1. From the original NAM Macrosystems proposal:

“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 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.”

To address this hypothesis I propose the following:

**Research Focus #1 – A broad statistical analysis of the relationships between tree-ring reconstructed climate variables (summer and winter precipitation, and maybe pre-monsoon temperature or VPD) with regional and sub-regional historical fire occurrence from fire scars.**

**Specific analysis methods could include: (1) regression: modeling variability in annual percentage or number of sites (or trees) recording fire as a function of summer and winter precipitation and a pre-monsoon variable (temp or VPD) if we can develop a new reconstruction (2) superposed epoc analysis testing for consistent patterns (including lagging relationships) of the aforementioned reconstructed climate variables with a timeseries of annual percentage or number of sites (or trees) scarred, and (3) a cleaned-up version of the existing analysis of associations between reconstructed summer precipitation and fire-scar seasonality. These three analyses together could make a nice paper and seem to fit with the original proposal.**

*Additionally, a general, but explicit test of H7 with the tree-ring records could be accomplished by extracting the upper quartile winter precipitation years, the lower quartile summer precipitation years (and synchronous pairs of these years) and then testing if a significant proportion of all reconstructed fires occur during these years (maybe a Chi-squared analysis). The next step would be to bring in SST anomalies (e.g., SOI).*

2. From the original NAM Macrosystems proposal:

**“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.”

“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.”

It seems to me that hypothesis H6 is less testable with the tree-ring records, but we could address the climate drivers of variability in grass (fuels) and the effects of variability in grass fuels on fire spread within different vegetation types and across elevation gradients (i.e., from lower forests to upper elevation forests). This seems like it could be a nice complementary analysis of the “mechanisms” that go with the statistical tests of synchronization of fire by the NAM proposed above.

**Research Focus #2 –**

**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.**

*Additionally, a regional (or sub-regional) fire-climate analysis (using summer and winter precip) of fire scar sites adjacent to grass vs. sites far from grass could help get at the potential differences in climate drivers of fire regimes of forests with grass fuels vs needle litter fuels.*