



THE COST OF TRUMP'S DENIAL

Donald Trump's denial of climate change is harmful to our health, our safety, and our economy.

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TL/DR:

By denying climate change, Donald Trump is harming our health right now, and putting future generations at risk.

- Researchers believe that global warming is already responsible for some [150,000 deaths each year](#) around the world.
 - Excessive heat is becoming [more frequent and more extreme](#).
 - More than [350 US workers have died](#) from heat-related illness in the past decade. In 2018 alone, there were [3,120 workers](#) that missed days of work due to heat exposure on the job.
- Climate change is affecting our access to clean drinking water.
 - Flooding from extreme rainfall last year took [six drinking water treatment plants](#) offline and overwhelmed wastewater facilities.
 - In Colorado, rising temperatures led to bark beetle infestations, which have led to elevated levels of [cancer-causing trihalomethane](#) in local water supplies.
 - Rising water temperatures have fueled [outbreaks of toxic algae](#), contaminating drinking water sources.
- Climate change and continued reliance on fossil fuels is affecting our access to clean air
 - Air quality is [measurably getting worse](#) under Trump, with 15% more unhealthy air days during his administration.

- Fine particulate pollution causes severe health problems and it increased by 5.5 percent on average across the country between 2016 and 2018, after decreasing nearly 25 percent over the previous seven years.
- [Air pollution from coal power plants](#) can include mercury, lead, cadmium, carbon monoxide, volatile organic compounds, and arsenic, yet Trump rolled back rules on emissions to help keep outdated coal power plants in operation.
- The [American Lung Association](#) warns that pollution from vehicle exhaust and power plants can cause lung cancer, heart disease, and asthma attacks, but Trump rolled back clean cars standards against the advice of career scientists.
- [Volatile organic compounds](#) that leak from fracking sites has been [linked to health problems](#), but Trump blocked rules on gas leaks from fracking wells.
- [Click here to jump to more research below](#)

By denying climate change, Donald Trump is harming our safety right now, and putting future generations at risk..

- Scientists have found [time after time](#) that human-caused climate change is making hurricanes stronger.
 - There have been [multiple severe hurricanes and tropical storms](#) in each of the first three years of Trump's presidency, including at least one category 5 storm each year.
 - In 2020, the [NOAA is predicting](#) an "above normal" Atlantic hurricane season, expecting 13-19 named storms, including 3-6 major hurricanes.
- In the Midwest, [warmer, more humid air is bringing heavy downpours](#) that caused [over \\$10 billion in damages](#) last spring.
 - Already in 2020 the pattern is repeating, with heavy rains [pounding central Michigan in May](#), causing two dams to burst.
- In coastal areas, sea level rise is [already sending](#) ocean water into streets, sewers, and homes.
 - In parts of Miami, "sunny day" coastal flooding, which happens without a major weather event is [becoming routine](#).
 - In Louisiana, a [Native American community in Isle De Jean Charles](#) is already having to move to higher ground, becoming among America's first "climate refugees."
- The 2018 National Climate Assessment found "the area burned by wildfire from 1984 to 2015 was [twice what would have burned](#) had climate change not occurred."

- The 2017, 2018, and 2019 western wildfire seasons caused [a combined \\$48 billion in damage and 163 deaths](#).
- [National security experts](#) and the [Department of Defense](#) have published reports warning that climate change puts our national security at risk by destabilizing conflict zones.
 - Our ability to respond to conflicts is also being impacted. A [2019 report](#) from the Department of Defense found that climate change is already [threatening mission-critical bases](#).
- [Click here to jump to more research below](#)

By denying climate change, Donald Trump is harming our economy right now, and putting future generations at risk..

- Two [separate reports](#) have warned of a potential loss of as much as 10% of GDP annually from the United States economy by the end of the century due to climate change.
 - That's more than twice the impact of the [Great Recession of 2007-2009](#) and three times the long-term projections for the impact of the current COVID-19 crisis, which the [CBO expects](#) will result in a 3.0% decline in real GDP over the next 11 years.
 - Climate change will end up [costing our economy more](#) (3.7% of GDP per year) than the COVID-19 pandemic by as early as 2050.
 - Those were both limited, one-time events. If we fail to address climate change we will be facing sustained, severe damage to our economy.
- [Another analysis](#) pegged the future economic cost of doing nothing in actual dollar amounts at almost \$700 billion per year.
- Since Trump took office, there have been 46 extreme weather or climate-related disasters that have caused [\\$462 billion in damages](#).
- Agriculture is impacted by both droughts and floods linked to climate change.
 - One drought event in 2011 cost over [\\$10 billion in direct losses](#) to the agriculture sector alone in Texas and Oklahoma.
 - In 2019, Midwest flooding left roughly [14 million acres unplanted](#).
 - The Montana Farmers Union issued a [report projecting](#) a 20 percent drop in range cattle production and a 25 percent decline in grain production by 2055.
- Our economy will be hurt by energy costs that will go up under climate change, by as much as [\\$30 billion per year](#) by mid-century as temperatures rise
- Tourism-based economies are already being hurt by climate change

- In the Florida keys, a [50 percent decline](#) in coral cover has [recreational diving and fishing businesses worried](#)
- Elsewhere in Florida, blue-green algae and red tide [fueled by climate change](#) had a [devastating effect on beach tourism in 2018](#). One county even had to spend [\\$7 million](#) just to clean up dead fish from the beaches.
- In the Rockies, snowfall has [declined 41 percent](#) since the 1980s, shortening the snow season by 34 days and threatening the \$20 billion snow sports tourism industry.
- Mountain streams fed by snowfall are also at risk of drying up, [shrinking trout](#) habitats popular with recreational anglers.
- Extreme heat also impacts worker productivity. A [study in 2014](#) found a 1.7% decline in worker productivity for each 1°C above 15°C. This also meant a 28% loss in per-capita income on a day above 86 degrees.
- [Click here to jump to more research below](#)

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HERE'S WHAT'S HAPPENING:

Health

A decade ago researchers reported that global warming is already responsible for some [150,000 deaths each year](#) around the world. In 2019, [researchers warned](#) that a child born now will experience health impacts from climate change throughout their entire life.

Excessive heat is already killing people. In the past decade, more than [350 US workers have died](#) from heat-related illness, and with climate change bringing [more extreme temperatures more often to more places](#), the problems will only get worse, especially for people who work outdoors.

If you're looking to cool down with a nice glass of water, climate change is also already affecting our access to clean drinking water in some places. Flooding from the extreme rainfall last summer that was linked to climate change took [drinking water treatment plants offline](#) and overwhelmed wastewater facilities, resulting in raw sewage being discharged into streams and rivers. In Colorado, rising temperatures have led to bark beetle infestations which have actually been found responsible for elevating levels of [cancer-causing trihalomethane](#) in local water supplies.

Elsewhere, rising water temperatures in places like the Great Lakes have fueled outbreaks of toxic algae which in 2014 forced Toledo to [shut down a municipal water intake](#), forcing residents to find other sources of water.

Access to clean air is also being impacted by Trump's focus on prioritizing dirty fossil fuels. The [Associated Press found](#) that after decades of improvement, air quality worsened under Trump, with 15% more days of unhealthy pollution levels after Trump took office than during Obama's second term. A [study from researchers at Carnegie Mellon University](#) found that fine particulate pollution increased 5.5 percent on average across the country between 2016 and 2018, after decreasing nearly 25 percent over the previous seven years.

[Air pollution from coal power plants](#) contains mercury, lead, cadmium, carbon monoxide, volatile organic compounds, and arsenic. The [American Lung Association found](#) that particle pollution that comes from coal power plants and vehicle exhaust can cause lung cancer, heart disease, and asthma attacks. Near fracking sites, methane, and volatile organic compounds are [known to leak into the air](#) and have been linked to [respiratory problems](#).

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Safety

Scientists have found [time after time](#) that human-caused climate change is making hurricanes stronger with higher water surface temperatures that provide fuel for more intense hurricanes. Each of the last three years of Trump's presidency so far has seen [multiple severe hurricanes and tropical storms](#) impacting our Atlantic and Gulf coasts, including at least one category 5 hurricane, costing thousands of lives and causing billions of dollars in damages. In 2020, the [NOAA is predicting](#) an "above normal" Atlantic hurricane season, expecting 13-19 named storms, including 3-6 major hurricanes.

In the Midwest, [warmer, more humid air is bringing heavy downpours](#) that caused [over \\$10 billion in damages](#) last spring. Already in 2020 the pattern is repeating, with heavy rains [pounding central Michigan in May](#), causing two dams to burst.

In coastal areas, sea level rise is [already sending](#) ocean water into streets, sewers, and homes. In parts of Miami, "sunny day" coastal flooding, which happens without a major weather event is [becoming routine](#). In Louisiana, a [Native American community in Isle De Jean Charles](#) is already having to move to higher ground, becoming among America's first "climate refugees."

In western states, wildfires are becoming more frequent and more severe. In fact, the 2018 National Climate Assessment found "the area burned by wildfire from 1984 to 2015 was [twice what would have burned](#) had climate change not occurred." The 2017, 2018, and 2019 western wildfire seasons have been particularly intense, causing a combined [\\$48 billion in damage and 163 deaths](#).

Climate change doesn't just put us at risk from natural disasters. [National security experts](#) and the [Department of Defense](#) have published reports warning of the multiple ways that climate change puts our national security at risk. Regions that are already hotbeds of conflict will continue to destabilize under even low levels of warming. On top of escalating threats, our ability to respond to them is already being affected by climate change. A [2019 report](#) from the Department of Defense found that climate change is already [threatening mission-critical bases](#).

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Economy

In addition to putting lives at risk, natural disasters that are linked to climate change come with a price tag that affects our economy. Two [separate reports](#) have warned of a potential loss of as much as 10% of GDP to the United States economy by the end of the century. Another [report](#) put that dollar amount at \$698.77 billion every year.

To put that in perspective, that's more than twice the impact the [Great Recession of 2007-2009](#) had on US GDP hitting the economy every year. As of June, the Congressional Budget

Office [projects](#) that after the economy begins to recover from the current COVID-19 crisis, the overall result will be a 3.0% decline in GDP when spread out over an 11 year period, but by the year 2050, economic losses due to climate change will surpass that amount, at 3.77 of GDP every year. Both the 2020 pandemic and the 2008 financial crisis were limited, one-time events. If we fail to address climate change we will be facing sustained, severe damage to our economy.

The scale of the economic damage yet to come is tremendous, but we can already see climate change's impact on our economy right now. In fact, just in the period of time since Trump took office, the United States has experienced 46 extreme weather or climate-related disasters that have caused [\\$462 billion in damages](#). Agricultural productivity can be impacted by both droughts and floods linked to climate change. One drought event in 2011 cost over [\\$10 billion in direct losses to agriculture](#) alone. Meanwhile, Midwest flooding left roughly [14 million acres unplanted](#) in 2019.

In the long run, continued warming will limit growing days in many parts of the world, affecting overall crop yields. Livestock will also be affected by water shortages and changes to grass and hay. For example, the Montana Farmers Union issued a [report projecting](#) a 20 percent drop in range cattle production and a 25 percent decline in grain production by 2055.

Increasing average temperatures and extreme weather events are expected to drive up energy demand, costing electricity ratepayers up to and additional [\\$30 billion per year](#) by mid-century that is attributable to climate change.

Climate change is also having an alarming impact on popular recreational activities and natural resources that are major drivers of tourism. In the Florida Keys, the local tourism economy [relies on the coral reefs](#) that support recreational diving and fishing industries, but increasing ocean temperatures have led to [a 50 percent decline in coral cover](#) in sites monitored by the Florida Fish and Wildlife Conservation.

Elsewhere in Florida, recent outbreaks of blue-green algae and red tide [fueled by climate change](#) have had devastating effects on local beach tourism. In 2018, Pinellas county had to spend [\\$7 million](#) to remove foul-smelling, rotting dead fish killed by red tide that washed up on the county's beaches. One vacation property manager saw [business down 65%](#), and another reported losing as much as \$20,000 per day during the 2018 red tide outbreak.

Snow in the west has [declined 41 percent](#) since the 1980s, shortening the snow season by 34 days and threatening the \$20 billion snow sports tourism industry. Mountain streams fed by snowfall are also at risk of drying up, [shrinking trout habits](#) popular with recreational anglers.

High heat days, in addition to posing a threat to worker health are also impacting workers' productivity and income. A [study in 2014](#) that looked back at 40 years of data from the United States found that high heat resulted in a 1.7% decline in worker productivity for

each 1°C above 15°C. This also meant a 28% loss in per-capita income on a day above 86 degrees.

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RESEARCH

HEALTH

MORTALITY

Scientific American: “Researchers Believe That Global Warming Is Already Responsible For Some 150,000 Deaths Each Year Around The World.” In June of 2009, Scientific American reported; “Researchers believe that global warming is already responsible for some 150,000 deaths each year around the world, and fear that the number may well double by 2030 even if we start getting serious about emissions reductions today. A team of health and climate scientists from the World Health Organization (WHO) and the University of Wisconsin at Madison published these findings last year in the prestigious, peer-reviewed science journal Nature. Besides killing people, global warming also contributes to some five million human illnesses every year, the researchers found. Some of the ways global warming negatively affects human health—especially in developing nations—include: speeding the spread of infectious diseases such as malaria and dengue fever; creating conditions that lead to potentially fatal malnutrition and diarrhea; and increasing the frequency and severity of heat waves, floods and other weather-related disasters.” [[Scientific American, 6/17/2009](#)]

CHILD HEALTH

2019 Study: Climate Change Will Threaten The Health Of Children Born Today At Every Stage Of Their Lives. In November of 2019, CNBC reported: “Climate change is already damaging the health of children, and its impacts will harm the entire generation with serious health problems throughout their lives, according to a new report from the medical journal The Lancet. Scientists and health experts from 35 academic institutions and United Nations agencies said that children will suffer from a rise in infectious diseases, malnutrition and air pollution if global warming continues on the current trajectory. A child born today will experience a world that is more than 4°C warmer by the time they turn 71 years old, a rate of warming that will threaten their health at every stage of their life, the report's authors said.” [[CNBC, 11/14/2019](#)]

HEAT-RELATED ILLNESSES

High Temperatures Caused By Climate Change Will Exacerbate Heat-Related Deaths And Outweigh Reductions In Cold-Related Deaths. According to the 2018 National Climate Assessment: “High temperatures in the summer are conclusively linked to an increased risk of a range of illnesses and death, particularly among older adults, pregnant women,

and children. People living in urban areas may experience higher ambient temperatures because of the additional heat associated with urban heat islands, exacerbating heat-related risks. With continued warming, increases in heat-related deaths are projected to outweigh reductions in cold-related deaths in most regions.” [[2018 National Climate Assessment, Chapter 14](#)]

Texas Doctor: “As Physicians We Are Realizing Climate Change Is The Greatest Public Health Emergency Of Our Time.” In February of 2020, CBS Austin reported: “The Texas Medical Association's 2020 Winter Conference included a climate change presentation from Dr. Robert Haley, an epidemiologist and professor at UT Southwestern Medical Center. According to Dr. Haley, rising temperatures are directly affecting health in a variety of ways. It's a message Austin Dr. Lisa Doggett with Texas Physicians for Social Responsibility echoes. Dr. Doggett says increased temperatures not only increase pollen production and allergies, but lead to more asthma symptoms, heart attacks, heat strokes and mosquito borne illnesses. ‘As physicians we are realizing climate change is the greatest public health emergency of our time,’ says Dr. Doggett.” [[CBS Austin, 2/3/2020](#)]

More Than US 350 Workers Have Died From Heat-Related Illness In The Past Decade. In July of 2019, Kaiser Health News reported: “It's a scene that plays out on airport tarmacs, in farm fields and on construction sites across the country: workers falling ill after laboring in hot or humid conditions for long hours without enough water and rest. Over the past decade, more than 350 workers nationwide have died from heat-related illness, according to data compiled by the U.S. Bureau of Labor Statistics. Tens of thousands have had heat-related illnesses serious enough that they missed at least one day of work.” [[Kaiser Health News, 7/16/2019](#)]

3,120 Incidences Of Heat-Related Workplace Injuries Were Recorded In 2018. According to data reported by the Bureau of Labor Statistics, there were 3,120 workplace injuries reported in 2018 that were categorized as exposure to environmental heat and resulted in days away from work. There were 1,280 cases resulting in one day away from work, 530 cases causing two days of missed work, and 670 causing three to five days of missed work. 620 cases resulted in even longer periods of missed work. [[Bureau of Labor Statistics Survey of Occupational Injuries and Illness Data, Table R70](#)]

ACCESS TO CLEAN WATER

Pollution From Flooding Runoff

National Climate Assessment Showed That Climate Change Is Affecting Clean Water Infrastructure Now, Not Just In The Future. An April, 2019 article in CNN looked at nine examples where the National Climate Assessment report contradicted EPA Administrator Wheeler's comments saying threats from climate were “50 to 75 years out”. According to CNN: “Wheeler said that access to clean drinking water worldwide was ‘the biggest environmental threat.’ Climate change is affecting the water infrastructure that keeps water in our country clean. ‘Changes in the frequency and intensity of climate extremes,’

compared with the 20th century, are 'deteriorating water infrastructure,' the report states." [CNN, [4/22/19](#)]

Flooding Driven By Climate Change Is Driving Pollutants Into Drinking Water Sources.

During a period of flooding on the Missouri River affecting Nebraska in the spring of 2019, Grist reported: "Six Nebraska public drinking water systems went offline, and dozens of wastewater treatment facilities failed — including one for Omaha which officials say could take weeks or months to restore. In several cases, raw sewage is being discharged into streams and rivers. For rural residents who get their water from private wells, that added pollution could prove dangerous. Emergency room visits for gastrointestinal issues increase after heavy rains. As climate change makes rainstorms more intense, this problem will only worsen. Across the Great Plains, the frequency of heavy downpours has increased by 29 percent over the past 60 years. Flooding isn't just a quickly damaging natural disaster that destroys roads, bridges, homes, and factories — it's a lingering public health issue. This problem isn't unique to Nebraska. In recent years, floods in Texas, the Carolinas, and coastal Virginia have swept hazardous material from the petrochemical industry, hog farms, and agricultural land into waterways, threatening public safety."

[[Grist, 3/21/2019](#)]

Bark Beetles

Climate Change Has Increased Forest Pests, Which Killed 7% Of Western US Forest Area And Ultimately Led To Dangerous Levels Of Carcinogen Precursor Chemicals In Colorado Drinking Water Treatment Plants. According to the Fourth National Climate Assessment:

"Climate change has also contributed to increased forest pest infestations, another major cause of tree death in Southwest forests and woodlands. Bark beetle infestations killed 7% of western U.S. forest area from 1979 to 2012, 148,149 driven by winter warming due to climate change 103,192 and by drought. Tree death from bark beetles in Colorado increased organic matter in local streams, elevating precursors of cancer-causing trihalomethane in local water treatment plant to levels that exceed the maximum contaminant levels for drinking water specified by the U.S. Environmental Protection Agency." [[Fourth National Climate Assessment, 2018, Chapter 25: Southwest](#)"]

- **Water Treatment Facilities In Watersheds Affected By Bark Beetle Infestations Had Significant Increases In Total Organic Carbon and Total Trihalomethane.** "The recent bark beetle epidemic across western North America may impact water quality as a result of elevated organic carbon release and hydrologic shifts associated with extensive tree dieback. Analysis of quarterly municipal monitoring data from 2004 to 2014 with discretization of six water treatment facilities in the Rocky Mountains by extent of beetle impact revealed a significant increasing trend in total organic carbon (TOC) and total trihalomethane (TTHM) production within high ($\geq 50\%$ areal infestation) beetle-impacted watersheds while no or insignificant trends were found in watersheds with lower impact levels." [[Brouillard, B. M., E. R. V. Dickenson, K. M. Mikkelsen, and J. O. Sharp, 2016: Water quality following extensive beetle-induced tree mortality: Interplay of aromatic carbon loading, disinfection byproducts, and hydrologic drivers. Science of The Total Environment, 572, 649–659.](#)]

Blue-Green Algae

EPA: “Warmer Water Due To Climate Change Might Favor Harmful Algae In A Number Of Ways...” On a web page about nutrient pollution, the US Environmental Protection Agency says: “Harmful algae usually bloom during the warm summer season or when water temperatures are warmer than usual. Warmer water due to climate change might favor harmful algae in a number of ways:

- Toxic blue-green algae prefer warmer water.
- Warmer temperatures prevent water from mixing, allowing algae to grow thicker and faster.
- Warmer water is easier for small organisms to move through and allows algae to float to the surface faster.
- Algal blooms absorb sunlight, making water even warmer and promoting more blooms.”

[\[US Environmental Protection Agency, “Climate Change and Harmful Algal Blooms” last updated 12/17/2019\]](#)

Higher Rainfalls Due To Climate Change Will Wash In High Amounts Of Nutrients And Worsen Blue-Green Algae Blooms. In August of 2018, the Palm Beach Post reported: “South Florida’s water woes come as researchers in their annual State of the Climate report released Wednesday warn that a warming globe could lead to an increase in ecological tragedies. The years 2014 through 2017 were the four warmest years on record for Earth since measurements began in the late 1800s, according to the report. ‘I find it stunning actually to see the extent of how these record warm temperatures affect very important parts of our ecosystem,’ said Greg Johnson, a NOAA oceanographer who co-presented the report. Johnson was speaking about an unprecedented three-year global coral bleaching event, but scientists, including Florida Atlantic University’s J. William Louda, have said algae blooms will worsen with the warmer temperatures and higher rainfall that come with climate change. Record May rains in Florida are largely to blame for the blue-green algae that grew this summer in the Caloosahatchee River and St. Lucie Estuary as high amounts of nutrients were washed in from the watershed. Discharges from Lake Okeechobee exacerbate the problem, adding algae and diluting the brackish waterways.” [\[Palm Beach Post, 8/1/2018\]](#)

EPA: “Changing The Climate Is Also Likely To Harm Water Quality In Lake Michigan.”

According to a fact sheet from the Environmental Protection Agency, “Changing the climate is also likely to harm water quality in Lake Michigan. Warmer water tends to cause more algal blooms, which can be unsightly, harm fish, and degrade water quality. Severe storms also increase the amount of pollutants that run off from land to water, so the risk of algal blooms will be greater if storms become more severe. Increasingly severe rainstorms

could also cause sewers to overflow into the lake more often, threatening beach safety and drinking water supplies." [[EPA, "What Climate Change Means For Wisconsin." August 2016](#)]

Lake Superior Saw An "Unprecedented" Algae Bloom In 2018. In August of 2018, the Associated Press reported: "Scientists are investigating an unprecedented algae bloom in Lake Superior and have sent samples for lab testing to determine if it is toxic. Kayakers and other visitors to the popular lakeshores along eastern Minnesota and northwestern Wisconsin found green scummy algae last week on Lake Superior's surface, Minnesota Public Radio reported . The bloom has largely dissipated but reports suggest it stretched 50 miles (80.5 kilometers) along the shoreline from near Superior, Wisconsin, to the Apostle Islands, said Robert Sterner, director of the Large Lakes Observatory at the University of Minnesota-Duluth. 'They're very noticeable and very unexpected in a place like the deep and cold and generally low-nutrient Lake Superior,'" Sterner said." [[Associated Press, 8/15/2018](#)]

2018: Algae Blooms, Which Have "Become An Annual Problem In The Lake," Were Found In Western Lake Erie. According to Monroe News, "Algae blooms are back in western Lake Erie, this time a little earlier than normal. Researchers say the higher temperatures this summer have brought out the sometimes- toxic algae about a week or two earlier. The algae that turn the water a pea soup green color have been spotted along the shore east of Toledo, around the Lake Erie islands and along some beaches in Cleveland. Researchers said that it's not clear yet whether these blooms are the beginning of the main summertime bloom or early-season surprises. Algae blooms can foul drinking water, sicken swimmers and harm aquatic life. They've become an annual problem in the lake and are a growing concern nationwide." [Monroe News, [7/11/18](#)]

2014: Drinking Water Supplies To 30,000 Monroe County Residents Were Affected By An Algae Bloom Near Toledo. According to Monroe News, "In 2014, drinking water supplies to nearly 30,000 Monroe County residents who are on the South County Water District lines were affected by an algae bloom that settled near the City of Toledo municipal water intake." [Monroe News, [7/11/18](#)]

- **Residents Of Luna Pier, Bedford, Erie, And Portions Of LaSalle Townships Were Advised Not To Use Their Water For Drinking Or Cooking.** According to Michigan Radio, "Governor Rick Snyder says that state agencies are ready to help southeastern Michigan residents and communities that are affected by the toxic contamination of Lake Erie water. Four Monroe County communities use water affected by the use ban that originated with problems just across the state border in Toledo. The Monroe County health department says residents of Luna Pier, Bedford and Erie Townships and a portion of LaSalle Township should follow restrictions announced by Toledo. The Ohio city says water should not be used for drinking or cooking. Toxins possibly from cyanobacteria blooms on Lake Erie have fouled the water supply. Snyder says that so far, Michigan officials have not received requests for help. He says the state will do all it can to minimize impacts to citizens and communities." [Michigan Radio, [8/3/14](#)]

- **The Ban Lasted Two Days.** According to The Washington Post, “On Monday morning, two days after residents of Toledo, Ohio, were ordered to stop drinking tap water, the ban was lifted and the water declared safe to drink. Adding a dose of theatricality to the announcement that the water was drinkable once again, Mayor D. Michael Collins (D) stood in front of reporters, called the water safe and downed a glass himself. The notice to stop using tap water, first issued by Toledo on Saturday, affected about half a million people. The city’s system produces 26 billion gallons of drinking water per year, water that is taken from Lake Erie to the Collins Park Water Treatment Plant for purification, according to last year’s annual report from the Toledo Department of Public Utilities. It was at this treatment plant that chemists found samples showing higher levels of the toxin microcystin, which causes abdominal pain, vomiting and kidney damage. Toledo’s water notice Saturday said that the problem may have been caused by algae in Lake Erie, the source of the city’s drinking water. Once the water ban went into effect, city and state officials began sending tens of thousands of gallons of water to distribution centers around Toledo and surrounding areas.” [Washington Post, [8/4/14](#)]

Exposure To Blue-Green Algae Can Cause Illness And In Some Cases Liver Failure, Nerve Damage, and Death. In August of 2014 the Northwoods Star Journal reported:

“Recreational exposure to toxic blue-green algae in humans can cause eye irritation, allergic skin rash, mouth ulcer, vomiting, diarrhea, and cold and flu-like symptoms. Liver failure, nerve damage and death have occurred in rare situations where large amounts of contaminated water were directly ingested. Those who feel they have been exposed to blue-green algae and are experiencing any of these symptoms should seek medical attention.” [[Northwoods Star Journal, 8/4/2014](#)]

Toxic Algae Can Cause Vomiting, Diarrhea, And Even Life-Threatening Illnesses In Humans And Pets Who Ingest It. According to Erie News Now, “As the temperatures rise, so does the threat for harmful algal blooms. Water sample testing recently prompted several algal advisories in Erie County. The tests showed high toxin levels at eight separate locations in Erie County, including parts of Presque Isle. You should watch out for a blue-green substance that is floating on the water’s surface. If ingested, the toxins can cause a variety of symptoms from vomiting to diarrhea and, in rare cases, life-threatening illness. The harmful blooms can appear and disappear quickly. People are urged to keep their dogs or other pets out of the water. The blooms are especially dangerous to pets because they can accidentally ingest more water than humans.” [Erie News Now, [5/28/18](#)]

ACCESS TO CLEAN AIR

Air Quality Is Deteriorating Under Trump

AP: After Decades Of Improvement, Data Now Shows 15% More Days Of Unhealthy Air In First Half Of Trump Admin. In June of 2019, the Associated Press reported: “After decades of improvement, America’s air may not be getting any cleaner. Over the last two years the nation had more polluted air days than just a few years earlier, federal data shows. While it remains unclear whether this is the beginning of a trend, health experts say it’s troubling

to see air quality progress stagnate. There were 15% more days with unhealthy air in America both last year and the year before than there were on average from 2013 through 2016, the four years when America had its fewest number of those days since at least 1980." [[Associated Press, 6/18/2019](#)]

United States Ranks 88th On Exposure To Particulate Matter. According to PolitiFact, "The United States ranks 88th on exposure to particulate matter, which Geddes called 'a really good indicator for health effects from air pollution.' The scientists used satellites and ground-based measurements to collect the data for 228 countries and territories dating from 2008 to 2015. That predates Trump. In general, however, changes between 2018 scores and the baseline (roughly 10 years earlier) are mixed and small, Wendling said." [PolitiFact, [8/23/18](#)]

AP FACT CHECK: Emissions Of Carbon Dioxide, Nitrogen Dioxide, And Particulate Matter Increased In 2017. In an article fact checking claims by the Trump administration about air quality improvement, the Associated Press reported: "Air quality has not improved since Trump took office and air in the U.S. is not the cleanest on record. Wheeler specifically is incorrect that emissions for all six of the 'criteria' air pollutants tracked by EPA have declined during the Trump administration. Of the six, three actually increased in 2017: carbon monoxide, nitrogen dioxide and two measures of particulate matter pollution. The other three, ozone, lead and sulfur dioxide, did decline. Indeed, after decades of improvement, progress in air quality stalled. Over the last two years the U.S. had more polluted air days than just a few years earlier, according to EPA data analyzed by The AP." [[Associated Press, 7/13/2019](#)]

Carnegie Mellon Study Found Particulate Pollution Increased 5.5% Since 2016, Reversing Decades Of Decline. In October of 2019, The New York Times reported: "New data reveals that damaging air pollution has increased nationally since 2016, reversing a decades-long trend toward cleaner air. An analysis of Environmental Protection Agency data published this week by researchers at Carnegie Mellon University found that fine particulate pollution increased 5.5 percent on average across the country between 2016 and 2018, after decreasing nearly 25 percent over the previous seven years." [[New York Times, 10/24/2019](#)]

AP: "Among 35 Major U.S. Cities, There Were 729 Cases Of 'Unhealthy Days For Ozone And Fine Particle Pollution.' That's Up 22 Percent From 2014 And The Worst Year Since 2012." According to the Associated Press, "Trump's own Environmental Protection Agency data show that in 2017, among 35 major U.S. cities, there were 729 cases of "unhealthy days for ozone and fine particle pollution." That's up 22 percent from 2014 and the worst year since 2012." [Associated Press, [6/5/19](#)]

"The State Of Global Air 2019 Report By The Health Effects Institute Rated The U.S. As Having The Eighth Cleanest Air For Particle Pollution." According to the Associated Press, "The State of Global Air 2019 report by the Health Effects Institute rated the U.S. as having

the eighth cleanest air for particle pollution — which kills 85,000 Americans each year — behind Canada, Scandinavian countries and others. The U.S. ranks poorly on smog pollution, which kills 24,000 Americans per year. On a scale from the cleanest to the dirtiest, the U.S. is at 123 out of 195 countries measured.” [Associated Press, [6/5/19](#)]

Rolling Stone Headline: “Air Quality in the U.S. Has Gotten Worse Under The Trump Administration, Which Couldn’t Care Less.” In October of 2019, Rolling Stone reported: “Air quality in the United States is getting worse, and research suggests the dirty air is taking years off Americans’ lives. According to a study published this week by the National Bureau of Economic Research, fine particulate pollution increased 5.5 percent between 2016 and 2018, and evidence suggests the spike is responsible for 9,700 premature deaths last year alone. The study was based on data provided by the Environmental Protection Agency. The bump in pollution comes after the amount of fine particulate matter in the air had decreased every year — and 24.2 percent overall — from 2009 to 2016. Some of the factors that study’s authors say are driving the increase are largely unrelated to Trump administration decisions: The health of the economy has prompted more driving and increased wildfires have put more particulate into the atmosphere. But the author’s also cite the government’s failure to enforce the Clean Air Act, which the Trump administration has worked to dismantle.” [[Rolling Stone, 10/24/2019](#)]

Air Pollutants From Fossil Fuel Sources

Coal Power Plans Are A Major Source Of Mercury Pollution. According to the Union of Concerned Scientists: “Coal plants are responsible for 42 percent of US mercury emissions, a toxic heavy metal that can damage the nervous, digestive, and immune systems, and is a serious threat to the child development. Just 1/70th of a teaspoon of mercury deposited on a 25-acre lake can make the fish unsafe to eat. According to the Environmental Protection Agency’s (EPA) National Emissions Inventory, US coal power plants emitted 45,676 pounds of mercury in 2014 (the latest year data is available).” [[Union of Concerned Scientists, 12/19/2017](#)]

Air Pollutants From Coal Power Plants Can Include Lead, Cadmium, Carbon Monoxide, Volatile Organic Compounds, and Arsenic. According to the Union of Concerned Scientists: “Other harmful pollutants emitted in 2014 by the US coal power fleet include: 41.2 tons of lead, 9,332 pounds of cadmium, and other toxic heavy metals. 576,185 tons of carbon monoxide, which causes headaches and places additional stress on people with heart disease. 22,124 tons of volatile organic compounds (VOC), which form ozone. 77,108 pounds of arsenic. For scale, arsenic causes cancer in one out of 100 people who drink water containing 50 parts per billion.” [[Union of Concerned Scientists, 12/19/2017](#)]

American Lung Association: Particle Pollution From Vehicle Exhaust And Power Plants Can Cause Lung Cancer, Heart Disease, And Asthma Attacks. According to the American Lung Association: “Lung cancer is the #1 cancer killer of both men and women in the U.S. When you think of risk factors for lung cancer, what comes to mind? Most of us think about the risk associated with smoking cigarettes, but did you know that air pollution can also cause

lung cancer? Overwhelming evidence shows that particle pollution in the outdoor air we breathe—like that coming from vehicle exhaust, coal-fired power plants and other industrial sources—can cause lung cancer. Particle pollution increases the risk of dying early, heart disease and asthma attacks, and it can also interfere with the growth and function of the lungs." [[American Lung Association, 6/21/2016](#)]

Volatile Organic Compounds Leaking From Natural Gas Wells Alongside Methane Can Cause Serious Health Issues Including Cancer And Birth Defects. In a 2015 story on the health effects of leaking gases in Aztec, NM, The Guardian, citing a study by University of Colorado professor Dr Detlev Helmig. The Guardian pointed out: "And it is not only methane that is leaking out of these gas wells but a host of other dangerous gasses, collectively known as volatile organic compounds (VOCs). They read like a devil's cookbook of nastiness, for example benzene, which causes leukemia and other health problems; polycyclic aromatic hydrocarbons that can cause cancer; and toluene, which is known to cause birth defects at high doses." [[The Guardian 8/14/2015](#)]

Fracking Has Been Linked To Cough, Shortness Of Breath, Wheezing, And Asthma. According to Forbes, "Cough, shortness of breath and wheezing are the most common complaints of residents living near fracked wells. Toxic gases like benzene are released from the rock by fracking. Similarly, a toxic waste brew of water and chemicals is often stored in open pits, releasing volatile organic compounds into the air. These noxious chemicals and particulates are also released by the diesel powered pumps used to inject the water. An epidemiological study of more than 400,000 patients of Pennsylvania's Geisinger clinic, done with Johns Hopkins School of Public Health, found a significant association between fracking and increases in mild, moderate and severe cases of asthma (odds ratios 4.4 to 1.5). Hopkins' Dr. Brian Schwartz cautions that residents should be aware of this hazard as 'some 'pristine' rural areas are converted to heavily trafficked industrial areas.'" [Forbes, [2/23/17](#)]

USA Today: Research Has Shown That "People Living Near Natural-Gas Wells Were More Than Twice As Likely To Report Upper-Respiratory And Skin Problems Than Those Farther Away." According to USA Today, "Another study this year in Environmental Health Perspectives found that people living near natural-gas wells were more than twice as likely to report upper-respiratory and skin problems than those farther away." [USA Today, [12/17/14](#)]

Natural Resources Defense Council: "Studies Have Shown Dangerous Levels Of Toxic Air Pollution Near Fracking Sites," Where "Oil And Gas Extraction Have Caused Smog In Rural Areas At Levels Worse Than Downtown Los Angeles." According to the Natural Resources Defense Council, "Studies have shown dangerous levels of toxic air pollution near fracking sites; and oil and gas extraction have caused smog in rural areas at levels worse than downtown Los Angeles." [Natural Resources Defense Council, accessed [3/29/17](#)]

SAFETY

HURRICANES

Link Between Hurricanes and Climate Change

[Video] Trump: Scientists Who Say Hurricanes Are Worse Than Ever “Have A Very Big Political Agenda.” TRUMP: They say that we had hurricanes far worse than what we just had with Michael. STAHL: But who says that? They say? TRUMP: Well, people say, people say. STAHL: But what about the scientists who say it's worse than ever? TRUMP: Uh, you'd have to show me the scientists because they have a very big political agenda.” [Trump Interview On 60 Minutes, [10/14/18](#), 0:06]

New York Times Headline: “Climate Change Is Making Hurricanes Stronger, Researchers Find.” On May 18, 2020, the New York Times reported: “Hurricanes have become stronger worldwide during the past four decades, an analysis of observational data shows, supporting what theory and computer models have long suggested: climate change is making these storms more intense and destructive. The analysis, of satellite images dating to 1979, shows that warming has increased the likelihood of a hurricane developing into a major one of Category 3 or higher, with sustained winds greater than 110 miles an hour, by about 8 percent a decade.” [[New York Times, 5/18/2020](#)]

Environmental Experts: The Trump Administration's Moves To Undermine U.S. Action On Climate Change Made Deadly Storms More Likely. “The U.S. government's most recent report by top climate scientists predicts that seas will rise by at least another few inches in the next 15 years and by 1 to 4 feet by the end of the century. Other research has concluded that sea levels could rise by more than 6 feet by the end of the century because of faster-than-expected melting in Antarctica. Trump's decision to pull the U.S. out of the Paris climate treaty, and EPA's subsequent unwinding of the three major Obama-era regulations aimed at slashing carbon pollution from power plants, vehicles and oil and gas operations, set the country on a path that makes Florence-like storms all the more likely, experts say.” [Politico, [9/19/18](#)]

NOAA: Human Activities May Have Already Made Changes To Atlantic Hurricanes. According to the Geophysical Fluid Dynamics Laboratory, “It is premature to conclude that human activities—and particularly greenhouse gas emissions that cause global warming—have already had a detectable impact on Atlantic hurricane or global tropical cyclone activity. That said, human activities may have already caused changes that are not yet detectable due to the small magnitude of the changes or observational limitations, or are not yet confidently modeled (e.g., aerosol effects on regional climate).” [NOAA, Geophysical Fluid Dynamics Laboratory, accessed [8/29/17](#)]

Anthropogenic Warming Likely To Increase Intensity Of Hurricanes By As Much As 11%.

According to the Geophysical Fluid Dynamics Laboratory, "Anthropogenic warming by the end of the 21st century will likely cause tropical cyclones globally to be more intense on average (by 2 to 11% according to model projections for an IPCC A1B scenario). This change would imply an even larger percentage increase in the destructive potential per storm, assuming no reduction in storm size." [NOAA, Geophysical Fluid Dynamics Laboratory, accessed [8/29/17](#)]

Increased Hurricane Activity Linked To Higher Surface Temperatures Caused By Man Made Carbon Emissions. According to the National Climate Assessment, "The recent increases in activity are linked, in part, to higher sea surface temperatures in the region that Atlantic hurricanes form in and move through. Numerous factors have been shown to influence these local sea surface temperatures, including natural variability, human-induced emissions of heat-trapping gases, and particulate pollution. Quantifying the relative contributions of natural and human-caused factors is an active focus of research." [National Climate Assessment, Extreme Weather, [2014](#)]

Warming Water Would Provide Fuel For More Intense Hurricanes. According to NASA, "The one way in which global warming could impact hurricanes is by making them more intense. More heat and water in the atmosphere and warmer sea surface temperatures could provide more fuel to increase the wind speeds of tropical storms." [NASA, Earth Observatory, accessed [8/28/17](#)]

2020 Season Outlook

NOAA Report: "An Above-Normal 2020 Atlantic Hurricane Season Is Expected." According to the National Oceanographic and Atmospheric Administration: "An above-normal 2020 Atlantic hurricane season is expected, according to forecasters with NOAA's Climate Prediction Center, a division of the National Weather Service. The outlook predicts a 60% chance of an above-normal season, a 30% chance of a near-normal season and only a 10% chance of a below-normal season. The Atlantic hurricane season runs from June 1 through November 30." [[NOAA press release, 5/21/2020](#)]

NOAA 2020 Atlantic Hurricane Outlook Predicts 13-19 Named Storms, Including 3-6 Major Hurricanes. According to the National Oceanographic and Atmospheric Administration: "NOAA's Climate Prediction Center is forecasting a likely range of 13 to 19 named storms (winds of 39 mph or higher), of which 6 to 10 could become hurricanes (winds of 74 mph or higher), including 3 to 6 major hurricanes (category 3, 4 or 5; with winds of 111 mph or higher). NOAA provides these ranges with a 70% confidence. An average hurricane season produces 12 named storms, of which 6 become hurricanes, including 3 major hurricanes." [[NOAA press release, 5/21/2020](#)]

Accuweather Forecasted 14-20 Tropical Storms For the 2020 Atlantic Hurricane Season With 7-11 Becoming Hurricanes. Based on the newest forecasting models, AccuWeather forecasters have extended the upper range of hurricanes predicted for the Atlantic

hurricane season. The hurricane team, led by Dan Kottlowski, the company's top hurricane expert, is now predicting 14 to 20 tropical storms, with additions also to the number of storms that become hurricanes: seven to 11 this season." [[Accuweather, 5/7/2020](#)]

CNN Headline: "Experts Agree This Hurricane Season Will Be Above-average, Maybe Even Extremely Active." On May 8, 2020, CNN reported: "Hurricane season is fast approaching and it is likely to be active -- maybe even an extremely active -- season. 'Nearly all seasonal projections that have been issued by various agencies, institutions and private forecasting companies call for this season to be quite busy,' CNN meteorologist Taylor Ward says. Almost all of which are forecasting an above-average -- more than six -- hurricanes this season, which begins June 1. Some are even calling for an 'extremely active' season -- more than nine hurricanes. There are over a dozen forecasts published. And even though the official forecast from the National Oceanic and Atmospheric Administration won't come until May 21, a strong consensus in the forecasts across the industry indicates the US is in for an active season." [[CNN 5/8/2020](#)]

Tropical Storm Imelda (2019 – Southeast Texas)

Tropical Storm Imelda Dropped Over Three And A Half Feet Of Rain On Southeast Texas.

On September 23, 2019, the Texas Tribune reported: "Five deaths are linked to floods from Tropical Storm Imelda, the worst storm in Texas since Hurricane Harvey and one of the wettest tropical cyclones in the nation's history, according to the National Weather Service. Imelda dumped as much as 43 inches of rain in some parts of southeast Texas, according to the National Weather Service. In comparison, Harvey dropped about 60 inches of rain." [[Texas Tribune, 9/23/2019](#)]

Tropical Storm Imelda Caused \$5 Billion In Damages And 5 Deaths According to data tracked by the National Oceanographic and Atmospheric Administration, Tropical Storm Imelda had an estimated cost of \$5.0 billion in damages and 5 deaths. The NOAA's summary of the disaster said: "Tropical storm and its remnants cause 24 to 36 inches of rainfall over a 3-day period across a large area between Houston and Beaumont, Texas. The largest storm total, 43.39 inches, was reported at North Fork Taylors Bayou, Texas. Many thousands of homes, cars and businesses were impacted by flood water due to this extraordinarily heavy rainfall. Imelda is yet another of the historically extreme rainfall and flood events that have become a regular occurrence across Southeast Texas over the last 5 years." [[NOAA National Centers for Environmental Information](#)]

Scientific Analysis Of Tropical Storm Imelda Found That Precipitation Was 1.6-2.6 Times More Likely Or 9%-17% More Intense Because Of Climate Change. On September 27, 2019, a partnership of climate researchers called World Weather Attribution published a report on Tropical Storm Imelda, concluding: "Taking high-resolution climate models into account, we conclude that two-day extreme precipitation events along the Gulf Coast as intense as observed on 19–20 September 2019 or higher have become 1.6 to 2.6 times more likely due to anthropogenic climate change, or 9% to 17% more intense." [[World Weather Attribution, 9/27/2019](#)]

Hurricane Dorian (2019 – Bahamas and Carolinas)

Hurricane Dorian Caused \$1.6 Billion In Damages And 10 Deaths. According to data tracked by the National Oceanographic and Atmospheric Administration, Hurricane Dorian had an estimated cost of \$1.6 billion in damages and 10 deaths. The NOAA's summary of the disaster said: "Category 1 hurricane makes landfall on the Outer Banks of North Carolina, after devastating the northern Bahama Islands as a historically-powerful and slow-moving hurricane. Dorian tracked offshore parallel to the Florida, Georgia and South Carolina coastline before making a North Carolina landfall, bringing a destructive sound-side surge that inundated many coastal properties and isolated residents who did not evacuate. Significant flood, severe storm, and tornado damage to many homes and businesses occurred on the Outer Banks of North Carolina. Dorian's intensification to a category 5 storm marks the fourth consecutive year, in which a maximum category 5 storm developed in the Atlantic basin - a new record. Dorian also tied the record for maximum sustained wind speed for a landfalling hurricane (185 mph) in the Atlantic, a record shared with the historic 1935 Labor Day Hurricane." [[NOAA National Centers for Environmental Information](#)]

Washington Post: The Science Connecting Climate Change To Hurricanes Like Dorian Is Strong. On September 4, 2019, the Washington Post reported: "The science connecting climate change to hurricanes like Dorian is strong. Warmer oceans fuel more extreme storms; rising sea levels bolster storm surges and lead to worse floods. Just this summer, after analyzing more than 70 years of Atlantic hurricane data, NASA scientist Tim Hall reported that storms have become much more likely to 'stall' over land, prolonging the time when a community is subjected to devastating winds and drenching rain. But none of the numbers in his spreadsheets could prepare Hall for the image on his computer screen this week: Dorian swirling as a Category 5 storm, monstrous and nearly motionless, above the islands of Great Abaco and Grand Bahama." [[Washington Post, 9/4/2019](#)]

Hurricane Dorian Caused Record Flooding On North Carolina's Outer Banks. In February of 2020, the Associated Press reported: "More than 9,000 dump truck loads of debris have been hauled away from Ocracoke Island after it was battered by Hurricane Dorian five months ago, according to numbers released this week. All of the lingering storm debris is set to be cleared from the island by the end of February, Hyde County emergency management director Justin Gibbs told The Virginian-Pilot. Crews have already disposed of about 6,650 tons of waste, including thousands of damaged trees, parts of hundreds of ruined homes and even household appliances like refrigerators and washing machines, Gibbs added. The September storm inundated the Outer Banks island with waters surging to a record 7 feet in some places, news outlets reported at the time. The storm heavily damaged homes, businesses and other infrastructure, and the recovery effort has been ongoing. Hyde County crews have been filling trucks with debris for months, dumping waste in a trash mound two stories tall on a parking lot near the Cape Hatteras National Seashore, the newspaper said. The estimated cost of the debris removal was \$26 million

two months ago, but the most recent numbers weren't immediately available, according to Gibbs." [[Associated Press, 2/7/2020](#)]

Hurricane Michael (2018 – Florida Panhandle)

Hurricane Michael Caused \$25.5 Billion In Damages And 49 Deaths. According to data tracked by the National Oceanographic and Atmospheric Administration, Hurricane Michael had an estimated cost of \$25.5 billion in damages and 49 deaths. The NOAA's summary of the disaster said: "Powerful category 5 hurricane made landfall at Mexico Beach, Florida with devastating winds of 160 mph and storm surge in excess of 15 feet. Mexico Beach was nearly destroyed, while Panama City suffered extensive damage. Florida's Tyndall Air Force Base also suffered a direct strike from Michael's most intense eye wall winds causing billions in damage costs. Michael's intense winds also reached well inland causing billions in damage costs to agriculture and forestry, as high winds hit during harvest season for numerous crops across several states. Michael is the third category 4 or higher storm to make landfall in the U.S. since 2017. Michael is the first category 5 to strike the U.S. mainland since Hurricane Andrew in 1992 and is only the fourth on record. The others are the Labor Day Hurricane (1935) and Hurricane Camille (1969). Michael was initially rated as a category 4 with 155 winds but upgraded to a category 5 with 160 mph winds upon further analysis." [[NOAA National Centers for Environmental Information](#)]

CBS News: "Sometimes Connecting Climate Change To A Specific Weather Event Is Difficult. With Hurricane Michael, It's Not." In October of 2018, CBS News reported: "Sometimes connecting climate change to a specific weather event is difficult. With Hurricane Michael, it's not. The science is easy: Earth's waters are getting warmer due to an increasing global temperature, and warmer waters fuel hurricanes. Water temperatures in the far northern Gulf of Mexico were 3 to 5 degrees Fahrenheit higher than normal for this time of year. Instead of water temperatures being near 80, they were in the mid-80s as Michael moved over the Gulf and approached the Florida coast. That's a huge difference. Even a small temperature bump in the ocean causes a tremendous addition of energetic heat and water vapor to a storm, meaning higher wind speeds and more storm surge. All other things being equal, a storm hovering above 85-degree water will become much stronger than a storm hovering above 80-degree water." [[CBS News, 10/13/2018](#)]

Hurricane Michael Hit The Florida Panhandle As A Category 5 Storm. In April of 2019, CNN reported: "Hurricane Michael, which barreled into the Florida Panhandle in October, was actually a Category 5 storm when it hit the coast, scientists at the National Hurricane Center said Friday. A post analysis report said the storm was stronger than originally thought, with winds at landfall estimated at 160 mph -- making Michael one of only four Category 5 hurricanes to touch down in the US. The storm was originally designated as a Category 4, with 155 mph winds, when it made landfall on October 10 near Mexico Beach and Tyndall Air Force Base in Florida, the hurricane center said in a statement." [[CNN, 4/19/2019](#)]

Hurricane Florence (2018 – Carolinas)

Hurricane Florence Caused \$24.5 Billion In Damages And 53 Deaths. According to data tracked by the National Oceanographic and Atmospheric Administration, Hurricane Florence had an estimated cost of \$24.5 billion in damages and 53 deaths. The NOAA's summary of the disaster said: "Hurricane Florence was a large and very slow moving hurricane that produced extreme rainfall across eastern North Carolina (up to 35.93") and South Carolina (up to 23.81"), as prodigious amounts of rainfall were common in many locations. Florence made landfall as a category 1, at Wrightsville Beach, NC with damaging storm surge up to 10 feet and wind gusts reported over 100 mph. However, the majority of the damage caused by Florence was due to the rainfall inland, which caused many rivers to surpass previous record flood heights. U.S. Marine base Camp Lejeune in North Carolina suffered extensive damage that will cost billions to repair. The total damage from Florence in North Carolina is more than the cost experienced during Hurricane Matthew (2016) and Hurricane Floyd (1999) combined." [[NOAA National Centers for Environmental Information](#)]

Study Confirmed Climate Change Made Hurricane Florence Bigger And Wetter. In January of 2020, Stony Brook University reported in Science X Daily: "A study led by Kevin Reed, Ph.D., Assistant Professor in the School of Marine and Atmospheric Sciences (SoMAS) at Stony Brook University, and published in Science Advances, found that Hurricane Florence produced more extreme rainfall and was spatially larger due to human-induced climate change." [[Stony Brook University/Science X Daily, 1/3/2020](#)]

Hurricane Florence Described As One Of The Worst Hurricanes To Hit The Carolinas Since Hugo. In September of 2018, National Geographic reported: "The slow-moving storm pushed storm surges as high as 10 feet onto the shore when it makes landfall Friday morning. It was described as one of the worst hurricanes to hit the coastal Carolinas since Hurricane Hugo battered Charleston in September 1989. But it is the potential for days of drenching rainfall, already causing flooding, that has officials most worried." [[National Geographic, 9/13/2018](#)]

Hurricane Irma (2017 – Florida & Georgia)

Hurricane Irma Struck the U.S. As A Category 4 Hurricane on September 10, 2017; Was Ranked As One Of the Most Powerful Atlantic Storms on Record. "About 1.5 million homes and businesses in Florida and Georgia remained without power on Friday after Hurricane Irma, including 46 of Florida's nearly 700 nursing homes caught in the deadly storm's path. Irma, which ranked as one of the most powerful Atlantic storms on record before striking the U.S. mainland as a Category 4 hurricane on Sept. 10, killed at least 84 people. Several hard-hit Caribbean islands, including Puerto Rico and the U.S. Virgin Islands, suffered more than half the fatalities. [...] A total of eight others died in Georgia and the Carolinas. North Carolina reported its first Irma death on Friday, saying a man there also had died of carbon monoxide poisoning from a generator." [Reuters, [9/15/17](#)]

Hurricane Irma Caused \$52 Billion In Damages And 97 Deaths. According to data tracked by the National Oceanographic and Atmospheric Administration, Hurricane Irma had an estimated cost of \$52.0 billion in damages and 97 deaths. The NOAA's summary of the disaster said: "Category 4 hurricane made landfall at Cudjoe Key, Florida after devastating the U.S. Virgin Islands - St John and St Thomas - as a category 5 storm. The Florida Keys were heavily impacted, as 25% of buildings were destroyed while 65% were significantly damaged. Severe wind and storm surge damage also occurred along the coasts of Florida and South Carolina. Jacksonville, FL and Charleston, SC received near-historic levels of storm surge causing significant coastal flooding. Irma maintained a maximum sustained wind of 185 mph for 37 hours, the longest in the satellite era. Irma also was a category 5 storm for longer than all other Atlantic hurricanes except Ivan in 2004." [[NOAA National Centers for Environmental Information](#)]

Scientists Say Climate Change Made Hurricane Irma Much Stronger. In September of 2017, BloombergNEF reported: "Climate change didn't cause Hurricane Irma, the most powerful storm to form in the open Atlantic Ocean, but did make it much stronger, scientists in Germany and the U.K. said. Irma made landfall in the Caribbean early Wednesday and barreled toward Puerto Rico on a path that may bring it ashore in Florida and destroy so much property that damages surpass Hurricane Katrina. 'Unfortunately, the physicality is very clear: Hurricanes get their destructive energy from the warmth of the ocean, and the region's water temperatures are super elevated,' said Anders Levermann, a climate scientist at the Potsdam Institute for Climate Impact Research, in an emailed statement on Wednesday." [[BloombergNEF, 9/6/2017](#)]

Hurricane Maria (2017 – Puerto Rico)

Hurricane Maria Caused \$93.6 Billion In Damages And 2,981 Deaths. According to data tracked by the National Oceanographic and Atmospheric Administration, Hurricane Maria had an estimated cost of \$93.6 billion in damages and 2,981 deaths. The NOAA's summary of the disaster said: "Category 4 hurricane made landfall in southeast Puerto Rico after striking the U.S. Virgin Island of St. Croix. Maria's high winds caused widespread devastation to Puerto Rico's transportation, agriculture, communication and energy infrastructure. Extreme rainfall up to 37 inches caused widespread flooding and mudslides across the island. The interruption to commerce and standard living conditions will be sustained for a long period, as much of Puerto Rico's infrastructure is rebuilt. Maria tied Hurricane Wilma (2005) for the most rapid intensification, strengthening from tropical depression to a category 5 storm in 54 hours. Maria's landfall at Category 4 strength gives the U.S. a record three Category 4+ landfalls this year (Maria, Harvey, and Irma). Maria was one of the deadliest storms to impact the U.S., with numerous indirect deaths in the wake of the storm's devastation." [[NOAA National Centers for Environmental Information](#)]

American Geophysical Union: Hurricane Maria's Record Rainfall Due Mostly To Climate Change. In April of 2019, the American Geophysical Union reported in Science X Daily: "Hurricane Maria dropped more rain on Puerto Rico than any storm to hit the island since

1956, a feat due mostly to the effects of human-caused climate warming, new research finds. A new study analyzing Puerto Rico's hurricane history finds 2017's Maria had the highest average rainfall of the 129 storms to have struck the island in the past 60 years. A storm of Maria's magnitude is nearly five times more likely to form now than during the 1950s, an increase due largely to the effects of human-induced warming, according to the study's authors. 'What we found was that Maria's magnitude of peak precipitation is much more likely in the climate of 2017 when it happened versus the beginning of the record in 1950,' said David Keellings, a geographer at the University of Alabama in Tuscaloosa and lead author of the new study in AGU's journal Geophysical Research Letters." [[American Geophysical Union/Science X Daily, 4/16/2019](#)]

"It Looks Like A Bomb Went Off" Said One Puerto Rican After Hurricane Maria Struck. On September 25, 2017, NBC News reported: "Puerto Ricans described desperate conditions on the hurricane-ravaged island and pleaded for more help from federal agencies on Monday, with some saying they felt the U.S. territory was being forgotten. 'It looks like a bomb went off,' said Monique Casablanca, 37, by phone from Ocean Park in the capital of San Juan. 'I've seen very little to no police presence, I've seen zero military presence. Nights are excruciating, there's screaming, there's gunshots. It's hot, so it's hard to sleep right now I haven't slept in 48 hours,' said Casablanca, a rental property manager." [[NBC News, 9/25/2017](#)]

Hurricane Harvey (2017 – Texas & Louisiana)

Hurricane Harvey Caused \$130 Billion In Damages And 89 Deaths. According to data tracked by the National Oceanographic and Atmospheric Administration, Hurricane Harvey had an estimated cost of \$130 billion in damages and 89 deaths. The NOAA's summary of the disaster said: "Category 4 hurricane made landfall near Rockport, Texas causing widespread damage. Harvey's devastation was most pronounced due to the large region of extreme rainfall producing historic flooding across Houston and surrounding areas. More than 30 inches of rainfall fell on 6.9 million people, while 1.25 million experienced over 45 inches and 11,000 had over 50 inches, based on 7-day rainfall totals ending August 31. This historic U.S. rainfall caused massive flooding that displaced over 30,000 people and damaged or destroyed over 200,000 homes and businesses." [[NOAA National Centers for Environmental Information](#)]

NYT Op-Ed: "The Severity Of Harvey, In Other Words, Is Almost Certainly Related To Climate Change." According to an op-ed in the New York Times, "The severity of Harvey, in other words, is almost certainly related to climate change. Yes, I know the sober warning that's issued whenever an extreme weather disaster occurs: No individual storm can be definitively blamed on climate change. It's true, too. Some version of Harvey probably would have happened without climate change, and we'll never know the hypothetical truth." [New York Times, [8/29/17](#)]

- **"Add Up The Evidence, And It Overwhelmingly Suggests That Human Activity Has Helped Create The Ferocity Of Harvey."** According to an op-ed in the New York Times,

“Add up the evidence, and it overwhelmingly suggests that human activity has helped create the ferocity of Harvey. That message may be hard to hear — harder to hear, certainly, than stories of human kindness that is now mitigating the storm's toll. But it's the truth.” [New York Times, [8/29/17](#)]

Politico: “Harvey Is What Climate Change Looks Like In A World That Has Decided, Over And Over, That It Doesn't Want To Take Climate Change Seriously.” According to Politico, “But there's an uncomfortable point that, so far, everyone is skating around: We knew this would happen, decades ago. We knew this would happen, and we didn't care. Now is the time to say it as loudly as possible: Harvey is what climate change looks like. More specifically, Harvey is what climate change looks like in a world that has decided, over and over, that it doesn't want to take climate change seriously.” [Politico, [2/28/17](#)]

- **“If We Don't Talk About The Climate Context Of Harvey, We Won't Be Able To Prevent Future Disasters And Get To Work On That Better Future.”** According to Politico, “If we don't talk about the climate context of Harvey, we won't be able to prevent future disasters and get to work on that better future. Those of us who know this need to say it loudly. As long as our leaders, in words, and the rest of us, in actions, are OK with incremental solutions to a civilization-defining, global-scale problem, we will continue to stumble toward future catastrophes. Climate change requires us to rethink old systems that we've assumed will last forever. Putting off radical change—what futurist Alex Steffen calls “predatory delay”—just adds inevitable risk to the system. It's up to the rest of us to identify this behavior and make it morally repugnant.” [Politico, [2/28/17](#)]

Human Contribution Responsible For Up To 30% Of Rainfall From Hurricane Harvey. According to the Atlantic, “But [Kevin Trenberth, a senior scientist at the U.S. National Center for Atmospheric Research] says that the extra heat could make the storm more costly and more powerful, overpowering and eventually breaking local drainage systems. ‘The human contribution can be up to 30 percent or so of the total rainfall coming out of the storm,’ he said. ‘It may have been a strong storm, and it may have caused a lot of problems anyway—but [human-caused climate change] amplifies the damage considerably.’” [Atlantic, [8/27/17](#)]

EXTREME PRECIPITATION/INLAND FLOODING

Link To Climate Change

National Climate Assessment: “Heavy Downpours Are Increasing Nationally...The Mechanism Driving These Changes Is Well Understood.” According to the 2014 National Climate Assessment: “Heavy downpours are increasing nationally, especially over the last three to five decades. The heaviest rainfall events have become heavier and more frequent, and the amount of rain falling on the heaviest rain days has also increased. Since 1991, the amount of rain falling in very heavy precipitation events has been significantly above average. This increase has been greatest in the Northeast, Midwest, and upper Great Plains – more than 30% above the 1901-1960 average. There has also been an increase in flooding events in the Midwest and Northeast, where the largest increases in

heavy rain amounts have occurred. The mechanism driving these changes is well understood. Warmer air can contain more water vapor than cooler air. Global analyses show that the amount of water vapor in the atmosphere has in fact increased due to human-caused warming.,,, This extra moisture is available to storm systems, resulting in heavier rainfalls. Climate change also alters characteristics of the atmosphere that affect weather patterns and storms.” [[2014 National Climate Assessment: Extreme Weather](#)]

2020 Season Outlook

Washington Post Headline: “One-Third Of The Lower 48 Faces Risk Of Flooding This Spring, Weather Service Says.” On March 19, 2020, the Washington Post reported: “A third of the United States is at risk of flooding this spring, including 23 states and 128 million Americans. That’s according to the spring flood outlook released by the National Weather Service on Thursday. The forecast for significant spring flooding comes a year after one of the worst seasons on record in 2019. But this year, the flooding isn’t expected to be quite as severe.” [[Washington Post, 3/19/2020](#)]

Great Lakes Water Levels Expected To Top 2019 Records In 2020. In January of 2020, Fox 2 Detroit reported: “With water levels in the Great Lakes breaking records in 2019, the U.S. Army Corps of Engineers is predicting levels to reach similar heights in 2020, with a chance of new records being set again. Projections that extend six months from the present-day estimate levels in every Great Lake, as well as Lake St. Clair will be well above the average levels, with Lakes Michigan and Huron appear the most likely to set record highs. Both came close to records in 2019.” [[Fox 2 Detroit, 1/8/2020](#)]

Recent Disasters

Scientists Say Climate Change Played A Hand In Deadly 2019 Midwest Floods. In March of 2019, Reuters reported: “Climate change played a hand in the deadly floods in the U.S. upper Midwest that have damaged crops and drowned livestock, scientists said on Thursday, while a Trump administration official said more homework was needed before making that link. The “bomb cyclone” that dumped rain on Nebraska, Iowa and Missouri and killed at least four people now threatens a wider region downstream of swollen rivers and smashed levees. Manmade greenhouse gases trap heat in the atmosphere, warming the oceans and making the air above them more humid, scientists said. When a storm picks up and eventually spits out that moisture, it can be devastating for people caught below. ‘The atmosphere is pretty close to fully saturated, it’s got all the water it can take,’ said Michael Wehner, a senior scientist at the Lawrence Berkeley National Laboratory.” [[Reuters, 3/21/2019](#)]

Record-Setting Precipitation Caused Over \$15 Billion In Flood Damage Across The Midwest And Eastern US. In January of 2020, Scientific American reported: “The contiguous U.S. had its wettest January through November period on record in 2019, and the period July 2018 - June 2019 was the wettest 12-month period in continental U.S. history. Almost every state had above-average precipitation in 2019, and the states of Michigan, Minnesota, North Dakota, South Dakota, and Wisconsin were record-wet. The

record wetness led to over \$15 billion in flood damage across the Midwest and Eastern U.S., according to insurance broker Aon. According to NOAA/NCEI, only one U.S. flood disaster since 1980 not associated with a hurricane has cost more—the great 1993 Midwest floods, at \$37 billion (2019 dollars).” [[Scientific American, 1/3/2020](#)]

- **Flooding On The Missouri River And Upper Midwest In March Of 2019 Cost \$10.8 Billion And Caused 3 Deaths.** According to data tracked by the National Oceanographic and Atmospheric Administration, flooding on the Missouri River and North Central US in March of 2019 had an estimated cost of \$10.8 billion in damages and 3 deaths. The NOAA's summary of the disaster said: “Historic Midwest flooding inundated millions of acres of agriculture, numerous cities and towns, and caused widespread damage to roads, bridges, levees, and dams. The states most affected were Nebraska, Iowa, Missouri, South Dakota, Minnesota, North Dakota, Wisconsin and Michigan. This flood was triggered by a powerful storm with heavy precipitation that intensified snow melt and flooding. Of note, the Offutt Air Force Base in Nebraska was also severely flooded the third U.S. military base to be damaged by a billion-dollar disaster event over a 6-month period (Sept 2018-Feb 2019). This historic flooding was one of the costliest U.S. inland flooding events on record.” [[NOAA National Centers for Environmental Information](#)]
- **Flooding On The Arkansas River In June Of 2019 Cost \$3 Billion And Caused 5 Deaths.** According to data tracked by the National Oceanographic and Atmospheric Administration, flooding on the Arkansas River in June of 2019 had an estimated cost of \$3.0 billion in damages and 5 deaths. The NOAA's summary of the disaster said: “Historic flooding impacts the Arkansas River Basin with damage to homes, agriculture, roads, bridges and levees focused across eastern Oklahoma and western Arkansas. Thousands of homes, cars and businesses were flooded due a combination of high rivers, levee failure and persistently heavy rainfall from May 20 through June.” [[NOAA National Centers for Environmental Information](#)]
- **Flooding On The Mississippi River And Southern States In July Of 2019 Cost \$6.2 Billion And Caused 4 Deaths.** According to data tracked by the National Oceanographic and Atmospheric Administration, flooding on the Mississippi River, Midwest, and South in July of 2019 had an estimated cost of \$6.2 billion in damages and 4 deaths. The NOAA's summary of the disaster said: “Additional major flooding impacted many Southern Plains states significantly affecting agriculture, roads, bridges, levees, dams and other assets across many cities and towns. The states most affected were Oklahoma, Nebraska, Missouri, Illinois, Kansas, Arkansas, Kentucky, Tennessee, Texas, Mississippi and Louisiana. Very high water levels also disrupted barge traffic along the Mississippi River, which negatively impacted a variety of dependent industries. Indiana and Ohio were also affected by persistent heavy rainfall that flooded farmland, which prevented and reduced crop planting by millions of acres.” [[NOAA National Centers for Environmental Information](#)]

SEA LEVEL RISE & COASTAL FLOODING

NOAA Oceanographer: “Really The Future Is Now In Terms Of Sea Level Rise Impacts.” In July of 2019, NPR reported: “Sea levels are rising, and that is sending more ocean water

into streets, sewers and homes. For people who live and work in coastal communities, that means more otherwise-sunny days disrupted by flooding. 'Really the future is now in terms of sea level rise impacts,' says William Sweet, an oceanographer for the National Oceanic and Atmospheric Administration. Average sea levels have already started rising as a result of global climate change. 'The ocean is at the brim. It's clogging storm water systems and it's spilling into streets.'" [\[NPR, 6/10/2019\]](#)

In 2018, 12 Communities Broke Or Tied Previous Records For Days With High-Tide Flooding. In July of 2019, NPR reported: "In 2018, 12 communities broke or tied their previous records for the number of days with high-tide flooding, some with more than 20 days of storm-free flooding, according to the report. All were on the Eastern seaboard, from Massachusetts down to Florida. " [\[NPR, 6/10/2019\]](#)

Sunny Day Coastal Flooding Is Now Routine In Miami And Getting Worse Because Of Sea-Level Rise. In August of 2019, the Washington Post reported: "It doesn't take a hurricane to cause flooding in Miami anymore. In fact, it doesn't even take a gust of wind. 'King tides' have been taking a toll on Miami for a number of years, and the phenomenon is only getting worse because of sea-level rise from human-induced climate change. A king tide is a higher -than-normal tide caused by specific alignments of the sun and moon. Miami set daily high tide records for more than a week straight for the period bridging late July and early August, despite a total lack of storminess in the region. Sunny day coastal flooding is now routine, submerging some areas on a monthly basis when the sun and moon line up just right. There's even a 'king tide season' in the late fall and early winter, when the flooding is particularly severe." [\[Washington Post, 8/8/2019\]](#)

National Climate Assessment Showed That Climate Change Is Affecting Sea Level Rise Now, Not Just In The Future. An April, 2019 article in CNN looked at nine examples where the National Climate Assessment report contradicted EPA Administrator Wheeler's comments saying threats from climate were "50 to 75 years out". According to CNN: "Sea level rise "has already increased the frequency of high tide flooding by a factor of 5 to 10 for several U.S. coastal communities," according to the National Climate Assessment. The report says that the rise has contributed to coastal flooding since the 1960s." [\[CNN, 4/22/19\]](#)

National Climate Assessment Showed That Climate Change Is Forcing Relocation Of Indigenous Communities Now, Not Just In The Future. An April, 2019 article in CNN looked at nine examples where the National Climate Assessment report contradicted EPA Administrator Wheeler's comments saying threats from climate were "50 to 75 years out". According to CNN: "The report found that 'climate-related impacts' are causing some US indigenous communities to 'consider or actively pursue community re-location as an adaptation strategy.' Because they are struggling with severe effects of climate change, the residents are considering uprooting their communities, which could make it harder to maintain 'cultural and community continuity,' the report notes." [\[CNN, 4/22/19\]](#)

\$48 Million Housing Grant Allocated In 2016 To Relocated Native American Residents Of Isle De Jean Charles, LA, America's First Climate Refugees. In May of 2016, the New York Times reported: "In January, the Department of Housing and Urban Development announced grants totaling \$1 billion in 13 states to help communities adapt to climate change, by building stronger levees, dams and drainage systems. One of those grants, \$48 million for Isle de Jean Charles, is something new: the first allocation of federal tax dollars to move an entire community struggling with the impacts of climate change. The divisions the effort has exposed and the logistical and moral dilemmas it has presented point up in microcosm the massive problems the world could face in the coming decades as it confronts a new category of displaced people who have become known as climate refugees. 'We're going to lose all our heritage, all our culture,' lamented Chief Albert Naquin of the Biloxi-Chitimacha-Choctaw, the tribe to which most Isle de Jean Charles residents belong. 'It's all going to be history.'" [[New York Times, 5/2/2016](#)]

NASA: "Melting Glaciers And Ice Caps Will Likely Cause Sea Levels To Rise, Which Would Make Coastal Flooding More Severe When A Storm Comes Ashore." According to NASA, "Even if tropical storms don't change significantly, other environmental changes brought on by global warming could make the storms more deadly. Melting glaciers and ice caps will likely cause sea levels to rise, which would make coastal flooding more severe when a storm comes ashore. In their 2001 report, the Intergovernmental Panel on Climate Change stated that global warming should cause sea levels to rise 0.11 to 0.77 meters (0.36 to 2.5 feet) by 2100." [NASA, Earth Observatory, accessed [8/28/17](#)]

By 2100, Up To 13 Million Americans Could Be Living In Coastal Areas That Would Be Vulnerable To "Severe And More Frequent Flooding." According to an article from TIME, "Study after study has shown that sea-level rise due to climate change will leave cities on U.S. coasts vulnerable to severe and more frequent flooding. Despite the warnings, though, Americans continue to live and build in regions likely to be inundated with water in a matter of decades. New research published in the journal Nature Climate Change suggests that as many as 13 million people may live in vulnerable regions along the U.S. coasts by 2100 if sea levels rise by 5.9 feet (1.8 m). That's three times as many people as would be affected in the absence of continued coastal development and anticipated population growth along the sea." [TIME; [3/14/16](#)]

The Eastern Coastline Is Likely To Face Drastic Change Due To Sea- Level Rising. According to an article from E&E, "Up to 70 percent of the coastline stretching from Maine to Virginia is likely to change rather than simply be inundated over the next several decades in response to sea-level rise, a study led by the U.S. Geological Survey has found. The USGS computer model, developed in collaboration with Columbia University's Earth Institute, found that sea-level rise likely will form a mosaic of dry land, wetlands and open seas, rather than a uniform submersion. The model projects how natural forces will change the landscape from 2020 through 2080." [E&E; [3/16/16](#)]

WILDFIRES

Link To Climate Change

Climate Change Is Increasing The Severity, Frequency, And Extent Of Wildfires. According to a report from the EPA: “Higher temperatures and drought are likely to increase the severity, frequency, and extent of wildfires in Colorado, which could harm property, livelihoods, and human health. In 2013, the Black Forest Fire burned 14,000 acres and destroyed over 500 homes. Wildfire smoke can reduce air quality and increase medical visits for chest pains, respiratory problems, and heart problems. The size and number of western forest fires have increased substantially since 1985.” [[Environmental Protection Agency, “What Climate Change Means for Colorado” August 2016](#)]

The National Climate Assessment Has Found That The Number Of Wildfires Is Likely To Increase As The Climate Warms And Could Induce “Profound Changes To Certain Ecosystems.” In August of 2018, The Atlantic reported: “As if there wasn’t enough evidence of that. Last year, the National Climate Assessment—written by a panel of scientists in the military, federal civilian agencies, and private universities—reviewed the complete scientific literature on climate change and wildfires. They concluded that the number of large blazes had increased since the early 1980s. They also said the number of wildfires ‘is projected to further increase in those regions as the climate warms.’ They warned this could induce ‘profound changes to certain ecosystems.’” [The Atlantic, [8/10/18](#)]

Acres Burned By Wildfire Doubled In Recent Decades Due To Climate Change. According to the 2018 National Climate Assessment Report: “Wildfire is a natural part of many ecosystems in the Southwest, facilitating germination of new seedlings and killing pests. Although many ecosystems require fire, excessive wildfire can permanently alter ecosystem integrity. Climate change has led to an increase in the area burned by wildfire in the western United States. Analyses estimate that the area burned by wildfire from 1984 to 2015 was twice what would have burned had climate change not occurred. Furthermore, the area burned from 1916 to 2003 was more closely related to climate factors than to fire suppression, local fire management, or other non-climate factors.” [[National Climate Assessment, Chapter 25, 2018](#)]

2020 Season Outlook

National Interagency Fire Center Identified Concerns With Warm And Dry Pattern That May Be Problematic For Oregon And Central Through Eastern Washington. According to the National Interagency Fire Center’s May, 2020 report on significant wildland fire potential outlook: “May is the transitional period into the Western Fire Season. Overall, the entry into the season is expected to be normal; however, there are areas of concern emerging for the summer months. While the Pacific Northwest received beneficial precipitation in late April, the overall pattern has been warm and dry which may be problematic for Oregon and Central through Eastern Washington.” [[National Interagency Fire Center, National Significant Wildland Fire Potential Outlook, 5/1/2020](#)]

National Interagency Fire Center Identified Northern California, And The Great Basin Area As Areas To Monitor Closely “As Fuels Continue To Dry And Cure.” According to the National Interagency Fire Center’s May, 2020 report on significant wildland fire potential outlook: “Northern California and the Great Basin area are also areas to monitor closely for Above Normal significant wildland fire potential as fuels continue to dry and cure. Additionally, fine fuel loading is expected to be above average for the third consecutive year in the lower elevations. Those fuels will dry and cure, becoming receptive to fire by mid-June.” [[National Interagency Fire Center, National Significant Wildland Fire Potential Outlook, 5/1/2020](#)]

Recent Disasters

2019 California & Alaska Wildfire Season Cost \$4.5 Billion And Caused 3 Deaths.

According to data tracked by the National Oceanographic and Atmospheric Administration, western wildfires in the summer and fall of 2019 had an estimated cost of \$4.5 billion in damages and 3 deaths. The NOAA’s summary of the disaster said: “California experienced a damaging wildfire season in 2019, largely resulting from the Kincadee and Saddle Ridge wildfires. In addition, a key California electrical utility provider turned off power to millions of homes and businesses several times during days with forecasted high winds and extremely dry conditions. This step was designed to minimize wildfires, with some success, but it also caused billions of dollars in losses to those affected. Alaska also suffered a near-historic wildfire season with more than 2.5 million acres burned. These wildfire conditions were primed due to Alaska’s record-breaking heat and dry conditions during the summer months. July 2019 was the warmest month ever recorded in Alaska.” [[NOAA National Centers for Environmental Information](#)]

2018 Western Wildfire Season Cost \$24.7 Billion And Caused 106 Deaths. According to data tracked by the National Oceanographic and Atmospheric Administration, western wildfires in the summer and fall of 2018 had an estimated cost of \$24.7 billion in damages and 106 deaths. The NOAA’s summary of the disaster said: “In 2018, California has experienced its costliest, deadliest and largest wildfires to date, with records back to 1933. The Camp Fire is the costliest and deadliest wildfire - destroying more than 18,500 buildings. California also endured its largest wildfire on record - the Medincino Complex Fire - burning over 450,000 acres. Additionally, California was impacted by other destructive wildfires: the Carr Fire in Northern California and the Woolsey Fire in Southern California. The total 2018 wildfire costs in California (with minor costs in other Western states) approach \$24.0 (\$24.5) billion - a new U.S. record. In total, over 8.7 million acres has burned across the U.S. during 2018, which is well above the 10-year average (2009-2018) of 6.8 million acres. The last 2 years of U.S. wildfire damage has been unprecedented in damage, with losses exceeding \$40.0 (\$40.8) billion. [[NOAA National Centers for Environmental Information](#)]

2017 Western Wildfire Season Cost Over \$18.9 Billion And Caused 54 Deaths. According to data tracked by the National Oceanographic and Atmospheric Administration, western wildfires in the summer and fall of 2017 had an estimated cost of \$18.9 billion in damages

and 54 deaths. The NOAA's summary of the disaster said: "A historic firestorm damages or destroys over 15,000 homes, businesses and other structures across California in October. The combined destruction of the Tubbs, Atlas, Nuns and Redwood Valley wildfires represent the most costly wildfire event on record, also causing 44 deaths. Extreme wildfire conditions in early December also burned hundreds of homes in Los Angeles. Numerous other wildfires across many western and northwestern states burn over 9.8 million acres exceeding the 10-year annual average of 6.5 million acres. Montana in particular was affected by wildfires that burned in excess of 1 million acres. These wildfire conditions were enhanced by the preceding drought conditions in several states." [[NOAA National Centers for Environmental Information](#)]

NATIONAL SECURITY

General Threat Assessment

Department of Defense Report: "Climate Change Will Affect The Department Of Defense's Ability To Defend The Nation." A Department of Defense report on climate change stated: "Climate change will affect the Department of Defense's ability to defend the Nation and poses immediate risks to U.S. national security. The Department is responding to climate change in two ways: adaptation, or efforts to plan for the changes that are occurring or expected to occur; and mitigation, or efforts that reduce greenhouse gas emissions. This Climate Change Adaptation Roadmap (Roadmap) focuses on the Department's climate change adaptation activities." [[US Department of Defense 2014 Climate Change Adaptation Roadmap](#)]

Ret. USMC Brig. Gen. Stephen Cheney The Hill Op-Ed: Climate Change Poses "Undeniable Threat" To National Security. In a July 2015 The Hill op-ed titled "Climate change poses undeniable threat to national security," USMC Brig. Gen. Stephen Cheney (ret.) wrote, "Climate change, caused in large part by the carbon pollution we dump into our air, presents risks to the safety of both our nation and our world at large. The threats of climate change include extreme weather, rising sea levels, reduced military capacity, and conditions that can enable worldwide violence and perpetuate terrorism." [The Hill op-ed, [7/30/15](#)]

National Climate Assessment Showed That Climate Change Is Affecting Military Infrastructure Now, Not Just In The Future. An April, 2019 article in CNN looked at nine examples where the National Climate Assessment report contradicted EPA Administrator Wheeler's comments saying threats from climate were "50 to 75 years out". According to CNN: "Climate change is 'already affecting' the Department of Defense's infrastructure, according to the report, by 'damaging roads, runways, and waterfront infrastructure.'" [CNN, [4/22/19](#)]

Instability In High-Conflict Regions

Security Experts Report Concluded That "Even At Scenarios Of Low Warming, Each Region Of The World Will Face Severe Risks To National And Global Security In The Next Three

Decades.” In February of 2020, the Center for Climate and Security published a report, saying: “As national security, military and intelligence professionals with decades of experience, we have dedicated our careers to anticipating, analyzing and addressing security threats to the United States, with the goal of protecting all citizens from harm. That includes threats ranging from the proliferation and use of nuclear weapons, to the likelihood of terrorist attacks striking our shores. With this report, we set out together to fully assess one of the most pressing threats to both national and global security in the 21st Century - climate change. Climate change is an evolving and multidimensional threat, caused by no single actor, but perpetuated by current human systems of energy, transportation, agriculture, and resource use. According to the world’s top empirical research, the impacts of climate change have the potential to destabilize human life at all levels. Using our unique expertise in the national security, military and intelligence fields, we assess the risks posed by climate change through a security lens. Based on our research, we have determined that even at scenarios of low warming, each region of the world will face severe risks to national and global security in the next three decades. Higher levels of warming will pose catastrophic, and likely irreversible, global security risks over the course of the 21st century.” [[Center for Climate and Security, “A Security Threat Assessment Of Global Climate Change,” February 2020](#)]

Security Experts Report Concluded That Even At Low Levels Of Warming, Climate Impacts threaten to Further Destabilize Fragile Regions Of Significant Military Engagement. In February of 2020, the Center for Climate and Security published a report, saying: “If global emissions are not reigned in, the world will experience destabilizing changes in both the near and medium-to-long terms which pose significant threats to security environments, infrastructure, and institutions. • At low levels of warming, the areas hit the hardest are those that are already the most vulnerable: dry and arid regions, least-developed countries, small island states, and the Arctic polar region. These are areas of significant military engagement, and climate impacts threaten to further destabilize these fragile regions.” [[Center for Climate and Security, “A Security Threat Assessment Of Global Climate Change,” February 2020](#)]

Military Infrastructure & Readiness

Military Times Headline: “Climate Change Threatens A Majority Of Mission-Critical Military Bases, Pentagon Report Says” In January of 2019, Military Times reported: More than two-thirds of the military’s operationally critical installations are threatened by climate change, according to a new DoD report. The January 2019 report, “Report on Effects of a Changing Climate to the Department of Defense,” was submitted to Congress Thursday without an official announcement of the report or a public release. Several environmental organizations made the report publicly available early Friday. After several reporters questioned why the report was not made public by DoD, the Pentagon published it on Defense.gov mid-Friday. The Pentagon did not assess all of its hundreds of installations, instead it selected “79 mission assurance priority installations based on their operational role,” the Pentagon said in its report. In its assessment of those 79 installations, which

included Army, Air Force and Navy installations — and notably no Marine Corps bases — the services reported that 53 of the 79 faced current threats from flooding; 43 of the 79 face current threats from drought and 36 of the 79 faced current threats from wildfires.” [\[Military Times, 1/28/2019\]](#)

Several Sites Have Experienced Drought, Causing Ruptured Utility Lines, Cracked Road Surfaces, And Wide Soil Cracks. According to the Report on Effects of a Changing Climate to the Department of Defense, “Several DoD sites in the DC area (including Joint Base Anacostia Bolling, Joint Base Andrews, U.S. Naval Observatory/Naval Support Facility, and Washington Navy Yard) periodically experienced drought conditions –extreme in 2002 and severe from 2002 through 2018. In addition, Naval Air Station Key West experienced drought in 2015 and 2011, ranging from extreme to severe, respectively. These examples highlight that drought conditions may occur in places not typically perceived as drought regions. Drought conditions have caused significant reduction in soil moisture at several Air Force bases resulting in deep or wide cracks in the soil, at times leading to ruptured utility lines and cracked road surfaces.” [Department of Defense, [1/2019](#)]

Severe Weather Severely Limits The Operations And Activities At Naval Base Guam. According to the Report on Effects of a Changing Climate to the Department of Defense, “Weather conditions over the Mediterranean Sea currently impact intelligence, surveillance, and reconnaissance (ISR), personnel recovery/casualty evacuation and logistics flights from Europe to the African continent; potentially increasing no-go flight days. At Naval Base Guam, recurrent flooding limits capacity for a number of operations and activities including Navy Expeditionary Forces Command Pacific, submarine squadrons, telecommunications, and a number of other specific tasks supporting mission execution. Additionally, recurrent flooding impacts operations and activities of contingency response groups at Andersen Air Force Base, as well as mobility response, communications, combat, and security forces squadrons.” [Department of Defense, [1/2019](#)]

Naval Base Coronado In California Is Subject To Extreme Flooding During Tropical Storms. According to the Report on Effects of a Changing Climate to the Department of Defense, “Navy Base Coronado experiences isolated and flash flooding during tropical storm events, particularly in El Niño years. Upland Special Areas are subject to flash floods. The main installation reports worsening sea level rise and storm surge impacts that include access limitations and other logistic related impairments.” [Department of Defense, [1/2019](#)]

August 2013: Monsoon Flooded More Than 160 Buildings, Led To Months Of Clean Up And Repair. According to the Department of Defense Climate-Related Risk to DoD Infrastructure Initial Vulnerability Assessment Survey (SLVAS) Report, “In August 2013, a late summer monsoon rain storm struck Fort Irwin. This storm brought several inches of rain in a short period of time. Storm water flowed into the main cantonment area from the mountains around the post causing great damage to property. More than 160 buildings in the cantonment area were flooded and sections of Fort Irwin’s extensive training area also

sustained major storm damage. Training structures were toppled and supporting electronic target and communications systems were damaged. Weeks of effort were required to clean storm debris from the cantonment area's roads and parking lots. Soldiers, Civilians, and contractors all pitched in clear debris from roads and buildings, and. Many buildings were closed for repair for months." [Department of Defense, [1/24/18](#)]

West Point Has Experienced Flooding 'Numerous Times In The Past 30 Years. According to the Department of Defense Climate-Related Risk to DoD Infrastructure Initial Vulnerability Assessment Survey (SLVAS) Report, "While less than 5 percent of the West Point Military Reservation is within 0-3 feet of mean sea level, that portion of the installation includes transportation and wastewater treatment infrastructure. Due to its physical/geographic location, flooding has occurred at West Point numerous times in the past 30 years. During Superstorm Sandy, some sections of the installation reported significant inundation." [Department of Defense, [1/24/18](#)]

Extreme Weather Impacts Damaged Cape Lisburne Long Range Radar Station In Alaska, And Cost \$46.8 Million. According to the Department of Defense Climate-Related Risk to DoD Infrastructure Initial Vulnerability Assessment Survey (SLVAS) Report, "Arctic sea ice is in constant change, growing in the fall and winter and receding in the spring and summer. The proximity of Air Force long range radar on the North Slope of Alaska to the Arctic shoreline makes them vulnerable to accelerated shoreline erosion from the duration and extent of sea ice fluctuations, increasing water temperatures, thawing of permafrost soils, and the effects of wave action. The rock seawall at the Cape Lisburne Long Range Radar Station on the northwest Alaska coast line protects the installation's gravel airstrip from tidal and storm driven wave action. Over the past decade the runway's seawall has been depleted and eroded by wave action and extreme weather events. The damaged rock reinforcement became ineffective, and the 5,450 linear foot wall had to be replaced at a cost of \$46.8 million." [Department of Defense, [1/24/18](#)]

March 2018: Military Exercises In Colorado Led To Wildfires That Caused Evacuation Of 250 Homes And Spread To Over 3,000 Acres. According to the Report on Effects of a Changing Climate to the Department of Defense, "In March 2018 two related wildfires broke out in Colorado during an infantry and helicopter training exercise for an upcoming deployment. Later determined to be due to live fire training, gusty winds and dry conditions allowed the fire to spread, reaching about 3,300 acres in size, destroying three homes, and causing the evacuation of 250 homes." [Department of Defense, [1/2019](#)]

Vandenberg Air Force Base In California Has Had Two Major Wildfires In 2016 And 2017 Burning Nearly 1,400 Acres In Total. According to the Report on Effects of a Changing Climate to the Department of Defense, "A wildfire in November 2017 burned 380 acres on Vandenberg Air Force Base in southern California. While no structures were burned, the fire prompted evacuation of some personnel. Firefighters from the U.S. Forest Service, Santa Barbara County, and other localities assisted the Vandenberg Fire Department in

managing the fire. The Canyon Wildfire at Vandenberg in September 2016 burned over 10,000 acres and came very close to two Space Launch Complexes. A scheduled rocket launch had to be delayed. Several facilities on the south part of the base were operating on generators due to the loss of electrical power lines." [Department of Defense, [1/2019](#)]

Joint Base Langley Eustis In Virginia Has Experienced 14 Inches In Sea Level Rise Since 1930. According to the Report on Effects of a Changing Climate to the Department of Defense, "Vulnerabilities to installations include coastal and riverine flooding. Coastal flooding may result from storm surge during severe weather events. Over time, gradual sea level changes magnify the impacts of storm surge, and may eventually result in permanent inundation of property. Increasing coverage of land from nuisance flooding during high tides, also called "sunny day" flooding, is already affecting many coastal communities. Joint Base Langley-Eustis (JBLE-Langley AFB), Virginia, has experienced 14 inches in sea level rise since 1930 due to localized land subsidence and sea level rise. Flooding at JBLE-Langley, with a mean sea level elevation of three feet, has become more frequent and severe." [Department of Defense, [1/2019](#)]

ECONOMY

COST OF RECENT DISASTERS

The US Has Experienced 46 Climate Or Extreme Weather Disasters Costing 3,604 Lives And More Than \$462 Billion Since Trump Took Office. According to data collected by the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI), the United States has sustained 46 weather and climate disasters since 2017 where overall damages/costs reached or exceeded \$1 billion. The total combined cost of these disasters added up to \$462,607,700,000 when CPI-adjusted to 2020 dollars. These disasters cost a combined 3,604 lives, with 2,981 lives lost from 2017's Hurricane Maria alone. [[NOAA National Centers for Environmental Information](#)]

AGRICULTURE

National Climate Assessment: From Just One Drought Event In 2011, "The Heat And Drought Depleted Water Resources And Contributed To More Than \$10 Billion In Direct Losses To Agriculture Alone." According to the National Climate Assessment, "An example of recent drought occurred in 2011, when many locations in Texas and Oklahoma experienced more than 100 days over 100°F. Both states set new records for the hottest summer since record keeping began in 1895. Rates of water loss, due in part to evaporation, were double the long-term average. The heat and drought depleted water resources and contributed to more than \$10 billion in direct losses to agriculture alone." [[National Climate Assessment, Extreme Weather, 2014](#)]

USDA: 19.4 Million Acres Went Unplanted In 2019, 73% (14.2 Million Acres) In Midwest States Affected By Flooding. According to a US Department of Agriculture press release in August of 2019, "Agricultural producers reported they were not able to plant crops on more than 19.4 million acres in 2019, according to a new report released by the U.S. Department of Agriculture (USDA). This marks the most prevented plant acres reported since USDA's Farm Service Agency (FSA) began releasing the report in 2007 and 17.49 million acres more than reported at this time last year. Of those prevented plant acres, more than 73 percent were in 12 Midwestern states, where heavy rainfall and flooding this year has prevented many producers from planting mostly corn, soybeans and wheat." [[USDA, 8/12/2019](#)]

Climate Change Is Already Impacting Farmers Confidence In Producing Future Crops. According to an article from The Independent, "Rising global temperatures may have a far bigger impact on food production than previously thought according to a study of how farmers in Brazil have actually reacted to a warmer climate over the past decade. In addition to the direct effects on harvests, scientists have discovered that warmer temperatures change the behaviour of farmers so they end up planting fewer crops than

they otherwise would under normal growing conditions. This change in farming practice triggered by warmer temperatures can actually be significantly more important in lowering overall crop yields than the more direct influence of hotter or drier weather on growing conditions, the researchers found.” [Independent; [3/7/16](#)]

Study: Under “Business-As-Usual,” Unmitigated Climate Change Scenario, “The Earth Could Lose A Significant Number Of Suitable Growing Days Per Year By The End Of The Century.” In June 2015, professor of geography at the University of Hawaii at Manoa Camilo Mora and colleagues released a study in the journal PLOS Biology which “indicate[s] that climate change may not be the net positive to plants that some prior research has suggested. If humans allow global warming to go on unmitigated under a business-as-usual scenario, the Earth could lose a significant number of suitable growing days per year by the end of the century. And that’s bad news for people as well as plants, with the potential for widespread food shortages and economic downturns. On the other hand, strong and even moderate efforts to cut down on global carbon output could reduce the impact of climate change and hardly hurt plant growth. The study underscores the importance of heading off climate change, says Mora, the paper’s lead author, while providing a look at what could happen if we don’t ... The places that lose growing days will far outweigh the places that gain. In fact, on a global scale, the authors predict that the Earth will lose a whopping 11 percent of its annual suitable growing days by the year 2100 under a business-as-usual scenario ... In fact, the authors predict that tropical parts of the world could lose up to 200 growing days out of the year by the end of the century under a business-as-usual scenario — that’s a loss of more than half a year’s growing days.” [Washington Post, [6/10/15](#); Public Library of Science, [6/10/15](#)]

Due To The Rising Temperatures In States Like Montana, Research Shows That This Could Result In A 20% Drop In Cattle, and 25% Grain Reduction By 2055. According to an article from the Great Falls Tribune, “A new report highlights economic threats faced by Montana’s farmers and ranchers as average temperatures rise and growing conditions change. The report projects a 20 percent drop in range land cattle production, and a 25 percent decline in grain production by 2055. The drop in cattle production could cost ranchers more than 12,000 jobs and \$364 million in earnings, says the report, which cites water shortages, increased temperature and concentrations of carbon that will make grass and hay less digestible and nutritious to livestock.” [[Great Falls Tribune, 2/26/2016](#)]

ENERGY COSTS

Nearly A Third Of Households Struggled To Pay Energy Bills According To A 2018 EIA Report. In September of 2018, NPR reported: “Nearly a third of households in the United States have struggled to pay their energy bills, the Energy Information Administration said in a report released Wednesday. The differences were minor in terms of geography, but Hispanics and racial minorities were hit hardest. About one in five households had to reduce or forgo food, medicine and other necessities to pay an energy bill, according to the [report](#). "Of the 25 million households that reported forgoing food and medicine to pay energy bills, 7 million faced that decision nearly every month," the report stated. More than 10 percent of households kept their homes at unhealthy or unsafe temperatures.” [[NPR, 9/19/2018](#)]

If Greenhouse Gas Emissions Continue Unabated, Electricity Will Cost Ratepayers \$30 Billion Per Year More By Mid-Century. According to the energy chapter of the Fourth National Climate Assessment, “If greenhouse gas emissions continue unabated (as with the higher scenario [RCP8.5]), rising temperatures are projected to drive up electricity costs and demand. Despite anticipated gains in end use and building and appliance efficiencies, higher temperatures are projected to drive up electricity costs not only by increasing demand but also by reducing the efficiency of power generation and delivery, and by requiring new generation capacity costing residential and commercial ratepayers by some estimates up to \$30 billion per year by mid-century.” [[Fourth National Climate Assessment, 2018 \(Chapter 4\)](#)]

TOURISM & RECREATION

The Economy Of The Florida Keys Is Heavily Dependent On Tourism Surrounding Its Coral Reefs, Which Are Suffering Damage From Rising Temperatures. In June of 2017, the Washington Post reported: “But what is happening here — as the warming of the sea devastates the coral reef — is a stark example of how rising temperatures can threaten existing economies. The 113-mile-long Overseas Highway between the mainland and Key West — linking islands that themselves emerged from an ancient coral archipelago — is lined with marinas, bait and tackle shops and an abundance of seafood restaurants. From the visitors who fill dive charters out of Key Largo to the local fishing industry’s catches of spiny lobsters, grouper, snapper and other species, nearly everything in the Florida Keys is tied in some way to the reefs. Diving, snorkeling, fishing, and eating seafood are among the key tourist activities that could be harmed if the reef continues to suffer damage.” [[Washington Post, 6/25/2017](#)]

- **Florida Fish and Wildlife Official Said His Team Had Seen A 50 Percent Decline In Coral Cover At Their Sites.** In a June, 2017 story on a program called CREMP that monitors coral reefs, WGCU News interviewed Florida Fish and Wildlife Conservation Commission’s Principal Investigator for the program, Rob Ruzicka. According to WGCU, “Ruzicka said the two decades of data collected through CREMP draw attention to a

concerning trend in Florida's coral health. 'We've seen a roughly 50 percent decline in the coral cover at our sites,' said Ruzicka. 'And while this can't necessarily be extrapolated throughout the entire Florida Keys and through the entire Florida reef tract, what we've seen within our monitoring sites is a large reflection on the amount of coral that we have lost.'" [\[WGCU, 6/23/2017\]](#)

UF Professor: Climate Change Could Lead To Increased Growth Of Harmful

Microorganisms In Nearshore Ocean Water, Including Red Tide. University of Florida Professor and Director of the Florida Sea Grant College Program Karl Havens wrote a paper for the Institute of Food and Agricultural Services Extension titled: "Climate Change and the Occurrence of Harmful Microorganisms in Florida's Ocean and Coastal Waters" According to the paper's summery: "Climate change is expected to result in increased temperatures of nearshore ocean water, and this could lead to increased growth of harmful microorganisms. These include algae that form noxious or toxic blooms, including red tides, and bacteria and other pathogens. This situation could have negative consequences in regard to human health and also Florida's ocean-related economy." [\[University of Florida/Institute of Food and Agricultural Sciences Extension publication #SGEF216\]](#)

- **September 2018 – November 2018: Pinellas County Spent \$7 Million On Cleaning Up Dead Fish Caused By Red Tide.** According to The Tampa Bay Times, "Pinellas suffered from the toxic algae bloom's effects for three months, starting in early September. Levy said the county spent more than \$7 million trying to clean up all the dead fish washing ashore, in some cases intercepting them before they could reach the beach." [\[Tampa Bay Times, 11/27/18\]](#)
- **One Vacation Property Manager Saw Business Down 65% During 2018 Red Tide Outbreak, Another Reported Losing As Much As \$20,000 Per Day.** In a September, 2018 story on businesses impacted by red tide, the Sarasota Herald Tribune reported: "Jackie Mauck, resort manager at Siesta Key Bungalows, estimates that business is down 65 percent from the norm this time of year. As people keep canceling reservations and new ones fail to trickle in, her workplace cut back on her hours and laid off a housekeeper. Mauck added that her hotel's owner had dismissed the possibility of applying for the state's bridge loan program. Six months was too little and 18 percent too high to risk during a time when her business already is struggling, she said. Michael Holderness, who owns Siesta Key Beachside Villas and other rental properties in the area, echoed Mauck's concerns. He said his businesses are incurring losses of \$20,000 per day, forcing him to dip into his reserves for 2019 to stay afloat." [\[Sarasota Herald Tribune, 9/24/2018\]](#)

Climate Change Is Causing Diminished Snowpack, Affecting Winter Tourism And Recreation. According to a report from the EPA: "Changes in temperature and precipitation are affecting snowpack—the amount of snow that accumulates on the ground. In most of the West, snowpack has decreased since the 1950s, due to earlier melting and less precipitation falling as snow. The amount of snowpack measured in April has declined by 20 to 60 percent at most monitoring sites in Colorado. Diminishing snowpack can shorten the season for skiing and other forms of winter tourism and

recreation. It also enables subalpine fir and other high-altitude trees to grow at higher elevations. The upward movement of the tree line will shrink the extent of alpine tundra and fragment these ecosystems, possibly causing the loss of some species.”

[\[Environmental Protection Agency, “What Climate Change Means for Colorado” August 2016\]](#)

Snow In The West Has Declined 41 Percent Since The 1980s, Shortening The Snow Season By 34 Days And Threatening The \$20 Billion Snow Sports Tourism Industry.

In March of 2019, CNBC reported: “The amount of snow in the west has seen an average drop of 41 percent since the early 1980s, according to research just published in the journal *Geophysical Research Letters*. As a result, the snow season shrunk by 34 days. Snow sports tourism contributes about \$20 billion to the U.S. economy each year, according to researchers at the University of New Hampshire and Colorado State University. The bulk of that spending is at ski resorts, like Colorado-based Vail Resorts.” [\[CNBC, 3/21/2019\]](#)

Trout Habitats In The Interior West Expected To Be Reduced By Half This Century.

According to an article in *Scientific American*, “Most scientists agree that the effects of global warming are starting to show up all around the world in many forms. Throughout America’s Rocky Mountain West, rivers and streams are getting hotter and drier, presenting new challenges for trout already struggling with habitat fragmentation and pollution. A recent report by the Natural Resources Defense Council (NRDC) and Montana Trout Unlimited (MTU) found that global warming is shrinking cold-water fish habitat, threatening the trout and other fish that depend upon it. Scientists believe that the nearly five degree (F) temperature increase forecasted for the Interior West could reduce trout habitat by half in this century, sending trout populations into a tailspin.” [\[Scientific American, 3/4/2010\]](#)

WORKER PRODUCTIVITY

Washington Post Headline: “Scorching Heat Is Driving Down Economic Productivity Around The World.”

In July of 2016, the Washington Post reported: A study released in late 2014 by the National Bureau for Economic Research suggested that warmer temperatures result in quantifiable economic costs. That paper showed a fairly dramatic negative influence of heat on economic productivity. In particular, the authors found that for a single very hot day — warmer than 86 degrees Fahrenheit — per capita income goes down by \$20.56, or 28 percent.” [\[Washington Post, 7/19/2016\]](#)

- **Researchers Studying Data From The United States Since 1969 Found That High Heat Resulted In A 1.7% Decline In Worker Productivity For Each 1°C Above 15°C.** According to a paper published by the National Bureau of Economic Research: “It is widely hypothesized that incomes in wealthy countries are insulated from environmental conditions because individuals have the resources needed to adapt to their environment. We test this idea in the wealthiest economy in human history. Using within-county variation in weather, we estimate the effect of daily temperature on annual income in United States counties over a 40-year period. We find that this single

environmental parameter continues to play a large role in overall economic performance: productivity of individual days declines roughly 1.7% for each 1°C (1.8°F) increase in daily average temperature above 15°C (59°F). A weekday above 30°C (86°F) costs an average county \$20 per person. Hot weekends have little effect. These estimates are net of many forms of adaptation, such as factor reallocation, defensive investments, transfers, and price changes. Because the effect of temperature has not changed since 1969, we infer that recent uptake or innovation in adaptation measures have been limited." [[Deryugina, Tatyana and Hsiang, Solomon M. "Does The Environment Still Matter? Daily Temperature And Income In The United States" NBER Working Paper Series, December 2014](#)]

FUTURE GDP IMPACT

2018 National Climate Assessment Found That Climate Change Could Trim GDP By 10% By 2100 If Significant Action Is Not Taken To Limit Warming. In November of 2018, the New York Times reported: "A major scientific report issued by 13 federal agencies on Friday presents the starkest warnings to date of the consequences of climate change for the United States, predicting that if significant steps are not taken to rein in global warming, the damage will knock as much as 10 percent off the size of the American economy by century's end. The report, which was mandated by Congress and made public by the White House, is notable not only for the precision of its calculations and bluntness of its conclusions, but also because its findings are directly at odds with President Trump's agenda of environmental deregulation, which he asserts will spur economic growth." [[New York Times, 11/23/2018](#)]

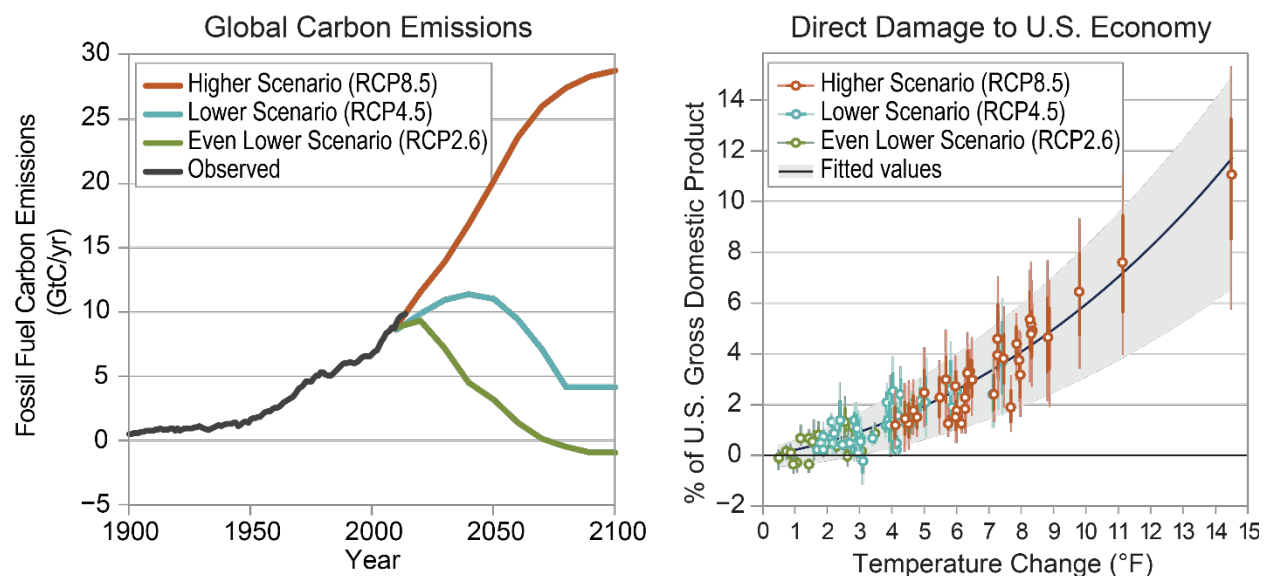


Chart source: [Fourth National Climate Assessment, 2018 figure 29.3: Estimates of Direct Economic Damage from Temperature Change](#)

National Climate Assessment: "Annual Losses In Some Economic Sectors Are Projected To Reach Hundreds Of Billions Of Dollars By The End Of The Century." According to the

summary findings of the Fourth National Climate Assessment, “In the absence of significant global mitigation action and regional adaptation efforts, rising temperatures, sea level rise, and changes in extreme events are expected to increasingly disrupt and damage critical infrastructure and property, labor productivity, and the vitality of our communities. Regional economies and industries that depend on natural resources and favorable climate conditions, such as agriculture, tourism, and fisheries, are vulnerable to the growing impacts of climate change. Rising temperatures are projected to reduce the efficiency of power generation while increasing energy demands, resulting in higher electricity costs. The impacts of climate change beyond our borders are expected to increasingly affect our trade and economy, including import and export prices and U.S. businesses with overseas operations and supply chains. Some aspects of our economy may see slight near-term improvements in a modestly warmer world. However, the continued warming that is projected to occur without substantial and sustained reductions in global greenhouse gas emissions is expected to cause substantial net damage to the U.S. economy throughout this century, especially in the absence of increased adaptation efforts. With continued growth in emissions at historic rates, annual losses in some economic sectors are projected to reach hundreds of billions of dollars by the end of the century—more than the current gross domestic product (GDP) of many U.S. states.” [[Fourth National Climate Assessment, 2018](#) (summary finding #2)]

(Video) Trump, When Asked About A Report That Warned Of GDP Loss From Climate Change, Said “I Don’t Believe It” Excerpt of a transcript of President Trump’s remarks before boarding Marine One on November 26, 2018:

Q: Mr. President, have you read the climate report yet?

THE PRESIDENT: I’ve seen it, I’ve read some of it, and it’s fine.

Q They say economic impact could be devastating — of climate change.

THE PRESIDENT: Yeah. I don’t believe it.

Q You don’t believe it?’

THE PRESIDENT: No. No. I don’t believe it. And here’s the other thing — you’re going to have to have China, and Japan, and all of Asia, and all of these other countries — you know, it — it addresses our country. Right now, we’re at the cleanest we’ve ever been, and that’s very important to me. But if we’re clean but every other place on Earth on is dirty, that’s not so good.

[[Trump Remarks Before Boarding Marine One, 11/26/2018](#) (video via [YouTube](#))]

2019 Study From IMF, Cambridge, And USC Researchers Found US GDP Will Decline 10.5% By 2100, 3.7% By 2050 Due To Climate Change. In August of 2019, CNBC reported:

“Climate change will exact a toll on global economic output as higher temperatures hamstring industries from farming to manufacturing, according to a new study published by the National Bureau of Economic Research. Record-breaking heat across the globe made headlines throughout July, and now researchers say a persistent increase in average global temperature by 0.04 degrees Celsius per year, barring major policy breakthroughs, is set to reduce world real GDP per capita by 7.22% by 2100. The researchers — hailing from the International Monetary Fund, the University of Cambridge and the University of Southern California — found little evidence that precipitation had an impact on GDP, but instead observed a large temperature-related effect. The U.S. is expected to see its GDP per capita decline 10.5%, China’s by 4.3% and the European Union’s by 4.6% over the next 81 years as a result of temperature fluctuations. In other words, if global GDP doubles or halves by 2100, the results suggest real GDP per capita would still be 7.22% below where it would be otherwise. In the nearer term, and assuming no major policy changes and continued greenhouse emissions, the climate-related drag on global GDP per capita is projected to surpass 2.5% and exceed 3.7% in the U.S. by 2050.” [\[CNBC, 8/20/2019\]](#)

Sticking With The Paris Climate Agreement Will Save The United States Over A Half Trillion A Year. According to research published in the Journal Earth’s Future, the annual economic losses under a 4 degree warming scenario (RCP8.5, business as usual), the United States would see losses of \$697.77 billion per year by the year 2100, however the annual economic losses due to climate change if we limit warming to 2 degrees (adhering to the Paris agreement goal) by the year 2100 is projected at \$168.48 billion per year, resulting in a net savings of \$529.29. [\[Kompas, T., Pham, V. H., & Che, T. N. \(2018\). The effects of climate change on GDP by country and the global economic gains from complying with the Paris Climate Accord. Earth’s Future, 6, 1153–1173\]](#)

Doing Nothing About Climate Change Will Cost The United States \$698.77 Billion Every Year. According to research published in the Journal Earth’s Future, the annual economic losses under a 4 degree warming scenario (RCP8.5, business as usual), the United States would see losses of \$697.77 billion per year by the year 2100, however the annual economic losses due to climate change if we limit warming to 2 degrees (adhering to the Paris agreement goal) by the year 2100 is projected at \$168.48 billion per year, resulting in a net savings of \$529.29. [\[Kompas, T., Pham, V. H., & Che, T. N. \(2018\). The effects of climate change on GDP by country and the global economic gains from complying with the Paris Climate Accord. Earth’s Future, 6, 1153–1173\]](#)

OTHER ECONOMIC CONTRACTIONS FOR COMPARISON

US GDP Shrunk By 4.8% During Pandemic In the First Quarter Of 2020. On April 29, 2020, ABC News reported: “The U.S. economy shrank 4.8% in the first quarter of 2020, ending a record streak of expansion, according to a preliminary estimate released by the

Commerce Department on Wednesday. The real gross domestic product (GDP) is among the first economic indicators to show the impact of the novel coronavirus pandemic on the U.S. economy." [[ABC News, 4/29/2020](#)]

5/19/2020: CBO Projected 5.6% Decline In GDP For 2020. On May 19, 2020 the Congressional Budget Office published interim economic projections for 2020 and 2021, which showed a 4.8% actual decline in GDP in the first quarter of 2020, followed by projections of severe decline in the 2nd quarter, followed by a gradual rebound in quarters 3 and 4. The overall annual real GDP growth was projected to be negative 5.6%. [[Congressional Budget Office, 5/19/2020 \(Table 1\)](#)]

6/1/2020: CBO Projected A Long-Term Impact Of 3.0% Of GDP From The COVID-19 Pandemic. On June 1st, 2020, the Congressional Budget Office reported: "The revised forecast for nominal GDP reflects a significant markdown in CBO's projection of real (inflation-adjusted) production in the United States as a result of the pandemic. Business closures and social distancing measures are expected to curtail consumer spending, while the recent drop in energy prices is projected to severely reduce U.S. investment in the energy sector. Recent legislation will, in CBO's assessment, partially mitigate the deterioration in economic conditions. CBO's May projection of real GDP in the second quarter of 2020 was \$724 billion (or 13.3 percent) lower in 2019 dollars than the agency's projection from January. Beyond the second quarter of 2020, the difference between those projections of real GDP shrinks, to \$422 billion in 2019 dollars (7.6 percent lower in the more recent projection) by the end of 2020 and roughly disappears by 2030. As a result of those differences, CBO projects that over the 11-year horizon, cumulative real output (in 2019 dollars) will be \$7.9 trillion, or 3.0 percent of cumulative real GDP, less than what the agency projected in January." [[Congressional Budget Office, 6/1/2020](#)]

US GDP Shrunk By 4.3% During The Great Recession Of 2007-2009. According to the website Federal Reserve History, which is operated by the Federal Reserve Bank of St. Louis, "The Great Recession began in December 2007 and ended in June 2009, which makes it the longest recession since World War II. Beyond its duration, the Great Recession was notably severe in several respects. Real gross domestic product (GDP) fell 4.3 percent from its peak in 2007Q4 to its trough in 2009Q2, the largest decline in the postwar era (based on data as of October 2013). The unemployment rate, which was 5 percent in December 2007, rose to 9.5 percent in June 2009, and peaked at 10 percent in October 2009." [[Federal Reserve History, 11/22/2013](#)]

- **NYT: Climate Change Could "More Than Double" The Losses Of The Great Recession.** In November of 2018, the New York Times reported on the US Government's Fourth National Climate Assessment, finding: "All told, the report says, climate change could slash up to a tenth of gross domestic product by 2100, more than double the losses of the Great Recession a decade ago." [[New York Times, 11/23/2018](#)]