SCHOOL of SUSTAINABILITY

ARIZONA STATE UNIVERSITY

In Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

Jared Thomas Yoder Stoltzfus

Will defend his dissertation

Facilitating Phosphorus Recovery Through Improved Waste Management

Abstract

Phosphorus (P) is an essential resource for global food security, but global supplies are limited and demand is growing. Demand reductions are critical for achieving P sustainability, but recovery and re-use is also required. Wastewater treatment plants and livestock manures receive considerable attention for P recovery, but municipal organic waste is another important source of P to address. Previous research identified the importance of diverting this waste stream from landfills for recovering P, but little has been done to identify the collection and processing mechanisms required, or address the existing economic barriers. In my research, I conducted a current state assessment of organic waste management by creating case studies in Phoenix, AZ and New Delhi, India, and surveyed biomass energy facilities throughout the US. With participation from waste management professionals I also envisioned an organic waste management system that contributes to sustainable P while improving environmental, social, and economic outcomes.

The results of my research indicated a number of important leverage points, including landfill fees, diversion mandates for organic waste, and renewable energy credits. Source separation of organic waste improves the range of uses, decreases processing costs, and facilitates P recovery, while creating jobs and contributing to a circular economy. Food is a significant component of the waste stream, and edible food is best diverted to food banks, while scraps are best given to livestock. Biomass energy systems produce multiple revenue streams, have high processing capacities, and concentrate P and other minerals to a greater extent than composting. Using recovered P in urban agriculture and native landscaping results in additional benefits to social-ecological systems by improving food security, reducing the urban heat island effect, sequestering carbon, and enhancing urban ecosystems.

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Faculty, students, and the general public are invited.

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