Occupational Health Risk to Agricultural Workers from Humid Heat

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As global per-person exposure to humid heat increases at a faster rate than dry heat, it is important to understand how the spatially non-uniform distribution of humid heat extremes affects populations uniquely vulnerable to the health risks associated with extreme humid heat exposure. Agricultural workers represent a population that is specifically exposed to heat-related health impacts as a result of the outdoor and physical nature of their work, compounded by a variety of socio-economic factors that make them vulnerable. Given that the timing and location of agricultural activity varies across the globe as a function of local climate and physiological differences between crops, it is important to identify the regions, crops, and seasons where workers are most at risk. Humid heat is crucial in quantifying thresholds for dangerous heat stress to individuals, as relative humidity and air temperature together contribute to the physiological intensity felt from outdoor heat. We overlay three globally gridded datasets that capture the given variabilities over the 1979 - 2019 period: a global map of the daily maximum wet-bulb temperature; a map of planting, growing, and harvest seasons for 25 crops across the world; and a map of real harvested area for these 25 crops. Using wet-bulb temperature (T_w) as a metric for humid heat and the lower bound of 27ºC daily maximum T_w, we count the days exceeding this threshold in each season at each grid cell for the 25 crops. We find that the most impacted crops are rice, maize, sorghum, and soybeans on a global basis. Notably, the cropland area for rice that sees more than two weeks of dangerous humid heat exposure in both the planting and harvest seasons has doubled over the last four decades. Globally, the regions that represent the broadest risk across crops are southeast Asia, equatorial and Amazonian South America, the Indo-Gangetic Basin, coastal Mexico, and the western coast of sub-Saharan Africa. Lastly, trends show that regions with the highest exposure currently are those for which humid heat extremes are increasing the fastest as well. As climate change exacerbates extreme humid heat events across the planet, efforts to mitigate the impacts of heat stress to agricultural workers will need to be informed by data that pinpoint the crop-specific seasonality of dangerous heat in the fields.