



Tropentag, October 5-7, 2011, Bonn

“Development on the margin”

## Climate Dynamics and Agricultural Development

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### Abstract

Agricultural land-use is a key driver for the development of marginal lands and rural societies. At the same time, the expansion of agricultural land and the intensification of production systems increase many land-use related conflicts (*e.g.* ecosystem decline, land tenures and access to water).

Strategies to alleviate hunger and poverty have to consider potential future developments that could change regional needs and/or the foundations of project plannings. In this regard, climate change could have a high impact on land-use and land-cover change. However, their projections are uncertain with high variability among different state of the art climate models. Nonetheless, the high relevance to land-use change together with high uncertainties outline the need for climate impacts studies on agricultural systems.

Recent studies on future climate change impacts on agriculture production emphasised on mean climate change patterns. Vulnerabilities to annual climate fluctuations have rarely been considered. Although they bear high potential risks to prevent marginal land to develop.

We assume that climate change impacts are underestimated when relying only upon analysis of mean climate changes. For that reason, our study focuses on yield fluctuations due to climate dynamics. We use the dynamic vegetation model LPJmL to model yield developments on a grid level and compare aggregated annual mean values with FAO statistics from 1970–2000. We then change the models climate input and analyse how climate change could impact yield fluctuation and agricultural production systems in the future. We obtain potential agricultural sensitivities to climate extremes from the grid cell level to the country scale and identify regions, most prone to climate and yield fluctuations.

Because rural incomes in tropical and sub-tropical regions are highly related to agriculture, studies on yield fluctuations do not only encompass food production, but also food access and food stability. In this regard, the study results can contribute to help establishing long lasting and cost efficient food security projects that reduce hunger and increase income among marginal people.

**Keywords:** Climate extremes, food security, land use, yield fluctuation