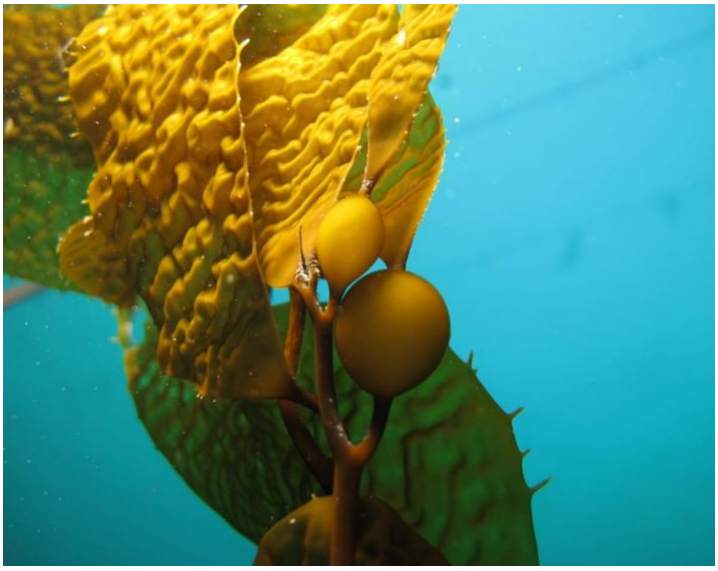
Group Project Proposal

January 22, 2021



Ecosystem Services and Social Licensing of Commercial Kelp Farming in California

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Title: **Ecosystem Services and Social Licensing of Commercial Kelp Farming in California**

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Objectives

Ocean Rainforest is interested in establishing the following objectives, as they apply to seaweed aquaculture in California. The proposed project herein is in collaboration with the Bren School of Environmental Science and Management at UC Santa Barbara.

- Comprehensive understanding of the perception of seaweed aquaculture in California across a broad spectrum of stakeholder groups such as community members, fishermen, Federal and State regulators, etc.
- Comparative analysis of ecosystem services derived from research accomplished in other areas of the world and applied to offshore and coastal seaweed cultivation in California. This research will likely be integrated with economic analyses and social perceptions to support more productive communications with various communities.
- Framework for incorporating social license into marine spatial planning efforts, including the Aquaculture Opportunity Areas initiative led by NOAA. The project hopes to use current public perception to inform future siting analyses, as well as better understand how to address public perceptions and concerns in communities around potential aquaculture sites.

Significance

Seaweed cultivation is widely understood to provide a number of ecosystem services, such as carbon sequestration (Chung et al. 2013; Jensen and Duarte 2016), eutrophication mitigation (Chung et al. 2013; Duarte et al., 2017; Visch et al., 2020: Yang et al., 2015), habitat (Visch et al., 2020), and wave attenuation (Hasselstrom et al., 2018). In comparison to land-based agriculture, seaweed farming uses no arable land or freshwater and, in most cases, requires no additional fertilizers (Hasselström et al. 2018). For these reasons, seaweed aquaculture has been recognized at a global level as among the most environmentally responsible and sustainable forms of biomass production (Duarte et al., 2017; Rebours et al., 2014).

In 2020, Jeff Bezos' Earth Fund awarded the World Wildlife Fund (WWF) $100 million for projects that pioneer innovative solutions to climate change, part of which will be used for scaling up sustainable aquaculture. Recently, Ocean Rainforest secured support from WWF as they continue to develop new markets for seaweed. Ocean Rainforest is also among a small collection of companies engaged in the initial stages of commercial kelp cultivation in California under the U.S. Department of Energy's Advanced Research Projects Agency - Energy (ARPA-E) Mariner Program.

Seaweed cultivation specifically in offshore environments represents a particularly novel and recent innovation. While offshore farming offers a number of critical advantages over traditional cultivation methods – including higher growth rates, less fouling and reduced competition for space – many of the opportunities associated with such a strategy are not well understood by the public or relevant stakeholders. Instead, fears traditionally associated with finfish aquaculture overshadow the numerous environmental and social benefits associated with seaweed cultivation. In a case study off the west coast of Sweden, researchers suggest that "in order to illuminate consequences of aquaculture development and facilitate trade-offs between different interests associated with e.g. spatial allocations, ecosystem services assessment is a useful tool through its ability to visualize the link between human well-being and the environment" (Hasselstrom et al., 2018). Through their early work under the ARPA-E Mariner Program, Ocean Rainforest has been challenged to navigate wide-spread misunderstanding of sustainable aquaculture practices. Through working with local fishing associations, regulatory agencies, and interested individuals in the surrounding community, it has become evident that among the most significant barriers to the long-term viability of seaweed cultivation is the analysis of location-specific ecosystem services, and the subsequent communication of cost/benefit analysis intended to strengthen social license for this nascent industry.

Ocean Rainforest aims to support the development of a comprehensive guide to assess ecosystem services and build social license that will benefit the industry at large, rather than creating a highly specific, localized strategy for garnering stakeholder awareness and support. The primary motivation for initiating an industry-wide strategy is to improve the potential for future business development. The results of this project are timely at a national level. In late August 2020, NOAA announced Southern California as one of two premiere areas for the recently implemented Aquaculture Opportunity Areas (AOA). The announcement came in response to the May 2020 Executive Order on Promoting American Seafood Competitiveness and Economic Growth, which requires NOAA to establish two AOAs per year for the next five years in order to encourage large-scale, commercial offshore seafood production in the United States. As described by NOAA, the selection of federal waters off the coast of Southern California and the Gulf of Mexico is in large part due to extensive siting analysis and a growing industry demand for the development of sustainable aquaculture operations in the region. The selected AOA sites will support the installation of three to five aquaculture projects for finfish, shellfish, macroalgae, or some combination of species. A framework that demonstrates the environmental and social costs/benefits of seaweed cultivation to the public and all interested stakeholders would pave the way for the development of the industry at a much broader, more impactful scale. As NOAA continues to roll out the federally-mandated AOAs, the results of the study proposed herein will further support NOAA's ambitious yet potentially transformative efforts, as well as help advance the aquaculture industry in the years ahead.

Ultimately, Ocean Rainforest is fully invested in a project to develop a comprehensive literature review and comparative analysis of the ecosystem services, as well as economic, social, cultural costs/benefits of kelp cultivation; an extensive public opinion survey of a sustainable kelp cultivation strategy; and subsequent guide detailing opportunities in seaweed aquaculture to use for strengthening social licensing. The framework for this project will be specific to California; however, the resulting body of work will lay the foundation for similar social licensing campaigns for aquaculture in the United States and internationally. A collaboration with the UCSB Bren School would provide an excellent opportunity to play a critical role in helping educate a broader audience in the sustained, transformative benefits of offshore seaweed cultivation.

Background

MacroSystems (MS) is an international collaboration project that explores the business opportunities associated with commercial scale seaweed cultivation. Led by Ocean Rainforest, MS has proposed a three-year pilot trial of a Macrocystis Cultivation Rig (MCR) – a state of the art structure designed to withstand offshore marine conditions. With funding from the U.S. Department of Energy's ARPA-E Division, Ocean Rainforest and the MS team intend to demonstrate the feasibility of large-scale kelp cultivation as a means to provide a sustainable source of raw material for animal feed, biofuels and a variety of other industrial products.

In June 2020, Ocean Rainforest and the MS team launched a demonstration project in the Santa Barbara Channel to test the durability of the cultivation system, as well as better understand how to minimize impacts on local communities, marine industries and surrounding ecosystems. In the initial stages of this project, Ocean Rainforest has seen first-hand the skepticism, hesitation and apprehension that surrounds seaweed aquaculture. In early discussions with the Commercial Fishermen of Santa Barbara, the Santa Barbara Trawlers Association, and other community stakeholder groups, Ocean Rainforest's proposed demonstration project was met with quick and forceful resistance. In that same vein, discussions with regulatory agency representatives during the preparation and submission of an individual permit application for the demonstration project revealed many collective misunderstandings about seaweed aquaculture. As a result, Ocean Rainforest was asked to provide extensive information and justifications that far exceed what is required for seaweed aquaculture projects in other parts of the world.

In an effort to improve public awareness and understanding associated with seaweed aquaculture, Ocean Rainforest has dedicated substantial time and effort to engaging relevant community members in early project siting analysis, as well as sharing relevant scientific information on environmental, economic, and social costs and benefits of seaweed aquaculture. Irrespective of attempts at community engagement, the Ocean Rainforest team continues to face questions related to the nature, scope and ultimate benefit of aquaculture to the local community. As Ocean Rainforest aims to help pioneer the industry in California, it has become apparent that having a well-researched framework that describes the best strategies and approaches to building social license is essential.

Equity

Ocean Rainforest and the collaborating group of Bren students would have the unique opportunity to address equity and environmental justice issues in California and beyond. By developing a strategy to build social license around seaweed aquaculture in the state, the entire project team would be challenged to bring together representatives from all relevant stakeholder groups. Stakeholders include, but are not limited to tribal leaders, traditionally underrepresented fishers, small business and other groups that are typically not given a seat at the table. The project would also strive to solicit input from socio-economically and racially diverse individuals to share their perceptions of seaweed aquaculture. Public outreach and survey activities would incorporate a variety of pathways for distributing and obtaining responses, as well as disseminating informational materials in an equitable way. Additionally, the project scope will incorporate indigenous populations and traditional ecological knowledge into considerations for ecosystem services assessment and stakeholder engagement strategy.

This project also provides an opportunity to address environmental justice issues through the development of accessible work products such as open source data and informational materials. Rather than an in-depth academic paper that may only be available to individuals in higher education settings, spatial analysis and other data will be hosted on an open access platform. Furthermore, the relatively simple, straightforward educational materials on offshore seaweed cultivation would help ensure that individuals throughout the community could make informed decisions based upon a better understanding of rigorous scientific assessment. The ultimate goal of this proposed project is to develop a framework that has the broadest opportunity to support environmental justice goals, as defined by the U.S. Environmental Protection Agency and CalEPA Environmental Justice Program.

Available Data

Ocean Rainforest will provide the Bren student team with a preliminary list of relevant papers and documents to support their initial literature review. Although preliminary data do exist with respect to the ecosystem services and social benefits of seaweed cultivation, the majority of these studies are specific to locations within Europe and Asia. Data related to ecosystem services and potential community benefits of kelp cultivation in California do not exist to the same extent. Furthermore, Ocean Rainforest is not aware of any available data regarding the social perception of seaweed aquaculture in California.

Over the course of the proposed project, the project team intends to compile all previous research and data on the costs and benefits of kelp cultivation into a comprehensive comparative analysis that will provide the foundation for stakeholder engagement

and social licensing strategy. A repository will provide a valuable resource for understanding and communicating knowledge of kelp aquaculture from environmental, economic, social and cultural perspectives. Project goals will further be supported by information gathered from Ocean's Rainforest's expensive experience working in Santa Barbara, as well as the data generated through a comprehensive public opinion survey. For example, Ocean Rainforest will advise the Bren team on lessons learned thus far from navigating the permitting process and project implementation activities associated with the ARPA-E Mariner Program demonstration project. Furthermore, Ocean Rainforest can provide expert guidance to the Bren team in survey development aimed at the most relevant stakeholder groups, as well as suggestions for how to best distribute and collect survey data from relevant contacts within the area. Given their prior engagement with representatives across a variety of stakeholder groups, Ocean Rainforest is well positioned to support a collaborative student team in their own endeavors to develop a broader framework for cost/benefit analysis and building social license.

Possible Approach

The goal of this proposal is to provide a basic framework that would allow for Ocean Rainforest and Bren students to work together to fully develop the scope of work and plan for execution. Therefore, in considering Ocean Rainforest's objectives and the broader needs of the California kelp industry, the following describe possible approaches to achieving the goals of this project.

Step 1: Complete a literature review with an annotated bibliography of resources pertaining to the ecosystem services of kelp cultivation. These resources will be added to Ocean Rainforest's current list of internal resources and will also be made available to the public for reference in aquaculture research.

Step 2: Comparative analysis of ecosystem services of kelp (including both the positive and negative impacts), as well as economic, social, and cultural cost/benefit analysis.

Step 3: Design and distribute a survey for collecting data on current stakeholder opinions about seaweed cultivation. Apply the results of the survey analysis to develop a strategy for strengthening social license.

Step 4: Conduct GIS mapping activities to create an accessible, public-facing spatial analysis of stakeholders to serve as a basis for understanding of the individuals and groups that have a stake in or will be impacted by offshore seaweed cultivation.

Step 5: Develop a framework for incorporating social licensing into a siting analyses and project implementation that recommends how to incorporate ecological, economic, social, cultural and environmental justice/equity considerations.

Step 6: Provide strategies for how to best communicate and strengthen social license in three primary stakeholder groups: fishers, community members, and government/regulatory stakeholders. This may include an infographic or brochure deliverable, or other communication focused work products. This phase may also provide an excellent foundation for a Bren capstone project in Strategic Environmental Communications.

Step 7: Outline recommendations for future research and projects, e.g. further data gathering and studies of ecosystem services of kelp harvesting or a capstone communications project to disseminate the findings.

Deliverables

In addition to the final written report, policy brief, poster and oral presentation, deliverables may include, but are not limited to:

- Publicly available annotated bibliography
- Public opinion survey and associated analytics
- GIS spatial analysis of stakeholders
- Informational materials to use in future stakeholder meetings

Internships

This project will cover a paid summer internship for one (1) student intern. The internship will involve further research and analysis of the Group Project objectives, as well as give the student intern the opportunity to enhance their professional writing and communication skills, along with their research and comprehensive analysis abilities. The intern would also have the opportunity to engage with a skilled and experienced team within the commercial seaweed cultivation industry, as well as network with other leaders of the developing field. Depending on insurance and proprietary considerations, there may be an opportunity for the intern to participate in field monitoring, harvesting or hatchery experience. While it cannot be guaranteed at this time, the goal would be to provide the intern with the rare opportunity to gain hands-on experience relevant to a postgraduate research or industry setting. The internship will aim to provide the student with a better understanding of the challenges of cultivation; the ecological context of aquacultural operations; and the potential for seaweed farming to provide solutions to many environmental, economic, social/cultural challenges within the state.

Supporting Materials

Citations

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Budget and Justification

This project will not require any additional funding.

Client Letter of Support

Olavur Gregersen | CEO
1117 State St
Santa Barbara, CA 93101

January 19, 2021

Bren School of Environmental Science & Management
University of California, Santa Barbara
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Greetings, Bren Group Project Review Commission —

This letter intends to affirm Ocean Rainforest's commitment to engage one Bren student as a summer intern to execute the work detailed in the attached Group Project Proposal. In addition to a three-month, paid internship experience in Santa Barbara, CA, Ocean Rainforest would provide additional information, guidance and potential funding support necessary for the student to successfully engage with the proposed project.

As a brief background, Ocean Rainforest, Inc. is the prime contractor for a multi-year contract funded through the U.S. Department of Energy's Advanced Research Projects Agency - Energy (ARPA-E) MARINER Program. Under the project heading "MacroSystems," Ocean Rainforest intends to demonstrate the feasibility of cultivating *Macrocystis pyrifera* in the Santa Barbara Channel. Ocean Rainforest, Inc. is a recently formed subsidiary of the parent company – Ocean Rainforest, Sp/F (ORF). Based in the Faroe Islands, ORF brings nearly ten years of experience in offshore cultivation of kelp and other seaweed species. By applying science, innovation and expertise in growing premium quality seaweed for sale and for research, ORF is internationally recognized as a key pioneer in the developing industry.

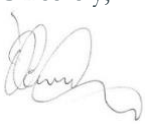
Given ORF's expertise in offshore cultivation, processing, sales, and distribution, Ocean Rainforest, Inc. is well positioned to lead the MacroSystems team in helping build the sustainable seaweed cultivation industry in California. Over the course of the project, our team intends to:

- Support the traditional fishing industry by creating fish habitat and therefore increasing local fish populations
- Improve the health of the marine environment by reducing the amount of excess nutrients in the water
- Reduce ocean acidification by capturing CO_2
- Encourage economic development in the local community by creating sustainable and reliable jobs

In the context of the Bren Group Project, Ocean Rainforest, Inc. has the capacity to devote $2,500 to a summer internship. Ocean Rainforest remains a fairly early stage start up and thus does not have the resources to provide a higher salary internship. Even so, Ocean Rainforest's small team of highly skilled, dedicated and passionate individuals could provide a transformative foundation for a Bren student interested in supporting the development of the industry.

For now, we appreciate the opportunity to be considered as a client for the group project proposed herein. The Ocean Rainforest team has enjoyed working with Annie Lovell and a collection of other Bren representatives over the course of the past few months and hopes to continue our collaboration in the weeks and months ahead.

Sincerely,



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