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PHENOLOGICAL AND BIOCLIMATIC DIVERSITY REVEAL CHALLENGES AND OPPORTUNITIES TO ADAPT ETHIOPIAN BARLEY (HORDEUM VULGARE L.) TO A CHANGING CLIMATE

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The climate crisis is impacting agroecosystems of the global South, threatening food security of millions of smallholder farmers. Understanding the effect of current and future climates on crop agrobiodiversity can drive breeding efforts and adaptation strategies to sustain livelihoods of farmers in challenging settings. In this study, we combined a genomic, phenotypic, and bioclimatic characterization of a representative collection of Ethiopian barley landraces sourced from the largest *ex situ* collection of the continent.

We used remote sensing data to derive current and projected climates associated to local cultivation of 418 Ethiopian barley genotypes, which represent the entire geographical and agroecological range of cultivation of the crop. We used a double digestion RAD sequencing to genotype the entire landrace collection plus 40 varieties representing improved materials released for cultivation in Ethiopia, deriving more than 50K SNP markers after strict quality control with MAF > 0.01. Genotypic data allowed to trace back genetic diversity of landraces to geographic and environmental diversity in the country, showing the uniqueness of local genetic materials. We measured the agronomic performance of the collection, including yield component traits and phenology at two experimental sites during the main growing season (Meher) of 2017 and 2018.

Here, we combine the genomic, bioclimatic, and phenotypic characterization

of this collection to identify genomic loci with adaptation potential in a genome wide association study framework. We also employ a machine learning approach to link barley genomic diversity with climate variation, estimating the genomic offset in future climate scenarios. We observed that signs of local adaptation are associated with loci involved in mechanisms of temperature sensing as well as disease resistance, and we discuss relevant associations in detail. Our results show that leveraging local genetic diversity can provide valuable options to foster new breeding models able to address smallholder farming systems.