

# THE TERRA THREAD

## THE PILOT

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## ABOUT THE THREAD

The Terra Thread is a student lead digital magazine, focusing on the application of IB taught science and math concepts to topics on a global scale : sustainability, environmental engineering, and pioneering research lie at the centre of our 'human written' articles. Our ethos is to present complex concepts in a simplistic format. We look to inform and inspire multiple minds of our own inclination in our community of International Schools in Bombay.

## THE THREAD TIES...

### BIOMIMICRY

HAVE YOU EVER WONDERED HOW NATURE BUILT A CIVILIZATION WITHOUT TOOLS AND TECHNOLOGY? IF YES, READ MORE ABOUT HOW NATURE HAS A BLUEPRINT READY FOR ITS INHABITANTS TO USE AND DEVELOP AS WELL AS HOW HUMANS CAN EXTRACT THIS UNTAPPED POTENTIAL FOR THE BENEFIT OF OUR CIVILIZATION.

### LOCKDOWN WASTELAND

THE WORLD STOOD STILL AS LOCKDOWNS SWEEPED ACROSS NATIONS, A COLLECTIVE PAUSE THAT RESHAPED OUR LIVES IN UNPRECEDENTED WAYS. WHILE THE IMPACT ON OUR DAILY ROUTINES AND ECONOMIES IS WELL-DOCUMENTED, A QUIETER CONSEQUENCE HAS BEEN STEADILY ACCUMULATING – THE SURGE IN WASTE GENERATION. THIS ARTICLE DELVES INTO THE SHADY REALM OF WASTE GENERATED DURING LOCKDOWN.

### BIOREMEDIATION

UTILISING MICROORGANISMS TO CARRY OUT THE INTRICATE PROCESSES OF DEGRADATION WE REQUIRE, BIOREMEDIATION HAS TREMENDOUS POTENTIAL FOR COMBATTING POLLUTION AND WASTE DISPOSAL PROBLEMS. READ ABOUT THE STRENGTHS AND LIMITATIONS OF THIS FIELD, AS WELL AS EXAMPLES OF ITS SUCCESS IN PRACTICE.

### OCEAN ACIDIFICATION

IN THIS ARTICLE, WE DELVE INTO THE PRESSING ISSUE OF OCEAN ACIDIFICATION AND ITS IMPACTS ON BOTH MARINE ECOSYSTEMS AND HUMAN COMMUNITIES. READERS WILL GAIN AN UNDERSTANDING OF THE ROOT CAUSES BEHIND THIS ENVIRONMENTAL CHALLENGE, INCLUDING THE ROLE OF INCREASED CARBON DIOXIDE EMISSIONS. MOREOVER, THE ARTICLE EXPLORES POTENTIAL SOLUTIONS AND MITIGATION STRATEGIES TO ADDRESS THE DETRIMENTAL EFFECTS OF OCEAN ACIDIFICATION AND SAFEGUARD OUR OCEANS AND HUMAN WELL-BEING FOR FUTURE GENERATIONS.

# NATURE'S BLUEPRINT: UNLOCKING INNOVATION THROUGH BIOMIMICRY

22 trillion seconds, 2.5 billion days, 84 million months, and 200,000 years – our journey as species can be quantified into just 14 words. Yet in this journey, we've spent countless eons innovating, exploring, creating, and developing to build an efficient and sustainable society. Have we achieved our goal? No. Have we learned from this experience? Yes. Has anyone done this before? Surprisingly, yes.

The nature we see around us – the flora and fauna, have been around for 4 billion years. Only 3.93 billion years before we ever stepped foot on the planet. After billions of years of research and development and trial and error, the failures of the process are fossils, and the successes are what you and I see outside our windows. What remains holds the secret to our survival.

As immature toddlers in the grand scheme of things, we must appreciate what nature has paved for us. That is exactly where biomimicry comes into action. Biomimicry, in essence, is the practice of learning from our surroundings, harvesting the knowledge provided, and efficiently utilizing it in human society. In fact, biomimicry is the blueprint that can be adapted across context, industries, and countries to be scalable to the needs of our people.

Logically, implementing a plan that has been under trials for 4 billion years and counting, with legitimate and concrete evidence of failed trials and successful stories has the potential to change the way we design our society. For example, we always associate termites to be the annoying and pesky insects that hog onto our furniture. However, the Eastgate building in Harare, Zimbabwe has an internal climate control system that is originally and completely inspired from termite mounds! In fact, further research is revealing more about the intricacies and innovation nature has been using before we even existed.

Despite this, you may ask yourself, "Why should we learn from nature?" The answer? Very simple.



- **Biomimicry is generous. Circularity, sustainability, regenerative design—it means that the things we humans make become a force for restoring air, water, and soil instead of degrading it. Nature uses structure to perform functions and passive forms of energy, whereas our inventions have typically used brute force, like mining ancient carbon and harmful chemicals. We can create conditions conducive to life, just like nature does. Everything we do must model how nature offers reciprocity and abundance for a diversity of life to flourish.**
- **Biomimicry brings relief. We're stressed. Our planet is stressed. Many are losing hope for solving the climate crisis and its many negative effects on ecosystems across the world. Biomimicry gives us hope, because we know the solutions are here, accessible, and validated by the many species contributing to their ecosystems today. By using nature as our mentor, we experience the powerful healing effects it has by connecting to the natural world—while also finding empowering relief to solve these challenges together.**
- **Biomimicry is sustainable. Our R&D cycles are slow, and climate change won't wait—we must look to the biological blueprints that have been successful over millennia to launch groundbreaking ideas, faster. We don't need to reinvent the strategies that are already here. We just need to learn how to adapt them. We believe the next generation wants to help solve these problems—they don't just want to protest. We can equip learners of all ages to see science as a vehicle for addressing access and equity, building literacy and mathematical skills, and for sense-making about their place in the world.**

**With the future of our world at stake, let us learn to leverage the power of communities and strive towards achieving a liveable, and more equitable habitat for us all. The goal is to create products, processes, and systems—new ways of living—that solve our greatest design challenges sustainably and in solidarity with all life on earth. We can use biomimicry to not only learn from nature's wisdom, but also heal ourselves—and this planet—in the process. After all, for all the challenges we face, nature has a solution.**

**Credit: <https://biomimicry.org/>**



# LOCKDOWN WASTELAND

OUR ESCAPE FROM THE COVID 19 PANDEMIC IN 2022 BROUGHT THE WORLD A MUCH NEEDED DAWN OF HOPE. BUSINESS BLOOMED, THE ECONOMY BOOMED AS CONSUMER SPENDING ROSE, BUT THIS WAS COUPLED WITH A SERIOUS ISSUE: WASTE MANAGEMENT OF KITS AND EQUIPMENT USED THROUGHOUT THE PANDEMIC.

WASTE MANAGEMENT REFERS TO VARIOUS PROCESSES REQUIRED TO DISPOSE OF OR RELOCATE WASTE MATERIAL SO AS TO MITIGATE ITS HARMFUL EFFECTS TO THE ENVIRONMENT IN THE SHORT AND LONG RUN. IT STANDS IN LINE WITH THE SDG OF RESPONSIBLE CONSUMPTION AND PRODUCTION. THE PRACTICE OF USE AND THROW, ALSO, HOLDS GREAT RELEVANCE TO THE MATTER, WHERE COMMODITIES ARE HOUSED A VERY LIMITED NUMBER OF TIMES AND THEN DISPOSED OFF. DUE TO THE CONTAGIOUS NATURE OF THE VIRUS, FREQUENT CONSUMPTION AND DISPOSAL OF CERTAIN ITEMS WERE DONE OUT OF SANITARY AND SAFETY PURPOSES.

BEFORE WE DIVE INTO THE MANAGEMENT SYSTEMS TAKEN ON BY THE WORLD POST COVID, LET US UNDERSTAND THE QUANTITY AND IMPLICATIONS OF THE WASTE GENERATED THROUGHOUT THE PANDEMIC. AS WHO RESEARCH SUGGESTS, "OVER 140 MILLION TEST KITS, WITH A POTENTIAL TO GENERATE 2,600 TONNES OF NON-INFECTIOUS WASTE (MAINLY PLASTIC) AND 731,000 LITERS OF CHEMICAL WASTE (EQUIVALENT TO ONE-THIRD OF AN OLYMPIC-SIZE SWIMMING POOL) HAVE BEEN SHIPPED, WHILE OVER 8 BILLION DOSES OF VACCINE HAVE BEEN ADMINISTERED GLOBALLY PRODUCING 144,000 TONNES OF ADDITIONAL WASTE IN THE FORM OF SYRINGES, NEEDLES, AND SAFETY BOXES."

THIS CLEARLY SHOWS THAT THE QUANTITY AND MATERIALS REQUIRE EFFICIENT AND IMMEDIATE DISPOSAL. THE WASTE MANAGEMENT PROTOCOLS VARIED DUE TO THE NOVEL NATURE OF THE PROBLEM, THE EQUIPMENT WERE FIRST TO BE SANITIZED AND TREATED AS HAZARDOUS WASTE AFTER COMING IN VERY LITTLE HUMAN CONTACT. WE SHALL DELVE INTO THE WASTE MANAGEMENT SYSTEMS DURING COVID, AND LATER DISCUSS THE NEW SOLUTIONS THAT BRED AFTER THE PANDEMIC.

THE MSW, MUNICIPAL SOLID WASTE, WAS ORIGINALLY MANAGED USING MORE TRADITIONAL METHODS.

- RECYCLING AND COMPOSTING: THE CLOSED OPERATION OF RECYCLING CENTERS AND COMPOSTING FACILITIES DURING THE PANDEMIC MAY HAVE AFFECTED RECYCLING EFFORTS AND THE DIVERSION OF ORGANIC WASTE FROM LANDFILLS. A NUMBER OF INFLUENCERS ENCOURAGED THE 'WORK FROM HOME' POPULUS TO START A COMPOSTING PIT IN THEIR OWN RIGHT.



- **LANDFILL MANAGEMENT: LARGER WASTE VOLUMES, INCLUDING MEDICAL WASTE, STRAINED LANDFILL CAPACITY. PROPER LANDFILL MANAGEMENT, INCLUDING COMPACTION, COVER, AND GAS CONTROL, WAS CRUCIAL TO MINIMIZE ENVIRONMENTAL RISKS. THE BREEDING OF VECTORS ON A LANDFILL CONTAINING WASTE LIKE THE ALUMINUM FOIL OF MEDICATION OR EVEN MASKS COULD DETRIMENTALLY IMPACT THE PUBLIC HEALTH OF THAT NATION.**

- **INCINERATION AND WASTE-TO-ENERGY: WASTE-TO-ENERGY FACILITIES OR INCINERATION PLANTS PLAYED A ROLE IN MANAGING THE INCREASED WASTE VOLUMES AND GENERATING ENERGY. THESE WERE CONVENIENT AS THEY REQUIRED NO SPACE, VERY LITTLE PROTOCOL, AND ENSURED THAT THE CONTAMINANTS IN THE WASTE WERE COMPLETELY NEUTRALIZED. HOWEVER, THIS ADDED TO THE CARBON FOOTPRINT AND WAS RULED INEFFICIENT.**

**A RESEARCH PAPER (AS IS CITED) STATED THE POSSIBLE USE OF MATH AND DATA SCIENCE TO CREATE A NETWORK THAT OPTIMIZED WASTE MANAGEMENT AND DISPOSAL (WITH RESPECT TO MONETARY, EFFICIENCY, AND TIME DEPENDENT FACTORS), INCORPORATING THE VARIABLES OF SOURCES OF THE WASTE, WORKERS, AND A MULTITUDE OF PROCESSES. IT USED COMPLEX MATHEMATICAL FUNCTIONS AS STRUCTURES FOR THE DATABASE.**

**ITS LINK IS PINNED BELOW.**

**IN ADDITION TO SUCH RESEARCH EMERGED MANY NEW TECHNIQUES OF WASTE DISPOSAL; THESE TECHNIQUES ADDED MODERN TECHNOLOGY TO THE MIX, INCREASING EFFICIENCY AND SAFETY IN THE PROCESSES OF WASTE DISPOSAL AND COLLECTION. SOME EXAMPLES ARE SHARED BELOW.**

#### **I. CONTACTLESS TECHNOLOGIES:**

- **TOUCHLESS WASTE COLLECTION: IMPLEMENTING CONTACTLESS WASTE COLLECTION METHODS, SUCH AS SENSOR-BASED BINS OR AUTOMATED WASTE COLLECTION SYSTEMS, REDUCES THE NEED FOR PHYSICAL CONTACT DURING WASTE DISPOSAL, MINIMIZING THE RISK OF VIRAL TRANSMISSION.**

- **DIGITAL WASTE MANAGEMENT SYSTEMS: UTILIZING MOBILE APPLICATIONS AND DIGITAL PLATFORMS FOR WASTE MANAGEMENT ALLOWS RESIDENTS TO SCHEDULE PICKUPS, REPORT ISSUES, AND ACCESS INFORMATION WITHOUT PHYSICAL INTERACTION.**



## **2. REMOTE MONITORING AND ANALYTICS:**

- IOT-ENABLED MONITORING: INTERNET OF THINGS (IOT) TECHNOLOGIES CAN BE USED TO MONITOR WASTE LEVELS IN BINS, OPTIMIZING COLLECTION ROUTES AND REDUCING UNNECESSARY TRIPS.**
- DATA ANALYTICS: ADVANCED DATA ANALYTICS CAN BE EMPLOYED TO ANALYZE WASTE GENERATION PATTERNS, OPTIMIZE WASTE MANAGEMENT OPERATIONS, AND MAKE DATA-DRIVEN DECISIONS TO IMPROVE EFFICIENCY.**

**WITH THIS SOME OTHER NOTABLE TECHNIQUES INCLUDE, SUSTAINABLE PACKAGING AND CIRCULAR ECONOMY WITH THE ETHOS OF REDUCTION, REUSAGE, AND RECYCLING; ROBOTIC ,AUTONOMOUS SORTING AND RECYCLING TECHNOLOGIES; AND DECENTRALIZED WASTE MANAGEMENT DATABASE.**

**IN CONCLUSION, IT MAY BE VIEWED THAT AS A WHOLE THE COVID PANDEMIC TAUGHT US A VERY IMPORTANT LESSON- THE CRITICAL NEED OF EVOLVING OUR WASTE MANAGEMENT SYSTEMS. THE WASTE DISPOSAL PRODUCTS OF THIS TIME HAVE BEEN NOTHING SHORT OF REVOLUTIONARY TO THE FIELD OF WASTE MANAGEMENT. I FIRMLY BELIEVE THAT THIS HAS PAVED A WAY FOR SUSTAINABLE DISPOSAL AND CONSUMPTION OF GOODS IN OUR FUTURE.**

**LINK OF THE RESEARCH PAPER -**

**[HTTPS://WWW.WHO.INT/NEWS/ITEM/01-02-2022-TONNES-OF-COVID-19-HEALTH-CARE-WASTE-EXPOSE-URGENT-NEED-TO-IMPROVE-WASTE-MANAGEMENT-SYSTEMS](https://www.who.int/news/item/01-02-2022-tonnes-of-covid-19-health-care-waste-expose-urgent-need-to-improve-waste-management-systems)**



# BIOREMEDIATION: A SOLUTION TO POLLUTION?

**BIOREMEDIATION: A SOLUTION TO POLLUTION?** IN A WORLD STRUGGLING WITH ENVIRONMENTAL CHALLENGES, MANAGING POLLUTION WITHIN SUSTAINABLE LIMITS HAS BECOME ONE OF OUR MOST PERTINENT PROBLEMS. POLLUTION FROM INDUSTRIAL ACTIVITIES, OIL SPILLS, AGRICULTURAL RUNOFF, AMONG OTHER HUMAN INTERVENTIONS HAS EXACERBATED THE ALREADY EXTENSIVE DAMAGE TO ECOSYSTEMS WORLDWIDE. CONVENTIONAL METHODS TO CONTROL POLLUTION OFTEN INVOLVE EXPENSIVE, POTENTIALLY DISRUPTIVE MEASURES. MEANWHILE, A PROMISING ALTERNATIVE SOLUTION HAS REVEALED ITSELF: BIOREMEDIATION.

DEFINED AS 'THE USE OF EITHER NATURALLY OCCURRING OR DELIBERATELY INTRODUCED MICROORGANISMS TO CONSUME AND BREAK DOWN ENVIRONMENTAL POLLUTANTS, IN ORDER TO CLEAN A POLLUTED SITE', BIOREMEDIATION RELIES ON LIVING ORGANISMS TO DEGRADE OR CONVERT POLLUTING SUBSTANCES. BY MAKING USE OF THE INHERENT CAPABILITIES OF MICROORGANISMS AND PLANTS, BIOREMEDIATION CAN TARGET VARIOUS POLLUTANTS, INCLUDING PESTICIDES, HYDROCARBONS, HEAVY METALS AND CHEMICAL FERTILISERS.

**SOME ADVANTAGES OF BIOREMEDIATION: ENVIRONMENTAL FRIENDLINESS:** GIVEN THAT BIOREMEDIATION IS FOUNDED ON THE USE OF MICROORGANISMS AND THEIR NATURAL BIOLOGICAL PATHWAYS AND SYSTEMS, THERE IS MINIMAL USE OF SYNTHETIC CHEMICALS, DECREASING THE POTENTIAL FOR FURTHER HARM TO ECOSYSTEMS.

**COST-EFFECTIVENESS:** WHEN COMPARED TO CONVENTIONAL METHODS OF POLLUTION CONTROL, BIOREMEDIATION OFFERS TO BE A MORE ECONOMICAL OPTION DUE TO THE LOWER INFRASTRUCTURE AND MAINTENANCE NEEDS, AS MICROORGANISMS CAN MULTIPLY EXPONENTIALLY WITHIN SHORT PERIODS OF TIME, EVEN IN THE POOREST OF CONDITIONS.

**FLEXIBILITY:** THIS APPROACH IS VERSATILE, ABLE TO CONFRONT A VERY WIDE RANGE OF CONTAMINANTS, GIVEN THE PRESENCE OF MYRIADS OF VARIETIES OF MICROORGANISMS, MAKING IT APPLICABLE IN DIVERSE SCENARIOS.

**LONG-TERM SUSTAINABILITY:** BIOREMEDIATION NOT ONLY ERADICATES POLLUTANTS BUT ALSO RESTORES THE THREATENED ECOLOGICAL BALANCE, FOSTERING SUSTAINABLE AND RESILIENT ECOSYSTEMS, IN CONTRAST TO OTHER METHODS WHICH MAY BE DISRUPTIVE.

**COMMUNITY ACCEPTANCE:** DUE TO ITS NON-INVASIVE NATURE AND POTENTIAL TO RESTORE HABITATS WITHOUT CAUSING ADDITIONAL DISRUPTION, BIOREMEDIATION IS AN OPTION THAT IS LIKELY TO BE MORE ACCEPTABLE.



**DISADVANTAGES AND LIMITATIONS: WHILE BIOREMEDIATION PRESENTS NUMEROUS ADVANTAGES, THERE ARE INHERENT LIMITATIONS: TIME CONSIDERATIONS: SINCE BIOREMEDIATION RELIES ON INTRICATE PROCESSES TAKING PLACE WITHIN MICROBES, WE COULD BE UNABLE TO CONTROL EVERY VARIABLE, AND SO IT COULD POSE A PROBLEM WHEN DETERMINING HOW MUCH TIME REMEDIATION WOULD REQUIRE. SITE-SPECIFIC FACTORS: SUCCESS OF REMEDIATION CAN BE INFLUENCED BY FACTORS SUCH AS SOIL COMPOSITION, TEMPERATURE, AVAILABILITY OF NUTRIENTS, PH AND RELATIVE CONCENTRATIONS, WHICH MAY BE PRONE TO FLUCTUATIONS. THIS IS DUE TO THE FACT THAT BREAKDOWN BY MICROORGANISMS OFTEN RELY ON ENZYME-CATALYSED REACTIONS, WHICH ONLY TAKE PLACE UNDER CERTAIN OPTIMAL CONDITIONS. POTENTIAL RISKS: IN SOME CASES, THE BREAKDOWN OF POLLUTANTS DURING BIOREMEDIATION CAN LEAD TO THE PRODUCTION OF HARMFUL BYPRODUCTS OR THE RELEASE OF OTHER CONTAMINANTS, WHICH DEFEATS THE PURPOSE OF REMEDIATION. SOME REAL-LIFE EXAMPLES OF BIOREMEDIATION: IN RESPONSE TO THE EXXON VALDEZ OIL SPILL IN ALASKA IN 1989, BIOREMEDIATION TECHNIQUES INVOLVING NUTRIENTS AND MICROBIAL AGENTS WERE EMPLOYED TO DEGRADE THE OIL AND RESTORE THE AFFECTED ECOSYSTEMS.**

**IN THE AMAZON RAINFOREST, OYSTER MUSHROOMS HAVE SHOWN CONSIDERABLE POTENTIAL IN MYCOREMEDIATION (USE OF MYCELIUM, OR FUNGAL NETWORKS, FOR REMEDIATION), EFFECTIVELY TREATING PETROLEUM-CONTAMINATED SOIL. PHYTOREMEDIATION, ANOTHER BIOREMEDIATION APPROACH, UTILISES PLANTS SUCH AS SUNFLOWERS, AND POPLARS TO ABSORB HEAVY METALS AND POLLUTANTS FROM SOIL AND GROUNDWATER, SUCCESSFULLY DETOXIFYING THE ENVIRONMENT. MOREOVER, MICROORGANISMS ARE ESSENTIAL TO THE TREATMENT OF SEWAGE, BREAKING DOWN ORGANIC WASTE AND REDUCING WATER POLLUTION. FURTHERMORE, IN COAL MINING REGIONS, PLANTS AND FUNGI ARE USED IN COAL MINE RECLAMATION EFFORTS TO RESTORE DEGRADED LANDSCAPES, CONTRIBUTING TO THE REGENERATION OF BIODIVERSITY. THESE ARE JUST SOME OF MANY EXAMPLES.. IN CONCLUSION, BIOREMEDIATION IS A GREAT PROSPECT FOR ENVIRONMENTAL RESTORATION, ADDRESSING THE URGENT NEED FOR SUSTAINABLE POLLUTION MITIGATION. BY CAPITALISING ON THE INTRINSIC CAPACITIES OF LIVING ORGANISMS, THIS APPROACH DEMONSTRATES NUMEROUS ADVANTAGES, ESPECIALLY ITS COST-EFFECTIVE NATURE AND POSSIBILITY FOR WIDESPREAD APPLICATION. HOWEVER, DUE TO THE PRESENCE OF EVIDENT CHALLENGES AND LIMITATIONS, CAREFUL CONSIDERATION IS REQUIRED FROM OUR SIDE IF WE ARE TO USE THIS METHOD ON A LARGE-SCALE. NONETHELESS, THERE IS CERTAINLY GREAT POTENTIAL FOR BIOREMEDIATION IN REHABILITATING POLLUTED SITES AND PRESERVING OUR DELICATE ECOSYSTEMS. AS RESEARCH AND TECHNOLOGY CONTINUE TO ADVANCE, BIOREMEDIATION HOLDS THE KEY TO A FUTURE WHERE WE CAN FINALLY DEAL WITH POLLUTION EFFECTIVELY.**



# OCEAN ACIDIFICATION: A RACE AGAINST TIME TO SAVE OUR SEAS

OCEANS MAKE UP OVER 70% OF THE SURFACE OF THE PLANET, AND THEY ARE CRUCIAL TO PRESERVING THE NATURAL BALANCE OF THE PLANET. A GROWING ISSUE, OCEAN ACIDIFICATION THREATENS MARINE LIFE AND THE FRAGILE EQUILIBRIUM OF MARINE ECOSYSTEMS. THE ISSUE OF OCEAN ACIDIFICATION IS EXAMINED IN THIS ARTICLE, ALONG WITH ITS ROOT CAUSES AND VARIOUS REMEDIES THAT COULD LESSEN ITS DEVASTATING CONSEQUENCES.

OCEAN ACIDIFICATION REFERS TO HOW SEAWATER'S PH LEVEL CONTINUALLY DECREASES DUE TO EXCESSIVE ABSORPTION OF CARBON DIOXIDE (CO<sub>2</sub>) FROM OUR ATMOSPHERE. AS CARBON DIOXIDE DISSOLVES WITHIN SEAWATER MOLECULES FORM CARBONIC ACID; SUBSEQUENTLY LOWERING BOTH PH LEVELS AND OVERALL MARINE ACIDITY. ATMOSPHERIC CARBON DIOXIDE CONCENTRATION HAS SKYROCKETED; PRIMARILY DUE TO FOSSIL FUEL CONSUMPTION. THE OCEAN CONSEQUENTLY ABSORBS MORE CARBON DIOXIDE—A PROCESS THAT ACCELERATES OCEAN ACIDIFICATION.

OCEAN ACIDIFICATION HAS PROFOUND CONSEQUENCES AND SERIOUSLY ENDANGERS MARINE LIFE. THE ACIDIC ENVIRONMENT CAUSES MARINE LIFE SUCH AS SHELLFISH AND PLANKTONIC SPECIES TO FACE ISSUES IN GROWTH, DEVELOPMENT AND REPRODUCTION. THE "RAINFORESTS OF THE SEA," OR CORAL REEFS, ARE PARTICULARLY FRAGILE. CORAL BLEACHING AND ULTIMATELY THE EXTINCTION OF ENTIRE REEF ECOSYSTEMS RESULT FROM THE CORAL POLYPS' INABILITY TO FORM THEIR CALCIUM CARBONATE SKELETONS DUE TO THE RISING ACIDITY. ADDITIONALLY, IN ACIDIC ENVIRONMENTS, SHELL-FORMING CREATURES LIKE OYSTERS, CLAMS, AND KRILL HAVE DIFFICULTY DEVELOPING AND MAINTAINING THEIR PROTECTIVE SHELLS. THE FOOD CHAIN IS THROWN OFF, WHICH HAS AN IMPACT ON LARGER MARINE ANIMALS LIKE FISH AND MARINE MAMMALS WHO DEPEND ON THESE ORGANISMS FOR FOOD. OCEAN ACIDIFICATION ALSO LEADS TO ECONOMIC LOSSES WITH JOB INSECURITY AS THE ACIDIC CONDITIONS DAMAGE MARINE ECOSYSTEMS WHICH THEN AFFECTS THE AQUACULTURE AND FISHING INDUSTRIES, CAUSING PEOPLE IN COASTAL POPULATIONS TO FACE PROBLEMS. OCEAN ACIDIFICATION ALSO CAUSES THE LOSS OF CORAL REEFS WHICH THEN NEGATIVELY AFFECTS TOURISM AND IMPACTS THE LOCAL ECONOMY. THESE CONSEQUENCES OFFER A HARSH ILLUSTRATION OF HOW HUMAN WELL-BEING AND THE HEALTH OF OUR OCEANS ARE INTERDEPENDENT.



**A FEW SOLUTIONS TO SOLVE THE PROBLEM OF OCEAN ACIDIFICATION INCLUDE:**

**1) REDUCING CARBON EMISSIONS:**

**CONTROLLING CARBON DIOXIDE EMISSIONS IS THE PRIMARY FOCUS FOR COMBATING OCEAN ACIDIFICATION. THE USAGE OF ALTERNATE SOURCES OF ENERGY LIKE SOLAR OR WIND POWER CAN PREVENT EXCESS EMISSIONS OF CARBON DIOXIDE WHICH CAN DRAMATICALLY ALTER THE RATE AT WHICH OCEAN ACIDIFICATION IS TAKING PLACE WHILE HELPING MARINE LIFE. THE IMPLEMENTATION OF INTERNATIONAL AGREEMENTS LIKE THE PARIS AGREEMENT AND PROMOTION OF SUSTAINABLE PRACTICES ACROSS VARIOUS BUSINESSES WOULD ALSO HELP US ACHIEVE THIS GOAL.**

**2) CARBON CAPTURE AND STORAGE (CCS):**

**ONE POTENTIAL METHOD TO REDUCE OCEAN ACIDIFICATION IS THROUGH THE USE OF CARBON CAPTURE AND STORAGE (CCS). BY CAPTURING AND STORING CARBON DIOXIDE (CO<sub>2</sub>) EMISSIONS FROM VARIOUS SOURCES CCS CAN EFFECTIVELY SLOW DOWN THE PROCESS OF OCEAN ACIDIFICATION. THIS IS ACHIEVED BY STORING CARBON DIOXIDE IN UNDERGROUND GEOLOGICAL FORMATIONS, PREVENTING ITS ABSORPTION BY THE OCEANS AND MAINTAINING A STABLE PH LEVEL. ALTHOUGH STILL IN DEVELOPMENT, CCS WHEN COMBINED WITH RENEWABLE ENERGY AND ECOLOGICAL PRACTICES OFFERS A COMPREHENSIVE STRATEGY TO COUNTERACT OCEAN ACIDIFICATION. HOWEVER IT IS IMPORTANT TO ALSO PRIORITISE EFFORTS IN REDUCING CARBON EMISSIONS AS THEY REMAIN THE MAIN CAUSE OF THIS ISSUE.**

**3) ENHANCED COASTAL MANAGEMENT:**

**IMPROVED COASTAL MANAGEMENT CAN BE EXTREMELY HELPFUL IN THE FIGHT AGAINST OCEAN ACIDIFICATION BY SAFEGUARDING AND FREQUENTLY SANITISING COASTAL ECOSYSTEMS LIKE MANGROVES AND SEAGRASSES. THESE ECOSYSTEMS STORE CARBON DIOXIDE, ACTING AS A NATURAL BARRIER TO SEAWATER'S ABILITY TO ABSORB IT. THE IMPACTS OF OCEAN ACIDIFICATION CAN BE SIGNIFICANTLY REDUCED BY PARTICIPATING IN ECOSYSTEM CLEANUP.**

**IN BRIEF, THE GRAVE ISSUE OF OCEAN ACIDIFICATION IS CAUSING AN ADVERSE IMPACT ON ECOSYSTEMS GLOBALLY, WITH WORRISOME ESCALATION RATES. ACTION MUST BE TAKEN IMMEDIATELY TO MITIGATE ITS NEGATIVE IMPACT ON NOT JUST HUMANS BUT ALSO ON MARINE LIFE. WE CAN TACKLE THIS ISSUE BY CUTTING CARBON EMISSIONS, FUNDING CARBON CAPTURE TECHNOLOGY AND PRESERVING COASTAL HABITATS, BUT ONLY WITH YOUR ASSISTANCE.**



# **MEET THE TEAM!**

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