



CLIMATE CHANGE AND CHICAGO

PROJECTIONS AND POTENTIAL IMPACTS

CHAPTER SEVEN - CONCLUSIONS

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CONCLUSIONS

The climate of the Chicago area is changing, but these changes appear to be due more than just natural variability. An increasing body of evidence indicates that the climate changes occurring here are related to the changes occurring in the climate system throughout the world as the result of the human-induced build up of heat-trapping gases in the atmosphere and other effects. It is clear from the range of projections analyzed here that a much greater degree of change can be expected over the coming century (particularly under a higher-emissions future) than has already been experienced to date. It is also clear that past emissions have committed the region and the world to a certain unavoidable level of global warming over the next several decades. Adaptation to climate changes will be necessary. At the same, the worst of the projected changes do not need to occur if prompt action is taken to reduce emissions of heat-trapping gases.

In the report, we have presented many examples of projected impacts on our health, water resources, ecosystems, and infrastructure. These illustrate how human-induced climate change could radically alter society and the environment in the Chicago area over this century. In these analyses, we have tried to be as quantitative as possible. However, in order to capture the most vivid picture of how Chicago's environment might be expected to change in the future, as a final step we build on the analyses presented in this report to estimate where Chicago

might effectively “move” to over the coming decades, in summer and in winter, under a higher vs. a lower emissions future.

The “moving climate” approach was first pioneered in a report analyzing the impact of climate change on Ecosystems in the Great Lakes region¹. In that report, summer conditions in the state of Illinois by end-of-century were projected to be similar to those of East Texas today, while winter conditions were estimated to be more like southern Missouri or northern Arkansas feel today. The original projections were based on seasonal average temperature and precipitation estimates under a mid-range scenario.

Here, we re-create these original seasonal “migrating state” projections specifically for the City of Chicago, under a higher vs. a lower emissions scenario (as opposed to a single mid-range scenario), and for the three future time periods on which this report focuses: near-term (2010-2039), mid-century (2040-2069) and end-of-century (2070-2099). As shown in Table 7.1 and illustrated in Figure 7.1, based on projected changes in seasonal average precipitation (whether snow or rain) and temperature, Chicago in the winter is projected to migrate

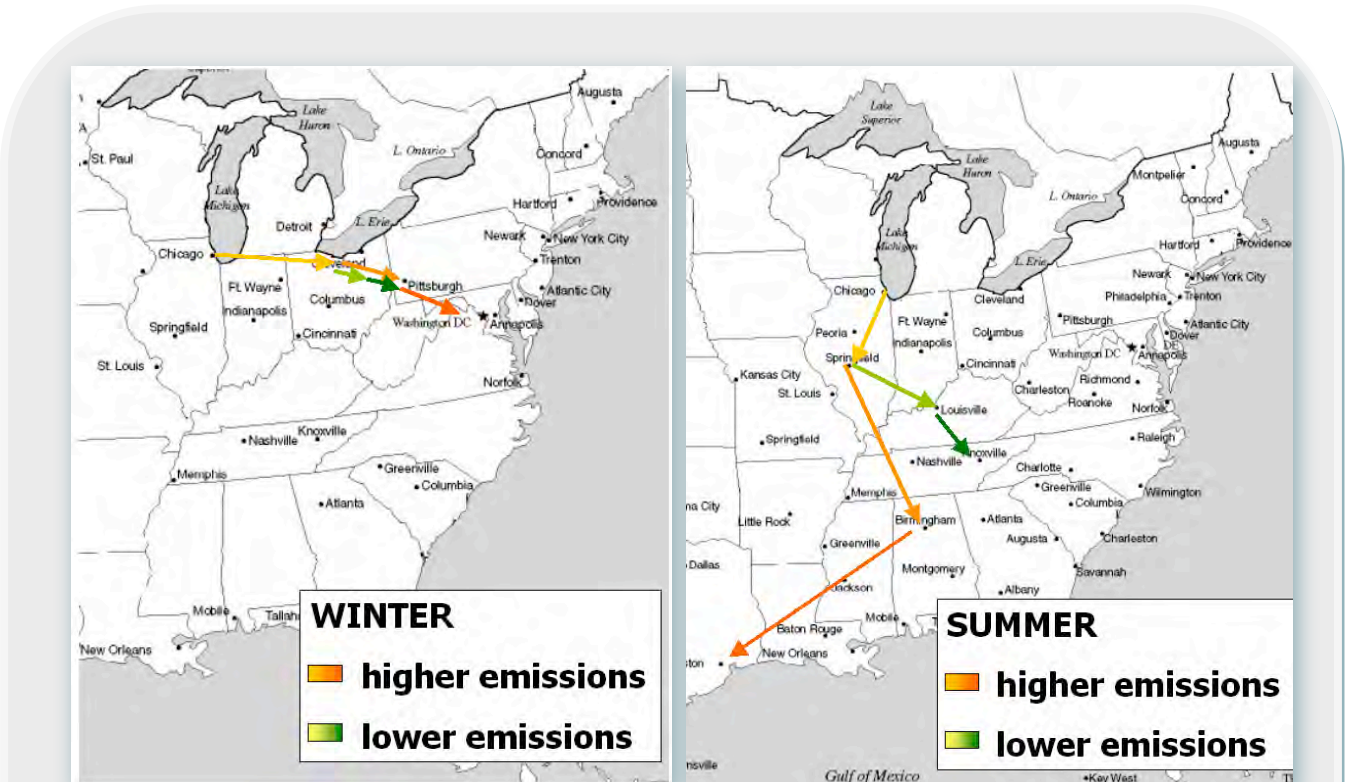


Figure 7.1. Projected migration of the City of Chicago in winter (DJF) and summer (JJA) based on changes in seasonal average temperature and precipitation as projected to occur under the higher and lower emissions futures in the near-term (2010-2039), mid-century (2040-2069) and end-of-century (2070-2099).

eastward, with its winters characteristic of those in Ohio or western Pennsylvania do today. Under the higher emissions scenario, by mid-century the migration is projected to be occurring nearly twice as fast as under the lower emissions scenario, with a Chicago winter climate more like that of northern Virginia by the end of the century. In contrast, Chicago summers are projected to migrate southward. Within a decade or two, the climate of an average summer would be more like that of Springfield, the state’s capitol, is today. By the end of the century, summers could be similar to those of Knoxville TN under a lower emissions future and Houston TX under higher emissions.

Although seasonal temperature and precipitation is a good measure of a city’s average climate, perhaps of more importance to the inhabitants of Chicago are how the winters and summers might actually *feel* and *look*. To that end, we have also produced a new form of the “migrating city” analysis, based on what makes

the seasons feel the way they do – snow and cold temperatures in the winter, and heat and humidity in the summer.

The results of this analysis are shown in Figure 7.2, where we estimate what Chicago summers could actually *feel* like in the future, based on a combination of both high daytime temperatures and humidity. The average summer June-July-August Heat Index value is projected to rise to 93.5°F under the lower and 105.5°F under the higher emissions future before the end of the century. Although using a Heat Index vs. an average temperature value makes little difference over the near term (in the next few decades, both analyses show Chicago feeling more like Springfield IL does today, Table 7.1), comparing mid-century and end-of-century projected increases in Chicago’s average summer Heat Index to historical summer Heat Index values reveals greater changes than those estimated based on temperature alone. This makes sense, since studies have already shown that humidity is increasing because of climate change². Together, rising temperature plus humidity would be expected to have an even greater impact than temperature alone. Based on its average

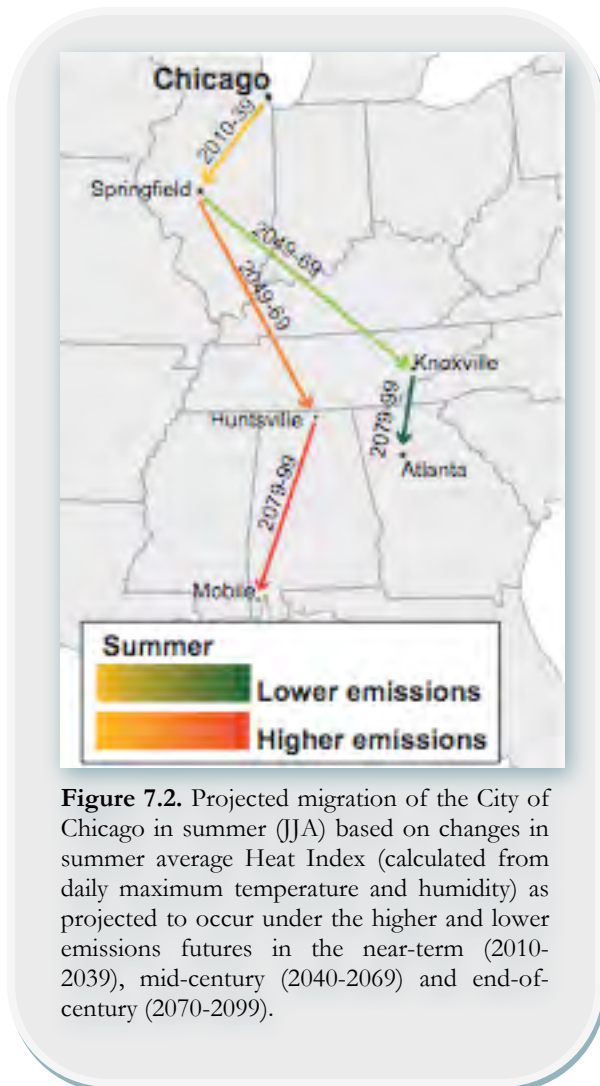


Figure 7.2. Projected migration of the City of Chicago in summer (JJA) based on changes in summer average Heat Index (calculated from daily maximum temperature and humidity) as projected to occur under the higher and lower emissions futures in the near-term (2010-2039), mid-century (2040-2069) and end-of-century (2070-2099).

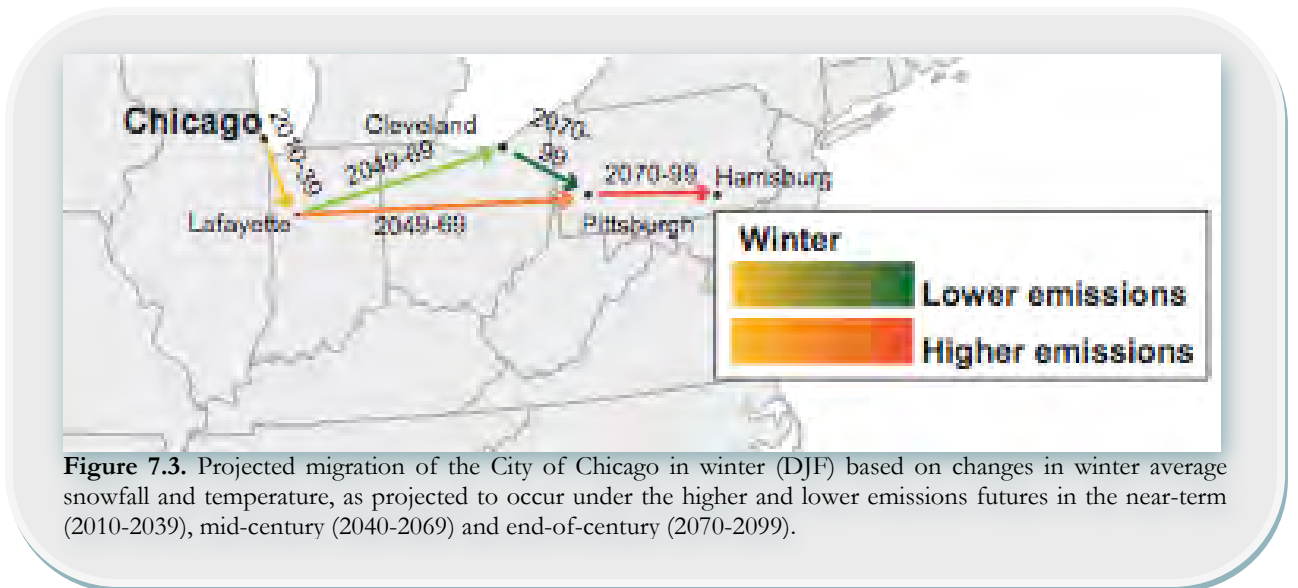


Figure 7.3. Projected migration of the City of Chicago in winter (DJF) based on changes in winter average snowfall and temperature, as projected to occur under the higher and lower emissions futures in the near-term (2010-2039), mid-century (2040-2069) and end-of-century (2070-2099).

summer Heat Index values, by the end of the century Chicago would be expected to be hot and sticky, feeling more like Atlanta GA does today under lower emissions, and Mobile AL under higher.

The defining characteristics of winter in Chicago are its snow, its wind, and its cold temperatures. While the ability of climate models to estimate future changes in wind speeds and direction at the local level, such as for Chicago, are limited, we can estimate how average winter snowfall and temperatures might be altered in the future due to climate change. Comparing future projections with present-day winter snow and temperature estimates for cities across the eastern U.S. reveals that Chicago can be expected to migrate nearly due east from its current location, maintaining almost the same amount of average winter snowfall that it does today (Figure 7.3). Thus, although summers may feel like the South, winters are expected to feel more like those of northern Ohio or central Pennsylvania do today, with no significant reduction in snow or ice in sight to make up for the hot, sticky summers.

It is important to note that it is scientifically impossible to state that something will happen, no matter what. The actual amount of change that we will see over the coming century, and how that change will affect the city, is uncertain for two reasons: first, because of socio-economic changes (What will future emissions be? How will the population of Chicago adapt to change?), and second, due to scientific uncertainty (What parts of the climate system and the responses of our society to changes in climate do we not fully understand yet? How will the climate fully respond to increasing human emissions over the coming century?).

	Emissions Scenario	Near-Term (2010-2039)	Mid-Century (2040-2069)	End-of-Century (2070-2099)
WINTER (DJF)				
	Hi		Pittsburgh, PA	Northern VA
	Lo		Akron, OH	Pittsburgh, PA
	Hi		Pittsburgh, PA	Harrisburg, PA
	Lo		Cleveland, OH	Pittsburgh, PA
SUMMER (JJA)				
	Hi		Birmingham, AL	Houston, TX
	Lo		Louisville, KY	Knoxville, TN
	Hi		Huntsville, AL	Mobile, AL
	Lo		Knoxville, TN	Atlanta, GA

Table 7.1. Projected migration of the City of Chicago in winter (DJF) and summer (JJA) as estimated using the traditional approach - based on changes in seasonal average temperature and precipitation – and using a new approach, based on winter average temperature and snowfall amount, and summer average Heat Index derived from daily maximum temperature and humidity. Changes shown are as projected under the higher and lower emissions futures in the near-term (2010-2039), mid-century (2040-2069) and end-of-century (2070-2099).

While there is much about the potential impacts of future changes in climate we can evaluate and estimate today, we also recognize that many uncertainties still remain. The first and most important source of uncertainty, however – that of socio-economic development – can only be resolved by the citizens of the Chicago and the rest of the world. Will we pursue a lower emissions pathway, conserving our energy and looking for alternative sources? Or will we continue our dependence on fossil fuels? Scientists can offer a sense of what will happen and some advice, but no certainty regarding what the future will look like. It is the decisions made by individuals, city governments, states, and nations that will set the pathway for emissions over the coming century and ultimately determine how climate change will affect the City of Chicago.

Nonetheless, there is much the people of the Chicago area can do to prevent the most serious impacts from occurring. The costs of inaction, therefore, are high, and could fundamentally change the character of the Chicago area. While the lower-emissions scenario also results in significant changes for the region, the

resulting, more limited changes illustrate that our emissions choices do make a difference and that we should immediately start down a path toward ambitious emissions reductions in order to ensure that our communities, economy, and ecosystems continue to thrive.

References

¹ Kling et al. Confronting Climate Change in the Great Lakes. UCS/ESA 2003

² Willett, K. et al. 2007. Attribution of observed surface humidity changes to human influence. *Nature*, 449, 710-712, doi:10.1038.