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A hotter-drought fingerprint on Earth's forest mortality sites—warming accelerates risks

William M. Hammond¹, A. Park Williams², John T. Abatzoglou³, Henry D. Adams⁴, Tamir Klein⁵, Rosana López Rodríguez⁶, Cuauhtémoc Sáenz-Romero⁷, Henrik Hartmann⁸, David D. Breshears⁹, and Craig D. Allen¹⁰

¹Department of Plant Biology, Ecology, and Evolution, Oklahoma State University, Stillwater OK, USA (william.hammond@okstate.edu)

²Lamont-Doherty Earth Observatory, Columbia University, Palisades NY, USA (williams@ldeo.columbia.edu)

³Management of Complex Systems, University of California, Merced CA, USA (jabatzoglou@ucmerced.edu)

⁴School of the Environment, Washington State University, Pullman WA, USA (henry.adams@wsu.edu)

⁵Department of Plant and Environmental Sciences, Weizmann Institute of Science, Rehovot, IL (tamir.klein@weizmann.ac.il)

⁶Sistemas Naturales e Historia Forestal, Universidad Politécnica de Madrid, Madrid, ES (rosana.lopez@upm.es)

⁷Instituto de Investigaciones sobre los Recursos Naturales, Universidad Michoacana de San Nicolás de Hidalgo, Morelia Michoacán, MX (csaenzromero@gmail.com)

⁸Department of Biogeochemical Processes, Max Planck Institute for Biogeochemistry, Jena, DE (hhart@bgc-jena.mpg.de)

⁹School of Natural Resources and the Environment, University of Arizona, Tucson AZ, USA (daveb@arizona.edu)

¹⁰Department of Geography and Environmental Studies, University of New Mexico, Albuquerque NM, USA (craigdallen@unm.edu)

Earth's forests face grave challenges in the Anthropocene, including hotter droughts increasingly associated with widespread forest die-off. But despite the vital importance of forests—especially historical forests—to global ecosystem services, their fates in a warming world remain highly uncertain. Critically missing is quantitative determination of hotter-drought climatic drivers at globally-distributed, ground-based, tree-mortality sites. We established a precisely geo-referenced global database documenting climate-induced mortality events spanning all tree-supporting biomes from 154 studies since 1970. Here we quantify a lethal global hotter-drought fingerprint from these tree-mortality sites across 675 locations encompassing 1,303 database plots. Frequency of these lethal climate conditions accelerates under projected warming, up 140% by +4°C. Our database, soon available at tree-mortality.net, provides initial footing for further community development of quantitative, ground-based monitoring of global tree mortality (e.g., still including peer-reviewed observations, but importantly also those from forestry professionals, land managers, and citizen scientists). Furthermore, our database immediately enables critical predictive model validation and improved remote sensing of mortality. While our initial database enabled empirical quantification of a global climate signal for hotter-drought triggered tree mortality, ongoing and online contributions to the database (with efforts to be more spatially representative) will enable myriad future analyses and progress toward understanding the role of hotter-drought in the mechanistically complex process of tree mortality. Our global fingerprint of lethal hotter-drought confirms many of Earth's forests are increasingly imperiled by further

warming.