

Live Session Audience Q&As

Dive In

Tuesday January 10, 2023

Jonathan Berube

Question: I've explored the hub, but wanted to ask the best way to connect with people close to me geographically? saw a lot of oregon/washington folks in the chat intro and would like to see what people are doing in my area.

Answer: Hi Jonathan, in the Hub you will see the Community (<https://hub.greenwave.org/community/>) where you can sort posts by location or post yourself and ask for connections close to you!

JanKarl Hayes

Question: is there a need for temporary workers during outplanting and harvest in New England or Alaska? As a way to get my feet wet, as it were?

Answer: It never hurts to reach out to farmers directly to ask! We don't have any apprenticeship programs at the moment, unfortunately.

bengt Liberg

Question: Are the online sessions at the same time each week?

Answer: Yes, course Landing Page:
<https://www.greenwave.org/how-to-start-a-kelp-farm-2022>

Craig Lewis

Question: How do we get the recordings?

Answer: <https://www.greenwave.org/how-to-start-a-kelp-farm-2022>

Bob LLewellyn

Question: Has anyone invented a way to de desalinize the crop to suit animal feed?

Answer: Hi Bob, Seaweeds have a long history of application in livestock feeds and supplements. In terms of reducing the salt content, you could look into washing or blanching seaweed in fresh water. [This study](#), published in 2022, investigated post-harvest quality changes of sugar kelp and determined that blanching seaweed in fresh water had the greatest reduction of NaCl compared to other treatment conditions.

Edward Hines

Question: There are different seasonal activities, but once a farm is established are there seasonal lulls where maintenance is less frequent (weather permitting)

Answer: Yes. The busiest times of the year are during farm deployment and outplanting in the fall, and then again during harvest in the spring. In the months in between, many farmers only check their crops every-other week or so weather permitting. You can read more about the time when the kelp is in the water here:

<https://hub.greenwave.org/lms/course/monitoring-maintenance/>

Ahmed Askar

Question: What are the preferred methods when conducting a nutritional analysis of the content in seaweed (kelp) ?

Answer: Hi Ahmed. We recommend you work directly with a reputable lab partner to conduct a nutritional analysis of your seaweed. You can request a FDA compliant nutrient panel as seen [here](#). GreenWave has worked with [Eurofins](#) to test seaweed for nutrients and potential contaminants. Depending on your application for seaweed, you may wish to perform tests in addition to the standard nutrient panel. GreenWave compiled a [working document](#) with some tests you may wish to consider for your kelp.

Pat Nolan

Question: I am in North Texas and do not live close to the coast. However, I have been reading/researching a few who have been growing kelp in tanks. I am interested in learning more about that.

Answer: Hi Pat, yes inland seaweed growth is really exciting! Unfortunately, our expertise is in ocean-based kelp farming in cold waters so we do not currently have guidance on that. However, you might be able to find connections in the Hub Community (<https://hub.greenwave.org/community/>)

You might look at dulse cultivation strategies – these are mostly done on land in tanks.

Cecilie Stuart

Question: I'm part of an educational group on the California coast inspiring youth(elementary/HS) on climate solutions and they have a "Help the Kelp" project. We need a Kelp expert to advise and meet once with students in Malibu CA. Please reach out if you'd like to be an advisor in Jan/Feb,can offer stipend. Ceciliestuart@bgcmalibu.org

Answer: Hi Cecilie, I'd recommend you post on the Hub Community (<https://hub.greenwave.org/community/>) under Bulletin Board!

Stacey Gifford

Question: Is there a plan to offer a similar guided course for starting a hatchery?

Answer: Thanks! Yes! Stay tuned for an announcement later this year! In the meantime, you can review the hatchery course material on the Hub.
<https://hub.greenwave.org/lms/#hatchery/getting-started>

Also join us for a Farmer Forum call on GreenWave's hatchery developments on February 1st.
https://us06web.zoom.us/webinar/register/WN_MxV7suyZTSKZiXpjzTNrog

Mike Spranger

Question: You mentioned that one type of farm setup has seaweed and shellfish on the same array while another approach is to dedicate arrays to either seaweed or shellfish. Can you speak to why one would go with one way versus the other?

Answer: Hi Mike, many farmers have found that as they start to scale their farms it makes more sense to separate shellfish and seaweed arrays for efficiency purposes. It's more efficient to work lines of gear that hold either kelp or oyster cages / mussel socks without having to disentangle kelp lines from shellfish lines on the same anchoring system. There's some science to suggest you get the same co-culture environmental benefits from pairing kelp and shellfish within 30 meters of each other:
<https://thefishsite.com/articles/kelp-and-bivalve-co-culture-gets-another-research-nod>

Dan Linton

Question: Do you guys know of any resources for learning about boating for those of us with very little boating experience?

Answer: There are lots of boating safety courses out there. Many local marinas host them annually. I would check with your local harbormaster and local Sea Grant office for recommendations. A good resource for marine safety in Alaska is AMSEA:
<https://www.amsea.org/>.

Adrian Azodi

Question: What are the usual processing facilities needed near the kelp farm for drying, storing and preparing kelp for shipping/sale?

Answer: The type of processing facilities needed depend on the format you are looking to achieve. At this stage, processing infrastructure is a bottleneck in the industry, so it would be difficult to point to typical processing facilities. Seaweed farms are frequently located in areas with fish processing infrastructure, which can sometimes be leveraged, specifically for freezing seaweed. Due to the lack of established processing facilities and the perishable nature of kelp, some processors opt to freeze and subsequently dry kelp in a different location or co-locate a drying operation, such as a high tunnel, nearby to seaweed farms.

bengt Liberg

Question: You mentioned community building. You having the overview of participants of this course, are you planning clustering per country? Or sharing local contacts? Would be great to team up with some people locally to create some national momentum (the netherlands is not very big ;) .

Answer: Hi there, I'd recommend you post on the Hub Community (<https://hub.greenwave.org/community/>) or search posts by location to make local contacts!

Jack Mason

Question: What's the best way to partner or collaborate with other prospective kelp farmers here to get started as a team?

Answer: Feel free to post and make connections on the Hub community!

Lorne Mitchell

Question: I've heard horror stories of shellfishing operations getting wiped out from storms, etc. Do you know if it's possible to get insurance for kelp farming in the event of losing your crops?

Answer: Crop insurance is something that's possible to get, although it's not well established for kelp farming. The Federal ELAP disaster assistance program applies to ocean farmers as well:
<https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/elap-general-fact-sheet.pdf>

Eric

Question: If it's not a money making thing. How would finance planning affect potential sites as whole regions or again, should we just be ruling out whole states (Mid Atlantic)

Answer: Hi Eric, some kelp farmers are making money, you just have to be realistic about where there are existing markets for your product, and where you will have to do your own marketing / customer recruitment to sell your kelp. Places like Maine and Alaska have established wholesale buyers. Places in Southern New England often look to selling direct to restaurants/consumers. We'll talk more about financial planning and markets in week 4's live session.

Andrew S

Question: I've heard from people at the Marine Sciences department at Rutgers University that studies are being done in states south of the New England region. Do you happen to know the results of any of these studies and which states are seeing promising results?

Answer: I don't know about this specific research, but I know of a farmer growing kelp on his oyster lease in Maryland this year. There has also been a fair amount of interest in the cultivation of warm water seaweeds in Florida. Here's a recent Florida Sea Grant webinar that might be of interest: <https://www.youtube.com/watch?v=eiUYEIUPk8s&feature=youtu.be>

Pat Nolan

Question: Has anyone grown or harvested kelp in lake systems?

Answer: Kelps are marine algae. I don't know of any commercial freshwater algae harvests.

Kristen Jock

Question: I am currently working on a farm in Long Island, Great Gun, growing both oysters and sugar kelp, and am looking to get more information on post harvest in terms of packaging, transportation, pricing and moving product strategy. Will that be a separate course in the future?

We have crop in the water that should be ready for harvest late March, so if there are any other resources besides the operations component of the farm hub, I would be greatly interested. Thx!

Answer: Hi Kristen, yes! Check out the Farmer Forum events on the Hub, we have an upcoming conversation on post-harvest handling on January 26th. Register here:

https://us06web.zoom.us/webinar/register/WN_AiRT01kuRXiOP0HqeTUWmw

Bojan Martin

Question: Why haven't you been able to grow Alaria?

Answer: Some farmers find that alaria is harder to cultivate – it tends to be a little more finicky, requiring a fair amount of light and high flow areas to bring in nutrients.

andrei vestemeanu

Question: Who are you selling to and for what use?

Answer: Adelia is selling her kelp to Blue Evolution for human food consumption, and Dave Blaney is selling his kelp to an east coast processor also stabilizing it and selling for food consumption. Other typical market channels are: fertilizer/soil amendments, cosmetics, and (developing) bioplastics.

Mike Doty

Question: any reason not to grow in open ocean instead of near coast?

Answer: The deeper your site, the much more complex and expensive your anchoring system will be – as open ocean currents tend to put a big load on farm systems. We'll talk more about these tradeoffs in the session on farm design.

Heather Laiskonis

Question: Who do you sell to? Any large companies for cosmetics, food, etc?

Answer: You can check out our [Market Opportunities page](#) for some information on potential markets.

Pat Nolan

Question: I am interested in kelp for animal/livestock feed and reducing methane.

Answer: Hi Pat, there is a long history of utilizing seaweed for livestock feed and methane reduction is an increasingly prevalent benefit being discussed. Recent studies, such as [this one](#) from UC Davis, validate the impact on methane reduction from red seaweed supplementation. Kelp species (such as sugar kelp) are also utilized in animal feed, but require additional research to demonstrate their impact on methane reduction. You can read about some of the considerations for the use of seaweed to reduce methane emissions from cattle in [this paper](#).

bengt Liberg

Question: Are there any processing cooperatives?

Answer: There are a few examples of farmers organizing cooperatively who also do some processing. There are also companies like The Crop Project dedicated specifically to processing, but they are not organized cooperatively at this time. As the industry scales, we expect to see more cooperative organizing, especially around processing.

Mike Doty

Question: can kelp continue to grow from stumps after harvest without reseeding?

Answer: There is a company called Ocean Rainforest in the Faroe Islands that does this. They are able to get multiple harvests from one seeding. Many farmers in the US have found they need to harvest the kelp in the spring to avoid any biofouling (the other critters that set on the kelp) and decrease the quality.

Devon Lane

Question: So my question is regarding to the Freshwater Bay, it is fairly shallow with an average of 8 meters across and it does freeze over "usually". Wondering if this is an issue that can be worked around regarding changing of harvesting?

Answer: Some farms are able to weather a small amount of ice if the lines are set deep enough. The challenge is that surface ice can be really disruptive, uprooting anchors and moving your whole farm if buoys or flotation get caught in the ice flow. It's definitely better to avoid areas that are known to ice over routinely.

Michael Teasdale

Question: We are currently doing a pilot project here (sugar kelp) in Newfoundland and talking to funders and marketing folks and am a bit split on the business case. Where is the best place to go in terms of a product (for human consumption) versus a service (ecosystem services). I.e., what is the best way (in terms of lowest hanging fruit so to speak) in terms of developing the

market and the sector (at least starting out).

Answer: Hi Michael, GreenWave recommends a whole leaf strategy which you can read about in the [Build Your Business Hub Course](#). Food applications, specifically for human consumption, are the largest market at this time, but whether you decide to sell to restaurants or try to partner with a value-added company can depend on factors like your location, volume, and your business goals.

Rachel Howell

Question: It seems like the main kelp crop is sugar kelp followed by a handfull of other species. Is there any concern from a regenerative perspective of lowering ocean biodiversity (similar to biodiversity loss from land based ag)? Is there interest in a future for more kelp species?

Answer: Great point! At the current scale of production, I don't think this is a concern, but definitely something to consider as the industry grows. Most states require the wild parent tissue of the seed kelp to come from a close proximity to the farm site, which helps mitigate this concern. And yes! There's lots of interest in trying to cultivate other types of kelp including bull kelp and dragon kelp in Alaska!

Mary Rose Surfleet

Question: Who are the principal buyers for your product Adelia?

Answer: Adelia sells to Blue Evolution, a company operating in Kodiak.

Remi

Question: Adelia, how much are you able to get for the kelp that you sell?

Answer: The price most farmers are getting for their kelp ranges from \$0.50 - \$1.50 for wet kelp sold to a wholesale buyer, to upwards of \$10/lb sold direct to consumer / restaurants.

Charlene LeBlanc

Question: Are you selling your product wet? or are you drying it yourself?

Answer: Most farmers are selling their product wet. Some are drying it to make it into a value added product. More info on how to seaweed product development here: <https://hub.greenwave.org/lms/course/nurturing-preparation/>

Rachel Howell

Question: Thoughts on carbon credits as a market avenue?

Answer: At this time, additional research is needed to understand specifics around carbon sequestration.

Giovanni Mottolese

Question: how resilient are current kelp farming practices against climate change projections in next 30 years (ex. raising level and temperature) ?

Answer: It's impossible to know, but no farmer on land or sea knows at this point what mix of agriculture will be resilient. Sea level rise means more ocean farmland. There is a huge amount of energy going into climate resilient breeding techniques at the university level. With more people, the food system being driven out to sea by drought etc; wild fisheries maxed out; we're likely going to need to expand food production to the sea no matter what. Kelp might or not might make sense in the future no one knows, but farm techniques, infrastructure, skills will be vital for whichever of the many thousand species of algae it makes most sense to grow. But which species will be most resilient is unknown. – Bren

Grace Melchers

Question: what kind of organisms have you noticed using your farms as habitat during and after harvest? Have you noticed use by any significant species to your geographical area? For example in the Pacific - rockfish or juvenile salmon?

Answer: Sport fishermen near the GreenWave farm in Branford, CT report it's the fishing hotspot in the area. Sorry Adelia and Dave weren't able to answer this.

Tom Gehring

Question: Will the course touching on all the possible uses for seaweed in regards to market opportunities (e.g. food, cosmetic industry, fertilizer industry, etc.)?

Answer: Hi Tom, the Business Planning session will touch on market opportunities and how to develop a basic financial model to assess sales opportunities. You can also learn about kelp sales by watching our [Kelp Sales 101](#) workshop.

Adrian Azodi

Question: Is there an opportunity to invest with farming operations/businesses like yours in Rhode Island, to leverage the existing seafood cultivation services that are nearby?

Answer: GreenWave doesn't facilitate private investments in farms.

Danielle Calini

Question: How can we connect with the guest speakers in the future as a community resource and or possible internships?

Answer: You'll find them in the Community in the Hub! (<https://hub.greenwave.org/community/>)
Feel free to tag them in a post using the @ function.

Remi

Question: Are there any people that we can have as speakers that started from the ground up (did not have any existing boats etc.)? Would love to hear their experience.

Answer: Thanks for this feedback! Sean den Adel who spoke in Site Evaluation started from the ground up, as did Suzie Flores (the speaker for week 4) and Mike Spranger (the speaker for week 5). Please feel free to ask them your questions!

Ben Wigren

Question: Will kelp grow in intertidal areas? Or do you need to have a certain depth?

Answer: Kelp is an intertidal species. Some farmers have had luck growing at very shallow depths in places like Long Island:
https://www.greenwave.org/holdfast-blog/shallow-water-kelp-farming-ny?_gl=1*1cgitjg*_ga*MTk5Njc3NDMxNS4xNjE2NDM1NjU5*_ga_PMCDDHHZ62P*MTY3NDE2ODA3OS4xNTQuMS4xNjc0MTcxNTQ2LjAuMC4w

Dave Light

Question: For the 2nd speaker in Alaska, sorry I'm bad with names, if you grew kelp in the four acres that you're not using because of market limitations, would that be beneficial for biodiversity and carbon capture? Or would it be too much to handle, like it could grow out of control?

Answer: At the moment, there isn't a carbon market for kelp.

Michael Wilson

Question: "I hear Sugar kelp mentioned a lot. Is that a viable species for farming on the pacific coast?"

Answer: Yes. *Saccharina latissima* is found in both the Atlantic and the Pacific.

Caroline Frentz

Question: I am very interested in the idea of siting kelp farms and using GIS to map zones where kelp farming could be advantageous and benefit water quality. As I am in California, where permitting can be very difficult, I think this could be very beneficial in the policy space to show industry potential and environmental benefits. Is there any resources available already which are like this?

Answer: Great idea, Caroline. Yes there have been some efforts made though none are specifically aimed at the siting of kelp farms. In California things are more complex and there are a number of overlays that have to be considered so GIS can be a helpful tool to illustrate what could be available. For example, the area of state waters - from north to south and out to the state limit (i.e. 3 miles) have been mapped out by the California Dept of Fish & Wildlife with regards to CDFW's Kelp Bed Management Lease Areas. These areas are organized into 3 divisions: leasable, closed and open areas and relate to commercial kelp harvest from wild populations. This management practice goes back 100+ years and reflects the historic abundance of kelp. However, it's not clear how these existing lease areas could impact siting of new farms. And as no new leases have been approved for 25 years, no one really knows how. In Federal waters, the southern California Bight has been identified by NOAA as an Aquaculture Opportunity Area (AOA) and studies are being done to identify optimal areas for locating ocean farm. You can refer to the Atlas [here](#) However this is not a regulatory permitting exercise as NOAA does not have the authority but this information will be publicly available and can inform siting of future farms. Also in 2018 Sarah Lester's [paper](#) focused on areas offshore in southern California bight to identify sites for seaweed, shellfish & fish farms.

Christen Marquez

Question: I am also particularly interested in development of the market of kelp for the use of bio plastics. I am not sure what my more specific question is other than maybe where to get an overview of the potential of that market for the commodity. Mahalo!

Answer: Hi Christen, there is increasing interest in utilizing kelp for bioplastics and we are seeing an emergence of companies in the space. To get you started, [here's a list](#) of companies working on seaweed packaging. You may also want to look into market research, such as [this report](#), to gain a better understanding of the market.

Gint Rudis

Question: what's the market price for a pound of wet kelp? dried kelp?

Answer: Typically farmers are receiving between \$.50 - \$1.50 per lb for wet kelp. Dried kelp is significantly more since kelp loses 90% of its biomass to water.

Tom Gehring

Question: Is there any concerns growing a species that is not local to where it is grown or is that not even possible?

Answer: Most states have regulations that limit where the parent tissue is sourced from, requiring that it come from within a certain geographic area in the proximity of the farm to prevent this from being a concern.

bengt Liberg

Question: What is the kelp mainly used for? What is the current market?

Answer: Food for human consumption is still the primary market for kelp. You can check out our [Market Opportunities](#) page for an overview. The Island Institute's [Edible Seaweed Market Analysis](#) provides helpful insights as well.

Janet S

Question: Is sugar kelp a suitable species for the extraction of algin, which as I understand it, is a widely used additive in foods, cosmetics etc. as a gelling or emulsifying agent?

Answer: Hi Janet, sugar kelp does have the potential to produce alginates. Macro Oceans published an [interesting piece](#) on this topic. You may also want to read the book [Alginates and their Biomedical Applications](#), as they reference the alginate content of sugar kelp.

Brian Baldauf

Question: how is the farm managed during the winter when our harbor sometimes freezes over. Concern is access and engine operation with sub freezing temps.

Answer: This is definitely a concern. In an ideal world you have year-round access to your site. During cold snaps, it's possible to lower the farm below the surface by replacing spherical buoys with cylindrical spar buoys that will shed the ice.

Rebecca Artmonsky

Question: where are you selling most of your kelp? who are the end users - food, cosmetics, livestock food? do you sell direct or via wholesalers?

Answer: Hi Rebecca, check out our [Market Opportunities page](#) for some information on potential markets.

Martin de los Rios

Question: Research seems to suggest that there are very few negative impacts of seaweed farming in the ocean. What environmental issues have you noticed we need to manage when farming kelp in the ocean?

Answer: Avoiding areas with marine mammal activity or haulouts and areas of fish spawning is one big way to mitigate conflict. Also avoiding siting in areas with sea grass or other fragile bottom types that could disrupt natural habitat.

Justin Realmuto

Question: Bren mentioned “don’t start until you have a forward contract”. What’s that?

Answer: A commitment from a buyer to purchase your kelp!

bengt Liberg

Question: Do you have different quality criteria per end use?

Answer: Each buyer might set different quality criteria and grade the kelp produced. Typically the highest quality grade is used for food products, and lesser qualities might still be useful for non-food use like soil amendments or biomaterials.

Marjorie Linares

Question: do you have experience selling into cosmetic and personal care industry?

Answer: Through our Seaweed Source work, we have connected with cosmetics companies looking to purchase seaweed. We’ve also talked to farmers looking to sell to this market sector or create their own kelp personal care products. Based on these conversations, we’ve noticed most cosmetics companies are looking for a seaweed extract, and will either purchase a dry seaweed format and extract it themselves, or purchase an extract from a processor.

Ivar V

Question: how much space do you realistically need for a small/medium processing station?

Answer: This will depend on the type of processing you are looking into and the volume of seaweed you wish to process.

Rebecca Artmonsky

Question: kelp plastic is going to be huge! how big can a farm get to meet that demand?

Answer: Hi Rebecca, the sizes of farms vary widely, from just a few acres to large leases, especially in Alaska, over 100 acres. Some farmers are growing quantities over 300,000 lbs of seaweed per year. There's also the possibility to source from multiple farmers to meet higher volume demands.

Chalo Hancock

Question: What about growing kelp in cold water lakes? Any thoughts on this?

Answer: Kelp is a marine algae and needs salt water to grow. I'm not aware of any commercial markets for freshwater algae.

Jocelyn Lindner

Question: I am aware Greenwave has worked with MPI and EnviroStrat to develop the seaweed sector in New Zealand. AgriSea is another major business in the industry here. Who would you suggest as a person to contact to seek further information?

Answer:

Eric

Question: any of the speakers start from scratch ? Seem slike everyone who talked , talked about how they already had gear

Answer: Sean den Adel in session 2 and Mike Spranger in week 5 both started from scratch.

Earl Meredith

Question: Are there marine mammal issues and how have you resolved any potential entanglement problems?

Answer: To date there haven't been any entanglement issues with marine mammals and kelp farms. But a great way to prevent this from happening is keeping lines under tension in the water, this makes them much less likely for marine mammals to snag and tangle.

john koene

Question: I'm in northern cal. The spot I want is close to my home I've seen a small amount of bullkelp growing in the spot. but how and who do I connect with for a permit I personally am not a paper pushing kinda guy barely understand the language behind the questions

Answer: In a nutshell, in California, John, you'll first need to acquire a lease from the Fish and Game Commission which is proving to be costly, time consuming and challenging, and then there are a number of agencies who will need to issue permits including Army Corps and California Coastal Commission. You may want to join forces with a team of people and you'll need investment too.

Mike Spranger

Question: For the two presenters: Have you had any negative events (mammal entanglement, run away gear, vandalism, etc) occur?

Answer: To our knowledge there has never been an instance of marine mammal entanglement, however lots of gear mishaps are common! Check out this recording of [Halloween Farm Horror Stories](#) to learn more!

William Athill

Question: We now have our license and we will be laying our first set of gear in the water as the weather gets better in the early spring. We will have to keep our lines quite short so our anchors are not too big so we can handle them. Are people favoring seeded vertical lines from a horizontal headline or are people using just a seeded horizontal line ?

Answer: Hi Will, congrats on the new farm! In the US by and large most farms are seeding horizontal arrays. However, there is one test farm in Alaska using the vertical dropper line system pioneered by Oceans Rainforest, which has many seeded vertical lines. All the guidance on the Hub, however, is relevant to horizontal lines.

Aaron Chung-Jukko

Question: Out of curiosity, how far away from the coastline do governments have jurisdiction on kelp farming?

Answer: It depends on the country and in the US, on each state but generally Exclusive Economic Zones (EEZs) run out to 200 miles. Beyond that lies international waters. In the US most states have jurisdiction in State Waters from shore to 3 nautical miles and Federal (national) limits run from 3 nautical miles (state boundary) to 200 nautical miles. However, in Florida on the Atlantic side, state waters are shore to 3 nautical miles but on the Gulf side state waters stretch to 9 miles as they also do in Texas - 9 nm and Puerto Rico - 9nm. Another

example, in the UK, territorial waters extend to 12 nm and national waters to 200 nm.

elise be

Question: What is the most current research and findings on carbon sequestration of kelp for climate solutions and carbon credits ?

Answer: Carbon credits have not been developed for kelp. However, GreenWave lists some of the research done on the environmental benefits of kelp more broadly on our [Kelp Climate Fund](#) site and [Methodology](#) page.

Cecilie Stuart

Question: What about need for kelp farms on USA west coast?

Answer: Kelp farms are thriving in AK and more challenging in OR, WA and CA due to permitting limitations. There are also a number of kelp farms in British Columbia.

Hazel Levine

Question: I do local (Groton, CT and in Woods Hole, MA) seaweed and kelp education with youth (mostly middle & highschoolers). I feel like it's important to get information out there and this is the best way to do it since these students will be our future kelp farmers and buyers. Do you have a way or a plan to connect youth educators and get the word out there?

Answer: Great point, Hazel! We don't have a youth curriculum but I know that the [Hurricane Island Institute](#) in Maine does lead a summer program for youth interested in aquaculture. And maybe this is something we could develop in the future! I'd also suggest checking out the [algae academy](#) k-12 algae curriculum.

Jason Surfleet

Question: what kind of sea conditions will ruin a crop? is there a wave height that is likely to destroy or damage a crop?

Answer: Since the kelp is below the surface, if the lines are held far enough below the surface they tend to weather very big storms. There's a test farm in Puerto Rico that recently tried sinking the entire farm during a hurricane and the lines fared totally fine once they were brought back to the surface. Too much flotation can cause a lot of turbulence on the farm that does damage the crop.

Yonah Feld

Question: How can a student of sustainability and interested in the field of ESG and corporate sustainability contribute to this field?

Answer: Invest in kelp companies and startups, stay tuned for programs that support farmers for the environmental benefits of their crop.

Megan Meyer

Question: Follow up for Bren - I was reading some material. Is it going to be very difficult for permitting in the westchester part of LIS

Answer: Typically areas with a lot of coastal residents and few maritime industries are harder to permit, but it depends.

Pat Nolan

Question: 8 months for approval. I was curious...is that just for the east Coast or universal for the U.S.?

Answer: You can find Leasing and Permitting information per state in this lesson in the Hub including an approximate timeline:

<https://hub.greenwave.org/lms/lesson-section/who-issues-leases-and-permits/>

Roisin Black

Question: "How far south can you farm sugar kelp on east coast? Knowledge of warmer water seaweed/farming?"

Answer: The farthest south we've heard about is a farmer in Maryland.

Alexander Boyle

Question: Can there be conflicts between kelp farms and larger ocean animals? Do whales, dolphins, sharks etc. ever pose a problem for farmers?

Answer: To date, there have been no recorded incidents of marine mammal entanglement. However it's something the industry should be cautious to avoid as it develops.

Yennicootoysters

Question: I have an existing shellfish farm in NY and we are not permitted to grow kelp, but I am curious what is the window of time between harvest to market does a farmer have.

Answer: It's quite short. Typically we recommend you get your fresh kelp into the hands of a buyer within 24-48 hours, or look to stabilize it yourself via freezing, drying, etc.

Fin

Question: Couldn't you use extra kelp to build up top soil. As a backup plan.

Answer: There are many instances of kelp being used as a soil amendment. Plant biostimulants seem to be particularly promising.

Bob LLewellyn

Question: What if you go out beyond the 12 mile limit where the state has no say, or beyond the 24 mile limits where even the Country has no say? What if you go out beyond the 12 mile limit where the state has no say, or beyond the 24 mile limits where even the Country has no say?

Answer: Not sure about the specifics here. I'd recommend you contact your local regulators.

Justin

Question: Do you have a simple length of line to kelp yield formula? The farm design tool does the math, but what is the math behind the tool? Advice for setting price for fresh food grade kelp sales to restaurants?

Answer: The farm design tool estimates 4lb/ft which is a conservative average. Although this can really vary from farm to farm, from 1lb/ft to over 12lb/ft. Not all sites are created equal. We've heard of farmers selling fresh kelp to restaurants for \$10-\$20/lb.

Ian Baldwin

Question: Hi all, I'm interested in building out processing infrastructure. Due to the seasonality of harvesting, I'm curious about synergetic uses for the equipment/processing sites. Wondering if the speakers have thoughts on this. Thanks!

Answer: Hi Ian, it's great to be thinking about synergistic processing equipment and sites. Because sugar kelp is very wet, it's difficult to find existing processing equipment to dry the kelp. However, many coastal communities have infrastructure to process fish, which involves freezing and can be synergistic.

Stefan

Question: "Question about the vessel(s): Is a 22ft Aluminum bow rider suitable? With regards to mechanical helpers to pull in the lines (etc), mostly 1 person year around, more during harvest, can you please give some practical advise? Thanks & cheers. Stefan from Newfoundland"

Answer: A lot of farmers work with boats this size. Having a davit or mechanical pull point to move and deploy anchors is very helpful.

Heather Laiskonis

Question: how well do oyster hatchery needs mirror kelp hatchery needs/capacity?

Answer: A lot of the infrastructure is similar, (water filtration systems, biohazard control, etc) but the process is quite different. Try checking out the hatchery curriculum on the Hub.

Kyle Anderson

Question: Any other educational opportunities for people on the West Coast?

Answer: Washington Sea Grant held a session on kelp farming for interested folks a while back.

Andy Lewis

Question: Hi - Is there a kelp product that can be processed from polluted water?

Answer: Hi Andy, as you likely assumed, kelp from polluted waters may not be suitable for food applications, depending on test results. One application I'd consider is materials, we've seen an emergence of companies working on bioplastics.

Lars Eriksson

Question: How much kelp can you harvest from one acre and how much money will you get for it?

Answer: This greatly depends on how densely your anchor is farmed. Typically you can expect anywhere from a 2-6lb average per foot of growline. And farmers in the US are receiving between \$.60 - \$1.50/lb for wet kelp.

Kelly Dennis

Question: Have carbon credits helped to support kelp farmers?

Answer: There is no established carbon market for kelp. However, GreenWave is supporting farmers through our [Kelp Climate Fund](#).

Tara Lingg

Question: Do you have any comments on kelp/seawood farming off shore in bays ? I saw a kelp farm demonstration where they were able to walk off shore in shallow water?

Answer: Yes! Check out [this story](#) of farming in shallow water in Long Island Sound.

Fin

Question: At what latitude does sugar kelp stop growing at approximately. I could only find it on the west coast in Washington state.

Answer: Good question. I'm not positive.

bengt Liberg

Question: Can you do post harvest freezing of the kelp for the animal feed?

Answer: Whether or not you can freeze kelp will depend on your processing chain and application. From what we've heard, farmers and others have had success freezing kelp for various applications. Freezing is a great method for stabilizing kelp for further processing, including drying.

Victoria

Question: Looking long term, any concerns on the dependence on plastic products/fossil fuels in order to run kelp farms? Ex: Is anyone developing natural materials (rope, buoys, etc.) to use in place of the current plastic standard? And has any testing been done on plastic contamination from the product growing on these materials?

Answer: Yes, some scientists are looking at whether there is any impact of microplastics in kelp from gear. There are lots of studies looking at natural materials including hemp, cotton, and other biodegradable seed twine. Viable Gear is a great startup out of Maine looking to create plastic-free alternatives for the ocean farming industry.

Christen Marquez

Question: Is deep sea kelp farming going to be ultimately necessary for large scale buyers?

Answer: There is still a lot of room to improve the efficiency of near-shore systems before we would need to look at deep sea options. The engineering costs and infrastructure needs are so complex that it's hard to make it pencil out.

Site Selection

Tuesday, January 17th 2023

Janet S

Question: I've heard about an invasive species of bryozoan that has devastated wild kelp beds in Nova Scotia (so I would assume it affects New England area too)... have you heard anything about it, and do you see that as a concern for kelp farming?

Answer: Bryozoans are a common species of biofouling found on kelp farms. The best way to mitigate their presence is to harvest the crop as soon as they start to set on the lines, as they tend to proliferate quickly with warmer temperatures.

Sean Boddy

Question: Do you have any engineers/engineering firms that you have worked with or would recommend for farm design?

Answer: Some farmers designing large sites have worked with Cliff Goudey & associates, a marine engineering firm in MA. Cliff will join us next week in the live session on farm design.

Jocelyn Lindner

Question: SUCH a good tool. Is there any interest or current development to make this tool accessible to people designing farms overseas? Even if this is a generic international option instead of choosing a state

Answer: Thanks, Jocelyn! Yes, we're looking into trying to make this applicable to other geographies. At the moment, you can select "Other" from the list of states when you're first starting a new design.

Brianna Rouse

Question: I know this is slightly off topic and not your expertise but is there such a thing as fresh water kelp farming

Answer: Not that we're aware of.

Mr Oscar I. Mukiri

Question: Is there a manual and budget for starting a seaweed farm? Sort of project proposal

Answer: The best I can recommend is the Farm Design Tool budget.

Brianna Rouse

Question: Also when I go to the community page I can't find where to connect with others at all

Answer: When you're in the community, you can view posts by location at the top left. You can also post and have people reach out to you!

Caroline Frentz

Question: I know that farming kelp can benefit localized water quality. I am curious about siting farms in areas with nutrient pollution if any) as a specific benefit and I am wondering what negative impacts that could have on the harvested kelp.

Answer: Very relevant to the issues Tela Troge talked about in the session on site evaluation!

Jonathan Berube

Question: Could you tell us the names of the tools used to measure salinity and transparency?

Answer: An easy way to measure salinity is with an inexpensive salinity refractometer, commonly used at commercial aquariums and available online. Water clarity can be measured with a low-tech secchi disk—a black and white disk with a string attached. You can read more here: <https://hub.greenwave.org/lms/course/site-evaluation/>

Bengt Liberg

Question: Does salinity vary significantly through the seasons?

Answer: Depends on the site. Riverine/freshwater contribution increases with rain and snow melt.

G

Question: What macroalgae have the greatest potential to improve water quality and why not farm for water quality improvement as an endpoint....leaving kelp in place without harvesting it?

Answer: This could definitely be a strategy in some regions with highly levels of nutrient runoff, especially if subsidized by municipal or state governments.

Fin

Question: I've been researching kelp since 2008 in California right now . What about oarweed for my area. To hot for sugar kelp. Latin name Laminaria digitata

Answer: Your location will impact which species farms are allowed to grow. It is possible to grow Giant kelp (Macrocystis) in central to southern CA and bull kelp from central to northern CA. Laminaria Farlowii (oarweed) is also possible as it is being grown under a research project led by University of Irvine professor Janet Kubler in southern CA around Santa Barbara area, Also Alaria is possible and will be the next species grown on Cal Poly Humboldt's farm.

Bengt Liberg

Question: Can you fertilize kelp?

Answer: Since the ocean is an open system, this isn't recommended – and could lead you to major negative implications for the surrounding marine ecosystem.

Frank Buncom IV

Question: Would it make sense to find sites that are downstream from land agricultural operations that, unfortunately, have high levels of nitrogen runoff? One of the benefits of kelp farming is nutrient extraction. Kelp can help clean coastal waters with heavy nutrient loads.

Answer: Yes! This is definitely one strategy that has worked for a lot of farms in places like Long Island Sound. The danger of relying on a point-source nutrient load though is if that changes, your site could be nutrient limited.

Mike Spranger

Question: Could you explain how we test for nitrogen please?

Answer: Nitrogen assessment requires lab processing. Because of salt in the ocean, this can't be do with loggers. To assess N, collect water from different depths, filter and freeze them, and send those to a processing lab.

Fred

Question: Re. Air temperature, assume water temp is <59deg F during the growing season, is avg. air temperature a factor esp. for periods when air temperature > water temperature? Air temp is important for deployment and harvest.

Answer: Not very much while kelp is growing. The ocean can take a lot of heat before it warms. It will matter a bit more in shallow, slow moving waters.

Emmanuel Exhume

Question: Is it possible to grow in such a way that the disruption of flow is minimized?

Answer: To an extent. For example, increasing spacing in between lines, but this could result in underutilization of your lease area.

Jamie Lee

Question: Kelp extracts nutrients from the water, is there anyway to gauge the capacity of a site, and size/volume of produce before it affects the natural habitats/vegetations, esp. planktons in summer?

Answer: Great question. That is a standing question right now. It is only in the past 5 years or so, when research (outside of Asia) started exploring the interaction of farms, water chemistry, and habitat.

Fin

Question: Is anyone farming Sand Point . In Alaska

Answer: There's some work being done in Sand Point:

<https://alaskapublic.org/2019/12/05/sand-point-will-be-home-to-innovative-seaweed-farming-model/>

Fin

Question: Or is anyone farming king cove also? Bueller bueller.

Answer: Here might be some interesting reading for you on processing locations in Alaska:

<https://www.mcdowellgroup.net/wp-content/uploads/2022/02/assessment-of-alaska-seaweed-processing-locations-1.26.22.pdf>

Morgan Anthony

Question: Is anyone able to speak about farms that are growing varying species of seaweed not just kelp? Is this practical/ possible for a small operation?

Answer: At the moment, most US ocean farms are growing multiple types of kelp because kelp have the benefit of holdfasts that will grow to connect to the growline. Some farms in Oregon

are cultivating dulse in tanks. And there is some work in Florida to cultivate red algae using a tie-method.

bengt Liberg

Question: what are epiphytes again? sorry

Answer: organisms that grow on top of other

Marjorie Linares

Question: what are some examples of epiphytes can how do they affect the yield? is this biofouling? do they hang from the line making it hard to harvest- what are the challenges encountered when facing epiphytes

Answer: Biofouling in general is the biggest threat to quality of kelp – snail eggs, bryozoans, hydroids, etc are all types of marine organisms that start to set on the kelp crop when the waters start to warm in the spring. This is part of why farmers tend to harvest in April and May before biofouling takes off.

John Smet

Question: what is an average and great kg / m yield for the kelp farms that you studied?

Answer: Average 7 max 14.5

Michael Teasdale

Question: What kind of growth/biomass rates would you estimate to be commercially sustainable? We those sites < 1uM Nitrogen concentration at those 'commercial' growth rates?

Answer: Farms with 2-6lb/ft + average are generally considered commercially sustainable.

LUCA MASTRANGELO

Question: how would you assess/measure nitrogen at a site over time before selecting it?

Answer: Ideally, you would collect water samples every two weeks or every month if there is some background data available. Samples must be filtered and frozen as quickly as possible before sending them to a water processing lab. Nitrogen in saltwater can't be measured in-situ.

Eduardo Muro

Question: How do we get in contact to receive a tool kit/share info on potential sites?

Answer: The toolkit was licensed to Reed Mariculture. At this point, I think you will need to contact them to have it assembled for you, like an on-demand approach. Another option is to get it from Dr. Umanzor's Mariculture Lab, with an option of having it on a per-cost basis in exchange for data. Data could limit to feedback. In that case, you can email Dr. Umanzor at sumanzor@alaska.edu.

To clarify, this is not a nutrient testing kit per se. Nitrogen from the ocean can't be measured as in freshwater. Water samples collected must be analyzed at a lab. The kit has all devices and instructions required to collect water samples, plus other parameters that can be measured directly, but then they must be sent in for analysis.

bengt Liberg

Question: Are there any open sources that share basic data in the region? Like temp, salinity, Nitrogen?

Answer: Different regions have different tools publicly available. A good one for the state of Alaska is <https://mariculture.portal.aocs.org/>. We've tried to outline other good resources for different US states in the [Permitting Directory](#) in the Hub.

Derek Nason

Question: Have any of you had success making or using DIY Niskin bottles? There is an Instrucibles page for one here: <https://www.instructables.com/Niskin-Bottle/>

Answer: Yes! We use a version of this on the GreenWave farm — it's a great tool for testing water at depth.

Tobias Stevens-Fleming

Question: '@Dr Schery - Can you provide a little more light on the advisable depth of 10m that is currently suggested.

Answer: Although you can grow kelp in much less water, 10 m allows for line sagging without having kelp rubbing the bottom and allows for water flow underneath the farm

Marjorie Linares

Question: how close can a site be to large human activity- public beaches in major metropolis?

Answer: Marjorie — This really depends on state regulations, some states have pre-approved areas for mariculture activities. But in general, the less popular the area, the more easier the process will be because there will be fewer opposition and stakeholders to convince.

Michael Teasdale

Question: In terms of site selection, what about proximity to native kelp beds? Is this a possible concern as easier spreading of byzoans/other epiphytes? What about urchin populations? Is urchin populations/distributions an important factor? Do the urchins climb up the lines and eat the kelp?

Answer: The possibility of farming in proximity to kelp beds is in some places dictated by local regulations. Yes, biofouling could move from a wild bed to a farm. Same as from a farm to another farm. The more you pack a site the higher the chance of getting outbreaks of epiphytes in general. Urchins are a concern, they do climb ropes, tube, chain... and do eat kelp.

Yonah Feld

Question: I am a college student very interested in kelp farming and I have to do a GIS final project and interested in land based factors in site assessment. I want to find a list of things on land that could help setup a kelp farm for success. Any ideas for what to start mapping?

Answer: Hi Yonah, I'd recommend you read our Site Evaluation course (<https://hub.greenwave.org/lms/course/site-evaluation/>) and take a look at our Ocean Farm Design Tool (<https://hub.greenwave.org/app/karm>) those might help you with your project!

bengt Liberg

Question: When data is available (open source, or own measurements) what is the radius that data would generally cover before new measurements are recommended? So, how many measurements are needed per square mile for example?

Answer: This varies greatly based on the topography. Can't narrow this down to a simply answer. For example, parameters like nutrient availability may not change significantly in a horizontal plane but light could. I would do a quick sampling of "easy" parameters like transparency and check for how water flows. If two sites do not look very different, I would not do a full sampling. Another example, if in a bay, I will sample at the mouth, middle, and inner bay.

Brianna Rouse

Question: I know the gulf of mex. has faster and rougher water conditions but does anyone know if it's possible to farm off the texas coast?

Answer: Hi Brianna— Unfortunately, there is currently no regulatory process for sugar kelp farming in Texas.

Brianna Rouse

Question: in your professional opinion is it possible to get an agency started ? I feel like kelp is a fairly new concept in farming and most states I assume didn't have agencies for this maybe 10-20 yrs ago.. also can you only farm sugar kelp?

Answer: Many state agencies that have traditionally regulated shellfish farming are now regulating the farming of aquatic plants. I would reach out to your local department of natural resources or department of agriculture for more information.

Danielle Calini

Question: What is the socially acceptable distance to have between kelp farms?

Answer: This depends on the region. Some oyster farms are sited right next to each other, and some are in entirely different bays. I would recommend talking to the neighboring farmers in the area you're proposing to site.

Marjorie Linares

Question: Thanks for answering my question regarding site close to human activity, Lindsay. Independently to regulatory and resistance constraints (the people factor) what about the health or quality of kelp close to a densely populated area - short version: is it viable if you surpass permit obstacles?

Answer: You would want to have your kelp tested for contaminants and heavy metals, but it's possible the kelp could still be edible / viable for non-food use.

Jack Mason

Question: How many times a season should a kelp farmer expect to check out the crop, beyond the major planting and harvesting work?

Answer: Hi Jack — typically we recommend every 2 weeks, min once a month. If there's a big storm event, you might need to check before and after.

Michael Teasdale

Question: What about setting up several 'smaller sites' for the first year (i.e., single vertical mooring) to check actual growth rates without all the infrastructure? What are some of the concerns with that approach?

Answer: This is a great tactic! We highly recommend experimental sites when possible. Sometimes the permitting burden can be immense, and so farmers choose to go through the process with a bigger commercially-scaled lease application to not have to go through the process twice. But if sample sites are an option in your area, by all means, do it!

Nontobeko Xulu

Question: Please advise on methods to follow to ensure juvenile kelp dislodges minimally after an out-plant.

Answer: I recommend you check out the guidance in our course on [outplanting](#) for best practices.

Jocelyn Lindner

Question: How did Sean access seed? Do you have your own hatchery?

Answer: Yep. We had Aluutiq Pride in Seward grow our seed.

Alexander Boyle

Question: What about megafauna, have there been conflicts between kelp farming operations and marine animals such as sharks, dolphins, whales, seals...?

Answer: Good question. To date, there have been no negative interactions with marine mammals and kelp farms, but it is a big concern especially in certain regions. Having lines under tension and not loose in the water column is the first line of defense.

Brianna Rouse

Question: I'm sorry I'm so new to this I don't really know what no regulatory process means... is it not allowed or just no one has tried or it's not a viable spot due to ocean conditions.

Answer: No worries, Brianna— to farm, you'll need to apply for a lease and a permit. The regulatory agencies responsible for granting leases and permits to ocean farmers vary by state. Unfortunately, this process has not been developed in Texas.

Michaëlle Exhume

Question: from my experience in testing crude oils, it has always been difficult to reproduce results for salinity data... I'm wondering if the same inconsistencies might exist in instruments that measure water salinity? are these conductivity meters? could this be another reason to use a refractometer instead?

Answer: Using a refractometer in the kit, is more because of costs. Other aspects: Conductivity meters do need frequent calibration. Loggers lose calibration if exposed to air when running. Salinities with a refractometer are very consistent as the principle is very simple.

Caitlin Cardinell

Question: In Alaska, what is the standard depth range for an appropriate farm location?

Answer: Anywhere from 25 feet to over 100 ft. The deeper the site, the more expensive the gear, given the need for larger anchors and longer scope.

G

Have you tested water and harvested kelp for pathogen indicators such as Fecal Coliform, etc.?

Answer: It is always recommended to have your kelp tested before commercial sale.

Kelsey Applegate

Question: Do you have any advice for touring farms? Does GreenWave keep a contact list of farmers in your network?

Answer: We don't! Mainly because we try to limit the amount of contact that each farmer gets. But some farms such as Hog Island Oysters in CA and Madeline Point Oyster Farms in ME offer paid farm tours.

Mike Spranger

Question: Has Tela's group been able to track benefit from their kelp farm to shellfish?

Answer: Only anecdotally.

Kelsey Applegate

Question: How many people does it take to work a farm?

Answer: Most farms are run by one farmer and 1-2 seasonal crew. Obviously this would increase as the farm sized scaled.

Danielle Calini

Question: How does it work to grow sugar kelp in the shallow waters?

Answer: Check out [this article](#) on this type of shallow water farming methods.

bengt Liberg

Question: Are the mentioned benefits to the environment of any help to increase the amount of farms? Get licenses, sites, subsidies?

Answer: The more we can talk about the benefits to kelp farming, the more social license the industry will get as a whole!

Roisin Black

Question: Does the Shinnecock Farm sell commercially?

Answer: They do.

Jamie Lee

Question: Any recommendations and tips for setting a farm in fjords with steep gradients?

Answer: I recommend asking this question during the live session on farm design. In general, you might need to look at a system that has a much more substantial anchoring system on the deeper end of your array, and a shallower setup near shore.

Brian Baldauf

Question: HOW DO YOU FARM IN SUCH SHALLOW WATER?

Answer: Check out this [article on shallow farming in Long Island here.](#)

Gear Selection and Farm Design

Tuesday, January 24th 2023

Mr Oscar I. Mukiri

Question: Please will we get a manual, after this training?

Answer: Hi Oscar, have you been able to log in to the Hub and take a look at the courses? They serve as the manual that we are using for this course! <https://hub.greenwave.org/>

Jamie Lee

Question: Any recommendations and tips for setting a farm in fjords with steep gradients?

Answer: Hi Jamie, It really depends on the substrate and depth. I will always recommend embedment style anchors. With a steep gradient you may end up with much longer scope on one side of the farm. If the anchors will bite into the bottom then it's just a matter of having proper scope to make sure your farm structure is within spec. Otherwise it's tough without specifics.

Jamie Lee

Question: To set a single-array line with deadweight, the anchor rode is said to be 3:1 for rope length:depth. Does the depth measurement start from the depth of the growline, or from seafloor to water surface?

Answer: Jamie, The 3 to 1 refers from the anchor to the grow line.

Jamie Lee

Question: If the depth at one side of anchor is at 15 meters (50 ft) and the other end is 20 meters (66 ft), would you prep the anchor rope lengths to their respective depth?

Answer: Yes, best to use a consistent scope ratio.

Jamie Lee

Question: If the depth at one side of anchor is at 15 meters (50 ft) and the other end is 20 meters (66 ft), would you prep the anchor rope lengths to their respective depth?

Answer: yes you will have different lengths of anchor lines. I would start with the dimensions of your kelp array and work backwards to your anchor lines.

Mike Doty

Question: what was grown in puerto rico. any links would be appreciated

Answer: Eucheuma isoforme ans Gracilaria.

ted burdacki

Question: How do you get to the center of a catenary array when harvesting kelp? it looks like it would be hard too access.

Answer: live answered

Jamie Lee

Question: If I connect a new stainless steel shackle to an old stainless steel part on an anchor, will the new steel cause corrosion to the old gear?

Answer: Yes corrosion is a problem. I do not use chain or metal shackles because of corrosion. It depends how hot your site is but you will have to pull those anchors up and inspect them more often if your using schackles and chain.

Bob LLewellyn

Question: Why aluminum? Plastic will cost less and not get eaten by the salt water (Electrolysis)

Answer: Aluminum is deffenitly possible, it's a little softer and often has to be custom made so could be a cost factor. It's also possible to build these sets without any metal
More important than matrials is attachment points. It's handy to weld on robust loops to alomimum pipe. As long as there are no other metals around, no problem with the aluminum.

Mike Doty

Question: will catenary work in open ocean. also curious if the catenaries are perfect hyperbolas.

Answer: Yes, if the components are robust enough. They are most closely related to parabolas.

Michael Teasdale

Question: We are in a rocky hard bottoms environment, any advice on anchors that can't really hook into the bottom?

Answer: I might look into stock anchors, they're made for rocky bottoms. It might take a bit before it gets a good bit though.

Mike Doty

Question: why galvanized steel instead of aluminum?

Answer: There are aluminum yacht anchors (Fortress) and they are easy to handle but weight is useful so steel is a preferred choice and being Galvanized means that can last decades.

Kiran Kling

Question: Dave - I'm seeing conflicting research about the carbon impacts of kelp farming. Can you speak briefly on carbon sequestration through kelp farming, and carbon introduced to the atmosphere as a result of marine life ecosystems enabled by kelp?

Answer: Hi Kiran! There's a lot of research going on right now around carbon sequestration and seaweed, but unfortunately the jury is still out on specifics, particularly when there is so much variability across geographies, farm designs, etc.

Michael Teasdale

Question: What about advantages/disadvantages concerning ice, any of the systems work well in terms of lowering/raising lines during heavy ice?

Answer: live answered

John Smet

Question: Does Alaska require all farms to remove gear in the summer? What if you are growing a perennial crop like *Macrocystis*?

Answer: every lease is different. almost all leases need to remove their growlines at the end of the season. As far as I know no one has permitted a *macrocystis* farm yet. I think it's possible and will be site specific. I'm permitted to leave my anchor and farming lines in year around which helps reduce the amount of work.

Gabby Harrison

Question: How would you harvest a large system like the 6 catenaries side by side? From the pictures it looks like you wouldn't be able to get a boat between the lines

Answer: Depends on the size of the boat and the depth of it's props. Generally the whole farm is harvested in a short rarm and it's best to start from the outside edge and work in. Best to start on the downwind or downtide side.

Liam Van Vleet

Question: For Alf: How many people work your farms and what are their roles? Thank you

Answer: live answered

Jack Mason

Question: Alf, with your scale, what are the sales uses for so much kelp?

Answer: live answered

James Wylie

Question: How many lineal feet did you need to produce 300-400lbs?

Answer: Hi James! We usually think about this in terms of biomass per foot, and in the past few years the industry average has been about 2-3 lbs per foot. There can be parts of an array that yield much more (like 6-10 lbs per foot), but right now we find that they tend to be interspersed with areas of significantly less growth.

sai chaitanya jasthi

Question: Is kelp used as raw material in Plastic manufacturing?

Answer: There are organizations attempting to innovate and scale the production of compostable packaging and other plastic alternatives made from seaweed!

Fin

Question: What about ethanol production .

Answer: Hi Fin! It is physically ossible to produce ethanol from seaweed, but right now the process is not energy efficient or cost-effective enough to form a viable market.

ana webb

Question: How is your system doing with storms/big waves? Thanks!! from patagonia

Answer: live answered

Gabby Harrison

Question: What would the capital costs look like for a typical farm? What would a reasonable payback period be?

Answer: Hi Gabby — We're going to be covering these exact topics in next week's webinar on Business Planning. I hope you'll join us then!

Roisin Black

Question: Can you grow oysters etc concurrently on multi arrays?

Answer: live answered

Janet S

Question: what protective measures, if any, do you take if major storms are predicted for your region? I'm thinking in particular about late season hurricanes and mid-winter Nor'easters, etc. (I'm in Nova Scotia, Canada)

Answer: live answered

Kerr Jefferies

Question: What is the impact of tidal range on the rigidity, tension or sag of the farm itself?

Answer: It's a big deal but the stretch of the lines helps a lot in smoothing this out. It's easiest to tension at low tide but be careful that the end buoys don't sink at high tide,

ted burdacki

Question: do you get a lot of marine growth on your buoys? do you have to paint them with bottom paint?

Answer: We have tons of natural grow of kelp, mussels and barnacles. I personally do not like working with bottom paint. My experience is the paint is only effective for one year.

Jack Mason

Question: How is proper line tension measured and maintained throughout the season?

Answer: Hi Jack, tensioning the system is something that most farmers do by look and feel. A well-tensioned system will have straight lines in the water, submerged at a constant depth. A slack system will have a fair bit of sag between flotation buoys along your growlines. [There are some examples in the Hub](#) of ways that you can rig up a tensioning buoy that will submerge under water when the array is pulled tight, and act as additional pull on the system at slack tide. Generally, your tension will shift over the course of the season as anchors settle and biomass grows. It will also vary from tide to tide. One method for making small adjustments to tension is to use a [deadeye system](#) on 5-line or catenary arrays (as Cliff mentioned in the live session.) Many farmers have found this helps in pulling the last bit of tension.

Jamie Lee

Question: To keep the grow line suspended 2m below surface, what is the ideal distance below surface to place the tension pill buoys on the anchor line?

Answer: Hi Jamie, we put it about 2m (6 feet) past the connection eye on the anchor line that connects to the growline. [This video](#) might be helpful.

Jamie Lee

Question: Could you explain how connecting the growline to anchor line with a pigtail will help with retrieving the growline for inspection?

Answer: It gives you a lifting point that you can pull on and bring to the surface without disturbing any of the kelp growing on your growline itself. It's not entirely necessary, but if you're tying your growline directly to your anchor line it can sometimes get tangled with the seedstring, and you end up losing some amount of growth over the course of the season.

Business Planning

Tuesday, January 31st 2023

John Smet

Question: Does Greenwave maintain a database of potential end customers or processors? Especially on the wholesale side.

Answer: Hi John! GreenWave has our Seaweed Source program where we connect active farmers with processors and buyers. Farmers, processors and buyers can apply to participate in our web-based application and 1:1 work where we support companies with their domestic sourcing strategy. Feel free to take a look here to learn more and apply once you're an active farmer: <https://www.greenwave.org/seaweed-source>

Jennifer Hickey

Question: I'm curious about other species besides sugar kelp grown for food

Answer: Hi Jennifer! Sugar kelp is the primary species cultivated and utilized in food. Other cultivated species, including bull kelp, alaria, and skinny kelp can be used in food applications. Check out Barnacle Foods for an example of food applications utilizing bull kelp.

Jack Mason

Question: For Suzie: What supply chain, processing or kelp industry support services do you see as unmet opportunities? What do farmers like you need or want to grow your business?

Answer: Hi Jack - cold chain shipping is a challenge as is finding local processing facilities outside of maine. There are a lot of ways for the industry can grow from product development to streamlining processing in southern new england and the NY/NJ area.

Colin Wadson

Question: Any plans to convert the farm design tool and business building tools to metric?

Answer: You can read more about the internationalization of the tool here: <https://hub.greenwave.org/community/topic/159/internationalisation-of-the-farm-designer/2?toPid=279>

John Smet

Question: Thanks Grace - is it possible to register as a farmer while still in the business planning stage? It would be helpful to connect with potential end markets to get a sense of price / lb and logistics to feed back into our financial model.

Answer: Great question! It's very important to be thinking about markets for your kelp early on. At this time, Seaweed Source is intended for active farmers and buyers to make connections for potential partnerships. We'll talk more about end markets (including price ranges) in this webinar. You can also learn more from our Sales Planning 101 webinar: <https://vimeo.com/780927649/db41deef15>. It's great to already have an understanding of price

range and logistics before connecting with buyers directly, so you can be as prepared as possible going into those conversations.

Rachel Howell

Question: where can people in alaska find more information on build back better funding?

Answer: Hi Rachel. I recommend checking out this website, run by the Southeast Conference: <https://www.alaskamariculturecluster.org/> (If you click on the top right "Stay informed" you'll get updates on any requests for proposals for grant funding.

Michael Teasdale

Question: What is "FW"? sorry if I missed it earlier

Answer: "Fresh Weight" — meaning wet kelp, not dried or processed in any way

Jocelyn Lindner

Question: what entails meeting food safety standards

Answer: Food safety standards will depend on local regulations and the needs of the specific customer you are selling to. Typically, you will need to have a documented food safety plan in place, some businesses use a HACCP plan for a comprehensive food safety plan. I recommend local guides from Sea Grant to get you started on food safety information and resources: https://seagrants.uconn.edu/wp-content/uploads/sites/1985/2020/01/Seaweed-Hazards-Guide_Jan2020_accessible.pdf. You will also want to test your kelp (a nutrient analysis and testing for potential hazards).

Jennifer Hickey

Question: How long is a typical seed spool?

Answer: Hi Jennifer — it depends on the standard protocol of the hatchery you're working with. Typically they're usually 200 or 400 ft.

Andrew S

Question: If you get a business loan, do you account for the first few years being losses in that finalized number or do you just have to assume you'll eat the losses yourself?

Answer: If you get a business loan, do you account for the first few years being losses in that finalized number or do you just have to assume you'll eat the losses yourself?

Francis Bousquet

Question: What about the Iodine Level of Kelp limiting the amount that can be ingested on a daily basis

Answer: Great question. Iodine levels are an important consideration if your kelp is intended for food markets. The industry has seen success reducing iodine level through blanching which you can learn about here: <https://pubmed.ncbi.nlm.nih.gov/32375299/>. You should test your kelp for iodine and compare this against the recommended daily intake from the FDA.

Rachel Howell

Question: you mentioned storm years that could change your plan, is there a way to retroactively protect against a predicted storm or would you have to do that at the time of gear deployment?

Answer: You can get crop insurance through the USDA and also i would be very mindful about deisging your farm based on the site (and not based on someone elses model)

James Wylie

Question: To Suzie- How does your sugar kelp cooperative work, and how far geographically does it extend?

Answer: We operate regionally right now because the problems we are trying to solve are pretty specific to southern New England BUT if you are somewhere else and wanted to talk we can absolutley have a call. suzie@stoningtonkelpco.com

Michael Wilson

Question: Is there a list of kelp hatcheries/nurseries for North America?

Answer: Hi Michael, take a look at this asset a Hub Community member put together: <https://hub.greenwave.org/community/topic/239/global-map-of-propagation-centers-and-hatcheries/2>

ted burdacki

Question: do you recomend setting up your business type by yourself, an on line service or a lawyer?

Answer: Hi Ted, for more information on business structure, we recommend the Legal Food Hub: <https://www.legalfoodhub.org/resource/deciding-on-the-right-structure-for-your-business/>. We do recommend consulting an attourney or accountant if possible

Diane F

Question: Would pharmaceutical use fall under food or non-food, from the food safety procedures prospective

Answer: Hi Diane, the regulations for pharmaceuticals are different from food-specific regulations. Keep in mind phara applications may require significant documentation and safety information similar to food markets

Heather Laiskonis

Question: When is this seaweed fest? And where?

Answer: There is one in CT, RI, MA and NY April 20-April 30 - visit newenglandkelp.com