

Will increased CO2 help feed the world?

A growing world population, combined with the effects of climate change, is expected to place extreme stress on the global food system in the coming decades. One piece of 'good' news, amidst the bad, is that increased atmospheric carbon dioxide concentrations have been shown in field experiments to significantly increase crop yields. A major challenge for scientists is to translate this information from experiments into simulations and projections of yield changes across regions or around the world. In recent years, we have developed a module for the LPJ-GUESS dynamic global vegetation model that enables exactly this scaling. To better understand whether the simulated forecasts are realistic, a careful evaluation of the model against observations is needed.

In this master's project, you will work with the latest version of the LPJ-GUESS crop model, perform simulations of historical and potential future crop yields, evaluate them against observations, and investigate the reasons for the simulated large yield increases. You will receive training in the use of a state-of-the-art scientific model and in data processing. In the process, you will also learn about the processes that determine how crop yields are likely to change in the future. Your research will contribute to improving the LPJ-GUESS crop model, which itself is an international collaboration between institutions in Sweden and Germany and contributes to a number of international assessments of the future food system (e.g., Alexander et al., 2018 <https://onlinelibrary.wiley.com/doi/10.1111/gcb.14110>; Rabin et al., 2020 <https://esd.copernicus.org/articles/11/357/2020/>).

How much do fires cost?

*The risk of wildfires is increasing globally with climate change. One of the consequences is increased fire damage, but also increased fire management costs. How high these costs are can only be estimated with great uncertainty. This master thesis is partly based on systematic literature search and synthesis on economic and non-economic damages, statistics & GIS-based analysis, and output on forest fires from the vegetation model LPJ-GUESS (e.g. Rabin, S.S., et al. (2017) *The Fire Modeling Intercomparison Project (FireMIP), phase 1: experimental and analytical protocols with detailed model descriptions. Geoscientific Model Development 10: 1175-1197*).*

The research will help improve fire consequence costs. You will gain insight into global ecosystem modelling and its evaluation. The work is done in cooperation with research groups in Munich, Frankfurt and Dresden.

For both works applies:

Advanced programming skills are not a prerequisite, since LPJ-GUESS modeling can be done without any modification of the underlying C++ code (only some basic commands in Linux are required), but the ability to analyse datasets with a programming-based software like Matlab or R is essential for the project, as well as an understanding of ecosystem modelling concepts. For topic (2), knowledge of GIS software is required.

Theses can be written in German or English, but for interaction with colleagues in however, good English 'speaking' skills are required.

As the work will be done at KIT's Campus Alpi, small student-contracts to cover rental costs in Garmisch can be offered.