Schedule for Third NIMBioS Working Group Meeting, May 16-20, 2015

A Mechanistic Dynamic Energy Budget Model of Tree Performance to Predict Functional Trait Drivers, Species Distributions, and Responses to Global Change

Broad Aims of WG (a reminder!)

1. Develop a mechanistic DEB model that simulates growth (net photosynthetic C-gain) and survival of individual tropical trees in response to light, soil moisture, soil nutrients, temperature, and relative humidity.
2. Use model to identify optimal trait values that maximize growth and survival of whole tree.
3. Test model by comparing predicted trends in functional traits, growth, and survival along resource availability gradients with data for Bornean and Bolivian tree species.
4. Predict: (i) species distributions based on differences in performance of trees in response to variation in resources, such as along natural environmental gradients and (ii) responses of trees to environmental shifts caused by global change.
5. Examine: (i) trade-offs in function along resource gradients and (ii) whether alternative trait combinations can yield similar demographic outcomes.

Proposed Subgroup Tasks

1. Evaluate tasks that are needed for syntrophy manuscript to be submitted and who will be responsible for those tasks (tasks that require in-person collaborative work should be prioritized over those that can be done individually or remotely)
2. Describe the scope of the Resource acquisition component manuscript (i.e., one or two manuscripts) and identify tasks needed to be completed for manuscript(s) to take shape and who will be responsible for those tasks (tasks that require in-person collaborative work should be prioritized over those that can be done individually or remotely)
3. Identification of possible grant proposal submissions (see list of research questions, page 3)
4. Develop preliminary modeling approach for tree mortality
5. Discussion of and decision on the relevant time-step for the whole-tree model (temporal grain)
6. Identification of key processes that are not yet fully incorporated but should be for a credible model, such as: temperature (especially leaf temperature), a way of handling pests or mutualists (such as herbivores or mycorrhizae), others?

Schedule for third meeting

Monday May 16 **Progress Reports**

Goals	Review progress to date on modeling tasks and manuscripts in preparation.
8:00	Breakfast
9:00-12:00	

1. *Sabrina Russo* –Overview of progress on whole-tree model components (10 minutes)
2. *Valentin Couvreur* – Resource acquisition component – part 1 (aka, hydraulic submodel – soil focus; 30 minutes)
3. *Glenn Ledder* – Resource acquisition component – part 2 (aka, Hydraulic & photosynthesis submodel – plant focus; 30 minutes)
4. *Glenn Ledder* – Architecture component (aka, Allometry submodel; 20 minutes)
5. Coffee break (15 minutes at an appropriate time)

12:00-1:00 Lunch – informal discussions

1:00-3:00

1. *Roger Nisbet* – Status of manuscript on syntrophy model (45 minutes)
2. *Erik Muller* – Update on Bioenergetics component (aka, Storage & allocation submodel; 30 minutes)
3. Coffee break (15 minutes)

3:00-5:00 *Group Discussion* – Prioritization of subgroup tasks and manuscript opportunities, with task leaders, participants, and short-term goals identified

5:00 Reception with NIMBioS staff and researchers (*not sure if this will be on the first day*)

Tuesday May 17 Subgroup Tasks

8:00	Breakfast – informal discussions
9:00-9:15	Group Photo
9:15-10:00	*Sabrina Russo* – Mechanisms of tree mortality (30 minutes) & discussion
	Coffee break (15 minutes)
10:15-12:00	*Subgroup work*
12:00-1:15	Lunch – informal discussions
1:15-5:00	*Subgroup work*

Wednesday May 18 Subgroup work

8:00	Breakfast – informal discussions
9:00-12:00	*Subgroup Work*
12:00-1:15	Lunch – informal discussions
1:15 – 5:00	Mid-afternoon subgroup reports to entertain reconsider directions of the subgroups, followed by pre-dinner plenary large-group discussion, as needed, or subgroups may continue working

Thursday May 19 Subgroup work

8:00	Breakfast – informal discussions
9:00-12:00	*Subgroup Work*
	Identify subgroups of members who might collaborate on a grant proposal (subgroup task 7)
12:00-1:15	Lunch – informal discussions
1:15 – 5:00	Mid-afternoon subgroup reports, followed by pre-dinner plenary large-group discussion and planning for final day.

Friday May 20

Outcome: Identification of work to be done following WG

8:00 Breakfast

9:00-12:00	*Summary and critical review* of components of models (Leaders will have been identified previous day) and Presentations on future grant proposals
12:00-1:00	Lunch
1:00-5:00	Many members' flights may depart during this time, so no work is planned. For those leaving Saturday morning, a short hike may be arranged.

List of Phenomena to be explained/Questions to be answered

1. Under what environmental conditions does mortality from C-starvation versus hydraulic failure predominate? And what is the strength of the dependence of mortality probability on values of parameters or variables for the tree species and for which parameters or variables?

2. Does improved storage or allocation to defense improve survival more than does drought tolerance under given environmental conditions?

3. Does greater storage allocation always increase survival probability? If not, then under what environmental conditions does it decrease survival probability and what is the role of compounding interest in this process?

4. Can ecological trade-offs emerge from local organ-level control or is global-level control required? Can functional (phenotypic) integration emerge from local organ-level control or global-level control? (ie, There is no rule at the whole plant level, but one emerges from the local rules.)

5. There is a shift in species composition towards faster growing species observed in some tropical forests that is thought to be due to climate change. Can our model reproduce these shifts in trait variation under climate change scenarios? Or, what shifts in trait values does our model predict under climate change scenarios? Do those match what we observe to be occurring now and what does that tell us about the important climate change drivers of forest change? How does the NPP (C-assimilation) of a monoculture consisting of the species with the highest survival probability compare to that of a monoculture of species that have lower survival probability? and is this greater or lesser NPP due to changes in the growth rate versus trait values (ie, faster growth, but lower wood density). How does acclimation to temperature or reduced rainfall affect these dynamics? How are these dynamics affected by nutrient-limitation? [would need to have acclimation effect in the model]. This could be linked to the measurements of traits and stand-level NPP.