

HARMFULNESS OF PLASTIC ON THE ENVIRONMENT

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ABSTRACT

Plastic, one of the most versatile and widely used materials of the 20th century, has also become one of the most severe environmental threats. Global plastic consumption had already crossed hundreds of million tons annually, and improper plastic waste management resulted in soil pollution, water pollution, air contamination, and biodiversity loss as Thompson, R.C. Plastics such as polyethylene (PE), polypropylene (PP), polystyrene (PS), and PVC persist in the environment for hundreds of years, causing long-term ecological imbalance. Microplastics—tiny plastic fragments formed due to weathering—had already been identified in oceans, freshwater bodies, soil, and even in marine organisms by early 2010s. This paper examines the environmental impact of plastic use with reference to data, examples, policies, and case studies. Barnes, discusses the harmful effects of plastic on land, water, air, wildlife, and human health, while also analyzing case studies like the Great Pacific Garbage Patch, plastic accumulation in India's landfills, and the problem of plastic carry bags. Finally, this paper suggests global and national strategies used to mitigate plastic pollution.

INTRODUCTION

Since the 1950s, global plastic production increased exponentially because of its durability, low cost, and wide applicability. According to the world produced around **300 million tons of plastic annually**, most of which was used only once and discarded. In developing countries like India, rapid urbanization, increasing population, and growing consumerism led to a sharp rise in plastic waste, particularly in the form of packaging materials and carry bags. plastics are convenient, their non-biodegradable nature means they remain in the environment for **500–1000 years**. By the early 2010s, environmentalists, scientists, and policymakers had already begun raising concerns about the long-term environmental effects of plastic. Landfills were overflowing, rivers were choked with plastic, marine species were dying from ingestion, and toxic chemicals were leaching into soil and water sources.

This paper explores these environmental harms in a detailed manner using data, research, and examples.

NATURE OF PLASTICS AND THEIR ENVIRONMENTAL PERSISTENCE

Plastics are synthetic polymers derived mainly from petroleum and natural gas. The most common plastics include:

- **PE (Polyethylene)** – used in bags, bottles
- **PP (Polypropylene)** – food containers, packaging
- **PVC (Polyvinyl Chloride)** – pipes, flooring
- **PS (Polystyrene)** – disposable cups, trays
- **PET (Polyethylene Terephthalate)** – beverage bottles

Non-Biodegradability

Scientific studies confirmed that plastics do not undergo natural decomposition.

A plastic bag can take up to **1000 years** to decompose in soil.

A PET bottle may take around **450 years** to break down.

Formation of Microplastics

When plastics are exposed to sunlight (photodegradation), they break into smaller particles called **microplastics** (less than 5 mm). By early 2010s, microplastics had already been detected in oceans, rivers, and even drinking water in some regions. These particles get mixed in soil and water cycles and enter food chains.

ENVIRONMENTAL IMPACTS OF PLASTIC POLLUTION

Impact on Soil and Land

Plastic waste dumped in open fields blocks the natural flow of water, causing artificial flooding and reducing groundwater recharge. Landfills containing plastics release harmful chemicals such as:

- **Bisphenol-A (BPA)**
- **Phthalates**
- **Styrene**
- **Vinyl chloride**

These chemicals contaminate soil, making it toxic for microorganisms and reducing soil fertility.

Example

Some cities like Delhi, Mumbai, and Kolkata reported severe landfill overflows where plastic formed **over 6–8%** of total municipal waste. Plastic bags blocked drainage systems during monsoons, especially in Mumbai (notable floods of 2005 worsened due to plastic choking drains).

Impact on Water Bodies and Marine Life

Plastic pollution in oceans was one of the most alarming global issues.

Plastic in Oceans

Studies showed that around **8 million tons of plastic** entered oceans annually by 2010s.

Case Study: Great Pacific Garbage Patch (GPGP)

Discovered in late 1990s and researched heavily in the 2000s–2010s.

It is a “floating plastic island” between Hawaii and California, estimated to contain **over 100 million tonnes of floating plastic** by early 2010s.

Marine Animal Deaths

Reports estimated that **over million seabirds and marine mammals** died annually due to plastic ingestion or entanglement.

Examples

- Turtles mistake plastic bags for jellyfish.
- Birds swallow bottle caps and die due to intestinal blockage.
- Fish ingest microplastics, transferring toxic chemicals into the marine food web.

Impact on Air

Plastic waste when burnt releases toxic gases:

- **Dioxins**
- **Furans**
- **Carbon monoxide**
- **Hydrochloric acid** (from burning PVC)

These gases cause air pollution, respiratory problems, and contribute to climate change.

Impact on Wildlife on Land

Animals such as cows, dogs, deer, and wild animals often ingest plastic waste thrown on roads or dumped in forests.

India Example

Veterinary studies found plastic bags in the

stomachs of stray cattle. In 2013, a cow in Delhi was found with more than 20 kg of **plastic** in its stomach during surgery.

Effect on Human Health

While humans do not directly consume large pieces of plastic, they are exposed through:

- Microplastics in food and water
- Leaching of chemicals into food from plastic containers
- Toxic fumes released from burning plastics
- research showed that chemicals like **BPA and phthalates** can
- Disrupt hormones (endocrine disruption)
- Affect reproductive health
- Increase the risk of cancer
- Cause developmental problems in children

CASE STUDY: PLASTIC BAG POLLUTION IN INDIA BACKGROUND

In India, thin plastic carry bags became widespread in the 1990s and 2000s. Due to their low cost, they were used once and discarded, creating severe littering problems.

Environmental Impact

- Blocked drainage in major cities
- Harmed stray animals, especially cows
- Reduced soil quality in agricultural areas
- Increased landfill pressure

Policy Response

- Several states including Himachal Pradesh (2009), Rajasthan (2011), and Delhi (2012) imposed partial bans on plastic carry bags.
- Public awareness campaigns encouraged cloth and jute bags.

- Municipalities started charging fees on plastic bags.

Though enforcement was inconsistent, this period marked India's early attempts to fight plastic pollution.

POLICY MEASURES (GLOBAL PERSPECTIVE)

Global Initiatives

- **UNEP** published major reports calling plastics a global environmental crisis.
- **European Union** introduced restrictions on single-use plastic bags.
- **Bangladesh (2002)** became the first country to ban plastic carry bags.
- **China (2008)** restricted ultra-thin bags nationwide.

India's Initiatives

- Plastic Waste (Management & Handling) Rules, 2011
- Ban on plastic bags in certain sensitive zones (hill stations, pilgrim sites)
- Promotion of recycling industry
- Encouragement of biodegradable alternatives

SOLUTIONS SUGGESTED

Reduce–Reuse–Recycle Model

- Reducing single-use packaging
- Reusing containers and bags
- Recycling plastic to produce useful materials

Biodegradable Alternatives

Corn-starch based plastics

- Bagasse (sugarcane fiber) products

- Paper and jute bags

Waste Segregation

Many Indian municipalities began promoting dry-wet waste segregation to divert plastics from landfills.

Public Awareness

Schools, colleges, NGOs, and environmental groups started campaigns to reduce consumption.

CONCLUSION

Even plastic pollution had reached a stage of global concern. The durability that makes plastic so useful also makes it dangerous for the environment. It pollutes soil, water, and air; threatens wildlife; disrupts ecosystems; and indirectly harms human health. Case studies like the Great Pacific Garbage Patch, the death of marine species, and India's landfill crisis illustrate the scale of the problem. Policy measures, though partially effective, laid the foundation for future plastic management strategies. It is crucial to focus on reducing single-use

plastics, strengthening waste segregation, promoting recycling, and encouraging eco-friendly alternatives. Long-term environmental sustainability is possible only when society collectively recognizes the harmful effects of plastic and adopts responsible consumption practices.

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