Working Group Report Out

Name of WG: Hydrology

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Summary of Discussion: Discussion was centered around 4 topics:  
 Research questions or research objectives: We do need to define research questions or at least monitoring objectives in order to define how hydrologic variables need to be monitored. Possible research objectives include quantifying the impacts of BAU or ASP on water quantity and quality, or detect trends in water quantity or quality caused by climate change, or … Since water balance is a precursor to nutrient or sediment budgets, we focused on that aspect.  
 Scale at which hydrologic measurements should be made: Water balances will be measured in catchments defined by either the smallest perennial stream, or intermittent channelized flow if no perennial stream is available. After quickly recognizing that the scale varies with availability of water, we came up with the idea that the scale could be defined by an intrinsic characteristic of each site. A possibility would be the area needed to obtain a given level of net primary productivity. This would lead to larger areas where water is scarce and smaller areas where large amounts of water are available. In the midst of this discussion, we also talked about the possibility of having a pair of watersheds (paired watershed study), which would be advantageous from the point of view of quantifying change caused by management, but difficult in areas where scientists have no control on private land.

Recommended procedure to assess each hydrologic variable: Measurements must include precipitation inputs, irrigation inputs, stream flow, evapotranspiration, groundwater storage, perhaps also groundwater outflow, subsurface flow (lateral flow or artificial drainage), soil moisture. This discussion was initiated with measurement of ET and surface flow but was halted due to the recognition that resources should not be spent on non-essential components of the water budget. Hence the need to consider relative magnitude of each component of the water budget, measurement uncertainty, and the corresponding contribution to the whole water budget uncertainty.

Uncertainty of the measurements: Since no site has really assessed measurement uncertainty for all the components of the water budget, we propose a multi-location project designed to assess this. We propose that a goal of overall uncertainty of the water budget is 20%, at the annual level and if possible at the monthly or bi-weekly level, across the whole network.

Decisions Made:

Scale: Propose the possibility of an intrinsic measure of spatial scale, for example a given amount of net primary productivity.

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Uncertainty of the measurements: design a multi-location project to assess measurement uncertainty for the components of the water budget. This would lead to a paper.

Multi-site project:

* Identify the major components of the hydrologic budget at one LTAR site (BAU, ASP, or observatory or all).
  + Quantify the magnitude of each component (Event basis)
  + Quantify the uncertainty of each component
  + Quantify the contribution of each component to the overall water budget uncertainty
* Define network uncertainty goal for water budget on an event, monthly, and annual basis.
* If overall water budget uncertainty > network or location specific uncertainty goal, improve estimates or measurements that contribute most to that uncertainty.
  + Install new equipment where it is needed.
* Daren will provide expertise on discharge uncertainty. Need to work with met data, and flux groups for ET measurement uncertainty, with soil group for soil moisture measurements, …
* Will necessarily include a survey of how measurements are done (equipment, SOP).

Water quality. Test bed to test different in-situ real-time sensors: N, P, forms of C, turbidity (sediment). Pathogens? Work through measurement compatibility. Is that compatible with intermittent runoff? Could these sensors be adjusted to intermittent flow? Come up with preferred sensors, and operating procedures. Sites: the two Chesapeake Bay groups. If other sites have been testing sensors, they are invited to participate by sending sensors. Year 1: test sensors at 1 or 2 sites. Year 2: expand to other sites.

Priority 1. Each site should pick one monitoring site (BAU, ASP, or observatory). We will send questions to describe the monitoring equipment and the methods used to estimate each component of the hydrology budget. We will provide guidance to those who don’t know how to do this. We will then use that information to quantify uncertainties in these measurements or estimates. Each site will also be asked to estimate annual values for each component of the hydrologic budget. Guidance will be provided.

Goal: Identify major components of the water budget that need to be estimated or measured more accurately. Quantify uncertainties for modeling purposes.

Priority 2: Each site should send one or two in-situ, real time water quality sensors they are considering. Those will be tested in Pennsylvania against each other and against concentration values measured in collected water samples.

Goal: Identify the feasibility of using these sensors.