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Abstract

Global warming, or more precisely global climate change, has garnered increasing recognition in the last few decades. However, what may not be immediately apparent are its local effects; the local manifestations of climate change in Cook County, Illinois are alarming. Observed changes in the climate have been persistent for decades or even longer. Projected temperatures are expected to rise, and consequently, flooding will increase. This study aims to correlate these climatic changes to the exacerbation of environmental injustices inherent due to the historical redlining practices of Cook County. The evidence suggests that climatic factors, such as flooding and rising temperatures, have played a compounding role in the obstacles faced by disadvantaged communities residing in Cook County.

Keywords: environmental injustices, climate change, redlining

1. Introduction

In 2010, the United Nations Framework made a statement on climate change: "To prevent dangerous interference with the climate system, the scientific view is that the increase in global temperature should be below 2 °C [relative to preindustrial levels]."[1] Similarly, many institutions have recognized the impending calamity if global climate change remains unaddressed. However, climate change's impact on specific local communities has largely gone unnoticed. One such community that has had to endure especially challenging environmental conditions is Cook County, Illinois.

1.1 Climate Changes and the Local Environment

A tangible outcome of climate change in Cook County is the rise in temperature. Since 1850, there has been an observed 1.5 °C increase in temperature, and temperatures are expected to increase by an additional 1.8 °C – 6 °C through the year 2100.[2]

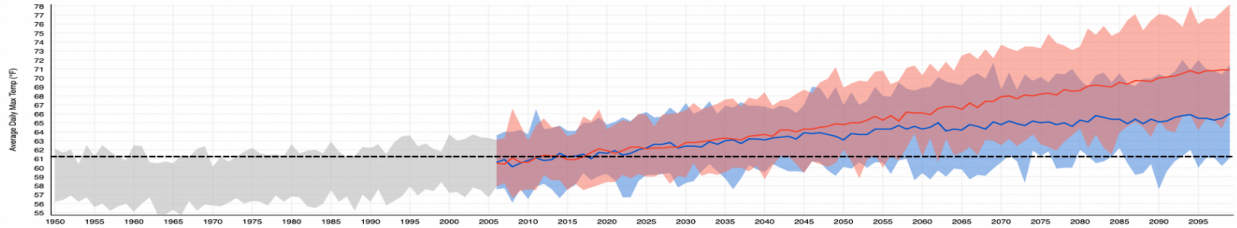

Figure 1. Mean daily temperature maximum for Cook County, Illinois in the past (grey) and the projected future under high (red) and low (blue) emission scenarios. Source: NOAA Climate Explorer.

The highest mean maximum temperature in 1950 is projected to be the lowest mean maximum temperature of 2100, as indicated by the black dotted line (Figure 1). Essentially, if carbon emissions rise at the current rate they are doing now – somewhere between the red and blue scenario – temperatures will increase to dangerous levels. In fact, for fourteen of the past twenty years, Cook County's average temperature has exceeded the 20th century average.[2] Furthermore, from 1895 to 2021, there has been an observed average change of +0.1 °C per decade. This evident temperature increase will have profound impacts on the local environment., such as flooding.

Not only are temperatures generally increasing, but rather, the extremity and severity of these temperatures are as well. This is evident in the abundance of very hot days (quantified as above 90 °F) and extremely hot days (quantified as above 100 °F).[3] The abundance of very hot days in Chicago counties is expected to increase from the current number of 25 to 36 days by the end of the century under low emissions, and 72 days under high emissions (Figure 2). Currently, extremely hot days are uncommon. However, by the end of the century there may be over 30 days of this type per year under high emissions and 8 days under low emissions.

This climatic pattern could have implications on the local environment for Cook County by inducing heat stress during these heat waves. Furthermore, with vegetation and animals finding themselves in unanticipated circumstances, the entire ecosystem is likely to undergo drastic changes as certain species will become extinct due to inability to adapt adequately.

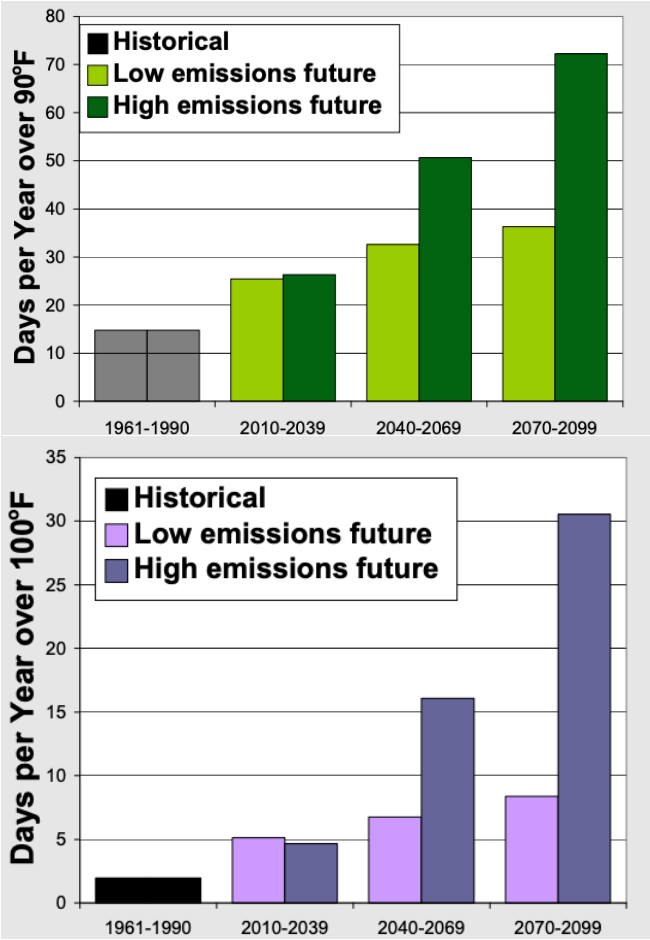

Figure 2. Projected frequency of 90 °F and 100 °F days per year in Chicago counties under low emissions scenario (light green & light purple) and a high emissions scenario (dark green & dark purple) for the tri-decadal periods of 2010-2039, 2040-2069, and 2070-2099. The grey and black bars represent historical data from the past. Source: Climate Change and Chicago: Projections and Potential Impacts (Chapter Two).

Historically, the relationship between temperature and precipitation has not been straightforward. However, typically, wet regions tend to get wetter and dry regions become drier during temperature increases.[4] Cook County is considered a wet region, and so with the increased heat, there is an anticipated increase in wetness and precipitation. A reason is that increased temperatures result in earlier melting periods and

shorter winter months, promoting wet precipitation.[5]

According to the 1981-2010 normal, Chicago counties received about 37 inches of precipitation per year.[3] The general trend from 1895-2021 showed a +0.11 inch increase per decade change in precipitation (Figure 3).[6]

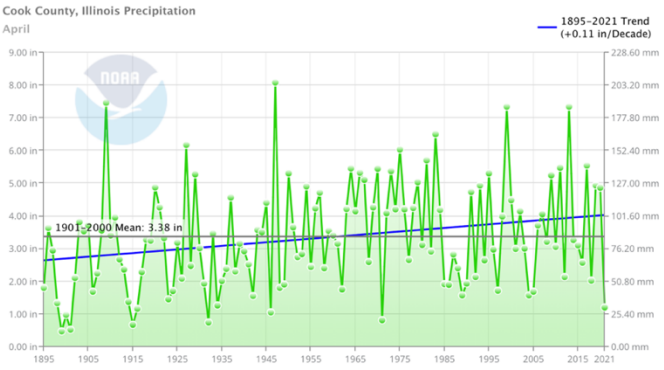

Figure 3. Total annual precipitation for Cook County from the years of 1895-2021 (green curve). The black line is the 20th century average. Source: NOAA Climate at a Glance.

The Intergovernmental Panel on Climate Change (IPCC) has projected the Chicago counties will experience near-term changes (2010-2039) of annual precipitation on the order of -2% to +7%, mid-century changes (2040-2069) on the order of -2% to +10% and end of the century changes (2070-2099) on the order of -1% to +19%.[6] These precipitation trends can generate runoff that can overwhelm flood systems in place and overtop banks of
river channels.

2. Methodology

These projections primarily rely on two tools that are freely accessible online: The National Oceanic and Atmospheric Administration (NOAA) Climate Explorer app and the Climate at a Glance application. The Climate Explorer tool reconstructs past climate changes through weather information recorded by meteorological instruments at weather stations.[2] It uses computational analysis to determine future climate change projections under both high and low emissions scenarios. The Climate at a Glance tool combines historic statistics and local climate trends with global scenarios of climate change.[6] The oceanic, atmospheric, and geophysical data is collected from significant archives on Earth, ranging from the depths of the ocean to the surface of the sun and ice cores.

It should be noted that there are critics who claim that there is an inherent uncertainty in the mathematical representations of Earth's climate system due to the nature of models. One source of uncertainty cited is that some of the processes of the earth-atmosphere system and their feedbacks are not yet fully understood, making it difficult for models to accurately resemble these complicated climate processes.[7] While these uncertainties do exist, scientists are confident that climate models provide reasonable estimates of future climate trends. This confidence in models, such as the ones listed above, stems from the ability to reproduce past and current trends in climate change with these models. Thus, there is a scientific consensus that there is enough information about future climate patterns to draw projections from.

3. Human Consequences of Redlining

Increased temperature and precipitation have culminated in devastating floods in Cook County. In January 2020, waves overcame the shoreline and barriers–and flowed into city streets of Oak Street district.[8] During this catastrophe, many private properties were damaged due to erosion of housing foundations.

The most concerning outcome of the ongoing and projected floods, however, is a disproportionate environmental burden borne by South Siders, a community of predominantly working-class Black and Latinx families. The environmental injustices faced by these populations is rooted in Cook County's history of

racist urban policies. America's first real estate lobby, called The National Association of Realtors, was created in 1908.[9] This organization worked against integrated neighborhoods, paving the way for the harmful practice of redlining: the mapping of neighborhoods with regard to riskiness of real estate investments. This allowed for the restriction of minority individuals from moving away from unsafe areas with high probability of floods because redlining provided a vehicle to control loans and sales with no accountability for racist underpinnings. Desirable areas were graded as an "A" and marked with green shading, while "hazardous" areas were graded "D" and shaded red.[9]

Historically, red ("D") districts were uncoincidentally largely minority neighborhoods such as Black and Hispanic communities. These individuals in the South Side of Cook County have had to endure decades-long battles with climate-induced lake and sewage water flooding into houses bought in the 1980s, and a lackluster response from the city.[10] Redlining, by preventing these individuals from gaining home ownership elsewhere, had left no option other than to endure the negative repercussions of the climate. Consequently, the effects of climate change joined with the lingering environmental impacts of the Southeast Side's industrial past–including numerous steel mills and a coke plant – have led to detrimental consequences for the underserved.

Another example of the inequities in who bears the burden of climate change can be seen in the Cook County confined disposal facility (CDF), which has been on the lakefront since 1984.[11] The CDF is a holding facility for material dredged from the lake. Undesirable facilities like this are located near marginalized populations once again due to redlining. Since such neighborhoods, including the South Side, have decreased land value, city planners can locate new industries, highways, warehouses and more because the members of these communities have no political power or economic status with which to resist. Furthermore, Lake Michigan is a major water supplier to the South Side of Cook County. Community members worry that erosion from flooding at the CDF could result in an eventual compromise of the facility's integrity and cause toxic waste to leach into the lake, polluting drinking water.[12]

The deeply segregated neighborhoods of Cook County that resulted from redlining also face significant temperature and heat vulnerability disparities. Increasing heat is detrimental in and of itself, being the annual cause of death for 12,000 individuals. Excess heat is also correlated with significant mental health ramifications and increased anxiety because without adequate shading outside and uncomfortable temperatures, people are more likely to stay at home and be isolated indoors.[13] Thus, these problems surfaced often in red zones of Cook County's redlining practices. Furthermore, added heat is more dangerous for those who have heart disease. The African American community of Cook County is the population most afflicted with heart disease. The year of 1995 highlights this disparity in heat impact on different racial and ethnic groups. During this year, Chicago experienced one of its worst heat waves.[14] However, communities experienced varying damage; the normalized temperature anomaly for "A" areas was -4.6 °F, while for "D" areas it was +1.3 °F. [9] Temperatures of these areas were compared relatively to the entire set of places in the Chicago area. Policy makers were aware of how the climate raised temperatures. They decided to have minority individuals live in areas prone to rising temperatures and subsequent detrimental effects, while keeping white, affluent individuals in places less impacted. This has caused a financial hardship for the underserved. Many of the residents in the "D" areas don't have air conditioning in their

homes and don't have easily accessible public institutions in which to escape the heat. Those who do have air conditioning face inflated energy bills.

4. Conclusion

The projected climatic changes to Cook County are disconcerting, especially given their disproportionate impact on minority communities. Redlining instilled practices that dictated the residency of disadvantaged communities It placed minority populations in areas that were largely afflicted with climate-induced issues such as excess heat and flooding — heightening the cost of climate change. New challenges presented in 2022 have only exacerbated the environmental injustices of Cook County, and the future does not look to be any better if no change is enacted.

References

1. Bodansky, D. (1993). The United Nations framework convention on climate change: a commentary. *Yale J. Int'l L., 18*, 451.
2. NOAA. (n.d.). Location data for Buncombe County, NC. Climate Explorer. Retrieved from https://crt-climateexplorer.nemac.org/local-climate-charts/?county=Cook+County&city=Chicago%2C+IL&fips=17031&lat=41.88&lon=-87.63&id=pcpn&zoom=9&thresholdVariable=tmax&station=USC00111497&station-name=CHICAGO+BOTANIC+GARDEN&nav=lo cal-climate-chart
3. Hellmann, J., Lesht, B., Nadelhoffer, K. (2007). Climate Change and Chicago Projections and Potential Impacts. *Chicago Climate Action Plan*, *2,* 18. Retrieved from https://www.cmap.illinois.gov/documents/10180/14193/Appendix+A+-+Primary+Impacts+of+Climate+Change+in+the+Chicago+Region.pdf/2a85b021-f3bd-4b98-81d1-f64890adc5a7
4. Mapped: How every part of the world has warmed – and could continue to warm. Carbon Brief. (2020). Retrieved from https://www.carbonbrief.org/mapped-how-every-part-of-the-world-has-warmed-and-could-continue-to-warm.
5. Blumler, M. A. (2018). The West Without Water: What Past Floods, Droughts, and Other Climatic Clues Tell Us About Tomorrow.
6. NCEI.Monitoring.info@noaa.gov. (n.d.). Climate at a glance. *National Climatic Data Center*. Retrieved from https://www.ncdc.noaa.gov/cag/
7. Heavens, N. G., Ward, D. S., & Natalie, M. M. (2013). Studying and projecting climate change with earth system models. *Nature Education Knowledge, 4*(5), 4.
8. Chicago Metropolitan Agency for Planning. (2013, June). Apendix A: Primary Impacts of Climate Change in the Chicago Region. CMAP. Retrieved from https://www.cmap.illinois.gov/documents/10180/14193/Appendix+A+-+Primary+Impacts+of+Climate+Change+in+the+Chicago+Region.pdf/2a85b021-f3bd-4b98-81d1-f64890adc5a7.
9. Numbers, B. (2020). Environmental Injustice in Chicago, *IL*. ArcGIS StoryMaps. Retrieved from https://storymaps.arcgis.com/stories/9d5246e2ecbf4b2babcabe33fee01f72.
10. Cusick, D. (2020). Past Racist "Redlining" Practices Increased Climate Burden on Minority Neighborhoods. *Scientific American.* Retrieved from https://scientificamerican.com/article/past-racist-redlining-practices-increased-climate-burden-on-minority-neighborhoods/.
11. Coursey, D., Geer, A.,Hagerbaumer, C., Hammond, D., & Mendelsohn, B. (1994). Environmental Racism in the City of Chicago: The History of EPA Hazardous Waste Sites in African-American Neighborhoods. *Federal Reserve Bank of St. Louis.* Retrieved from WorldCat.org.
12. Pyzyk, K. (2020). How Chicago is coping with the effects of climate change. MPR News. Retrieved from https://www.mprnews.org/story/2020/04/22/after-the-flood-how-chicago-is-coping-with-the-effects-of-climate-change.

13. Cianconi, P., Betró, S., & Janiri, L. (2020). The impact of climate change on mental health: a systematic descriptive review. *Frontiers in psychiatry,* 74. https://doi.org/10.3389/fpsyt.2020.00074.
14. Uchoa, K. (2020). The Deadly Chicago Heat Wave Is As Relevant to Racial Justice Today As It Was 25 Years Ago. *NRDC.* Retrieved from https://www.nrdc.org/stories/deadly-chicago-heat-wave-relevant-racial-justice-today-it-was-25-years-ago.

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