The American Midwest and Climate Change

Life in America's breadbasket is good and getting better

CO2COALITION

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June 2023

CO2COALITION

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EXECUTIVE SUMMARY

Assertions by the 4th U.S. National Climate Assessment (NCA4) that the American Midwest will suffer negative effects – some catastrophic – from climate change are scientifically invalid and contrary to reality. Highly qualified professionals of the CO_2 Coalition arrived at this conclusion after a careful review of real-world data and NCA4's research methodologies and findings.

Among the concerns raised by NCA4 are dangerously warming temperatures, a decline in the Midwest's agricultural productivity and increasing droughts, flooding, tornadoes and heat-related deaths.

Temperature: With respect to increasing warmth, the CO_2 Coalition found serious flaws in NCA4 data stemming from the well-known urban heat island effect on thermometers, NCA4 adjustments to measured historic temperatures and fabrication of data for monitoring stations that no longer exist or are no longer reporting data. All these factors contributed to NCA4's exaggeration of modern warming.

The data reveal that, while there has been a modest warming over the last several decades, recent temperatures are comparable to those measured nearly 100 years ago. In addition, there is no discernable trend of increasing summer heat or heat waves.

Wet or dry: With respect to excessive precipitation or too little, droughts have occurred periodically in recent decades. However, they have been short and not nearly as intense as droughts in the past. Long-term moisture records (beginning in 1895) make it abundantly clear that climatic changes that include modest warming and increases in atmospheric CO_2 and soil moisture, coupled with technological advancement, have been favorable to the region's agriculture.

Tornadoes: Despite claims of warming causing an increase in tornadoes, the data show a slight decrease in them. This is consistent with what would be expected with global warming because most of the temperature increase occurs toward the poles and lessens the temperature differentials between hot and cold regions that drive tornadic activity.

Temperature-related deaths have been decreasing worldwide, and it is cold, not warmth, that is the cause of most such mortalities. Data for heat-related deaths in the Midwest show a sharp decline in the last 40 years.

Agricultural productivity has increased in the Midwest as it has in most of the rest of the world. Greater crop production is consistent with an overall greening of Earth that has been linked to changes in the climate. Researchers attribute 70% of global greening to the direct fertilization effect of carbon dioxide and 8% to warmer temperatures.

Reductions of CO_2 emissions, which are proposed to address a purported climate emergency, would be ineffective and prohibitively expensive. According to one estimate, the cost to transition the ten Midwestern states to so-called renewable power would cost more than $6 trillion, or $92,000 per capita.

A theoretical effect of such a transition is calculated as averting 0.043^{o} C of warming by the year 2100, which translates to a cost of $14 trillion for each tenth degree of warming averted.

Computer models on which the NCA4 relies to assess future global warming are overpredicting temperature increases by 2.5 times – a dangerous basis for reengineering energy systems and, with them, the world economy.

BACKGROUND

This is the third in a planned series of state and regional studies by the CO_2 Coalition on how climate change may affect various portions of the United States and the world. An outline of this report was submitted for review by Dr. Patrick Michaels shortly before his untimely death on July 15, 2022.

Previous regional and state reports:

> *Pennsylvania's Regional Greenhouse Gas Initiative Relies on Faulty Data – Why RGGI is a "solution in search of a problem"* – July 2021
>
> *Virginia and Climate Change – Separating fact from fiction* – February 2022

This report is based principally on the work of the following:

- **Dr. Patrick J. Michaels**, Senior Fellow for the CO_2 Coalition and Competitive Enterprise Institute, past Virginia State Climatologist; past President of the American Association of State Climatologists.
- **Gregory Wrightstone**, geologist, CO_2 Coalition Executive Director and Expert Reviewer for the U.N. Intergovernmental Panel on Climate Change.
- **Dr. Indur Goklany**, Electrical Engineering and Systems Science. Worked with federal and state agencies, think tanks, and the private sector for over 45 years, including over 30 years working on climate and global change issues. Writings include over 150 papers, books and monographs along with two books.
- **Dr. John Christy,** Distinguished Professor of Atmospheric Science and Director of the Earth System Science Center at The University of Alabama in Huntsville and Alabama's State Climatologist. Awarded NASA's Medal for Exceptional Scientific Achievement in 1991.
- **Dr. William Happer**, Professor Emeritus in the Department of Physics at Princeton University. He has published over 200 peer-reviewed scientific papers. Fellow of the American Physical Society and the American Association for the Advancement of Science and a member of the American Academy of Arts and Sciences, the National Academy of Sciences and the American Philosophical Society.

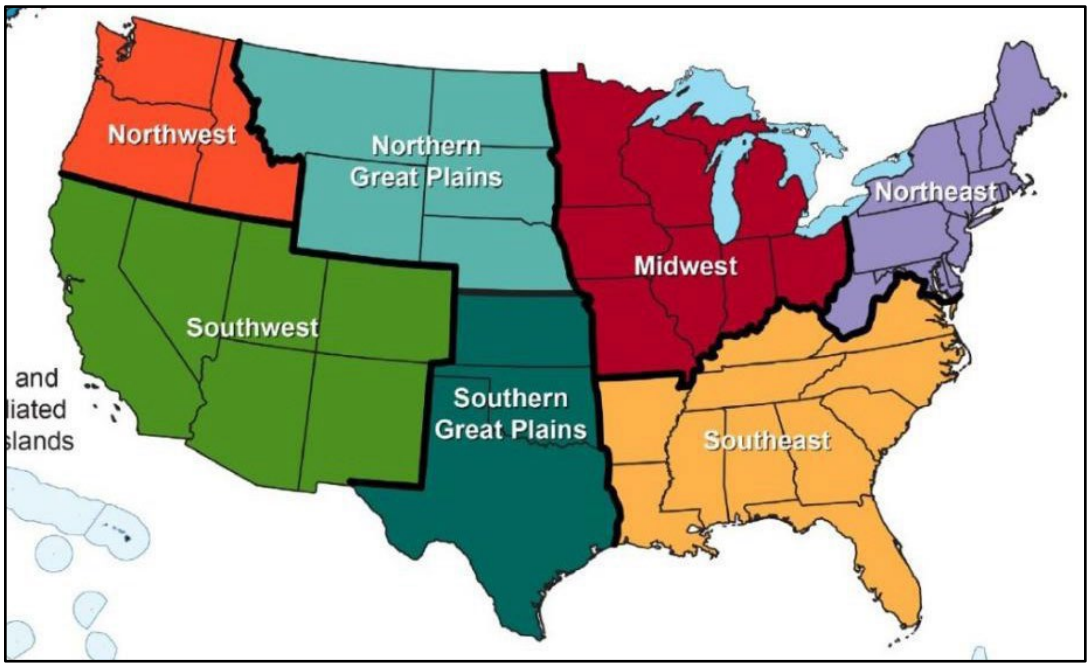
These and other contributors to this evaluation represent the fields of climatology, meteorology, physics, geology, agronomy and more.

INTRODUCTION

Modeled impacts of climate change on the Earth's ecosystems and the human condition are likely the primary driver of policy for decisions at the state, local and federal level. These decisions are behind trillions of dollars of expenditures and should be based on sound science, along with validated models and data. Within this report, we examine climate models and the effects of our changing climate on the Midwestern United States.

The recently completed 4th U.S. National Climate Assessment (NCA4 2018), reviewed purported impacts of climate change on seven regions, including the Midwest, which covers the states of Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Nebraska, Ohio, South Dakota and Wisconsin (Figure 1). This paper will evaluate many of the claims made within the 4th National Climate Assessment concerning climate change in these states.

Figure 1: National Climate Assessment Regions



4th U.S. National Climate Assessment 2022

The U.S. Midwest, including the corn and soybean belts contained within or adjacent to it, is rightfully considered the most productive large agricultural region on Earth. Agriculture is an important component for climate assessments in any region of the globe but especially so here in America's breadbasket and, thus, will figure prominently in this assessment of climate-change impacts.

The natural combination of heat, geography and humidity results in—literally—some of the most extreme heat indices measured on earth, except for those seen occasionally in portions of extreme

subtropical deserts, such as the Sahara, the southern Middle East and, to a much smaller extent, the U.S. Desert Southwest.

Severe weather always plays a prominent role in any climate. The Midwest and nearby regions have, by far, the highest frequency of the world's most intense mesocyclones (*i.e.,* tornadoes). Additionally, the U.S. Midwest is subject to some of the most intense low-latitude snowstorms in our hemisphere, also because of the aforementioned factors of temperature, geography and humidity.

This 4th National Climate Assessment (NCA4) was quite alarming in its predictions of current and future catastrophes for Americans and their well-being. In this report, we will examine the assertions made concerning temperature and other climate-related phenomena. The overview of NCA4 claimed that:

- Nearly all modern changes in temperature were attributed to the increase in greenhouse gases, in particular, carbon dioxide (CO_2).
- Extreme weather and other harmful climate phenomena are increasing.
- Global action to significantly cut greenhouse gas emissions can substantially reduce climate-related risks.

The 4th Climate Assessment includes a 70-page assessment of the current and future effects of climate change specifically on the Midwestern states. These Midwest-specific effects include the following items:

- Increasing extreme high temperature events
- Reduction of Midwest agricultural productivity
- Increasing heavy rainfalls and drought
- Substantial, yet avoidable, loss of life, mainly due to higher temperatures and flooding
- Increased adverse economic impacts estimated in the billions of dollars
- Loss of habitat leading to a reduction of biodiversity, including loss of species
- Existing and worsening health impacts from climate change

We will examine these claims to determine whether there is scientific evidence to support them. Using peer-reviewed studies and government reports, we will provide enough evidence to allow readers to make up their minds as to whether modest warming and more CO_2 are harmful or beneficial to the residents of the American Midwest.

Temperature

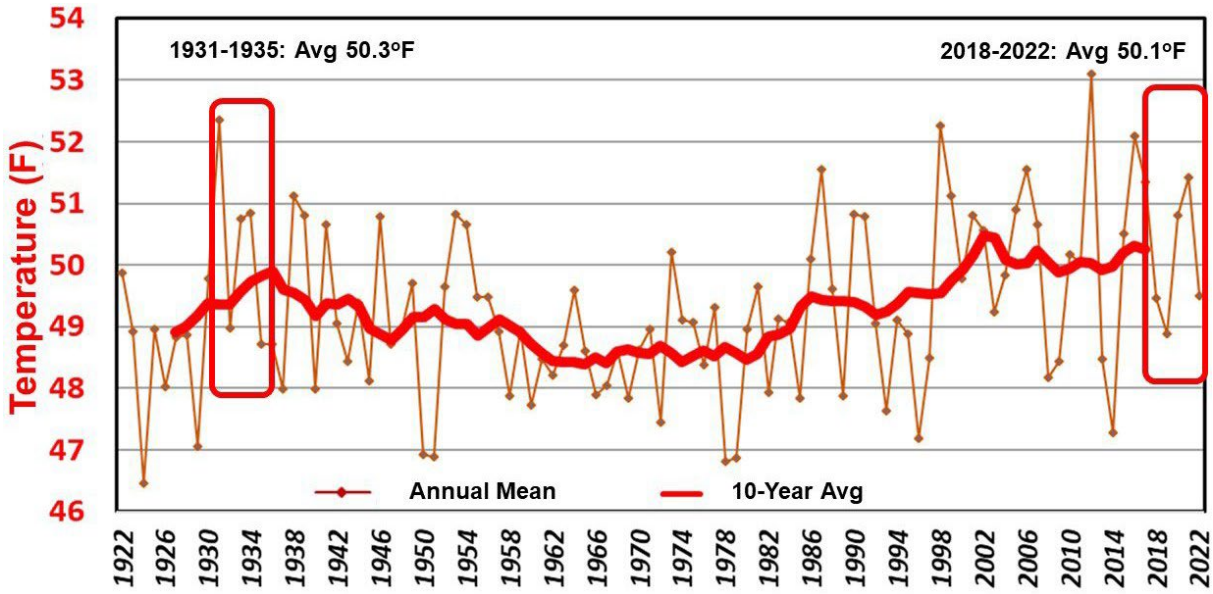
According to NCA4, the Midwest will increasingly experience extremely high temperatures. In addition, the U.S. Environmental Protection Agency (EPA 2023), alleges that the Midwest's average air temperature increased by more than 1.5° F between 1900 and 2010 and that the rate of increase has

accelerated in recent decades. The EPA also claims that "major heat waves have been occurring more frequently across this region for many decades, resulting in increased deaths during these extreme events."

Do NCA4 and the EPA have their facts straight concerning increasing heat and heat waves? In this section, we will review historical temperature records to determine if recent temperature changes are unusual and unprecedented. If past temperatures during periods of low CO_2 levels were similar, or higher, than recent records, then that would be strong evidence that our modern temperatures are not being driven primarily by increases in carbon dioxide.

The data from the NOAA's U.S. Historical Climatology Network (USHCN 2023) show that, although there has been a modest rise in temperatures dating to the late 1970s, the period of the early to mid-1930s saw higher temperatures than our most recent Midwestern temperatures (Figure 2).

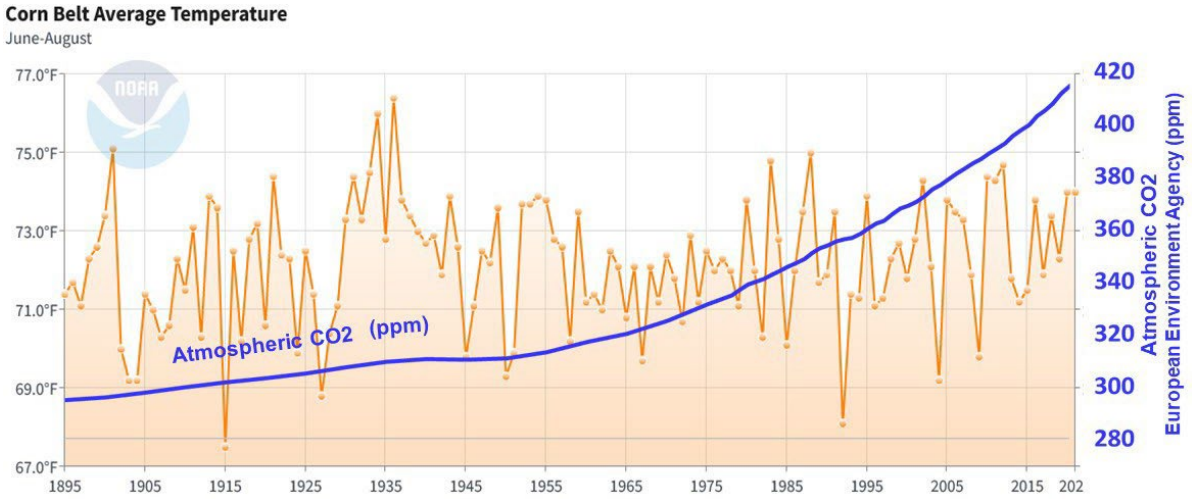
Figure 2: Midwest USHCN temperature data



USHCN 2023

Summer (June-August) average corn belt temperature shows neither coherent warming nor cooling (Figure 3). The largest hot anomalies are in the late 1920s to the late 1930s. Note that there is no apparent correlation between temperature in this region and atmospheric carbon dioxide.

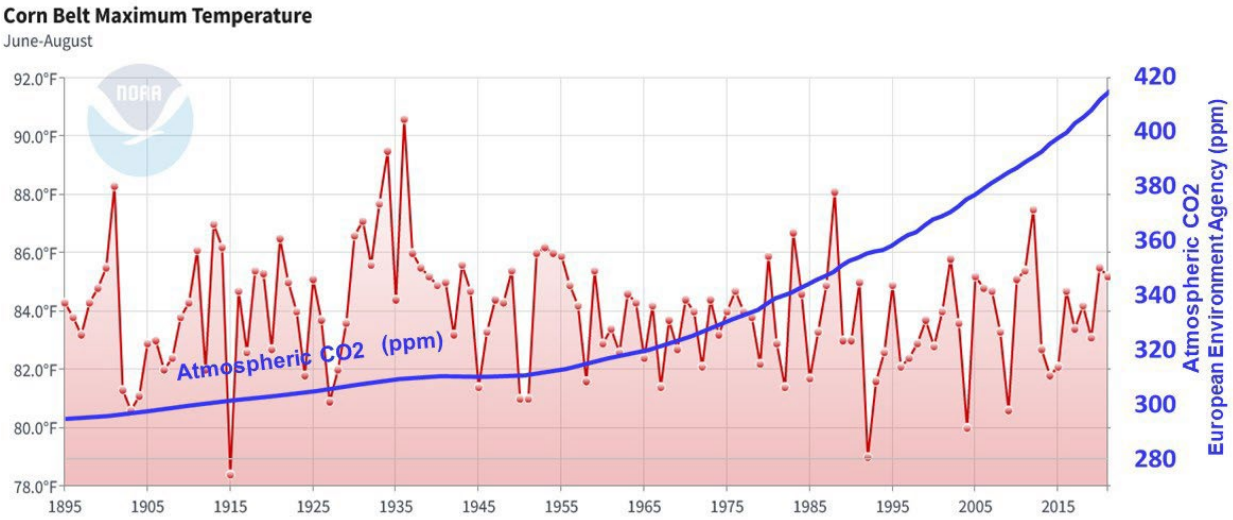
Figure 3: Average summer corn belt temperature



Source temperature: NCEI (2023) / Source CO_2: European Environment Agency 2021

Along with projections of escalating temperatures, more alarmingly are the claims that heat waves have been increasing and are expected to get worse in the future from CO_2-driven warming. The facts tell quite a different story. Temperature data reveal that the worst of the heat waves since the late 1800s occurred some 100-years ago during the dust bowl era of the 1920s and 1930s (Figure 4). Note that CO_2 levels were at a low 320 ppm during that time compared to 420 ppm today.

Figure 4: Maximum summer corn belt temperature



Source temperature: NCEI 2023) / Source CO_2: European Environment Agency 2021

Further confirmation that modern heat waves pale in comparison to those of the past is provided by historical records of the highest temperature recorded for each state. The National Centers for Environmental Information (2023) provides that information and reveals that only South Dakota (2006) recorded a high temperature record after 1954 and seven of the ten states set records in the 1930s (Figure 5).

Figure 5: Record high temperatures by state

State	Temp. °F	Temp. °C	Date
Illinois	117	47	14-Jul-54
Indiana	116	47	14-Jul-36
Iowa	118	48	20-Jul-34
Michigan	112	44	13-Jul-36
Minnesota	114	46	July 6, 1936[1]
Missouri	118	48	July 14, 1954[1]
Nebraska	118	48	July 24, 1936[1]
Ohio	113	45	July 21, 1934[1]
South Dakota	120	49	15-Jul-06
Wisconsin	114	46	13-Jul-36

NCEI 2023

Temperature adjustments and fabrication of data

The temperature data shown above for the corn belt uses data from the National Oceanic and Atmospheric Administration's (NOAA) U. S. Historical Climatology Network. There are three huge problems intrinsic to the data:

- Urban heat island effect that raises temperatures
- Adjustments to measured historic temperatures
- Fabricated data for stations that no longer exist or are no longer reporting

Urban heat island – Changes in infrastructure led to many monitoring stations being closer to newly constructed buildings and nearer to other heat sinks such as asphalt, concrete and brick structures. In addition, many facilities that were once pristine rural sites ideally situated decades ago have been encroached upon by suburban expansion and heat-trapping infrastructure.

NOAA believes that their "homogenization" techniques compensate for these warming influences. Examination of the sites tells a different story.

Anthony Watts (2022) physically examined monitoring stations and found that approximately 96 percent of U.S. temperature monitors used to assess climate change fail to meet NOAA's published standards for "acceptable" and uncorrupted placement of stations. According to the author:

> *Data from the stations that have not been corrupted by faulty placement show a rate of warming in the United States reduced by almost half compared to all stations.*

Adjustments to data – NOAA often adjusts data from actual measured temperatures to a temperature that their scientists believe it should be. One of the adjustments that has been made is "time of day" bias which refers to data collected in the afternoon (too hot) or early in the morning (too cool). These are legitimate reasons to remove or alter data from the series.

There was a bigger skew to afternoon highs in the early data (pre-2002), which led to adjustments that "cooled" the older data. The more recent data alterations (post-2002) warmed the data. This type of alteration represents about 25% of the adjustments.

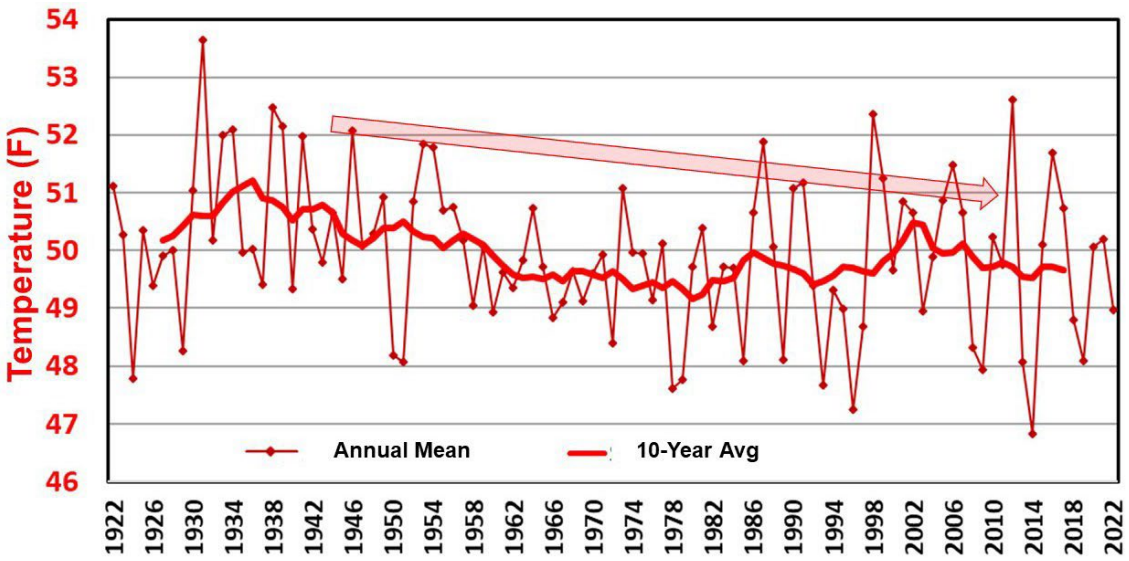
Fabrication of data - The majority of the remaining alterations are due to missing data which are modeled rather than gleaned from thermometers. For example, in the United States, USHCN-adjusted temperatures are calculated for all 1,218 stations every month regardless of whether the station actually reported data.

Station reporting has declined sharply over the last 30 years.

About 50 percent of the adjusted data in 2021 came from modeled temperatures rather than a thermometer (Heller 2022). In other words, temperature data from a station that no longer exists or is no longer reporting data is created based on what the modelers think that it should be rather than what it is.

All these adjustments have tended to increase the recent temperature and cool the past data. And that is how NOAA is able to turn 90 years of slight cooling (raw, unadjusted data) in the Midwest into a recent warming trend (Figures 6, 7 and 8).

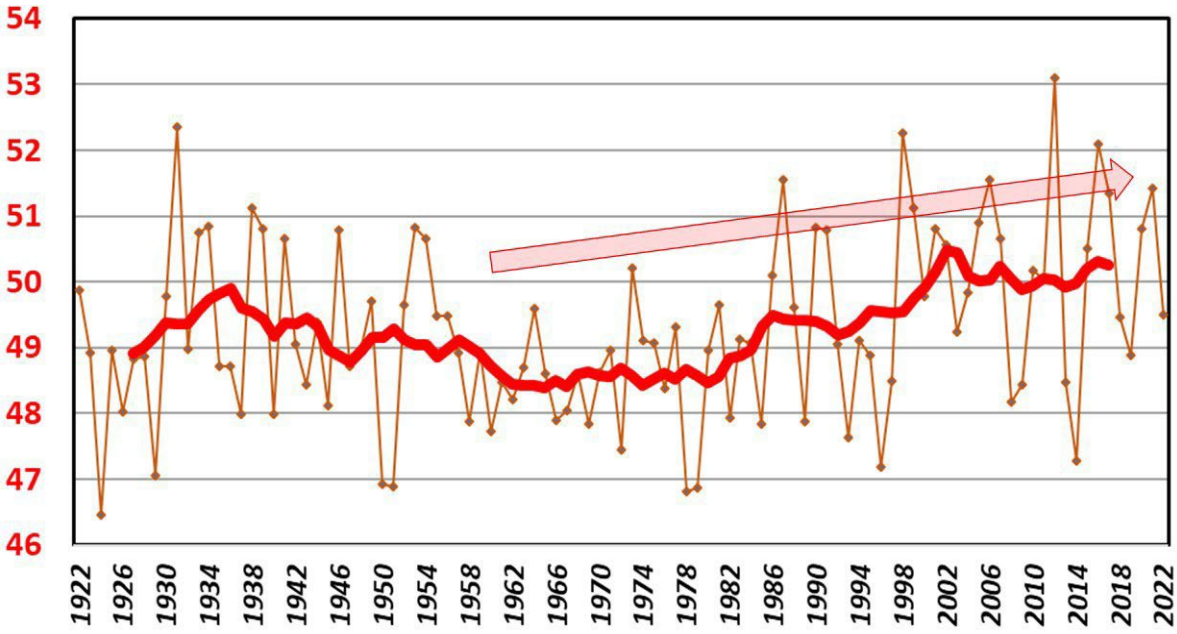
Figure 6: Raw, unadjusted Midwest USHCN data



USHCN 2023 Courtesy Heller

All this creates warming where none existed before modifications were made to the raw data.

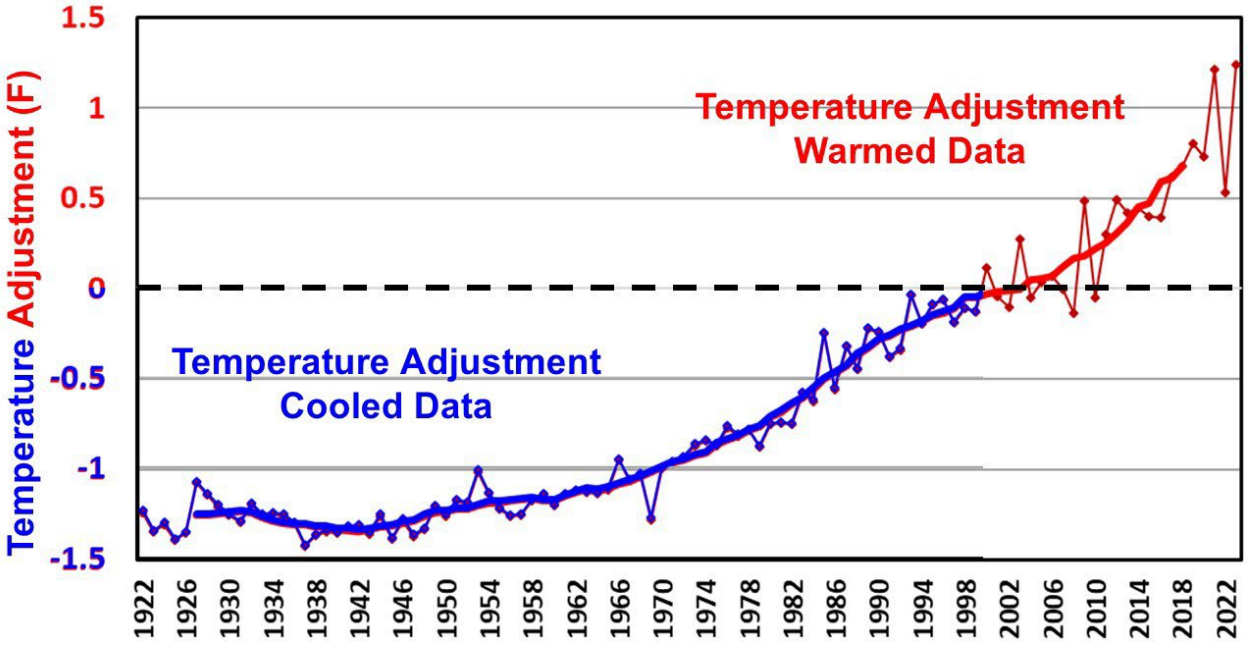
Figure 7: Adjusted final Midwest USHCN data



USHCN 2023 Courtesy Heller

Comparing the raw Midwest data to the final adjusted NOAA data (Figures 8), we find that there was a consistent reduction in the older temperatures and an increase in modern data.

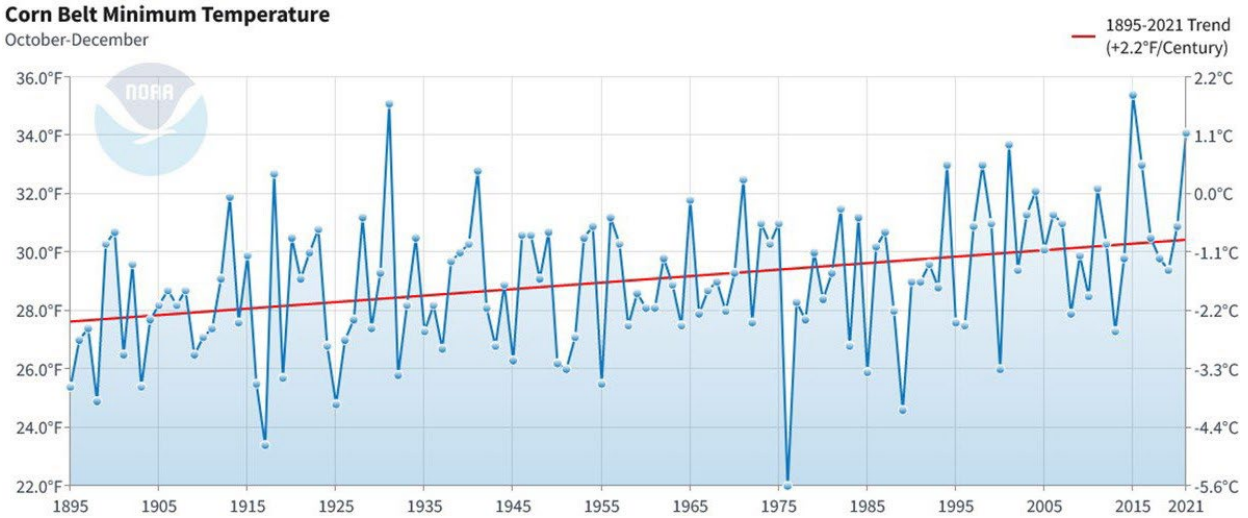
Figure 8: Adjustments cool the older data and warm the recent



USHCN 2023 Courtesy Heller

As any resident of the Midwestern states can attest, winter can be brutally cold in this region. The good news is that the lowest temperatures have been warming slightly. Figure 9 shows that Corn Belt minimum temperature has increased about 2° F since the late 1800s.

Figure 9: Corn Belt Minimum Temperature



NCEI 2023

In summary, the data reveal that, while there has been a modest warming over the last several decades, recent temperatures are comparable to those measured nearly 100 years ago. In addition, we find no discernable trend of increasing summer heat or heat waves.

Droughts and flooding

> *At-risk communities in the Midwest are becoming more vulnerable to climate change impacts such as flooding, drought…*
>
> *— 4th National Climate Assessment*

Claims of increasing flooding and drought are standard fare for nearly all government-funded studies. Drought and flooding are particularly important for the areas of the Midwest due to the large negative impacts that these severe weather events have on the agricultural productivity of the area.

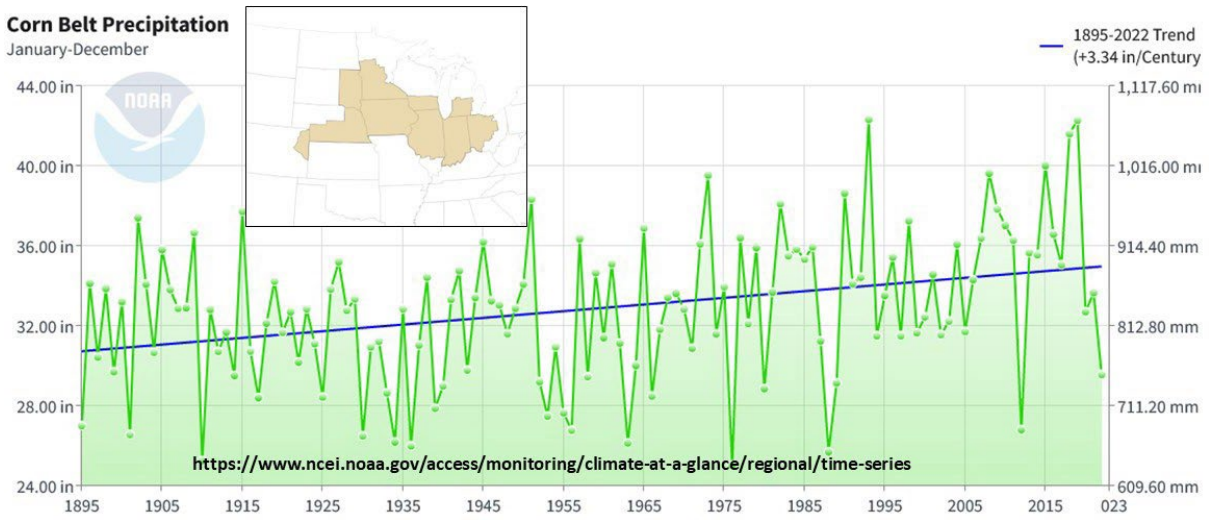
Drought is the single greatest threat to the agricultural sector around the world. According to the United Nations Food and Agriculture Organization (UNFAO 2023), drought "has been established as the single greatest culprit of agricultural production loss." They estimate that drought costs the agricultural sector $37 billion in losses annually. While drought can make life difficult for the general population, it is agriculture that bears 82% of all drought impacts.

With that in mind, we will now "follow the science" to assess data concerning drought and floods. Both events are primarily driven by increasing or decreasing changes in precipitation and soil moisture. Drought is also made worse by high temperatures and heat waves, but as noted in the section above, high-temperature events are not increasing so heat-driven drought has not been a significant factor in recent decades.

Precipitation in the Corn Belt has seen a steady rise over the last 120-plus years as shown in Figure 10. Since drought is the primary scourge of crop growth throughout the world, the modest increase in precipitation should have beneficial effects on agriculture and crop yields. Flooding events during the spring planting season and the fall harvest can have significant negative effects on production, but these pale in comparison to drought.

Corn yield is significantly correlated with summer rainfall (Hatfield 2012), and it is a rare year where excessive wetness suppresses yields over the large region.

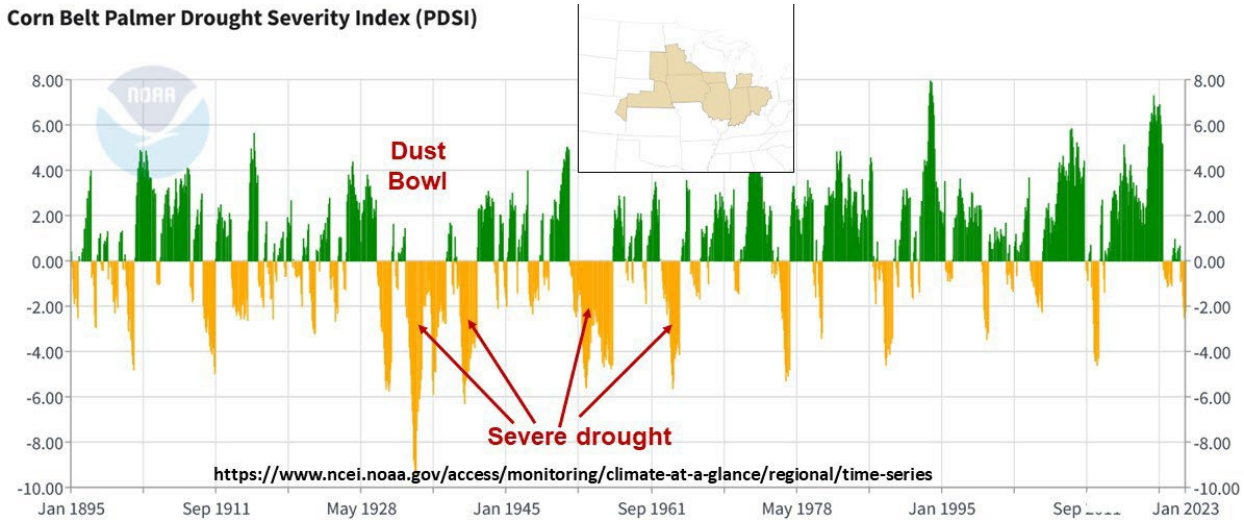
Figure 10: Corn Belt precipitation



National Centers for Environmental Information-Climate 2023

Summer agriculture responds both to short and longer periods of moisture. Below, the Palmer Drought Severity Index (PDSI) is shown over the Corn Belt for the period 1895 to January of 2023. The PDSI is an integrated indicator of long-term soil moisture (Figure 11). Note that the PDSI is a normalized index with a mean of zero and a standard deviation of two units. Plus or minus two are noted as the thresholds for "moderately excessive wetness" or moderate drought.

Figure 11: Corn Belt Palmer drought severity index



National Centers for Environmental Information-Climate 2023

The good news for the farming community is that, while droughts have occurred periodically over the recent decades, they have been short and not nearly as intense as droughts in the past. Long-term moisture records (beginning in 1895) make it abundantly clear that our changing climate, coupled with technological advancement, has become increasingly favorable for crop yield over the past 125 years.

These values are normalized to the long-term record that begins in 1895. The prevalence of moderately excessive moisture (the green bars in the range of between 1.0 and 3.0) in the post-1960 era is strong evidence for beneficial and persistent climate change in favor of increasing crop yields. The salutary effects of more rain were so obvious that even the 4th National Climate Assessment had to recognize the benefits:

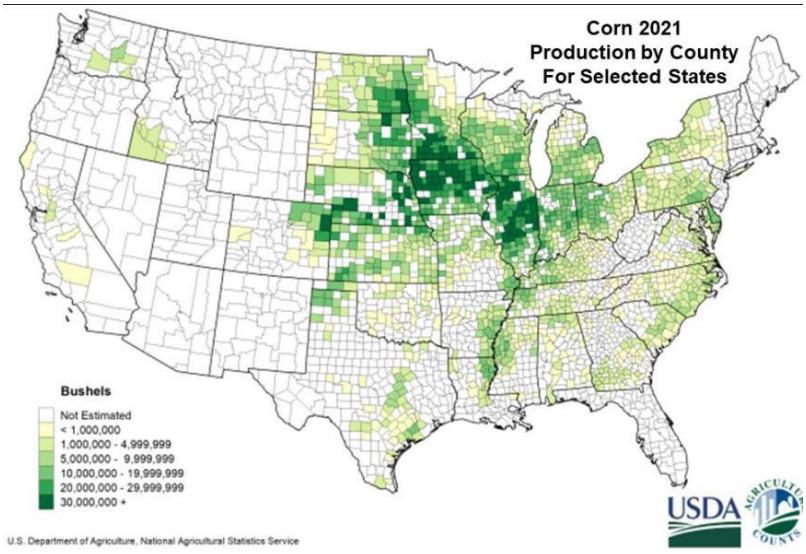
> *Over the past 30 years, increased rainfall from April to June has been the most impactful climate trend for agriculture in the Midwest, providing a favorable supply of soil moisture…*

Agriculture and climate

> *Projected changes in precipitation, coupled with rising extreme temperatures before mid-century, will reduce Midwest agricultural productivity to levels of the 1980s.*
>
> *— 4th National Climate Assessment*

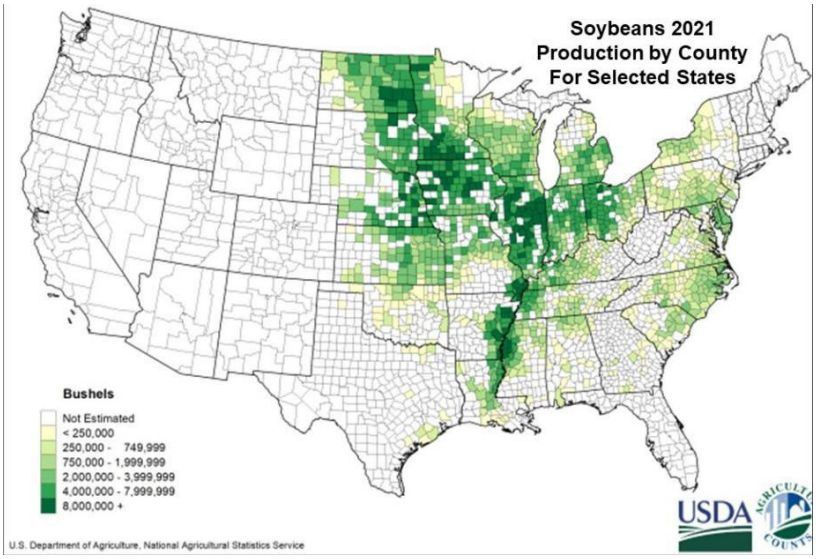
The two primary commodity crops in the Midwest are corn and soybeans, which are grown on 75% of the arable land. Wheat and oats are lesser but still important crops. Review of information from United States Department of Agriculture (USDA 2023, Figures 12 and 13) reveal why this portion of the country has rightly earned the moniker of "America's breadbasket." The determination of whether modest warming and increasing CO_2 will have positive or negative effects to the agriculture in this area is vitally important and is a fundamental purpose of this report.

Figure 12: Corn belt productivity by county



United States Department of Agriculture corn and soy production by county 2023

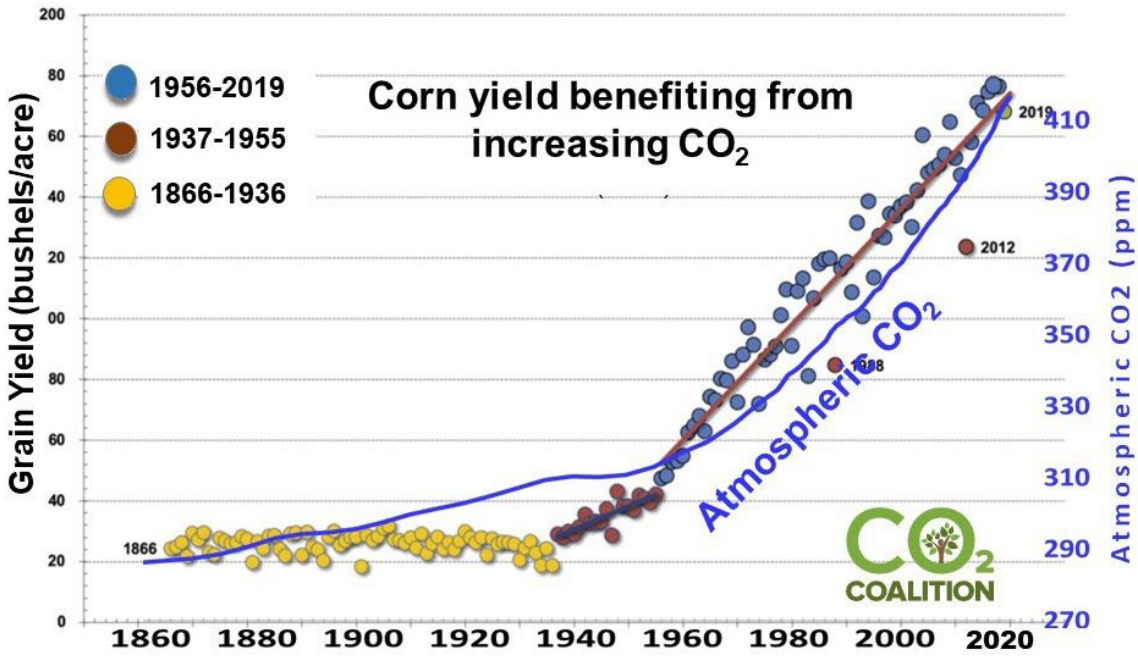
Figure 13: Soy belt productivity by county



United States Department of Agriculture corn and soy production by county 2023

Crop growth continues to break records, both globally and in the Midwest. Likely drivers of this are better technology, warmer weather, optimization of fertilization, greater use of genetically enhanced crops and increasing carbon dioxide. Figure #14 shows the relationship between corn production in bushels per acre and CO_2 increase (Nielsen 2023). While this chart covers all United States corn production, the Midwest is the primary source of corn and, as such, can be viewed as representative of the Midwest as a whole.

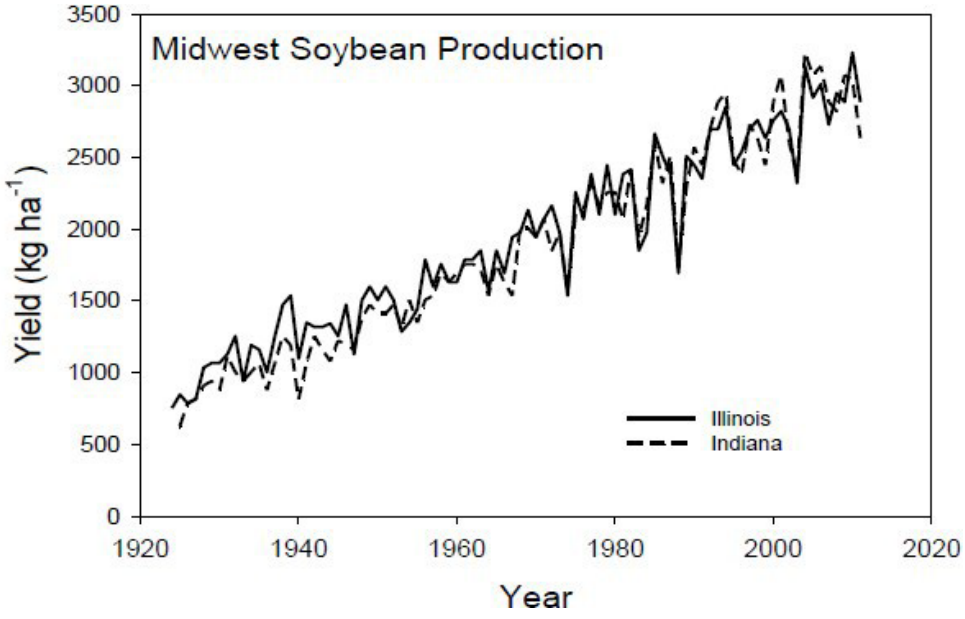
Figure 14: Corn yield - bushels per acre



Source corn production: Nielsen 2023 / Source CO_2: European Environment Agency 2021

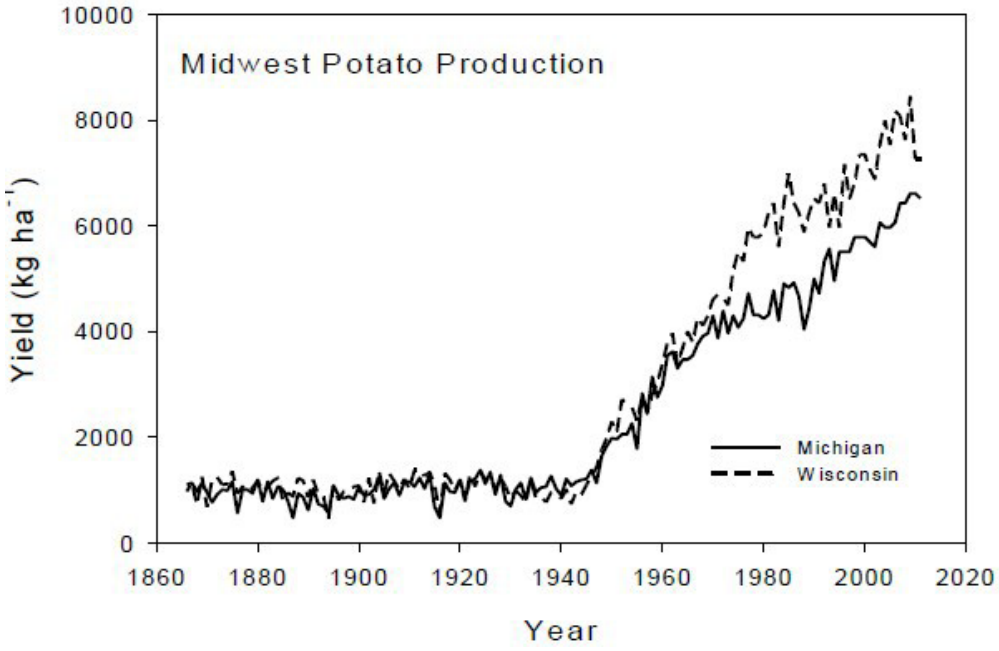
The Midwest's production of other important crops such as soybeans and potatoes also continues to increase at an astonishing rate. We could post multiple similar graphs of other crops showing increasing yields. Despite claims of the pending demise of agriculture in the Midwest due to man-made temperature increases, only positive effects of our changing climate are evident in the data.

Figure 15: Midwest soybean production



Hatfield 2012

Figure 16: Midwest potato production

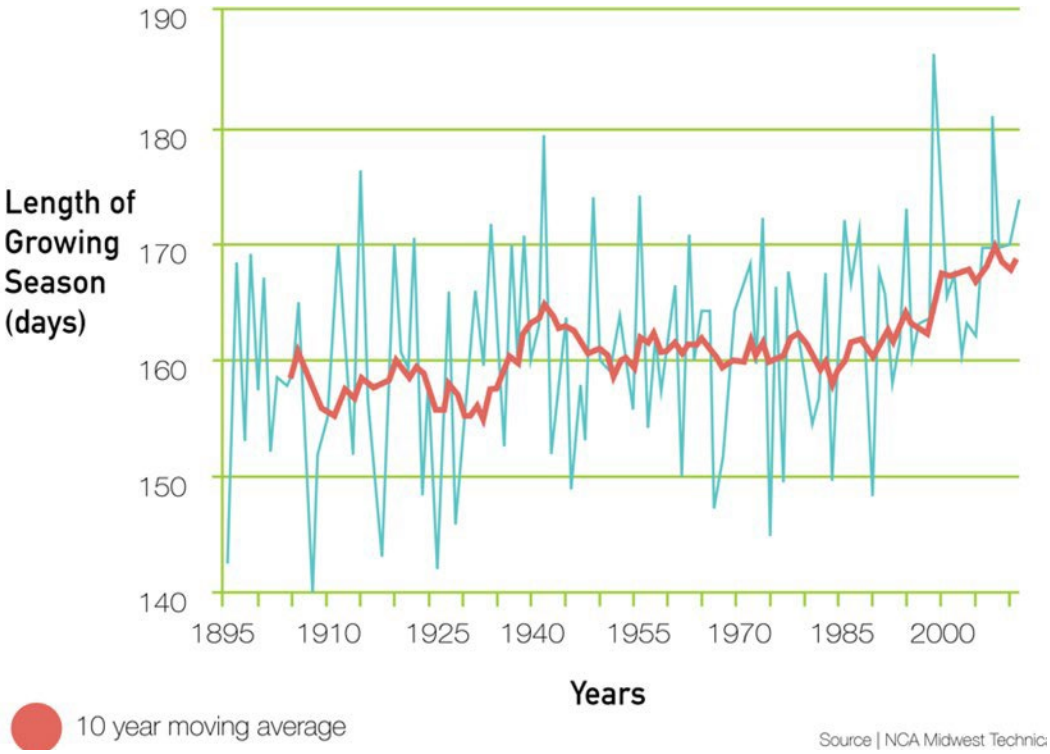


Hatfield 2012

Growing season length

Figure 17 shows variations in the length of the Midwest's growing season since 1895. Longer growing seasons benefit agriculture greatly, as killing frosts end earlier in the spring and arrive later in the autumn. This allows more plantings and prevents harm from late spring killing frosts in the valuable fruit orchards prevalent in parts of the Midwest.

Figure 17: Length of growing season in the American Midwest



Kunkel et al. 2013

CO_2 fertilization

Zhu et al. (2016) remains the definitive study of the extent of "greening" caused by the direct effects of increasing atmospheric carbon dioxide, which include enhancing vegetative growth and increased water-use efficiency. His target was Leaf Area Index (LAI) which measures vegetation changes. He found statistically significant increases over much of the corn and soybean regions since satellite records began in 1982.

Zhu et al. (2016) attribute 70% of global greening to the direct fertilization effect of increasing carbon dioxide, with lesser contributions from nitrogen deposition (9%), warmer temperatures (8%) and land use change (4%).

Decreasing water needs for plants are linked directly to increased atmospheric CO_2. As CO_2 increases, plants' transpiration rate decreases, meaning that the plants lose less water and require less from their root systems. Enhanced growth associated with water-use efficiency is aided by increasing precipitation (which itself is increasing over the corn and soybean regions) when crops are most sensitive, which is prior to flowering and during the period of fruit-setting.

The increasing CO_2 and decreased water requirements are linked also to increasing soil moisture content.

It is very clear that changes in climate and the atmosphere's composition are increasing crop yields in the Midwest's corn and soybean regions.

Health effects

The U.S. EPA (2023) claims that, in the Midwest, "major heat waves have been occurring more frequently across this region for many decades, resulting in increased deaths during these extreme events."

The 4th National Climate Assessment concurs with the EPA and predicts that the health of the citizens of the Midwest can expect to be negatively affected in the future by:

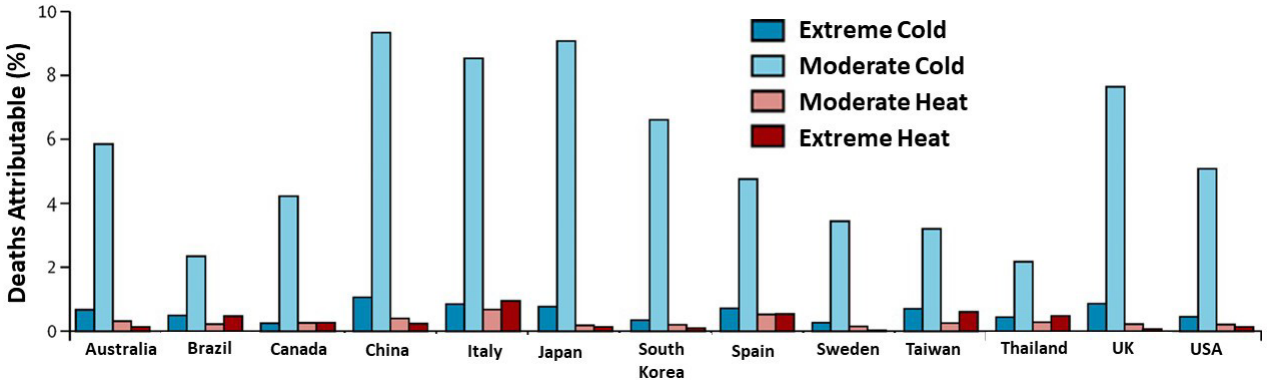
- Existing and worsening health impacts from climate change.
- Increasing frequency and intensity of poor air quality days.

Contrary to these claims, multiple recent studies confirm that cold kills considerably more people than heat. In fact, cold is, by far, the biggest weather-related killer worldwide. Warmer weather would mean far fewer temperature-related deaths.

A study of temperature-associated mortality in the U.K. and Australia found that that cold kills more than 15 times as many people in these countries as heat (Vardoulakis 2014).

In the largest study to date on deaths attributable to heat or cold, Gasparrini (2015) and a large team of collaborators from around the world examined more than 74 million deaths in 13 countries between 1985 and 2012. The study revealed that *cold weather kills 20 times as many people as heat*. Worse, one in 15 deaths from all causes was attributable to cold. Only one death in 250 was attributable to heat. In every country examined, cold-related deaths greatly outnumbered deaths from heat (Figure 18).

Figure 18: Cold kills 20 times as many worldwide as heat

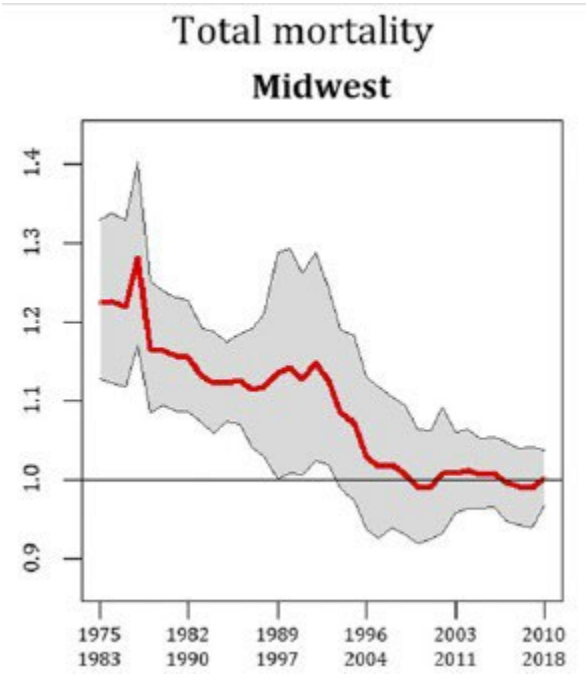


Gasparrini 2015

Between 1979 and 2006, United States annual death rates from heat declined by 10%, while deaths from cold fell by a dramatic 37% (Goklany 2009). In fact, extreme-weather deaths and death rates have been tumbling since the 1920s, notwithstanding the modest global warming since then.

Sheridan et al. (2020) reviewed heat-related deaths for nine regions of the United States. In it, they reviewed deaths related to extreme-heat-events (EHE) versus non-EHE periods and found significant declining heat-related mortality for all nine regions and a particularly striking decline in heat-linked deaths in the Midwest.

Figure 19: Heat-related mortality in the American Midwest



Sheridan 2021

Relative risk by region for total mortality on EHE days as compared with non-EHE days, divided into rolling 9-yr intervals. The red line represents the point estimate, and gray shading represents the 95% confidence interval.

— Sheridan

Contrary to claims made by the EPA and NCA4, the statistics clearly tell us that temperature-related deaths are decreasing in the Midwest and around the world. From this data, we can safely conclude that global warming saves lives.

Tornadoes

Tornadoes are particularly feared in the United States because they kill and injure more U.S. citizens than any other type of storm. While many other countries are spared the twisters' wrath, the United States is the world leader in the number of tornadoes per year—1,250—with Canada trailing in a distant second place with just 100.

The unique geography of the U.S. makes it tornado prone. Cold air masses traveling south out of Canada and east over the Rocky Mountains collide with the warm, moist air masses of the Gulf of Mexico and provide the key ingredients for formation of the severe thunderstorms that spawn tornadoes: warm, moist air close to the ground; cool, dry air aloft; and horizontal winds that travel faster aloft than near the surface.

Contrary to a common misperception, severe weather events, including tornadoes, are not caused by warming temperatures but rather by an increase in the differential between warm and cold air masses. Warmer surface temperatures in general favor more intense thunderstorm development, but enhanced warming aloft—a predicted occurrence by greenhouse gas-induced warming—would drive intensity in the other direction because the less contrast between the surface and upper layers, the less force behind vertical air motion.

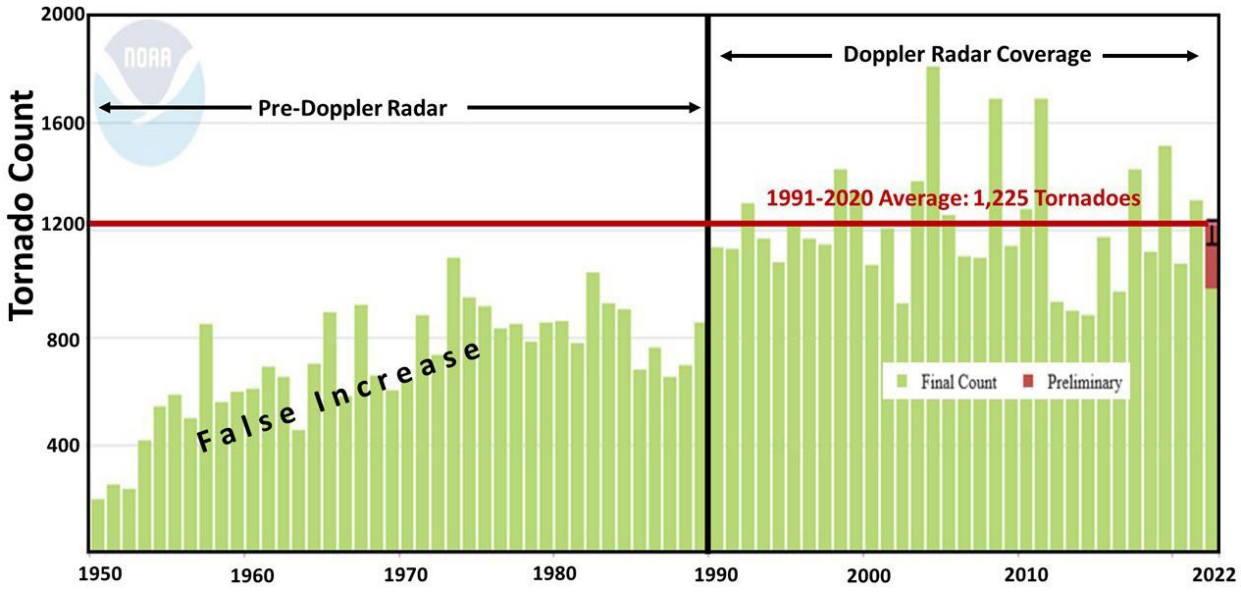
Air moves relatively unimpeded in the middle of the North American continent. As Midwestern sages have oft noted, "The most substantial object between the North Pole and Chicago is a barbed-wire fence." It is the interaction of these thermally disparate air masses, stirred by a constantly wavering jet stream, that is responsible for the frequency and severity of these storms.

With specific regard to tornadoes (which require strong thunderstorm development), the necessary rotation is induced by changes in the wind direction with height ("vertical shear"). An active jet stream also is likely to be a positive factor in tornado development. But a warming world is one in which the pole-to-tropic temperature differential decreases (because of enhanced high-latitude warming), which would decrease jet stream dynamics.

Detection of tornadoes has changed over time. The national deployment of the WSD-88 doppler radar in 1988 resulted in a major increase in detection of the number of weak storms (Enhanced Fujita scale 0 or 1). So gross tornado frequency is likely to be misleading by the under-counting of weak storms prior to the Doppler detection system. This can be appreciated by comparing total tornado numbers (Figure 20) to very strong (EF3, EF4 and EF5) and catastrophic tornadoes (Figure 21).

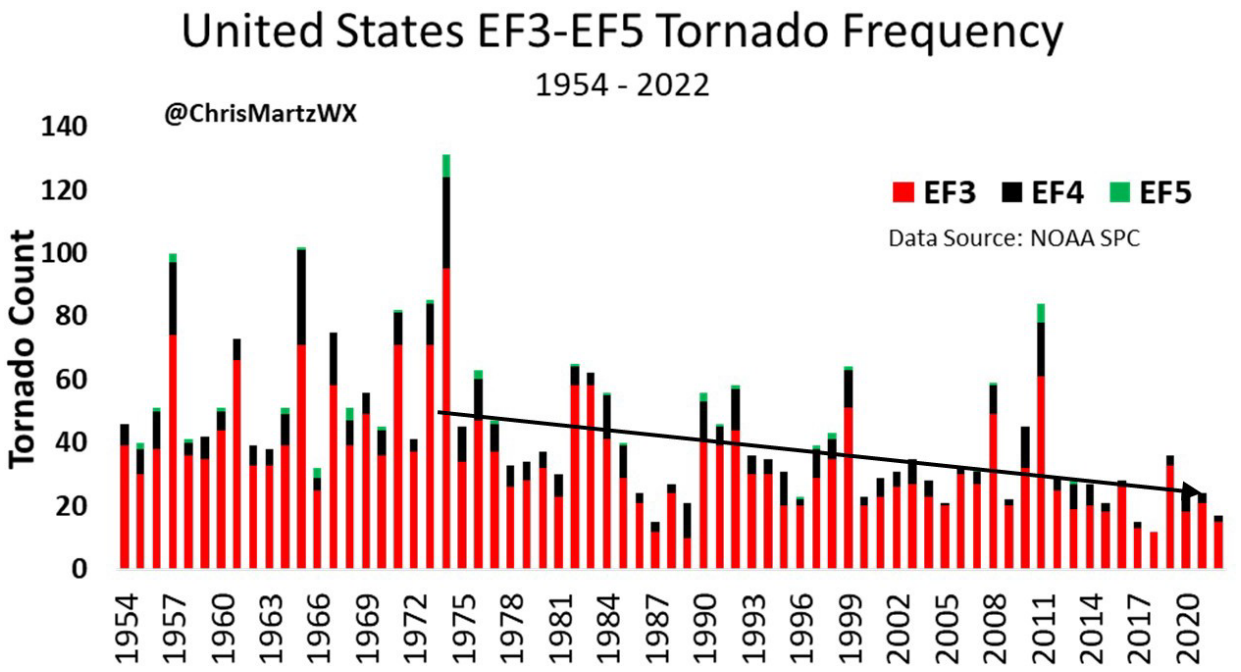
The obvious increase in the numbers of total tornadoes in Figure 20 from 1950 to 1990 reflects an increase in reporting, not an increase in the actual number of tornadoes. EF3 to EF5 tornadoes, the extremely destructive and catastrophic classes, generally do not require radar for detection (though radar is extremely useful in tracking and warning). They exhibit a slight *decrease* in frequency since the mid-1990s (Figure 21).

Figure 20: Number of tornadoes of all scales



NOAA Storm Prediction Center 2023

Figure 21: Declining number of strongest tornadoes (EF3 to EF5)



NOAA Storm Prediction Center 2023, Courtesy Chris Martz

The statistics presented here are for tornadoes in the continental United States. There is no strong evidence for any changes in geographic distribution, so the figures shown here are applicable to the Midwest. The slight reduction in the most severe storms would argue that the interacting constellation of factors that drive tornadoes is conspiring to produce a small decrease.

Emission reductions: Costs and effects on temperature

EPA's model to assess the climate implications of policy is the Model for the Assessment of Greenhouse Gas Induced Climate Change (MAGICC). It assumes a varying equilibrium climate sensitivity from 1.5 to 4.5°C (the amount of warming from a doubling of atmospheric CO_2).

MAGICC calculates that if *all* carbon dioxide emissions from the entire United States were set to zero in 2010, and kept at zero until 2100, the amount of global warming "mitigated" (using a climate sensitivity of 2.0) would be 0.074°C (0.133°F).

At the same time, it appears that India and China are determined to increase their coal-fired electricity production, and hence, their emissions are expected to continue increasing for the next several decades. While Chinese emissions are currently well over twice those of the U.S., the factor will be about triple by the end of the century. Put simply, the U.S. is rapidly on the way to being a minor contributor to global carbon dioxide emissions.

A review of recent CO_2 emissions data from the U.S. Energy Information Administration (2016) reveal that the Midwestern states had combined emissions that were 22.9% of the total United States emissions of 5,161 million metric tons. Looking only at the American Midwest's emissions, the MAGICC simulations (using 2.0 sensitivity) project that, had the Midwestern states achieved a complete elimination of the area's CO_2 emissions in 2010, it would only avert 0.009°C (0.016°F) by the year 2100 (Figure 22).

This is far less than the difference in temperature that humans experience every few seconds in a "constant" environment and far below our ability to even measure, a change that is scarcely different from zero. According to MAGICC, any attempt by a Midwestern state to reduce the planet's atmospheric temperature by reducing their CO_2 emissions is climatically meaningless.

Figure 22: Amount of warming averted by elimination of CO_2 emissions

Model for the Assessment of Greenhouse-gas Induced Climate Change How much temperature rise will be averted by 100% reduction in CO2 emissions?						
Jurisdiction	CO_2 emissions by state (2016) in millions of metric tons	% of US emissions	Temperature rise averted by decreasing CO2 by 100% (Climate sensitivity of 2.0°C)			
			by 2050 (°C)	by 2050 (°F)	by 2100 (°C)	by 2100 (°F)
United States	5,161.00	100.0%	0.041	0.0738	0.1040	0.1872
Illinois	204.1	4.0%	0.0016	0.0029	0.0041	0.0074
Indiana	181.9	3.5%	0.0014	0.0026	0.0037	0.0066
Iowa	73.1	1.4%	0.0006	0.0010	0.0015	0.0027
Michigan	151.8	2.9%	0.0012	0.0022	0.0031	0.0055
Minnesota	89.3	1.7%	0.0007	0.0013	0.0018	0.0032
Missouri	117.7	2.3%	0.0009	0.0017	0.0024	0.0043
Nebraska	48.6	0.9%	0.0004	0.0007	0.0010	0.0018
Ohio	206.3	4.0%	0.0016	0.0029	0.0042	0.0075
South Dakota	15	0.3%	0.0001	0.0002	0.0003	0.0005
Wisconsin	95.6	1.9%	0.0008	0.0014	0.0019	0.0035
Midwest All	**1183.4**	**22.9%**	0.0094	0.0169	0.0238	0.0429

MAGICC - Model for the Assessment of Greenhouse Gas–Induced Climate Change

The near-zero effect of the area's emission reductions needs to be assessed in the context of the rapid expansion of global emissions from the developing nations, in particular India, China, Russia and Brazil.

A recent report (Tanton 2020) assessed the capital costs associated with a total "electrification" of the states and the nation. Tanton assessed the costs and results of attempts to transition the entire electric power grid in the United States to renewable power designed to eliminate emissions of greenhouse gases from fossil fuels.

He estimated that the costs for the ten Midwestern states to transition completely to renewable power would be more than $6 trillion. The costs to each resident ranged from a low of $87,258 in Illinois to a staggering $110,526 for South Dakotans. The average cost per capita for Midwestern residents is slightly more than $92,000 (Figure 23).

Using the MAGICC calculation of 0.041° C of warming averted by the year 2100, the cost to America is $14 trillion per each tenth of a degree of warming prevented. We leave it to the reader to decide if that is a wise investment.

Figure 23: Estimated costs for "electrification" by renewables

State	Total	Population (2020 Census)	Per Capita Cost
Illinois	$1,118,000,000,000	12,812,508	$87,258.48
Indiana	$685,000,000,000	6,785,528	$100,950.14
Iowa	$337,000,000,000	3,190,369	$105,630.41
Michigan	$931,000,000,000	10,077,331	$92,385.57
Minnesota	$529,000,000,000	5,706,494	$92,701.40
Missouri	$518,000,000,000	6,154,913	$84,160.41
Nebraska	$192,000,000,000	1,961,504	$97,884.07
Ohio	$1,066,000,000,000	11,799,448	$90,343.21
South Dakota	$98,000,000,000	886,667	$110,526.27
Wisconsin	$550,000,000,000	5,893,718	$93,319.70
Grand Total	**$6,024,000,000,000**	**$65,268,480**	**$92,295.70**

Tanton 2020

Modeling future climate

The current rush to "net zero" and the plans to spend enormous sums of money are based on mathematically complicated climate models that predict a significant rise in future temperatures. If we are to base policy decisions on predictive models, we should find out if the models are capable of forecasting accurately—and real science tells us that they are not.

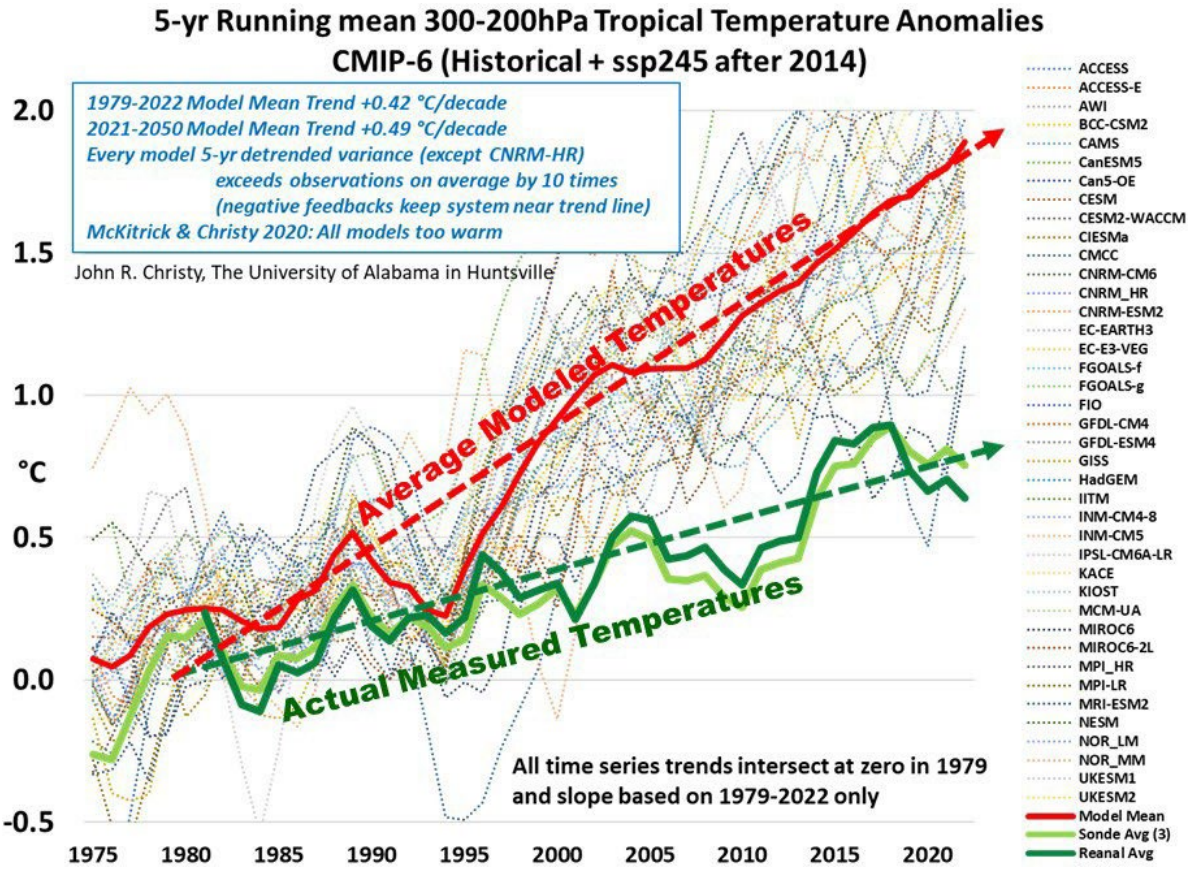
Accordingly, a short explanation of how climate models work is in order: The models are based on assessments of climate sensitivity, which is the estimated temperature response to a doubling of atmospheric CO_2 concentrations. In other words, if our current 420 ppm level doubled to 840 ppm, what increase in temperature could we expect? On top of this greenhouse-induced warming, models also estimate positive "feedbacks" such as an increase in water vapor to magnify the warming effect.

The most recent version of the 100-plus climate models (CMIP6 2022) projects that a doubling of CO_2 would cause warming ranging from 1.8–5.6° C (3.2–10.1°F). Contrast that to the climate sensitivities calculated by respected physicists Happer, Lindzen and Van Wijngaarden in recent CO_2 Coalition publications. In these, they estimate that climate sensitivity is less than 1.5° C and most likely below 1.0° C:

- 2n-Stream Radiative Transfer - Van Wijngaarden and Happer (2022)
- Infrared Forcing by Greenhouse Gases - Van Wijngaarden and Happer (2022)
- On Climate Sensitivity – Lindzen (2020)

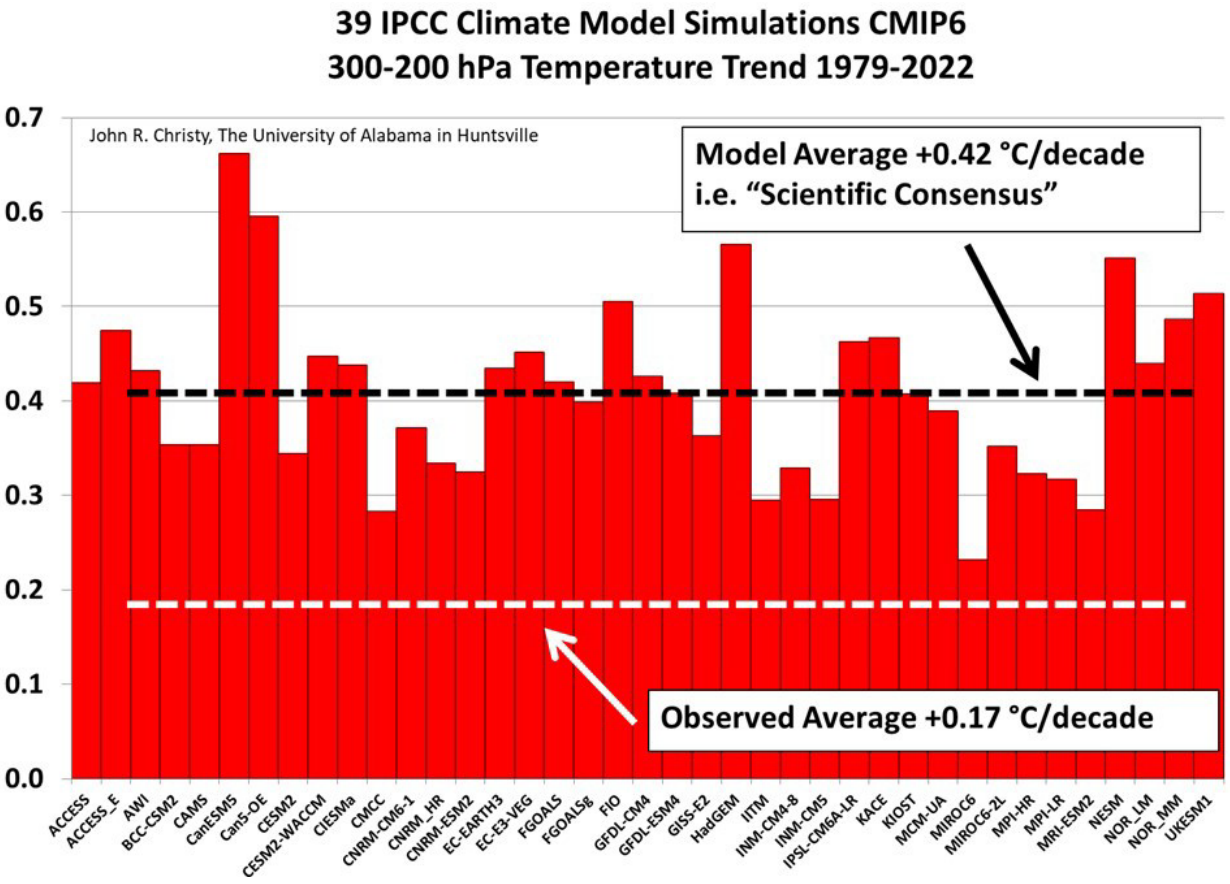
A detailed examination by John Christy, a distinguished climatologist at the University of Alabama at Huntsville and Alabama State Climatologist, provides a stark assessment of the validity (or non-validity) of the models that are used in support of efforts to attain net zero emissions (Figures 24 and 25). The two charts below document that the average of the modeled temperatures predict a warming rate of 0.42°C per decade versus the measured temperature increase of 0.17°C per decade. That means that the models are overpredicting temperature increase by at least 2.5 times (McKitrick and Christy 2018). If natural temperature drivers have been responsible for 50% of the measured warming, then the overprediction would rise to five times too high.

Figure 24: Average of modeled tropical temperature anomalies vs. real-world temperatures



Modified from Christy 2023

Figure 25: 39 IPCC model simulations 1979 – 2022



Modified from Christy 2023

A report recently published in the journal Nature (Hausfather 2022) by five of the top climate modelers from NASA and Texas A & M confirms that the models used by the IPCC significantly overpredict warming.

> *…a subset of the newest generation of models are 'too hot' and project climate warming in response to carbon dioxide emissions that might be larger than that supported by other evidence*
>
> *— Hausfather et al. 2022*

Governments are enacting polices that rely on complex computer programs, using an array of complicated equations "tweaked" by the scientists who built them, to arrive at a temperature forecasted some 100 years into the future. We cannot confidently forecast temperature a mere 10 days in the future but are asked to base climate policies and risk trillions of dollars on models that have failed and failed again the test of prediction versus observation.

CONCLUSION

- The 4th National Climate Assessment's claims of climate-induced negative consequences for the Midwest are hyperbole with no basis in science and antithetical to the reality of a region likely to continue prospering under increasingly benign conditions for its agricultural sector.

- Recent temperatures are comparable to those for the region nearly 100 years ago with no trend of increasing summer heat or heat waves.

- Data show declines in droughts, tornadoes and heat-related deaths.

- Midwest agricultural productivity has increased, consistent with record global crop harvests and an overall greening of Earth largely from increasing warmth and atmospheric CO_2.

- Proposed reductions of CO_2 emissions would have no measurable effect on the climate and would be prohibitively expensive.

- NCA4 computer models overpredict future warming by 2.5 times; it is irresponsible and dangerous to use their forecasts for policy decisions.

ACKNOWLEDGEMENTS

About the CO_2 Coalition

The CO_2 Coalition was established in 2015 as a non-partisan educational foundation operating under Section 501(c)(3) of the IRS code for the purpose of educating thought leaders, policy makers and the public about the important contribution of carbon dioxide to our lives and the economy.

The Coalition seeks to engage in an informed and dispassionate discussion of climate change, humans' role in the climate system, the limitations of climate models and the consequences of mandated reductions in CO_2 emissions.

In carrying out our mission, we seek to strengthen the understanding of the role of science and the scientific process in addressing complex public policy issues like climate change. Science produces empirical, measurable, objective facts and provides a means for testing hypotheses that can be replicated and potentially disproven. Approaches to policy that do not adhere to the scientific process risk grave damage to the economy and to science.

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