Proposed Agenda for Forest Disturbance Meeting, Friday, November 30 @ 1PM EST

The objective of this meeting is for the team members of the NASA funded project, *"Improving BASINS/HSPF predictions of nitrogen export to improve TMDL accuracy using NASA imagery,"* to describe their efforts and to scope out an approach to work with the CBP to incorporate the results of our effort into the CBPO to improve its capacity to estimate nutrient loading.

NASA Project Team and Responsibilities

Phil Townsend, University of Wisconsin

- Lead Principal Investigator
- Development of remote sensing inputs to characterize loads of N from forested components of watersheds
- Effort led by Ph.D. student Aditya Singh
- *OUTCOME: Model coefficients to apply to MODIS imagery to produce monthly estimates of nitrogen loads from forested pixels to be used in the Chesapeake Bay Model*

Angelica Gutierrez-Magness, University of Maryland

- Operation and potential modification of Chesapeake Bay Model to assess the new inputs from remote sensing
- *OUTCOME: Implementation of Chesapeake Bay Model to assess how the use of the MODIS-derived inputs affect model performance*

Keith Eshleman, Appalachian Laboratory

- Hydrology: develop load estimates for forested watersheds as used to calibrate (one data set) and then validate (a different data set) the remote sensing models
- *OUTCOME: load estimates from forested areas to help better characterize temporal and spatial variability in loads from forests*

Brenden McNeil, West Virginia University

- Assess impacts of different disturbance types on water quality
- Lindsay Deel, Ph.D. student
- *OUTCOME: understanding causes of variability described above*

Project Overview

Mathematical models are a critical element in predicting the effects of human activities and natural processes on the quality of water in lakes and streams. Water quality decision support systems such as BASINS (EPA software based on the hydrological simulation model known as HSPF) are presently being used to simulate pollutant loads from large complex multi-use watersheds in order to partition the total load of various constituents into more management-relevant components, thus improving the efficacy of nutrient management efforts. Such partitioning is an important aspect of establishing and addressing total maximum daily loads (TMDLs) of various pollutants—a task presently mandated by USEPA under the Clean Water Act regulations. Some of the more useful applications of BASINS in this regard include (1) categorizing non-point source loads as either controllable or non-controllable to facilitate establishing meaningful tributary nutrient reduction goals for Chesapeake Bay subwatersheds; and (2) estimating pollutant

loads by major land use category (e.g., forest, agriculture, urban, etc.). Remote sensing imagery can play a significant role in (1) partitioning pollutant loads among different land cover types; (2) aiding in the detection of changes in nutrient retention due to land cover conversions (i.e., the permanent change from one land cover type to another); and (3) incorporating landscape dynamics (i.e., seasonal changes in vegetation density or properties) into simulations of nutrient loads over time.

The overall project goal is to improve inputs to BASINS/HSPF to increase accuracy of predictions of N export to the Chesapeake Bay. The specific objective is to develop a remote sensing based approach to characterize nutrient export from the forested components of watersheds, on a monthly nasis. Most models for predicting nitrogen export or loads assume no spatial or temporal variations in N export from large areas of forestland. Although clearly mixed land use and fertilizer application are major drivers of diminished water quality, realism in the modeling of export from forestland is required to properly address land use contributions. Current assumption of Chesapeake Bay Model is a uniform load: "an acre of 'forests, woodlots, and wooded' land contributes 3.1 lb/year of nitrogen to the watershed."

The Chesapeake Bay watershed is 60% forested, and this biased assumption has been demonstrated to be problematic in numerous studies. Our objectives are:

(1) Develop inputs from remote sensing that allow us to better characterize seasonal and inter-annual variability of nitrogen loads from forests; and
(2) Implement these inputs within the HSPF (Chesapeake Bay Model) context to improve overall estimates of nutrient loads from all cover types based on more realistic parameterization of forests.

It is important to note that the variations in N loads from forests may vary as a consequence of numerous factors, including climate, disturbance. Our proposed remote sensing model is agnostic as to the causes of variation in N export from forests; it simply uses the functional properties of forests as derived from remote sensing to infer the nutrient retention status of those forests.

<u>Objective of Meeting</u>

There is a very specific outcome of this meeting. That is: what should be the way forward in terms of testing our MODIS-derived remote sensing product as an alternative to parameterizing forest N loads compared to the current implementation? How will we modify the model within special actions to accept this input? How will we recalibrate/tune the model based on this new input? How will we evaluate the model results and compare to the current implementation using this new input? (Note that our estimates of N loads from forests are monthly.)

<u>Proposed Agenda:</u>

1:00 Introduction to Meeting and Review of Objectives (Phil Townsend, PI on the NASA Project)
1:05 Participants introduce themselves
1:15 Phil Townsend and Aditya Singh powerpoint presentation on the work to predict N loads from forests in Chesapeake Bay Watershed, and discussion

1:45 Angelica Gutierrez discusses considerations in the implementation of the results from MODIS work into the Chesapeake Bay Model
2:00 Discussion of these results and how to proceed with testing within Chesapeake Bay model
2:15 Discussion of the evaluation strategy and what would be needed if CBPO wanted to operationalize the MODIS product
2:30 Brenden McNeil and Lindsay Deel discuss value-adding the interpretation of specific disturbances
2:45 Establish a timetable for interactions; discuss a potential workshop in Annapolis for the operationalizing of MODIS derived forest load estimates