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# Early Triassic hothouse climate sustained by vegetation collapse

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The Permian–Triassic Mass Extinction (PTME) is the most devastating loss of species richness and abundance in the geological record. It is generally agreed that the extinction was driven by global warming resulting from a huge injection of carbon into the atmosphere, but it remains unclear why these lethally-hot temperatures persisted for the entire 5 million years of the Early Triassic, when Earth system feedbacks should have returned temperature to pre-extinction levels within a few hundred thousand years.

Here we show that high temperatures could be sustained by the collapse of terrestrial vegetation. Plant life was devastated during the PTME, with global vegetation biomass dropping significantly, leaving a “Coal Gap” in the Early Triassic. We reconstruct the changes in vegetation through the late Permian to the Middle Triassic using a combination of fossil occurrences and lithological indicators of climate zonation, and use this spatial-temporal map of productivity and biomass to inform a long-term climate-chemical model. Our model results show that Siberian Traps degassing alone cannot explain the persistence of warmth through the Early Triassic, but when the vegetation changes are added, the model buries substantially less organic carbon, and has limited continental weathering rates, producing a record of tropical temperatures and carbon isotopes that are a good fit to the geological record. We conclude that the collapse of the tropical vegetation at the PTME ushered in a sustained period of extremely high surface temperatures, which delayed biotic recovery by millions of years.