Breakout Group Summary:

Surface/Subsurface loss mechanisms

Participants (Review of recordings will be needed to complete list): Jeff Arnold, Lisa Duriancik, Zachary Easton, Gary Feyereisen, Chad Penn, Noah Schmadel, Tamie Veith, Mark Williams

The last portion of the workshop was dedicated to discussions about the shortcomings of models in simulating phosphorus processes and transport, the possibilities for model improvements, and the datasets which would support these improvements. The three breakout groups were categorized by major processes and mechanisms in SWAT, APEX, and other models with respect to legacy phosphorus. The breakout groups were instructed to discuss the following:

- Significant gaps in the models in regards to the breakout group topic (i.e., surface and subsurface loss mechanisms)
- The evaluation and/or potential improvement of routines governing the gaps in particular models
- Availability of datasets or the need for datasets to aid model routine improvements

Breakout Group: Surface/Subsurface loss mechanisms (sediment transport, solubility in runoff, manure interactions, transport in lateral flow, colloidal forms, groundwater contributions.

This breakout group discussed five gaps

1. Tile drainage representation

Tile drainage was the first gap discussed. Primarily, the discussion on tile drainage focused on the connectivity between the soil surface and the installed drains. The connectivity processes including macropore (crack (SWAT)) flow and even matrix flow would be benefit from checking for accurate process simulation in models. SWAT was the common model that was discussed as an example.

Furthermore, group participants commented that the physical representation (properties) of the tile network would benefit from evaluation within models simulating phosphorus processes. The impact of scale (large watershed to field) on model accuracy was also a concern. Are models more effective simulating full watersheds or can models also represent field-level information.

There was a question about a bug in the drainage tile routine of SWAT in which Tile P does not contribute to other routines. This will need to be checked in SWAT+ since it will likely be the SWAT model used in the legacy P project currently underway.

Datasets that may serve to improve tile drainage routines and the capacity to corroborate tile drainage parameterization and model outputs is a 30-m resolution spatial dataset on tile networks that is currently under development. An AFRI Grant on surface – tile connectivity has been proposed and possibly awarded.

2. Small ponds/Isolated Wetlands (Surface and subsurface movement)

At the tail end of the discussion of tile drainage and subsurface connectivity, the gaps in the simulation of phosphorus processes in saturated surface areas, such as small ponds and isolated wetlands, was introduced. Sediment deposition in these areas as well as processes in the water in these ponds (reservoirs) should be evaluated.

Differences between natural and manufactured saturated areas may affect the parameterization and modules enlisted to simulate these 'small ponds'. For example, areas dominated by karst geological formation have been modeled as "unstructured" tiles with split allocations. Ephemeral and surface saturated areas also will need to be differentiated.

Datasets to distinguish karst, ephemeral, and surface are necessary.

3. Soil profile transport

The particular concern with the transport of phosphorus through the soil profile was how well models represent isotope research results and either simulate preferential or other form of P movement.

Helpful datasets include soil water coverage to estimate soil water volume correctly, but if velocity estimates or measurements are missed, contact time between soil and water contact time will likely be incorrect.

4. Stream bank erosion and sediment

Without streambank erosion and sediment correctly represented, storage and transport of P will be impacted significantly. In SPARROW, crude lump storage has been

Processes that are not anthropogenic or are strictly geophysical have to be considered along with the anthropogenic processes in model routines on streambank erosion. On the other hand, deposition appears to be represented well.

Channel erosion has been limited by the lack of appropriate input data. Furthermore, there is not a national database of phosphorus in streambanks. However, other datasets are likely available for improving input parameters and output corroboration in streambank erosion routines. The following are potential examples of datasets to improve streambank erosion simulation:

- Datasets from Iowa, Kansas, and Indiana are available (more information is needed to pinpoint these datasets)
- Google Earth
- Multiple stream or reach cross-sections measured by LiDAR, UAVs, better topo surveys, and constructed flowpaths
- Meandering mapping
- Vegetative control

5. Conservation practice integration into models

The group discussed revisiting model representation of developed management and conservation practices. We also discussed the potential for a template or blank BMP for inputting an appropriate set of parameters in the correct modules to build specific practices. It was mentioned that conservation practice templates have been developed to some degree and would be worth using and evaluating. Options for specific efficiency inputs of conservation practices in models are currently in progress and would offer another option for integrating conservation and management practices.

Broad question to ponder: How many processes can actually be represented effectively?

*Notes by Amy S. Collick