

OFFICIAL FEEDBACK FORM

DIALOGUE DATE	Wednesday, 7 July 2021 15:00 GMT +03:00
DIALOGUE TITLE	UNFSS Science Days Side Event Domestication for sustainable seaweed aquaculture: a major research challenge for the future of blue food systems
CONVENED BY	Dr. Philippe Potin, Coalition Leader, Safe Seaweed Coalition Dr. Flower Msuya, Founder and Chair, Zanzibar Seaweed Cluster Initiative
DIALOGUE EVENT PAGE	https://summitdialogues.org/dialogue/29367/
DIALOGUE TYPE	Independent
GEOGRAPHICAL FOCUS	No borders

The outcomes from a Food Systems Summit Dialogue will be of use in developing the pathway to sustainable food systems within the locality in which they take place. They will be a valuable contribution to the national pathways and also of interest to the different workstreams preparing for the Summit: the Action Tracks, Scientific Groups and Champions as well as for other Dialogues.

1. PARTICIPATION

TOTAL NUMBER OF PARTICIPANTS

57

PARTICIPATION BY AGE RANGE

0 0-18 13 19-30 23 31-50 10 51-65 5 66-80 80+

PARTICIPATION BY GENDER

28 Male 23 Female 3 Prefer not to say or Other

NUMBER OF PARTICIPANTS IN EACH SECTOR

1	Agriculture/crops	1	Education		Health care
19	Fish and aquaculture	1	Communication		Nutrition
	Livestock	1	Food processing	1	National or local government
	Agro-forestry		Food retail, markets		Utilities
10	Environment and ecology	4	Food industry	1	Industrial
3	Trade and commerce	1	Financial Services	9	Other

NUMBER OF PARTICIPANTS FROM EACH STAKEHOLDER GROUP

5	Small/medium enterprise/artisan		Workers and trade union
	Large national business		Member of Parliament
1	Multi-national corporation		Local authority
2	Small-scale farmer	6	Government and national institution
	Medium-scale farmer		Regional economic community
	Large-scale farmer	3	United Nations
2	Local Non-Governmental Organization	1	International financial institution
4	International Non-Governmental Organization	2	Private Foundation / Partnership / Alliance
2	Indigenous People	3	Consumer group
11	Science and academia	11	Other

2. PRINCIPLES OF ENGAGEMENT

HOW DID YOU ORGANIZE THE DIALOGUE SO THAT THE PRINCIPLES WERE INCORPORATED, REINFORCED AND ENHANCED?

All seven Principles of Engagement were incorporated into the design and delivery of this Dialogue. The moderator, keynote speaker, panel members, and team reinforced the Principles both during and after the event, through the messages we delivered throughout, and by the interactions between the presenters and the audience. A broad variety of stakeholders were invited and attended. Even though the topic was, necessarily, scientifically focused, we designed the event to be accessible and to allow for maximum participation, through audience polls, live chat responses, and an extended Q&A session. The message transmitting the Report also highlights the Principles.

HOW DID YOUR DIALOGUE REFLECT SPECIFIC ASPECTS OF THE PRINCIPLES?

Act with Urgency: One of the speakers highlighted the importance of rapidly bringing the seaweed industry “out of the Stone Age.” **Commit to the Summit:** The moderator highlighted the relationship of this event to the Summit and invited participants to consider which messages from this Dialogue should feed into the Summit. **Be Respectful:** All participants were treated with respect. Different perspectives were encouraged. **Recognize Complexity:** The topic of seaweed domestication and its ramifications within the food system represent the complexity of our food system more generally. **Embrace Multi-Stakeholder Inclusivity:** The event was designed with interventions from speakers from Africa, East Asia, Europe, South America, and North America, drawn from various stakeholder groups. Participants attended from around the world. The invitation was sent to a broad range of stakeholders, with encouragement for onward sharing. During the Q&A, attention was paid to queries from people who were not previously known to the organizers. All questions posed in the chat that did not receive live responses in the event were included in a follow-up Q&A Annex to this report, with responses from the speakers. **Complement the Work of Others:** Seaweed domestication is a nascent topic. The speakers highlighted their own and others’ ongoing research and pointed to the significant research agenda in this area. **Build Trust:** Different perspectives were invited and welcomed.

DO YOU HAVE ADVICE FOR OTHER DIALOGUE CONVENORS ABOUT APPRECIATING THE PRINCIPLES OF ENGAGEMENT?

There are many ways to allow for inclusivity in these Dialogues, even if breakout rooms are not used. We used audience polling – some serious, some slightly humorous – to draw the participants in and help them feel more part of the event. We actively encouraged chat participation, with questions receiving close to real-time responses in the chat. Several questions received live responses during the Q&A session at the end of the event. Sourcing help from graduate students significantly enhanced the quality of this Dialogue.

3. METHOD

The outcomes of a Dialogue are influenced by the method that is used.

DID YOU USE THE SAME METHOD AS RECOMMENDED BY THE CONVENORS REFERENCE MANUAL?

Yes

No

4. DIALOGUE FOCUS & OUTCOMES

MAJOR FOCUS

The event focused on seaweed domestication, with attention to its potential to contribute to achieving the SDGs, especially its contributions to SDG2. Drawing on presentations by leading researchers and practitioners, the event demonstrated the significant potential of seaweed to contribute positively to the food system, as well as the multitude of open questions and the broad research agenda that remains.

ACTION TRACKS

- ✓ Action Track 1: Ensure access to safe and nutritious food for all
- ✓ Action Track 2: Shift to sustainable consumption patterns
- ✓ Action Track 3: Boost nature-positive production
- ✓ Action Track 4: Advance equitable livelihoods
- ✓ Action Track 5: Build resilience to vulnerabilities, shocks and stress

KEYWORDS

- Finance
- ✓ Innovation
- Human rights
- ✓ Women & Youth Empowerment
- ✓ Policy
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- ✓ Governance
- Trade-offs
- ✓ Environment and Climate

MAIN FINDINGS

Safe and responsible seaweed domestication could lead the path in restoring ocean diversity and sustainably feeding the world.

There are many avenues for seaweed to contribute to achieving SDG2 beyond direct human consumption. Seaweed is part of the global ecosystem. It can be used to feed land and ocean animals and participate in the planet's biodiversity. Seaweed can boost nature-positive food production, advance equitable livelihoods and promote social, gender, and economic equality. Growing seaweed has high potential to help combat climate change. It is a nutritious food source, high in carbohydrates, necessary minerals, and vitamins. Over 20% of all aquaculture production is seaweed.

The seaweed domestication process should be "eco-evolutionary," using integrated knowledge of ecology and genetics to promote sustainable seaweed production. The future of seaweed domestication should be based on sustainable management practices. Management practices remove competitors and modify species' environments, which maintains the species' evolutionary potential without reducing genetic diversity. Long-term domesticate-domesticator interaction eventually leads to mutualistic coevolution.

There is research and development on improving seaweed biomass yield by selective breeding and non-genetic morphology modification. Current research is focused on improving seaweed light harvesting by optimizing the morphogenesis and physiology of the plant.

For communities impacted by overfishing, seaweed production could be an alternative. Current seaweed harvesting and cultivation methods are very labor-intensive, inefficient, and low-tech. There is a need for innovative solutions to pull the industry "out of the Stone Age". Seaweed farming creates jobs for coastal communities, particularly women, advancing social, gender, and economic equality. A transparent seaweed production industry will protect the producer, consumer, and the environment.

Climate change poses a growing challenge to native seaweed domestication. High water temperature promotes the growth of diseases and epiphytes. New strains were imported from the Philippines to maintain the seaweed industry in Tanzania.

There is limited research on native seaweed strains in Tanzania and the environmental impact of imported strains.

There is a lack of seaweed food products in Western markets. The seaweed food market is limited by low shelf-life, low consumer awareness, and acceptance.

There is a need to streamline the supply and demand side of seaweed as a sustainable food source. Seaweed domestication needs clear guidelines to avoid genetic and environmental pollution while providing safe, socially, and economically responsible opportunities for the communities.

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OUTCOMES FOR EACH DISCUSSION TOPIC - 1/8

Evolution of Seaweed Domestication

The future of seaweed domestication is an “eco-evolutionary process” via safe and responsible management practice. Domestication is a long and complex process during which domesticators select and modify organisms that can develop well in the domesticator’s environment. Domestication can cause a reduction in species genetic diversity and biodiversity when done poorly without holistic ecology, biological and environmental consideration. In addition, when transplanting seaweed into a new region, we are also at risk of importing pests and diseases that could spread to native seaweed. Therefore it is important to consider genetic and environmental pollution during the domestication process.

Local varieties should be the focus of the local seaweed domestication process, allowing producers to preserve genetic diversity and biodiversity. The “eco-evolutionary process” focuses on best management practices and breeding strategies that maintain the domesticates’ evolutionary potential. The seaweed domestication effort should be led by producers and supported by Government, the local community, and the academic community.

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OUTCOMES FOR EACH DISCUSSION TOPIC - 2/8

Role of Gender in the seaweed industry

The seaweed industry offers new economic opportunities for women especially in developing regions. There will be challenges in opening the pathway for women in the seaweed industry, in particular family and community restrictions. Culture and society norms expect women to stay at home, not in the field. To break down these barriers, as a community we need to encourage women's participation, demonstrate and show that opening up opportunities for women will increase everyone's livelihoods. There are opportunities for governing bodies and NGOs to kick start, promote, and empower women in the industry.

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OUTCOMES FOR EACH DISCUSSION TOPIC - 3/8

Seaweed's potential contributions to the achievement of SDG2

There are many avenues for seaweed to contribute to achieving SDG2 beyond direct human consumption. Among them, seaweed beds in marine ecosystems can provide many services including for other fisheries that depend on seaweed production. Seaweed can be used to feed land and ocean animals and participate in the planet's biodiversity.

Seaweed domestication contributes to food safety while combating climate change. It is already an important ingredient in coastal communities' cuisine. Seaweed aquaculture can substitute and supplement high emission and high-intensity land-based agriculture. By switching from meat and fish to seaweed, we can reduce the food security pressure faced by the existing food system. It is an untapped resource with high potential. In addition to being a sustainable food source, seaweed cultivation is part of regenerative aquaculture.

A transparent and unified seaweed supply chain and the market will promote safe and sustainable domestication, production, and consumption. Government, NGOs, and industries need to actively support the entire seaweed industry supply and demand side.

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OUTCOMES FOR EACH DISCUSSION TOPIC - 4/8

Importance of advancing research

Climate change poses an imminent challenge to seaweed domestication. Native seaweed that grows naturally is at a higher risk of adverse environmental conditions, diseases, and epiphytes. Production of native seaweed is decreasing due to rapid and unpredictable environmental changes. Currently, there is a lack of research and knowledge of native species. Imported domesticated strains could become invasive and occupy the space of native species.

A joint research effort between seaweed producers and academia is needed in improving seaweed biomass yield and climate change resilient seaweed strains. Currently, there is an ongoing effort to develop higher-yield seaweed strains while avoiding genetic and environmental pollution and maintaining local ecology. NGOs, government, and industry could support the research effort with additional funding, collaborations, and open science policy.

ACTION TRACKS

<input type="checkbox"/>	Action Track 1: Ensure access to safe and nutritious food for all
<input type="checkbox"/>	Action Track 2: Shift to sustainable consumption patterns
<input checked="" type="checkbox"/>	Action Track 3: Boost nature-positive production
<input type="checkbox"/>	Action Track 4: Advance equitable livelihoods
<input checked="" type="checkbox"/>	Action Track 5: Build resilience to vulnerabilities, shocks and stress

KEYWORDS

<input type="checkbox"/>	Finance	<input type="checkbox"/>	Policy
<input type="checkbox"/>	Innovation	<input checked="" type="checkbox"/>	Data & Evidence
<input type="checkbox"/>	Human rights	<input type="checkbox"/>	Governance
<input type="checkbox"/>	Women & Youth Empowerment	<input checked="" type="checkbox"/>	Trade-offs
<input type="checkbox"/>		<input checked="" type="checkbox"/>	Environment and Climate

OUTCOMES FOR EACH DISCUSSION TOPIC - 5/8

Developing new farming technologies

Seaweed production Innovations are highly valuable and impactful. Pioneering of new technologies needs open conversation between developers, producers, local ecologists, and the surrounding communities, throughout the development process and beyond. All key stakeholders need to be flexible and adaptive to unexpected change. Due to climate change and the rise in ocean temperature, traditional shallow farming techniques are suffering. Instead, producers are forced to develop new deepwater farming technologies. Transition to deep water farming requires additional capital and labor. There is a need to develop new seaweed farming technologies to be resilient to environmental changes.

The goal is to build a model community with better farming practices, by collaborating with local NGOs to analyze human behavior and attitude toward environment-friendly practice. In addition, new farming technologies should encourage, promote and protect women to participate fully in the production chain. Technology should advance equitable livelihoods and promote full and productive employment.

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<input type="checkbox"/>	Action Track 1: Ensure access to safe and nutritious food for all
<input type="checkbox"/>	Action Track 2: Shift to sustainable consumption patterns
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KEYWORDS

<input type="checkbox"/>	Finance	<input type="checkbox"/>	Policy
<input checked="" type="checkbox"/>	Innovation	<input type="checkbox"/>	Data & Evidence
<input type="checkbox"/>	Human rights	<input type="checkbox"/>	Governance
<input checked="" type="checkbox"/>	Women & Youth Empowerment	<input type="checkbox"/>	Trade-offs
<input type="checkbox"/>		<input checked="" type="checkbox"/>	Environment and Climate

OUTCOMES FOR EACH DISCUSSION TOPIC - 6/8

Creating a market for value-added seaweed products

Except for East Asian markets, there are very limited seaweed-based food products in the global market. The seaweed market is restricted by short shelf life, limited consumer awareness, and acceptance. We need to put the effort into marketing seaweed as a safe, nutritious, and delicious food source. We also need to seek out natural and organic preservatives methods to extend shelf life.

Seaweed has a high potential for rapid adoption in diets if it is promoted in the right context. Such rapid adoption could significantly increase demand. To increase consumer acceptance, seaweed should be included in local food, starting with restaurants. The world is craving new, delicious, and sustainable food. Seaweed is a very good contender. A transparent supply chain and market can establish seaweed as a safe, delicious, nutritious, and sustainable food source.

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OUTCOMES FOR EACH DISCUSSION TOPIC - 7/8

The need for rapid evolution in seaweed domestication

Food insecurity and climate change are growing challenges in the upcoming decades. Seaweed domestication offers a sustainable solution for both. Domestication is a way to increase seaweed production levels to meet both challenges. Every stakeholder along the supply and demand chain can promote the growth of seaweed domestication. Clear regulation is necessary for safe and responsible seaweed production. Rapid evolution is needed to tackle the challenges we are facing. However rapid evolution comes with higher risks, such as genetic or environmental pollution, biodiversity reduction, or negative unintended social and economic impact. Long-term domesticate-domesticator interaction eventually leads to favorable mutualistic coevolution. There is a tradeoff between rapid growth of seaweed production and transparency with all stakeholders to uphold a high standard during the entire process.

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KEYWORDS

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| <input type="checkbox"/> | Finance | <input type="checkbox"/> | Policy |
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| <input type="checkbox"/> | Women & Youth Empowerment | <input checked="" type="checkbox"/> | Trade-offs |
| <input type="checkbox"/> | | <input checked="" type="checkbox"/> | Environment and Climate |

OUTCOMES FOR EACH DISCUSSION TOPIC - 8/8

ACTION TRACKS

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KEYWORDS

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| <input type="checkbox"/> Finance | <input type="checkbox"/> Policy |
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| <input type="checkbox"/> Human rights | <input type="checkbox"/> Governance |
| <input type="checkbox"/> Women & Youth Empowerment | <input type="checkbox"/> Trade-offs |
| | <input type="checkbox"/> Environment and Climate |

AREAS OF DIVERGENCE

The Dialogue encouraged lively engagement, and participants enthusiastically shared ideas about the possible solutions seaweed could bring to achieving SDG2. However, there were some divergent opinions about possible solutions in the seaweed industry and its role in eradicating global hunger.

The chat was particularly rich with participants and experts sharing their thoughts on seaweed as a food source. For example, participants proposed that seaweed consumption could reduce the methane footprint contributed by the cattle industry. However, experts cautioned against making overarching statements about seaweed's potential contribution to methane reduction. A commercial cultivation process for algae that produce bromo-halogenated chemicals that can reduce methane emissions has not been established yet, and feed products from this algae would only affect cattle raised using artificial feed rather than those raised on pasturelands.

There was a divergence of opinions about the time and methods needed for integrating seaweed into the Western diet. Participants were enthusiastic about gradually adding seaweed products into everyday diets, while experts suggested telling the right story about seaweed, learning to cook seaweed properly, and partnering with restaurants. Seaweed may not be able to replace cattle byproducts as a protein source because most cultivated seaweed is low in protein. In Asian seaweed-consuming countries, seaweeds are typically used as condiments or to add minerals to the diet, rather than as sources of protein. One expert warned that seaweed should not be viewed as a panacea to solving global hunger, as Western digestive systems are less equipped to break down polysaccharides of seaweed and therefore nutrients may not become available, at least initially. A team member noted that the East Asian (Japanese) gut microbiome contains a specific bacterium, not found in most Western gut microbiomes, that helps break down the polysaccharide in seaweed. Furthermore, other studies have shown that these bacteria do appear in animals when seaweed is incorporated into their diet.

Finally, there was discussion around the need to produce more data about responsibly breeding seaweed that will produce the most biomass without sacrificing genetic biodiversity. Experts agreed that research and regulations are needed to maintain natural genetics and ensure local varieties of seaweed stay within the correct region. When local varieties are not sufficient for commercialization and other varieties must be imported, strict quarantine measures must be in place.

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ATTACHMENTS AND RELEVANT LINKS

ATTACHMENTS

- **Event Flyer**
<https://summitdialogues.org/wp-content/uploads/2021/06/Science-Days-Seaweed-Domestication-flyer.pdf>
- **Dialogue Title Graphic**
<https://summitdialogues.org/wp-content/uploads/2021/06/TITLE.pdf>
- **Dialogue Introduction Graphic**
<https://summitdialogues.org/wp-content/uploads/2021/06/INTRO-FINAL.pdf>
- **Keynote Speaker Graphic**
<https://summitdialogues.org/wp-content/uploads/2021/06/MYRIAM-VALERO.pdf>
- **Panelist Conversation Graphic**
<https://summitdialogues.org/wp-content/uploads/2021/06/PANEL.pdf>
- **Responses to Poll Questions Deployed During Event**
<https://summitdialogues.org/wp-content/uploads/2021/06/Poll-Responses.pdf>
- **Dialogue Follow-Up Email**
<https://summitdialogues.org/wp-content/uploads/2021/06/Follow-Up-Email.pdf>
- **One-Page Event Summary**
<https://summitdialogues.org/wp-content/uploads/2021/06/Science-Days-Side-Event-One-Pager.pdf>
- **Questions and Answers from Event Chat**
<https://summitdialogues.org/wp-content/uploads/2021/06/Chat-QA-Final-1.pdf>