

# How climate change impacts the economy

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Credit: [Olearys](#)

The [Fourth National Climate Assessment](#), published in 2018, warned that if we do not curb greenhouse gas emissions and start to adapt, climate change could seriously disrupt the U.S. economy. Warmer temperatures, sea level rise and extreme weather will damage property and critical infrastructure, impact human health and productivity, and negatively affect sectors such as agriculture, forestry, fisheries and tourism. The demand for energy will increase as power generation becomes less reliable, and water supplies will be stressed. Damage to other countries around the globe will also affect U.S. business through disruption in trade and supply chains.

A [recent report](#) examined how [climate](#) change could affect 22 different sectors of the economy under two different scenarios: if global temperatures rose 2.8° C from pre-industrial levels by 2100, and if they increased by 4.5° C. The study projected that if the higher-temperature scenario prevails, [climate change impacts](#) on these 22 sectors could cost the U.S. \$520 billion each year. If we can keep to 2.8° C, it would cost \$224 billion less. In any case, the U.S. stands to suffer large economic losses due to climate change, second only to India, according to [another study](#).

We are already seeing the economic impacts of the changing climate. According to Morgan Stanley, climate disasters have cost North America \$415 billion in the last three years, much of that due to wildfires and hurricanes.

In 2017, Texas's estimated losses from Hurricane Harvey were \$125 billion; Hurricane Sandy caused about \$71 billion of damages in 2012. And while it's not yet possible to directly link climate change to hurricanes, [warmer temperatures](#) and higher sea levels are known to enhance their intensity and destructiveness.

"Science advances also give us more detailed spatial information to say

which assets and operations are in harm's way with climate change—for example say, just how many buildings will be inundated due to sea level rise," said climatologist Radley Horton, associate research professor at Lamont-Doherty Earth Observatory. But the indirect economic impacts may be felt long before an actual disaster.

"For example, it's not just whether a building is underwater or not," he said. "What's important are the harder-to-define things like when does societal risk perception shift? It may be that buildings lose their value before the water actually arrives, once people realize that eventually the water's going to arrive. We need deeper thinking about the interconnection between physical and social systems."

Here are some of the many ways that climate change will likely affect our economy, both directly and indirectly.

## **Agriculture**

The sector most vulnerable to climate risk is agriculture.

Environmental economist Geoffrey Heal, a professor in the Columbia Business School, explained that although agriculture makes up a fairly small part of the total U.S. economy, "locally these effects could be big. There are about a dozen states in the Midwest that are very dependent on agriculture and they could take quite a big hit."

They already have. Extreme rainfall events have increased 37 percent in the Midwest since the 1950s, and this year, the region has experienced above normal amounts of rain and snowmelt that have caused historic flooding.

Many fields have washed away and livestock have drowned; Nebraska alone lost \$440 million worth of cattle, and as of March, Iowa had

suffered \$1.6 billion in losses.

The National Oceanic and Atmospheric Administration (NOAA) expects the coming months to bring even more flooding, which could impact our food supply. To date, farmers have only planted 67 percent of their corn crop compared to last June, when they had planted 96 percent. This lost yield could cause prices for animal feed and ethanol to rise, and potentially disrupt marketplaces at home and abroad. As a result of climate change impacts, the Midwest is projected to lose up to 25 percent of its current corn and soybean yield by 2050.

In addition to flooding, increased heat and drought will likely reduce crop yields. According to a 2011 [National Academy of Sciences report](#), for every degree Celsius the global thermostat rises, there will be a 5 to 15 percent decrease in overall crop production. Many commodity crops such as corn, soybean, wheat, rice, cotton, and oats do not grow well above certain temperature thresholds. In addition, crops will be affected by less availability of water and groundwater, increased pests and weeds, and fire risk. And as farmers struggle to stay afloat by finding ways to adapt to changing conditions, prices will likely increase and be passed along to consumers.

## **Infrastructure**

Much of our society's [critical infrastructure](#) is at risk from flooding. "Sea level rise could potentially cause a loss of value of assets in the trillions of dollars—probably anywhere from two to five trillion dollars—by the end of the century," said Heal. "That's loss from damage to housing, damage to airports on the coasts, damage to docks, the railway line that runs up and down the East Coast all of which is within a few feet of sea level, damage to I-95 which runs also along the coast. And that's just the East Coast. If you take a global perspective, this is repeated around the world." Much of this infrastructure will likely need to be repaired or

replaced.

[Military bases](#) are also vulnerable. According to a [2016 report](#) published by the Center for Climate and Security policy institute, sea level rise could flood parts of military bases along the East and Gulf coasts for up to three months a year as soon as 2050. Inland military installations near rivers are also vulnerable, because they can overflow with heavy precipitation, which is expected to become more common as the atmosphere warms. Extreme weather will necessitate more maintenance and repair for runways and roads, infrastructure and equipment.

In addition, our communication systems will be affected. A [2018 study](#) found that over 4,000 miles of fiber optic cable as well as data centers, traffic exchanges and termination points—the lifeblood of the global information network—are at risk from sea level rise. According to NOAA's sea level rise projections, this infrastructure could be underwater by 2033 because most of it is buried along highways and coastlines. When it was built 25 years ago, climate change was not a concern, so while the cables are water resistant, they are not waterproof. New York, Miami and Seattle and large service providers including CenturyLink, Intelliquent and AT&T are most at risk. Threats to the internet infrastructure could have huge implications for businesses in the U.S.

## **Human health and productivity**

If temperatures rise 4.5° C by 2090, 9,300 more people will die in American cities due to the rising heat. The annual losses associated with extreme temperature-related deaths alone are projected to be \$140 billion.

Increasing warmth and precipitation will also add to the risk of waterborne and foodborne diseases and allergies, and spur the

proliferation of insects that spread diseases like Zika, West Nile, dengue and Lyme disease into new territories. Extreme weather and climate-related natural disasters can also exacerbate mental health issues. The most vulnerable populations, such as the elderly, children, low-income communities and communities of color, will be most affected by these health impacts.

Temperature extremes are also projected to cause the loss of two billion labor hours each year by 2090, resulting in \$160 billion of lost wages. Because of heat exposure, productivity in the Southeast and Southern Great Plains regions is expected to decline by 3 percent, and some counties of Texas and Florida could lose more than 6 percent of labor hours each year by 2100. According to a 2014 Rhodium Group study, the largest climate change-related economic losses in the U.S. will be from lost labor productivity.

## **Tourism**

Two billion dollars could be lost in winter recreation due to less snow and ice. For example, rapid warming in the Adirondack Mountains could decimate the winter activity sector, which makes up 30 percent of the local economy.

In addition, as water temperatures increase, water quality could suffer due to more frequent and more intense algae blooms, which can be toxic, thus curtailing recreational water activities and freshwater fishing. More frequent and severe wildfires will worsen air quality and discourage tourism. Sea level rise could submerge small islands and coastal areas, while deforestation and its destructive impacts on biodiversity could make some tourist destinations less attractive.

## **Businesses and the financial market**

Climate change and its impacts across the globe will threaten the bottom line of businesses in a variety of ways. The frequency and intensity of extreme weather, both in the U.S. and in other countries, can damage factories, supply chain operations and other infrastructure, and disrupt transport. Drought will make water more expensive, which will likely affect the cost of raw materials and production. Climate volatility may force companies to deal with uncertainty in the price of resources for production, energy transport and insurance. And some products could become obsolete or lose their market, such as equipment related to coal mining or skiing in an area that no longer has snow.

Whether in the U.S. or abroad, new regulations such as carbon pricing and subsidies that favor a competitor may affect a business's bottom line. A company's reputation could also suffer if it's seen as doing something that hurts the environment. And investors and stakeholders are increasingly worried about the potential for "stranded assets"—those that become prematurely obsolete or fall out of favor, and must be recorded as a loss, such as fossil fuels that many believe should stay in the ground or real estate in a newly designated flood plain.

In 2018, the Carbon Disclosure Project asked more than 7,000 companies to assess their financial risks from climate change. The CDP found that, unless they took preemptive measures, 215 of the world's 500 biggest companies could lose an estimated one trillion dollars due to climate change, beginning within five years. For example, Alphabet (Google's parent company) will likely have to deal with rising cooling costs for its data centers. Hitachi Ltd.'s suppliers in Southeast Asia could be disrupted by increased rainfall and flooding. Some companies have already been impacted by climate change-related losses. Western Digital Technologies, maker of hard disks, suffered enormous losses in 2011 after flooding in Thailand disrupted its production.

PG&E became liable for fire damages and had to file for bankruptcy

after its power lines sparked California's deadliest wildfire last fall. And GE cost its investors \$193 billion between 2015 and 2018 because it overestimated demand for natural gas and underestimated the transition to renewable energy.

"The movement away from fossil fuels will have a big impact which could affect banks and investment firms that have relationships with the fossil fuel industry," said Heal. "For example, the stock market value of the U.S. coal industry in 2011 was something like \$37 billion. Today it's about \$2 billion. So anybody that lent a lot of money to the coal industry 10 years back would be in trouble. One of the things worrying those in the financial field is that this could happen to the oil and gas industry. So people who have invested in them or lent money to them are potentially at risk."

## **Climate change and opportunity**

The good news is that climate change also presents business opportunities. The Carbon Disclosure Project reported that 225 of the world's 500 biggest companies believe climate change could generate over \$2.1 trillion in new business prospects.

There will be more opportunity in clean energy, resilient and green buildings, and energy efficiency. Hybrid and electric vehicle production and the electric public transit sector are expected to grow. Construction of green infrastructure and more resilient coastal infrastructure could create many new jobs. [Carbon capture](#) and sequestration and [uses of captured CO<sub>2</sub>](#) present opportunities, especially in light of the new 45Q federal tax credits. In addition, there are forward-thinking new businesses—witness the dramatic rise of Beyond Meat, the company selling plant-based burgers at Carl's Jr. and A&W.

As the Arctic sea ice melts, new shipping lines will open up for trade,

substantially cutting transport time. The warming Arctic could also offer more prospects for oil and gas drilling. Weather satellites and radar technology will be in demand to monitor extreme weather. Air conditioning and cooling products will be needed around the world. Biotech companies are developing new crops that are resistant to climate change impacts. Pharmaceutical companies expect increased demand for drugs to combat diseases such as malaria and dengue and other infectious diseases. And the market for military equipment and private security services may expand because the scarcity of resources could trigger civil unrest and conflict.

What individuals, businesses and governments can do to protect themselves

How much climate change will hurt the economy depends on what measures we take to adapt to and prepare for it.

## **Individuals**

Individuals need to consider the implications of climate change when choosing where to spend and invest their money. And be aware that while a particular risk may not seem to be factored into prices yet, things could turn on a dime when the realization of risk sinks in, resulting in a massive redistribution of wealth. So it's best not to buy or move to an area near wild lands, which have a higher risk of wildfires. Don't move into a flood zone or buy real estate in an area that's vulnerable to [sea level rise](#). And in any case, purchase flood and fire insurance, and diversify your investments.

Individuals should also think about different opportunities in terms of new places that people are moving to. And, if possible, people who work outdoors in construction, agriculture or tourism should consider alternative jobs within the sector or new industries to work in.

## **Businesses and financial entities**

Businesses need to scrutinize their operations carefully. "There's a groundswell towards the view that any companies that fail to study their exposure to [extreme weather](#) and fail to disclose the types of vulnerabilities, including indirect ones, are going to have a hard time in the future," said Horton. "Are companies looking at what's coming down the road and making strategies to deal with it? I think investors are going to demand that and the companies that don't do that are going to have trouble getting underwriting, getting infrastructure funded by the Moody's of the world, and getting insurance." He added that he's seen a change in the last three or four years in what his students are demanding and believes that young people in the future will not work for companies that are not thinking about climate change.

Banks and funds need to analyze where their investments are and see if they are vulnerable to climate change. Have they invested in someone who has coastal property, or given a loan to a fossil fuel company or in agriculture operations that might be affected by climate change? Sixty-three percent of financial risk managers surveyed now believe climate change is a major concern. As a result, "The total value of funds that have integrated environmental, social and governance factors into their investment process has more than quadrupled since 2014, rising to \$485 billion as of April," reported the Wall Street Journal.

## **Governments**

Governments should proactively think about the risks their communities face before disaster strikes.

They should be investing in resiliency measures such as hardening infrastructure, improving water resources, building redundancy into

important systems, moving people out of harm's way and improving health care services. "You want to do it before the disaster but you also need to be cognizant that the only time people will listen seems to be right after a disaster," said Horton. "Those are also the times when money's available to rebuild."

Government leaders are currently debating whether the country can afford the Green New Deal (an ambitious plan to address [climate change](#)) or something like it. "The question should be, 'Can we afford not to afford it?'" Nobel Prize-winning economist Joseph Stiglitz, a professor at Columbia University, wrote in an [op ed](#), "We will pay for climate breakdown one way or another, so it makes sense to spend the money now to reduce emissions rather than wait until later to pay a lot more for the consequences... It's a cliché, but it's true: An ounce of prevention is worth a pound of cure."

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