

### Carbon Emissions on Coral Reefs

Global warming has contributed to much more than meets the eye. Underneath the surface of shifting temperature and weather patterns, global warming has found a way to exert deleterious effects on ecosystems of life underwater. Within this ecosystem, coral reefs are currently facing detrimental effects as a result of global warming and increasing human pressure. These reefs, a means of safe habitat and a crucial source of income for people, are extremely vulnerable to climate change.

One prevalent effect caused by the rise in water temperature from global warming is coral bleaching, as coral reefs tend to expel their microscopic algae, otherwise known as *zooxanthellae*, from their tissues. *Zooxanthellae* is an algae that lives in symbiosis with many marine invertebrates, often present in their cytoplasm. In coral reefs, this algae essentially protects reefs by providing food through the nutrients they receive from photosynthesis, a process already made harder as sea levels rise. With these algae expelled, coral reefs lose their unique color and are subject to escalating amounts of stress and mortality. This leaves coral reefs more vulnerable and bleached than ever before, especially to diseases. In 2005, about 50% of the coral reef population in the Caribbean was lost in that one year as a result of a massive coral bleaching event. The warm temperatures of water near Puerto Rico and the Virgin Islands expanded southwards, causing thermal stress unprecedented than the combined amount in the past 20 years (noaa.gov). Coral reefs continue to face skyrocketing quantities of marine heatwaves each year.

Coral bleaching is not only caused by warm temperatures of water, but also increased pollution. Runoff and precipitation from storms can cause diluted ocean waters with their pollutants, causing bleached coral reefs near the shore. Excessive exposure to the sun, high solar irradiance, and low tides, events mainly caused by the repercussions of global warming, all contribute to coral bleaching. Once these coral reefs are bleached, there are no existing opportunities for recovery. In a report from the Intergovernmental Panel on Climate Change in 2018, 1.5°C of global warming could cause the loss of up to 90% of coral reefs, and up to 99% in the 2030s. The alarming situation at hand is in need of dire assistance.

Another of the many ecological casualties of global warming on coral reefs include ocean acidification, a process resulting from excessive amounts of carbon. One of the ways the environment mitigates carbon emissions is through the absorption of carbon into the ocean, which dissolves into carbonic acid. Massive amounts of carbonic acid not only cause ocean acidification directly affecting coral reefs, but also threatens the fundamental chemical balance of coastal waters and oceans all across the world. The pH of the ocean decreases over time, altering ocean chemistry and harming the myriad of oceanic organisms sensitive to ocean acidity. The existence of coral reefs depend on the chemical balance of the ocean, as do many organisms that live in symbiosis with them. If coral reefs were to be completely extinct, a possibility soon predicted to occur in the near future, many organisms of marine life dependent on them would die out simultaneously. Ocean acidification slows the rate at which coral reefs produce calcium carbonate, which decelerates their coral skeletal growth. Lower pH values reduce the amount of nutrients such as dissolved ions and salts available to support these coral reefs, which can be devastating as sea levels rise and coral reefs need proximity to sunlight in order to photosynthesize. Evidently, ocean acidification would threaten the wellbeing of marine life as the ocean harbors more species in its ecosystem than any other.

Although coral reefs may not seem significant to everyday life, their extinction would influence greater than the 25% of marine life they inhabit. Many organisms such as fish, sea turtles, crabs, jellyfish, and more are neglected of their safety from predators, spawning grounds, and shelter. Coral reefs additionally sustain the base of ocean food chains. Pacific Islander communities will be affected by reduced amounts of tourism that contribute greatly to their economy, degrading the inflow of foreign income. Communities lacking the presence of coral reefs will lose coastal protection, ecosystems, and cause property damage. Coral reefs detain storms and strong waves, reducing the impact that harmful weather events have on organisms near the shore or in the ocean. Destruction and land erosion are caused by climate change in islander communities, exacerbating the amount of property damage in the area. More property damage contributes to the immigration of people, leaving them to detach from their homes filled with culture and pride financially depleted. These repercussions are only expected to increase in severity as climate change rises.