

**Macroalgae Farming:
An Ocean-Based Solution to Reduce Climate Change
Lead: Fearless Fund, Alyson Myers**

Context and Rationale: Our oceans contain 97% of Earth’s water; they also have absorbed approximately 26% of our CO₂. Oceans are experiencing warming and lower pH (known as ocean acidification) and are a likely candidate for multi-faceted solutions to avoid climate change while benefitting marine ecosystems. Marine macroalgae utilize CO₂ through photosynthesis to build biomass and have the potential to provide a source of carbon-neutral fuels or a carbon removal/sequestration strategy. This solution focuses on the use of floating marine macroalgae, known as Sargassum Natans and Fluitans with a broad distribution in the western Atlantic, Caribbean and Gulf of Mexico to accomplish these goals. Recently, the US DOE ARPA-E funded research to explore the scaling of macroalgae farming, including this Sargassum project, for conversion to carbon neutral fuel to diversify our energy sources and potentially reduce/replace some portion of fossil fuels. Concurrent with the DOE effort, Sargassum has arrived in unusually large quantities in recent years on beaches in the Caribbean causing expense to protect beaches for tourism-dependent island economies. Solutions to the “beaching” problem have been elusive due to the variable nature of Sargassum locations, quantities and timing.

Overview of Contribution

Fearless Fund, a 501(c)3 committed to ocean health, and directed by Alyson Myers, has conducted research, including in-water trials, on the farming of Sargassum under US DOE ARPA-E funding. Efforts have focused on farming and wild harvest in nuisance situations.

How the contribution leverages living natural systems to avert climate change

Macroalgae farming has the potential to assist two strategies to avoid climate change: the conversion of biomass to carbon-neutral fuels to reduce fossil fuel usage and carbon removal from the system. The process avoids the use of land, fresh water and fertilizers typical of land-based agriculture (for example, corn for ethanol). The most important aspect is that macroalgae farming is scalable.

Benefits

The provision of carbon-neutral fuels and/or carbon removal are the most important benefits. Macroalgae farming also provides benefits to ocean ecosystems in the form of increased habitat for fish and invertebrates which may increase fisheries and biodiversity. Sustainable harvest, which is a task of the team, is important to providing ecosystem benefits. The new process will increase employment. It contributes to the achievement of Sustainable Development Goals (SDG’s) in the following ways: 1, No Poverty (adding employment), 6 Clean Water (conserving fresh water through use of saline ocean water), 7 Affordable Clean Energy (conversion of biomass), 9 Industry Innovation (new sources of raw materials), 12 Responsible Consumption (new sources of raw materials), 13 Climate Action (renewable fuels and/or carbon

removal), 14 Life Below Water (additional habitat), 17 Partnerships for Goals (international cooperation).

The net impact to date is the utilization of 500,000 USD for research and analysis in the form of ocean trials, best farming methods, analysis of biomass, the purchase of equipment from small businesses and the creation of a Techno Economic Analysis (TEA) which links farming and harvest parameters to production costs per DMT.

Countries involved in the effort

Caribbean islands, US, Netherlands.

Stakeholder engagement

Fishers, fishery councils, youth and small businesses.

Where can the contribution occur?

Caribbean, US, Mexico and Central America.

Contribution shall be delivered as follows

The process takes place offshore and engages the marine community for ships and staffing and potentially low-tech manufacturing. Transformational impacts include novel techniques, novel production process and increased scale (over today's cottage scale).

Initiative contributes to Climate Action Summit workstreams

The contribution contributes to novel ocean-based production—for energy transition, for raw materials (new sourcing), and for ocean restoration which will increase fisheries for food security. We shall train a new workforce in a new economic activity that internalizes the stewardship of natural ecosystems

Partnerships

Current partnerships include universities, government agencies, foundations and NGO's. Current funding is US-based.

Stewardship and Metrics

Sustainable harvest is central to stewardship. In-water harvest can save associates organisms and reduce erosion on beaches (heavy equipment is often used for beach cleaning). Metrics include carbon as a % of total biomass and cost per Dry Metric Ton (DMT).

Communication Strategy

Film, media, and conferences.

Proponents and Commitment

Caribbean islands seek a solution for unwanted beachings of Sargassum that impact tourism revenue. Today that solution is expensive, land-based with heavy equipment and not sustainable. Islands and coastal regions in the Sargassum zone are committed through

necessity. Today, we seek ways to reduce CO₂ in oceans, and we seek new sources of biomass that can be grown in novel ways without fresh water.