

“Healthy Ocean, Healthy World”

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Statement of Authenticity

To whom it may concern,

I, Sarah Schuck, certify that all materials presented here are of my own creation and that any work adopted from other sources is duly cited and referenced as such.

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Crash! There is a thundering in the distance, a low rumble you can feel in your bones. Can you hear it? *Crash!* Closer and closer, louder and louder, it tugs at your core. There! Finally, standing with your feet sinking in the sand, you see it. Deep blue waves foam white as they meet the shore in a tumultuous collision where life both ends and begins. So savage yet so calm, the ocean stretches as far as the eye can see. Fear and excitement knot in your stomach as you stare, a feeling rising in your soul. For me, it feels like home. All my life, I've had the privilege of living by the beautiful shores of Cape May, New Jersey. But this beauty is not infinite, and my home, along with many others', faces a terrible threat. Our oceans are suffering, paying the price of our progress, but our innovation could also be the key to saving them.

Agriculture has not been kind to the ocean. Over the past century, we have found new ways to make agriculture more efficient and productive, but we failed to see how greatly our actions affected the environment. Every year in the United States, an estimated four million tons of phosphorus and twelve million tons of nitrogen are applied as fertilizer to agricultural land (USGS Water Resources Mission Area, 2019). While the use of these products has increased the efficacy of crop yields and farmland management, they rarely remain on the farm. The components present in chemical fertilizers have the potential to massively deteriorate the health of aquatic ecosystems. While our intentions may have been just, the aquatic environment has suffered because of this overuse of chemical products in agriculture. But in order to reverse this damage, we must first understand how it happened.

Through irrigation processes and precipitation, agricultural runoff—or water from fields that contains pesticides, fertilizers, and sediment—makes its way into nearby waterways (Busch Systems, n.d.). These toxic contaminants have many negative effects, but perhaps one of the most detrimental is eutrophication. Eutrophication is a process that begins with excess nutrients

in a body of water, causing an overabundance of algae and bacteria, which lead to a decrease in oxygen levels, killing any organisms in that ecosystem (NOAA, 2023). Just as blood runs through our veins to our heart, these dangerous conditions travel through rivers and streams and into the ocean, resulting in eutrophication on a much larger scale and with even worse repercussions. And unfortunately, it's easy to ignore the problems you can't see.

The ocean spans over 70% of Earth, yet there are people who have never even seen its waters, nor do they realize just how much it impacts everyone (NOAA, 2023). There is an apparent divide that stretches between traditional agriculture and the ocean, but if you look closer, you'll see that they have always been connected, just as waves meet the shore. The ocean is responsible for the production of over 50% of the world's oxygen and stores fifty times more carbon dioxide than the atmosphere. Additionally, ocean currents are responsible for weather systems across the globe, affecting the inland rainfall patterns that agriculture depends on (NOAA, n.d.). As we face an increasing population, rapidly rising temperatures, and a loss of agricultural land, it is important now more than ever to find new and more efficient ways to support ourselves while healing our damaged environment. The answer has been staring us in the face for years, crashing on our shores to get us to listen. Can you hear it? It's the solution.

The ocean has the potential to reinvent agriculture and reverse the harm we have done through it. In our recent search for more eco-friendly alternatives, the term "sustainable agriculture" has been thrown around countless times, but why is it so important? The USDA National Institute of Food and Agriculture defines it as agriculture "intended to protect the environment, expand the Earth's natural resource base, and maintain and improve soil fertility" in order to satisfy both societal and environmental needs (NIFA, n.d.). Our population is expected to grow to over nine billion by 2050, and the World Bank estimates that global food

production will have to increase by 70% in order to accommodate this demand (Maryville University, n.d.). So, if we want to feed our growing population, we need to ensure a healthy environment to sustain us for years to come. But how does the ocean factor into all this? Well, what if I told you that the ocean sequesters up to 70% of the world's carbon dioxide (Slootweg & Saducas, 2022)?

You heard me right. 70% of carbon sequestration occurs in the ocean, primarily in its incredible kelp forests. Kelp and other seaweeds help to improve aquatic biodiversity and water quality, and they could also be a new and entirely natural fertilizer with the potential to revolutionize traditional agriculture (Slootweg & Saducas, 2022). Seaweed is rich in minerals and nutrients, and as a fertilizer, it can promote higher seed germination; improve root strength, crop yields, and water retention; and enhance soil structure and quality (Slootweg & Saducas, 2022). But the benefits of seaweed don't stop at fertilization. According to the United States Environmental Protection Agency, livestock production alone accounts for 37% of agricultural methane emissions (EPA, 2020). However, recent research has found that adding a specific type of seaweed, *Asparagopsis taxiformis*, to the diets of both dairy and beef cattle can reduce up to 82% of their emissions without impacting the taste or quality of the cows' milk and meat (Nelson, 2021). Although, this specific seaweed is not abundant enough in the wild to support large-scale use, and the long term effects on the cattle's nutrition and health are still unknown (Nelson, 2021). Overall, there are many challenges to overcome before we can know for sure if this is an effective solution, but the data is promising, and we are walking a very optimistic path.

As you can see, the use of seaweed in agriculture has a lot of future potential, and its popularity is only growing. Favored for the many vitamins and antioxidants it provides, seaweed has been a part of agriculture for a very long time but never at a worldwide scale. Current

harvesters and advocates fear that inexperienced industries looking to profit off of seaweed's increasing potential will develop too many large farms too quickly, disrupting the delicate balance of ocean ecosystems (Held, 2021). In order to prevent this, we need to determine how to effectively regulate aspects like farm size, location, and permit requirements, with rules on what types of seaweed can be grown and where. As with any new industry, there are many unknowns, but seaweed, like all plants, has the ability to purify both the air and water, and if we harness this power responsibly, we will be one step closer to a healthy ocean and a healthy world.

Crash! The sound is familiar, a roaring thunder that warms your soul. Can you hear it? It's the future, but if we are not careful, we will lose it. The ocean has been my home all my life, and it breaks my heart to know that beyond those beautiful shores, it faces a challenge. But I believe that, beneath those deep blue waves, there is also hope. The ocean is the heart of the earth, where life both ends and begins, beating with the promise of a better future. Will you hear it?

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