



*The*

*Environment*

*Magazine*

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# Message from Editor in Chief

My name is Henry Yao. I am Editor in Chief of the Environment Magazine.

The purpose of this magazine is to provide a platform for students of all backgrounds to express their views on current environmental issues to a broad audience. I believe that every student has the ability to make a positive difference in the world, and through this magazine, we aspire to unleash their potential. The project is open to everyone, and there are unlimited spots available for participation. We welcome all students who want to be a part of this effort.

To contribute articles to The Environment Magazine, please contact [playfndn.environment@gmail.com](mailto:playfndn.environment@gmail.com). Volunteer hours will be recognized.

# Ocean Acidification: the Cause and the Harm

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Underneath the mesmerizing clear blue surface of the ocean hides a much less beautiful secret, a deadly and dangerous trend that has not only damaged but also killed all that lies beneath that surface. According to CoastAdapt, since the times of the Industrial Revolution, which marks the period when our society shifted towards fossil fuels, in just about 200 years, the average pH level of ocean water dropped from 8.2 to 8.1, which is approximately a 26% increase in acidity, which over the last 55 million years, has been the fastest that acidity levels have increased in such a short time period.

The cause for this ocean acidification like the cause of many other environmental issues is carbon dioxide. According to NRDC (Natural Resources Defense Council), when carbon dioxide is released into the atmosphere, ocean water will often absorb it, on average absorbing about a third of the carbon dioxide in our atmosphere, leading to chemical reactions which results in carbon dioxide and water coming together to form carbonic acid, and in the process, releasing hydrogen ions

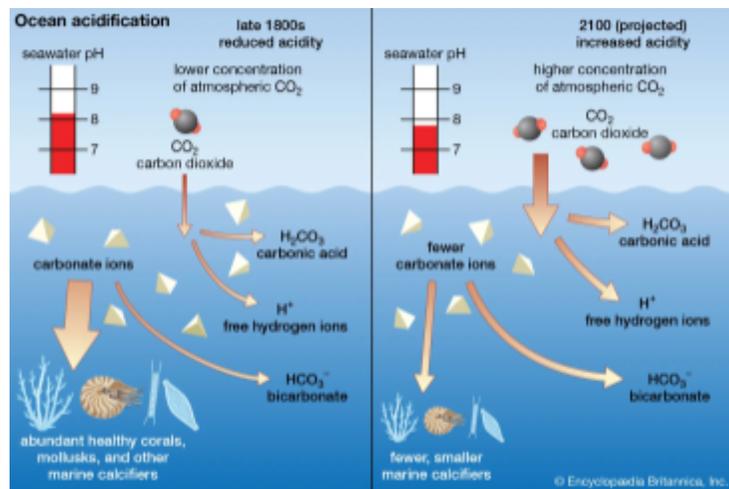


Figure 1: Ocean Acidification Process (source [britannica.com](http://britannica.com))

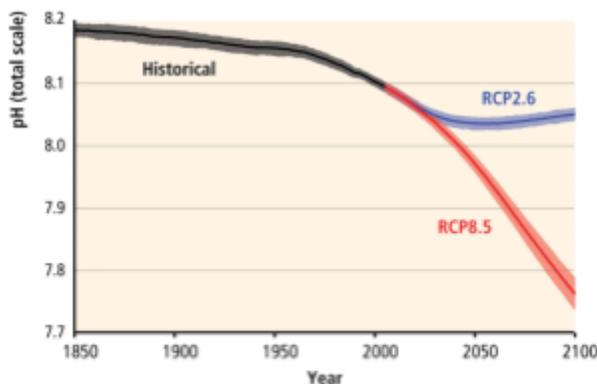


Figure 2: Projected Ocean Acidification Trend (RCP8.5 - high emission, RCP2.6 - low emission) (source: [coastadapt.com.au](http://coastadapt.com.au))

that increase acidity. According to the National Ocean Service, by the end of the century, the average ocean pH level could possibly drop from its current value at around 8.1 to 7.8, a value only comparable to over 10 million years ago, which would be a 150% increase in acidity.

This acidification process of our oceans comes with grave consequences for great amounts of marine life along with our environment and even human life. According to the US Environmental Protection Agency, a higher acidity in the ocean corresponds with more hydrogen ions compared to

carbonate, which leads to slower formations of calcium carbonate structures needed for shells and skeletons, and in cases of extreme acidity, these structures can be totally dissolved. This consequence of ocean acidification can impact many marine organisms including clams, oysters, scallops, mussels, corals, starfish, sea urchins, sea butterflies, and more. According to National Geographic, in the case of other animals like crabs and lobsters, ocean acidification can also slow down their shell shedding processes. This acidity also has the capability to greatly impact the development of these organisms. In the early stages of development, when marine organisms are much smaller during their larva stage, increased acidity has a great impact on the growth of these organisms. According to the US Environmental Protection Agency, organisms like fish can lose their sense of smell and their ability to avoid predators, while other organisms like the sea urchin and oyster will not develop correctly.

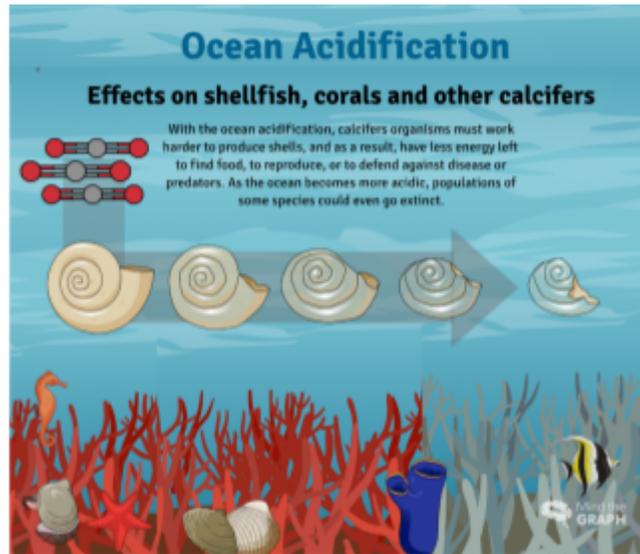


Figure 3: Effects on Marine Life  
 (source: [mindthegraph.com](http://mindthegraph.com))

Beyond the impact on just marine organisms, our environment and our lives will be affected as well. High acidity also has a huge effect on coral reefs, which according to NRDC, shelter over 25 percent of marine animals, and have already been experiencing damage, for example Australia’s Great Barrier Reef, which since 1990, has experienced a 14% decrease in the rate it builds. According to CoastAdapt, acidity can also make coral reefs much weaker

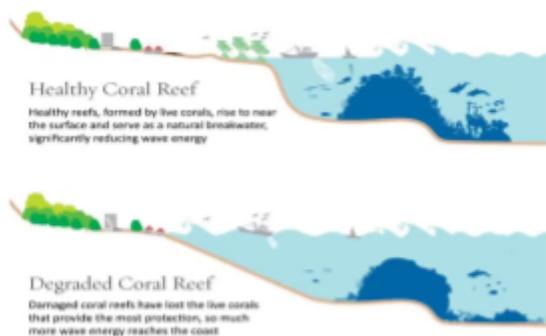


Figure 4: Coral Reef Protection of Coast  
 (source: [theconversation.com/us](http://theconversation.com/us))

against storms. When it comes to us, ocean acidification has the capability to greatly threaten marine life, which also can impact us. As marine life dies out, we lose valuable food sources and the markets associated with them which are a source of employment for many. CoastAdapt estimates that by the year 2100, losses of marine life caused by ocean acidification could reach economic losses of \$100 billion annually, and the destruction of coral reefs, which protect civilian-inhabited coastlines from storms, would greatly endanger people and buildings.

But it's never too late for change. One way to combat the growing issue that ocean acidification is becoming is to limit our carbon outputs is by making simple changes in our daily life including eating and buying local products, biking or walking short distances instead of driving, recycling, and taking public transport like riding the bus or train and carpooling whenever possible. The second way that we can help slow down and prevent ocean acidification is to place efforts into ensuring that there are no pollutants or spills that are going into local water sources. These pollutants, including things like fertilizers, can also contribute to ocean acidification, and we should try our best to prevent harmful substances like these from entering marine environments.

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# Society's Growing Problem

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With society advancing every year, there are hardly any places left with a peaceful, nature-focused style of life. However, over the last summer, I visited Yuanyang county, a rare exception to this trend, in the Chinese province of Yunnan. There, people can escape the hustle-bustle of modern society, and seclude back to a more tranquil lifestyle.

Cascading down the Ailao mountains, the Honghe Hani Rice Terraces cover southern Yunnan, painting it into a colorful masterpiece. These rice terraces produce the area's main crop, red rice. Their environment is a continuous cycle of four elements: the forest, villages, terraced fields, and water. When it rains, droplets hit the mountains, later dripping down into the rice terraces. The rainwater, filled with nutrients from the forests, fertilizes the rice paddies and then runs down into the Honghe River. There, it evaporates and creates clouds, which starts the cycle all over again. Thus, it is no wonder that Yuanyang is a place protected within the Measures for Conservation and Management of World Cultural Heritage Sites.



Figure 1. Terraced rice paddies in Yuanyang, Yunnan province, are considered a man-made wonder. (Source: [chinadaily.com](http://chinadaily.com) )

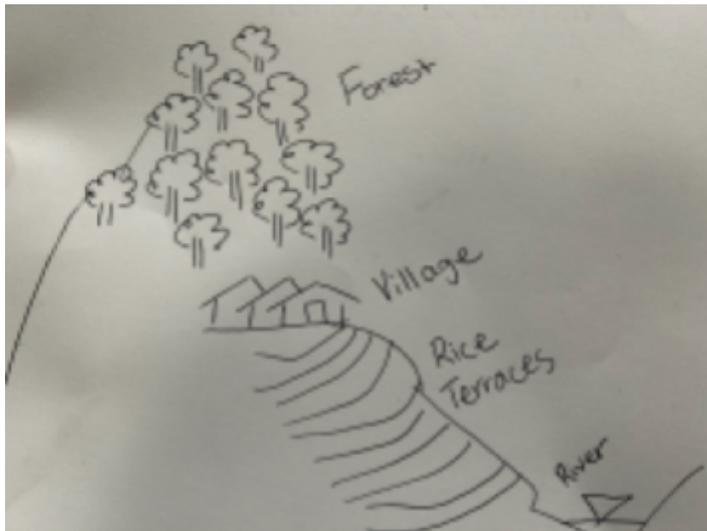


Figure 2. Diagram of the cycle of four elements

The Hani people use the stream that runs from the mountains down to the terraces to wash clothes and clean food. The Hani live as one with nature and that's why Yuanyang is also considered an UNESCO World Heritage Site. However, as this forest oasis becomes more and more exposed to the outside world, things have been changing. The people there have started to litter and leave garbage on the ground. For example, I noticed people throwing plastic bags and bottles on the floor. Most of them did

not sort garbage into compost, landfill, and recyclable sections. I believe this is mostly because they have not been taught or educated about pollution and littering. This, for example, is a picture I took during my visit there. Trash was piled on the floor, littering the environment, and no one seemed to care.

While leaving plastic and trash on the floor may not look harmful, they can potentially be deadly to the surrounding ecosystem. Garbage dumped on the floor can release microplastics that modify soil, preventing plants from growing. Plastic bottles and rings may also be ingested by nearby animals, eventually killing them. Even deadlier for the Hani, however, is the possibility of trash contaminating the water supply. The Hani rely on the same water to do everything, and dirty water could lead to disease in crops, causing starvation, or sickness from drinking the water. It is important that trash stays where it belongs and doesn't come in contact with the environment.



Figure 3. Trash pile in Yuanyang, Yunnan

Luckily, younger generations there have begun to become educated on this problem, and are taking action. Every once in a while, they gather up to patrol the villages and pick up loose garbage. It is comforting to see that young people there are picking up on this problem and doing something about it.

Taking action starts with spreading awareness, and educating people on this ever-growing problem. Just like Yunnan, we need to teach our youth to be more aware about saving the environment. We can teach them to compost and recycle, pick up trash when they see it, and not litter. And when the youth begin to take action, a ripple effect will occur, inspiring everybody else to take action as well. If a small village high up in the mountains of China can do it, why can't we?

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# A New Type of Solar Panel

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Since the Industrial Revolution, we have been using fossil fuels such as coal, oil, and natural gas as our main source of energy. Fossil fuels, when burned, release carbon dioxide and pollute our environment. Unfortunately, in modern society, almost everything is powered by fossil fuels. Currently, around 80 percent of our energy is produced by burning fossil fuels. Each year, we burn around 490 exajoules of fossil fuels, equivalent to almost 80 billion barrels of oil.

Fossil fuels are harmful to the environment, pollute our air and atmosphere, and are limited in supply. In fact, it is estimated that all fossil fuel reserves will be used up in only 100 years, forcing us to find other alternatives. In recent years, solar power has become the fastest-growing source of green energy. Solar power is generated by solar cells or panels from sunlight. There are many types of solar cells, often classified by generation.

The first generation of solar panels are the standard panels you see on rooftops. They are made from crystalline silicon (c-Si). Crystalline silicon solar panels are durable and highly efficient. They last for more than twenty-five years, and they average around 15 to 20 percent PCE (power conversion efficiency). This means that 15 to 20 percent of solar light that is absorbed by the panel will be turned into usable energy. However, they are rigid, heavy, and very expensive. A six-kilowatt solar system costs more than \$15,000, averaging out to around \$2.50 per watt.

The second-generation solar panels are based on thin-film technology. They are most commonly cadmium telluride (CdTe), copper indium gallium selenide (CIGS), and amorphous silicon (a-Si, TF-Si) based. These types of solar panels are comparable to crystalline silicon panels. They are flexible and lightweight, but are made from rare earth metals and thus have a limited supply.

In 2009, researchers at Tokyo University first discovered that utilizing perovskite structures in solar cells could be beneficial. Perovskite-structured solar panels, while still not commercially available, have shown to be a better alternative compared to traditional solar panels.

Perovskite has been proven to be more renewable than traditional solar panels. Perovskite is an extremely common crystal structure that makes up around 38 percent of the Earth's mass, with most being found in the mantle. Silicon solar panels, however, use rare earth metals such as neodymium and praseodymium. Another benefit of perovskite solar panels is that they are flexible and light. They are also easy to install and can be placed almost anywhere, including curved or sharp surfaces. Meanwhile, silicon solar panels can only be placed on flat surfaces and are difficult to install. Although, the most important benefit of perovskite solar

panels is their energy efficiency. Today, experimental perovskite cells can reach up to 25 percent PCE.

While perovskite solar cells have many benefits, they also have their share of disadvantages. Perovskite solar panels have good efficiency in moderate temperatures, but lose energy efficiency in warmer climates. Another drawback of perovskites is that they are not as durable as silicon panels. When exposed to weather and erosion, they degrade quickly and will not last. Most perovskite-structured solar panels contain tin or lead, which can be toxic and dangerous when exposed to people. These are all things researchers and scientists will have to improve on to push widespread commercialization of perovskite solar panels.



Figure 1: Flexible perovskite solar modules (Source: <https://en.dazhengtop.com/>)

Perovskites have improved tremendously since its debut. Now, a Chinese company, DaZheng, is working to bring it into the market. In a few years, solar films will be everywhere: on walls, windows, and even our backpacks and jackets. It is safe to say that perovskites hold a promising future in our quest for renewable energy and a better environment.

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# Environmentalists in Action

In this issue, we would like to thank the following Environmentalists.

On September 23, 2023, Bethany Chen, Isabella Chen, Brian Haapanen, Aiden Mok, Alex Tong, Sophie Tong, Henry Yao, and Austen Yee cleaned up Dougherty Valley High School parking lot, Bollinger Canyon Road, Windermere Parkway, and the surrounding areas.



On October 29, 2023, Brian Haapanen, Joyce Miao, and Henry Yao cleaned up Bernal Community Park.



# About

**The Environment Magazine** is published by the Environment Club. It collects introductory articles on environmental protection written by youth volunteers, with the goal of educating students and parents on how to protect the environment. It aims to provide a platform for all students to express their opinions and inspire change through activism. It also empowers students to become environmentalists and make a positive impact on the world.

**The Environment Club** is a group of passionate middle and high school students dedicated to environmental protection. We started by organizing youth volunteers to clean up the trails and streets in our local community, and now we're taking the next step by promoting awareness and change through our publication, The Environment Magazine. Our goal is to inspire others to take action and make a positive impact on the environment, both locally and globally. The Environment Club is a subdivision of the PLAY Foundation, a 501(c)(3) non-profit organization.