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Compostable Plastics in the Waste Stream: Management Scenarios and Life Cycle Impacts

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Background & Motivation

Plastic Packaging Waste
Accumulation in the Environment

The U.S. EPA estimates 14 million tons of plastic packaging waste was generated in the U.S. in 2018. Only 13% of that waste was recycled, with the majority landfilled [1].

Plastic packaging waste is often mismanaged through littering and illegal dumping. Over 1 million tons of domestic plastic waste was mismanaged according to 2016 estimates [2]. When exports to countries lacking adequate management is included, estimated total U.S. contributions to plastic waste in the environment range from 1.25-2.47 million tons [2].

The Role of Biodegradable Plastics

Elimination and substitution of plastic packaging with new materials that are less prone to accumulation and more readily degradable is one strategy in a suite of interventions necessary to drastically reduce plastic waste accumulation in the environment, especially in regions with high rates of mismanagement [3].

Biodegradable plastics can play a meaningful role in managed waste streams as potential feedstocks for composting operations. The U.S. Plastics Pact has signaled an increased focus on circular waste management of packaging using recyclable and compostable materials. However, these materials may still be landfilled unless composting and recycling infrastructure can scale to meet the growing demand.

Plastic Waste Management –Life Cycle Impact Perspective

Life Cycle Assessment (LCA) is a tool that can evaluate products and systems in terms of environmental impacts. LCA can compare consumer products and packaging but often omits End-of-Life from its scope. Additionally, LCA can evaluate the performance of municipal solid waste systems and the specific waste stream components within in those systems.

This research utilizes a waste-specific tool (EASEWASTE) in addition to an indicator for persistence in the environment to examine the performance and environmental implications of biodegradable plastic packaging materials in managed waste streams. Perspectives from municipal solid waste (MSW) professionals on potential difficulties and costs to their systems are also considered.

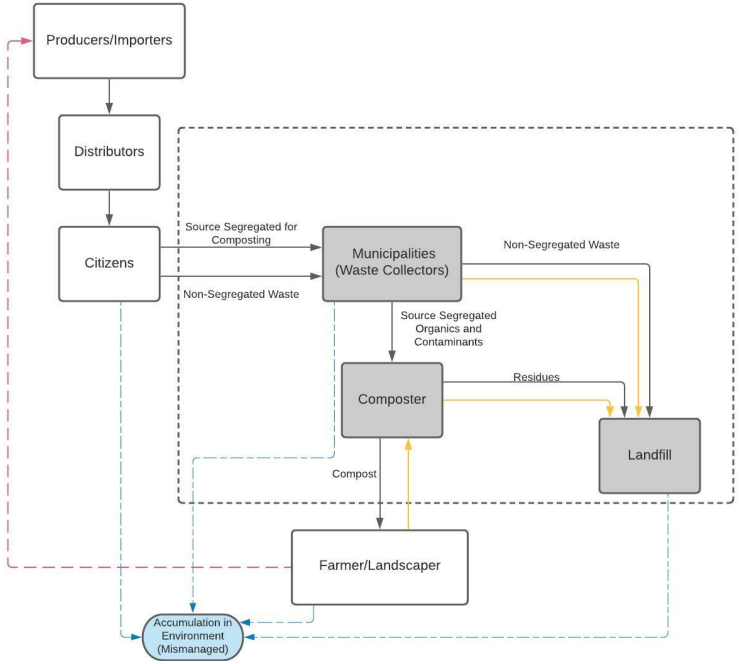


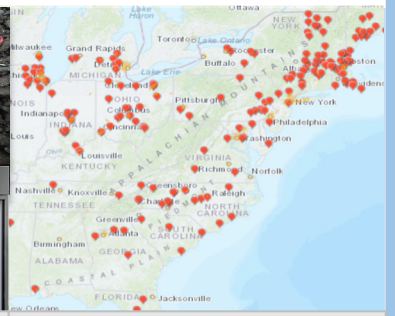
Fig. 1. Bioplastic composting system diagram
A black dashed line surrounds the system boundary. Black arrows indicate mass transfer and yellow arrows indicate monetary transfer. Blue arrows represent possible pathways to environmental accumulation

UGA New Materials Institute

This research is made possible by the expertise and support of UGA's New Materials Institute (NMI). UGA NMI is committed to preventing waste through the design of materials and systems that adhere to Green Engineering principles.

UGA NMI is involved in research, development and testing of novel biodegradable products and packaging materials, including multilayer materials designed to be fully biodegradable in any environment. Simultaneously, UGA NMI is assessing composting infrastructure in the United States focusing on best practices and barriers to expansion. Disseminating information on composting infrastructure to all stakeholders in the compost value chain is a critical component of this effort. This work is supported by a grant from the Walmart foundation.

Respirometer, Field Testing at UGA



Composters targeted for UGA Survey

References

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