Plastic Pollution: Global Challenges and Local Solutions Through Campus Sustainability Initiatives

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As we move through our daily routines, we rely on a tool so pervasive that we hardly notice it: plastic. From the moment you wake up and brush your teeth with a plastic toothbrush to getting dressed in clothes woven with synthetic fibers, plastic is everywhere. Later, when you're rushing to class and grab a coffee, it's likely served in a plastic cup. We all recognize the problems posed by single-use plastics; images of littered beaches have caused many of us to buy reusable bags or water bottles, but what often escapes our attention is just how deeply plastic is woven into the fabric of modern life. Just as ancient civilizations relied on natural resources like wood, clay, and metals to sustain their societies, our modern dependence on petroleum-based plastics reflects a similar pattern of resource exploitation, though now on a global scale. Solving this wicked problem will require large-scale systemic change, but individual actions matter too. If each of us does our part, we can make a change.

The first synthetic plastic was created in 1862, and the first fully synthetic plastic was made in 1907. It exhibited exceptional qualities, non-conductive and resistant to heat, making it indispensable for electrical applications, especially in the rapidly growing automotive and electronics industries. This breakthrough sparked an increase in plastic production and highlighted the potential of synthetic polymers to replace traditional materials such as wood, glass, and metal. From 1930 to 1940, plastic continued to grow, finding its market in World War 2. After World War 2, plastic found its way into consumer products. These materials were widely used across several industries due to their affordability and adaptability. Using single-use plastics in the 20th Century signified a key shift in consumer behaviour, as things like plastic bags and straws became common due to their ease and low cost. Environmental concerns

increased as a result of this consumer movement, which greatly increased plastic trash. The Great Pacific Garbage Patch was discovered in the late 1980s and early 1990s, highlighting the extent of plastic garbage in marine habitats and raising awareness of the ecological harm caused by plastic pollution. Due to their strength, durability, and chemical resistance, plastics are now utilized in nearly every industry, ranging from electronics and construction to healthcare and transportation. They improve the quality of life and make inexpensive solutions possible in poor countries. However, their fast rise has sparked considerable environmental concerns, as the same qualities that make plastics valuable also lead to persistent waste and marine contamination. Plastics have evolved in response to societal demands, but a sustainable future depends on resolving waste issues (Stanley et al., 2025).

Plastics have become a major environmental hazard due to their durability and resistance to natural degradation. Since most plastics take hundreds of years to decompose, they continue to build up in landfills and ecosystems. As of 2015, an estimated 55% of worldwide plastic garbage was thrown, 25% burnt, and only 20% recycled, leaving billions of tons of plastic polluting soil and oceans. Marine environments are particularly vulnerable, as plastic trash kills aquatic life through ingestion and entanglement, affecting food chains and biodiversity. Although incineration reduces the amount of waste produced, it uses up 4% of the world's petroleum supplies and generates harmful emissions that contribute to climate change and air pollution. Furthermore, microplastics, tiny pieces created from degraded plastics, are increasingly detected in seas, rivers, and even the atmosphere, suggesting long-term ecological hazards. These implications underline the critical need for improved waste management, global bans on single-use plastics, and investment in sustainable alternatives to avert irreparable environmental damage (Jiang et al., 2020).

Plastics have negative effects on human health in addition to contaminating the environment. Microplastics have penetrated water systems, food chains, and even the air we breathe, prompting concerns about their buildup in human tissues, even the human brain.

According to research, these particles may interfere with biological functions and induce oxidative stress and inflammation. Additionally, chemicals used in plastic production, such as phthalates and bisphenol A (BPA), are recognized endocrine disruptors, connected to hormone imbalances, reproductive disorders, and developmental problems. These compounds can leach into food and beverages from packaging, especially when exposed to heat. In locations with inadequate waste management, burning plastics releases harmful substances like dioxins and furans, which are connected with respiratory ailments, immune system damage, and increased cancer risk. The extensive use of plastics in medical equipment, packaging, and consumer products means exposure is practically inescapable, making it necessary to restrict toxic chemicals, improve recycling processes, and accelerate research into safer, biodegradable alternatives (Jiang et al., 2020).

A multifaceted strategy combining technological advancement, legislative changes, and international cooperation is needed to combat plastic pollution. The two primary areas of emerging technologies are collection and prevention. Prevention technologies try to block plastics from entering waterways, such as stormwater filters, laundry balls, and wastewater filtration systems that trap microfibers before they reach rivers and seas. Robotic skimmers, autonomous drones, and large-scale booms are examples of collection technologies that are used to clear floating garbage from rivers and marine habitats. The Ocean Cleanup system for macroplastics and specialist equipment like the "Hoola One" vacuum for microplastics on beaches are two examples. However, technology by itself is insufficient to address the issue; it needs to be combined with upstream tactics like better waste management, circular economy principles, and incentives for businesses to switch to sustainable alternatives. To expand these solutions globally, policy interventions, including international agreements, tariffs on plastic items, and prohibitions on single-use plastics, are crucial. The most promising way to reduce plastic pollution and its negative effects on the environment and human health is through cooperative efforts between governments, businesses, and non-governmental organizations,

backed by sufficient finance and focused deployment in pollution hotspots (Schmaltz et al., 2020). However, these changes can start at the local level.

The University of Northern Iowa uses disposable plastic cups in Maucker Union and the Rod Library cafés. Students often grab drinks between classes. While this is convenient, these single-use plastics harm the environment. Most plastic cups come from petroleum-based materials, which rely on nonrenewable fossil fuels that emit greenhouse gases and deplete natural resources. Once thrown away, they often end up in landfills or waterways. They break down into microplastics that last for centuries.

Many Native American nations historically showed deep respect for the land. They viewed themselves as part of the natural world, not separate from it. They practiced sustainable hunting, agriculture, and resource use, taking only what they needed. This approach allowed the earth to renew itself for future generations. This perspective fits closely with UNI's own values. The university states that it "embraces stewardship of our mission and land." It recognizes that "a sustainable natural environment is essential for public health and the long-term vitality of our university." By acknowledging the Indigenous understanding that people have a spiritual and practical connection to the land, UNI reinforces its duty to nurture and protect the environment through its daily actions. Starting a reusable cup program would help the school fulfill this mission.

I first set out to develop a reusable cup program at the University of Northern Iowa as a method to minimize single-use waste and generate meaningful change at the local level. Encouraging students to make little, sustainable decisions that add up to a significant impact was my aim. I was certain that the initiative might be successful because UNI Dining Services and the Environmental Health department provided me with great support. However, following interactions with Dining Services, I realized that UNI already had a reusable cup program in place, a fact that impacted the path of my proposal. I decided to focus on raising knowledge and engagement for the current program through focused marketing initiatives rather than beginning

from scratch. To spread the word, this entails producing promotional materials, interacting with students on social media, and working with campus organizations. The program will monitor discounts given to consumers who use reusable cups in order to gauge its effectiveness. This will provide precise information on program use rates and their effects. I intend to increase the visibility and accessibility of sustainable behaviors by expanding an already-existing program, which will ultimately promote an environmentally conscious campus culture.

Plastics have altered modern life, offering convenience and affordability, yet their durability has created one of the most severe environmental and health issues of our time. From their creation in the early 20th century to their widespread use today, plastics have become firmly rooted in global systems, yet this development comes at a cost: persistent waste, marine pollution, and dangerous chemical exposure. A comprehensive strategy that incorporates policy reform, cultural transformation, and technical innovation is needed to address these problems. While global solutions are vital, genuine progress often begins at the local level. Plastic pollution is not an isolated issue but part of a broader narrative of resource management that has defined the rise and fall of civilizations throughout history. Promoting the University of Northern Iowa's current reusable cup program is one strategy to cut down on single-use plastics and encourage students to adopt sustainable practices. Through boosting awareness and involvement, we may demonstrate that tiny, everyday activities lead to broader systemic change. Ultimately, the fight against plastic pollution is not only about decreasing waste, but it is also about reconsidering our relationship with convenience and committing to behaviors that preserve both the planet and future generations.

References

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