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Impact-based seasonal rainfall forecasting to trigger early action for droughts

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The Horn of Africa faces an ongoing multi-year drought due to five consecutive failed rainy seasons, a novel climatic event with unpreceded impacts. Over 50 million individuals in the region are expected to be highly food insecure by the end of 2022 and early 2023. The severity of these drought impacts call for the urgent upscaling and optimisation of early warning systems that trigger early actions. However, drought research focuses mainly on meteorological and hydrological forecasting, while early action is seldom addressed specifically. This leads to a gap between early warning and early action, which heavily reduces the effectiveness of these systems.

To address this gap, this study investigates the effectiveness of early action for droughts by using seasonal ensemble forecasts from the European Centre for Medium-Range Weather Forecasts (ECMWF) SEAS5 system, predicting rainfall for the March-April-May (MAM) and October-November-December (OND) rainy seasons. We show that these seasonal rainfall forecasts reflect major on-the-ground impacts, which we identify from 9 years of monthly drought surveillance data from 21 counties in Kenya. Subsequently, we show that the SEAS5 drought forecasts with short lead times have substantial potential economic value (PEV) when used to trigger action before the OND season across the region ($PEV_{max} = 0.43$). Increasing lead time to one or two months ahead of the season decreases PEV, but the benefits of early action still persist ($PEV_{max} = 0.2$). Highest value for early action is found for the OND season in Kenya and Somalia, with excellent PEV_{max} of around 0.8 in Somalia. This indicates exceptional potential for early action to reduce impacts in this drought-prone country. The potential for early action is relatively low for the MAM season across the region, due to the season's lower predictability. To illustrate the practical value of this research, we showcase how our methodology can be used by a pastoralist in the Kenyan drylands to effectively trigger livestock destocking ahead of a drought using SEAS5 forecasts.

These results are making headway to the development of concrete early action triggers for drought-prone regions, which are urgently needed to translate early warning to early action for droughts. It also emphasizes the need to expand historical datasets of drought impacts and early actions to support future research and policy development. Therefore, this work supports early decision-making and the development of early action protocols across the different countries in the Horn of Africa.