**Fire and Monsoon project: Identifying a Research Plan**

***From Macrosystems Proposal:***

***3. Will the combination of climate change and spread of invasive species change the frequency of wildfires and patterns of connectivity in wildfire regimes across the domain and how will that perturbation disrupt those forcings that induce synchrony in regional ecological processes?***

**H6. Invasive species and wildfire connectivity.** Increases in the spread of winter-active invasive grasses in the western part of the domain and summer-active invasive grasses in the central part of the domain will increase the dry fuel load of lower elevation ecosystems, increase synchrony in the wildfire regimes across elevation gradients, and generally increase the frequency of wildfire across the domain.

**H7. Paleoclimate and fire.** Dendrochronological phases with high fire frequency coincide with domainwide spatiotemporal patterns of winter and summer precipitation that are deduced, from modeling with the land-atmosphere RCM, to be correlated with anomalies in Pacific SST that favor high winter precipitation (fuel build-up at lower elevations) and low summer precipitation (dry fuel at higher elevations).

We will test H6 by using the coupled WRF-CLM-ECOTONE-CATHY models to estimate fire frequencies for pinyon-juniper woodlands located in specified grid domains that border desert grasslands, and test for the influence of the spread of invasive grasses on fire frequency in both systems. We will test the sensitivity of this relation to different locations in the NAMS domain and during different climate regimes. We will test H7 by comparing the modeling results from H6 against reconstructed fire regimes from the tree ring record using analyses of fire scars. In this latter analysis we will search for relationships between fire frequency and distributions of winter and summer precipitation after cross-correlation between fire scar chronologies and climate chronologies constructed from the early- and late-wood ring analyses.

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Here is my take on Ellis’ notes on a set of general research topics, and considering the Macrosystems proposal:

1. Seasonality of fire recorded in scars: Ellis’ timing and variability of tree phenology questions, related to fire scar formation. This is key to understanding if premonsoon or monsoon conditions are influencing fire frequency. This would rely on Dan’s and MKHs sampling in Catalina’s – is this enough to really address this important issue? (especially if at least some of our analyses are in the Jemez?)

2. The character and role of herbaceous (grass) growth could link well to the larger proposal, since increases in invasive grasses and impacts on fire are a line of inquiry. There are a couple of things to look at here that were mentioned: a) grass as fuel and cyclicity/lags on ENSO-like time scales, b) using elevation (if this can be used to identify grass vs non-grass fuel) to look at fire history and links to climate on grassy vs forested sites, and c) Ellis’s pine litter vs grass for fire spread and the spatial variability (if we can indeed confidently identify grass dominated vs forested region over past centuries).

3. Elevation gradients (can link to #2 also) to evaluate different Ellis’ hypotheses related to monsoon (and pre-monsoon) fire-climate response among vegetation types along the gradient. To keep this manageable, select two areas with elevation transect potential (SE AZ and Jemez?).

Related questions of upper elevation high severity of fire (from Ellis: Is fire in upper elevation, wet, cool mixed conifer, aspen and spruce forests associated with consecutive dry summer and winter seasons, or inhibited by consecutive antecedent wet (or even average) summer and winter conditions?) as well as back to back fire years analysis could be part of this.

A bit more on paleoclimate data available for this project:

* Set of earlywood and latewood chronologies from prior work, PIPO, PSME (network in figure below), plus Mesa Alta from Chris G.
* Existing reconstructions of cool and monsoon precipitation, but not tailored to the two fire scar regions. Re-do to target Jemez and SE AZ if we decide on these regions
* Potential to reconstruct pre-monsoon conditions based on PSME with in northern monsoon region (done for 4 Corners region, May-June average maximum temperature)

