

Macrosystems Biology (MSB) Principle Investigators Meeting (Boulder, CO, March 11-14, 2012)

<http://www.cvent.com/events/2012-macrosystems-biology-pi-meeting/event-summary-9d3a8565926d4f9e96f512ad6b53b8d6.aspx>

Report of participants from “Do Macrosystems Govern Macroecology?” (M2M) Project

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UCAR meeting room

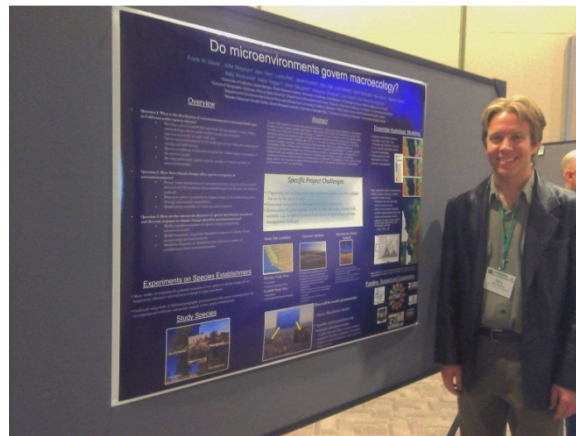
Twenty funded macrosystem biology projects were represented at the MSB PI meeting. The meeting opened with a poster session on Sunday evening, followed by two days of morning presentations and afternoon breakout groups. A tour of the NEON facilities nearby was offered Monday afternoon. The meeting was held at the Green Campus of the University Center for Atmospheric Research in Boulder.

Projects represented spanned studies from climate change to biogeochemistry. Leaders in the field such as Jim Clark of Duke, Jim Brown from New Mexico and Jack Williams from Wisconsin were among the PI's (see attached project list). Projects represented both full projects and exploratory grants. Including PI's and co-PI's, attendees at the meeting numbered about 80.

Research relevant ours included projects of Jim Brown (Effect of temperature on Biodiversity in the tropics), Jim Clark (Effects of climate on seed establishment) and projects on phenology, camera-trapping to monitor global vertebrate diversity, physiological modeling of lizards, and dynamic climate downscaling (see attachment for PI's and Co-PIs). We learned a lot from exchanging conceptual foundations and project design details with related projects. All projects are just underway, so there were not yet opportunities for extensive exchange of results, but this will change rapidly. Another PI meeting is planned for next year and the exchange of concepts this year should be accompanied by very informative exchanges of results at next year's meeting.

There was a lot of interest in our poster Sunday night. We spoke to PI's, post-docs and others about our common challenges. Some feedback: including herbivory as a treatment (planting outside as well as

inside an enclosure; how will we incorporate information about soil differences; a suggestion to measure fungi (using soil DNA assay for functional groups of mycorrhizae), and interest in the specific modeling approaches we will be using. Common challenges mentioned in/around the session were: incorporating information from multiple scales of measurement and coordinating and communicating among interdisciplinary teams.



John Dingman with the M2M poster

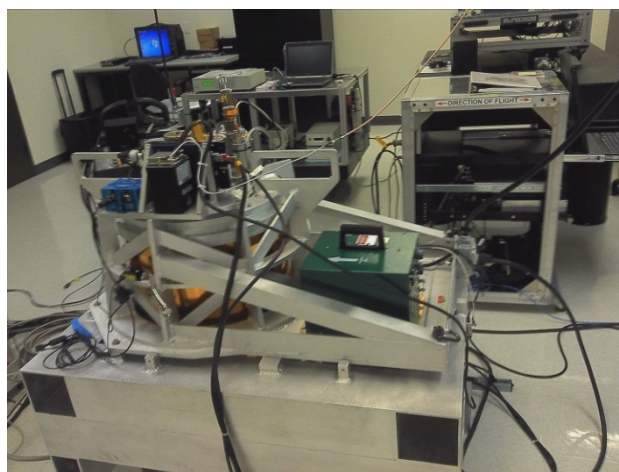
On Monday, the NSF program officers spoke about the goals of the meeting- including defining this new field, connecting us with NEON and each other, and giving all of us an opportunity to discuss common challenges and network among one-another. Additionally, they mentioned that they are working with Frontiers in Ecology and the Environment to produce a special issue (see below). Several talks during the morning addressed, in general, the field of macrosystem biology, challenges of scaling across continents, uncertainty propagation, and scaling across time. David Schimel discussed NEON and the history of the field. Alan Gelfand of Duke discussed spatial thinking for ecological matters, and thinking beyond descriptive statistics, dealing with transformed (i.e. paved/built-upon) systems in SDM's, and including stochasticity and probabilistic models (vs. convex-hull). Jason McLachlan from Notre Dame pointed to the Zobitz et al. 2011 Oecologia data assimilation paper for guidance in incorporating data into models and scaling across time. He also pointed out the value of using paleo data not just to confirm/verify models, but as data to incorporate in model-building. Problems of modeling soil moisture were mentioned and difficulty was discussed by Schimel and Gelfand. All agreed that observational data has been limiting to this field in the past, and we're in a new era of detection and extensive dataset creation (e.g. text-mining, legacy data, NEON, broad and varied data quality).

Breakout groups in the afternoon discussed these concepts. Our project delegation (Lee, Lynn and John) attended different breakout groups, but came to similar conclusions about what macrosystems biology is, and what the challenges are. Challenges that were acknowledged: knowing when experimental details can be scaled-up to models, incorporating *process*, not just pattern in models, which details matter, at what scales are your data relevant, trade-offs in measurement of both space and time; and dealing with thresholds and non-linear responses when scaling up from fine-scale experimental data to broad-scale patterns.

On Tuesday morning, there were presentations on data management, including on what data management firms like DataOne and Unidata can provide, and the importance of archiving data, and metadata (.eml). They mentioned a lot of things that we've been concerned with- nomenclature, documentation, metadata, etc. Corinna Gries (LTER) gave a talk on the utility of workflow systems (e.g. Kepler, Taverna, VisTrails) for automating and documenting workflows. We may think about documenting our methods/steps this way during model and code development to facilitate with data sharing. In particular Kepler was emphasized as a tool in keeping an organized workflow that incorporates steps done in other programs, such as R, Python (ArcGIS), Matlab, etc. EML was generally emphasized as a metadata standard.

We had lunch with Jim Clark (Duke Univ.) on Tuesday. He has some experience with seedling establishment data- specifically phenology data. Lynn might speak to him about recording and analyzing plant establishment data.

Lynn attended the field data collection breakout group, where challenges including consistency of observation and scaling up without linearly scaling up effort (i.e. automating and economizing with scale). Few other groups had an experimental component, and field studies were recognized as being relatively more expensive, but getting at *process*. Lee attended the simulation modeling breakout group, and John attended the information management group. During the information management breakout session many of the projects were grappling with how to manage and disseminate large datasets. Discussions took place on the advantages / disadvantages of housing the data in centralized location compared to having the data close to where it is being processed. One group was writing 6 TB/day and advocated FedExing hard drives is still the best viable option then trying to transfer data over networks.



NEON measurement tower and Lidar-MSS airborne remote sensing unit (NEON headquarters tour)

David Schimel led our NEON tour group on Tuesday evening- calibration of devices, infrastructure for repairing equipment and a sample tower control center (prefab box). We also saw one of three identical hyperspectral sensors that will be flying once yearly at all of the NEON sites. The new remote sensing platform included a hyperspectral sensor comprised of 428 bands, waveform LiDAR, and a 60 megapixel camera. David let us know that NEON will not be using HOBO dataloggers, and did assure us that our sampling network is at a finer scale, which is entirely different than what they are sampling with their equipment. He said that HOBOs do tend to drift over time, so we will need to keep that in mind. Adrian Rocha gave us a little more advice about maintaining logger equipment (silicone gel, aluminum foil, conduit).

On Wednesday we met to discuss the special issue of *Frontiers in Ecology and the Environment*. There was a lot of discussion around defining the field of “macro systems biology” [as a side-note, Henry Gholtz, sitting next to Lynn, pointed out that the title of this panel was chosen not because it perfectly represented the field, but because no one else had “made claim” to this phrase yet, and we are free to change it around]. The special issue is to have 4-6 papers, about 3500 words each. Small groups broke off to discuss the four different papers proposed. More information will be provided later on, but they are essentially: What is macroscale ecology? What tools are unique to macrosystem ecology/how do you do this kind of science? What are the social challenges to doing this kind of interdisciplinary science? What are the technical challenges to doing this kind of science? If you’d like to hear more or work on authorship on one of these papers, email David Schimel or Pat Sorrano, or wait for more notes to come out and email the group facilitator.

Session notes should be available soon.



Lee, Lynn and John weigh effects of warming and bark beetle damage, Rocky Mountain National Park, Wednesday after meeting