Abstract: A longstanding challenge in ecology lies in quantifying biogeographic shifts in forest communities following the Last Glacial Maximum (ca. 21,000 years ago). Understanding biogeographic shifts has practical importance: which species have the capacity to track modern climate change? This has remained a challenge for primarily two reasons: uncertainty and dependence.

Biogeographic reconstructions of forest communities rely predominantly on fossil pollen records, which act as a proxy for surrounding vegetation. But the link between the proxy and vegetation is uncertain as a result of both data and process uncertainty. In this talk I will describe collaborative work towards addressing this longstanding question about biogeographic forest shifts from a Bayesian perspective. In particular, I frame this work as a lesson on the challenges associated with inference for spatio-temporal models with a high order of dependence, especially over large spatio-temporal domains. In addition to presenting a Bayesian hierarchical model that we developed that links multinomial pollen count data to underlying vegetation modeled as a gaussian process, I discuss some of the attempts to improve computational tractability of this model. I highlight current work in which we rewrite the model using a parameter augmentation scheme to improve posterior sampling efficiency, and results from this work.