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TL Climate change

Atauro's Ocean Farmers

On Timor-Leste's Atauro Island, seaweed—a source of carbon-capture that protects marine ecosystems—is being increasingly affected by shifting climate patterns. Atauro has a population of 10,302 inhabitants who rely on an ocean-based economy for survival. Income generation opportunities are limited on the island, and over 1,200 ocean farmers engage in seaweed farming. The activity supports the island's communities to generate export income and is a more lucrative option than moving to the capital, Dili, on the mainland.

Seaweed does not require fertiliser or feed. Instead, it uses simple ropes with seedlings attached to them. These seedlings are submerged in the clear, shallow waters of Atauro and harvested every 40 days. The farmers then clean, sun-dry and sell the harvest to MDF partner Cottonii, one of Timor-Leste's few seaweed exporters.

However, the farmers' drying and processing practices need to improve to meet the high international standards of the large factories that Cottonii plans to sell to in the future. With MDF support, Cottonii has trained its farmers to address these gaps. MDF's intervention engaged technical expertise from Indonesia to support Atauro's farmers and connect them with new buyers. Apart from these changes, Cottonii has another challenge to address—one more tenacious than changing the behaviour of their farmers: climate change.

Location is everything

Geographically, Atauro is secluded, sitting about 30km from the mainland. The coastal areas are shallow, with relatively clear water. These shallow waters, the absence of rivers that carry sediment to the ocean, and relatively consistent temperatures make the island a prime candidate for seaweed farming. Like any plant, seaweed's ability to grow depends on its environment. Because seaweed obtains its nutrients from seawater, the more fertile the aquatic environment, the more the cultivation thrives. The temperature range, pH levels and other water quality parameters can impact the growth of seaweed.

Over the past 5–10 years, these parameters fundamental for the growth of seaweed have been changing rapidly due to climate change. Intense, erratic rainfall affects the delicate balance between the salinity and pH of the shallow oceans of Atauro—a recipe for disaster for seaweed farmers. In 2022, MDF and Cottonii commissioned Kilimanjari, an NGO based in Indonesia, to conduct a potential location assessment for seaweed cultivation to understand the effects of changing oceans on seaweed farming. The report found that the locations with ideal conditions for cultivating seaweed are shifting as climate change alters ocean temperatures and salinity.

While climate change is rendering some locations unusable for seaweed farming, it is also reducing the number of months farmers can grow seaweed. Over the past 10 years, farmers have been able to grow seaweed throughout the year; however, intense rain systems have now made this more challenging. In some locations, the number of months seaweeds can grow

without climatic disruptions has dropped from year-round to eight to nine months of the year, forcing farmers to forgo an income of **USD150 (AUD227)** per year.

Ice-ice, baby

Changes in salinity, light intensity and temperature also increase the crop's susceptibility to disease. The stress of shifting ocean parameters results in seaweed producing a moist organic substance, a disease known as ice-ice. Ice-ice attracts bacteria and results in the whitening of seaweed tissues, affecting the plant's carrageenan composition. The intensity and prevalence of ice-ice outbreaks in Atauro are increasing with climate change, and seaweed bleached due to ice-ice can't be sold to high-end exporters. To continue growing viable seaweed, Atauro's communities will need to change their farming techniques.

Sun-drying during monsoons

Drying and processing will also need climate-proofing. Seaweed is traditionally dried on the beach using basic sun-drying techniques. However, more rainfall requires more labour from farmers to avoid moisture contamination. In addition, stronger waves disrupt drying and increase exposure to moisture. Since large buyers require a low moisture content in their seaweed, Cottonii must improve drying before exporting.

Adapting to the new reality

Disease outbreaks, shifting monsoon seasons and limited availability of accurate weather reports have all resulted in a decline in seaweed yields and access to farm grounds. The impact is felt most strongly by women working on seaweed farms. To adjust to these challenges, farmers have been shifting their seaweed farms to locations away from the ocean nearest to their *suku* (village). However, changing locations isn't a one-stop solution. Moving seaweed farms away from *sukus* results in more labour required for maintenance. Farmers must also follow an updated growing cycle.

With MDF support, Cottonii and Kilimanjari are developing a new crop calendar for farmers to follow. With Kilimanjari's expertise, MDF and Cottonii are considering giving farmers the flexibility to choose types of seaweed that are more suitable to the new climatic conditions. MDF is also supporting farmers to construct raised bamboo racks and cover material that mitigates exposure to rainfall and high waves, improving drying. Cottonii has invested in a warehouse to store seaweed securely to avoid moisture contamination.

The social importance of seaweed farming has brought *sukus* together, with farmer clusters developing to grow and dry seaweed as well as collectively negotiating for better prices. However, the future of seaweed farming in Atauro will depend on how effectively farmers can adapt to climate change. MDF will continue to support Cottonii to address adaptation at a community level and within the business. Awareness of climate change and opportunities to address adaptation remain limited for ocean-based farming communities in Timor-Leste; MDF and Cottonii are seeking to address this gap. Adaptation is necessary to ensure the ocean farmers of Atauro continue to generate incomes and uphold their livelihoods while businesses like Cottonii continue to thrive.