Minutes of the SERA-IEG 17 Annual Meeting held in Windsor, Ontario, Canada. July 28 to 31 2009

Held in conjunction with the **Great Lakes P Forum,**
hosted by the **Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)**

Location: Hilton Hotel and St. Clair Centre, Windsor, Ontario

Tuesday July 28th (Hilton Hotel)

The SERA 17 group was welcomed by Quirine Ketterings, 2008/2009 chair of SERA 17. Following the welcome, Gail Hesse, Director of the Ohio EPA and chair of the Ohio Lake Erie Phosphorus Task Force presented the Keynote Address "Advice to those wanting to manage P in the Great Lakes - Learning from the Ohio experience"

Gail Hess provided an overview of the three major algal species responsible for algal blooms in Lake Erie (Microcystis, Cladophora, and Plectonema Wollei). The algal blooms primarily occur in the western basin of Lake Erie. Several sources of P inputs to Lake Erie have been suggested, including agriculture, mussels, lawn fertilizers, and public wastewater treatment facilities. She concluded that Agriculture is the major P source because: mussels influence cycling and are not a source, lawn fertilizers are primarily low P and slow-release, which lead to low losses, and the point sources are already under strict controls. Sixty-one percent of all P inputs to agriculture in the drainage basins are from fertilizer (32% manure, 7% biosolids). Some changes in agriculture (including larger equipment, move to more fall- and surface-applied P fertilizer, and P applications for multiple crops in the rotation) are resulting in greater P losses. Recommendations are to increase soil testing, follow soil test results when recommending fertilizer applications, and update the P-index for the region.

Wednesday July 29th (St. Clair Centre)

The Wednesday program was divided into 5 sessions followed by a Poster session and Banquet.

Session 1 - Distribution and Cycling of P within the Great Lakes

Jeff Reutter, Ohio Sea Grant Director, Ohio State Univ., discussed the basics of P in the Great Lakes. He provided an overview of land uses and trends in P concn. in water. Lake Erie drainage basin has the most agriculture, it is the shallowest great lake, has the highest nutrient status, and is the most productive ecosystem. Sedimentation and P loading are the greatest concerns. The Maumee river is the primary sediment contributor. P concentrations decreased from 1970's through 1995, however, P concn. have increased from 1995 to 2008.

Joe Makarewicz , SUNY at Brockport, presented research results on BMP effects on water quality of one of the finger lakes. The small lake was used a model of the great

lakes. BMPs were implemented in the watersheds around the lake which reduced N loading by 70% and TP loading by 30%. There were corresponding decreases in macrophyte growth and bacteria levels in the lake. Fifteen related articles were published in Journal of Great Lakes Research, vol 35, supplement 1 (2009).

Bob Hecky, University of Minnesota, Duluth, presented data showing that there is a rise in the dissolved P concentration in Lake Erie. The rise in soluble reactive P could be from Zebra Mussels. The mussels have been shown to significantly increase soluble reactive P in laboratory studies. There is a significant increase in the Zebra Mussel population in Lake Erie.

Session 2 – Streams and Rivers: Conduits, sinks or sources of P?

Helen Jarvie, Centre for Ecology and Hydrology, UK, discussed impacts of river processes on P delivery and transport. In general, they have found that the majority of sediments have the capacity for P uptake in agricultural systems (Jarvie et al., 2008, J Hydrology 350:261-273). They found that there was relatively low soluble P in pore-water of riverine sediments at the sediment-water interface, but the concentration increased with depth in the sediments. The sediment uptake process tend to dominate compared to biological uptake, however, the sediment uptake capacity is influenced by biological activity. This was illustrated in "load-flow plots" where P release was greater than expected at low-flow for some rivers due to anoxic conditions at low flow.

David Baker, Heidelberg College, Ohio, presented the trends in TP and DRP for tributaries draining into Lake Erie. Both TP and DRP peak during storm flow. There has been a consistent decrease in flow-weighted mean (FWM) SS concentrations. The FWM DRP declined until 1995, followed by an increasing trend in FWM DRP. Dissolved bioavailable P concentrations now exceed the particulate bioavailable P concentrations. There are large increases in DBAP loading in winter months corresponding to increases in flow and FWM DBAP concn.

Session 3 – From Field to Stream – Addressing the gaps

Bil Gburek, retired USDA-ARS, addressed the complexities of hydrologic controls on P delivery and the use of export coefficients in assessing P loss from watersheds. He emphasized that we need to develop experiments at time and space scales that are similar to the questions being asked. The connection between field evaluation and streams have been passed over or simplified and misses the real complexity in the watersheds. We still need to address the connection between the P-index and stream water quality.

Tiequan Zhang, Agriculture and Agi-Food Canada, described the relative amounts of P lost through surface runoff and leaching in tile drained systems, including BMPs to reduce P leaching in tile-drained fields

Don Flatten, University of Manitoba, presented data and discussed the magnitude of snowmelt P loss, P distribution in snowmelt, and BMP impacts on snowmelt runoff and P loss. Snowmelt hydrographs are extended over many days, the depth of interaction with soil is low, and there is very little sediment load. Primary P form is DRP regardless of flow rates. High soil test P is correlated with high DRP losses, but the coloration breaks down at low soil test P values. No-till tends to increase TDP and TP losses from snowmelt and vegetative buffer strips do not reduce P loss and may increase P losses in some situations.

Session 4 – Getting to the Source of the matter – measuring and mitigating agricultural P sources

Andrew Sharpley, Univ. Arkansas, presented in place of Peter Kleinman (USDA-ARS), and discussed soil controls on P losses. The soil buffering capacity of soils can be our friend (helping to reduce P concentrations through adsorption) or foe (desorbing P for long periods if STP is high). There are some good correlations between STP and runoff P concentrations. The buildup of STP in areas with high runoff is a chronic problem/P source and is difficult to control. In some situations reduced-till may be preferred to no-till because it mixes low-P soil with high-P surface soil, reducing the P concentration in contact with runoff water. Hydrology represents the greatest source of variability when estimating P loss from a field.

April Leytem, USDA-ARS, summarized the effects of manure characteristics on P availability and P loss from manure-amended soils. In general, more soluble P in the manure creates more P in the runoff. More phytate P in the manure produces less soluble P and less P in the runoff. Manures have different P source coefficients, dependant on manure characteristics and related to animal diets. Feeding DDGs increase both soluble P content and total P content of manures. Feeding phytase, highly available P grains, and low-P diets reduces the soluble P content and total P content of manures. BMPs of injection and tillage reduce P losses in the short term.

Session 5 – What additional mitigation tools are needed beyond the P index?

Keith Reid, OMAFRA, discussed the initial P-index concept relative to what has developed and the uses of the current P index. He suggested that the current P index was a simple and flexible tool, but all the modifications have made it convoluted. We have tried to adapt the P index into applications for which it was not initially intended or designed.

Eric van Bochove, Agriculture and Agri-Food Canada, presented the development of the “Indicator of Risk of Water Contamination by Phosphorus” (IROWC-P) tool. The tool is effectively the largest P-index developed. It is a multiplicative P-index with source, transport, and landscape connectivity components. The tool has been used to assess P loss from soils across Canada.

Jerry Lemunyon, USDA-NRCS, provided an overview of the P loss assessment from the NRI-CEAP study. Current conservation practices reduce P loss by 37%. Manured fields are high risk for P loss and loose 82% more P than non-manured fields. With enhanced management, P losses could be reduced by 60%. Comments from the audience suggested that we might consider integrating a sustainability index into the P index and evaluate the benefits from the current management.

Following the five sessions was a Poster session with 30 posters and a banquet. At the end of the banquet Frank Coal gave a brief remembrance of Greg Mullins, who passed away just prior to the meeting and Jerry Lemunyon gave an overview of the history of SERA 17.

Thursday, July 30th – Field Tour of Essex County, Northern Shore of Lake Erie

The field tour had six stops highlighting research, agricultural production, and conservation practices in the region.

- First stop was at the Agriculture and Agri-Food Canada Greenhouse and Processing Crops Research Center, where we looked at results from long-term fertility and rotation research on corn yields and toured a state-of-the-art drainage system designed to monitor surface and subsurface nutrient losses from a large-plot drainage experiment.
- The second stop was at Great Northern Hydroponics, a 50-ac greenhouse facility producing fresh tomatoes. The greenhouse used intensive management (fertigation, CO_2 fertilization, integrated pest management) to produce approx. 55 kg tomatoes/m^2/yr. The excess nutrient solution was recycled back to the irrigation water when possible. Non-recycled excess irrigation water was being run through some experimental wetlands to remove the nutrients.
- The third Stop was at a Cargill fertilizer and chemical dealer, where they explained the general management of fertilizers in the area. We also visited a local producer, who described his cropping and fertilization practices and explained why those practices had been adopted.
- The fourth stop was at a private farm that had worked with the Essex Region Conservation Authority (ECRA) to adopt best management practices such as GIS-assisted chemical applications, no-till, and tree plantings. The ECRA described their cost-share program used to encourage producers to upgrade and improve their management practices to benefit water quality.
- The fifth stop was at the Essex County Demonstration farm, which was used to promote conservation practices and demonstrate that agriculture could co-exist with wildlife/natural areas.
- The sixth stop was at the Sprucewood Shores Estate Winery, where we toured the vineyard, winery, and had a short-course in wine tasting followed by a dinner.

Friday July 31st – St. Clair Centre

The Friday program began with a panel discussion, followed by some wrap-up comments, the SERA-17 business meeting, and the workgroup meetings.

Panel Discussion

The panel consisted of Andrew Sharpley (Univ. Arkansas), Brad Joern (Purdue Univ.), Roberta Parry (US-EPA), and Keith Reed (OMAFRA). The panel, with audience participation, addressed the following four questions/topics:

1. How can site assessment tools be used most effectively to choose appropriate management options to mitigate P losses from agriculture? Who is the target audience? How should tools be linked to practices?

   Andrew Sharply suggested we develop 2 tools, a simple tool to address producer actions and a second tool that could be applied to a regulatory/quantitative application. Roberta Parry stated that regulatory bodies will fall back on the P-index because it is supported by the research community and has the USDA stamp of approval. They will not develop their own separate regulatory tool.

2. What should future site assessment indices look like to get us to the right management options? Is a diversity of approaches okay? What is the role of site assessment in tactical management? How far can we go to inform daily decisions of farmers and other agricultural nutrient managers?

   General comments are that some of the indices may be too liberal, hence some of the problems with a lack of change in management. It was noted that the indices need to resolve to a single value of X and then should allow producers to change their management as long as the management does not result in an index value greater than the accepted X stated in the NMP.

3. Role of site assessment in strategic management. At what level can we expect site assessment tools to contribute to strategic decisions?

   Roberta Parry suggested that it would be helpful to make the P-Index useful from a TMDL standpoint. Thus allowing watershed planners to use the P-index to determine if they are meeting the Ag portion of the TMDL for P loss in a watershed.

   It was commented that the current tool was not intended to reduce P loads or meet reduction criteria, but to encourage management practices that would reduce the risk of P loss and direct producers to adopt better management. If we want a tool to help meet a reduction criteria then that is a different tool.

4. What technology and market conditions need to be in place to make P balancing work?

   The overall issue of P loss is to balance P inputs on a regional scale. The P index is really not meant to do this, but rather it is a short-term fix to adopt management practices that will allow continued over-application of P while minimizing the risk of P loss. Gains have been made by encouraging the animal industry to reduce P concentrations in feed, which was helped by high P prices the last few years.

SERA 17 Business Meeting

It was proposed that next year's annual meeting be held in Madison WI, hosted by Pete Vadas (USDA-ARS), Laura Wood Good (Univ. Wisconsin), and John Panuska (Univ. Wisconsin). There had been some discussion of holding the meeting in Florida, however there was not any representation from Florida in attendance. Therefore, it was unanimously decided that the meeting take place in Madison Wisconsin.

Quirine Ketterrings nominated Pete Vadas (USDA-ARS) as the future chair of SERA 17. No other nominations were received. Pete Vadas' nomination was voted upon and it was unanimously decided that he be the future chair of SERA 17.

The body divided into three workgroups to conclude the meeting. The workgroups were:

- BMP/Factsheet workgroup – Forbes Walker
- Modeling/P-index workgroup – Nathan Nelson
- Extension workgroup – Quirine Ketterings
- Aquatics/Transport – Doug Smith

Workgroup reports follow.

2009 SERA 17 Modeling/P-index workgroup minutes

Goals and progress from the 2008 meeting and corresponding discussion from the 2009 meeting are as follows:

1. Objective: Create a database of field-scale runoff studies that can be used to validate P-indices.
    a. Progress: Pete Klienman had organized people to collect datasets from their respective geographic regions (Pete Klienman, North-east; Pete Vadas, central/north central; Nathan Nelson, Midwest; Darren Harmel, South; and April Leytem, West). The datasets will be arranged in excel workbooks, with one workbook for each site. Some datasets have been collected, but not posted on the web as of yet.
    b. Further Discussion: the "minimum" criteria for a data set needs to be very well defined. It should not be too restrictive, for example, are runoff and erosion sufficient? The latitude and longitude of the location may be very useful, but may not be required. There could be instances where research was done on private property and the lat/lon would potentially incriminate the cooperator. There was concern about posting the data on a freely accessible web site.
    c. Objectives: Continue to populate the benchmark field runoff database.
2. Objective: Assist in incorporating recent research in the update/development of process models
    a. Progress: Pete Vadas has been communicating with Mike White on updating SWAT with his model on P loss from manure/fertilizer sources. He has received back a beta version of SWAT.
    b. Discussion: Pete is also working on making a stand-alone version of his model available for others to use.
    c. Objectives: Continue to evaluate current routines in models like SWAT or RUSLE2. If we feel they are inadequate or have suggestions for change, make efforts to contact model developers and have changes implemented.
3. Objective: Develop a framework for standardized/national P Loss Assessment, or next generation of the P-index. This would be a quantitative index.
    a. Progress: We had a discussion of a National P Index at the 2008 ASA meetings with representatives from NRCS. They would like a uniform look, feel, and structure for P indices (like RUSLE2). This followed with a list-serve discussion about the components that would be required in a national P index in Nov. 2008. We had proposed that we summarize the current "quantitative" P indices, but had not made any progress on that
    b. Objectives: Document in a white paper type format a framework for a next generation P Index. Address questions like what does an Index need to do, what should it do, what technology is available to us, can an Index be simple but still powerful quantitatively, what is current status of development. This will be done by next meeting so we can make a presentation on it or make it the focus of a session.

BMP Workgroup Notes
Windsor, ON July 31st 2009

Forbes Walker, University of Tennessee

The BMP workgroup met to discuss our plans to revise some of the current BMP factsheets and develop some new ones. It was noted that the current factsheets were released in 2005 and no new ones have been finalized since then. It was suggested that an email be sent out on the list serve for any suggested changes / revisions that are needed.

The group discussed other possible factsheets that could be developed and hopefully released before the next SERA 17 meeting:

1. Manure and tillage – Rory McGuire (Virginia Tech), Josh McGrath (University of Maryland) are currently working on this
2. Manure management options – it was suggested with contact Virginia Tech and North Carolina State University who already have some extension materials on this topic
3. Feeding Distillers Grains – Rick Koelsch and Charlie Wortmann from University of Nebraska were suggested as possible authors
4. Feeding low phytate corn / soybeans – April Leytem from ARS Kimberley Idaho will draft this
5. Snow melt – a draft version of this factsheet was prepared several years ago by Sheilah Nolan (Alberta Agriculture) and others. Don Flaten (University of Manitoba) volunteered to take a look at the current version and see if any additional revisions are needed.
6. Ditch management – Chad Penn (Oklahoma State) and others are working on this
7. Biosolids - already drafted by Amy Shober (University of Florida)
8. Urban issues – to be developed by Amy Shobe (University of Florida)
9. Organic fertilizer sources – Rob Mikkelsen (IPNI) was suggested as a possible author

Some of these factsheets are in draft and others will have to be developed from scratch.

There was additional discussion on the need to possibly develop a white-paper on issues relating to no-till, phosphorus stratification and whether or not some tillage may be beneficial. In some parts of the USA tillage would greatly increase the amount of erosion so would not be a recommended practice. In Canada and some of the northern USA where erosion is not considered to be a dominant issue, some tillage may alleviate some phosphorus loss pathways.

Forbes Walker (University of Tennessee) will continue to co-ordinate the BMP factsheet workgroup.

Aquatics and Transport Workgroup

The first order of business was to coordinate a list of field and lab procedures dealing with In-stream or Aquatic processes related to P transport, and then to compile the procedures. Here is a brief list to start with, others will be added.

Lab:

- Equilibrium Phosphorus Concentration
- Exchangeable Phosphorus
- Phosphorus Sorption Index
- Phosphorus Buffering Capacity
- Phosphorus Sorption Ratio

Field:

- In-stream Injection
- Fluvarium
- Helen Jarvie's Daily Load End Member Analysis
- Use of Point Source Inputs in lieu of In-Stream Injections
- Nutrient Enrichment Media (used to measure limiting nutrients for periphyton)
- In-Situ Cartridges to analyze P gradients in the sediment (Helen Jarvie discussed these in her presentation)

Fluvarium techniques was included as a "field" technique, as lab procedures are generally "shake and bake" type bench top experiments. The original "fluvarium" experiments were done by House and Dennison on an experimental reach of a stream.

The above list will be added to within the weeks following the meeting. We will then set a tentative date and have people submit a brief description of the methodology. Doug Smith volunteered to submit something for the 5 lab procedures listed thus far, and the injection and fluvarium field methods.

We have also discussed coordinating regional research using these techniques. For those in ARS, the NP211 planning will start next summer, so now may be a good time to start coordinating some of these ideas.

Pete Vadas led an effort several years ago to start bibliographies on many transport processes. The question of starting or updating a bibliography on the topic was raised, with an emphasis on aquatic transport processes.

Another question raised was whether or not to include issues of transport from the edge of field to the stream in the workgroup focus.

There was some discussion about clarifying P terminology.