

# Climate Change Texas: The Worst-case Scenario is Happening Now

*An Evaluation of Recent Academic Work on Ongoing and Regional  
Climate Change Impacts and the Latest Future Projections*

Bruce Melton PE  
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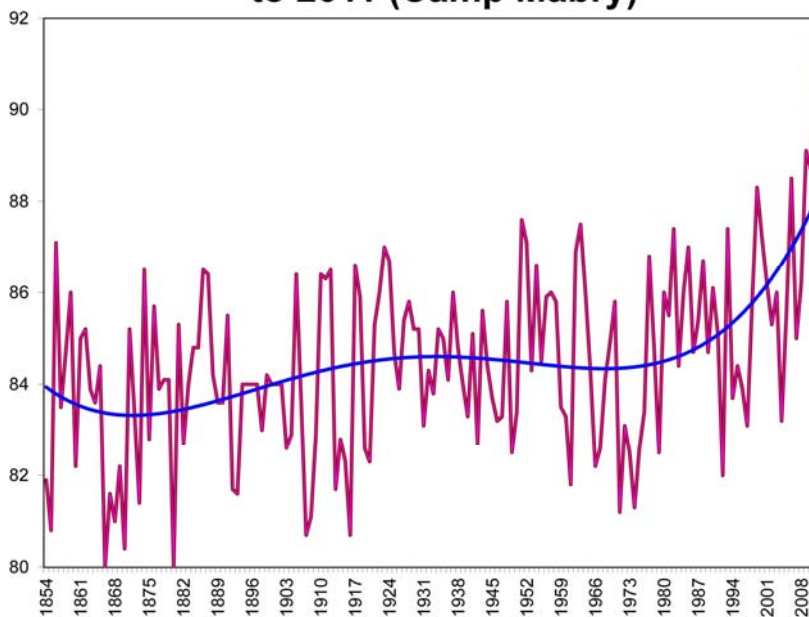
[Caption: Austin, Texas, Late Summer 2011: This is not autumn in Central Texas. The fall leaf drop does not begin here until about mid-October and extends through the first of the year. This photo shows the tree kill in a suburban neighborhood in Southwest Austin (Scenic Brook Drive).

AUSTIN -- If this is not dangerous climate change, then this is exactly what dangerous climate change will be like in as little as a decade. What has been happening in Texas, with these unprecedented (in time frames that matter) droughts and wildfires, is exactly what the climate scientists have been warning us about for over 20 years. We have been building up to this point since about the turn of the century, and now ecosystems have tipped over the edge. Climate feedbacks have kicked in hard.

The Texas Forest Services tells us that a half billion trees have died. The first of this series of droughts in 2005/6 was just classified as extreme. The last two have been one category worse than extreme—the exceptional category. The last 12 months were drier than the worst 12 months of the great drought of the 1950s. This has been a \$10 billion drought, with another \$1 billion in damages from the fires.

Worse, it's hotter now. This summer was 5.4 degrees warmer than average. This may not seem like a lot, but think how sick you would be if you had a 104 degree temperature. The reason that increased heat makes such a big difference in a drought is that extra heat greatly increases evaporation. Four percent more water evaporates for every degree of temperature increase. With 5.4 degrees of warming above average, summertime evaporation in Austin was more than 22 percent greater than normal. In other words, the same drought is much worse if it is only a little hotter. In the same breath, even with normal rainfall, because of warmer temperatures, drought can persist because of much greater evaporation. The warmer temperatures are easy to see looking at the average August temperature for the period of record.

**Austin Average August Temps 1854 to 2011 (Camp Mabry)**



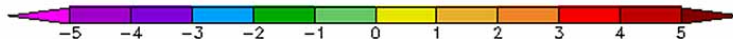
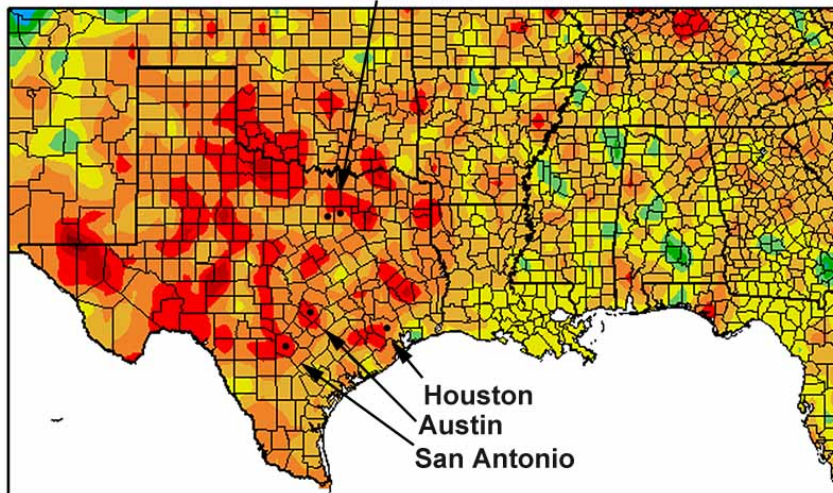
It is important to talk about the urban heat island effect here too. The chaos of information presented by our media today does little to shed light on the latest climate science. An evaluation of regional temperature departure from normal for 2011 shows the exceptional nature of this most recent in a string of droughts.

Urban heat island signatures are easily evaluated and constant correction is an integral part of climate work on global land/ocean temperatures. Corrections are made through the comparison of individually impacted weather stations and their normal neighboring rural weather stations. Published work on the heat island effect shows that even without correction, the heat island's influence on global temperatures is as yet inconsequential because of the relative size of the heat islands compared to the global surface.

**Departure from Normal Temperature (F)**

1/1/2011 - 12/31/2011

**Dallas/Fort Worth**



Generated 1/2/2012 at HPRCC using provisional data.

Regional Climate Centers

The evaluations can also be visually confirmed looking at the temperature departure from normal for the region during the 2011 drought. Where the heat island effect looks to be dramatically visible in the Austin and San Antonio metropolitan areas, it is dramatically absent from the Houston and Dallas metro areas.

The total number of fires in Texas since November 2010 (through September 20, 2011) is 22,790, totaling 3,759,331 acres. This exceeds the previous record of 2.1 million acres, set in just 2005/6, by 80 percent. We almost doubled the last record, set just five years ago.

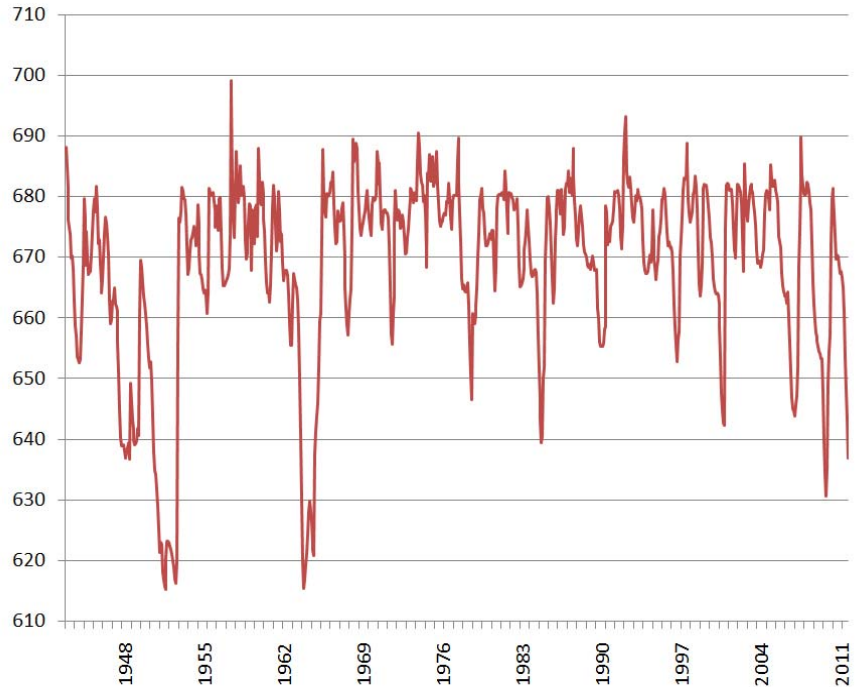
Thirty-three percent of U.S. wildland fires this year have been in Texas. This number is 61 percent greater (as of September 2011) than the 10-year national average for the entire United States. Six of the 10 largest wildfires in Texas history have occurred in 2011.

Sure, there have been bigger droughts and bigger fires in the early 1900s or the 1800s or the 1,300 hundreds or 3,000 year BC, but our complicated society did not evolve back then. We do not have the water to support our region today. This is why we have water use restriction in effect now, and last summer and every summer since the turn of the 21st century.

It cannot be emphasized more that this is exactly what our climate scientists have been warning us would happen for the last 20 or 30 years. Only their warnings were generations distant from actual impacts happening today. The impacts happening now are far ahead of the projected schedule. The reason is that the projected future climate changes have always been based on the middle of the road “Kyoto” suggested emissions behaviors.

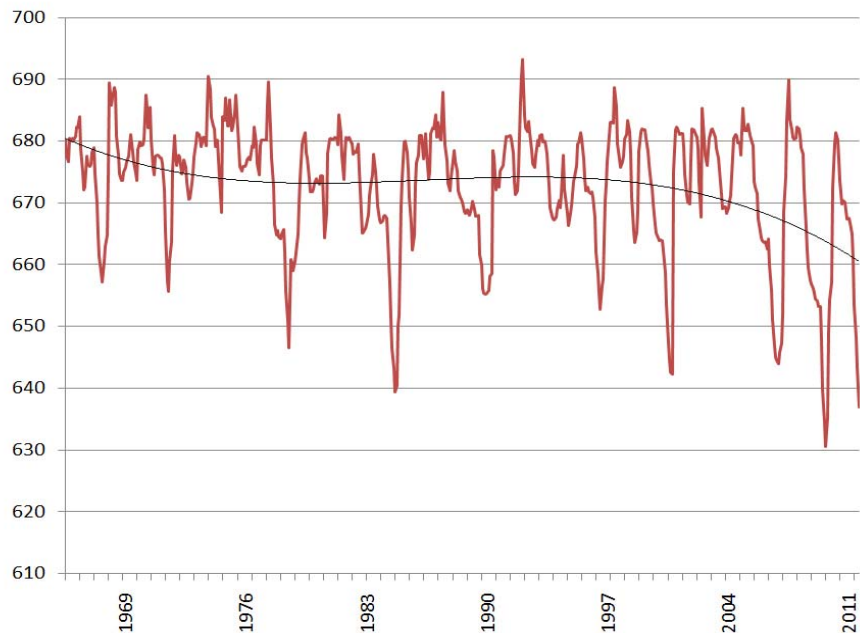
Our society has not limited our emissions as was suggested by climate scientists to be a prudent way of avoiding dangerous climate change. What should have been a global emissions path reduction to a few percentage points less than the emissions made in 1990 has instead

### Lake Travis Water Surface Elevation 1943 to 2011



Casual observation tells us that there have been two droughts (1951 and 1964) much larger than our recent drought. What is not shown in this graph is that LCRA discharged water to generate electricity until the mid 1960s. The amount of water needed for electrical generation is far greater than used for drinking and still much greater than what is used for irrigation downstream. Since the mid 1960s, LCRA only generates electricity when they are releasing irrigation water or excess stormwater. They no longer release water just to generate electricity.

### Lake Travis Water Surface Elevation 1964 to 2011



When we start comparing apples a little more closely to apples, leaving off the data where LCRA was releasing massive amounts of water for electricity generation, a trend does become apparent. The question is: “Is this trend a natural cycle or is it related to climate change?” The answer is unrelated to whether or not this trend is anything more than normal weather fluctuations. Statistically, we can not yet say. Morally? For over twenty years now, climate scientists have been telling us that things like this are going to happen in the future if we do not control our greenhouse gas emissions. We have yet to begin controlling our GHG emissions.

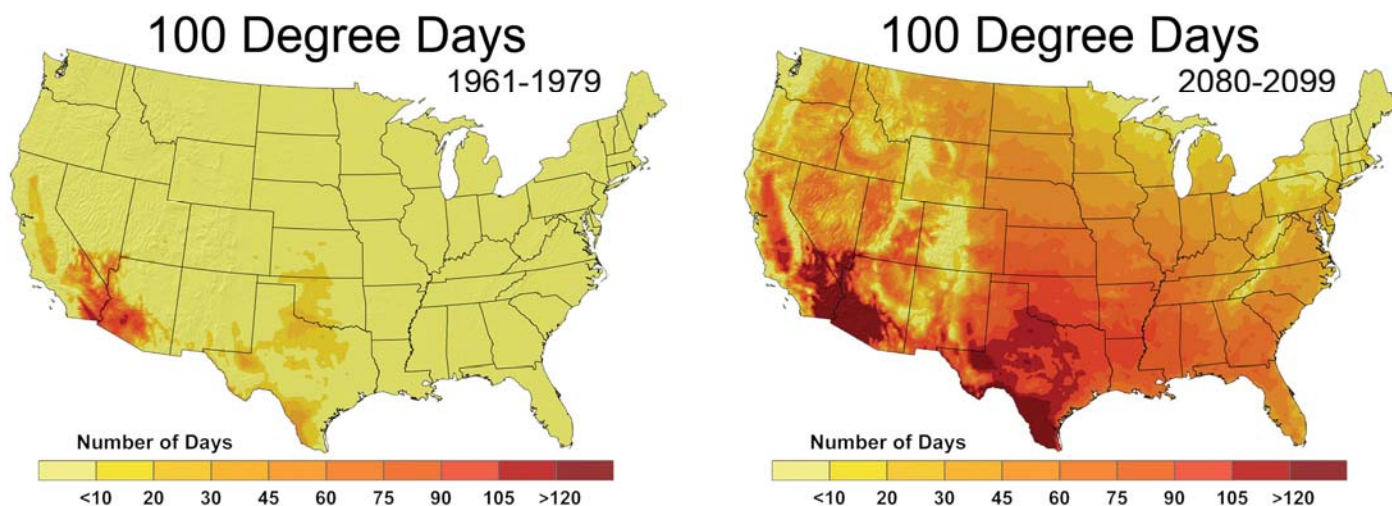
seen emissions grow to fifty percent greater than they were in 1990. Climate scientists warned us that if we did not significantly limit our emissions, our climate would change much faster, with much greater risks of even larger changes do to positive feedbacks that we were just beginning to understand.

Since the IPCC stopped taking papers for the 2007 report in 2005, we have learned a lot about these feedbacks. We have also been able to document changes to our climate happening much faster than previously projected and these two things are, as suggested by our climate scientists for a generation or more, intimately related.

In June 2009, the U.S. Global Change Research Program (USGCRP), founded by Ronald Reagan, published a report that tells us that by 2080, Austin will see an average of 90 to 120 days of 100 degree weather every year—10 times more than today's average of 12 days per year.

## U.S. Global Change Research Program

(Global Change Research Act of 1990, Office of the President)



Based on middle of the road emissions scenarios, Texas will see summer temperatures as hot as or fifty percent more extreme as the Sonoran Desert Research station in Arizona today. USGCRP, *Global Climate Change Impacts in the United States*, Thomas R. Karl, Jerry M. Melillo, and Thomas C. Peterson, (eds.). Cambridge University Press, 2009.

Look Closely at Arizona. The area of the map with 100 degree day data from the 1961-1979 data can be considered to be representative of the average for the 20<sup>th</sup> century. What the USGCRP tells us is that enormous areas of the North American continent will see the same climate that has seen the evolution of the Saguaro Cactus, in the Sonoran desert of south central Arizona or in many cases, a climate that is up to 50 percent more extreme than that of the Sonoran Desert today.

But the most mind-boggling part of this future projection is that it is based on the IPCC A1B scenario. This is one of the middle of the road emissions scenario families where our society makes a modest effort to reign in greenhouse gas emissions. It is loosely based on a path that could be represented by efforts with the Kyoto protocol where new efficient technologies are rapidly put into use and there is a balanced emphasis on all energy sources. For decades it has been considered to be the most likely scenario of actual emissions. But this thinking is enormously dated. We are currently smack-dab in the middle of the worst-case scenario considered by climate models. Even with the economic recession, global carbon emission in 2010 were double the recent average and as high as anything seen since the late 1970s/early 1980s.

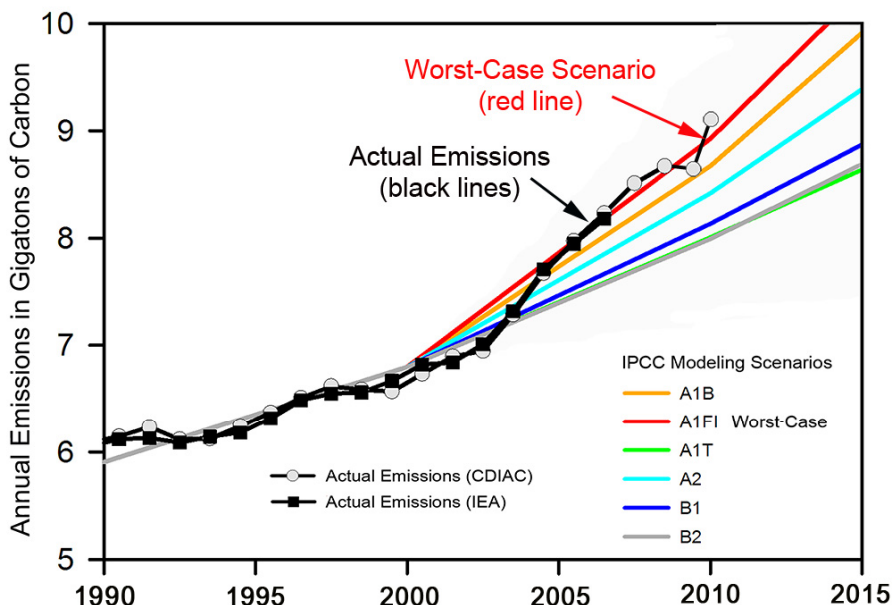
Let me repeat one more time: The USGCRP projections are based on the middle of the road scenario. We are currently on the worst-case scenario path. This means that temperature change will be more to significantly more than we have been expecting for decades. And this is one of the main reasons why our climate has already changed so much, so rapidly and why future change will be even faster than projected. This middle of the road scenario is also considered in the next two examples of climate projections as well. It is very clear from discussions of these results by the principal investigators in their research papers that these results are conservative and the future is very likely to see changes that are greater than what are indicated.

A paper in *Geophysical Research Letters* in July 2010 by two researchers from Stanford and Purdue (Diffenbaugh and Ashfaq) tells us that climate conditions will continue to rapidly worsen in the interior of North America and especially the West. The worsening will be so rapid that in Central Texas the current decade of 2010 to 2019 will see two to three droughts as bad as or worse than the drought of the 1950s.

Beginning in just 8 years, in the decade 2020 to 2029, Central Texas will see four to five droughts as bad as or more extreme than the drought of the 1950s.

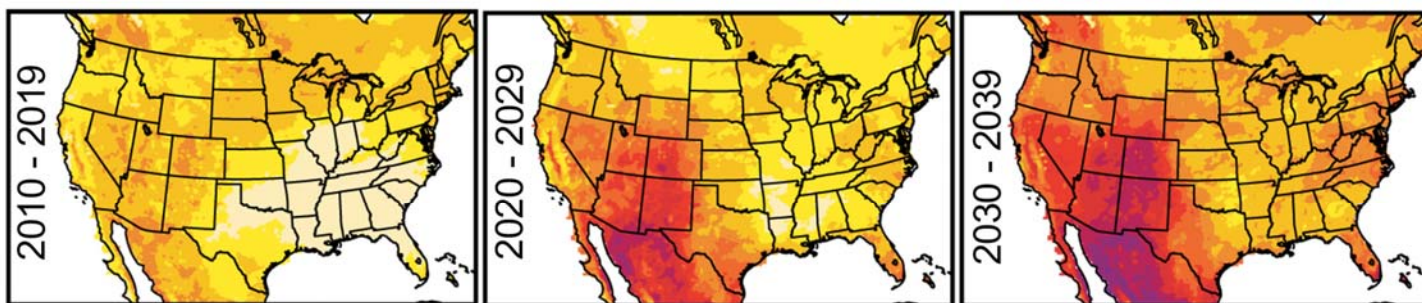
The implications of these projections are staggering. And remember, these projections are based on the middle of the road scenario. It is quite likely that changes will be even greater than what these Stanford researchers suggest.

### IPCC Model Scenarios vs. Actual Emissions



Observed global fossil-fuel and industrial CO2 emissions compared with averages of 6 scenario groups from the IPCC Special Report on Emissions Scenarios (colored lines). The Carbon Dioxide Information and Analysis Center (CDIAC) and the International Energy Agency provided the current observations of CO2 emissions. The latest update was obtained from [www.globalcarbonproject.org](http://www.globalcarbonproject.org).

Source: *Synthesis Report, Climate Change, Global Risks, Challenges and Decisions, Climate Change Congress, International Alliance of Research Universities, University of Copenhagen, March 2009. Raupach and Canadell, Carbon and the Anthropocene, Current Opinion in Environmental Sustainability, August 2010. Updated 2008 to 2010: CDIAC 2009 = 8.627 Gtons C, CDIAC 2010 = 9.137 Gtons C.*



Research out of Stanford and Purdue shows that the hottest season from 1951 to 1999 will be repeated two to three times across much of the U.S. in just the next decade. (Diffenbaugh and Ashfaq 2010)



A report out of the National Climatic Data Center in February 2011 (Dia) tells us that beginning in just 19 years (2030) Dust Bowl conditions will be the average climate condition across much of the interior of the U.S. By 2060, much of the interior of the nation will be two to three times as bad as the Dust Bowl with some areas four to five times more extreme than the Dust Bowl.

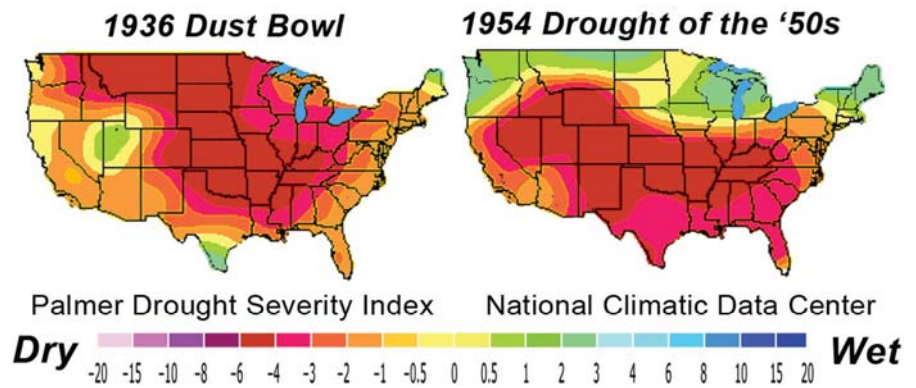
The 20-year projection is sobering. What is depicted here is the average condition. Across much of the United States, the average drought condition will be similar to that of the Dust Bowl. It is very important to understand that these findings indicate the average condition. Some years will be worse, but on average, it will be as bad as the Dust Bowl—continually—and in some areas four to five times as bad as the Dust Bowl. What is most important to remember about exceptionally extreme events such as these is that it is the most extreme events that do the most damage. Climate change increases the occurrence of these most catastrophic of events. As the temperature increases, the number of extreme events disproportionately increases too. What this means is that a little warming increases the number of extreme events a lot, not a little.

By mid-century however, we reach completely catastrophic levels of continuous drought several times more extreme than the Dust Bowl. Implication of this type of non-stop drought and adaptation strategies for these extreme conditions have simply not been contemplated in the literature. Significant work is underway to gain insight into these situations that seemed so improbably just a few years ago.

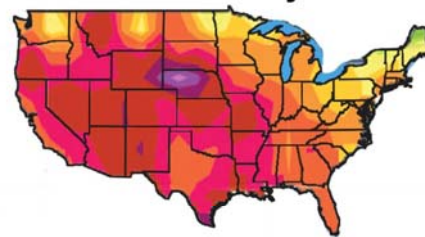
Again, I must insist on repeating that this research, like that from Stanford and the USGCRP, looks at the A1B scenario or a middle of the road climate emissions projection. In reality we are now on the worst-case path. Climate changes are almost certain to be more extreme than these studies have shown.

This is no longer business as usual. Water use restrictions will not meet this challenge alone. We must act now to convince our leaders that this is not just another in a long string of extraordinary weather events that we cannot yet blame on climate change. If we do not immediately change our habits and lifestyles, we will run out of water. Our forests are already dying because they have run out of water. The evidence supporting the relationship between this string of unprecedented droughts and climate change is overwhelming.

A paper by Kevin Trenberth and colleagues from the National Center for Atmospheric Research, Scripps Institute and The Weather Underground has summarized 61 different findings concerning climate changes already occurring and dating back to 1998. An example of these findings includes the Moscow Heat Wave of 2010 where over 60,000 died. The findings show that this heat wave was 80 percent likely to have been caused by climate change.

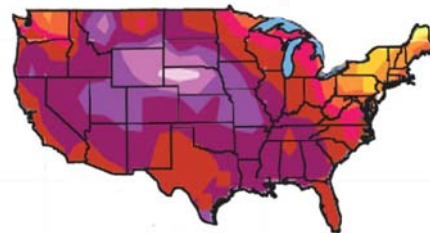


### 2030 - 2039 Projection



The results of 21 climate models using the IPCC A1B scenario and represented using the Palmer Drought Severity Index, as compared to the Dust Bowl and the Drought of the '50s. There is little difference between the two biggest droughts of the twentieth century and about the year 2035. Dust bowl-like conditions will not disappear however, but will worsen significantly. If immediate reductions in greenhouse gas emissions are made, Dr. Dai says conditions in 2060 - 2069 will be slightly less extreme than shown.

### 2060 - 2069 Projection



Reference: North American Drought, Paleo Perspective, National Climatic Data Center, Dai, Drought under global warming - a review, Wiley Interdisciplinary Reviews, Climate Change, p 45 through 65, January / February 2011.

A draft paper by James Hansen, Director of the NASA Goddard Institute for Space Studies (The main U.S. climate modeling agency) tells us that the Texas drought in 2011 is significantly similar to the Moscow heat wave (only we have a lot more air conditioning in Texas contributing to far fewer deaths.) The Hansen paper speaks to the issue that, because our climate has so significantly changed, all weather now must be considered to have been caused by climate change.

Many of us have heard by now that it was much drier during the droughts of the 1600s, 1700s and 1800s before reliable record keeping began in Texas. These droughts however, do not hold a candle to what scientists have discovered to be true “megadroughts.” Two of them happened between the 900s and about 1350. These droughts saw rainfall drop to 25 percent of normal and they lasted for centuries—hundreds of years!

Water level changes of hundreds of feet in closed basin lakes of The Great Basin show that these droughts were widespread. Hundred-year old trees growing a hundred feet or more below the current water level attest to that. The climate also likely changed quite rapidly when rain did begin to fall again because many of these trees remain intact with their branches, submerged and semi-preserved in the cold waters. One tree in Jenny Lake at the foot of the Grand Tetons in Wyoming still has a raptor nest in it, now about a thousand years old.

There is also evidence that large portions of the Great Plains desertified during these droughts. This is one of those big things the climate scientists have been warning us about now for decades. During these desertification events, much of the Great Plains actually changed to a sea of shifting sand. This desertification was much larger than that at the turn of the 19th century that fostered the term “Great American Desert.”

Sure, there have been bigger droughts and bigger fires in the early 1900s or the 1800s or the 1300 hundreds or 3,000 years BC, but our complicated society did not have 1.7 million people in the Austin/Round Rock Metropolitan Area then.

Projections of climate changes from a few decades ago have been shattered. Future projections are exceedingly stark, and these projections are based on the middle of the road scenario—far, far from where our emissions are today. Now the climate scientists are warning us of upcoming weather far more extreme than our civilization has ever experienced and that our society will have difficulty adapting.

We must prioritize our actions towards immediate action *and* adaptation strategies far more rigorous than anything yet contemplated. Climate scientists continue to warn us, and their warnings continue to worsen.

Our State Climatologists has attributed only a small portion of our 2011 event to climate change. I have amassed a very large amount of data over the years looking at this issue in Central Texas and specifically the validity of the previous heat wave of record in the mid 1920s. The culmination of this work can be seen in a three part series published on an investigative internet journal the Rag Blog. A summary of my reporting shows that the heat records of the mid 1920s are likely to be in error. This means that the 2011 heat wave was not an event that shattered the previous record by more than 30 percent. It means that the 2011 event likely obliterated the previous record event by over 100 percent. This of course means that our State Climatologists opinion of the science is significantly dated. These articles can be seen at:

<http://theragblog.blogspot.com/2011/12/bruce-melton-welcome-to-climate-change.html>

Even with the erroneous 1923 and 1925 heat records intact in the data, what we have just seen in Central Texas, in combination with the warnings we have been given for over two decades and the evidence showing the global trend of climate change is much faster than previously assumed; scientifically and morally there is no reason to doubt that climate change is not the cause.

The solutions however, will be nowhere near as expensive or “ruinous to our economies” as have been suggested by many voices reported by the media. The most recent academic evaluations of the solutions to the cleaning up climate change pollution have shown that costs will be exceedingly non-ruinous. Many non-academic sources are also claiming that this “new energy economy” that we are embarking upon will not only

be highly prosperous for humankind, but it will also be highly profitable for humankind as well. Historically, this kind of fundamental societal change is very well correlated with highly prosperous and highly profitable historic changes to our civilization. Much more on this topic is also included in the three part series mentioned above.

*Bruce Melton is a professional engineer, environmental researcher, filmmaker, writer and front man for the band Climate Change. You can see his latest climate change outreach, films, writing and music at [www.meltonengineering.com](http://www.meltonengineering.com) Bruce's new book, *Climate Discovery Chronicles*, detailing 41 recent discoveries in climate science with 100 color photos, was published in November and is available from Amazon or Barnes and Noble's website. It can also be ordered from any bookstore through Ingram Publishing. For more information go to:*

<http://www.meltonengineering.com/Climate%20Discovery%20Chronicles%20Book%20Series.html>

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