

CORAL RESTORATION



Coral Restoration
Forest Restoration
Mangrove Restoration

Myanmar Stoves Campaign
Hornbill Reintroduction
Action Against Hunger
Soneva Namoon

EDITION 8



The Maldives, an enchanting island nation, boasts captivating underwater beauty. Corals, essential to ocean biodiversity, host 25% of sea life on the reef.

The Soneva Foundation Coral Restoration Programme aims to restore precious coral reef systems, establishing a thriving coral hub in the Maldives.

To execute this vision, the Soneva Foundation established a new Maldivian NGO known as Soneva Conservation. Operating from the AquaTerra science centre at Soneva Fushi, Soneva Conservation oversees the largest coral farm in the Indian Ocean, equipped with both in-situ and ex-situ capabilities.

Commencing with a one-hectare coral nursery, one of the world's largest utilising Mineral Accretion Technology (MAT) at the outer edge of the house reef, our efforts expanded to include the Maldives' first Coral Spawning and Rearing

Lab at AquaTerra. This lab replicates the reef's natural environment, enabling coral spawning. To complement our in-situ lab, we introduced 30 micro-fragmenting tanks, a technique involving breaking healthy coral colonies into tiny pieces, nurturing the fragments and then transplanting them onto damaged reefs.

Based on these initiatives, we expect to produce approximately 150,000 coral fragments each year.

2,630

coral micro-fragments growing

12,500

coral colonies outplanted

30,590

coral colonies rescued

150,000

coral fragments per year





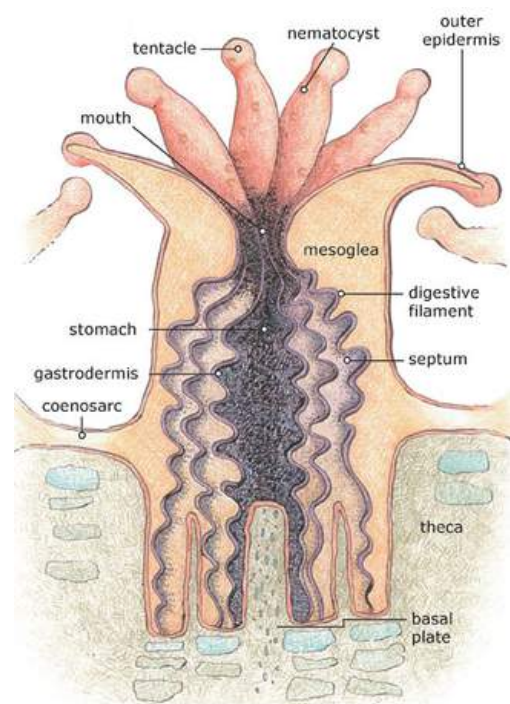
What are corals?

Corals are animals living in a symbiosis with algae, while producing limestone.

A coral colony, as we can observe in the ocean, is composed of numerous individuals, all living and growing in a connected manner. One individual is referred to as a coral polyp, looking like a cylinder surrounded by tentacles, which is usually not visible except during feeding time. The tentacles are used as a defence mechanism and to gather food.

Even though coral polyps eat with the help of their tentacles, their main energetic income is generated by the sun, through photosynthesis of the algae living in symbiosis with them. This type of algae is called *zooxanthellae* and is in the outer cells of the coral. The nutrients generated by photosynthesis support coral metabolism, growth and therefore survival. In return, corals protect the algae and support it with other nutrients generated from respiration.

Although some species live in cold and dark waters, corals are mostly found in the warm tropical seas, preferably in temperatures between 23°C and 30°C.



Credit: Wikipedia

Why are coral reefs important?



Coral reefs, the world's most biodiverse marine ecosystem, hosting over 25% of marine life.



Coral reefs contribute significantly to humanity, providing food security, income for tourism and shoreline protection.



Approximately half a billion people globally rely directly on coral reefs for their food and livelihood.



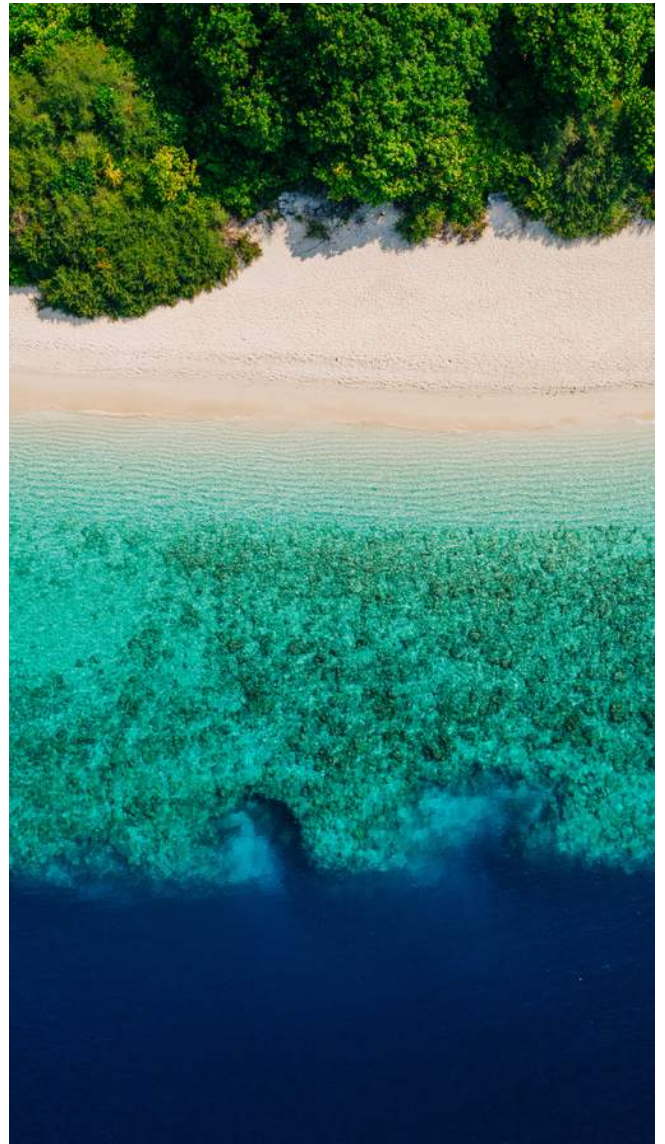
Coral reefs act as efficient wave reduction systems, protecting shorelines from erosion and reducing storm impacts.



Coral reef tourism, as in the Maldives, generates an estimated US\$10 billion globally each year.



Coral research also contributes to medical treatments, including cancer and HIV research.



Why coral restoration?

Conservation and restoration efforts seek to protect coral reefs and expedite their healing process. These help reduce threats, allowing corals to adapt and become more resilient. Adaptive breeding programmes also support faster coral evolution, helping them cope with ever-changing ocean temperatures.

The Soneva Foundation Coral Restoration Programme aims to restore precious coral reef systems and create a thriving coral hub for the Maldives. The coral reef in the Maldives has been damaged by earlier severe weather events like heat waves, leading corals to bleach and die.

To help reefs recover, the Soneva Foundation strives to create a large diversity of resilient corals, that are healthy enough to reproduce in the wild and continue to grow

around the reefs and sustain a healthy functional ecosystem for the Maldives as our climate changes.

The Soneva Foundation aims to foster a thriving ecosystem for generations to come, benefitting not only the reefs but also the marine life they support.



Our aim is to restore healthy coral reef systems



Coral restoration methods

The Soneva Foundation Coral Restoration Programme employs various methods to restore coral reefs including the Mineral Accretion Technology nursery, coral spawning and rearing lab and micro-fragmentation tanks.

Ahmad ‘Aki’ Allahgholi first got involved with the programme by setting up the MAT nursery through his Coralive organisation. He has since joined Soneva as the Guardian of Ecosystems to lead a team of six permanent hosts and four interns.

“Our proudest moment is the expansion of operations. We started with having an in-situ nursery – the largest one in the Maldives and Indian Ocean – as our only form of coral restoration. Now we have an ex-situ coral spawning lab and micro-fragmenting lab, 3D printing of substrate to recruit more coral naturally and transplant our micro-fragments and baby corals to the reef and rope nurseries. We also have monitored rehabilitation sites around the house reef as well as the development of a facility that allows us to house more coral babies to grow and create resilient species for our future reefs,” says Aki.

The team has also developed living breakwaters to reduce beach erosion and created another sanctuary for corals to grow and fish to live in.

“As it stands, we have the capacity to grow over 200,000 corals in our ex-situ laboratories. This is the optimal goal, and we will strive for this. However, it must be said that, as we are developing our methodology and learning about the coral growth, reproduction and recruitment rates around the Maldives, this will most likely fluctuate each year,” says Aki.



Coral Spawning and Rearing Lab



Micro-fragmenting tanks

In the following pages, we will explain in greater detail the various coral restoration methods used by the Soneva Foundation.

MICRO-FRAGMENTATION Revolutionising Coral Restoration



Micro-fragmentation, a groundbreaking method, involves delicately breaking healthy coral colonies into minuscule pieces, nurturing them in controlled micro-fragmenting tanks until they flourish, and subsequently transplanting them onto damaged reefs. This innovative approach not only accelerates coral growth but also augments genetic diversity, creating a protective environment crucial for successful coral restoration.



The originator of this technique is Dr David Vaughan, the visionary behind the Plant a Million Corals Foundation.

"By chance, I inadvertently fragmented a three-year-old massive coral produced through sexual reproduction. To my amazement, the micro-fragments exhibited accelerated growth, and they could be seamlessly fused back together to form a substantial colony that would otherwise have taken many years to develop," reveals Dr Vaughan.

Game-changer

The development of this technique involved the use of a specialised saw, initially designed for crafting coral jewellery from fossils or coral skeletal rock. Live corals are meticulously cut into one-centimetre fragments. These micro-fragments exhibit remarkably faster growth, facilitated by a swift 'wound healing' response, making rapid coral culture a feasible reality.

Aside from the impressive growth rates – up to 20 times for certain species – micro-fragmentation demonstrates adaptability to both massive and branching corals. The technique allows identical clones to reunite and generate larger colonies in considerably shorter timeframes, presenting opportunities for increased quantities and more substantial colonies.

"It is undeniably a game-changer for coral restoration," adds Dr Vaughan.

30 micro-fragmenting tanks

Through his Plant a Million Corals Foundation, Dr David Vaughan is actively involved in designing, constructing and supplying micro-fragmenting labs for coral restoration projects. The integration of a land nursery, employing this technique alongside the traditional field nursery, represents a synergistic combination. This dual approach significantly enhances both the quantity and size of the reef. In October 2023, Dr Vaughan installed 30 micro-fragmenting tanks at Soneva Fushi and provided comprehensive training to the coral restoration team.



Micro-fragments on plugs ready to grow in tanks



Dr David Vaughan pioneered the micro-fragmenting technique

"This seamlessly complements Soneva Foundation's existing efforts in advancing field nursery production at scale. The addition of micro-fragmentation offers the potential to double production numbers, introducing more species and facilitating the planting of larger corals. Combined with sexual reproduction on land and the settlement of new offspring for genetic diversity, the Soneva Foundation has established a comprehensive and sustainable programme for coral restoration on the island, serving as a model for expansion throughout the Maldives and globally," notes Dr Vaughan.

Make a difference

Expressing optimism, he anticipates that initiatives like the Soneva Foundation's Coral Restoration Programme will make a substantial difference for reefs worldwide.

"We must collectively recognise that our actions as a planet impact our oceans and natural resources, particularly coral reefs. While these new technologies enable us to restore reefs using coral strains resilient to current conditions, and do so at an accelerated pace, we must also address the root causes of climate change and other stressors to facilitate the recovery of reefs. I remain hopeful," affirms Dr Vaughan.

CORAL SPAWNING & REARING Facilitating Coral Reproduction



With over 40 years of research, it is established that seasonal temperature changes, sunlight and lunar cycles intricately influence coral reproduction in the wild. The Coral Spawning and Rearing Lab replicates on land the environmental conditions necessary for coral spawning, meticulously controlling parameters such as light, temperature, tides and more. This enables corals to spawn more frequently and at predetermined times.

Dr Jamie Craggs, immersed in reef restoration and coral reproductive research since 2010, recalls his fascination during a field training programme in Singapore's annual mass spawning event. "Witnessing this natural wonder captivated me and led me to focus all my research interests on coral reproduction," he shares.

Upon returning to the UK, Dr Craggs laid the foundations for the world's first planned reproduction of broadcast spawning corals

in aquarium environments. Following the success of triggering the first predictable coral spawning in an aquarium, Professor Mike Sweet encouraged Dr Craggs to document the methods for his PhD and explore their potential for reef restoration.

In 2017, a landmark paper detailing the coral spawning system design and husbandry method was published. This open access paper garnered numerous inquiries from researchers globally, prompting the formation of the Coral Spawning Lab in late 2019, capable of delivering prefabricated labs.

Maldives' first lab

Dr Craggs and his team have distributed over 60 spawning and rearing systems worldwide. The Soneva Foundation lab, installed in AquaTerra at Soneva Fushi in 2023, marked the Maldives' first lab of its kind. Plans for the addition of V-shaped raceways in early 2024 are underway to complement the system.

"The Phase Two expansion at Soneva Fushi will be the largest capacity project to date. Once complete, the systems will be capable of holding over 60,000 corals at any moment in time. With the newfound knowledge of staggered natural spawning in the Maldives, and the ability to work with multiple spawns throughout the year, these facilities will outpace any other in the Indian Ocean, potentially even globally," asserts Dr Craggs.

Manipulate the corals to spawn

The Soneva Coral Team achieved success by collecting sufficient coral eggs during the November full-moon cycle. Going forward, the team will no longer need to spend nights in the ocean collecting coral eggs and sperm.

"A significant benefit is that we can manipulate the corals to spawn at different times. Rather than working in the field all night, which is costly, tiring and potentially dangerous in rough sea conditions, we can phase-shift the spawning to occur during the day. We can now also manipulate corals to spawn out of season, providing more access to eggs and sperm throughout the year, further increasing production potential," explains Dr Craggs.



Early in 2024, V-shaped raceways will be incorporated, drawing inspiration from nature's meandering rivers. This design ensures water moves efficiently, with the V-shape allowing corals to grow at a 45-degree angle, preventing sediment from settling and enhancing survival rates during the corals' early growth phase.

Impressed with the Soneva Foundation Coral Restoration Programme, Dr Craggs commends the facilities at Soneva Fushi, providing a significant platform for coral production at an unmatched scale. He acknowledges the Foundation's ambition to be a leading example in reef restoration, driven by Sonu and the senior team's understanding of the reefs' intrinsic value surrounding the island and the Maldives as a whole.

Despite global threats to coral reefs, Dr Craggs remains hopeful, considering himself an eternal optimist. He emphasises the dedication of organisations and individuals applying cutting-edge research to secure a future for reefs and says: "Soneva Foundation's ambition embodies all of this, and that fills me with a good deal of hope."

MINERAL ACCRETION TECHNOLOGY

Electrifying Coral Growth

Mineral Accretion Technology (MAT) harnesses low-voltage electricity to enhance the health and growth rates of corals and other calcifying marine organisms.

As electrons flow from an anode to the coral metal structures submerged underwater, calcium carbonate (CaCO_3 or limestone), the primary building material for most hard and some soft corals, accumulates on these structures. This process facilitates the attachment and rapid growth of coral fragments, while a slight increase in the pH level creates an ideal environment for coral propagation.

The Soneva Foundation initiated its journey with a one-hectare coral nursery, boasting 432 table structures – one of the world's largest applications of Mineral Accretion Technology (MAT). Strategically positioned at the outer edge of the Soneva Fushi house reef, this pioneering venture aims to amplify coral growth and restoration.

The MAT nursery has been meticulously populated with 50,000 coral fragments

sourced from colonies rescued from development sites. Upon their transplantation, the nursery is replenished with additional coral fragments from the coral spawning lab and micro-fragmentation lab.

"As soon as these corals reach a fragment size of approximately 7cm, they will be transferred to the MAT nursery. This transition not only allows them to adapt to the different conditions in situ – varying pH and oxygen levels, potential turbidity, and pollution – but also promotes rapid growth into robust colonies before being finally transplanted onto the natural reef," explains Aki.

The parallel operations of different labs contribute to the creation of a substantial number of individual corals. These corals are then transferred to the MAT nursery, where they undergo adaptation and fortification before being directly transplanted onto the natural reef. This intricate process ensures the optimal development and resilience of the coral colonies, fostering a thriving marine ecosystem.



Since February 2022, the Soneva Conservation coral team has relocated 31,000 coral colonies and fragments from areas around the Maldives under threat due to ongoing development.

To rescue the coral, the team uses a hammer and chisel to cut into the rock around the colony, ensuring they do not cut or break off live coral. The corals are then placed into a container of seawater and transported from the development site to Soneva Fushi, where the team dives them down and places them either into the large MAT coral nursery or plants them directly onto the reef using cement.

From the rescued coral colonies, the team filled up the MAT nursery with 50,000 coral fragments and outplanted 12,500 coral colonies and 30,000 coral fragments to rehabilitation sites around the Soneva Fushi house reef. Together, this equals about 200,000 coral fragments.

The team continues to monitor their health and progress over the seasons to develop a database that optimises coral restoration to species and the local environment. Their focus is to optimise and sustain each restoration method with an +85% success rate in coral propagation and growth, using sound scientific methodology to help restore coral reefs and create a database that will make the coral programme world-renowned.



ONE BILLION CORAL FRAGMENTS



Addressing the global challenge of coral degradation requires a concerted effort, with various tasks operating in tandem to steer us in the right direction. Therefore, the Soneva Foundation Coral Restoration Programme, even on a large scale, stands as just one element within a multifaceted strategy essential for effective environmental restoration.

"The Australian Institute of Marine Science (AIMS) has determined that, to restore our coral reefs to their state 20 years ago, the annual outplanting of one billion coral fragments is necessary," states Aki.

In line with this goal, a coordinated global effort involving 6,000 to 7,000 coral restoration projects, similar to the Soneva Foundation's undertaking, is imperative. The scalability of the two labs with tanks and the MAT nursery is evident, yet the primary challenge lies in securing an ample number of

marine biologists and environmental specialists to oversee these projects. The annual outplanting of 150,000 coral fragments per project demands a substantial workforce and well-prepared logistics.

The associated costs of such an ambitious undertaking naturally come into question.

"The capital expenses would amount to around US\$ 5 billion, with annual operating expenses reaching approximately US\$ 1.5 billion," explains Aki.





Press play to watch our video



Brenda Ricardo Noé Madeba

Deforestation is responsible for around 11 percent of global carbon emissions. Restoring forests is an important solution to reversing climate change and improving biodiversity.

The Soneva Foundation started forest restoration in Thailand in 2011 and has since expanded to Mozambique, Nepal and the Philippines. These projects will restore

4,000 hectares of natural forest by planting 5.2 million trees from a variety of native species by 2025.

The Soneva Foundation's philosophy on forest restoration is to use a wide variety of indigenous tree species, which are planted by the local community.

To date, the Soneva Foundation has planted over 2 million trees.



Alcidio Francisco prepares a seedling that will be planted in the forest.

Positive impact

5.2 million trees

to be planted by 2025

4,000 hectares

to be restored

3.3 million tonnes CO2

to be mitigated

1 NO POVERTY



13 CLIMATE ACTION



15 LIFE ON LAND

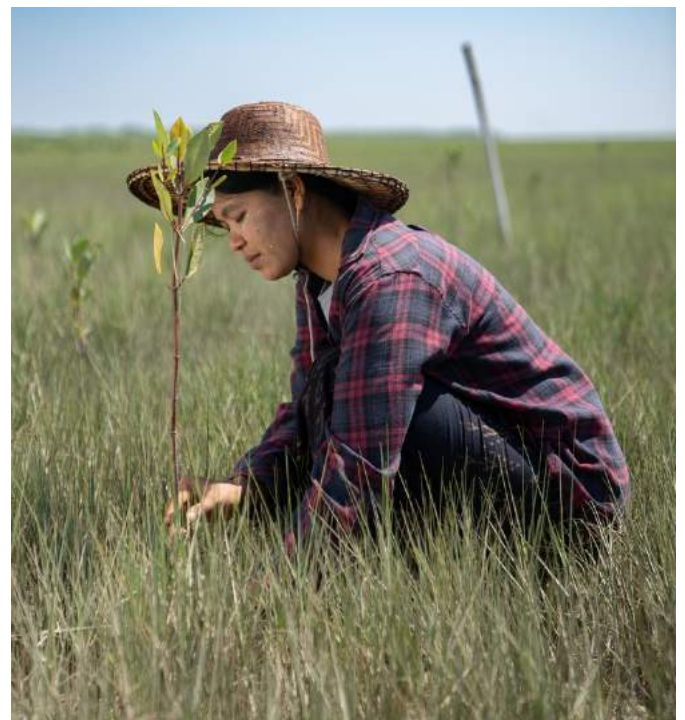




Mangrove forests are coastal guardians and play a vital role in ocean biodiversity. One of its biggest strengths lies in the forest's ability to capture and store carbon.

The Soneva Foundation engaged Worldview International Foundation to plant 2.5 million mangroves in Myanmar, restoring 1,000 hectares of mangrove forests. The last 1 million mangroves was planted in the soil on September 2023.

The mangrove restoration project is being registered under VERRA and is expected to generate 1.5 million carbon credits.



Mangrove planting in Kyun Chaik, Myanmar

Positive impact

2.5 million mangroves
to be planted

1,000 hectares
to be restored

1.5 million tonnes CO2
to be mitigated

1 NO POVERTY



13 CLIMATE ACTION



14 LIFE BELOW WATER





FUEL EFFICIENT STOVES

250,000 people have benefited from the Myanmar Stoves Campaign

The Myanmar Stoves Campaign is a Soneva Foundation programme that distributes fuel efficient cook stoves to thousands of families. It is the first Gold Standard-certified carbon project in Myanmar.

Indoor cooking on inefficient stoves is a silent killer. Air pollution from domestic cooking is responsible for the premature deaths of over four million people a year worldwide, more than HIV/AIDS and malaria combined.

Myanmar has one of the fastest rates of deforestation in the world, with most of the wood used for domestic cooking.

Each fuel efficient stove saves 2.5 tonnes of wood per year and reduces air pollution by 80 percent – improving the health and safety of the whole community.

The Myanmar Stoves Campaign has been successfully operating for 10 years, together with our implementation partner Mercy Corps Myanmar. So far, 55,000 stoves have been distributed, benefitting 260,000 people.

Positive impact

55,137

stoves distributed

259,062

people benefitted

305,153

GS VERs issued

USD 42 million

in social value generated

1 NO POVERTY



3 GOOD HEALTH AND WELL-BEING



7 AFFORDABLE AND CLEAN ENERGY



13 CLIMATE ACTION





HORNBILL REINTRODUCTION

The Soneva Foundation, in collaboration with the Hornbill Research Foundation, is spearheading the reintroduction of hornbills to Koh Kood in Thailand, a species that faced extinction on the island approximately 40 years ago.

The significance of the hornbill lies in its crucial role as a key species for the island's ecosystem. By aiding in the dispersion of seeds from larger trees, these majestic birds contribute significantly to enhancing the biodiversity of the island's forests.

Under the auspices of Thailand's Zoological Parks Organization, the hornbills have been carefully released on Koh Kood, following approvals from the Department of National Parks and in cooperation with local authorities.

Since May 2022, a total of nine oriental pied hornbills have been successfully reintroduced. Additionally, two hornbills are currently acclimating to the island's forests within an enclosure, ensuring they adapt seamlessly to the environment before their eventual release.

While the newly released oriental pied hornbills are initially sticking close to familiar territory, there is a noticeable and encouraging trend of them exploring and venturing further afield as they gradually tap into their natural instincts.

Anticipation is building for the upcoming 2024 mating season, spanning from January to June, with the optimistic expectation of witnessing the birth of Koh Kood-born hornbill chicks. This initiative represents a vital step towards the restoration of the island's ecosystem and the preservation of its natural heritage.

9 hornbills

released

2 hornbills

ready to be released

15 LIFE ON LAND





Around the world, 150 million children are missing out on meals and essential health and nutrition services. Childhood malnutrition potentially leads to serious illness and death.

The Soneva Foundation has worked with Action Against Hunger in Bangladesh since 2020 to strengthen households' capacity for climate-adaptive and resilient livelihoods to tackle food insecurity and under-nutrition.



Shilpi Khatun feeds her children healthy food

Positive impact

830

households to be impacted

3,910

people that could benefit



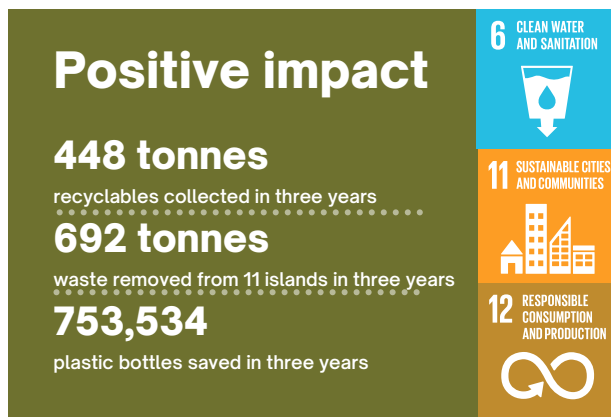
We have just extended this commitment for another three years. Our implementation partner, Action Against Hunger, is teaching families new skills and offering business training, as well as increasing food production at home using new climate change-resistant farming methods. This dual action plan ensures families can access nutritious food, either from their gardens or through generated income.

So far, we have improved the lives of 350 households and aim to reach 830 and positively impact nearly 4,000 people.

SONEVA NAMOONA

Soneva Namoonaa is driving the transformation towards zero-waste communities in the Maldives, employing a strategic approach centered on three pillars: 'Reduce,' 'Recycle,' and 'Inspire' to instill a mindset of environmental stewardship.

At the forefront of their initiatives is a water bottling facility in Maalhos, established to combat single-use plastic consumption. Serving households, guesthouses, cafes, and restaurants in Baa Atoll, this facility has prevented over 750,000 plastic bottles from entering landfills or polluting oceans. A second bottling operation is slated to commence in Kudafari in 2024.



Concurrently, Soneva Namoonaa is actively involved in raising awareness about sustainable alternatives to single-use plastics, extending to products like menstrual cups. Collaborating with UNFPA Maldives and Zero Waste Maldives, the NGO has conducted workshops benefiting over 200 women across nine islands in Baa and Noonu, distributing more than 100 menstrual cups.

Working in tandem with Women's Development Committees (WDC), Soneva Namoonaa is fostering a culture of reuse through the Alun Balun' second-hand market.



A noteworthy achievement occurred on World Tourism Day when 6 WDCs in Baa Atoll collectively extended the useful life of more than 200 clothing items, significantly reducing landfill waste.

Engaging with 22 islands in various stages of adopting sustainable waste management, Soneva Namoonaa, supported by a second USAID Clean Cities, Blue Ocean (CCBO) grant, is implementing projects on four islands to promote home composting and introduce waste collection guidelines with WAMCO, the state-owned waste collection entity.

The 'Fehi Madharusa' (Green School) framework, co-developed with the Ministry of Education, is expanding to 44 schools this academic year, furthering the integration of sustainable practices into educational curricula.

Additionally, in collaboration with the Maldives Swimming and Life Saving Skills Training School, Soneva Namoonaa has trained 36 swimming and water rescue instructors across all 12 islands, enhancing the aquatic skills of over 700 youth.



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