

Impact of Faulty Waste Disposal Practices on Air, Water and Soil resources

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ABSTRACT

Faulty waste disposal practices pose significant threats to air, water, and soil resources, undermining environmental quality and public health. Improper handling of solid, liquid, and hazardous wastes leads to the release of toxic gases, particulate matter, and greenhouse gases, contributing to air pollution and climate change. Leachates from open dumps and poorly managed landfills contaminate surface and groundwater with heavy metals, pathogens, and organic pollutants, impairing water quality and aquatic ecosystems. Similarly, continuous accumulation of waste residues degrades soil structure, reduces fertility, and disrupts soil microbial activity, thereby affecting agricultural productivity and food safety. The impacts are particularly severe in developing regions where rapid urbanization, inadequate infrastructure, and weak regulatory frameworks prevail. This article highlights the interconnected effects of faulty waste disposal on key natural resources and emphasizes the need for integrated waste management strategies, strict policy enforcement, and public awareness to mitigate environmental degradation and promote sustainable resource management.

Introduction

India generates a large amount of municipal solid waste (MSW) daily, and a major portion is not handled properly. Around **30–32%** of total waste remains unaccounted, meaning it is dumped openly, burned, or mismanaged. About 75% of municipal waste is disposed of unscientifically in open dumps or poorly managed sites. Some studies estimate **80–90%** of MSW is dumped or burned without proper landfill standards. Only **20–25%** of waste is disposed of in scientific or engineered landfills. Claims of high “waste processing” rates are misleading—actual scientific processing is significantly lower. India faces a major gap between wastes generated, collected, and scientifically treated (Kapoor and Chakma, 2024). Faulty waste disposal practices such as open dumping, open burning, unmanaged landfilling, and improper segregation threaten the quality of the environment and public health. Particulate matter, dioxins, and greenhouse gasses from

uncontrolled burning are among the harmful pollutants emitted into the air when solid waste is disposed of carelessly (CBCB, 2022). Similar to this, leachate from decaying garbage seeps into groundwater and soil, transporting pathogens, heavy metals, and organic pollutants that contaminate drinking water sources and reduce soil fertility (Gupta et al, 2015). Runoff from rubbish heaps also causes eutrophication and microbiological pollution in surface water bodies close to dumpsites (Sharholy et al, 2008). Together, these impacts highlight how inadequate waste management systems directly threaten ecological integrity and human well-being. Improper waste disposal has always been a global concern. The rapid growth of industries, improved technologies, and standard of living are major factors that give rise to waste generation. Studies have reported serious health risks of improper waste disposal reporting potential health risks as respiratory problems such

as asthma, bronchitis, and aggravated allergies due to inhalation of these pollutants.

Faulty waste practices and associated impacts on air, water and soil resources

Open dumping

Open dumping involves throwing waste in open areas, roadsides, forest edges, and riverbanks without any containment. It leads to soil contamination, foul smell, pest infestation, and pollution of nearby water sources. This practice is common in hilly regions where proper disposal sites are limited. Example: In 2025, the government of Himachal floated a tender for a waste-management plant in Kasol, because videos went viral showing “a mountain of garbage and plastic bags dumped in a forest” near the valley — clearly dumped in a non-official, unauthorised area (Bhardwaj, 2025). Near Paprola town, villagers reported “solid waste and plastic dumped in a rivulet,” with waste spilling into fields and damaging crops.

The detrimental effects of open dumping vary from higher incidence of respiratory, gastrointestinal, and other waste-related illness found in communities close to open dumps. Toxic substances (dioxins, furans, mercury, and particulate matter) released by open dumping and related open burning deteriorate air quality and present long-term health hazards. Open dumping drastically changes the physicochemical characteristics of the soil and decreases the variety of plants surrounding dumpsites. Leachate from open dumpsites contaminates soil and groundwater, and nearby groundwater frequently falls short of drinking water regulations (Dubey et al, 2024). Leachate from open dumpsites contaminate adjacent groundwater by seeping into the soil and spreading both downward and outward. This penetration was confirmed by elevated levels of heavy metals and other pollutants found in wells about 60 meters from the dumpsite. Because of the high ion concentration, the soil in the dumpsite region becomes soft and has poor resistivity, indicating a considerable presence of leachate. Groundwater used for wells in the area may be dangerous since this contamination reaches the water table (Alao, 2023).

Open burning

Waste is burned in open areas to rapidly reduce waste volumes this process releases poisonous gasses, smoke, and particle matter. Particularly in mountain valleys with stagnant air, it degrades the quality of the air and can cause respiratory problems. There have been recorded incidents in the town of Shimla where trash built up behind public buildings was burned instead of properly treated. Particularly in communities with poor garbage collection systems, this issue is made worse (Madan, 2015).

Significant dangers to human health are associated with the pollutants emitted during burning, particularly respiratory

and cardiovascular disorders, exacerbated asthma, bronchitis, and long-term concerns like carcinogenic consequences due to persistent organic pollutants (POPs) like dioxins and furans, particulate matter, carbon monoxide, sulfur and nitrogen oxides, benzene, toluene, and other volatile organic compounds, have been shown to originate from the open burning of municipal solid waste (MSW). Toxic heavy metals and persistent organic pollutants are frequently concentrated in combustion ash and residual particles. These can build up in soil, changing its chemical composition, damaging soil organisms, decreasing fertility, and lowering the soil's ability to sustain growth. Surface water quality and aquatic life are at risk when burning ashes and toxic residues settle on land or are carried into streams and rivers by rainfall or runoff, particularly when heavy metals or POPs are present. This demonstrates how burning or dumping can contaminate water with chemicals, which may then bioaccumulate through the food chain (Dubey et al, 2025).

Dumping waste into water bodies

Direct rubbish disposal into rivers, streams or rivulets contaminates irrigation supplies, damages aquatic life, and endangers public health. In Paprola plastic and solid debris were illegally dumped into a tiny watercourse, polluting water downstream and damaging crops in irrigation channels. Waste including plastic and building debris, was dumped into the Ingle rivulet in the lower parts of Dharamsala (Sakoh region), which had an impact on fields that depend on that water source (Sood, 2025). Anaerobic decomposition in water body releases methane and carbon dioxide; burning waste near bodies of water releases toxic gases; increase in number of disease-transmitting vectors (mosquitoes and flies); and toxins from contaminated water aerosolize. Leachate infiltration causes soil pollution ie, decreased fertility and changed pH of the soil. Heavy metal buildup (Pb, Cd, Hg) resulting into disturbance of the microbial community in the soil. Reduced productivity in agriculture. In water, pathogen, heavy metal, and hazardous chemical contamination occurs. Eutrophication brought on by an excess of nutrients (N & P) cause Fish deaths due to a drop in dissolved oxygen. Toxin bioaccumulation in aquatic animals and waterborne illness transmission are also caused by dumping waste into water bodies.

Improper disposal of hazardous waste

Discarding batteries, chemicals, medical waste, or e-waste with regular garbage. Improper disposal of hazardous waste can seriously damage the environment including air, water and soil resources. Toxic substances such heavy metals, solvents, acids, and persistent organic pollutants can seep into the ground when hazardous trash is disposed of or not treated. They build up in the soil over time, lowering fertility, deteriorating its quality, and impeding plant growth. Land may become unfit for agriculture or natural vegetation

due to this soil contamination, which can last for years or decades (EPA, 2023). Pollutants can enter groundwater and surface water bodies (rivers, lakes, aquifers) through leachate, which is created when rainwater seeps through garbage. This pollution damages aquatic ecosystems, endangers drinking water supplies, and renders water unfit for irrigation or human use. Toxins may cause fish and other aquatic species to perish or have their reproductive systems harmed; they may also find their way into the food chain, which could eventually have an impact on animal and human health (Siddiqua et al, 2022). Hazardous gases, vapors, and particulates such as dioxins, heavy-metal particulates, volatile organic compounds (VOCs) and other pollutants are emitted when garbage is burned or volatile chemicals evaporate. These airborne contaminants deteriorate the quality of the air and provide major health dangers, such as increased cancer risk, neurological impairment, and respiratory and cardiovascular issues. In addition to contributing to climate change, the breakdown of organic waste in landfills releases greenhouse gases such as carbon dioxide (CO_2) and methane (CH_4).

In one instance, residents of Majra village of Himachal Pradesh expressed dissatisfaction over a waste management facility's years-long practice of disposing of solid waste untreated and merely covering it with dirt. Locals said that the plant's leachate and tainted water seeped into natural water sources and groundwater, contaminating borewells and wells and rendering the water unfit for human consumption(Dutta,2021).

Littering in Public places

Littering in public areas contaminates the air, water, and soil; these effects are particularly severe in Himachal Pradesh's delicate ecosystems. Waste that is disposed of along roadsides, marketplaces, tourist destinations, and riverbanks, including plastics, metals, food waste, and hazardous materials, can release toxic compounds into the soil, decreasing fertility and damaging flora. Rainfall causes litter to wash into rivers and streams, where it contributes to microplastic pollution, releases pollutants, disturbs aquatic life and has an impact on populations who depend on these waters. Litter is also burned outside in many hill communities, releasing greenhouse gases, particulate matter and harmful fumes that deteriorate air quality and endanger respiratory health. Because pollutants spread swiftly through runoff and can destabilize already fragile soils, these consequences are more noticeable in Himachal Pradesh due to its steep slopes and delicate ecosystems. In general, littering exacerbates environmental deterioration, endangers biodiversity, and affects the Himalayan region's ecological equilibrium (Environmental Literacy Council(2024), Institute for Environmental Research and Education(2025).

Overflowing and Uncovered bins

Uncovered and overflowing trash cans allow trash to be dispersed by rain, wind and animals, directly contaminating the land, water and air. Decomposing trash releases methane, ammonia and other poisonous gases into the air and people frequently burn the extra waste, which releases particle matter and toxic smoke that are damaging to respiratory health. As is frequently observed in many Himachal Pradesh towns, when rain falls on open bins, contaminated runoff washes plastics, microplastics, pathogens and chemicals into adjacent streams and drains, decreasing water quality and endangering people that rely on spring water and hill streams. When waste spills onto the ground, chemicals and organic debris seep into the soil, lowering soil fertility, changing pH and drawing bugs that spread disease. In hill regions like Himachal, where settlements are dense and slopes are steep, unmanaged overflowing bins accelerate pollution spread into rivers such as the Beas and Sutlej, making the ecological impact more severe (Environmental Literacy Council, 2024; Institute for Environmental Research and Education, 2025).

Poor disposal of Construction and Demolition waste

Air, water, and soil resources can be seriously harmed by improper disposal of construction and demolition (C&D) waste, including concrete rubble, bricks, metals, paints, solvents and dust. Dust and fine particle matter are released into the air when construction and demolition trash is disposed of publicly or in piles, which lowers air quality and exacerbates respiratory issues. Rainfall introduces dangerous contaminants, increases turbidity, changes pH and pollutes surrounding drains, rivers, and groundwater by carrying loose debris, cement particles and chemical residues. Lime, metals and hazardous substances can seep into the soil from heavy materials left on land, decreasing fertility, changing the soil's structure, and harming flora. Additionally, unmanaged construction and demolition trash obstructs natural drainage routes, which is especially troublesome in mountainous areas and causes soil erosion, slope instability, and sedimentation in water bodies. Environmental studies have extensively documented these effects, which are substantial in India's rapidly urbanizing regions, especially the Himalayan states. (Central Pollution Control Board, 2017; United Nations Environment Programme, 2018).

Illegal Landfilling

Soil, water, and air quality have been continually deteriorated in Himachal Pradesh due to illegal landfilling and dumping of trash, including building debris, muck, plastic, and regular municipal waste. Unscientific dumping

of rubbish and muck into rivers, lakes, rivulets, and mountain slopes has contaminated watershed and forest lands in a number of districts. Muck dumping into Govind Sagar Lake and its tributaries, for example, reportedly decreased fish populations and damaged aquatic ecosystems (Rathore, 2024). Plastic, solid waste, and construction debris have been dumped along roadsides and rivulets close to cities like Paprola, contaminating drinking water sources, irrigation supplies, agricultural areas, and water quality (The tribune, 2025). Dumped waste, particularly from construction and demolition, leaches heavy metals, salts, and other pollutants onto soil, changing soil chemistry, decreasing fertility, and damaging vegetation. This is consistent with evidence from around the world that unmanaged landfills are linked to groundwater contamination and soil degradation. In many rural or marginal regions without proper waste-management facilities, garbage is frequently burned outdoors, generating hazardous gases, particulates, and persistent organic pollutants that deteriorate air quality and pose a health risk to people. Because of the high terrain and tight connections between soil, groundwater, and surface water in the delicate Himalayan environment, illegal landfilling poses a major threat to the environment and human health in Himachal Pradesh (Siddiqua, 2022).

Improper sewage disposal

Water, soil, and air quality can be seriously harmed by improper sewage disposal, such as dumping untreated wastewater into rivers, drains, open fields, or unmanaged pits. Waterborne illnesses, eutrophication, and the devastation of aquatic ecosystems result from sewage released into surface water, which contaminates rivers, lakes, and streams with organic waste, nutrients (nitrogen, phosphorus), pathogens, and chemical contaminants. Sewage seepage into the ground can change the chemistry of the soil over time, increasing salt and nutrient load, decreasing fertility, damaging soil microorganisms, and making the area less suited for vegetation or cultivation. The breakdown of organic matter in places where sewage gathers in open pits or stagnates releases harmful gases and particle matter into the atmosphere, which can worsen local air quality and cause respiratory problems. These gases include methane and hydrogen sulfide. Such inappropriate sewage disposal poses increased risks in areas like the hilly terrain of Himachal Pradesh, where many small towns and villages lack proper sewage treatment: contaminated runoff can quickly reach streams or springs used for drinking water, soil degradation can endanger delicate hill slopes, and air pollution from sewage stagnation can affect densely populated settlements (WHO,2006).

One of the most urgent environmental and public health issues of our day is the incorrect handling of hazardous chemicals, open dumping, uncontrolled landfilling, and burning of waste. Communities that live close to waste sites suffer long-term ecological harm, biodiversity loss, and a rise in disease incidence as a result of these practices, which seriously contaminate the land, water, and air. Because pollutants can spread through leachate, groundwater, and air emissions, the detrimental effects go beyond the immediate region of waste disposal sites, impacting urban people and larger ecosystems. Uncontrolled trash disposal also increases greenhouse gas emissions, which worsens climate change and jeopardizes environmental sustainability. Community involvement and public awareness are equally crucial. In addition to encouraging people to reduce, reuse, and recycle, educational efforts can help foster a sense of environmental responsibility and deter illegal dumping and littering. Utilizing contemporary technologies like GIS-based trash monitoring systems in conjunction with sanitation worker training and capacity building can improve operational effectiveness and environmental safety. To reduce waste creation, embrace sustainable manufacturing and consumption practices, and utilize eco-friendly packaging, businesses, local governments, and families must work together.

CONCLUSION

Faulty waste disposal practices pose a serious threats to environmental quality and public health. Uncontrolled burning and decomposition of waste release toxic gases and particulate matter into the atmosphere, contributing to air pollution and climate change. Improper dumping and leachate formation contaminate surface and groundwater with hazardous chemicals and pathogens, reducing water availability and safety. Similarly, the accumulation of solid and hazardous waste degrades soil structure, fertility, and biodiversity, impairing agricultural productivity and ecosystem functioning. Addressing these impacts requires integrated waste management strategies, strict regulatory enforcement, public awareness, and adoption of sustainable practices to protect natural resources and ensure long-term environmental sustainability.

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