

# Irrigation and climate change may trigger deadly heatwaves in China

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## Video Abstract

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# Abstract

A research team at MIT has spent years trying to unravel how climate change will affect Earth's habitability in the future. Using sophisticated computer simulations, they've shown that extreme heatwaves will sweep across a region spanning southwest and south Asia, potentially rendering some areas inhospitable to human life. Now, in the third part of this ongoing study, they've shifted focus to China – currently the largest emitter of greenhouse gases in the world. Using regional climate models that examine how irrigation impacts surface conditions, the team found that the current pace of greenhouse gas emissions will leave North China Plain, an intensely irrigated region that is presently home to about 400 million people, vulnerable to extreme heatwaves, making it difficult for humans to survive in what is now one of the most densely populated regions on Earth. The reason? Irrigation exacerbates heatwave conditions, worsening the impact of climate change. In recent years, China has experienced more and hotter heatwaves, as the mean surface temperature for the country has risen at a rate roughly double that of the rest of the world. Most studies have focused only on this mean temperature when characterizing heatwave intensity, overlooking the important contribution of surface humidity, which directly impacts how humans feel heat stress. Irrigation substantially increases surface humidity as well as the total energy of the atmospheric boundary layer. To account for this effect, the team first estimated the impact of irrigation in the period spanning from 1975 to 2005. They found that irrigation significantly increased the daily maximum wet-bulb temperature – and thus the intensity of heatwaves – over this time frame. The wet-bulb temperature represents the lowest temperature that air can be cooled to through water evaporation, and thus provides a measure of the body's capacity to cool itself by sweating. The upper limit for human survivability is 35°C. After validating the model's performance, the team simulated the link between irrigation and extreme heat waves for the years 2070 to 2100 under two conditions: a moderate-mitigation scenario in which greenhouse gas emissions are reduced, and a business-as-usual scenario in which current emission rates are maintained. They projected that the combination of irrigation and unmitigated climate change will increase the daily wet-bulb temperature over irrigated areas by nearly 4°C. In practical terms, this means that at the current pace of greenhouse gas emission, irrigated areas in North China Plain will experience extreme wet-bulb temperatures that exceed the threshold for human survival at least a handful of times over this 30-year period. On a more positive note, even moderate climate change mitigation efforts can significantly reduce the risk of these deadly heatwaves, suggesting it's still possible to keep North China Plain livable in the future. If China and other industrialized nations can make some tough cuts to carbon emissions, the rich soils of this region may yet support China's population for decades to come.