

# Impact of ecotoxicology and environmental risk assessment on human health

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## ABSTRACT

With its negative effects on human health and food security, environmental pollution has become a major global concern. Frequent exposure to high levels of pollution that can be harmful to both humans and animals occurs. An important global problem, air pollution causes a considerable number of early deaths annually. Lung cancer, heart failure, stroke, chronic obstructive pulmonary disease, and respiratory infections are the main causes of these deaths. According to data from the World Health Organisation (WHO), almost all people on the planet-roughly 99%-are exposed to air pollution levels that are higher than advised. Investigating the effects of environmental pollutants on ecosystems, wildlife, and human populations, ecotoxicology, environmental risk assessment, and their potential health ramifications are related fields of study. The impact of environmental risk assessment and ecotoxicology on human health will be the main focus of this chapter. Human exposure to environmental pollutants may result in adverse outcomes such as neurotoxicity, carcinogenicity, infertility, and metabolic problems, among other things. rous hence can be utilized as seed source for raising the quality plantations of the species.

**Key Words** - ecosystems, wildlife, ecotoxicology, environmental risk assessment,

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## INTRODUCTION

The fields of ecotoxicology and environmental risk assessment are essential to comprehending the possible effects of pollutants and toxins on human health and ecosystems. Ecotoxicology is the study of how harmful compounds affect natural systems. It entails analysing the effects of pollutants on different ecosystem components, such as species, populations, communities, and ecosystems overall. Examples of these pollutants include pesticides, heavy metals, and industrial chemicals. Understanding the ecological effects of pollution exposure, such as alterations in food webs, biodiversity, and ecosystem structure and function, is the main goal of ecotoxicology. Environmental health, sustainable development, biodiversity

conservation, and mitigating climate change have become top priorities in European and global policy-making in recent years. Ecosystem toxicity brought on by human activity is a complex and important issue that is currently being discussed globally by policymakers, scientists, and society at large. Global attention has been drawn to the noteworthy and uneven gains in economic and technical progress that have occurred recently, together with the careless and unsustainable use of non-renewable resources. Because of this, a number of substances and byproducts from these activities have become pollutants and have a negative effect on the integrity and health of the ecosystem (Kostich and Lange, 2016). The effects

of the pollutants under discussion here range from the local to the regional to the transboundary. This is because pollutants are transported, circulated, and accumulate in different environmental compartments (National Research Council Committee on Health Effects of Waste Incineration 2000). As a result, the problem of environmental pollution has become a widely held concern worldwide.

### **ECOTOXICOLOGY**

The scientific field of ecotoxicology is concerned with examining the harmful effects that pollutants and toxic compounds have on ecosystem-dwelling creatures. To comprehend how pollutants travel through the environment, build up in organisms, and affect populations and ecosystems, it integrates concepts from toxicology and ecology. Environmental toxicology is a field that documents the serious threats that the presence of various contaminants, especially trace elements, has posed to the health of people, plants, and ecosystems. Many of these contaminants can induce a variety of illnesses in humans, accumulate in human tissues, and have a long half-life (Guo *et al.* 2019). Exposure to levels of these pollutants over recommended thresholds can cause or aggravate a number of illnesses, including as cancer, reproductive disorders, respiratory conditions, and immune system deficiencies. Consequently, the detrimental effects of hazardous pollutants have surfaced as noteworthy scientific and societal impediments to the goal of creating contaminant-free food. Environmental risk assessment and ecotoxicology are related disciplines that offer important insights into the possible effects of contaminants on ecosystems and human health. Effective environmental management and public health policy development need a thorough grasp of these linkages.

Environmental pollutants found in drinking water, air, food, and many consumer products include mercury, lead, aluminium, cadmium, and arsenic (Tchounwou, 2012). Toxicants originating from contaminants, herbicides, insecticides, and

fertilisers are examples of biological agents and hazardous materials that can have a negative impact on organisms and their populations. The distribution and abundance of species are reduced as a result of these effects. Population dynamics changes have a profound effect on the ecosystem, leading to a decrease in stability and output. The term "environmental health" describes the range of facets of human health that are impacted by elements found in the physical, biological, chemical, social, and psychosocial domains (Gunjyal *et al.*, 2023). A state of complete mental, physical, and social well-being can be referred to as health rather than just the absence of disease or illness. Numerous environmental obstacles possess the capacity to obstruct human health and welfare. The challenges listed above include air pollution, pathogenic microbes, inadequate governance, inadequate healthcare accessibility, chemical pollution, and poor water quality.

The main concerns of environmental health facilities are various environmental elements that may provide health dangers. These elements include making certain that clean food and drink are available, dealing with problems pertaining to inadequate housing, controlling pests that might spread illness, reducing the amount of bad air quality, and addressing the issue of irritating noise (Ramachandra *et al.*, 2018). The study of environmental toxicology looks at the harmful effects of various chemical, biological, and physical agents on living things at several levels of investigation, such as the molecular, cellular, organismal, and population levels. This covers the negative consequences that environmental pollutants-both naturally occurring and man-made-have on the air, water, and soil (Shahid *et al.*, 2020). Among the important endeavours in the study of ecotoxicology is the identification of: -

1. Chemical Exposure: Investigates the pathways by which pollutants enter the environment and the ways in which they come into contact with living things.

2. **Toxicokinetics and Toxicodynamics:** Examines the mechanisms of toxicity as well as the uptake, distribution, metabolism, and excretion of harmful compounds in living things.
3. **Effects on Population and Communities:** Examines how pollution affects people as well as the composition and dynamics of ecological communities.
4. **Biomarkers:** Determines an organism's exposure to, impact from, and susceptibility to environmental pollutants by using biological indicators.
5. **Field and Laboratory Studies:** To comprehend effects in the actual world, this approach combines controlled laboratory experiments with field observations.

Due to the potential threats that various contaminants bring to human and ecological health, the importance of keeping a clean and safe environment has become a key priority in current scientific discourse. People these days have shown a greater awareness of the detrimental impact that pollution have on the environment and human health. As a result, there is an increasing tendency to support more ecologically sustainable and equitable development practises. As a result, the link between environmental preservation and sustainable development is highly valued in the global agenda. This declaration emphasises how important it is to promote the development of ecologically friendly techniques for identifying, tracking, and reducing dangerous pollutants. In order to advance a comprehensive strategy for ecologically sustainable development, it is essential that researchers, scientists, citizens, and policymakers form a strong and productive relationship.

#### **ENVIRONMENTAL RISK ASSESSMENT (ERA):**

The process of environmental risk assessment is assessing the possible harm to the natural environment that could result from the presence of a stressor, such as a chemical, biological, or physical element. Potential hazards are identified,

exposure levels are evaluated, and related risks are described as part of the process. The method of environmental risk assessment (ERA) entails estimating the likelihood that communities and organisms will be exposed to one or more chemicals and result in unfavourable ecological effects (Wolt *et al.*, 2010). The environmental risk assessment method consists of a number of important components.

1. **Hazard Identification:** This process locates and describes possible risks connected to a specific chemical or stressor.
2. **Exposure Assessment:** Ascertains the extent to which organisms are exposed to and the amount of stressor that is present in the environment.
3. **Risk Characterization:** Based on the evaluations of exposure and hazard, this step determines the probability and severity of negative consequences.
4. **Regulatory Decision-Making:** Offers data to decision-makers so they may create rules and policies to control and lessen risks.

#### **POSSIBLE EFFECTS ON HUMAN WELL-BEING:**

The protection of biodiversity, sustainable development, climate change, and ecosystem health have been the top goals of Indian and global policy-making in recent years (Shivanna , 2022).

- When people come into contact with contaminants that have contaminated soil, water, or the air, this is known as direct exposure and can lead to contamination.
- The process by which toxins build up within the food chain and potentially jeopardise the safety of food products that humans eventually consume is referred to as "food chain contamination."
- For workers in companies that use or produce hazardous materials, occupational exposure is a problem since they might come into close touch with these materials.
- Contaminants in the air and water can harm people's health in a number of ways, such

as through skin contact, ingestion, and inhalation.

- Prolonged exposure to low levels of environmental toxins may have long-term health repercussions, including the possibility of developing diseases including cancer, developmental problems, and reproductive issues.

Understanding the possible effects of environmental toxins on human health is crucial for facilitating effective risk communication and ensuring that the public is properly informed about potential risks and suitable preventive measures.

### CONCLUSION

Because toxicology has made it easier to examine specific environmental substances for their potential effects on human health, it has revolutionised environmental health. The science of ecotoxicology examines the effects of toxic compounds on living organisms, especially in their native habitats. Finding out how pollutants impact organisms at scales ranging from molecules to entire ecosystems is the aim of this research. The goal of ecotoxicology and environmental risk assessment is to comprehend how contaminants impact ecosystems and how they may impact human health. The combination of these disciplines leads to the creation of comprehensive programmes for safeguarding the environment and the general public's health. Given the high probability that environmental toxins may enter human systems through a variety of pathways, risk assessment aimed at estimating the concentration of the pollutant in the environment should also take human exposure and risk factor into account. The health and environmental risk assessment of pollutants was conducted based on the concentration of pollutants in the environment, with consideration given to potential negative implications on human wellbeing and the environment.

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