Overview

• Context – water quality & agriculture
• Review of long-held beliefs & changing viewpoints related to agriculture and water quality
• Leaps and bounds in recent times? Where has research been focussed in past 5-10 years?
• Current key areas of uncertainty?
• Challenges to advancing knowledge and steps we can take to minimize these challenges (collaboration?)
Context: Agriculture & Water Quality?

Effects of agriculture on water quality = priority research area → especially near Great Lakes
Agriculture & Water Quality...

More context...

• N & P both present issues for water quality → emphasis on these nutrients seems to oscillate but P is currently a priority

• Other water quality issues? (e.g. pesticides, pathogens)

• Contaminants differ in the way they are cycled, stored and/or transported → tricky to quantify export and manage/regulate together
Review of Past Beliefs...

- P mainly considered a surface runoff issue (sediment P), and subsurface P losses considered to be negligible; NO3 in GW

- BMPs developed for reduction of nutrient export (e.g. conservation tillage or no-till; buffer strips)

- Nutrient management efforts
Changing viewpoints related to water quality & BMPs in agricultural areas...

- Discussion since 1990s- regarding the role of tile drains in water quality

- Export via tiles highly variable in space and time but often linked to preferential flow
  – episodic and/or site specific

- A choice... tiles or surface runoff?? (is this landscape or soil type dependent?)
Changing viewpoints related to water quality & BMPs in agricultural areas...

• Riparian zone efficiency
• Tile drains bypass them!
• Seasonality?
• Flooding?
• Nutrient saturation?
• Full ecosystem services ➔
  e.g. $\text{NO}_3^-$ ➔ $\text{N}_2\text{O}$
Changing viewpoints related to water quality & BMPs in agricultural areas...

- No-till may be problematic?
Recent Progress/Research Areas Over Past 5-10 Years

• Generating precise estimates of nutrient export from agricultural areas (including seasonality)
• Understanding and quantifying contributions from drainage tiles
• Defining contributing areas
• Measures of riparian zone efficiency
• Modelling initiatives (some including the use of imagery)
• Controlled drainage
• Quantifying the effects of management practices (e.g. tillage type & timing, fertilizer application method & rate/nutrient mgmt indices, use of cover crops); tile intensity on water quality
Areas of Uncertainty/Challenges?

- The need for data
  - Longterm data sets
  - Winter sampling
    - How much data do you need? (scientific publications, confidence in results, generating policy) → # sites, length of data collection required?
    - Sampling frequency needed? Can we create a prescribed protocol or is it site-specific? Season-specific?
    - Data Management?

- Field methods? Edge of field monitoring. What works? Do we need some consistency across sites?
- Identifying management practices/ individual management decisions by landowners (lack of consistency across sites and sometimes lack of disclosure of info); Differences across jurisdictions?
- Getting cooperators on board (especially for long-term)
- Field Vs modelling Vs lab approaches – consistent or conflicting results?
- Issues of scale? Plot-field-regional scale
- Climate change?
Reducing some of these challenges through collaboration?

• Data Repositories

• Opportunities for dialogue/exchange of ideas with people doing similar work

• Opportunities for collaboration with people doing different but complimentary work?

• Science to Policy/Science to Practice: understand that the systems are complex and the solutions to water quality involve the system, the stewardship actions and the supportive policy working in a supportive way.