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Climate Risk in Rural Value Chains: Using System Dynamics for Adaptation Planning in the Brazilian Amazon

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Abstract

Increased incidence of extreme weather events and corresponding future projections suggest that the Amazon region will not be spared out by the consequences of climate change. Relative natural resource abundance in the Amazon does not, as often proposed, imply low vulnerability to increased climate variability. Amazon populations and their economic activities have developed under extraordinary conditions of natural resource abundance. As a result, adaptive capacity to sudden changes has not naturally developed over time. Unexpected changes in river flow volume and seasonal rainfall intensity may thus hurt Amazonian rural economies no less than those in traditionally more drought prone areas, such as the semi-arid north east. Climate change will also affect the capacity of Amazon biome to maintain the provision of globally and locally valued ecosystem services, such as carbon storage and endemic biodiversity.

In this paper we propose a System Dynamics approach to analysing representative value chains of the three main sectors in the Amazonian rural economy, namely agriculture (including cattle production), timber and non-timber forest extraction, and fisheries. Together these sectors contribute annually with over € 12 billion to the Brazilian GDP. Our research is based on field data collected in the Northern Brazilian Amazon in 2009 within the Small Grant research programme of the German Federal Ministry for Economic Cooperation and Development (BMZ).

Major value chains were identified using official statistics and characterised based on semi-structured interviews with local traders, producer cooperatives and government officials. Based on these data, we show how dynamic discrete time models can be developed and implemented using the dynamic simulation software STELLA. We analyse a set of prototype models for representative value chains in the Northern Brazilian Amazon with respect to their vulnerability to climatic changes as predicted by IPCC scenarios and the results of regional simulations of future climate-vegetation interactions. Subsequently we show how model results can be used to involve local stakeholders and decision makers in participatory strategic planning for climate change adaptation.

Keywords: Climate change, risk management, System Dynamics

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