If you have a strong background in the modelling of environmental systems, computer programming (e.g. C++, Fortran, R) and an interest into vegetation or ecosystem science, I am sure we find a project for you when we meet and discuss. Just contact me to organize a meeting. In the meantime, you might consider the projects below, which do not necessarily demand very strong programming skills.

Thomas Hickler

Can remote sensing products be used to detect early warning signals of ecosystem tipping points?

The hypothesis that tipping points often are preceded by increased variability of ecosystem state variables and a slower recovery from disturbance (see e.g. Scheffer et al. 2009) should be explored using satellite products such as the Normalized Difference Vegetation Index (NDVI, see e.g. Hickler et al. 2005).

Which factors are driving global patterns in forest structure and functioning?

A generalized forest model (Smith et al. 2001, Hickler et al. 2004, Hickler et al. 2012) should be tested against forest plot data on species or plant functional type composition, forest biomass, tree density and size class distribution. Sensitivity experiments should be carried out to generate hypotheses concerning the main driving forces, such as climate, soil characteristics and tree life history traits.

Special requirements: Basic programming knowledge (e.g. C++, Fortran) would be beneficial.

Which global areas that are important for biodiversity preservation could be affected by major biome shifts?

Global projections of biome shifts as a result of climate change should be overlaid on maps of global conservation areas and biodiversity hotspots, see e.g. Thomas et al. (2008). Land use change scenarios might also be considered.

Special requirements: Experience in handling of large data sets and GIS.

Which factors determine the distribution of trees?

It should be analysed how well the distribution of European trees can be predicted using different climatic variables. Of particular interest is how well models using climatic variables that are associated with a special physiological mechanism, such as freezing tolerance, perform compared with purely correlative models, see e.g. Svenning and Skov (2004), Thuiller et al. (2006)

Special requirements: Experience in R programming.

Which factors determine the distribution of major forest types in North America?

A vegetation model parameterized for Europe (Hickler et al. 2012) should be parameterized for north-eastern U.S. The model should be tested against the current forest distribution and changes during the last 1000 years as part of the PALEON project.

Past fire regime in central Europe/Carpathians and the influence of biomass availability, climate and anthropogenic impact.

Counting charcoal particles from lake/peat sediments, and statistically inferring the fire regime: fire peaks, frequency, and fire return interval.

Literature:

Hickler, T., Eklundh, L., Seaquist, J.W., Smith, B., Sykes, M.T., Ardö, J., Olsson, L. & Sjöström, M. (2005) Precipitation controls sahel greening trend. *Geophysical Research Letters*, 32, 21, L21415

Hickler, T., Prenctice, I.C., Smith, B., Sykes, M.T. & Zaehle, S. (2004) Using a global vegetation model to test a comprehensive hypothesis on the effects of plant hydraulic architecture on water uptake in different types of plants. *Towards an integrated ecology through mechanistic modelling of ecosystem structure and functioning* (ed. by T. Hickler). KFS AB, Lund, Sweden.

Hickler, T., Vohland, K., Feehan, J., Miller, P.A., Smith, B., Costa, L., Giesecke, T., Fronzek, S., Carter, T.R., Cramer, W., Kühn, I. & Sykes, M.T. (2012) Projecting the future distribution of european potential natural vegetation zones with a generalized, tree species-based dynamic vegetation model. *Global Ecology and Biogeography*, 21, 50-63

Scheffer, M., Bascompte, J., Brock, W.A., Brovkin, V., Carpenter, S.R., Dakos, V., Held, H., Van Nes, E.H., Rietkerk, M. & Sugihara, G. (2009) Early-warning signals for critical transitions. *Nature*, 461, 53-59

Smith, B., Prentice, I.C. & Sykes, M.T. (2001) Representation of vegetation dynamics in the modelling of terrestrial ecosystems: Comparing two contrasting approaches within european climate space. *Global Ecology and Biogeography*, 10, 621-637

Svenning, J.-C. & Skov, F. (2004) Limited filling of the potential range in European tree species. *Ecology Letters*, 7, 565-573

Thomas, C.D., Ohlemuller, R., Anderson, B., Hickler, T., Miller, P.A., Sykes, M.T. & Williams, J.W. (2008) Exporting the ecological effects of climate change. *Embo Reports*, 9, S28-S33

Thuiller, W., Lavorel, S., Sykes, M.T. & Araujo, M.B. (2006) Using niche-based modelling to assess the impact of climate change on tree functional diversity in europe. *Diversity and Distributions*, 12, 49-60