NO PREP

Climate Change and Coral Reefs

Fragile Ecosystems at Risk

Includes: Student reading, case study, differentiated questions, teacher key

Name: Period: Date:

Climate Change and Coral Reefs: Fragile Ecosystems at Risk

If the rainforest is the "lungs of the Earth," then coral reefs are its beating heart. These underwater cities, built by tiny animals called coral polyps, host one of the most diverse ecosystems on the planet. From brilliant clownfish to graceful sea turtles, coral reefs support thousands of species and provide food, jobs, and protection to millions of people. But climate change is putting these ecosystems on life support. Rising ocean temperatures, acidification, and human pressures are driving coral reefs toward collapse, threatening both marine life and human communities.

The Importance of Coral Reefs

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The Importance of Coral Reefs

Covering less than one percent of the ocean floor, coral reefs are home to nearly a quarter of all marine species. Their complex structures create shelter for fish, invertebrates, and countless other creatures. Reefs also protect coastlines by buffering waves and storms, reducing erosion and flooding. For humans, reefs mean tourism, fishing industries, and cultural value. In short, coral reefs are biodiversity hotspots that link ecology, economy, and culture in powerful ways. Yet, despite their importance, reefs are fragile. Corals are living animals that rely on a symbiotic relationship with zooxanthellae, microscopic algae that live within their tissues. These algae give corals their vibrant colors and, through photosynthesis, provide the majority of the coral's energy. When the environment shifts, that relationship breaks down, leading to a dangerous phenomenon: coral bleaching.

How Climate Change Harms Coral Reefs

The biggest threat to reefs comes from rising sea temperatures caused by global warming. When the water gets too warm, corals expel their zooxanthellae, leaving behind white skeletons—a process known as bleaching. Without their algae partners, corals lose their main food source and may die if stressful conditions persist.

Bleaching events have become increasingly common, devastating reefs across the globe, from Australia's Great Barrier Reef to the Caribbean. Another danger is ocean acidification. As the ocean absorbs excess carbon dioxide from the atmosphere, the water's chemistry changes, making it harder for corals to build their calcium carbonate skeletons. Acidification weakens reef structures, making them more vulnerable to storms and erosion. Combined with pollution, overfishing, and destructive practices like dynamite fishing, climate change adds to the already heavy burden reefs face.

Impacts on Humans and Marine Life

The decline of coral reefs reverberates across ecosystems and economies. Fish that depend on reefs lose their habitats, threatening food supplies for communities worldwide. Entire industries tied to tourism collapse as once-vibrant snorkeling and diving spots turn into lifeless graveyards. Coastal areas lose natural storm protection, making them more vulnerable to hurricanes and rising seas. For developing nations, especially island communities, reef loss can be catastrophic. Not only do they lose a source of protein and income, but cultural traditions tied to reefs disappear. Scientists warn that unless drastic action is taken, the majority of coral reefs could vanish by the end of this century.

Solutions: Can Coral Reefs Survive?

Despite the threats, solutions exist. Reducing carbon emissions is the most important step, as it directly addresses warming and acidification. Locally, governments can establish marine protected areas (MPAs) to reduce stress from fishing and pollution, giving reefs a better chance of survival. Coral restoration projects, where scientists grow and transplant healthy corals, have shown promise, though they are expensive and labor-intensive. Public awareness is also key. Divers and tourists can avoid touching or breaking corals, and consumers can reduce demand for unsustainably harvested seafood. Global cooperation, innovative science, and individual choices all matter. The story of coral reefs is not yet over—but their survival depends on the choices humanity makes in the coming decades.

Key Information: Table: Key Threats and Impacts on Coral Reefs

Threat	Impact on Reefs	Impact on Humans
Rising temperatures	Bleaching and coral death	Loss of fisheries and tourism
Ocean acidification	Weak skeletons, reduced growth	Vulnerability to storms
Pollution	Algae blooms, disease	Poor water quality for people
Overfishing	Collapse of reef food webs	Loss of livelihoods

Case Study: The Great Barrier Reef Bleaching Events

The Great Barrier Reef, the largest coral reef system in the world, stretches more than 1,400 miles along Australia's northeast coast. It is often described as the only living structure visible from space. But in recent decades, this natural wonder has faced repeated bleaching events triggered by rising sea temperatures. Major bleaching events, including those in 1998, 2016, and 2020, struck large portions of the reef, killing or severely weakening corals across thousands of square miles. By 2012, scientists estimated that about half the reef's coral cover had been lost since the 1980s. These events not only hurt biodiversity but also damage Australia's economy, which relies on the reef for tourism and fishing. The emotional impact is just as significant: Indigenous groups with cultural ties to the reef see their heritage endangered, while scientists warn that without drastic cuts to greenhouse gas emissions, the reef's long-term survival is in jeopardy. The Great Barrier Reef has become a symbol of both the fragility of coral ecosystems and the urgency of fighting climate change.

1. Why do rising ocean temperatures cause coral bleaching?

2. How have the Great Barrier Reef bleaching events affected both nature and human communities?

Multiple Choice

1. What role do zooxanthellae play in coral health?
    a) They protect reefs from storms
    b) They remove excess carbon dioxide from reefs
    c) They provide energy through photosynthesis
    d) They form coral skeletons directly

2. What is ocean acidification's main effect on coral reefs?
    a) It makes coral skeletons grow thicker and stronger
    b) It reduces ocean salinity
    c) It makes it harder for corals to build skeletons
    d) It increases algae growth

3. Why are coral reefs important to coastal communities?
    a) They increase pollution
    b) They provide storm protection, food, and tourism
    c) They produce fossil fuels
    d) They raise ocean water temperatures around reefs

Matching

Write the letter of the correct definition on the line next to each term.

Term	Definition
1. ___ Coral expel their algae, turning white under stress	A) Ocean acidification
2. ___ CO_2 changes seawater chemistry, weakening skeletons	B) Great Barrier Reef
3. ___ Microscopic algae that give corals energy and color	C) Marine protected areas
4. ___ Regions set aside to reduce fishing and pollution	D) Coral bleaching
5. ___ Largest coral reef system, heavily affected by bleaching	E) Zooxanthellae

Fill-in-the-Blank

1. Coral reefs rely on microscopic algae called _____ to survive.

2. The process of corals turning white and losing their algae is called _____.

3. The largest coral reef system in the world is the _____ Barrier Reef.

Short Answer

Answer each question in 2-4 complete sentences.

1. Explain how climate change creates multiple threats to coral reefs.

_____

_____

_____

2. Why are coral reefs often described as biodiversity hotspots?

3. Suggest one local action and one global action that could help coral reefs survive.