ENVIRONMENTAL LAW INSTITUTE
CJP CLIMATE JUDICIARY PROJECT™

Drawing the Causal Chain: The Detection and Attribution of Climate Change

Executive Summary[1]

Attributing effects to causes is a central issue of both climate science and the law. In climate science, this is done through detection and attribution research. Detection refers to the identification of a particular climate-related change, such as an increase in global average surface temperature. Attribution refers to the identification of a cause of this change, such as human-caused greenhouse gas emissions. Attribution science has played an important role in the Intergovernmental Panel on Climate Change's (IPCC) conclusion that "it is unequivocal that human influence has warmed the atmosphere, ocean and land." Such a conclusion was reached, in part, through numerous independent model simulations of the climate with and without human influence. These invariably revealed that the observed warming trend would not be possible without human activity, namely the burning of fossil fuels.

Scientists may attribute the likelihood and magnitude of certain extreme weather events to climate change, but with differing degrees of confidence depending upon the kind of event. Most attribution studies discuss confidence in language adopted from the IPCC, which is calibrated to the amount of uncertainty that underlies a given finding. In general, confidence in an attribution statement is highest when multiple, independent teams arrive at similar conclusions using different observational data sets, different climate models, and different attribution techniques. Scientists have very high confidence in their understanding of the influence of climate change on certain events, such as heatwaves, but lower confidence in other events, such as tornados. The ability to attribute one specific event to climate change depends on several factors, including understanding the influence of climate change on that type of event generally.

Attribution science can be used to assess the influence that climate change has on the impacts of some individual events. For example, three separate attribution studies found that precipitation from Hurricane Harvey was increased by between 7% and 38% and that the storm was made four times more likely to occur with such heavy rain because of human-caused climate change. Scientists then showed that this increase in precipitation resulted in a 1- to 3-foot increase in the depth of the flood, and an increase of 14% in the extent of the flood. Reinsurance companies identified around $90 billion worth of losses due to this flood, and it was estimated that $13 billion of these losses could have been avoided if there had been no human-caused climate change. The high-resolution nature of the model used in this study also allowed scientists to determine which houses were flooded due to climate change. In Harris County where Houston is situated, about half of the flooded homes were Hispanic households, a disproportionate number considering that census data indicate those households account for only 36% of the county's population. Other impacts, like deaths from heatwaves, can also be attributed on average to climate change because of the well-documented relationship between

temperature increase during a heatwave and average increase in mortality. For instance, this kind of work estimated that over 500 people died in Paris during the 2003 European heat wave because of climate change.

Judges are already being asked to make decisions about who might be held responsible for climate impacts, and they will likely be asked more often to do so. While the question of responsibility extends beyond the realm of science, the scientific field of source attribution can provide some insights for apportioning relative contributions from individual sources. Source attribution relies on greenhouse gas accounting, which quantifies the emissions of a particular source. Sources could be actors, such as countries or companies, economic sectors, such as agriculture, or activities, such as long-distance airline flights. By dividing the emissions of a source by the total amount of anthropogenic emissions, scientists can identify the relative contribution of that source's emissions to climate change and thus to climate impacts. While this is simple in theory, it becomes complicated when considering the different approaches that have been proposed to quantify greenhouse gas emissions for which a source might be alleged to be responsible. For example, should a state be responsible for emissions that are associated with the combustion of exported fossil fuels from that state, or only the emissions within the territory of the state? Questions like these arose in *Held v. Montana* and will likely continue to do so. In addition, different methods for calculating a state's proportional contribution to a specific impact might yield dramatically different results. It will be up to judges and other policymakers, informed by science, to determine where the responsibility lies and how one should measure the contributions of the responsible parties.

[1] This is a summary of Drawing the Causal Chain: The Detection and Attribution of Climate Change by Michael F. Wehner.