International Blue Carbon Scientific Working Group
13th Annual Meeting & Scottish Blue Carbon Workshop

November 10-13th, 2021

The Royal Society of Edinburgh, Edinburgh, Scotland

Workshop Summary Report

Coordinating organizations:

CONSERVATION INTERNATIONAL

IUCN

unesco
Intergovernmental Oceanographic Commission

Workshop partner organizations:

SCOTTISH BLUE CARBON FORUM

RSE
The Royal Society of Edinburgh
KNOWLEDGE MADE USEFUL

University of St Andrews

THE PEW CHARITABLE TRUSTS

Funding organizations:

the David & Lucile Packard FOUNDATION

NASA

Coordinating Organizations:
Conservation International (CI)
International Union for Conservation of Nature (IUCN)
Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific, and Cultural Organization (IOC UNESCO)

Workshop Partner Organizations:
Scottish Blue Carbon Forum
The Royal Society of Edinburgh
University of St. Andrews
The Pew Charitable Trust

Funding Organizations:
The David and Lucile Packard Foundation
National Aeronautics and Space Administration (NASA)

Scottish Blue Carbon Workshop Organizing Committee:
William Austin, University of St Andrews and the Scottish Blue Carbon Forum
Claire Elverum, Conservation International

International Blue Carbon Initiative Scientific Working Group Chairs:
Steve Crooks, Silvestrum Climate Associates
Emily Pidgeon, Conservation International

Executive Summary

The Blue Carbon Initiative (BCI) International Scientific Working Group held its 13th annual meeting in Edinburgh, Scotland, on November 10, 2021, the day prior to the Scotland Blue Carbon Conference. The meeting was co-hosted by the International Blue Carbon Scientific Working Group (IBCSWG) and the Royal Society of Edinburgh. It included close to 100 participants (53 in person and 45 online) from over 18 countries (See Annex 1 for a full list of meeting participants).

The overarching goals of the IBCSWG are to advance blue carbon (BC) science, particularly as needed to facilitate climate-relevant policy and management, to expand blue carbon research collaboration, and to ensure the integration of blue carbon into international climate change actions. The meeting in Scotland was held to take advantage of the momentum from the announcement of oceans and climate nexus coming from the UNFCCC COP26 held in Glasgow the week prior and identify key priorities for the IBCSWG to advance in the coming year. Blue carbon project standards were identified as an important product that the working group could produce to ensure scientific leadership in the blue carbon space.

Background on the Blue Carbon Initiative

The coastal ecosystems of mangroves, tidal marshes, and seagrass meadows provide numerous benefits and services that are essential for climate change adaptation along coasts globally. These include protection from storms and sea level rise, prevention of shoreline erosion, regulation of coastal water quality, provision of habitat for commercially important fisheries and endangered marine species, and food security for many coastal communities. Additionally, these ecosystems sequester and store significant amounts of coastal “blue carbon” (BC) from the atmosphere and ocean and are now recognized for their role in mitigating climate change.

Despite these benefits and services, coastal blue carbon ecosystems are some of the most threatened ecosystems on Earth, with an estimated 340,000 to 980,000 hectares being destroyed each year. It is estimated that up to 67% of mangroves, at least 35% of tidal marshes, and at least 29% of seagrass meadows have been lost. If these trends continue at current rates, a further 30–40% of tidal marshes and seagrasses, and nearly all unprotected mangroves could be lost in the next 100 years. When degraded or lost, these ecosystems can become significant sources of greenhouse gas carbon dioxide and the soil carbon collected over millennia cannot be replaced on a climate-relevant timescale.

The Blue Carbon Initiative (BCI) is a global program working to mitigate climate change through the restoration and sustainable use of coastal and marine ecosystems. The BCI brings together governments, research institutions, non-governmental organizations and communities from around the world. The Initiative is coordinated by Conservation International (CI), the International Union for Conservation of Nature (IUCN), and the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific, and Cultural Organization (IOC-UNESCO).

The objective of the BCI are to:

- Develop management approaches, financial incentives and policy mechanisms for ensuring the conservation, restoration and sustainable use of coastal blue carbon ecosystems;
- Engage local, national, and international governments to promote policies that support coastal blue carbon conservation, management and financing;
- Develop comprehensive methods for assessing blue carbon stocks and emissions;
- Implement projects around the world that demonstrate the feasibility of blue carbon accounting, management and incentive agreements; and
- Support scientific research into the role of coastal blue carbon ecosystems for climate change mitigation.

The International Blue Carbon Scientific Working Group identifies priority research areas, synthesizes current and emerging blue carbon research, and provides the robust scientific basis for coastal carbon conservation, management, and assessment. The Working Group consists of experts in coastal carbon science, carbon assessment, remote sensing, and international climate change policy. The Working Group meets annually in blue carbon-rich countries and collaborates closely with local experts and government officials to identify or expand activities supporting the conservation and restoration of blue carbon ecosystems.

The goals of the Scientific Working Group are to:

1. Advance blue carbon science, particularly to facilitate its integration in climate-relevant policy and management
2. Expand collaboration across blue carbon research and implementation, and
3. Ensure the integration of blue carbon science into climate change actions globally.

Some key contributions of the Blue Carbon Scientific Working Group include a manual for measuring blue carbon titled "Coastal Blue Carbon: methods for assessing carbon stocks and emissions factors in mangroves, tidal salt marshes, and seagrass meadows." The manual provides managers, scientists and other practitioners in the field with standardized recommendations for carbon measurements and analysis. It has been translated into Chinese, English, French and Spanish. Additionally, the Scientific Working Group co-founded and is supporting the "Coastal Carbon Research Coordination Network", an effort to build tools and capacity for data-sharing, specifically focused on ecosystem processes and coastal wetland carbon cycling. Members of the BCI have consulted with the UN and national governments to integrate blue carbon science into policy: they have worked with countries on their greenhouse gas inventories; helped to write the Intergovernmental Panel on Climate Change (IPCC) 2013 Wetlands Supplement; lead the IPCC Special Report on the Oceans and the Cryosphere under a

Changing Climate (SROCC); as well as authoring many other influential reports and guidance documents.

Working Group Meeting

November 10th, 2021

The Royal Society of Edinburgh, Edinburgh, Scotland

IBCSWG Meeting Opening Session – Presentation
Speakers: Dr. Emily Pidgeon (Conservation International) and Dr. Steve Crooks (Silvestrum), IBCSWG co-chairs, Prof. William Austin (University of St Andrews), Scottish Blue Carbon Forum

The meeting organizers and IBCSWG welcomed the attendees, thanked the sponsors, introduced the topic of blue carbon, and reviewed the history of the BCI. The introductory session concluded with personal introductions and attendees' reasons for participating.

Session 1: UNFCCC COP26 Blue Carbon Outcomes
Moderators: Dr. Emily Pidgeon (Conservation International) and Dr. Steve Crooks (Silvestrum)

1.1 Overview of UNFCCC and Blue Carbon to date – Presentation
Speakers: Dr. Emily Pidgeon (Conservation International) and Dr. Steve Crooks (Silvestrum)

Efforts to include Blue Carbon in the UNFCCC started with a side event in 2010 at COP16 in Cancun. Despite being largely ignored then, now, at COP26, there was immense attention and resources pledged to blue carbon with members from the working group holding many events. Going into COP26, the oceans community came together to promote the Ocean-Climate Dialogue and the UNFCCC to focus their attention to Oceans in various fora. To provide helpful resources, Conservation International with other organizations set forth a guidance paper titled Building on the Ocean-Climate Dialogue: Options for strengthening action on the ocean under the UNFCCC. In addition, the Blue Carbon: Integrating Ocean Ecosystems in Global Climate Action document helped define the various blue carbon ecosystems.

The outcomes of our efforts were Article 60 and 61 of the final decision text (1/CP.26) establishing an annual dialogue to strengthen ocean-based action starting in June 2022, and having provided guidance to the bodies of the UNFCCC to integrate and strengthen ocean-based action within their workplans and mandates. With the newly instated Ocean-Climate Dialogue, there will be an opportunity for the working group to shape that agenda. Countries reached an agreement on the rules for international cooperation through market and non-market mechanisms (also known as Article 6), paving the way for increased climate action and finance flows to mitigation actions, including natural climate solutions.

Additional announcements from COP26 related to blue carbon include a pledge to limit methane emissions by 2030, with 100 countries participating, a Deforestation Pledge by 110 world leaders to end deforestation by 2030, a Blue Natural Capital Financing Facility (BNCFF) announcement. The UpLink - World Economic Forum Ocean Challenge was launched with Friends of Ocean Action and 1t.org. The challenge partners (including Conservation International and Belize) made several pledges around blue carbon ecosystems, and the U.S. announced its plan to conserve blue carbon ecosystems as part of larger strategy for carbon sinks, among other ocean announcements.

1.2 Synthesis of COP26 from COP attendees

Around the room comments were shared from those who attended COP26 about what was highlighted at COP and the discussions relevant to blue carbon. These comments were important, as they guided the discussion for the meeting. Overall, it was clear how mainstream blue carbon has become in climate discussions.

Now that blue carbon is a reality, sessions at COP26 revolved around the reality of financing these projects to reach the scale that is needed for climate mitigation. This included how to fund these projects and how the corporate sector should engage in funding opportunities. Blue carbon is also actively being included in policy, which provides the opportunity to scale from country to regional approaches. With many players in the blue carbon world, a priority of the scientific community is to provide guidance on how to scale blue carbon properly. The Ocean-Climate dialogue a year ago provided room for these discussions to happen going into COP26 and these continued discussions will provide a platform to ensure this alignment. It was also stated that including other ecosystems in blue carbon, such as macroalgae, may be a priority but more science is needed.

1.3 Priorities and action items for the IBCSWG from COP discussions and outcomes

The blue carbon project standards were discussed in further detail with suggestions of what this product could include. The idea would be to synthesize current best practices and point to existing work all with the goal of restoring ecosystems to a healthy state, while improving the lives of people and biodiversity. It was suggested that the group look at how the terrestrial forest research and climate change mitigation communities have done this, but keeping in mind how the ocean is different in terms of carbon flows and how communities use the ocean. Also noted was the importance of translating both this to the implementation, policy and financing sectors.

A survey should be conducted to synthesize current available information. For example, the group could look into and reference how Plan Vivo considers social benefits and other methodologies for biodiversity, in addition to looking at the Vida Manglar project in Cispata, Colombia, for how to engage communities. Also look nationally and regionally; e.g., in Singapore there are three initiatives for quality projects – Singapore Impact Exchange, to be launched next year and having different prices linked to quality; Task Force for scaling the Voluntary Carbon Market; and the International Standards Organization (ISO). The Group agreed on pulling together a first draft of these blue carbon project standards in the following year and working group members volunteered to be part of this initiative.

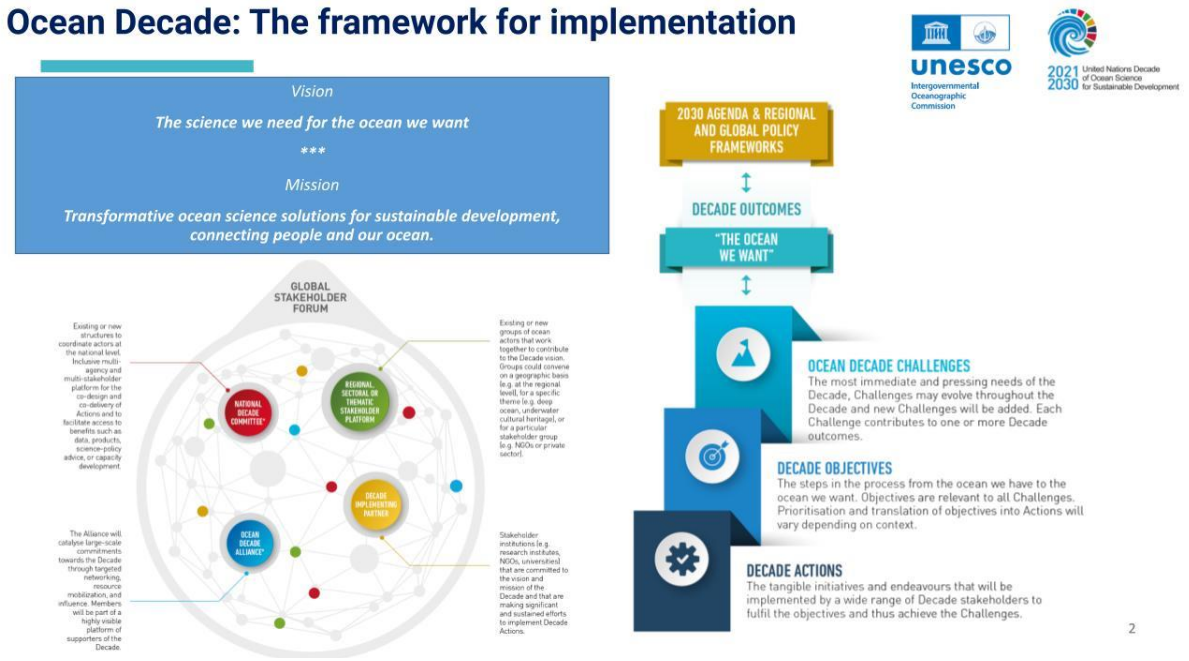
Session 2: Priority Blue Carbon Activities for 2022
Moderator: Dr. Lola Fatoyinbo (NASA)

2.1 UN Decade of Ocean Science for Sustainable Development and designing a Blue Carbon program – Presentation
Speakers: Dr. Emily Pidgeon (Conservation International) and Dr. Kirsten Isensee (IOC-UNESCO)

IOC-UNESCO is the coordinating body for the United Nations Decade of Ocean Science for Sustainable Development (2021-2030). Dr. Isensee shared a new Call for Decade Actions. The vision of the Ocean Decade is 'the science we need for the ocean we want'. The Ocean Decade provides a convening framework for scientists and stakeholders from diverse sectors to develop

the scientific knowledge and the partnerships needed to accelerate and harness advances in ocean science to achieve a better understanding of the ocean system and deliver science-based solutions to achieve the 2030 Agenda.

To achieve the Ocean Decade vision, workshop attendees agreed that it is important to submit an action for a Blue Carbon program. A proposal is due at the end of January and will be led by the Scottish Blue Carbon Forum, Conservation International, IUCN and scientists from the IBCSWG.



2.2 Blue Carbon training course – Presentation
Speaker: Dr. Jennifer Howard (Conservation International)

There is an increased interest from partners and governments to implement BC at scale, as there is a lack of experience around integrating blue carbon into on-going climate mitigation actions and uncertainty of how or what to measure. A training course will provide an easy-to-understand introduction to blue carbon to any audience and will have more advanced modules for those looking to understand specifics such as climate change mitigation, Blue Carbon policy, Blue Carbon finance and measuring and monitoring. It was agreed that at least five BCI experts would volunteer to review the course modules and provide comments to improve the content. In addition, working group members might be asked to provide audio or video recordings to supplement course instruction.

2.3 Forming a Kelp subgroup – Recording
Speakers: Dr. Emily Pidgeon (Conservation International) with virtual presentation from Dr. Albert Pessarrodona (University of Western Australia)

Wild macroalgae is distributed along most of the world's coastlines and has been of recent interest to the blue carbon community to understand the role of macroalgae in ocean carbon sequestration. Macroalgae can simulate an estimated 1 PgC/yr(mostly brown macroalgae), and in terms or sequestration potential, it is estimated that around 100 Tg of carbon are sequestered by macroalgae each year, which is more than all the other blue carbon ecosystems combined. Farmed macroalgae occupies a small fraction of the total macroalgae area so their contribution is not as significant. Production of farmed macroalgae is led by China (57.5%) and Indonesia (28.5%).

Despite this promising potential, macroalgae are currently not included in carbon accounting – there is little to no policy, regulation and/or monitoring and verification of macroalgal carbon finance projects. Doing so can support and accelerate conservation and restoration of macroalgae ecosystems and benefit industry (i.e., kelp farmers) and major macroalgae producers (i.e., China) and holders (i.e., Norway).

Macroalgae could contribute to climate change mitigation in three main ways: (1) Restoration and preservation of natural seaweed forests (2) Developing more aquaculture and industry for seaweed cultivation, whereas products developed from harvested seaweed can contribute to climate change by replacing oil and plastic-based products, and (3) Growing seaweed solely for carbon sequestration purposes only.

Macroalgae carbon sequestration is vastly different to other blue carbon habitats, normally occurring outside of the initial habitat, so further science to clarify these flows is needed. Despite these opportunities, knowledge gaps hinder carbon accounting and verification, in addition to the macroalgae carbon pathways not being conducive to current policy, regulation and monitoring structures.

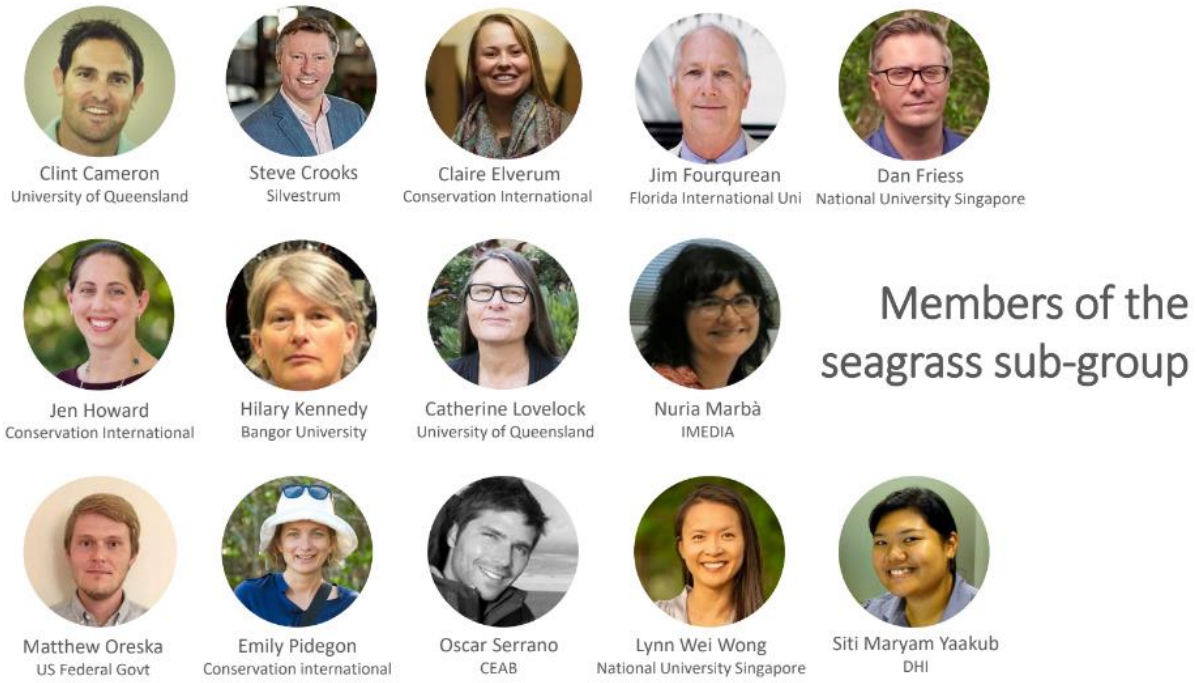
The Blue Carbon Initiative is forming a kelp/macroalgae subgroup to support and accelerate conservation and restoration of macroalgae ecosystems through climate finance and policy and will do so by tackling the questions needed to make macroalgae an actionable blue carbon ecosystem.

Session 3: Seagrass subgroup
Moderator: Prof. Dan Friess (National University of Singapore, seagrass subgroup chair)

3.1 Seagrass group progress and discussion of priorities – Presentation
Speakers: Prof. Dan Friess (National University of Singapore, subgroup chair) and Dr. Clint Cameron (Charles Darwin University)

The interest in furthering the study of seagrass's role in climate mitigation came about a year ago when thinking about all ecosystems covered in the working group. Seagrass has significant science and knowledge gaps that currently prevent integration of seagrasses into the carbon accounting, market methodologies and policies, so this subgroup was formed to define and advance the science needed to advance seagrasses as a blue carbon ecosystem in policy, carbon financing and conservation globally.

The following list of subgroup members was formed to address what was needed to achieve the goal of the group:



The first tasks of the subgroup were to understand the role of watershed-scale stressors in constraining seagrass blue carbon projects, collate the knowledge base on seagrass blue carbon stocks and fluxes and host a seagrass group meeting in Singapore (COVID allowing). The first question on watershed-scale stressors is looking at external factors and stressors that contribute to changes in seagrass carbon stocks and fluxes (i.e., eutrophication and sedimentation). Identifying these relationships allows for conceptualizing scenarios to assess current strategies to manage watershed stressors and identify how they affect carbon accounting. Based on this knowledge, the next step would be to find solutions to mitigating and including watershed stressors in blue carbon accounting.

More broadly, the main question this group will be looking into is a systematic review of seagrass carbon stocks and fluxes. The IBCWG published the first comprehensive review of blue carbon stocks in seagrass ecosystems a decade ago (Fourqurean et al. 2012), but this was done with very limited data and concentrated in a few geographies. Since then, there has been a

rapid expansion and acceleration of studies of seagrass ecosystems. This updated systematic review will include considerations of calcium carbonate, epiphytes, etc. The process to complete the systematic review included identifying over 6,706 records through database searches and working that number down to about 500 manuscripts to pull information from by screening titles and abstracts.

3.2 Seychelles' Seagrass and NDCs – Presentation
Speakers: Tom Hickey and Stacy Baez (The Pew Charitable Trusts)

The Pew Charitable Trusts (Pew) has a project supporting countries to include the restoration and protection of seagrass, saltmarsh or mangroves as part of their Nationally Determined Contributions (NDCs) to the Paris Agreement. Currently seagrass is reported in 159 countries; area estimates range widely from 177,000 to 600,000 km^2. Seagrasses are disappearing at a rate of 110 km^2 yr^{-1} since 1980 and it's estimated 30% of their original area has been lost since 1879. Seagrasses are recognized by the IPCC for the measurable contribution (adaptation and mitigation) they can make to the primary goal of the Paris Agreement. Seagrasses are important for fisheries, flood protection and shoreline stabilization, and also carbon storage.

Every five years countries resubmit updated NDCs, so Pew works with countries to achieve this, first through research, then policy and then ambition. For example, Pew has been working with partners in Seychelles to strengthen seagrass accounting in their NDC. Even though there is visibly a large amount of seagrass surrounding the islands of Seychelles, the current map for Desroches Island lists the amount of seagrass at zero, so there is a lot of room for improvement to map the 11 different species of seagrass throughout the country. In 2020, Seychelles' NDC stated that it will map the extent of mangrove and seagrass ecosystems and assess seagrass carbon stocks, ensure that 100% of mangrove and seagrass ecosystems are protected by 2030, and establish a long-term monitoring program for seagrass habitats. Now that the NDC has been set, Pew is working with the University of Oxford on the research side to advance the mapping of seagrass carbon over the full EEZ of Seychelles to complete a field validated map of seagrasses.

SeyCCAT, the policy partner, led the socialization process of seagrass with the people of Seychelles. As part of this project, SeyCCAT led a community seagrass naming process to name different seagrass types. There were 141 general public respondents to the survey, 57 being fisherman, and they came up the following local words for different functional groups:

- *Enhalus* sp.: Gomon gran fey
- *Thalassia* spp., *Cymodocea* spp., *Halodule* spp.: Gomon torti (torti means "turtle")
- *Thalassodendron* spp.: Gomon levantay (levantay means "to wave")

Session 4: Updates from Working Group Members

Moderators: Prof. Dorte Krause-Jensen (Aarhus University) and Dr. Hilary Kennedy (Bangor University)

4.1 Role of conservation and restoration of Indonesian mangroves meeting their NDCs – Presentation
Speaker: Prof. Boone Kaufman (Oregon State University)

This project has taken place over the last two years to develop and apply the methodologies necessary to look at the potential contributions from mangrove conservation and restoration using Indonesia as a case study. Restoring and conserving Nature based Solutions in Indonesia have great potential, as nearly half of the archipelago's mangroves have been lost mostly to aquaculture and coastal development during the past 50 years. The growing awareness of the value of Blue Carbon ecosystems is reflected in AR6 in the land use and AFLU chapters.

As part of the Paris Agreement, Indonesia has committed to reducing national emissions by 29% and 41% under unconditional and conditional mitigation scenarios in 2030. Indonesia's forestry sector is expected to contribute up to 60% to the total emission reduction target from all sectors. The research question of this project was: "What are the potential contributions of mangroves in Indonesia meeting its NDCs?" There are two possible pathways or strategies in which mangroves could function as part of Indonesia's NDC in 2030:

1. Halting further mangrove deforestation and degradation
2. Current or projected government policies on mangrove reforestation/restoration

A spatial analysis was conducted for 2009-2019. The national land cover maps of Indonesia were made at the minimum scale of 1:250,000 using the Landsat image mosaic data. This study found that while mangroves comprise about 2.6% about of Indonesia's total forest area, they accounted for about 9% of total greenhouse gas emissions from the forest sector. The potential emission reduction from halting all deforestation of primary and secondary mangroves coupled with restoration activities could potentially result in an emission reduction equivalent to 8% of the emission reduction target for the forestry sector in Indonesia's NDC by 2030. The large source of greenhouse gas emissions from a relatively small proportion of the forest area underscores the value for inclusion of mangroves as a natural climate solution.

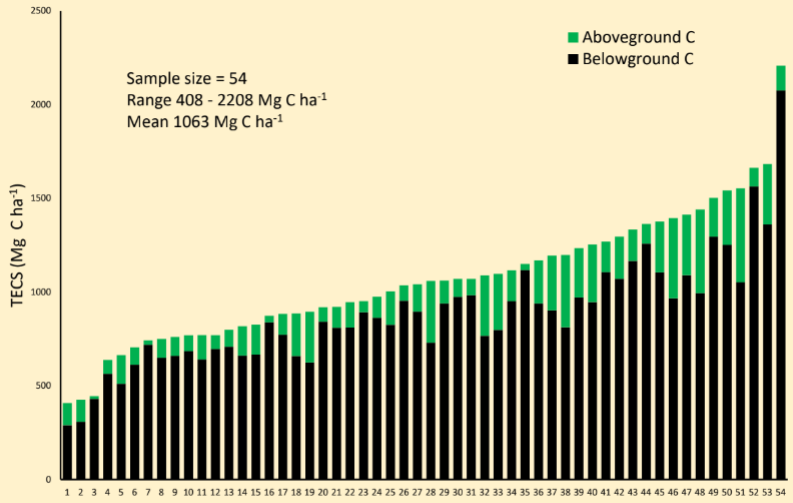


Figure 2. The total ecosystem carbon stocks of mangroves of Indonesia. The total sample size includes data from 54 sites. Data are from Arifanti et al. (2019), Donato et al. (2011) Kauffman et al. (2020), and Murdiyarso et al. (2015).

4.2 Seagrass discovery and Blue Carbon futures – Presentation
Speaker: Prof. Carlos Duarte (King Abdullah University of Science and Technology)

This presentation connects to the topic of uncharted exploration of seagrass extent, focusing on the Bahamas. There are 2,500 km^2 of seagrass in the Bahamas bank within a total bank area of 160,000 km^2. There have been different attempts to determine the seagrass extent with approaches like remote sensing. Through work with Beneath the Waves, they have undertaken 2,100 dives to ground truth the amount of seagrass in the Bahamas bank and that effort only covered about 5% of the area they needed. Tagging tiger sharks and green turtles and attaching 3601 cameras to their bodies and taking advantage of their long-range movement and wide depth range (down to 700m in depth) is helping expand the scope of the inventory.

The Bahamas may have a total 92,000 km^2 of seagrass (57,000 km^2 of those mapped with high confidence). This new estimate highlights the gross underestimation of previous efforts. The value of restoring seagrass to their previous abundance is between USD 6 trillion and USD 7 trillion, so it is important to know current and historical extent of seagrass.

4.3 Blue Carbon achievements (science and policy) in Australia over the past decade – Presentation
Speaker: Dr. Oscar Serrano Gras (Centre for Advances Studies of Blanes, Spanish National Research Council)

It is estimated that 10% of the blue carbon ecosystems worldwide are found in Australia. In 2013, scientists were able to produce Tier 1 (global values to estimate stocks) data. In 2017, they produced Tier 2 (national level) data of Australia. With this momentum, in 2019-2021

there was an effort to pull together data on the three blue carbon ecosystems in Australia (albeit using only 3 sites). Currently there is also an initiative to merge terrestrial maps with blue carbon maps in Australia. Despite all this progress on mapping blue carbon, there is still improvements to be made. Also, conversion factors need more research to understand what happens to carbon stocks during habitat loss.

4.4 Blue Carbon and Net Zero Emission – an Indonesian context – Presentation
Speaker: Prof. Daniel Murdiyarso (Center for International Forestry Research)

Indonesia is working to be at Tier 2 with data to respond to the intention to make forests and other land use (FOLU) a net sink in 2030 and clarify how mangrove blue carbon can contribute to that. There are 29 research publications since 2014 that cover a major proportion of the mangroves across the archipelago.

The result of the research shows that mangrove Blue Carbon has a high potential to reduce emissions from land-use sector under FOLU net sink scheme. Country-specific emission factors with least uncertainties may be adopted for national reporting and project development, and estimated rehabilitation area could be used to estimate Blue Carbon potentials and hydrogeomorphic settings.

4.5 Eelgrass Blue Carbon work from Denmark – Recording
Speaker: Dr. Carmen Leiva-Duenas (Aarhus University)

In the 1900s in Denmark, eelgrass covered about 6700 km^2, but has declined due to disease and eutrophication. To calculate the current amount of eelgrass, this research looked at data from study sites in four fjords in Denmark, and at each fjord, sampled at two sites, one more exposed (external) than the other (internal). At each site, they took sediment cores and biomass sampling.

About 5% of Danish nitrogen load is sequestered annually by eelgrass sediments. Danish eelgrass meadows store 1.5 Tg N in the top 1 meter, which is equivalent to 1740% of terrestrial nitrogen load by Denmark in 2000. In conclusion, Danish eelgrass organic carbon and nitrogen stocks/burial rates that were obtained during the research, match values of eelgrass meadows elsewhere. Main sources of organic material are seagrass and algal detritus. Eelgrass contribution to stocks seems to have decreased towards present, while eutrophication has increased. About 0.9% of Danish CO_2 emissions and between 5-7% of terrestrial nitrogen load are sequestered annually by eelgrass sediments.

4.6 Australian Blue Carbon Methodology – Presentation
Speaker: Prof. Catherine Lovelock (University of Queensland)

Developing Australia's Blue Carbon Methodology has been a work in progress for many years. A large group of experts from Australia contributed to the methodology, which was

commissioned by the Clean Energy Regulator (division that issues Australia Carbon Credit Units). Australia has had historic loss of coastal wetlands, so this is effort is aimed at increasing restoration. Many states already have strong wetland management programs, such as under Ramsar. There has been considerable investment in research characterizing blue carbon since 2012. A carbon market is possible because Australia's Greenhouse Gas Inventory has included coastal wetlands since 2015. The federal government commitment to develop a Blue carbon methodology for the Emission Reduction Fund (2020-2021), and also funds the International Partnership for Blue Carbon (IPBC) and other international activities in Indo-Pacific.

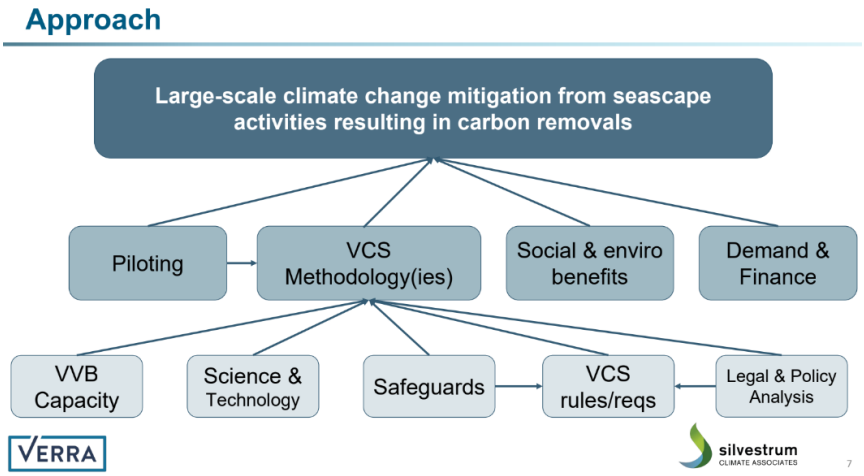
Scoping studies identified tidal restoration on land where tides have been excluded as the "activity" with the most opportunity. Based on these studies, the government decided that a method for "tidal restoration" – restoring tidal inundation to restore wetland vegetation, biomass and soil carbon – was a priority. Activities for tidal restoration include modifying tidal gates, bund walls or other impediments to tidal inundation. The tidal restoration method is a model that considers carbon sequestration in biomass and soils of coastal wetlands, reductions in GHG emissions, and emissions from transitions among different vegetation types with the project and with sea level rise (E_{TR}). The model includes seagrass, mangroves (tall, scrub, tall hinterland), saltmarshes (broadly defined), sparsely vegetated saltmarsh (saltflats), and supratidal forests.

Developing this methodology has been beneficial as the government has identified gaps, which they are addressing, it has helped building capacity of scientists on this topic, in addition to raising awareness and being an applicable model for other countries in the Pacific. Some concerns identified include how to realize direct benefits to landowners, especially indigenous ones. While this methodology is wrapping up, the process is not over. Professor Lovelock plans to propose a new blue carbon method to address standing gaps.

4.7 Seascape Carbon Initiative – Presentation
Speaker: Dr. Steve Crooks (Silvestrum)

Now that projects have been operationalized and implemented, the Seascape Carbon Initiative launched a few months ago with Verra. The goal of this work is to unlock the potential of marine and sustainable seascape management activities to deliver large-scale climate solutions and sustainable development benefits. The scope includes marine and coastal activities that could generate significant and verifiable climate and sustainable development value.

This work is currently looking to include wild seaweed (conservation and restoration), farmed seaweed (aquaculture or ocean carbon deposition), and seabed management (avoided emissions from trawling). VERRA is currently looking at reframing methodologies and at questions on science, safeguards, legal questions (ownership) and financial viability.



4.8 Making the case for considering air-water CO_2 exchanges in Blue Carbon accounting – Recording

Speakers: Dr. James W. Fourqurean (Florida International University) and Dr. Bryce Van Dam (Helmholtz-Zentrum Hereon)

Blue carbon assessments have largely been based on organic carbon stocks sediments. However, blue carbon burial is just one part of a complex coastal cycle. In seagrasses, this is complicated, with lateral mixing and benthic processes impacting air-water CO_2 exchange. To measure the question of air-water CO_2 exchange, the first meta-analysis of air-water CO_2 fluxes in seagrass meadows using direct measurements by atmospheric equivalents was performed.

Conclusions from this research include: (1) net CO_2 emissions for the tropical seagrass meadow, attributed specifically to net burial of $CaCO_3$ > OC, (2) Dynamics are especially important given the broad distribution of blue carbon sites in the tropics where calcification is greatest, and (3) blue carbon assessments that don't consider the air-water exchange have the potential to over- (or under-) estimate net C sequestration potential.

Blue Carbon: Beyond the Inventory
International Conference, Workshop & Fieldtrip

November 11-12th, 2021

The Royal Society of Edinburgh, Edinburgh, Scotland

Following the IBCSWG meeting, the Scottish Blue Carbon Forum hosted its workshop over two days, where working group members attended and presented. The final agenda can be found here. Additional events in the evening of the conference included a dinner at Edinburgh Castle and a reception hosted by the Conference and Glenmorangie at the National Museum of Scotland, with speeches from Annabel Turpie (Director of Marine Scotland) and Mairi Gougeon (Scottish Cabinet Secretary for Rural Economy and Tourism).

Additional photos can be found here.

Field Trip Day – Additional photos can be found here

Members from the working group and additional participants of the Blue Carbon conference visited two field sites on Saturday, November 13, 2021.. The first field visit was to the Skinflats Managed Realignment site, which was previously an agriculture site. In 2009, the Royal Society for the Protection of Birds (RSPB) Scotland installed a regulated tidal exchange that allowed for partial inundation at hightide of the mudflats and saltmarsh. It was then determined that managed realignment was the best option for the inter-tidal site and there was a breach in the seawall in October 2018. [1,2]

[1] https://www.innerforthlandscape.co.uk/projects/conserving-restoring/skinflats-managed-realignment
[2] https://www.rspb.org.uk/our-work/conservation/landscape-scale-conservation/sites/inner-forth/

The second field visit was to Aberlady Bay, which is a local nature reserve on the John Muir coastal trail.

Annex 1: Attendee List

Name	Affiliation	Email	In person/Virtual
Albert Pessarrodona Silvestre	University of Western Australia	albert.pessarrodona@uwa.edu.au	Virtual
Angus Garbutt	UK Centre for Ecology & Hydrology	ag@ceh.ac.uk	In person
Barbara Berx	Marine Scotland Science	Barbara.Berx@gov.scot	Virtual
Bill Turrell	Marine Scotland Science	bill.turrell@gov.scot	In person
Boone Kauffman	Oregon State University	Boone.Kauffman@oregonstate.edu	In person
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