Organisms-to-Ecosystems Working Group
Third Meeting Agenda

Homework Prior to Meeting 3:

1. Read: Landers DH, Nahlik AM. 2013. Final ecosystem goods and services classification system (FEGS-CS). EPA/600/R-13/ORD-004914, Washington, DC, USA. (on BaseCamp)
2. Read: Two new reports just out from US EPA on ecosystem services as assessment endpoints for ERA (uploaded to BaseCamp)
3. Compile toxicity data for EE2 & chlorpyrifos (or at least get papers and upload to BaseCamp; use appropriate folder labels)
4. Download and familiarize yourself with Instream and AQUATOX – both are freely available

Objectives for Meeting 3:

1. Complete some model forecasts for both case studies (with or without DEB implemented) to gain a concrete sense of how toxicants will impact our model systems.
2. Agree on how to link model outputs from InSTREAM/AQUATOX to ecosystem service delivery.
3. Develop a framework/approach for valuation of ES.
4. Develop a framework/approach and strategy (including funding) for DEB implementation into InSTREAM/AQUATOX.
5. Have a clear understanding of the integration of mols-orgs and orgs-ES models.

Sunday, September 25, 2016
Working group members arrive.

Monday, September 26, 2016

8:00 – 9:00 Breakfast

9:00 – 11:00 Welcome; Revisit Overall Objectives for WG; Where are We? Where Do We Need to Go? Discussion of Specific Objectives and Agenda for Meeting 3; Adjust if Necessary (**Valery & Chris**)

11:00 – 12:00 Update on Status & Plans of Mols-to-Orgs Group (**Roger**); Discussion of Implications for our WG (All)

12:00 – 13:00 Lunch

13:00 - 16:00 Technical Presentations & Discussions: How are energetics implemented in InSTREAM? (**Steve**); How are energetics implemented in Bjorn's trout model? **(Bjorn)**; How are energetics implemented in AQUATOX? (**Andrew**); How are energetics implemented in DEB? (**Roger**); Options for integrating DEB into InSTREAM & AQUATOX (**Nika** with help from Roger & Rob)

16:00 – 17:00 Preliminary meetings of sub-groups (see Day 2) to map out the plan of action for Day 2's work (All)

17:00 NIMBioS Group Photo and Reception

Tuesday, September 27, 2016

8:00 – 9:00 Breakfast

9:00 – 12:00 Work in Sub-groups to flesh out case studies (with person in bold as lead; Valery will circulate among groups as needed):
Group 1: Discuss & run simulations for Case Study 1 with InSTREAM, Bjorn's trout model and standard DEB (**Steve**, **Bjorn**, Roger, Virginie, Pernille)
Group 2: Discuss & run simulations for Case Study 2 (**Andrew**, Rob, Nika, Chris)
Group 3: Map out linkage between InSTREAM, AQUATOX and ecosystem services; agree on which services & beneficiaries will be considered & how valuation will be approached; determine whether and how the two new US EPA reports on ecosystem services influence our case studies (**Randy**, Yetta, Kris, Richard)

12:00 – 13:00 Lunch

13:00 – 17:00 Continue work in sub-groups with focus on generating concrete results

Wednesday, September 28, 2016

8:00 – 9:00 Breakfast

9:00 – 11:00 Subgroups present outputs from previous day in plenary with discussion

11:00 – 12:00 Revisit integration with Mols-to-Orgs WG

12:00 – 13:00 Lunch

13:00 – 17:00 Start writing up case studies in subgroups

17:00 - WG Happy Hour (details TBD)

Thursday, September 29, 2016

8:00 – 9:00 Breakfast

9:00 – 12:00 Continue writing up case studies, run additional simulations if needed.

12:00 – 13:00 Lunch

13:00 – 15:00 Final session; assess progress achieved; develop plan for completing Meeting 3 Objectives; agree on next steps to be taken and deadlines to prepare for Meeting

4; plans for additional outputs; discuss opportunities for funding beyond NIMBioS.

Friday, October 1, 2016
Working group members depart.

Reminder of Our Overall Objectives (as stated in WG proposal):

Objective 1(Meeting 1): *Develop a general conceptual model that can mechanistically and quantitatively link ecosystem services valued by the public to underlying ecosystem processes and the attributes of the species or groups of species contributing to those processes. To ensure a smooth interface with the molecules-to-organisms WG, we will consider daphnids and rainbow trout as key drivers of the ecosystem services that we model to demonstrate proof of concept. We will translate the conceptual models into mathematical terms, determining the data needed to parameterize and test each model.*

The first step will be to identify the key ecosystem functions that contribute to ecosystem services for which each of these taxa are drivers (e.g., biomass production, nutrient processing). We have chosen daphnids and trout as case study species because there is a wealth of data on these species at different levels of biological organization and because they are standard test species used in ecological risk assessment. The conceptual models will articulate all of the entities, state variables, and key processes that relate responses in our representative taxa to ecosystem-level responses. The models will be designed to predict impacts of chemicals (and other stressors) on ecosystem service delivery from information on individual-level effects in ecologically realistic scenarios; they will explicitly incorporate nonlinearities and feedback in the systems.

Once the conceptual models are construed, they will be converted to mathematical models using physiologically structured population models (PSPMs); de Roos and Persson 2013) and simulation modeling (i.e., individual-based models (IBMs); Grimm and Railsback 2005) to capture the dynamics of our focal species. By building on these well-established approaches that link individuals-to-populations, we will go on to develop entirely new ecological production functions that capture how changes in the population dynamics of our focal species alter ecosystem function, which can then be related to the delivery of ecosystem services. The aim will be to develop process-based and probabilistic models that can be parameterized with a combination of standard toxicity test data and ecological/life history data from the literature. That said, an important output of Objective 1 will be to clearly identify data requirements with perspectives on what modeling or extrapolation tools might be useful in the absence of a full data set for parameterization.

Objective 2 (Meeting 2): *Conduct preliminary tests of submodel forecasts, identify data gaps, conduct sensitivity analyses, and refine the models as necessary.*

Ultimately, we seek to develop models and a modeling framework that can be used to predict effects of chemical stressors on the delivery of ecosystem services. A key challenge the group will address is evaluating model performance at higher levels of biological organization or with

regard to the functions supporting ecosystem services. At these levels, available data are fewer and the systems far more complex; we expect that applying principles of control theory will become pivotal when predicting potential feedback in data-sparse systems. Throughout the model evaluation phase, but especially with regard to evaluating model forecasts of higher-level responses, we will adopt an evaluation strategy based on the concept of model *evaludation* (Augusiak et al., 2014) which is defined as a fusion of 'evaluation' and 'validation' and describes the entire process of assessing a model's quality and reliability. The group will identify evaludation approaches and metrics considered suitable for deciding when a model's performance is satisfactory.

Objective 3 (Meeting 3): *Meet with the Molecules-to-Organisms WG, share progress, and agree on an approach for model integration and overall framework development.*

Since our overall objective is to mathematically link the models developed in each WG, this effort will be facilitated by a coordinated meeting of the two WGs and will require considerable discussion. At this joint meeting of both WGs we will share the progress and challenges that each group has experienced and agree on the key elements that need to be included in developing a molecules-to-ecosystems framework. An important aim will be to ensure that model outputs of the molecules-to-organisms group can serve as model inputs for the organisms-to-ecosystems group.

Objective 4 (Meeting 4): *Link the completed organism-to-ecosystem service models with the molecule-to-organism models and develop a general framework and set of recommendations that can be used to generate similar models for other (less data-rich) species.*

The overarching goal of this and the partner working group is to develop a modeling framework that links molecular-level responses to the delivery of ecosystem services in a such a way that improves risk estimates of chemical contaminants using available data. The lessons learned and resulting molecule-to-ecosystem approach will be accompanied by recommendations for the application of the modeling approach to other species, systems, and stressors. Future research needs and plans for addressing them will be discussed. To facilitate discussion and ongoing research, models and documentation will all be made publicly available once published.