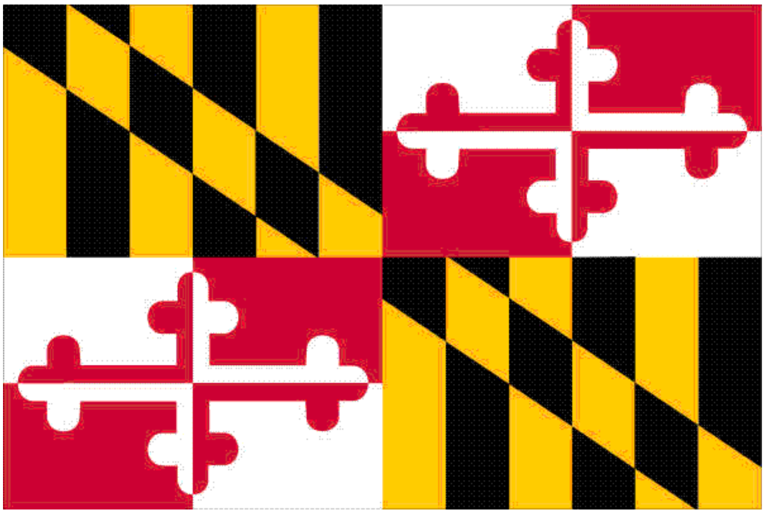
Observed Climate Change and the Negligible Global Effect of Greenhouse-gas Emission Limits in the State of Maryland



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Summary for Policy Makers

In April 2007, Maryland Governor Martin O'Malley created the Maryland Commission on Climate Change and tasked it with preparing a Climate Action Plan specifically focusing on the following items:

- to address the drivers and causes of climate change
- to prepare for the likely consequences and impacts of climate change to Maryland
- to establish benchmarks and timetables for implementing the Climate Plan

Interestingly, the two most important analyses were left off this list, the first being a review of Maryland's climate history with an eye towards understanding the roles of natural variability and human-caused "global warming" in shaping its past and current climate and, the second being a quantification of the effect that reducing greenhouse gas in Maryland will have on Maryland's future climate. Without a complete understanding of the former, it is impossible to relate "global changes" to local impacts, and without understanding the latter, it is impossible to justify any emissions restriction actions under the guise of "climate change."

In this document, we provide these overlooked, but nevertheless vital analyses. In doing so, we find that there is scant evidence that "global warming" is or has impacted Maryland's climate to any large degree, instead we find while Maryland's temperatures have been slowly rising for more than a century, that natural year-to-year and decade-to-decade scale variations dominate the state's precipitation and drought history. We find that tropical cyclones more often provide Maryland's farmers and water managers with a respite from the late summer dryness that stresses their crop and water systems than they produce catastrophic damages from a direct landfall. We find that Maryland's coastal regions have been rapidly growing in population despite a long-term sea level rise and that Marylanders have become less sensitive to summertime heat waves.

Most significantly, Maryland's greenhouse gas emissions have virtually no effect on global climate. In fact, if Maryland was to immediately cease all carbon dioxide emissions, now and forever, the rate of year-over-year growth in global carbon dioxide emissions (primarily fueled by massive emissions increases in China) would completely subsume Maryland's total contribution in *just one months' time*. Thus, Governor O'Malley's call for a *reduction*, rather than a complete cessation, of Maryland's greenhouse gas emissions will have absolutely no effect on global or local climate.

Unfortunately, the same cannot be said for the economic consequences of greenhouse gas emissions' reduction—they are estimated to be large, and negative.

This is the perfect recipe for an all pain and no gain scenario for Maryland's citizenry.

Observed climate change in Maryland

Annual Temperature: Averaged across the state of Maryland, there has been long-term trend in the state's annual temperature history since 1895, the year when well-compiled temperature records first become available from the U. S. National Climatic Data Center. Figure 1 shows Maryland's temperature history and indicates that the overall rise in temperature has occurred at a rate of about 0.17ºF per decade, or a total change of about 2ºF from 1895 to 2007. The temperature rise has not been continuous, however. The warming began in the late 1800s and continued thorough the early 1950s. The warming was interrupted by a rapid cooling of statewide average temperatures from the mid-1950s to the mid-1960s when the statewide average temperature dropped by nearly 2ºF. Warming then resumed in the mid-1960s and has continued until the present. This long-term temperature rise is likely related, in part, to the land-use changes and urbanization that have been on-going across Maryland for the previous century or more—conversion of forests and pastureland to cities and suburbs has the impact of elevating the local temperature. Superimposed on the overall warming trend is a significant degree of interannual and interdecadal variation.

Maryland statewide average annual temperatures, 1895-2007

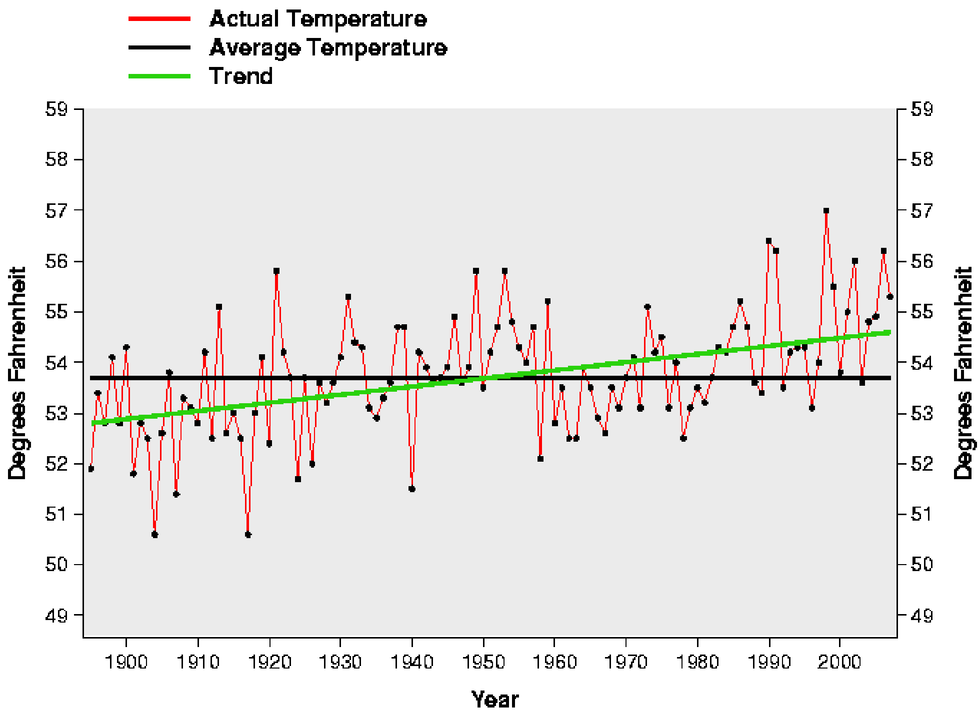

Figure 1. Maryland's long-term statewide annual average temperature history, 1895-2007. Source: US National Climate Data Center (http://www.ncdc.noaa.gov/oa/climate/research/cag3/md.html)

Precipitation: Averaged across the state of Maryland for each of the past 113 years, statewide annual total precipitation exhibits no statistically significant long-term trend, and averages just over 43 inches per year. Instead of a long-term trend indicative of climate change, Maryland's annual precipitation history is dominated by large year-to-year and decade-to-decade variability. For instance, Maryland's annual precipitation has varied from as much as 62.74 inches falling in 2003 to a little as 23.77 inches in 1930. Variability on this time scale is part of the natural climate of Maryland.

Maryland's annual precipitation history, 1885-2007

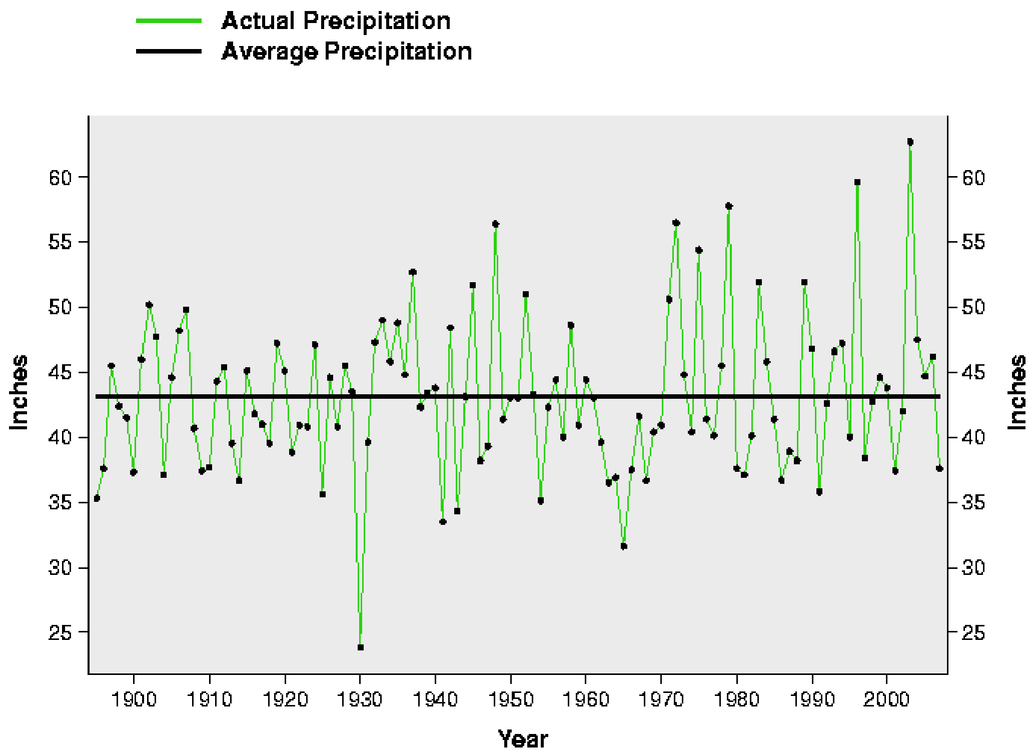

Figure 2. Maryland's long-term statewide annual precipitation history. Source: US National Climate Data Center (http://www.ncdc.noaa.gov/oa/climate/research/cag3/md.html)

Drought: As is evident from Maryland's long-term observed precipitation history, there are oftentimes strings of dry years, for instance, in the mid-1960s. Several dry years in a row can lead to widespread drought conditions. However, as is also evident from Maryland's precipitation history, there is no long-term change in the total precipitation across the state. Consequently, neither has there been any long-term trend in drought conditions there—as indicated by the history of the Palmer Drought Severity Index

(PDSI)—a standard measure of moisture conditions that takes into account both inputs from precipitation and losses from evaporation. Instead of a long-term trend, the PDSI is dominated by shorter term variations which largely reflect the state's precipitation variability. An extreme drought in the early 1930s and the extended drought in the mid-1960s mark the most significant events of the past 113 years.

Maryland's drought severity, 1885-2007

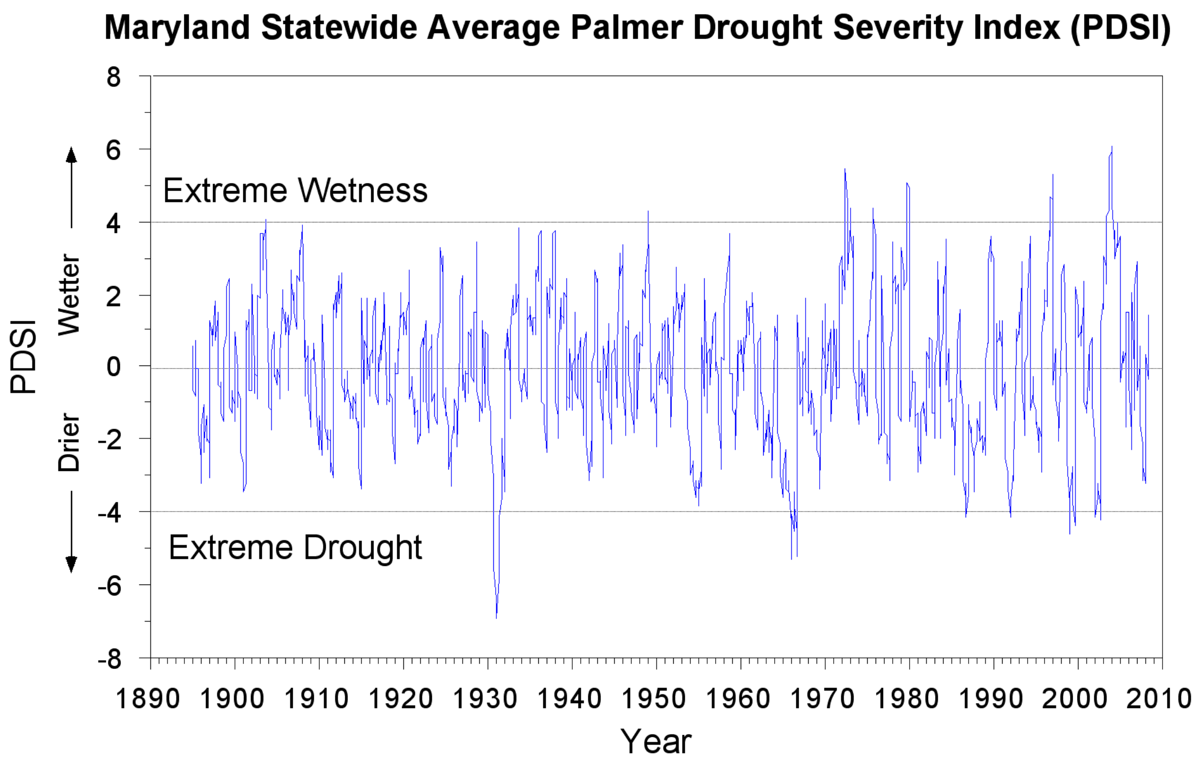

Figure 3. Maryland's long-term statewide monthly Palmer Drought Severity Index values as compiled and maintained by the National Climate Data Center (http://cdo.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp)

Paleo-drought Records: An even longer-term look back into moisture conditions in Maryland can be had using information contained in the annual growth record of tree-rings. Dr. Edward Cook and colleagues were able to reconstruct a summertime PDSI record for Maryland that extends back in time more than 1500 years. That paleoclimate record of moisture indicates that alternating multi-decadal periods of wet and dry conditions have occurred with regularity during the past 1500 years. Additionally, the long-term record indicates droughts prior to the 20th century that have been of much longer duration and greater severity than anything experienced in recent years. Droughts in the late-1800s, early 1600s and around 650 AD dwarf any recent dry conditions. The paleo moisture record provides clear indication that droughts (and wet periods) are a normal part of the region's environment and thus cannot be used as an example of events that are caused by any type of "global warming."

Maryland's reconstructed paleo-drought severity

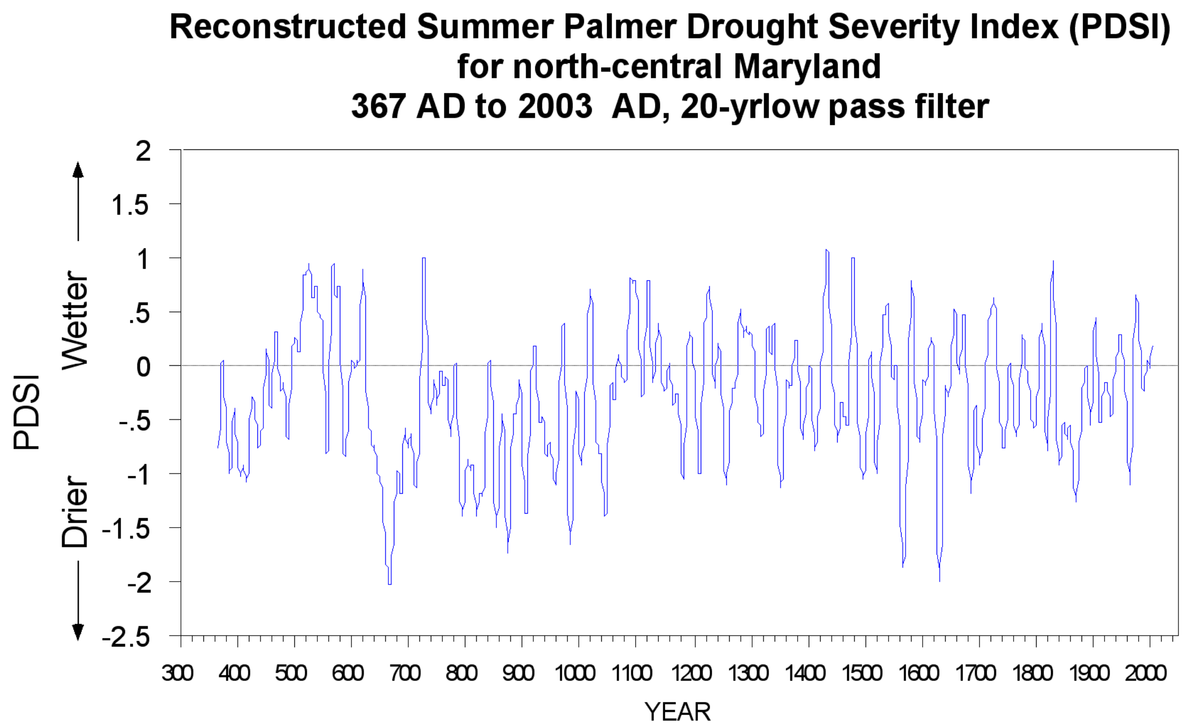

Figure 4. The reconstructed summer (June, July, August) Palmer Drought Severity Index (PDSI) for north-central Maryland from 367 A.D. to 2003 A.D. depicted as a 20-yr running mean. (National Climate Data Center, http://www.ncdc.noaa.gov/paleo/pdsi.html)

Crop Yields: In Maryland, the annual yields from the state's leading cash crops such as corn and soybeans have risen dramatically during the past 60 years (USDA), while, as we have seen, the climate there has changed relatively little. This indicates that factors other than climate are largely responsible for the rapid yield rise.

Maryland Crop Yields, 1950-2007

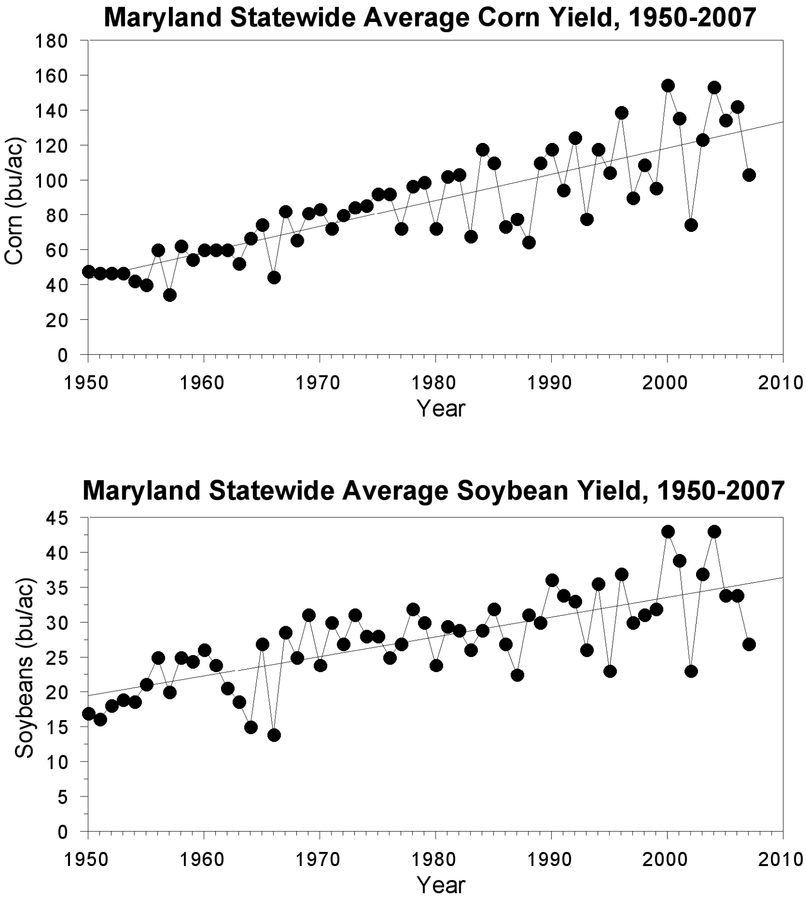

Figure 5. History of crop yields (1950-2007) of the two most economically significant crops in Maryland, corn (top) and soybeans (bottom). There is no indication that long-term climate changes are negatively impacting crop yields.

Crop yields increase primarily as a result of technology—better fertilizer, 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 are responsible for some of the year-to-year variation in crop yields about the long-term upward trend but are little responsible for the upward trend itself. 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. Thus, projections of negative impacts to Maryland's agriculture that may result from climate change are unfounded.

Sea Level Rise: The relative sea level along the Maryland coast has changed due to a combination of the land slightly sinking and the ocean slightly rising (Davis, 1987; Aubrey and Emery, 1991, USGS). The United States Geological Survey describes the various forces behind the sea level rise in the Chesapeake Bay (http://pubs.usgs.gov/fs/fs102-98//):

> Tide gauges for the Chesapeake Bay and the Mid-Atlantic coast show rates of sea-level rise twice that of the worldwide average. Scientists disagree on the cause of the recent increase in the rate of rise. Is the increase caused by land subsidence, or is it related to a changing climate and ocean volume? Anthropogenic (man-induced) causes are often sought to account for anomalies in the short historical records of environmental change. Sediment compaction resulting from extraction of ground water is another popular explanation used today to account for land subsidence. On a much broader scale, a zone of subsidence along the entire Mid-Atlantic coast has been attributed to crustal adjustment still taking place following the removal of vast thicknesses of glacier ice to the north thousands of years ago (isostatic adjustment).
>
> The Chesapeake Bay has also been identified as one of four anomalous areas along the U.S. East Coast that appear tectonically active. A zone of crustal downwarping and sediment accumulation known as the Salisbury embayment has long been recognized beneath the Delmarva Peninsula. It is clearly possible for vertical movement to occur along such zones. Another geologic factor that might account for anomalous rates of sea-level change, at least for the mouth of the bay, is possible subsidence related to compaction of the fill of a large buried impact crater that underlies much of the Norfolk, Hampton Roads, and Cape Charles area. For the Chesapeake Bay, the rate of sea-level rise has certainly accelerated, but just as certainly, rising sea level is the norm in the region rather than the exception. The applied scientific issues in this area revolve around understanding, coping with, and more importantly, planning for an ongoing dynamic Earth process like sea-level change.

Together, these processes have led to subsidence of coastal Maryland, and they drive a relative sea level rise. Acting on top of the sinking of the land, is a rise in global sea level from a combination of natural cycles and warming seas (Kolker and Hameed, 2007). Yet, despite this slowly rising level of the oceans, Maryland's residents have successfully adapted, as the growing population of coastal Maryland attests.

Maryland's coastal population has increased by about 36% since 1980 and Maryland's Sea Grant program reports that Maryland "now ranks fifth [in the U.S] in population density, with almost 70 percent of that population living in the two-thirds of the state designated as the 'coastal zone.'" Two of Maryland's coastal counties rank among the fastest growing coastal counties (in terms of percentage population change) in the Northeast according to the U.S. Department of Commerce. So clearly Maryland'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 that a dispassionate look at future sea level rise projections finds them to be less than alarming.

Projected Population Change in Northeastern Coastal Counties 2003-2008

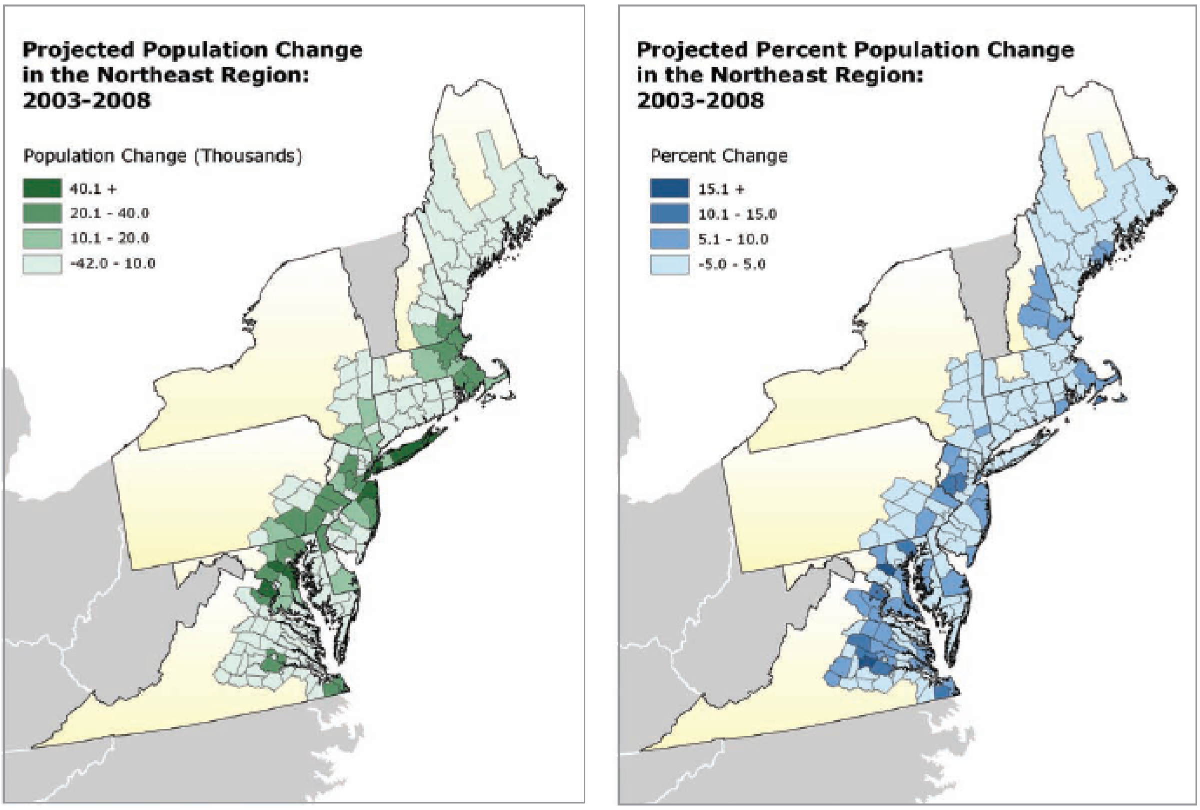

Figure 6. Projected population change in the coastal counties of the northeastern U.S. (top) from 2003-2008 and expected percentage change in population (bottom) (source: U.S. Department of Commerce).

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, depending on the total amount of warming that occurs. The IPCC links a lower sea level rise with lower future warming. The established warming rate of the earth is 0.17ºC 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. 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 Maryland coastlines have been experiencing for more than a century—and have adapted to.

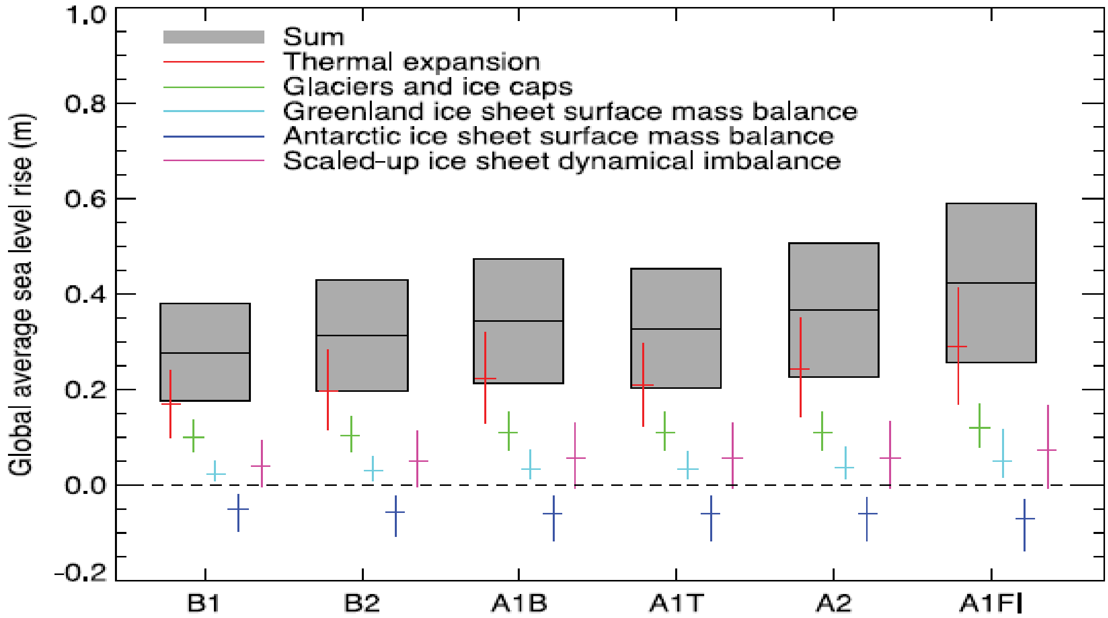

Figure 7. Range of sea level rise projections (and their individual components) for the year 2100 made by the IPCC AR4 for its six primary emissions scenarios.

There are a few individuals 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 Maryland 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 the most reliable scientific information, and in fact, ignore what 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 slow the rate of global sea level rise (because the water remains trapped in ice and snow). And new data suggest that the increasing rate of ice loss from Greenland observed over the past few years has started to decline (Howat et al., 2007). 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.

Hurricanes: With only a small portion of the state directly bordering the Atlantic Ocean along with its relatively northward location tends to largely reduce the chances of a large hurricane making a direct hit on Maryland. However, Maryland is impacted by far more tropical cyclones than is indicated by direct hurricane landfalls alone. For instance, on occasion, hurricanes and other tropical systems can raise the water level in the Chesapeake Bay and result in substantial flooding along Maryland's many miles of Bay shores as Hurricane Isabel did in 2003. Also, the remnants of many tropical systems which come ashore along the southeastern U.S. coastline impact the weather to some degree over Maryland. On rare occasions, the impacts can result in devastating floods, such as those associated with the remnants of hurricane Agnes in 1972, or in clustered tornado outbreaks, such as those experienced in western Maryland in 2004. But on much more frequent occasion, the impact takes the form of a widespread and beneficial rainfall during the time of year when rainfall is most needed for Maryland's agricultural interests.

The late summer months is the time during the year when, climatologically, the precipitation deficit is the greatest and crops and other plants are the most moisture stressed. A passing tropical cyclone often brings much needed precipitation over large portions of the state during these late summer months. In fact, recent research shows that Maryland, on average, receives about 15% percent of its normal September precipitation, and about 8 to 12 percent of its total June through November total precipitation from passing tropical systems (Knight and Davis, 2007). And since a large percentage of Maryland's field crops is grown under non-irrigated conditions, widespread rainfall from a tropical cyclone becomes almost an expected and relied upon late summer moisture source.

Tropical Cyclone Precipitation

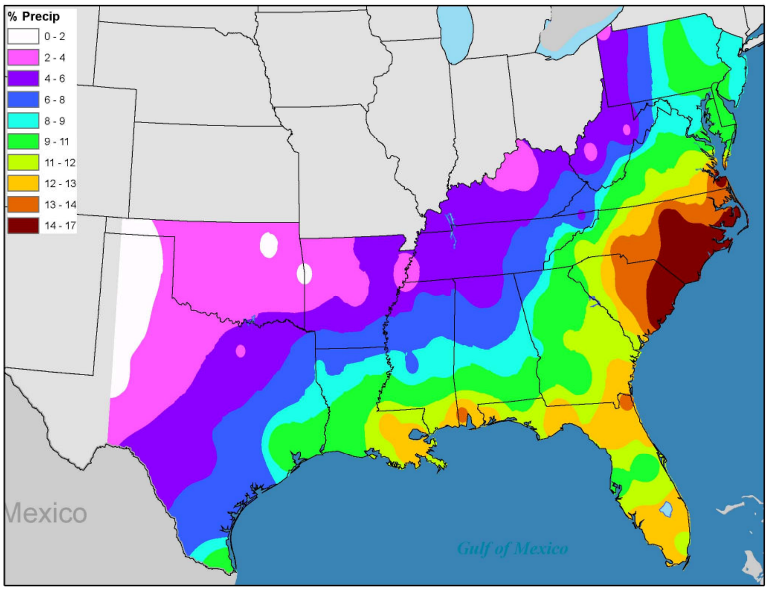

Figure 8. Percentage of June through November precipitation that comes from tropical systems (Knight and Davis, 2007).

Since 1995 there has been an increase in both the frequency and intensity of tropical storms and hurricanes in the Atlantic basin at large. 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.

In fact, natural cycles dominate the observed record of Atlantic tropical cyclones, which dates back into the 18th and 19th centuries. 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

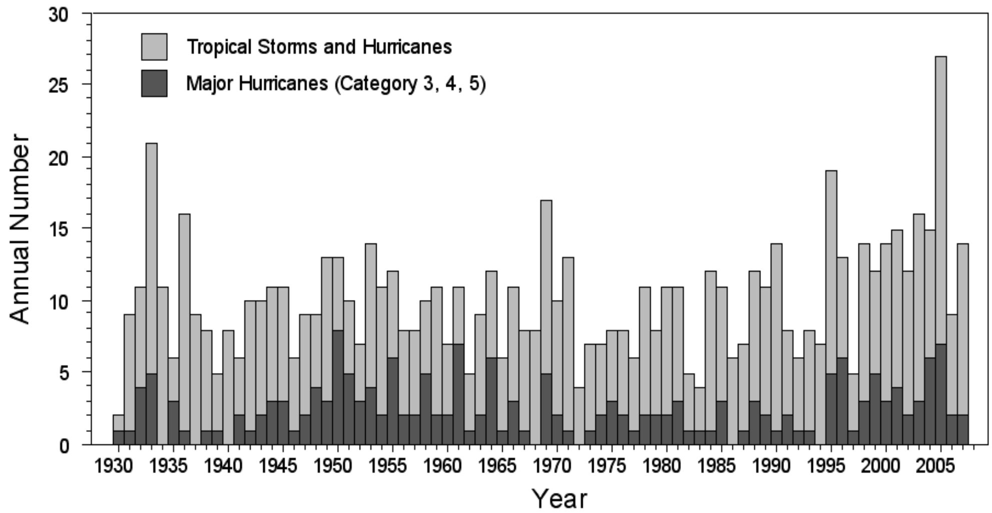

Figure 9. Annual number of tropical cyclones and major hurricanes observed in the Atlantic basin, 1930-2007. Bars depict number of named systems (light gray) and major (category 3 or greater) hurricanes (dark gray) (source: National Hurricane Center).

These 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. And 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). And from patterns in paleoclimate datasets coupled with model simulations, the AMO can be simulated back for more than 1,400 years (Knight et al., 2005).

Atlantic Multidecadal Oscillation

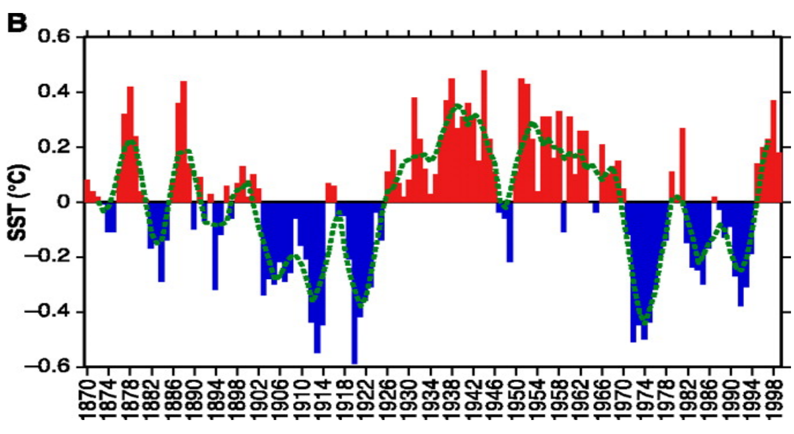

Figure 10. The observed historical timeseries of the Atlantic Multidecadal Oscillation (AMO) (from Goldenberg et al., 2001).

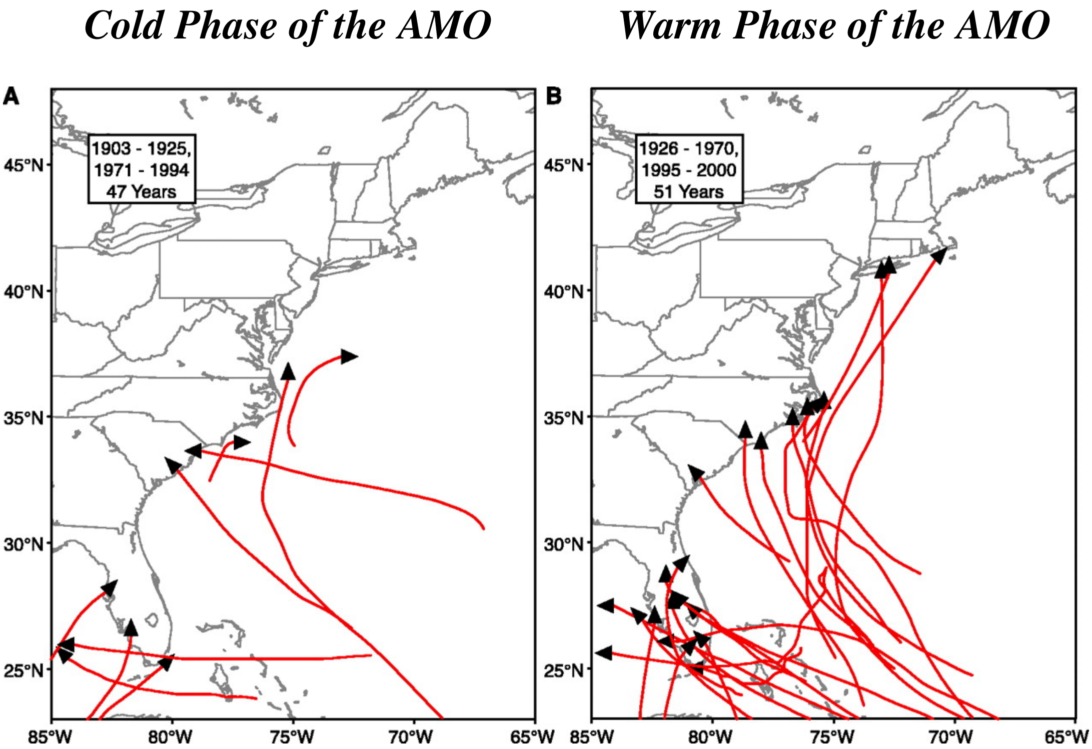

*Figure 11. Contrast of U.S. East Coast major hurricane landfalls between colder (**A**) and warmer (**B**) values of the Atlantic multidecadal mode. The solid red lines indicate where the storms were at major hurricane intensity (from Goldenberg et al., 2001).*

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 (as far as backward the various paleodatasets will allow). 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. And in research that examined sediment records deposited from beach overwash in a lagoon in Puerto Rico, scientists Donnelly and Woodruff (2007) have identified patterns of Atlantic tropical cyclone activity extending back 5,000 years.

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 heightened activity levels are likely here to stay awhile, as the oscillations usually last several decades.

And so, inevitably, a hurricane will make a direct strike on Maryland again in the future, and when it does, it will encounter a state whose population demographics have changed quite a bit since the last major storm impact. A direct or indirect strike from a hurricane now will likely lead to more damage and destruction than it did in the past. While this gives the impression that storms are getting worse, in fact, it simply may be that there are a greater number of assets that lie in their path.

An example of this can be found in research by a team of researchers led by Dr. Roger Pielke Jr. (2008) which sheds some light on how population changes underlay hurricane damage statistics. Dr. Pielke's research team examined the historical damage amounts from tropical cyclones in the United States from 1900 to 2005. What they found when they adjusted the reported damage estimates only for inflation was a trend towards increased amounts of loss, peaking in the years 2004 and 2005, which include Hurricane Katrina as the record holder for the costliest storm, causing 81 billion dollars in damage.

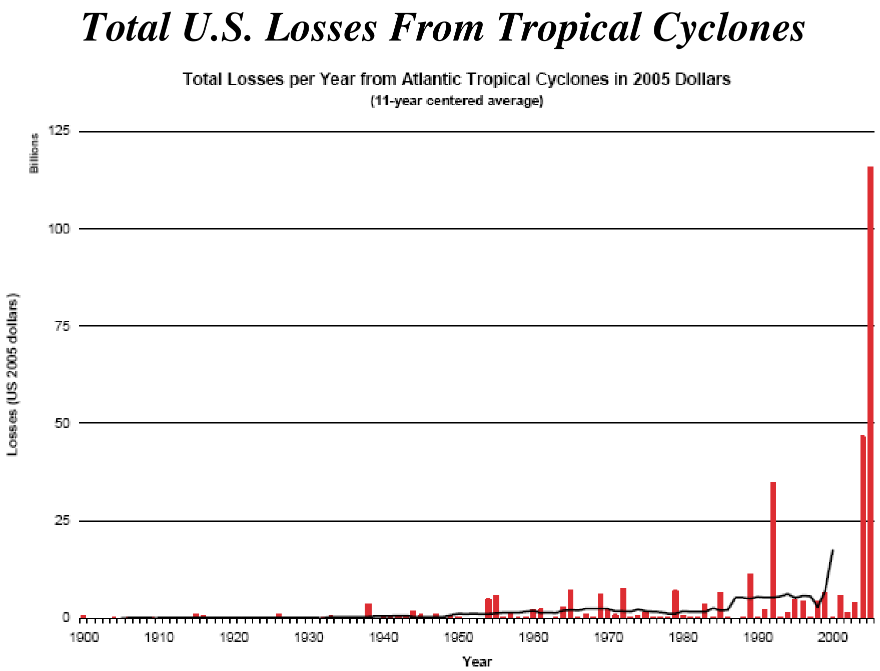

Figure 12. U.S. tropical cyclone damage (in 2005 dollars) when adjusted for inflation, 1900-2005 (from Pielke Jr., et al., 2008)

However, many changes have occurred in hurricane prone areas since 1900 besides inflation. These changes include a coastal population that is growing in size as well as wealth. When the Pielke Jr. team made adjustments considering all of these factors, they found no long-term change in damage amounts. And, in fact, 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 Pielke Jr. and colleagues studied.

Normalized Total U.S. Losses From Tropical Cyclones

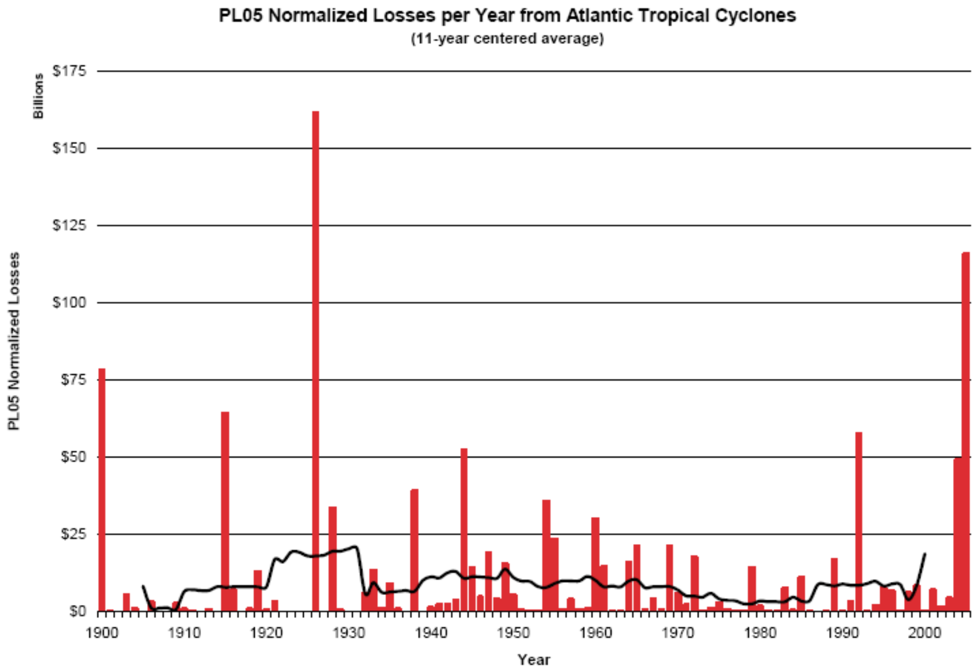

Figure 13. U.S. tropical cyclone damage (in 2005 dollars) when adjusted for inflation, population growth and wealth, 1900-2005 (from Pielke Jr., et al., 2008)

This result by the Pielke Jr. 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 Dr. Pielke 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 global warming.

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

Even in the absence of any long-term trends in hurricane landfalls along the Maryland or the U.S. coast, or damage to U.S. coastlines when population demographics are taken into account, the impact from a single storm, such as 2003's Hurricane Isabel, can be enormous as residents of Maryland know 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 thinking on hurricanes and their potential impact (http://wind.mit.edu/~emanuel/Hurricane_threat.htm):

> 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.

Heatwaves: A number of studies have shown that during the past several decades, the population in major U.S. cities, including those in and around Maryland, has grown better adapted, and thus less sensitive, to the effects of excessive heat events (Davis et al., 2003ab). This desensitization is attributed to better medical practices, increased access to air-conditioning, and improved community response programs. In some cities, by the 1990s, heat-related mortality was virtually non-existent. In general, the locations across the country where high summertime temperatures are commonplace were found to be well-adapted to high heat events and typically displayed little if any mortality response to heat waves. This is true of Baltimore, the Maryland city that was included in the study, as well as the nearby cities of Philadelphia, Pa., Washington, DC, and Norfolk, Va. All of these cities have exhibited statistically significant declines in heat-related morality over the past 30-40 years. That the population was once more sensitive to heat waves than it is now is clear and strong evidence that Marylanders have adapted their way of life to best cope with high summer temperatures. There is no reason to believe that this adaptation will change into the future.

Heat-related mortality trends across the U.S.

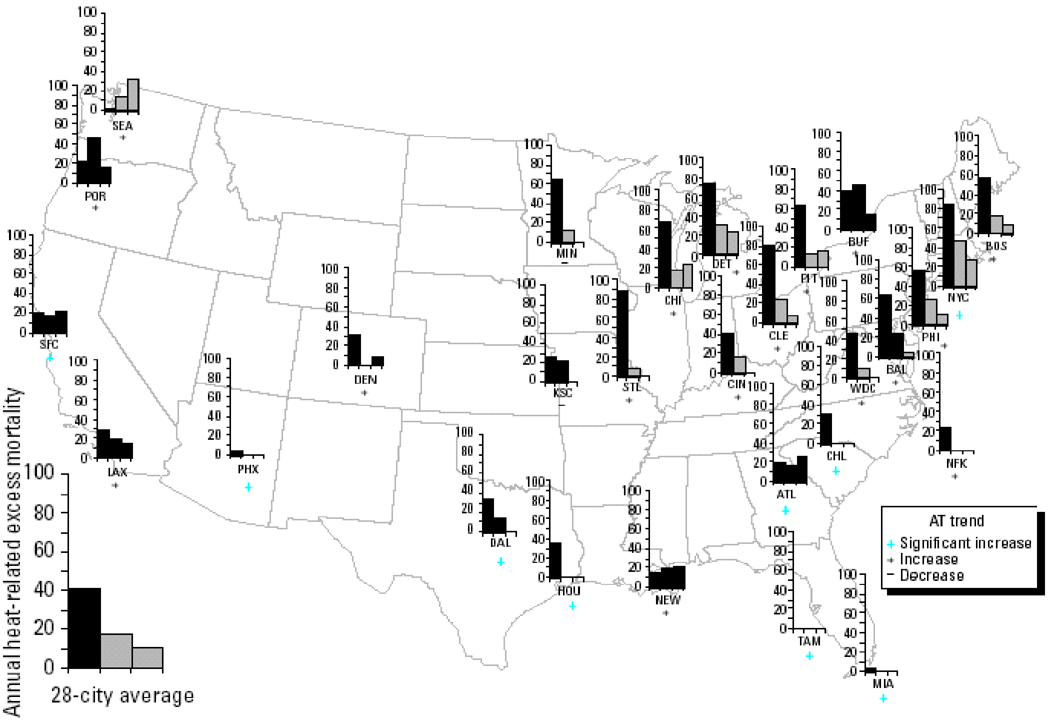

Figure 14. Annual average excess summer mortality due to high temperatures, broken down by decade, for 28 major cities across the United States. For each city each of the three bars represents the average mortality during successive decades (left bar 1964-66 + 1973-1979; middle bar 1980-1989, right bar 1990-1998). Bars of different color indicate a statistically significant difference. No bar at all means that no temperature/mortality relationship could be found during that decade/city combination (taken from Davis et al., 2003b).

The declining sensitivity to high summer temperatures that has taken place in Maryland and in cities across the country is well illustrated in the Figure 14 (taken from Davis et al., 2003b). Each of the bars of the illustration 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 is declining (the bars are get smaller), and in many cities in the southeastern United States, there is no bar at all in the 1990s, indicating that there were no statistically distinguishable heat-related deaths during that decade (the most recent one studied). In other words, the population of those cities has become nearly completely adapted to heat waves. 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.

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 provides another demonstration that populations adapt to their prevailing climate conditions. 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.

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

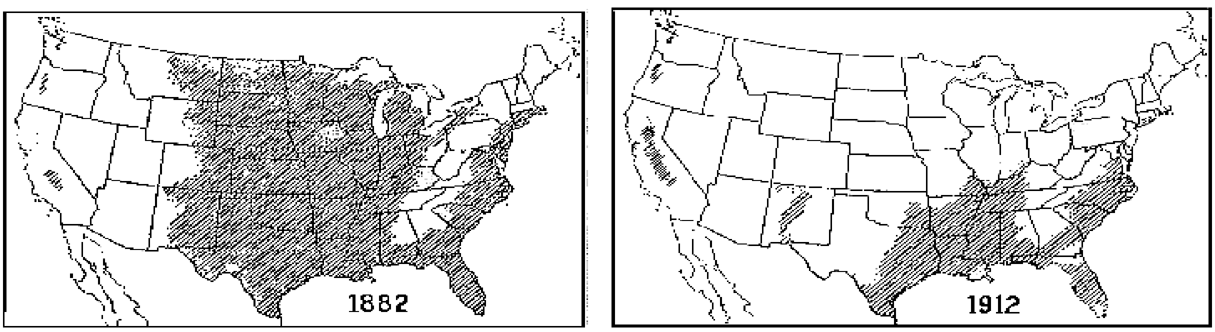

Figure 15. Shaded regions indicate locations where malaria was endemic in the United States (from Zucker et al., 1996).

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 fact, 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—including the eastern 2/3rds (non-mountainous portions) of Maryland. 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 fact, in 1946 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 involved.

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 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).

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 Maryland. 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

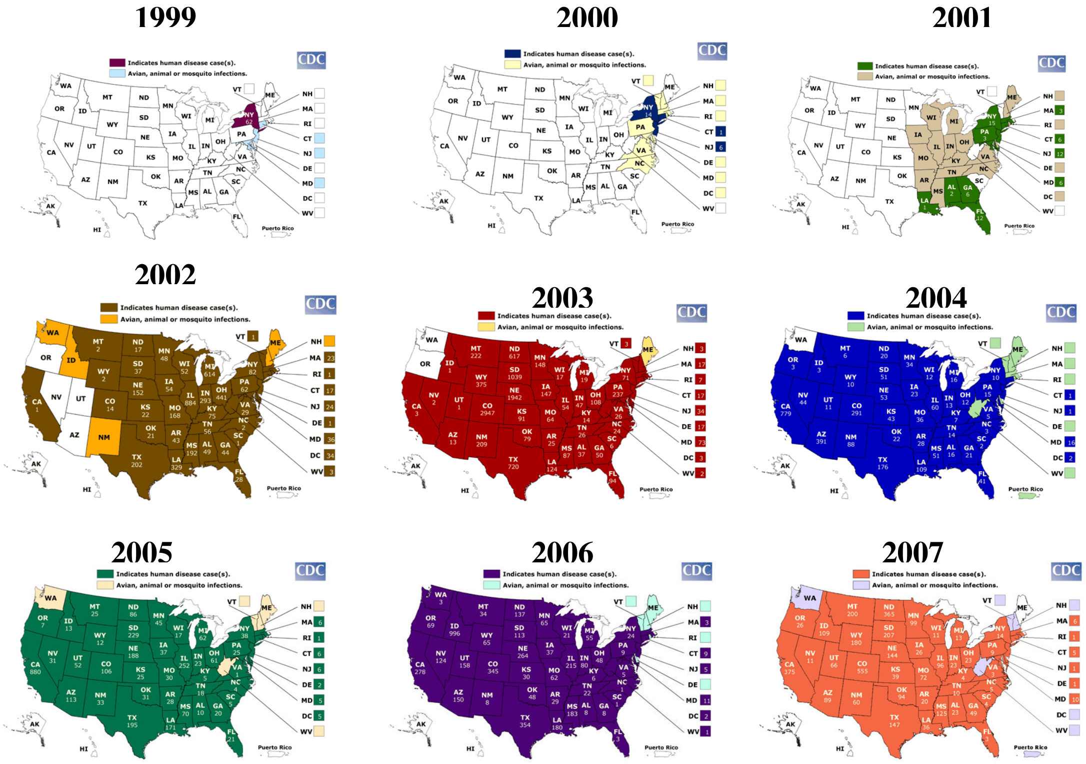

Figure 16. Spread of the occurrence of the West Nile Virus from its introduction to the United States in 1999 through 2007. By 2003, virtually every state in the country had reported the presence of virus. (source: http://www.cdc.gov/ncidod/dvbid/westnile/Mapsactivity/surv&control07Maps.htm).

The vector for West Nile is mosquitoes; wherever there is a suitable host mosquito population, an outpost for West Nile virus can be established. And 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 Maryland is simply wrong. The already-resident mosquito populations of Maryland 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 Maryland because the extant climate/ecology of Maryland is one in which the virus can thrive. The reason that it was not found in Maryland in the past was simply because it had not been introduced. Climate change in Maryland 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 were 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 Maryland 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 Maryland.

Impacts of climate-mitigation measures in Maryland

Globally, in 2004, humankind emitted 27,186 million metric tons of carbon dioxide (mmtCO_2), of which emissions from Maryland accounted for 80.6 mmtCO_2, or a mere 0.3% (EIA, 2007a, b). The proportion of manmade CO_2 emissions from Maryland 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 Maryland's CO_2 emissions (EIA, 2007a).

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 *11 times* greater than Maryland's *total* emissions. **This means that even a complete cessation of *all* CO_2 emissions in Maryland will be completely subsumed by global emissions growth in just one**

month's time! In fact, China alone adds about five Maryland's-worth of *new* emissions to its emissions total each and every year. Clearly, given the magnitude of the global emissions and global emission growth, regulations prescribing a *reduction*, rather than a complete cessation, of Maryland'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. A complete cessation of CO_2 emissions in Maryland 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 Maryland, 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 Maryland – now 1.4% – 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)	Maryland (1.4% of U.S.)
2000	26,609	14,934	5,795	81
2025	41,276	18,308	7,103	99
2050	50,809	18,308	7,103	99
2100	75,376	21,534	8,355	117

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

In Table 2, we compare the total CO_2 emissions saving that would result if Maryland'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	Maryland	Kyoto Const.
2000	0	0
2025	99	4,697
2050	99	4,697
2100	117	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 Maryland's CO_2 emissions (calculated as column 2 in Table 2 divided by column 3 in Table 2).

Table 3

Maryland's percentage of emissions savings

Year	Maryland
2000	0.0%
2025	2.1%
2050	2.1%
2100	1.5%

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 Maryland:

Table 4

Projected global temperature savings (ºC)

Year	Kyoto Const	Maryland
2000	0	0
2025	0.03	0.0006
2050	0.07	0.001
2100	0.15	0.002

Accordingly, a cessation of all of Maryland'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	Maryland
2000	0	0
2025	0.2	0.004
2050	0.9	0.02
2100	2.6	0.04

A complete cessation of all anthropogenic emissions from Maryland will result in a global sea-level rise savings by the year 2100 of an estimated 0.04 cm, or two *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 countries' *entire* emissions in about a decade. In this context, any cuts in emissions from Maryland would be extravagantly pointless.

Costs of Federal Legislation

And what would be the potential costs to Maryland 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 Maryland would decline by $1,191 to $3,863 and by the year 2030 the decline would increase to between $5,022 and $9,157. The state would stand to lose between 27,000 and 40,000 jobs by 2020 and between 76,000 and 101,000 jobs by 2030. At the same time gas prices could increase by over $5 a gallon by the year 2030 and the states' Gross Domestic Product could decline by then by as much as $13.1 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.

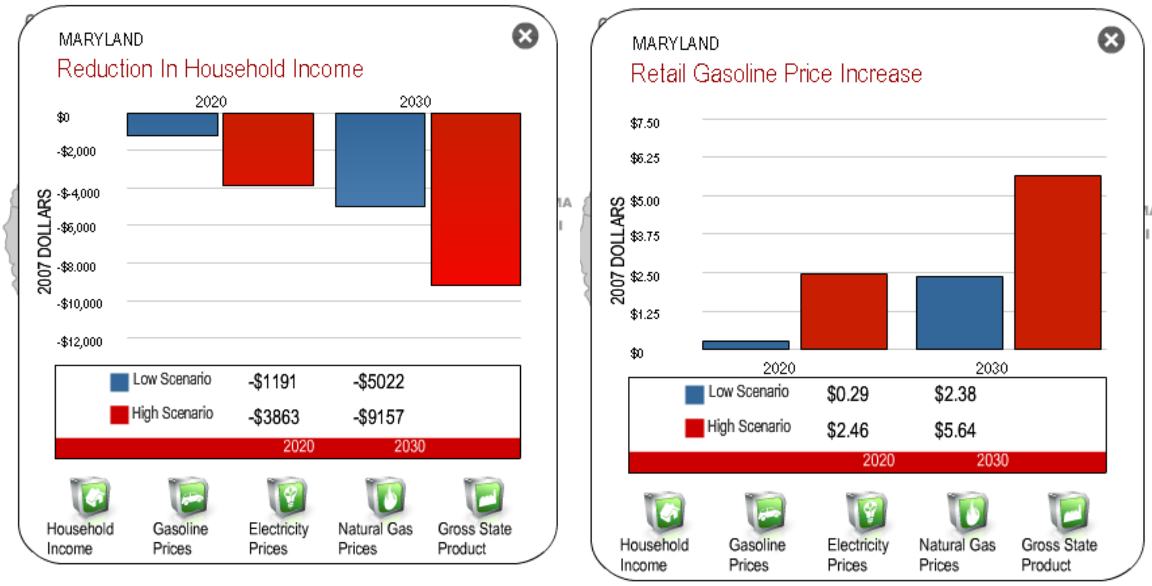

Figure 17. The economic impacts in Maryland of federal legislation to limit greenhouse gas emissions green. (Source: Science Applications International Corporation, 2008, http://www.instituteforenergyresearch.org/cost-of-climate-change-policies/)

Maryland Scientists Reject UN's Global Warming Claims[1]

At least 660 Maryland 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 Maryland scientists who signed the petition can be viewed here:
http://petitionproject.org/gwdatabase/Signers_BY_State.html

[1] Questions about this survey should be addressed to the petition organizers.

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