

The Ten Warning Signs of Global Warming

Joe Ridout
Public Citizen

Texans are famous for their creative ways of describing their hot summer weather. Colorful sayings include “hotter than a stolen tamale,” “so hot the hens are laying hard-boiled eggs,” and “hotter than Lucifer’s oven.” But, as the state of Texas displays more and more of the harmful effects of global warming, we may need to add new—if less elegant—turns of phrase, like “hot enough to triple heat-related deaths,” “warm enough to wipe out coastal communities as sea levels rise,” or “hot enough to turn spring into summer.”

The “greenhouse effect” is what makes life on our planet possible. Greenhouse gases like carbon dioxide, methane, and water vapor trap some of the sun’s energy to warm the earth’s surface to a livable temperature. But an overabundance of CO₂, through the burning of fossil fuels like coal and oil, are turning the greenhouse effect from a beneficent process into a harmful one. As humans burn fossil fuels, greenhouse gases have accumulated to where they exceed their natural levels in the atmosphere and trap more heat than needed. The greenhouse gas most implicated in this process of global warming is carbon dioxide (CO₂).

The most objective, well-respected source we have on global warming is the Intergovernmental Panel on Climate Change (IPCC), which has issued reports on global warming in 1990, 1995, and 2001. The most recent report needed 2600 pages to compile all the evidence pointing toward human responsibility for climate change. And, with 122 main authors, 515 contributing authors, and another 450 scientists from all over the world who reviewed the report before it was published, the IPCC can hardly be dismissed as a politically-motivated organization. While there can never be indisputable certainty as to humankind’s role in warming the atmosphere, the conclusions have been stronger with each study by the IPCC. In its most recent (2001) report, the IPCC estimated that surface temperatures could rise up to 10.4 degrees F over this century, and sea levels could rise nearly 3 feet.

Evidence that the earth is undergoing a dangerous warming trend becomes more glaring with each year. Nineteen of the hottest twenty years ever measured have all occurred since 1980. The warmest year measured to date was 1998; the second and third warmest were 2002 and 2003. Not coincidentally, the amount of CO₂ in the atmosphere has been found to be at its highest level in every successive year. From a baseline of 280 parts per million (ppm) before the industrial revolution, as of March 2004, the CO₂ concentration was measured at 379 parts per million. Even more alarming, CO₂ concentrations are building up faster than ever. And, as more and more of the world industrializes, we are seeing carbon concentrations rise accordingly. As of 2004, CO₂ is now increasing by about 3 ppm annually, versus about 1 ppm annually in the middle of the twentieth

century. The following sections discuss the consequences of the warming trend we are seeing, and can expect to see, as a result.

Floods

Climate scientists have shown that extreme weather events will increase as the planet's warming trend continues. Warmer sea temperatures produce more tropical storms and hurricanes, which puts Texas' coastal residents in particular danger.

Floods are expected to increase in frequency and severity, as shown through the recent misfortune of the city of San Antonio. In October, 1998, San Antonio was subjected to 11 inches of rainfall in 1 day—twice as much as the city had ever received in a day. Ultimately, the flood of 1998 killed 31 residents of San Antonio and caused over \$750 million in property damages. As if this weren't bad enough, the city was hit by a second destructive flood in 2002, as was much of the rest of Texas. Both the 1998 and the 2002 floods were events of a magnitude that should be expected to occur only once every 500 years. Two "500-year" floods in a four-year period are unlikely to simply be a coincidence. Statewide, the 2002 flood caused over \$1 billion in damages to 41 Texas counties. Furthermore, as many Texans are aware, floods cause damage even after the flood is over. Molds and fungi, including *stachybotrys chartarum* or "black mold" can grow inside buildings long after floodwaters have receded. Over time, the consequence of unchecked global warming may not be only extreme weather, but also extreme financial burdens.

Heat Deaths

IPCC climatologists forecast an increase of up to 10.4 degrees F over the next century. This increase will be driven principally by heat-trapping greenhouse gases like carbon dioxide. In Texas, the July heat index is predicted to rise by 25 degrees over this century. These unfamiliarly high temperatures are expected to cause more heat-related illnesses and heat-related deaths, and large cities such as Houston and Dallas will be particularly vulnerable to these weather extremes. The city of Dallas, according to the EPA, could face three times as many heat-related deaths each summer as a consequence of the artificially high temperatures brought about by global warming. Even leaving aside the EPA's model, the news already is disturbing enough; Texas has led the nation in heat-related deaths in three of the last seven years. During the worst of these years, in July 1998, the state experienced a heat wave that killed more than 70 Texans. Nonetheless, in perspective, this disaster was comparatively minor next to the recent extreme heat wave that killed 20,000 people in Europe and 1500 in India in the summer of 2002. In a warmer world, greater risk from heat death will be generalized and widespread, particularly in urban areas, where the "heat island effect" causes cities to retain heat longer through its asphalt, cement, and tar roofs. The United Nations weather agency says that large cities can expect to suffer twice as many deaths from heat waves by 2020.

Drought

A study by the World Meteorological Association found that the 1990s had been the hottest decade in 1000 years. The present decade is projected to be even warmer, and Texas is likely to experience a greater frequency and severity of droughts. In fact, based on droughts observed in recent years, what now seems like an unusual period of lack of rainfall may before long come to be viewed as the norm. The 1999-2002 drought was one of the three most extensive droughts in the last 40 years. The summer of 2002 was the nation's hottest since the "Dust Bowl" era of the 1930s. Locally, the period from April through June of 1998 was the driest three-month period in 104 years for Texas, as well as for Louisiana and Florida. Warmer temperatures will cause increased evaporation and exacerbate problems of water scarcity for many Texans. One study examined increasing evaporation of Texas' water resources around the San Antonio Edwards Aquifer region. A National Assessment of Climate Change found that the area would suffer reduced springflows, less irrigation, and a regional welfare loss of \$2.2-\$6.8 million per year due to global warming. Springflows at Comal springs were shown to decrease by 10-16% by 2030 and 20-24% by 2090. Consequently, as water resources are diverted from agricultural use, farm income is expected to fall from 16-30% by 2030 and 30-45% by 2090. Longer droughts also mean that Texas can expect to share the problem of increased wildfires that its western neighbors are experiencing. In 2002, the western United States experienced its second worst wildfire season in the last 50 years, with over 7 million acres being burned. Oregon, Arizona, and Colorado had their worst wildfire seasons ever recorded.

Change in Seasons

Global warming already has disrupted our normal cycles of spring and fall. The increase in CO₂ has led to the spring arriving 10.8 days earlier than it did in 1959. Likewise, the winter season has come progressively later in the Northern hemisphere since 1840. Lakes and rivers freeze an average of 8.7 days later, and ice cover begins melting 9.8 days earlier than it did 150 years ago.

The warming trend has already led to measurable biological changes in numerous organisms. A study in the esteemed science journal *Nature* revealed that, as of 2003, 81% of the species studied have undergone biological changes due to global warming. These changes include earlier blooming, breeding, egg-laying and migrating due to earlier springs. The authors concluded that rising temperatures "could easily disrupt the connectedness among species" and, furthermore, could result in the extinction of many of these species.

Not all organisms will suffer under increased warming conditions. Many trees and some crops like cotton, sorghum, and soybeans are expected to benefit under conditions of increased CO₂ content. Nonetheless, for people, livestock, and pets, the overall prognosis is negative.

Species Extinction

Elevated global temperatures will put numerous species at risk, as organisms are forced to abandon ecosystems they may have spent thousands of generations specifically adapting to. Camille Parmesan, a biologist at the University of Texas, has found that numerous species already are moving northward due to rising temperatures. As a result, they push many endangered species further toward extinction. For instance, toucans in Central America, driven northward by climate change, now prey upon the chicks of the endangered quetzal bird. The number of species at risk for extinction due to global warming is alarmingly high, and some already appear to have succumbed to the sudden transformation of their native habitat by rising temperatures. The golden toad, for example, has not been seen since the late-1980s and is believed to have gone extinct when warmer temperatures radically changed the Costa Rican cloud forest, its only known habitat. According to a 2004 study published in the *Nature*, up to 37% of 1,103 species studied could face extinction or near-extinction as a consequence of global warming.

Rising Sea Levels/Melting Ice Caps

One of the greatest impacts global warming is expected to have in Texas is that warmer temperatures will trigger a rise in sea levels. Warmer temperatures raise sea levels in two ways: by releasing frozen water stored in glaciers and ice sheets into the world's oceans, and because warmer water takes up more volume. According to the latest estimate from the Intergovernmental Panel on Climate Change (IPCC), sea levels could rise nearly three feet by the end of the century. A rise of this magnitude would be devastating to Texas' coastal communities, especially when considering that subsidence already causes many coastal areas to slowly sink under their own weight, which makes the relative sea level rise even higher. In addition to property losses on the part of beachfront property owners, rising sea levels will also reduce the amount of public beach land available to Texans. Higher sea levels also pose a danger to coastal aquifers, which could face intrusion by saltwater into sources of agricultural and drinking water. Any of these possibilities would have a devastating effect on the state budget as well. For instance, the cost of sand replenishment to protect coastal Texas from just a 20-inch sea level rise by 2100 is estimated at \$4.2-\$12.8 billion. If carbon reduction measures are not taken, the Gulf coast of Texas is expected to lose 500 square miles of its shoreline as sea levels rise. Former land commissioner Garry Mauro has illustrated this by comparing it to "a modern-day Paul Bunyan with a chainsaw cutting one-and-a-half miles off the Texas coast all the way from Port Arthur to the Rio Grande." Ultimately, global warming not only harms the citizens and the economy of the state, it also threatens to rob Texas of its land as well.

Although no one should seriously believe that climate change can occur over a span of 5 days, as depicted in the 2004 movie "The Day after Tomorrow," an increasing number of climate scientists are taking seriously the notion that climate change may occur more

rapidly than previously assumed. Instead of a steady deterioration over centuries, the earth's climate may experience a "positive-feedback loop" in which natural processes associated with warming temperatures mutually reinforce one another and accelerate the warming trend. As one example, warmer temperatures would melt more of the earth's ice sheets, which would expose the darker, heat-absorbing surface under the ice sheets, which would to an accelerated temperature rise that would melt the remaining ice faster. Paleoclimate data suggest that this has happened in the past. Likewise, as CO₂-influenced warming causes permafrost in tundra regions to thaw, the exposed permafrost releases some of its own frozen carbon back into the atmosphere and speeds up the process. Another scenario for rapid climate change which is disputed by some climate scientists but gaining popularity is the possibility that the "thermohaline circulation" of the ocean—the transfer of tropical waters to warm the cooler North Atlantic—can be disrupted or even shut down as melting ice packs dilute ocean water salinity and thus prevent it from circulating normally. Recent climate studies show that, 8,200 and 12,700 years ago, a period of gradual warming was followed by abrupt cooling—up to 5 degrees per decade.

A 2004 report from the Pentagon synthesized some of the recent findings in the area of rapid climate change, warning of the possibility of global famine and wars over shrinking resources, and urging that global warming be raised "beyond a scientific debate to a national security concern." Indeed, one could easily argue that the destructive potential of climate change exceeds the threat posed by terrorism to the U.S. over the long term.

Disease and Pests

Another health risk global warming poses for Texas is that warming weather is expected to be favorable to the spread of pests, including some species not indigenous to the state which will migrate north as the climate changes. The West Nile Virus, for instance, has succeeded in spreading beyond its original tropical home partly because the climate of the U.S.'s southernmost states are gradually becoming more suitable for disease-bearing mosquitoes and other invasive tropical species. Many insects indigenous to the state should flourish as well, because freezing winter temperatures which naturally control bug populations will be less frequent. In this context, the reappearance of dengue fever in Laredo is one more troubling sign that global warming has already begun to affect the health of Texans.

Ozone/Pollution

Global warming imperils Texans' health by altering the composition of the air we breathe. The higher CO₂ levels observed today do not pose a direct threat to human health, but their indirect effects are severe. For one, temperatures above 90°F can produce more ozone, a leading component of smog. Ozone has been shown to damage lung tissue, particularly among children and the elderly. The hotter summers predicted by IPCC and most other climate scientists will have a significant impact on Texas, which already experiences a high number of days over 90 degrees. According to a study by the EPA,

“ground-level ozone has been shown to aggravate respiratory illnesses such as asthma, reduce existing lung function, and induce respiratory inflammation.” At a time when Texas leads the nation in workers without health insurance, global warming-led production of ozone should raise significant concern.

Insurance

A less-understood aspect of the economic costs of climate change is how global warming will raise—and likely already is raising—Texans’ insurance rates. Although the federal government doesn’t appear to take global warming seriously, insurance companies most assuredly do, and must adjust their rates accordingly. The world’s largest reinsurer, the Munich Re Group, called the unusually hot summer of 2003 “the summer of the future,” in the sense that it expects global warming to keep temperatures climbing in the years ahead. The reinsurance group also indicated that the “increased risk and losses” due to rising temperatures “means adjustments in premiums.” For Texans, who already pay the highest home insurance rates in the country, this is unwelcome news.

To be fair, though, the insurance industry has abundant reasons to raise premiums based on risk factors associated with global warming. On a decade-by-decade basis, storms causing in excess of \$5 million in insured losses nationwide have increased from 10 in the 1950s to 35 in the 1990s. These catastrophes have grown from about \$100 million annually in the 1950s to \$6 billion per year in the 1990s. Insurance losses from extreme weather events for the United States went from \$2 billion per year in the 1980s to \$12 billion per year in the 1990s. Ultimately, global warming already is imposing real financial costs on consumers, whether they realize it or not.

Solutions

Ironically, were it not for Texas’ abundant petroleum resources, the state likely would be the world’s poster child for solar power. Texas’ electrical power usage peaks during summer use of air conditioners—precisely when the sun’s energy is most powerful. Although the fossil fuel lobby is unusually powerful and well-connected in Texas, we nonetheless are seeing many cities, counties, and individual entrepreneurs show creativity and innovation to move the state away from its past fossil fuel dependency. Slowly but surely, Texas is becoming a global leader in renewable energy in the twenty-first century just as it pioneered fossil fuel energies in the twentieth century. Particularly encouraging is that many Texas cities have introduced bold initiatives to develop renewable energy resources. Austin, for example, has adopted a plan to obtain 20% of its energy from renewables and increase efficiency by 15% by 2020. Given Texas’ unusually large contribution to worldwide carbon emissions, a statewide plan mandating carbon reduction would go a long way toward helping the planet heal.

The use of renewable, clean energy will not mean the use of medieval apparatus to recreate a fourteenth-century standard of living. Companies now employ advanced technologies to capture wind and solar power much more efficiently (and cheaply) than

decades ago. Solar panel costs have come down 95% over the last 25 years, while producing substantially more energy. Wind energy, for its part was the world's fastest-growing energy source during most of the 1990s, and West Texas is quickly becoming the capital of wind-generated energy.

There are a number of simple things we can do to significantly reduce our contribution to global warming on the levels of state, city, and individual households. A statewide mandate to reduce CO2 emissions from power plants, industry, and vehicles is urgently needed, while we still have the opportunity to avoid the worst scenarios possible under global warming.

Elected officials should ensure that state and municipal buildings are energy efficient, thereby setting a good example for their constituents. Cities whose utility companies have programs to purchase wind or solar which have utility options to purchase. In addition, cities currently lacking such programs should be encouraged to adopt one.

There are many ways in which individuals can lessen their contribution to global warming. By purchasing fuel-efficient vehicles, consumers will produce less CO2, as well as fewer other emissions that reduce the air quality of their community. A 35 mpg vehicle will produce 8,000 fewer pounds of CO2 every year than a 20 mpg vehicle. Replacing ordinary incandescent light bulbs with compact fluorescents can save 94 kilowatt-hours per year per lamp, assumes that the lights are on for 2,000 hours per year. Replacing old refrigerators, furnaces, and boilers with efficient ENERGY STAR models can reduce the appliance's energy consumption by almost two-thirds.

Although the notion is politically uncomfortable, a "carbon tax" should also be considered as one measure to curb greenhouse-gas emissions. This would give companies strong encouragement to use energy-efficient means to produce their goods. A system of tax breaks coupled with a "carbon tax" (a tax which reflects the real cost of carbon pollution cleanup) would help make carbon reduction a high priority. If we fail to make it a priority, eventually, the day will come when taxpayers will be called upon to spend money to clean up carbon pollution. While it may be politically easier now to avoid the issue, it is neither in the best interest of Texas citizens nor cost-efficient over the long term.

Finally, oceanographers and other scientists are presently studying how man-made climate change can be offset, by encouraging tree and plant growth as a "carbon sink" or by adding iron to ocean waters rich in aquatic plankton, so as to remove carbon from the atmosphere. The "iron hypothesis" holds that fertilizing phytoplankton with small amounts of iron—one of its essential nutrients—can cause an enormous increase in carbon-storing plants, which can help offset the greenhouse effect. Ingenious attempts like this to grapple with the problem of global warming may someday achieve a degree of success. But, like a heavy smoker who optimistically believed that science would one day find a cure for cancer, we are likely to find that faith in scientific miracles is a foolish substitute for personal responsibility.

References

Floods

Scientists say that global warming leads to more frequent severe weather, including floods.

San Antonio has been devastated by two recent floods.

In October, 1998, San Antonio was subjected to 11 inches of rainfall in 1 day—twice as much as the city had ever received in a day.¹

Both the 1998 and the 2002 floods were events of a magnitude that should only happen once every 500 years.²

Heat Deaths

There is now broad consensus among climate scientists for the existence of a global warming trend; those who dispute its existence often are on the payroll of coal or oil companies.

Climatologists forecast an increase of up to 11 degrees F over the next century.³

Texas' July heat index is expected to rise by 25 degrees over this century.⁴

Since 1980, the earth has experienced 19 of its 20 hottest years on record, with 1998 the hottest and 2002 and 2003 coming in second and third⁵

¹ <http://home.earthlink.net/~omiland/portfolio/new.htm>

² http://www.bexar.org/prm/Budget/Budget2002-03/Flood_Control_Fund.pdf;
www.geocities.com/investmentrealestate_2000/boerne_texas_real_estate_flood_plain.html

³ IPCC, 2001; http://fp.arizona.edu/khirschboeck/nats101gc/ghg_ipcc.htm

⁴ Union of concerned scientists, <http://www.ucsusa.org/documents/ACFq3GPIV.pdf>

⁵ Natural Resources Defense Council [NRDC],
<http://www.nrdc.org/globalWarming/fcons.asp>

The EPA has found that Dallas' heat-related deaths could triple by 2050.⁶

In July 1998, a heat wave in Texas killed more than 70 people.⁷

In 2002, an extreme heat wave killed 20,000 people in Europe, 1500 in India.⁸

The United Nations weather agency predicts that large cities will suffer twice as many deaths from heat waves by 2020.⁹

Texas has led the nation in heat-related deaths in 3 of the last 7 years.¹⁰

Drought

The 1999-2002 drought was one of the three most extensive droughts in the last 40 years.¹¹

A National Assessment of Climate Change found that the San Antonio Edwards Aquifer would suffer reduced springflows, less irrigation, and a regional welfare loss of \$2.2-\$6.8 million per year due to global warming. Springflows at Comal will decrease by 10-16% by 2030 and 20-24% by 2090. As water resources is diverted from agricultural use, farm income is expected to fall from 16-30% by 2030 and 30-45% by 2090.¹²

⁶[http://yosemite.epa.gov/oar/globalwarming.nsf/UniqueKeyLookup/SHSU5BWHN8/\\$File/tx_impct.pdf](http://yosemite.epa.gov/oar/globalwarming.nsf/UniqueKeyLookup/SHSU5BWHN8/$File/tx_impct.pdf)

⁷ Allen R. Myerson, "Heat Wave in Texas Brings 15th Straight Day Over 100 degrees," *New York Times*, July 21, 1998; <http://www.tdhca.state.tx.us/pr/pr57.html>

⁸http://www.wired.com/news/technology/0,1282,61562,00.html?tw=wn_tophead_8
<http://www.nrdc.org/globalWarming/fcons.asp>

⁹ World Meteorological Association,
<http://www.cnn.com/2000/NATURE/11/21/hague.conference.reut/>

¹⁰ Physicians for Social Responsibility,
http://www.envirohealthaction.org/upload_files/ACF2727.pdf

¹¹ <http://www.nrdc.org/globalWarming/fcons.asp>

¹² Chi-Chung Chen, Dhazn Gillig, and Bruce A. McCarl, "Effects of Climatic Change on a Water Dependent Regional economy: a study of the Texas Edwards Aquifer;"
<http://64.233.161.104/search?q=cache:eyrRFBsEQ1IJ:ageco.tamu.edu/faculty/mccarl/papers/781.pdf+%22Springflows+at+comal%22&hl=en>

In 2002, the western United States experienced its second worst wildfire season in the last 50 years; more than 7 million acres burned. Oregon, Arizona, and Colorado had their worst wildfire seasons ever recorded.¹³

The 1990s were the hottest decade in 1000 years, according to the World Meteorological Organization.¹⁴

The period from April through June of 1998 was the driest three-month period in 104 years for Texas, Louisiana and Florida.¹⁵

The summer of 2002 was the nation's hottest since the "Dust Bowl" era of the 1930s.¹⁶

Species Extinction

According to a 2004 study published in Nature, global warming will lead to the extinction of up to 37% of all species.¹⁷ We already are seeing examples of global warming causing species extinction. The golden toad, for example, recently became extinct when warmer temperatures radically changed the Costa Rican cloud forest, its only known habitat.¹⁸

A University of Texas scientist has found that many species are being forced to move northward due to rising temperatures.¹⁹ As a result, they push endangered species further

¹³ <http://washingtontimes.com/upi-breaking/20031203-014041-2950r.htm>

¹⁴ <http://www.rspb.org.uk/policy/climatechange/index.asp>
<http://www.newscientist.com/dailynews/news.jsp?id=ns9999345>

¹⁵ <http://www.nrdc.org/globalWarming/fcons.asp>

¹⁶ NOAA,
<http://www.planetark.org/dailynewsstory.cfm/newsid/17757/story.htm>

¹⁷ Nature 427, 145 - 148 (08 January 2004); doi:10.1038/nature02121;
http://www.nature.com/cgi-taf/DynaPage.taf?file=/nature/journal/v427/n6970/full/nature02121_fs.html

¹⁸ http://news.nationalgeographic.com/news/2003/08/0822_030822_snakehunter.html

¹⁹ <http://www.cbsnews.com/stories/2003/01/02/tech/main534993.shtml>

toward extinction. For instance, toucans in Central America, driven northward by climate change, now prey upon the chicks of the endangered quetzal bird.²⁰

More Diseases and Pests

The Journal of the American Medical Association has found a correlation between climate change and the spread of infectious disease.²¹

As global warming has increased in recent years, the warmer climate has led to the spread of disease-bearing mosquitoes. As a result, dengue fever has reappeared in Laredo, and many Texans have been stricken with the West Nile Virus.²²

Rising Sea Levels/Melting Ice Caps

According to NASA, the polar ice cap is now melting at the alarming rate of nine percent per decade. Arctic ice thickness has decreased 40 percent since the 1960s.²³

Recently the Arctic's largest ice shelf broke up near Canada's Ellesmere Island, releasing an ice-dammed freshwater lake into the ocean. (Scientists believe that the similar melting of an Arctic ice dam 8,200 years ago triggered an episode of abrupt climate change.)²⁴ The North Atlantic's salinity has declined continuously for the past 40 years - the most dramatic oceanic change ever measured.²⁵

²⁰ <http://www.washingtonpost.com/wp-srv/inatl/longterm/climate/topnews.htm>;
<http://forests.org/articles/reader.asp?linkid=19012>

²¹ Patz, J. A., P. R. Epstein, T. A. Burke and J. M. Balbus. 1996. "Global climate change and emerging infectious diseases," Journal of the American Medical Association, Vol. 275, No. 3, January 17, pp. 217-223; <http://www.climate.org/CI/health/disease.shtml>;
<http://www.climate.org/CI/health/abstracts/disease.shtml#patz>

²² <http://www.emedicine.com/MED/topic528.htm>

²³ NRDC, <http://www.nrdc.org/globalWarming/fcons.asp>

²⁴ <http://msnbc.com/news/970325.asp>

²⁵ Fortune, 9 February 2004;
<http://64.233.161.104/search?q=cache:IrFDXiUEKPAJ:www.chesapeakeclimate.org/fortune.htm+%22north+atlantic%27s+salinity%22&hl=en>

The current pace of sea-level rise is three times the historical rate and appears to be accelerating.²⁶

Studies by the EPA and others predict a 1-foot rise in Gulf Coast sea level is likely by 2050, and could occur as early as 2025.²⁷

Texas could lose 500 square miles of its shoreline as sea levels rise. Garry Mauro, former commissioner of the Texas General Land Office has illustrated this by stating “imagine a modern-day Paul Bunyan with a chainsaw cutting one-and-a-half miles off the Texas coast all the way from Port Arthur to the Rio Grande.”²⁸

Sea levels could rise 3 feet by the end of the century.²⁹ Texas’ coast would be particularly vulnerable to higher sea levels, and the state would be faced with either losing coastal land or absorbing huge out-of-pocket costs to protect it. For instance, the cost of sand replenishment to protect coastal Texas from just a 20-inch sea level rise by 2100 is estimated at \$4.2-12.8 billion.³⁰

After existing for thousands of years, the northern section of the Larsen B ice shelf in Antarctica -- a section larger than the state of Rhode Island -- collapsed between January and March 2002, disintegrating at a rate that astonished scientists.³¹

According to a 2004 report by the Pentagon, global warming “should be elevated beyond a scientific debate to a US national security concern.” The Pentagon advised President Bush that climate change could lead to “catastrophic” shortages of water and food, which in turn would touch off global wars for scarce resources.³²

²⁶ <http://www.nrdc.org/globalWarming/fcons.asp>

²⁷ <http://yosemite.epa.gov/oar/globalwarming.nsf/content/VisitorCenterCoastalResidents.html>

²⁸ [http://yosemite.epa.gov/oar/globalwarming.nsf/UniqueKeyLookup/SHSU5BPQFF/\\$File/dallas.pdf](http://yosemite.epa.gov/oar/globalwarming.nsf/UniqueKeyLookup/SHSU5BPQFF/$File/dallas.pdf)

²⁹ http://www.findarticles.com/cf_0/m1272/2656_128/58576582/p6/article.jhtml

³⁰ [http://yosemite.epa.gov/oar/globalwarming.nsf/UniqueKeyLookup/SHSU5BWHN8/\\$File/tx_impct.pdf](http://yosemite.epa.gov/oar/globalwarming.nsf/UniqueKeyLookup/SHSU5BWHN8/$File/tx_impct.pdf)

³¹ <http://nsidc.org/iceshelves/larsenb2002/>

³² http://www.ems.org/climate/pentagon_climatechange.pdf

Climate scientists predict that in 25 years all of the glaciers in Montana's Glacier National Park will be gone.³³

Glaciers of the European Alps have lost about half their volume since 1850.³⁴ Climate scientists predict that in 25 years 90% of the glaciers in the Alps will be gone.³⁵

The glaciers Hemingway wrote about in "The Snows of Kilimanjaro" are only about 1/5 the size they were when he wrote the short story, and are expected to be completely melted by 2015.³⁶

Change in Seasons

Global warming already has disrupted our normal cycles of spring and fall. The increase in CO₂ has led to the spring season coming 10.8 days earlier than it did in 1959.³⁷

Winter season has come progressively earlier in the Northern hemisphere since 1840. Lakes and rivers freeze an average of 8.7 days later, and ice cover begins melting 9.8 days earlier than it did 150 years ago. The chief culprit appears to be man-made global warming gases produced since the Industrial Revolution.³⁸

Biological changes are already happening as a result of the earth's warming. A study in the journal *Nature* revealed that, as of 2003, better than 4 out of 5 species have undergone biological changes due to global warming. These changes include earlier blooming, breeding, egg-laying and migrating due to earlier springs. The authors concluded that

³³ <http://www.earth-policy.org/Updates/Update32.htm>

³⁴ <http://www.commondreams.org/headlines02/0925-05.htm>

³⁵ <http://www.mtn.org/iasa/olympics.html>

³⁶ <http://www.cnn.com/SPECIALS/2001/americasbest/science/medicine/pro.lt.hompson.html>

³⁷ Brown, J.L, Shou-Hsien, L. and Bhagabati, N. 1999. Long-term trend toward earlier breeding in an American bird: A response to global warming? *Proceedings of the National Academy of Science, U.S.A.* **96**: 5565-5569; <http://www.nature.com/doi/10.1038%2F17709>

³⁸ <http://www.cnn.com/2000/NATURE/09/07/global.warming/>

rising temperatures “could easily disrupt the connectedness among species” and could result in numerous extinctions.³⁹

This early warming trend has also been observed in the Arctic, where sea ice now melts earlier than before. Consequently, Arctic marine mammals have suffered disruptions in their food supply. For example, polar bears have increasingly less time to hunt on the sea ice and are forced to return to shore with less fat accumulated than they are accustomed to.⁴⁰

Ozone/Pollution

Studies have demonstrated that temperatures above 90°F mean more ozone in the air, which is particularly significant in light of Texas’ climate.⁴¹

According to the EPA, “Ground-level ozone has been shown to aggravate respiratory illnesses such as asthma, reduce existing lung function, and induce respiratory inflammation.”⁴²

The EPA has already found that San Antonio is already in violation of the 8-hour ozone standard.⁴³

Recently, Houston overtook Los Angeles as the smog capitol of the United States.⁴⁴

³⁹ <http://www.stanford.edu/dept/news/report/news/2003/january8/root-18.html>; <http://www.countercurrents.org/en-stanford.htm>

⁴⁰ http://www.ucusa.org/global_environment/global_warming/page.cfm?pageID=509

⁴¹ <http://www.fsec.ucf.edu/ed/AFM/researcherportfolio/activity10arp.htm>; http://www.envirohealthaction.org/upload_files/ma-dbyd.pdf

⁴² [http://yosemite.epa.gov/oar/globalwarming.nsf/UniqueKeyLookup/SHSU5BVMDY/\\$File/pa_impct.pdf](http://yosemite.epa.gov/oar/globalwarming.nsf/UniqueKeyLookup/SHSU5BVMDY/$File/pa_impct.pdf); <http://www.epa.gov/ttn/oarpg/naaqsfin/o3health.html>

⁴³ <http://knowledge.fhwa.dot.gov/cops/italladdsup.nsf/0/FAF0046666389E3885256E77006522EF?opendocument&CurrentCategory=Other%20Transportation%20and%20Air%20Quality%20Technical%20Assistance>

⁴⁴ <http://www.sfgate.com/cgi-bin/article.cgi?file=/news/archive/2000/08/08/state2240EDT0251.DTL>

Insurance

Texans already pay the highest homeowner insurance rates in the country.⁴⁵

Storms causing in excess of \$5 million in insured losses have increased from 10 in the 1950s to 35 in the 1990s. These catastrophes have grown from about \$100 million annually in the 1950s to \$6 billion per year in the 1990s.⁴⁶

In the 1980s, insurance losses from extreme weather events averaged \$2 billion per year for the United States. In the 1990s, that number jumped to \$12 billion per year.⁴⁷

The Flood of 1998 killed 31 residents of San Antonio and caused over \$750 million in property damages. The 2002 flood caused over \$1 billion in damages to 41 Texas counties.⁴⁸

Storms that caused property insurance losses greater than \$100 million (1992 dollars) occurred 72 times from 1990-1996. There had been only 142 such \$100+ million storms in the previous 4 decades.⁴⁹

Severe weather events caused a combined total of \$18.2 billion in claims to insurance companies in 1998 and 1999. Future losses may dwarf even the record losses of the 1990s. Data from A.M. Best Co., an insurance rating company, indicates that global warming could cause catastrophes that would cost insurers \$100 billion, reportedly equal to the total value of the capital and surpluses of the world's top 25 global reinsurers.⁵⁰

The Munich Re Group, the world's largest reinsurer, has acknowledged that the unusually hot summer of 2003 is in fact "the summer of the future." The reinsurance

⁴⁵ http://www.gtfrealty.com/articles/2002_summer.pdf

⁴⁶ <http://www.noaanews.noaa.gov/stories/s504.htm>

⁴⁷ <http://www.clf.org/pubs/money.htm>;
<http://www.heatisonline.org/contentserver/objecthandlers/index.cfm?id=3551&method=full>

⁴⁸ <http://ucplanning.uc.edu/web/env/envcase.htm>

⁴⁹ Chagnon, S.A., 1999: Record high losses for weather disasters in the United States during the 1990s: How excessive and why? *Natural Hazards*, 18, 287-300

⁵⁰ <http://www.insurancejournal.com/magazines/southcentral/2001/01/22/coverstory/22518.htm>

group has indicated that the “increased risk and losses” due to rising temperatures “means adjustments in premiums.”⁵¹

⁵¹ <http://www.insurance-portal.com/123003.htm>