## CORALS OF CLIMATE CHANGE? Gargi Rawat University School of Environment Management Guru Gobind Singh Indraprastha University

Life on earth exists in myriad forms and places. From the highest heights to the deepest depths of our planet, fascinating creatures inhabit it, and corals are one such fascinating creature that inhabit the oceans.

### What are Corals?

Corals are marine organisms that inhabit the ocean in colonies made up of hundreds to thousands of individual animals called polyps. They are neither plants nor rocks, but rather animals of the phylum Cnidaria.

At shallow depths along the edges of islands and continents, free-swimming coral larvae present in ocean water attach to submerged rocks and form corals. They grow by building calcium carbonate exoskeletons, resulting in the formation of coral reefs. These coral reefs create a one-of-a-kind underwater ecosystem. The coral reef's biodiversity is often referred to as the sea's rainforest. They make up less than 1% of the ocean but are home to nearly 25% of all marine life. Reefs are classified into three structural types: fringe, barrier, or atoll. The primary difference between corals and coral reefs is that corals are living animals, whereas reefs are physical structures formed by coral polyp colonies.

Corals of diverse species can be found in all the world's oceans. Most reefs are found between the Tropics of Cancer and Capricorn, Pacific and Indian Oceans. These marine invertebrates are extremely fascinating creatures, owing to the array of colours they exhibit. Their distinct colours are caused by a symbiotic relationship with algae.



Fluorescent solitary stony corals at the Coral Morphologic lab, Miami. Source : Lynne Sladky / AP

Corals provide algae with protection in sunlit, shallow seas in exchange for the algae producing energy through photosynthesis, which the corals use to survive and build their skeletons. The stability of this symbiotic relationship is essential to the survival of corals. As a direct consequence of ongoing global warming and climate change, these remarkably captivating corals are now among the most threatened ecosystems on the planet.

# The link between climate change and coral reefs:

According to the IUCN Report 2015, one-third of the world's reef-building corals are threatened with extinction. Corals thrive at an ideal temperature of 20 degrees Celsius. With the earth's atmosphere warming primarily due to anthropogenic greenhouse gas emissions, the global surface temperature has increased by approximately 1°C since pre-industrial times, resulting in ocean warming. A 1-2°C increase in ocean temperatures over a long period of time has a significant impact on the survival of these marine organisms.

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It causes bleaching, which turns corals white or colourless. Corals become endangered and eventually perish if they are bleached for a prolonged period.

The coral bleaching phenomenon due to the temperature rise in ocean water causes corals to expel the symbiotic algae living in their tissues, responsible for their colour and food. The coral is compelled to expel its mutually beneficial partner because the heat stress causes the algae inside the coral to release oxygen free radicals that damage coral tissue. Some corals begin to emit vibrant colours in a last-ditch effort to survive the rising ocean temperatures, an occurrence known as 'glowing corals' that signals the adverse conditions faced by these soon-to-be dying corals. Over the past few years, unprecedented mass coral bleaching events have occurred worldwide. Ocean warming brought on by climate change has led to the destruction of around 50% of the corals on the Great Barrier Reef in Australia due to bleaching in the span of a single year (2016–2017). The issue is made worse by other climate change-linked phenomena such as tropical storms and altered precipitation patterns.

The Northwestern Hawaiian Islands in the United States have undergone the worst bleaching ever recorded in human history. Climate change alters oceanic currents, which cause nutrient cycling to fluctuate near their coastlines. Lack of food results in an uneven distribution of coral larvae and has an overall negative impact on coral health. Additionally, the change in the chemistry of ocean water due to increased carbon dioxide absorption results in a lowering of the pH.

Ocean acidification reduces the rate of calcification in organisms that create reefs, further deteriorating the corals' structural strength by hampering their development rate. Corals are smothered in shallow ocean bottoms due to sedimentation caused by rising sea levels.

Algal blooms are brought on by increased runoff of nutrients and land-based pollutants; this contributes to murky water conditions that block sunlight, inhibiting coral growth.

Together, all these impacts significantly change how coral ecosystems operate and the services they offer to underwater organisms and people worldwide. According to UNESCO, all 29 reefcontaining World Heritage Sites would lose their coral reefs by the end of the century if greenhouse gas emissions continued at the existing rate.



Healthy Coral (left) vs. Bleached Coral (right)

## **Importance of Coral:**

#### HOME OF MARINE BIODIVERSITY

Coral reefs have the richest biodiversity of any ecosystem globally. They are home to several marine creatures with more than one-quarter of all marine fish species. Corals serve as both a habitat and food source for numerous other species, including algae and echinoderms.

#### VALUABLE ECOSYSTEM SERVICES

Reefs offer a wide range of ecosystem services, including food. They act as breakwalls, shielding from floods and high waves. Coral reefs are breeding grounds for fish and support the fishing and tourism sectors.

#### **DYNAMIC VALUE**

Over 500 million people are estimated to rely on coral reefs directly or indirectly for their daily needs. The journal Global Environmental Change, 2014 reveals that coral reefs are worth \$1 trillion in terms of their social,

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cultural, and economic contributions. Furthermore, a 2015 report by the WWF predicts that by 2100, the loss of reef ecosystem services due to climate change will cost at least US\$500 billion annually.

#### ECOSYSTEM HEALTH INDICATORS

Coral reefs also act as key indicators of ecosystem health. Corals that are deteriorating serve as a warning sign for what may happen to other vulnerable ecological systems, such as river deltas. Upon crossing the coral reef survival threshold, other ecosystems would begin to deteriorate more rapidly and irreversibly.

#### RECREATION AND TOURISM ATTRACTION

Large variety of marine species found on the coral reefs delights tourists. These species are a wonder to watch via snorkeling or scuba diving. Underwater adventures provide for recreational activities, enhance tourism, and contribute to the economy.

## **Action and Awareness:**

According to the Global Coral Reef Monitoring Network's 'Status of Coral Reefs of the World' report, the world has lost 14% of its coral reefs since 2009.

It is critical to keep the global average temperature rise well below 2°C for the survival of coral reefs worldwide. Dedicated efforts must be made to limit the temperature rise to 1.5°C, in accordance with the Paris Agreement on climate change. Additional steps such as addressing local pollution and practicing sustainable fishing practices must also be combined.

Global commitments must be reinforced via the Sustainable Development Goals for protecting and preserving coral ecosystems. SDG 13 (combat climate change) and SDG 14 (life below water) must continue to work towards conserving and sustainably using the oceans, seas, and marine resources for sustainable development. Traditional linear models of economic production must change and evolve into circular economies. SDG 8 (inclusive and sustainable economic growth) and SDG 12 (sustainable consumption and production patterns) both highlight the need for this shift.

To protect and preserve coral reefs, innovations and investments must support research in the field of coral biology. Like GMOs, the field of genetic hybrids can be explored for the genetic selection of heat-resistant corals that can withstand rising global temperatures. Governments all over the world must view corals as economic assets. and their management and restoration must make sound financial sense to motivate them to make longterm investments for coral preservation.

On a global scale, the 'Glowing Glowing Gone' campaign was launched to raise awareness about coral protection.

The campaign was inspired by the "Coral Glowing" phenomenon, which occurs when bleached corals begin to glow in luminescent colours of blue, yellow, and purple—all to protect themselves from the underwater heat waves brought on by climate change. These glowing colours in bleached corals act as a protective layer like sunscreen when the symbiotic micro-algae are lost.

This captivating but tragic phenomenon serves as a warning that not only the corals, but the planet as a whole has hit a tipping point, and we are now on the verge of losing not just another species but an entire ecosystem that supports life.

Coral reefs are on the front lines of the impacts of climate change, and it is not too late to work towards protecting these fascinating marine creatures of our beautiful blue planet.

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