

From Soil Health to Global Food Security



**A NATION
THAT
DESTROYS
ITS SOIL
DESTROYS
ITSELF**

- Franklin D.
Roosevelt

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Foreword

Safer Phosphates Foundation is an independent Dutch foundation dedicated to advancing sustainable agriculture, environmental protection, and food safety globally.

While our work began with a focus on raising awareness about heavy metals in fertilizing products, our mission has evolved to address the interconnected challenges of soil health, water and air quality, and long-term food security. Our goal is to support a holistic transition toward sustainable and resilient farming systems that safeguard human health, protect ecosystems, and ensure productive soils for future generations.

This publication by the Safer Phosphates Foundation provides a comparative overview of soil protection regulations across a selection of countries in Latin America, Asia, and other key regions. By mapping existing legal frameworks, policies and monitoring systems, the report highlights how different jurisdictions address the protection of soils as a vital environmental and agricultural resource.

Healthy soils are essential for sustainable agriculture, food security, and ecosystem resilience. However, soil degradation and contamination remain growing global challenges. In many parts of the world, soil protection policies are fragmented – spread across environmental, agricultural and land-use legislation – and often lack clear standards or effective enforcement mechanisms. This publication aims to shed light on how countries are addressing these challenges and where significant regulatory gaps remain.

Through a collection of country profiles, the report examines national approaches to soil protection, including regulatory frameworks, monitoring systems, and policies related to soil contamination and agricultural inputs. While data availability varies across countries, the analysis provides a first structured overview of how soil protection is addressed across diverse regulatory contexts and identifies emerging policy trends and best practices.

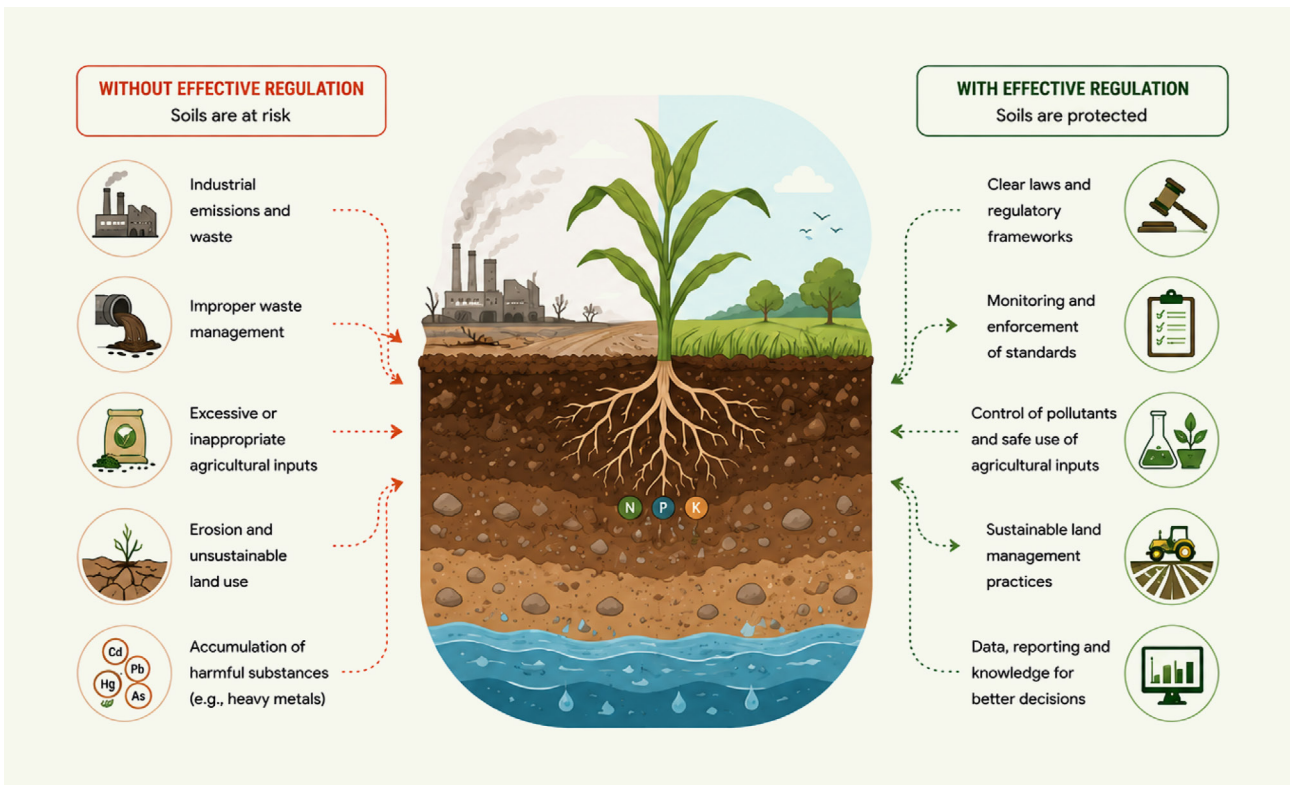
By bringing together regulatory information from multiple regions into a single, accessible resource, this publication seeks to support evidence-based dialogue among policy-makers, researchers, industry stakeholders and civil society. The objective is not only to highlight differences in regulatory approaches but also to encourage stronger governance and greater awareness of the importance of soil protection in sustainable agriculture.

Safer Phosphates Foundation is committed to fostering informed discussion on soil protection and the prevention of soil contamination, including the role that agricultural inputs may play in the long-term health of soil and food systems.

For more information, please visit our [website](#), follow us on our social media channels ([LinkedIn](#), [X](#) and [YouTube](#)), and [subscribe to our monthly newsletter](#) for updates and exclusive content.

Introduction

Soils play a fundamental role in supporting agriculture, food production, and environmental stability. They store nutrients, regulate water cycles, sustain biodiversity, and enable crop growth. **Nevertheless, across the world, soils are increasingly under pressure from erosion, pollution, intensive land use, and unsustainable agricultural practices.** Protecting soil resources has therefore become an important challenge for policymakers and agricultural stakeholders.



Despite this growing awareness, regulatory approaches to soil protection vary significantly between countries. In many cases, soil is not governed by a single dedicated law but rather through a combination of environmental regulations, agricultural policies and land-use rules. This fragmented approach often makes it difficult to assess how effectively soils are protected and where policy gaps remain.

Soil contamination, including the accumulation of harmful substances in agricultural land, remains a long-term concern in many regions. Pollutants can enter soil through a variety of pathways, including industrial activities, waste management practices, and agricultural inputs. Over time, these contaminants may affect soil fertility, ecosystem health, and food production systems.

A detailed overview of EU legislation addressing heavy metal pollution in soils is available in the Safer Phosphates Foundation's [White Book](#) (2024). An overview of national legislation and regulatory approaches across EU Member States can be found in the Foundation's [Ground Rules](#) publication (2025).

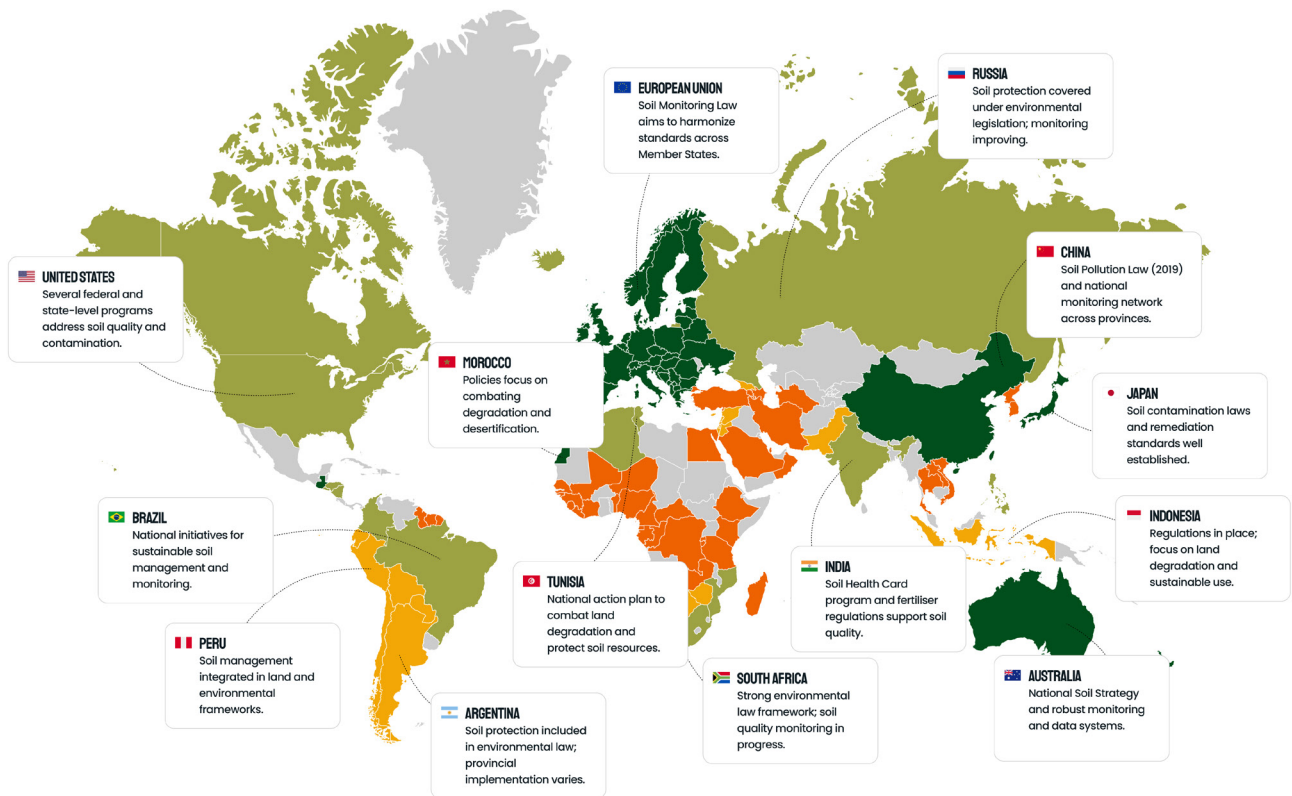
Soil Protection Policies and Regulatory Approaches

Countries regulate soil protection through a range of policy instruments and legal frameworks. In some jurisdictions, dedicated legislation establishes specific measures for soil conservation, contamination control and monitoring of soil quality. In others, soil protection is integrated into broader environmental or agricultural policies that indirectly address soil-related risks.

These frameworks typically include measures related to land management practices, pollution prevention, environmental monitoring, and the control of substances that may degrade soil quality. The level of detail, enforcement mechanisms and availability of monitoring data can differ considerably across countries.

In recent years, soil protection has increasingly been linked to broader policy objectives such as climate adaptation, biodiversity protection, and sustainable agriculture. However, regulatory coverage remains uneven, and many countries continue to face challenges stemming from limited monitoring systems, incomplete data, or fragmented governance structures.

By examining national approaches across different regions, this publication aims to provide an overview of how soil protection is addressed in practice. A comparative perspective helps to highlight both progress and remaining gaps, offering insights into how policies and regulatory tools can evolve to better support the long-term protection of soils.



Argentina

Argentina addresses soil protection through a combination of soil-specific and broader environmental legislation rather than through a single comprehensive soil code.

A key pillar is the **Law on Soil Conservation** (No. 22428), which declares the conservation and recovery of the productive capacity of soils to be of general interest and provides a framework for public and private action, including voluntary soil conservation consortia. This is complemented by the **General Environmental Law** (No. 25675), which establishes minimum standards for sustainable environmental management and incorporates principles such as prevention, restoration and environmental responsibility. Together, these laws provide the core national basis for addressing soil degradation, erosion and broader environmental harm.

In practice, soil protection in Argentina is closely tied to agricultural production systems, particularly in regions where intensive cropping has increased pressure on soil fertility and structure. Soil conservation is promoted through sustainable land-management practices such as crop rotation, no-till farming, and improved nutrient management. Argentina is often cited internationally for its large-scale adoption of no-till agriculture, which has helped reduce erosion risks in many cropping areas – even if concerns remain about longer-term sustainability where crop diversification is limited.



Institutionally, implementation is shaped by Argentina’s federal structure. National laws set minimum standards, but provinces retain an important role in enforcement and land-use governance, which can lead to uneven application across jurisdictions. Soil information and monitoring are supported mainly by the National Agricultural Technology Institute (INTA), which has built important public databases and research networks. **One notable example is SISINTA, the Argentine Soil Information System**, developed to safeguard and share soil profile data from across the country. INTA also leads national and international efforts in soil organic carbon mapping, including contributions to FAO-led global soil initiatives.

On food safety, Argentina does not appear to have a single soil-focused heavy metals regulation, but contaminant controls in the food system help address downstream risks linked to soil pollution. The Argentine Food Code, implemented through ANMAT and other competent authorities, sets contaminant rules for food products and therefore indirectly contributes to controlling exposure to substances such as heavy metals entering the food chain.

Academic and scientific communities also play a visible role. The Argentine Soil Science Association (AACS), founded in 1960, promotes research, technical exchange, and professional discussion on soil conservation and management, and remains one of the country's main reference bodies in the field.

A useful example of good practice is the growing integration of soil protection into broader landscape restoration and climate-resilient rural development efforts. Internationally supported programs in Argentina increasingly link sustainable land management, ecosystem restoration, and resilient food production, demonstrating how soil governance can be embedded in broader regional development strategies.

Despite these efforts, data availability remains fragmented. While Argentina possesses substantial technical capacity and valuable soil databases, monitoring is not yet fully harmonized at the national level, and differences across provinces can make it difficult to build a complete and consistent picture of soil degradation and contamination risks.

Brazil

Brazil is one of the world's largest agricultural producers, and soil protection is addressed through a broad set of environmental and land-management policies rather than through a single dedicated soil law.

The cornerstone of Brazil's environmental governance is the **National Environmental Policy** (Law No. 6938/1981), which establishes the principles of environmental protection and introduces the "polluter pays" principle, requiring those responsible for environmental damage to restore degraded areas. This framework is complemented by additional legislation, such as the **National Solid Waste Policy** (Law No. 12305/2010) and the **Environmental Crimes Law** (Law No. 9605/1998), which provide mechanisms to address pollution, hazardous waste management, and environmental liability. Together, these laws form the legal basis for tackling soil contamination and degradation across the country.

In practice, soil protection measures are closely linked to land-use regulation, conservation policies, and sustainable agriculture initiatives. For example, Brazil's Forest Code and other land governance tools regulate land clearing and require landowners to maintain native vegetation, which indirectly contributes to preventing soil erosion and degradation. Public policies and agricultural programs increasingly promote sustainable soil management practices such as conservation agriculture, crop rotation, and integrated crop-livestock-forestry systems to improve soil health and maintain productivity.



These approaches are also embedded in regional development and agricultural innovation programs led by the Ministry of Agriculture and state authorities to support climate-resilient farming systems and sustainable land management.

Enforcement and monitoring are mainly carried out by federal institutions such as the **Brazilian Institute of Environment and Renewable Natural Resources** (IBAMA) and the Ministry of the Environment, alongside state environmental agencies. These bodies are responsible for environmental licensing, monitoring polluting activities, and imposing sanctions for environmental violations. However, enforcement capacity varies across regions and governance levels, which can lead to uneven implementation of environmental protection. Soil monitoring is supported by national research initiatives and databases developed by public research institutions, although Brazil does not yet operate a fully integrated national soil monitoring system comparable to those existing in some other regions.

One notable good practice is the Soil Health BR Platform, developed by the Brazilian Agricultural Research Corporation (EMBRAPA) in November 2025. This initiative aims to assess and monitor soil health across Brazil and promote regenerative and climate-resilient agriculture by compiling soil data and supporting sustainable land management practices. The platform illustrates how research institutions and policymakers collaborate to improve soil monitoring and knowledge sharing. Academic institutions also play an important role in advancing soil science research. Universities such as the University of São Paulo and the Federal University of Viçosa (UFV) contribute significantly, while organizations such as the Brazilian Soil Science Society facilitate scientific exchange and policy discussions on soil conservation.

The Brazilian Society for Soil Science (SBCS), established in 1947, is recognized as the main scientific entity in Agricultural Sciences, SBCS seeks to strengthen collaboration among researchers, educators, and technical professionals working on soil and water issues in Brazil. The SBCS scientific structure is made up of four divisions, with Division 3 specializing in Soil Use and Management.

Civil society organizations are also active in promoting soil protection and sustainable land management. For instance, initiatives supported by organizations such as the Tropical Forest Alliance Brazil and other environmental NGOs focus on landscape restoration, sustainable supply chains, and responsible agricultural practices that enhance soil health and reduce land degradation. These initiatives complement governmental policies by engaging farmers, companies, and local communities in sustainable land-use practices.

Food safety policies also indirectly address soil contamination risks. The Brazilian Health Regulatory Agency (ANVISA) establishes limits for contaminants, including heavy metals such as cadmium and lead, in food products and conducts monitoring programs aimed at protecting public health. While these regulations do not directly regulate soil contamination, they contribute to managing risks associated with the transfer of contaminants from soils into agricultural products and food systems.

Despite these initiatives, data availability and monitoring remain fragmented. Comprehensive national soil quality datasets are still limited, and integrated assessments of soil degradation and contamination are often lacking. This highlights the need for stronger coordination between scientific research, agricultural policy, and environmental governance in Brazil.

The Brazilian Soil Health Partnership is an initiative linked to the Center for Carbon Studies in Tropical Agriculture (CCARBON). Its mission is to raise awareness about soil health, how to measure it, and its importance for the future of agriculture. The partnership included a team of 50 researchers developing innovative solutions for a more sustainable future.

Peru

In Peru, soil protection is increasingly recognized as an important component of environmental and agricultural policy, although it is not governed by a single overarching framework.

Instead, it is addressed through a combination of environmental, agricultural, and land-use legislation. **The General Environmental Law** (No. 28611) establishes the core principles of environmental protection and sustainable resource management, while the **Law on Conservation and Sustainable Use of Soils** (No. 30115) specifically promotes the protection, recovery, and sustainable use of soils as a strategic national resource. These legal instruments are supported by broader governance structures such as the National Environmental Management System, which coordinates environmental policy across sectors and levels of government.

In practice, soil protection is closely linked to sustainable land management and rural development priorities. Policies led by the Ministry of Agrarian Development and Irrigation promote practices such as soil conservation, agroecology, and improved water management, particularly in regions vulnerable to erosion and desertification. These efforts are especially relevant in the Andean and coastal zones, where soil degradation can significantly affect agricultural productivity and local livelihoods.



Environmental enforcement and monitoring are carried out by institutions such as the Ministry of the Environment (MINAM) and the Environmental Evaluation and Enforcement Agency (OEFA), together with regional authorities. These bodies are responsible for environmental oversight, compliance monitoring, and enforcement of regulations related to pollution and land degradation. However, similar to many countries with decentralized systems of governance, the capacity for implementation varies considerably, particularly in more remote areas.

Civil society and international cooperation projects further support soil protection efforts. Various programs focus on restoring degraded land, promoting sustainable agricultural practices, and strengthening community-based land management, particularly in rural and vulnerable regions.

Peru has also developed several initiatives to improve soil monitoring and data availability. The country participates in international soil mapping efforts coordinated by the FAO and has developed national environmental information systems that include soil-related indicators. Academic institutions such as the National Agrarian University La Molina play a key role in soil research and capacity building, while scientific organizations, including the Peruvian Society of Soil Science, contribute to knowledge exchange and policy discussions.

Food safety and agricultural policies also contribute indirectly to addressing soil contamination risks. The National Service for Agrarian Health (SENASA) and other authorities regulate inputs and monitor contaminants in agricultural production, including substances that may originate from soils and affect food safety.

Overall, while Peru has made progress in recognizing soils as a strategic resource and developing targeted policies, challenges remain in terms of data availability, monitoring, and consistent implementation. Strengthening coordination between environmental, agricultural, and regional development policies will be key to improving soil protection outcomes in the future.

China

China has developed one of the most comprehensive regulatory frameworks for soil protection among major economies, reflecting increasing concerns over environmental degradation and food safety.

A key milestone is the **Law on the Prevention and Control of Soil Pollution** (in force since 2019), which establishes a national system for soil risk assessment, monitoring, classification, and remediation. This law introduces core principles such as a prevention-first approach, risk-based management and polluter responsibility, while requiring local governments to take responsibility for soil protection outcomes. It complements the broader Environmental Protection Law (2015), forming the backbone of China's environmental governance framework. The Law on the Prevention and Control of Soil Pollution represents a major shift from fragmented regulation toward a more integrated and enforceable soil protection regime.

China's approach combines environmental regulation with land-use and food security policies. **The "Soil Ten Plan" (2016)** established national targets for improving soil quality and controlling contamination sources, particularly in agricultural land. This dual focus is supported by scientific evidence showing that soil pollution has become a severe environmental issue due to rapid industrialization and agricultural intensification.



Research consistently identifies heavy metals, especially cadmium, as key pollutants, with rising trends observed across major agricultural regions over recent decades. Additional meta-analyses confirm that heavy metal contamination is widespread and poses long-term risks to soil health and food production systems.

Institutional responsibilities are shared across several authorities, notably the Ministry of Ecology and Environment (MEE) and the Ministry of Agriculture and Rural Affairs (MARA), with strong involvement of local governments. Enforcement mechanisms include mandatory soil surveys, land classification systems, and remediation obligations for polluters. The regulatory framework also integrates soil protection targets into government performance assessments, strengthening accountability across administrative levels.

China has made significant investments in soil monitoring and data collection. **The National Soil Pollution Survey (2005–2013)** provided a baseline assessment of contamination across the country and informed subsequent regulatory development. However, while summary findings have been released, detailed datasets remain only partially accessible, limiting transparency and independent analysis. Academic literature confirms that many studies rely on regional datasets and fragmented monitoring systems, which makes it difficult to obtain a fully consistent national picture of soil contamination.

A notable example of good practice is the implementation of programs for the safe utilization of contaminated farmland. These initiatives combine agronomic techniques, soil amendments, and crop selection strategies to reduce the transfer of contaminants into food crops. Scientific studies show that diversified cropping systems and improved land management practices can help mitigate heavy metal accumulation in soils. Research institutions such as the Chinese Academy of Sciences (CAS) play a central role in developing remediation technologies and supporting policy implementation.

Food safety considerations are closely linked to soil protection policies. Studies demonstrate a direct relationship between soil contamination and food safety risks, particularly through the accumulation of heavy metals in crops, with cadmium identified as a major concern. China's regulatory framework addresses these risks through contaminant limits in food and integrated monitoring systems that connect soil quality, agricultural practices, and public health outcomes.

Overall, China has made substantial progress in establishing a structured and science-informed system for soil protection. However, challenges remain in ensuring consistent enforcement across regions, improving transparency and accessibility of soil data, and addressing legacy contamination in heavily industrialized areas. Strengthening coordination between environmental governance, agricultural policy, and scientific research will be critical to ensuring long-term soil sustainability.

India

In India, soil governance is spread across environmental law, agricultural regulation, land-restoration programs, and food-safety rules. The broad legal anchor is the Environment Protection Act (1986), which empowers the central government to set standards for the “quality of air, water, or soil” and for pollutant concentrations. Alongside this umbrella law, India regulates fertilizers through the **Fertilizer Control Order** (1985), which lays down quality specifications for fertilizers and, for several categories including organic fertilizers, sets maximum limits for heavy metals such as arsenic, cadmium, chromium, mercury, nickel, and lead. Food-related contaminant control is covered by the **Food Safety and Standards Act** (2006) and contaminant regulations issued under it. Taken together, this means that India’s soil policy framework is functionally real but legally fragmented: soils are protected through multiple sectoral instruments rather than a single coherent soil law.



In operational terms, India has increasingly framed soil protection through soil health, land-degradation neutrality, and sustainable agriculture rather than through classic contaminated-land regulation alone. The most visible national program is the **Soil Health Card Scheme**, launched in 2015, which supports states in testing farm soils and issuing farmers a card with results and nutrient-management recommendations.

Under the National Mission for Sustainable Agriculture, the Soil Health Management component also promotes location-specific nutrient management, residue management, organic inputs, and soil-fertility mapping. As a good-practice example, the Soil Health Card system stands out because it combines laboratory infrastructure, farmer-level advisories, and national digital reporting in a way that links policy to farm management. An impact study commissioned by the Ministry of Agriculture and carried out by MANAGE (National Institute of Agricultural Extension Management) found that the scheme was designed not only to improve fertilizer balance but also to support productivity, sustainability, and better use of soil-testing infrastructure.

Monitoring and data generation are spread across several institutions. The Central Pollution Control Board and State Pollution Control Boards are responsible for pollution control and contaminated-site oversight under environmental law, while the agriculture side relies heavily on the Ministry of Agriculture and Farmers Welfare, state departments, and technical bodies such as the **ICAR–National Bureau of Soil Survey and Land Use Planning**. India also has substantial geospatial capacity: ISRO’s Space Applications Centre publishes the Desertification and Land Degradation Atlas of India, and the Bhuvan geoportal makes soil and land-related spatial data available for planning and analysis. At the more detailed survey level, the Soil and Land Use Survey of India provides scientific databases on soil and land characteristics for planning purposes. These systems show that India does have significant institutional capacity for soil information, but the data architecture remains distributed across multiple agencies and platforms rather than consolidated in a single national soil-quality monitoring system.

A notable recent development is the notification of the Environment Protection (Management of Contaminated Sites) Rules (2025), which create a formal procedure for identifying suspected contaminated sites, carrying out preliminary and detailed site assessments, listing contaminated sites and assigning responsibilities. According to the Ministry of Environment, Forest and Climate Change, the rules require local bodies or district administrations to identify suspected sites, while State Pollution Control Boards and Pollution Control Committees must assess them and upload information to a centralized portal.

This is important because India had long relied more on guidance documents and case-by-case enforcement than on a dedicated nationwide contaminated-sites rulebook.

Several peer-reviewed studies from India report that heavy metals in agricultural soils can accumulate through wastewater irrigation, fertilizer and pesticide use, traffic, and industrial emissions, and may then transfer to vegetables and grains, creating food-chain risks. One widely cited study on north Indian food-crop systems found heavy-metal contamination in soils and staple crops, while later studies on agricultural soils in Jhansi and other regions similarly highlight cadmium, lead and related health concerns, especially for children and for communities near roads or polluted areas. These findings align with FSSAI contaminant rules and guidance notes on metals in food, which explicitly regulate food contamination resulting from environmental sources.

Overall, India has a substantial but uneven soil-protection framework: strong agricultural programs, extensive mapping and survey capacity, and now a more formal contaminated-sites regime, but still no single integrated soil law and no fully unified public soil-monitoring system.

Indonesia



Indonesia addresses soil protection through a combination of environmental, agricultural, and land-use regulations rather than through a single dedicated soil law.

The main legal basis is the **Environmental Protection and Management Law** (No. 32/2009), which establishes principles for pollution control, environmental restoration, and sustainable resource use. This framework is complemented by sectoral legislation such as the Forestry Law (No. 41/1999) and the Law on Sustainable Agricultural Cultivation Systems (No. 22/2019), which include provisions on land management and soil conservation. Together, these instruments create a multi-sectoral approach to preventing soil degradation, although soil-specific regulation remains fragmented.

In practice, Indonesia's soil protection policies are closely tied to land-use pressures, particularly deforestation, peatland degradation, and agricultural expansion. National strategies therefore prioritize ecosystem restoration and sustainable land management. Programs led by the Ministry of Environment and Forestry and the Peatland and Mangrove Restoration Agency focus on restoring degraded peat soils through rewetting, revegetation, and community-based management. These initiatives are widely recognized as good practice, as they address both soil degradation and climate mitigation by reducing emissions and fire risks.

Institutional responsibilities are shared across several authorities. The Ministry of Environment and Forestry oversees pollution control and environmental monitoring, while the Ministry of Agriculture focuses on soil fertility and agricultural land management. Enforcement relies on environmental permitting systems and environmental impact assessments, although implementation capacity can vary significantly across regions, particularly in remote or resource-intensive areas.

Indonesia has made progress in soil and land monitoring through national information systems and international cooperation. Environmental data are collected through platforms such as the **Indonesian Environmental Information System (SILH)**, and the country participates in FAO-led global soil initiatives. However, soil quality data remain fragmented and often project-based, limiting the ability to build a consistent national picture of contamination trends.

Moreover, studies have shown that heavy metal contamination is a growing concern in Indonesian soils, particularly in areas affected by mining, industrial activity, and intensive agriculture. For example, concentrations of cadmium and lead exceeding environmental standards in agricultural soils were found in parts of West Java. Other research highlights contamination risks around industrial and mining sites, where heavy metals such as zinc, cadmium, and vanadium have been detected at varying distances from emission sources. In agricultural contexts, studies also show that soils used for vegetable production can accumulate metals such as iron, zinc, manganese, and mercury, with magnetic susceptibility methods used as proxies for monitoring contamination levels.

Additionally, the link between soil contamination and food safety is evident from recent research. For instance, irrigation with polluted water can lead to elevated concentrations of heavy metals in both soils and crops for rice production systems, in some cases exceeding international food safety thresholds. This highlights the importance of integrating soil protection with food safety regulation and agricultural practices.

Food safety policies in Indonesia partially address these risks through the work of the **Indonesian Food and Drug Authority (BPOM)**, which sets contaminant limits for food products, including heavy metals. While these regulations primarily target food safety outcomes, they indirectly contribute to managing soil-related risks within agricultural systems.

Overall, Indonesia's approach to soil protection reflects a strong emphasis on ecosystem restoration and land-use management rather than standalone soil regulation. While institutional frameworks and good practices, such as peatland restoration, are well developed, challenges remain in terms of data fragmentation, monitoring consistency, and enforcement. Strengthening coordination between environmental policy, agricultural management, and scientific research will be essential to improving long-term soil governance and sustainability.

Japan

Japan regulates soil protection through a combination of soil-specific legislation, agricultural land rules, and broader environmental and food-safety measures, rather than through one all-encompassing soil code.

The central statute for urban and industrial contamination is the **Soil Contamination Countermeasures Act**, which aims to identify soil contamination by designated hazardous substances and prevent harm to human health. It requires investigations in certain circumstances, allows governors to designate regulated areas, and supports remedial or risk-management measures. Alongside this, the **Act to Prevent Soil Contamination on Agricultural Land** specifically targets contamination of farmland by hazardous substances, with a view both to protecting public health and preventing damage to agricultural production. Japan also applies Environmental Quality Standards for Soil Pollution under the Basic Environment Law, which set reference values for 29 items to protect human health and the living environment. Together, these instruments give Japan a relatively mature and clearly articulated legal framework for soil contamination control.

A distinctive feature of the Japanese system is that it differentiates between agricultural land contamination and site contamination linked to past industrial or commercial uses. For agricultural land, prefectural governors are required to continuously monitor soil conditions for cadmium, copper, and arsenic,



and can designate areas for counter-measures where standards are exceeded. For urban and industrial land, **the Soil Contamination Countermeasures Act** relies on trigger-based investigations, designated investigation agencies, and area-based controls, including restrictions on land alteration and requirements for remediation or exposure prevention. The Ministry of the Environment also publishes enforcement surveys and technical guidance, showing a regulatory model that combines statutory duties with detailed administrative procedures.

In practice, Japan's soil policy has long been shaped by heavy metal contamination, especially cadmium in paddy soils, often linked historically to mining and smelting. Academic literature describes cadmium as the most significant heavy-metal issue for Japanese agricultural soils and notes that contamination from old mines and smelters became a major social and agricultural concern. A recent legal analysis also shows that Japan's soil legislation evolved incrementally, with agricultural protection first and more comprehensive contaminated-land regulation later, reflecting the country's experience with pollution-related disease and land redevelopment.

One useful example of good practice is Japan's long-running approach to reducing cadmium risks in rice-producing areas. Government materials explain that Japan has combined agricultural countermeasures, contaminant standards for rice and area-based measures to reduce cadmium exposure. In parallel, research institutions under NARO have developed a Digital Soil Map of Japan, a web-based mapping tool that shows soil types and characteristics nationwide and is used for agricultural guidance, soil preparation and climate-related farmland assessment. This is a strong example of how Japan links regulation, farmer support, and public research infrastructure.

Monitoring and institutional responsibilities are relatively well defined. The Ministry of the Environment oversees the **Soil Contamination Countermeasures Act**, publishes annual enforcement-status surveys, and maintains guidance on soil and groundwater management. On the agricultural side, prefectures implement the agricultural land contamination framework, while the Ministry of Agriculture, Forestry and Fisheries (MAFF) monitors chemical hazards in food and agricultural products, including cadmium occurrence data and uses this information to verify whether risk-reduction measures in production areas are working. Japan therefore has stronger institutional continuity and reporting than many countries reviewed in this project. However, the system is still somewhat fragmented: data on contaminated sites, agricultural soil pollution, and broader soil characteristics are spread across different ministries, prefectures, and research bodies rather than consolidated in a single national portal.

Food safety is closely connected to soil governance in Japan. Government information from the Consumer Affairs Agency notes measures for cadmium in rice and broader contaminant controls in food, while MAFF has published surveillance data on chemical hazards in agricultural products. This means that soil protection is not treated only as an environmental issue but also as part of an integrated system for protecting agricultural production and consumer health.

Overall, Japan stands out for having a clear legal architecture, long experience with agricultural soil contamination, and relatively robust administrative tools. Its strengths lie in enforceable legislation, prefectural monitoring duties, and strong technical support from public institutions. The main limitation is less an absence of rules than the dispersion of information across legal and administrative channels, which can make comprehensive public access to soil-quality data less straightforward than the underlying institutional capacity would suggest.

Russia

Russia does not have a single stand-alone legislation on soil protection code, but it does have a dense legal framework that addresses soils through land, environmental, sanitary and agricultural legislation.

At the core is the **Land Code of the Russian Federation**, whose chapter on land protection states that the objectives of land protection include preventing and eliminating pollution, depletion, degradation, damage and destruction of land and soils, and restoring the fertility of agricultural land. This is complemented by the **Federal Law on Environmental Protection** (No. 7-FZ of 2002), which provides the broader legal basis for pollution prevention, restoration, and environmental supervision, and by the **Federal Law on State Regulation of Ensuring the Fertility of Agricultural Land** (No. 101-FZ of 1998), which sets obligations for land users to preserve and improve agricultural soil fertility. In other words, Russia's system is not soil-law-centered in form, but it is soil-relevant in substance, especially where agricultural land is concerned.

This framework treats soil contamination and soil degradation mainly through the lenses of land protection, fertility restoration and pollution control. The Land Code expressly regulates the use of land plots affected by chemical contamination, while the fertility law requires landowners and users to undertake measures aimed at preserving and reproducing soil fertility.



In practice, this means that Russia's approach is stronger on agricultural land management and legal duties attached to land use than on an integrated contaminated-sites regime of the type seen in some other jurisdictions. The Ministry of Agriculture has also linked soil fertility to state programs and specific measures such as liming, reclamation, and other agronomic interventions to maintain productive capacity.

Institutionally, soil-related governance is spread across several bodies. Rospirodnadzor carries out federal environmental supervision, including oversight of regulated facilities and compliance with environmental requirements, while the Ministry of Agriculture and its subordinate bodies are central for agricultural land monitoring and fertility policy.

An important operational actor is Rosselkhozemmonitoring, a federal institution whose mandate is to support the Ministry of Agriculture in the state monitoring of agricultural land and in the development of the Unified Federal State Information System on Agricultural Land. This is a significant example of good practice: although it is focused on agricultural land rather than all soils, it shows a move toward more systematic, digital monitoring of land condition, use, and fertility indicators. The Ministry of Agriculture also publishes periodic reports on the state and use of agricultural land, which help structure national-level information on soil-related pressures and management needs.

At the same time, data availability remains one of the clearest weaknesses of the Russian system. Monitoring information exists, but it is dispersed across environmental supervision, hydrometeorological reporting, agricultural monitoring, and region-specific studies. For instance, assessments of heavy-metal pollution in Russian soils often depend on a mixture of open scientific publications and environmental agencies' reporting documents rather than on a single national database: while many surveyed agricultural soils remained below critical limits on average, the coverage of surveys should be expanded and approaches to pollution indicators should be unified. Russia has substantial institutional capacity, but the accessibility and consistency of soil data remain uneven.

Data also show that soil contamination in Russia is highly spatially differentiated. Studies point to long-standing heavy-metal pollution around major metallurgical and industrial centers, while agricultural soils are generally

less severely affected on average, though local exceedances still occur.

Food safety and agricultural market control also intersect with soil governance. While Russia does not appear to regulate heavy metals in soils through a single food-law pathway, Rosselkhoznadzor and related authorities monitor agricultural commodities, and this broader control architecture is relevant where soil contamination may affect crop quality and safety. In this sense, Russia's soil regime is best understood as a distributed system: land law, environmental law, agricultural fertility rules, and product-control mechanisms all contribute pieces of the overall framework. The main gap is therefore not the total absence of rules, but the fragmentation of competencies and data. Strengthening interoperability between monitoring systems, improving public access to soil-quality information, and broadening survey coverage would make the existing legal framework more effective in practice.

Tunisia

Tunisia has a relatively well-developed legal basis for soil protection, but it is spread across several instruments rather than consolidated in a single “soil code.”

The most directly relevant statute is the **Law on Water and Soil Conservation**, which establishes the framework for interventions to protect soils against water and wind erosion, sand encroachment, and degradation, and applies to slopes, glacis, wadis, mountain foothills, and other vulnerable areas. Another important piece of legislation is the **Water Code**, which governs hydraulic public domain management and water protection and is highly relevant to salinization and erosion risks in irrigated and semi-arid areas. Tunisia’s broader environmental framework is reinforced by the legislation establishing the **National Environmental Protection Agency (ANPE)**, including Law No. 92-115 of 1992, which underpins environmental impact assessment obligations for activities likely to affect the environment. In practice, soil protection is therefore regulated through a mix of conservation, water, land-use, and environmental-impact rules rather than through a single integrated soil pollution law.

The Tunisian approach has historically focused more on erosion control, desertification, salinity and sustainable land management than on contaminated-land regulation in the narrow sense. This reflects the country’s agroecological conditions: soil degradation is strongly driven by aridity, fragile soils, water scarcity, and unsustainable land use, especially in



the center and south. Official and academic sources alike describe erosion, salinization, and desertification as major soil threats. A classic national overview notes that the Ministry of Agriculture’s soil services have long been responsible for studying and monitoring soil resources, while more recent academic work confirms that land degradation remains a structural challenge and that governance is still fragmented across institutions and policy domains. Recent scientific studies also show that salinity remains a major pressure on irrigated soils. A study from 2023 reported that roughly half of Tunisia’s irrigated area is affected by salinization, driven by arid conditions, low-quality irrigation water, shallow saline groundwater, and weak drainage.

Institutionally, responsibilities are distributed across several bodies. The Ministry of Agriculture, Water Resources and Fisheries and its technical directorates lead on agricultural land, erosion control, and water and soil conservation, while the ANPE and the Tunisian Observatory for the Environment and Sustainable Development (OTEDD) support environmental oversight and information management. OTEDD is a permanent mechanism for collecting, producing, analyzing, managing, and disseminating environmental information to support public decision-making. On the

research side, Tunisia has a significant public scientific infrastructure: the Institution of Agricultural Research and Higher Education (IRESA) coordinates the agricultural research system, and institutes such as the National Research Institute for Rural Engineering, Water and Forestry (INRGREF) work specifically on rural engineering, water, forestry, and soil conservation. This institutional density is a strength, but it does not automatically translate into a unified public soil-monitoring system. Soil-related information exists in multiple repositories and projects, but it remains dispersed across ministries, observatories, research institutes, and international platforms.

A notable best-practice example is Tunisia's long-standing investment in sustainable land and water management in oasis systems. The World Bank's Oases Ecosystems and Livelihoods Project supported the scaling up of sustainable land and water management and biodiversity conservation techniques to protect oases against flooding, sand invasion, and land degradation while improving productivity and livelihoods. Building on this logic, the GEF-backed Oasis Landscape Sustainable Management initiative was designed to expand integrated oasis management and landscape restoration. Another current example is the SoilFER project, launched by the FAO and Japan in 2025, which aims to generate updated soil data, detailed soil maps, and decision-support tools for farmers and government. These initiatives are particularly relevant because they combine restoration, data production, and local land-management support rather than treating soils only as a pollution-control issue.

On monitoring and data availability, Tunisia appears to have important technical capacity but incomplete integration and public accessibility. The UNCCD national report and work led by the Sahara and Sahel Observatory point to national efforts to address desertification and achieve land degradation neutrality, including training and capacity building. Tunisia also has legacy soil datasets such as the SOTER Tunisia database, compiled under the FAO's Land Degradation Assessment in Drylands framework from existing surveys and publications. Yet recent academic work still describes monitoring and governance as fragmented, with a need for stronger institutional coordination and more operational data systems. A 2023 remote-sensing study on Greece and Tunisia also underlined the usefulness of Sustainable Development Goal (SDG) 15.3.1 tools for tracking land degradation, suggesting that geospatial monitoring can help fill part of the evidence gap.

Although explicit soil pollution regulation is limited, environmental protection and food-system considerations remain significant. Tunisia's environmental impact assessment regime applies to many industrial, commercial, and agricultural activities with potential environmental effects, and this can indirectly help manage risks to soils from waste, effluents, and poorly planned land use. Overall, Tunisia's framework is stronger on soil and water conservation, anti-desertification policy, and land-restoration practice than on a dedicated contaminated soil regime. Its main challenge is therefore not the absence of laws or institutions, but the need to connect them better: linking conservation law, environmental permitting, scientific monitoring, and public data systems would make Tunisia's soil governance more coherent and easier to evaluate over time.

Morocco

Morocco has a relatively dense framework of legislation on soil, water and environment that together cover major soil risks.

The most directly relevant instrument is the **Law on Water and Soil Conservation**, which provides the legal basis for interventions against erosion, silting, desertification pressures, and land degradation in vulnerable areas. This sits alongside **Law No. 11-03 on the Protection and Improvement of the Environment**, which establishes general principles such as prevention and the polluter-pays approach, and the Law on Environmental Impact Studies, which requires environmental assessment for projects likely to affect natural resources, including land and soil. Morocco's **Water Code** is also relevant because water scarcity, salinization, and poorly managed irrigation are central drivers of soil degradation in the country. Taken together, these instruments show that Morocco's soil governance is legally real, but spread across conservation, environmental, and water legislation rather than consolidated in one overarching soil statute.

In policy terms, Morocco's soil agenda has historically focused more on erosion control, fertility management, desertification and sustainable land use than on contaminated-land regulation in the narrow sense. This reflects the country's exposure to aridity and pressure on agricultural land. A presentation prepared for the FAO Global Soil Partnership notes that only about 28% of Morocco's national soil resources have been mapped and characterized at different scales, underlining the importance of soil survey and mapping



for planning and resource protection. Morocco has also invested for years in soil-fertility work through agricultural research and public programs; INRA's own activity reporting refers to soil databases, land-suitability mapping, and the development of soil-fertility maps as tools for better agricultural planning. These efforts suggest a policy model in which soil protection is closely tied to agricultural productivity and land stewardship rather than treated only as a pollution-control issue.

Institutionally, responsibilities are distributed across several bodies. The Ministry of Agriculture leads on agricultural soils, land management, and irrigation-related issues; the **Agence pour le Développement Agricole** embeds natural-resource preservation into agricultural investment and rural development policy; and environmental oversight is supported through impact-assessment and environmental-governance mechanisms under the environment ministry and related agencies. Research capacity is particularly important in Morocco's system.

The Institut National de la Recherche Agronomique (INRA) has a long history of soil mapping and agronomic research, including work on soil suitability, crop monitoring, and drought-related soil moisture assessment. This gives Morocco a stronger scientific base than is sometimes visible from legislation alone, although institutional responsibilities remain somewhat fragmented between conservation, agriculture, irrigation, and the environment.

A notable example of good practice is Morocco's long-running effort to produce soil fertility maps and decision-support tools for farmers and policymakers. INRA reports that, under agreements involving public authorities and OCP, the country developed projects on "Agricultural Soil Fertility Maps in Morocco" as part of wider agricultural modernization efforts. More recently, in 2025, the first national high-resolution reference maps of available phosphorus and exchangeable potassium across Moroccan croplands were also presented based on thousands of soil samples and digital soil mapping methods. This is important because it moves Morocco toward more operational, spatially explicit soil management rather than relying only on broad agronomic recommendations. Another relevant practice is CGMS-Maroc, a crop growth monitoring and drought early-warning system developed over two decades, which integrates climate, crop, and soil moisture information to support food-security planning in rainfed cereal systems.

On contamination, Morocco appears to have more evidence than regulation: heavy-metal risks around mining and industrial areas, including lead, cadmium, zinc, and arsenic contamination in soils near former mining zones and industrial clusters, have been repeatedly identified. This shows that Morocco's practical soil challenge is not only erosion and desertification, but also the legacy of industrial and extractive activities in particular territories. However, available information remains uneven and often site-specific rather than consolidated in a national public soil-contamination platform.

Data availability is therefore a mixed picture. Morocco clearly has institutional capacity, soil science expertise, and mapping experience, but public access to harmonized national soil datasets still appears incomplete. The FAO material indicating partial national mapping coverage, combined with the need for recent academic projects to generate new baseline fertility maps, points to a landscape where soil data exist but are not fully standardized or easily accessible in one place. In the absence of a highly visible national soil-contamination portal, environmental impact assessment, agricultural surveys, and research projects continue to fill part of the gap. Food-safety controls also provide an indirect safeguard: ONSSA oversees food safety and contaminant-related controls, while Moroccan regulations on contaminants in food products help manage downstream risks where pollutants move from soils into the food chain. Overall, Morocco's framework is stronger on soil and water conservation, fertility management, and land-restoration practice than on a dedicated contaminated-soils regime; its main policy need is greater integration between legal rules, monitoring systems, and publicly accessible soil data.

ADDITIONAL KEY REGIONS

South Africa



South Africa regulates soils through a combination of agricultural resource conservation law, general environmental law and a more specific contaminated-land regime, rather than through a single standalone soil act. The Conservation of Agricultural Resources Act No. 43 of 1983 (CARA) is the main soil-conservation statute: it is intended to control the use of natural agricultural resources to promote the conservation of soil, water sources, and vegetation. At the broader environmental level, the National Environmental Management Act No. 107 of 1998 (NEMA) sets the overarching principles for preventing pollution and ecological degradation and for cooperative environmental governance. Contaminated land is then addressed more directly under the National Environmental Management: Waste Act No. 59 of 2008, especially Part 8 and the associated National Norms and Standards for the Remediation of Contaminated Land and Soil Quality, which establishes a framework for identifying contaminated land and using soil screening values in site assessment and remediation. Together, these instruments give South Africa a relatively advanced legal architecture for soil protection, even if responsibilities are split across sectors.

In practice, however, South Africa's soil agenda extends well beyond contaminated land. A large share of policy attention is focused on erosion, overgrazing, veld degradation, declining soil fertility, and desertification, especially in dryland agricultural systems. The Department of Agriculture, Land Reform and Rural Development identifies CARA as a

core statute within its mandate, and South Africa's 2022 report to the UNCCD (United Nations Convention to Combat Desertification) describes national efforts to address degradation linked to overgrazing, soil erosion, poor storm-water management and unsustainable land use. Academic work on the country's Land Degradation Neutrality (LDN) process similarly notes that South Africa has developed national LDN targets and has tried to embed sustainable land management more systematically across policy sectors. This means that, compared with some countries where soil policy is framed mainly around industrial contamination, South Africa's soil governance is more visibly tied to land productivity, ecosystem restoration, and climate-resilient land management.

Institutionally, enforcement and monitoring are divided between environmental and agricultural authorities. The environmental side is led by the national department responsible for environment and by provincial environmental authorities, using NEMA and the Waste Act, while agricultural land conservation falls mainly under DALRRD and provincial agriculture departments. A major technical actor is the Agricultural Research Council (ARC), especially its Soil, Climate and Water program, which states that it maintains the Soil Information System as a national asset. ARC materials further indicate that this system includes a substantial soil profile database

and national soil information resources that support classification, mapping, soil quality work and land-use planning. This is one of the clearer examples of good practice in South Africa: while not a regulatory instrument, the ARC soil information infrastructure provides the scientific basis needed for better agricultural management and for evidence-based soil governance. ARC's recent planning documents also show continuing work on soil-health monitoring and national soil-related research services.

A second useful practice example is South Africa's active engagement in Land Degradation Neutrality target-setting and implementation. The UNCCD documentation and recent official statements linked to South Africa's 2025 G20 presidency show that the country has elevated desertification, land degradation and drought issues politically and is positioning LDN implementation as a priority. This matters for soil protection because it links local soil and rangeland management to national planning, restoration priorities, and international reporting. In parallel, the Soils4Africa initiative, in which South African institutions have been involved, aims to improve soil information systems through harmonized methodologies and open-access soil information for African agricultural land. While continental in scope, it is relevant as an example of how South Africa's domestic soil-information capacity connects to broader regional monitoring efforts.

Regarding contamination, a 2020 review on threats to soil and water resources in South Africa describes a broad range of pressures, including erosion, nutrient depletion, salinization and pollution. Other studies document heavy metal contamination in mining-affected soils and sediments, for example in platinum and gold-mining areas, and argue

that soil pollution around mining districts remains a significant ecological and human-health concern. This is especially relevant in South Africa, where legacy mining landscapes intersect with settlements, agriculture, and water systems. Academic work has also argued that South Africa needs more context-specific soil-quality risk assessment because mining-impacted soils can present risks that are not always well captured by generic screening approaches.

Food safety provides another indirect but important entry point. South Africa's Regulations Relating to Maximum Levels of Metals in Foodstuffs set maximum levels for metals in food under the Foodstuffs, Cosmetics and Disinfectants Act, which helps manage downstream risks when contaminants move from soil into crops and food products. Research on home-grown vegetables and other foodstuffs in South Africa has shown that metal uptake can be a real concern in some contexts, reinforcing the link between soil quality, agricultural practices, and public health.

Overall, South Africa has stronger legal and institutional foundations for soil protection than many countries, especially because it combines a contaminated-land regime with a long-standing agricultural resource conservation framework. Its main weakness is not a lack of law, but the fragmentation of data and mandates. Soil information exists through ARC, UNCCD reporting, provincial systems, and environmental regulators, yet it is not always presented in one transparent, harmonized national platform. Improving interoperability between agricultural monitoring, contaminated-land enforcement, and publicly accessible soil datasets would make South Africa's already substantial framework more coherent and more effective over time.

United States of America

The United States has a highly developed, but decentralized, soil-protection framework, combining federal environmental cleanup laws, agricultural conservation programs, and extensive state-level rules.

There is no single federal measure on soil protection; contaminated land is mainly addressed through CERCLA/Superfund, which gives the Environmental Protection Agency (EPA) authority to respond to releases or threatened releases of hazardous substances that may endanger public health or the environment. Soil contamination is also managed through the **Resource Conservation and Recovery Act** (RCRA) for hazardous waste and corrective action, while EPA's Regional Screening Levels provide nationally used comparison values for contaminants in soil, air, and drinking water during site assessment. This gives the United States a strong contaminated-land framework, but one that is primarily risk-based and site-specific rather than a comprehensive soil-health regime.

Agricultural soil protection is addressed mainly through the **USDA Natural Resources Conservation Service** (NRCS), which provides technical and financial support for soil conservation, erosion reduction, nutrient management, cover crops, and soil-health practices. The Web Soil Survey, operated by NRCS using data from the National Cooperative Soil



Survey, is one of the clearest examples of good practice: it provides online soil maps and information for more than 95% of US counties, supporting land-use planning and farm management decisions. NRCS also runs soil-health programs and tools to help farmers improve soil structure, organic matter, water retention, and resilience.

Monitoring and data availability are comparatively strong, but not fully integrated. The **National Resources Inventory** (NRI) tracks land cover, soil erosion, wetlands, conservation practices, and related natural-resource indicators at scientifically selected sample sites. USDA's Economic Research Service reports that the 2017 NRI found water-driven erosion above tolerance levels on around 18% of cultivated cropland and wind-driven erosion above tolerance on around 14%, showing that erosion remains a significant agricultural soil issue.

At the same time, contaminated-site data are managed separately through EPA systems such as Superfund and Brownfields databases, while many states maintain their own contaminated-sites inventories. This creates a paradox: the United States has very rich soil and land data, but information is fragmented across agricultural, environmental, federal, state, and local platforms.

A notable good-practice example is the EPA Brownfields and Land Revitalization Program, which provides grants and technical assistance to assess, clean up and reuse contaminated or potentially contaminated properties. The program is relevant to soil protection because it links contamination management with urban regeneration, local economic development, and environmental justice. EPA describes Brownfields support as helping communities, states, tribes, and others to assess and safely clean up contaminated properties for sustainable reuse.

Food safety also connects to soil contamination policy. The FDA recognizes that environmental contaminants can enter food because they are present in soil, water, or air where foods are grown, and its **Closer to Zero** initiative aims to reduce children's dietary exposure to contaminants such as lead, arsenic, cadmium, and mercury. This provides an indirect but important soil-related safeguard, especially where heavy metals move from soil into crops.

The multi-layered approach of the United States of America reflects its complex federal system. For instance, on soil contamination, research highlights heavy metals and pesticides as persistent risks for crop health, ecosystems, and human exposure, while US-specific research continues to underline the importance of site-specific risk assessment, legacy pollution management, and sustainable soil-health practices. Overall, the United States has strong legal tools, advanced datasets, and extensive conservation infrastructure, but soil governance remains fragmented between pollution cleanup, agricultural conservation, food safety, and state-level implementation.

Australia

Australia's soil protection framework is composed of a combination of national soil policy, contaminated-land standards, state and territory regulation and agricultural soil-health programs.

Unlike countries with a single soil code, Australia relies on a federal model in which the Commonwealth sets national strategies and technical frameworks, while states and territories implement most land-use, planning and contaminated-land controls. The most important recent policy document is the **National Soil Strategy**, released in 2021 as Australia's first national soil policy. It sets a 20-year vision to "value, manage and improve" soils and is built around three goals: prioritizing soil health, empowering soil innovation and soil stewards, and strengthening soil knowledge and capability. The Strategy is complemented by the National Soil Action Plan, which supports practical implementation and investment in soil data, monitoring, and stewardship.

For contaminated land, the core national instrument is the **National Environment Protection (Assessment of Site Contamination) Measure (ASC NEPM)**. The ASC NEPM, originally made in 1999 and amended in 2013, establishes a nationally consistent risk-based approach for assessing site contamination and protecting human health and the environment where contamination has occurred. It provides technical schedules, investigation levels, and guidance used by regulators, environmental auditors, consultants, landowners, developers, and industry. However, implementation is still carried out through state and territory



legislation and environmental protection agencies, meaning that practical enforcement can vary between jurisdictions. This gives Australia a strong and technically sophisticated contaminated-land framework, but one that remains decentralized in application.

Australia's broader soil pressures are not limited to contamination. National environmental reporting identifies erosion, acidification, salinization, sodification, soil carbon loss, contamination, and urban and industrial expansion as major pressures on Australian soils, with climate change adding further stress through droughts, extreme weather events, and rising temperatures. Academic research similarly frames agricultural soil degradation in Australia as a multi-driver challenge, linked to erosion, structural decline, salinity, acidification, nutrient imbalance, and land-management practices. This helps explain why Australian soil policy places strong emphasis on soil health, agricultural resilience, and climate adaptation, not only on polluted sites.

A notable good-practice example is the development of national soil-information infrastructure. The Australian National Soil Information System (ANSIS), led by CSIRO with government support, provides access to nationally consistent soil data and information to support sustainable soil management. It builds on Australia's long history of soil mapping and responds directly to the problem of fragmented soil datasets across jurisdictions and institutions. The National Soil Monitoring Program, also led by CSIRO, is intended to provide nationally consistent soil data that can indicate trends in soil health and condition over time. These initiatives are particularly relevant because they address one of the main weaknesses of soil governance: the lack of harmonized, accessible, long-term soil monitoring data.

Institutionally, responsibilities are spread across several levels. The Department of Agriculture, Fisheries and Forestry leads national soil strategy and agricultural soil-health policy, while the Department of Climate Change, Energy, the Environment and Water oversees national environmental protection frameworks, including the National Environment Protection Measures. State and territory environment protection authorities are responsible for contaminated-land regulation, site audits, remediation orders, and land-use controls. Research and technical capacity are supported by CSIRO, universities, state agriculture agencies, and professional bodies such as Soil Science Australia. This network gives Australia considerable expertise, but it also reinforces the need for coordination between federal strategy, state regulation, research infrastructure, and farm-level implementation.

Academic studies on Australian soils show how food safety and soil contamination remain relevant. Research on vegetables grown in urban and metal-smelter-affected areas in New South Wales found that heavy metals

such as cadmium, lead, zinc, and copper could be a dietary exposure concern when crops are produced on contaminated soils. More recent work on residential and community gardens in Melbourne similarly assessed soil metal contamination risks, especially lead, showing that legacy contamination can be relevant even outside industrial sites. These findings link soil protection to food safety, urban agriculture, and public health, complementing the regulatory focus of the ASC NEPM.

Overall, Australia has a strong and increasingly strategic soil governance framework, with advanced contaminated-site assessment standards and important national soil-data initiatives. Its main challenge is not the absence of policy, but the fragmentation of implementation and information across federal, state, territory, scientific, and private systems. Continued development of ANSIS and the National Soil Monitoring Program, together with better integration of contaminated-land regulation and agricultural soil-health policy, will be central to improving long-term soil protection.

European Union

Across the European Union, soil protection is governed by a complex and multi-layered regulatory framework, rather than a single dedicated soil law.

As highlighted in the Safer Phosphates Foundation's White Book (2024) and Ground Rules (2025) publications, soil governance in Europe is embedded in a wide range of policies covering agriculture, environment, chemicals, and food safety. Central among these is the **EU Fertilizing Products Regulation (EU) 2019/1009**, which sets limits on contaminants such as cadmium in fertilizers and promotes the use of lower-contaminated inputs. However, while this regulation provides a baseline at EU level, the reports emphasize that it remains insufficient to fully prevent long-term soil contamination, as current thresholds (e.g., 60 mg/kg P₂O₅ for cadmium) still allow for gradual accumulation in soils over time.

More broadly, soil protection in the EU is addressed indirectly through multiple legal instruments, including water, waste, industrial emissions, and agricultural policies. The White Book highlights that directives such as the **Water Framework Directive and Industrial Emissions Directive** contribute to limiting pollutant inputs to soils, while CAP measures promote more sustainable land management practices.



Nevertheless, this fragmented approach results in uneven coverage of soil-related risks, particularly for diffuse agricultural pollution and the long-term accumulation of contaminants.

A key development in recent years is the emergence of EU-level soil monitoring and governance initiatives. While no binding EU soil law has historically existed, the publications note increasing political momentum toward a more structured approach, including the proposed **Soil Monitoring Law under the EU Soil Strategy for 2030**. This initiative aims to establish a harmonized framework for soil monitoring, data collection, and assessment across Member States, addressing one of the major gaps identified in both reports: the lack of consistent and comparable soil data at EU level. Currently, soil monitoring relies on a patchwork of national systems and EU tools such as the LUCAS survey, which, although valuable, does not provide a fully integrated or continuous monitoring system.

Both publications emphasize that soil contamination by heavy metals, particularly cadmium, remains a critical issue.

Cadmium is identified as a persistent pollutant that accumulates in soils and can enter the food chain, posing risks to human health and ecosystems. The Ground Rules report shows that Member States adopt very different approaches: some have introduced stricter national limits and proactive measures, while others rely primarily on EU-level standards. This leads to uneven levels of protection across the Single Market, as well as differences in enforcement and monitoring practices.

Monitoring and data availability therefore remain central challenges. Despite initiatives at EU level, soil data are still fragmented, heterogeneous, and often not fully accessible, making it difficult to assess contamination trends and policy effectiveness. The proposed Soil Monitoring Law is expected to address these issues by introducing common indicators, harmonized methodologies, and regular reporting obligations, thereby improving transparency and supporting evidence-based policymaking.

At the same time, the EU policy landscape is increasingly shaped by broader sustainability objectives under the **European Green Deal** and the **Zero Pollution Ambition**. The Safer Phosphates Foundation argues that reducing heavy metal inputs through fertilizers is a key and actionable pathway to improving soil quality. Among the recommendations highlighted in the White Book are stricter cadmium limits, greater harmonization across Member States, and increased investment in low-contaminated fertilizers and innovation.

Overall, the EU has a relatively advanced but fragmented soil governance system, characterized by strong sectoral policies but limited integration.

While regulatory tools exist to address specific pressures, the absence of a comprehensive soil framework and harmonized monitoring system has long been a structural weakness. The development of a Soil Monitoring Law represents a significant step toward addressing these gaps, but its effectiveness will depend on implementation, enforcement, and the alignment of national and EU-level policies.



Conclusion

This publication set out to provide a comparative overview of soil protection frameworks across a diverse group of countries and other key regions around the world. Despite significant differences in legal systems, agricultural models, and environmental conditions, several clear cross-cutting findings emerge.

First, soil protection remains a fragmented policy area globally. Only a limited number of countries have adopted dedicated soil legislation, while most rely on a combination of environmental, agricultural, land-use, and food safety frameworks. In many cases, these instruments provide partial coverage of soil-related risks but lack integration, particularly when it comes to long-term contamination processes such as the accumulation of heavy metals. This fragmentation is evident across both advanced and emerging economies, from the decentralized systems of the United States and Australia to the multi-layered but uneven frameworks observed in countries such as India, Indonesia, and Morocco.

Second, the analysis confirms that soil degradation and contamination are closely intertwined challenges. While traditional soil policies have focused on erosion, desertification, and fertility loss, increasing attention is now being given to contamination risks, especially from industrial activities, mining, and agricultural inputs. Heavy metals such as cadmium, lead, mercury, and arsenic represent a particularly important concern due to their persistence, bioaccumulation, and direct links to food safety and human health. Across several countries examined, contamination is not always addressed through explicit

soil legislation but rather indirectly through environmental controls, agricultural standards, or food safety regulations.

Third, monitoring and data availability remain among the most significant global gaps. While many countries have developed strong scientific expertise and technical capacity, soil data are often fragmented, inconsistent, or not publicly accessible. Even in countries with advanced systems, such as the United States or Australia, information is spread across multiple platforms and institutions. In others, monitoring is limited or project-based, making it difficult to assess trends or design targeted policy responses. The development of harmonized soil monitoring systems and digital tools therefore emerges as a critical priority.

At the same time, the report highlights several promising practices and policy innovations. These include national soil monitoring platforms (e.g., Brazil's Soil Health initiatives, Australia's National Soil Information System), targeted remediation and land restoration programs (e.g., China's contaminated farmland management, Indonesia's peatland restoration), and farmer-oriented tools such as soil health cards in India. These examples demonstrate that effective soil governance requires a combination of regulation, scientific knowledge, and practical implementation at the farm level.



Against this backdrop, preventing heavy metal contamination must become a central component of soil protection strategies worldwide. This requires coordinated action across policy-makers, farmers, industry, and research communities.

Recommendations for Policymakers

Policymakers play a key role in establishing the regulatory and economic conditions necessary to protect soil health. Based on the findings of this report, the following actions are recommended:

- Encourage and support the implementation of the **FAO International Code of Conduct for the Sustainable Use and Management of Fertilizers**, which provides globally recognized principles for responsible fertilizer management, including minimizing contamination risks;
- Align national and regional legislation with international best practices to ensure **consistency, credibility, and comparability** across jurisdictions;
- Establish and periodically review **science-based limit values for heavy metals** in fertilizers, soils, food, water, and air, taking into account long-term accumulation effects. Priority heavy metals should include cadmium (Cd), lead (Pb), mercury (Hg), arsenic (As), and chromium (Cr) due to their toxicity and persistence in agricultural systems;
- Promote international standards to avoid regulatory fragmentation and ensure a **level playing field for agricultural and industrial stakeholders**;
- Introduce or strengthen **systematic soil monitoring programs**, including harmonized indicators and long-term data collection;
- Support the development of **digital tools, traceability systems, and data platforms** to improve reporting, transparency, and risk assessment;
- Promote the use of **fertilizers with low heavy metal content** through incentives, labelling schemes, or public procurement criteria;
- Invest in **research, innovation, and knowledge-sharing initiatives**, including collaboration between public authorities, research institutions, and the private sector.

01



Implement the **FAO International Code of Conduct for the Sustainable Use and Management of Fertilizers**, which provides globally recognized principles for responsible fertilizer management, including minimizing contamination risks.

05



Introduce or strengthen **systematic soil monitoring programs**, including harmonized indicators and long-term data collection.

02



Align national and regional legislation with international best practices to ensure consistency, credibility, and comparability across jurisdictions.

06



Support the development of **digital tools, traceability systems, and data platforms** to improve reporting, transparency, and risk assessment.

03



Establish and periodically review **science-based limit values** for heavy metals in fertilizers, soils, food, water, and air, taking into account long-term accumulation effects. Priority heavy metals should include cadmium (Cd), lead (Pb), mercury (Hg), arsenic (As), and chromium (Cr) due to their toxicity and persistence in agricultural systems.

07



Promote the use of **fertilizers with low heavy metal content** through incentives, labelling schemes, or public procurement criteria.

04



Promote **international standards** to avoid regulatory fragmentation and ensure a level playing field for agricultural and industrial stakeholders.

08



Invest in **research, innovation, and knowledge-sharing initiatives**, including collaboration between public authorities, research institutions, and the private sector.

Recommendations for Farmers

Farmers are at the frontline of soil management and play a critical role in preventing soil degradation and contamination. The following practices are recommended:

- Conduct **regular soil analyses** to monitor heavy metal concentrations and detect potential risks at an early stage;
- Apply fertilizers responsibly and, where possible, select products with **low levels of contaminants**;
- Follow best practices consistent with the **FAO Code of Conduct for Fertilizers**;
- Implement the **Voluntary Guidelines for Sustainable Soil Management**, where feasible, to improve soil structure, fertility, and resilience;
- Participate in **training and knowledge-sharing initiatives** to stay informed about evolving practices, technologies, and regulatory requirements.

In conclusion, this report underscores that **soil protection is both a local and a global challenge**. While regulatory approaches differ, the underlying risks are shared, and so are the opportunities for improvement. Strengthening soil governance, improving data systems, and reducing contamination risks, particularly from heavy metals, will be essential to ensuring **sustainable agriculture, safe food systems, and environmental resilience** for future generations.





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