HEAVY METAL POLLUTION: ENVIRONMENT

NEWS: About 242 million hectares of world's agricultural land contaminated by toxic heavy metal pollution

WHAT'S IN THE NEWS?

A global study has found that 242 million hectares of agricultural land are contaminated by toxic heavy metals, threatening food security and public health. Cadmium, arsenic, lead, and other metals—mainly from fertilizers, mining, and industrial waste—are affecting nearly 1.4 billion people, especially in Asia and Africa.

Context and Recent Findings

- A study published in *Science* led by researchers from **Tsinghua University** analyzed over **1,000 global datasets** to assess heavy metal contamination in agricultural soils.
- The findings reveal that approximately **242 million hectares of global agricultural land** are contaminated by toxic heavy metals.
- The study estimates that **14–17%** of all agricultural land **exceeds safe limits** for at least one toxic heavy metal, threatening **food security, ecosystems, and human health**.
- The contamination poses risks to **900 million to 1.4 billion people** globally, particularly in developing and densely populated regions.

Key Regions and Contaminated Belts

- A **heavily polluted belt** stretches across **Southern Europe, the Middle East, South Asia, and Southern China**.
- These areas are most affected due to **centuries of mining activity, industrialization, irrigation practices, and the geological presence of natural metals** in the soil.
- The contamination varies by region:
    - **Cadmium** is the most **widespread globally**.
    - **Nickel, chromium, arsenic, and cobalt** are dominant pollutants in **regional hotspots** across Asia, Africa, and parts of Russia.

What is Heavy Metal Contamination?

- **Definition**: Heavy metal contamination occurs when concentrations of toxic metals and metalloids in the soil **exceed natural or safe thresholds**, rendering land unsuitable for agriculture or habitation.
- **Persistence**: These metals do **not degrade over time** like organic pollutants, making their impact **persistent across generations**.

- **Common heavy metals** involved include **cadmium, lead, arsenic, nickel, mercury, chromium, and cobalt**.

Sources and Impacts of Heavy Metals on Agriculture and Health

Heavy Metal	Primary Sources	Agricultural Impact	Human Health Impact
Cadmium	Phosphate fertilizers, mining, industrial waste	Reduces crop yield, soil toxicity	Kidney damage, bone diseases
Arsenic	Groundwater used for irrigation, pesticides, mining	Contaminated rice and crops, lower productivity	Cancer risk, food poisoning
Lead	Vehicle exhaust (historically), industrial emissions	Soil infertility, disrupted plant growth	Neurological damage, developmental delays
Nickel	Fossil fuel combustion, metallurgical operations	Plant toxicity, reduced germination	Respiratory issues, skin irritation
Chromium	Leather tanning, dyes, pigments, electroplating	Hinders seed germination, toxic to microbes	Liver and lung damage
Cobalt	Mining and smelting processes	Bioaccumulation in food crops	DNA damage, thyroid dysfunction

Why It Matters: Long-Term and Interlinked Risks

- Soil degradation and food insecurity due to reduced agricultural productivity.
- Increased risk of **bioaccumulation** of toxic metals in food chains, affecting both humans and livestock.
- Exposure to even low levels of heavy metals over long periods can lead to **chronic health issues**, including cancer, birth defects, and cognitive impairments.
- **Climate change** may further exacerbate metal mobility and toxicity in soils through altered precipitation and temperature patterns.

Global Initiatives and Responses

- **UN agencies and environmental NGOs** are pushing for global soil monitoring frameworks, especially in vulnerable and low-income regions.
- Countries like **China, the EU nations, and Australia** have already conducted **nationwide soil contamination surveys**, establishing threshold limits and remediation strategies.

- There is a growing call for **international cooperation** to support data collection and pollution control in **Africa, South Asia, and Central Asia**, where baseline data is still lacking.
- Emphasis is being placed on **sustainable farming**, **technological innovation**, and **environmental policy enforcement**.

Measures to Reduce Heavy Metal Contamination in Soils

- **Soil Remediation Techniques**:
    - **Phytoremediation**: Using specific plants (e.g., sunflowers, Indian mustard) that absorb heavy metals.
    - **Soil washing**: Removing metal-laden particles through chemical solutions.
    - **Chemical stabilization**: Immobilizing metals in soil using additives that reduce their mobility and bioavailability.
- **Strengthening Regulations and Enforcement**:
    - Imposing **limits on heavy metals in fertilizers and pesticides**.
    - Enforcing strict **industrial waste management laws** to prevent dumping in or near agricultural zones.
    - Regulating **mining practices** to minimize runoff and dust emissions.
- **Monitoring and Mapping Programs**:
    - Setting up **real-time soil testing networks** across agricultural zones.
    - Creating **national and regional pollution maps** to track contamination hotspots and monitor trends over time.
    - Integrating soil health parameters into agricultural and land-use planning policies.
- **Public Awareness and Farmer Training**:
    - Training farmers in **crop rotation**, **safe irrigation practices**, and **soil testing methods**.
    - Promoting the use of **treated water and organic inputs** to reduce dependence on chemical fertilizers.
    - Developing **mobile apps or village-level awareness campaigns** to spread knowledge of heavy metal risks and solutions.

Conclusion

- Heavy metal contamination in agricultural land is a **global, multi-generational crisis** that undermines both **food security and public health**.
- While scientific tools and policy frameworks exist, **implementation, international coordination, and public awareness** are key to effective mitigation.
- India and other countries in high-risk zones must **adopt a multi-pronged strategy** involving monitoring, remediation, regulation, and community-level intervention.

Source: **https://www.downtoearth.org.in/environment/about-242-million-hectares-of-worlds-agricultural-land-contaminated-by-toxic-heavy-metal-pollution-study**