Ecological forecasting has become a critical tool for managers and decision makers, and robust models are indispensable to provide reliable projections of species geographic range shifts and ecosystem functioning. Process-based approaches are expected to improve predictions under novel environmental conditions, wherein the trustworthinessof correlative approaches is questioned. However, this common assumption has never been properly verified.  
In this context, the aims of V. Van der Meersch PhD thesis is to do a fine comparison of the capacity of correlative models and process-based models to predict past and future distributions of iconic temperate tree species from European forests. We examine different versions of the models which differ in complexity and calibration methods in order to test different hypotheses about what convey model robustness. This comparison involves three temporal situations (late Quaternary, recent past, future) and different scales.  
This particular project falls squarely within these purposes. We will collaborate to take advantage of the richness and precision of NFI data to gain some constructive insights on model similarities/differences at a higher spatiotemporal resolution and to offer a new perspective on the future of Swiss forests.

Simulations and analyses:  
This work will involve two process-based models: (i) PHENOFIT, which focuses on phenology and how it relates to survival and reproduction, and (ii) CASTANEA, which is much more complex and simulates carbon and water cycles. Both models have been validated for several European species. We will also run several well-established correlative models.  
As a first step, we plan to run simulations for the whole country. Then, we will focus on plots that were systematically sampled since the 1980s. We will identify regions of greatest discrepancy and the causes of these discrepancies both in species range limits and in range shift velocity. In particular, we will assess the effects of greater climate variability and climatic distance from present day conditions on the accuracy of models’ projections.

Data requirements:  
We will make use of the presence/absence NFI data since the 1980s both for adults and juveniles (presence-only in the latter case).  
Both process-based models run at a daily step, and need several climate variables (average/min/max temperatures, precipitation, evapotranspiration, and in addition for CASTANEA wind speed, global radiation and relative humidity).