

NOV 2019

POLICY BRIEF



Summary

- Montana has warmed very little during the past century, and not at all during the past 15 years.
- Montana is experiencing a long-term gradual increase in precipitation, alleviating fears of more frequent drought.
- Montana crop production sets new records almost every year, due in significant part to more atmospheric CO₂ and beneficial climate changes.
- Even if Montana were to completely eliminate its CO₂ emissions, the resulting impact on global temperature would be too small to measure.

Climate Change and Montana: A Scientific Assessment

By James Taylor and Anthony Watts

Executive Summary

Montana Democratic Gov. Steve Bullock signed on July 1, 2019, an executive order creating the Montana Climate Solutions Council.¹ Bullock charged the council with preparing the state for climate change impacts and devising a plan to reach net-zero carbon dioxide (CO₂) emissions by 2035. This paper provides Montana-specific climate information to help educate lawmakers so they can craft the best possible climate-related policies on behalf of the people of Montana.

Bullock's executive order claimed that "climate change poses a serious threat to Montana's natural resources, public health, communities, and economy." To support this assertion, the executive order cites a publication titled *2017 Montana Climate Assessment* (MCA). According to the executive order, the MCA found "annual average temperatures in the state have risen 2 to 3 degrees Fahrenheit since 1950 at approximately double the rate of the nation as a whole, and are projected to increase 4.5 to 6.0 degrees Fahrenheit by mid-century and 5.6 to 9.8 degrees Fahrenheit by the end of the century."

¹ Office of the Governor, State of Montana, "Executive Order No. 8-209 Creating The Montana Climate Solutions Council and Joining the State Of Montana to the U.S. Climate Alliance," July 1, 2019, https://governor.mt.gov/Portals/16/docs/2019EOs/EO-08-2019_Creating%20Climate%20Solutions%20Council.pdf?ver=2019-07-02-141610-417

MCA paints an overly alarmist and misleading picture of recent, current, and future climate changes in Montana. This *Policy Brief* aims to put the Montana climate picture in a more accurate perspective. It will provide information on the following topics:

1. A Summary of Global Climate Change

During the past three million years, climate has alternated between ice age glacial periods and warmer interglacial periods.² The modest warming of the past century has lifted temperatures from the depths of the Little Ice Age, which brought the coldest temperatures of the past 10,000 years. Temperatures remain relatively low compared to those experienced prior to the Little Ice Age.

Lower temperatures have been mostly beneficial to human well-being. They have spurred higher crop yields and reduced the prevalence of extreme cold weather, which kills 20 times more people than moderate and high temperatures.³

“MCA PAINTS AN OVERLY ALARMIST AND MISLEADING PICTURE OF RECENT, CURRENT, AND FUTURE CLIMATE CHANGE IN MONTANA. THIS POLICY BRIEF AIMS TO PUT THE MONTANA CLIMATE PICTURE IN A MORE ACCURATE PERSPECTIVE.”

2. Climate Change in the United States

Since the beginning of the twenty-first century, warming in the United States has been modest. Government officials have “adjusted” earlier temperature data downward, making the past appear colder than it actually was and thus making the rise in global temperature that has occurred over the past century appear more dramatic.⁴ Since 2005, the National Oceanic and Atmospheric Administration (NOAA) has

been collecting more-reliable data from weather stations across the United States that are not situated in urban heat sinks. These temperature stations show relatively small amounts of warming, if any at all. Objective data also show extreme weather events are generally not becoming more frequent or severe.

3. Climate Change in Montana

Weather and climate data show climate change has had a minimal impact on Montana. Montana temperatures have warmed only modestly during recent decades. Complementing this

² Sandy Eldredge and Bob Biek, “Ice Ages – What Are They and What Causes Them?,” Utah Geological Survey, accessed August 28, 2019, <https://geology.utah.gov/map-pub/survey-notes/glad-you-asked/ice-ages-what-are-they-and-what-causes-them>

³ Antonio Gasparrini *et al.*, “Mortality risk attributable to high and low ambient temperature: a multicountry observational study,” *The Lancet*, Vol. 386, July 25, 2015, <https://www.thelancet.com/action/showPdf?pii=S0140-6736%2814%2962114-0>

⁴ Tony Heller, “61% of NOAA USHCN Adjusted Temperature Data Is Now Fake,” RealClimateScience.com, February 11, 2019, <https://realclimatescience.com/2019/02/61-of-noaa-ushcn-adjusted-temperature-data-is-now-fake>

modest warming, Montana is experiencing a long-term gradual increase in precipitation, alleviating any fears of a significant increase in drought. Further, what little warming has occurred has largely been beneficial for Montana, as it has for much of the world. Montana crop production sets new records almost every year, due in significant part to longer growing seasons, fewer frost events, and additional concentrations of atmospheric CO2.

4. Montana Energy Use and Impacts

Even if CO2 were associated with catastrophic global warming, Montana has already substantially curtailed its CO2 emissions. Montana ranks among the top 10 states with the lowest CO2 emissions. Emissions-free hydroelectric power provides the majority of Montana's electricity. Even if Montana were to eliminate all of its CO2 emissions, the resulting impact on global temperature would be too small to measure.

5. Montana Harms from CO2 Reductions

Montana would suffer disproportionate economic harm from government programs meant

to restrict greenhouse gas emissions. Government-imposed climate programs focus largely on scaling back or eliminating the production and use of coal and oil. Any such restrictions would significantly harm Montana's economy. Montana is America's sixth largest coal producer and 13th largest oil producer. Other than punishing Montana's energy sector, climate activists are increasingly targeting livestock production and meat consumption. This would also disproportionately harm Montanans, as the state ranks among the top states for beef and sheep production.

“OTHER THAN PUNISHING MONTANA’S ENERGY SECTOR, CLIMATE ACTIVISTS ARE INCREASINGLY TARGETING LIVESTOCK PRODUCTION AND MEAT CONSUMPTION. THIS WOULD ALSO DISPROPORTIONATELY HARM MONTANANS, AS THE STATE RANKS AMONG THE TOP STATES FOR BEEF AND SHEEP PRODUCTION.”

6. Major Flaws in the ‘2017 Montana Climate Assessment’

The *2017 Montana Climate Assessment*, which has been used by Montana's governor to justify aggressive climate action, includes among its participants members of highly biased climate alarmist groups, but it fails to include work from skeptical scientists or groups who actively question the alarmist narrative.

Moreover, MCA's authors cherry-picked data outside of their proper context and misleadingly presented such data to display an alarmist picture of climate change and its effects in Montana. MCA's authors repeatedly ignored data that contradicted their forgone conclusions and made assertions directly contradicted by objective data.

1. A Summary of Global Climate Change

To understand how climate change is impacting Montana, it is important to fully grasp the context of global climate change. This section provides a brief overview.

Naturally occurring changes are a constant feature of Earth's dynamic climate. Modest recent changes in global climate fit well within natural variability. Approximately three million years ago, Earth entered an ice age epoch that is still in effect.⁵ Glaciations have dominated this long period, with recurring ice-sheet advances lasting for 100,000 years to 150,000 years and short warming periods, known as interglacial warm periods, occurring for an average of approximately 10,000 years.⁶ Earth is currently in the midst of an interglacial warm period, one that has lasted for the past 10,000 years. (See Figure 1.)

Within glaciations and interglacial warm periods, dramatic changes in temperature and climate are the rule rather than the exception. Temperature changes of several degrees Celsius regularly occur, often quite suddenly.

Even before the warming of the past century, the present interglacial warm period produced temperatures oscillating within a range of several degrees Celsius.⁷ Current temperatures, even after approximately 150 years of gradual recovery from the cold of the Little Ice Age, remain within the lower end of interglacial warm period temperatures.⁸ (See Figure 1.)

History reveals higher temperatures have always been more beneficial to human health and welfare than lower temperatures. A Medieval Warm Period that began in approximately AD 1,000 brought temperatures as high or higher than in our current climate. They were the catalyst for increasing crop production, human population, and prosperity.⁹ During that time, wine grapes were grown in normally chilly England, and Vikings were able to settle and establish farms in previously inhospitable Greenland. The onset of the Little Ice Age around AD 1,300, however, contributed significantly to an era of crop failures, plague, pestilence, and declining human population.¹⁰

During the past 150 years, Earth has slowly emerged from the Little Ice Age. This warming, which began before the invention of

⁵ Sandy Eldredge and Bob Biek, *supra* note 2.

⁶ Michael Marshall, "The History of Ice on Earth," *New Scientist*, May 24, 2010, <https://www.newscientist.com/article/dn18949-the-history-of-ice-on-earth>

⁷ Craig Idso, David Legates, and S.F. Singer, "Climate Science," in *Climate Change Reconsidered II: Fossil Fuels*, Nongovernmental International Panel on Climate Change, (Arlington Heights, IL: The Heartland Institute, 2019), p. 137, <http://climatechangereconsidered.org/wp-content/uploads/2019/01/Full-Book.pdf>

⁸ U.N. Intergovernmental Panel on Climate Change, *First Assessment Report*, 1990, p. 202, https://www.ipcc.ch/site/assets/uploads/2018/03/ipcc_far_wg_i_full_report.pdf

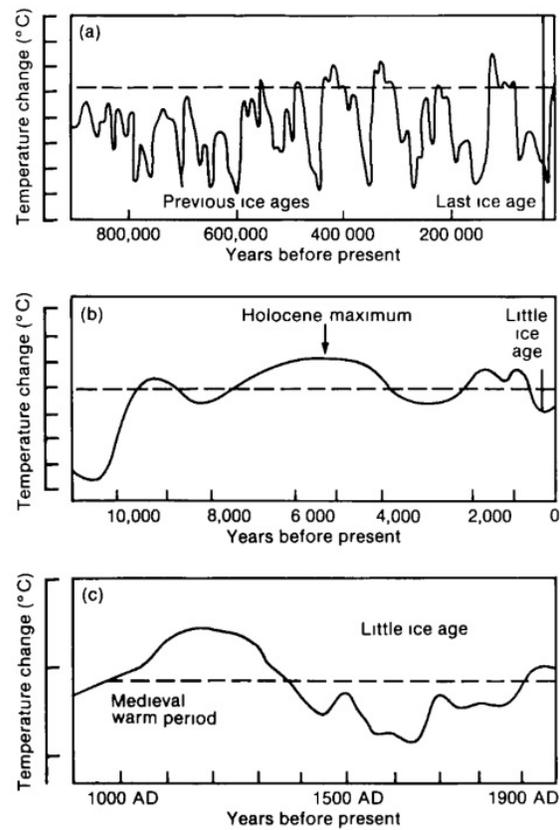
⁹ John P. Rafferty, "Medieval Warm Period," *Encyclopedia Britannica*, accessed August 2019, <https://www.britannica.com/science/medieval-warm-period>

¹⁰ Mauricio Lima, "Climate Change and the Population Collapse During the 'Great Famine' in Pre-Industrial Europe," *Ecology and Evolution*, Vol. 4, Issue 3, January 2, 2014, <https://onlinelibrary.wiley.com/doi/full/10.1002/ece3.936>

coal-fired power plants and automobiles, has brought immeasurable benefits. Crop production sets new records almost every year. Satellite instruments have measured a dramatic greening of the Earth.¹¹ Deserts are receding and plant life is increasingly taking root in arid regions of the globe.¹² Extreme weather events are becoming less frequent.¹³ Lower temperatures, which kill far more people than moderate or even high temperatures, are becoming less frequent.¹⁴

The pace of recent warming continues to be much slower than U.N. climate model predictions. In 1990, the U.N. Intergovernmental Panel on Climate Change (IPCC) predicted global temperature would rise by 0.3 degrees C per decade.¹⁵ However, empirical temperature data covering the three decades following 1990 show the average global temperature rise has been only about 0.13 degrees C per decade, less than half the pace IPCC predicted.¹⁶ As a result, IPCC lowered its prediction to just two-tenths of a degree C per decade, and likely will need to lower it again.¹⁷ It is probable that

Figure 1: Historical Temperature Changes



Source: U.N. Intergovernmental Panel on Climate Change, *First Assessment Report*, 1990, p. 202, https://www.ipcc.ch/site/assets/uploads/2018/03/ipcc_far_wg_1_full_report.pdf

¹¹ NASA, "Carbon Dioxide Fertilization Greening Earth, Study Finds," nasa.gov, April 26, 2016, <https://www.nasa.gov/feature/goddard/2016/carbon-dioxide-fertilization-greening-earth>

¹² Randall J. Donohue *et al.*, "Impact of CO₂ Fertilization on Maximum Foliage Cover Across the Globe's Warm, Arid Environments," *Geophysical Research Letters*, May 15, 2013, <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/grl.50563>

¹³ Michael Bastach, "UN's New Report Shows There's 'Little Basis' for a Favorite Claim of Climate Activists," *The Daily Caller*, October 8, 2018, <https://www.thegwpf.com/ipcc-report-extreme-weather-events-not-getting-worse>; James Taylor, "Sorry Global Warming Alarmists, but Extreme Weather Events Are Becoming Less Extreme," *Forbes.com*, May 8, 2013, <https://www.forbes.com/sites/jamestaylor/2013/05/08/sorry-global-warmists-but-extreme-weather-events-are-becoming-less-extreme/#7fd1651a55a4>

¹⁴ Antonio Gasparrini *et al.*, *supra* note 3.

¹⁵ U.N. Intergovernmental Panel on Climate Change, *supra* note 8, p. xxii.

¹⁶ Roy Spencer, "Global Warming," *drroyspencer.com*, January 2, 2019, <http://www.drroyspencer.com/2019/01/uah-global-temperature-update-for-december-2018-0-25-deg-c>

¹⁷ U.N. Intergovernmental Panel on Climate Change, *Fifth Assessment Report*, 2014, p. 4, https://www.ipcc.ch/site/assets/uploads/2018/05/SYR_AR5_FINAL_full_wcover.pdf

as this modest warming continues, so will the tangible, measurable net benefits.¹⁸

2. Climate Change in the United States

Long-term warming in the United States has been modest, at most. Thermometers at weather stations throughout the country show significant warming from the late 1800s through the mid-1940s, followed by cooling from the mid-1940s through the late 1970s. Indeed, in the 1970s, many scientists, echoed in the popular media of that period, warned of an imminent, new ice age.¹⁹ However, since the late 1970s, Earth has experienced modest warming. Thermometer readings in the United States report current temperatures are approximately the same as they were 80 years ago.²⁰

The reality that thermometer readings have shown no dramatic climate change has been masked in large part by government gatekeepers who have adjusted raw data to give the appearance of more extreme warming.²¹ (See Figure 2.) For example, NOAA's National Climatic Data Center has been adjusting tempera-

tures from past decades downward, making it look as though there has been approximately 1.5 degrees Fahrenheit (0.8 degrees C) of warming since the early twentieth century, a figure that's much higher than what the raw temperature data reveal. As a result, virtually all reported warming in the United States during the past 80 years is a result of controversial adjustments to the raw temperature data. As previously noted, the unadjusted, raw data show current temperatures are approximately the same as they were in the 1930s.

The asserted reasons for the temperature adjustments are that land-use changes, inconsistencies in what time of day temperature readings are made, and other variables affected recorded temperatures. However, to the extent this may be true, the identified inconsistencies should lead researchers to the conclusion that recent temperature data, not past temperature data, should be adjusted so that they are lower. Most notably, land-use changes have tended to result in long-term weather stations being located in urban areas, where asphalt and recent industrial activity have caused temperatures to appear higher than they otherwise would be.²² Additionally, the recent practice of using latex

¹⁸ For a more complete discussion of why temperatures are not rising as fast as U.N. predictions have indicated, see Craig Idso, Robert Carter, and Fred Singer, *Why Scientists Disagree About Global Warming*, (Arlington Heights, IL: The Heartland Institute, 2016).

¹⁹ See, for example, "Another Ice Age?," *Time*, June 24, 1974, <http://web.archive.org/web/20060812025725/http://time-proxy.yaga.com/time/archive/printout/0,23657,944914,00.html>

²⁰ Tony Heller, *supra* note 4.

²¹ *Ibid.*

²² See Anthony Watts, "Satellites Image the Urban Heat Islands in the Northeast," wattsupwiththat.com, December 14, 2010, <https://wattsupwiththat.com/2010/12/14/image-the-urban-heat-islands-in-the-northeast>, citing data from NASA, "Satellites Pinpoint Drivers of Urban Heat Islands in the Northeast," December 13, 2010, nasa.gov, <https://www.nasa.gov/topics/earth/features/heat-island-sprawl.html>; CO2 Science, "The Impacts of Urban Heat Islands on Natural Warming Trends," [CO2science.org](http://co2science.org), May 5, 2017, <http://www.co2science.org/articles/V20/may/a4.php>; A.T.J. de Laat and A.N. Maurellis, "Industrial CO2 Emissions as a Proxy for Anthropogenic Influence on Lower Tropospheric Temperature Trends,"

Figure 2: Raw U.S. Temperature Readings vs. Adjusted Data

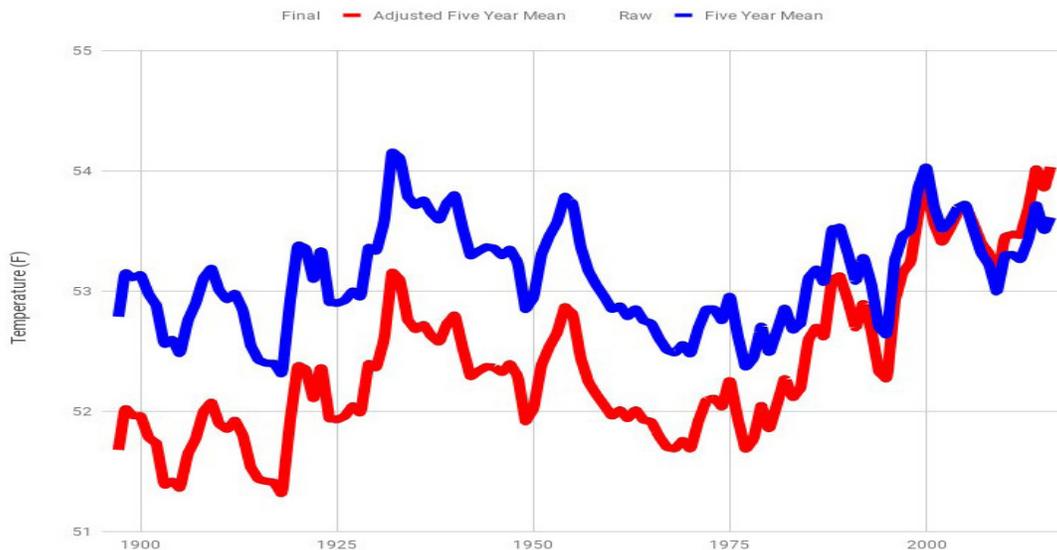


Figure 2: The blue line represents unadjusted thermometer readings, which show temperatures are no higher now than they were 80 years ago. *Source:* Tony Heller, “61% Of NOAA USHCN Adjusted Temperature Data Is Now Fake,” *realclimatescience.com*, February 11, 2019, <https://realclimatescience.com/2019/02/61-of-noaa-ushcn-adjusted-temperature-data-is-now-fake>

paint on boxes containing thermometers also artificially increases temperature readings.²³

Thus, if adjustments to the raw data from urban heat areas ought to be made, more recent data should be adjusted downward and data from decades in the distant past should be adjusted upward. If they were altered in this way, temperature data would show only a small amount of warming over the past 80 years. However, despite these well-established concerns, government overseers of temperature data continue to adjust temperature data from past decades downward, giving the appearance that the

record shows significantly more recent warming.

With that said, even the controversially adjusted data show U.S. warming has occurred at a pace of merely 0.18 degrees F per 10 years, or one-tenth of one degree C per 10 years, since the beginning of the twentieth century. This is only one-third of the 0.3 degrees C global warming that was predicted by the IPCC in 1990. While the IPCC did not make country-specific temperature predictions, the long-term pace of U.S. warming has been recorded at a much slower pace than IPCC global warming predictions.

Geophysical Research Letters, Vol. 31, Issue 5, March 11, 2004, <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2003GL019024>

²³ Anthony Watts, *Is the U.S. Temperature Record Reliable?*, (Arlington Heights, IL: The Heartland Institute, 2009), https://www.heartland.org/_template-assets/documents/publications/SurfaceStations.pdf

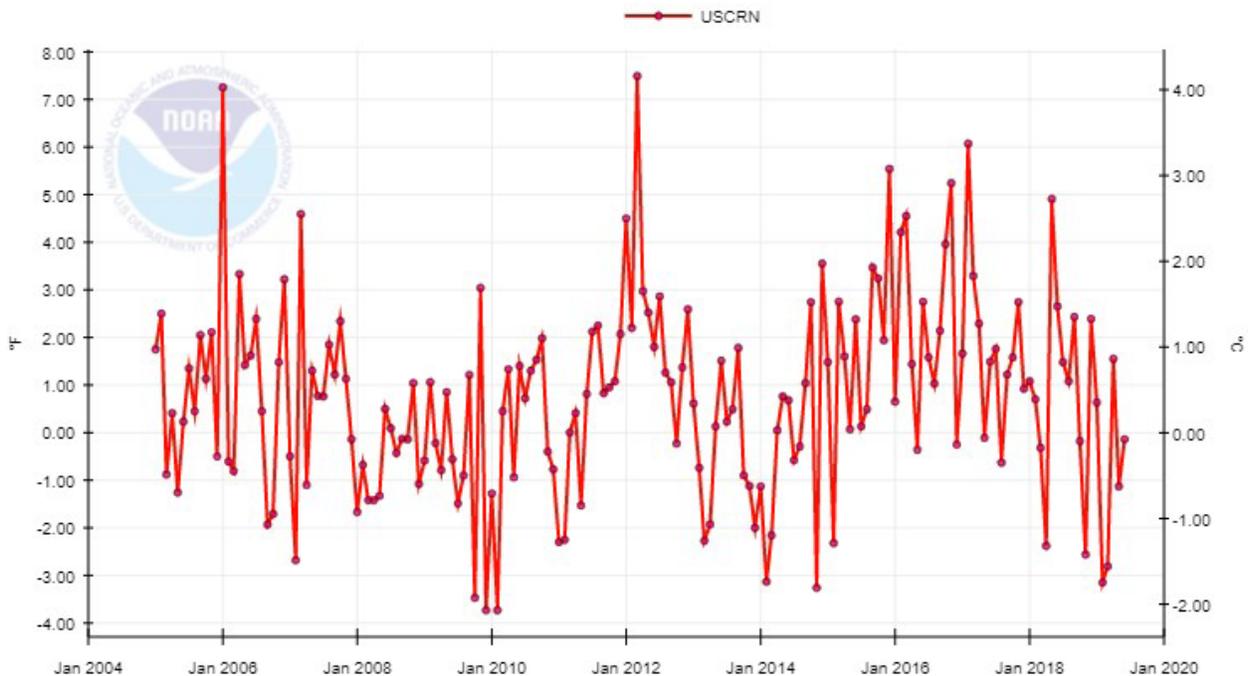
To its credit, NOAA in 2005 established a network of more than 100 pristine weather stations throughout the lower 48 states, commonly called the U.S. Climate Reference Network (CRN). CRN’s temperature readings are not subject to any adjustments, because CRN collects temperature data uniformly, utilizes consistent observation practices, and the stations are situated far from urban areas, where local human activities inaccurately impact temperature data. CRN’s temperature data, going back to 2005, show no net warming in average U.S. temperatures. (See Figure 3.)

Curiously, even after implementing its nationwide network of uncorrupted weather and temperature stations, NOAA has continued

to publish official temperature data—including its Montana-specific data—sourced from its faulty and admittedly corrupted network, rather than from the much more accurate CRN network. Utilizing the old, faulty network provides government overseers an excuse to alter data and produce reported warming that does not appear in any of the raw temperature readings, including readings produced by the CRN network.

Regardless of how much warming is occurring, the feared negative consequences of higher temperatures have not occurred. To the contrary, scientific evidence shows crop production throughout the world sets new records virtually every year, including in the United

Figure 3: U.S. Temperatures, as Reported by the CRN Network



Source: Data provided by U.S. Climate Reference Network, National Oceanic and Atmospheric Administration, accessed August 2019, <https://www.ncdc.noaa.gov/crn>. Chart provided by meteorologist Anthony Watts.

States.²⁴ Satellite instruments show the Earth is greening, including in the United States.²⁵ Health studies and mortality data show lower temperatures and cold winter months kill far more people globally and in the United States than high temperatures and hot summer months.²⁶ And although extreme weather events continue to occur, there is no indication they are becoming more frequent or severe in the United States.²⁷

In short, a warmer world and a warmer United States are proving to be more beneficial for human health, human welfare, and the environment than a colder world and a colder United States.

3. Climate Change in Montana

In recent decades, Montana has experienced minimal departure from long-term tempera-

ture and precipitation trends. And to the extent some changes have occurred, the available reliable evidence indicates those changes have been largely beneficial.

“REGARDLESS OF HOW MUCH WARMING IS OCCURRING, THE FEARED NEGATIVE CONSEQUENCES OF HIGHER TEMPERATURES HAVE NOT OCCURRED. TO THE CONTRARY, SCIENTIFIC EVIDENCE SHOWS CROP PRODUCTION THROUGHOUT THE WORLD SETS NEW RECORDS VIRTUALLY EVERY YEAR, INCLUDING IN THE UNITED STATES.”

Temperature Changes

Even NOAA’s adjusted data, which date back to the late 1800s, show temperatures in Montana are rising at a pace of approximately 0.2 degrees F (0.11 degrees C) per decade. (See Figure 4.) This translates to an average of 2 degrees F (1.1 degree C) per century.²⁸ This is well within natural historical variation and merely one-third of

the 3 degrees C of warming per century that was predicted by the United Nations’ flawed computer models.

Importantly, there has also been no increase in the modest pace of warming in recent years in

²⁴ Food and Agriculture Organization, “World Food Situation,” United Nations, last updated April 7, 2019, <http://www.fao.org/worldfoodsituation/csdb/en>; U.S. Department of Agriculture, “Crop Production Historical Track Records,” April 2018, https://www.nass.usda.gov/Publications/Todays_Reports/reports/croprtr18.pdf

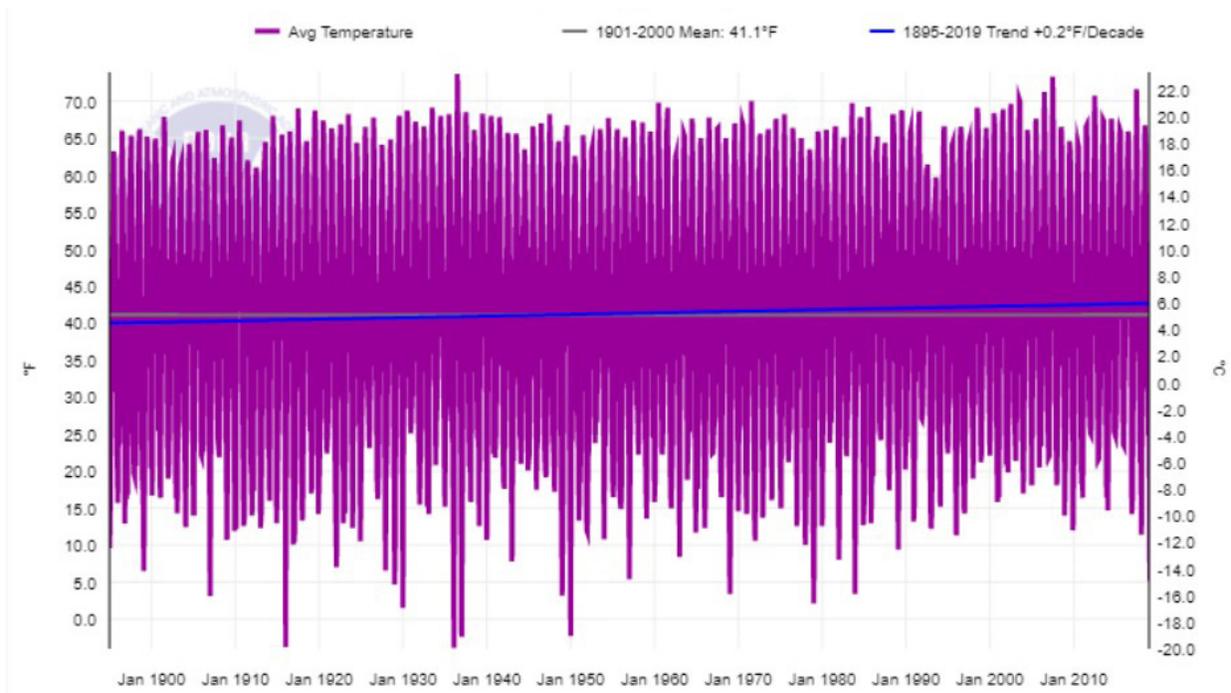
²⁵ NASA, *supra* note 11.

²⁶ Antonio Gasparini *et al.*, *supra* note 3; Indur M. Goklany, “Winter Kills: Excess Deaths in the Winter Months,” wattsupwiththat.com, January 6, 2010, <https://wattsupwiththat.com/2010/01/06/winter-kills-excess-deaths-in-the-winter-months>

²⁷ Michael Bastach, *supra* note 13; James Taylor, *supra* note 13.

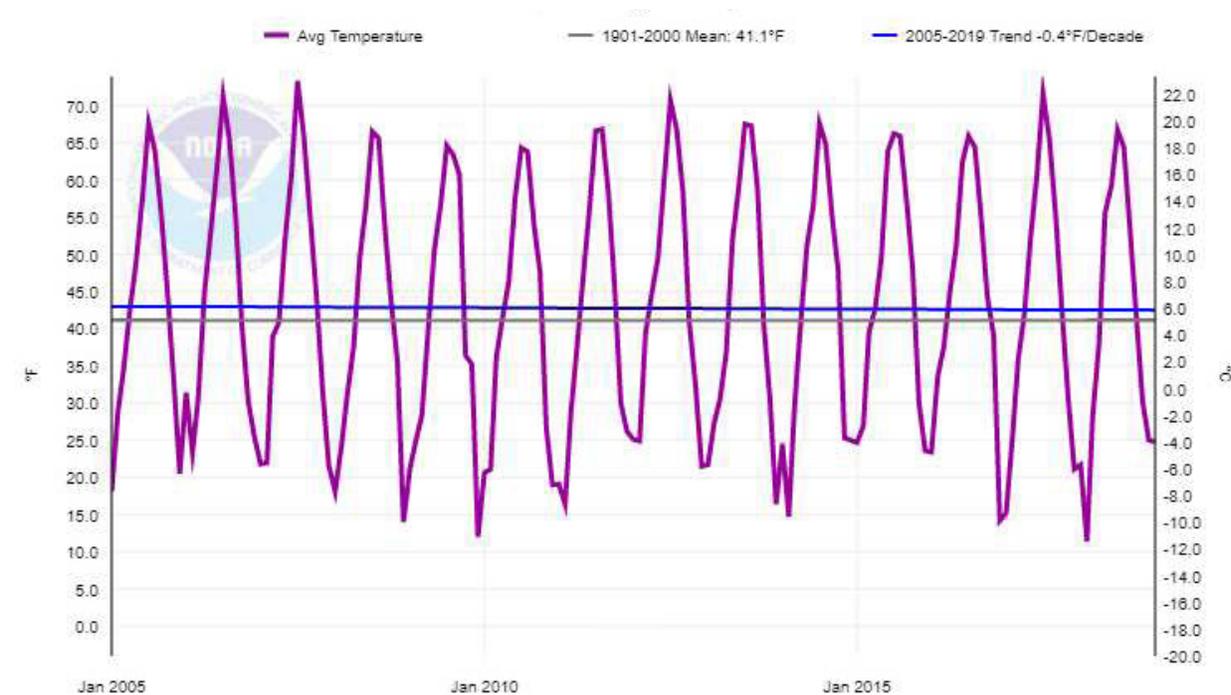
²⁸ National Centers for Environmental Information, “Climate at a Glance,” Statewide Time Series, Montana, Average Temperatures 1895–2019, National Oceanic and Atmospheric Administration, accessed October 2019, https://www.ncdc.noaa.gov/cag/statewide/time-series/24/tavg/all/12/1895-2019?base_prd=true&begbaseyear=1901&endbaseyear=2000&trend=true&trend_base=10&begtrendyear=1895&endtrendyear=2019

Figure 4: NOAA Montana Temperature Readings, 1895–2019



Source: Data and chart provided by the U.S. National Oceanic and Atmospheric Administration, accessed September 2019, https://www.ncdc.noaa.gov/cag/statewide/time-series/24/tavg/all/12/1895-2019?base_prd=true&begbaseyear=1901&endbaseyear=2000&trend=true&trend_base=10&begtrendyear=1895&endtrendyear=2019.

Figure 5: NOAA Montana Temperature Readings, 2005–2019



Source: Data provided by the U.S. National Oceanic and Atmospheric Administration's National Centers for Environmental Information, accessed September 2019, <https://www.ncdc.noaa.gov/cag/statewide/time-series>. Graphed by meteorologist Anthony Watts.

Montana. Indeed, Montana temperatures have cooled. Since 2005, when the CRN temperature network became operational, NOAA data showing average monthly temperatures reveal Montana temperatures have been declining at a pace of 0.4 degrees F per decade. (See Figure 5.)

Precipitation Changes

NOAA data also reveal there has been a modest increase in Montana precipitation since the early 1900s, which should alleviate concerns that global warming may cause droughts in the state.²⁹ Although drought has periodically occurred in Montana during recent years (a condition that has happened intermittently throughout the historical record), the modest long-term increase in precipitation occurring since the early 1900s has persisted thus far in the twenty-first century. (See Figure 6.)

Beneficial Climate Trends

Montana farmers and crop yields have benefited greatly as the Earth continues its modest recent warming. Record yields for wheat, corn, barley, oats, potatoes, sugar beets, and hay have all been set in Montana during the past decade.³⁰ Although drought in 2017 brought a brief pause to the long-term increase

in crop yields, crop yields bounced back under favorable climate conditions in 2018. Montana winter wheat farmers, for example, enjoyed record yields in 2018 and are forecasted to match that record in 2019.³¹ Additionally, Montana durum wheat achieved record yields in 2019.³²

“MONTANA FARMERS AND CROP YIELDS HAVE BENEFITED GREATLY AS THE EARTH CONTINUES ITS MODEST RECENT WARMING. RECORD YIELDS FOR WHEAT, CORN, BARLEY, OATS, POTATOES, SUGAR BEETS, AND HAY HAVE ALL BEEN SET IN MONTANA DURING THE PAST DECADE.”

Montana’s agricultural success under warming conditions mirrors that of the United States as a whole. Figure 7 on page 13 shows the rising yields for America’s cereal crops—corn, wheat, and rice. The consistently rising crop yields throughout the country reveal that Montana’s agricultural success under moderately warming conditions is not a fluke.

²⁹ *Ibid.*

³⁰ U.S. Department of Agriculture, “Montana Agricultural Statistics,” October 2018, p. 25, https://www.nass.usda.gov/Statistics_by_State/Montana/Publications/Annual_Statistical_Bulletin/2018/Montana-Annual-Bulletin-2018.pdf

³¹ “September Small Grains Highlights,” *Sidney Herald*, September 30, 2019, https://www.sidneyherald.com/news/agriculture/september-small-grains-highlights/article_4034a37e-e3bd-11e9-aa69-8bb6a0cd15d2.html

³² *Ibid.*

Figure 6: Annual Precipitation Highs, Lows, and Averages in Montana

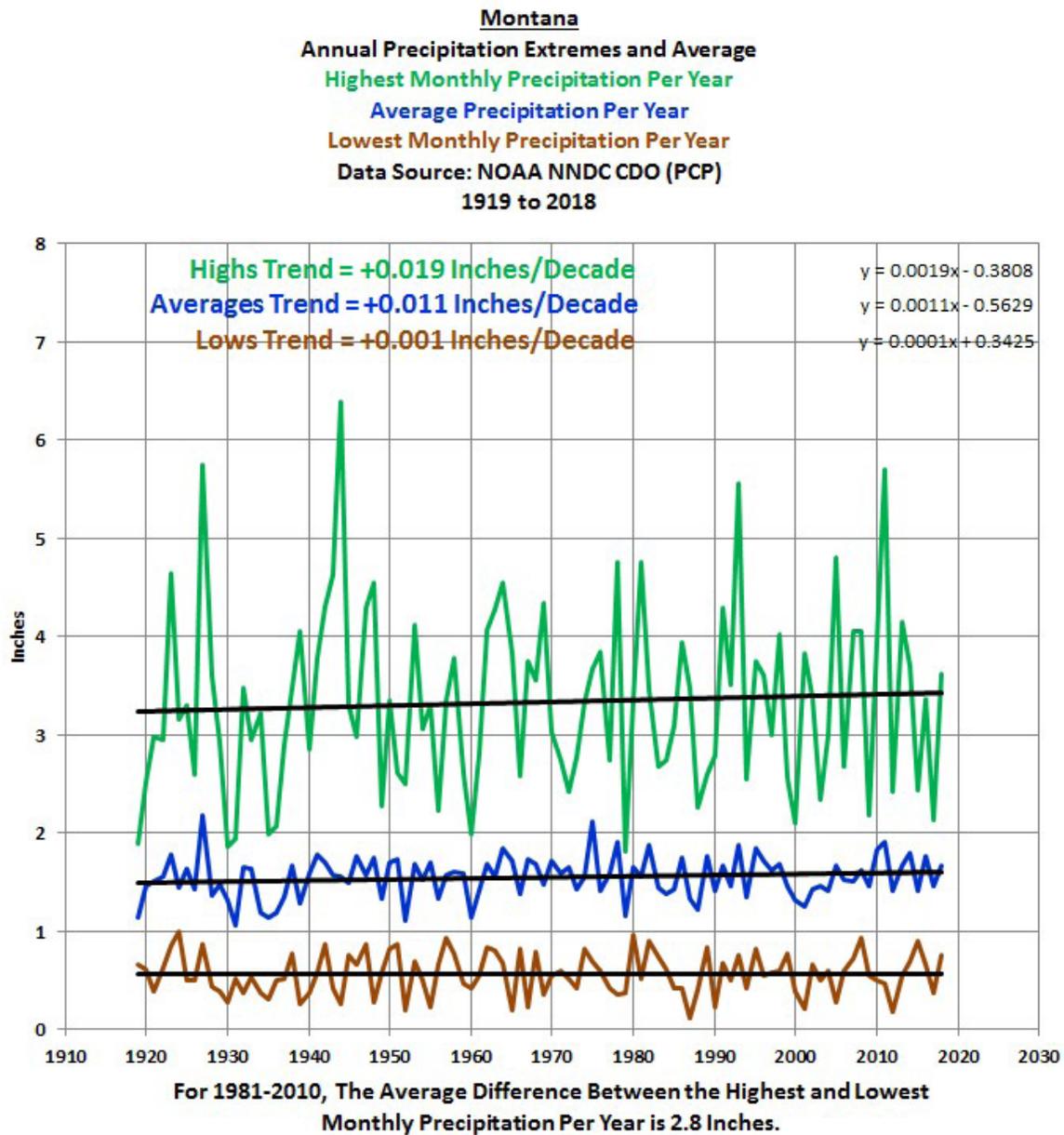


Figure 6: The blue line shows precipitation in Montana since 1919 has increased by approximately 0.011 inches per decade. The brown line shows an increase in average Montana precipitation during the driest month of the year. The green line shows a similar increase in precipitation during the wettest month of the year. *Source:* Data provided by the U.S. National Oceanic and Atmospheric Administration’s National Centers for Environmental Information, accessed September 2019, <https://www.ncdc.noaa.gov/cag/statewide/time-series>. Data graphed by meteorologist Anthony Watts and Bob Tisdale.

Aside from agriculture, Montana will likely continue to profit from modest warming in other ways. Satellite measurements of global vegetation intensity show Montana is benefitting from global greening more than almost any other region of the planet.³³ Montana, like the rest of the nation and globe, will also likely continue benefiting from reduced cold temperature-related mortality and declines in extreme weather events. Moreover, a warmer climate would provide greater opportunities for tourism, exercise, and recreation in Montana, with longer seasons for hiking, camping, fishing, golfing, bicycle riding, and myriad other outdoor activities.

4. Montana Energy Use and Impacts

Montana CO2 emissions contribute very little to national and global emissions. Only eight states emit fewer total CO2 emissions than Montana.³⁴ Moreover, emissions-free hydroelectric power provides the majority of Montana’s electricity. (See Figure 8 on page 14.)

According to calculations included in the U.S. National Center for Atmospheric Research climate models, a complete elimination of U.S. CO2 emissions would lower global tem-

Figure 7: U.S. Cereal Crop Yields per Hectar

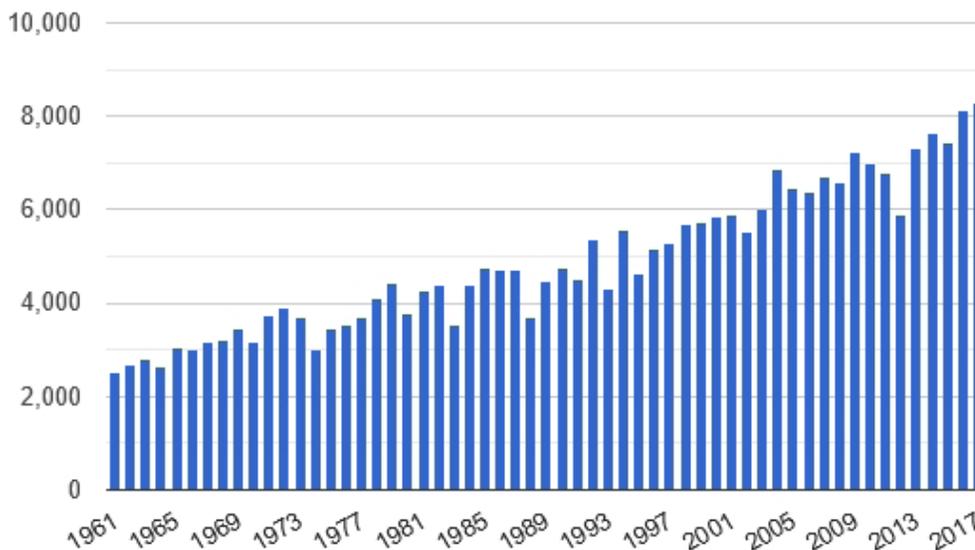


Figure 7: Yields per acre for U.S. cereal crops—corn, wheat, and rice—have consistently improved as the climate modestly warms. Source: “USA: Cereal Crop Yield by Hectar,” TheGlobalEconomy.com, accessed October 24, 2019, https://www.theglobaleconomy.com/usa/cereal_yield/.

³³ Randall J. Donohue *et al.*, *supra* note 12.

³⁴ U.S. Energy Information Administration, “Energy-Related Carbon Dioxide Emission by State, 2005-2016,” *Independent Statistics & Analysis*, February 27, 2019, <https://www.eia.gov/environment/emissions/state/analysis>

perature (compared to global temperatures with existing U.S. emissions) by a mere 0.14 degrees C by the year 2100.³⁵ Montana produces less than 2 percent of total U.S. CO2 emissions.³⁶ Even under an optimistic scenario, completely eliminating Montana CO2 emissions would lower global temperature by only approximately 0.003 degrees C by the year 2100, an amount too small to be measured or noticed.

5. Montana Harms from CO2 Reductions

While attempts by Montana policymakers to restrict or eliminate CO2 emissions will in no measurable way reduce global temperature, such efforts would inflict much economic suffering on the citizens of the state. Government-imposed climate programs focus largely on restricting the production and use of coal and oil. Any such restrictions would punish important Montana economic activity. Mon-

Figure 8: Montana Net Electricity Generation by Source, June 2019

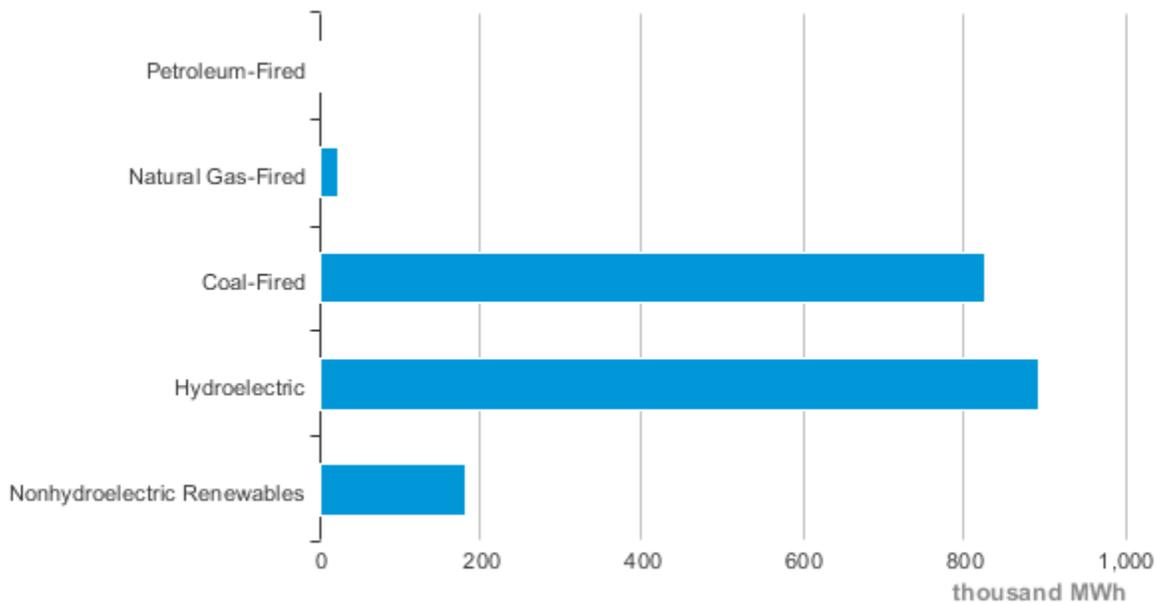


Figure 8: Montana generates the majority of its electricity from zero-emissions energy sources. *Source:* U.S. Energy Information Administration, “State Profile and Energy Estimates: Montana,” *Independent Statistics & Analysis*, accessed October 2019, <https://www.eia.gov/state/?sid=MT#tabs-4>

³⁵ Patrick J. Michaels and Paul C. Knappenberger, “We Calculate, You Decide: A Handy-Dandy Carbon Tax Temperature Savings Calculator,” *Cato at Liberty*, July 23, 2013, <https://www.cato.org/blog/current-wisdom-we-calculate-you-decide-handy-dandy-carbon-tax-temperature-savings-calculator>

³⁶ U.S. Energy Information Administration, *supra* note 34.

tana is America's sixth largest coal producer and 13th largest oil producer.^{37,38}

Restricting or discouraging oil or coal production would harm the Montana economy and kill jobs. In 2017, more than 1,100 workers, many with high salaries, were directly employed in coal production in Montana. Total annual coal-related payrolls in Montana amounted to nearly \$100 million, and there are many other jobs dependent on the coal industry not included in these figures.³⁹ Eliminating Montana's fossil fuel sector would also put a strain on state and local government income. In 2018, the state collected \$60 million from its Coal Severance Tax.⁴⁰ Additionally, the coal Gross Proceeds Tax collected \$17.3 million, of which \$9.1 million went to local governments.⁴¹ Other coal-production-related taxes lifted state revenues from that sector to greater than \$110 million.⁴² The state also collects another \$65.5 million from the Oil and Gas Production Tax.⁴³

Restricting or discouraging coal, oil, and natural gas production would force government to reduce education spending or raise taxes to make up for the shortfall.

Beyond energy restrictions, climate activism is increasingly targeting livestock production and meat consumption. This also threatens to disproportionately harm Montana, which is an important beef and sheep producing state. Montana ranks seventh among the 50 states in beef cattle production and eighth in sheep and lamb production.^{44,45}

Climate activists' anti-livestock agenda is clearly spelled out in the U.N. publication titled "Livestock's Long Shadow."⁴⁶ According to this publication:

- "The livestock sector emerges as one of the top two or three most significant contributors to the most serious environmen-

³⁷ "Coal Production by State," *World Atlas*, accessed October, 2019, <https://www.worldatlas.com/articles/coal-production-by-state.html>

³⁸ "Crude Oil Production in the United States in 2018, by State (in 1,000 Barrels)," *Statista*, accessed October 2019, <https://www.statista.com/statistics/714376/crude-oil-production-by-us-state>

³⁹ "Montana Coal Production and Employment," Montana Coal Council, https://www.montanacoalouncil.com/index_2.htm

⁴⁰ Montana Department of Revenue, "Montana Department of Revenue Biennial Report: July 1, 2016 to June 30, 2018," p. 15, <https://mtrevenue.gov/wp-content/uploads/2019/01/2016-2018-Biennial-Report.pdf>

⁴¹ *Ibid*, p. 102.

⁴² Sonja Nowakowski, "Senate Joint Resolution 5: Coal in Montana; Fiscal Impacts," Montana Legislative Environmental Policy Office, p. 6, January 17, 2018, <https://leg.mt.gov/content/Committees/Interim/2017-2018/EQC/Meetings/Jan-2018/sj-5-coaltaximpacts.pdf>

⁴³ Montana Department of Revenue, *supra* note 40.

⁴⁴ "Ranking of States with the Most Beef Cows," Beef2Live.com, October 8, 2019, <https://beef2live.com/story-ranking-states-beef-cows-0-108181>

⁴⁵ "Ranking of States With The Most Sheep and Lambs," Beef2Live.com, September 8, 2019, <https://beef2live.com/story-top-10-states-sheep-lambs-0-117992>

⁴⁶ Food and Agriculture Organization, "Livestock's Long Shadow: Environmental Issues and Options," United Nations, 2006, <http://www.fao.org/3/a-a0701e.pdf>

tal problems, at every scale from local to global.”⁴⁷

- “Livestock’s contribution to environmental problems is on a massive scale ...”⁴⁸
- “At virtually each step of the livestock production process substances contributing to climate change or air pollution, are emitted into the atmosphere, or their sequestration in other reservoirs is hampered.”⁴⁹
- “[T]he livestock sector is a major stressor on many ecosystems and on the planet as whole. Globally it is one of the largest sources of greenhouse gases.”⁵⁰
- “[L]ivestock’s contribution [to climate change] is enormous. It currently amounts to about 18 percent of the global warming effect – an even larger contribution than the transportation sector worldwide.”⁵¹
- “In the absence of major corrective measures, the environmental impact of livestock production will worsen dramatically.”⁵²

The United Nations also targets livestock in

other publications. In September 2018, the U.N. Environment Program published an article titled “Tackling the World’s Most Urgent Problem: Meat.” The article, summarizing the views of the winners of the U.N. Champions of the Earth Award, stated, “[Our] use of animals as a food-production technology has brought us to the verge of catastrophe. The destructive impact of animal agriculture on our environment far exceeds that of any other technology on Earth.”⁵³

The article added, “The greenhouse gas footprint of animal agriculture rivals that of every car, truck, bus, ship, airplane, and rocket ship combined. There is no pathway to achieve the Paris climate objectives without a massive decrease in the scale of animal agriculture.”

An August 2019 United Nations report, titled *Climate Change and Land*,⁵⁴ further blamed livestock and agriculture for asserted climate change.

In a *Nature* magazine article announcing the report, Hans-Otto Portner, co-chair of the U.N. IPCC’s Working Group on Impacts, Adaptation, and Vulnerability, said, “It would indeed be beneficial, for both climate and human

⁴⁷ *Ibid*, p. xx.

⁴⁸ *Ibid*.

⁴⁹ *Ibid*, p. 79.

⁵⁰ *Ibid*, p. 267.

⁵¹ *Ibid*, p. 272.

⁵² *Ibid*, p. 275.

⁵³ U.N. Environment Program, “Tackling the World’s Most Urgent Problem: Meat,” unenvironment.org, September 26, 2018, <https://www.unenvironment.org/news-and-stories/story/tackling-worlds-most-urgent-problem-meat>

⁵⁴ U.N. Intergovernmental Panel on Climate Change, *Climate Change and Land*, 2019, <https://www.ipcc.ch/report/srccl/>

health, if people in many rich countries consumed less meat, and if politics would create appropriate incentives to that effect.”⁵⁵

In the same *Nature* article, Ruth Richardson, executive director at the Global Alliance for the Future of Food, made it clear that climate activists seek immediate and revolutionary—rather than incremental—changes to curtail livestock production. “We need a radical transformation, not incremental shifts, towards a global land-use and food system that serves our climate needs,” Richardson said.

In short, jumping on board the climate activist bandwagon is likely to bring substantial harm to Montana livestock producers. Currently, there are 2.5 million cattle and calves in Montana’s livestock inventory and 215,000 sheep, with 66 percent of agricultural land used for pasture and range for livestock.⁵⁶ The livestock sector is a source of employment for the state’s citizens and revenues for governments. With climate activists making it clear that meaningful greenhouse gas restrictions must include restrictions on livestock, Montana’s economy would necessarily suffer. Moreover, alarmists would not only be destroying one of the state’s

“IN SHORT, JUMPING ON BOARD THE CLIMATE ACTIVIST BANDWAGON IS LIKELY TO BRING SUBSTANTIAL HARM TO MONTANA LIVESTOCK PRODUCERS.”

important economic sectors, along with jobs and revenues, they would also be driving up food costs for Montana families, as the price of meat is increased when livestock restrictions are imposed and production falls.

Under climate change legislation, Montana crop producers would also pay a steep price. In 2018, Montana wheat production alone was valued at more than \$1 billion.⁵⁷ As noted by the U.S. Department of Agriculture (USDA), “Agricultural production is sensitive to changes in energy prices, either through energy consumed

directly or through energy-related inputs such as fertilizer.” The USDA also observed, “Higher energy-related production costs would generally lower agricultural output, raise prices of agricultural products, and reduce farm income, regardless of the reason for the energy price increase.”⁵⁸

Climate action programs seek to restrict oil and gasoline use and substantially raise the price of gasoline and diesel through carbon dioxide taxes, cap-and-trade programs, and other means. Oil and diesel prices are key components in farming costs, so higher oil prices

⁵⁵ Quirin Schiermeier, “Eat Less Meat: UN Climate-Change Report Calls for Change to Human Diet,” *Nature*, August 8, 2019, <https://www.nature.com/articles/d41586-019-02409-7>

⁵⁶ National Agricultural Statistics Service, “Montana Agricultural Facts,” U.S. Department of Agriculture, 2018, p. 3, https://www.nass.usda.gov/Statistics_by_State/Montana/Publications/Special_Interest_Reports/agfacts.pdf

⁵⁷ *Ibid.*, p. 2.

⁵⁸ U.S. Department of Agriculture, “Impacts of Higher Energy Prices on Agriculture and Rural Economies,” August 2011, p. i, https://www.ers.usda.gov/webdocs/publications/44894/6814_err123_1_.pdf?v=41432

would raise the costs of operating essential farming equipment.⁵⁹

A *Great Falls Tribune* article notes, “One of the challenges to farmers is the high costs of operations, not just land but also fertilizer and equipment. The most popular combine sold in Montana is the John Deere S670, which retails with a header for \$425,000.”⁶⁰ That piece of equipment has a 251-gallon tank that runs on diesel fuel. The higher fuel costs become, the more costly food production will be.⁶¹

Additionally, the price of natural gas is the primary factor affecting nitrogen fertilizer expenses, accounting for as much as 70 percent of those costs.⁶²

Moreover, all Montana energy consumers and Montana businesses will suffer negative consequences from rising energy prices. Energy is the lifeblood of the economy, with the cost of energy factoring into the prices of all goods and services bought and sold. Montana residents would pay higher prices directly in the form of higher electric bills and gasoline prices,

and indirectly as businesses that are forced to pay higher energy prices would likely raise the prices of the goods and services they sell to Montanans. Even such seemingly benign programs as tax credits for renewable energy research must be paid, ultimately, by taxpayers throughout the state.

6. Major Flaws in the ‘2017 Montana Climate Assessment’

Gov. Bullock has referenced the *2017 Montana Climate Assessment* to gain support for proposals to restrict CO2 emissions.⁶³ However, MCA is deeply flawed.

To begin with, the assessment was biased from its inception. MCA was produced in cooperation with The Nature Conservancy and the Alternative Energy Resources Organization (AERO). Before being invited to participate in formulating the assessment, AERO’s website asserted, “the earth’s atmosphere is being catastrophically altered by the combustion of

⁵⁹ Stephanie Kelly and Tom Polansek, “Farmers Worldwide Struggle with Rising Fuel Costs,” Reuters, May 18, 2018, <https://www.reuters.com/article/us-usa-fuel-farming/farmers-worldwide-struggle-with-rising-fuel-costs-idUSKCN1J0CR>

⁶⁰ Kristen Inbody and David Murray, “How Much Do You Know About Montana Agriculture?,” *Great Falls Tribune*, updated February 1, 2018, <https://www.greatfallstribune.com/story/news/local/2016/02/01/snapshot-life-stats-montana-ag/79660020/>

⁶¹ “John Deere S-670 Combine,” RitchieSpecs.com, accessed October 2019, <https://www.ritchiespecs.com/model/john-deere-s670-combine>

⁶² Adam Jones, “How Natural Gas Prices Movements Could Affect Fertilizer Producers,” *Market Realist*, November 7, 2017, <https://articles2.marketrealist.com/2017/11/natural-gas-price-movements-fertilizer-investor-week-ending-november-3>

⁶³ Cathy Whitlock *et al.*, *2017 Montana Climate Assessment*, Montana Institute on Ecosystems, September 2017, <http://live-mca-site.pantheonsite.io/sites/default/files/thumbnails/image/2017-Montana-Climate-Assessment-Ir.pdf>

those fuels and the emissions of greenhouse gases, with dangerous consequences.”⁶⁴ The Nature Conservancy also spelled out its predetermined perspective and activist agenda prior to being invited to participate in formulating MCA. According to the Nature Conservancy webpage, “Together with supporters like you, we can halt the catastrophic impacts of climate change.”⁶⁵

What exposes the real bias of the assessment is that none of the thousands of credible and credentialed voices in the scientific and scholarly community offering solid data calling alarmist narratives into question were invited to participate. For example, climate experts working with the Nongovernmental International Panel on Climate Change have published an extensive and remarkable series called *Climate Change Reconsidered*, which includes thousands of pages of scientific summaries and thousands of references to datasets and peer-re-

viewed studies that expose flaws in alarmist arguments like those presented in the *Montana Climate Assessment*.⁶⁶ The choice by the producers of The MCA to exclude such voices meant groups like the Nature Conservancy and AERO could promote their overly alarmist agendas with little resistance.

“WHAT EXPOSES THE REAL BIAS OF THE ASSESSMENT IS THAT NONE OF THE THOUSANDS OF CREDIBLE AND CREDENTIALLED VOICES IN THE SCIENTIFIC AND SCHOLARLY COMMUNITY OFFERING SOLID DATA CALLING ALARMIST NARRATIVES INTO QUESTION WERE INVITED TO PARTICIPATE.”

This failure is one of the reasons why the specific assertions in the assessment are full of glaring errors. This includes Gov. Bullock’s reference to the assessment’s claim regarding Montana’s temperature history. In the “Major Findings” section of the assessment’s “Executive Summary,” the MCA claims, “Average annu-

al temperatures, including daily minimums, maximums, and averages, have risen across the state between 1950 and 2015. The increases range between 2.0-3.0°F (1.1-1.7°C) during this period ... [high agreement, robust evidence].”⁶⁷ However, an objective look at the

⁶⁴ Alternative Energy Resources Organization, “Energy,” accessed October 8, 2019, <https://aeromt.org/energy/>

⁶⁵ Nature Conservancy, “Our Priorities: Tackle Climate Change,” accessed October 8, 2019, <https://www.nature.org/en-us/what-we-do/our-priorities/tackle-climate-change>

⁶⁶ Craig D. Idso, Robert M. Carter, and S. Fred Singer, *Climate Change Reconsidered II: Physical Science*, Nongovernmental International Panel on Climate Change, (Arlington Heights, IL: The Heartland Institute, 2013), <http://climatechangereconsidered.org/wp-content/uploads/2019/01/CCR-II-Physical-Science-10-17-2013-entire-book.pdf>; Craig D. Idso, Sherwood B. Idso, Robert M. Carter, and S. Fred Singer, *Climate Change Reconsidered II: Biological Impacts*, Nongovernmental International Panel on Climate Change, (Arlington Heights, IL: The Heartland Institute, 2014), <http://climatechangereconsidered.org/wp-content/uploads/2019/01/CCR-II-Biological-Impacts-full-report.pdf>; Roger Bezdek, Craig D. Idso, David Legates, and S. Fred Singer, *Climate Change Reconsidered II: Fossil Fuels*, Nongovernmental International Panel on Climate Change, (Arlington Heights, IL: The Heartland Institute, 2019), <http://climatechangereconsidered.org/wp-content/uploads/2019/01/Full-Book.pdf>

⁶⁷ Cathy Whitlock *et al.*, *supra* note 63, p. 8.

data show how misleading the assessment's assertion and Gov. Bullock's reference to that claim truly are.

As shown in Figure 9, 1950 was an abnormally cold year that was an extreme outlier in the data, and 2015 was an abnormally warm year. There is no reason to present a Montana temperature history that begins with the year 1950 unless the presenter is seeking the most alarmist storyline possible to mislead readers about the long-term temperature trend. As noted in Figure 9, 1935 was a comparably warm year compared to 2015, but the MCA deleted that part of Montana's temperature history.

A temperature history that begins with the

year 1930 and ends in 2018 shows very little warming in Montana. The same applies for a temperature history that begins in 1940 or 1960. Any temperature history beginning in 1930, 1940, or 1960 would show a 1–2 degree temperature increase, which is in keeping with the Montana temperature history reported by NOAA and discussed in Section 3. (Also see Figure 4 on page 10.) Further, a temperature history beginning in 2005 would show no warming at all, as shown in Figure 5 on page 10.

Surely, the authors of the assessment were aware of these facts. Nevertheless, they presented none of these important data and chose instead to present the most alarmist and mis-

Figure 9: Montana Average Temperature, 1930–2018

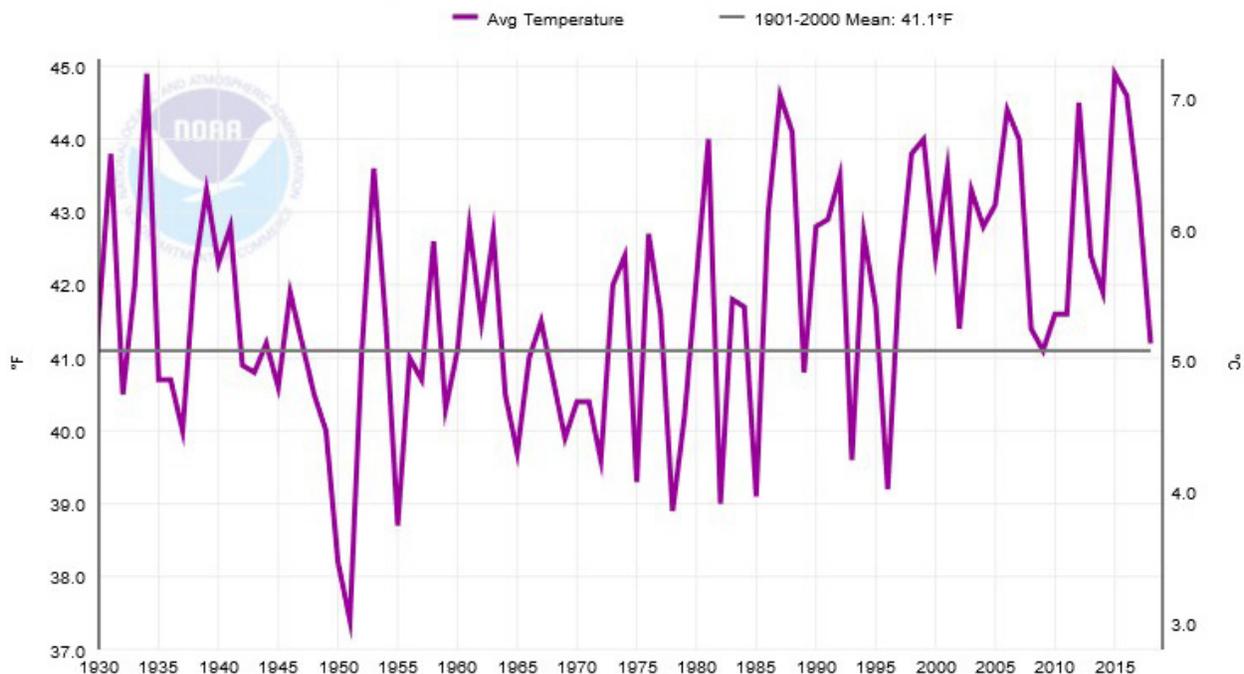


Figure 9: Graph shows Montana temperatures have risen only modestly over the past century. *Source:* U.S. National Oceanic and Atmospheric Administration, accessed October 2019, https://www.ncdc.noaa.gov/cag/statewide/time-series/24/tavg/12/12/1930-2019?base_prd=true&begbaseyear=1901&endbaseyear=2000

leading framing of the data possible to provide a false narrative about Montana temperatures.

Many other examples of biased and misleading assertions permeate the assessment, too. For a more complete and accurate summation of scientific evidence regarding climate change, readers are encouraged to review *Climate Change Reconsidered*, referenced above.

Conclusion

Weather and climate data show climate change has had a minimal impact on Montana, and to the extent modest climate changes have occurred, most of the impacts have been largely beneficial. But even if Montana were showing signs of substantial climate change or neg-

ative climate change impacts, Montana has already dramatically curtailed its carbon dioxide emissions, which means state government action to reduce carbon dioxide emissions or otherwise address climate change would have extremely minimal climate impact. However, these actions to restrict greenhouse gas emissions would unquestionably limit Montana natural resource production, thereby reducing government revenues, raise energy prices for Montana consumers and businesses, and deal a crippling blow to Montana's livestock and crop production.

The best course of action for Montana policymakers is to base policy on the best scientific and economic evidence, not unsubstantiated climate alarmism. And the best evidence shows Montana is not causing nor experiencing significant climate change net harms, and it's unlikely to in the coming decades.

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