Pollution

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Modeling Plastic Pollution: A system dynamics approach to understand and control macroscopic plastic flow dynamics

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Abstract

Human activities have led to many unintended consequences in the world of plastic pollution that cannot be understood from the outset. Modeling can help researchers to study individual and collective agent behavior in complex systems. For plastic pollution, modeling allows researchers to identify and explain those unintended consequences, and accordingly to change public policy to optimize management strategies. However, there is a critical need for more comprehensive methods to monitor the flow of plastic from source to sink. The current lack of detailed data could make finer-resolution models somewhat inaccurate. This gap in knowledge is important to address in order to control mismanagement and pollution of plastics into the environment. We propose a queueing framework called QODIC to monitor rates of plastic flow into and out of a designated system, which utilizes simple differential equations and plots them graphically. By taking the area between the two curves, we can find accumulation of plastic and cleanup times (when no plastic remains in the system). Using our model, we predict that there is 37.5 million tons of plastic floating in the ocean as of 2015 and that it will take 42.2 years to clean up plastics in the ocean if action is taken. Models like QODIC are integral to understanding the current state of plastic pollution.