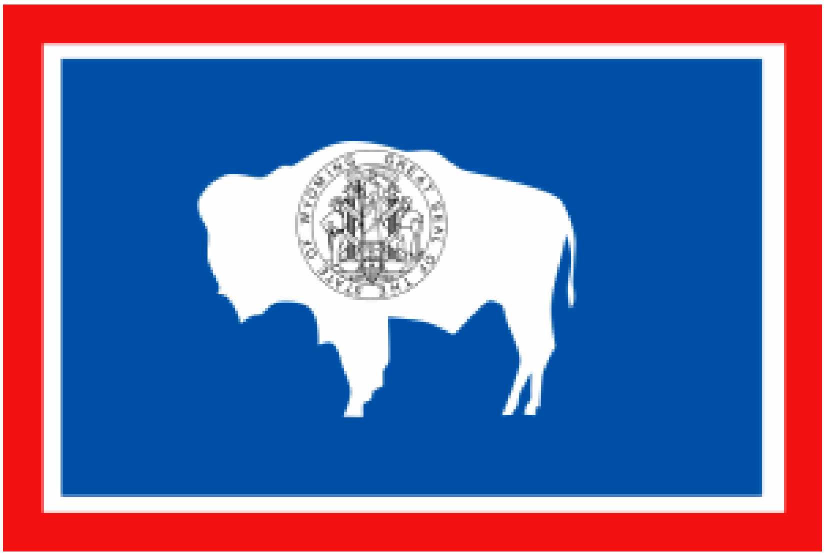
Observed Climate Change and the Negligible Global Effect of Greenhouse-gas Emission Limits in the State of Wyoming



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Observed climate change in Wyoming

Annual temperature: The historical time series of statewide annual temperatures in Wyoming begins in 1895. Over the entire record, there has been an upward trend, which has resulted in temperatures in the early 21st century being about 2ºF warmer than temperatures 100 years ago. Despite this long-term rise however, the record is largely dominated by annual and decadal-scale variability. The run of recent warm years comes on the heels of a period of falling temperatures that extended from the early 1950s through the early 1980s. Previous to then, temperatures warmed rapidly from the 1910s through the 1930s. The highest annual average statewide temperature was observed in 1934.

Wyoming annual temperatures, 1895-2007

Annual mean temperatures

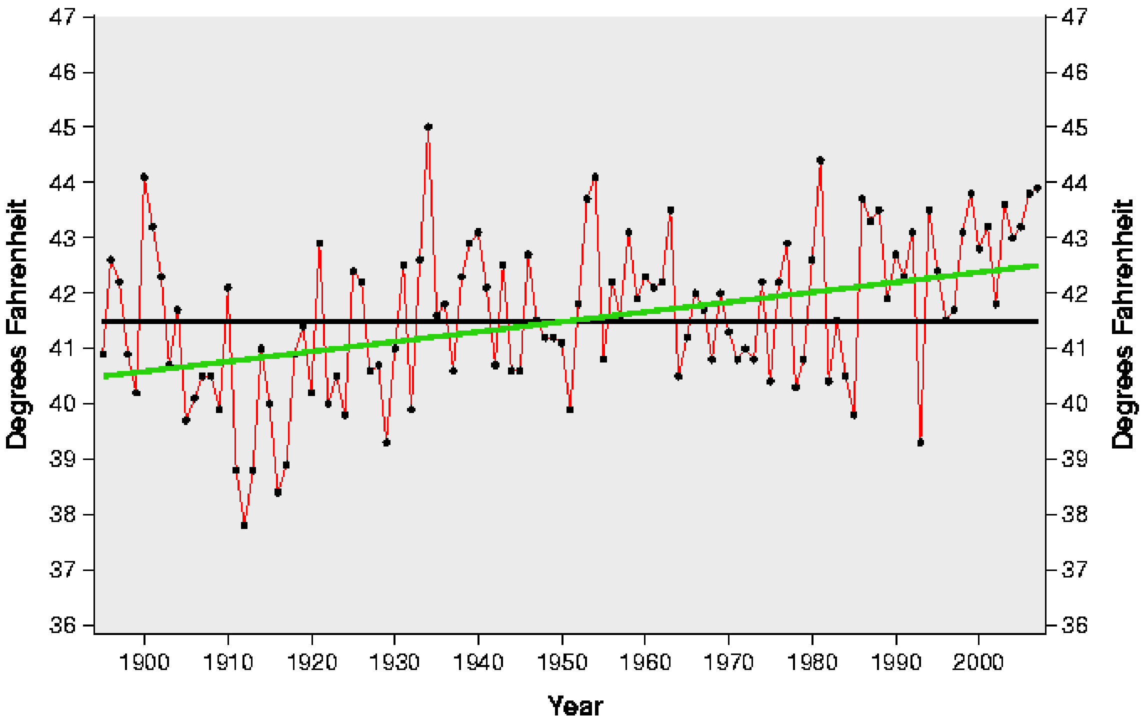


Figure 1. *Annual statewide average temperature history for Wyoming, 1895-2007 (available from the National Climatic Data Center, http://www.ncdc.noaa.gov/oa/climate/research/cag3/wy.html).*

Seasonal temperatures: When Wyoming annual temperatures are broken down into individual seasons, it can be seen that most of the warming of the past 113 years has occurred primarily during spring and summer, and that temperatures during fall and winter seasons have exhibited little century-scale changes. Still, throughout all seasons, there is a large degree of interannual and interdecadal variability.

Wyoming seasonal temperatures, 1895-2007

Seasonal mean temperatures

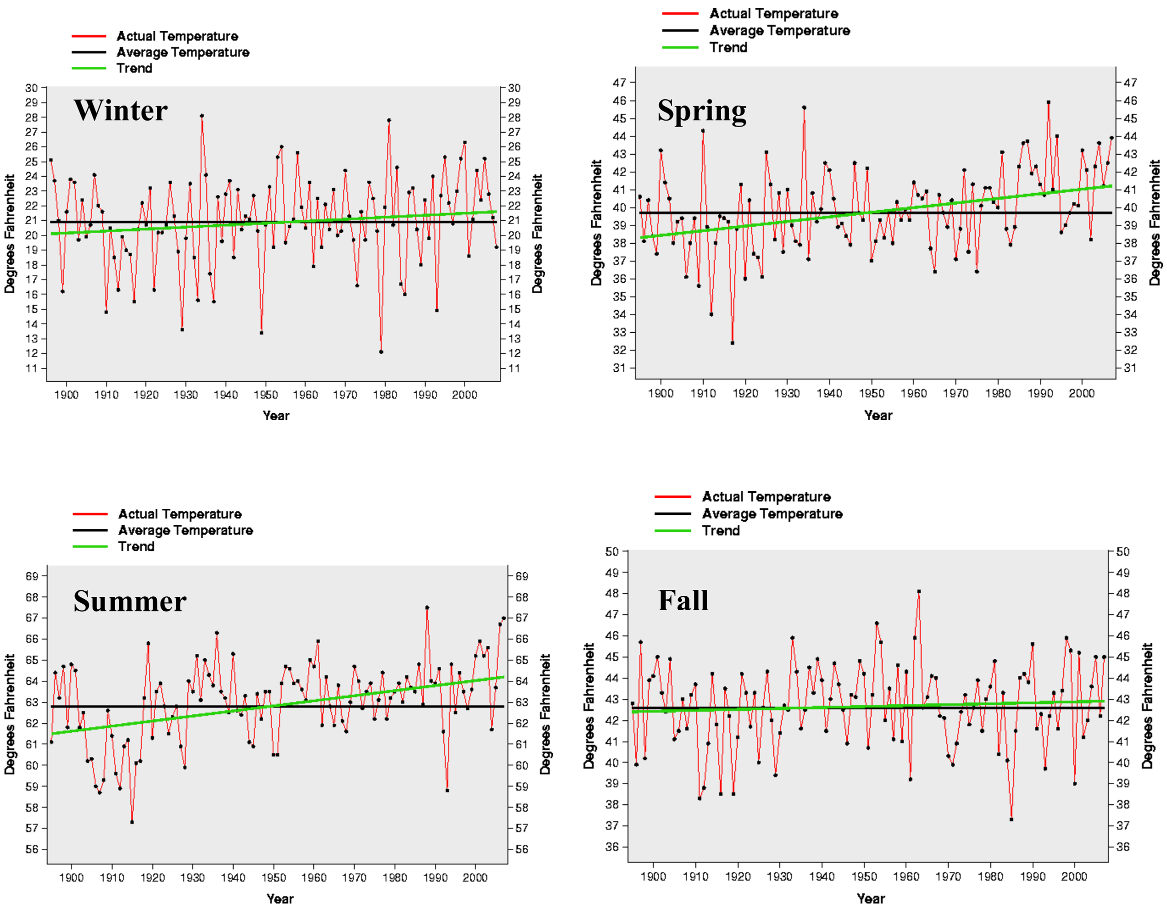
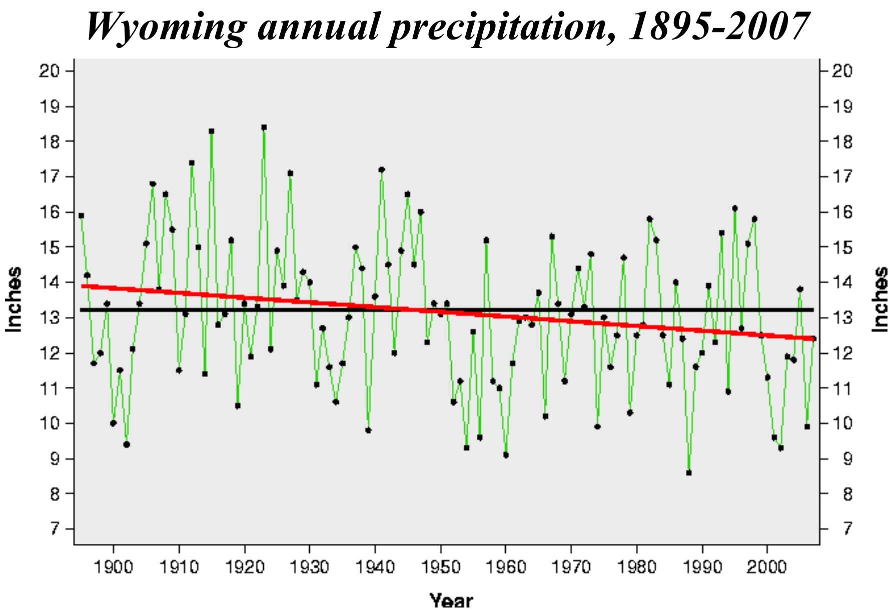


Figure 2. *Seasonal statewide average temperature history of Wyoming (source: National Climatic Data Center, http://www.ncdc.noaa.gov/oa/climate/research/cag3wy.html).*

Precipitation: The precipitation history of Wyoming indicates that the first half of the 20th century was wetter than the latter half, and thus exhibits an apparent overall downward trend. However, a trend in precipitation is not present since about 1950 indicating that there is not an ongoing tendency for less precipitation to fall over Wyoming.



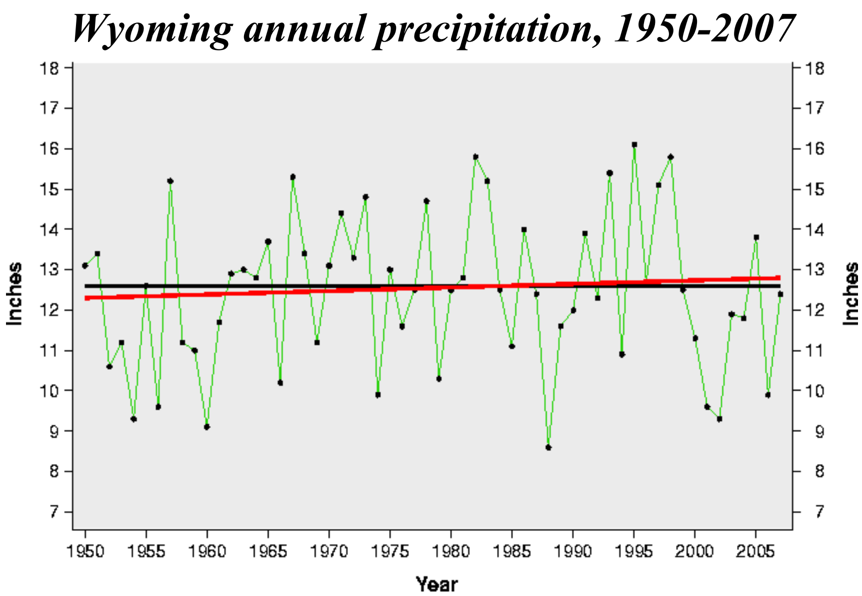


Figure 3. *Statewide average precipitation history of Wyoming. The first half of the 20th century was a wetter period in Wyoming than was the latter half of the 20th century. However, there has been no trend from 1950 through 2007 (source: National Climatic Data Center, http://www.ncdc.noaa.gov/oa/climate/research/cag3wy.html).*

Drought: Since 1895, there has been an overall trend towards drier conditions across Wyoming, likely a result of rising spring and summer temperatures coupled with a decline in precipitation from the early half of the 20th century to the latter half.

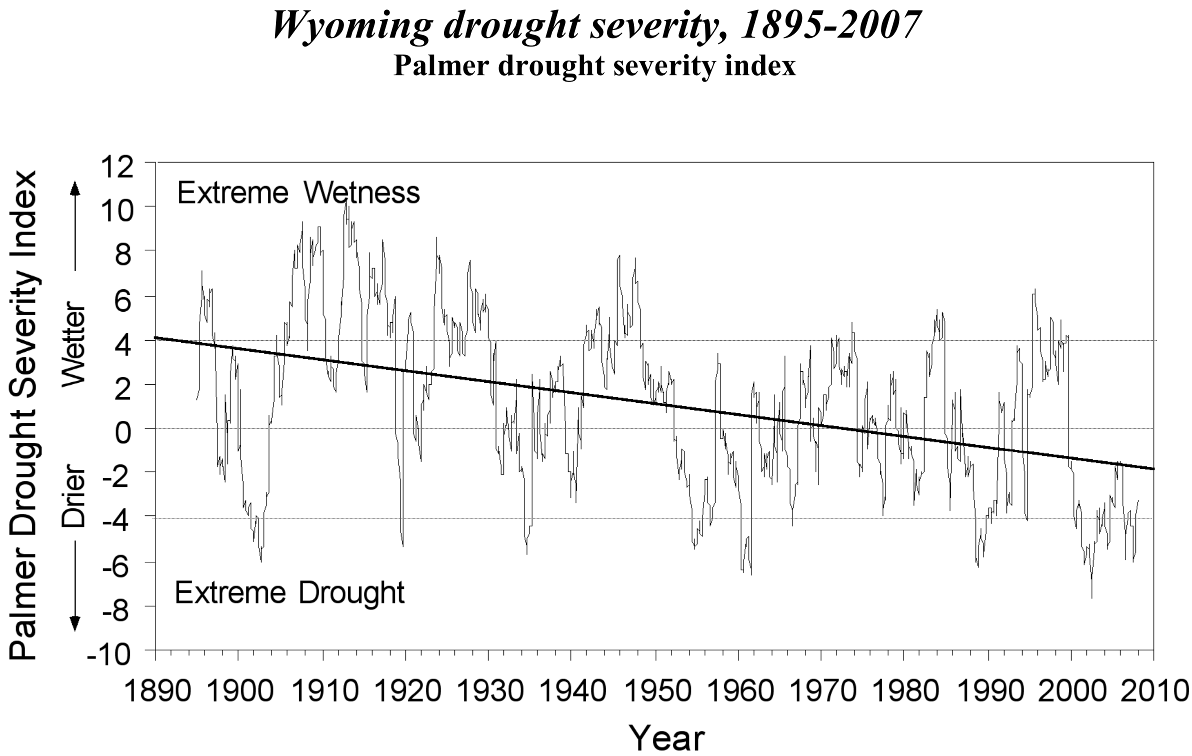


Figure 4. *Monthly statewide average values of the Palmer Drought Severity Index (PDSI) for the state of Wyoming, 1895-2007 (data from the National Climate Data Center, www.ncdc.noaa.gov)*

According to records compiled by the National Climatic Data Center since 1895, statewide monthly average Palmer Drought Severity Index values—a standard measure of moisture conditions that takes into account both inputs from precipitation and losses from evaporation—show statistically significant downward trend (towards drying), although short-term variations are still quite evident. The string of dry years since the year 2000 acts together with the wet period in the earth 1900s to induce a large negative trend in the drought record for Wyoming.

Paleodrought: The droughts experienced during the past century in Wyoming pale in comparison to the megadroughts that have occurred there in the past. The character of past climates can be judged from analysis of climate-sensitive proxies such as tree-rings. Using information about past precipitation contained in tree rings, Dr. Edward Cook and colleagues have been able to reconstruct a summertime PDSI record for Wyoming that extends back in time more than 2000 years.

Interestingly, the trend over the past two millennia has been towards generally *wetter* conditions. In fact, one of the wettest periods during the past 2,000 years in Wyoming, and across the American West at large, was the wet period that occurred during the early 20th century. But rather than anomalously wet periods, the most remarkable characteristic of the reconstructed drought history of Wyoming is the prolonged dry periods and "megadroughts" that occurred many time in past centuries—droughts that dwarfed any conditions experienced in recent memory. In fact, *average* conditions from about 0 AD to 1000 AD were drier than the *driest* 20-yr periods during the 20th century.

The paleo-climate records give us clear indication that droughts are a natural part of the Wyoming's climate system and thus should not be used as an example of events that are caused by any type of anthropogeninc climate change. Instead, they have been far worse in the past, long before any possible human influences.

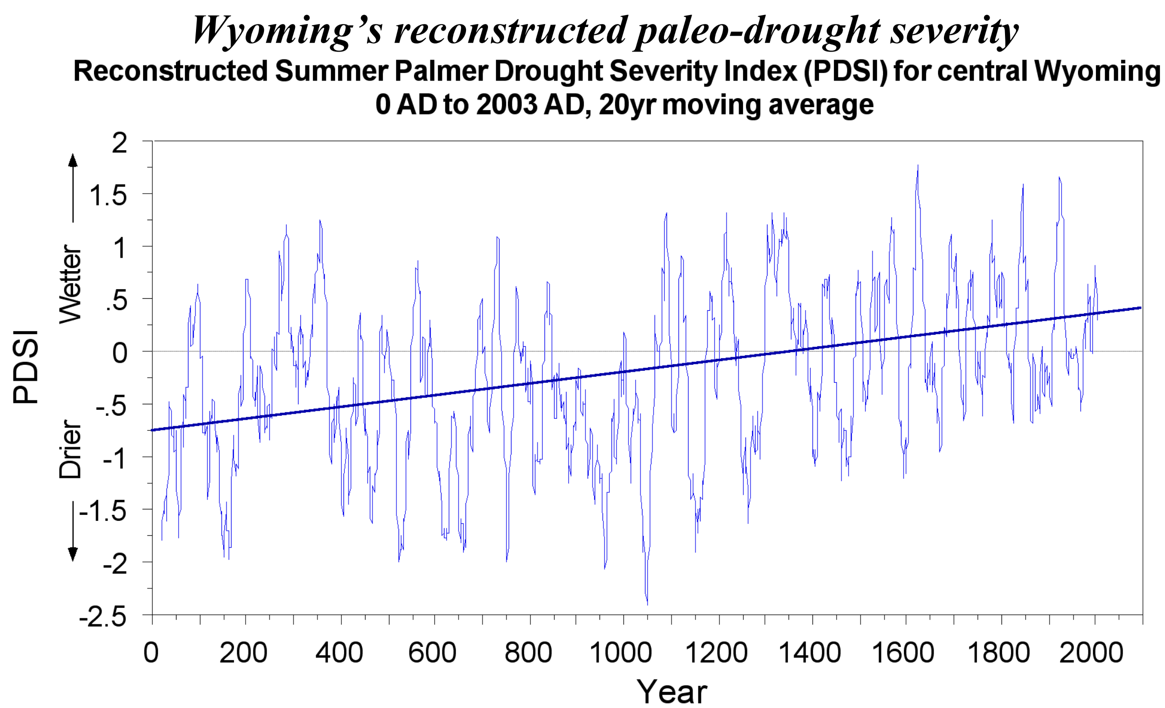


Figure 5. The reconstructed summer (June, July, August) Palmer Drought Severity Index (PDSI) for Wyoming from 0 A.D. to 2003 A.D. depicted as a 20-yr running mean. (National Climate Data Center, http://www.ncdc.noaa.gov/paleo/pdsi.html)

Wildfires: There is a clear link between dry conditions and the outbreak of wildfires across the western United States, including the state of Wyoming. Figure 6 shows the co-occurrence of regional wildfire and dry conditions in the U.S. Northern Rockies for the past several hundred years. Notice that most regional wildfire (red triangles) occur when conditions are dry (PDSI is below zero, or summer precipitation is less than normal). Most widespread wildfire outbreaks occur during times of low moisture levels.

Co-occurrence of droughts and wildfires in the Rocky Mountains

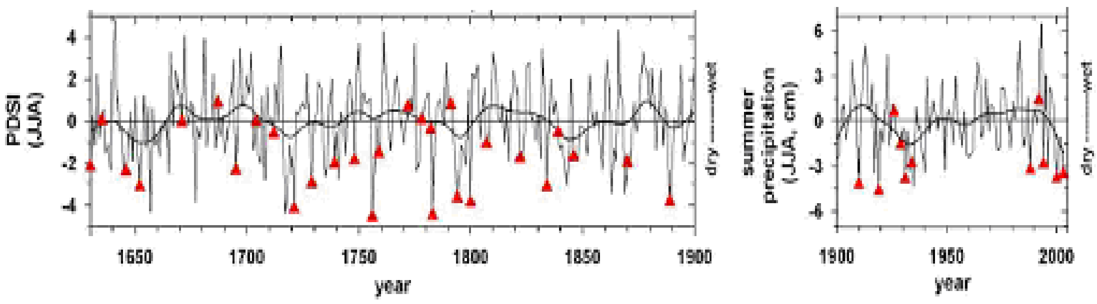


Figure 6. Reconstructed summer Palmer Drought Severity Index during historical years (left) and regional summer precipitation during modern years (right) overlaid with the occurrence of regional wildfires (red triangles) in the Northern Rocky Mountains. (Source Heyerdahl et al.)

And, as we have seen from our review of the paleodrought history of Wyoming (Figure 5), periods of low moisture levels are not uncommon and have been occurring for more than 2000 years.

A recent study created a paleo-reconstruction of wildfires across the western U.S. during the past 550 years using data collected on fire scars on trees (Kitzberger et al., 2007). In addition to finding the expected close occurrence between wildfires and droughts, the authors also found linkages between cycles of wildfire frequency and natural cycles of regional climate variability, both over the Pacific as well as the Atlantic ocean. These natural cycles can go along way to explaining much of the variability in wildfire outbreaks.

Throughout history, wildfire and drought have been linked together in Wyoming and the western United States. And wildfires and drought are both influenced by natural oscillations in patterns of sea surface temperature and atmospheric circulation systems in the Atlantic and Pacific oceans. There have been times in the past that have been extensively drier and have been associated with a greater frequency of wildfires than anything that we have experienced in the past 100 years, prior to any widespread human impact on the composition of the atmosphere. This demonstrates that without any possible human alterations past climate has changed and varied enough to make both drought and wildfire a common occurrence in Wyoming.

Vector-borne diseases: Malaria, dengue fever, and West Nile Virus, which have been erroneously predicted to spread owing to "global warming," are not tropical diseases. Climate change will accordingly have a negligible effect on their transmission rates. These diseases are readily controlled by well-known public health policies.

Malaria epidemics occurred as far north as Archangel, Russia, in the 1920s, and in the Netherlands. Malaria was common in most of the United States until the 1950s (Reiter, 1996). In the late 1800s, when the United States was colder than today, malaria was endemic east of the Rocky Mountains—a region stretching from the Gulf Coast all the way up into northern Minnesota, including the eastern half of Wyoming.

In 1878, 100,000 Americans were infected with malaria, and some 25,000 died. Malaria was eradicated from the United States in the 1950s not because of climate change (it was warmer in the 1950s than in the 1880s), but because of technological advances. Air-conditioning, the use of screen doors and windows, and the elimination of urban overpopulation brought about by the development of suburbs and automobile commuting were largely responsible for the decline in malaria (Reiter, 1996).

Malaria occurrence in the United States, 1880s

Figure 9. *In the late 19th century malaria was endemic in shaded regions, including the eastern half of Wyoming.* ***Source:*** *Reiter, 2001.*

The effect of technology is also clear from statistics on dengue fever outbreaks, another mosquito-borne disease. In 1995, a dengue pandemic hit the Caribbean and Mexico. More than 2,000 cases were reported in the Mexican border town of Reynosa. But in the town of Hidalgo, Texas, located just across the river, there were only seven reported cases (Reiter, 1996). This is just not an isolated example. Data collected over the past decade have shown a similarly large disparity between incidence of disease in northern

Mexico and in the southwestern United States, though there is very little climate difference.

Another "tropical" disease that is often wrongly linked to climate change is the West Nile Virus. The claim is often made that a warming climate is allowing the mosquitoes that carry West Nile Virus to spread into Wyoming. This reasoning is incorrect. West Nile Virus, a mosquito-borne infection, was introduced to the United States through the port of New York in summer 1999. Since its introduction, it has spread rapidly, reaching the West Coast by 2002. Incidence has now been documented in every state as well as most provinces of Canada. This is not a sign that the U.S. and Canada are progressively warming. Rather, it is a sign that the existing environment is primed for the virus. In the infected territories, mean temperature has a range more than 40ºF. The virus can thrive from the tropics to the tundra of the Arctic – anywhere with a resident mosquito population. The already-resident mosquito populations of Wyoming are appropriate hosts for the West Nile virus—as they are in every other state.

Impacts of climate-mitigation measures in Wyoming

Globally, in 2003, humankind emitted 25,780 million metric tons of carbon dioxide (mmtCO_2: EIA, 2007a), of which emissions from Wyoming accounted for 62.9 mmtCO_2, or only 0.24% (EIA, 2007b). The proportion of manmade CO_2 emissions from Wyoming will decrease over the 21st century as the rapid demand for power in developing countries such as China and India outpaces the growth of Wyoming's CO_2 emissions (EIA, 2007b).

During the past 5 years, global emissions of CO_2 from human activity have increased at an average rate of 3.5%/yr (EIA, 2007a), meaning that the annual *increase* of anthropogenic global CO_2 emissions is more than 10 times greater than Wyoming's *total* emissions. This means that even a complete cessation of *all* CO_2 emissions in Wyoming will be undetectable globally and would be entirely subsumed by rising global emissions *in just less than a month's time*. *A fortiori,* regulations prescribing a *reduction*, rather than a complete cessation, of Wyoming's CO_2 emissions will have no effect on global climate.

Wigley (1998) examined the climate impact of adherence to the emissions controls agreed under the Kyoto Protocol by participating nations, and found that, if all developed countries meet their commitments in 2010 and maintain them through 2100, with a mid-range sensitivity of surface temperature to changes in CO_2, the amount of warming "saved" by the Kyoto Protocol would be 0.07°C by 2050 and 0.15°C by 2100. The global sea level rise "saved" would be 2.6 cm, or one inch. A complete cessation of CO_2 emissions in Wyoming is only a tiny fraction of the worldwide reductions assumed in Dr.

Wigley's global analysis, so its impact on future trends in global temperature and sea level will be only a minuscule fraction of the negligible effects calculated by Dr. Wigley.

We now apply Dr. Wigley's results to CO_2 emissions in Wyoming, assuming that the ratio of U.S. CO_2 emissions to those of the developed countries which have agreed to limits under the Kyoto Protocol remains constant at 39% (25% of global emissions) throughout the 21st century. We also assume that developing countries such as China and India continue to emit at an increasing rate. Consequently, the annual proportion of global CO_2 emissions from human activity that is contributed by human activity in the United States will decline. Finally, we assume that the *proportion* of total U.S. CO_2 emissions in Wyoming – now 1.1% – remains constant throughout the 21st century. With these assumptions, we generate the following table derived from Wigley's (1998) mid-range emissions scenario (which itself is based upon the IPCC's scenario "IS92a"):

Table 1

Projected annual CO_2 emissions (mmtCO_2)

Year	Global emissions: *Wigley, 1998*	Developed countries: *Wigley, 1998*	U.S. (39% of developed countries)	Wyoming (1.1% of U.S.)
2000	26,609	14,934	5,795	63
2025	41,276	18,308	7,103	78
2050	50,809	18,308	7,103	78
2100	75,376	21,534	8,355	92

***Note:** Developed countries' emissions, according to Wigley's assumptions, do not change between 2025 and 2050: neither does total U.S or Wyoming emissions.*

In Table 2, we compare the total CO_2 emissions saving that would result if Wyoming's CO_2 emissions were completely halted by 2025 with the emissions savings assumed by Wigley (1998) if all nations met their Kyoto commitments by 2010, and then held their emissions constant throughout the rest of the century. This scenario is "Kyoto Const."

Table 2

Projected annual CO_2 emissions savings (mmtCO_2)

Year	Wyoming	Kyoto Const.
2000	0	0
2025	78	4,697
2050	78	4,697
2100	92	7,924

Table 3 shows the proportion of the total emissions reductions in Wigley's (1998) case that would be contributed by a complete halt of all Wyoming's CO_2 emissions (calculated as column 2 in Table 2 divided by column 3 in Table 2).

Table 3

Wyoming' percentage of emissions savings

Year	Wyoming
2000	0.0%
2025	1.7%
2050	1.7%
2100	1.2%

Using the percentages in Table 3, and assuming that temperature change scales in proportion to CO_2 emissions, we calculate the global temperature savings that will result from the complete cessation of anthropogenic CO_2 emissions in Wyoming:

Table 4

Projected global temperature savings (ºC)

Year	Kyoto Const	Wyoming
2000	0	0
2025	0.03	0.0005
2050	0.07	0.001
2100	0.15	0.002

Accordingly, a cessation of all of Wyoming's CO_2 emissions would result in a climatically-irrelevant global temperature reduction by the year 2100 of about two *thousandths* of a degree Celsius. Results for sea-level rise are also negligible:

Table 5

Projected global sea-level rise savings (cm)

Year	Kyoto Const	Wyoming
2000	0	0
2025	0.2	0.003
2050	0.9	0.02
2100	2.6	0.03

A complete cessation of all anthropogenic emissions from Wyoming will result in a global sea-level rise savings by the year 2100 of an estimated 0.03 cm, or one *hundredths* of an inch. Again, this value is climatically irrelevant.

Even if the entire Western world were to close down its economies completely and revert to the Stone Age, without even the ability to light fires, the *growth* in emissions from China and India would replace our *entire* emissions in little more than a decade. In this context, any cuts in emissions from Wyoming would be extravagantly pointless.

Costs of Federal Legislation

And what would be the potential costs to Wyoming of legislative actions designed to cap greenhouse gas emissions? An analysis was recently completed by the Science Applications International Corporation (SAIC), under contract from the American Council for Capital Formation and the National Association of Manufacturers (ACCF and NAM), using the National Energy Modeling System (NEMS); the same model employed by the US Energy Information Agency to examine the economic impacts.

For a complete description of their findings please visit:
http://instituteforenergyresearch.org/economic-impact/index.php

To summarize, SAIC found that by the year 2020, average annual household income in Wyoming would decline by $894 to $2898 and by the year 2030 the decline would increase to between $3678 and $6707. The state would stand to lose between 2,000 and 3,000 jobs by 2020 and between 6,000 and 8,000 jobs by 2030. At the same time gas prices could increase by nearly $5 a gallon by the year 2030 and the states' Gross Domestic Product could decline by then by as much as $1.4 billion/yr.

And all this economic hardship would come with absolutely no detectable impact on the course of future climate. This is the epitome of a scenario of all pain and no gain.

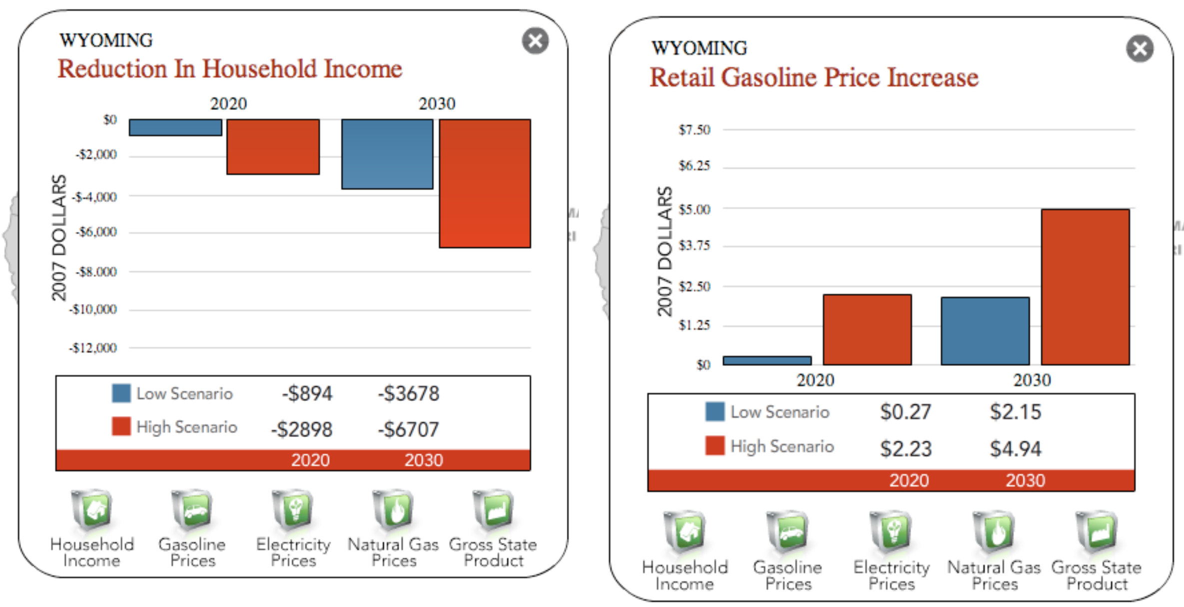


Figure 8. *The economic impacts in Wyoming of federal legislation to limit greenhouse gas emissions green. (Source: Science Applications International Corporation, 2008, http://instituteforenergyresearch.org/economic-impact/index.php)*

Wyoming Scientists Reject UN's Global Warming Claims

At least 198 Wyoming scientists have petitioned the US government that the UN's human-caused global warming hypothesis is "without scientific validity and that government action on the basis of this hypothesis would unnecessarily and counterproductively damage both human prosperity and the natural environment of the Earth."

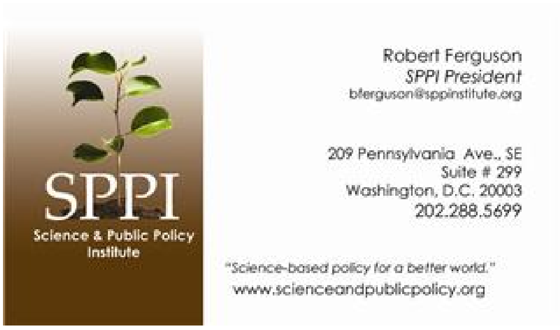
They are joined by over **31,072** Americans with university degrees in science – including **9,021** PhDs.

The petition and entire list of US signers can be found here:
http://www.petitionproject.org/index.html

Names of the Wyoming scientists who signed the petition:

Charles K. Adams, John W. Ake, William W. Allen, Percy G. Anderson Jr., Lowell Ray Anderson, Marion L. Andrews, Lance L. Arnold, Joseph P. Bacho, Donald T. Bailey, Robert C. Balsam Jr., Charles J. Barto Jr., Curtis M. Belden, John C. Bellamy, PhD, Joseph C. Bennett, Donald W. Bennett, Floyd A. Bishop, David Bishop, Lloyd P. Blackburn, Richard G. Boyd, Dennis Brabec, Lee Brecher, PhD, Francis M. Brislawn, Paul Brutsman, J. B. Bummer, Roger T. Bush, John D. Campanella, Scott P. Carlisle, Carl D. Carmichael, Keith T. Carron, PhD, Paul C. Casperson, MD, Marci M. Chase, Robert H. Chase, Robert G. Church, E. James Comer, Daniel P. Coolidge, Robert F. Cross, PhD, John J. Culhane, Ray Culver, William Hirst Curry, PhD, Jan Curtis, Steve L. Dacus, Mark A. Davidson, Dick Davis, PhD, Robert Joseph Dellenback, PhD, Hugh D. Depaolo, Martin L. Dobson, Scott N. Durgin, John C. Elkin, Fred M. Emerich, DVM, Paul M. Fahlsing, Susan J. Fahlsing, Kenneth K. Farmer, S. R. Faust Jr., Ray A. Field, PhD, Stuart C. Fischbeck, J. Goolsby, PhD, James E. Greer, Richard C. Greig, Durward R. Griffith, Falinda F. Hall, Daniel J. Haman, Homer R. Hamilton, PhD, C. J. Hanan, W. Dan Hansel, Paul Michael Harnsberger, Robert A. Harrower, William D. Hausel, W. Dan Hausel, Mike C. Hawks, Henry William Haynes Jr., PhD, Scott J. Hecht, Bill K. Heinbaugh, John H. Hibsman Jr., Paul R. Hildenbrand, Mark Hladik, Michael S. Holland, Kenneth O. Huff, G. William Hurley, Irven Allan Jacobson, Eldred D. Johnson, Archie C. Johnson, Terrell K. Johnson, Jack B. Joyce, Victor R. Judd, William T. Kane, PhD, J. Kauchich, William Keil, Kevin Kilty, PhD, Leroy Kingery, Robert W. Kirkwood, Duane D. Klamm, Paul Koch, PhD, Robert A. Koenig, Bernard J. Kolp, PhD, Joe E. Kub Jr., Harry C. La Bonde Jr., Richard Laidlaw, PhD, Jerry T. Laman, Donald Roy Lamb, PhD, John R. Landreth, Robert B. Lane, William Anthony Laycock, PhD, Lewis A. Leake, Howard R. Leeper, Dayton A. Lewis Jr., Don J. Likwartz, Michael C. Lock, Thomas L. Lyle, Richard E. Mabie, Don Madden, Rick D. Magstadt, L. C. Marchant, Leland Condo Marchant, Robinson McCune, John F. McKay, PhD, Robert "E. ""Bob""" McKee, Edmund Gerald Meyer, PhD, John W. Miller, Reid J. Miller, Kenneth R. Miller, Terry S. Miller, Tom D. Moore, Howard B. Moreland, Harold Mosher, Roger B. Mourich, Lance T. Moxey, DVM, Evart E. Mulholland, Ralph W. Myers, Lance Neiberger, Judith E. Nelson, Daniel Anthony Netzel, PhD, Keith A. Neustel, Mark A. Newman, Despina I. Nikolova, Lee Nugent, Edmond L. Nugent, Robt D. Odell, R. D. Odell, Robert D. O'Dell, Paul O. Padgett, Thomas Parker, Bruce H.

Perryman, Paul T. Peterson, Donald Polson, Larry C. Raymond, Wallace K. Reaves, Paul Albert Rechard, Kenneth F. Reighard, Steven Y. Rennell, Timothy C. Richmond, Robert W. Riedel, Terry P. Roark, PhD, W. F. Robertson, Ted Roes lll, A. R. Rogers, Arthur R. Rogers, Robert G. Rohwer, Larry J. Roop, Richard D. Rosencrans, David H. Scriven, Leslie E. Shader, PhD, Riley Skeen, Terry K. Skinner, Ralph Smalley Jr., Ray C. Smith, DVM, Thomas B. Smith, Stan Smith, James P. Spurrier, Robert J. Starkey Jr., PhD, Richard Steenberg, Larry R. Stewart, Donald Leo Stinson, PhD, Tony C. Stone, Eldon D. Strid, K. Sundell, PhD, Archer D. Swank, Tim L. Thamm, S. Thompson, Keith A. Trimels, John F. Trotter, Ron M. Tucker, Kenneth F. Tyler, Ronald D. Wagner, Jon H. Warner, B. Watne, PhD, Larry Weatherford, PhD, Michael Wendorf, Frank D. Werner, PhD, Robert J. Whisonant, Douglas C. White, Donna L. Wichers, James Williams, Larry Dean Hayden Wing, PhD, Robert D. Winland, Bruce M. Winn, Charles K. Wolz, Bret H. Wolz, Marcelyn E. Wood



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