF SOIL POLLUTION IN OTHER NON-AGRICULTURAL SOILS

The link between soil pollution and the achievement of SDG targets 9.4, 11.3, 15.1 and 15.3 was 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 soil degradation. In SDG targets 6.2 and 6.3 the importance of waste management and sanitation activities to reduce the release of pollutants into the environment is emphasized. Targets 11.6 and 12.4 highlight the necessity to properly manage urban and industrial wastes, which are amongst of the main sources of soil pollution in non-agricultural soils.

According to existing evidence (Cetin, 2016; EEA, 2014) industrial and mining activities, together with landfills, nuclear accidents and bomb tests have left a legacy of sites heavily contaminated with heavy metals, radioactive nuclides, hydrocarbons and persistent organic pollutants (POPs) worldwide. Sources of soil pollution vary from region to region, and are clearly related to the main past and present economic activities. Waste disposal plays an important role and is a major problem for small islands and developing countries where there is a lack of: adequate waste management plants, strict legislation to control waste disposal, and promotion of recycling and reuse.

KEY 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?

DISCUSSION SUMMARY

During this session, many examples of legacy pollution were presented together with the great diversity of pollutants from different human activities and their location in different regions. Mining, industrial activities and nuclear power plants were repeatedly mentioned as sources of pollution in different regions of the world.

The first point remarked by participants in this session was the difficulty to differentiate between agricultural and non-agricultural soils when referring to soil pollution, especially since agricultural soils are frequently affected by nearby activities. The complexity of clearly identifying the source of pollution (agricultural, industrial, urban, etc.) and the lack of information on diffuse pollution affecting soils worldwide are the main reasons why this problem has long been ignored. It was noted that there is plenty of estimated data but relatively few formally validated measurements and datasets, so it was agreed during the discussion that assessing diffuse pollution should be a priority due to the scarcity of data on the risks to human health, the environment and ecosystem services provided by such polluted soils.

Examples of inventories and monitoring systems of polluted sites, mainly in Europe, were presented. Many countries have lists of potentially polluting activities that can be easily georeferenced by using land use maps. This allows proper land use planning and the prevention of soil pollution in land uses with a higher impact on human health, such as agricultural fields or urban areas. Promoting the establishment of smart communities and cities, especially in small islands states and developing countries, will contribute to prevent and minimize the negative impacts of soil pollution.

The concluding remarks of this session called for more investment to develop consistent inventories of polluted sites at the national level. They will contribute to the reduction of the negative impacts of soil pollution on human health by assigning suitable a use that minimizes the negative impacts of such sites.



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 and the environment through direct contact with contaminants, which compromise the ability of the soil to filter, buffer and transform inorganic and organic contaminants (Blum, 2005), and may influence other physical, chemical, or biological properties that deter soil ecosystem services. These essential soil functions ensure the production of safe and nutritious food and good quality groundwater. In drylands especially, where water availability is a limiting factor to agricultural production, wastewater from treatment plants is often used as an alternative water source for irrigation to create resilience to climate change. Often, this water (and the solid waste it carries) is of low physical, chemical and sanitary quality, causing soil pollution and human health problems (Blume *et al.*, 1980; Liu, 2011).

In this context, Theme 2 linked strongly to the achievement of various SDGs, especially 2 and 3 on zero hunger and good health and well-being. However, the achievement of other goals is essential to accomplish these two objectives, such as SDG 6 that aims to ensure the availability and sustainable management of water, which is essential to guarantee food production. SDG 6 calls for urgent actions against soil pollution to improve the quality of water by reducing open-air defecation, reducing pollution, eliminating dumping, and minimizing the release of hazardous chemicals. Target 9.4, on the development of sustainable and environmentally sound technologies and industries, contributes to reducing the release of contaminants into the atmosphere and soils, and hence, to attenuating diffuse pollution from industrial activities to agricultural fields. Similarly, the achievement of goal 11 can only be reached by tackling soil pollution, which, in turn, can be prevented by investing in safer and cleaner transport systems and improving municipal and other waste management. Making urban areas safe and sustainable would involve ensuring proper urban waste disposal and management (SDG target 11.6) as well as the environmentally sound management of chemicals and other industrial wastes (SDG target 12.4).

Polluted soils play a role in contributing to climate change by negatively affecting various species and ecosystems on the planet and their resilience under a changing climate. Addressing soil pollution would therefore contribute to slowing down or, at least, not accentuating changes in the global climate (SDG 13). Healthy soils are more resilient to climate-related hazards and less prone to erosion caused by extreme weather events. Healthy soils support healthy plant growth that contribute to carbon removal from the atmosphere. Discussions under this theme were also focused on the achievement of SDGs 14 and 15 concerning the protection of marine and terrestrial ecosystems.

The UNEA3 resolution on soil pollution calls on member countries to address soil pollution in the framework of the global environment, food security, development and health agendas in an integrated manner, especially through preventive and risk management approaches (United Nations Environment Programme, 2017b). The research presented under this theme provided a solid basis for identifying new developments and major gaps that need to be filled in order to achieve the objectives of the international agendas.

SUB-THEME 2.1: SOIL POLLUTION AND FOOD SAFETY

Manure and sewage sludge are often used as amendments to increase crop productivity and soil organic matter content, but often without the proper pre-treatment or composting. Heavy metals, persistent organic compounds and emerging pollutants, such as antibiotic resistant bacteria, pharmaceuticals or hormone disruptors, are then released into soils. Crops may absorb pollutants available in soil solution and accumulate them in different plant tissues, including edible parts. Contaminated food poses a great risk to human health, being the main entrance route of heavy metals into humans. Tackling soil pollution contributes to ensuring access to safe, nutritious and sufficient food as mentioned in SDG target 2.1.

Robust scientific data showed the transfer of soil contaminants into the food chain. Presenters of this session showed several examples of heavy metal accumulation in edible plant parts and the models used to derive critical exposure thresholds and ingestion rates. However, there was a common concern among participants that those thresholds do not consider the bioavailability of pollutants in the soil and that thresholds vary from country to country. Human health risk assessments in developed countries, such as in the European Union or the United States, are sophisticated and based on complex models, but these are not harmonized, hence discussion continues on the threshold levels of pollutants in food and soils. The issue of AMR bacteria was also presented as a significant risk to human health; the use of poultry manure to increase soil fertility is introducing high and diverse quantities of resistant microorganisms in soils due to fewer regulations for poultry litter than for cattle manure. Microbial virulence and the potential to transmit genetic information to other microorganisms in the environment needs to be studied in more detail and were deemed a crucial aspect of soil pollution and food safety that can no longer

be ignored due to their important impacts globally. Consumers or the general population were at the forefront of these talks, with all presentations mentioning the hard work that is being done to prevent soil contamination and therefore to increase food safety for consumers.

KEY 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?

DISCUSSION SUMMARY

There was consensus that soil pollution has a direct effect on crops, with presentations ranging from broader studies looking at the transfer of contaminants from agricultural contaminated soils to crop plants in Italy, to the transfer of contaminants such as cadmium and arsenic to rice crops and the strategies for reducing their levels through management practices in Japan.

To reduce the unacceptable levels of contaminants in food, soil and water is the major priority in the next years, according to participants. Soil pollution influences the quality and safety of food through the introduction of food-borne pathogens, human pathogens, dispersion of antibiotic resistance genes, reductions in yield, and reductions in soil biodiversity with unknown effects. The cost of inaction is intolerable because it would jeopardise food safety and security compromising the achievement of the SDGs.

International regulations, such as the Codex Alimentarius should be adapted to address complex mixtures of contaminants in soils, pollutants of emerging concern and food aspects. Ultimately, standardised and flexible tools to derive soil-screening values need to be developed. It was also discussed that it would be useful to ask the reverse of the question of how soil pollution affects food production in order to have a more comprehensive idea on the process of soil pollution. We also need to consider the question of how food production techniques contribute to soil pollution.

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

Unsustainable agricultural practices or changes in land use may turn soil into a source of pollution, affecting human health through direct exposure and through the entrance of contaminants into the food chain, as well as affecting other sections of the environment, such as water bodies, air and living organisms. Overuse of fertilizers facilitates the leaching of nutrients to groundwater, causing nutrient pollution of fresh water and marine environments, threatening the achievement of the SDGs 6 and 14. Sediment itself can have many negative impacts on surface waters. To ensure healthy lives and environment in safe cities, soil pollution has to be prevented and minimized.

Local soil contamination occurs frequently in connection to past and present industrial activities, waste management and disposal, including remnants of hazardous materials such as obsolete pesticides. Countless chemical agents, some of them highly persistent, are found at various levels in the ground and can enter the water table, the locally produced food, and become airborne. This kind of contamination and its adverse health effects have been documented in many cases, but the overall magnitude of the impact on human health of soil pollution is not known. This is in contrast with air or water pollution, for which reliable estimates on their burden of disease have been available for some two decades.

Once the sources of soil pollution have been identified, the mechanisms and pathways that contaminants follow from soils into human body and other compartments of the environment, such as air and water bodies, need to be analysed. The ability of soil to filter, buffer, retain and transform contaminants is well known, but this ability can be overridden or altered if soil is mismanaged.

Another neglected issue that clearly links soil pollution to human health and a safe environment has been recognised in SDG target 6.2, which aims to guarantee sanitation for all. Open defecation is an important source of pathogens and antimicrobial resistant microorganisms that enter the soil and can pass to the food chain or pose direct harm by dermal exposure (skin contact) or inhalation (breathing) of polluted soil particles.

This sub-theme tackled the latest research on how to assess the impacts of soil pollution on food production, human health and the environment, and how to monitor the effects of soil pollution on human health and all living organisms, from soil micro and macro-biota to grazing animals, birds and affected fisheries. Researchers presenting in this session confirmed the different exposure pathways to soil contaminants through inhalation of dust, ingestion of contaminated water, food-chain transfer, and soil ingestion. The ecological impacts of soil pollution are often overlooked or only the effects on the macro biota are considered. Ecotoxicological risk assessments should be carried out for soil organisms, which are ultimately responsible for maintaining healthy and fully functioning soils. Another change in the overall conception of the soil pollution problem that was suggested during this session was to move from measuring concentrations of contaminants to measuring their effects in multiple organisms through bioassays.

KEY QUESTIONS

- 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?

DISCUSSION SUMMARY

The conclusions of this session highlighted the need to invest in long-term studies to better understand the effects of continued exposure to low doses of contaminants and the synergistic and antagonistic effects between different pollutants. It was also agreed that risk assessments and the monitoring of soil pollution are needed to tackle its prevention and remediation and provide proper management practices.

Participants agreed that it would be interesting for FAO and GSP to develop standardized terms and indicators that correlate soil pollution levels with the compliance or threat to the compliance of the SDGs. In this regard, research on the extent and effects of emerging contaminants such as microplastics, POPs or AMR should be increased to include them in the indicators. Technology transfer related to genome sequencing for soil microbiome assessment is an essential step towards a better understanding of the ecotoxicological effects of contaminants on soils.

This session brought together different stakeholders, including research institutions, policymakers, international organizations and industry. While these stakeholders have different objectives and priorities, there was a clear agreement about the urgent need to deal with the issue of soil pollution and the impacts that it has on food safety, the environment and human health. Policy makers were also present and shared overviews of existing laws associated with the topic, what is currently being done to avoid the impacts on food safety and what still needs to be done.

THEME 3: REMEDIATION OF POLLUTED SITES

The first step prior to remediation of polluted sites is the identification of potential sources of pollution, which needs to be confirmed through site investigation and soil analyses. Having a national soil survey available will facilitate the identification of polluted soils apart from being a solid base for land use decisions.

In accordance with SDG target 17.18 related to data, monitoring and accountability, developing and developed countries should significantly increase the availability of high-quality, timely and reliable data. The UNEA3 resolution also requested the promotion of coordinated data collection and management of information on soil pollution.

Soil pollution has been neglected for too long and clear actions were only taken in those cases where immediate negative effects were observed in the environment and human health. Soil pollution is determined by a complex combination of factors, such as the type of pollutant, site history and geological background and is therefore specific to the local and regional levels. The lack of knowledge on the fate of contaminants in soil and the scarcity of available information on toxicological and integrated studies (Cachada *et al.*, 2016) was also highlighted during the symposium.

Prevention of soil pollution is undoubtedly the best solution for the achievement of sustainable societies and for ensuring the legacy of a healthy and productive planet for future generations. The development of appropriate policies to regulate point source and diffuse pollution and strengthening the implementation of existing ones are essential for prevention.

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. Recent developments in the use of remote sensing in soil mapping offer possibilities for assessing soil pollution and improving incomplete spatial and thematic coverage of current regional and global soil information.

Protocols for assessing and mapping point source pollution have been developed and refined over the past decades in many developed countries and can be applied to other parts of the world but adaptations are needed to address national priorities, existing legislations, availability of resources and technical capacity. Understanding the idiosyncrasies and social and economic situations of each region is essential for designing the best techniques to monitor soil pollution accordingly.

Several novel techniques to assess soil pollution were discussed in this session, such as geographical information systems (GIS), remote sensing, visible and near infrared spectroscopy (Vis-NIR), nuclear and multi-isotopic techniques. To obtain comparable data on soil pollution among regions and countries, it is important to establish standardized assessment and analytical protocols and develop a harmonized framework for the collection and reporting of data on soil pollution. However, soil contaminants are not systematically measured in soil laboratories and there are no harmonized methodologies that allow comparisons between countries or even regions.

The usefulness of soil pollution mapping was stressed in several presentations and discussions, not only to guide remediation efforts, but also for land use/urban planning and decision-making according to suitability for use.

KEY QUESTIONS

- 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?

DISCUSSION SUMMARY

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. The development of user-friendly methods and cost-effective approaches

to evaluate contaminants in soils is essential to ensure that developing countries will be able to generate the requested data.

Participants highlighted the wealth of experience in assessing and mapping point source pollution particularly in developed countries and that other countries should build on the lessons learnt to avoid costly mistakes. There were also discussions about expanding the parameters used for assessing soil contamination under the concept of sustainable remediation.

All participants in this discussion agreed on the need to increase efforts to assess and monitor diffuse pollution. Discussions here related to the polluter-pays principle. The mobilization of citizens is essential to urge governments to remediate polluted sites and to fully implement the “polluter-pays” principle in national and international legislation where applicable and/or provisions exist. Requiring traceability of chemical compounds released into the environment would make it possible to identify the source, prevent future accidents or deliberate releases, and develop strategies for prioritizing pollutants of urgent concern.

In many countries, the recent trend is to follow a site-specific risk assessment based on land use, proximity to urban areas and the possibility of transfer of pollutants to subsoil, groundwater and other environmental compartments.

Threshold levels were not addressed under this theme, but thoroughly discussed under sub-theme 4.1.

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

It is important to restore polluted soils to a standard at which the current or proposed site use may proceed with minimal risk to humans and the environment. 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 (Rodríguez Eugenio, McLaughlin and Pennock, 2018). Increasingly expensive physical remediation methods such as chemical inactivation or sequestration in landfills are being replaced by biological methods such as enhanced microbial degradation or phytoremediation, as demonstrated by the high number of scientific papers presented on successful case studies in this regard. However, dig-and-dump remains the main remediation technique in cases of severe pollution, where rapid action is required; creating a subsequent problem of disposal of the polluted surface soil that has been removed.

Differences between restoration and remediation arose during the discussions, and participants agreed on the need to determine, prior to the risk assessment, the future use of a polluted site to choose which techniques are most appropriate in each case. Remediation techniques are varied and often there is no single technique that can be applied. Techniques vary according to the characteristics of the site, the type of contamination, and the capabilities and technologies existing in the country. Sustainable remediation emerges as a new alternative, cost-effective approach to deal with legacy polluted sites, with the objective of balancing economic viability, conservation of natural resources and biodiversity, and the enhancement of the quality of life in surrounding communities (Holland et al., 2011). In cases of extended and heavy contamination, land reclamation is not feasible and pollution stabilization by natural methods is the best approach.

KEY 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?

DISCUSSION SUMMARY

There were discussions around the importance of applying a risk-based approach to decision making regarding whether to remediate a polluted site or not. This approach is consistent with a recognized need to factor in bioaccessibility and bioavailability of the pollutants in establishing criteria for remediation.

During the discussion, it was highlighted that in developing countries, financial resources, human capacity and availability of analytical tools are limitations to remediation. Research and development of user-friendly, hand-

held measuring devices that can be easily used in the field are essential to ensure access to data in remote or rural areas. In many countries, there are no laboratories with the capacity to analyse soil contaminants, which require fine and costly techniques.

Given the high cost of soil pollution remediation and lack of capacity in developing countries, participants agreed on the urgent need to raise political awareness of the benefits of soil pollution remediation in developing countries and to increase international funding for soil pollution remediation activities. Some of the proposals for achieving these objectives were to demonstrate the negative impact of inaction on public health and food safety, and to develop measures of the benefits of remediation in terms of improvements in public health and gains in crop yields and economic productivity.

A generally accepted idea is that remediation should always be carried out under social and economic criteria, with the impact on human health as the primary consideration.



THEME 4: GLOBAL STATUS OF SOIL POLLUTION

The resolution on soil pollution adopted during UNEA3 encourages Member States to undertake necessary measures at national and regional levels to assess the extent of soil pollution in their territories, to identify the main sources of soil pollution and strengthen policies and legislations to prevent, reduce and manage soil pollution. It is a global imperative to establish an agenda for action and collaboration to address and manage soil pollution. Governments and research institutions should incorporate soil pollution into their work programmes in order to generate reliable information on the status of soil pollution.

The SDG target 10.7 calls for the facilitation of orderly, safe, regular and responsible migration and mobility of people. Soil contamination typically leads to reduction of crop yields and may result in the abandonment of polluted arable land. Reducing migration caused by environmental problems must be a global priority and it is through the strengthening of policies for pollution prevention and remediation that an active and effective contribution can be made to this end.

SDG 15 in its target 15.1 requires the conservation and restoration of terrestrial and inland freshwater ecosystems and their services in line with obligations under international agreements. The framework proposed in the “Towards a pollution-free planet” report adopted during UNEA3 is an aspirational goal, seeking actions to eliminate anthropogenic pollution that degrades ecosystems, harms human health and well-being, and affects the functioning of all living species. Currently, the three conventions (Basel, Rotterdam and Stockholm) regulate the use, trade and transboundary movement of different hazardous compounds. The Minamata Convention on Mercury draws attention to a global and ubiquitous metal that, while occurring naturally, has broad uses in everyday objects and is released to the atmosphere, soil and water from a variety of sources. Many international frameworks and agreements aspire to prevent pollution but greater efforts must be focused on their full implementation and enforcement to prevent further pollution. Global agreements requiring remediation of contaminated sites should also be promoted. The polluter-pays principle could also be considered here to ensure the conservation of ecosystems and the restoration of polluted soils, which are failing to fully provide their ecosystem services. However, refinements are needed to determine liability in cases of diffuse pollution. To achieve SDG target 15.5 (take urgent and significant action to reduce degradation of natural habitats and halt the loss of biodiversity) it is essential to prevent and combat soil pollution.

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, 2015). Furthermore, the existence of legislation that ensures the liability for soil pollution and regulates new activities contributes to prevent new soil pollution.

There is no agreement among researchers on how to best assess the hazard of soil contaminants. Some researchers stress the ineffectiveness of the use of total concentrations for certain pollutants and prefer bioassays; others stress the inadequacy of the data available to derive threshold values and use background concentrations (in these cases assessments are based on experience and previous knowledge of the soil) (Beyer, 1990). Recently, scientists and environmental consultants tend to use different approaches for hazard identification and risk assessment of complex chemical mixtures, including the study of interactions that can occur between chemicals or at target sites that alter the toxicity of contaminants (Heys *et al.*, 2016).

Presentations in this session showed the variety of legal approaches used to prevent, control and remedy soil pollution. In Europe, despite the existence of legal instruments for more than 30 years in some countries, there is still no agreement on how to measure and report contaminated sites or on the procedure for identifying, investigating and remedying polluted soils.

Discussion on the circular economy emerged during the session, and participants stressed the importance of controlling all components of the process, as these could be a source of long-term pollution, for example from the use of improperly composted manure.

Diffuse contamination was also mentioned during the presentations and discussions. Participants emphasized the need to define liability more clearly in legislation and to establish mechanisms to identify the responsible party in order to ensure prevention and remediation in the event of diffuse pollution.

Participants agreed on the importance of defining threshold values and soil quality standards with a flexible and transparent approach based on available data, also considering bioavailability. There is sufficient evidence on heavy metals to establish global threshold values based on different soil and ecosystems types, climate conditions,

and parent material, but this is not the case for many other compounds, such as persistent organic pollutants (POPs), polycyclic aromatic hydrocarbons (PAHs), pollutants of emerging concern (PECs), etc., for which further research is required to determine their bioavailability, soil permanence and ability to enter the food chain.

KEY 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?

DISCUSSION SUMMARY

Three main conclusions emerged from the presentations and discussion on sub-theme 4.1. Further efforts should be made to harmonise measurement methods through the development of guidelines that include threshold values for a wider range of chemical elements and compounds and that allow justified risk-based decisions to be made.

The principles of prevention and precaution should be widely applied globally to ensure effective pollution prevention. Policymaking should be a collaborative approach and should include economic, social and environmental aspects, including human health. Furthermore, it was accepted that all policies should include awareness-raising components and, building on the second pillar of the GSP, this action should also be encouraged.

There are already many guidelines and threshold values that have been validated in different countries and regions that could be used as a basis for the development of flexible global guidelines based on regional specificities.



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. The UNEA3 declaration calls for building capacities in every country to achieve the effective prevention, control and management of soil pollution. The development of technologies, the transfer of expertise and joint efforts are essential to tackle the problem of soil pollution, as it transcends borders.

Discussions in this session were illustrated by several local studies, the main sources of soil pollution and the different approaches to address it.

KEY 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?

DISCUSSION SUMMARY

It is clear that in every region of the world major soil pollution sources are different, as are the measures and legal frameworks to be implemented. There is an urgent need to assess soil pollution information regionally and nationally. Solid evidence is required for governments and decision-makers to commit to developing legislation on the prevention, minimization and remediation of soil pollution.

Participants agreed that one of the main global priorities is to increase awareness on soil pollution. One cannot act against what is not well understood or perceived as a problem. Farmers must be involved in the research and decision-making process, they must understand the negative effects of their actions and contribute their knowledge of the soil and crops to implement SSM practices, taking into account the specificity of each site.

On the global assessment of soil pollution, participants agreed that it should be a country-driven process, but there is no obligation for countries to undertake an inventory of all contaminated sites. The lack of international standards for comparing pollution between countries was also identified as one of the main obstacles to this exercise. A feasible approach could be to estimate the figures globally as a basis for local validation and research.

The first step in developing a global assessment of soil pollution is to develop soil information where it is lacking. Accurate soil maps are essential to facilitate modelling or estimate soil pollution. Key factors such as parent material and climatic conditions, which are reflected in the soil maps, would be useful for these estimates and for identifying regional models to start the pilot studies that will serve as the basis for the development of global guidelines.



RECOMMENDATIONS

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

RECOMMENDATION 1: TO SUPPORT THE DEVELOPMENT AND IMPLEMENTATION OF TOOLS AND GUIDELINES THAT WOULD SUPPORT THE PREVENTION AND REMEDIATION OF SOIL POLLUTION, SUCH AS THE INTERNATIONAL CODE OF CONDUCT FOR THE USE AND MANAGEMENT OF FERTILIZERS.

Several gaps were identified in existing international regulations and agreements related to soil pollution. For example, nutrients have generally not been considered as pollutants in soils, but the evidence presented in this symposium has shown that the controlled management of nutrients is essential to maintain healthy soils able to fully perform their functions. The misuse of organic and synthetic fertilizers leads to nutrient imbalances in soils, alters soil biodiversity, and produces changes in soil pH (acidification) which contributes to the mobilization and bioavailability of other contaminants. In addition, excess nitrogen inputs contribute to the release of N₂O into the atmosphere, a greenhouse gas with a higher potential warming effect than CO₂. Excess N and P cannot be absorbed by plants and soils, and consequently these macro elements contaminate surficial and groundwater bodies.

RECOMMENDATION 2: TO INCLUDE SOIL POLLUTION ASSESSMENT AND MINIMIZATION MEASURES IN THE SOIL DOCTORS PROGRAMME IN ORDER TO SUPPORT LAND USERS TO MAINTAIN HEALTHY SOILS UNDER LOCAL CONDITIONS FOR LONG-TERM BENEFITS.

Farmers have custody of many the most fertile and productive soils in the world, with the accompanying responsibility to protect these soils from degradation and maintaining their health and functioning. By providing user-friendly, cost-effective measures to assess, prevent and minimize soil pollution, farmers should be provided the tools to implement sustainable soil management practices that require less agrochemical inputs. Healthy soils are more resistant to droughts and floods and less prone to erosion, maintaining a rich and healthy plant cover, they are rich in diverse communities of organisms, which reduce the risk of various soil-borne diseases. There are various available technologies that can be transferred to assess different contaminants in soils, such as PAHs and oil-derived compounds. However, more research is needed to develop feasible measuring techniques to assess agrochemicals, such as pesticides and heavy metal residues in soils and food.

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

RECOMMENDATION 3: TO ADVOCATE FOR THE IMPLEMENTATION OF EXISTING GUIDELINES, SUCH AS THE CODEX ALIMENTARIUS, THE REVISED WORLD SOIL CHARTER, THE VOLUNTARY GUIDELINES FOR SUSTAINABLE SOIL MANAGEMENT, THE CODE OF CONDUCT ON PESTICIDE MANAGEMENT, THE GLOBAL ACTION PLAN ON ANTIMICROBIAL RESISTANCE AMONGST OTHERS, TO ENSURE SAFE FOOD IN THE FACE OF EMERGING SOIL POLLUTANTS.

Several international agreements and guidelines are in place to regulate and minimize the impact of hazardous chemicals on human health, the environment and the food chain. However, the rapid development of the industry and the constant release of new compounds in the environment require more actions to understand the possible interactions between chemicals. Ecotoxicological and human toxicological assessment should be done before the approval of new products, considering the pre-existent mixture of compounds in each place.

RECOMMENDATION 4: TO ESTABLISH AN EXPERT AND MULTI-STAKEHOLDER WORKING GROUP TO DEVELOP FEASIBLE AND REGIONALLY CONTEXTUALIZED GUIDELINES FOR ASSESSING, MAPPING, MONITORING AND REPORTING ON SOIL POLLUTION.

Soil pollution is a global threat; it affects every ecosystem and region in the world; acute and chronic adverse effects on human health have been documented but the overall health impact is not known and an assessment is urgently needed. However, sources and contaminants are not the same everywhere. Experts, land users, policy-makers and other stakeholders are called to identify the major issues in their regions and to identify the main factors to be considered in assessing, mapping and monitoring soil pollution in their region and their implications for human and ecosystem health. The way of reporting on contaminated soils should be supported by facilities for data storage and management, and regulations in force in each country. It is necessary to identify existing national inventories that can be complemented with information on soil pollution and to identify the most feasible way to do this in those countries that do not have previously established data infrastructures.

THEME 3: REMEDIATION OF POLLUTED SITES

RECOMMENDATION 5: TO ESTABLISH A WORKING GROUP TO DEVELOP GUIDELINES FOR THE MANAGEMENT OF POLLUTED SOILS, INCLUDING A DATABASE OF GOOD PRACTICES FOR ADDRESSING SOIL POLLUTION (MANAGEMENT AND REMEDIATION).

A technical group with experience on soil pollution remediation shall be established to identify the best available techniques to remediate or minimize soil pollution, taking into account the national and local characteristics. These guidelines should consider the social, economic and environmental impacts of soil pollution remediation. Changes in land use must be evaluated as an option when the cost or complexity of remediation are too high.

RECOMMENDATION 6: TO IMPLEMENT CAPACITY DEVELOPMENT BUILDING AND TRAINING ACTIVITIES COVERING THE FULL CYCLE OF SOIL POLLUTION: FROM ITS ASSESSMENT TO ITS REMEDIATION – INCLUDING THE STRENGTHENING OF FACILITIES FOR DATA ANALYSIS AND MANAGEMENT.

Identifying the main national weaknesses and strengths in soil pollution prevention and management is the first step in establishing work plans, focusing efforts on weaknesses and promoting knowledge transfer between regions. The GSP and ITPS will take the lead in organizing training courses and developing training materials, with the support of experts from the working groups. Establishing pilot projects in the different regions where less information is available will allow for the development of regionally contextualized guidelines, considering the main social, economic and environmental factors in each region, and the training of experts directly on the field.

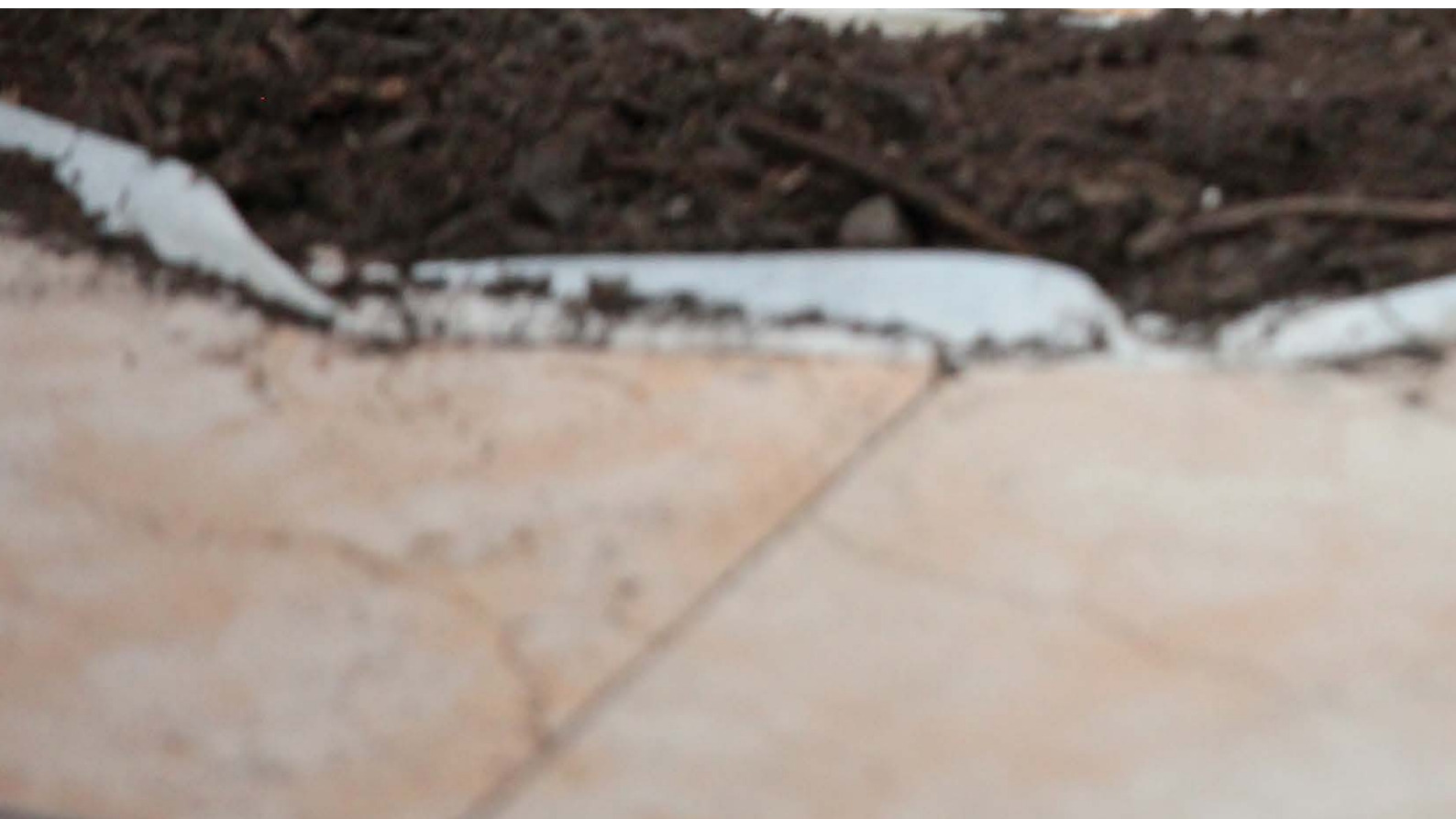
THEME 4: GLOBAL STATUS OF SOIL POLLUTION

RECOMMENDATION 7: TO IMPLEMENT THE ACTIVITIES OF THE GLOBAL SOIL LABORATORY NETWORK (GLOSOLAN), INCLUDING HARMONIZED METHODS TO IDENTIFY AND MEASURE SOIL CONTAMINANTS.

In line with the call in the UNEA3 soil resolution, a coordinated approach to combating soil pollution should be promoted by the relevant UN organisations, including the GSP. Data collection and management of soil pollution data should be carried out in a consistent and harmonised manner. Leveraging the interconnected infrastructure provided by the GLOSOLAN, standardized measurement methods can be developed for the main pollutants, so that the information generated in different regions is comparable.

RECOMMENDATION 8: TO IMPLEMENT A GLOBAL ASSESSMENT OF THE STATUS OF GLOBAL SOIL POLLUTION USING A COUNTRY-DRIVEN PROCESS IN LINE WITH THE UNEA3 RESOLUTION “*MANAGING SOIL POLLUTION TO ACHIEVE SUSTAINABLE DEVELOPMENT*” AND TO PROMOTE THE ESTABLISHMENT OF NATIONAL SOIL INFORMATION SYSTEMS THAT INCLUDE DATA/INFORMATION ON CONTAMINANTS.

At the third session of the UN Environment Assembly countries adopted a resolution on soil pollution that calls for the assessment of the extent and future trends of soil pollution, the risks and impacts of soil pollution on health, the environment and food security including land degradation and the burden of disease resulting from exposure to contaminated soil. It further calls for urgent action and cooperation between countries and support agencies to address the issue. Implementation of the resolution will build on existing efforts being led by various partner agencies. The Global Soil Partnership has successfully conducted a previous country-driven data collection on soil organic carbon. Despite the inherent difficulty and high cost of analysing soil contaminants, gathering basic information related to soil pollution, such as policies to prevent, control and remedy soil pollution, the number and extent of polluted sites, and the identification and location of potentially polluting activities, could help to better understand the problem of soil pollution globally and identify the main gaps. We must build on the infrastructure and work dynamics that have already been established to address this new global data collection challenge. The fact that the process of analysis and data collection is led by countries will ensure their full commitment in the fight against soil pollution, since the analysis of the main sources and the extent of soil pollution in their territories will serve to better guide the decision-making process and identify gaps in their legislation that should be reinforced.





CONCLUSIONS AND WAY FORWARD

The GSOP18 brought together experts engaged in activities within FAO, the GSP and its ITPS, the UN Environment, the Secretariat of the Basel, Rotterdam and Stockholm Conventions, and the WHO, together with independent scientists, policymakers and land users. Their common goal was soil pollution assessment, prevention and mitigation as part of an overall sustainable soil management and the global agendas for sustainable development and food security. Scientists from across the globe were active in presenting the results of studies describing the risk posed to human health and the environment by soil pollution, demonstrating the existence of this hidden threat, addressing the challenges of monitoring and managing soil pollution and discussing and developing the key messages reflected in this document. UN members and especially their policy advisors and decision-makers are encouraged to use this outcome document and its recommendations to implement them at national level.

Experts at the symposium concluded that there is convincing scientific evidence that soil pollution is a global threat to food production systems, to human health and to the environment and that coordinated action needs to be ramped up to address this issue.

The symposium provided scientific evidence that soil pollution is caused mainly by human actions, and demonstrate their implication for environment and health; it also identified the main knowledge gaps that remain, and on which efforts should be focused on. Several possible solutions with a local approach were proposed, which should now be studied in detail to determine their applicability on a larger scale. One of the main conclusions of the symposium is that the data available from different regions are very heterogeneous, fragmented and in many cases absent. There is enormous complexity in the analysis of soil contaminants, as laboratory analyses are often extremely expensive and are not usually available in all soil laboratories. Cost-effective and user-friendly techniques to measure soil contaminants were presented and their use should be promoted and tested in other regions with different soils and environmental conditions to determine their global applicability. The adaptation of sound and innovative practices to local conditions is essential to support the effective addressment of soil pollution. In parallel, it is important to clarify the implications of soil pollution for human health by assembling further evidence and developing a clearer picture of the health impacts in different regions and local settings.

From the perspective of achieving the SDGs, the prevention of soil pollution and the minimization and remediation of former pollution were identified as a priority due to the serious implications of this threat, not only for the health of our soils but especially for human health, water and air quality, food safety and the conservation of ecosystems.

Soil pollution is a global issue, which transcends borders and whose source can be very distant. For these reasons, tackling soil pollution requires joint efforts of all stakeholders to prevent, minimize and remediate it when feasible. The prevention of soil pollution should be a top priority worldwide, because the cost of remedying or changing the land use is too high. Human activities are the main sources of soil pollution and therefore investment should be made in developing environmentally friendly industrial technologies and implementing sustainable soil management techniques. Reducing the daily release of hazardous chemicals into the environment should also be an overall priority.

The status of global soil pollution is still unknown. Despite the efforts done in some regions to understand the extent of soil pollution, little systematic data is available, focusing mainly on point sources of soil pollution. The extent and consequences for human health and the environment of nonpoint or diffuse sources of soil pollution remain unknown and very few studies have been conducted in this regard. Investment in national soil information systems and the development of local capacities are a precondition for fulfilling the UNEA3 mandate.

The VGSSM were developed in an inclusive process and approved by FAO member countries. Their implementation is important in order to progress with the accomplishment of several of the sustainable soil management objectives, such as:

- to ensure that the availability and flows of nutrients are appropriate to maintain or improve soil fertility and productivity, and to reduce their losses to the environment;
- to reduce soil salinization, sodification and alkalization;
- to ensure that water is efficiently infiltrated and stored to meet the requirements of plants and ensure the drainage of any excess;
- to ensure that contaminants are below toxic levels, i.e. those which would cause harm to plants, animals, humans and the environment;
- to guarantee that soil biodiversity provides a full range of biological functions; and
- to undertake soil management systems for producing food, feed, fuel, timber, and fibre that rely on optimized and safe use of inputs.

Symposium participants recommended that the VGSSM be refined to provide context-specific guidance on the sustainable management of soils at the national and local scales to prevent and minimize soil pollution. To achieve this, a working group will be established in the GSP to coordinate the development of a technical and institutional manual for assessing, mapping, monitoring and reporting on soil pollution.

In making recommendations for remediation strategies and minimizing soil pollution, a strong scientific basis is needed. It was therefore recommended that research focus on reducing uncertainties through the analysing and promotion of long-term experiments, validation of results through meta-analyses and geographical targeting in understudied regions. An important activity in this regard will be the establishment of a working group to develop guidelines for the management of polluted soils, including a database of good practices for addressing soil pollution (management and remediation), in order to foster technical collaboration to ensure the transfer of best available techniques worldwide. The implementation of pilot projects where the proposed measures are put into practice in different regions and under different climatic conditions, soil types, land use and ecosystem sensitivity will provide the necessary evidence to adapt these techniques to different local conditions.

The resolution on ‘Managing soil pollution to achieve sustainable development’ adopted by countries at the third session of the United Nations Environment Assembly provides a good basis for contributing to harmonized and consolidation action through joint approaches by countries and supporting partners in advancing the agenda. In this respect, the symposium was a highly relevant contribution to mandate set forth in the resolution.

Finally, the strongest agreement reached during the symposium was on the need to raise awareness of threats posed by soil pollution. Everyone, from children and young people to politicians, policymakers, chemical producers and users, farmers and consumers, must be aware of what is soil pollution, its causes and especially its impacts on our environment, our food, water and health. Soil pollution should be confronted with action for all stakeholders so that they can be the solution to soil pollution.

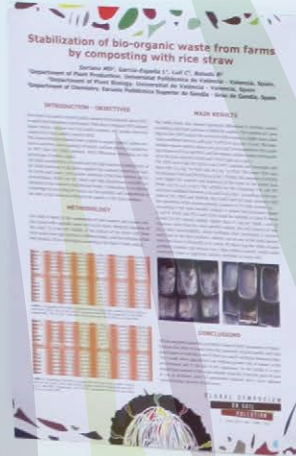
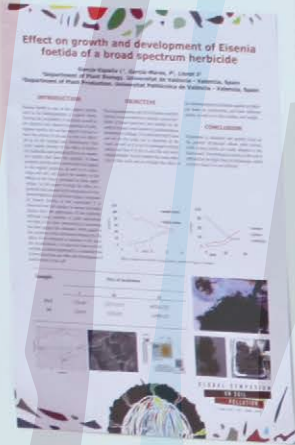
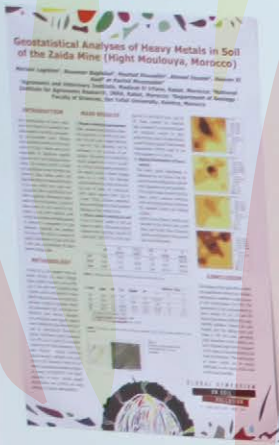


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GLOBAL SYMPOSIUM ON SOIL POLLUTION

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