

Coupling Carbon Sequestration with Nitrogen and Phosphorus to Synergize Water Quality Trading in the Muskingum Watershed of Ohio

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Introduction

A major problem in water quality trading (WQT) is the high price per gallon of water treated to reduce nitrogen (N) or phosphorus (P) for NPDES permit holders. Simply, the sum of the nutrients being traded must exceed the permit holder's facility upgrade price per gallon. This is particularly difficult for "minor" waste water treatment plants (WWTP) which treat less than a million gallons per day. Minor WWTPs cannot take advantage of the economy of scale like the "major" facilities and have high transaction costs so end up spending 2-7 times as much per gallon for facility upgrades to meet new EPA regulations. To date, most WQT projects have focused on trading nitrogen and/or phosphorus, usually by introducing conservation measures to farms. Because the price of these nutrients is relatively low, many WQT programs have stalled.

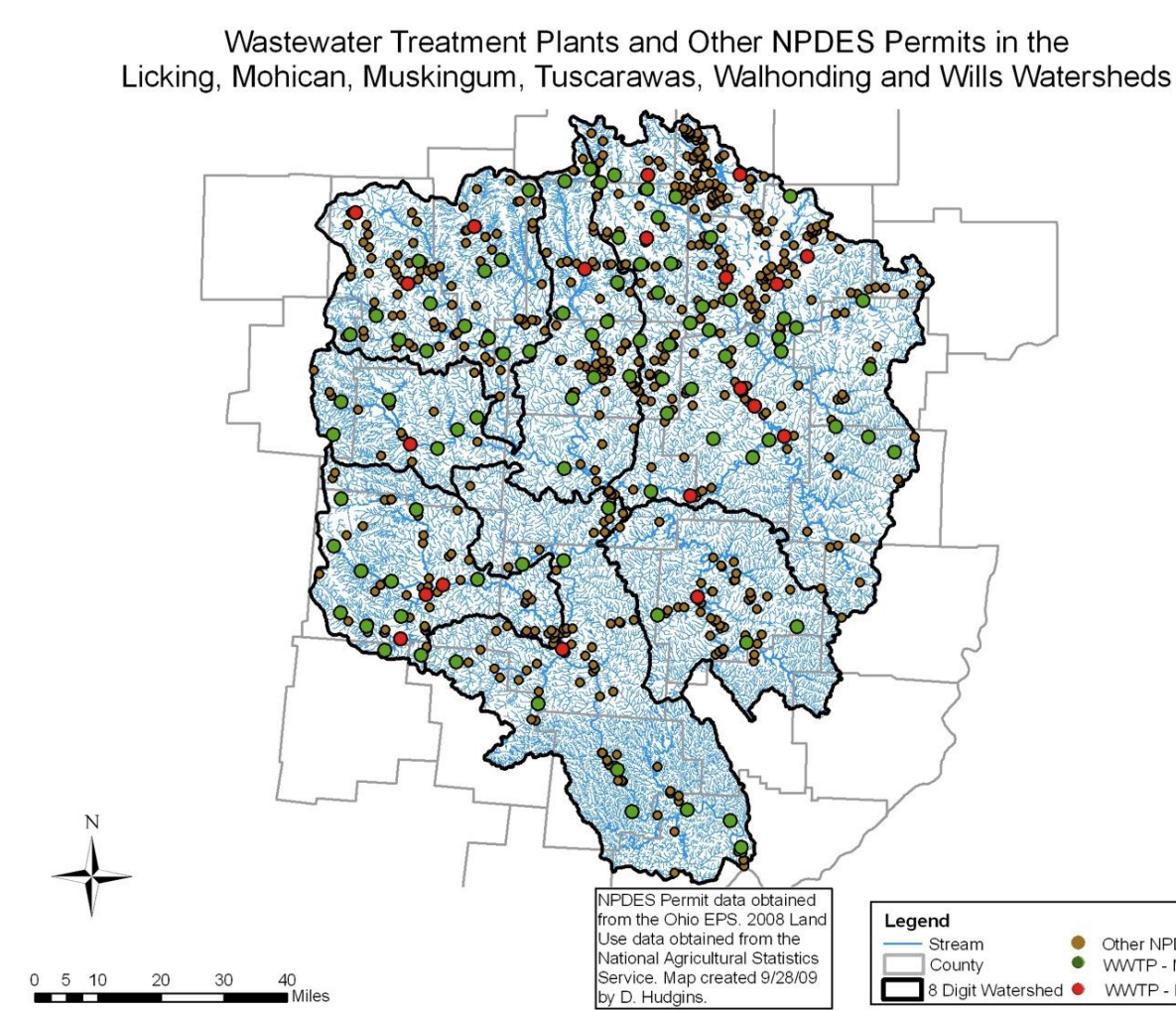
Our project aims to synergize an existing successful phosphorus(P) and nitrogen (N) water quality trading program by adding carbon (C) conservation measures. The trading program (Moore 2014) has helped the Sugar Creek Watershed double the number of good streams and halve the bad streams in twenty years. By bundling C conservation measures with P and N, the program will lower its overall cost and expand. The C conservation measures will focus on no-till farming with cover crops, encouraging pasture-fed dairy farming, and planting trees. Although calculation of carbon credits is fairly complex and needs refinement, a gross estimation of no till farming+cover crops credits will be 2-6 t/hectare.

DETAILS FOR COUPLING C, N, and P

- A carbon price of \$30/tonne is similar to Canadian, EU, and Californian cap and trade current practice for 2020.
- Calculation of credits will be done using the COMET-Farm toolkit.
- Verification of carbon credits will be through signing up with a carbon credit registry, such as the [Climate Action Reserve](#), the [American Carbon Registry](#), or and the [Verified Carbon Standard](#).
- No till carbon sequestration varies widely by soil types, soil depth, soil compaction, bulk density, and other factors and should be verified by the OSU Carbon Sequestration Lab to establish baselines.
- The Muskingum Watershed Conservancy District (MWCD) has been offering a cost-share program (\$12/acre) through Ohio SWCDs to pay for cover crops. Other buyers might be developed through environmental-impact bonds or teaming up with other carbon projects.
- In 2017 of a total of 129,571,602ha of cropland, there were 42,288,396ha (33%) no till and 39,576,459ha reduced tillage in the Muskingum Watershed
- If 30 million hectares were converted to Brandt's no till plus cover crops, there would be an estimated **180,000,000 tonnes of carbon to be sequestered** and many cleaner streams.

The Existing Situation

- \$15 per pound P
- price not low enough for EPA permit holders



Ohio EPA Approved WQ Trading Area
21 counties in SW Ohio--700 minor permits

Present P and N Conservation Measures

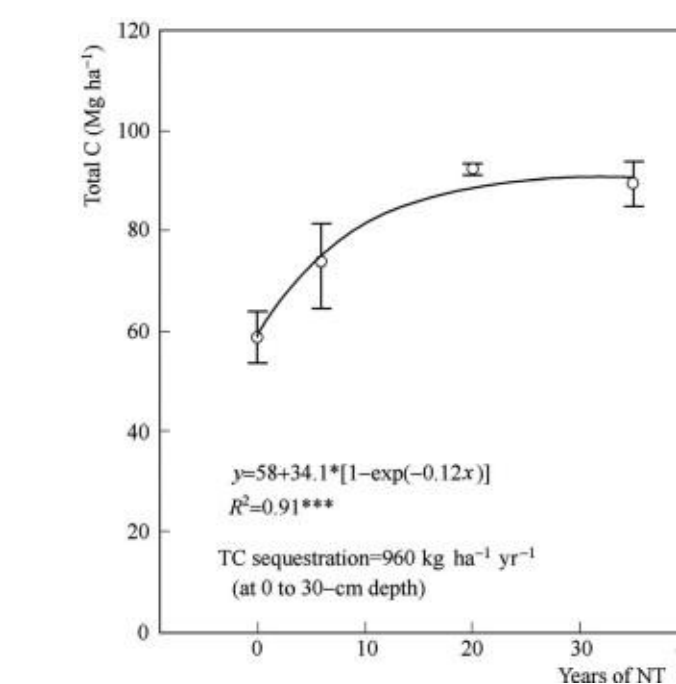
- Milk House Waste Storage
- Feedlot Runoff Prevention
- Manure Storage Facility
- Comprehensive Nutrient Management Plan
- Stream Crossing

Solution: Bundling C, N, and P

- \$30 per tonne C lowers overall N and P cost
- new P trading cost \$5 per pound
- trading program rapidly expands to new permits



Photo: Farm and Dairy



Source: Islam and Reeder 2014

- David Brandt's No-till (NT) plus cover crops sequesters 6 tonnes carbon per ha (Islam and Reeder 2014)
- NT only calculated as 2 tonnes per ha
- 71% of survey farmers in NW Ohio liked bundling nutrient credits over single credit trading (Guo 2018)

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