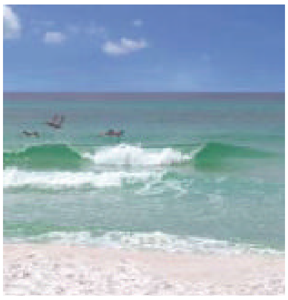
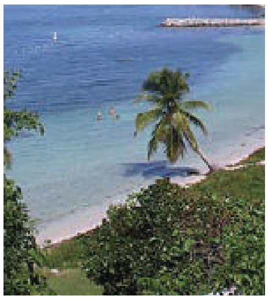
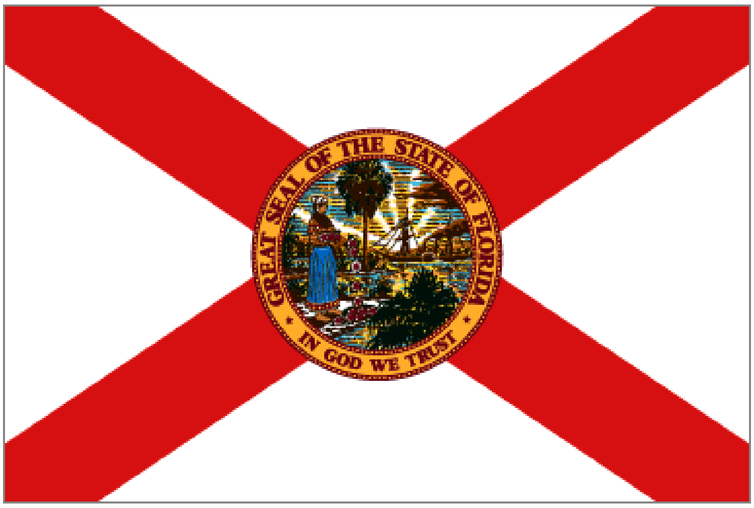
Observed Climate Change and the Negligible Global Effect of Greenhouse-gas Emission Limits in the State of Florida







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Background and Summary

In October 2008, the Governor's Action Team on Energy and Climate Change released a draft version of its 14-month effort of developing an Action Plan aimed at reducing greenhouse gas emissions from Florida. The impetus behind the creation of the Action Team and the development of the Action Plan grew out of a summit on climate change ("Serve to Preserve: A Florida Summit on Global Climate Change") hosted by Governor Crist in July of 2007. This event "gathered leaders of business, government, science, and advocacy to examine the unique risks of climate change to Florida and the nation, and to explore the economic development opportunities available through an aggressive response to climate change."

Interestingly, while the term "climate change" is splashed all over the place, presumably as the underlying reason for the need of the "Florida Energy and Climate Change Action Plan" in the first place, *nowhere within the entire Action Plan is there an analysis performed which demonstrates the impact that the Action Plan's regulations and recommendations will have on "climate change."* The Action Plan prominently touts its projected impacts on reducing greenhouse gas emissions from Florida, but nowhere translates the projected emissions reductions to projected mitigation of climate change. Without a quantification of the climate impacts, the value of the Action Plan in achieving its primary goal of protecting Floridians from "climate change" cannot be assessed.

How could such a glaring oversight occur? Simple. The Governor's Action Team on Energy and Climate Change has a dirty little secret it doesn't want you to know about—*the Action Plan will have absolutely no meaningful impact on the future course of global (much less statewide) climate change.*

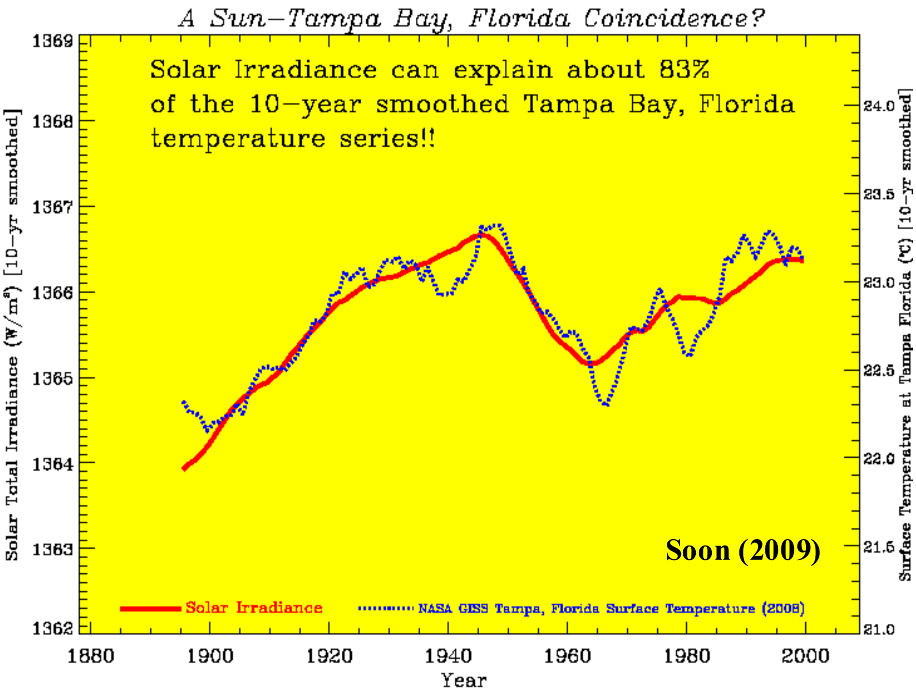
In this report we do what the Action Team should have done. In fact, we do the Action Team one better. We analyze what the impacts on future climate change will be if Florida's ceased *all* of its greenhouse gas emissions, now and forever. What we find is compelling.

Even a complete cessation of greenhouse emissions from Florida will likely slow the future rate of global warming by less than one one-hundredths (<0.01) of a ºC per century. The impact of sea level will be an equally meager tenth of a centimeter. What's worse, greenhouse gas emissions are increasing so rapidly in China that new emissions from China will completely subsume the entirely of Florida's emissions cessation in less than 6 month's time. Clearly, the Action Team's Plan merely calling for incremental reductions in greenhouse gas emissions will fare even poorer. There is simply no climatic gain to be had from emissions reductions in Florida.

Additionally, we review Florida's long-term climate history and find little in the way of evidence that greenhouse gas build-up in the atmosphere has altered Florida's climate. There has been no long-term change in state wide average temperature, precipitation, or drought frequency. Solar irradiance can explain much the state's temperature history. Natural cycles in the state and regional climate can largely explain changes in patterns of hurricane activity and vector-borne disease outbreaks. The state's population has largely adapted to the region's weather and is virtually immune from occurrence of heat waves. The rate of future sea level rise is not projected to be largely different from the on-going rate of sea level rise along Florida's coast—a rise that has been well-adapted to as Florida's rising coastal development and population attests.

All told, Floridian's have been little impacted by global "climate change" and regulations prescribing a reduction in the state's greenhouse gas emissions, such as those recommended by the Energy and Climate Change Action Plan will have no detectable effect on future climate change. Unfortunately, the same can't be said about the impact of emissions regulations on the state's economy, which have been projected to be large and negative.

As such, the Action Plan presents a perfect recipe for an all pain, no gain outcome. Outcomes will likely include reduced state revenues, staggering unemployment in both the private and public sectors and the threat of imploding State employee and teachers' pension funds.



Observed climate change in Florida

Annual temperature: The historical time series of statewide annual temperatures in Florida begins in 1895. Over the entire record, there has been no statistically significant temperature change. Recent temperatures are similar to the temperatures experienced across the state in the 1920s, 1930s, and 1940s. Annual and decadal-scale variability is also clearly evident in the statewide temperature history as year-to-year and multi-year swings in temperature are quite evident. Evidence that "global warming" has lead to unusual temperature conditions in the state is completely lacking.

Florida annual temperatures, 1895-2007

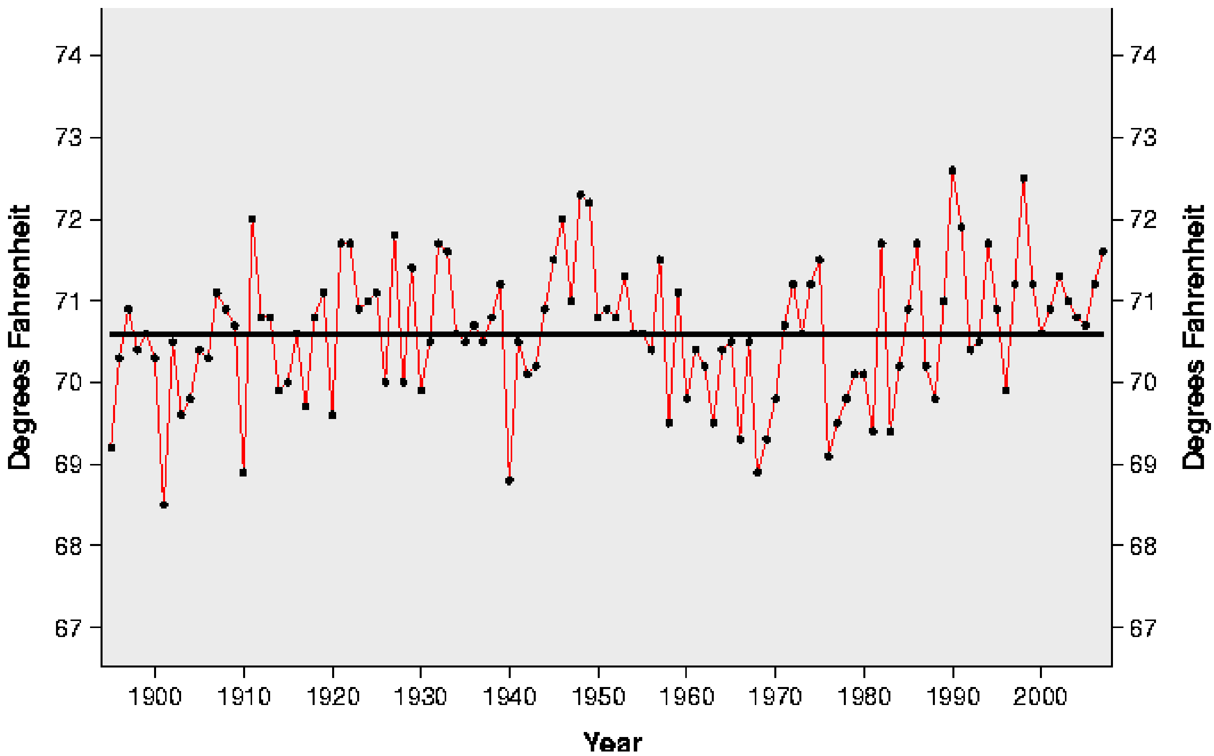


Figure 1. *Annual statewide average temperature history for Florida, 1895-2007, (source: National Climatic Data Center, http://www.ncdc.noaa.gov/oa/climate/research/cag3/fl.html).*

Seasonal temperatures: When the statewide average temperature history for Florida is broken down into the four seasons, it can be seen that the same general patterns persist throughout much of the year. While summer temperatures have crept upwards in recent decades, the other three seasons of the year show little to no long-term trend. The warmest decades during the winter and spring were typically prior to the mid-20th century. Again, year-to-year and/or decade-to-decade variability is quite pronounced and largely dominates any long-term change.

Florida seasonal temperatures, 1895-2007

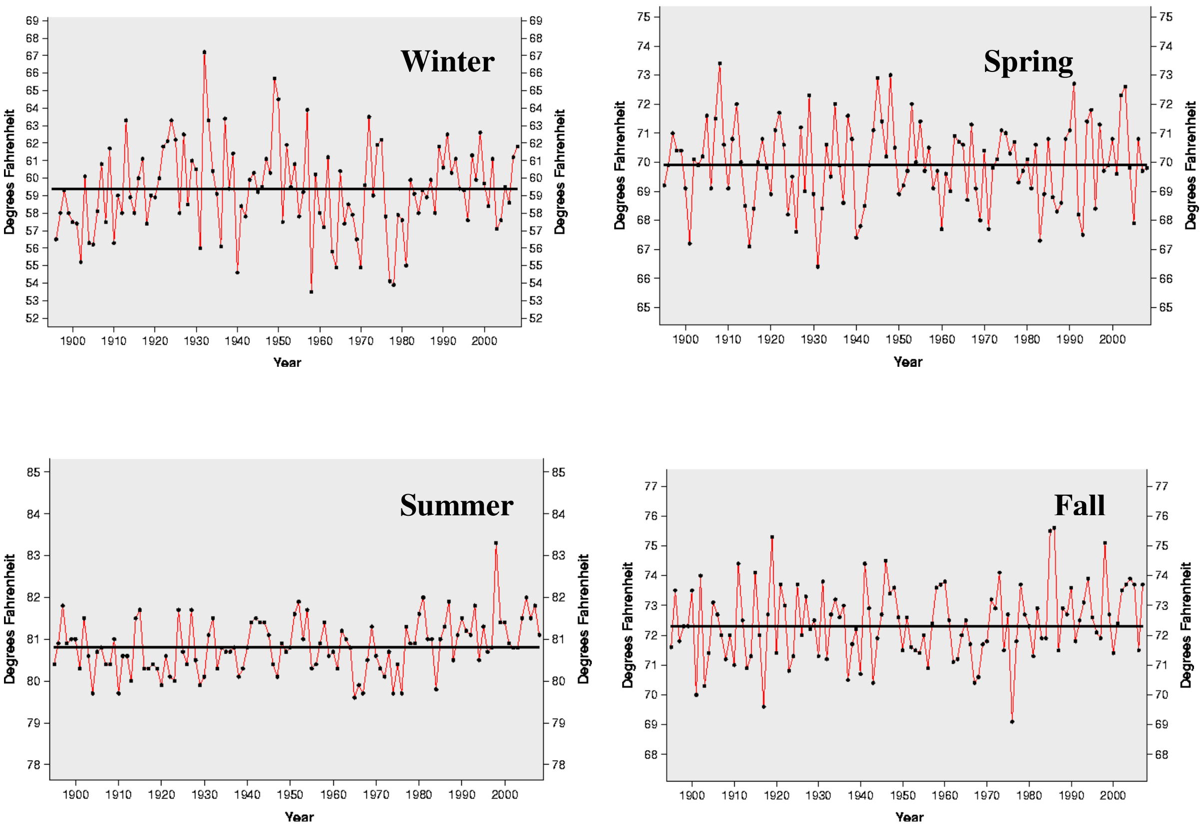
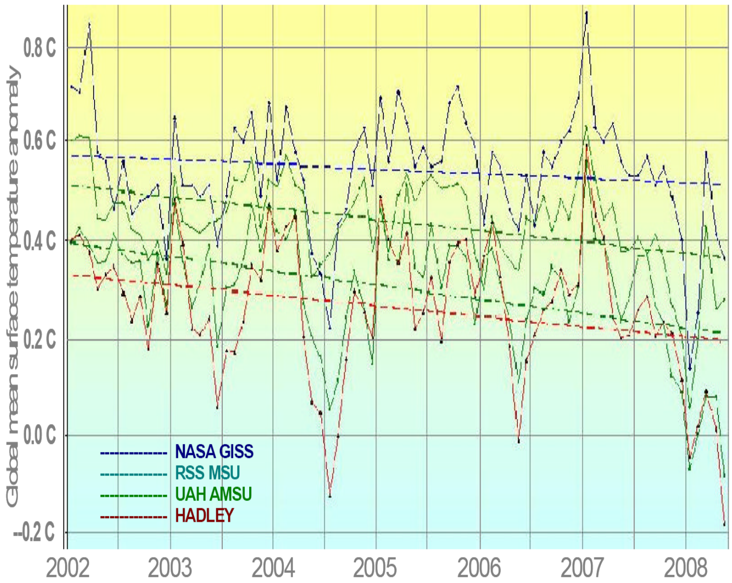
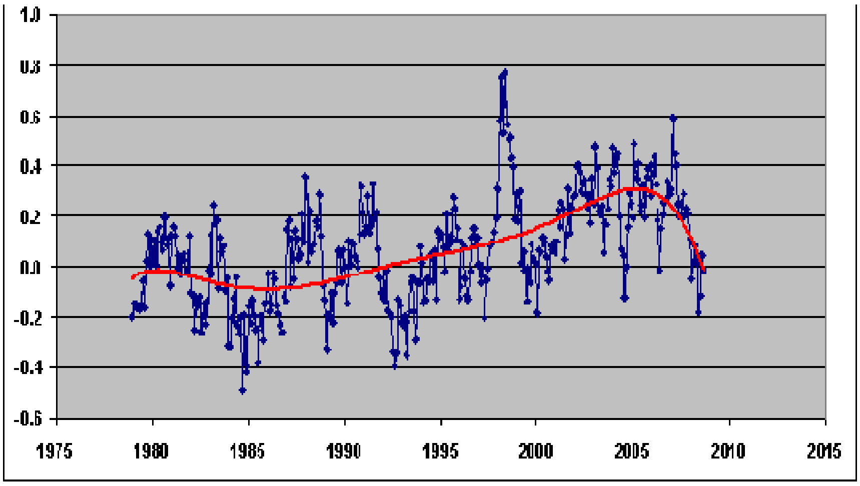


Figure 2. *Seasonal statewide average temperature history of Florida. (Source: National Climatic Data Center, http://www.ncdc.noaa.gov/oa/climate/research/cag3/fl.html)*

Recent *global* temperatures: As the global temperature graph below shows, all four of the world's major global surface temperature datasets (NASA GISS; RSS; UAH; and Hadley/University of East Anglia) show a decline in temperatures that have now persisted for seven years. The fall in temperatures between January 2007 and January 2008 was the greatest January-January fall since records began in 1880.



All four of the world's major surface-temperature datasets show seven years of global cooling. The straight lines are the regression lines showing the trend over past seven years. It is decisively downward.



Lower-troposphere global surface temperature anomalies, 1979-2008 (UAH satellite data).

The year 2008 will turn out to have been no warmer than 1980 – 28 years ago. This is not a short-run change: the cooling trend set in as far back as late 2001, seven full years ago, and there has been no net warming since 1995 on any measure.

Precipitation: The statewide total annual precipitation history of Florida shows that although the past year or two have been relatively dry, there has been no long-term overall trend in the state's annual precipitation totals. Like the case with temperature, shorter term variations rather than a long-term trend dominate the record.

For instance, the state's wettest year on record, 1947, received 72.57 inches of precipitation — above 30 inches more than the driest year, 1927, in which only 40.83 inches of precipitation fell. The variability from wet years to dry years is part of the general climate of the state and the precipitation pattern in recent decades does not depart from natural expectations. Again, no evidence of global warming is apparent.

Florida annual precipitation, 1895-2007

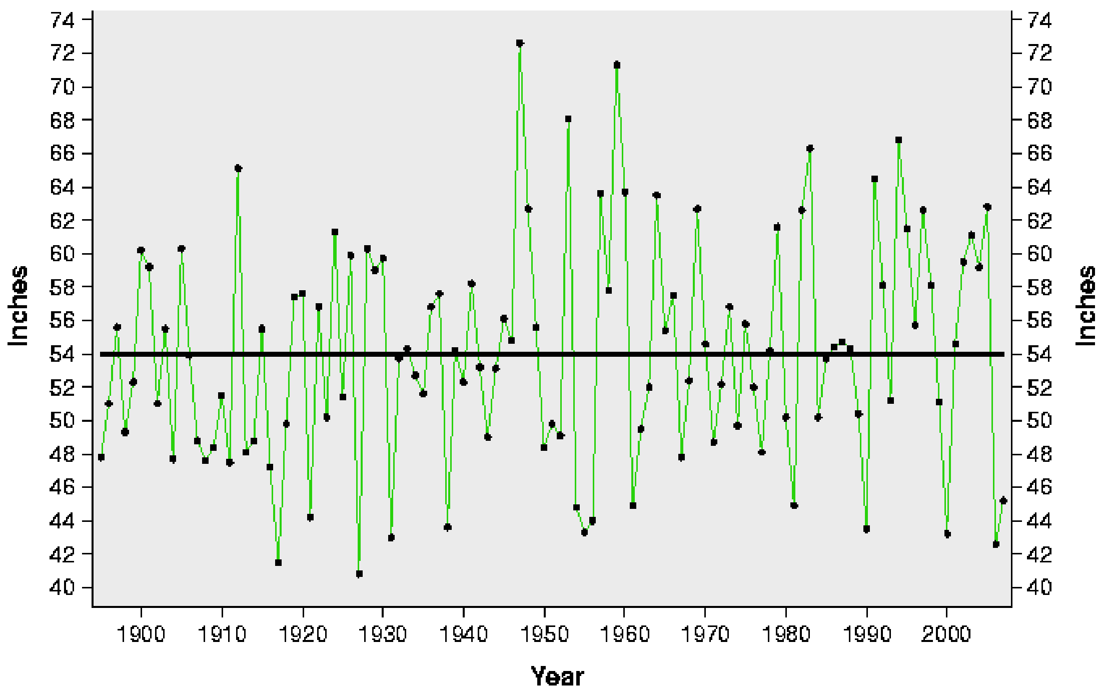


Figure 3. *Total annual statewide precipitation history for Florida (source: National Climatic Data Center, http://www.ncdc.noaa.gov/oa/climate/research/cag3/fl.html).*

Drought: Statewide monthly average Palmer Drought Severity Index (PDSI) values — a standard measure of moisture conditions that takes into account both inputs from precipitation and losses from evaporation — show neither a trend towards wetter nor drier conditions across the state of Florida during past 113 years. Instead, short-term variations lasting from year to multiple years are evident in Florida's moisture record. Dry conditions which characterize the past year or two are a natural part of the region's climate and not an unusual occurrence that could be related to "global warming."

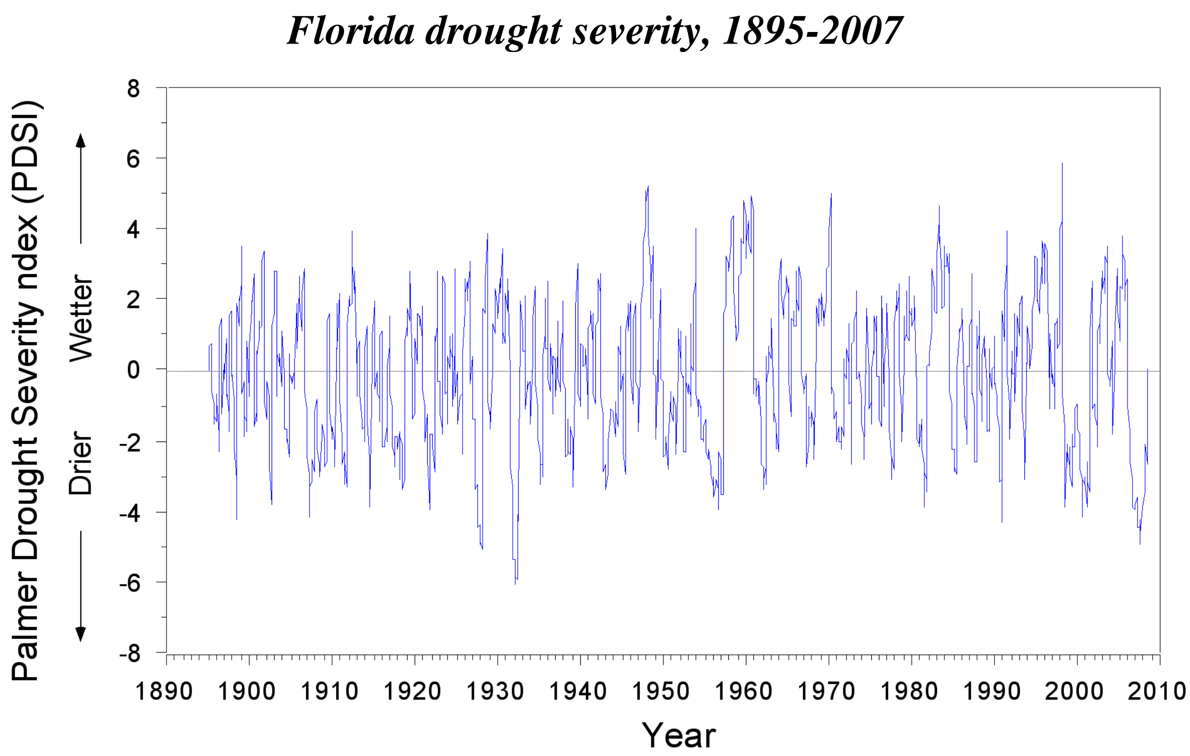


Figure 4. *Monthly statewide average values of the Palmer Drought Severity Index (PDSI) for the state of Florida, 1895-2007 (source: National Climate Data Center, www.ncdc.noaa.gov)*

Hurricanes[1]: Florida has the dubious distinction of holding several not-so-enviable records when it comes to hurricane strength, frequency, and subsequent death and damages (Blake et al., 2007). The Florida Keys Hurricane of 1935 was the most intense Atlantic hurricane ever to strike land when it passed over Florida's middle keys on September 2, 1935, killing 408 Floridians along the way. That storm was but one of Florida's five entries among the top-10 most intense storms ever to make landfall in the United States. Number 3 in that list is 1992's Hurricane Andrew which also ranks 2nd on the list of all-time most damaging storms (behind Katrina) — causing just under 50 billion dollars in damage. All of the top-5 costliest hurricanes in U.S. history impacted Florida to some extent. Number 7 in the intensity list is the Lake Okeechobee Hurricane of 1928 which caused a 6 to 9 foot lake surge killing 1,836 people and ranking it the second all-time in the list of deadliest U. S. hurricanes (behind only the Galveston Hurricane of 1900). When considering what would have happened had historical hurricanes struck today (given the current population demographics), it is estimated that the Great Miami Hurricane of 1926, whose eye passed directly over Miami as a category 4 hurricane, would have caused nearly $160 billion in damages—more than Katrina and Andrew combined. Additionally, the state of Florida sports the lowest return period and highest frequency of hurricane strikes.

Return Period (years) for Category 1 Hurricanes

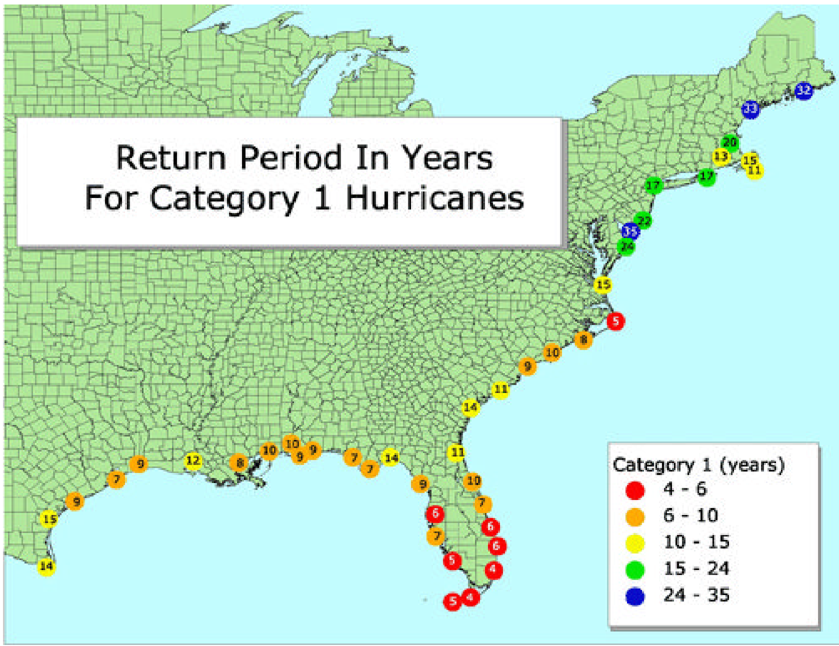


Figure 5. *Average return frequency (in years) of hurricane landfalls in Florida (source: National Hurricane Center)*

[1] http://scienceandpublicpolicy.org/images/stories/papers/originals/florida_climate_change.pdf

Total Number of Hurricane Landfalls, 1926-2005

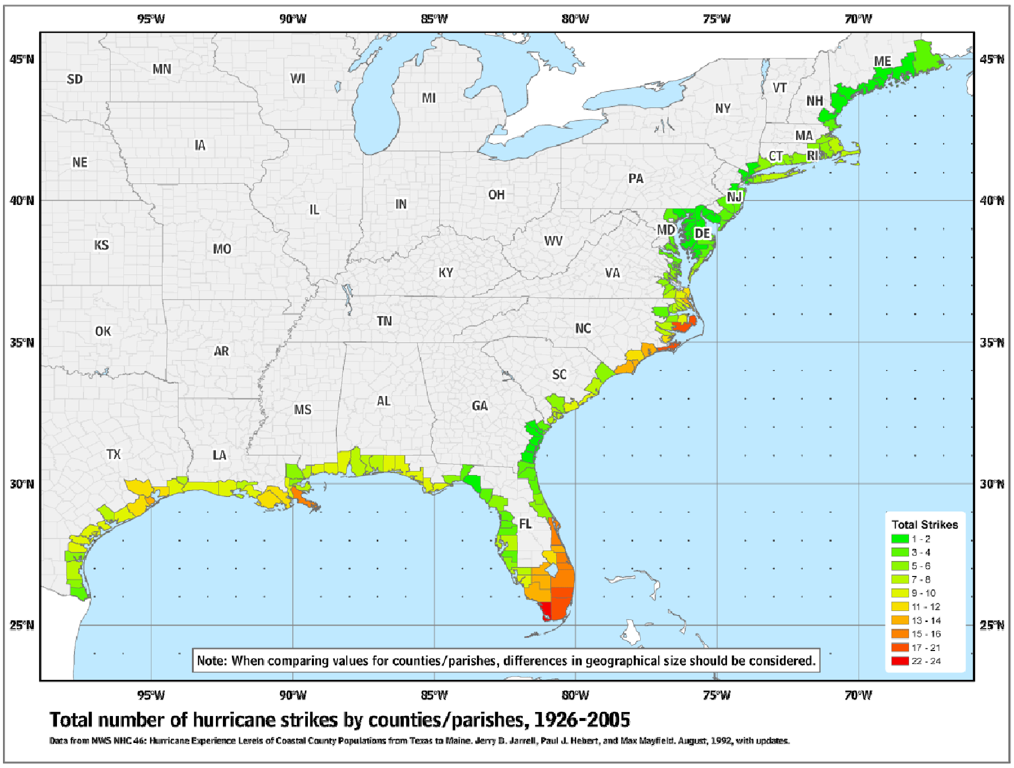


Figure 6. *Total number of hurricane landfalls, 1926-2005 (source: National Hurricane Center)*

So clearly, Floridians have a lot at stake when hurricane season approaches each year. The question of whether or not human-induced changes in the earth's greenhouse effect may impact current or future hurricane patterns is probably nowhere more important than it is in Florida with its 17.3 million coastal residents (making up half of the vulnerable coastal population from Texas through North Carolina).

The best available scientific evidence suggests that natural variations, on time scales ranging from years to decades, dominate any small impacts that a warming climate may have on the frequency and intensity of Atlantic tropical cyclones. Clearly, the most important determinant for future vulnerability is not changes to the hurricanes themselves, but changes to the population and wealth structure of Florida's coastal communities. Many of these rank among the fastest growing localities in America, having increased five-fold since the mid-20th century (U.S. Census Bureau, 2006).

Since 1995 there has been an increase in both the frequency and intensity of tropical storms and hurricanes in the Atlantic basin. While some scientists have attempted to link this increase to anthropogenic global warming, others have pointed out that Atlantic hurricanes exhibit long-term cycles, and that this latest upswing is simply a return to conditions that characterized earlier decades in the 20th century. Along the Florida coast, according to records from the National Hurricane Center (http://www.aoml.noaa.gov/hrd/tcfaq/E23.html), the number of total hurricane strikes exhibits decadal variations, but no real long-term trends. The number of hurricanes impacting Florida during the last 10-year period, 1997-2006, was similar to periods in the first half of the 20th century. However, since it follows a 3 decade-long period of relative quiet, the recent period has seemed exceptionally active. In fact, it has *not* been in the greater historical perspective.

Hurricanes Impacting Florida by Decade, 1897-2006

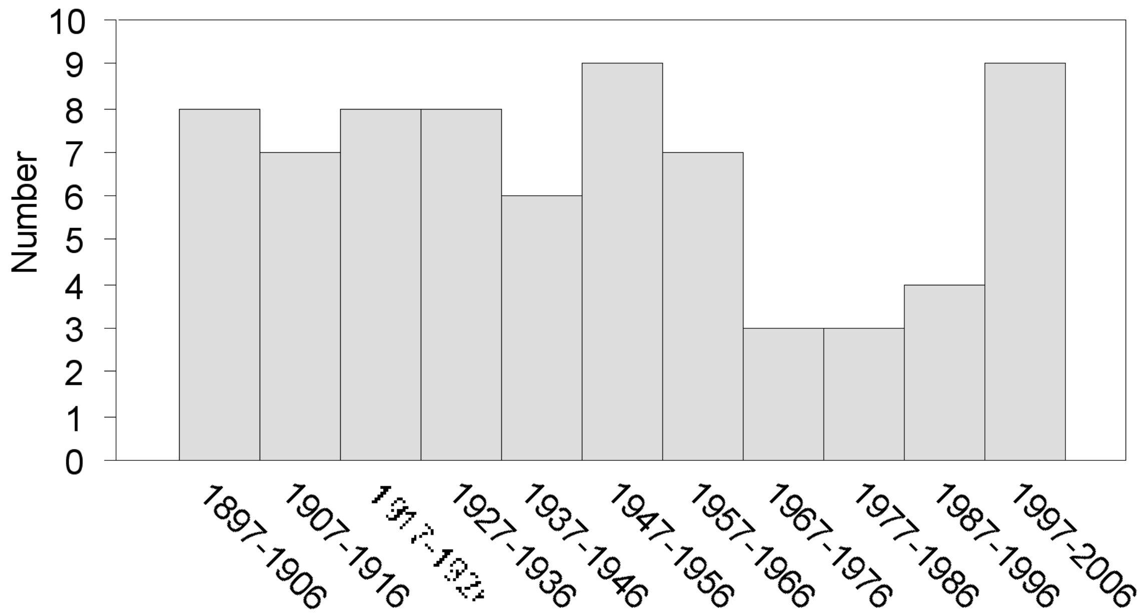


Figure 7. *Number of hurricane impacting Florida, by decade, 1897-2006 (data source: National Hurricane Center).*

Neither has there been any long-term trend towards greater damages from hurricanes—not when changes in inflation and population demographics are correctly considered.

A research team by a team led by Dr. Roger Pielke Jr. (2008) examined the historical damage amounts from tropical cyclones in the United States from 1900 to 2005. They found that when they adjusted the reported damage estimates for inflation, a trend appeared towards increased amounts for loss, peaking in the years 2004 (with the storms that hit Florida) and 2005. This period included Wilma in Florida, and of course, Katrina as the record holder, causing 81 billion dollars in damage.

Total Losses per Year from Atlantic Tropical Cyclones (2005 dollars)

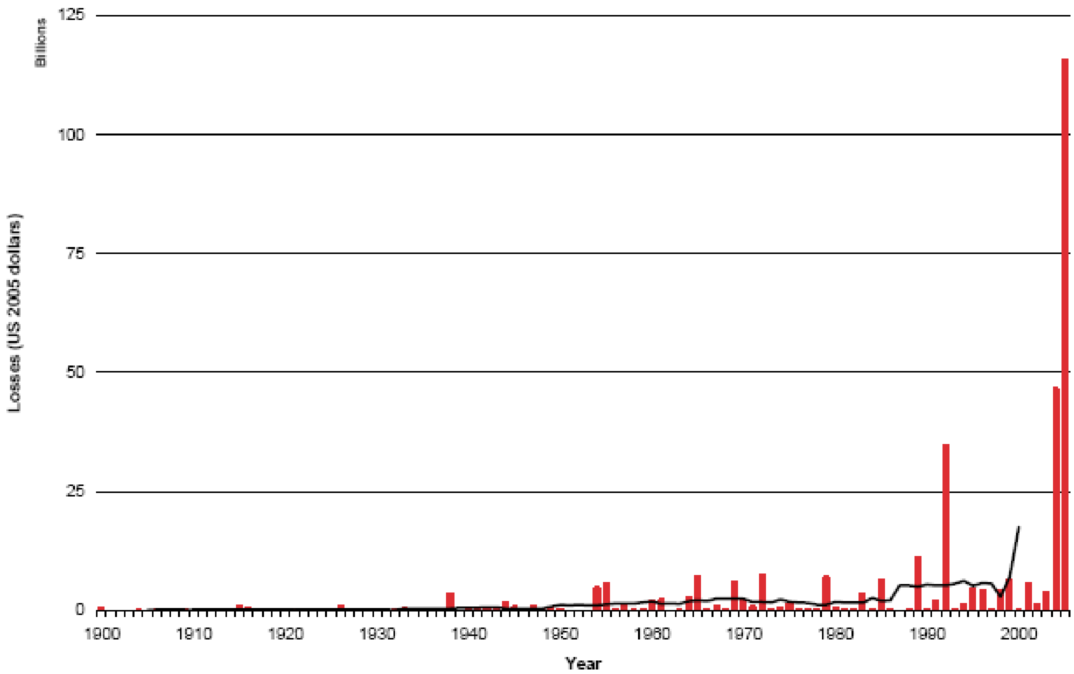


Figure 8. *U.S. tropical cyclone damage (in 2005 dollars) when adjusted for inflation, 1900-2005 (from Pielke Jr., et al., 2008).*

Other changes in hurricane prone areas since 1900 besides inflation include a coastal population that is growing in size as well as wealth. When the Pielke team made adjustments considering all three factors, they found no long-term change in damage amounts. The loss estimates in 2004 and 2005, while high, were not historically high. The new record holder for what would have been the most damaging storm in history had it hit in 2005 was the Great Miami hurricane of 1926, which they estimated would have caused 157 billion dollars worth of damage. After the Great Miami hurricane and Katrina (which fell to second place), the remaining top-ten storms (in descending order) occurred in 1900 (Galveston 1), 1915 (Galveston 2), 1992 (Andrew), 1983 (New England), 1944 (unnamed), 1928 (Lake Okeechobee 4), 1960 (Donna/Florida), and 1969 (Camille/Mississippi). There is no obvious bias towards recent years. In fact, the combination of the 1926 and 1928 hurricanes places the damages in 1926-35 nearly 15% higher than 1996-2005, the last decade the Pielke team studied.

Normalized Losses per Year from Atlantic Tropical Cyclones (2005 dollars)

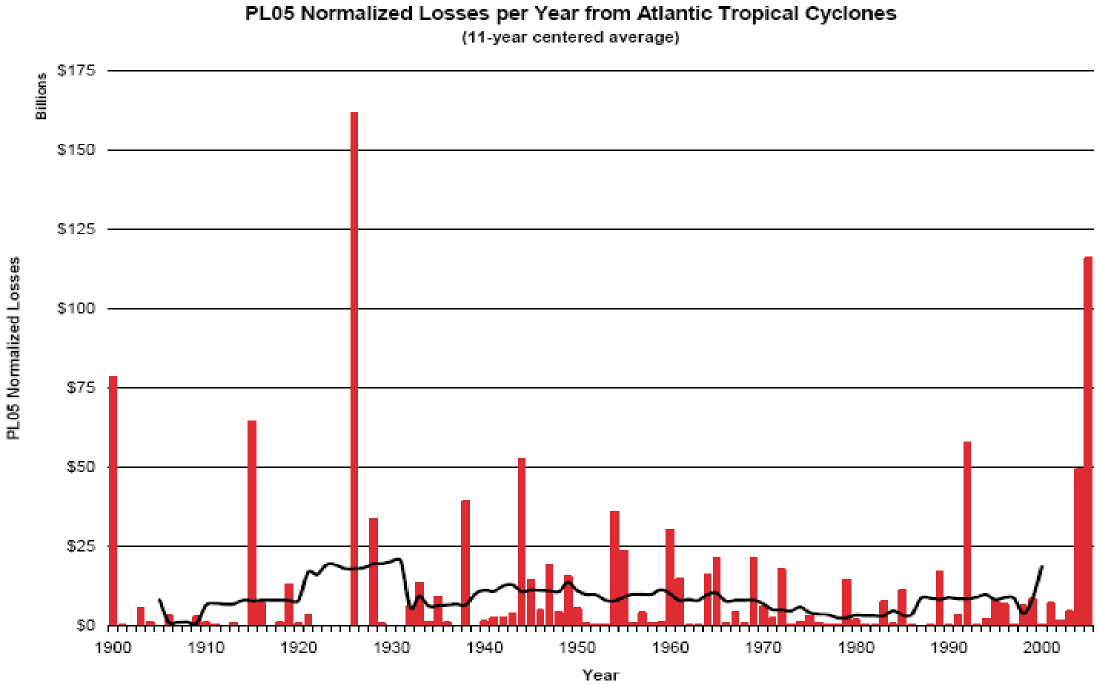


Figure 9. *U.S. tropical cyclone damage (in 2005 dollars) when adjusted for inflation, population growth and wealth, 1900-2005 (from Pielke Jr., et al., 2008).*

This result by the Pielke team, that there has not been any long-term increase in tropical cyclone damage in the United States, is consistent with other science concerning the history of Atlantic hurricanes. One of Pielke's co-authors, Dr. Chris Landsea, from the National Hurricane Center, has also found no trends in hurricane frequency or intensity when they strike the U.S. While there has been an increase in the number of strong storms in the past decade, there were also a similar number of major hurricanes in the 1940s and 1950s, long before such activity could be attributed to human activities.

As Pielke writes, "The lack of trend in twentieth century hurricane losses is consistent with what one would expect to find given the lack of trends in hurricane frequency or intensity at landfall."

Rather than long-term trends, natural cycles dominate the observed record of Atlantic tropical cyclones, dating back to the 18th and 19th centuries (e.g., Chylek and Lesins, 2008). Multi-decadal oscillations are obvious in the long-term record of hurricane activity in the Atlantic basin — hurricane activity was quiet in the 1910s and 1920s, elevated in the 1950 and 1960s, quiet in the 1970s and 1980s, and has picked up again since 1995.

Atlantic Hurricane Activity, 1930-2007

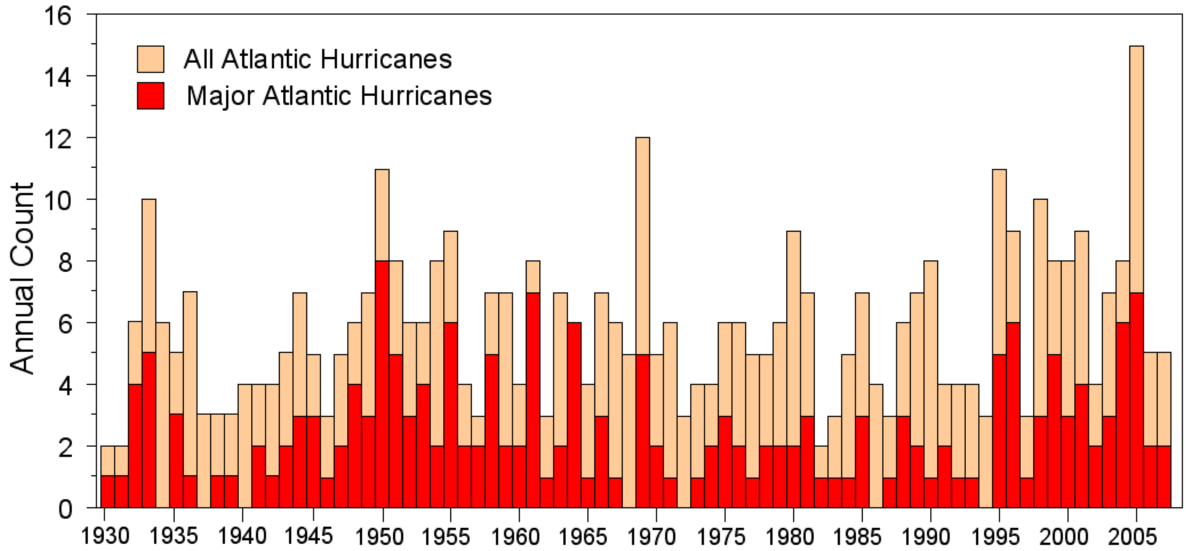


Figure 10. *Annual number of tropical cyclones and major hurricanes observed in the Atlantic basin, 1930-2007. Bars depict number of named systems (light orange) and major (category 3 or greater) hurricanes (dark orange) (source: National Hurricane Center).*

The timing of these oscillations matches well with the oscillations of a phenomenon known as the Atlantic Multidecadal Oscillation (AMO) which reflects changes in large-scale patterns of sea surface temperatures in the Atlantic Ocean. Much research has shown a connection between the AMO and Atlantic hurricane activity (e.g., Goldenberg et al., 2001; Knight et al., 2006, Zhang and Delworth, 2006; Chylek and Lesins, 2008). Warmer cycles of the AMO — such the current one — are associated with enhanced tropical cyclone activity in the Atlantic Ocean and Gulf of Mexico, while the cold phase of the AMO is associated with lessened storm activity. Analyzing patterns in paleoclimate datasets coupled with model simulations, the AMO can be simulated back for more than 1,400 years (Knight et al., 2005). This is strong evidence that the AMO is part of the earth's natural climate variations and cycles, and not a consequence of recent "global warming."

Further, not only is there evidence that the AMO has been operating for at least many centuries (prior to any possible human influence on the climate), but there is also growing evidence that there have been active and inactive periods in the Atlantic hurricane frequency and strength extending many centuries into the past. For instance, research by Miller et al. (2006) using oxygen isotope information stored in tree-rings in the southeastern United States, finds distinct periods of activity/inactivity in a record dating back 220 years. In other research that examined sediment records deposited from beach over wash in a lagoon in Puerto Rico, scientists Donnelly and Woodruff (2007) have identified patterns of Atlantic tropical cyclone activity extending back 5,000 years

Atlantic Multidecadal Oscillation (AMO)

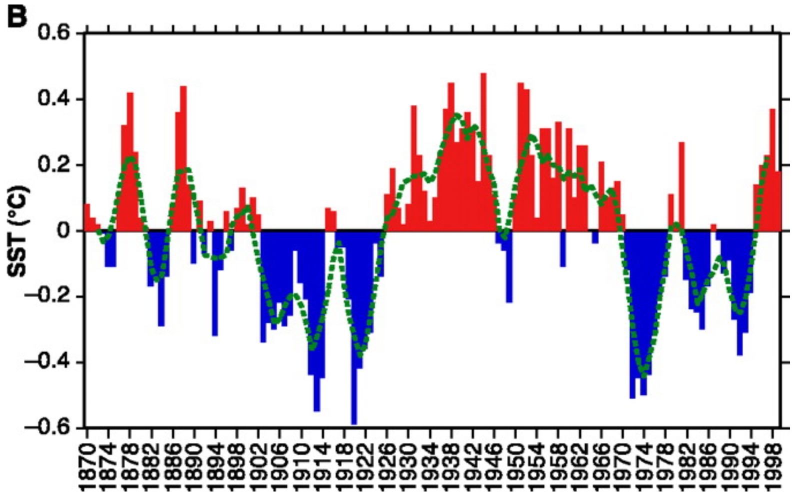


Figure 11. *The observed historical time series of the Atlantic Multidecadal Oscillation (AMO) (from Goldenberg et al., 2001).*

Hurricane Tracks During Cold Phases of the AMO (left) and Warm Phases (right)

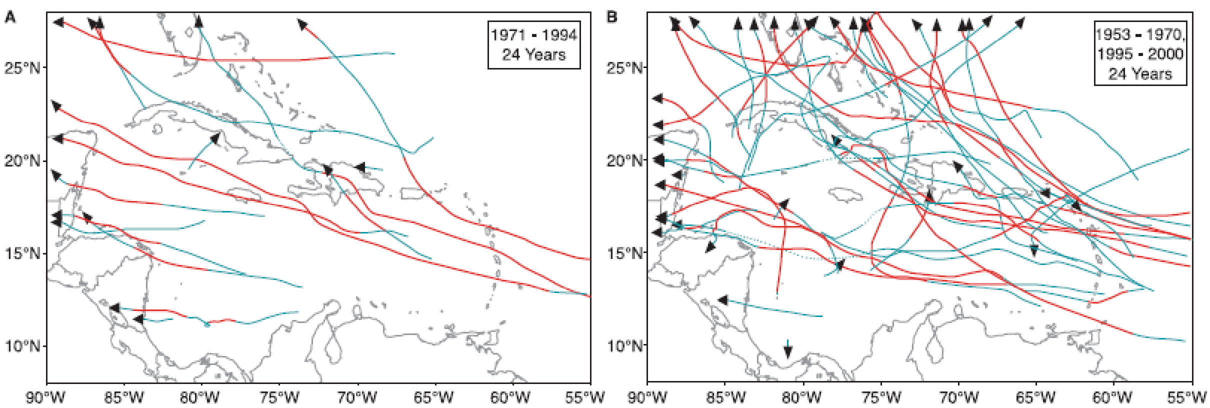


Figure 12. *Contrast of Caribbean and Gulf of Mexico hurricane occurrences between colder (left) and warmer (right) values of the Atlantic Multidecadal Oscillation. The solid red lines indicate where the storms were at major hurricane intensity (from Goldenberg et al., 2001).*

So clearly, there is strong evidence for natural oscillations in the frequency and intensity of tropical cyclone activity in the Atlantic basin. Hurricane researchers have known this fact for many years and they expected the coming of the period of enhanced activity that began in 1995. Further, they recognize that the heighten activity levels are likely here to stay awhile, as the oscillations usually last several decades. Back in 2002, leading hurricane researchers Dr. William Gray and Dr. Christopher Landsea authored an article for the *Miami Herald* in which they warned Florida's residents of bad things to come:

> "The combined effect in the next few decades of more land falling major hurricanes in Florida with very large and increasing coastal populations with much more property at risk leads to a recipe for disaster. Projections of major hurricane strikes and population/wealth changes over the next twenty to thirty years lead to some amazing conclusions. We anticipate that the rate of economic loss in the state of Florida due to hurricane landfalls will be about **six to eight times** the rate that occurred during the 1970s, 1980s and 1990s. Anyone living in or doing business in the state of Florida needs to heed these warnings of probable impacts in the future and to best plan for them." [emphasis in original]

The question of whether human-induced climate changes will impact *future* patterns of tropical cyclone frequency and/or intensity in the Atlantic basin is currently one of the most active research topics in climate science. Simply put, there is no general consensus on the matter.

As we head into the future, some believe that human activity will lead to an overall climate warming. A warming climate is reasonably expected to lead to higher sea surface temperatures in the tropical Atlantic spawning grounds of hurricanes. Sea surface temperatures play an important role in the processes of formation and intensification of tropical cyclones. Therefore, some researchers (e.g., Knutson and Tuleya, 2004; Emanuel, 2005; Webster et al. 2005) suggest that hurricanes will become stronger in a warmer world.

However, at the same time, some of the climate changes that are projected to occur as the levels of atmospheric carbon dioxide continue to grow into the future, are ones that act to hinder tropical cyclone formation and development. This includes projections of increased vertical wind shear (Vecchi and Soden, 2007ab) and increasing atmospheric stability (Knutson and Tuleya, 2004). Thus, when *all* of the projected changes are incorporated into climate models, the models generally predict only small increases in intensity (maximum winds increase by just 6%) over the course of the next coming century (Knutson and Tuleya, 2004), and *decreases* in frequency of storms (Bengtsson et al., 2006; Knutson et al., 2008). The small intensity increases are produced by a climate model which was driven by scenarios of future carbon dioxide increases that are much greater than current trends suggest that they will be (Michaels et al., 2006), and whose sensitivity to CO2 loading is demonstrably exaggerated (Monckton 2008, Spencer, 2008) Thus, even the small projected intensity increases may be overestimates.

Some claims are being made that the current period of elevated hurricane activity is the result of human-induced climate changes which have led to a long-term increase in the number and intensity of hurricanes during recent decades (e.g., Hoyos et al., 2006; Webster et al., 2005; Emanuel, 2005) as well as over the longer term (Holland and Webster, 2007). However, analytical errors (Landsea, 2005), the lack of strike (Landsea, 2005) and damage (Pielke Jr., 2005; Pielke Jr. et al., 2008) trends in the United States, changes in observational technology (Landsea et al., 2006; Landsea, 2007), among other issues (Klotzbach, 2006; Landsea, 2007), coupled with climate models simulations that project only minor intensity increases and frequency decreases that are not anticipated to be detectable towards the end of the 21st century, combine to argue against those who have claimed to have detected anthropogenic-induced trends (Knutson et al., 2008).

Certainly, there is neither strong current evidence, nor any strong future projections, that support the idea that the frequency and/or intensity of Atlantic basin tropical cyclones—which included all the storms that potentially impact Florida—have increased or will increase in the future in any detectable manner as a result of the human enhancement of the earth's natural greenhouse effect and any accompanying climate changes.

Despite the lack of any trends in hurricane landfalls along the U.S. and Florida coast, or damage to U.S. coastlines when population demographics are taken into account, the impact from a single storm can be enormous as residents of Florida know all too well. The massive build-up of the coastline has vastly raised the potential damage that a storm can inflict. Recently, a collection of some of the world's leading hurricane researchers issued the following statement that reflects the current scientific thinking on hurricanes and their potential impact (http://wind.mit.edu/~emanuel/Hurricane_threat.htm) in coming years:

> As the Atlantic hurricane season gets underway, the possible influence of climate change on hurricane activity is receiving renewed attention. While the debate on this issue is of considerable scientific and societal interest and concern, it should in no event detract from the main hurricane problem facing the United States: the ever-growing concentration of population and wealth in vulnerable coastal regions. These demographic trends are setting us up for rapidly increasing human and economic losses from hurricane disasters, especially in this era of heightened activity. Scores of scientists and engineers had warned of the threat to New Orleans long before climate change was seriously considered, and a Katrina-like storm or worse was (and is) inevitable even in a stable climate.

Rapidly escalating hurricane damage in recent decades owes much to government policies that serve to subsidize risk. State regulation of insurance is captive to political pressures that hold down premiums in risky coastal areas at the expense of higher premiums in less risky places. Federal flood insurance programs likewise undercharge property owners in vulnerable areas. Federal disaster policies, while providing obvious humanitarian benefits, also serve to promote risky behavior in the long run.

We are optimistic that continued research will eventually resolve much of the current controversy over the effect of climate change on hurricanes. But the more urgent problem of our lemming-like march to the sea requires immediate and sustained attention. We call upon leaders of government and industry to undertake a comprehensive evaluation of building practices, and insurance, land use, and disaster relief policies that currently serve to promote an ever-increasing vulnerability to hurricanes.

Sea Level Rise: The relative sea level along the coast of Florida has changed primarily as a result of an increase is global sea levels, with an additional contribution from land subsidence resulting from on-going geologic processes (Aubrey and Emery, 1991; Maul and Martin, 1993). While land subsidence dominates the relative rate of sea level rise further west along the Gulf Coast, the shores of Florida have fairly secure geologic bedding such that the rates of land subsidence there are relatively small. The total rate of sea level rise along the Florida coast has been about 2.5mm/yr (or about 10 inches per 100 years) over the past half-century or so. As the rising population of Florida's coastal communities attests, the residents of Florida have adapted to this on-going rate of sea level rise.

Florida's coastal counties are experiencing high growth and development rates. Many of Florida's coastal counties rank among the fastest growing coastal counties along the southern U. S. coastline according to the U.S. Department of Commerce. So clearly Florida's coastal residents have successfully adapted to this rise in sea level and there seems little evidence that the ongoing and/or potential future sea level rise is enough of a concern to quell the influx of new inhabitants. A primary reason for this is likely that a dispassionate look at future sea level rise projections finds them to be less than alarming.

Projected Population Change in Southern Coastal Counties 2003-2008

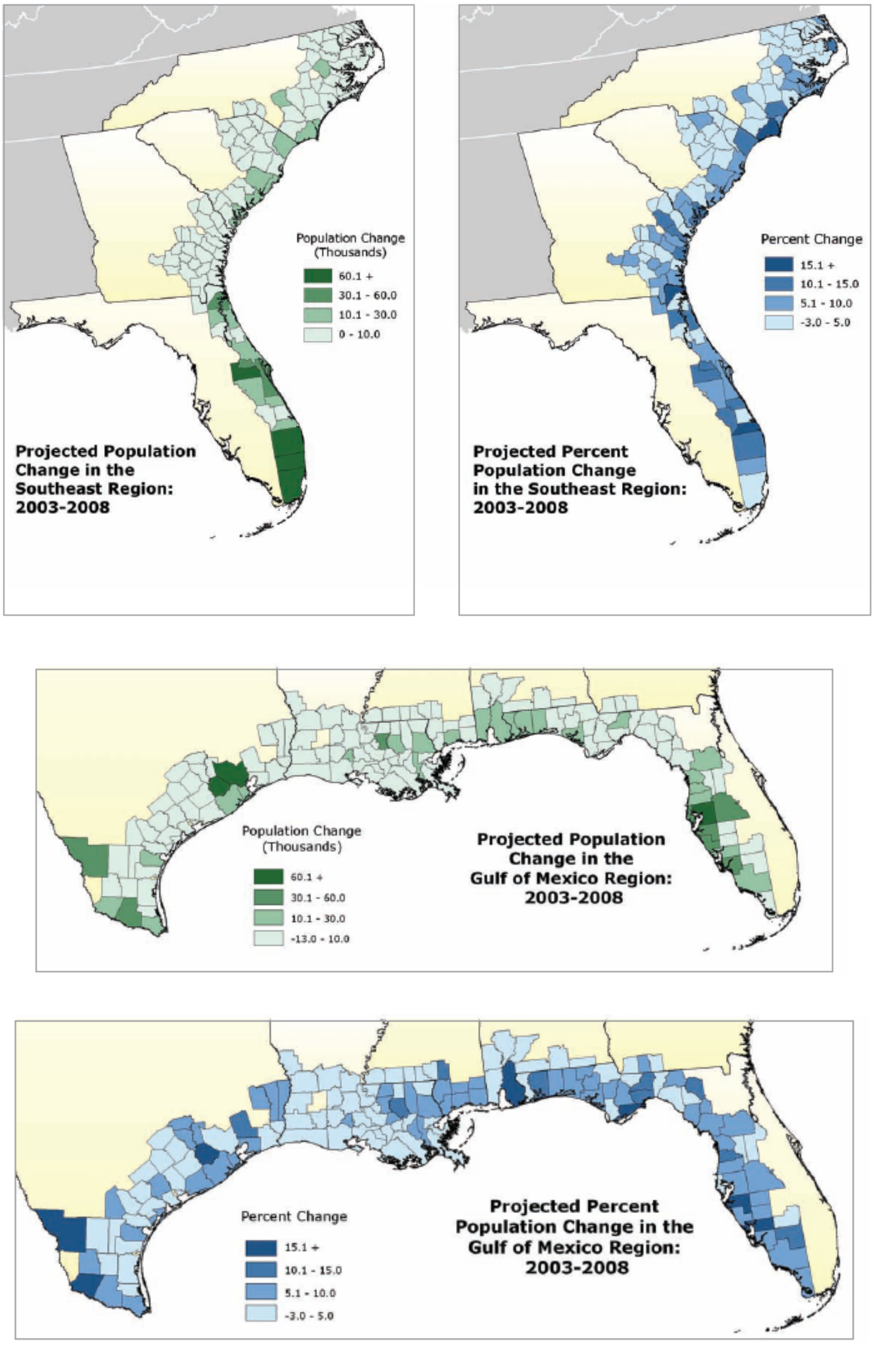


***Figure 13**. Projected population change in the coastal counties of the southern U.S. from 2003-2008 and expected percentage change in population (source: U.S. Department of Commerce).*

The latest projections of future sea level rise, as given in the *Fourth Assessment Report* (AR4) of the Intergovernmental Panel on Climate Change (IPCC), suggest a potential sea level rise in the coming century of between 7 and 23 inches — occurring at a rate not much different than the on-going rate of sea level rise along the Florida coastline. The actual rise over the next century will depend on the total amount of global warming that occurs. The IPCC links a lower sea level rise with lower future warming. The claimed warming rate of the earth is 0.18ºC per decade, which is near the low end of the IPCC range of projected warming for the 21st century (which is from 0.11 to 0.64ºC per decade). Therefore, since we observe that the warming rate is tracking near the low end of the IPCC projections, we should also expect that the rate of sea level rise should track near the low end of the range given by the IPCC — in this case, a future rise much closer to 7 inches than to 23 inches. The behavior of global temperatures and global sea level rise in recent years seems to support this slower rate (Wunsch et al., 2007; Willis et al., 2008). Thus, the reasonably expected rate of sea level rise in the coming decades is not much different to the rate of sea level rise that Florida's coastline have been experiencing for more than a century — and have adapted to.

IPCC Projections of 21st Century Sea Level Rise

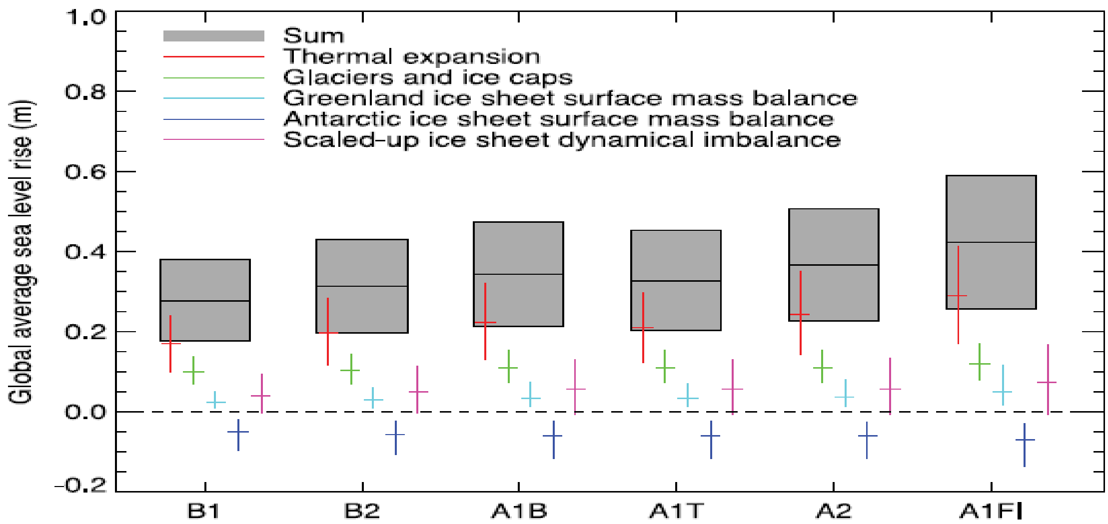


Figure 14. *Range of sea level rise projections (and their individual components) for the year 2100 made by the IPCC AR4 for its six primary emissions scenarios. (source: IPCC, 2007)*

There are a few alarmists who argue that sea level rise will accelerate precipitously in the future and raise the level of the ocean to such a degree that it inundates portions of coastal Florida and other low-lying areas around the world and they clamor that the IPCC was far too conservative in its projections. However, these rather alarmist views are not based upon reliable scientific information, and ignore our best understanding of how a warmer world will impact ice loss/gain on Greenland and Antarctica and correspondingly, global sea level. It is a fact, that all of the extant models of the future of Antarctica indicate that a warmer climate leads to more snowfall there (the majority of which remains for hundreds to thousands of years because it is so cold) which acts to retard the rate of global sea level rise (because the water remains trapped in ice and snow). New data suggest that rapid rates of ice loss from Greenland in the future are not likely (Joughin et al., 2008; van de Wal et al. 2008). Scenarios of disastrous rises in sea level are predicated on Antarctica and Greenland losing massive amounts of snow and ice in a very short period of time—an occurrence with virtual zero likelihood.

In fact, an author of the IPCC *AR4* chapter dealing with sea level rise projections, Dr. Richard Alley, recently testified before the House Committee on Science and Technology concerning the state of scientific knowledge of accelerating sea level rise and pressure to exaggerate what it known about it. Dr. Alley told the Committee:

> This document [the IPCC *AR4*] works very, very hard to be an assessment of what is known scientifically and what is well-founded in the refereed literature and when we come up to that cliff and look over and say we don't have a foundation right now, we have to tell you that, and **on this particular issue, the trend of acceleration of this flow with warming we don't have a good assessed scientific foundation right now**. [emphasis added]

Thus the IPCC projections of future sea level rise, which average only about 15 inches for the next 100 years, stand as the best projections that can be made based upon our current level of scientific understanding. These projections are far less severe that the alarming projections of many feet of sea level rise that have been made by a few individuals whose views lie outside of the scientific consensus.

Wildfires: There is a strong linkage between drought and wildfires in Florida. For instance, the dry period lasting from about 1998 through 2001 was associated with active wildfire seasons and repeated Fire Management Assistance Declarations. In the string of wet years from 2002-2006, there were virtually no Fire Management Assistance Declarations as wildfires were relatively scarce across the state (Federal Emergency Management Agency, http://www.fema.gov/news/disasters_state.fema?id=12).

In fact, wildfire variations are part of Florida's natural history and much of Florida's natural landscape and ecosystems are shaped by and have come to depend on fire (Florida Division of Forestry, http://www.fl-dof.com/wildfire/index.html). As such, the Florida Park Service runs an active program of prescribed burns in order to best manage the many ecosystems of it's 700,000 plus acre system of state parks. Just recently, the Florida Park Service, which conducts more controlled burns than any other state, surpassed the total of 1 million acres burned by controlled fires. As human development has fragmented the natural landscape and wildfires are now often fought vigorously, where they burned naturally before, the Park Service's effort of controlled burning is an attempt to make up for the suppression of natural fires. Florida's natural climate variations still play a role in Florida's fire seasons, but more and more, human fire management is becoming a dominating and controlling force.

Crop Yields: In Florida, the annual yields from crops such as corn have risen dramatically during the past 50 years (USDA), while the climate there has changed little. This indicates that factors other than climate are largely responsible for the rapid yield rise.

Yields increase primarily as a result of technology — better fertilizer, widespread irrigation, more resistant crop varieties, improved tilling practices, modern equipment, and so on. The level of atmospheric carbon dioxide, a constituent that has proven benefits for plants, has increased as well. The relative influence of weather is minimal compared with those advances. Temperature and precipitation fluctuate but show no long-term trend; they are instead responsible for some of the year-to-year variation in crops yields about the long-term upward trend. Even under the worst of circumstances, minimum crop yields continue to increase. Through the use of technology, farmers are adapting to the climate conditions that traditionally dictate what they do and how they do it and producing more output than ever before. There is no reason to think that such adaptations and advances will not continue into the future.

As for climate change itself, the type of warming that has occurred in the Northern Hemisphere during the last century should not be detrimental to Florida agriculture. During the past 50 years, most of this warming has happened in the cold, dry air masses found over central Asia (Siberia) and northwestern North America. These cold air masses, when they drop southward over the United States, are the cause of agriculturally damaging cold outbreaks throughout the state. Any alleviation of these low temperatures should decrease the intensity of cold outbreaks in Florida—of particular importance to the state's citrus crops.

Heat-related Mortality: The state of Florida is a peninsula surrounded on three sides by large bodies of water that helps to keep summer temperatures from reaching dangerously high levels and the population has become well-adapted to the summertime climate there. As a result, there is little indication that heat waves raise mortality across Florida (Davis et al., 2003ab).

A number of studies have shown that during the several decades, the population in major U.S. cities has grown better adapted, and thus less sensitive, to the effects of excessive heat events (Davis et al., 2003a, 2003b). Each of the bars in the Figure below represents the annual number of heat-related deaths in 28 major cities across the United States. There should be three bars for each city, representing, from left to right, the decades of the 1970s, 1980s and 1990. For nearly all cities, the number of heat-related deaths (on a per capita basis) is declining (the bars get smaller). This adaptation is most likely a result of improvements in medical technology, access to air-conditioned homes, cars, and offices, increased public awareness of potentially dangerous weather situations, and proactive responses of municipalities during extreme weather events.

Heat-related mortality trends across the U.S.

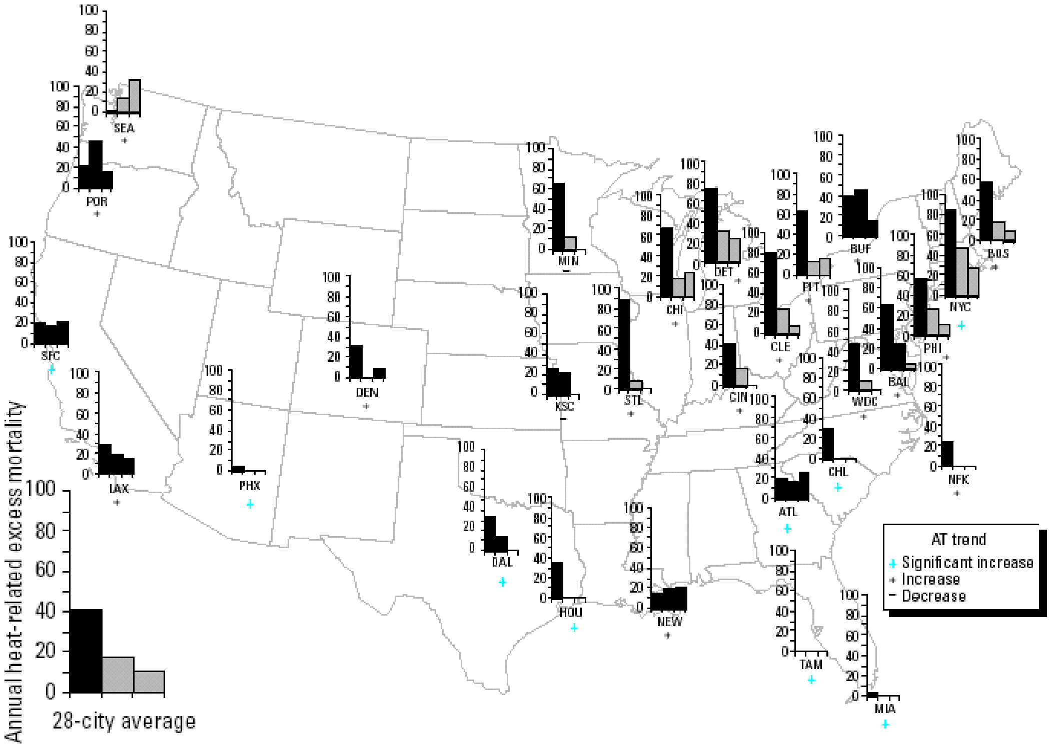


Figure 15. *Annual heat-related mortality rates (excess deaths per standard million population). Each histogram bar indicates a different decade (from left to right, 1970s, 1980s, and 1990s). (Source: Davis et al., 2003b).*

The pattern of the distribution of heat-related mortality shows that in locations where extremely high temperatures are more commonplace, such as along the southern tier states, the prevalence of heat-related mortality is much lower than in the regions of the country where extremely high temperatures are somewhat rarer (e.g. the northeastern U.S.). This is true for the two Florida cities that were part of the study—Tampa and Miami. In both of these locations, no significant relationship was found between daily mortality and daily temperatures during the summertime (with the exception of a very small relationship in Miami during the 1960s). This provides another demonstration that populations adapt to their prevailing climate conditions—as undoubtedly is the case for

Floridians. Contrary to pessimistic projections of increasing heat-related mortality, if temperatures warm in the future and excessive heat events become more common, there is every reason to expect that adaptations will take place to lessen their impact on the general population.

In a subsequent study, Davis et al. (2004) focused not just on summertime heat/mortality relationships, but looked across all months of the year. Unlike the lack of response to summer high temperatures, Davis et al. (2004) found that, during the wintertime, cold, dry air masses can, on occasion, drop down into Florida from the north and cause a rise in mortality.

Relationship between monthly average temperature and monthly average mortality for the Florida cities of Tampa and Miami

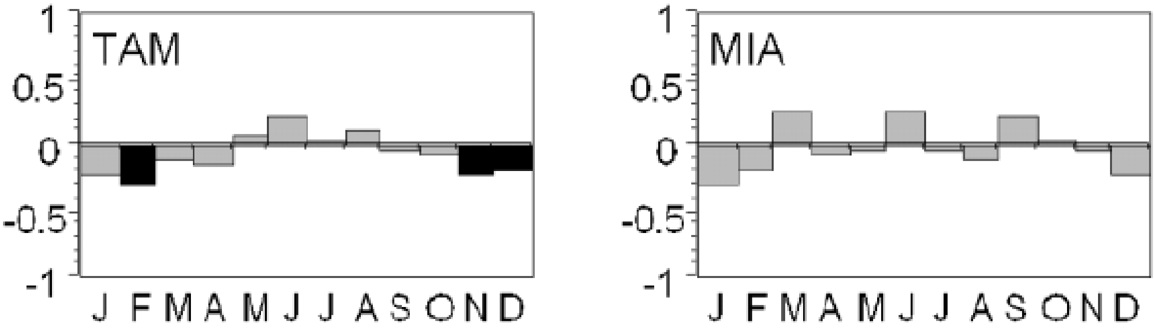


Figure 16. *Relationship between average monthly temperature and total monthly mortality in Tampa (left) and Miami (right). Positive bar mean high temperatures lead to higher mortality, while negative bars mean lower temperatures lead to high mortality. Only the bars shaded in black represent statistically significant relationships (from Davis et al., 2004).*

The figure above (taken from Davis et al., 2004) shows the relationship between monthly averaged temperature and monthly averaged mortality (anomaly) for the Florida cities of Tampa (left) and Miami (right) (in extra deaths per ºC for a standardized population). Negative bars indicate a negative relationship between temperature and mortality, that is, the colder it is, the more people die and vice versa for warmer than average conditions. Solid bars mean the relationship is statistically significant. Positive bar indicate positive relationships between temperature and mortality, that is more people die when it is hotter than normal, and few die when it is below normal. For the most part, Tampa and Miami exhibit more negative bars than positive ones, with the cold season months showing negative relationships and a couple months in summer showing weak positive relationships. Taken together, a warming climate, especially one in which winters warmed a greater degree than summers (in character, matching the pattern of warming that has been observed in the Northern Hemisphere for the past 50 years or so), would result in fewer temperature-related deaths in Florida, or at least in the two major cities examined in the Davis et al. (2004) study.

Vector-borne Diseases: “Tropical” diseases such as malaria and dengue fever have been erroneously predicted to spread due to global warming. In fact, they are related less to climate than to living conditions. These diseases are best controlled by direct application of sound, known public health policies.

Malaria Distribution in the United States

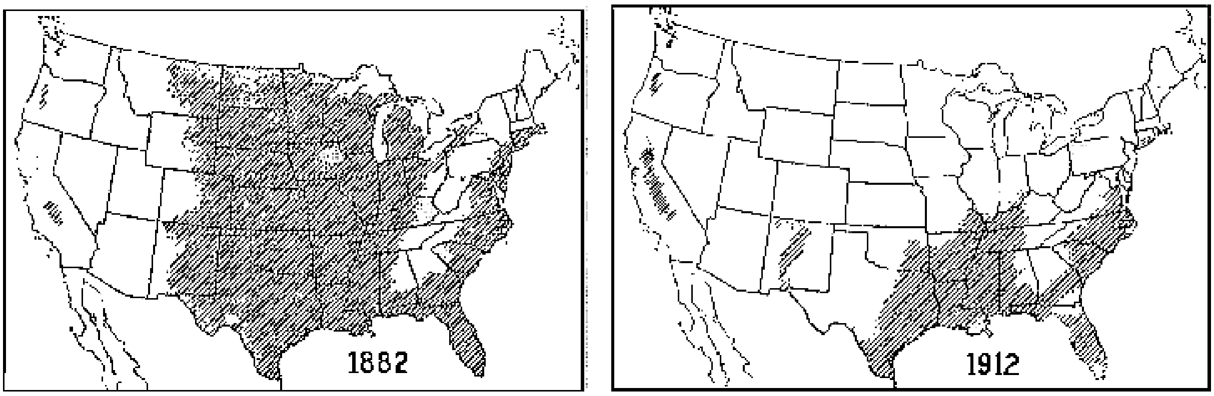


Figure 17. *Shaded regions indicate locations where malaria was endemic in the United States (source: Zucker et al., 1996).*

The two tropical diseases most commonly cited as spreading as a result of global warming, malaria and dengue fever, are not in fact “tropical” at all and thus are not as closely linked to climate as many people suggest. For example, 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 prior to the 1950s (Reiter, 1996). In the late 1800s, a period when it was demonstrably colder in the United States than it is today, malaria was endemic in most of the United States east of the Rocky Mountains—a region including the entirety of Florida. In 1878, about 100,000 Americans were infected with malaria; about one-quarter of them died. By 1912, malaria was already being brought under control, yet persisted in the southeastern United States well into the 1940s. In 1946 the Congress created the Communicable Disease Center (the forerunner to the current U.S. Centers for Disease Control and Prevention) for the purpose of eradicating malaria from the regions of the U.S. where it continued to persist. By the mid-to-late 1950s, the Center had achieved its goal and malaria was effectively eradicated from the United States. This occurred not because of climate change, but because of technological and medical advances. Better anti-malaria drugs, 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; Reiter, 2001). Today, the mosquitoes that spread malaria are still widely present in the Unites States, but the transmission cycle has been disrupted and the pathogen leading to the disease is absent. Climate change is not a factor.

The beneficent 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 of the disease (Reiter, 1996). This is just not an isolated example, for data collected over the past several decades has shown a similarly large disparity between the high number of cases of the disease in northern Mexico and the rare occurrences in the southwestern United States (Reiter, 2001). There is virtually no difference in climate between these two locations, but a world of difference in infrastructure, wealth, and technology—city layout, population density, building structure, window screens, air-conditioning and personal behavior are all factors that play a large role in the transmission rates (Reiter, 2001).

Dengue Fever at the Texas/Mexico border from 1980 to 1999

Figure 18. *Number of cases of Dengue Fever at the Texas/Mexico border from 1980 to 1999. During these 20 years, there were 64 cases reported in all of Texas, while there was nearly 1,000 times that amount in the bordering states of Mexico. (source: Reiter, 2001).*

Another "tropical" disease that is often falsely 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 Florida. However, nothing could be further from the truth.

West Nile Virus was introduced to the United States through the port of New York City in the summer of 1999. Since its introduction, it has spread rapidly across the country, reaching the West Coast by 2002 and 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 naturally primed for the virus.

Spread of the West Nile Virus across the United States after its Introduction in New York City in 1999

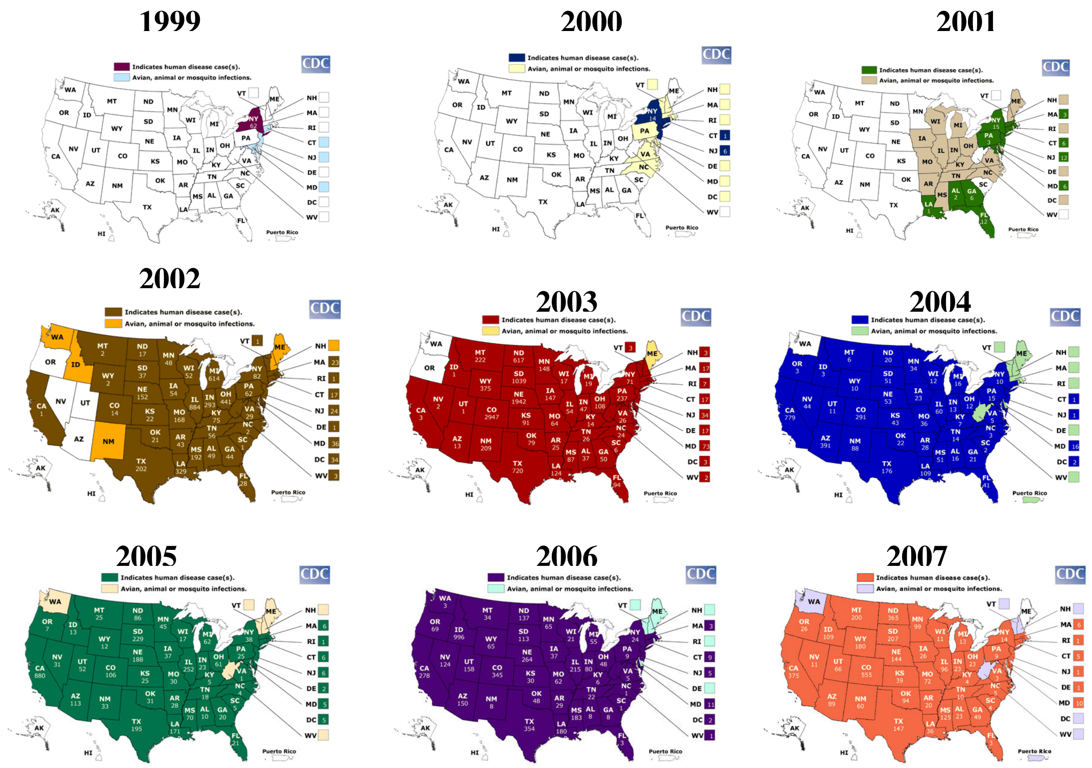


Figure 19. *Spread of the occurrence of the West Nile Virus from its introduction to the United States in 1999 through 2007. By 2003, virtually every state in the country had reported the presence of virus. (source: http://www.cdc.gov/ncidod/dvbid/westnile/Mapsactivity/surv&control07Maps.htm).*

The vector for West Nile is mosquitoes; wherever there is a suitable host mosquito population, an outpost for West Nile virus can be established. It is not just *one* mosquito species that is involved. Instead, the disease has been isolated in over *40 mosquito species* found throughout the United States. So the simplistic argument that climate change is allowing a West Nile carrying mosquito species to move into Florida is simply wrong. The already-resident mosquito populations of Florida are appropriate hosts for the West Nile virus — as they are in every other state.

Clearly, as is evident from the establishment of West Nile virus in every state in the contiguous U.S., climate has little, or nothing, to do with its spread. The annual average temperature from the southern part of the United States to the northern part spans a range of more than 40ºF, so clearly the virus exists in vastly different climates. In fact, West Nile virus was introduced in New York City — hardly the warmest portion of the country — and has spread westward and southward into both warmer and colder and wetter and drier climates. This didn't happen because climate changes allowed its spread, but because the virus was introduced to a place that was ripe for its existence — basically any location with a resident mosquito population (which describes basically anywhere in the U.S).

West Nile virus now exists in Florida because the extant climate/ecology of Florida is one in which the virus can thrive. The reason that it was not found in Florida in the past was simply because it had not been introduced. Climate change in Florida has absolutely nothing to do with it. By following the virus' progression from 1999 through 2007, one clearly sees that the virus spread from NYC southward and westward, it did not invade slowly from the (warmer) south, as one would have expected if warmer temperatures was the driver.

Since the disease spreads in a wide range of both temperature and climatic regimes, one could raise or lower the average annual temperature in Florida by many degrees or vastly change the precipitation regime and not make a bit of difference in the aggression of the West Nile Virus. Science-challenged claims to the contrary are not only ignorant but also dangerous, serving to distract from real epidemiological diagnosis which allows health officials critical information for protecting the citizens of Florida.

Landscape Changes: Florida's landscape has undergone extensive changes during the past 100 years as the state's growing population has crafted the landscape to take advantage of Florida's climate for both lifestyle and agriculture.

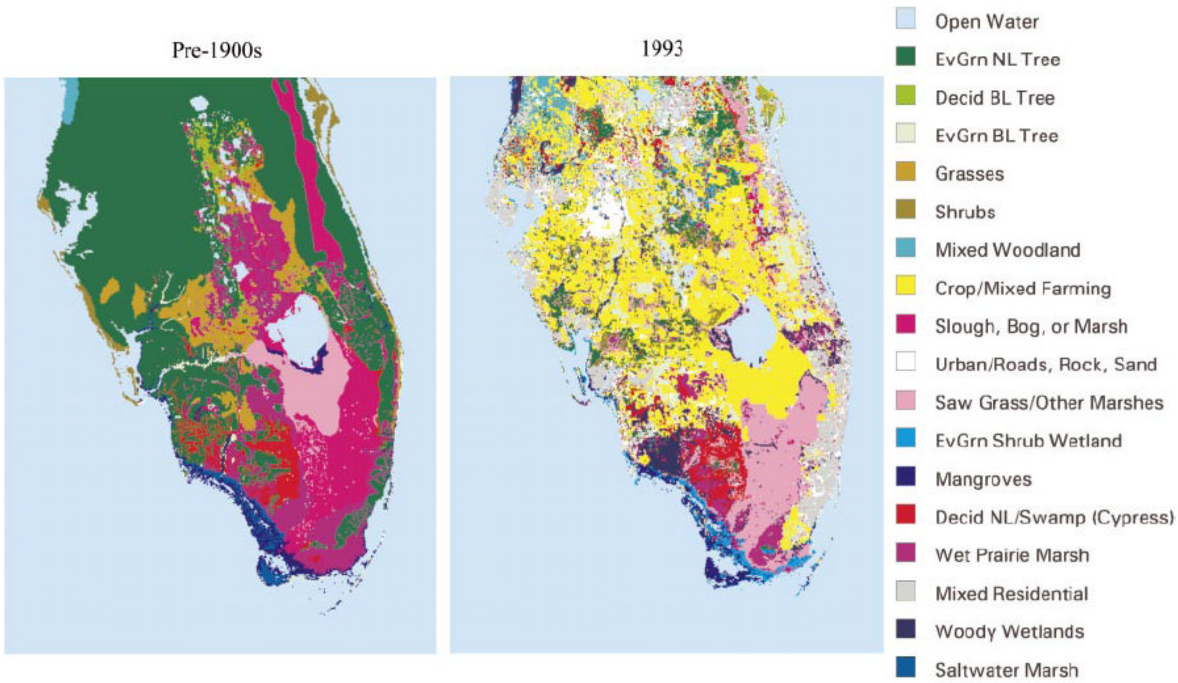


Figure 20. *Land-cover data for pre-1900 period (left) and in 1993 (right) from data from the United States Geological Survey (from Marshall et al., 2004a).*

These widespread landscape changes have been shown to have had a demonstrable impact of Florida's climate. Marshall et al. (2004a) examined how the transformation of the natural landscape by agriculture, urbanizations, and surface water diversion has impacted the climate of the Florida peninsula through a series of regional models and observations. When they replaced the pre-1900 landscape in their model with the landscape present in 1993, they found that the local atmospheric circulation patterns changed in a way which promoted a decline summer rainfall and at the same time an increase in summer afternoon temperatures (a trend apparent in Figure 2). Marshall et al (2004a) concluded that:

> These results could have important implications for water resource and land-use management issues in south Florida, including efforts to restore and preserve the natural hydroclimate of the Everglades ecosystem. **This study also provides more evidence for the need to consider anthropogenic land-cover change when evaluating climate trends**. [emphasis added]

In other words, changes to Florida's landscape over the past 100 years have led to significant changes in the patterns of summer rainfall as well as temperature, and these changes have nothing to do with carbon dioxide emissions.

In another study, Marshall et al., (2004b) found the interesting (and counter-intuitive) result that land-use changes may be increasing the likelihood and severity of damaging frosts negatively impacting the state's citrus industry. They determined that the wide-scale draining of wetlands for conversion to agricultural land has led to a reduction of the moderating effect of the wetlands on the region's nighttime low temperatures and an increase in the chance of damaging frost. Marshal et al. (2004b) conclude that:

> Our results provide another example of the potential for anthropogenic changes in land usage to perturb the climate system.

The significance of these results is apparent—climate changes that have resulted from landscape changes have an impact on Florida's current and future water resource needs as well as aspects of Florida's economy. And these changes are largely independent from any climate changes that may result from other natural or anthropogenic sources. These results provide a clear indication that the simplistic assumption that all climate variation results from "global warming" is wrong. Florida's climate is the result of complex interactions between natural and anthropogenic forces. Any role played by current or future changes to the global greenhouse effect will remain difficult to reliably detect or predict. The same is true for the impacts of any greenhouse gas reduction measures considered by the state—although to even a greater degree.

Impacts of climate-mitigation measures in the state of Florida[2]

Globally, in 2004, humankind emitted 27,186 million metric tons of carbon dioxide ($mmtCO_2$), of which emissions from Florida accounted for 258 $mmtCO_2$, or a mere 0.95% (EIA, 2007; EIA, 2008). The proportion of manmade CO_2 emissions from Florida will decrease over the 21st century as the rapid demand for power in developing countries such as China and India rapidly outpaces the growth of Florida's CO_2 emissions (EIA, 2007).

During the past 5 years, global emissions of CO_2 from human activity have increased at an average rate of 3.5%/yr (EIA, 2007), meaning that the annual *increase* of anthropogenic global CO_2 emissions is nearly *4 times* greater than Florida's *total* emissions. This in turn means that even a complete cessation of *all* CO_2 emissions in Florida will be completely subsumed by global emissions growth in under four month's time! China alone adds more than two Florida's-worth of *new* emissions to its emissions' total each and every year. Clearly, given the magnitude of the global emissions and

[2] See Appendix: U.S. Emissions and Mitigation table

global emission growth, regulations prescribing an *incremental* reduction rather than a complete cessation of Florida's CO_2 emissions will have absolutely 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. Even a complete cessation of CO_2 emissions in Florida 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.

To demonstrate the futility of emissions regulations in Florida, we apply Dr. Wigley's results to the state, 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 Florida – now 4.3% – 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)**	**Florida (4.3% of U.S.)**
2000	26,609	14,934	5,795	250
2025	41,276	18,308	7,103	305
2050	50,809	18,308	7,103	305
2100	75,376	21,534	8,355	359

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

In Table 2, we compare the total CO_2 emissions saving that would result if Florida'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	Florida	Kyoto Const.
2000	0	0
2025	305	4,697
2050	305	4,697
2100	359	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 Florida's CO_2 emissions (calculated as column 2 in Table 2 divided by column 3 in Table 2).

Table 3

Florida's percentage of emissions savings

Year	Florida
2000	0.0%
2025	6.5%
2050	6.5%
2100	4.5%

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

Table 4

Projected global temperature savings (ºC)

Year	Kyoto Const	Florida
2000	0	0
2025	0.03	0.002
2050	0.07	0.005
2100	0.15	0.007

Accordingly, a cessation of all of Florida's CO_2 emissions would result in a climatically-irrelevant and undetectable global temperature reduction by the year 2100 of *less than 1 one hundredths* of a degree Celsius. This number is so low that it is effectively equivalent to zero. Results for sea-level rise are also negligible:

Table 5

Projected global sea-level rise savings (cm)

Year	Kyoto Const	Florida
2000	0	0
2025	0.2	0.013
2050	0.9	0.059
2100	2.6	0.117

A complete cessation of all anthropogenic emissions from Florida will result in a global sea-level rise "savings" by the year 2100 of an estimated 0.12 cm, or about five *hundredths* of an inch. Again, this value is climatically irrelevant and virtually zero.

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 Florida would be extravagantly pointless. Florida's carbon dioxide emissions, it their sum total, effectively do not impact world climate in any way whatsoever.

Costs of Federal Legislation

And what would be the potential costs to Florida 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://www.accf.org/pdf/NAM/fullstudy031208.pdf

To summarize, SAIC found that by the year 2020, average annual household income in Florida would decline by $918 to $2,976 and by the year 2030 the decline would increase to between $3,868 and $7,053. The state would stand to lose between 78,000 and 118,000 jobs by 2020 and between 221,000 and 294,000 jobs by 2030. At the same time gas prices could increase by just less than $5 a gallon by the year 2030 and the states' Gross Domestic Product could decline by then by as much as $35.1 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.

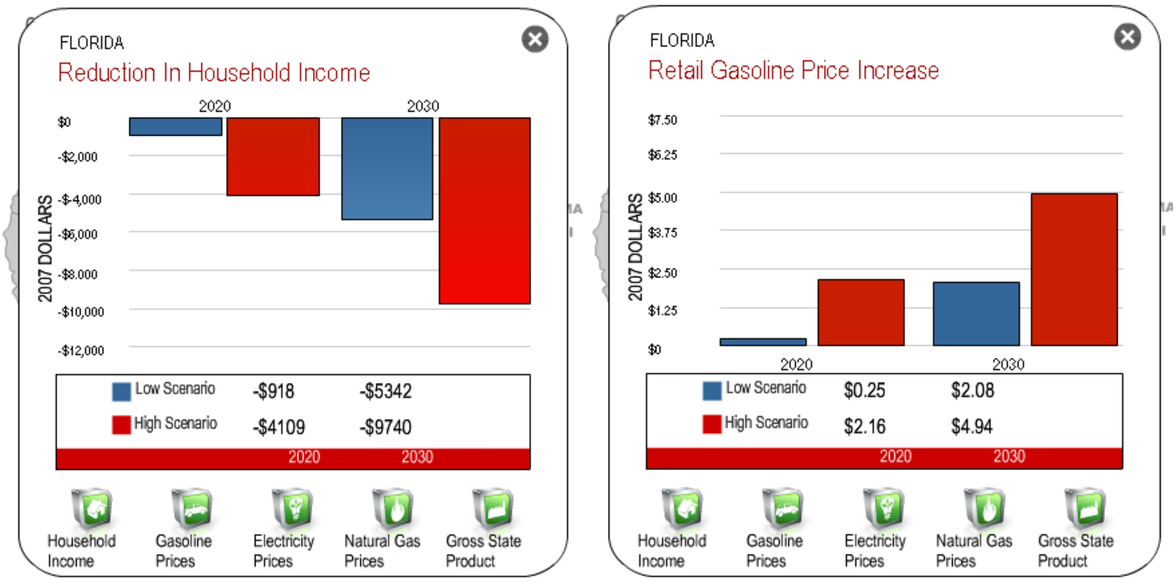


Figure 21. *The projected economic impacts in Florida of federal legislation to limit greenhouse gas emissions green. (Source: Science Applications International Corporation, 2008, http://www.instituteforenergyresearch.org/cost-of-climate-change-policies/)*

Florida Scientists Reject UN's Global Warming Claims

At least 1,502 Florida's scientists have agreed 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 by state can be found here:
http://www.petitionproject.org/gwdatabase/Signers_BY_State.html

Appendix: U.S. Emissions and Mitigation Table

State	2004 Emissions (million metric tons CO2)	Percentage of Global Total	Time until Total Emissions Cessation Subsumed by Foreign Growth (days)		Temperature "Savings" (ºC)		Sea Level "Savings" (cm)	
			Global Growth	China Growth	2050	2100	2050	2100
AK	47.0	0.17	18	28	0.0008	0.0013	0.0108	0.0217
AL	140.3	0.52	53	84	0.0025	0.0037	0.0321	0.0647
AR	63.7	0.23	24	38	0.0011	0.0017	0.0146	0.0294
AZ	96.9	0.36	37	58	0.0017	0.0026	0.0222	0.0447
CA	398.9	1.47	152	239	0.0071	0.0106	0.0914	0.1840
CO	93.1	0.34	35	56	0.0017	0.0025	0.0213	0.0430
CT	45.5	0.17	17	27	0.0008	0.0012	0.0104	0.0210
DC	4.0	0.01	2	2	0.0001	0.0001	0.0009	0.0018
DE	16.9	0.06	6	10	0.0003	0.0004	0.0039	0.0078
FL	258.0	0.95	98	155	0.0046	0.0069	0.0591	0.1190
GA	175.7	0.65	67	105	0.0031	0.0047	0.0402	0.0810
HI	22.7	0.08	9	14	0.0004	0.0006	0.0052	0.0105
IA	81.8	0.30	31	49	0.0015	0.0022	0.0187	0.0377
ID	15.6	0.06	6	9	0.0003	0.0004	0.0036	0.0072
IL	244.5	0.90	93	146	0.0044	0.0065	0.0560	0.1128
IN	239.9	0.88	91	144	0.0043	0.0064	0.0549	0.1107
KS	77.8	0.29	30	47	0.0014	0.0021	0.0178	0.0359
KY	151.5	0.56	58	91	0.0027	0.0040	0.0347	0.0699
LA	180.5	0.66	69	108	0.0032	0.0048	0.0413	0.0833
MA	83.6	0.31	32	50	0.0015	0.0022	0.0192	0.0386
MD	80.6	0.30	31	48	0.0014	0.0021	0.0185	0.0372
ME	23.3	0.09	9	14	0.0004	0.0006	0.0053	0.0107
MI	189.9	0.70	72	114	0.0034	0.0051	0.0435	0.0876
MN	102.8	0.38	39	62	0.0018	0.0027	0.0235	0.0474
MO	139.8	0.51	53	84	0.0025	0.0037	0.0320	0.0645
MS	65.1	0.24	25	39	0.0012	0.0017	0.0149	0.0300
MT	35.1	0.13	13	21	0.0006	0.0009	0.0080	0.0162
NC	152.3	0.56	58	91	0.0027	0.0041	0.0349	0.0703
ND	49.9	0.18	19	30	0.0009	0.0013	0.0114	0.0230
NE	43.6	0.16	17	26	0.0008	0.0012	0.0100	0.0201
NH	22.0	0.08	8	13	0.0004	0.0006	0.0050	0.0101
NJ	128.6	0.47	49	77	0.0023	0.0034	0.0295	0.0594
NM	59.0	0.22	22	35	0.0011	0.0016	0.0135	0.0272
NV	47.9	0.18	18	29	0.0009	0.0013	0.0110	0.0221
NY	216.7	0.80	82	130	0.0039	0.0058	0.0496	0.1000
OH	263.6	0.97	100	158	0.0047	0.0070	0.0604	0.1216
OK	100.4	0.37	38	60	0.0018	0.0027	0.0230	0.0463
OR	42.5	0.16	16	25	0.0008	0.0011	0.0097	0.0196
PA	282.5	1.04	107	169	0.0050	0.0075	0.0647	0.1304
RI	11.0	0.04	4	7	0.0002	0.0003	0.0025	0.0051
SC	87.5	0.32	33	52	0.0016	0.0023	0.0200	0.0404
SD	14.0	0.05	5	8	0.0002	0.0004	0.0032	0.0064
TN	123.6	0.45	47	74	0.0022	0.0033	0.0283	0.0570
TX	652.5	2.40	248	391	0.0116	0.0174	0.1495	0.3010
UT	65.7	0.24	25	39	0.0012	0.0017	0.0150	0.0303
VA	129.0	0.47	49	77	0.0023	0.0034	0.0295	0.0595
VT	7.0	0.03	3	4	0.0001	0.0002	0.0016	0.0032
WA	82.9	0.30	32	50	0.0015	0.0022	0.0190	0.0382
WI	108.8	0.40	41	65	0.0019	0.0029	0.0249	0.0502
WV	113.0	0.42	43	68	0.0020	0.0030	0.0259	0.0521
WY	63.9	0.24	24	38	0.0011	0.0017	0.0146	0.0295
U.S. Total	**5,942.2**	**21.86**	**2261**	**3558**				

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