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Agroecological practices as climate adaptation strategy in Madagascar

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Abstract

Climate change is threatening agriculture and food security in many African countries, including the island state of Madagascar. Madagascar is particularly vulnerable to climate change because it already faces low yields and high levels of food insecurity. Agricultural production is dominated by small-scale subsistence farming with little use of external inputs such as synthetic fertilisers. Rice is the main staple crop, grown on about half of the country's cropland, followed by cassava, maize and sweet potatoes.

In recent years, agroecology has received increased attention as a potential solution to achieving sustainable agricultural development. It has been suggested that agroecological practices contribute to more resilient and environmentally sustainable farming systems, while reducing dependence on external inputs. Contributing to this discussion, the present study addresses the question of whether agroecological practices can enhance yields and yield stability in Madagascar under climate change. The study assesses climate change impacts on staple crops in Madagascar and the potential of agroecological practices to mitigate these impacts.

A climate impact assessment is conducted using an ensemble of ten CMIP6 climate models and the DSSAT crop model to simulate the production of rice, maize and cassava under different climate scenarios at a resolution of 0.25° at a national scale. Particular emphasis is given to the combined effects of elevated CO₂ and water and nutrient limitations. The application of organic fertiliser and mulch are included as agroecological practices.

Management practices in the model are informed by national census data and a household-level survey of Malagasy farmers. Model performance is validated using data from field experiments and national yield statistics. The results show the negative effects of rising temperatures and changing precipitation patterns. However, these effects are buffered for rice and cassava due to CO fertilisation. Implementing agroecological measures can mitigate the effects of climate change.

Keywords: Agroecology, climate change, Madagascar