BLUE BOX

3 SENSITIZATION AND CAPACITY-BUILDING

OCEAN WARRIORS: EDUCATIONAL KIT FOR OCEAN CONSERVATION

PROMAR
Prevención de Residuos Marinos

On behalf of:

Federal Ministry
for the Environment, Nature Conservation,
Nuclear Safety and Consumer Protection

of the Federal Republic of Germany

adelphi abrelpe PARLEY cegesti Socya UN environment programme

Ocean Warriors:
Educational Kit for ocean conservation
First edition, December 2023

Project: Prevention of Marine Litter in the Caribbean Sea (PROMAR)
Project leader: adelphi (Germany)
Executing partners: CEGESTI (Costa Rica), Parley (Dominican Republic) and Socya (Colombia)

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Prolog

Welcome to "Ocean Warriors: Educational Kit for Ocean Advocacy," an inspiring and educational initiative stemming from the PROMAR project - Prevention of Marine Waste in the Caribbean Sea. This project, supported by the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) and led by the prominent German organization adelphi, is dedicated to significantly reducing the flow of plastic waste, particularly single-use packaging, impacting the Caribbean Sea.

This educational kit represents a significant stride in PROMAR's efforts to promote Circular Economy solutions in the Dominican Republic, Costa Rica, and Colombia. In collaboration with "Parley for the Oceans," a global network committed to raising awareness about the beauty and vulnerability of our oceans, we present a comprehensive educational tool designed to inspire and educate future generations about the vital importance of marine conservation.

"Ocean Warriors" integrates the PROMAR BlueBox's CAP Survey (Knowledge, Attitudes, and Practices assessment) to evaluate the impact of awareness projects on participating communities. This strategic approach allows us to measure the effectiveness of our initiatives and guide future actions based on the results obtained.

Targeted at educators and teachers, this educational kit is a dynamic resource that merges science, geography, and environmental studies into a coherent curriculum. Our goal is to instill in students a deep appreciation for the oceans while fostering a sense of responsibility for the protection of marine ecosystems.

We extend an open invitation to municipalities, educational institutions, environmental groups, NGOs, community organizations, private companies, and the general population to join us in ocean advocacy. Through the implementation of these tools, we hope to motivate their use in coastal communities and make a significant contribution to reducing terrestrial waste flows affecting our precious marine environments.
Together, as ocean warriors, we can forge a more sustainable future and preserve the beauty of our seas for generations to come!

INTRODUTION

Introducing "Ocean Warriors: Educational Kit for ocean defense," an innovative and comprehensive resource designed to educate and inspire students about the importance of ocean conservation and the prevention of marine litter. This educational kit aligns with the vision of "Parley for the Oceans," a global network that raises awareness about the beauty and fragility of the oceans while collaborating on projects to end their destruction. The kit is specifically designed for teachers and educators, providing them with a wealth of lesson plans, activities, and learning resources to educate students about ocean culture, understanding the impact of marine litter, and empowering them to become guardians of the oceans.

"Ocean Warriors: Educational Kit for ocean defense" is a dynamic tool that integrates science, geography, and environmental studies into a cohesive curriculum. Its goal is to instill in students a deep appreciation for the oceans while fostering a sense of responsibility for the protection of marine ecosystems.

Through interactive lessons and engaging activities, students will explore the causes and consequences of marine litter, learn about sustainable practices, and discover how they can contribute to the global movement for cleaner oceans.

This educational kit is not only informative but also action-oriented, encouraging students to participate in practical initiatives such as beach cleanups, recycling programs, and promotional campaigns. Aligned with the vision of Parley for the Oceans and its Parley AIR Strategy (Avoid, Intercept, and Redesign), the kit emphasizes the interconnectedness of all life on Earth with the health of our oceans, inspiring a sense of urgency and purpose in young students.

With its comprehensive lesson plans, resources, and hands-on activities, "Ocean Warriors: Educational Kit for ocean defense" equips educators with the tools they need to cultivate a generation of environmentally conscious citizens committed to preserving our oceans for future generations.

LEARNING OBJECTIVES

UNIT 01 - THE MOST IMPORTANT THING IN THE WORLD...

At the end of this unit, students will be able to demonstrate a comprehensive understanding of oceanic biodiversity, including the factors contributing to it, the various ecosystems within the ocean, and the importance of preserving and protecting marine life.

UNIT 02 - IF THE OCEANS DIE, WE DIE TOO...

At the end of this unit, students will be able to demonstrate a profound understanding of the fragility of the oceans, including the environmental, ecological, and human impact factors contributing to this fragility. They will be able to analyze the interconnection of various oceanic systems and articulate the importance of sustainable practices to preserve the health and balance of marine ecosystems.

UNIT 03 - THE NEVER-ENDING STORY OF PLASTIC

At the end of this unit, students will be able to understand the causes and effects of the plastic pollution crisis, identify key solutions and initiatives aimed at mitigating plastic pollution, and evaluate the impact of individual and collective actions to address this global environmental issue.

UNIT 04 - THE GREAT PLAN FOR A BETTER FUTURE

At the end of this unit, students will be able to analyze and evaluate various solutions to plastic pollution, understand the impact of these solutions on the environment, and propose innovative strategies to address plastic pollution in their local communities.

UNIT 01 - THE MOST IMPORTANT THING IN THE WORLD...

LESSON 01: WONDERS OF THE OCEAN - BARREL JELLYFISH

We've prepared a class to learn about
the largest jellyfish in the ocean.

Lesson Objective:

- Introduce students to the biology and ecological significance of the barrel jellyfish.
- Explore the impact of environmental factors on barrel jellyfish populations.
- Promote critical thinking and scientific research through hands-on activities and discussions.

Materials:

- Access to educational resources on the biology and ecology of jellyfish.
- Visual aids such as diagrams, images, and videos of barrel jellyfish.
- Laboratory equipment for conducting experiments (if applicable).
- Writing materials for note-taking and recording observations.

Curriculum Plan:

01 - Introduction to Barrel Jellyfish (45 minutes)

- Begin with a brief overview of jellyfish as a group of marine animals**.**

LESSON 01: WONDERS OF THE OCEAN - BARREL JELLYFISH

Continuation...

- Analyze the unique characteristics and physical traits of the barrel jellyfish.
- Use visual aids to help students understand the appearance and behavior of barrel jellyfish.

02 - Biology and Ecology of Barrel Jellyfish (60 minutes)

- Explore the life cycle and reproductive strategies of the barrel jellyfish.
- Discuss the ecological role of the barrel jellyfish in marine ecosystems.
- Highlight interactions between the barrel jellyfish and other marine organisms.

03 - Environmental Factors Affecting Barrel Jellyfish (45 minutes)

- Investigate the impact of environmental factors such as temperature, salinity, and pollution on barrel jellyfish populations.
- Engage students in a discussion about climate change and its potential effects on the distribution and abundance of jellyfish.

05 - Group Discussion and Reflection (30 minutes)

- Facilitate a group discussion on students' observations and experiences with barrel jellyfish.
- Encourage critical thinking by posing open-ended questions about the importance of studying these marine organisms.

06 - Culminating Project: Research and Presentation (90 minutes)

Assign students to research a specific aspect of the biology, ecology, or conservation efforts related to barrel jellyfish. Have students present their findings to the class through oral presentations or multimedia formats.

Assessment:

- Participation in class discussions and activities.
- Completion of research projects and presentations.
- Demonstrated understanding through quizzes or written reflections on the topic.

By engaging high school students in this comprehensive lesson plan, they will gain a deeper understanding of barrel jellyfish, their ecological significance, and broader implications for marine ecosystems.

EXPLORE MORE ABOUT BARREL JELLYFISH...

LIZZIE DALY
WILDLIFE TV
Youtube chanell

DANABBOTT
CINEMATOGRAPHER
Website

ARTICLE 01: WONDERS OF THE OCEAN - BARREL JELLYFISH

Let's delve into one of the largest species of jellyfish in the ocean.

"Last July, biologist and BBC presenter Lizzie Daly embarked on a week-long adventure to showcase the beauty and fragility of marine life along the UK's coast for her Wild Ocean Week campaign. With underwater cinematographer Dan Abbott capturing every dive, Daly encountered whales, seals, and dolphins, but it was the encounter with creatures on the seventh day that went viral."

Right off the coast of Cornwall, Daly encountered a giant barrel jellyfish as large as herself. Among the world's largest jellyfish, *Rhizotoma pulmo* follows summer plankton blooms along the coasts of the Atlantic and the Mediterranean.

Each of its undulating arms has hundreds of tiny mouths, and its tentacles even serve as a habitat for juvenile trout and salmon.

Barrel jellyfish typically measure around half a meter in length and a meter in width, but the gentle giant Daly swam with measured closer to 1.5 meters in length and a full meter in width. It likely weighed over 80 pounds. Parley met with Lizzie and Dan to learn more about the encounter.

Lizzie Daly

Daniel Abbott

Q & A

Were you expecting to see a jellyfish that big? What was your reaction?

Lizzie: We weren't expecting anything. It was an absolute delight to get that experience. We spent an hour swimming with it. Barrel jellyfish are the largest species in UK waters and are known to be distinctively large, but I've never seen a barrel fish or any jellyfish that big. It was the size of my body. Absolutely incredible.

Dan: It took me a few seconds to figure out what it was, and then there was a moment of "Oh wow!" Then the cameraman in me took over, and I started trying to get as many interesting angles as I could, not knowing how long I'd have to capture it!

Were you scared?

Dan: Watching a slow, graceful animal in beautiful conditions is not the time for an underwater cameraman to feel afraid.

Lizzie: I wasn't scared. They're not a threat. They have a mild sting, but they're not harmful to humans.

How was the rest of the week's filming?

Dan: It was a really special week, not just because we were able to see and film some stunning UK marine wildlife, but because it was very raw. Sometimes the wildlife didn't show up, sometimes weather cancelled our plans for us, and sometimes you encounter an animal that goes viral around the world.

LLizzie: Wild Ocean Week was fantastic. I feel very lucky to see wildlife all over the world and to have these incredible encounters, but the best part is sharing those stories. Those experiences are nothing if you don't share them to inspire and connect with others.

What would you say to aspiring explorers and naturalists?

Dan: One of the main messages we kept running throughout the week was that anyone can go out and see what the ocean has to offer, which is what I would say to anyone wanting to explore or get into learning about wildlife.

Lizzie: Exactly, the one thing I'd say is that you can see so many exciting things on the coast. Get in the water, grab a snorkel mask. Just go for it to see what's out there. Anybody can go out and get in the water with a giant barrel jellyfish.

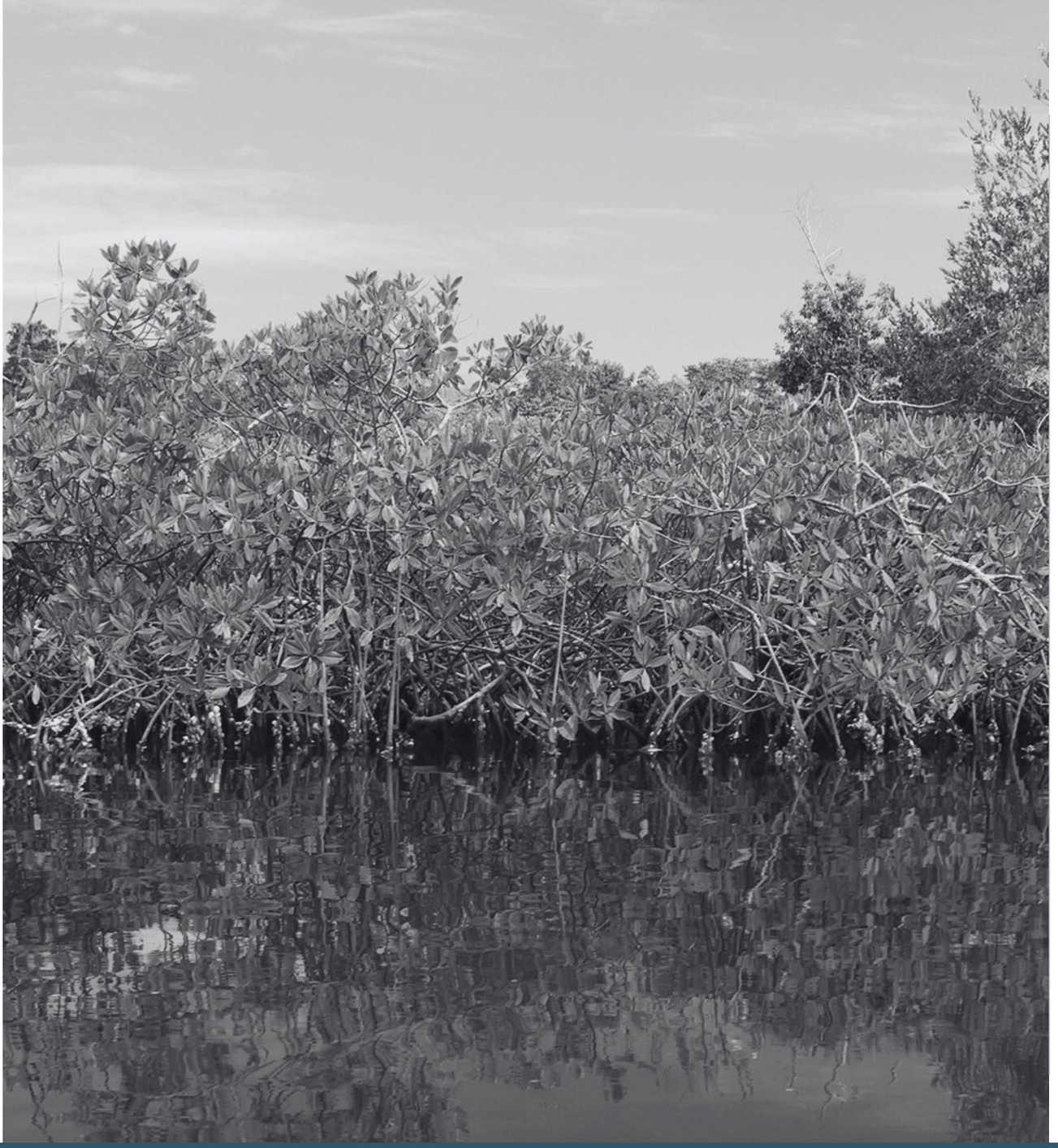
REFERENCE

PARLEY

The entirety of the content in this article has been extracted from the Parley for the Oceans website.

Cited:

Parley (December 11, 2019). Ocean Wonders: Barrel Jelllyfish. Parley for the Oceans website, Journal. Retrieved from: https://parley.tv/journal/2019/11/12/ocean-wonders-barrel-jellyfish



LESSON 02: MANGROVES - OASIS OF COMPLEXITY

We've prepared a class lesson to explore the many mysterious complexities, adaptations, and advantages of coastal mangrove forests.

Lesson Objective:

- Students will understand the ecological significance of mangroves and their role in coastal ecosystems.

Materials:

- Computers with internet access.
- Projector.
- Printed copies of the article 'Mangroves: Oasis of Complexity' from Parley.
- Drawing materials (paper, pencils, markers).

Curriculum Plan:

01 - Introduction to Mangroves (15 minutes)

Start by discussing the concept of coastal ecosystems and their importance.

- Introduce the topic of mangroves and explain that students will learn about their ecological significance.

LESSON 02: MANGROVES - OASIS OF COMPLEXITY

Continuation...

02 - Reading and Discussion (30 minutes)

- Distribute printed copies of the article 'Mangroves: Oasis of Complexity' from Parley to the students.
- Have students read the article individually or in small groups.
- Lead a class discussion on the key points covered in the article, encouraging students to share their thoughts and questions.

03 - Research Activity (40 minutes)

- Instruct students to use computers with internet access to conduct further research on mangroves.
- Ask them to look for additional information on the ecological functions of mangroves, their biodiversity, and their role in coastal protection.
- Encourage students to explore reliable sources such as scientific journals, environmental organizations, and government websites.

04 - Presentation and Reflection (25 minutes)

- Have students present their findings to the class, using visual elements if possible.
- Facilitate a reflection session where students discuss what they have learned about mangroves and their ecological significance.
- Encourage students to consider potential threats to mangrove ecosystems and generate ideas for conservation efforts.

05 - Creative Expression (20 minutes)

- Ask students to create visual representations of mangrove ecosystems using drawing materials.
- Display and discuss the artworks, highlighting the complexity and beauty of mangrove habitats.

06 - Conclusion (10 minutes)

Summarize the key conclusions of the lesson and emphasize the importance of preserving mangrove ecosystems for future generations.

Assessment:

- Participation in class discussions and activities.
- Quality of research conducted on mangroves.
- Creativity and effort demonstrated in the creation of visual representations.

ARTICLE 02: MANGROVES - OASIS OF COMPLEXITY

In honor of World Wetlands Day, science writer and storyteller Ben Fiscella Meissner explores the many mysterious complexities, adaptations, and advantages of coastal mangrove forests.

In our current era of climate change, the most threatened regions of civilization are the coastlines. From sinking metropolises like Jakarta to the eroding shores of California and Louisiana, and small island nations like the Maldives that have no 'inland,' many face the reality of being swallowed by the sea. Regardless of the landmass, humanity has always gravitated toward the edge.

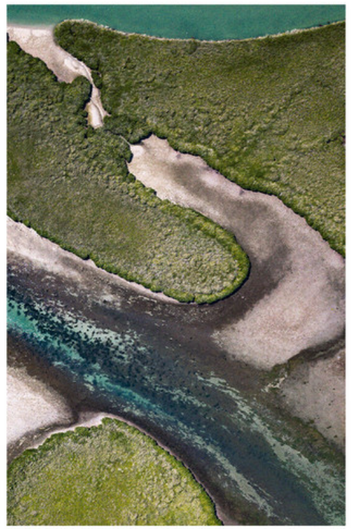
In spite of the vast inland spaces, around 40% of the world's population lives within 100 kilometers of a coastline, whether for access to the rich productivity of shallow coastal waters, the magnetism of trade in ports, or the simple yet profound spiritual experience of gazing upon a horizon filled with water. The coast has long been considered this desirable zone. But today, that desire is tinged with apprehension.

As sea levels rise, reshaping the coastal paradise as we know it with absolute indifference, it becomes evident that our planet doesn't need us to change; we need to change. The semi-fluid margin where land and ocean meet might have once given us the illusion of permanence. At least long enough to decide where to build an idyllic beachfront infrastructure. But if we look at the coast over time, we see a dynamic and undulating curtain disguised as a solid boundary. Life that thrives there does not embrace a false sense of permanence but rather embraces a philosophy of ephemeral existence.

This distinction in our perception of time and space goes beyond real estate interests. If we understand that our environment is in constant flux and currently at a pace faster than expected, then shaping our future cannot rely on a strategy of relocation or reinforcement. We must integrate adaptability as a fundamental belief.

Contemplating the ancestral settlers of our coasts, prosperous green metropolises that used to cover about 75% of the coastlines and tropical inlets, might inform the necessary revisions to the current development paradigm. The drive to drain these 'swamps' and declare a new beachfront could give us pause. Can we justify draining resilience to install fragility? It's about more than just the presence of a wooded coastline providing shelter and sustenance.

It is about what we could learn by surrendering to the complexity of nature and appreciating the adaptive qualities of a coastal forest as something worth incorporating into our own sense of residence.



Propágulo de manglar

"To thrive on the ocean's edge, mangroves exhibit viviparity, giving rise to live young plants instead of dormant seeds, called propagules. Here, a red mangrove propagule has lodged in the mud at low tide, and its heavy bottom has rooted into the ground first. These propagules can survive for weeks being transported kilometers by tides and currents, allowing them to colonize new coastal margins."

The impenetrable facade of a mangrove forest doesn't offer the same fluorescent welcome as a coral reef, like a tapestry of undulating colors and enticing textures that stretches beneath you. And unlike a tropical or boreal forest, you won't often find any well-trodden trail making its way through the trees. Mangrove forests aren't designed to host bipeds, not even most large mammals. The term mangrove refers to a collection of shrubs and trees, over 70 species from diverse taxa, that can tolerate and thrive along the interface of land and sea. Though they cover only 0.1% of the Earth's continental surface, their contribution to ecological balance can't be confined to a single percentage point, nor can it speak to the carbon stored in their soils for thousands of years.

"Perhaps the most defining feature of mangroves is their ability to embrace saltwater as a constant."

These coastal forests have been shaped throughout their evolution to withstand and even thrive in our modern notion of apocalyptic conditions that occur daily. During low tide, the exposed and aerial root systems of Rhizophora mangle or red mangrove can remain completely dry on the tidal plain. Red mangrove is distributed globally in the tropics and subtropics, where it colonizes exposed coastal edges and creates a vision of chaos and a hyperproductive ecosystem. With the rising tide, these root systems turn into saltwater aquariums, vibrant nurseries for juvenile fish species to seek refuge in aquatic mazes where their size and agility are advantageous. The rich organic material falling from the upper canopy, along with terrestrial runoff, provides an abundance of food, while the extensive root surface provides an ideal habitat for filter-feeding mollusks.

Instead of merely enduring the diurnal extremes of their dynamic environment, mangroves like Rhizophora have adapted to these fluctuations as a source of competitive advantage. During low tide, their stilt roots allow the plants to breathe through special pores called lenticels, a method to cope with compacted and waterlogged soil that would normally suffocate a plant. When water enters or exits with the tides, the root architecture provides enough support to withstand this sudden river of force. The larger central trunks, supported by a set of stilt roots called prop roots, keep the forest canopy above the high tide line, while collections of finer underground roots assist in nutrient absorption in the nutrient-poor soil.

Perhaps the most defining feature of mangroves is their ability to embrace saltwater as a constant. This tolerance allows them to compete with other plants and colonize the coast to form dense forests. Their adaptations vary by species, but mangroves can exclude salt by filtering water into the plant at the root level or excrete salt, expelling the mineral as a concentrated waste product through glands in their leaves. When the cellular mechanisms to transport salt out of the tree finally wear out, the leaf litter provides rich organic matter to feed into the shallow-water prairies beneath. From here, the matter settles into sediment-rich mud, incorporated into a layering decomposition process that we can also appreciate as carbon sequestration.

Mangrove forests, surviving on the relentless edge of salty and brackish land masses, grow, strengthen, filter, and build perpetually. Man-made foundations on sand are as useless as sand castles, causing a much greater loss of resources. But mangroves hold the coast together at no cost, and their underground roots bind the sediments, providing more substance to trap the soil.

Many features of mangroves are challenging to study accurately because many aspects vary. The forest is such a dynamic and fluid place that taking uniform measurements can be impossible. What is widely accepted is that when storm surges crash into the tangled wall of a mangrove forest, the energy is largely dissipated. In hurricane-prone regions like the Caribbean, people navigate their boats through the winding channels of mangrove forests to secure their vessels before storms, a telling sign of their natural defenses.

The importance of coastal mangroves as nurseries for fish populations cannot be underestimated. The life cycle of many marine organisms utilizes a variety of habitats throughout their life stages, and the earlier stages require proper shelter, food, and protection from disturbances...

Many larger fish species, such as snapper and grouper, utilize mangroves in their juvenile stages before transitioning to more open habitats like coral reefs. Protecting mangroves should not be viewed in isolation; they are links within a more complex ecosystem, bound together by countless relationships among elements and organisms. These forests are places of origin and fertility, a blessing for all when left intact.

Despite the dedicated quest for knowledge by the scientific community, these are just glimpses of understanding in a system that is not easily quantified, categorized, and valued within our traditional measures of worth. It's challenging to make broad statements about the dollar value of a hectare of mangroves in Florida, India, and Mexico. Even the complex biochemical reaction of a leaf falling from a tree to interact with bacteria, saltwater, microorganisms, and fish is not easily understood because any case in which that leaf falls could be vastly different from the next. But when measured certainty may falter, I believe we can choose to consider the essence of the mangrove's adaptive persistence as an invaluable truth.

When we consider our current knowledge of ecosystems, it's safe to say we know enough to reveal that our anthropocentric systems of development and commercial industry are outdated and rigid to the extreme. Our societies depend on natural resources, but our production chains fail to grasp the complexity of the ecosystems in which they operate. As trends like biomimicry and nature-inspired processes grow, new and exciting inventions that harness only one feature of a plant or an animal may overlook the forest for the trees. Beyond any sophisticated adaptation, such as the use of ionized potassium molecules to exclude salt from water through a membrane, what if the concepts of ecosystem resilience and resistance became core values in all our routines and processes? The issues of our developing civilization will only become more complex, but we can harness natural complexity without pretending to fully understand or possess it.

LESSON 03: ROLLING IN THE DEEP

A lesson to learn about interconnectivity, the darkness of the Challenger Deep, and the light it sheds on the world.

Lesson Objective:

- Students will understand the Challenger Deep, the deepest known point in the Earth's seabed, and its significance in oceanography and marine exploration.

Materials:

- Access to the internet and research materials.
- Maps and diagrams of the Mariana Trench and the Challenger Deep.
- Videos or documentaries about deep-sea exploration.
- Writing materials for note-taking and assignments.

Curriculum:
This plan has a duration of 2 class periods.

Lesson 01 - Introduction to the Challenger Deep (90 minutes)
Start with a discussion about ocean exploration and why it is important.

- Introduce the concept of the Mariana Trench and its significance as the deepest part of the world's oceans.

LESSON 03: ROLLING IN THE DEEP

continuation...

- Show maps and diagrams of the Mariana Trench, specifically highlighting the location of the Challenger Deep.
- Discuss the history of exploration in the Challenger Deep, including notable expeditions and discoveries. The article titled 'Dawn Wright: Rolling in the Deep' from Parley can be used as a resource for this purpose.

Research Assignment:

Students will be tasked with finding information about a specific deep-sea exploration mission or discovery related to the Challenger Deep.

Lesson 02: The Science of Deep-Sea Exploration (90 minutes)

Review the results of the assignment and have students share their research with the class.
Discuss the unique challenges of exploring extreme depths, including pressure, temperature, and lack of light.
Show videos or documentaries about deep-sea exploration, focusing on the technology and methods used to study the ocean floor.

- Engage students in a discussion about potential future discoveries and advancements in deep-sea exploration.

Assessment:

Students will write a short essay reflecting on the importance of deep-sea exploration and its potential impact on our understanding of Earth's oceans.

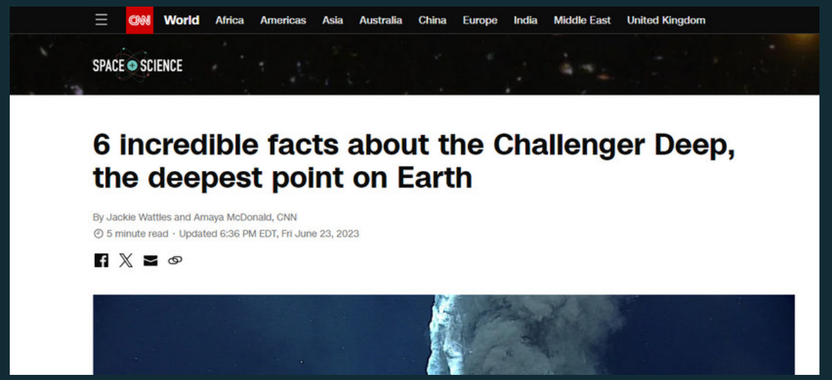
Extension Activity: Virtual Excursion

Students will have the opportunity to explore virtual simulations or interactive websites showcasing deep-sea environments, including the Challenger Deep.

EXPLORE MORE ABOUT THE CHALLENGER DEEP...

An article by Jackie Wattles for CNN where she mentions some incredible facts about the Challenger Deep, the deepest point in the ocean in the Mariana Trench.

ACCESS THE LINK HERE.



ARTICLE 03: DAWN WRIGHT - ROLLING IN THE DEEP

We talked to the scientist making history about interconnectivity, the darkness of the Challenger Deep abyss, and the light she sees in the world.

Dawn Wright y Victor Vescovo celebran una expedición exitosa

Dawn Wright knew when she was just eight years old that she wanted to study the ocean for her entire life. Inspired by watching 'The Undersea World of Jacques Cousteau' every Sunday in her living room, she was captivated by the world outside her door and the magic of the volcanic island she lived on. This led her to live in the library studying books on oceanography and science, consuming everything she could about the different schools that trained professional oceanographers.

It worked: Dawn graduated from Texas A&M University with a master's degree in oceanography, and in 1994, she received a Ph.D. from the University of California with a dissertation titled 'From Pattern To Process on the Deep Ocean Floor: A Geographic Information System Approach.'

At 62, Dawn is now the Chief Scientist of the Environmental Systems Research Institute (Esri), a global leader in geographic information systems and spatial data science software. Her technology is used by governments, conservation organizations, and is present in over 10,000 universities. Her work at Esri focuses on facilitating the connection between Esri and the scientific community, especially enabling scientists to conduct their research with geospatial technology.

Last year, on July 12, Dawn descended to the Challenger Deep, the deepest point on our planet, reaching areas of the ocean floor that had never been explored before. Alongside retired naval officer and submarine explorer Victor Vescovo, the pair reached a depth of 10,919 meters in a submersible, where Dawn used high-resolution sonar to map a part of the Earth that had never been seen in such detail. We typically think of explorers from a different perspective: in space or venturing through the land many moons ago. But Dawn is an example of a different kind, seeking the answers we still need about our planet today, particularly in its largest ecosystem: our oceans. We spoke with Dawn about making history on the Challenger Deep expedition, what it's like down there, and the darkness and light of life on Earth.

"We saw tiny creatures living there, like anemones and sea cucumbers, small arthropods, these tiny creatures that can withstand 16,000 pounds per square inch of pressure, living in complete darkness. Those seemingly insignificant little creatures, along with my insignificant colleague Victor and me, making all this possible, are part of our small community. We too are part of it; we are part of the entirety of life on this planet. Turning to broader thoughts about life on the planet and the miracle that is life on this planet, we all matter, and we are all interconnected."

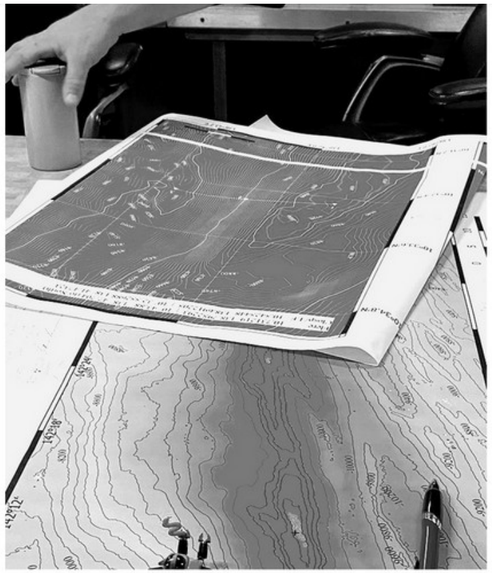
Dawn Wright, Chief Scientist at Esri

Q & A

You studied geology and then you got a Masters in oceanography. How and when did your passion for the ocean start? Where did your grow up?

I grew up in the Hawai‘ian islands. So that will do it! My family is from the East Coast of the US but my mother actually played a larger role in guiding where our family ended up through her career in teaching. My father was a high school basketball coach and a failed NBA recruit. So my mother took the lead and she got a teaching position in Hawai‘i and so we moved there when I was six. I was raised in Hawai‘i and spent a lot of time at the beach, doing a lot of swimming, body surfing and exploring. That is part of the culture of Hawai‘i too, to enjoy but also to hold the ocean as sacred, as life giving. It's a natural part of everyday life there.

From the age of eight, I decided that I wanted to study the ocean as a career and I was encouraged at first by watching Jacques Cousteau on TV. I grew up in the 60s, and it was a wonderful time because the entire country had pretty much only three choices of television programming. There wasn't this overabundance of streaming channels and cable TV and there was no social media. Everyone watched these three networks and on one network there was always the undersea world of Jacques Cousteau on Sunday nights followed by the wonderful world of Disney. That was my steady diet of science communication! Just about everyone who watched Jacques Cousteau was enthralled by it, but I found out later on that he was more of an activist, more of an underwater photographer than a scientist.



I really wanted to be a scientist and I figured out that I lived on a volcanic island, then I found out about the origin of the island that I grew up on, Maui. I had a chance to visit the Haleakalā volcano and I thought ‘well if there are volcanoes on the ocean floor, I surely want to specialize in that?.

So it becomes ‘how do you do these sorts of things?’ It's like for young people who want to become astronauts, how do you get into that? How do you become that or people who are enthralled by anything really, by filmmaking or animation, how do you do it? I learned by reading books in an actual library, by sitting down on a table with actual books and reading about oceanography, science and reading about the various schools that trained professional oceanographers.

That led me to geology as an undergraduate major. I came away with an undergraduate degree in geology and went into a graduate programme in oceanography with a specialty in geological oceanography. Then I went to sea for three years with what is now known as the International Ocean Discovery Programme, but at the time that I joined it it was the Ocean Drilling Programme. I was at sea for three years as an ocean-going technician and learning much much more.

It was a series of two month sailing expeditions through the Indian and Pacific, right? What did you learn about our oceans over that three year period?

There is nothing like going to sea on an actual research vessel with scientific objectives to open up all kinds of worlds. My first expedition as a marine technician was actually to Antarctica. I was sent to the Weddell Sea and it was just mind blowing because you see the penguins, the seals and the albatrosses. I went to my first penguin rookery in Punta Arenas, Chile but as a technician you are responsible at sea for helping the scientific party to get their work done. Drilling vessels are out for two months because you spend so much time anchored to the sea floor bringing up cores of sediment and rocks. Then the technical crew is responsible for processing those cores, getting them split in half ready for the scientific party to examine.

We also were responsible for running the initial scientific tests on the cores, running them through magnetometers and doing chemical analyses of the sediment samples. My main job was to process scientific reports – I had to read and edit all of the reports that came from the scientific party as they did all of these experiments on these cores and interpreted what the cores were saying about the history of the earth in that particular location. There was no better training for me, I'm ever thankful for it.

You've spent about 40 years working in our oceans every day – what change have you seen in the oceans over that period?

Boy, when you put it that way….40 years! I hadn't even counted.

I didn't mean to scare you!

Well one of the big changes is that the oceans are heating up. They're warming, the temperatures are getting alarmingly high because of all of the heat. The oceans or the ocean as a unified global system of our planet is absorbing around 90% of the excess heat that we're generating from our activities on land. So that is one of the biggest changes and you can see that in our weather patterns from day to day, along with our long term climate view. We're talking about this in California right now because we are in the grip of yet another series of atmospheric rivers fuelled by the warmer ocean. So we're going to get these storms that are more powerful, that carry more water and more precipitation. For us in California, living on land, we are experiencing this as a coastal state but everywhere that you are on the planet, you are affected by this warming of the ocean. The other big consequence that we see is the growing acidification of the ocean because as much as 25% of the greenhouse gasses that are emitted on land are being absorbed. That's making the ocean more acidic, the coral reefs are in danger and then there's the lack of oxygen. The ocean is losing its oxygen, especially in the deeper portions as well. Those are the big three – the temperature, the acidification and the oxygen.

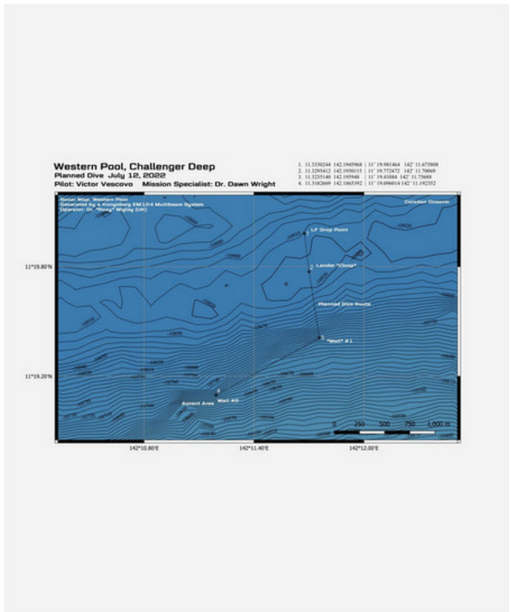
You just mentioned the deepest points of the ocean – this area of the world has been a big part of your story over the past year with your expedition to Challenger Deep. How did you feel when you kind of found out you were going and you were going to be the first Black person to travel there?

The big thing for me was getting the opportunity to go as an oceanographer first. I'm someone who has studied the ocean for so many years and been to all of the major ocean basins in terms of my research work but there are some areas that are holy grails for many of us.

I had studied the Tonga trench and I was involved in mapping that trench and having done that – of course you want to go to the deepest trench to visit it but if you're not able to get the funding or if you're not involved in a specific scientific study that is studying that, then your chances are slim to none of actually getting to go. I was overjoyed at just getting the opportunity to go as an explorer.
Being the first Black person is the icing on the cake, although I would like to hope at some point that we don't have to make these types of pronouncements in terms of the first man, the first woman, the first Black person, the first Asian person.

Also on our expedition was my good friend Nicole Yamase who went the year prior as the first Pacific Islander. She's from the federated states of Micronesia. These are things that matter now, but I look forward to our society evolving to the point where we are all looking at each other with equality and respect and we don't have to make these pronouncements.
But until then, yes that was very precious to me and very significant, also because of the way that it is being viewed by the Black community globally. Upon returning I got a nice tag on Facebook from Derek Davis who works with the National Association of Black Scuba Divers. He gave a presentation to elementary school children recently and showed them the CBS news snippet of me and Victor Vescovo following our dive. All of the questions, all of the inspiration coming from those children, it's just amazing. Kids need to see this, they need to dream. It certainly was the case for me.

Dawn practica entrar y salir del submarino.



Este mapa se utilizó para navegar y rastrear la posición del submarino durante el estudio de Challenger Deep / cartografía de Rochelle Wigley

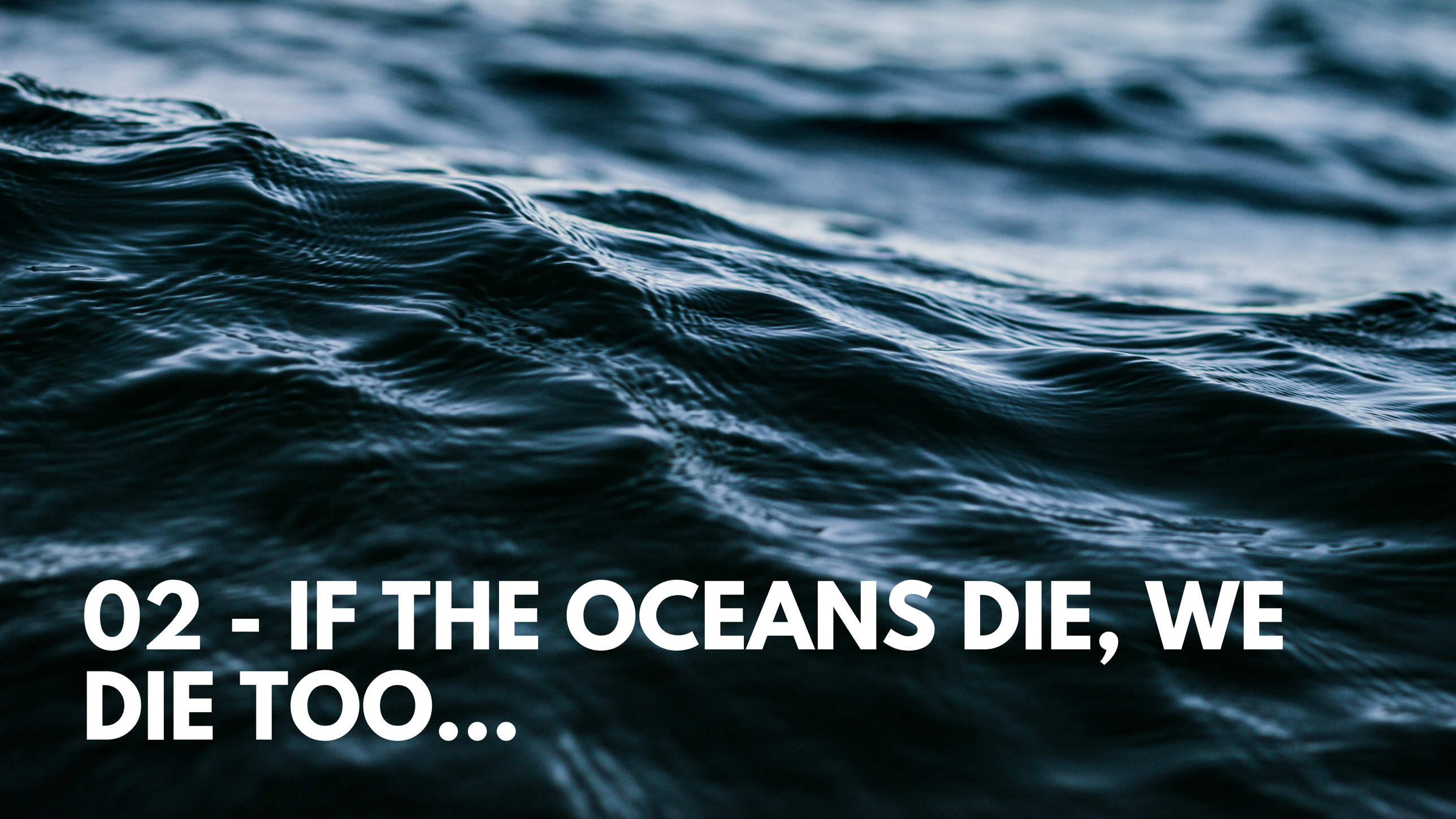
What's it like down there?

It's very quiet, there are no large creatures, the pressure is too great for even just a regular-sized fish to survive in the deepest part of Challenger Deep. Scientists who study the creatures that live in the deepest parts of the ocean surmise now that 8 or 9,000 meters is about the deepest that fish are known to exist. It's exhilarating, and it never gets old, the fact that you're descending through the lit zone of the ocean, which is beautiful aqua blue, then things slowly turn to gray and then pitch black. You hope that you're also treated to a firework show by the bioluminescent creatures that live in that zone of the ocean. What is not known by most people is that the twilight zone, that zone just as the ocean turns dark, that is where most of the biomass in the ocean is. We were treated to a nice little firework show by bioluminescent jellyfish and siphonophores.

In fact, Victor stopped our descent at around 9,018 meters and started flashing the lights of the submersible to attract these creatures and they flashed in return. We had a little bit of communication with them and then we continued our descent. So that is always a thrill.

Then when you actually get to the bottom….that is amazing and it was really emotional for me. There was really nothing to see at the place that we landed. It was fairly level and covered with sediment. Victor and I were both shocked because we landed on the sedimented, fairly flat portion within this depression in Challenger Deep. We were in the Western Pool. There's an Eastern, Central and Western pool.

Dos anémonas blancas del género *Galatheanthemum* que viven en tubos crecen a partir de una formación rocosa basáltica, encontrada en Challenger Deep.



02 - IF THE OCEANS DIE, WE DIE TOO...

LESSON 04: SARGASSUM SEAS

We've prepared a class to explore the mysterious oceanic realm of Sargassum algae and its potential to capture carbon, combat acidification, and create biomaterials.

Lesson Objective:

- Students will understand the ecological impact of Sargassum algae on marine ecosystems and explore potential solutions to mitigate its effects.

Materials:

- Access to the article 'Sargassum Seas' from Parley.
- Computers or tablets for research.
- Poster boards and art materials.
- Access to a local beach or marine environment (if possible).

Curriculum Plan:

01 - Introduction to Sargassum (15 minutes)

Start by discussing the concept of marine ecosystems and their importance.

- Introduce the topic of Sargassum algae and its increasing presence in marine environments.

LESSON 04: SARGASSUM SEAS

Continuation...

02 - Reading and Discussion (20 minutes)

- Have students individually or in small groups read the article 'Sargassum Seas' from Parley. Lead a class discussion on the key points of the article, focusing on the ecological impact of Sargassum algae.
- Show visual aids to help students understand the appearance and behavior of barrel jellyfish.

03 - Research Activity (30 minutes)

- Assign students to research the ecological role of Sargassum algae in marine ecosystems.
- Encourage them to explore both positive and negative impacts on marine life.

04 - Group Work: Solutions (20 minutes)

- Divide students into small groups and ask them to brainstorm possible solutions to mitigate the negative effects of Sargassum algae.
- Each group should create a poster presentation describing the proposed solutions.

05 - Presentation and Discussion (20 minutes)

Have each group present their proposed solutions to the class. Facilitate a discussion on the feasibility and potential impact of each solution.

06 - Excursion or Virtual Tour, if Possible (30 minutes)

If possible, take students on a field trip to a local beach or a marine environment affected by Sargassum algae. Alternatively, organize a virtual tour of an area affected by Sargassum to provide students with a real-world perspective.

07 - Reflection and Conclusion (10 minutes)

- Lead a classroom reflection on what students have learned about Sargassum algae and its impact on marine ecosystems.
- Discuss possible individual or collective actions that can be taken to address this issue.

Assessment:

1. **Poster presentations.**
2. **Class participation in discussions.**
3. **Reflection papers on the excursion/virtual tour experience.**

EXPLORE MORE ABOUT SOLUTIONS TO SARGASSUM

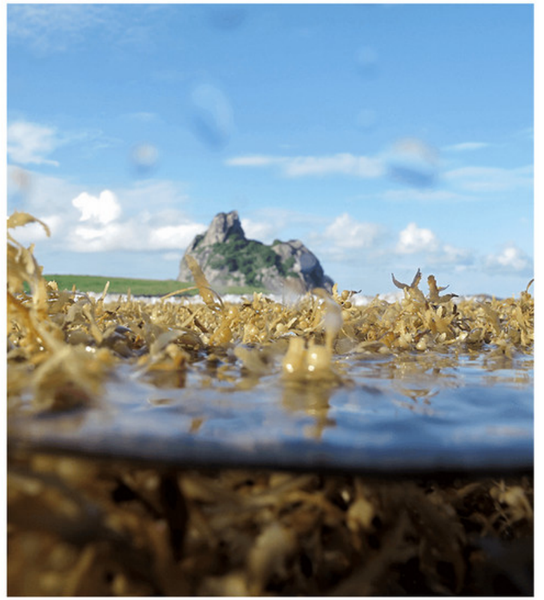
"SOS Carbon is an Dominican organization that aims to transform an environmental, economic, and health crisis in coastal communities into new sustainable industries with a positive impact on job creation and social and economic development. The goal is to enhance regional resilience and address the global impact of climate change."

ACCESS THE LINK HERE.

ARTICLE 04 - SARGASSO SEAS

Exploring the mysterious oceanic realm of Sargassum algae and its potential to help capture carbon, combat acidification, and create biomaterials.

In the second of a series of posts created in collaboration with local scientists, Brazil coordinator Thais Gonçalves delves into the mysterious world of sargassum, the vast floating mats of algae that give their name to the famous Sargasso Sea. In this interview with Paulo Antunes Horta from the Federal University of Santa Catarina, we explore the potential of these algae to capture enormous amounts of CO2, improve ocean health, and even create new biomaterials.



Q & A

What is Sargassum and where is it found?

Among seaweeds, Sargassum is one of the easiest to find. In a shallow dive, you are likely to see browny marine plants – and that is Sargassum. It is quite well known in the Caribbean and here in Brazil, and most of the “marine forests” underwater, specially in the west Atlantic, are formed by Sargassum.

The sargassum that lives in the open ocean – is it the same as that found on rocky reefs?

We now know, by molecular marker analysis, that we have different kinds of Sargassum species, but we don’t have full genomes yet. In Brazil, we couldn’t find significant differences between samples from rocky shores and on the floating Sargassum masses – these floating “islands” of 8000 km long in the Atlantic that start in Africa, pass in front of the Amazon and reach the Caribbean. Of course, that is always changing due to climate change and all the land uses we have in the Amazon. These huge masses are influenced by the runoff with all kinds of fertilizers that comes from the Amazon region.

Is the Brazilian Sargassum sea connected with the more famous North Atlantic region?

When it comes to species, some scientists believe that there are three species in the floating Sargassum masses in the Central-North blooms and only two species in the South Blooms. But they are quite similar overall, and we need to study them better. We really do not know if the Sargassum of the South Atlantic was always there, and now they are more or less connected, or if it has a different origin. We need to investigate the source of all the Sargassum seas – both the one in the South and the Sargasso Sea in the North Atlantic.

Are there a lot of species and endemic species associated with this sargassum sea?

Yes, we have a lot of invertebrates and a few fishes as well – but what we have the most are cryptic diversity, species that we do not know quite well yet. There is a lot to discover and research groups from Europe to the Caribbean and South America are getting together to investigate that. So we expect a lot of exciting news in the near future.

What is the relationship between Sargassum, carbon dioxide and climate change?

When Sargassum is growing, it is taking CO2 from the water and thus increasing the PH of the ocean, which helps with the problem of ocean acidification. By taking CO2 from the water, it also helps the ocean to absorb more carbon from the atmosphere. So we are learning that if we work well and get global collaboration, we can have Sargassum extracting CO2 and sinking, every year, removing the same amount of biomass that we have in all of the world's mangroves. That’s a lot of biomass that can sink and sequester carbon, but there is also a lot that can be done with that biomass, like bioplastics – shoes, masks, etc. It is a way of transforming a problem, because Sargassum blooms can also turn into a problem for tourism and for the economy, into a solution. In a way, it is also an opportunity to help local people and the government.

Would projects like that require more Sargassum to grow or could they use existing stocks?

We can start with the existing ones, but it is also possible to cultivate Sargassum – mainly on oil platforms. That was an idea that our research group discussed with MIT and I believe they are exploring it right now.

What is the relation between the Amazon and the Sargassum in the Caribbean?

Around 2010, when Brazil started to explore and export more iron from the Amazon, it increased deforestation as well. All that still happens today, as most people know about deforestation in the Amazon. With deforestation, the soil gets exposed and every time it rains, the runoff washes away nutrients from the soil.

So the Amazon River water right now is leading to eutrophication — excessive input of nutrients — into tropical waters, causing the rapid proliferation of Sargassum blooms. Our research has shown that deforestation is deeply connected to the change in quality of the runoff and eutrophication of the ocean – which affects the marine ecosystem as a whole. It's happening mostly in Brazil, but it affects Mexico, the Caribbean islands, the US, Africa – and really the entire globe. We have small islands that are ruined because of eutrophication problems, and to solve this problem will require global efforts to really find the origin and deal with the causes.

What benefits does Sargassum bring to the oceans?

These floating "forests" create many habitats. When we look to a forest on land, we see birds, monkeys, all different kinds of animals using trees. The Sargassum has the same role in the water. Fishes, invertebrates, a lot of animals, a lot of life needs and uses the Sargassum as food, as a home.
There are all the benefits of the biogeochemical process , the sink of CO2 and all that, and we have studies showing that Sargassum seas in a region lead to more fish, more life and that positively impacts the local fishing industry. Of course, when we upset the balance, and we have a Sargassum bloom, we are going to have to deal with the problems. And the problems are quite big – I'm talking about one meter tall piles of seaweed over an entire beach. That same amount of Sargassum covering a reef is going to mean no oxygen and no sun – and the reef dies. So the benefits are huge, but considering the fertilization and eutrophication of our oceans that we face right now, it is also a big problem.

What can we do about it?

First, we need to change each of us. Everyone is responsible for the pollution. Is your house plugged to the local sewage system? Are you doing your part? After we take care of our primary home, we need to talk about governments – from local and regional to national scale. It is all political and we need to remember we are always sending a message. Finally, we need agreements to give the local people the right tools to deal with the problem. There are a lot of new techniques to deal with Sargassum blooms now. People in Mexico, for instance, are building houses with Sargassum biomass! It can be a big problem – but there are lots of solutions as well that we need to make available.

LESSON 05: MINING THE DEEP SEA

We are preparing a class to learn about deep-sea mining.

Lesson Objective:

- Students will understand the environmental impact of deep-sea mining and evaluate its potential benefits and drawbacks.

Materials:

- Computers with internet access.
- Copies of the article "Deep-Sea Mining" from Parley.
- Notebooks and pens.

Curriculum:

01 - Introduction to deep-sea mining (10 minutes)

Start by discussing the concept of deep-sea mining and its potential impact on marine ecosystems.

- Show students images or videos of deep-sea mining operations to provide context for the lesson.

LESSON 05: MINING THE DEEP SEA

Continuation...

02 - Reading and Analysis (20 minutes)

Distribute copies of the article "Deep-Sea Mining" from Parley to the students.
Instruct students to read the article carefully and take notes on key points related to deep-sea mining, environmental concerns, and potential benefits.

03 - Group Discussion (15 minutes)

Divide the class into small groups and ask them to discuss their opinions on deep-sea mining based on the information from the article.
Encourage students to consider both potential advantages and disadvantages of deep-sea mining.

04 - Research Activity (30 minutes)

Ask students to use computers to research additional sources on deep-sea mining and its environmental impact.
Instruct them to find at least two additional articles or studies that provide different perspectives on the topic.

05 - Debate (20 minutes)
Gather the class again for a debate on the topic of deep-sea mining.

- Divide students into two groups: one in favor of deep-sea mining and the other against. Each group will present their arguments based on the results of their research.

06 - Reflection (10 minutes)

- Have students write a brief reflection on what they learned about deep-sea mining during the lesson.
- Encourage them to consider their own opinions on the topic and how their views may have been influenced by the information they found.

07 - Conclusion (5 minutes)
Summarize the key points discussed during the lesson and emphasize the importance of critically evaluating environmental issues such as deep-sea mining.

Assessment:

- Student participation in group discussions, research activities, and debates.
- Quality of reflections on deep-sea mining.

By engaging high school students in this comprehensive lesson plan, they will gain a deeper understanding of deep-sea mining, its ecological significance, and broader implications for marine ecosystems.

ADDITIONAL ACTIVITIES:

Invite a guest speaker, such as an environmental scientist or marine biologist, to further discuss the topic of deep-sea mining with the class.

ARTICLE 05: MINING THE DEEP SEA

In July 2023, the benchmark will be set for mining and exploration from now on.

No material comes without a cost.

As the world moves towards nature-centric solutions to the climate crisis, including electric cars, humans face monumental dilemmas that are not as black and white as ending our relentless dependence on fossil fuels.

Once on the road, gasoline-powered cars emit around 4.5 times more pounds of greenhouse gases than electric cars...

...But the materials used to manufacture the batteries powering electric cars are products of mining, often in tropical forests and areas of the Global South, already disproportionately affected by climate change.

Metals, especially nickel and cobalt, are key ingredients in rechargeable lithium-ion batteries that power electric cars. These metals are largely extracted in Indonesia, Chile, and the Congo rainforest, and the industry is rife with environmental degradation and human rights abuses.

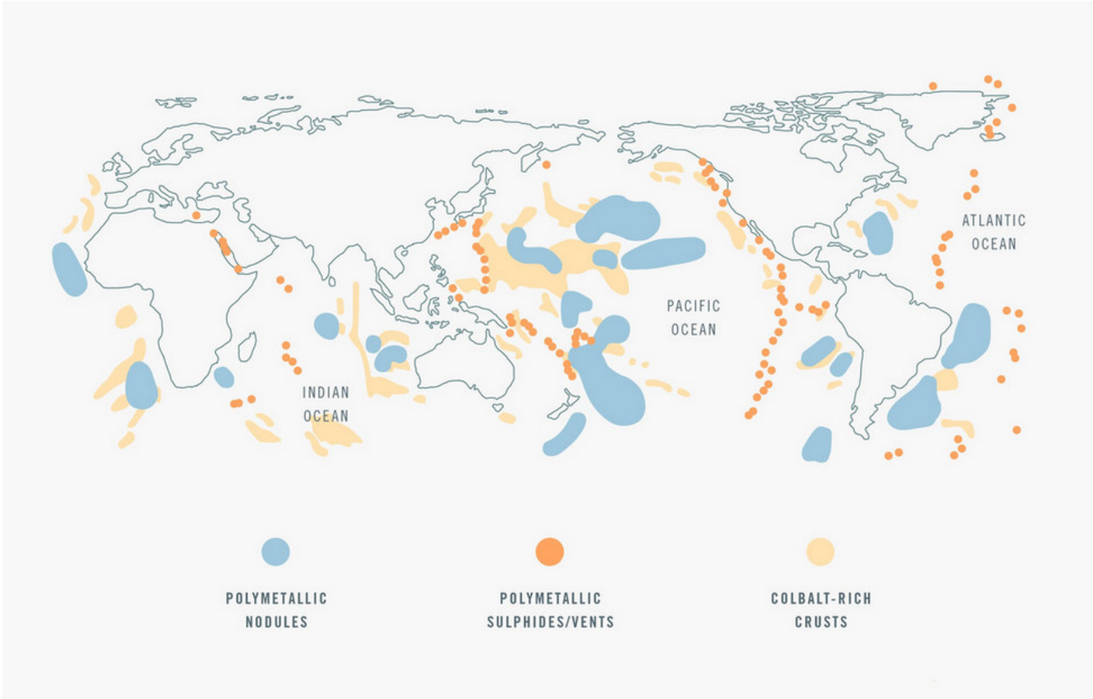
The oceans host 99% of Earth's biosphere, the zones where life can survive. The deep sea, about 200 meters below the surface where light begins to fade, constitutes 95% of the oceans, making it the largest biosphere on the planet.

Some parts of the deep sea also contain large amounts of cobalt and nickel.

This raises an incredibly difficult moral and scientific question: could extracting from the oceans for the metals needed to produce electric cars (and things like mobile phones, chargers, and laptops) present an opportunity to cause less harm? Do we really need to continue mining, or is recycling batteries and electronic products a viable alternative?

The United Nations' Paris Agreement states that to limit global warming to the 1.5°C tipping point, global greenhouse gas emissions must peak by 2025 and decrease by 43% by 2030. By 2050, emissions must reach net zero. But how will we achieve that?

In this AIR Guide, we delve into deep-sea mining, examining why people want to do it and whether it is necessary for the green economy. Later this month, we will also meet with marine biologists, ocean experts, and filmmaker Matthieu Rytz, director of the documentary Deep Rising, to discuss the complex dilemma of advancing a green economy that causes the least possible harm.



World map showing the location of the three main marine mineral deposits: polymetallic nodules, polymetallic or massive seafloor sulfides, and cobalt-rich ferromanganese crusts. (Reference: Frontiers)

A DECISION ABOUT

With all eyes on the deep sea, time is running out to finalize a Mining Code. Over the past two years, the International Seabed Authority (ISA), the United Nations body tasked with deciding where and how deep-sea seabed mining can take place in international waters, has been working to establish regulations with the goal of limiting damage and protecting marine environments. The ISA has been indecisive about its exact timeline for deciding whether deep-sea mining will be allowed and, if so, what a formal Mining Code will say.

In a meeting held in March, the ISA stated its intention to finalize a Mining Code and begin accepting mining company applications by July 9, 2023. However, that date has passed, and it is still unclear when these decisions will be made. One thing is certain: when they are, they will set the stage for how we will explore and exploit the oceans in the future. Currently, countries are scheduled to meet again in late July to discuss a possible moratorium on the controversial practice, but companies are poised to begin operations in early 2024.

Could deep-sea metal mining make the destruction of forests and other parts of the land unnecessary, disproportionately affecting developing countries and indigenous peoples? Or is it a misstep we are taking without fully understanding the effects?

Why do people want to exploit the depths of the seas?

Currently, lithium-ion batteries are the best option for energy storage in any commercially sold battery. This makes them key alternatives for fossil fuel engines in electric vehicles. These batteries (also used in personal electronic devices such as smartphones and computers) also require specific metals, including cobalt and nickel. Mining and fossil fuel companies have found polymetallic nodules (rocky deposits the size of a potato that grow approximately one millimeter per million years) containing high amounts of cobalt, manganese, nickel, and copper in the Clarion-Clipperton Zone (CCZ).

The 6 million square kilometer strip of the Pacific Ocean is located between Hawaii, Kiribati, and Mexico. It is the main focus for exploratory seabed mining and alone holds up to 5 times more cobalt and 3 times more nickel than known terrestrial reserves.

Advocates for deep-sea mining say that extracting nodules from the deep sea would alleviate the pressure on land mines that are currently the source of metals used in lithium-ion batteries. These mines would not disappear, but some argue that deep-sea nodules would impede the expansion of land mining. They also say that deep-sea mining would create fewer opportunities for mineral mining to be involved in environmental degradation and human rights abuses, including modern slavery and extraction of indigenous lands without consent.

Cobalt, in particular, is toxic, but the population of the Democratic Republic of Congo, which currently produces almost 80% of the world's cobalt, often extracts it from the Earth with their own hands. Land mining is also destroying ancient tropical forests. Since 2011, companies operating on the island...

...mines in Sulawesi, Indonesia, have destroyed a strip of tropical rainforest three times larger than London. While logging and industrial agriculture explained part of this damage, the nickel mines opened on the island turned Sulawesi into the epicenter of nickel mining in Indonesia, producing around 1 million metric tons of the metal in 2021.

A rarely seen dandelion siphonophore, photographed during a National Oceanic and Atmospheric Administration deep-sea research mission. (Source: NOAA)

DEEP SEA MINING WILL HARM ECOSYSTEMS WE DON'T YET UNDERSTAND

The oceans are the largest carbon sink on Earth. They've absorbed a full quarter of the carbon dioxide (CO2) released since humans started burning fossil fuels during the Industrial Revolution – and they've also trapped around 90% of the excess heat created by climate warming gasses. Much of this carbon is locked away in the floor of the deep sea, the very place where proposed mining would take place.

More than 80% of our oceans are also unmapped and unexplored, meaning that we have no real idea of the damage deep-sea mining will cause. To date, over 5,500 species have been discovered in the CCZ, of which more than 90% had never been documented before.

Scientists, including Dr. Sandor Mulsow, a United Nations scientist and marine geologist, are concerned that we still don't understand how these life forms will be affected by mining and the companies hoping to exploit them. It is also enormously costly and may not even be necessary given the other solutions that are already in progress.

Alternative Solutions

In a 2022 report from the World Wide Fund for Nature (WWF), the organization estimated that recycling critical metals in batteries—which can be done—would reduce the demand for new sources of these metals by 20% to almost 60% by 2050.

They estimate that by implementing new renewable technologies, the demand for all the critical minerals they studied, including nickel, manganese, cobalt, copper, platinum, lithium, and rare earth elements, can be reduced by 30%, with the most notable reductions in cobalt, nickel, and manganese, the primary minerals in deep-sea nodules. The WWF estimates that new technologies like solid-state or iron phosphate batteries would reduce the demand for these metals by 40% to 50%.

Some companies have already committed to moving towards a circular supply chain, reducing demand and limiting the need for new sources of metals.

Nations are stepping back

The deep seabed and Antarctica are the only areas on Earth where mineral resource extraction is not yet conducted commercially. Deep-sea mining is not imminent. The ISA includes 168 member countries, and a growing number of these nations oppose allowing deep-sea mining until the environmental impacts are fully understood.

So far, Germany, Chile, Costa Rica, Ecuador, the Federated States of Micronesia, Fiji, France, Germany, New Zealand, Palau, Panama, Samoa, and Spain are among a growing group of nations calling for a "precautionary pause" or a ban on deep-sea mining. They argue that there is currently not enough data available to assess the impact mining would have on marine life.

Renowned electric battery consumers are also taking a stance against deep-sea mining. Major automakers, including BMW, Volvo, and Rivian, have already pledged not to use materials extracted from the deep seas and are urging governments to impose a moratorium on this practice. Some are also shifting to iron and lithium phosphate batteries, which are energy-efficient and do not require cobalt or nickel.

03 - THE NEVER-ENDING STORY OF PLASTIC

LESSON 06: THE IMPACT OF PLASTICS ON FOOD AND THE ENVIRONMENT

We prepared a class to learn about the impact of plastic pollution on food.

Lesson Objective:

- Students will understand the impact of plastics on food and the environment, including plastic pollution sources, their effects on marine life and ecosystems, and possible solutions to reduce plastic waste.

Materials:

- Computers or tablets with internet access.
- Projector or smart board for presentations.
- Printed copies of relevant articles and infographics.
- Writing materials for note-taking and group work.

Curriculum:
This plan has a duration of 2 class periods.

Lesson 01 - Understanding Plastic Pollution

LESSON 06: THE IMPACT OF PLASTICS ON FOOD AND THE ENVIRONMENT

continuation...

Lesson 01 - Understanding Plastic Pollution

L01-01 - Introduction (15 minutes)

- Begin by discussing the prevalence of plastic in everyday life and its impact on the environment.
- Show images or videos of plastic pollution in oceans and other ecosystems.

L01-02 - Reading and Discussion (30 minutes)

- Provide students with printed copies of the article "ParleyAIR: Plastics and Food" from Parley.
- Instruct students to read the article individually and highlight key points about the impact of plastics on food and the environment.
- Facilitate a class discussion based on the reading, focusing on sources of plastic pollution, its effects on marine life, and potential consequences for human health.

L01-03 - Group Activity: Infographic Creation (30 minutes)

- Divide the class into small groups.
- Provide each group with materials to create an infographic illustrating the impact of plastic pollution on food and the environment.
- Encourage students to use information from the article, as well as additional research, to support their visual representations.

L01-04 - Group Presentations (15 minutes)

Each group presents its infographic to the class, explaining key points and findings related to plastic pollution.

Lesson 02 - Solutions to Plastic Pollution

L02-01 - Review (10 minutes)

Recap the key points from the previous day's discussion on plastic pollution.

L02-02 - Research Activity (40 minutes)

- Instruct students to use computers or tablets to research possible solutions to reduce plastic waste and pollution.
- Encourage them to explore initiatives, technologies, and policies aimed at addressing plastic pollution.

L02-03 - Class Discussion (20 minutes)

Facilitate a discussion based on students' research findings, focusing on effective strategies to reduce plastic waste and mitigate its impact on food and the environment.

L02-04 - Reflection and Action Plan (20 minutes)

- Ask students to reflect on what they have learned about plastic pollution and its implications.
- Instruct them to develop an action plan outlining the steps they can take individually or as a group to reduce their own plastic consumption and promote awareness in their community.

LESSON 06: THE IMPACT OF PLASTICS ON FOOD AND THE ENVIRONMENT

L02-05 - Conclusion (10 minutes)

Summarize the key conclusions of the lesson and encourage students to continue exploring ways to address plastic pollution in their daily lives.

Assessment:

- Participation in class discussions.
- Quality of infographic creation.
- Findings from research on solutions to plastic pollution.
- Reflection and action plan to reduce plastic consumption.

Additional Activity:

Organize a school-wide campaign or initiative focused on reducing single-use plastics in cafeterias, classrooms, or events.

ARTICLE 06: PLASTICS AND THE FOOD WE EAT

How did our food system become intertwined with pollution?

Food is one of our most basic needs as humans. So it's particularly ironic that we poison the planet that sustains us in order to produce it might not be the most obvious culprit, but plastic and the foods we eat are intertwined in a big way. It goes so far beyond plastic utensils and takeout containers. From the fertilizers we use to grow it to grocery store vegetables encased in plastic film, to the cookware we use in our kitchens, which can contain harmful forever chemicals, it's almost impossible to avoid plastic being used in at least some parts of the processes that ensure we have food on our tables.

As part of our ongoing Parley AIR series, we're doing a deep dive into the planet and our food system — how plastics can be found at virtually every phase of food production, how the way we grow food on a global scale is accelerating climate change, and the people pushing to make plastic-free food accessible.

Our food systems are responsible for about one-third of human-caused greenhouse gas emissions, the toxic gasses that accelerate climate change. A big contributor is nitrous oxide released by fertilizers used for crop production.

Synthetic fertilizers are often made from petrochemicals, i.e. oil. And as the global shift to green energy intensifies, oil companies are looking to pump demand for other products that use oil, including plastics and petrochemicals like fertilizer.
The International Energy Agency (IEA) expects that by 2050, over half of gas consumption will go towards producing hydrogen, a key component of ammonia, which is the base of nitrogen fertilizer. Half.

Currently, the synthetic ammonia used to make nitrogen fertilizer uses about 5% of the world's oil and gas, but experts expect this source to be the largest driver of growth in global oil demand through 2026. A 2021 report by the Institute for Agriculture and Trade Policy, GRAIN, Greenpeace International found that in the past 60 years, synthetic fertilizer use has grown almost 10-fold. The report also found that in 2018, the synthetic nitrogen fertilizer supply chain was responsible for estimated emissions of 1,250 million tons of CO2, a fifth of the greenhouse gas emissions caused by agriculture and about 300 million tons more than the annual CO2 output of the global aviation industry.

Synthetic fertilizers also aren't the only agrochemicals tied to plastics and planet-warming emissions. Even fertilizers that aren't oil-based are often coated in plastic before they're spread across the Earth.

A 2022 report from the Center for International Environmental Law highlighted the impact. The plastic from coated agrochemicals directly introduces microplastics into the environment, compounds the hazards caused by synthetic fertilizers, especially to nearby waterways, and becomes another way in which microplastic enters our bodies.

PLASTICS AND SEAFOOD

It’s not just the food that we grow in soil. Both the fishing and aquaculture industries are huge contributors to plastic waste, climate change and the devastation of our Blue Planet. You’ve probably heard that abandoned fishing nets, lines and rope account for 10% of plastic garbage in our oceans, including almost half of the Great Pacific Garbage Patch. But fishing isn’t the only way seafood ends up being part of our dinner.

Globally, aquaculture — farming seafood and other aquatic life in pens in the oceans — supplies more than half of all seafood produced for human consumption. And it uses a ton of plastic.

Nets, foam buoys and bags used for storing harvests are obvious plastic sources, but it’s actually when these items start to break down that causes the biggest damage. As aquaculture has boomed in popularity...

so has the amount of microplastics in the oceans. It’s not just the nets and buoys. Fish cultivated in aquaculture farms are fed pellets through plastic pipes that shed microplastics into the waters in which the fish feed. Eventually, that plastic gets into us.

PLASTICS IN US

On average, we could be eating about a credit card’s worth of plastic every week. Plastic and the toxic chemicals it's made from end up in everything from beer to breast milk, and scientists are just starting to study the dire effects this has on human health.

PLASTICS AND FOOD PACKAGING

Food packaging is the most visible source of plastic people see. It’s almost impossible to avoid – clamshells full of lettuce, plastic bags full of grapes, convenient, squirtable snacks for kids with plastic twist-off tops. Even the tiny barcode stickers on fruit. Grocery stores are packed with plastic.

Food packaging and takeout containers make up almost half of the material in landfills in the U.S., the largest producer of plastic waste in the world. In the U.S., food also accounts for up to one-third of a household’s carbon footprint.

It’s often touted as a way to reduce food waste, but that’s not always the case. A study by the sustainability non-profit Wrap found that plastic packaging around produce like bananas and cucumbers does not reduce food waste. Instead it often forces people to buy more than they will use. Then there’s takeout. Plastic litter from takeout orders — including cups, plates, cutlery and straws — is a main source of the roughly 20 million metric tons of plastic pollution that ends up in the natural environment annually. It flows from restaurants to rivers and into our oceans.

LESSON 07: BIOPLASTICS

We are preparing a class to explore how 'eco-friendly' bioplastics are.

Lesson Objective:

- Introduce students to the concept of bioplastics.
- Explore the properties, production process, and potential applications of bioplastics.
- Encourage critical thinking about the environmental benefits and challenges associated with bioplastics.

Materials:

- Presentation slides or handouts.
- Samples of bioplastic products (if available).
- Printed copy of Parley's 'Bioplastics' reading.
- Internet access for research activities.

Curriculum:

01 - Introduction to Bioplastics (10 minutes)

Start with a brief discussion on the environmental impact of traditional plastics.

- Introduce the concept of bioplastics as an alternative to conventional plastics.

LESSON 07: BIOPLASTICS

02 - What Are Bioplastics? (15 minutes)

- Define bioplastics and explain their composition, including renewable sources like corn starch, sugarcane, or cellulose.
- Discuss the differences between bioplastics and traditional plastics in terms of production and decomposition.

03 - Properties and Applications (20 minutes)

- Explore the properties of bioplastics, including their strength, flexibility, and biodegradability.
- Present examples of bioplastic products and their potential applications in various industries.

04 - Production Process (15 minutes)

- Explain the production process of bioplastics, including polymerization and molding techniques.
- Discuss the environmental implications of bioplastic production compared to traditional plastic manufacturing.

05 - Environmental Impact (20 minutes)

- Provide students with a copy of the Parley article on 'Bioplastics.'
- Facilitate a class discussion on the environmental benefits and challenges associated with bioplastics.
- Encourage students to critically analyze the life cycle of bioplastics, considering factors such as resource use, energy consumption, and end-of-life disposal."

06 - Conclusion and Reflection (10 minutes)

- Summarize key points about bioplastics and their impact.
- Assign a reflection activity or a research project for students to explore real-world examples of initiatives or innovations in bioplastics and discuss their impacts (both positive and negative).

Assessment:
Students can be assessed through class participation, group discussions, or individual research projects focused on specific aspects of bioplastics.

By engaging high school students in this lesson plan, they will gain a fundamental understanding of bioplastics and their impact throughout the lifecycle.

ARTICLE 07: BIOPLASTICS

How did our food system become intertwined with pollution?

Traditional plastics are not working. The toxic material is fueling climate change and has contaminated virtually every corner of the planet. It may also be making us sick. A 2020 study estimated that if we continue on the current trajectory, the amount of plastic waste produced will triple in the next two decades. But it doesn't have to happen.

Single-use plastic bans are beginning to take hold worldwide, which is a great start to addressing the plastic pollution crisis. As these bans come into effect, we need alternatives. Replicating all the functions of plastic (from yogurt cups to medical devices, including shoes and clothing) is challenging...

...do, but we have never had so many resources dedicated to eco-innovation. Bioplastics can function in many ways similar to plastic made from fossil fuels. And they are definitely on the rise. Although bioplastics only account for less than 1% of the plastic market, the global bioplastics market will be worth almost 44 billion dollars this year.

Are bioplastics better than other plastics? That depends. Their goal is to provide a much-needed alternative to traditional plastic made from fossil fuels, but that doesn't make them perfect. The Material Revolution is just beginning, and creating real solutions to the plastic pollution crisis and climate change will require significant changes in how we consume.

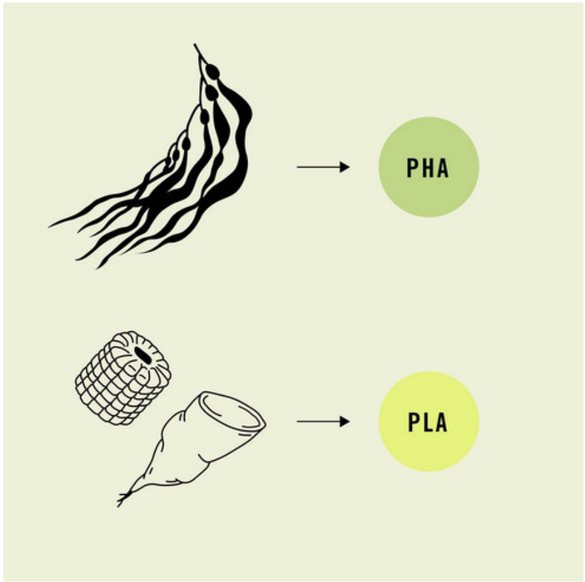
> *"The fact is that single-use bioplastic items are still not environmentally sustainable. The environmental cost of these items remains high given their short lifespan compared to their environmental impact. We need to change the way we consume and use materials by ensuring to use them for an extended period instead of discarding them after a few minutes."*
>
> **Dr. Sarah-Jeanne Royer - Scientific Advisor at Parley**

The production of chemicals, including plastics, has multiplied by 50 since 1950 and is expected to increase by the same amount in the next three decades. Plastic production increased by 80 percent just between 2000 and 2015. Today, the mass of all the plastic on this planet is double the mass of all mammals. In a recent report, scientists found that the amount of chemical waste in our ecosystem has reached dangerously high levels for humans and the plants and animals with whom we share the Earth.

Bioplastics are a promising step forward and a hallmark of the Material Revolution that's about to explode, but we need to tread carefully. Before we can embrace emerging "bio-materials," we need to examine them more closely. If we don't, we risk making the same mistakes that caused the current plastic crisis. We need truly biodegradable materials that work in harmony with nature. We also need to reimagine the systems and thinking that led us to the place we're in now.
Here's what you need to know about where we're at with bioplastics now and what the future of biodegradable plastic alternatives might look like.

WHAT ARE BIOPLASTICS

Ninety-nine percent of traditional plastic is made from ethane, a material that comes from fossil fuels. But bioplastics are made at least in part from renewable resources. These are mostly plants and biological materials, which has some scientists experimenting with everything from lobster shells to DNA from salmon sperm to create plastic alternatives.
Essentially, bioplastics use protein and carbohydrate molecules that naturally occur in some plants and algae to create flexible, sturdy plastics that can replace plastics made entirely from fossil fuels. The two most common types are polyhydroxyalkanoate (PHA), which is usually made from sugars that are grown from algae, and polylactic acid (PLA), which is made from the sugar from corn and sugarcane. Most bioplastic items will be stamped with either PHA or PLA, letting you know which one it is.



Algae like spirulina, which is at least half protein, is a particularly good renewable source of building blocks that can be used to create malleable bioplastic. This type of PHA bioplastic can fill the need for plastic-like material in medical devices but can also make single-use plastics like cups and cutlery easier on the planet. It's also a good alternative to polyethylene terephthalate (PET), the type of fossil-fuel-based plastic most plastic bottles are made from.

The other main type of bioplastic, PLAs, are made from starchy plants like cassava and corn. The starch mimics polyethylene, the type of plastic used in plastic films, packing and bottles. It can also be formed into a safer version of styrofoam. A 2017 study estimated that switching from traditional plastic to corn-based PLA would cut U.S. greenhouse gas emissions, which are the highest in the world, by 25%. The effect could be even bigger if these bioplastics are made using renewable energy. And because PLA is often made in the same facilities that produce ethanol, it's the cheapest source of bioplastic we have right now.

Some bioplastics are biodegradable or even compostable in industrial facilities. Under optimal conditions, microorganisms can turn a bioplastic bottle into water, carbon dioxide and compost within a few months. But not all bioplastics biodegrade. Some still need to be recycled.

AN IMPERFECT SOLUTION

No solution to the plastic pollution crisis comes without some caveats, and bioplastic is no exception. Systems aren't yet set up for bioplastics, so a lot of it ends up in the wrong bin, in landfill or in the natural environment – including the oceans.

A detailed study published in May 2023 by Parley Science Advisor Dr. Sarah-Jeanne Royer and colleagues at UC San Diego's Scripps Institution of Oceanography found that natural and wood-based cellulose fabrics degraded within a month when submerged off a pier at the university. Synthetic textiles, including so-called compostable plastic materials like polylactic acid (PLA), and the synthetic portions of textile blends, showed no signs of degradation even after more than a year submerged in the ocean.

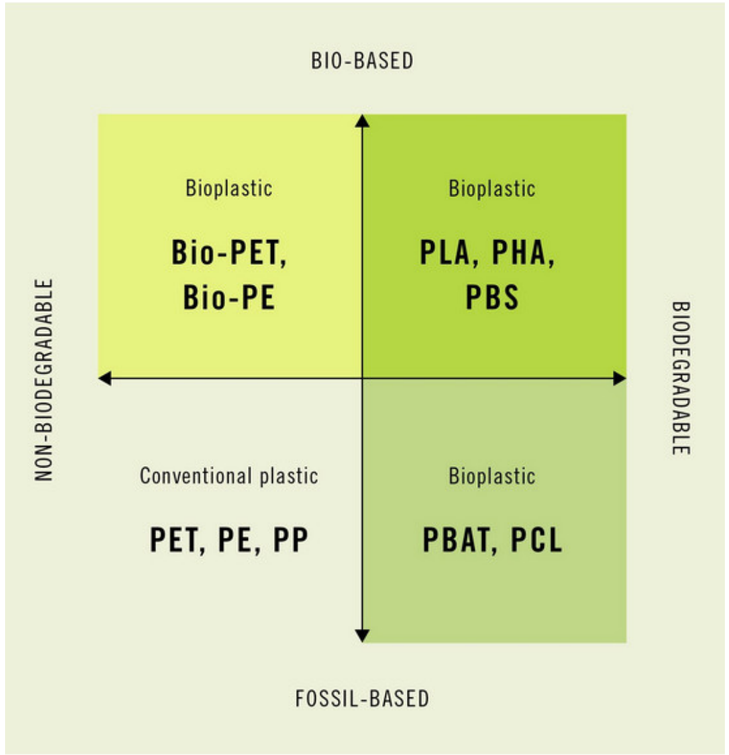
Most bioplastics also won't decompose in your backyard compost bin. They need industrial facilities that use the very specific amounts of heat and moisture the material needs to break down...

....— and the infrastructure isn't quite there yet. In the U.S., only about 15% of industrial composting facilities accept some form of compostable packaging — rather than just food scraps — and most of these are concentrated in the largest urban areas. Canada has just one composting facility that accepts bioplastics.

"Biodegradability time is much shorter for natural materials, such as cellulose and cotton, and most bioplastics don't degrade in natural environments at all," says Royer. "There is a lot of greenwashing around bioplastic and these products being advertised as a sustainable replacement for single use plastics, but unless you put these materials under high pressure and high temperature conditions, they will not biodegrade and hence remain in the environment for an unlimited amount of time."

The fact that bioplastics aren't made from oil is a huge game-changer. But plastic alternatives, especially those made from terrestrial plants, pose some other problems. Petrochemicals used for fertilizer, which are made from traditional plastics, are still widely used in agriculture around the world. This is especially true for monoculture crops, which are needed to produce PLA, the type of bioplastic made from plants rather than algae. Increased demand for farmland to produce starchy plants for bioplastics could also add to the already rapidly expanding farmland that drives deforestation. Right now PLA only makes up around 10% of all bioplastics, but the market for bio-materials is poised to explode.

Bioplastics aren't perfect yet, but scientists are working to develop better plastic alternatives and they're getting close. Since PHAs are made from bacteria, they have a much smaller carbon footprint than PLAs. Some research suggests they may also break down in seawater within a few years. Other innovators are working on creating bioplastic made from seaweed that can be composed in a regular backyard bin. Seaweed is a crop that grows faster than land-based crops, doesn't require deforestation and absorbs 20 times as much carbon as land forests. Last year, scientists also revealed a new type of bioplastic embedded with enzymes that are activated by warm, moist soil.



They digest the polymers that make up the bioplastic. Thanks to the enzymes, the PLA-based plastic breaks down in regular compost in about a week.

According to Royer, if you can't use reusables in place of single-use plastic items, products made from tree pulp or paper are better than the synthetic bioplastics available right now since they actually biodegrade: "Consumers who are concerned about plastic pollution should be mindful of the materials they are buying."

WHAT TO DO WITH YOUR BIOPLASTICS

Because bioplastics are made from different materials, it's really hard to determine whether a certain bioplastic should be composted or recycled, and whether or not it's actually possible to do either with current systems. So what should you do if a bioplastic crosses your path?

First, look for a label so you can figure out what type of bioplastic it is. Bio-PE and Bio-PET are chemically very similar to PE and PET plastics, and usually still contain mostly traditional plastics, so these can be recycled normally. Coke's PlantBottle, which still contains 70% oil-based plastic, is a Bio-PET.

Just like fossil-fuel-based plastic film, biodegradable plastic film can't be recycled. But if it's labeled PLA or PHA, you can route it to an industrial composting facility. The problem is, not all places have municipal composting available, so bioplastics that can only biodegrade in very controlled environments end up sticking around in landfills for hundreds of years. They can also end up in the ocean, where standard PLA and PHA won't biodegrade.

To make sizable change, shifts need to happen on a system-wide level. Become an activist. Push for change. This can be advocating local officials to implement industrial composting facilities in your community. Or for better communication about what people should do with bioplastics from the businesses that have adopted them.

> "It's important that you have teams which represent systems thinking in every dimension, from science, design, and engineering, to environmental justice. At the education level we need to bring in more teaching around things like green chemistry. We need to be studying biology and biomaterials, nature's materials, in order to really understand them. We need to be using the latest tools of synthetic biology to build new materials that unlock nature's building blocks," said Suzanne Lee, founder of Biofabricate in an interview with Parley founder Cyrill Gutsch.

You can also make small, sustainable changes in your own life while pushing for big change. Audit the places you can reduce plastic in your life, whether they come from bioplastics or plastics made from fossil fuels. Bioplastics still take energy (and greenhouse gases) to make and transport, so reducing and reusing should be your first plan of attack, even with plastic alternatives. If you see a coffee shop that has switched to compostable cups, push them to have stronger messaging about how to dispose of their bioplastics.

04 - THE GREAT PLAN FOR A BETTER FUTURE

LESSON 08: WHY WE DO BEACH CLEANUPS

We prepared a class to find out if beach cleanups really help address marine pollution.

Objective of the class:

- Students will understand the effectiveness of ocean cleaning in addressing marine pollution and explore alternative solutions to mitigate the impact of plastic waste on marine ecosystems.

Materials:

- Printed copies of the article "Do Cleanups Work?" from Parley.
- Whiteboard and markers.
- Laptops or tablets for research.
- Art supplies for creative projects.
- Permission slips for excursions (optional).

Curriculum:

01 - Introduction (20 minutes)

- Start by discussing the topic of marine pollution and its impact on ocean ecosystems. Introduce the concept of ocean cleaning and its role in combating plastic waste in the oceans.

LESSON 08: WHY WE DO BEACH CLEANUPS

Continuation...

02 - Reading and Analysis (40 minutes)

- Instruct students to individually or in small groups read the article "Do Cleanups Work?" from Parley Air.
- Encourage students to take notes on key points, statistics, and arguments presented in the article.
- Facilitate a class discussion on the main findings of the article, focusing on the effectiveness of ocean cleaning and any potential limitations or challenges.

03 - Critical Thinking Activity (30 minutes)

- Divide the class into small groups and provide each group with a specific question related to the effectiveness of ocean cleaning, such as "What are the economic implications of large-scale ocean cleanups?" or "How do ocean currents affect the distribution of plastic waste?"
- Instruct each group to conduct additional research using laptops or tablets to support their answers to the assigned question. Have each group present their findings to the class, encouraging critical thinking and collaborative learning.

04 - Debate and Discussion (30 minutes)

- Organize a structured debate on the topic of ocean cleaning, where students take on roles as advocates for cleanups and proponents of alternative solutions, such as reducing plastic consumption or implementing stricter regulations.
- Encourage respectful dialogue and evidence-based arguments, allowing students to develop their oratory and persuasion skills.
- Facilitate a whole-class discussion after the debate, enabling students to reflect on different perspectives and consider possible compromises or integrated approaches.

05 - Creative Project (40 minutes)

- Assign students a creative project related to marine conservation, such as designing posters advocating for responsible plastic use, creating sculptures from recycled materials, or composing original songs or poems about ocean pollution.
- Provide art materials and inspiration resources, allowing students to express their understanding of environmental issues through artistic mediums.
- Display or perform the completed projects within the school community to raise awareness about marine conservation efforts.

06 - Conclusion and Reflection (20 minutes)

- Lead a final discussion on the lessons learned from exploring the effectiveness of ocean cleaning and alternative solutions to marine pollution.
- Encourage students to reflect on their own role in promoting sustainable practices and protecting marine ecosystems.
- Assign a reflective writing prompt as homework, asking students to consider how they can contribute to reducing plastic waste in their daily lives.

LESSON 08: WHY WE DO BEACH CLEANUPS

Continuation...

Assessment:

- Participation in debates and in-class activities.
- Quality of critical thinking responses during group work.
- Creativity and effort demonstrated in completing the creative project.
- Reflection on personal actions toward environmental conservation.

A TOOL TO HELP YOU ORGANIZE CLEANUPS...

Discover the Practical Guide for Beach Cleanups, another tool from PROMAR BlueBox where you will have instructions and recommendations on how to organize your own cleanup event.

ARTICLE 08: WHY WE DO BEACH CLEANUPS

Are coastal cleanups actually helping?

Parley for the Oceans team members and nearly 380,500 volunteers joined forces to organize 13,364 cleanups in 2022. It’s the largest group of volunteers we’ve ever had, bringing our total to over 1,042,514 participants.

This year, our cleanups collected plastic and other trash from beaches in 28 countries around the world, from Sri Lanka to Mexico. Since 2015, together with our collaborators we’ve collected over 7.2 million pounds of debris, including almost 5.5 million pounds of plastic, through cleanup action. Combined with the impact of our coastal community plastic interception programs, we've diverted 16.9 million pounds of debris away from marine environments.

That’s a lot of big numbers to wrap your head around, and still not enough to contend with the millions of tons of plastic that end up in our oceans every year. After every cleanup, the tide carries in more plastic, while more and more is produced from fossil fuels. So why do we do it? Is the effort worth it? In short, yes, it is.

Coastline cleanups are part of a bigger puzzle. Intercepting plastic before it enters the oceans in the first place, largely through rivers, and putting pressure on the companies that produce the most plastic to switch to non-plastic materials are at the core of stemming the stream of plastic flowing into our oceans. But we need all of the parts to solve the problem, and that includes removing the plastic that’s already made it into the seas.

Cleanups don’t require equipment or special skills, meaning it’s a realistic way everyone, from anywhere, can have an impact.

To wrap up 2022, we’ve put together this explainer to show the very real impact beach cleanups have on not only getting plastic trash out of our oceans, but safeguarding the fragile, irreplaceable marine ecosystems that plastic pollution directly harms, especially when it washes ashore.

When you take a look at how local ecosystems are directly impacted by marine plastic pollution, it becomes clear that every effort counts.

WHY COASTLINES?

Ninety-nine percent of the habitable space on this planet is in our oceans. Coastlines are what connect us land-dwellers to this vast, life-filled part of Earth. Coastlines aren't just easily accessible, research has shown they're also opportune places to intercept plastic pollution.

For years, models have guessed that most plastic that enters the oceans gets caught in large systems of ocean currents called gyres, which keeps this pollution in the deep seas. But a recent study by researchers at the University of Bern in Switzerland tipped that notion on its head. The scientists found that most plastic that enters our oceans doesn't stay in the open sea. In fact, they estimated that about 80% of floating marine plastic waste is swept no more than 10 kilometers, or about 6 miles, from a coast, even five years after it enters the seas.

A lot of plastic pollution also washes ashore, providing humans with an opportunity to capture it so it doesn't break down into microplastics or get washed back out to sea, where it either gets lost or requires specialized equipment and skills to retrieve.

Organized beach cleanups can also intercept plastic trash before it can enter the oceans in the first place. The most common sources of plastic debris found on beaches aren't fishing nets or nurdles, they're everyday items like cigarette butts, food wrappers, beverage bottles, straws, cups and plates, bottle caps and single-use bags.

LOCALIZED HELP FOR IMPACTED ECOSYSTEMS

One of the biggest ways beach cleanups help reverse the damage plastic pollution does is by cleaning it from the immediate marine ecosystems it chokes. Mangroves, coral reefs, animal feeding grounds and nesting areas are all damaged by plastic pollution, often to a point that renders them poisonous. Cleanups are a catalyst that communities can use to directly and positively impact their local wildlife and coastline.

💥 Update: In October 2023, a report from one of Norway's largest research organizations found that Intercepting plastic waste effectively prevents microplastics from forming. It may sound obvious, but cleaning up larger plastic items really works. Experts at NORCE Research found that within a year of volunteers removing bottles, bags and plastic from the coastline of an island near Bergen, the amount of microplastics on land and in the water fell by 99.5%. Gunhild Bodtker, senior researcher at Norce, told Sky News: "I was happily surprised because it means the cleanup has efficiently reduced the leakage of microplastic into the sea – and that is really good news. Clean up plastic on the shores, clean up all the plastic in the environment. It really makes a difference."

NESTING AREAS

In October of 2022, Parley Argentina lead Yago Lange led a cleanup that removed a dense accumulation of fishing gear from a seal nesting site. The location, a remote protected area on Patagonia's coastline, which is also a UNESCO World Heritage Site, was choked with plastic bins, buckets and fishing gear.

CORAL REEFS

Coral reefs are the most biologically diverse of all marine ecosystems. They support an estimated 25% of all marine life and 32 of the current 34 existing animal phyla in our oceans. These delicate ecosystems are also critically impacted by plastic pollution.

Coral reefs themselves ingest microplastics and starve to death, removing the foundation for all the life they support. Parley teams have been working to remove ghostnets in Panama and Mexico, especially from fragile coral reefs where they can sway back and forth, damaging the coral and entangling wildlife.
Parley Australia teams and volunteers have rallied to collect more than 100,000 kilograms (about 220,500 pounds) of trash from beaches in Cape York in Queensland, Australia. This stretch of coastline acts as a gateway to the Great Barrier Reef Marine Park, and every piece of plastic trash intercepted here directly protects the world's largest coral reef.

Because the beach is fragile, they do everything on foot, often walking as much as 20 kilometers (about 12.5 miles) a day to reach impacted beaches.

"We see turtles and dugong on our cleanup trips, sharks and rays, whales and dolphins. We find plastic containers with shark bites in them, " said Belinda Flanders, a member of the Parley Australia team.

Right now, her team is researching solutions to another problem: What to do with plastic debris once it's collected from coastlines. The bulk of the marine plastic pollution problem is in northern Australia, while the facilities that can recycle it are in the south.

"We can easily remove it from the beach but there is not yet one solution for Parley to effectively process the material locally," said Belinda. "It's not so much a struggle as a challenge. We care and think deeply about how the material will be used next."

MANGROVES & SEAGRASS BEDS

Plastic pollution creates a physical barrier that prevents mangroves and seagrass beds from growing, thriving, and ultimately being huge carbon sinks. It also starves the plants of oxygen. And while cleaning them up may seem like an insurmountable task, research has shown that the amount of plastic a mangrove traps is really important.

When it comes to natural filters, mangroves are particularly good at trapping debris like floating plastic pollution. But it comes at a cost.
Mangroves adapt to withstand some plastic pollution, which collects in the shrubs' extensive root systems. But too much of it kills both the coastal swamps and the crabs, molluscs and microbes that live there.

Limpieza del río Parley en Brasil

REMOTE & RUGGED SPACES

On islands in particular, marine pollution that washes onto coastlines can become a social justice issue. “In Hawai’i we’re all one ecosystem but there is a clear distinction between the on-shore and off-shore coastlines. This is the same for almost every island in the world,” said Kahi Pacarro, chief executive officer of Parley Hawai’i.

In Hawai’i, the beaches on the side of the islands with offshore winds — in which winds come from land rather than sea — are the places where resorts have set-up shop. That’s because the beaches are generally cleaner since the wind doesn’t blow in pollution from the oceans. The sides of islands exposed to on-shore winds are typically home to underserved populations of people or rugged expanses that are refuges to animals since they receive very little human traffic.

“It’s a rare situation where the winds switch and start bringing the debris to land on the off-shore side of the island,” said Kahi. This happened a couple of years ago in a tourist area. The winds shifted, washing plastic bottles, bags and fishing gear onto the famous Waikiki Beach.

“All of the sudden the government started to care and call us to deal with it because it was visible. But that same type of debris is washing up every day on the other side of the island,” said Kahi. Aside from being starkly divided in who on the islands is forced to see — and deal with — plastic pollution brought in from the oceans, Hawai’i is also the extinction capital of the world. One species, the monk seal, is especially prone to beach plastic.

“We only have 1,400 left. Every single one counts. They’re very curious so they play with the debris and removing pollution from the coastlines keeps monk seals from becoming entangled and dying,” said Kahi.

AN OPPORTUNITY FOR EDUCATION

Kahi remembers the first time a friend taught him about microplastic pollution. He had taken a couple friends from New Zealand to the beach he grew up surfing, Kailua Beach on Oahu’s southwestern shore.

“I was showing them how the beaches were clear of nets because the local community was proactive in cleaning it up,” Kahi remembered. “They said to me, ‘Kahi, Look at your feet.’”

Mixed in with the sand caving around his feet were confetti-size bits of colorful debris. They had been there before, but he hadn't yet learned to see them hidden in plain sight.

“That’s called microplastic and it’s the remnants of all the stuff we use,” one of his friends told him.

“I was dumbfounded. I had a decent education, I considered myself caught up-to-speed on current events, yet I was blind to one of the most obvious issues facing our planet and this message was being delivered to me on the beach I grew up on. I thought, if I’m blind to this, what does that mean for the rest of the population of Hawai’i?” said Kahi.

According to Kahi, seeing whole products, like plastic toothbrushes and bottles, are powerful visuals that prompt people to truly think about their own habits. “People think, ‘I brush my teeth with a plastic toothbrush and I just picked up 7 off this beach. What happens to mine when I throw it away?,’” he said.

Pushing legislation to stem the flow of plastic products into stores, inspiring new businesses that use better materials, and being the catalyst for change among existing producers have all been sparked through cleanups.

“Cleanups are extremely important. They are a gateway to a larger understanding of the issues surrounding plastic pollution, which leads to the larger discussion of unregulated capitalism,” said Kahi. “My own journey was being shown the issue firsthand by others on my local beach and I’ve watched thousands of others take that journey since I decided to help provide this opportunity.”

A CATALYST FOR SYSTEMIC CHANGE

Every action adds up, but to truly end plastic pollution, we have to turn off the faucet. “What the cleanup does, besides removing material from the beach that would otherwise go back into the oceans, is provide the opportunity to understand that the stuff we are finding is the collective result of our consumerism. The second step is OK, what do we do about it?,” said Kahi.

Before he joined the Parley team, Kahi led a data collection mission through beach cleanups that logged how many cigarette butts were littering Hawai’ian beaches. He had seen the issue firsthand, but when he brought it to the attention of legislators, they told him they couldn’t do anything without data. So Kahi collected it.

“With the data, we were then able to push through a local ban on smoking in city parks, which then extended to a statewide ban. It is now illegal to smoke in parks, beaches and at bus stops in Hawai’i, which is huge for us,” said Kahi, adding that although the bans aren’t perfect, his team has since collected data to see how they’re working. They’ve seen a drastic reduction in the number of cigarette butts on Hawai’ian beaches.

Beyond the benefits of removing immediate threats to sea life and marine habitats, data collection and education opportunities, cleanups also make an immeasurable difference as a tool for strengthening communities' responses to marine threats and fostering reconnection to nature. Spend an hour at a neighborhood cleanup or sifting through the sand at a local beach and you’ll understand. At every cleanup, we leave the beach better than we found it, but another shift happens internally. Join a cleanup and you’ll never see plastic the same way again.

LESSON 09: SOCIAL JUSTICE - EXPORTING THE PLASTIC CRISIS

We prepared a class to discover how the global recycling industry contaminates low-income communities.

Lesson Objective:

- To understand the intersection of social justice and environmental sustainability through the lens of recycling.
- To explore the impact of recycling on marginalized communities and global environmental issues.
- To develop critical thinking skills and empathy towards social justice causes.

Materials:

- Articles or videos related to social justice and recycling.
- Paper and pens.
- Recycling bins.
- Art materials (optional).

Curriculum:

01 - Introduction (10 minutes)

- Begin the lesson by discussing the concept of social justice and its relevance to environmental issues. Engage students in a brief discussion about the importance of recycling and its impact on communities.

LESSON 09: SOCIAL JUSTICE - EXPORTING THE PLASTIC CRISIS

02 - Understanding Social Justice and Recycling (20 minutes)

- Provide students with articles or videos highlighting the connection between social justice and recycling.
- Discuss key points from the materials and encourage students to ask questions and share their thoughts.

03 - Case Studies (30 minutes)

- Divide the class into small groups and provide them with case studies related to environmental injustice and recycling initiatives in different communities.
- Ask each group to analyze the case studies and identify how recycling practices can impact social justice issues.

04 - Guest Speaker or Panel Discussion (20 minutes)

- Invite a guest speaker or organize a panel discussion with experts in environmental justice or community recycling programs.
- Encourage students to ask questions and engage in meaningful dialogue about the real-world applications of social justice through recycling efforts.

05 - Reflection and Action Plan (20 minutes)

- Have students reflect on what they have learned throughout the lesson.
- Ask them to brainstorm ways to promote social justice through recycling in their own community. Foster creativity and critical thinking.

06 - Culminating Activity (30 minutes)

- Organize a hands-on activity, such as creating artwork from recycled materials or conducting a mini recycling campaign within the school.
- This activity will reinforce the importance of sustainable practices while raising awareness about social justice among students.

07 - Conclusion (10 minutes)

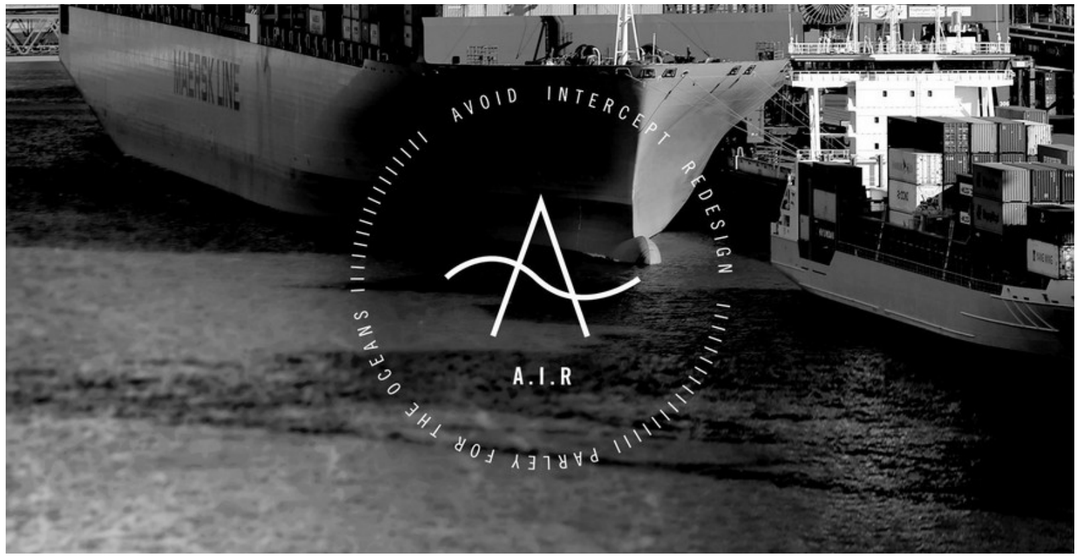
Conclude the lesson by summarizing key insights and encouraging students to continue exploring ways to advocate for social justice through sustainable actions like recycling.

08 - Homework Assignment

Assign the article titled 'Parley AIR Social Justice: Exporting the Plastic Crisis' from Parley and facilitate a discussion on the challenges and issues linked to social justice faced amid the growing plastic crisis.

ARTICLE 09: SOCIAL JUSTICE: EXPORTING THE PLASTIC CRISIS

The global recycling industry pollutes low-income communities. Here's how.



Most plastic isn't recycled in the first place — only about 9% of what's created — and the plastic yogurt cups, takeout containers, bottles and bags that are so-called recycled exacerbate a complex problem that's invisible to much of the world.

The global plastic waste trade ships plastic from mostly wealthy nations to mostly developing countries, passing the burden of plastic pollution. The trade disproportionately impacts women, people living in low-income countries, and People of Color.

It's also responsible for a ton of greenhouse gas emissions —the carbon emissions of the plastic waste shipped overseas from the U.S. alone is equivalent to the annual emissions of 26,000 cars. It is absolutely better to recycle plastic than to toss it in the trash — recycling a plastic bottle consumes 76 percent less energy than making it from scratch — but recycling can spark a false sense that single-use plastic is harmless as long as it's turned into something else.

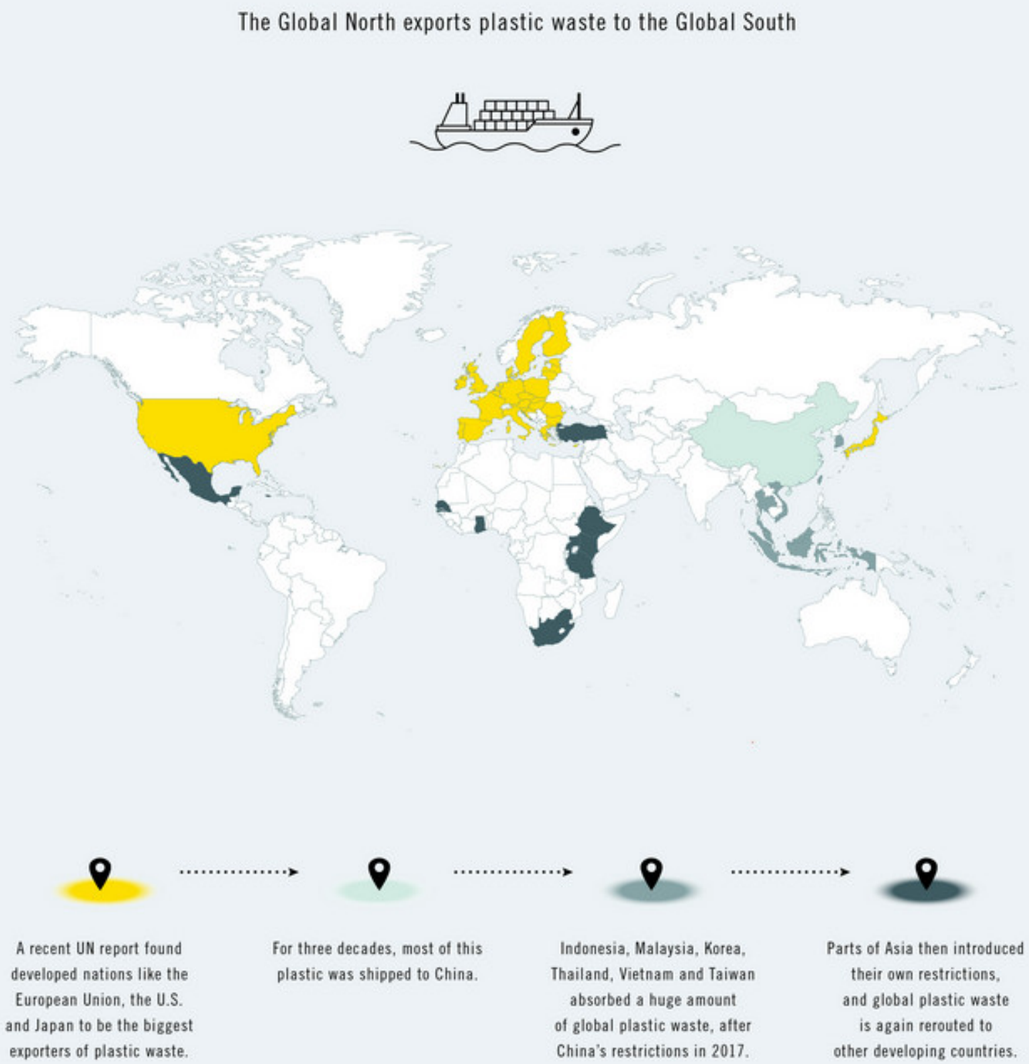
In part one of a three-part series on social justice and plastics, we're getting into the human toll of current recycling systems, and how the global waste trade disproportionately impacts marginalized people.

WHAT HAPPENS TO THE PLASTIC YOU RECYCLE?

When you do toss something into the recycling bin, you might think it goes to a nearby facility where it's melted and formed into a new bottle or takeout container. It usually isn't. Instead, recycled plastic typically makes a carbon-heavy trip across the globe to low-income countries that are tasked with sorting the often toxic mess. The contents of your recycling bin can travel as much as 8,000 miles before it reaches a recycling facility. That's because just a handful of countries are responsible for processing the lion's share of global plastic waste, and shifting policies are constantly changing to which countries plastic waste is being routed.

Estimates vary as to which countries are the biggest contributors to the plastic waste stream, but one thing does stay constant. High and upper middle income countries account for almost all plastic waste exports, and lower income countries bear the brunt of the plastic waste burden.

In 2020, a United Nations report found that 71% of plastic exports came from developed countries, the biggest contributors being the European Union (40% of the global total) — especially Germany — the U.S. (15%), and Japan (12%). At the same time, 75% of this plastic ended up in developing countries.



For three decades, most of this plastic was shipped to China, which is also the world's largest virgin plastic producer and exporter. But in 2017, China banned most plastic imports. The following year, Indonesia, Malaysia, Korea, Thailand, Vietnam and Taiwan introduced restrictions of their own. These countries had absorbed a huge amount of global plastic waste exports after China's restrictions. The loads flooded the countries with plastic waste, including toxic chemicals.

So the flow shifted again. Plastic garbage from wealthy nations, especially the U.S., rerouted to other developing countries. Mexico, Jamaica, Ghana, Uganda, Tanzania, South Africa, Ethiopia, Senegal, and Kenya took the brunt of it. In 2020, 40% of plastic waste from the U.K. was shipped to Turkey. Not all plastic is recycled equally – a lot of the plastic waste that makes it to these countries is the least-valuable and most difficult to recycle, meaning it often clogs rivers and makes its way to the coast, and never becomes a new plastic product at all.

While wealthy nations produce most of the world's plastic, low-income, marginalized countries are predominantly tasked with disposing of it.

A report published in 2021 documented the human toll this waste route has on people living in low-income countries. Although most countries now ban the importation of anything but the highest quality plastics, that doesn't stop wealthy nations like the U.S., the biggest plastic waste producer in the world, to ship their cheap waste to countries that haven't yet imposed restrictions.

As a result, plastic waste from high income countries contaminates water supplies, kills crops, causes respiratory illness from exposure to burning plastic, and fuels the rise of organized crime abound in areas that accept shipments of plastic waste. And once it arrives, the most socially marginalized people — many times women — are most affected.

Trabajadores de residuos en Chattogram, Bangladesh. Imagen de Mumtahina Tanni.

Women are more likely to work as informal waste collectors than in formal waste management and reports show that in informal waste management economies, highly recyclable, and therefore more valuable plastics, are typically reserved for men in countries throughout Africa, Latin America and Asia. If women do sell these types of plastics, they're often paid less for them than a man would get. So in the end, women are paid less for working in the same toxic environment as men.

CELEBRATING MARGINALIZED WASTE PICKERS

For now, the global waste trade is how wealthy nations deal with plastic. It isn't a solution, but it's still important to highlight the people at the end of the line who currently play a critical role in reducing plastic pollution around the world. In India, roughly 2.2 million people work as informal waste pickers. The work is typically done by people from marginalized groups and people in lower castes...

... The implications of informal waste management are complicated. The industry both creates jobs for women and exasperates gender inequality in the plastic industry.
During India's first pandemic lockdown, in 2020, informal waste workers were deemed non-essential. They weren't allowed to leave their homes to work. These people, largely women, were left with no work for four months and plastic waste piled up in landfills, rivers and coastlines. This made artist and activist Shilo Shiv Suleman, founder of Fearless Collective, think about how so-called disposable plastics permeate essentially every place on Earth.

> *"Very often in our environmental and social justice movements, we become so focused on one struggle that we don't see the interconnectedness of our issues," shilo told parley. "We started to see the intersections between disposable plastics, disposable lives, disposable incomes, and consumption and waste management, exposing a framework within which some lives are considered disposable and labour is not valued equally."*

In Delhi, waste pickers mostly belong to Dalit and Muslim minorities. And so, women waste pickers face intersectional discriminations along the lines of gender, caste, religion, and occupation. Through Fearless Collective, Shilo used art — in the form of a mural in Delhi — to highlight female waste pickers and the essential service they provide in preventing recyclables from ending up in landfills and oceans.

"Often when we talk about power, we talk about caste, class, gender, race but we don't talk about visibility. Those who are the most visible and whose stories are the most articulated are most often also the most powerful and those who are on the margins are often left behind," said Shilo.

Vertedero en el sur de Tangerang, Indonesia. Imagen de Tom Fisk.

WHAT CAN I DO?

Corporations are always at the base of the plastic crisis. In fact, 20 firms produce 55 percent of the world's single-use plastics. It's their products that create these problems in the first place. Put pressure on these companies to change their product — through social media campaigns, local legislation, or otherwise — and refuse to buy products made by known plastic polluters like Coca-Cola and PepsiCo.

You can also push the President of the United States — leader of the biggest plastic-polluting country in the world — to curb plastic production at the highest level and hold the companies that created the plastic crisis accountable. Sign the #PlasticFreePresidency petition and learn more about how we can all push for systemic change.

If you haven't yet, review our Plastic Free Guide for tips on how to reduce your plastic use and gather talking points to share with your community. The burden of responsibility shouldn't fall to the individual, but not using plastic in the first place is still one of the biggest impacts you can make as a single person. If you have to use single-use plastic, don't recycle low-grade plastics like takeout containers, those clamshells that berries come in, styrofoam or plastic to-go cups. These are cheap and often can't be recycled, so you end up shipping your garbage across the globe and making it someone else's problem.

TAKE ACTION

Read up, make noise, spread the word and give others the tools to do the same. Systemic change won't come unless we demand it.

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