



# Manatees and Climate Change

*Imagine a Florida where the coral reefs have dissolved, droughts are the norm, exotic species outnumber native ones, daily high tides flood the streets of coastal cities, and people are abandoning multi-million dollar coastal homes and retreating inland. Climate change has made this hypothetical a reality for the Sunshine State, with impacts already being observed.*

Florida is a highly developed state, with more than 70% of the population living or working along the state's 1,197 miles of coastline. These coastal areas have always been threatened by hurricanes and flooding, but in recent years, a much more serious and long-term threat to the coasts has been identified: climate change.

## What is Climate Change?

Climate change is fueled by the rapid release of greenhouse gases (GHGs) into the Earth's atmosphere, including carbon dioxide, nitrous oxides, and methane. These gases trap heat from the Sun within our atmosphere. GHGs can come from both natural and human-generated sources. Throughout Earth's history, events such as volcanic eruptions and large meteor impacts have caused global climate change (including ice ages). These natural events caused widespread changes to the Earth's climate and resulted in extinction of many species.

What is different about our current climate crisis is the speed at which our climate is changing. These rapid changes are driven by human activities, including the burning of fossil fuels such as oil, natural gas, and coal. The Intergovernmental Panel on Climate Change (IPCC) is comprised of thousands of independent scientists from across the globe. These scientists review and consolidate climate change data to make policy decisions using the best available climate science, and they are not compensated for their time or contributions. The IPCC, in its most recent report, has concluded that most of the observed increases in average global temperatures during the last 50 years are attributable to anthropogenic (human-caused) GHG emissions. They also stated that the warming of the Earth's climate is unequivocal and that the atmosphere and ocean have warmed, snow and ice amounts have diminished, and sea level has risen.

Increasing air and ocean temperatures cause glaciers at extreme northern and southern latitudes to melt, which leads to sea level rise. Additionally, warming water expands and has a greater volume than cold water, which further contributes to sea level rise. Global ocean temperature will continue to rise throughout the 21st century, with the greatest amount of warming projected in the tropical and northern subtropical regions. During the 20th century, sea level rose by 0.19 m. The IPCC projects that average sea level may rise as much as 1 meter by 2100 if the concentration of carbon dioxide in the atmosphere rises above 700 ppm (parts per million). Even if we were to completely stop GHG emissions today, the effects of our rapidly changing climate would be felt for decades to come.

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## How Will Manatees Be Affected?

While some have hypothesized that increased ocean surface temperatures associated with climate change may benefit manatees, this view fails to recognize how the species may be affected by countless other consequences associated with climate change, including sea level rise, changes in seagrass abundance and location, and loss of funding as agencies shift resources away from individual species in an attempt to confront climate change. Manatees are part of an interconnected aquatic ecosystem and are affected by the health of the plants and animals that share this and the surrounding terrestrial ecosystems. As humans adapt to climate change, it is likely that other species, including manatees, will be adversely affected.

Manatees, as herbivores, rely on seagrass as a primary food source. Seagrass grows in shallow, relatively clear water. However, as sea level rises, and is accompanied by increased turbidity and other impacts to water quality, seagrasses will likely be negatively impacted. Over time, seagrass beds may become reestablished, but major shifts in seagrass distribution and abundance could threaten Florida's manatees, along with the many species of fish and invertebrates that also inhabit seagrass beds. With sea level rise, coastal habitats will also be threatened by "armoring," as coastal towns and cities build seawalls and levees to deflect rising waters. Such human-made structures can be detrimental to benthic (water-body floor) habitats, including seagrass beds.

As coastal habitats shift, manatees and boats may find themselves traversing new travel corridors that are not protected by manatee speed zones. Additionally, with a changing climate, manatees may extend their range farther north along the Atlantic coast and west along the Gulf coast. These adjacent states currently lack well defined manatee speed zones, and residents are not accustomed to sharing the waterways with manatees. Manatees will face increased risk if they inhabit waters that lack safeguards for their protection.

The frequency, intensity, and even composition of storms, such as hurricanes, will change with increasing land and ocean temperatures. Manatees may be killed, displaced, or suffer delayed effects to health and reproduction due to ecosystem changes resulting from intense storms. The magnitude of impact varies with the destructiveness of the storm, the density of manatees in the area, the number of storms within a season, or concurrence with other mortality factors. Storm surge, in addition to rising sea levels, may cause saltwater intrusion in certain freshwater aquifers and other coastal waters that currently provide sources of freshwater vegetation and drinking for manatees. Manatees will need to adapt to such changes in order to survive. More intense rainfall and inundation events may result in more frequent red tide events, which are fueled by fertilizer runoff into coastal waters. Red tide is caused by a population explosion, or bloom, of a single-celled marine organism called a dinoflagellate, which produces a neurotoxin that can be fatal to manatees and other marine life. Such events can be fatal to large numbers of manatees.

Perhaps the most challenging obstacle that manatees will face with a changing climate is a lack of financial resources dedicated to the protection of this species. As human priorities shift to disaster reduction, concern for wildlife may decrease, and agency funding may shift away from individual species.

## What Can Be Done?

In order to protect manatees and Florida's future, we must restrain our GHG emissions, stop building and rebuilding in Florida's coastal high-hazard area, and educate ourselves about the potential impact of climate change on both our generation and future generations. Forests and wetlands must be protected because they act as carbon sinks, removing carbon dioxide from the atmosphere and helping to diminish greenhouse gas emissions. Healthy wetlands also help prevent coastal flooding, filter pollutants, and protect our shorelines from erosion. We need to invest in the health of our ecosystems because healthier systems will be more resilient against a changing climate. Every proactive step we take now will help safeguard the future for manatees and ourselves.

