Arkansas and Climate Change

No Warming. No Crisis. No Problem.

CO2 COALITION

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July 2025

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EXECUTIVE SUMMARY

This report will examine the scientific basis for claims of harmful climate-change-related effects in Arkansas.

Like other areas around the world, claims have been made that Arkansas is experiencing negative impacts from unusual and unprecedented warming driven by increasing human emissions of carbon dioxide (CO_2). A "solution" to this supposed problem is to establish a "net zero" economy that adds no CO_2 to the atmosphere. Here, we will rely on Arkansas state agency documents, data from American and global governmental agencies and peer-reviewed scientific studies to glean the truth about Arkansas' climate and its impacts.

Several detailed climate assessments have been published recently that review historical climate records for Arkansas and the southeastern United States. These include the 5th National Climate Assessment (NCA5) report (USGCRP, 2023) and the National Oceanic and Atmospheric Administration's (NOAA) Arkansas State Climate Summary (Runkle et al., 2022).

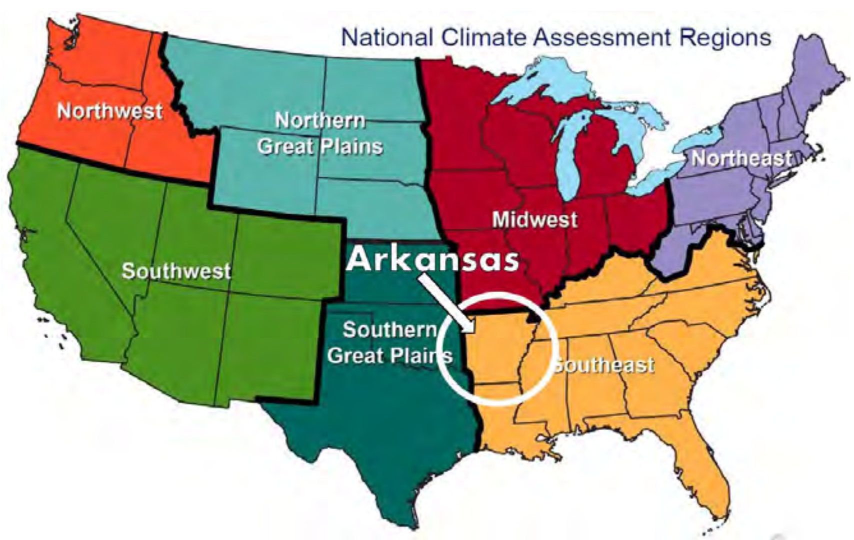

Figure 1: *National Climate Assessment Regions. USGCRP (2018)*

Promotion of the need to achieve "net zero" emissions is predicated on claims of existing and future devastating calamities resulting from CO_2-enhanced warming.

The primary and quite surprising (to the authors) takeaway of our research is that the state of Arkansas has experienced virtually no warming over the past 100-plus years. The modest rise in temperature of 1.2 °C since the beginning of the Industrial Revolution that is exhibited throughout most areas of the world cannot be found in Arkansas. The data confirm that heatwaves and maximum temperatures have declined.

Our conclusion? There is no evidence of a climate crisis in Arkansas. Rather, its citizens are benefiting from ecosystems that are thriving and flourishing.

ARKANSAS PHYSIOGRAPHY

Arkansas' climate and weather are affected greatly by its varied topography. The state's physiography (Figure 2) is divided into two major regions: the Interior Highlands in the northwest and the Gulf Coastal Plain in the southeast. These, in turn, are divided into five provinces: the low-lying Mississippi River Alluvial Plain and West Gulf Coastal Plain and the higher elevation Ouachita Mountains, Arkansas River Valley and Ozark Plateaus.

The state's climate varies dramatically from the high elevations of the Ozark and Ouachita Mountains in the north and west to the low-lying plains along its eastern and southern boundaries. The variances in altitude are a determining factor in the temperature and climate profile and can vary significantly with much cooler temperature distribution over the elevated terrains of the state's Interior Highlands and the generally warmer temperatures of the state's Gulf Coastal Plain.

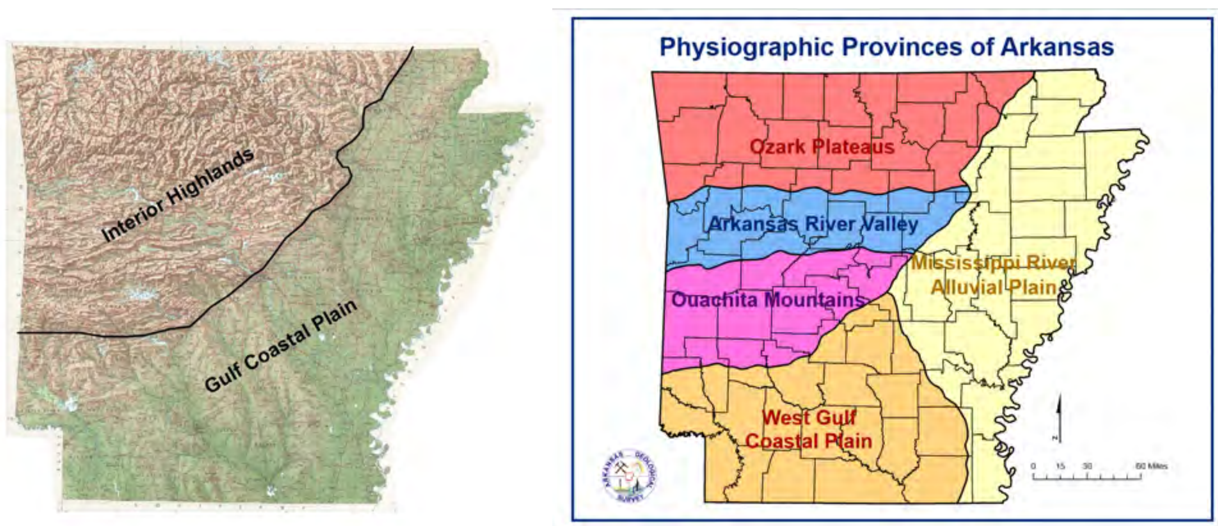

Figure 2: *Arkansas Physiography. Arkansas Department of Energy and Environment Office of the State Geologist (2025)*

PHYSICAL SCIENCE BASIS—CLIMATE CHANGE IN ARKANSAS

TEMPERATURE

The primary alleged negative consequence of increasing atmospheric CO_2 is that its greenhouse warming effect will increase temperatures to unusual, unprecedented and dangerous levels. For instance, according to the NCA5 report:

> *"Across all regions of the US, people are experiencing warming temperatures and longer-lasting heatwaves." (USGCRP, 2023)*

Apparently, "global" warming isn't so global after all, because Arkansas has seen no warming at all over the last 100-plus years. In fact, according to the United States Environmental Protection Agency (U.S. EPA):

> ***"Unlike most of the nation, Arkansas has not become warmer during the last 50 to 100 years."*** *(United States Environmental Protection Agency, 2016)*

Our evaluation of historic temperature data (1891 to 2024), provided by NOAA's U.S. Historical Climatology Network (USHCN) (NOAA National Centers for Environmental Information, 2025d), supports this "no warming" conclusion for average Arkansas temperatures.

In contrast, the Arkansas State Climate Summary (Runkle et al., 2022) claims that temperatures in Arkansas have risen approximately 0.5 °F since the beginning of the 20th century. As we will discuss in detail below, the small increase in temperature claimed by State Climate Summary is based on all Arkansas NOAA weather stations, despite evidence that many urban and suburban stations have recorded artificially high measurements in recent decades owing to the "urban heat island" (UHI) warming effect from increased human infrastructure and heat sources.

Even if this claim was accurate, bear in mind that a 0.5 °F rise in temperature is imperceptible to the reader sitting in their temperature-controlled home or office where the thermostat won't even be triggered to respond to a change that small. Consider the following facts:

- The temperature rises by more than 0.5 °F between 10:00 a. m. and noon on most days.
- 0.5 °F is the temperature change that results from an elevation change of about 280 feet.
- At mid-latitudes, 0.5 °F is the approximate temperature change that results from moving north or south just 17 miles.
- Temperature ranges for most important crops vary by tens of degrees Fahrenheit. Corn, wheat, potatoes and soybeans are produced from Mexico to Canada. Compared to the temperature variations between these countries, 0.5 °F is negligible.

In this publication, we will rely on the data from NOAA's U.S. Historical Climatology Network (USHCN) (NOAA National Centers for Environmental Information, 2025d). These data provide information from a smaller subset of the same NOAA weather stations, excluding many of the weather stations most corrupted by UHI. The locations of the 15 USHCN stations used in this report are shown in Figure 3.

TEMPERATURE ADJUSTMENTS AND FABRICATION OF DATA

The data from USHCN is the highest quality, long-term (beginning in 1891) direct thermometer records available for Arkansas. Even so, there are several factors intrinsic to the data that serve to overstate modern warming and understate warming of earlier periods:

- Urban heat island effect is reduced but not eliminated (Watts, 2022).
- Adjustments are made to raw historical temperatures (NOAA National Centers for Environmental Information, 2025d).
- Data are fabricated for stations that no longer exist or are no longer reporting (Heller, 2022).

To learn more about how temperature data have been intentionally manipulated in Arkansas, see Appendix B on temperature adjustments and fabrication of data.

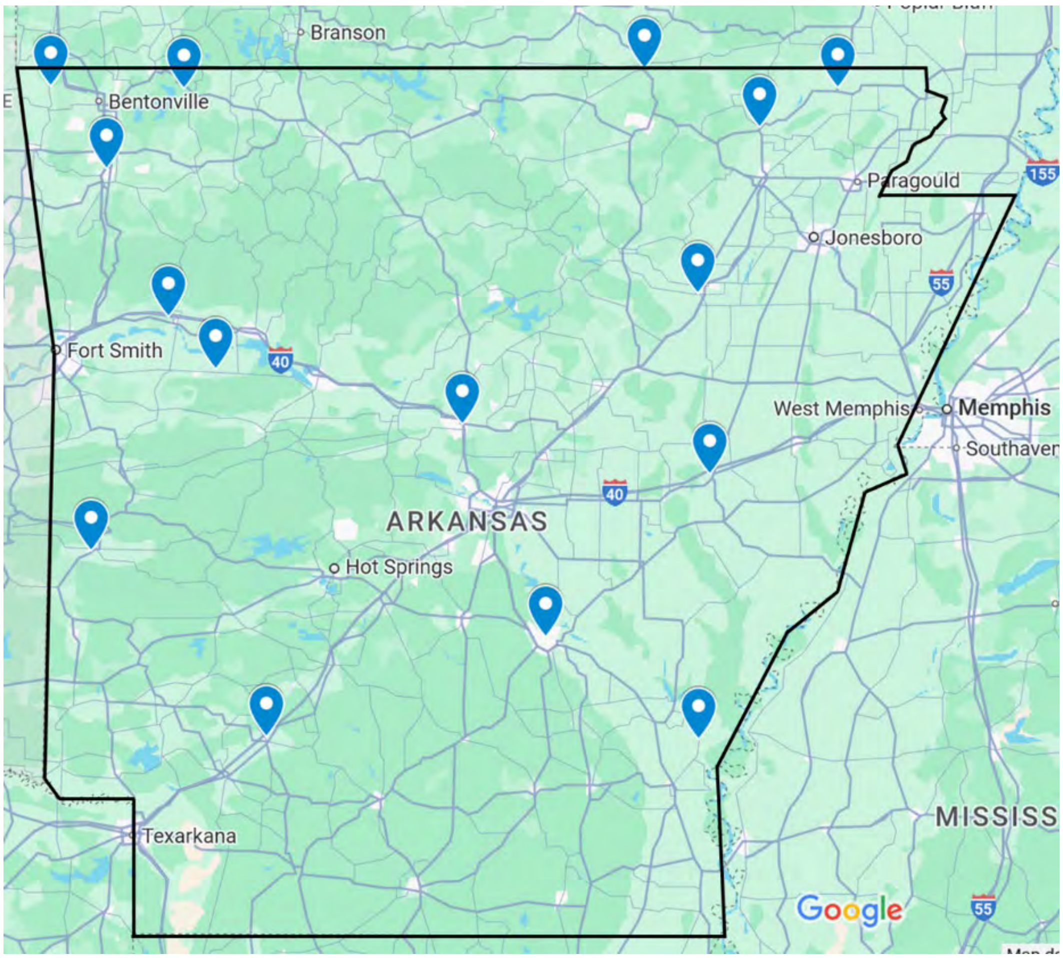

Figure 3: *Map of NOAA's USHCN Weather Stations. NOAA National Centers for Environmental Information (2025d)*

AVERAGE TEMPERATURES IN ARKANSAS

Analysis of the USHCN data reveals that the annual average mean temperature for Arkansas (Figure 4) since 1891 has remained nearly unchanged with no discernible or statistically significant trend of either increase or decrease. Modern temperatures over the last 40 years are nearly identical to those measured in the first 50 years of this record.

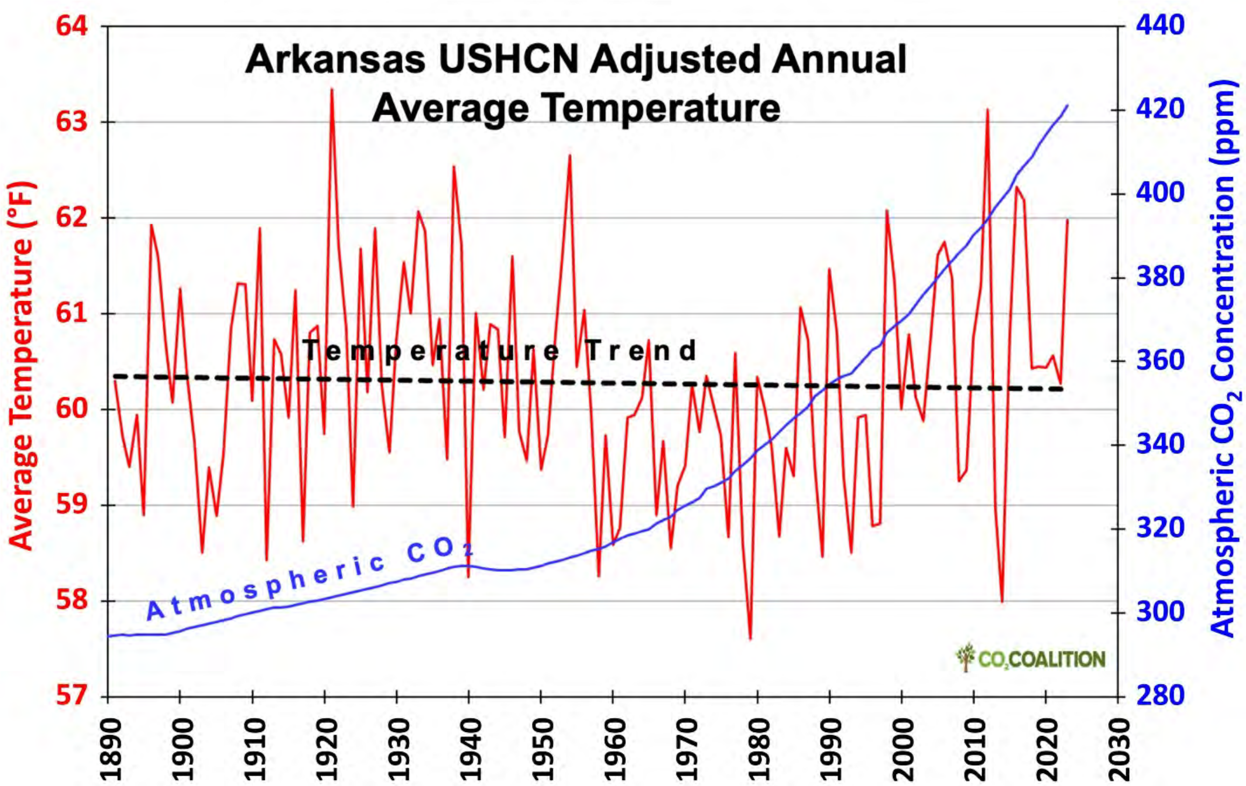

Figure 4: *Annual Average Mean Temperatures in Arkansas, Plotted With the Atmospheric CO_2 Concentration. Temperature: NOAA National Centers for Environmental Information (2025d), CO_2 concentration (1958 and prior): NASA Goddard Institute for Space Studies (2018), CO_2 concentration (1959 onward): Lan and Keeling (2025) (NOAA)*

Please note that the late 19th and early 20th centuries had very low atmospheric CO_2 concentrations of less than 320 ppm while the most recent decades witnessed steadily increasing CO_2 concentrations that are nearly 50% higher.

MINIMUM TEMPERATURES IN ARKANSAS

A strongly beneficial aspect of our examination of the temperature in Arkansas is documentation that the average daily low temperatures (usually at night) have warmed modestly (Figure 5). The 1.0 °F rise in minimum temperature has likely contributed to an increase in the length of the state's growing season. According to the United States Environmental Protection Agency (2025b) and Kunkel (2024), the growing season length in the contiguous United States has increased by more than two weeks since 1900.

Because of warmer nighttime cold temperatures, killing frosts stop earlier in the spring and arrive later in the autumn. Since Arkansas' low temperatures have not warmed as much as the rest of the U.S., it is likely that the state's growing season has increased, but not nearly as much as the rest of the U.S.

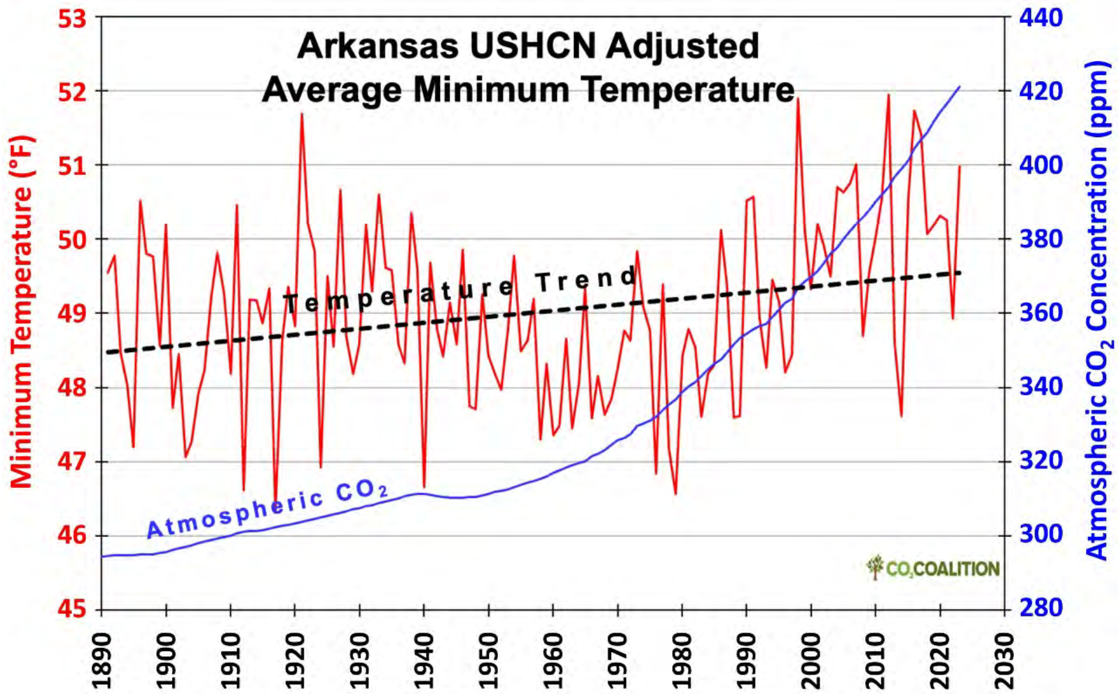

Figure 5: *Annual Average Minimum Temperatures in Arkansas, Plotted With the Atmospheric CO_2 Concentration. Temperature: NOAA National Centers for Environmental Information (2025d), CO_2 concentration (1958 and prior): NASA Goddard Institute for Space Studies (2018), CO_2 concentration (1959 onward): Lan and Keeling (2025) (NOAA)*

As we shall see in a later section of this report the combination of slightly warmer low temperatures and increasing CO_2 levels are a strong one-two punch increasing crop productivity in Arkansas.

MAXIMUM TEMPERATURES AND HEATWAVES IN ARKANSAS

The annual average maximum temperature in Arkansas has declined by more than 1.0 °F since 1900 (Figure 6). This decline in the state's highest temperatures occurred despite steadily rising levels of CO_2, a greenhouse gas claimed to be fueling an increase of temperature to heights that are unusual and unprecedented.

Data from the U.S. EPA (Figure 7) show that heatwaves in the United States peaked in the 1930s, long before human emissions began to increase in earnest in the mid-20th century. In fact, the atmospheric CO_2 concentration during that period was only 70% of our most recent concentration (Figures 4 to 6). These data contradict the claim of the most recent NCA5 report that "heatwaves in the Southeast [which encompasses Arkansas] are happening more frequently" (USGCRP, 2023).

In Arkansas, similar to other states, very hot temperatures are in a long-term decline. This is confirmed by reviewing the percentage of days above 90 °F (Figure 8). Furthermore, a

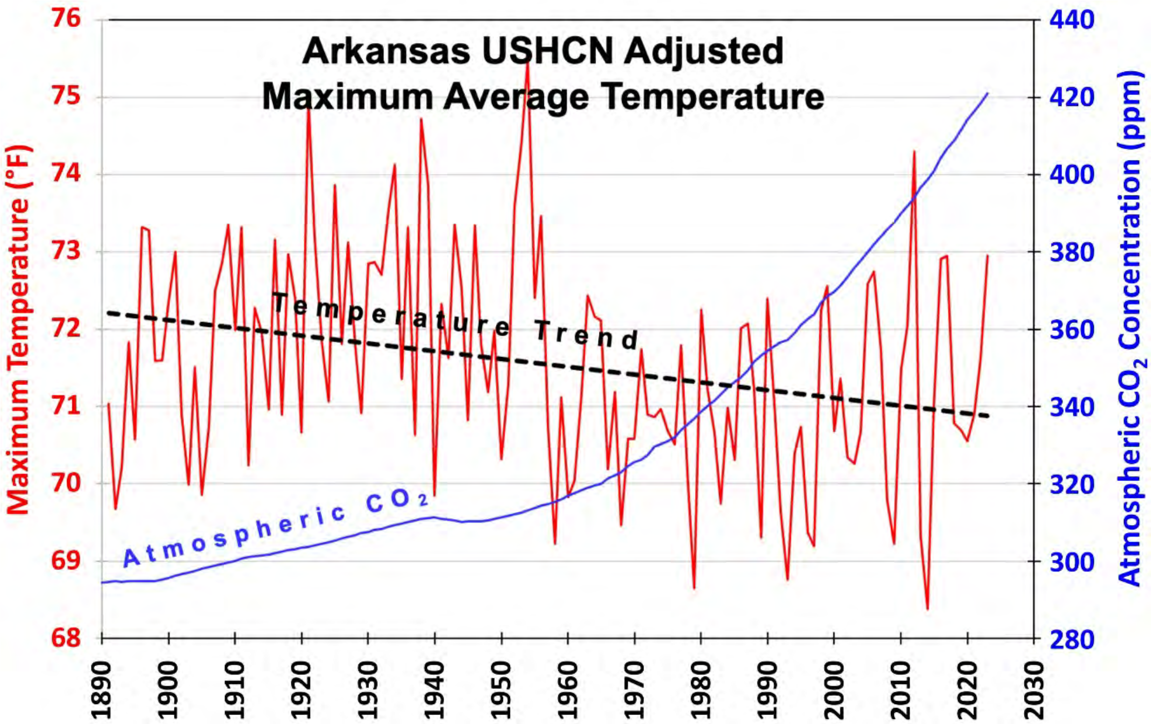

Figure 6: *Annual Average Maximum Temperatures in Arkansas, Plotted With the Atmospheric CO_2 Concentration. Temperature: NOAA National Centers for Environmental Information (2025d), CO_2 concentration (1958 and prior): NASA Goddard Institute for Space Studies (2018), CO_2 concentration (1959 onward): Lan and Keeling (2025) (NOAA)*

comparison of the heat record and atmospheric CO_2 concentration suggests a negative correlation between increasing CO_2 concentration and the number of extremely hot days.

A review of the actual temperature data above should allay any concerns over a pending climate catastrophe in Arkansas. Despite a 50% increase in atmospheric CO_2 concentration since the late 18th century, Arkansas has not seen any of the much-ballyhooed unusual and unprecedented warming claimed by those promoting a man-made climate crisis. Prior to 1995, the Arkansas motto was “Land of Opportunity.” Based on our review, perhaps the state should consider the adoption of a new motto: “Land of No Man-Made Warming.”

EXTREME WEATHER EVENTS

The NCA5 report lists “drought” and “extreme rainfall” as threats to the Southeast region of the United States, which includes Arkansas (USGCRP, 2023). The NCA5 report added that “hurricanes have been intensifying more rapidly since the 1980s … and causing heavier rainfall and higher storm surges.”

To determine if these claims of increasing severe weather are true, we turn to official U.S. government records.

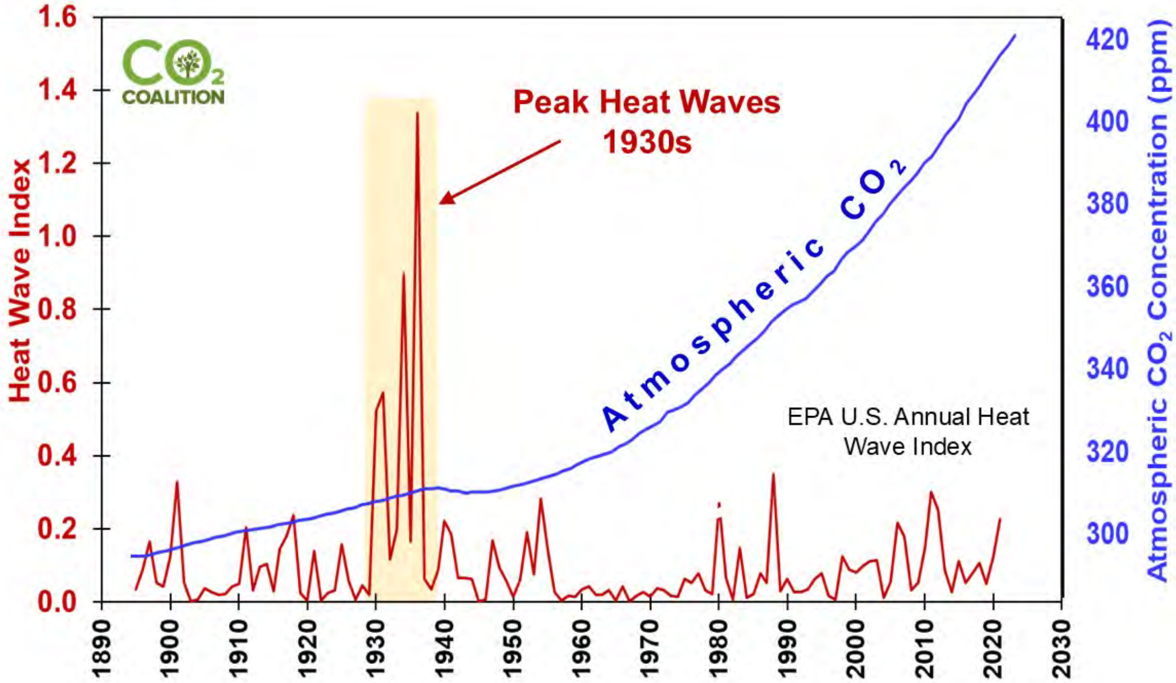

Figure 7: *Contiguous United States Annual Heat Wave Index. United States Environmental Protection Agency (2025a)*

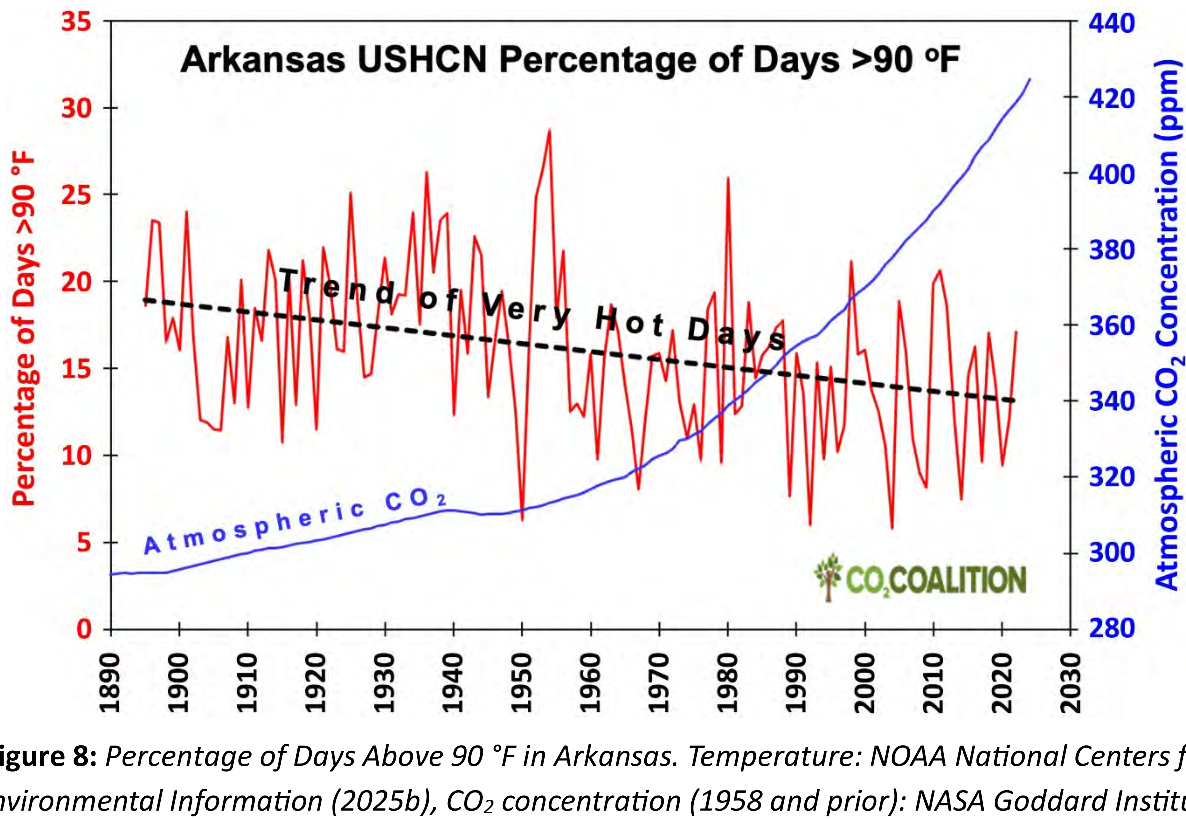

Figure 8: *Percentage of Days Above 90 °F in Arkansas. Temperature: NOAA National Centers for Environmental Information (2025b), CO_2 concentration (1958 and prior): NASA Goddard Institute for Space Studies (2018), CO_2 concentration (1959 onward): Lan and Keeling (2025) (NOAA)*

DROUGHT

Drought is the single greatest threat to the agricultural sector in Arkansas and around the world. According to the Food and Agriculture Organization of the United Nations (UNFAO 2021), "drought has been established as the single greatest culprit of agricultural production loss." This report estimated a cost of $37 billion in agricultural losses from drought. While drought can make life difficult for the general population, it is agriculture that bears 82% of the economic impacts.

Claims of falling agricultural productivity due to drought are standard fare for those promoting climate fear. Since the economic and human toll from sustained droughts are enormous, we will review the data to learn if they are increasing or decreasing in Arkansas.

Drought is driven by a regional decrease in soil moisture. The two drivers of drought are extreme heat and a decrease in precipitation. We have seen in the previous section on temperature, that high temperatures and heat waves have been in decline in Arkansas, therefore, heat-driven drought has been a non-factor in the past century.

The Palmer Drought Severity Index (PDSI) is an indicator of long-term drought conditions. According to the NOAA National Integrated Drought Information System (2025), "the PDSI is a standardized index based on a simplified soil water balance and estimates relative soil moisture conditions."

Based on the data from NOAA (Figure 9), since 1895, the Arkansas PDSI values have fluctuated greatly from year to year, with no discernible trend, which means that the data show no increase in the severity of drought in Arkansas. This observation stands in direct contradiction to NOAA's Arkansas State Climate Summary, which claims that "naturally occurring droughts are projected to be more intense" (Runkle et al., 2022).

Precipitation in Arkansas can be estimated using the anomaly in precipitation relative to the observed average precipitation levels between 1895–2000. As shown in Figure 10, the long-term trend since the late 1800s shows that there has been a modest increase in precipitation in Arkansas.

Where it occurs, drought is the primary scourge of crop growth throughout the world. However, the modest increase in the precipitation in Arkansas should have beneficial effects on the state's agricultural yields. Although flooding during the spring planting season and the fall harvest can have significant negative impacts on production, its negative effect pales in comparison to drought.

Summer agriculture responds both to shorter and longer periods of moisture. Corn yield is significantly correlated with summer rainfall (Hatfield, 2012). It is a rare year where excessive wetness suppresses yields over the corn belts of North America and Europe. We provide more data on the beneficial agricultural results of increasing CO_2 in a later section on agricultural productivity.

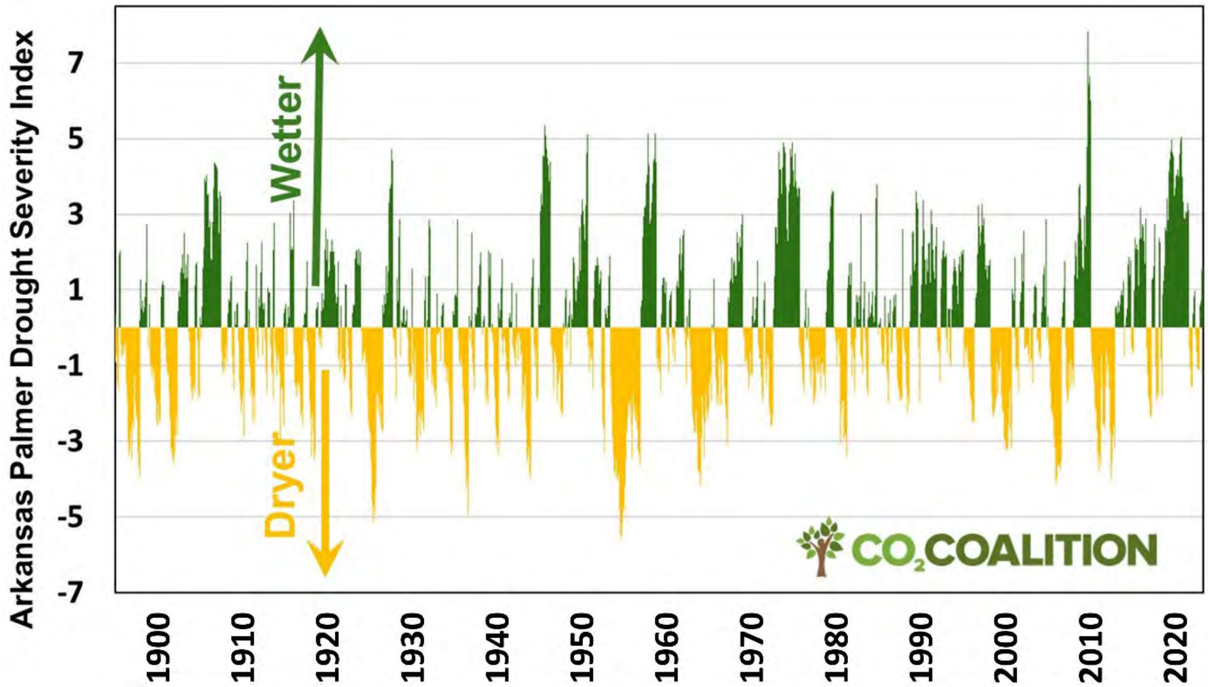

Figure 9: *Arkansas Palmer Drought Severity Index (PDSI). NOAA National Centers for Environmental Information (2025a)*

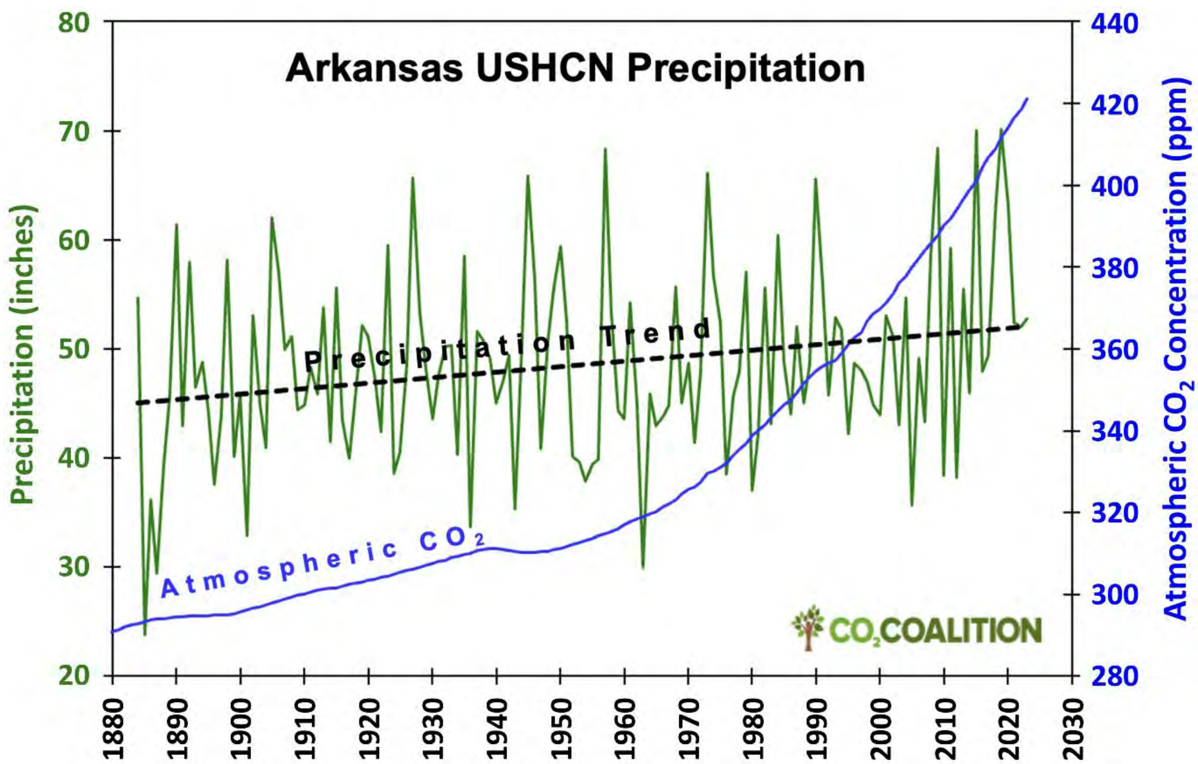

Figure 10: *Annual Precipitation in Arkansas. Precipitation: NOAA National Centers for Environmental Information (2025d), CO_2 concentration (1958 and prior): NASA Goddard Institute for Space Studies (2018), CO_2 concentration (1959 onward): Lan and Keeling (2025) (NOAA)*

FREQUENCY OF TORNADOES WITH MAGNITUDES EF3 AND ABOVE

> *"The science is clear. Climate change is making extreme weather events, including tornadoes, worse." (U.S. Senator Bernie Sanders)*

With the media hyping every tornado and linking them to man-made climate change, Senator Sanders can be forgiven for assuming that they are increasing. What do the data tell us?

The Federal Emergency Management Agency (FEMA) indicates that the region that includes Arkansas has the greatest frequency of high-wind events like tornadoes in the United States (Rowden and Aly, 2018). Hence, the analysis of tornado frequency is pertinent to our report.

For our assessment of tornado activity and damages caused by it in Arkansas, we analyze data on tornadoes categorized as EF3 and above. For long term data on tornadoes, it is recommended by NOAA to use these very large events because the early historic records of tornadoes are unreliable: "One of the main difficulties with tornado records is that a tornado, or evidence of a tornado, must have been observed. A tornado in a largely unoccupied region is not likely to be documented." Tornadoes that are EF3 and above are so big that they were very likely to have been documented, even early in the 20th century with lower population density.

Data from NOAA show that the frequency of these strong and violent tornadoes with category EF3 and above have not been increasing (Figure 11) and a strong argument can be made that they have decreased a bit.

Note: The only known EF5 tornado (most destructive) in Arkansas occurred in 1929.

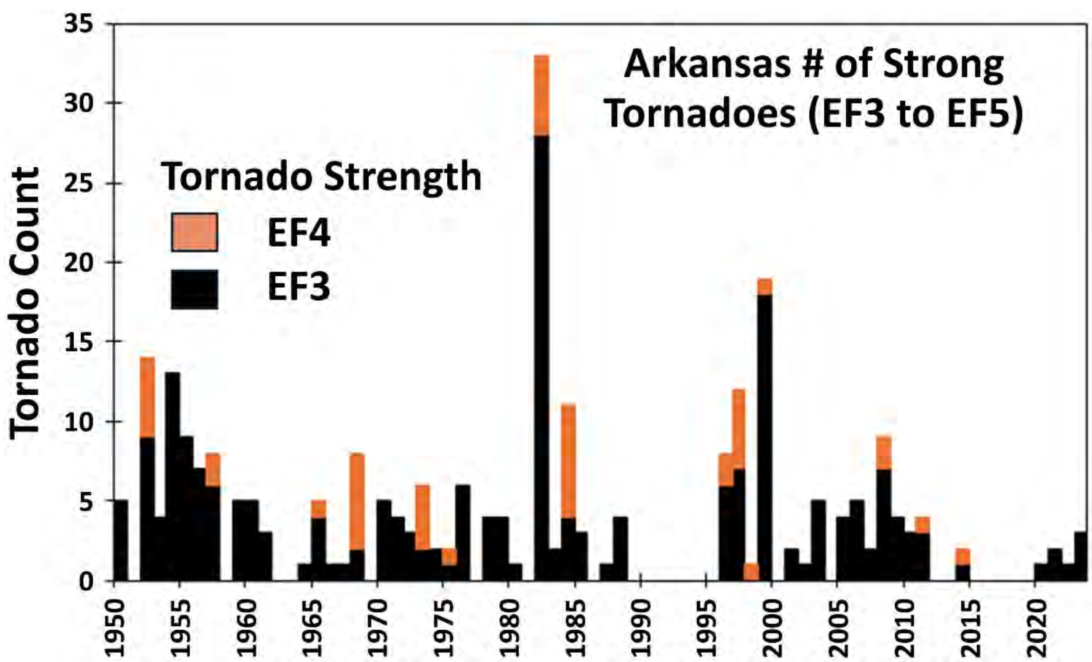

Figure 11: *Frequency of Tornadoes in Arkansas With Magnitudes EF3 and Above. NOAA National Centers for Environmental Information (2025c)*

The data from NOAA show that injuries and deaths from tornadoes (with magnitudes EF3 and higher) have not been increasing, as shown in Figure 12. A declining trend in tornado frequency, improvements in weather warning systems and in the protective quality of structures correlate with no increase in injuries and deaths being reported. This is consistent with a significant global decline in the number of deaths from severe climate events since 1900.

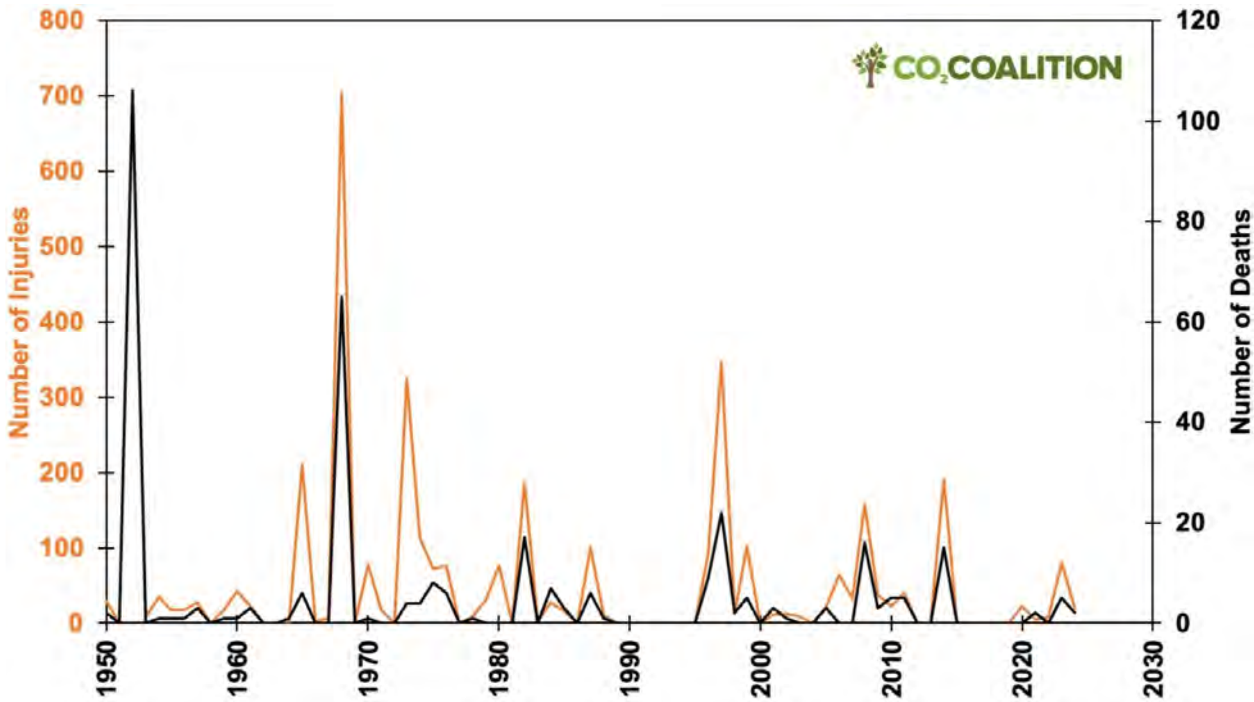

Figure 12: *Direct Deaths and Injuries From Tornadoes of Magnitudes EF3 and Above in Arkansas (x-axis not to scale). NOAA National Centers for Environmental Information (2025c)*

FLOODING

According to the U.S. Geological Survey, "significantly increasing peak streamflow trends are of concern to local, State, and Federal agencies in Arkansas because of the corresponding increased flood risk to highway structures and surrounding communities" (Ensminger and Breaker, 2019).

Understanding flood frequencies is therefore important, especially in light of prevalent claims that man-made climate change is making extreme rainfall and its associated flooding worse. In our analysis we use the data on historic river crest heights available for the Mississippi River and Arkansas River to understand recent changes in the number of floods and to see if flooding is getting worse for these rivers. Not surprisingly, the data show ups and downs but no general increase in flooding.

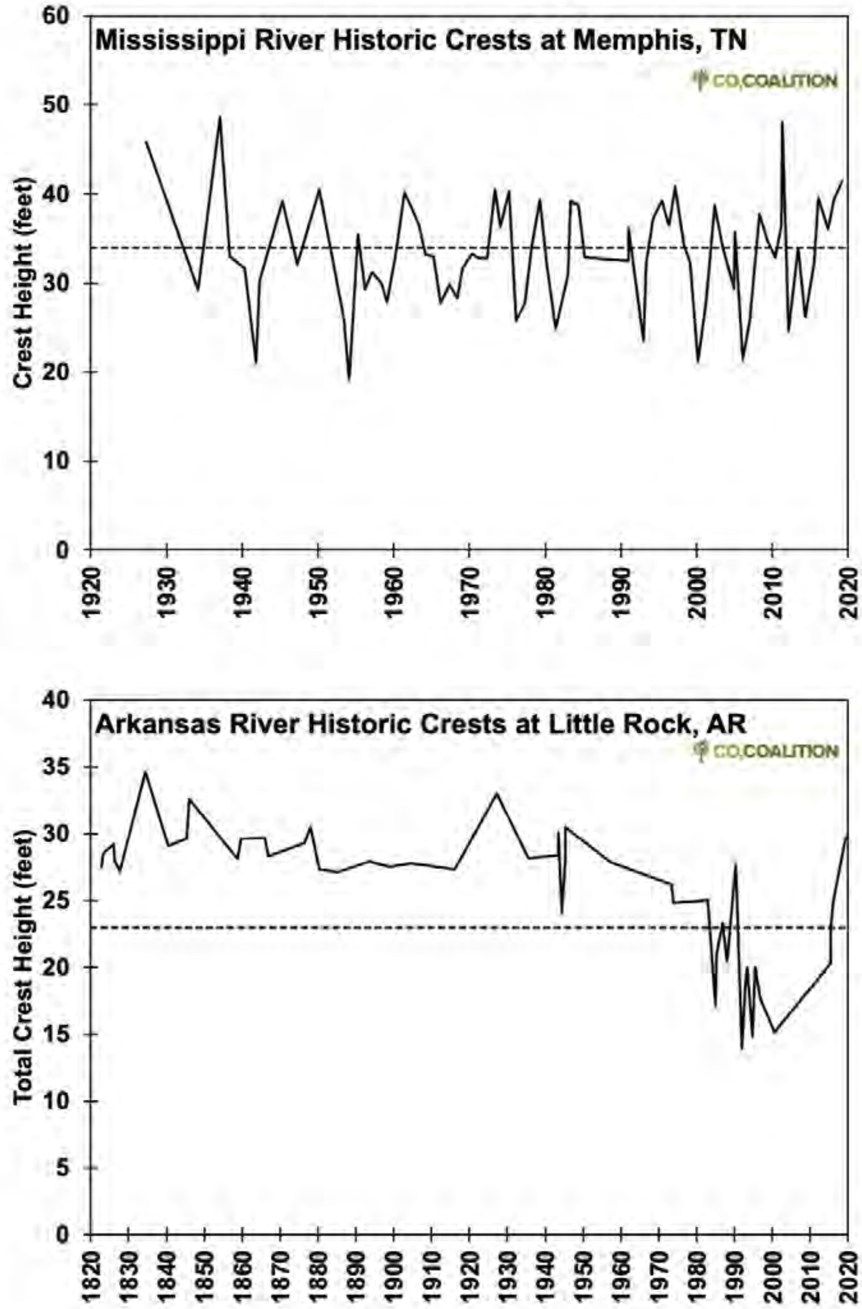

Figure 13: *Historic Crest Heights of the Mississippi River (Memphis, TN) and Arkansas River (Little Rock, AR). NOAA National Water Prediction Service (2025a, 2025b)*

U.S. TRENDS IN HURRICANE ACTIVITY

Since Arkansas does not share a coastline with the Atlantic Ocean or the Gulf of America, the state and its residents are spared the most catastrophic effects of high wind and tidal surges during landfalling hurricanes. The state does, however, experience the often-torrential rains and flooding that can accompany a hurricane that moves onshore after making landfall in Texas, Louisiana or Mississippi.

Because of this, we also extend our analysis on extreme weather events to include data on hurricane frequency. The overall data for hurricane landfalls in the United States (1851–2023) (Figure 14) show that hurricane frequency has not been increasing as is often claimed by those promoting a man-made climate crisis.

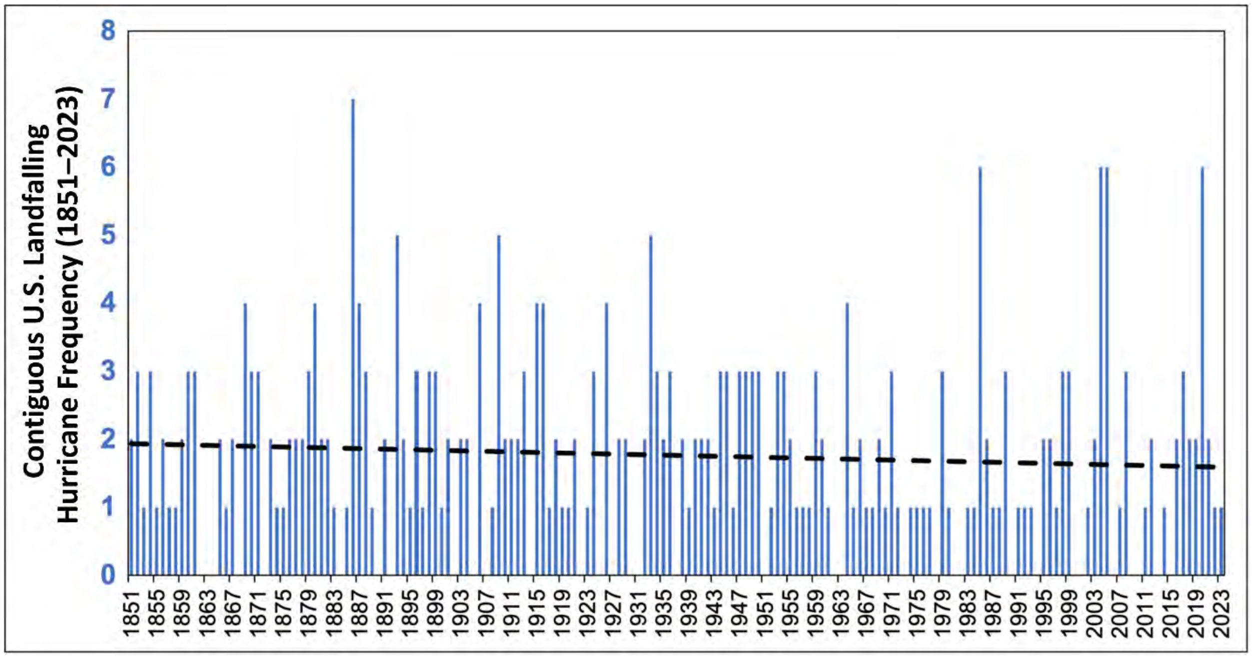

Figure 14: *Number of Hurricane Landfalls in the Contiguous United States. NOAA Atlantic Oceanographic & Meteorological Laboratory (2025)*

WILDFIRES IN ARKANSAS AND THE UNITED STATES

A common media-driven narrative links man-made climate change to ever-increasing and dangerous wildfires. Fortunately, long-term data from the National Interagency Fire Center (2020, 2025) contradict this notion and reveal that both the area burned and the number of fires in the contiguous United States are currently about 20% of the levels in the first half of the 20^{th} century.

Similarly, the data from the Arkansas Department of Agriculture (Figure 15), which date back to 1935, show significant declines in both the area burned by wildfires and number of wildfires.

Are climate change and increasing CO_2 affecting the size and number of wildfires in Arkansas and the world? The surprising answer is that they most likely are the primary drivers of a beneficial decrease in wildfires. For wildfires to occur, very arid conditions are required to sufficiently dry fuels like grass and wood to ignite. We have already noted that droughts are declining and precipitation is increasing modestly. Combined, these are contributing to an overall increase in soil moisture, which is a powerful fire retardant.

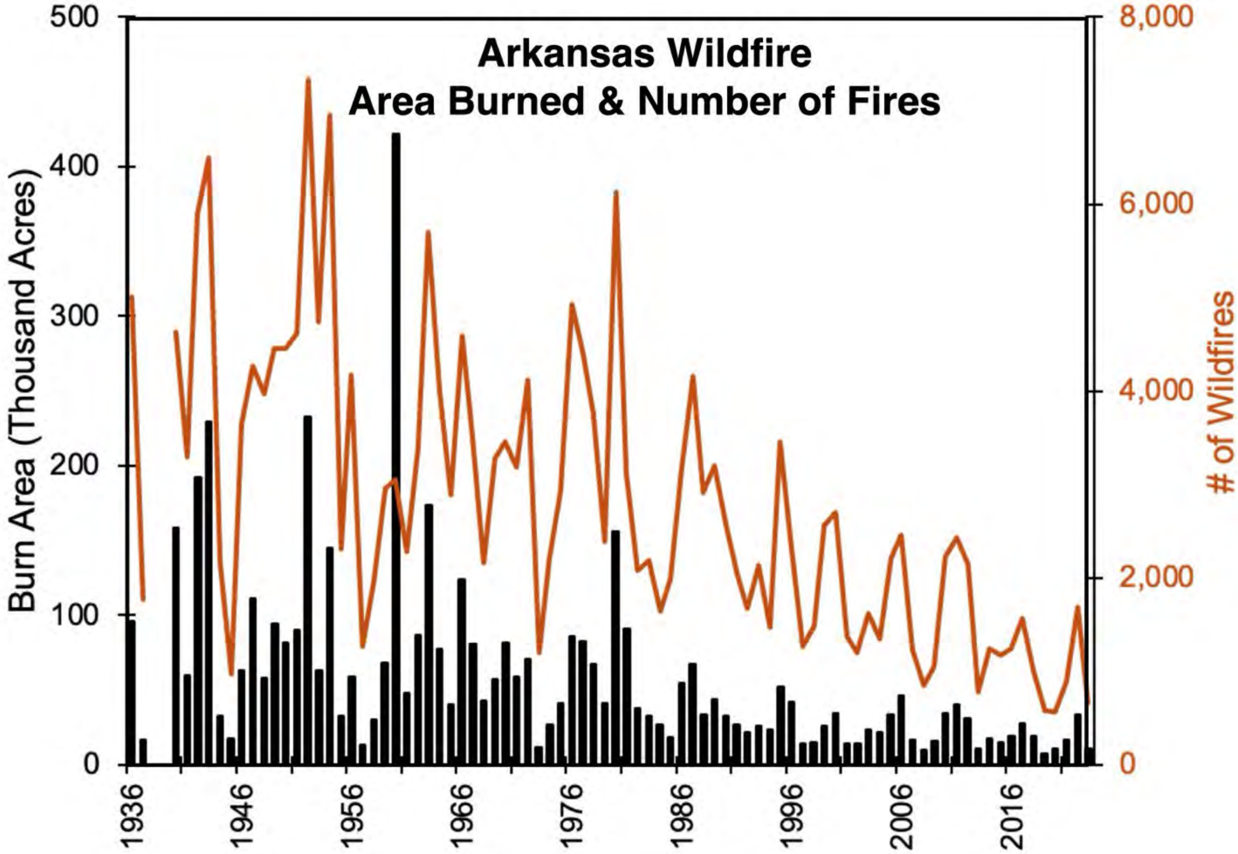

Figure 15: *Area Burned and the Number of Wildfires in Arkansas.*
Arkansas Department of Agriculture (2025)

The second greatest moisture loss in plants (the first is direct evaporation) is via transpiration. Transpiration is the process where plants "breath in" air with CO_2 through pores (stomata) and "exhale" oxygen-enriched air along with water vapor. The increase in the atmospheric concentration of CO_2 over the last 150 years—and especially since about 1950—has boosted the fertilization effect of carbon dioxide in the air. This means that vegetation needs to transpire less, resulting in less water being lost through the stomata.

Fire experts from the U.S. Forest Service recommend proper fire management techniques to reduce the risk of wildfires, where prescribed, or controlled, fires can "reduce the potential for large, costly catastrophic wildfires" (Wood, 2022). Arkansas is no exception, where prescribed fires are recommended for removing flammable woody debris, as wind and ice storms can cause branches and trees to topple to the ground (Walkingstick and Liechty, 2007). Currently, prescribed burns are applied to approximately 300,000 acres each year in Arkansas (Walkingstick and Liechty, 2007).

Contrary to claims of CO_2-driven climate change increasing both the number and extent of wildfires, both have exhibited sizable declines as the atmospheric concentration of CO_2 has increased steadily. Proper forest and land management is key to minimizing unwanted fires both in Arkansas and the rest of America, not "controlling" the uncontrollable, namely climate change.

PLANTS LOVE CO_2 AND SO SHOULD YOU

NASA satellites have revealed a great increase in vegetation (greening) across the globe from the near-polar regions to the equator. Since the early 1980s, NASA satellites, with enhanced infrared sensors, began measuring leaf area. According to NASA, CO_2 increases explain about 70% of the greening (Hille, 2016; Schernikau and Smith, 2022; Zhu et al., 2016). In fact, a NASA study found that less than 4% of the Earth's surface had experienced decreasing leaf area during the period 1982–2009 (Figure 16, Zhu et al., 2016).

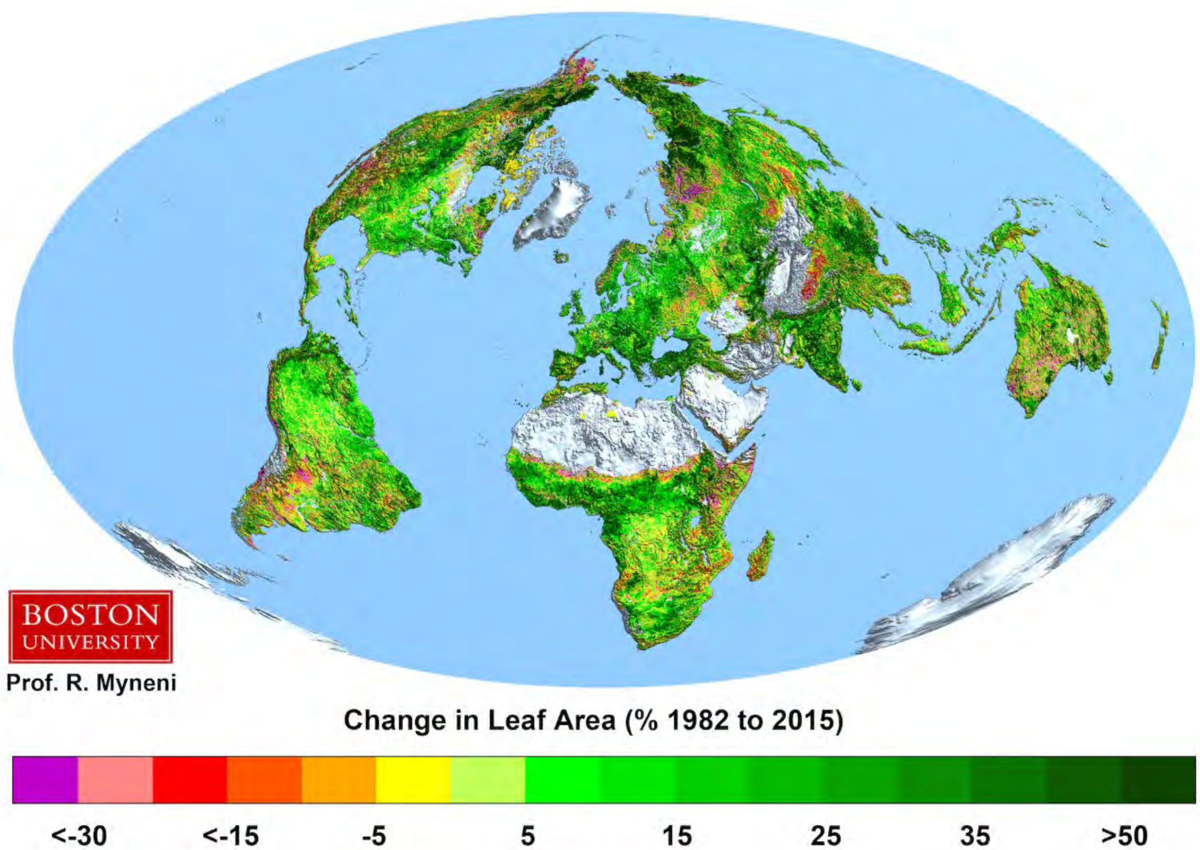

Figure 16: *Increasing CO_2 is Greening the Planet. Modified from Zhu et al. (2016), permission R Myneni*

Leaf area is the most important single measure of ecosystem health. It directly relates to the source of all food, habitat, water retention and cover, which provides safety for wildlife. Food, water, shelter and safety are all at the top of the hierarchy of needs for wildlife and humans.

An analysis of NASA's Leaf Area Index (LAI) data for Arkansas reveals a significant ecological transformation over the past 24 years (Figure 17). The state has experienced a marked increase in the density and extent of forest and woodland ecosystems, concurrent with a reduction in exposed soil surfaces and degraded grassland habitats. In short, unhealthy farmlands became healthy and forests became larger and denser.

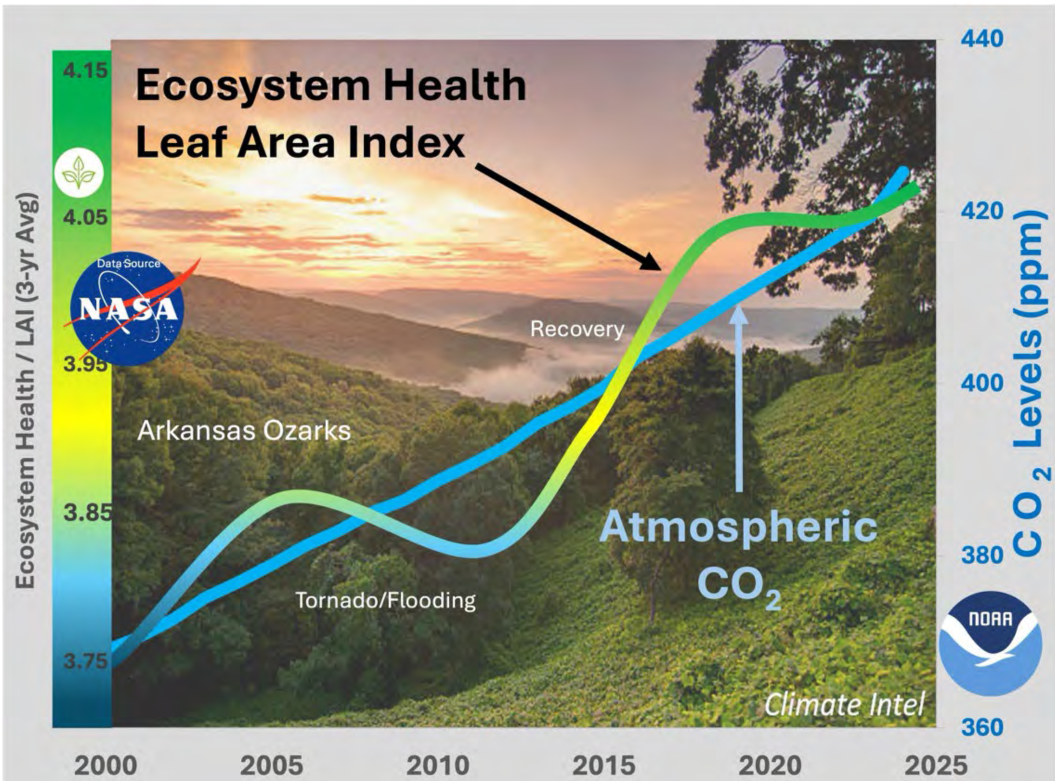

Figure 17: *Arkansas Ecosystem Health vs. CO_2. Climate Intel, NASA-NEO Leaf Area Index (2000–2024)*

In Arkansas, farmland, grassland, forests and woodland ecosystems have all been thriving from increasing CO_2 and proper forest management (Figure 18).

Vegetation loves CO_2 and the healthy and growing forests of Arkansas are more confirmation of that fact.

Globally, forests have expanded and grown denser primarily because of rising atmospheric CO_2 concentrations and the woodlands of Arkansas are no exception. According to the Arkansas Department of Agriculture (2022), forested area in the state has been increasing over the last 40-plus years. The current wooded area in Arkansas is 18.9 million acres (Figure 19), reflecting a nearly 14% increase in woodlands in the state since the early 1970s. With 11.7 billion trees covering 56% of the state, the state's forests are prospering.

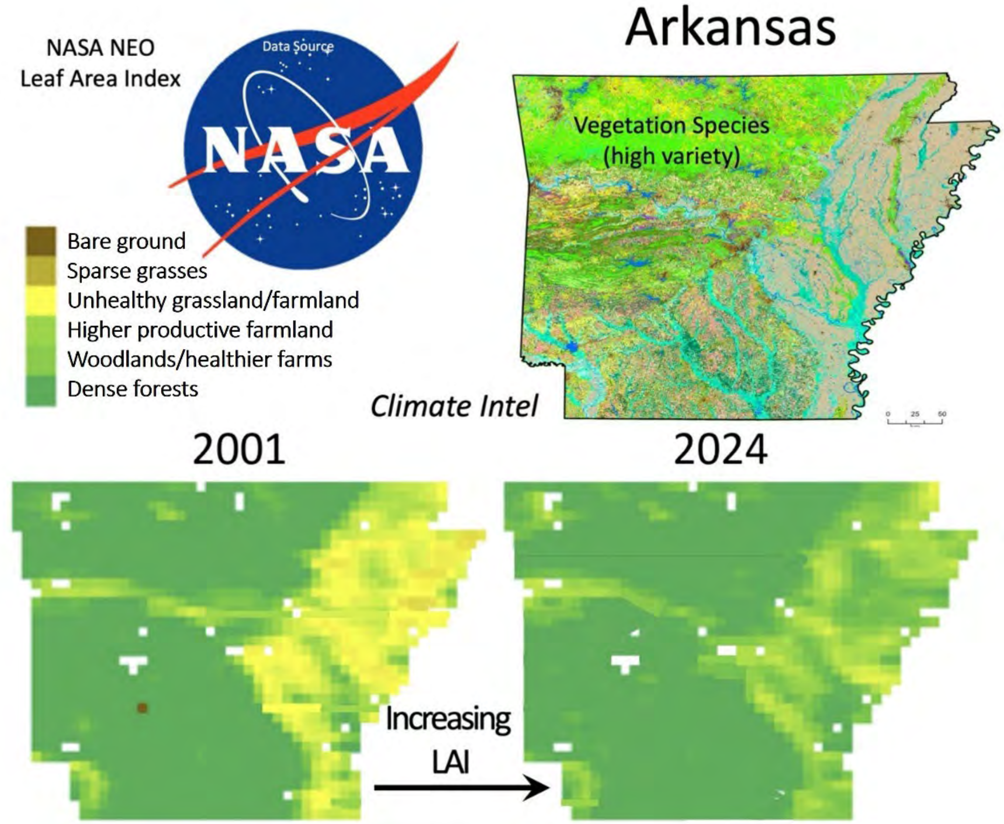

Figure 18: *Arkansas Leaf Area Index Analysis. Climate Intel, NASA-NEO Leaf Area Index (2000–2024)*

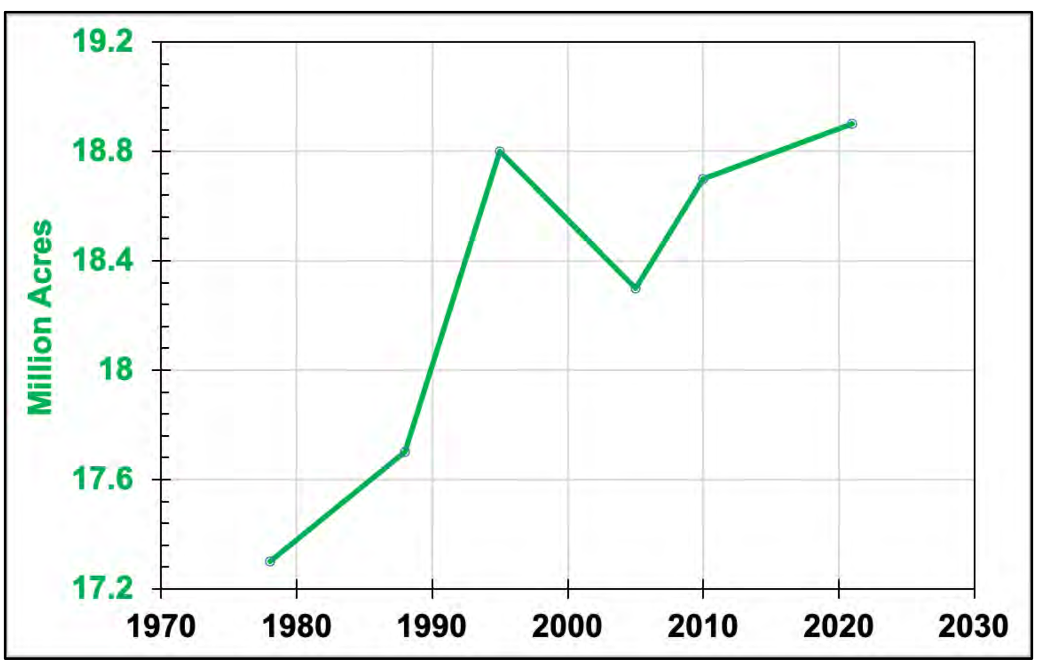

Figure 19: *Arkansas Forestland Acreage (Million Acres). Arkansas Department of Agriculture (2022)*

AGRICULTURE IN ARKANSAS

> *"Rising temperatures, extreme heat, drought, wildfire on rangelands, and heavy downpours are expected to increasingly disrupt agricultural productivity in the United States. Expected increases in challenges to livestock health, declines in crop yields and quality, and changes in extreme events in the United States and abroad threaten rural livelihoods, sustainable food security, and price stability." (USGCRP, 2018, Fourth National Climate Assessment)*

Contrary to claims of agricultural declines, global agricultural production has been breaking records year after year. Food production is greatly outpacing population growth (Figure 20). This boost in production is attributable to modest warming, increasing carbon-dioxide-fertilization effect and use of fossil-fuel-derived nitrogen fertilizer. Because of a naturally warmer climate and the CO_2 produced by the burning of fossil fuels, the world today sustains tenfold the number of people (8.04 billion) than at the beginning of the Industrial Revolution (791 million).

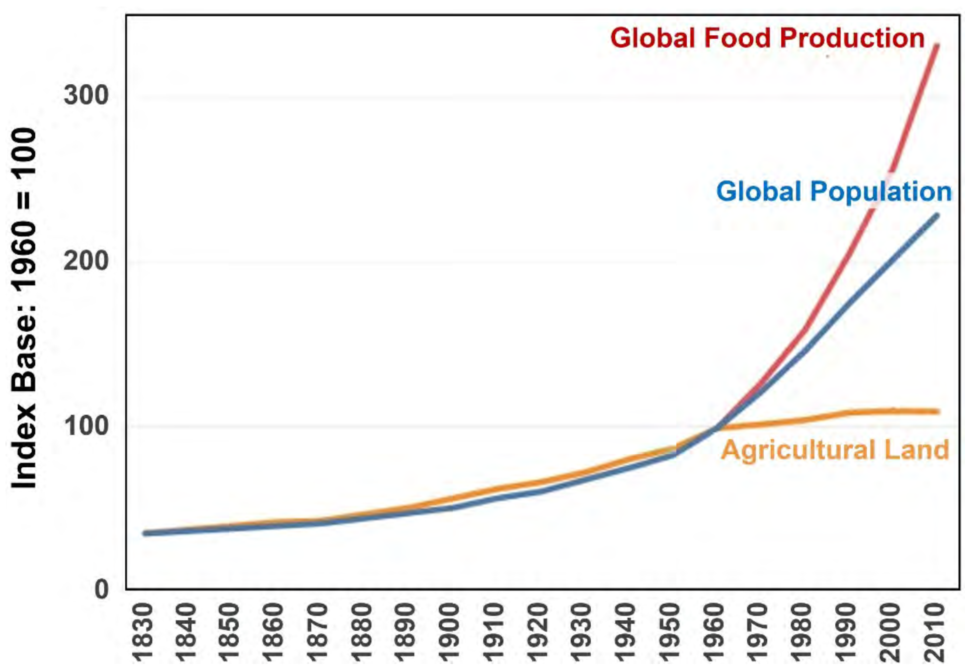

Figure 20: *Global Food Production Index, Population and Land Use for Agriculture. Organisation for Economic Co-operation and Development (2024)*

As we described briefly in the previous section on wildfire, increasing CO_2 also reduces the amount of water that plants lose during transpiration. Transpiration is the loss of water vapor through stomata, i.e., little holes in the leaves. Plants have stomata to allow them to "inhale" CO_2 from ambient air and "exhale" oxygen-enriched air.

Transpiration enables photosynthesis where, using energy from sunlight, plants decompose water molecules (H_2O) and combine the hydrogen atoms with the CO_2 molecules from the air to produce sugar. Waste oxygen molecules (O_2) exit through the stomata. Water molecules also escaping from the stomata dry out plants. When plants sense that there is more CO_2 in the air, they grow leaves with fewer stomata and partially close existing stomata. In other words, plants need fewer stomata to carry out photosynthesis in CO_2-enriched air. As a result, less water vapor escapes from a leaf, increasing a plant's resistance to drought.

We learned earlier in Figure 5, that the coldest (usually nighttime) temperatures in Arkansas are warming. Modestly rising temperatures are benefiting the Arkansas agricultural sector by extending growing seasons.

The length of growing seasons in the contiguous United States has increased by more than two weeks since the beginning of the 20th century (Kunkel 2024, Figure 21). Killing frosts end earlier in the spring and arrive later in the fall, providing farmers the opportunity for more plantings. Rising temperatures have greatly reduced the risk of killing frosts in late spring, which are the weather-related events most feared by orchard growers.

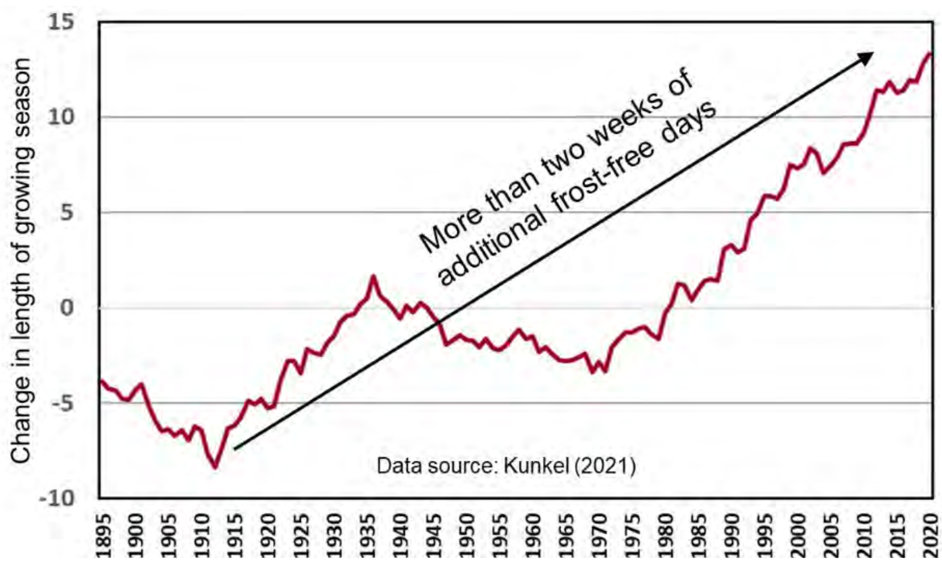

Figure 21: *Growing Season is Lengthening in the Contiguous United States. Kunkel (2024)*

It has been well documented that more CO_2 directly benefits plant growth. The first to link high CO_2 concentrations to faster plant growth was Swiss botanist Jean Senebier in 1796. Since then, many thousands of peer-reviewed studies have confirmed his conclusion. Research has also shown that increased CO_2 helps plants resist drought, extreme heat, pollution and other environmental stresses. In fact, CO_2 has long been used to boost greenhouse yields. Optimal greenhouse concentrations have been reported to be between 800 and 1,200 ppm, more than twice the current atmospheric levels (Wang et al., 2022).

A valuable recent study, *Environmental Drivers of Agricultural Productivity Growth: CO_2 Fertilization of US Field Crops* (Taylor and Schlenker, 2023), has quantified how much of the increase in crop growth is attributable to CO_2-driven enhancement. These researchers found a large CO_2 fertilization effect: A “1 part per million-increase in atmospheric CO_2 equates to a 0.4%, 0.6% and 1% yield increase for corn, soybeans and winter wheat,” respectively. Based on these metrics, our 140-ppm increase in CO_2 since the beginning of the Industrial Revolution has led to 56%, 84% and 140% increases in the yields of corn, soybeans and wheat, respectively.

The agricultural sector in Arkansas is a major driver of the state's economy. It contributes to the state's GDP, creates jobs, and generates tax revenue. Arkansas has a much larger part of its economy that comes from the Aggregate Agriculture Sector than any other neighboring state (University of Arkansas, 2022). Every year, about $16 billion of the state's income comes from agriculture. Soybean was the most valuable crop in 2024, worth nearly $1.7 billion (USDA National Agricultural Statistics Service, 2025a).

There are about 42,000 farms in Arkansas, covering 14.0 million acres and 42% of Arkansas' land area (University of Arkansas System Division of Agriculture, 2022). In terms of food security for the nation, Arkansas plays a key role in being one of the top producers of various crops (Figure 22) and poultry. Arkansas is ranked number one in the U.S. for rice production. More than 50 percent of all rice in the U.S. is produced in Arkansas and the 2,300 family-owned farms in more than 40 counties are responsible for achieving this staggering feat, employing more than 25,000 Arkansans.

If more CO_2 and warmer weather were going to cause a decline in food production, should there not have been some recognizable negative effects by now? Contrary to predictions, all signs point to robust food production globally and in Arkansas, which will continue to increase far into the foreseeable future. In summary:

> *“The rising level of atmospheric CO_2 could be the one global natural resource that is progressively increasing food production and total biological output … **the rising level of atmospheric CO_2 is a universally free premium, gaining in magnitude with time, on which we all can reckon for the foreseeable future.**” (Wittwer, 1995)*

CARBON DIOXIDE THROUGH TIME

To put modern atmospheric concentrations into proper perspective, it is helpful to review how CO_2 levels have changed through time.

The current level of CO_2 in the atmosphere as measured at the Mauna Loa Observatory in Hawaii is about 430 parts per million (ppm) by volume (as of May 2025) (Lan and Keeling, 2025). This is an increase of 150 ppm from the pre-industrial concentration of about 280 ppm in the mid-1800s. This approximately 50% increase appears significant when viewed through the narrow time frame of a few decades or centuries (Figure 23).

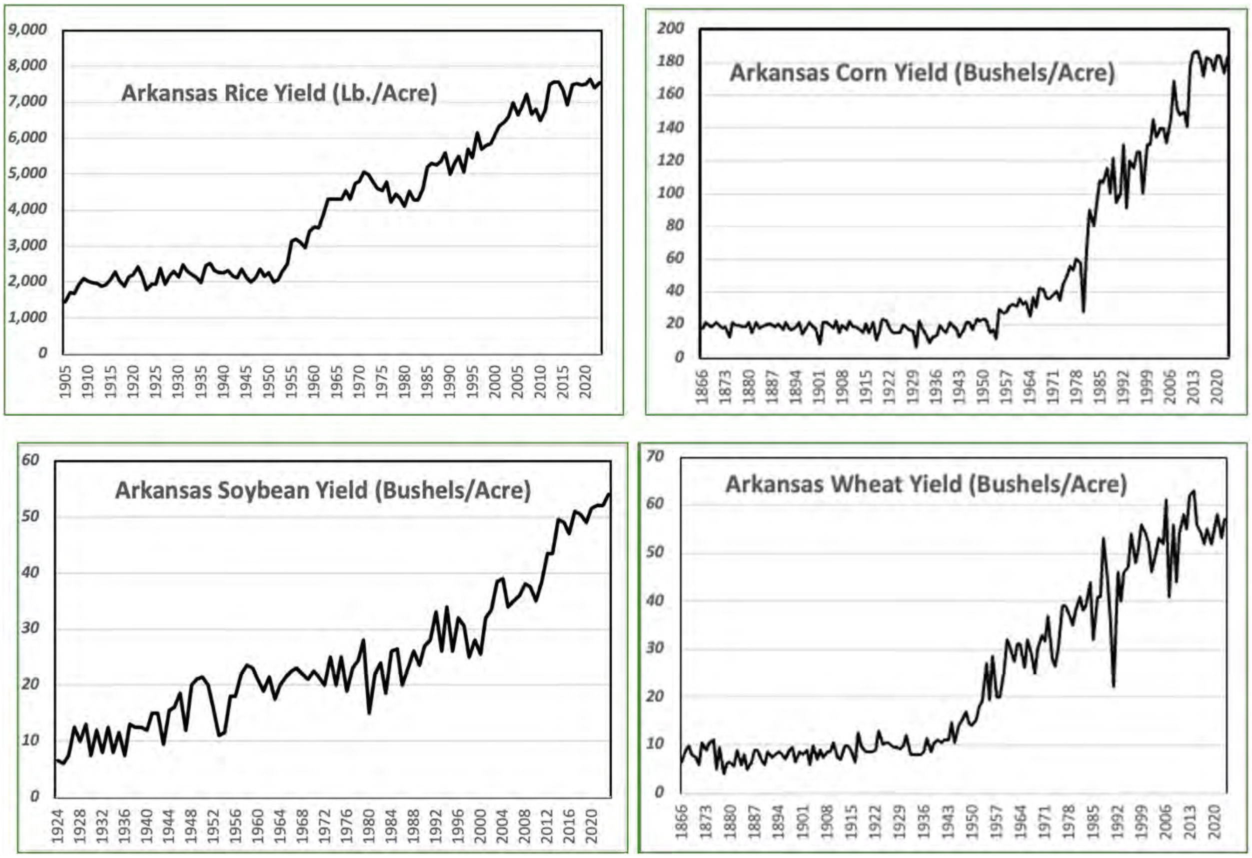

Figure 22: *Crop Yields in Arkansas (Rice, Corn, Soybean, and Wheat).*
USDA National Agricultural Statistics Service (2025b)

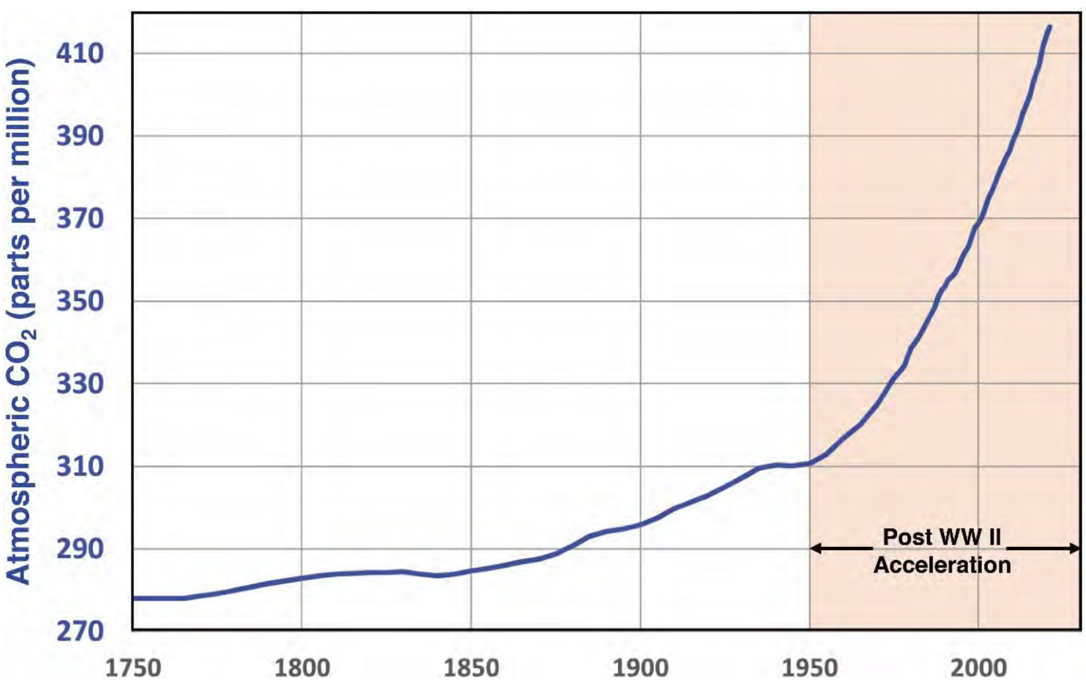

Figure 23: *Carbon Dioxide Concentration (1750 to 2022).*
European Environment Agency (2015, 2024)

However, appearances are deceiving. Time scale is important. Put in a long geologic perspective, today's level of CO_2, while representing a recent increase, is significantly lower than it has been during nearly all of Earth's history. We shall see that today's CO_2 concentration—nearly at a historical low—is preventing trees and other plants from reaching their full growth potential via photosynthesis.

The very low pre-Industrial Revolution CO_2 levels began increasing significantly in the mid-20th century during the post-World War II economic boom (Figure 23). Our current concentration of 430 ppm represents an increase of approximately 50% over the last 200 years. Bear in mind that, if CO_2 were driving warming, it should be apparent in the period of the last 70-plus years when levels were increasing at a significant rate.

This recent increase in atmospheric CO_2 is attributable to human emissions, primarily from the use of fossil fuels and, to a lesser extent, the manufacture of cement (Engelbeen et al., 2024). A simple carbon-dioxide budget (Figure 24) shows that the amount of carbon dioxide being emitted by modern human activity is significantly greater than the amount of additional carbon dioxide appearing in the atmosphere. Interestingly, a substantial amount of the gas being emitted through human activities is being sequestered—removed from the atmosphere—by natural processes such as photosynthesis and absorption into the oceans.

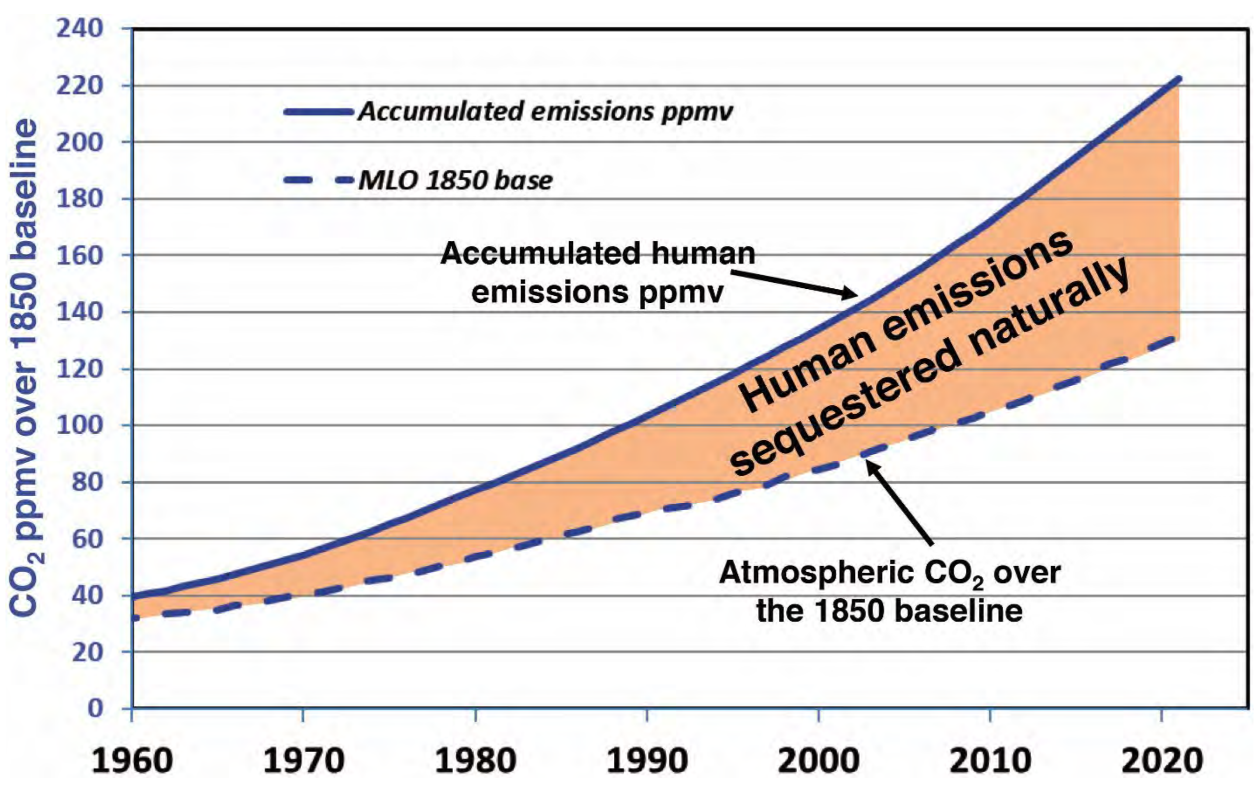

Figure 24: *Human Emissions Since 1850 vs. Atmospheric CO_2 (Mauna Loa Observatory). Emissions: Friedlingstein et al. (2025); Global Carbon Budget (2025), Atmospheric CO_2 Concentration: Lan and Keeling (2025), (Data courtesy of Engelbeen, 2023)*

As explained above, increasing atmospheric CO_2 is leading to great increases in global vegetation and crop productivity. This is because the ancestors of most of the vegetation that populate our planet today first appeared when CO_2 levels were more than 2,500 ppm. The very low concentrations today do not provide enough CO_2 to maximize the growth potential of these plants.

While the increase in the recent past appears to be significant, it is necessary to place this increase in the context of geological history. In this longer view (Figure 25), we find that current CO_2 levels of slightly more than 400 ppm are one-sixth of the average concentration over the last 600 million years and only 5% of peak levels of about 8,000 ppm. Therefore, current levels are near a historic low.

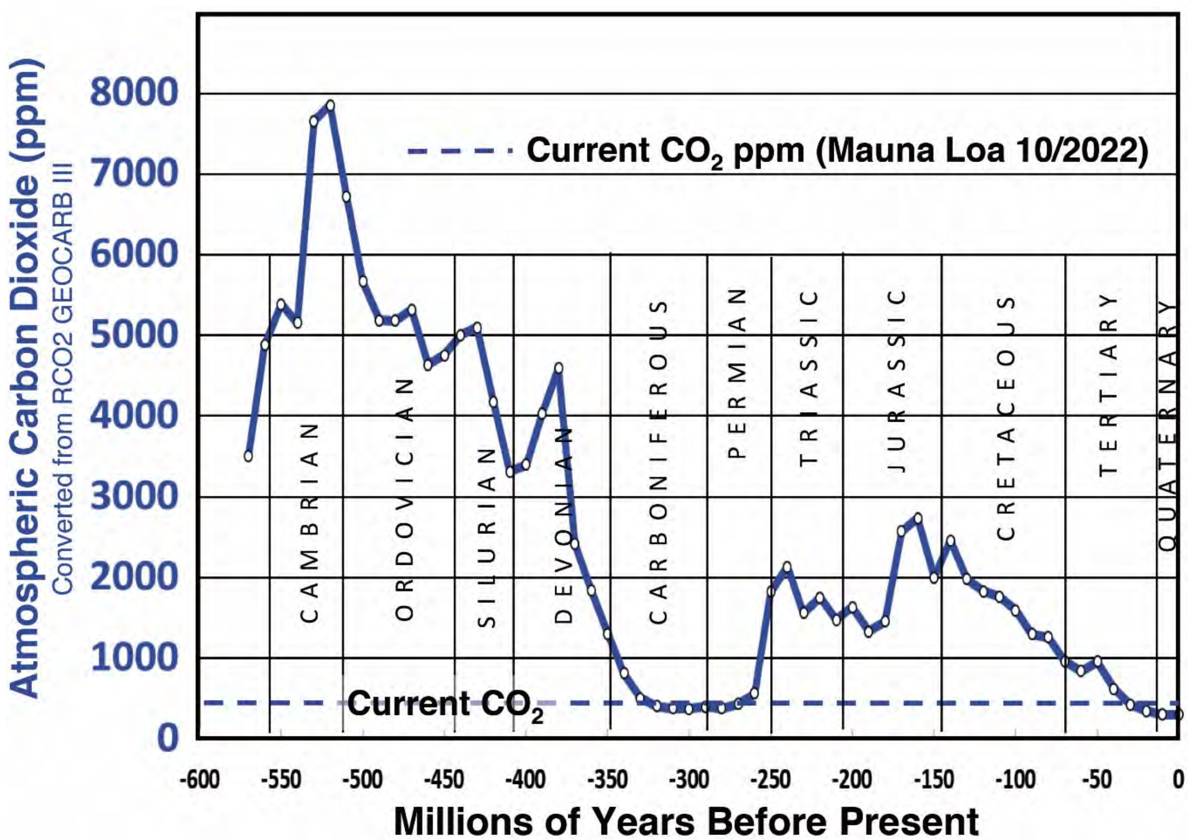

Figure 25: *600 Million Years of Carbon Dioxide Concentration. Berner and Kothavala (2001a, 2001b)*

EMISSION REDUCTIONS: COSTS AND EFFECTS ON TEMPERATURE

We used the Model for the Assessment of Greenhouse-gas Induced Climate Change, or MAGICC, to comprehend the theoretical influence of reducing greenhouse gas emissions in Arkansas and the U.S. on the change in global temperatures (Cato Institute, 2016; MAGICC IP Co, Inc., 2022; Michaels et al., 2023). Just 1.2% of the CO_2 emissions in the United States in 2016 came from Arkansas. Our analysis will try to determine how much less of an increase in temperature may be attained across the U.S. and in Arkansas by cutting CO_2 emissions to zero. We make the assumption that CO_2 emissions from human activity will be eliminated—an impossible eventuality.

Table 1: *Calculation of Climate Impact Based on Emission Reduction for the U.S. and Arkansas, Using the Model for the Assessment of Greenhouse-Gas Induced Climate Change (MAGICC)*

Model for the Assessment of Greenhouse-Gas Induced Climate Change						
How much temperature rise will be averted by 100% reduction in CO_2 emissions?						
Jurisdiction	**CO_2 emissions by state (2016) (million metric tons)**	**% of US emissions**	**Temperature rise averted by decreasing CO_2 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**
Arkansas	62.4	1.2%	**0.0005**	**0.0009**	**0.0013**	**0.0023**

Cato Institute (2016); MAGICC IP Co, Inc. (2022); Michaels et al. (2023)

If Arkansas could achieve the impossible and reduce its net CO_2 emissions to zero, what effect would that have on global temperatures? We find that the amount of warming averted would be an unmeasurably small 0.0009 °F by 2050 and 0.0023 °F by 2100. Based on the energy policies of countries such as India and China, global CO_2 emissions are expected to increase rather than decrease (Friedlingstein et al., 2025; Global Carbon Budget, 2025), which makes CO_2 emission reductions in Arkansas an even more meaningless effort to stop a non-existent problem.

SUMMARY AND CONCLUSIONS

By every metric reviewed concerning the effect of climate change in Arkansas, we find that the state's ecosystems are thriving, and its citizens are benefiting from increasing atmospheric levels of the "miracle molecule" carbon dioxide. In summary:

- Current levels of carbon dioxide are at nearly historically low concentrations.
- Arkansas average daily temperatures have not increased over the last 130 years.
- Coldest (nighttime) temperatures have increased by 1.0 °F, providing lengthened growing seasons.

- Average maximum daily temperatures have declined over the last 100 years.
- Heat waves peaked in the 1930s and have been in slight decline since that period.
- Precipitation data, while varying greatly from year-to-year, show a modest beneficial increase.
- Droughts are not increasing in Arkansas.
- The most destructive tornadoes (EF3–EF5) are not increasing.
- Agricultural production, globally and in Arkansas, is increasing due to more CO_2 and lengthened growing seasons. State agricultural productivity has been breaking records almost every year.
- Vegetation in Arkansas and around the world is increasing.
- Greenhouse-induced warming that would be averted (< 0.002 °F by 2100) by eliminating Arkansas's CO_2 emissions would be too small to measure.
- Wildfires in Arkansas have been declining significantly in both number and area burned.

There is no climate crisis in Arkansas occurring either now or looking forward many decades into the future. To the contrary, we find that the state and its citizens are doing quite well. Life in Arkansas is good and getting better.

Finally, in Arkansas and the world, efforts to reduce CO_2 emission will result in unnecessary cost, produce no benefit and could be harmful to plant growth. In short, such proposals are an expensive solution in search of a problem.

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- **Vijay Jayaraj** is a Science and Research Associate of the CO_2 Coalition. He graduated with an M.S. in Environmental Sciences from University of East Anglia, UK, a P.G. degree in Energy Management from Robert Gordon University, UK, and a B.E. in Engineering from Anna University, India. He is a prolific contributor, writing about the benefits of CO_2 and energy and climate science, most often from the viewpoint of the developing world.
- **Gregory Wrightstone** is the CO_2 Coalition's Executive Director. He graduated with an M.S. in Geology from West Virginia University, was an Expert Reviewer for the U.N. Intergovernmental Panel on Climate Change (AR6) and author of two bestselling books on climate change.
- **Dr. Frits Byron Soepyan** is a Science and Research Associate of the CO_2 Coalition. He graduated with a Ph.D. in Chemical Engineering and B.S. in Chemical Engineering and Mathematics from The University of Tulsa. As a Postdoctoral Research Associate and later as a Process Systems Engineer he conducted research on various emission reduction and decarbonization methods. After learning about the benefits of CO_2 and the danger of "Net Zero" policies, Dr. Soepyan joined the CO_2 Coalition.
- **Dr. Maaneli Derakhshani** is the Senior Science Advisor of the CO_2 Coalition. He is a theoretical physicist and philosopher of physics, with a Ph.D. in the Foundations of Physics from Utrecht University in 2017. He has previously worked as a postdoc at Rutgers University, New Brunswick (Department of Mathematics) and Utrecht University (Department of Mathematics). He is also currently a Fellow of the John Bell Institute for the Foundations of Physics and a Member of the Foundational Questions Institute.
- **Dr. William Happer** is Professor Emeritus in the Department of Physics at Princeton University and Cofounder and Chair of the CO_2 Coalition. He has published over 200 peer-reviewed scientific papers. He is a Fellow of the American Physical Society, 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.
- **Forrest Frantz** is Climate Intel's Executive Director and an Aerospace Technical Fellow in Biospheric Science, Climate Change, and Systems Engineering.

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

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This publication is the fifth in a planned series of state and regional studies researching the effects of climate change on different states and regions of the United States of America. Past reports from states and regions include:

1. Pennsylvania's Regional Greenhouse Gas Initiative Relies on Faulty Data: Why RGGI is a "Solution in Search of a Problem" (July 2021).
2. Virginia and Climate Change: Separating Fact from Fiction (February 2022).
3. The American Midwest and Climate Change: Life in America's Breadbasket is Good and Getting Better (June 2023).
4. Wyoming and Climate Change: CO_2 Should Be Celebrated, Not Captured (February 2024).

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 made by carbon dioxide (CO_2) to our lives and economy. The organization 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.

The CO_2 Coalition is comprised of more than 180 experts in the fields of science, engineering, physics and more who promote the many benefits of modest warming and increasing carbon dioxide.

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APPENDIX A

USHCN Arkansas Stations

The table below provides information regarding the fifteen USHCN stations in Arkansas where the temperature data are gathered (NOAA National Centers for Environmental Information, 2025d).

Station #	Lat	Long	Elev	State	Station Name
30936	34.8822	-91.2153	56.4	AR	BRINKLEY
31596	35.0842	-92.4289	96	AR	CONWAY
31632	36.4197	-90.5858	91.4	AR	CORNING
32356	36.4164	-93.7917	432.8	AR	EUREKA SPRINGS 3 WNW
32444	36.1006	-94.1744	387.1	AR	FAYETTEVILLE EXP STN
32930	36.4261	-94.4481	384	AR	GRAVETTE
34572	36.4947	-91.535	153	AR	MAMMOTH SPRING
34756	34.5731	-94.2494	344.4	AR	MENA
35186	35.6042	-91.2744	69.5	AR	NEWPORT
35512	35.5125	-93.8683	253	AR	OZARK 2
35754	34.2256	-92.0189	65.5	AR	PINE BLUFF
35820	36.2639	-90.9681	96	AR	POCAHONTAS 1
35908	33.8203	-93.3878	93.9	AR	PRESCOTT 2 NNW
36253	33.81	-91.2703	45.7	AR	ROHWER 2 NNE
36928	35.3028	-93.6369	152.4	AR	SUBIACO

APPENDIX B

Temperature Adjustments and Fabrication of Data

The temperature data included in this report are from the National Oceanic and Atmospheric Administration's (NOAA) U.S. Historical Climatology Network (USHCN) (NOAA National Centers for Environmental Information, 2025d). There are three issues intrinsic to the data that have served to artificially exaggerate warming for over 100-plus years:

- Urban heat island effect that raises temperatures (Watts, 2022),
- 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 claims that their "homogenization" techniques compensate for these warming influences. However, examination of the sites tells a different story.

Watts (2022) physically examined 128 monitoring stations and found that approximately 96% of these 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 Watts:

> *"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." (Benson and Watts, 2022)*

Adjustments to data: NOAA often adjusts the data from actual measured temperatures to a temperature that their scientists believe it should be. One of the adjustments that has been made is the "time of observation" modification , which refers to data collected in the afternoon (too hot) or early in the morning (too cold). 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 remaining alterations are calculations based on assumptions that are used in lieu of missing thermometer readings. 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% 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 are created based on what the modelers think that the temperature should be rather than what the temperature is.

All these adjustments tend to increase the recent temperatures and cool past data. And that is how NOAA is able to reduce the cooling of the average and maximum temperatures in Arkansas (Figures B-1 and B-2, respectively).

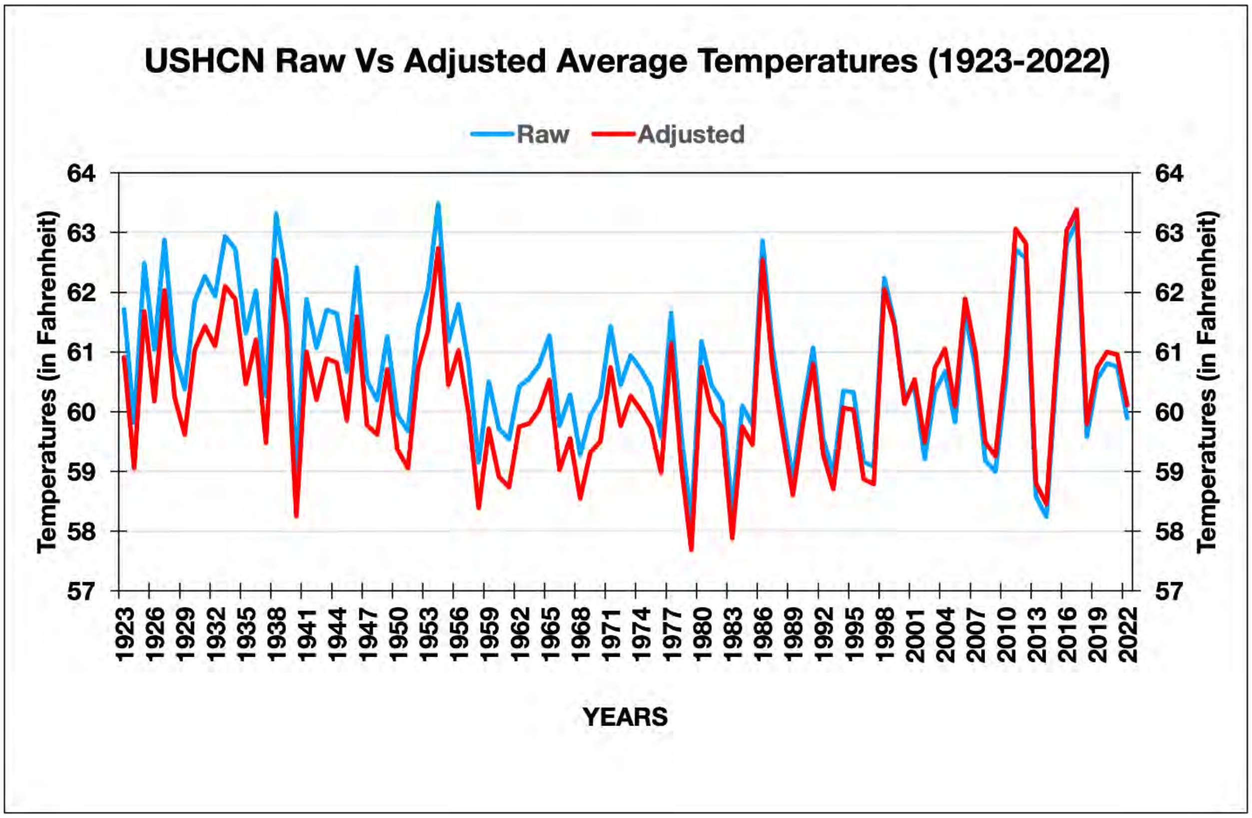

Figure B-1: *USHCN Raw vs. Adjusted Annual Average Mean Temperature in Arkansas. NOAA National Centers for Environmental Information (2025d)*

All this creates artificially elevated warming where little warming existed before modifications were made to the raw data.

Comparing the USHCN data for the raw temperatures to the final (adjusted) temperatures for Arkansas (Figure B-3), we find consistent and significant reductions in the older temperatures and increases in modern temperatures.

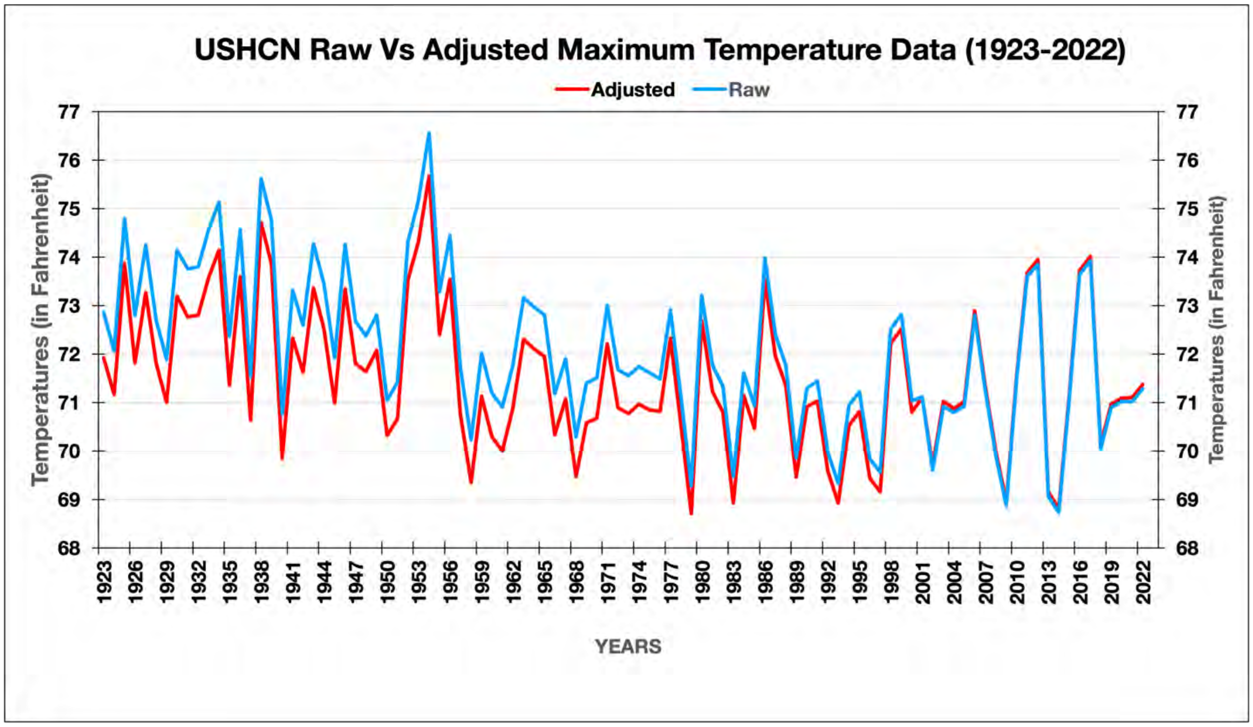

Figure B-2: *USHCN Raw vs. Adjusted Annual Average Maximum Temperature in Arkansas. NOAA National Centers for Environmental Information (2025d)*

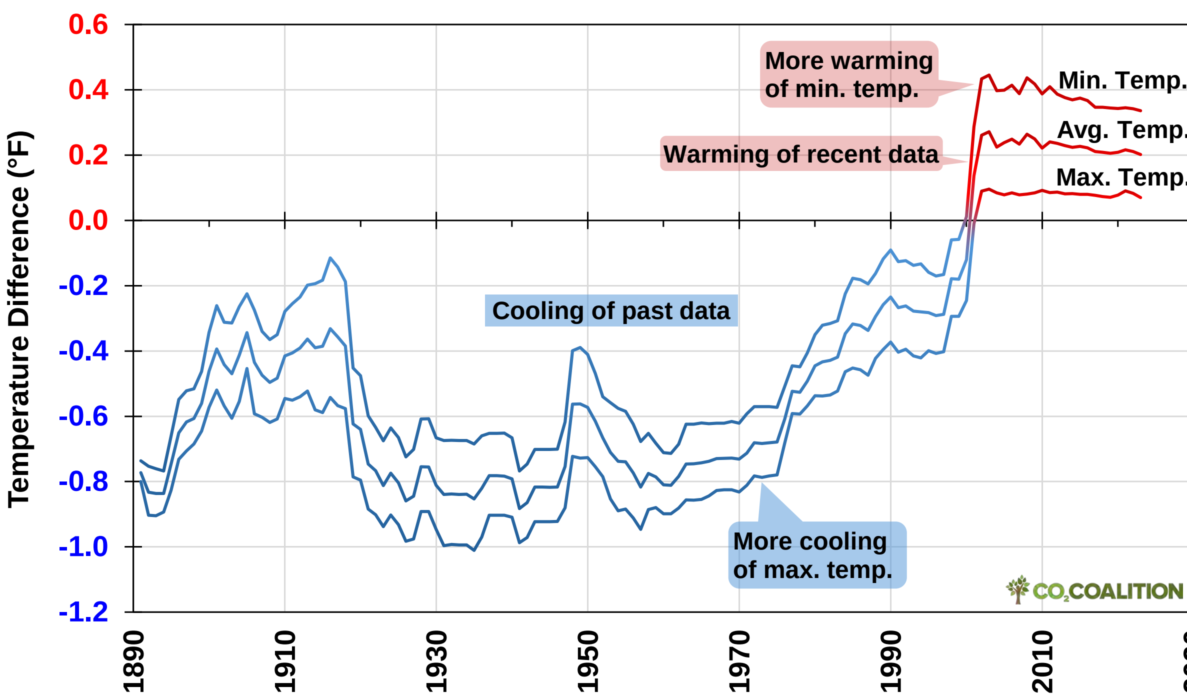

Figure B-3: *Arkansas USHCN Temperature Difference (Adjusted Minus Raw). NOAA National Centers for Environmental Information (2025d)*