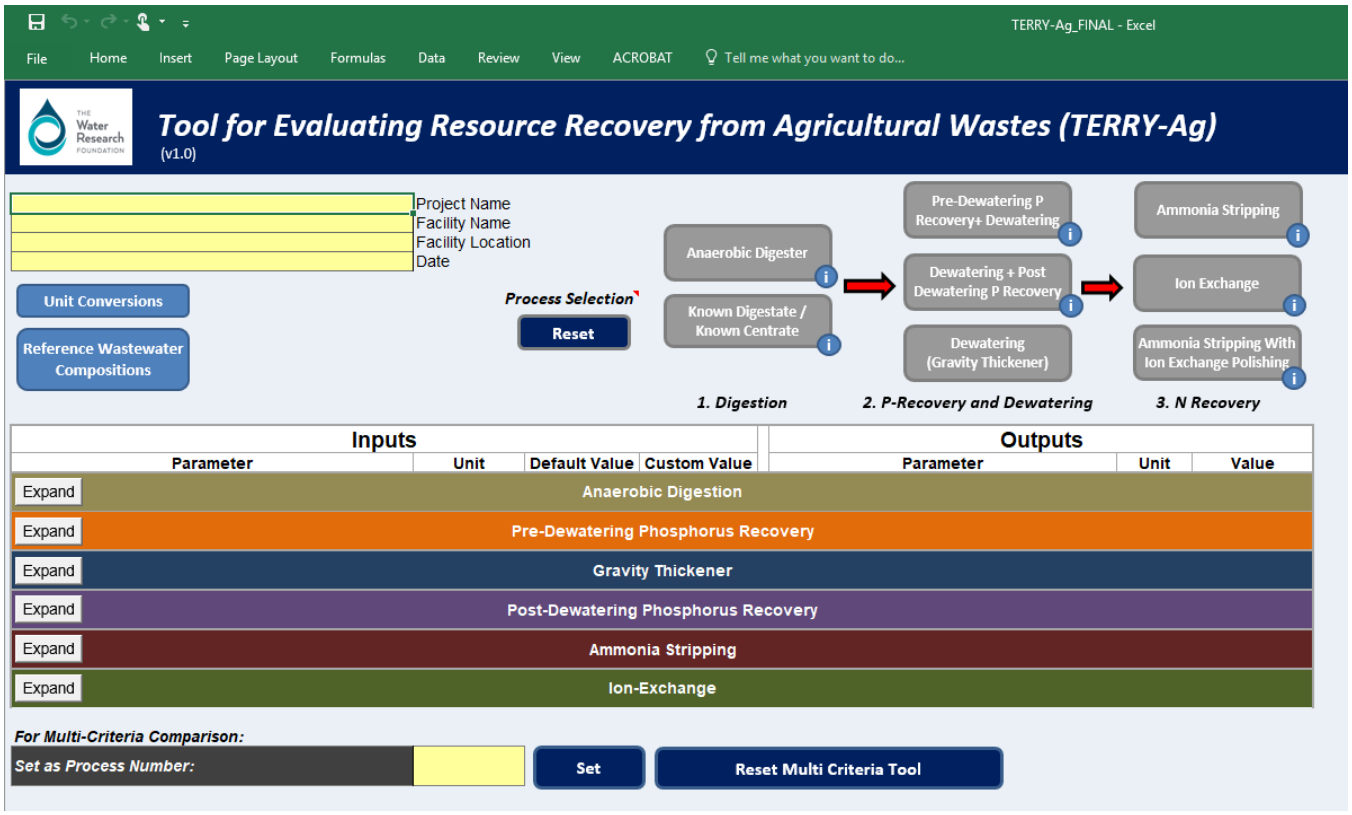
Executive Summary

Recovering nutrients from agricultural waste

Tool for Evaluating Resource Recovery (TERRY) –
Nutrient Recovery from Agriculture (STAR_N5R14/4898)



TERRY-Ag provides a high-level, conceptual cost and energy estimation for nutrient recovery from agricultural wastes/sludges or from municipal sludges, as well as an estimate of the potential fertilizer production and revenue from the recovery processes.

The Central Issue

Recovery of resources such as carbon, as well as nutrients in the form of marketable products, is an idea that has gained traction over the last decade. It is becoming evident that in addition to reducing the environmental footprint of wastewater treatment, resource recovery might also provide a monetary benefit to water resource recovery facilities (WRRFs). Agriculture is one of the major contributors to nutrient pollution in watersheds. As in the wastewater industry, there is great potential for nutrient recovery from agricultural wastestreams. The question for the agricultural industry is "Where do I start to even consider nutrient recovery?"

Context and Background

This project builds upon work done under the WRF Resource Recovery Challenge *Towards a Renewable Future: Assessing Resource Recovery as a Viable Treatment Alternative* (NTRY1R12) of which the *Tool for Evaluating Resource Recovery* (TERRY) was first developed to examine the recovery of phosphorus from wastewater.

The goal for this project was to expand TERRY to include modules that allow for evaluation of nutrient recovery (nitrogen and phosphorus) from agriculture wastes using suitable technologies. While several methods of phosphorus recovery, especially in the form of struvite are being widely applied at full-scale, technologies for recovery of nitrogen from agricultural and municipal

wastestreams are still developing. This tool provides conceptual level designs and costs associated with two recovery technologies that are showing the greatest promise for full-scale implementation to recover nitrogen from agricultural and municipal streams.

Findings and Conclusions

The tool provides users with the option to change some of the global parameters and cost assumptions associated with the conceptual-level design to global variables to account for evolving unit costs associated with the treatment train being considered.

Management and Policy Implications

The TERRY-Ag tool provides a high level, conceptual cost and energy estimation for nutrient recovery from agricultural wastes/sludges or from municipal sludges, as well as an estimate of the potential fertilizer production and revenue from recovery processes. The tool includes factsheets for the various technologies that are available for nutrient recovery. A series of five tutorial modules allows users to learn to use the TERRY-Ag tool with ease. The TERRY-Ag tool is designed to aid in decision making by providing a preliminary evaluation of the potential of nutrient recovery from a given wastestream. It is intended as a first step for facilities interested in exploring the feasibility of recovering nitrogen and phosphorus onsite now or in the future.

Related WRF Research

Project Title	Research Focus
Towards a Renewable Future: Assessing Resource Recovery as a Viable Treatment Alternative (NTRY1R12)	Provides a comprehensive state-of-the-science review of extractive nutrient recovery (both N and P), an interactive matrix which serves as a reference guide to quickly learn the basics of nutrient recovery technologies, case studies of 20 WRRFs, and tool to evaluate the opportunity for P-recovery for a facility.
Manure Resource Recovery: Co-Digestion with Fats, Oil, and Grease (STAR_N3R14a/4948)	Demonstrates the performance and economic link between co-digestion and low-input ammonia stripping N-recovery, and reduce ammonia concentration in, and emissions from, animal and municipal wastewater.
Technologies for Dairy Nutrient Recovery: Evaluation of Low-impact Ammonia Stripping with Bio-Fertilizer Recovery and Support for Technology Decision Making (STAR_N3R14b/4856b)	Investigates the impacts of long-chain fatty acids loading and feeding frequency on biomethane production, process stability, bioconversion kinetics and microbial community structure, during manure anaerobic co-digestion
Integrated Management of Animal Manure Wastes: Nutrient Recovery, Bio-Fertilizers, Enhanced Biomethane Production, and Management Tools (STAR_N3R14c/4856c)	Uses a life-cycle analysis to determine the water and energy use, and nutrient balance impacts of anaerobic digestion (AD) systems. Includes a Microsoft Excel-based modeling tool to estimate water, nitrogen, phosphorus, and energy balance for different scenarios using a combination of manure management and AD+NR processes (AD, primary screening, dissolved air flotation, and ammonia stripping).

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