LAFAYETTE COLLEGE

Reversing property rights to address agricultural water pollution: Insights from a performance-based water quality trading system

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Harmful Algal Blooms (HABS) more severe since 1995

Blooms largely caused by Phosphorus, DRP doubled since 1995

Maumee River contributes 50% of Phosphorus and drives HAB severity

Detroit

Windsor

Maumee Bay

Lake Erie

Toledo

Cleveland

N 25 miles 40km

Image: NOAA

Image: www.underwatertimes.com

Actions to reduce nutrient runoff

- Based on 1972 U.S. Clean Water Act
- Regulations (e.g. TMDLs)
- Voluntary cost-share programs (e.g. EQIP)
- Market based policies such as water quality trading programs: practice-based or performance-based (e.g. MNTT)

- However, questions remain about their cost-effectiveness (e.g., Classen et al. 2008)
- The Clean Water Act does not directly regulate emission from agricultural production (Keiser and Shapiro 2019)
- Fertilizer tax remain a taboo in major agricultural states.

Reversing property rights

The New York Times

Opinion

Polluting Farmers Should Pay

Fertilizer runoff is making us sick. States can step in to regulate farmers.

By Catherine Kling

Dr. Kling is an environmental economist at Cornell University.

Aug. 25, 2019

https://www.nytimes.com/2019/08/25/opinion/water-quality-agriculture.html

Reversing property rights

- Building on:
- Rabotyagov et al. (2013) – reversing property right, practice based, nonlinearity
- Liu et al. (2020) – western Lake Erie watershed field level information and hypothetical policy scenarios

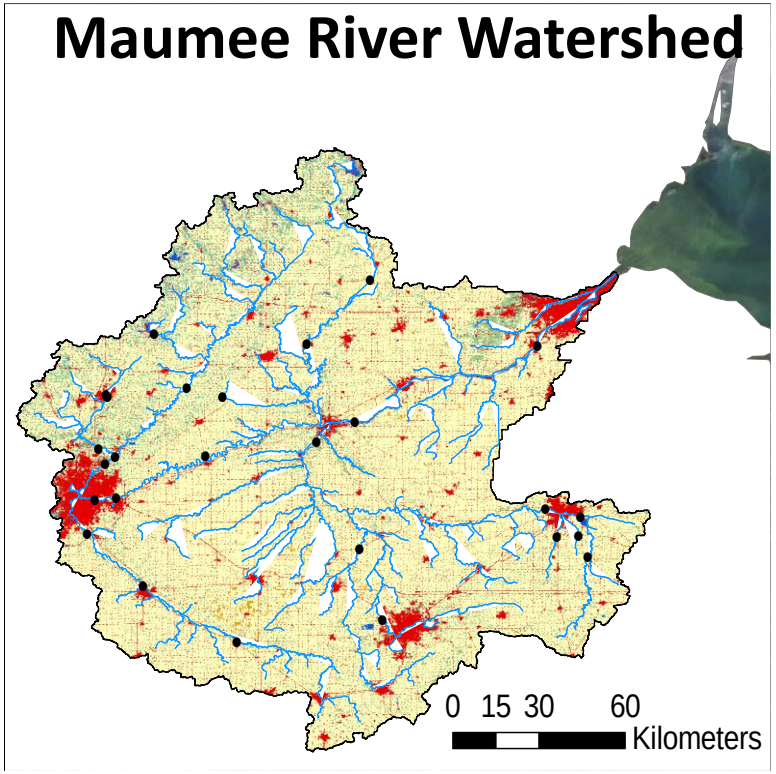
- Design a performance-based water quality trading system with farmers as the traders to meet the mandatary credit target
- What is the potential efficiency gains compared to the existing cost-share payment programs and a hypothetical fertilizer tax

GLWQA nutrient reduction target

2016 Great Lakes Water Quality Agreement Protocol, Annex 4 **Spring** (March-July) Targets

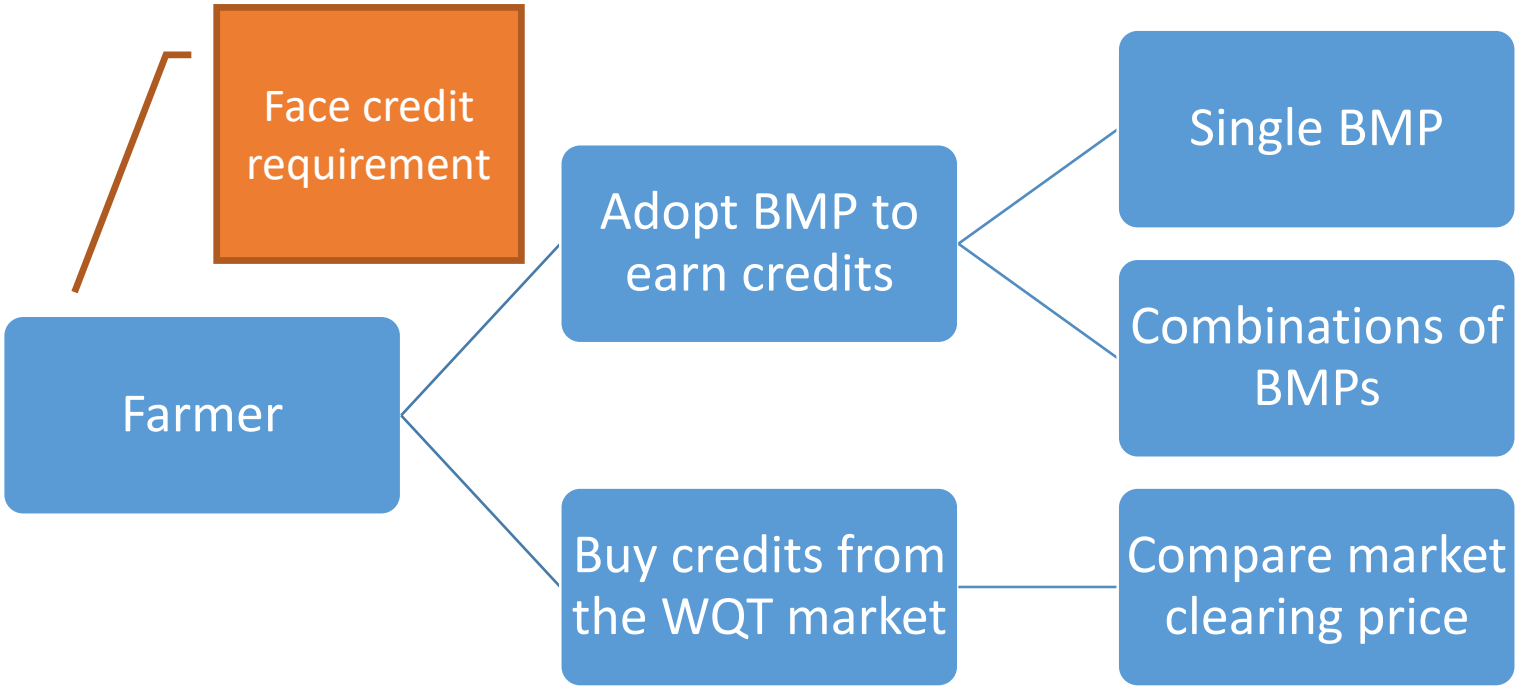
	Maumee Watershed	Western Lake Erie
Dissolved Reactive P (**DRP**)	186 MT	**40% less**
Total P (**TP**)	860 MT	**40% less**

Baseline Load Year: 2008



- Only a combination of fertilizer tax and BMP cost-share payments can achieve this goal.
- (Liu et al. 2020)

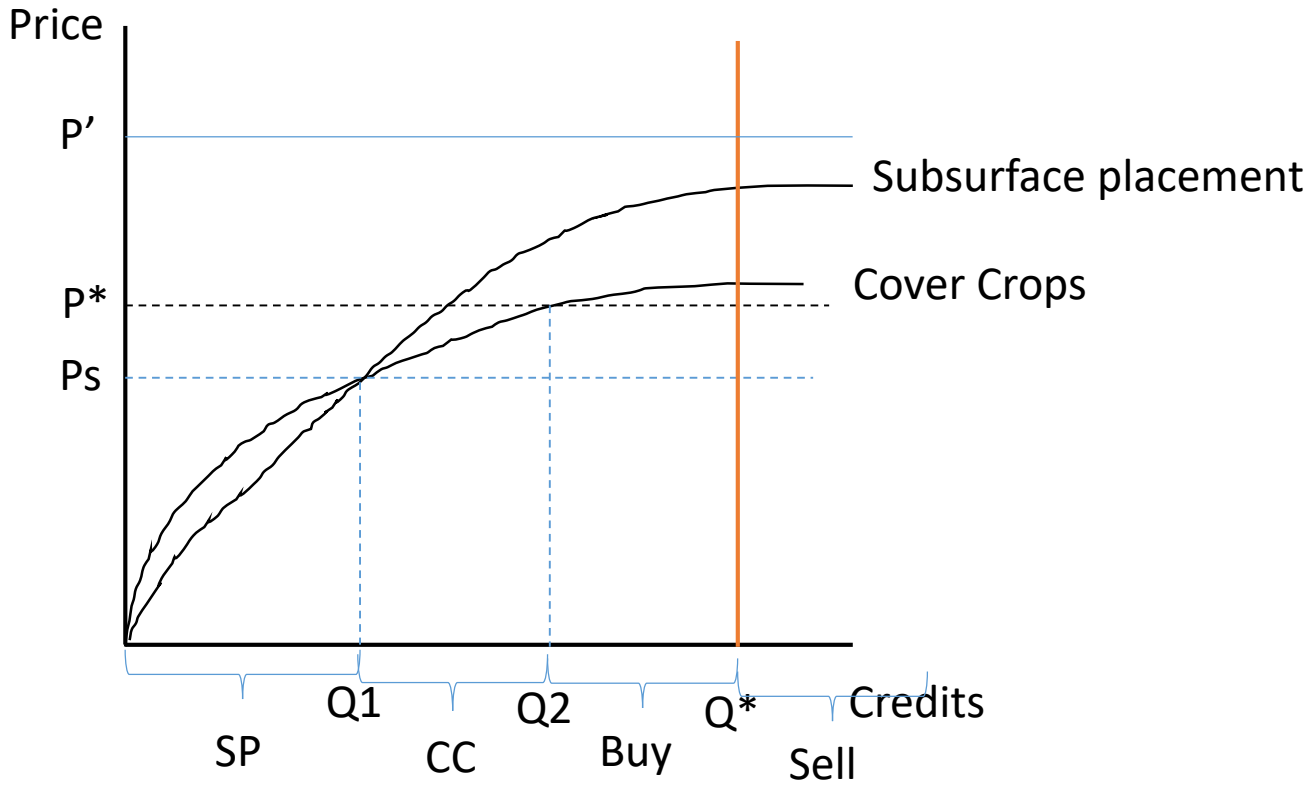
Spatially explicit BMP-specific credit system



Spatial heterogeneity:

1. Heterogeneous adoption costs – field level survey data
2. Performance-based heterogeneous BMP-specific credit – SWAT model

Illustration



Clear market by AD=AS of credits

Ongoing work & challenges

- Aggregate the demand and supply of credits to simulate market clearance
- Looking for the most cost-effective first-best scenario
- Hypothetical, but can serve as a baseline for other policies to quantify the potential tradeoffs

- Challenges:
- Costs and credits for combinations of BMPs

Thank you!

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