

The Sea Grant Files, Season 7, #4
Climate Change Attribution and Lake Superior's Productivity
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Hi, I'm Jesse Schomberg and you are listening to The Sea Grant Files.

I'm not sure if you caught the headline in the Washington Post about a month ago¹ ... it read "Hottest weather ever recorded in late September bakes Great Lakes and Northeast." Even if you missed the news you likely felt the heat if you were anywhere in the upper Midwest.

2017 hasn't been an easy weather year on Earth. Take Southern Europe's blistering summer, for instance. It included a heat wave so deadly it was nicknamed Lucifer.² Scientists said climate change increased the chances of getting a heat wave like Lucifer by at least a factor of four in a recently released analysis of the phenomenon.³ They report that the chances of experiencing the summer that Europe just endured increased by at least a factor of 10 since 1900 due to climate change.

And then, just last week the remnants of Hurricane Ophelia, slapped Ireland. Ireland's weather service said Ophelia was most powerful storm on record to wander as far east as it did in the Atlantic. The word "hurricane" still sounds all-too familiar, especially to those mourning the loss of loved ones and recovering from the other Atlantic Hurricanes of 2017 ... Harvey, Irma, Maria and Nate.

Experts, including James McCarthy, professor of Oceanography at Harvard University, calculate the economic losses from hurricanes in the U.S. and 76 wildfires, intensified by human-induced climate change, will be the most costly combined weather events in U.S. history.⁴ When the final accounting is completed, the economic losses of three hurricanes and the wildfires, which happened within one month, could cost nearly \$300 billion in damage. Added to the damages are enormous health expenses related to air and water quality ... not to mention the loss of life.

Bringing the climate conversation back home, it's worth talking about what is happening in Lake Superior with regard to the warmer, more volatile climate here in the Arrowhead region of Minnesota. Among other things, scientists have noticed an increase in algae production, especially the smaller species.

In a journal article published in Nature Communications earlier this year, researchers funded by Minnesota Sea Grant showed that Lake Superior has experienced a slow, but steady, increase in primary production since the last ice age.⁵ They say this is likely because the natural weathering of rocks in the basin added iron and phosphorous to the lake. However ... and here's the important part ... in the last 100 years, they detected a rapid surge in Lake Superior's primary production. The researchers said the surge coincides with warmer surface water temperatures and longer summer stratification related to less ice cover in winter. That increase in primary production within the last century is unprecedented, they concluded. Even abrupt climate changes like those experienced in the Medieval Climate Anomaly spanning 950-1250 AD ... or the Little Ice Age that lasted from 1400-1900 ... were not as influential as the one Lake Superior

is experiencing now. The researchers attribute these changes to climate warming because of human activities.⁵

Scientists have become increasingly able to attribute particular events to climate change over the past decade. In fact, The National Academy of Sciences recently published an interesting report about attributing extreme weather to climate change.⁶ In it, the co-authors document advances in understanding the science behind extreme events and the science of extreme event attribution, which seeks to tease out the influence of human-caused climate change from other factors, such as natural sources of variability like El Niño. As event attribution capabilities improve, they could help inform choices about assessing and managing risk, and in guiding climate adaptation strategies. This may help us avoid unproductive conversations regarding whether a particular event was ‘caused’ by climate change, but rather focus on how a mix of complex factors are resulting in change and disruption.

The scientific evidence is mounting. It’s indicating that carbon pollution is changing the jet stream in ways that contribute to high pressure ridges that block or stall weather patterns.⁷ A similar effect stalled Superstorm Harvey over Houston, leading to that devastating once-in-25,000-year ... or some say 50,000-year ... deluge. Climatologist Michael Mann, director of the Earth System Science Center at Penn State, noted that the way the jet stream is responding to the changing climate may be causing more persistent weather extremes, creating even more extreme and longer-duration heat waves than we would otherwise expect.

What can we do about climate change? Well, there’s the topic for the next episode of The Sea Grant Files! Since you’re listening, we know you’re staying informed. Keep it up! Take steps to prepare for extremes in precipitation and temperature. Help communities affected by hurricanes, heat waves, and fires with time and money. Pay attention to your own carbon footprint and that of your community. Consider how your community can adapt and strengthen its resilience to changing patterns—we can do this in ways that make our communities better places to live now, and when severe weather hits!

This episode of the Sea Grant Files was produced by Sharon Moen, Kristian Erickson, Maija Jenson, KUMD, and me, Jesse Schomberg. To find the references to the articles I mentioned or to listen to more episodes of The Sea Grant Files and to subscribe to our podcast, visit the Minnesota Sea Grant website at www-dot-seagrant-dot-umn-dot-edu. You can also follow Minnesota Sea Grant on Facebook and Twitter. Thanks for listening.

¹Samenow J., 2017. Hottest weather ever recorded in late September bakes Great Lakes and Northeast. Washington Post. https://www.washingtonpost.com/news/capital-weather-gang/wp/2017/09/25/hottest-weather-ever-recorded-in-late-september-bakes-great-lakes-and-northeast/?utm_term=.5738bb511f4e

² Wikipedia, 2017 Southern Europe heat wave.

https://en.wikipedia.org/wiki/2017_Southern_Europe_heat_wave

³ Cullen, H., van Oldenborgh, G.J., Karoly, D., Otto, F., and van Aalst, M., 2017. Euro-

Mediterranean Heat – Summer 2017. World Weather Attribution. <https://wwa.climatecentral.org/>

⁴ Watson, R., McCarthy, J.J. and Hisas, L., 2017. The economic case for climate action in the United States. Universal Ecological Fund. <https://feu-us.org/case-for-climate-action-us2/>

⁵ M.D. O’Beirne, Werne, J.P., Hecky, R.E., Johnson, T.C., Katsev, S. and Reavie, E.D. 2017.

Anthropogenic climate change has altered primary productivity in Lake Superior. Nature Communications. <https://www.nature.com/articles/ncomms15713>

⁶ National Academies of Sciences, Engineering, and Medicine. 2016. *Attribution of Extreme Weather Events in the Context of Climate Change*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/21852>.

⁷ Mann, M.E., Rahmstorf, S., Kornhuber, K., Steinman, B.A., Miller, S.K. and Coumou, D. 2017.

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