Questions and Hypothesis

(Note: we have updated PI participation in each hypothesis – may differ from original proposal)

**Question I: What Are the Short- and Long-Term Effects of Drought on Biota and Biogeochemical Cycling in Tropical Forests?**

***Hypothesis 1a.*** *Over the short-term, droughts will alter the spatial dynamics of seedling survival and growth along catenas. Drought effects will be exacerbated on well-drained ridges favoring drought tolerant species, while in poorly drained valleys drought will improve soil aeration and generally enhance survival and growth. (Zimmerman, Uriarte, Thompson, Walker)*

***Hypothesis 1b.*** *Over the long-term, increasing frequency of drought will lead to changes in community composition as drought-sensitive wet forest species become locally extinct or restricted to moist soils environments. High elevation forests may suffer more rapid changes in community composition, once a critical threshold of drying has been reached. (Uriarte, Waide, Willig, Zimmerman)*

***Hypothesis 2a.*** *Increased frequency of drought will enhance soil C storage in the short term due to slower decomposition rates associated with changes in the activity, abundance, and community composition of microorganisms and litter fauna. Greater soil oxygen availability during drought will increase soil P retention over the short-term, and decrease nitrous oxide and methane emissions resulting in a negative feedback to climate change. (Willig, Bloch, Cantrell, Gonzalez, Lodge, McDowell, Pett-Ridge, Schowalter, Silver, Waide)*

***Hypothesis 2b.*** *Over the longer term, greater drought frequency in tropical forests will decrease soil C storage. This will result primarily from lower NPP and associated C inputs in response to plant water stress and decreased P availability. (Silver, Lugo, McDowell, Wood)*

***Hypothesis 3a.*** *Increased frequency of drought will be accompanied by decreased stream discharge, increased leaf-litter subsidies and patchy anoxic conditions in stream pools, resulting in: (i) changes in stream trophic dynamics; (ii) increased rates of leaf decomposition; and (iii) increased production and evasion of CH4 and N2O due to higher nutrient and DOC levels and periodic development of anoxic conditions. (Covich, Crowl, Heartsill-Scalley, McDowell, Pringle, Ortiz, Ramirez)*

***Hypothesis 3b****. Longer-term, cumulative effects (3-6 y) of increased drought frequency will occur despite brief high discharge events that “reset” the system (in-between droughts), resulting in: (i) reduced subsidies of emergent aquatic insects to forest food webs; (ii) enhanced algal primary production; and (iii) extended periods of increased leaf-litter storage. (Crowl, Covich, McDowell, Pringle, Ortiz, Ramirez)*

**Question II: What are the Effects of Increased Frequency of Intense Hurricanes on Tropical Forest Biota and Biogeochemical Cycling?**

***Hypothesis 4.*** *An increased frequency of severe storms will increase the dominance of shade intolerant, pioneer plant species. Changes in vegetation composition will induce changes in heterotroph communities, including animals and microbes. (González, Willig, Lodge, Cantrell, Shiels, Zimmerman)*

***Hypothesis 5.*** *Soil C stocks will decrease with increasing hurricane frequency because of a lag in recovery of plant litter and woody debris production relative to heterotrophic respiration. Decreased woody litter inputs with increasing frequency of severe storms will change the composition of soil microbial communities and lead to faster turnover times of C in soils. (González, Lodge, Cantrell, McDowell, Silver)*

***Hypothesis 6.*** *Increased frequency of intense hurricanes could result in higher-elevation streams shifting from consumer-controlled to producer-controlled ecosystems, due to the increase in stream nutrient concentrations, litter inputs, and light inputs that re-configure terrestrial-aquatic linkages in these headwater streams and riparian forests. (Pringle, Ballantyne, Covich, Crowl, Heartsill, McDowell, Ortiz, Ramirez)*

**Question III: How do Changes in Climate Interact with Hurricane Disturbance, Land Cover, and Land Use Legacies to Shape Ecosystems of the Future?**

***Hypothesis 7.*** *A greenhouse gas-enhanced climate will drive changes at the global-to-regional scales, resulting in new, unique climate regimes forcing ecological change. Land use and land cover change (LULCC) will exacerbate the global-to-regional forcing. The additive effect will result in decreased rainfall and increased cloud heights on average but greater extremes in precipitation for the LEF*. (*Mote, Zimmerman)*

***Hypothesis 8.*** *Interactions between increased frequency of hurricanes and drought, mediated by land use legacies, will lead to novel biotic communities with altered biogeochemistry. This results from idiosyncratic responses of shade intolerant species to hurricane disturbance and drought, and their feedbacks on heterotroph communities, carbon storage, and nutrient cycling. (Zimmerman, whole group)*