# Preliminary Analysis, Partner Review

Michael Dann reviewing for Pat Sorensen

1. Points
   1. Goal: Determination of the effect of changes in climate on microbe activity in forest roots, and growth of the roots themselves. I believe Pat has made this point quite clear.
   2. Data: Cross-site study of soil core samples, affected by varying temperatures, snow-pack, and frost-depth. The covariates are presumably affected by an altitude gradient up the slope. The dependent variables are root biomass, soil moisture, enzyme activity, and N mineralization. The cores are spatially distributed by altitude, site, and by root ingrowth/exclusion properties.
   3. Exploration:
      1. Plots of root mass by snow-depth-accumulation and frost-depth accumulation (stratified by core type, root exclusion or ingrowth) shows very little relationship between snow-depth-accumulation and root growth or between frost-depth-accumulation and root growth
      2. Exclusion cores are shown to positively exclude root growth in most cases.
      3. Mixed effects models are run on *organic* soil (top 5cm) and many of the variables are found to effect nitrification in organic soil.
      4. Scatter plots of the microbial activity v snow/frost depth/temperature and colored by year demonstrate strong year effects that are not explained by covariate. Granted there’s just one covariate in each plot, but I still think it says something about underlying variability in the year that is not being picked up by the covariates.
      5. Model comparison via AIC for Nitrogen OH mod in the organic soil, looks like a good result: “The model selection suggests that the most parsimonious model of nitrification in the organic soil horizon includes core type and snow depth and duration - this implies that the effect of more or less snow along the gradient on microbial nitrification is in part mediated by the presence or absence of plant roots.”
   4. Description of models: The majority of the models presented are mixed or random effects models of 1-3 explanatory variables (with potentially some cross effects). This appears to be a reasonable starting point for the given data.
   5. Suggestions:
      1. The ingrowth cores that have non-zero root-growth (most of them) will allow you to normalize enzyme activity and nitrogen mineralization to root mass, allowing microbial activity independent of root growth to be assessed.
      2. Scales in the exploration need normalization so comparison between traits is easier(xlim =c(lower, upper) parameter). Also try superimposing the histograms.
      3. Mixed effects models are run on *organic* soil (top 5cm) but not on *mineral* soil (bottom layers). Why is that? Is there a potential hierarchical model hiding here?
      4. Looking at your scatter plots, you might need to go back to first principles and try to find some covariates that better explain why the year seems to have such a big impact. Personally, I have no idea what fuels microbial growth, but I would start by looking at climate variables are aggregates used in the literature.
      5. Model comparison via AIC for Nitrogen OH mod in the mineral soil “The results show that there is not much differentiation between a model that includes only volumetric water content at the time of soil sampling or core type and soil temperature at the time of soil sampling. The winter climate variables are not among the best predictors of net N mineralization.”  
         I think here there is an opportunity to ask what causes volumetric water content. Do more roots cause more water content? Is there a water transport process going on? Can a quick and dirty calculation on the climate variables be aggregated into a water transport proxy (evapotransport model)?
2. Seems like a good start. Unfortunately I can’t help you much on the various glmm packages. In general I think the focus should be on looking at your AIC results and trying to pin them down to physical processes in either microbial growth or creating climate aggregates that better explain the variance.  
   So many of your effect sizes appear small except for a few:
   1. year (which I think might be getting confounded with harvest date due to collinearity)
   2. core type

I think there is a variable(s) correlated with year that might explain your data. And this random year effect is just being picked up by your “harvest date” variable. Just like in lab 10 where we had a random time effect to explain variations in a hierarchical mosquito population, which we then replaced with precipitation. The difficult part then is in finding the driver.