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"Reconcile land system changes
with planetary health"

Exploring the impacts of climate change on food security and household income: A cge model approach

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Abstract

Climate change presents a growing threat to food security and rural livelihoods in Afghanistan, where agriculture remains the primary income source for most households. Many studies have assessed the economic impact of climate change on cereal crops; however, limited studies have explored the impact of climate change on horticulture crops and household welfare in Afghanistan. This study assesses the impacts of climate change on food security and household income in Afghanistan using a Computable General Equilibrium (CGE) model. Specifically, it aims to: (i) assess the impacts of climate change on the commercialisation of fruits and vegetables ; (ii) examine the effect of horticultural commercialisation on household income levels; and (iii) analyse how climate change influences food consumption expenditure across different household groups. The model integrates climate-induced shocks such as variations in crop yields, land productivity, water stress, as well as commercialisation, household income, and food security. a three-step approach: (1) Cropping pattern (simulating the yield of fruits and vegetables) to establish empirical relationship between yield response of fruit and vegetable and climatic parameter (temperature and precipitation); used quadratic regression model and FAO water production model to simulating the relationship between climate variable and irrigated crops by estimating the relationships between relative yield (Yâ/Ymˆ) and relative evapotranspiration (ET â/ ET mˆ) , (2) stochastic simulation using Monte Carlo methods to generate yield shocks from historical climate data; and (3) developed using the CGE model created by Lofgren et al. at IFPRI. The model data source is the Social Accounting Matrix (SAM) compiled by the Bironi Institute in 2018. Precipitation and temperature data compiled from the ERA5-Land Daily Aggregated dataset from 1974 to 2024 based on agroecological zones. Actual evapotranspiration (AET) and potential evapotranspiration (PET) data were collected using the CROPWAT software, with the Penman-Monteith method applied for PET and the crop water requirement model used for AET. Preliminary model simulations suggest that climate change shocks may significantly threaten food security by reducing the productivity of fruit and vegetable crops and increasing food prices, with serious implications for rural household incomes.

Keywords: Afghanistan, CGE model, climate change, crop commercialisation, food security, household income

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