Blue Carbon Database Report

Coastal Carbon Network
Database Version 1.2.0
April 22, 2024

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Executive Summary

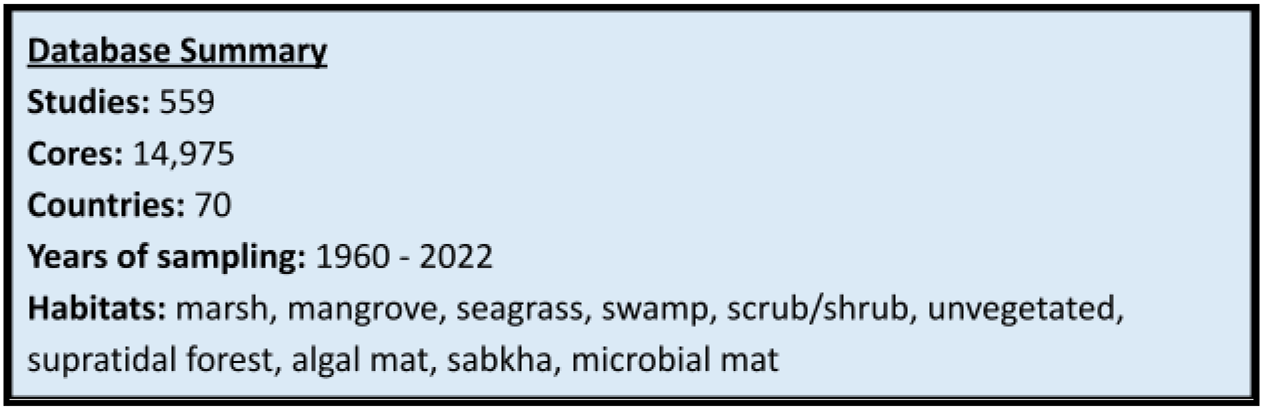
- Since the official publication of Version 1.0.0 in October of 2023, the Coastal Carbon Network has added 8,429 soil cores to the Data Library, which is served through the Coastal Carbon Atlas
- This update brings in a large amount of new data from outside the US, which greatly increases the Library's representation of global marshes and mangrove habitats
- Much of this progress is due to the engagement and contributions of individual researchers, both within the United States and internationally
- These improvements in the stewardship and accessibility of country-specific data help build capacity for countries to leverage this data for initiatives, such as incorporating coastal wetlands into their greenhouse gas inventorying efforts, establishing Nationally Determined Contributions, and scaling projects up from local to national scales

Introduction

The Coastal Carbon Network (CCN) seeks to accelerate the pace of discovery in coastal wetland carbon science by providing our community with access to data, analysis tools, and synthesis opportunities. Our activities include bringing data libraries online, creating open source analysis and modeling tools, providing training and outreach opportunities, hosting data synthesis workshops targeted at strategically reducing uncertainty in coastal carbon science issues, and to create a community of practice. One of these resources is the Coastal Carbon Data Library, a global database of disaggregated soil carbon data from blue carbon habitats. This data is made accessible through the Coastal Carbon Atlas, an interactive web application developed to allow users to explore, query, and download data from tidal wetlands around the world.[2]

The Data Library was created from the doctoral work of CCN director, Dr. James Holmquist. Holmquist's initial synthesis brought together 1,535 soil cores from the United States to look at different strategies to best map the country's carbon stocks.[6] However, it was not until October 2023 that the first version of the Data Library would be officially published on the Smithsonian Institute's Figshare platform.[3]

This most recent update, Version 1.2.0, was published to Figshare in March of 2024, and adds 8,429 soil cores from 229 additional unique studies to the Library, sampled both internationally and in the United States.[4] This report covers updates to the database since its official release (Version 1.0.0), explains key library growth metrics, and highlights a few recent CCN efforts that expanded important habitat representation.



Database Summary

Studies: 559

Cores: 14,975

Countries: 70

Years of sampling: 1960 - 2022

Habitats: marsh, mangrove, seagrass, swamp, scrub/shrub, unvegetated, supratidal forest, algal mat, sabkha, microbial mat

CCN Data Library Representation

The Data Library has input from 70 countries across six continents. The United States currently leads total representation with over 5,000 of the almost 15,000 total cores.

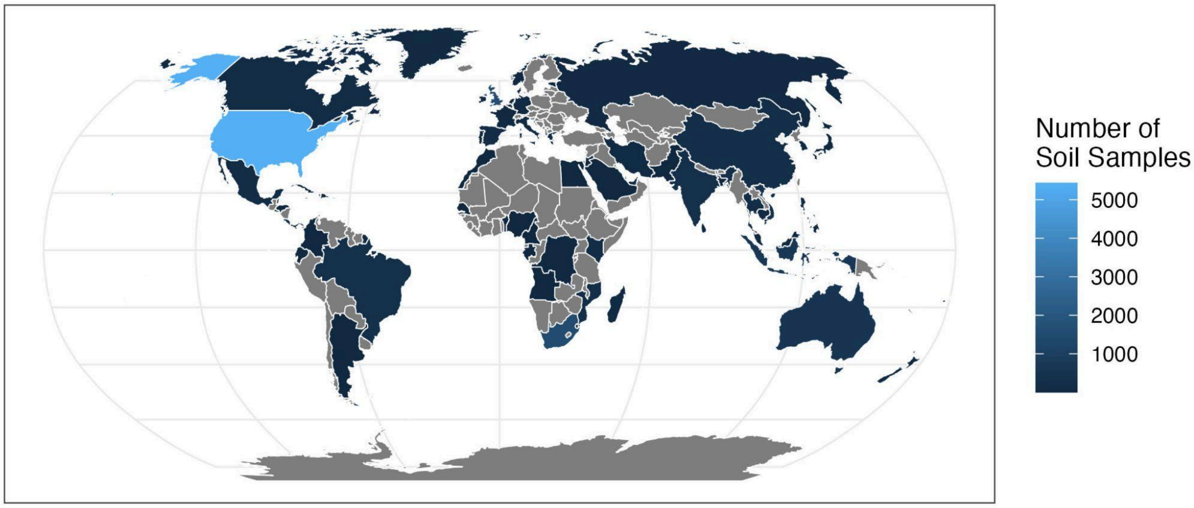


Figure 1. Global map of cores included in the Data Library. Total country core count is represented by a color gradient, with a scale from <1,000 to >5,000 cores.

Core Count Growth Over Time

Since the Data Library's first official publication, five years after Dr. Holmquist completed his US based synthesis, the efforts of the Network have more than doubled the size of this global repository. Updates to the Data Library are now issued regularly as new datasets are submitted and curated, and as the CCN team updates the database's structure to reflect the most comprehensive organization of coastal wetland data. Accompanying the Data Library, updated versions of the synthesis are also served through the Coastal Carbon Atlas.[2]

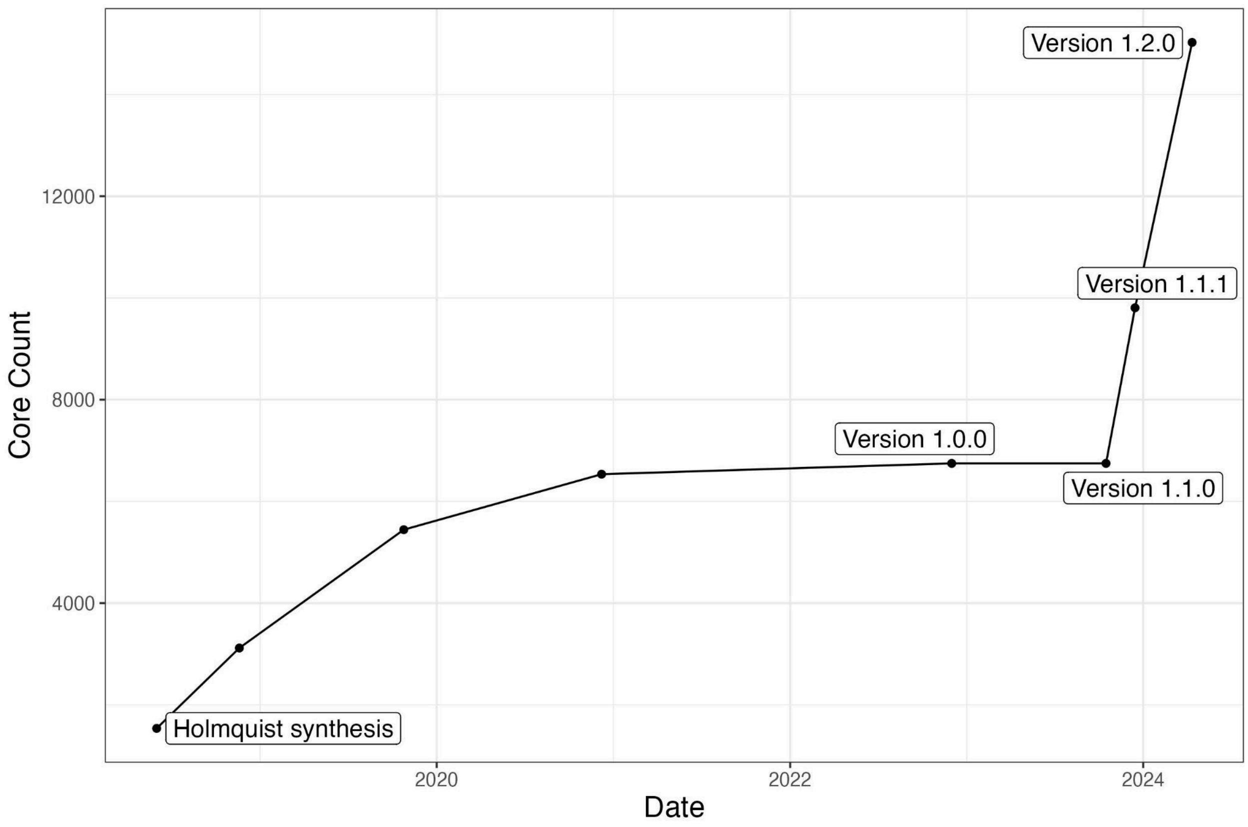


Figure 2. Timeline of cores present in the Data Library from the project's origin in 2018 until the current update with each version noted. This report covers improvements since the release of Version 1.0.0.

What's New

New datasets included in this update came largely from marsh and mangrove habitats of 40 different countries, 13 of which had no previous representation in the database. The Network's recent efforts to archive original data have been focused on finding sample sources that reflect habitats' global area coverage while increasing core counts from habitats that are vital suppliers of blue carbon ecosystem services. This influx of data comes from more than 200 studies that span 48 years of sampling and provide an ever clearer picture of global coastal carbon stocks.

Change in Data Representation by Country

The majority of new cores were added from the United States, the United Kingdom, and South Africa, bringing the increased core counts in each country to over 1,000. While the CCN is a global collaboration, the Network was created and initially funded with a focus on increasing the capacity of the US' carbon stock assessment. In spite of the fact that the US only comprises 8.6% of global tidal ecosystems, it maintains its outsized representation in the Data Library in large part due to its initial core count lead as a result of the synthesis that began this effort.[12] As the Network has grown, international representation increased dramatically as well, with new collaborators and funding sources for global work. With this update, international data has grown over 350% and has surpassed the current 5,422 cores from within the US.

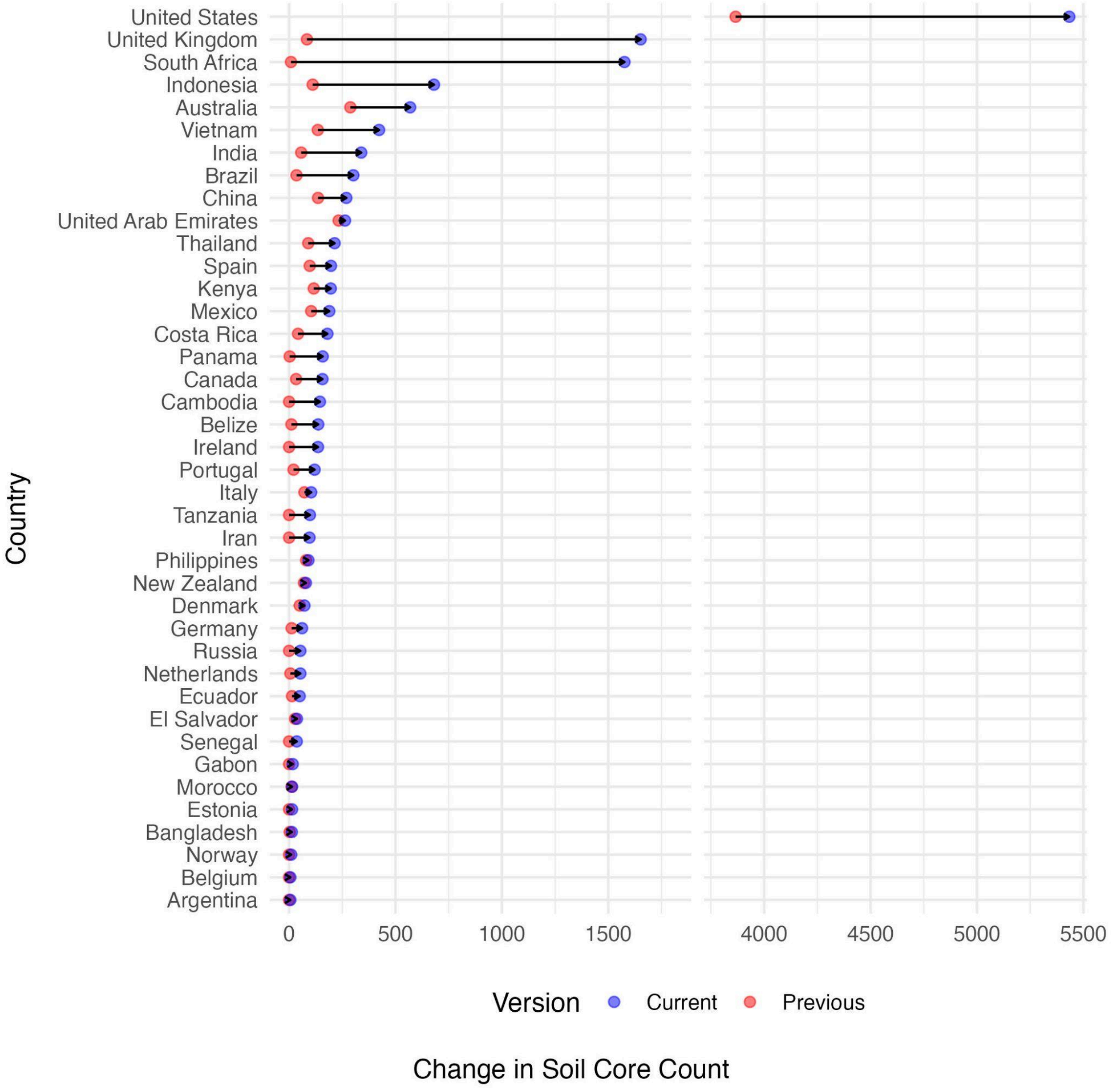


Figure 3. Change in data representation across countries by the number of cores from Version 1.0.0 to this update.

Despite the recent growth of the Data Library, some habitats and countries remain underrepresented. Of the three most represented habitats - marsh, mangrove, and seagrass - real world area coverage is inverse to their presence in the Data Library with seagrasses taking up approximately 160,000 square kilometers,[9] mangroves 147,000 square kilometers,[13] and marshes 53,000 square kilometers.[14] Since the database's launch in October of last year, we have sought to close this representational gap and have more than doubled the number of mangrove cores present in the Data Library.

For countries with large amounts of coastal wetland, such as Australia, Brazil, Canada, China, and Indonesia, the amount of available data still reflects lacking coverage. There are also several countries with substantial coastal wetland habitat that have no available data; namely: Papua New Guinea, Myanmar, Guinea, and Sierra Leone. Representation, too, of countries with smaller areas of wetland should also not be overlooked. Improvements in available data are especially needed for small island nations, such as those in the Caribbean and Indo-Pacific, which rely heavily on the services that their coastal wetland ecosystems provide. In the future, we hope to expand the scope of our data to include a greater diversity of source locations for each of our habitats.

Spotlight Efforts

Among the 229 new studies included in this version, several key efforts helped to grow the Data Library to its current size featuring nearly 15,000 cores. To recognize these collaborators and data contributors, the CCN would like to highlight a few of these recent international efforts.

NOAA Blue Carbon Inventory Project

For the past two years, the CCN has been providing technical support to the National Oceanic and Atmospheric Administration Blue Carbon Inventory Project (NOAA BCIP), which seeks to enhance the capacity for countries to integrate coastal wetlands data into their greenhouse gas inventories.[5] Through this effort, the Network has engaged more directly with stakeholders in countries with little to no available blue carbon data.

Center for International Forestry Research

In late 2023, the CCN team harmonized data from the Center for International Forestry Research (CIFOR) data repository that houses detailed soil core information from countries around the world.[1] CIFOR is a non-profit headquartered in Bogor, Indonesia that seeks to improve the technical understanding of climate change through scientific research on the challenges of forest and landscape management. The collection and archival of this data was coordinated by the Sustainable Wetlands Adaptation and Mitigation Program (SWAMP). The Coastal Carbon Atlas now hosts the 1,604 cores from the mangroves of 10 different countries across Asia and South America.

Global Salt Marsh Synthesis

The majority of the marsh data included in this update is due to a synthesis effort led by Dr. Tania Maxwell, a research scholar with the International Institute for Applied Systems Analysis Biodiversity and Natural Resources Program. Maxwell recently finished a postdoc at the University of Cambridge, funded by the Nature Conservancy, where she collated a dataset of soil organic carbon from tidal marshes around the world and developed an estimate of carbon stock for these habitats globally.[8] This work led to the contribution of 2,806 tidal marsh cores taken in over 20 different countries.

Central American Stock Assessments

This update features the publication and integration of carbon data from Costa Rica and Panama stock assessments, contributed by steering committee member, and long-time collaborator, Dr. Miguel Cifuentes-Jara. In addition to leading the data collection efforts which elevate in-country inventorying capacity, Cifuentes-Jara has coordinated outreach and trainings in multiple countries to foster relationships between scientists, industry managers, and the public around developing holistic blue carbon monitoring and management practices.

The expansion of representation of Central America in the blue carbon community wouldn't be complete without mentioning the work of Dr. Hannah Morrissette. In 2021, Dr. Morrissette was part of Belize's first national mangrove stock assessment project that sampled above and belowground carbon throughout the country.[10] Morrissette and her team worked with stakeholders at all levels throughout the country to promote collaboration and knowledge sharing to solidify support from the communities whose livelihoods depend on the health of mangrove habitats and whose actions are most vital to their conservation.

South African Carbon Data

And finally, we would like to highlight our collaboration with Professor Janine Adams and Anesu Machite from Nelson Mandela University in South Africa.[11] Published in March of 2024, Adams and Machite's data publication contributed a synthesis of soil carbon data consisting of 23 studies and student theses. This synthesis includes 1,546 cores and surface soil samples, from marsh, mangrove, and seagrass habitats along the coast of South Africa. This effort helped to largely grow the number of cores in South Africa from 9 in Version 1.0.0 to 1,576 in this version. At present, South Africa is one of three countries with the greatest number of soil cores included in the Data Library.

State of the Data

Habitat Representation

Both marsh and mangrove habitat saw significant increases in available data in this update; however, marshes remain the dominant habitat type across the entire database. Out of the almost 15,000 total cores comprising the database, about half come from marsh habitat, a third from mangrove, and less than 7% each from seagrass, unvegetated, swamp, and other habitats. Habitats classified as "other," or those that represent a combined 1.2% of the Data Library, include algal mat, sabkha, microbial mat, and supratidal forest. The dominance of marsh representation throughout the history of the Data Library was led by large sampling efforts in the United States. International representation, on the other hand, was historically dominated by mangroves until this update, and the inclusion of the global marsh synthesis led by Dr. Tania Maxwell.

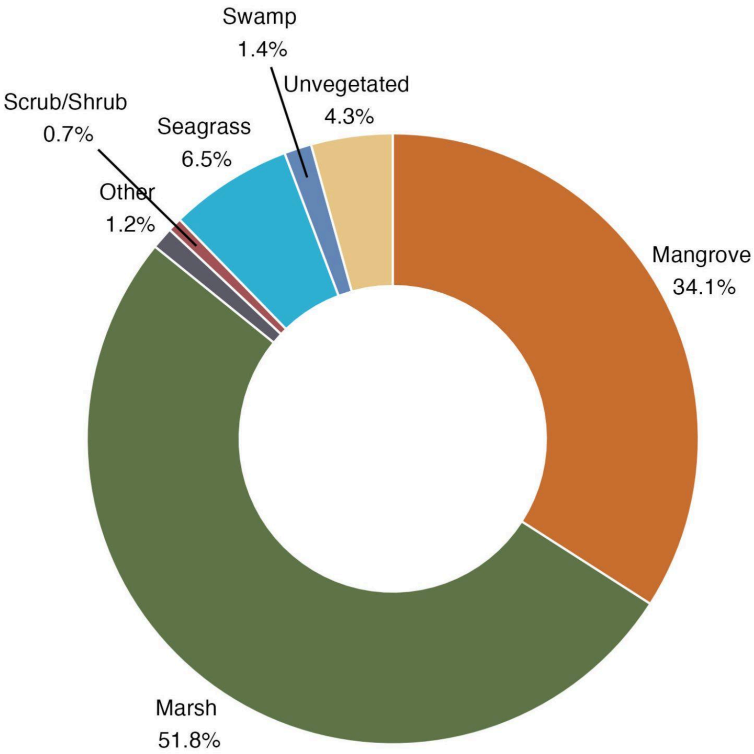


Figure 4. Composition of habitats by percent of total cores.

Change in Data Analysis Categories

In addition to compiling data, the CCN also classifies soil cores based on the types of analyses for which they can be used. Cores meet the requirements for calculating carbon stocks if they include dry bulk density and a measurement of organic matter or carbon content. Over 10,000 soil profiles now included in the Data Library have sufficient data to calculate carbon stocks. Far fewer cores have associated data to sufficiently complete the more complex analyses of determining carbon burial rates or forecasting burial rates in the context of a changing climate. To determine the rate at which carbon is buried in sediment layers, cores must provide stratigraphic dating information; and, to determine forecasting, these cores must also have precise elevation measurements. This update doubles the number of dated cores, bringing the total count to over 1,000.

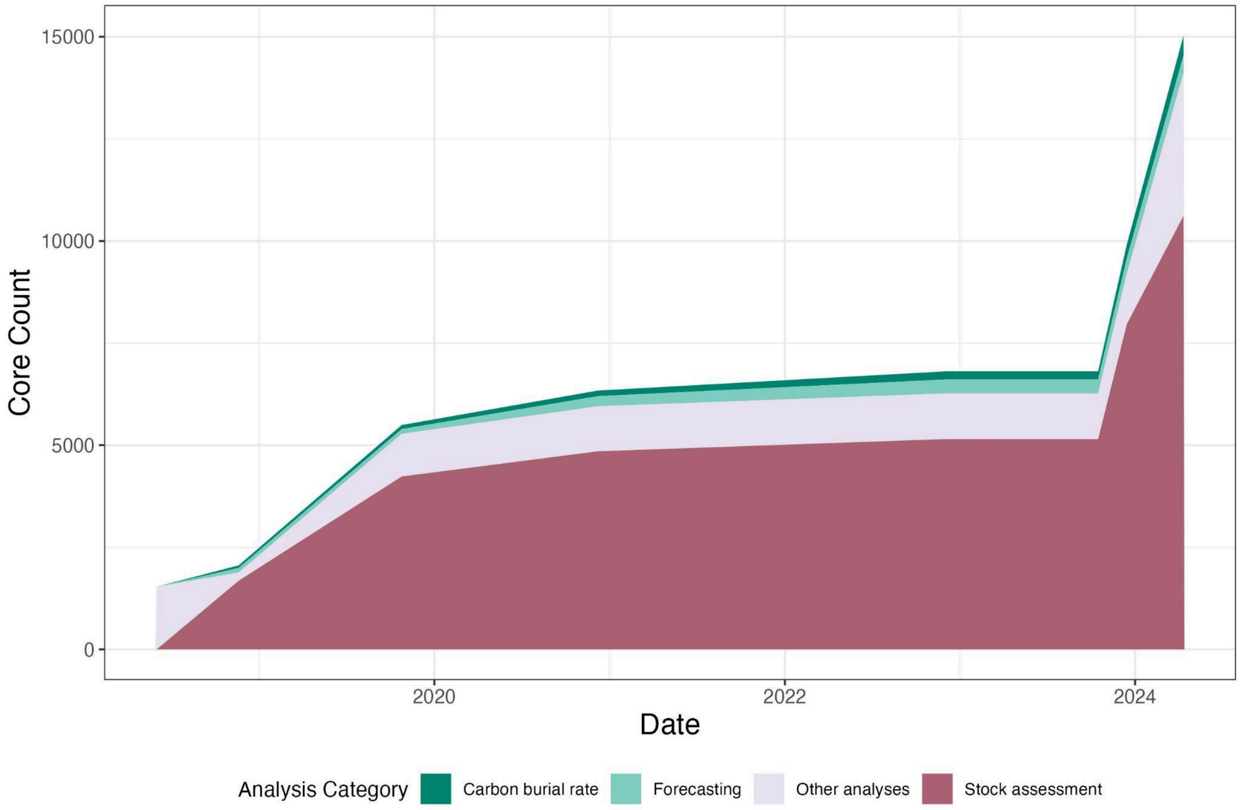


Figure 5. Summary of the number of cores with data sufficient for key analyses over the history of the Data Library.

Another metric of data quality is the depth to which samples were taken. If the contact point between wetland sediment and bedrock is reached, this is considered a complete profile.[7] The majority of these in the Data Library come from mangrove and marsh habitat, with 601 complete mangrove soil profiles and 206 complete marsh soil profiles. Of these profiles, mangrove habitats were dominated by deep cores, those greater than a meter in length, while soil samples from seagrass and unvegetated habitats tended to be shallow - those sampled at less than 20 centimeters. Despite being more difficult to obtain due to sediment depth or equipment constraints, deep cores provide data that are the most representative of the area in which they were taken.

Inventorying Applications

Most data in the Data Library are measurements used to calculate stock assessments of soils. To perform these calculations, soil core data is summarized and standardized to include only those data that can accurately represent how much carbon can be found in one meter of soil in a given habitat. A stock assessment is an important metric for understanding how particular habitats aid in creating the Nationally Determined Contributions (NDCs) that are vital to evaluating the impacts of climate change. Here we provide a snapshot of soil carbon stocks in the two most abundantly represented habitats within our database: mangroves and marshes.

Global Mangrove Carbon Stocks

Although useful as a benchmark, the average global stock assessment falls short when calculating NDCs for those countries who have available stocks. Mangrove stocks are particularly noteworthy as they provide data on the second most prolific habitat type in the database - found in almost two thirds of represented countries. Leading both the global mangrove area cover and representation in the Data Library, Indonesia has 573 cores with stock assessment data.

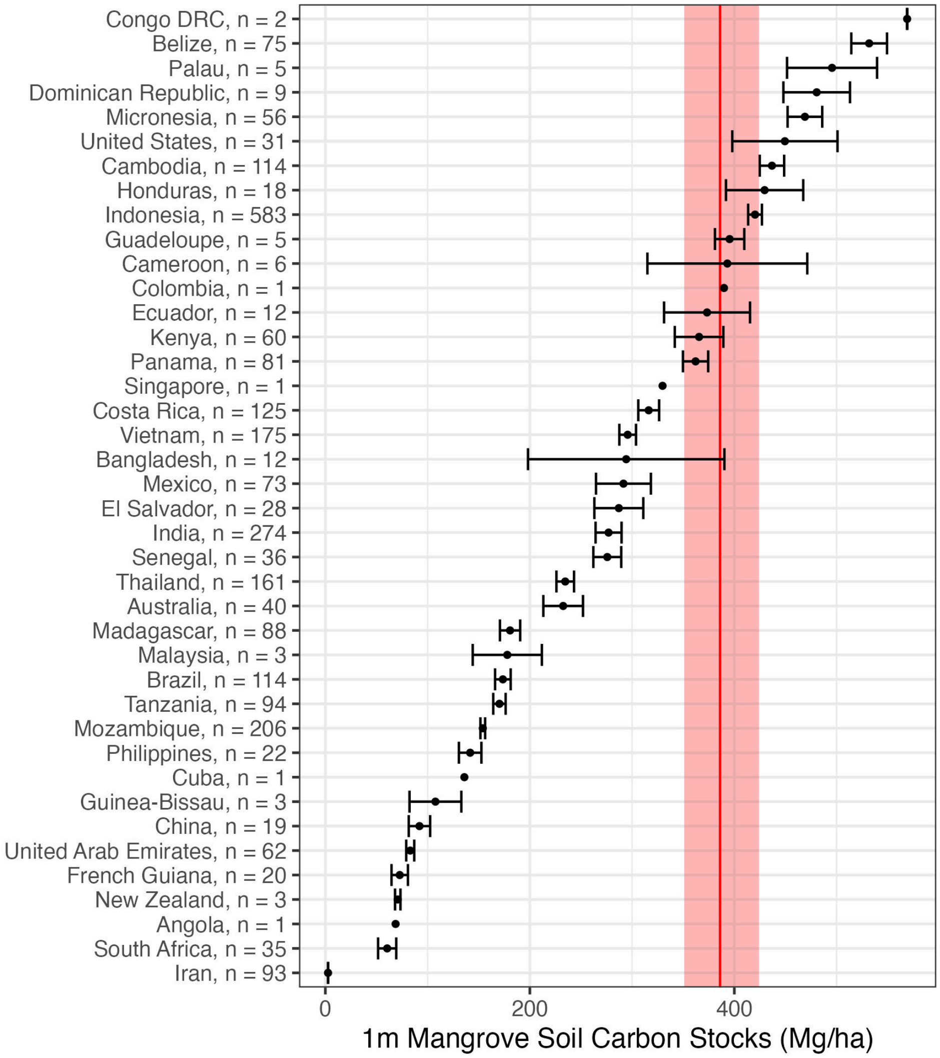


Figure 6. Mangrove soil carbon stocks standardized to the top one meter of soil by country compared to our database's calculated global average.

Global Marsh Carbon Stocks

Within the Data Library and Atlas, marshes are the most represented habitat, spanning 23 countries. Sixteen of these have core profiles complete enough to generate the standard 1-meter stock assessment. The US, holding approximately a third of the global area extent of marshes, has the greatest representation with 486 complete core profiles.[14] Despite the input from many of the most representative countries hosting marsh ecosystems, there remain some key exceptions. The CCN has partnered with organizations in several of these countries that are helping develop national carbon inventorying programs to help build up representation.

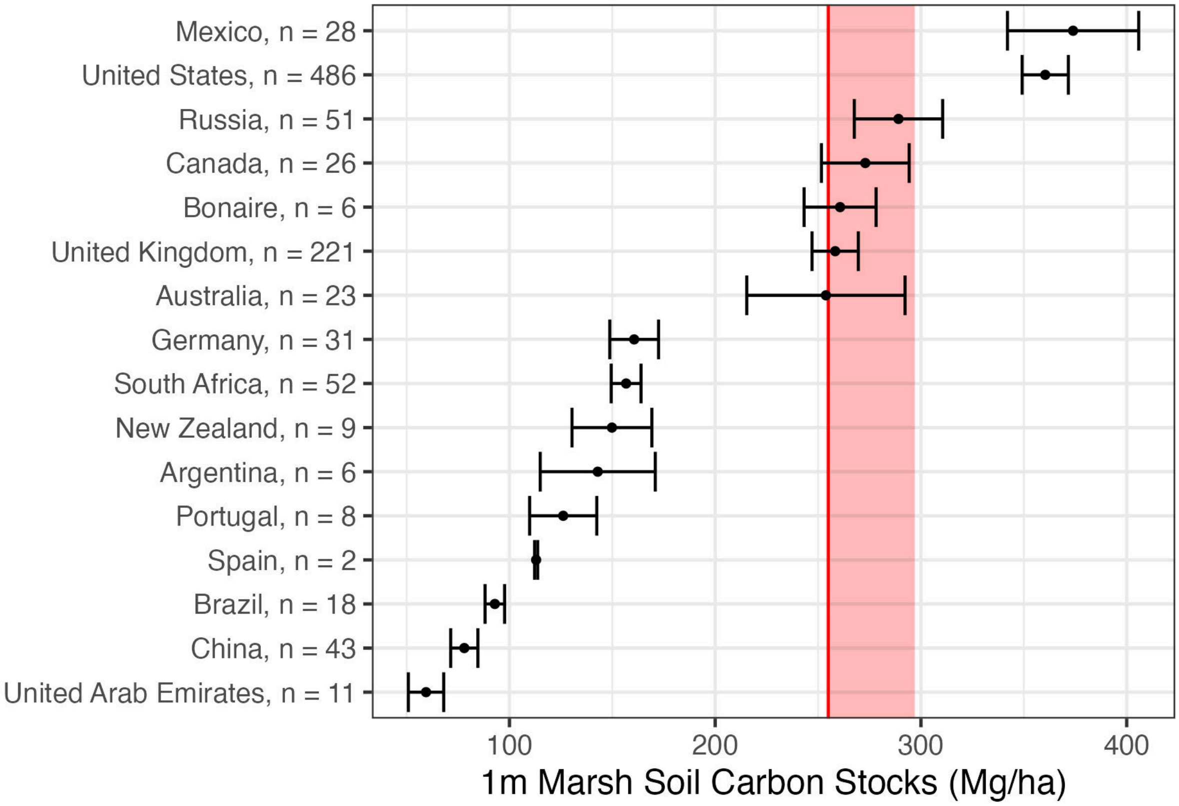


Figure 7. Marsh soil carbon stocks standardized to the top one meter of soil by country compared to our database's calculated global average.

Acknowledgements

The CCN would like to acknowledge the following authors and collaborators who contributed data and intellectual input to the Coastal Carbon Data Library from the publication of Version 1.0.0 to Version 1.2.0. We recognize both authors who published original data through the CCN, and externally published data included in Version 1.2.0 of the Data Library.

CCN Published Datasets Added

Beers et al 2023: Schile-Beers, Lisa M; Altieri, Andrew H.; Megonigal, J. Patrick (2023). Dataset: Mangrove, tidal wetland and seagrass soil carbon stocks along latitudinal gradients. Smithsonian Environmental Research Center. Dataset. https://doi.org/10.25573/serc.11971527

Brown et al 2024: Brown, Cheryl A.; Mochon Collura, T Chris; DeWitt, Ted (2024). Dataset: Accretion rates and carbon sequestration in Oregon salt marshes. Smithsonian Environmental Research Center. Dataset. https://doi.org/10.25573/serc.25024448

Cifuentes et al 2023: Cifuentes-Jara, Miguel; Manrow-Villalobos, Marylin (2023). Dataset: Study of total economic valuation of the main services provided by mangroves in the Gulf of Chiriquí, Panama. Smithsonian Environmental Research Center. Dataset. https://doi.org/10.25573/serc.24294928

Cifuentes et al 2024: Cifuentes-Jara, Miguel; Pérez, Christian Brenes; Manrow-Villalobos, Marilyn; Torres, Danilo (2024). Dataset: Land use dynamics and mitigation potential of the mangroves of the Gulf of Nicoya, Costa Rica. Smithsonian Environmental Research Center. Dataset. https://doi.org/10.25573/serc.24943866

Costa et al 2023: Costa, Matthew T.; Ezcurra, Exequiel; Ezcurra, Paula; Salinas-de-León, Pelayo; Turner, Benjamin L.; Leichter, James; et al. (2023). Dataset: Sediment depth and accretion shape belowground mangrove carbon stocks across a range of climatic and geologic settings.. Smithsonian Environmental Research Center. Dataset. https://doi.org/10.25573/serc.21295716

Craft 2024: Craft, Christopher (2024). Dataset: Tidal freshwater forest accretion does not keep pace with sea level rise. Smithsonian Environmental Research Center. Dataset. https://doi.org/10.25573/serc.24895293

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Langston et al 2022: Langston, Amy; Coleman, Daniel; Jung, Nathalie; Shawler, Justin; Smith, Alexander; Williams, Bethany; et al. (2024). Dataset: The Effect of Marsh Age on Ecosystem Function in a Rapidly Transgressing Marsh. Smithsonian Environmental Research Center. Dataset. https://doi.org/10.25573/serc.24913215

Loomis and Craft 2024: Loomis, Mark, J.; Craft, Christopher (2024). Dataset: Carbon Sequestration and Nutrient (Nitrogen, Phosphorus) Accumulation in River-Dominated Tidal Marshes, Georgia, USA.. Smithsonian Environmental Research Center. Dataset. https://doi.org/10.25573/serc.24518755

Machite and Adams 2024: Machite, Anesu; Raw, Jaqueline; Adams, Janine (2024). Dataset: A Synthesis of South African Estuaries. Smithsonian Environmental Research Center. Dataset. https://doi.org/10.25573/serc.24394426

Morgan et al 2024: Morgan, Pamela; Burdick, David; Short, Frederick (2024). Dataset: Soil organic matter in fringing and meadow salt marshes in Great Bay, New Hampshire and southern Maine. Smithsonian Environmental Research Center. Dataset. https://doi.org/10.25573/serc.25222124

Morrissette et al 2023: Morrissette, Hannah; Baez, Stacy K.; Schile-Beers, Lisa M; Bood, Nadia; Martinez, Ninon D.; Novelo, Kevin; et al. (2023). Dataset: National total ecosystem carbon stock for the mangroves of Belize. Smithsonian Environmental Research Center. Dataset. https://doi.org/10.25573/serc.21298338.v2

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Palinkas and Engelhardt 2024: Palinkas, Cindy M.; Engelhardt, Katharina A. M. (2024). Dataset: Spatial and temporal patterns of modern sedimentation in a tidal freshwater marsh. Smithsonian Environmental Research Center. Dataset. https://doi.org/10.25573/serc.24470152

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Radabaugh et al 2023: R. Radabaugh, Kara; P. Moyer, Ryan; R. Chappel, Amanda; L. Breithaupt, Joshua; Lagomasino, David; E. Dontis, Emma; et al. (2023). A Spatial Model Comparing Above- and Belowground Blue Carbon Stocks in Southwest Florida Mangroves and Salt Marshes. Smithsonian Environmental Research Center. Dataset. https://doi.org/10.25573/serc.23960826

Rovai et al 2022: Rovai, Andre; Twilley, Robert; Castaneda-Moya, Edward; Riul, Pablo; Cifuentes-Jara, Miguel; Manrow-Villalobos, Marilyn; et al. (2023). Dataset: Global controls on carbon storage in mangrove soils. Smithsonian Environmental Research Center. Dataset. https://doi.org/10.25573/serc.21295713

Schieder and Kirwan 2019: Schieder, Nathalie; Kirwan, Matthew (2024). Dataset: Sea-level driven acceleration in coastal forest retreat. Smithsonian Environmental Research Center. Dataset. https://doi.org/10.25573/serc.25259983

Shaw et al 2021: Shaw, Timothy; Cahill, Niamh; Barbieri, G; Ashe, E; S. Khan, Nicole; Brain, M; et al. (2023). Dataset: Relative sea-level change and driving processes during the past ~4000 years in the Chesapeake Bay, U.S. Atlantic Coast. Smithsonian Environmental Research Center. Dataset. https://doi.org/10.25573/serc.24526066

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Appendix

Table 1: New Cores for Each Country

country	**total cores**	**habitat**	**sources**
Argentina	6	marsh	Rios et al 2018
Australia	281	marsh, seagrass	Adame et al 2020, Beasy and Ellison 2013, Conrad et al 2019, Ewers Lewis et al 2020, Gallagher et al 2021, Gorham et al 2021, Russell et al 2023, Serrano AUS unpublished, Serrano et al 2019, Lafratta et al 2018
Bangladesh	10	mangrove	Akther et al 2021
Belgium	6	marsh	Mazarrasa et al 2023

Belize	126	mangrove, seagrass, scrub/shrub	Morrissette et al 2023, Beers et al 2023
Brazil	267	mangrove, marsh, seagrass	Rovai et al 2022, Adaime 1978, Azevedo 2015 unpublished, Copertino unpublished, Kauffman et al 2020 Brazil, Lacerda et al 1997, Neto and Lana 1997, Zanin 2003, Howard and Fourqurean 2020, SWAMP Data Soil carbon Barreto 2017 Brazil, SWAMP Data Soil carbon Boca Grande 2017 Brazil, SWAMP Data Soil carbon Caetano 2017 Brazil, SWAMP Data Soil carbon Furo Grande 2017 Brazil, SWAMP Data Soil carbon Mangue Sul 2017 Brazil, SWAMP Data Soil carbon Mauripe 2017 Brazil, SWAMP Data Soil carbon Salina 2017 Brazil, SWAMP Data Soil carbon Acarau Boca 2016 Brazil, SWAMP Data Soil carbon Caete 2017 Brazil, SWAMP Data Soil carbon Furo de Chato 2017 Brazil, SWAMP Data Soil carbon Mangizal Cauassu 2016 Brazil, SWAMP Data Soil carbon Manguinho 2016 Brazil, SWAMP Data Soil carbon Porto Ceu Mangrove 2016 Brazil, SWAMP Data Soil carbon Porto Ceu Shrimp 2016 Brazil, SWAMP Data Soil carbon Marisma High 2017 Brazil, SWAMP Data Soil carbon Marisma Low 2017 Brazil, SWAMP Data Soil carbon Marisma Medium 2017 Brazil
Cambodia	145	mangrove	Sharma et al 2021
Canada	124	marsh, mudflat	van Ardenne et al 2018, Chmura and Hung 2004, Connor et al 2001, Gu et al 2020, Kohfeld et al 2022, Wollenberg et al 2018
China	133	marsh	Gao et al 2016, Li et al 2019, Liu et al 2017, Loh et al 2018, Lu et al 2019, Wan et al 2017, Wang et al 2017, Xia et al 2022, Yang et al 2016, Yuan et al 2017
Costa Rica	138	mangrove, other	Rovai et al 2022, Cifuentes et al 2024 Nicoya

Denmark	22	marsh, seagrass, unvegetated	Graversen et al 2022, Holmer et al 2006
Ecuador	36	mangrove	Costa et al 2023
El Salvador	9	mangrove	Rovai et al 2022
Estonia	14	marsh	Sammul et al 2012
Gabon	17	mangrove	Trettin et al 2020
Germany	49	marsh	Bunzel et al 2019, Hansen et al 2016, Pollman et al 2021
India	282	mangrove	SWAMP Data Soil carbon Bhitakarnika 2013 India, SWAMP Data Soil carbon Cauassu Leste Shrimp 2016 Brazil, SWAMP Data Soil carbon Cauassu Oeste Shrimp 2016 Brazil, SWAMP Data Soil carbon Cumbe Leste Camaro 2016 Brazil, SWAMP Data Soil carbon Cumbe norte Camarao 2016 Brazil, SWAMP Data Soil carbon Case Shell 2014, SWAMP Data Soil carbon Jardin Du Elephant 2014, SWAMP Data Soil carbon Lac Simba Deux 2014, SWAMP Data Soil carbon Lac Simba 2014, SWAMP Data Soil carbon Lac Sounga Deux 2014, SWAMP Data Soil carbon Lac Sounga 2014, SWAMP Data Soil carbon Mwana Mouele South 2014, SWAMP Data Soil carbon Mwana Mouele 2014, SWAMP Data Soil carbon Ndougou 2014, SWAMP Data Soil carbon Paga 2014, SWAMP Data Soil carbon BRM10 2014, SWAMP Data Soil carbon MRM8 2014, SWAMP Data Soil carbon MRT7 2014, SWAMP Data Soil carbon MRT9 2014, SWAMP Data Soil carbon NCM1 2014, SWAMP Data Soil carbon NCM4 2014, SWAMP Data Soil carbon NCM5 2014, SWAMP Data Soil carbon NCT2 2014, SWAMP Data Soil carbon NCT3 2014, SWAMP Data Soil

			carbon NCT6 2014, SWAMP Data Soil carbon Cilacap 2011
Indonesia	570	mangrove	Kusumaningtyas et al 2018, SWAMP Data Soil carbon Berahan kulon 2019, SWAMP Data Soil carbon Timbulsloko 2019, SWAMP Data Soil carbon Bunaken 2011, SWAMP Data Soil carbon Kubu Raya 2011 Indonesia, SWAMP Data Soil carbon Sembilang 2011 Indonesia, SWAMP Data Soil carbon Tanjung Puting 2009 Indonesia, SWAMP Data Soil carbon Teminabuan 2011 Indonesia, SWAMP Data Soil carbon Timika 2011 Indonesia, SWAMP Data Soil carbon Arguni Bay West Papua 2015 Indonesia, SWAMP Data Soil carbon Bintuni Bay West Papua 2018 Indonesia, SWAMP Data Soil carbon Buruway West Papua 2016 Indonesia, SWAMP Data Soil carbon Etna Bay West Papua 2017 Indonesia, SWAMP Data Soil carbon Kaimana City West Papua 2017 Indonesia
Iran	96	mangrove	Hamzeh and lahijani 2022
Ireland	136	marsh	Burke et al 2022, Cott et al 2013, Grey et al 2021
Italy	32	marsh	Guerra et al 2022, Vitti et al 2020
Kenya	80	seagrass, unvegetated	Githaiga et al 2017
Mexico	85	marsh, mangrove	Adame et al 2013, Adame et al 2015, Adame et al 2021, Cuellar-Martinez et al 2019, Cuellar-Martinez et al 2020, Costa et al 2023
Morocco	2	marsh	Noguiera et al 2022
Netherlands	47	mangrove, marsh	Senger et al 2020, Mazarrasa et al 2023, Van de Broek et al 2018

New Zealand	9	marsh	Bulmer et al 2020
Norway	10	marsh	Ward 2020
Panama	155	mangrove, scrub/shrub, seagrass	Rovai et al 2022, Costa et al 2023, Cifuentes et al 2023 Panama, Beers et al 2023
Philippines	11	seagrass, mangrove	Kamp-Nielsen et al 2002, MacKenzie et al 2021
Portugal	99	marsh, mudflat	Camacho et al 2014, Kumar et al 2020, Martins et al 2022, Mazarrasa et al 2023, Santos et al 2019, de los Santos et al 2022
Russia	53	marsh	Shamrikova et al 2019, Siewert et al 2016
Senegal	36	mangrove	SWAMP Data Soil carbon Baouth 2014 Senegal, SWAMP Data Soil carbon Diamniadio 2014 Senegal, SWAMP Data Soil carbon Djirnda 2014 Senegal, SWAMP Data Soil carbon Fambine 2014 Senegal, SWAMP Data Soil carbon Mounde 2014 Senegal, SWAMP Data Soil carbon Sang 2014 Senegal
South Africa	1567	marsh, mangrove, seagrass	Raw et al 2020, Adams and Human 2016, Bekker 2015, Bezuidenhout et al 2011, Brown and Rajkaran 2020, Els 2017, Els 2019, Geldenhyus et al 2016, Hoppe-Speer et al 2013, Human et al 2022, Johnson et al 2020, Lemley 2018, Matabane 2018, Mbense et al 2016, Mbense 2019, Naidoo 2014, Peer et al 2018, Rajkaran and Adams 2011, Rautenbach 2015, Raw et al 2019, Veldkornet 2016 PhD, Veldkornet et al 2016, Verle 2013, Vromans 2010, Wooldridge et al 2016
Spain	100	marsh, mudflat	Camacho et al 2014, Gonzalez-Alcaraz et al 2015, Kumar et al 2020, Mazarrasa et al 2023, de los Santos et al 2023

Tanzania	98	mangrove	Dai et al 2022, Trettin et al 2020
Thailand	124	mangrove	Bukoski et al 2020, Sharma et al 2021
United Arab Emirates	30	marsh	Schile et al 2016
United Kingdom	1568	marsh	Ford et al 2016, Miller et al 2022 Scotland, Newton 2017, Pagès et al unpublished, Payne et al 2019, Ruranska et al 2020, Ruranska et al 2022, Smeaton et al 2021, Smeaton et al 2022a, Smeaton et al 2022b, Smeaton et al 2023
United States	1568	marsh, swamp, scrub/shrub, seagrass, mangrove, unvegetated, mudflat	Weston et al 2023, Wang et al 2023, Vinent and kirwan 2017, Vincent and Dionne 2023, van Ardenne et al 2018, Turck 2014, Thom 1992, Stevens et al 2024, Stahl et al 2024, Snedden 2021, Snedden 2018, Smith and Kirwan 2021, Shaw et al 2020, Schieder and Kirwan 2019, Saunders 2013, Rovai et al 2022, Radabaugh et al 2023, Radabaugh et al 2021, Radabaugh et al 2018, Piazza et al 2020, Palinkas and Engelhardt 2024, Palinkas and Cornwell 2024, Morgan et al 2024, Miller et al 2022, Messerschmidt et al 2020, McGlathery et al 2018, Anisfeld et al 1999, Bryant and Chabreck 1998, Cahoon et al 1996, Craft et al 1993, Markewich et al 1998, Orson et al 1998, Patrick and DeLaune 1990, Roman et al 1997, Rybczyk and Cahoon 2002, Yando et al 2016, Marot et al 2020, Loomis and Craft 2024, Langston et al 2022, Kemp et al 2024, Howard and Fourqurean 2020, Gillen et al 2018, Everhart et al 2020, Drake et al 2024, Darienzo and Peterson 1990, Curtis et al 2022, Craft 2024, Brown et al 2024, Bost et al 2024, Beers et al 2023
Vietnam	288	mangrove	SWAMP Data Soil carbon Ca Mau 2012 Vietnam, SWAMP