

## SERA-17 2015 Annual Meeting, Minneapolis MN

November 18 – 19

### Minutes

Meeting was opened by Carl Bolster, chair of SERA-17, at 8:00 AM. The meeting began with oral presentations broken up into 3 sessions. Following each session, all speakers from that session were made available for ~ 20 minutes of a moderated discussion. Following the presentations, there was an approximately 1-hr break out session for the workgroups, after which the groups reported to the entire group what they had discussed and the group's plans for the upcoming year. Business meeting was the final item on the agenda.

### PRESENTATIONS

#### **Session 1 – Impact of P on Water Quality**

*The impact of excess P on MN lakes and Rivers* – Steven Heiskary, MN Pollution Control Agency:  
Described impact of excess phosphorus on lakes and rivers in Minnesota. Various lines of evidence were presented that demonstrate impacts, distinct regional patterns in Minnesota's lakes and rivers, and how this information was used in development of eutrophication (phosphorus) water quality standards (WQS) for lakes and rivers. Examples included use of diatoms collected from lake sediment cores as a means to infer lake P status. In forested areas, diatoms infer P levels similar to modern concentrations (low). In rural and agricultural areas, diatoms from pre-European settlement infer lower P status than current conditions. A case study of a restored lake in an agricultural watershed demonstrated how this information can be incorporated with modern-day measures. The frequency and consequences of harmful algal blooms (HAB) was another useful example of the impact of excess P. While the WQ standards use TP, SRP is used in the diagnostic phase of TMDL studies to help define sources.

*River bank materials as a source and as carriers of P to Lake Pepin* – Satish Gupta, University of MN:  
The Minnesota River is a major contributor of sediment to the Mississippi River. USGS studies in 1994 showed that the Greater Blue Earth River Basin was the main source of sediment to the Minnesota River at Mankato. Recent LiDAR analysis showed that river bank erosion is the main source of sediments in rivers of the GBERB with as much as 79% of the measured sediments coming from river bank erosion/sloughing between 2005-2009. Chemical analysis of soil cores to 70 meter depth showed average total P concentrations varying between 400-500 mg/kg. A recent study shows that inorganic P concentrations of sediments in Lake Pepin pre-1850 match closely with inorganic P concentrations of fine particles in bank materials thus suggesting particle enrichment was the main process for higher P concentrations in Lake Pepin. The study further shows that increased TP in sediment post-1850 is likely due to P adsorption from sources such as sewage, waste from meat processing plant and other industrial activities, and leakage from the phosphorus fertilizer production plant along the Mississippi River upstream of Lake Pepin.

*Using paired edge-of-field data to assess impacts of management on surface and subsurface P loss* – Kevin King, ARS: Presented research from 20 paired sites with 2100 runoff events measured so far. Found that event flow-weighted mean concentrations of SP and TP are greater in surface than tile runoff. In 2015 which was a very wet year, nitrate flushed out of Maumee River very quickly with minimal to no nitrate following large rain events in June/July, but P continued to respond to those June/July storms resulting in additional P loading.

*How Management practices impact the relative proportion of dissolved P in surface Runoff* – Antonio Mallarino, Iowa State University: Presented results from field-scale and field rainfall simulation studies with corn-soybean rotations. Commercial fertilizer had higher P runoff and a greater percent was soluble than for liquid or solid manures. Incorporation greatly decreased total and soluble P loss from inorganic fertilizer and manures to less than half of surface broadcast without incorporation. For runoff events occurring 24 hours after application, increased rate of P application increased relative soluble P component in addition to increasing total P. A two-week delay in runoff was as effective as incorporation for decreasing P loss. Two-year results from an ongoing study with no-till showed no significant differences in soluble and total P loss between P fertilizer broadcast every 2 years in the fall and planter-band fertilizer every year.

## **Session 2 – The role of uncertainty in modeling and data collection**

*Overview of modeling strengths and limitations, need for uncertainty analysis* – Carl Bolster, USDA-ARS: Discussed sources of model uncertainty (model structure error; model input error; model parameter error) and presented results from uncertainty analysis using the Annual P Loss Estimator (APLE) model. Briefly discussed reasons why model uncertainties are often ignored (lack of expertise, lack of access to uncertainty analysis software, fear of undermining model credibility, unsure how to communicate to lay audience) but challenged modelers in audience to make greater efforts to provide estimates of prediction uncertainties when presenting modeling results.

*Uncertainty in nutrient loads from tile-drained landscapes* – Mark Williams, ARS: Sampling frequency, load estimation algorithm, and compositing strategy introduced varying levels of uncertainty in dissolved P load from tile-drained fields and headwater watersheds. Infrequent sampling (up to 30 d) introduced large uncertainties in estimates of P load. To minimize uncertainty in tile-drained landscapes, it is recommended that continuous discharge measurements combined with linear interpolation of nutrient concentrations be used to calculate load. To be within 10% of 'true' loads, samples for dissolved P should be collected every 13 to 26 hr.

## **Session 3 – modeling P through the landscape**

*Applications of APEX for P loss assessment and the P-Index evaluation* – Nathan Nelson, Kansas State University: Presented results from three levels of APEX calibration: Best professional judgment; full calibration; regional calibration. For runoff, all three worked satisfactorily. For sediment loss, however,

results using best professional judgment were very poor, full calibration was best, and regional calibration was satisfactory. For predictions of P loss, best professional judgment performed poorly whereas full and regional calibration worked fairly well.

*Applications of TBET for P loss assessment and P-Index evaluation* – David Radcliffe, University of Georgia: Presented predictions of runoff, erosion, and P loss using TBET for fields in AR, GA & NC. Results with uncalibrated model were somewhat acceptable for GA, but not AR or NC. Calibration improved runoff predictions to acceptable levels for AR and NC but erosion and P loss were not improved greatly. Probably not feasible to use TBET on regional scale or states other than where it has already been set up.

*Can hydrological complexity simplify watershed modeling?* – Zach Easton, Virginia Tech: Watershed models often aggregate data at a resolution too coarse to characterize important sub-field hydrologic and biogeochemical responses. As a result, they tend to do poorly at finer resolutions. Results were presented showing that using the topographic index as a proxy to distribute soil properties across a watershed improves field scale predictions or processes such as runoff response, soil moisture and, as a result phosphorus loss.

*Harmonizing algorithms for estimating P loss at different spatial scales* – Keith Reid, Ag Canada: Current work in Canada on P loss risk assessment tools for field scale and for national indicators was presented, along with the challenges of harmonizing algorithms across those scales. A common goal of both tools is to accurately reflect the magnitude of P losses in response to inherent conditions and management practices, while being transparent and relatively simple to use. Both tools use a component structure for the P loss calculations, and are (as much as possible) using the same P source X transport factors. The data sources for each, however, are quite different. The field scale P index depends on input by the grower or consultant who is intimately familiar with the soil and the nutrient management in each field. The national indicator is dependent on values for parameters on the Census of Agriculture data (collected once every 5 years and then interpolated), or on data that is calculated from census data (like soil test values, which are derived from estimates of cumulative P loading to census regions). Along with uncertainties in the data inputs, issues were identified with calibration and validation, and the challenges of deriving meaningful relationships between predicted P loss at a field scale and water quality measurements at a watershed scale. There are significant advantages to using the same algorithms to predict P loss at many different scales, and progress is being made, but the challenges are daunting.

## **WORKGROUP REPORTS**

Extension – Decided against doing any more fact sheets.

Policy – John Lory reported on the Information Exchange activity facilitated by SERA-17 with US-EPA and NRCS. The EPA-NRCS-SERA17 Information Exchange Activity was initiated four years ago to promote information exchange among the three member organizations. The objective of the group is to “discuss

state of the science with respect to nutrient management and nutrient transport issues with particular focus on animal feeding operations.” John has provided leadership on this activity since its inception with the members of the SERA-17 executive committee serving as the other SERA-17 representatives in these sessions. John is now proposing that leadership of the SERA-17 component of this activity be a fourth year of responsibility for leadership in SERA-17, that is, the former former chair will serve as the leader of this activity. There was general agreement at the meeting that this was an appropriate approach. John Lory and Deanna Osmond agreed to work to implement this plan.

Modeling – Group agreed on the following projects:

1. Develop a new review paper on modeling P
  - The paper will use as starting points the book and our journal article on modeling P in artificial drainage systems
    - We won’t repeat what was covered in these two, only developments since then
    - The paper should be forward looking, responding to the question of “What do we need to improve process-based modeling of P cycling and loss?”
  - Examples of what could be included
    - Predicting sediment seems to be a weakness based on CIG work with APEX and TBET
    - If WEPP is to replace USLE and its modifications, some have found that it is difficult to incorporate WEPP or have another model exchange information with WEPP
    - CIG projects suggest that APEX and TBET (and by inference SWAT) underpredict DRP when STP is high
    - Manure pool needs to be added to SWAT, APEX, and TBET
    - Pools in models should correspond to measurable pools in soils
    - Input of STP to SWAT, TBET, and APEX is confusing and output of pools may not be clear
    - Stream processes may need to be expanded to cover legacy P in bank erosion (on the scale described by Satish Gupta)
    - Fluxes between P pools in SWAT and other models is static, it may need to vary with level of P
  - Near the end of the process of developing the paper, we should have a meeting between SERA-17 modeling group and SWAT modelers
  - Carl will ask for input on model topics by the end of 2015 and send out an outline in early 2016
  - Paper will be organized by processes, not by model so we don’t get too long-winded about our favorite model (just our favorite process)
2. Develop a letter to NIFA program officers recommending that modeling P in artificially drained fields be a priority in future RFPs where it would be applicable
  - In the letter provide the text that could be used in an RFP
3. During the workgroup reporting time, a member of a different workgroup requested that we put together a publication on “Communicating Models”

- This could involve improving understanding among a range of stakeholders, from scientists to crop advisers to the public, about how specific models work and what they do.
- Tom Bruulsema volunteered to assist with the effort from a non-modeler standpoint
- This could be accomplished in a few different ways
  - White paper published on the SERA-17 website
  - Companion paper published with the review paper on modeling P
  - Publication submitted as part of the CIG P-index special collection of modeling/p-index papers.

Members Present: Zach Easton, Anoma Senaviratne, Candiss Williams, Alisha Mulkey, David Radcliffe, Nathan Nelson, Keith Reid, Carl Bolster, Brian Wiebe, Pete Kleinman, Chin Tan, John Ramirez-Avila.

BMPs and Soil Fertility:

- **BMPs: greatest interest in moving BMPs forward. Round table about individual interests:**
  1. Doug: NRCS emphasis on soil health, SH is not the silver bullet in WLEB, but think it is important in the toolbox—tradeoffs for practices that are traditionally used for P reduction
  2. Kevin King: look at 4 Rs more soil testing and placement and also disconnecting hydrologic pathways
  3. Zhang: quantification of manure P levels (fertility) and availability to meet crop needs, soil P testing doesn't reflect P loss...and doesn't address soil P storage
  4. John Lory: soil fertility
  5. Kim: NT/Till and soil response to P
  6. Tom: 4Rs that PUE, yields, etc.
  7. Mark: transport of P, sources (soil, legacy, fertilizer)
  8. Don: TMDLs for Lake Champlain, BMPs are going to be enforced but not sure they know which ones are the best for reducing P
  9. Janet: plant species diversification
  10. Barbara: BMPs that leave cover crops are useless up in Canada, looking at what is good in their region, soil testing being used for right purposes
  11. Trevor: BMPs pluses and minuses, target placement on landscape (hydrology, sensitivity, critical source area)
  12. Emily: Cover crops-timing and use of them in conjunction with manure application
  13. Gabe: Science that is produced, design programs for farmers, and help policy makers determine which policies to put into place, prioritize BMP effectiveness. Should be paying farmers to do BMPs bc spring floods wash them away or should we spend money on accurate placement of BMPs?
  14. Yutao: Manure P, soil health, soil P loss
  15. Merrin: Climate drivers on P immobilization and flow paths, which BMPs are going to get us through the winter period (but they also have summer)

16. Dory: ways to improve soil health in hopes of increasing WHC and root growth, mixed forage systems in critical source areas (forage), redistribution of nutrients at top slopes and slow nutrient loss down at down slopes.
17. Martha: labile P not accounted for in STP, placement of practices across a landscape to improve soil health
  - **P issues and BMP placement problem and solution are climate, landscape and cropping system specific (regional differences)**
    1. Land management and observations from BMP placement
    2. Define soil health: soil to support plants, animals and humans (NRCS)
  - **Soil Health**  
 What is soil health and what are the BMPs that contribute to soil health. How do we measure soil health? How does soil health BMPs differ from region to region – Review paper on soil health and P reduction (Gabe take the lead on a paper, Doug, Kevin, Dory, Tom, John, Merrin, Mark, Martha will help)

#### **Soil Testing for P Recommendations**

- A need over course of next year to formulate how we have this discussions; need a forum to start discussing this and benefit for spatial discussions
  1. Don: NRCS recommends P at replacement levels unless at Very High P Index
  2. KK: way over applying based on soil test. Not accurately estimate labile in soil that can move over rapidly. Possibly need a little pop-up P
  3. Zhang: soil test that will reflect P available in soil, including labile
  4. Antonio: If use fertilizer, use soil test per crop recommendation, 590 criteria for manure: bc farmers need to get rid then use N-based rate and can apply unless PI is at a certain level. This is only true for CAFOs...small farms can do whatever they want. Is the PI credible and use it for the cutoff for P application.
  5. John: Industry 4Rs...right rate, there is a gap between how conceptualize P fertility and communicate P fertility to our farmers, there isn't much information about fertility (thinks regulations are too high in MO) and that there will be a WQ benefit without reduction in yields, when do you start applying at removal and how do you justify when you are and when you aren't doing that.

Members Present: Doug Smith, Dory Franklin, Merrin Macrae, Yutoo Wang, Gabrielle Ferguson, Emily Duncan, Trevor Wallace, Barbara Cade-Menun, Candiss Williams, Don Ross, Martha Zwonitzer, Mark Williams, Tom Bruulsema, Kim Schneider, Tiequan Zhang, Antonio Mallarino, John Lory, Kevin King.

## **BUSINESS MEETING**

Carl: opened floor to any issues for discussion

Andrew: indexing and idea of publishing, to publish some of this (Pete suggested JEQ) Pete: special issue proposal around the CIG projects, what learned from modeling and P-Index assessment Andrew: possible that some of the discussion topics could be published in the proposed special issue (possibly in spring), submissions due in May (possibly 40 papers)

Carl: website maintenance, Andrew's student is currently doing this. Send to Andrew and he will forward them on to her. Working through Ag Communication's Department at UArk

Next Year's meeting: Location and what covered

- Tri-society meeting will be held in Phoenix. Will coordinate with Nutrients and Environmental Quality (work with chairs of society)
- Possible field trips include visiting Urban LTER site, meet with folks that run NSF funded P Research Network, half day field trip to see project using algae to reclaim P (majority would like the field trip)...Doug will check into this.
- WebEx for the meeting, presentations for those who cannot make it or rather a post-webinar that offers the same material
- Should we run webinars, should we charge or offer for free? But CCAs have to charge to get CEUs so could be expensive, but if not offering CEUs then could be cheaper.
- Can we just do the meetings live via streaming and charge folks for that? Would we have to use conference sites facilities or will they let us use our own cameras. (Amy will look into this)
- Need to start thinking about annual meeting for 2017. Toledo, Ohio was suggested as a potential meeting site for 2017 given the high profile P issues in the region. Membership supports this! Doug and Amy will begin to discuss this and get with Deanna to help start with the planning.

Topics Covered:

- Manure and Fertilizer
  - Winter spreading and timing of application
- Irrigation
  - Mass balances, Arid locations
  - Climate change (swings in weather)
- Soil Test P
  - Rapid fire on 2 topics (10 people each) then spend next 2 hours discussing the topics (e.g. soil test recommendations)
  - Nathan: poster session at ASA, then rapid fire talks to start SERA and put posters up on wall here
  - Facilitated discussion
- Non-growing season P reducing BMPs
- BMP prioritization

Further Topics of Discussion:

Forbes: SERA 46, Hypoxia in MS River, attached to Nutrient reduction frameworks; RFP for things that are similar to what SERA 46 is working on that might be applicable to what we are doing.

Carl: Thank you for serving. Pass off to Doug in January

Adjourn at 4:55.