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GENOMIC, AGRONOMIC, AND BIOCLIMATIC CHARACTERIZATION OF COWPEA (VIGNA UNGUICULATA) AND RICE (ORYZA SATIVA) LANDRACES COMBINED WITH SEASONAL WEATHER FORECASTING TO ENHANCE CLIMATE ADAPTATION FOR SMALLHOLDER FARMING COMMUNITIES IN MOZAMBIQUE

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Smallholder farmers play a crucial role in global food security. In the wake of the climate crisis, farmers experience increasing unpredictability of weather events and fluctuating crop yields. To enhance resilience and adaptability of smallholder farmers in northern Mozambique (MZ) we combine genomics, climate science and social science to co-design a dual climate service that distributes climate-ready cowpea (Vigna unguiculata) & rice (Oryza sativa) varieties and provides tailored seasonal rainfall forecasts.

We assembled a landrace collection of cowpea (425) and rice (331) varieties with an origin in MZ & neighboring countries from global and local gene banks. We have characterized the molecular diversity in the collection using genotyping by sequencing (ddRAD) and collected bioclimatic data and agronomic performance data in common garden experiments that involved farmers in participatory variety evaluation. To develop a seasonal forecasting tool, we derived Climate Predictions from downscaled seasonal forecast systems of the Copernicus Climate Change Service (C3S).

Preliminary data on sequencing of restriction-site associated DNA fragments for cowpea yielded over 3.2 billion reads and 49,727 high quality single

nucleotide polymorphisms (SNPs). A genome-wide association study mapping climatic adaptation identified 105 loci with potential breeding value. Rice samples yielded 996,061,072 million reads. Further data analysis work is ongoing. For seasonal forecasting, we have developed the R package AquaBeher, a prototype seasonal forecast tool of the agronomic onset of the rainy season for the study site.

We envisage a dual genetic and forecasting climate service which will empower farmers to make informed decisions delivering a direct impact on agricultural resilience and provide a lasting improvement of local food security.