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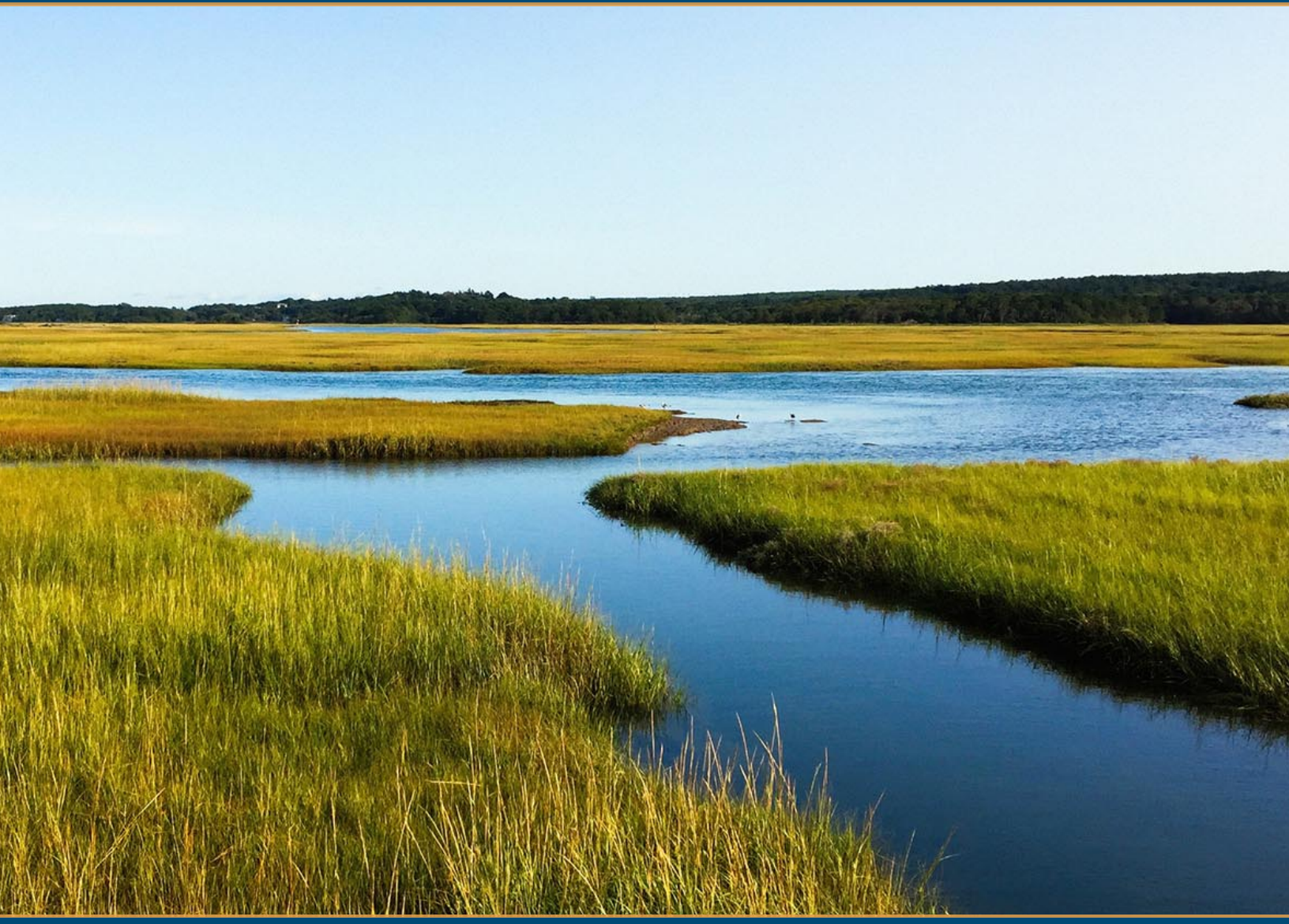

Sea Grant Law Center

The University of Mississippi School of Law

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Volume 13:1

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Editor-in-Chief
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Editor's Note

This edition of the Sea Grant Law & Policy Journal (Journal) is the result of the Sea Grant Blue Carbon Law Symposium, which was held at the University of Georgia in Athens, GA on May 17-18, 2023. The Blue Carbon Law Symposium was part of the Journal's Symposium Series and co-organized by the National Sea Grant Law Center, South Carolina Sea Grant Consortium, Georgia Sea Grant, University of Georgia Institute of Government, and University of Georgia School of Law, with funding by the National Sea Grant Law Center from the U.S. Department of Commerce, National Oceanic and Atmospheric Administration under Award No. NA18OAR4170079. More info on the Blue Carbon Law Symposium can be found here.

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THE FIRST BLUE CARBON LAW SYMPOSIUM: A THRESHOLD FOR PRACTITIONERS, REGULATORS, AND STAKEHOLDERS

Brita J. Jessen[1]

I. INTRODUCTION

Solutions to current and future impacts of climate change are complex, transdisciplinary, and multi-sector. Social and physical sciences are needed to determine effective and long-term outcomes; regulations and policies depend on accurate interpretation of law and integration of societal values; and ground-level management actions require multi-agency partnerships and combined investments of public and private assets, not to mention support and guidance from the communities that would be impacted. *Coastal natural resources management* therefore exists at the interface of public and private spheres of influence and depends on productive and trust-based relationships among practitioners of science, policy, law, economics, and social justice.

With these intersections in mind, cross-sector partnerships and information-sharing anchored the first **Sea Grant Blue Carbon Law Symposium** (Symposium), hosted by the University of Georgia in May 2023 and cooperatively developed through the University of Georgia's Marine Extension Program, School of Law, Carl Vinson Institute of Government, and South Carolina Sea Grant Consortium. While centered on legal needs and challenges, the Symposium convened multiple sectors involved with Blue Carbon research,

[1] Interdisciplinary Research and Partnerships Lead, South Carolina Sea Grant Consortium. The concept of the Symposium was sparked by a white paper, *Legal Issues Affecting Blue Carbon Projects on Publicly-Owned Coastal Wetlands*, co-authored by Read Porter, Cody Katter, and Cory Lee, through the Rhode Island Sea Grant Law Program. The Symposium would not have been possible without the commitment and support of its Steering Committee (David Eady, David Golden, Marilyn Hemmingway, Katie Hill, Catherine Janasie, Adam Orford, Romany Webb, along with the author), planning team, featured speakers, dedicated participants, and sponsors. The Symposium was supported through a National Sea Grant Law Center award (NA18OAR4170079) with additional grants from First Horizon Bank, Wicker-Brammell PLLC, and The Nature Conservancy. I gratefully acknowledge Natalie Bock, Eleonora Machado, Crystal Narayana, Sara Karlsson, the University of Georgia's Delta Innovation Hub, the Georgia Climate Conference, Mark Risse, Susan Lovelace, and Shana Jones for their support and expertise. Additional gratitude is extended to Queen Quet of the Gullah Geechee Nation and to Barbara Mann, artist-in-residence to the Georgia Sea Grant program, for connecting not only our minds but also our hearts with the inspirational beauty and intrinsic value of natural coastal ecosystems.

federal and state policy, private investment, and equitable decision-making through co-production with community stakeholders.

This special issue of the SEA GRANT LAW & POLICY JOURNAL highlights the legal frameworks and challenges associated with carbon offsetting on private and publicly held lands along coastal regions of the U.S. This introduction article presents the attributes of coastal Blue Carbon ecosystems and introduces the socio-ecological context that supports the following legal and policy articles within this special issue. More information on the Symposium speakers and conference proceedings can be found on the webpage. While the 2023 Symposium was a successful event, we recognize that two days of collective learning is not nearly enough time to cover all topics and case studies in detail; thus, we hope to reconvene the Blue Carbon Law Symposium in years to come.

II. ABOUT BLUE CARBON

A rapid and holistic global effort is necessary to prevent an average global temperature exceeding 1.5° C above pre-industrial levels, which the Intergovernmental Panel on Climate Change has established as a tipping-point for extreme regional climate impacts that likely include "warming of extreme temperatures in many regions … increases in frequency, intensity, and/or amount of heavy precipitation in several regions … and an increase in intensity or frequency of droughts in some regions."[2] The industrial era's greenhouse gas emissions to the atmosphere have raised the concentration of carbon dioxide (CO_2) from approximately 280 to 420 ppm,[3] with noticeable effects that include sea level rise in some regions,[4] shifting ranges of habitats and wildlife,[5] and stronger hazardous storms.[6] Coastline and coastal watershed communities, which

[2] Intergovernmental Panel on Climate Change, *Summary for Policymakers*, *in* GLOBAL WARMING OF 1.5°C. AN IPCC SPECIAL REPORT ON THE IMPACTS OF GLOBAL WARMING OF 1.5°C ABOVE PRE-INDUSTRIAL LEVELS AND RELATED GLOBAL GREENHOUSE GAS EMISSION PATHWAYS, IN THE CONTEXT OF STRENGTHENING THE GLOBAL RESPONSE TO THE THREAT OF CLIMATE CHANGE, SUSTAINABLE DEVELOPMENT, AND EFFORTS TO ERADICATE POVERTY 7 (Masson-Delmotte, V. et al. eds. 2018).
[3] Rebecca Lindsey, *Climate Change: Atmospheric Carbon Dioxide*, NAT'L OCEANIC & ATMOSPHERIC ADMIN. (May 12, 2023).
[4] Sönke Dangendorf et al., *Persistent acceleration in global sea-level rise since the 1960s*, 9(9) NATURE CLIMATE CHANGE 705 (2019)
[5] I-Ching Chen et al., *Rapid Range Shifts of Species Associated with High Levels of Climate Warming*, 333(6045) SCIENCE 1024 (2011).
[6] Thomas R. Knutson et al., *Science Brief Review: Climate change is probably increasing the intensity of tropical cyclones*, *in* CRITICAL ISSUES IN CLIMATE CHANGE SCIENCE (Corinne LeQuéré, Peter Liss & Piers Forster eds., 2021).

comprise 52% of the U.S. population, face some of the most significant risk in terms of safety, economies, and cultural identity.[7] Other national assets such as ports and military installments are also at increased risk from climate change-driven coastal hazards.[8]

In an effort to mitigate both drivers and impacts of climate change, some science and policy practitioners look to natural resources such as productive coastal habitats that can function as net *sinks* of greenhouse gases while providing critical ecosystem services (e.g., contaminant sequestration, storm buffering, wildlife habitat, and other socio-economic values). Carbon sinks are defined through the net balance of the ecosystem's metabolism: Primary producers (plants and microorganisms) convert atmospheric carbon dioxide into biomass through photosynthesis; while some of this biomass is then consumed or exported, the majority may be stored within sediments at timescales of hundreds to thousands of years.[9] *Coastal Blue Carbon Ecosystems* – marine, coastal, or tidal freshwater ecosystems that produce and store more organic carbon than that which is consumed or exported – are naturally performing an inverse function of fossil fuel combustion.

It must be noted at the outset that there is a critical mismatch of timescales: The release of greenhouse gases through oxidation of fossil fuel stores, sequestered over millennia through ancient primary production and storage, cannot be reversed in equal measure through natural sequestration within a comparatively fractionable timescale (years to decades). In his presentation at the Symposium Dr. Daniel Friess noted that the sequestration of greenhouse gases by global coastal wetland conservation is estimated to offset approximately 3% of

[7] Paul Sandifer & Geoffrey I. Scott, *Coastlines, Coastal Cities, and Climate Change: A Perspective on Urgent Research Needs in the United States*, 8 FRONTIERS IN MARINE SCI. no. 631986 (2021)

[8] *Id.*; KATE GUY ET AL., CTR. FOR CLIMATE AND SEC., A SECURITY THREAT ASSESSMENT OF GLOBAL CLIMATE CHANGE: HOW LIKELY WARMING SCENARIOS INDICATE A CATASTROPHIC SECURITY FUTURE (2020).

[9] Not all well-functioning coastal ecosystems are carbon sinks: For example, oyster reefs may be sinks or sources. F. Joel Fodrie et al., *Oyster reefs as carbon sources and sinks*, 284(1859) PROC. OF THE ROYAL SOC'Y B: BIOLOGICAL SCI. 20170891 (2017). Seasonal or inter-annual conditions can also impact carbon gains and losses, as do upstream inputs such as nutrient and sediment supply. Catherine E. Lovelock & Ruth Reef, *Variable Impacts of Climate Change on Blue Carbon*, 3(2) ONE EARTH 195 (2020). This variability is an important reason why local monitoring is essential for greenhouse gas accounting.

annual GHG emissions (around 300 Tg of CO_2 equivalents (CO_2e)[10] avoided emissions each year[11]). Yet with a high risk of negative climate impacts on both local and global scales, this is a non-negligible piece of the necessary solution that comes with decades of research[12] and a portfolio of beneficial outcomes for the resilience and socio-economic sustainability of coastal communities.[13]

Scientists studying the earth's carbon cycle can expound on the complexities and variations of a *carbon budget* (containing gains, losses, and storage) among and within habitats, regions, seasonal cycles, and inter-annual periods. Reducing uncertainties at decadal-to-centennial timeframes and geographic scales requires a national investment in programs such as the Smithsonian Environmental Research Center's Coastal Carbon Network,[14] the U.S. Carbon Cycle Program,[15] state-level greenhouse gas inventories, federal wetlands inventories, and place-based work through the National Estuarine Research Reserve System. The Sea Grant network is investing in blue carbon research and education at national and program levels.[16] Despite these multiple investments, the science will not be complete before law and policy actions are needed; therefore, using best practices of risk analysis and buffering for unknowns (e.g., whether a newly restored system will be set back by a major storm) must be part of the strategy going forward.

The field of carbon crediting and offsets has been highly scrutinized, often with fair measure.[17] For reasons described above, true climate change mitigation

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[10] While CO_2 is the most abundant greenhouse gas product from anthropogenic activities, other greenhouse gases (methane, nitrous oxides, perfluorocarbons, hydrofluorocarbons, and sulfur hexafluoride) contribute different levels of 'forcing,' or radiative heat capture, and will break down at different timescales. "CO_2 equivalents" is a unit to standardize the level of heat capture by these different molecules over a set time period.

[11] Peter I. Macreadie et al., *Blue carbon as a natural climate solution*, 2 NATURE REV. EARTH & ENV'T 826 (2021).

[12] Carlos M. Duarte, *Reviews and syntheses: Hidden forests, the role of vegetated coastal habitats in the ocean carbon budget*, 14(2) BIOGEOSCIENCES 301-310 (2017).

[13] Edward B. Barbier, *The Value of Coastal Wetland Ecosystem Services*, *in* COASTAL WETLANDS 947 (Gerardo M.E. Perillo et al., eds., 2d ed. 2019).

[14] *Coastal Carbon Network*, SMITHSONIAN ENV'T RSCH. CTR. (last visited Mar. 1, 2024).

[15] U.S. CARBON CYCLE SCIENCE PROGRAM (last visited Mar. 1, 2024).

[16] Brita J. Jessen & Katie Hill, *Sea Grant at the Blue Carbon Frontier: Integrating Law, Science, Community Values, and Economics*, OCEANOGRAPHY (in review).

[17] Phillip Williamson, & Jean-Pierre Gattuso, *Carbon Removal Using Coastal Blue Carbon Ecosystems is Uncertain and Unreliable, With Questionable Climatic Cost-Effectiveness*, 4 FRONTIERS IN CLIMATE no. 853666 (2022).

will not be enabled through "business as usual" actions of fossil fuel use offset by natural lands conservation or enhancement.

Additionally, unregulated and non-transparent crediting systems have the potential to hype untested methods of greenhouse gas quantification or restoration practices without credible science and legitimate gains (factors of *additionality* and *permanence*, as described by Orford in this issue). Finally, practices that are not grounded in social equity have the potential to exploit land holders through carbon rights transactions at less than true value.[18] Highly mindful of these cautionary issues, the Steering Committee for the Blue Carbon Law Symposium conducted extensive interviews of blue carbon practitioners, land managers, scientists, social equity advocates, and law and policy experts to curate a selection of panelists for the Symposium.

III. OBJECTIVES AND THEMES

The Blue Carbon Law Symposium was designed around a framework for cross-sector sharing among representatives of climate law, carbon markets, corporate decision-makers, scientists, accreditation practitioners, community representatives, and international speakers. The value of this Symposium was in the opportunity for sector representatives to share out the vision, constraints, information syntheses and gaps, and trusted resources available. The objectives of the Symposium were to:

- Understand the legal and policy context of carbon credit markets and how blue carbon fits with these markets;
- Discuss the state of blue carbon science;
- Assess the quality of claims about blue carbon project potential under qualification conditions;
- Learn about specific blue carbon projects being developed in the U.S. and internationally; and
- Identify challenges, barriers, and social equity needs to determine successful blue carbon projects.

The first half-day session of the Symposium was held concurrently with the Georgia Climate Conference, allowing policy makers and business leaders

[18] CONSERVATION INTERNATIONAL ET AL., HIGH-QUALITY BLUE CARBON PRINCIPLES AND GUIDANCE (2022).

from southeastern states to cross-register. To this end, David Golden led a panel of corporate and legal representatives to identify and share the reasoning and needs of the private sector in order for sustained natural capital investments. Notable special addresses were made by Dr. Sarah Kapnick, Chief Scientist with the National Oceanic and Atmospheric Administration (NOAA) and Jocelyn D'Ambrosio, Senior Counsel at the Council on Environmental Quality within the Executive Office of the President. Dr. Kapnick and Ms. D'Ambrosio shared the vision under the current Biden administration to incorporate coastal blue carbon ecosystems within the Administration's *Ocean Climate Action Plan*[19] and the cooperative agency initiative *America the Beautiful*, which aims to conserve 30% of U.S. lands and waters by 2030.[20]

Stephanie Simpson and Nikki Rovner, both with The Nature Conservancy, shared the process to develop the country's first coastal blue carbon crediting effort through seagrass restoration in Virginia. This effort is based on partnerships from academic and state scientists and policy-makers willing to create a pathway for blue carbon credit sharing between the state and a private partner (i.e., The Nature Conservancy) and can serve as a model for future efforts.[21]

Braided throughout the panels was an emphasis on the role of community equity and stakeholder engagement. Queen Quet, chieftess of the Gullah Geechee Nation that extends from North Carolina through northeast Florida, and Gullah Geechee Nation representative Glenda Simmons-Jenkins, delivered a special address and facilitated a discussion focused on the cultural significance and critical resources derived from coastal ecosystems of the southeast U.S. Bryan van Stippen of the National Indian Carbon Coalition was joined by Tannia Frausto of WILDCOAST based in Mexico and Tonna-Marie Surgeon Rogers and Aitza Pabón of Waquoit Bay and Jobos Bay National Estuarine Research Reserves, respectively, to share their experiences of blending community perspectives with ecosystem management for enhanced carbon storage. By sharing the stories of their local community's identity, needs, and existential connection to the land, each stakeholder representative gave weight and realness to the value of inclusive decision-making.

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[19] OCEAN CLIMATE ACTION PLAN, OCEAN POL'Y COMM., WHITE HOUSE (2022).
[20] *America the Beautiful*, U.S. DEP'T OF THE INTERIOR (last visited Mar. 1, 2024).
[21] Jill Bieri, *Virginia Seagrass Restoration Project Establishes a Model for Similar Action Worldwide*, U.S. NATURE4CLIMATE (Nov. 6, 2022).

IV. THE BLUE CARBON FRONTIER – FROM VISION TO PRACTICE

The articles presented in this special issue will cover key policy needs to bridge together national and state climate strategies (Orford); allowances with current compensatory mitigation policies (Hill & Spivack); state-level frameworks (Black et al.); and policy needs for the development of blue carbon crediting on federal and state-held lands (Porter). Along with other policy and research guidance,[22] the information assembled and evaluated by these authors better positions our collective and cross-disciplinary field of practice to develop coastal blue carbon policy, legislation, and project implementation.

Adding to the reviews contained in this special issue, the following recommendations were collected during the Symposium and through follow-up conversations with blue carbon practitioners in governmental and private sector roles:

1) Implementation of pilot projects are needed on U.S. state lands with a robust research and monitoring component to learn from unanticipated outcomes. While many restoration practices have been developed for coastal ecosystems, this new era of public-private partnerships, with the involvement of multiple regulatory and crediting agencies, creates a new system. Thus social, economic, and ecological monitoring and evaluation are paramount.

2) Projects will have multiple objectives and stakeholders; therefore, clarity of how success is defined and measured needs to be set through equitable and transparent co-production.[23] As one government administrator at the Symposium stated, "It's not [only] about the blue carbon; it's how we do this equitably."

3) There is strong interest for a federal authority to drive investments into coastal blue carbon project development, implementation, and monitoring. Both academic professionals and non-governmental groups look to the U.S. agencies, including NOAA, U.S.

[22] *See e.g.,* RESTORE AMERICA'S ESTUARIES, A NATIONAL BLUE CARBON ACTION PLAN: OPPORTUNITIES AND RECOMMENDATIONS (2021); JEAN BRODEUR ET AL., NAT'L OCEANIC & ATMOSPHERIC ADMIN., NOAA BLUE CARBON WHITE PAPER (2022).
[23] *See* Paul Beier et al., *A How-to Guide for Coproduction of Actionable Science*, 10(3) CONSERVATION LETTERS 288 (2017).

Environmental Protection Agency, U.S. Fish and Wildlife Service, and U.S. Securities and Exchange Commission, to lead national-level policy and regulations for coastal blue carbon enhancement while protecting and sustaining other critical ecosystem services and provisions.

4) Not all coastal blue carbon projects will enter the marketspace for credits. For those that will, investors and practitioners require: (i) a robust understanding of market certainties and risks and (ii) an understanding of which coastal blue carbon-associated rehabilitation and conservation projects will be directed to state or national greenhouse gas inventories and which will be allocated to the market-based crediting system. Both efforts require further coordination among a diverse range of stakeholders.

V. CONCLUSION

Responding to current and future impacts of climate change requires an "all hands-on deck" approach. The conservation, stewardship, and rehabilitation of marine, coastal, and tidal ecosystems that promote greenhouse gas sequestration is a platform to bring together a new network of communities, private partners, state and federal decision-makers, and inter-disciplinary research-to-management practitioners. Further, it is an opportunity for boundary-spanning organizations such as the National Sea Grant Law Center and partner Sea Grant programs to enable a neutral space for cross-sector pollination and examination of new methods and outcomes.

The articles in this special issue serve as a guide for all parties involved, regardless of experience in law and policy. To build a sustainable and equitable path forward we must first learn the challenges faced for each sector.

BLUE CARBON LAW

Adam D. Orford[1]

This Article explores the emerging law of blue carbon, defined as rules governing human interventions into Earth's marine carbon cycles. Blue carbon law is of growing importance today as pressure mounts to incorporate coastal conservation and restoration activities into market-based carbon sequestration schemes, and as the planet's deep oceans are evaluated for their carbon sequestration potential. The Article conceptualizes two broad trends in blue carbon law: the international law of carbon credit markets creating incentives to commodify and monetize blue carbon resources; and the responsive integration of commodification concepts into existing laws that already manage and influence blue carbon systems, with attendant risks and opportunities. In the United States, the rise of blue carbon appears to be posing a fundamental challenge to long-established international norms and rules for carbon crediting, as U.S. state actors are increasingly pushing to qualify for carbon finance for existing conservation activities. These developments, in turn, raise questions about the valuation of mandated conservation and the potential for the carbon market system to compensate the maintenance and protection of ecosystem services.

I. INTRODUCTION

Following the first Blue Carbon Law Symposium hosted at the University of Georgia in May 2023,[2] this Article seeks to characterize an emerging "law of blue carbon," with specific emphasis on the ongoing development of market-based systems to incentivize marine carbon sequestration, integration of carbon

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[1] © Assistant Professor, University of Georgia School of Law. J.D., M.P.P., Ph.D. (Energy & Resources). Many thanks to Brita Jessen, Katie Hill, Cathy Janasie, and all of the members of planning committee for the Blue Carbon Law Symposium; to the National Sea Grant Law Center and other sponsors for their generous financial support of the event; and to everyone who participated. Thanks to the participants of the UGA-Emory Faculty Exchange, particularly Mark Nevitt, for their valuable and helpful feedback on an early draft.

[2] The Blue Carbon Law Symposium was a collaboration between the South Carolina Sea Grant Consortium, Georgia Sea Grant, and the University of Georgia School of Law. *See* https://www.scseagrant.org/blue-carbon-law-symposium/.

sequestration concepts into existing legal regimes, guardrails on activities that affect blue carbon sequestration, and recently proposed legislation.

The study reveals a growing interest in creating legal systems that commodify, monetize, maximize, and merchandise the marine environment's carbon sequestration services, as well as a justified growing concern over these proposals. Measurement systems to allow for the management of blue carbon resources; qualification rules for marketable credits that increase confidence in their real-world value; and markets to buy and sell carbon sequestration services to the highest bidder, are offered up as underutilized tools for climate change response that also benefit aquatic ecosystem conservation, and are simultaneously accused of servicing the greenwashing purposes of polluting industry.[3] Whether coming to the topic optimistically, cautiously, or skeptically, it is hoped that this Article will prove useful to anyone seeking to understand and improve emerging laws governing marine carbon sequestration.

In this spirit, Part I of this article endeavors to offer a comprehensive definition of "blue carbon law," arguing that it ultimately encompasses the rules of human intervention into Earth's marine carbon cycles, which are increasingly understood as potential tools in efforts to respond to climate change. Part II reviews the development of carbon credit markets for terrestrial carbon management activities, which have formed the basis for commodification initiatives in the blue carbon realm. Part III then seeks to identify existing laws and legal frameworks that meet the definition of blue carbon law, and to determine how emerging efforts at blue carbon commodification might drive change in these regimes. Part IV, finally, provides a brief conclusion that reviews recent proposed federal legislation and flags the most pressing questions that blue carbon law will need to address in the near future. At the end of the analysis, such questions are less likely to relate to whether blue carbon sequestration will be commodified and traded, than with how it will be, and to whose benefit.

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[3] *E.g.*, *see* Patrick Greenfield, *Revealed: More than 90% of Rainforest Carbon Offsets by Biggest Certifier are Worthless, Analysis Shows*, THE GUARDIAN (Jan. 18, 2023); *and see Verra Response to Guardian Article on Carbon Offsets*, VERRA (Jan. 18, 2023).

II. DEFINING BLUE CARBON LAW

Definitions hold extraordinary power.[4] It is appropriate, therefore, to begin a law review article of this type with a definitional inquiry: "what is blue carbon law"? It is a difficult question, and so the following sections in this Part break it into pieces. The first begins with the noun: what is *carbon*? With that in hand, the next proceeds to consider which of the carbon is *blue*. With those terms clarified, the last section discusses what the *law* of any such thing might be. The Part as a whole defines blue carbon as rules governing human interventions into marine carbon cycles.

A. "Carbon": Life, Energy, and Climate Change

What is carbon? Physicists tell us that it is any atom with six protons in its nucleus.[5] Notwithstanding some details about isotopes, that's all there is to it.[6] Almost all of the carbon in existence today was created in stars over the last

[4] By defining, for example, what is or is not a "renewable" energy technology, financing is driven toward or away from entire industries. 26 U.S.C. § 45(c) (defining qualifying energy resources for purposes of the clean energy production tax credit). By defining what is or is not a "pollutant," the United States federal government's powers to regulate greenhouse gases causing climate change are restricted or preserved. *Massachusetts v. EPA*, 549 U.S. 497 (2007) (interpreting whether the words "air pollutant" in Clean Air Act § 202 may encompass greenhouse gases causing climate change). By defining what is or is not the "waters of the United States," so is the scope of federal protection for millions of acres of wetlands. Sackett v. EPA, 598 U.S. 651 (2023) (interpreting the term "waters of the United States" under the Clean Water Act for purposes of federal wetlands jurisdiction).

[5] *Carbon*, ENCYCLOPEDIA BRITANNICA (online ed. 2023); *Atom*, ENCYCLOPEDIA BRITANNICA (online ed. 2023). *See generally* INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY (IUPAC), IUPAC PERIODIC TABLE OF THE ELEMENTS AND ISOTOPES.

[6] In 99% of cases, atoms with six protons also have six neutrons, a form of matter called carbon-12. Almost all of the rest of the six-proton group has only one extra neutron, and is called carbon-13. A radioactive isotope, carbon-14, also exists in trace amounts, as it is constantly being created in Earth's atmosphere when cosmic rays transform protons in nitrogen into neutrons. Setting aside lab-made isotopes, these three arrangements of protons and neutrons "are" carbon as found in nature. Many other carbon isotopes have been created in physics labs but are highly unstable and do not occur in nature. IUPAC, CARBON FACT SHEET.

approximately fourteen billion years.[7] There is a great deal of it, in various forms, throughout the known universe, including on Earth.[8]

Carbon's physical structure is uniquely conducive to bonding with other elements to create more complex molecules.[9] Many abundant minerals contain carbon, and Earth's molten mantle and the rocks of its solid crust (the lithosphere) contain a huge amount of it.[10] Earth's other major carbon "reservoirs"[11] include its oceans and other aquatic environments (the hydrosphere); its air (the atmosphere); all of the life upon it (the biosphere), and the relatively near-surface sediments and deeper sedimentary rock layers containing gigantic masses of dead biomass (lacking a catchy -sphere name, but crucial to distinguish). Carbon in its many forms permeates all of Earth's systems.

The reservoirs, however, are only half of the carbon story. The other half is "flux," meaning the aggregate movement of any material between any reservoirs. Billions of tons of nitrogen, oxygen, sulfur, and, yes, carbon, are constantly moving between the oceans, atmosphere, soils, rocks, and life on earth. Together, these reservoirs and fluxes constitute Earth's "biogeochemical cycles," meaning "the natural pathways by which essential elements of living matter are circulated" between earth systems.[12] In the same way that a reservoir behind a dam is actually always emptying over the dam and refilling from its stream

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[7] Jennifer A. Johnson, *Populating the Periodic Table: Nucleosynthesis of the Elements*, 363 SCI. 474, 475 (2019).
[8] Jie Li et al., *Carbon versus Other Light Elements in Earth's Core*, *in* DEEP CARBON: PAST TO PRESENT [hereinafter DCPP] 40, 57 (Beth N. Orcutt et al. eds. 2020) (approximately 1% mass fraction carbon in earth's core); Cin-Ty A. Lee et al., *A Framework for Understanding Whole-Earth Carbon Cycling*, *in* DCPP, 313, 316 Fig. 11.3 (excluding earth's core, earth's carbon reservoirs total about $1.75*10^{18}$ (1.75 quintillion) tons).
[9] *Carbon Bonding*, ENCYCLOPEDIA BRITANNICA (online ed. 2023) ("The carbon atom is unique among elements in its tendency to form extensive networks of covalent bonds not only with other elements but also with itself.").
[10] Maria Temming, *Here's Where Earth Stores Its Carbon*, SCI. NEWS (Oct. 1, 2019).
[11] In earth sciences, a "reservoir" is "an amount of material defined by certain physical, chemical, or biological characteristics that, for the purposes of analysis we consider to be reasonably homogenous. Examples: oxygen in the atmosphere…" Michael C. Jacobson et al., *Introduction: Biogeochemical Cycles as Fundamental Constructs for Studying Earth System Science and Global Change*, *in* EARTH SYSTEM SCIENCE: FROM BIOGEOCHEMICAL CYCLES TO GLOBAL CHANGES (Jacobson ed., 2d ed. 2000).
[12] *Biogeochemical Cycle*, ENCYCLOPEDIA BRITANNICA (online ed. 2023) (emphasis added).

source, seemingly static accumulations of the elements of nature are constantly being depleted and replenished in reservoirs as these materials circulate via biological, chemical, and physical processes. In the "deep" (or "slow") carbon cycle, vast amounts of carbon flow between Earth's mantle and its atmosphere and vice versa, outward via volcanic activity, and inward along numerous pathways, from CO_2 absorption by the world's oceans, to incorporation of carbon into marine life forms, to sedimentation of the carbon in those life forms after they have died, to the movement of the carbon-bearing sediments into the mantle via mineralization and plate tectonics.[13] Each of these subprocesses is also itself a cycle, also occurring constantly.[14] At all times, the growth or diminution of any given reservoir is attributable to the difference between total fluxes – additions and subtractions – via these movement processes.

Understanding carbon in terms of biogeochemical cycling, it is possible to appreciate the amazing role that carbon plays in three separate but interrelated processes: life, energy, and climate change. Again, carbon's unique structure results in its propensity to form chemical compounds, and one special class of these are the organic molecules, essential to life. "Carbon-based life-forms" are called that because carbon makes up something like half (by dry weight) of all the biomass on Earth,[15] and all known life is built on and requires carbon to function. Yet this is only the beginning of carbon's import to humanity. Millions of years of sedimentation of organic carbon compounds has resulted in the formation of massive reservoirs of fossil hydrocarbons – materials we call coal, and oil, and natural gas, or "fossil fuels"[16] – which have a special property all their own: in the presence of oxygen, and with sufficient activation energy, they burn.[17]

Humanity's modern energy potential was unlocked with the discovery, extraction, beneficiation, and combustion of fossil fuels.[18] And yet the same

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[13] *See* Lee et al., *supra* note 8.
[14] Holli Riebeek *The Carbon Cycle*, NASA EARTH OBSERVATORY (Jun. 16, 2011).
[15] Yinon Bar-On et al., *The Biomass Distribution of Earth*, 115 PNAS 6506 (2018) ("All of our reported values can be transformed to dry weight to a good approximation by multiplying by 2, the characteristic conversion factor between carbon and total dry mass").
[16] Bob Strauss, *Does Oil Come from Dinosaurs?*, THOUGHTCO (Aug. 15, 2019).
[17] *Combustion*, ENCYCLOPEDIA BRITANNICA (online ed. 2023).
[18] *See generally*, DANIEL YERGIN, THE PRIZE: THE EPIC QUEST FOR OIL, MONEY, AND POWER (2008); TIMOTHY MITCHELL, CARBON DEMOCRACY: POLITICAL POWER IN THE AGE OF OIL (2011).

unique attributes that give rise to carbon's usefulness also have produced its third and final role: as existential threat to the modernity it has helped create. Hydrocarbon combustion releases energy, true, but elemental matter cannot be created or destroyed, only converted. In the process of hydrocarbon combustion, the carbon atoms in fossil fuels are recombined with oxygen to form carbon dioxide. Those sedimented reservoirs of ancient life that would, undisturbed, eventually have been reabsorbed into Earth's mantle, have instead been blasted by the megaton into the atmosphere for the last two hundred years. Prior to the industrial revolution, Earth's atmosphere contained about 270-280 ppm CO_2, while today that concentration has increased to about 420 ppm, and is rising steadily.[19] This new human-caused fossil-atmospheric flux, far in excess of earth's natural countervailing removal fluxes, has increased the atmospheric carbon stock and thus the thermodynamic properties of the atmosphere itself, resulting in a gradual increase in Earth's global mean surface temperature, and all of the climatic disruptions and catastrophes, past, present, and future, that this entails.[20]

Carbon, the sixth element, is fundamental to life, to energy, and to climate change. This latter threat has driven the development of the sciences discussed above, as humanity has realized that its intervention into the planet's deep carbon cycle now threatens us all, and has asked what might be done to slow or even reverse the coming change.

B. "Blue Carbon": Location, Destination, and Convention

In this context, what is blue carbon? To be clear, to the extent that carbon has any color, none of it is blue. Rather, the term "blue carbon" comes from a need to distinguish important parts of the carbon cycle from each other, and it is the fashion of the day to identify subcategorizations and taxonomies of climate-

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[19] *Keeling Curve*, UNIV. OF CAL., SAN DIEGO (last visited Feb. 14, 2024) (continuous atmospheric CO_2 sampling data since 1958); Tom M.L. Wigley, *The Pre-Industrial Carbon Dioxide Level*, 5 CLIMATIC CHANGE 315 (1983) (260-290 ppm).

[20] For the current state of climate science, *see* CLIMATE CHANGE 2021: THE PHYSICAL SCIENCE BASIS. CONTRIBUTION OF WORKING GROUP I TO THE SIXTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (Masson-Delmotte et al., eds.) (2021).

and energy-related systems using colors.[21] The so-called "colors of carbon" distill some of the complexity of carbon cycles by "moving past traditional, broad classifications … to more nuanced definitions based on carbon function, attribute, or location."[22] But what this means in practice is that "blue carbon" is whatever people say it is, and what they say it is, is – mostly – marine carbon, with a great deal of debate around the edges.

The term "blue carbon" entered into the literature in substantially its present form in a 2009 United Nations Environment Programme report titled *Blue Carbon: The Role of Healthy Oceans in Binding Carbon*,[23] which argued for increased consideration of ocean carbon cycles in climate policy. Although the report was not overly concerned with definitions, it defined blue carbon in passing as "the carbon captured by the world's oceans," meaning the carbon absorbed and ultimately "sequestered" (stored for some duration, ideally permanently) in all marine ecosystems and sediments, which the report argued was a potentially important component both of emissions reduction and future atmospheric carbon removal efforts. Despite its focus on deep ocean sequestration potential, however, the report mostly examined coastal vegetated ecosystems such as mangroves, seagrasses, and salt marshes, which the report described as responsible for about half of the ocean's annual carbon intake flux.[24] Thus, the first use of the term "blue carbon" introduced some fundamental ambiguity, as it seemed to focus mostly on the location of the carbon stock (coastal, deep, etc.), while closer consideration reveals that it was truly concerned with destination: the report told us that blue carbon was not just carbon in marine ecosystems, but also carbon ultimately bound to be sequestered in them.

This ambiguity matters because "blue carbon" is often discussed today as if it was a locational delineation only, even though locational boundaries by

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[21] Natalie Marchant, *Grey, Blue, Green – Why Are There So Many Colours of Hydrogen?*, WORLD ECON. FOR. AGENDA (Jul. 27, 2021).
[22] Laura Zinke, *The Colours of Carbon*, 1 NATURE REV. EARTH & ENV'T 141 (2020).
[23] United Nations Environment Programme Rapid Response Assessment, BLUE CARBON: THE ROLE OF HEALTHY OCEANS IN BINDING CARBON (Christian Nellemann et al., eds. 2009) ["UNEP Blue Carbon Report"]. The report used a taxonomy of brown, black, blue, and green carbon that has not caught on. *Id.* at 15-19. *See also* Google Ngram Viewer for term "blue carbon," ("blue carbon" usage begins climbing in 2010, immediately after UNEP report published).
[24] UNEP Blue Carbon Report, *supra* note 23, at 37, 39; Appendix 1.

themselves create more confusion than clarity (as was discussed in the Symposium[25]). For example, "coastal blue carbon" could be understood as just the carbon currently bound up in coastal ecosystems. But it could also be understood as all the carbon in coastal ecosystems that is destined to be sequestered, or even all the carbon destined to be bound up in coastal ecosystems (meaning even, perhaps, some amount of carbon currently in the atmosphere), whether or not destined to be sequestered later; or something else entirely. Similar problems arise when considering the carbon bound up in ocean waters and life. Does the portion of carbon currently bound up in marine biomass but destined to be re-released into the atmosphere count? What about inorganic carbon dissolved in ocean water? Again, the destination-based distinction helps – it is clearer if blue carbon is only the carbon that ends up sequestered in or under the ocean, although it is still a little vague how long it has to stay there to qualify as "sequestered."

The locational focus also gives rise to debate about whether other watery ecologies should qualify. Should terrestrial wetlands, peatlands, or sediments under rivers and lakes be discussed as blue carbon? These are also aquatic ecosystems, and if "blue carbon" means aquatic carbon, then why exclude them? Furthermore, if the focus is on destination, and the goal is sequestration, then shouldn't sequestration in aquatic environments all be considered and counted, regardless of the distinctions between upland, coastal, or marine environments? On the other hand, distinct ecological characteristics do justify divisions and distinctions – peatland, for example, produces more methane than does, say, marine shell formation. Instead, the terms "green carbon" (for terrestrial forests and peatlands) and "teal carbon" (for freshwater ecosystems) have begun to be used. This gives rise to its own confusion, however, as, for example, carbon that begins in terrestrial ecosystems can be washed via rivers into the oceans.[26] Is this green, or teal, or blue carbon, or all three? And if destination is part of the definition, is this blue carbon from beginning to end, or only at the moment it enters the ocean? This ambiguity suggests the need for a cutoff rule – a moment at

[25] There was debate about whether, for example, peatlands and carbon in freshwater rivers and lakes should "count" as blue carbon.
[26] Terry Plank & Craig E. Manning, *Subducting Carbon*, 574 NATURE 343 (2019) ("Terrestrial organic carbon is also washed onto the seafloor by large rivers.").

which some other kind of theoretical blue carbon (e.g., carbon that might get drawn into the ocean from the atmosphere) actually becomes blue carbon.

With these concerns noted, this Article will follow the weight of current convention and use the term "blue carbon" hereafter to mean any carbon destined for sequestration in and under the world's oceans, at the point at which it enters the marine environment, while noting that debate continues about the pros and cons of the choices embodied in this definition. Ultimately, these efforts at color-coded taxonomical simplification are no substitute for a clear understanding of which carbon cycle processes, specifically, are being discussed, or governed, at any given time.

C. "Blue Carbon Law": The Rules of Intervention

Given the above, what is blue carbon law? The addition of one short word – "law" – has serious consequences, as it implies a profound shift in focus. Carbon is physical stuff. Blue carbon may be a human construct, but it is mostly a descriptive one, focusing, again, on matter, and matters, beyond human control. Blue carbon *law*, however, implies something more human: human activity, and human social systems to control or influence that activity. By adding one short word, therefore, we must add the consideration of human activities concerning blue carbon.

Defining blue carbon as carbon destined to be sequestered in marine environments, then it follows that relevant human activities are those that influence marine carbon sequestration processes, whether in quantity or quality. As already discussed, humanity's release of sequestered fossil carbon into the atmosphere is profoundly influencing Earth's carbon cycles. It is well established that this, in turn, is influencing the marine carbon cycle, as the oceans absorb CO_2 in relation to the amount of it in the atmosphere. But there are many, many other human activities that also influence the marine carbon cycle. Which should qualify as the purview of blue carbon law? As everything in the carbon cycle is connected, arguably even power plant emissions controls are blue carbon law, but this seems intuitively overbroad. Rather, some constraining factor is required.

The fluxes are that factor. To this point, Earth's carbon cycles have been discussed as if they "just happen," but the movement of material, the fluxes, are operative processes that are influenced by many outside factors, including human factors. In the marine context, two of these processes are often referred to as the "ocean carbon pumps": the "solubility pump" is the tendency of ocean circulation and pressure to draw carbon downward through the marine water column, while the "biological pump" describes the same phenomenon driven by marine life.[27] Other processes that result in marine carbon sequestration include transport via weathering of carbonaceous rocks and terrestrial organic carbon picked up in river waters[28] and sedimentation of dead vegetation in coastal ecosystems.[29] Human activities have influenced all of these processes. Shoreline development has reduced coastal carbon sequestration pathways.[30] Fishing has negatively influenced the ocean's biological carbon pump,[31] as has ocean acidification.[32] Having realized this, numerous proposals for purposeful human intervention into these cycles – marine geoengineering – have also arisen; as have numerous proposals to influence and regulate the human activities that indirectly influence blue carbon. It is in all of these human activities, finally, that law comes into play. All of these must be the subject of blue carbon law.

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[27] Tim DeVries, *The Ocean Carbon Cycle*, 47 ANN. REV. ENV'T RES. 317 (2022); David A. Siegel et al., *Quantifying the Ocean's Biological Pump and Its Carbon Cycle Impacts on Global Scales*, 15 ANN. REV. MAR. SCI. 329 (2023).

[28] Robert G. Hilton & A. Joshua West, *Mountains, Erosion and the Carbon Cycle*, 1 NAT. REV. EARTH ENV'T 284 (2020).

[29] Daniel M Alongi, *Carbon Sequestration in Mangrove Forests*, 3 CARBON MGMT. 313 (2012); Carlos M. Duarte & Dorte Krause-Jensen, *Export from Seagrass Meadows Contributes to Marine Carbon Sequestration*, 4 FRONT. MAR. SCI. art. 13 (2017); Dorte Krause-Jensen & Carlos M. Duarte, *Substantial Role of Macroalgae in Marine Carbon Sequestration*, 9 NAT. GEOSCI. 737 (2016).

[30] Tyler C. Coverdale et al., *Indirect Human Impacts Reverse Centuries of Carbon Sequestration and Salt Marsh Accretion*, 9 PLOS ONE e93296 (2014).

[31] Grace K. Saba et al., *Toward a Better Understanding of Fish-Based Contribution to Ocean Carbon Flux*, 66 LIMNOL. OCEANOGR. 1639 (2021); Daniele Bianchi et al., *Estimating Global Biomass and Biogeochemical Cycling of Marine Fish with and without Fishing*, 7 SCI. ADV. eabd7554 (2021); Gaël Mariani et al., *Let More Big Fish Sink: Fisheries Prevent Blue Carbon Sequestration—Half in Unprofitable Areas*, 6 SCI. ADV. eabb4848 (2020).

[32] Dieter A. Wolf-Gladrow & Björn Rost, *Ocean Acidification and Oceanic Carbon Cycling*, *in* GLOBAL ENV'T CHANGE 103 (Bill Freedman ed., 2014); Matthias Hofmann & Hans-Joachim Schellnhuber, *Oceanic Acidification Affects Marine Carbon Pump and Triggers Extended Marine Oxygen Holes*, 106 PNAS 3017 (2009).

In other words, blue carbon is not only a location or a destination or a moment of arrival, but the result of a variety of processes which, themselves, can be and are influenced by human behavior. The law of blue carbon, then, must be society's efforts to govern those behaviors. If "law" is understood as a general term for systems of socially agreed-upon rules to support social constructions of responsibility, entitlement, permission, and prohibition, then "blue carbon law" means the rules for the treatment of the ocean as a tool in the larger project of global carbon management—the rules to govern human intervention into Earth's marine carbon cycles.

As will be explored in detail below, many existing laws and legal systems already qualify as "blue carbon law" under these definitions. From local laws controlling shoreline development, to the international system of maritime jurisdiction under the UN Convention on the Law of the Sea, rules already exist that influence and govern (or decline to govern) human activities that impact marine carbon cycles. But before getting to these rule systems, it is necessary to examine in some detail another emerging legal system that is influencing all the others: the market commodification of carbon sequestration services.

III. BLUE CARBON IN THE INTERNATIONAL CARBON MARKET FRAMEWORK

At this moment, a law of blue carbon *markets* is emerging, and this in turn will render great change on many other systems of blue carbon law. This Part, therefore, discusses this new phenomenon, the rise of blue carbon in the international carbon market framework. With new market mechanisms creating new opportunities to profit from management of qualifying carbon resources, governments and private actors are increasingly recognizing their carbon resources as potential sources of revenue.[33] Simultaneously, blue carbon resources are increasingly understood as some of the highest-value carbon resources in existence, with blue carbon credits consistently attracting a premium on voluntary

[33] Natasha White & Ewa Kurkowska, *Global Carbon Markets Face Upheaval as Nations Remake the Rules*, BLOOMBERG GREEN (Jun. 5, 2023). *See also* Christine Bertram et al., *The Blue Carbon Wealth of Nations*, 11 NATURE CLIMATE CHANGE 704 (2021) (evaluating potential value of national blue carbon sequestration potential).

markets.[34] This combination of factors has driven the recent creation of blue carbon crediting mechanisms that could transform coastal and marine ecosystem conservation funding.

But in order to truly appreciate what is happening, it is necessary to begin by stepping back into the history of the international market framework for carbon sink protection and enhancement more generally. In the language of reservoirs and fluxes, there has been a great deal of effort to create market systems to incentivize the purposeful expansion of the atmosphere-biosphere carbon flux, by rewarding activities that increase the amount of carbon stored (or "sequestered")[35] in terrestrial plant life, which must necessarily have removed that carbon from the atmosphere.

As discussed below, blue carbon crediting is built on the international "land use, land-use change, and forestry" crediting rules that began developing under the UN Framework Convention on Climate Change and its subsidiary agreements in the mid-1990s. This body of law, primarily concerned with the inclusion of carbon sequestration-enhancing activities in climate emissions inventory and reduction regimes, attempted to commodify, monetize, and compensate carbon sequestration-promoting behaviors in terrestrial forests. It is mostly concerned with qualification rules, that is, in determining which activities "count" for purposes of inclusion in these schemes, and these questions have proven to be enormously controversial. Yet, as will become clear, all of the issues associated with the forest carbon credit system are directly translatable to the blue carbon context. Thus, the story of the "sinks options" under the international climate law framework is also where the legal story of blue carbon law must begin. Rules developed for the Clean Development Mechanism (CDM) and Reducing Emissions from Deforestation and Forest Degradation (REDD+)

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[34] Daniel A. Freiss et al., *Capitalizing on the Global Financial Interest in Blue Carbon*, 1 PLOS CLIMATE e0000061 (2022) ("Current blue carbon credit sales attract a premium in comparison to traditional large-scale REDD+ projects"); *Carbon Exchange CIX Completes 250,000 Tonne Carbon Credit Auction*, REUTERS (Nov. 4, 2022) (blue carbon credits sold at 40% premium).

[35] Although carbon sequestration is, technically, the "long-term storage" of carbon in a non-atmospheric reservoir, major challenges arise in defining the length of time that qualifies as "long-term," or, better yet, "permanent." *See generally* *Carbon sequestration*, ENCYCLOPEDIA BRITANNICA (online ed. 2023).

programs initiated under the Kyoto Protocol live on in the emerging law of blue carbon markets.

A. The Model: "Sinks Options" under International Climate Law

The United Nations Framework Convention on Climate Change (UNFCCC) is the primary international treaty on climate change,[36] and the international law of climate change is, primarily, whatever is agreed to by the parties following UNFCCC processes. The UNFCCC, as ratified in 1992, contained no binding emissions reduction commitments by signatory nations, rather leaving those to be developed later. At the first UNFCCC Conference of Parties (COP1),[37] held in Berlin in 1995, the parties, including the United States, agreed to begin developing a subsidiary treaty protocol that would include stringent national emissions reduction commitments by industrialized nations.[38] The work on this new protocol was completed in 1997, and the treaty parties officially adopted the new framework for mandatory national emissions reductions at COP3, held at Kyoto.[39]

The Kyoto Protocol, as it was called, was mostly concerned with creating a binding schedule of carbon emissions reductions to be followed by wealthy, industrialized nations. In the language of the treaty, these parties agreed to achieve "quantified emission limitations" by means of national "reduction

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[36] U.N. Framework Convention on Climate Change, May 9, 1992, S. Treaty Doc No. 102-38, 1771 U.N.T.S. 107. *See also* https://unfccc.int/ (UNFCCC information portal).

[37] By convention, the UNFCCC conferences of parties are identified sequentially, COP1, COP2, etc. The outcomes of the meetings are also often identified by the name of the city where the conference was held (e.g., Berlin, Kyoto, Bali, Cancun, etc.). *See*, *Bodies: Conference of Parties (COP)*, UN CLIMATE CHANGE (last visited Feb. 14, 2024). Party decisions are numbered sequentially as #/CP.# – for example the third decision at COP4 is identified 3/CP.4.

[38] UNFCCC Dec. 1/CP.1, *The Berlin Mandate: Review of the Adequacy of Article 4, Paragraph 2(a) and (b), of the Convention, including Proposals related to a Protocol and Decisions on Follow-up* (Apr. 7, 1995), *published in* UN Doc. FCCC/CP/1995/7/Add.1.

[39] UNFCCC Dec. 1/CP.3, *Adoption of the Kyoto Protocol to the United Nations Framework Convention on Climate Change*, *published in* UN Doc. FCCC/CP/1997/7/Add. [hereinafter Kyoto Protocol]. Confusingly, the Kyoto Protocol required its own series of meetings and decisions, which occurred simultaneously with the COPs, and were called Conferences of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP). Decisions reached at these meetings are designated #/CMP.#.

commitments."[40] As relevant here, however, the agreement endorsed several mechanisms that allowed participating nations to reduce their national emissions reduction responsibilities not by actually reducing emissions at the source, but rather by protecting and enhancing carbon "sinks," meaning reservoirs that are drawing in atmospheric carbon, primarily in forests. In the language of the treaty, nations could take credit for reductions-equivalents achieved via the "protection and enhancement of sinks and reservoirs of greenhouse gases."[41]

i. The Kyoto Mechanisms and REDD+ Paradigm

The Kyoto Protocol's "sinks options" required the creation of a complex system of accounting rules for identifying and tracking units of reduced-emissions-via-sinks-activities, and new rules to define which activities would and would not be allowed to generate qualifying credits. The Kyoto Protocol created three pathways, or "mechanisms" in the language of the treaty, for claiming GHG reductions via sinks protection and enhancement: "Joint Implementation" (JI), which allowed nations to transfer certain "emissions reduction units" they generated by "enhancing anthropogenic removals by sinks;"[42] the "Clean Development Mechanism" CDM), which allowed industrialized nations to accrue "certified emissions reductions" through investment in "project activities" in developing nations;[43] and market trading mechanisms, or at least support for an international carbon credit market, as the parties were allowed to work to define "the relevant principles, modalities, rules and guidelines, in particular for verification, reporting and accountability for emissions trading" in the future.[44]

Writing in 2001, in terms that resonate to this day, analysts noted that there was a great deal of controversy over the inclusion of the Kyoto Protocol's sinks options even as they were introduced:

> These so-called 'sinks' options have remained controversial for several reasons. Some fear that changes in emissions and uptakes

[40] *Id.* Art. 3, ¶ 1.
[41] *Id.* Art 2, ¶ 1(a)(ii).
[42] *Id.* Art. 6.
[43] *Id.* Art. 12.
[44] *Id.* Art. 17.

> by sinks cannot be measured with sufficient accuracy, thus distorting compliance requirements and threatening trading in carbon credits. Some see carbon stored in terrestrial pools as inherently impermanent and unstable, in that human activities may lead to their release at any time. Others see them as a diversion from … the reduction of fossil emissions.[45]

All of these concerns have a basis in reality. Measurement of carbon sequestration on broad scales is an extraordinarily difficult task involving a great deal of uncertainty that can only be reduced, never eliminated, by incorporating up to date scientific research into accounting methodologies which must then be consistently and accurately applied. Credits must rely on what are essentially promises not to disturb or release sequestered carbon, which always presents risks that promises will be broken – or that events more outside of human control, like forest fires, will render promises meaningless. And finally, even if the market is working perfectly, it is simply not possible to offset all of humanity's carbon emissions through the sinks options, and fears that forestry activities will be used to mask failures to achieve necessary absolute emissions reductions is probably the most important contributor to ongoing hesitancy to incorporate these activities into existing emissions reduction schemes. But again, these problems have been recognized for over thirty years, and the UNFCCC parties still moved forward, slowly but steadily, with crediting rules.

Immediately after the Kyoto Protocol was ratified, work proceeded on developing rules for crediting terrestrial carbon stock management activities under its compliance mechanisms (Appendix 1 gathers the relevant decisions together for ease of reference). In 1998, the parties agreed to bifurcate the process and to begin by developing rules for human-induced "afforestation, reforestation, and deforestation,"[46] meaning rules to assess and credit various changes in terrestrial carbon stocks. What this meant was that the parties also agreed to put

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[45] Ian Noble and R.J. Scholes, *Sinks and the Kyoto Protocol*, 1 CLIMATE POLICY 5, 5-6 (2001).
[46] UNFCCC Dec. 9/CP.4, *Land-Use, Land-Use Change and Forestry* (1998), *published in* UN Doc. FCCC/CP/1998/16/Add.1.

off developing rules for carbon stock maintenance and conservation until a later date.

Consistent with this approach, from 1998 to 2005 the UNFCCC parties created rules for crediting what were now called "Land Use, Land Use Change, and Forestry" (LULUCF) activities under the Kyoto compliance mechanisms. LULUCF activities were allowed to be applied to industrialized nations' reduction commitments;[47] the standard unit of measurement was set to 1 ton of CO_2-equivalent (CO_2e);[48] the CDM was allowed to include only "afforestation and reforestation" activities for its first compliance period (2008-2012),[49] and these credits were only to be used while "taking into account the issues of non-permanence, additionality, leakage, uncertainties and socio-economic and environmental impacts, including impacts on biodiversity and natural ecosystems."[50] National limits were set on how much CDM forestry crediting could be used;[51] national inventories were ordered for terrestrial carbon reservoirs;[52] and good practice guidance for such inventories was developed and adopted.[53] These efforts ultimately resulted in detailed rules for validation,

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[47] Proposed in UNFCCC Dec. 15/CP.7, *Principles, Nature and Scope of the Mechanisms pursuant to Articles 6, 12 and 17 of the Kyoto Protocol* (2001), *published in* UN Doc. FCCC/CP/2001/13/Add.2; adopted as proposed in UNFCCC Dec. 2/CMP.1 ¶ 6 (2005), *published in* UN Doc. FCCC/KP/CMP/2005/8/Add.1.

[48] Proposed in UNFCCC Dec. 16/CP.7, *Guidelines for the Implementation of Article 6 of the Kyoto Protocol* (2001), UNFCCC Dec. 17/CP.7, *Modalities and Procedures for a Clean Development Mechanism, as defined in Article 12 of the Kyoto Protocol* (2001), and UNFCCC Dec. 18/CP.7, *Modalities, Rules and Guidelines for Emissions Trading under Article 17 of the Kyoto Protocol* (2001), *published in* UN Doc. FCCC/CP/2001/13/Add.2; adopted as proposed in UNFCCC Decs. 9/CMP.1, 3/CMP.1, and 11/CMP.1 (2005), respectively, *published in* UN Docs. FCCC/KP/CMP/2005/8/Add.1 & /Add.2.

[49] UNFCCC Dec. 17/CP.7 ¶ 7(a) (2001).

[50] UNFCCC Dec. 11/CP.7 ¶ 2(e) (2001) (instructing development of "modalities" for including Article 12 afforestation and deforestation project activities). Avoided deforestation was excluded from the first Kyoto compliance period. Raymond E. Gullison et al., *Tropical Forests and Climate Policy*, 316 SCIENCE 985 (2007).

[51] Proposed in UNFCCC Dec. 11/CP.7, *Land use, Land-Use Change and Forestry*, *published in* UN Doc. FCCC/CP/2001/13/Add.1; adopted as proposed in UNFCCC Dec. 16/CMP.1, published in UN Doc. FCCC/KP/CMP/2005/8/Add.3.

[52] *Id.*

[53] Proposed in UNFCCC Dec. 13/CP.9, *Good practice guidance for land use, land-use change and forestry in the preparation of national greenhouse gas inventories under the Convention* (2003), published in UN Doc. FCCC/CP/2003/6/Add.1; adopted as proposed in UNFCCC Dec. 17/CMP.1 (2005), published in UN Doc. FCCC/KP/CMP/2005/8/Add.3.

verification, and registration of afforestation and reforestation projects under the Kyoto mechanisms.[54] Again, however, the LULUCF projects qualifying for the Kyoto mechanism did not include all sequestration-enhancing land use activities, nor any activities that reduced or avoided ongoing deforestation. These were left to other policy processes to develop.

The second set of crediting rules was developed under a framework the parties initially called "reducing emissions from deforestation in developing countries" (RED),[55] and then "reducing emissions from deforestation *and forest degradation* in developing countries" (REDD),[56] and finally REDD *plus* any "additional forest-related activities that protect the climate" (REDD+).[57] The various relevant UNFCCC discussions on the topic were eventually finalized in a series of decisions referred to as the Warsaw Framework for REDD+.[58] Unlike the LULUCF rules, which were used for national emissions reduction compliance purposes, the REDD+ paradigm developed into a voluntary program concerned with development financing in developing countries, to support their protection rather than exploitation and destruction of terrestrial carbon stocks, but without clear integration into the reduction compliance system. In the language of the treaty, the parties agreed to seek to encourage "appropriate market-based

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[54] Proposed in UNFCCC Dec. 19/CP.9, *Modalities and Procedures for Afforestation and Reforestation Project Activities under the Clean Development Mechanism in the First Commitment Period of the Kyoto Protocol* (2003), published in UN Doc. FCCC/CP/2003/6/Add.2; adopted as proposed UNFCCC Dec. 5/CMP.1 (2005), *published in* UN Doc. FCCC/KP/CMP/2005/8/Add.1.

[55] UNEP-WCMC, REDUCING EMISSIONS FROM DEFORESTATION: A KEY OPPORTUNITY FOR ATTAINING MULTIPLE BENEFITS (2007); UNEP-WCMC, REDUCING EMISSIONS FROM DEFORESTATION: GLOBAL MECHANISMS, CONSERVATION AND LIVELIHOODS (2007) (early reports discussing "RED").

[56] RA Houghton et al., *The Role of Science in Reducing Emissions from Deforestation and Forest Degradation (REDD)*, 1 CARBON MGMT. 253 (2010) (describing transition from RED to REDD to REDD+, 2007-2011) (emphasis added).

[57] UN Climate Change, *What is REDD+?*.

[58] *Warsaw Framework for REDD+*, REDD+ WEB PLATFORM (last visited Feb. 14, 2024). Additional documentation is available on the REDD+ Web Platform, and particularly the Lima REDD+ Information Hub, https://redd.unfccc.int/info-hub.html.

approaches"[59] and "results-based finance"[60] for REDD+ activities. Toward this end, developing country parties were invited to submit "forest reference emission levels," essentially determinations of ongoing deforestation rates, to serve as baselines against which avoided deforestation and associated payments could be calculated.[61] But avoided deforestation payments under REDD+ remained entirely voluntary, and the manner in which money flowed for them, and the manner in which credit for them was taken, was not resolved by UNFCCC rulemaking. Rather, private parties and the voluntary market (discussed in the next section) stepped in to fill the gap. REDD+ became a system for wealthy countries to pay countries with tropical forests to leave them intact rather than clear-cut them – but those payments were in addition to whatever activities those countries were doing to reduce their national emissions – and other parties attempting to take credit for these conservation activities has been highly controversial.

In summary, the Kyoto Protocol crediting frameworks for LULUCF activities under the JI, CDM, and carbon markets mechanisms, and later the rules for REDD+ programs, created the first public international law governing human intervention into carbon cycles, albeit only part of the terrestrial component of the atmosphere-biosphere cycle. The purpose of these rules was to create incentives for behavior impacting the quantity and rate of growth of terrestrial carbon reservoirs, with different rulesets for sequestration increases (afforestation and reforestation) and sequestration maintenance (avoided deforestation, etc.).

For purposes of the discussion of blue carbon, what is important is that these legal frameworks are directly translatable models for blue carbon law.

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[59] UNFCCC Dec. 2/CP.17, *Outcome of the Work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention* ¶66 (2011); UNFCCC Dec. 1/CP.18, *Agreed outcome pursuant to the Bali Action Plan* ¶¶28-29 (2012) (creating work plan to improve finance mechanisms), published in *Key Decisions Relevant for Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+)* (Feb. 2016) [hereinafter Decision Booklet REDD+].

[60] UNFCCC Dec. 9/CP.19, *Work Programme on Results-Based Finance to Progress the Full Implementation of the Activities referred to in Decision 1/CP.16, Paragraph 70* (2013), published in Decision Booklet REDD+.

[61] UNFCCC Dec. 12/CP.17, *Guidance on Systems for Providing Information on How Safeguards Are Addressed and Respected and Modalities relating to Forest Reference Emission Levels and Forest Reference Levels as referred to in Decision 1/CP.16* (2011), published in Decision Booklet REDD+.

Increasing biomass, whether coastal vegetation or marine phytoplankton or something else, is akin to afforestation, in that it has a positive long-term carbon reservoir increase potential. Similarly, restoring damaged wetlands or fisheries stocks or ocean pH or anything else is akin to reforestation, and is subject to some of the same concerns about baselines and timing that reforestation rules have had to address. Just so, coastal wetlands conservation and other avoided reservoir degradation programs are directly equivalent to avoided deforestation paradigms, with all the same problems. The Kyoto Protocol, then, created a ready-made ruleset for blue carbon credit creation and exchange.

To better understand the developing law of many of these systems, however, it is also necessary to move beyond the UN framework, into the systems of private governance that have developed to define qualification for the associated benefits. That is, it is necessary to examine the voluntary markets and carbon credit methodologies which developed in response to the Kyoto sinks options, and which have recently expanded to encompass blue carbon projects.

ii. Voluntary Markets and Private Methodologies

The Kyoto Protocol drove the development of so-called "compliance markets" for emissions reduction credits, meaning credit systems that allowed regulated entities to demonstrate their compliance with reductions mandates or commitments. These compliance markets were concerned with gatekeeping, accepting only those credits that met each relevant mandate's standards.[62] But mandate systems like the Kyoto Protocol were never universally adopted, and therefore were not the only drivers of demand for carbon credits. Many parties not subject to mandatory reduction responsibilities still wished to demonstrate their environmental commitments by claiming carbon reduction through the purchase of credits, and a parallel "voluntary market" system developed, fractious and fragmented, to serve this demand.[63] Although these are often discussed as totally

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[62] *See, e.g.*, *Development of EU ETS (2005-2020),* EUROPEAN COMM'N (last visited Feb, 15, 2024) (Kyoto Protocol drove "need for policy instruments to meet [its] targets."). N.B.: two significant subnational emissions reduction regimes emerged in the United States after that country refused to ratify the Kyoto Protocol. The California Cap-and-Trade system, and the Regional Greenhouse Gas Initiative influenced the development of qualification methodologies in similar fashion.
[63] *Mandatory & Voluntary Offset Markets*, CARBON OFFSET GUIDE (last visited Feb. 15, 2024).

distinct systems, methodologies have developed that serve both, and the distinction is not always so clear cut. Both systems are built on similar basic concepts relating to the creation of tradable credits, and thus the compliance and voluntary accreditation standards co-evolved, answering the same fundamental questions, sometimes differently, sometimes not. In both, credit "integrity" is of paramount concern, and legal uncertainties remain to be resolved.

The "carbon credit" concept has been around since at least the 1990s, as U.S. policymakers imported prior market-based air pollution control systems – particularly the Montreal Protocol cap and trade system for ozone depleting substances, and the 1990 Clean Air Act Amendments' marketable credit system for sulfur dioxide pollution – into the context of emerging international agreements on climate change.[64] Significant progress began to be made on standardization of carbon credit systems around 2005, the same time that the Kyoto Protocol parties adopted the LULUCF rules discussed above. In quick succession, several influential "project-based" accounting protocols were released.

In 2005, the GHG Protocol organization issued a *GHG Protocol for Project Accounting*, proposing voluntary rules for organizations attempting to claim reductions from emissions-sequestration project activities.[65] In 2006, the International Organization for Standardization issued its ISO 14064 standard, including ISO-14064-2 and 14064-3, creating "principles and requirements … for monitoring, quantifying and reporting [GHG] project performance relative to baseline," and for "validating or verifying" the GHG removal claims made in any given creditable carbon projects.[66] In the same year, the Voluntary Carbon

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[64] Carbon credits were first discussed in the U.S. Congress in 1991, by reference to these analogous systems. Testimony of Rep. Sherwood Boehlert, *Technologies and Strategies for Addressing Global Warming: Hearing before the House Committee on Science, Space, and Technology, 102d Cong.* 8-10 (Jul. 17, 1991) (advocating for a market-based approach to GHG reduction based on the acid rain market system enacted in the Clean Air Act Amendments of 1990).

[65] THE GREENHOUSE GAS PROTOCOL, THE GHG PROTOCOL FOR PROJECT ACCOUNTING (2005). Around the same time, the GHG Protocol also issued corporate accounting protocols that have been much more influential. *See* THE GREENHOUSE GAS PROTOCOL, A CORPORATE ACCOUNTING AND REPORTING STANDARD (2004) (revised in 2015).

[66] INT'L ORG. FOR STANDARDIZATION, ISO 14064-2:2006 v (2006).

Standard Association (VCSA, renamed "Verra" in 2018) published its first Voluntary Carbon Standard (VCS), which was updated for consistency with ISO-14064 in 2007.[67] This last effort proved to be the most important and lasting of the early standards.

VCS 2007, as it was called, sought to provide universal rules for the creation of what it called Voluntary Carbon Units (VCUs), meaning credits for the reduction or removal of one ton of CO_2e from the atmosphere, for project-based activities. VCSA contemplated the creation of VCUs according to what it called "methodologies," meaning any "approach related to: the determination of project baseline scenario(s); identification and determination of GHG sources, sinks, and reservoirs associated with the baseline scenario(s) and project; demonstration of the project's additionality; and definition of the project's monitoring process." That is, it created rules for assessing existing conditions, rules for determining what the project activities could be said to do under those circumstances, rules for monitoring project outcomes, and, most importantly, rules for determining whether the project was doing something that wouldn't have just happened on its own without the project occurring, i.e., its additionality.[68] All of the VCS additionality tests had one thing in common: project-based carbon credits could not, under any circumstances, be awarded for activities that were already mandated by law.[69]

Within the VCS 2007 framework, other VCS products set out the activity-specific rules for generating VCUs. Beginning in 2008, VCS began releasing "methodologies," "modules," and "tools" – typically developed and reviewed by third parties – designed to develop VCUs for the voluntary carbon markets in numerous project contexts. Although they did create some direct reduction methodologies, the great majority of the VCS rulesets contemplated crediting forestry and other land use projects. VCS followed the international framework closely, separating its work between Kyoto-style LULUCF activities (though it used the term "agriculture, forestry, and other land use," or "AFOLU"),[70] and

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[67] VCSA, VOLUNTARY CARBON STANDARD 2007 (2007).
[68] *Id.* at 14-15.
[69] *Id.*
[70] VCSA, METHODOLOGY FOR IMPROVED FOREST MANAGEMENT THROUGH EXTENSION OF ROTATION AGE (VM0003) version 1.0 (finalized 2010).

conservation protocols based on REDD+.[71] As of this writing, VCSA/Verra had issued over one billion VCUs under the VCS framework.[72]

Unlike the Kyoto mechanisms, however, it is not necessary to speculate about how the VCS system could or would apply to blue carbon projects, because Verra itself has published methodologies on two relevant project types: VM0024 (Methodology for Coastal Wetland Creation) and VM0033 (Methodology for Tidal Wetland and Seagrass Restoration).[73] Although VM0024 has never been used to generate VCUs, the first VM0033 project was registered in 2021,[74] and the first U.S. project is now under development in Virginia.[75] These methodologies are not perfect, and they all make controversial decisions regarding additionality, permanence, or other issues that pertain to credit quality and integrity, meaning whether these credits represent actual or only chimeric sequestration value. To their credit, the VCS methodologies are open source and have been subject to critique and debate in the scientific and policy literature. For example, the original version of VM0033 was immediately criticized for overstating sediment sequestration.[76] Meanwhile, the methodologies have been discussed in research seeking to address knowledge gaps,[77] and proposing to incorporate what has been learned into new standards and protocols.[78]

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[71] VCSA, REDD+ METHODOLOGY FRAMEWORK (REDD+MF) (VM0007) version 1.0 (finalized 2010).
[72] *Verified Carbon Standard Project and Credit Summary*, VERRA (last visited Feb. 15, 2024).
[73] VERRA, METHODOLOGY FOR TIDAL WETLAND AND SEAGRASS RESTORATION (VM0033) (introduced 2015), version 2.0 (2021).
[74] Methodology searches performed at https://registry.verra.org/app/search/VCS.
[75] *VCS Project 2360: Virginia Coast Reserve Seagrass Restoration Project*, Verra (last visited Feb. 15, 2024).
[76] Sophia C. Johannessen & Robie W. Macdonald, *Geoengineering with Seagrasses: Is Credit Due Where Credit Is Given?* 11 ENV'T RSCH. LET. 113001 (2016); Matthew P. Oreska et al., *Comment on Geoengineering with Seagrasses: Is Credit Due Where Credit Is Given?*, 13 ENV'T RSCH. LET. 38001 (2018); Sophia C. Johannessen & Robie W. Macdonald, *Reply to Oreska et al 'Comment on Geoengineering with seagrasses: is credit due where credit is given?'*, 13 ENV'T RSCH. LET. 38002 (2018); Brian A. Needelman et al., *The Science and Policy of the Verified Carbon Standard Methodology for Tidal Wetland and Seagrass Restoration*, 41 ESTUARIES AND COASTS 2159 (2018).
[77] E.g., Clint Cameron et al., *High Greenhouse Gas Emissions Mitigation Benefits from Mangrove Rehabilitation in Sulawesi, Indonesia*, 40 ECOSYSTEM SERVICES 101035 at 2 (2019).
[78] E.g., Mark S. Reed et al., *Governing High-Integrity Ecosystem Markets* (unpublished 2023).

Legal literature has its own contributions to make, as there remain many unresolved legal issues that are not clearly handled in the crediting methodologies. REDD+ in particular has generated legal controversy as carbon commodification involves *de jure* or *de facto* decisions about who owns the carbon resource and has the right to benefit from it, questions that turn on property law.[79] This is particularly important in areas where indigenous communities have claims to land that is being managed by third parties or incumbent governments for financial gain in the international system, and where benefits sharing practices and agreements may be lacking. These problems have been severe in REDD+ – a UN project – and are likely to persist in any voluntary market system.[80] Furthermore, blue carbon has its special credit integrity problems: in addition to traditional tenure and carbon right questions, blue carbon credits require measurement of a poorly understood resource, and determinations about permanence in the face of ongoing sea level rise. Each of these and many other problems have been addressed in a recent white paper, titled *High-Quality Blue Carbon Principles and Guidance*, published by a group of ocean carbon credit stakeholders,[81] but only time will tell the extent to which these principles will be integrated into emerging international voluntary carbon credit markets.

iii. The Paris Synthesis: Toward Worldwide Voluntary Markets

Notwithstanding advances made under the Kyoto-style binding emissions reduction commitments, the Kyoto system ultimately was abandoned because the United States refused to participate. The mandatory system was replaced in an agreement finalized during COP21, held in Paris,[82] that shifted the world climate

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[79] Charlotte Streck, *Who Owns REDD+? Carbon Markets, Carbon Rights and Entitlements to REDD+ Finance*, 11 FORESTS 959 (2020).
[80] *Id.*
[81] CONSERVATION INTERNATIONAL ET AL., HIGH-QUALITY BLUE CARBON PRINCIPLES AND GUIDANCE (2022).
[82] UNFCCC Dec. 1/CP.21, *Adoption of the Paris Agreement* (2015), *published in* UN Doc. FCCC/CP/2015/10/Add.1 [hereinafter "Paris Agreement"].

change regime toward voluntary reductions efforts.[83] The Paris Agreement, as it is called, requires that each UNFCCC party nation submit a regular "nationally determined contribution" to global emissions reduction efforts,[84] which contribution is wholly voluntary and left to each party to attempt to achieve.

Other parts of the Paris Agreement exist to facilitate the parties' achieving their voluntary targets, and one of its primary mechanisms is an international voluntary carbon market.[85] In the language of the Treaty, the parties recognized that "voluntary cooperation" between nations could increase their mitigation "ambition" and "promote sustainable development and environmental integrity."[86] The parties were therefore authorized to use "internationally transferred mitigation outcomes [ITMOs] to achieve nationally determined contributions,"[87] provided they do so in a manner to "promote sustainable development," "ensure environmental integrity and transparency, including in governance," "apply robust accounting," and "avoid[] double counting."[88] The parties also established a "mechanism" to facilitate trading of private and public carbon credits,[89] while preserving activities similar to REDD+ incentive payments as "non-market mechanisms" developed for similar purposes.[90] As with Kyoto, the development of decisions to agree on the meaning of these terms and the rules underlying the systems they created – the so-called "Paris Rulebook" – was left to further meetings of the parties.

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[83] Robert Faulker, *The Paris Agreement and the New Logic of International Climate Politics*, 92 INTL. AFFAIRS 1107 (2015) (discussing shift); Annalisa Savaresi, *The Paris Agreement: A New Beginning?*, 34 J. ENERGY & NAT. RES. L. 16 (2016) (same). *See generally* Matthew J. Hoffman, CLIMATE GOVERNANCE AT A CROSSROADS: EXPERIMENTING WITH A GLOBAL RESPONSE AFTER KYOTO (2011) (discussing rise of "governance experiments" in shadow of Kyoto).
[84] Paris Agreement Arts. 3, 4.2.
[85] *Id.* Art 6.
[86] *Id.* Art. 6.1.
[87] *Id*. Art. 6.3.
[88] *Id.* Art. 6.2.
[89] *Id.* Art. 6.4.
[90] *Id.* Art. 6.8.

The process of agreeing on the Paris Article 6 Rulebook has been technical and prolonged. After failure to come to terms in 2019,[91] much of the Article 6 Rulebook was finalized at COP26 in Glasgow in 2021.[92] Further slow progress on implementation was made at COP28 in Sharm al-Sheik in 2022.[93] Major disputes included fights over the rules for avoiding double-counting, the use of billions of remaining Kyoto-era credits in the new market, the set-aside of market proceeds for adaptation funding in developing nations, and how overall emissions reductions were to be accomplished.[94] Ultimately parties agreed to allow some but not all unused Kyoto compliance credits (but not REDD+ credits) to be carried forward, attempted to strengthen provisions related to double counting, created a grievance process to handle disputes over offsetting projects, and set up systems to divert funds to adaptation and ensure overall emissions reductions. But with respect to blue carbon, a key remaining issue remains unresolved as of this writing: how to define "removals" for purposes of the Paris market mechanisms, a matter that was taken up but not resolved during the 2023 Conference of Parties in Dubai.[95]

In summary, over the last thirty years the parties to the UNFCCC have debated the extent to which carbon management activities in the terrestrial

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[91] *In-Depth Q&A: How 'Article 6' Carbon Markets Could 'Make or Break' the Paris Agreement*, CARBON BRIEF (Nov. 29, 2019, updated Dec. 23, 2019); *COP25: Key Outcomes Agreed at the UN Climate Talks in Madrid*, CARBON BRIEF (Dec. 15, 2019).

[92] UNFCCC Decs. 2/CMA.3, *Guidance on Cooperative Approaches referred to in Article 6, Paragraph 2, of the Paris Agreement*, 3/CMA.3 *Rules, Modalities and Procedures for the Mechanism Established by Article 6, paragraph 4, of the Paris Agreement*; 4/CMA.3 *Work Programme under the Framework for Non-Market Approaches referred to in Article 6, Paragraph 8, of the Paris Agreement*, all published in UN Doc. FCCC/PA/CMA/2021/10/Add.1 (2021). *See also COP26: Key Outcomes Agreed at the UN Climate Talks in Glasgow*, CARBON BRIEF (Nov. 15, 2021); *COP26: Key Outcomes for Food, Forests, Land Use and Nature in Glasgow*, CARBON BRIEF (Nov. 17, 2021).

[93] UNFCCC Decs. 6/CMA.4, *Matters relating to Cooperative Approaches referred to in Article 6, Paragraph 2, of the Paris Agreement*; 7/CMA.4, *Guidance on the Mechanism Established by Article 6, paragraph 4, of the Paris Agreement*; 8/CMA.4, *Matters relating to the Work Programme under the Framework for Non-Market Approaches referred to in Article 6, Paragraph 8, of the Paris Agreement*, all published in UN Doc. FCCC/PA/CMA/2022/10/Add.2 (2023). *See also COP27: Key Outcomes Agreed at the UN Climate Talks in Sharm el-Sheikh*, CARBON BRIEF (Nov. 21, 2022).

[94] Cf. Carbon Brief summaries in prior footnotes.

[95] Subrata Chakrabarty & Ashwini Hingne, *Operationalizing Article 6: Issues for COP28 To Address*, WRI INDIA (Feb. 23, 2023).

ecosystem context, particularly forestry, can be used to demonstrate progress in parties' efforts to reduce emissions and respond to climate change. It is relatively straightforward to extend these concepts to blue carbon, which has already been done in the voluntary carbon market sector, and is likely to be coming in the new international carbon market under the UNFCCC framework. The objections to these practices also persist: fears of greenwashing and paper reductions that do not have real-world value have accompanied every step of each process discussed above. Yet these years have also resulted in the development of open-source crediting methodologies and processes to debate and improve them, and the slow emergence of an international voluntary carbon market framework that will allow the use of credits developed under these rules.

As discussed in the next two sections, these developments may be treated very differently from jurisdiction to jurisdiction. This is visible in the largely negative treatment of terrestrial carbon offset credits in the compliance markets on the one hand, and the growing interest in carbon markets for purposes of revenue generation in states without compliance markets, on the other. These latter developments, in particular, pose novel policy questions.

B. Blue Carbon Credits in Compliance Markets

Although the UNFCCC processes have been the source of most carbon market rules to date, these processes ultimately rely on member nations to develop their own carbon market systems, which may impose additional requirements on what kinds of offsets can be used. The compliance markets, focused primarily on driving emissions reductions at their sources, have largely avoided the incorporation of offset crediting.

For example, the European Union Emissions Trading System (EU ETS) was developed to allow EU countries to meet their compliance obligations under the Kyoto Protocol, and is now the largest compliance market in the world. Although offset credits were permitted in the EU ETS, rules for its third phase prohibited the use of credits from LULUCF projects, and after 2020 the system is no longer allowing offset crediting, pending decisions on Paris Article 6

mechanisms.[96] Consequently, it seems unlikely that the EU ETS will incorporate blue carbon credit offsets in the near future.

In the United States, the Regional Greenhouse Gas Initiative created a cap and trade system for emissions reductions from the power sector in northeastern U.S. states.[97] Regulated energy utilities can meet a certain percentage (currently 3.3%) of their compliance obligation by provision of offset credits.[98] One of the eligible offset credit types is similar to the LULUCF and REDD+ paradigms discussed above, allowing project-derived credits for reforestation, improved forest management, avoided conversion, and (in limited circumstances) afforestation activities.[99] RGGI has its own credit qualification rules,[100] and each RGGI state has its own rules governing their use, built off a model rule.[101] Thus, although blue carbon projects are still effectively invisible to the RGGI compliance framework, a model does exist for incorporating them should that be desired. Similarly, the California Cap and Trade system also currently allows covered entities to use offsets to cover up to 6% of their total compliance obligations.[102] California has developed its own protocols for forest-based offsets,[103] and again forestry activities, including reforestation, improved forest management, and avoided conversion activities, are eligible.[104] These credits are limited to activities in the United States however, and while California has considered permitting REDD+ projects, this has been fiercely debated and the

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[96] *Climate Action: Use of International Credits*, EUROPEAN COMM'N DIRECTORATE-GENERAL FOR CLIMATE ACTION (last visited Feb. 15, 2024).
[97] *See generally* THE REG'L GREENHOUSE GAS INITIATIVE (RGGI), https://rggi.org (last visited Feb. 15, 2024).
[98] *Offsets*, RGGI (last visited Feb. 15, 2024).
[99] *Forestry and Afforestation*, RGGI (last visited Feb. 15, 2024).
[100] *Verification Process*, *Offsets Requirements*, RGGI (last visited Feb. 15, 2024).
[101] *State Statutes & Regulations*, RGGI (last visited Feb. 15, 2024). *See also* RGGI, OFFSET HANDBOOK FOR REGIONAL GREENHOUSE GAS INITIATIVE (RGGI) MODEL RULE OFFSET SUBPART XX-10 AND MODEL OFFSET CONSISTENCY APPLICATIONS AND MODEL MONITORING AND VERIFICATION REPORTS VERSION 1.1 (2015); RGGI, RGGI MODEL RULE: SUBPART XX-1 CO_2 BUDGET TRADING PROGRAM GENERAL PROVISIONS (2017).
[102] *California's Compliance Offset Program*, CAL. AIR RES. BD. (CARB) (Oct. 27, 2021).
[103] *Id.*
[104] CARB, COMPLIANCE OFFSET PROTOCOL U.S. FOREST PROJECTS 11-15 (2015).

state has not yet done so.[105] California has not yet developed a protocol for crediting blue carbon projects in its Cap and Trade program.

Perhaps the most permissive compliance market system in the world today is the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), which allows airlines to claim to meet emissions reduction commitments using not only reforestation, afforestation, and improved forest management, but also REDD+ credits. However, to date, even CORSIA has not integrated blue carbon into its offset crediting rules. Other emerging compliance markets are still developing their rules as well. Under the New Zealand Emissions Trading Scheme, companies can offset their emissions through forestry activities including afforestation and reforestation (but not avoided deforestation), but only if those activities occur in New Zealand, although this is currently under revision.[106] The Chinese ETS also allowed for use of credits from domestic forestry projects, although this has been suspended since 2017 and the status is currently unclear.[107]

In other words, although none of the compliance markets in the world today specifically allow the use of offset credits generated by blue carbon projects, many have developed mechanisms for recognition and use of terrestrial carbon sequestration models that could be expanded. The barriers to doing so are primarily political and policy-driven, though technical challenges will always exist. Even lacking compliance market integration, however, the carbon market sector offers a potentially enormous source of revenues for jurisdictions with

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[105] CARB, STAFF WHITE PAPER: SCOPING NEXT STEPS FOR EVALUATING THE POTENTIAL ROLE OF SECTOR-BASED OFFSET CREDITS UNDER THE CALIFORNIA CAP-AND-TRADE PROGRAM, INCLUDING FROM JURISDICTIONAL "REDUCING EMISSIONS FROM DEFORESTATION AND FOREST DEGRADATION PROGRAMS (2015); *Sector-Based Offset Credits*, CARB (last visited Feb. 15, 2024); Jesse Leuders et al., *The Ongoing Political History of California's Initiative to Include Jurisdictional REDD+ Offsets within Its Cap-and-Trade System*, *in* THE CALIFORNIA REDD+ EXPERIENCE (Center for Global Development 2014).

[106] N.Z. MINISTRY FOR THE ENV'T, A REDESIGNED NZ ETS PERMANENT FOREST CATEGORY (2023).

[107] GUO MINPING ET AL., INT'L INST. OF GREEN FIN., *Exploring the Forestry Carbon Offsets in China*, (2021); Xu Nan, *Rebooting China's Carbon Credits: What Will 2022 Bring?*, CHINA DIALOGUE (Jun. 9, 2022).

carbon resources,[108] and in the face of potential billions this model has proven too tempting to ignore.

C. Emerging Carbon Commodification in Resource-Rich U.S. States

Although many U.S. states with robust climate laws and mandatory compliance markets have declined to incorporate forestry and have not yet considered including blue carbon crediting in their limited offset systems, a number of other U.S. states, many of which would not be considered leaders in the climate law space, have recently begun developing surprisingly comprehensive carbon resource inventory systems. Their reason for doing so is not altruistic: these states are preparing to attempt to generate revenue from their previously uncompensated conservation activities.

For example, the Governor of Alaska has recently initiated a legislative program seeking to capitalize on emerging carbon markets. In his words, "Alaska has vast forests and coastlines that can provide natural carbon management. Just as our forests act as carbon 'sinks,' so, too, can we host offshore kelp forests that can absorb carbon, reduce ocean acidification, and *generate revenue and economic activity*."[109] Emphasizing that Alaska Native corporations had brought in over $370 million in carbon management revenue between 2019 and 2023,[110] the Governor's office submitted two bills to the Alaska legislature, including a bill that would create a leasing program to allow third parties to use state land to generate carbon credits, and to authorize the state itself to seek to generate carbon offset credits on state lands, which program requires the state to develop project criteria for additionality, validation and verification, and so on.[111] With Alaska's

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[108] *E.g.*, JULIEN CLAES ET AL., MCKINSEY INSIGHTS ON SUSTAINABILITY, *Blue Carbon: The Potential of Coastal and Oceanic Climate Action*, (2022); *Are blue carbon markets becoming mainstream?*, ECONOMIST IMPACT (Apr. 11, 2022); *see also* Haley Toadvine, *Blue Carbon Credits Emerge as Potential New Market for Global Sustainability*, EARTH.ORG (Jun. 11, 2021); Nicola Jones, *Why the Market for 'Blue Carbon' Credits May Be Poised to Take Off*, YALE ENV'T 360 (Apr. 13, 2021).

[109] *Alaska Must Act Now to Capitalize on Carbon Markets*, OFF. OF GOVERNOR MIKE DUNLEAVY (Jan. 16, 2023) (emphasis added).

[110] *Governor Dunleavy Outlines Carbon Management Bill Package*, OFF. OF GOVERNOR MIKE DUNLEAVY (Jan. 12, 2023).

[111] H.B. 49, 33rd Leg. (Alaska 2023).

budget in chaos,[112] state leaders with dollar signs in their eyes are hoping to fill gaps with billions in carbon revenues.[113] Louisiana and Texas, similarly, hope to commodify their conservation activities. As discussed further below, both states are moving to coordinate their coastal zone management activities with the voluntary carbon markets. Researchers are studying the potential for Mississippi's participation as well,[114] and even the state of Washington is considering legislation to permit state conservation activities to qualify for carbon credits.[115]

These state proposals raise policy questions that have not yet received adequate attention. Resource-rich U.S. states are, in effect, hoping to step into the shoes of the developing countries under the REDD+ paradigm, something that has never been permitted before. The international carbon sequestration crediting initiatives developed under the UNFCCC cannot, by their fundamental definitions, apply to projects undertaken in industrialized nations like the United States. REDD+ was, by its own terms, confined to reduction of deforestation activities "in developing countries." Kyoto-style JI and CDM were constrained as their purpose was to qualify reductions in non-Annex I countries for compliance responsibilities by Annex I countries. A core requirement of VCS accreditation is the demonstration of additionality – that the project would not have happened anyway – and among the concerns of additionality is that it excludes all activities that are already required by law. Operating compliance markets in the United States place significant limits on sequestration-based offset crediting. In other words, under prevailing market systems, ongoing governmental conservation activities in the United States are entirely excluded from monetization. There is currently no way for, say, the state of Georgia to access international carbon

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[112] Elwood Brehmer, *Alaska's Budget Fights Resemble Lower 48 Fiscal Struggles*, ALASKA J. OF COMMERCE (Sep. 29, 2021); Matt Acuna Baxton, *Alaska's State Government Could Run Out of Money before July, but It Probably Won't*, ALASKA CURRENT (Feb. 23, 2023); Sean Maguire & Iris Samuels, *Alaska Budget Stalled with Special Session All but Inevitable*, ANCHORAGE DAILY NEWS (May 13, 2023).
[113] Jennifer L, *Alaska to Earn $30B from A New Revenue Source: Carbon Credits*, CARBONCREDITS.COM (Dec. 19, 2022).
[114] Bonnie A. Coblentz, *Emerging Carbon Offset Market May Benefit State*, MISS. STATE UNIV. EXTENSION (Oct. 14, 2021).
[115] Isabella Breda, *DNR Wants in on WA's Emerging Carbon-Credit Market*, THE SEATTLE TIMES (Feb. 9, 2023).

finance flows for simply maintaining its carbon stocks. The only way to monetize existing carbon stocks is to threaten to, or actually, exploit them.

The question should be discussed and debated: should this change? Should additionality requirements constrain compensation for currently uncompensated state-managed conservation? On the one hand, land management funding has largely flowed to developing countries, and this in essence would place U.S. states in competition with those nations for carbon credit finance. On the other hand, Alaska, Texas, and Louisiana all currently generate significant state revenues from the oil and gas industries, and face significant pressure to commodify and extract their natural resources – which they can be paid to do – rather than conserve them, for free. If payment for state conservation can replace (rather than supplement) state revenues for oil and gas development, that could be a net positive for the climate. But to the extent that states simply seek to generate a secondary revenue stream while continuing to extract oil and gas as fast as possible, there seems to be little climate benefit to permitting their conservation activities to profit from international carbon markets. To the extent that they are excluded from the international markets, furthermore, there may be potential for the United States itself to reimburse state conservation activities, and to use the conditional availability of federal conservation funds as a lever to achieve other climate goals. It appears that the rise of blue carbon crediting, and the vast potential to make money from conservation, will require answers to these questions in the near future.

In summary, the worldwide shift from compliance to voluntary carbon credit market systems, and the rising awareness of the potential value of coastal ecosystem carbon sequestration, have combined to drive interest in the incorporation of blue carbon projects into existing carbon market credit rules, even as doing so still faces major challenges, especially in the United States. As discussed in the following section, the carbon market rules are not the only ones that qualify as "blue carbon law," and the interest in commodification of blue carbon is also raising questions about the extent to which blue carbon value is already being, or could be, integrated into existing legal regimes.

IV. RESPONSIVE INTEGRATION OF BLUE CARBON COMMODIFICATION CONCEPTS INTO EXISTING LAWS

The prior Part reviewed the rules and controversies surrounding the creation of marketable carbon credits for terrestrial carbon sequestration protection and enhancement, the application of those rules in the blue carbon context, the coming finalization of long-awaited rules for international carbon markets, and the rising interest in commodifying and monetizing carbon resources, including coastal blue carbon resources, in resource-rich jurisdictions. This Part reviews how the pressures toward commodification of carbon sequestration activities might be incorporated into existing laws, from natural resource protection regimes, to industrial regulations, to subtler but no less important rules for environmental inventory and valuation. It is not intended to be a comprehensive accounting of every possible law related to blue carbon, but rather to identify major important examples and consider the extent to which they have been already, or might be in the future, modified to contend with ongoing blue carbon commodification. Integration of blue carbon considerations into existing laws was first proposed in 2013,[116] and although the last ten years have seen little progress, the recent developments in market-based credit systems are creating new pressures that may soon be reflected in existing laws.

Prior to beginning the more detailed review, however, one overarching legal system deserves mention: the UN Convention on the Law of the Sea (UNCLOS), which, among other things, divides up jurisdiction over marine areas. Being primarily concerned with the marine environment, blue carbon law will necessarily entail examinations of the problems of marine jurisdiction – the legal authority to govern the sea. Today, that jurisdiction is highly fragmented, or missing, and questions of jurisdiction over marine carbon sequestration activities

[116] Linwood H. Pendleton et al., *Considering "Coastal Carbon" in Existing U.S. Federal Statutes and Policies*, 41 COASTAL MGMT. 439, 446–47 (2013); Ariana E. Sutton-Grier et al., *Incorporating Ecosystem Services into the Implementation of Existing U.S. Natural Resource Management Regulations: Operationalizing Carbon Sequestration and Storage*, 43 MARINE POL'Y 246, 249-50 (2014).

are just beginning to be raised.[117] International, national, and subnational authorities around the world share jurisdiction over parts of the ocean and shore areas, completely without regard to the physical realities of biogeochemical cycles, and, particularly in cases where new international regulation or coordination is proposed, blue carbon law will require grappling with thorny jurisdictional questions. More concretely, however, many existing laws do already govern many parts of the larger system, and this Part considers how blue carbon issues might begin to change even those laws that do exist.

A. Natural Resource Protection Laws and Blue Carbon Commodification

In the United States, federal laws such as the Coastal Zone Management Act ("CZMA")[118] and Section 404 of the Clean Water Act[119] operate to prevent human disturbances to natural resources providing carbon sequestration services. These laws have not traditionally focused on the carbon consequences of their operations, but the rising interest in blue carbon commodification is already driving change in the CZMA, if not in Section 404.

i. The Coastal Zone Management Act

The CZMA incentivizes state coastal resource conservation – and therefore blue carbon conservation – by conditioning state eligibility for certain conservation funding on federal approval of state Coastal Management Programs (CMPs).[120] The CZMA can be considered a blue carbon law because it indirectly governs human interventions into the coastal carbon cycle, disincentivizing the destruction of carbon-sequestering coastal resources and the release of that sequestered carbon, and, at least potentially, incentivizing coastal habitat restoration activities that promote increased carbon sequestration over the status quo.

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[117] *E.g.*, ROMANY WEBB ET AL., SABIN CTR. FOR CLIMATE CHANGE L., COLUM. L. SCH., REMOVING CARBON DIOXIDE THROUGH OCEAN ALKALINITY ENHANCEMENT AND SEAWEED CULTIVATION: LEGAL CHALLENGES AND OPPORTUNITIES (2021).
[118] 16 U.S.C. §§ 1451-1466.
[119] 33 U.S.C. § 1344.
[120] 16 U.S.C. § 1455.

However, the CZMA's blue carbon impact is indirect, as the law itself, and its several programs, were drafted and implemented without attention to the carbon sequestration value of conserved resources, and have not incorporated carbon management concepts in any significant way so far. The CZMA's CMP provisions do not require states to consider or discuss carbon management, and do not identify carbon sequestration as a policy priority.[121] NOAA regulations governing CMP evaluation consequently do not discuss or require submissions related to carbon,[122] and NOAA evaluations of state CMPs do not examine state carbon management programs.[123] Indeed, in 2019 NOAA itself said that while it was "supportive" of comments urging more consideration of carbon management in CMPs, emissions mitigation and "sequestration of carbon dioxide are beyond the scope" of NOAA's CMP review.[124]

The CZMA's state grant programs have also not incorporated carbon considerations. The CZMA § 306A Resource Management Improvement Grant program[125] funds state programs to preserve or restore coastal resources through land purchase, but the program's guidance does not discuss carbon sequestration as a potential conservation value or award criterion.[126] Similarly, the CZMA § 309 Coastal Zone Enhancement Grant program[127] funds state initiatives that pursue specific conservation policy objectives, including particularly wetlands protection, but again NOAA's regulations[128] and guidance[129] do not discuss carbon in any way. And the CZMA's Coastal Estuarine and Land Conservation

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[121] 15 U.S.C. §§ 1455, 1456.
[122] 15 C.F.R. Part 923 (NOAA regulations for review and approval of state coastal management program).
[123] Reviewed NOAA Final Evaluation Findings for Washington, Oregon, California, Texas, Louisiana, Mississippi, Alabama, Georgia, Florida, South Carolina, North Carolina, Maryland, Rhode Island.
[124] NOAA OFF. FOR COASTAL MGMT. (NOAA OCM), FINAL EVALUATION FINDINGS: CALIFORNIA COASTAL MANAGEMENT PROGRAM JANUARY 2009 TO JUNE 2018 54 (2019).
[125] 16 U.S.C. § 1455a.
[126] NOAA OCM, COASTAL ZONE MANAGEMENT ACT SECTION 306A GUIDANCE (2023).
[127] 16 U.S.C. § 1456b.
[128] 15 C.F.R. Part 923, Subpart K.
[129] NOAA OCM, CZMA SECTION 309 PROGRAM GUIDANCE: 2021 TO 2025 ENHANCEMENT CYCLE (2019); NOAA OCM, CZMA SECTION 309 PROGRAM GUIDANCE: 2016 TO 2020 ENHANCEMENT CYCLE (2014).

Program,[130] which is supposed to protect valuable coastal resources, include guidelines for conservation purchases that have not been updated since 2003 and make no mention of carbon.[131] Even as these programs received significant injections of new funds under the Bipartisan Infrastructure Law,[132] the CZMA's blue carbon impact remains entirely indirect.

It is possible, however, that NOAA's future CZMA activities will need to better integrate carbon sequestration values, as states are increasingly pushing to incorporate the potential financial value of the coastal carbon resource they are protecting into their CZMA plans and programs. In Texas, for example, the 2017 Texas Coastal Resiliency Master Plan (TCRMP)[133] did not mention carbon sequestration once, but the 2023 TCRMP discussed carbon sequestration dozens of times, and has begun quantifying carbon sequestration outcomes of the state's conservation and restoration programs.[134] Similarly, Louisiana's new Climate Action Plan calls for integration of carbon inventory and sequestration quantification into all CZMA CMP projects.[135] Lacking federal guidance, these states are making their own claims about the carbon value of their activities, and undertaking their own efforts to monetize coastal conservation. NOAA's CMP review, grant proposal review, and research programs under the CZMA will need updating if they are to keep abreast of the states on these issues.

ii. Section 404 Wetlands Compensatory Mitigation

Clean Water Act § 404 prohibits discharge of dredged or fill material into waters and wetlands under federal jurisdiction except as permitted by appropriate

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[130] 16 U.S.C. § 1456d, Pub. L. 107–77, title II, 115 Stat. 776 (2001).
[131] NOAA OCM, COASTAL AND ESTUARINE LAND CONSERVATION PROGRAM: FINAL GUIDELINES (2003).
[132] *Bipartisan Infrastructure Law and Inflation Reduction Act Awards*, NOAA OCM (last visited Feb. 16, 2024).
[133] TEX. GEN. LAND OFF., TEXAS COASTAL RESILIENCY MASTER PLAN (2017).
[134] *Id.* at 33, 35, 37, 38,
[135] LA. CLIMATE INITIATIVES TASKFORCE, LOUISIANA CLIMATE ACTION PLAN 90-91 (2022).

agencies.[136] Section 404's implementing regulations require that federal permitting agencies avoid and minimize dredge and fill impacts whenever possible, and impose compensatory mitigation responsibilities on permittees to offset most unavoidable impacts.[137] Many of the waters and wetlands protected under Section 404 are coastal, and so, like the CZMA, the Section 404 program regulates human disruption and release of blue carbon and therefore meets this Article's definition of blue carbon law.[138]

As early as 2014 ocean science and policy experts were arguing that blue carbon ought to be worked into Section 404's compensatory mitigation rules.[139] Where any wetland fill was approved, they suggested that "the stored carbon in the wetland and the carbon sequestration potential of the wetland could be added as additional functions that would need to be mitigated."[140] Similarly, carbon sequestration offsetting has been recognized in passing by legal academic literature calling for incorporation of ecosystems services valuation into Section 404 and other natural resource laws.[141] However, also like the CZMA, Section 404 implementing agencies have not taken action to incorporate carbon considerations into their work, and, unlike the CZMA agencies, there is also no indication that Section 404 implementing agencies have had any appetite for doing so. Longstanding calls to integrate ecosystems services frameworks into

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[136] Although the *Sackett* decision is likely to significantly curtail Section 404 wetlands protections, this is likely to be less of a concern for coastal wetlands, which tend to be more physically connected and obviously adjacent to federal waters, and thus jurisdictional. *See* Sackett v. EPA, 598 U.S. 651 (2023). However, the full implications of the *Sackett* decision will not be clear for several years as implementing agencies issue rulemakings and jurisdictional determinations. *Id.*
[137] U.S. ENV'T PROT. AGENCY (U.S. EPA) & U.S. ARMY CORPS OF ENG'R (USACE), MEMORANDUM OF AGREEMENT REGARDING MITIGATION UNDER CWA SECTION 404(B)(1) GUIDELINES (discussing mitigation hierarchy: avoidance, minimization, and compensatory mitigation); 40 C.F.R. Part 230, Subpart J (Section 404 compensatory mitigation rules).
[138] WETLAND CARBON AND ENVIRONMENTAL MANAGEMENT (Ken W. Krauss et al. eds., 2022).
[139] Sutton-Grier et al., *supra* note 116, at 249.
[140] *Id.*
[141] J. B. Ruhl, James Salzman & Iris Goodman, *Implementing the New Ecosystem Services Mandate of the Section 404 Compensatory Mitigation Program - A Catalyst for Advancing Science and Policy*, 38 STETSON L. REV. 251 (2008); J. B. Ruhl, *Ecosystem Services and the Clean Water Act: Strategies for Fitting New Science into Old Law*, 40 ENV'T L. 1381 (2010); J. B. Ruhl & James Salzman, *Ecosystem Services and Federal Public Lands: A Quiet Revolution in Natural Resources Management*, 91 U. COLO. L. REV. 677 (2020).

federal natural resources laws have had minimal effect so far,[142] and there is currently no reason to suspect that calls to integrate carbon sequestration services will fare any better. Quite the contrary, the U.S. Supreme Court significantly curtailed the jurisdictional scope of the Section 404 program and most of the coming regulatory development under that law is going to be focused on issuing yet another rule providing regulatory definitions of Waters of the United States.[143] To this author's knowledge there have been no effort to define Section 404 compensatory mitigation responsibilities by reference to carbon sequestration services.

On the other hand, it is at least possible that carbon market incentives will drive change, although not in terms of potential profit. Rather, as mitigation requirements are akin to project costs, then blue carbon markets could serve as lower-cost alternative compliance mechanisms in the Section 404 system. Crediting regimes could certainly facilitate carbon-oriented compensatory mitigation rules, where Section 404 permittees could be required to offset carbon impacts, and allowed to do so by purchasing blue carbon credits as part of their compliance obligations. Furthermore, in the same way that U.S. compliance markets impose geographical limits on qualifying credits, so the Section 404 system could achieve its purpose of U.S. water quality protection by requiring credits for blue carbon projects to be developed in the United States (or even the same watershed), and to demonstrate that the credits also provide water quality co-benefits. It is not suggested that this would be a panacea, and offset crediting would be problematic in the wetlands compensatory mitigation space as much as in the carbon emissions reduction space, but the development of an international voluntary carbon market that includes blue carbon resources and wetlands projects in the United States does suggest some intriguing possibilities for Section 404 mitigation if otherwise well managed.

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[142] Donna R. Harwell, *Ecosystem Services in U.S. Environmental Law and Governance for the Ecosystem-Based Management Practitioner*, *in* ECOSYSTEM-BASED MANAGEMENT, ECOSYSTEM SERVICES AND AQUATIC BIODIVERSITY: THEORY, TOOLS AND APPLICATIONS 373-74 (Timothy G. O'Higgins et al., eds. 2020); Ruhl & Salzman, *supra* note 141, at 694-96.

[143] For the history of rulemaking and current status of ongoing efforts at revision following *Sackett*, *see* U.S. EPA, *Current Implementation of Waters of the United States* and *Definition of "Waters of the United States": Rule Status and Litigation Update*.

B. Industrial Regulations and Blue Carbon Commodification

As scientific understanding of marine carbon cycles improves, it is becoming apparent that many restrictions on industrial and resource extraction activities also qualify as blue carbon laws. If marine biomass contributes to the ocean's biological carbon pump, then fish stocks have carbon relevance, and the federal fisheries law is a blue carbon law. If seabed resource extraction activities have the potential to disturb marine carbon sequestration processes, then laws governing activities like aquaculture and mining are blue carbon laws. In the future, as links between terrestrial and marine carbon reservoirs are better understood, even terrestrial resource protection laws might count. As this occurs, it is likely that permitted activities requiring environmental review will increasingly be required to incorporate blue carbon considerations. And as nations and private actors investigate the use of the oceans for carbon sequestration purposes, these activities themselves will become separate industries subject to further carbon-cognizant restrictions. The commodification of carbon sequestration may create competing pressures that influence resource extraction and permitting, but also create new industries with their own attendant environmental risks.

i. The Magnuson-Stevens Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA)[144] governs the pace of removal of a significant amount of biomass from the oceans, a direct intervention in the ocean carbon cycle. As mentioned above, emerging evidence demonstrates that fishing harms marine carbon sequestration functions,[145] and therefore rules that regulate fishing also act to conserve bulks of marine biomass that feed marine carbon sequestration processes. Thus, the MSA and laws like it also arguably meet this Article's definition of blue carbon law.

However, it may be even more difficult to integrate carbon considerations into MSA regulatory programs than into the CZMA or Section 404. The MSA establishes regional fishery management councils that are responsible for

[144] 16 U.S.C. §§ 1851-1870.
[145] Saba et al., Bianchi et al., Mariani et al., *supra* note 31.

developing fishery management plans (FMPs), which must operate to prevent overfishing and achieve the largest long-term catch that can be taken from a fishery without harming its productivity.[146] The MSA accomplishes this by setting annual catch limits (ACLs) and other regulatory controls on the fishing industry,[147] but these rules make no reference to ecosystem services, the closest being the requirement that determinations of optimum yield "tak[e] into account the protection of marine ecosystems,"[148] and identification of the "benefits of protection afforded to marine ecosystems … resulting from maintaining viable populations (including those of unexploited species), … maintaining evolutionary and ecological processes (e.g., disturbance regimes, hydrological processes, [and] *nutrient cycles*)."[149] There has also been some discussion of incorporating more ecosystem-based fisheries management concepts into the MSA, which would likely involve considering ecosystem services to a greater degree, although potentially more focused on services that the marine ecosystem provides to support fisheries than on services that fish stocks themselves provide to carbon sequestration and other processes.[150] Other literature, however, has developed the idea of ecosystem services provided by fish stocks, including carbon flux regulation,[151] and it would be possible to update MSA processes to include consideration of carbon sequestration impact of fisheries activities as part of a fisheries law revision focused on creating more climate-ready fisheries.[152]

It is also useful, however, to consider whether the MSA's animating regulatory philosophy is consistent with blue carbon concerns. Arguably, the MSA's worldview is more hostile than helpful. The MSA's provisions are entirely directed toward protection of fisheries for fishing, not for any other purpose, and

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[146] 16 U.S.C. §§ 1851-53.
[147] *E.g.*, 50 C.F.R. § 600.310.
[148] *Id.* § 600.10.
[149] *Id.* § 500.310(e)(3) (emphasis added).
[150] Peter T. Kuriyama et al., *Issues at the Fore in the Land of Magnuson and Stevens: A Summary of the 14th Bevan Series on Sustainable Fisheries*, 54 MARINE POL'Y 118 (2015); Marina Cucuzza et al., *Evaluating the Theoretical and Practical Linkages between Ecosystem-Based Fisheries Management and Fisheries Co-Management*, 126 MARINE POL'Y 104390 (2021).
[151] Cecilia M Holmlund & Monica Hammer, *Ecosystem Services Generated by Fish Populations*, 29 ECO. ECON. 253 (1999).
[152] *See, e.g.*, Ocean Based Climate Solutions Bill, H.R. 8632, 116th Cong. (2020) (containing provisions on climate ready fisheries).

to the extent that blue carbon concerns are considered in the fisheries context, they may militate *against* fishing, to the extent that the amount of fishing that a particular fishery can sustain productively is more than the optimum amount for carbon sequestration. It may be, therefore, that the best way to integrate carbon considerations into the MSA is via environmental impact review (see discussion below) or, again, through some sort of market-based system. Either, however, will be heavily dependent on high-quality information about carbon stocks and flows as related to fisheries which do not yet exist.

ii. Deep-Sea Mining Regulations

In addition to carbon-bearing sediments, parts of the deep ocean floor are covered with millions of "polymetallic nodules" – metal-bearing concretions that have formed over millions of years and now constitute a potentially important new source of rare metals needed for electric vehicle batteries and other new energy technologies.[153] Recently, mining companies and nations with nodule resources have proposed expanded deep sea mining operations to exploit this resource.[154] In some respects, including disrupted sequestered carbon, deep sea mining may be less environmentally harmful than terrestrial mining operations.[155] However, many of the impacts are not well understood, and there is concern that dredging and vacuuming the ocean floor to recover nodules will have environmental effects, including both species and carbon sequestration impacts,

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[153] James R. Hein et al., *Deep-Ocean Polymetallic Nodules as a Resource for Critical Materials*, 1 NATURE REV. EARTH & ENV'T 158 (2020); Kira Mizell, *What's in a Nodule?*, NOAA OCEAN EXPLORATION (Aug. 26, 2021).

[154] *E.g.*, *Norway Proposes Opening Its Waters to Deep Sea Mining, Says Minerals Needed in Green Transition*, ASSOC. PRESS (Jun. 20, 2023); Joanna Chu, *Why has a Canadian Company Partnered with the Tiny Island of Nauru to Fast-Track Deep-Sea Mining?*, TORONTO STAR (Feb. 20, 2023).

[155] Daina Paulikas, *Life Cycle Climate Change Impacts of Producing Battery Metals from Land Ores versus Deep-Sea Polymetallic Nodules*, 275 J. CLEANER PROD. 123822 (2020) (modeling climate impacts, including sequestration degradation, between terrestrial and deep-sea mining).

that could take millennia to undo.[156] Rules regulating deep-sea mining of polymetallic nodules must then also qualify as blue carbon laws.

Currently, deep-sea mining regulation is conducted by the International Seabed Authority (ISA), an organization operating under the auspices of UNCLOS.[157] The ISA maintains a Mining Code that is supposed to govern both exploration and exploitation of deep-sea mineral resources, but currently only the exploration regulations have been completed. The exploitation element of the Mining Code has been under development since 2014, and was supposed to be finished by 2020 but has been delayed.[158] In June 2021, the island nation of Nauru submitted a formal demand to the ISA that triggered a two-year countdown before ISA had to begin accepting deep sea mining applications, with or without a code.[159] The ISA did not finish its work before its July 2023 meeting.[160] Meanwhile, nations and advocates have called for worldwide moratoria, for strict environmental protections in the eventual mining code, and for the ISA to hurry, while mining companies have been submitting applications to begin operations.[161]

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[156] Raphaël Deberdt & Philippe Le Billon, *A Green Transition Should Prioritize the Ocean's Carbon Sinks over Deep-Sea Mining*, POL'Y OPTIONS (Jul. 28, 2022) (citing relevant literature); Lisa A. Levin et al., *Challenges to the Sustainability of Deep-Seabed Mining*, 3 NATURE SUSTAINABILITY 784 (2020); Daniëlle S.W. de Jonge et al., *Abyssal Food-Web Model Indicates Faunal Carbon Flow Recovery and Impaired Microbial Loop 26 years after a Sediment Disturbance Experiment*, 189 PROGRESS IN OCEANOGRAPHY 102446 (2020) (disruptions to biotic processes that influence carbon cycle); PIPPA HOWARD ET AL., FAUNA & FLORA INT'L, AN ASSESSMENT OF THE RISKS AND IMPACTS OF SEABED MINING ON MARINE ECOSYSTEMS (2020); and 2023 Update to same; Mary Beth Gallagher, *Understanding the Impact of Deep-Sea Mining*, MIT NEWS (Dec. 5, 2019).

[157] *About ISA*, INT'L SEABED AUTH. (last visited Feb. 16, 2024).

[158] Jenessa Duncombe, *The 2-Year Countdown to Deep-Sea Mining*, EOS (Jan. 24, 2022).

[159] *Id*.

[160] Karen McVeigh, *Row Erupts over Deep-Sea Mining as World Races To Finalise Vital Regulations*, THE GUARDIAN (Mar. 21, 2023).

[161] Valentina Ruiz Leotaud, *Greenpeace Mexico Launches Campaign against Deep-Sea Mining*, MINING.COM (Jun. 11, 2023); Florence Jones, *Banks Representing a Third of UK Assets Vow Not to Invest in Deep-Sea Mining*, MINING TECH. (Jun. 23, 2023); *European Science Advisory Group Urges Moratorium on Deep-Sea Mining*, ENVIROTEC (Jun. 2023); Catarina Demony & Helen Reid, *France's Macron Says Deep-Sea Mining Must Not Go Ahead*, REUTERS (Jun. 30, 2022); *G7 Countries Say Strict Environmental Rules Needed for Deep-Sea Mining*, REUTERS (May 27, 2022); *UN to Start Allowing Deep-Sea Mining Applications from July*, DW (Apr. 1, 2023).

The ISA's draft exploitation regulations include environmental impact statement and harm minimization requirements, but it is not clear how effective such regulations can actually be in environments that are very poorly understood in the first place.[162] Certainly the carbon impacts of these operations are not well understood – the U.S. Geological Survey (USGS) for example is only now funding basic research to characterize carbon in sediments in critical marine mineral environments.[163] And as recent research has claimed to have identified over 5,000 previously undocumented species in an area of the deep ocean targeted for sea-bed mining, it is increasingly clear that biological impacts are poorly understood as well.[164] It is not clear how mining companies or the ISA can accurately assess the environmental, species, or carbon impacts of exploitation activities when the processes and resources being impacted are barely understood, but it is also possible that a carbon market could support such activities. The availability of offset mechanisms could justify conditioning deep-sea mining on scientifically defensible environmental resource evaluation and, with respect to carbon impacts, replacement of disturbed seabed carbon via a compensatory mitigation strategy similar to that in Section 404 discussed above. Again, this is not offered as a panacea – it is possible that no amount of offsetting can replace deep sea sediment carbon values, and it is possible that such mining should be avoided based entirely on biodiversity considerations. But if such mining is to continue, then it is probably better that its carbon sequestration impacts be required to be assessed and mitigated, rather than ignored.

iii. Geoengineering Project Rules and Requirements

While fishing and deep-sea mining are not directly intended to influence carbon cycles, the rise of carbon sequestration commodification is incentivizing the development of new industries specifically focused on doing so. "Geoengineering" is a broad term encompassing human interventions into earth

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[162] INT'L SEABED AUTH., DRAFT EXPLOITATION REGULATIONS (2019).
[163] *Deciphering Blue Carbon in Critical Marine Mineral Environments*, U.S. GEOLOGICAL SURVEY, MENDENHALL RSCH. FELLOWSHIP PROGRAM (last visited Feb. 16, 2024).
[164] Muriel Rabone, *How Many Metazoan Species Live in the World's Largest Mineral Exploration Region?*, 33 CURRENT BIOLOGY 2383 (2023) (claiming discovery of over 5,000 unnamed species on abyssal plain in region targeted for mining).

systems at a worldwide scale.[165] Several geoengineering techniques involve the ocean: deep ocean carbon burial involves pumping liquified CO_2 into marine subsurface geologic formations; ocean fertilization involves increasing marine nutrient density to encourage phytoplankton growth and sequestration, and ocean liming and other techniques involve altering ocean chemistry to enhance carbon removal.[166] However, the "nature-based solutions" carbon removal paradigm somewhat confounds the traditional geoengineering distinctions. For example, many of the carbon credit legal regimes discussed in Section II.A. actually discuss carbon sink enhancement activities as a form of emissions reduction, rather than geoengineering. Nonetheless, many of the activities that might accomplish these sequestration goals would also qualify under most definitions of geoengineering, and in particular raise many of the ethical problems of that field. While ocean carbon sequestration enhancement via mangrove planting might not be as problematic as, say, addition of physical materials to change ocean chemistry, such as ocean liming, both are achieving similar ends. Whether or not the distinction is fully justified, there is increasing concern that these activities are not possible to regulate, particularly when undertaken in ocean and marine environments outside national jurisdictions.

The sea, of course, is not entirely law-free, and ocean geoengineering has been the subject of a great deal of debate in several international law treaty conventions. The parties to the UN Convention on Biological Diversity – ratified by every UN member state except the United States – called for its member states to ensure that no ocean geoengineering activities that may affect biodiversity be conducted.[167] Parties to the London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention) and the 1996 replacement protocol (London Protocol) – including the U.S. – adopted

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[165] *See generally* Geoengineering, Encyclopedia Britannica (online ed. 2023).
[166] *Id.*; Paul Voosen, *Ocean Geoengineering Scheme Aces Its First Field Test*, SCIENCE (Dec. 16, 2022).
[167] UN CBD Dec. X/33, *Biodiversity and Climate Change* ¶¶ 8(w), (x) (Oct. 29, 2010), published in UN Doc. UNEP/CBD/COP/DEC/X/33; *reaff'd* UN CBD Dec. XI/20, *Climate-Related Geoengineering* (Dec. 5, 2012), UN Doc. UNEP/CBD/COP/DEC/XI/20; UN CDB Dec. XIII/4, *Biodiversity and Climate Change* (Dec. 17, 2016), UN Doc. CBD/COP/DEC/XIII/4.

restrictions on commercial-scale ocean fertilization activities[168] More detailed reviews have identified other potentially applicable restrictions on ocean alkalinity enhancement and seaweed cultivation for purposes of carbon sequestration.[169] Most of these decisions are non-binding, however, and ocean-based geoengineering restrictions are currently more a matter of norms than enforceable rules. The creation of carbon market incentives will likely drive efforts to experiment with carbon sequestration technologies and techniques on the shores and deep oceans.

In the United States, there is little clarity on what regulations will be imposed on researchers testing new ocean carbon removal processes. A recent proposal for a model law to govern potential use conflicts and create a clear permitting regime suggests that much work is still needed.[170] While current calls are intended to be proactive, the rising pressures of carbon finance may require the adoption of these rules reactively, as businesses seek to find profit in ocean experimentation.

iv. Environmental Impact Assessment

Although it is difficult to assess the exact impact of environmental review law, it is widely believed that mandatory environmental impact assessment serves to promote the avoidance of environmental harms, even where harm minimization is not otherwise required. Thus, environmental review already serves as a general-purpose guardrail on some industrial activities, forcing the assessment and disclosure of potential environmental harms from actions subject to review. Furthermore, general environmental review mandates, such as those under the

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[168] *See generally* *Ocean Fertilization under the LC/LP*, Int'l Maritime Org. (IMO) (last visited Feb. 16, 2024); *Marine Geoengineering*, IMO (last visited Feb. 16, 2024).

[169] ROMANY M. WEBB ET AL., SABIN CTR. FOR CLIMATE CHANGE L., COLUM. L. SCH., REMOVING CARBON DIOXIDE THROUGH OCEAN ALKALINITY ENHANCEMENT: LEGAL CHALLENGES AND OPPORTUNITIES (2021); KOREY SILVERMAN-ROAT ET AL., SABIN CTR. FOR CLIMATE CHANGE L., COLUM. L. SCH., REMOVING CARBON DIOXIDE THROUGH SEAWEED CULTIVATION: LEGAL CHALLENGES AND OPPORTUNITIES (2021); *see also* Phillipe Sands et al., *Re: The Restriction of Geoengineering under International Law*, UNITED NATIONS HUMAN RIGHTS OFF. OF THE HIGH COMM'R (Mar. 26, 2021).

[170] ROMANY M. WEBB & KOREY SILVERMAN-ROATI, SABIN CTR. FOR CLIMATE CHANGE L., COLUM. L. SCH., DEVELOPING MODEL FEDERAL LEGISLATION TO ADVANCE SAFE AND RESPONSIBLE OCEAN CARBON DIOXIDE REMOVAL RESEARCH IN THE UNITED STATES (2023).

National Environmental Policy Act (NEPA), allow and often require the integration of emerging science in a manner that more purpose-built and less flexible environmental laws can rarely match. Thus, environmental impact assessment may serve as a useful source of protection in the blue carbon space.

In the United States, NEPA has incorporated climate change for many years.[171] The most recent NEPA climate guidance, furthermore, directly discusses carbon sequestration in natural sinks.[172] Pursuant to the new guidance, "for actions involving potential changes to biological GHG sources and sinks, agencies should include a comparison of net GHG emissions and carbon stock changes that are anticipated to occur, with and without implementation of the proposed action and reasonable alternatives," including "carbon sequestration potential, and the net change in relevant carbon stocks in light of the proposed actions and timeframes under consideration."[173] The guidance specifically notes that "actions that involve ecosystem restoration," and "some resource management activities," will require analysis and disclosure of complex changes in carbon sequestration potential, and encourages agencies to use available scientific tools in their assessments.[174]

A review of recently published environmental impact statements with the word "ocean" and "marine" in the title[175] reveals that blue carbon sequestration has now been incorporated into at least one environmental impact statement, although without particularly robust or detailed quantitative measurements or estimates.[176] As new science is developed, it is likely that parties will increasingly demand assessment of carbon impacts under NEPA and other environmental review processes. Even lacking a mitigation requirement, the forced production of

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[171] *See* Michael D. Smith, *NEPA and Climate Change*, 10 ENV'T PRACTICE 75 (2008) (discussing early developments).
[172] National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change, 88 Fed. Reg. 1196, 1207 (Jan. 9, 2023).
[173] *Id.*
[174] *Id.*
[175] Search performed at the U.S. EPA's Environmental Impact Statement (EIS) Database.
[176] *E.g.*, U.S. BUREAU OF OCEAN ENERGY MGMT., OCEAN WIND 1 OFFSHORE WIND FARM FINAL ENVIRONMENTAL IMPACT STATEMENT 3.6-7 to -8 (2023). *But see* NOAA, EFFECTS OF OIL AND GAS ACTIVITIES IN THE ARCTIC OCEAN FINAL ENVIRONMENTAL IMPACT STATEMENT (Oct. 2016) (no discussion of carbon).

information may be prove extremely useful in mainstreaming the use of resource inventory and valuation data that is being developed independently.

C. Mandated Inventory and Valuation, and Blue Carbon Commodification

It is said that "what gets measured gets managed."[177] And indeed, measurement – making people and resources "legible" and manageable for purposes of top-down control – is arguably a core function of most government.[178] From the activities of the USGS to the international framework for global climate inventory, significant government resources are invested in simply generating reliable information about the world, and many of these are focused on environmental resources and values. Thus, some existing inventory and resource tracking laws are likely to need to increasingly confront and consider blue carbon going forward.

i. Carbon and Coastal Wetlands Inventories

Every year since 1993 the United States Environmental Protection Agency (EPA) has published and updated a national inventory of greenhouse gas emissions and sinks.[179] The most recent, published in 2023, covers the period from 1990 to 2021.[180] However, the EPA's annual inventory does not address ocean carbon, restricting its review to coastal wetlands and submerged lands within the U.S. territory.[181] This omission is traceable to the underlying inventory methodologies that EPA follows, the international *IPCC Guidelines for National*

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[177] This is a fairly common saying, but for some critical discussion of it, *see* Paul Zak, *Measurement Myopia*, THE DRUCKER INST. (Apr. 7, 2013); Danny Buerkli, *"What Gets Measured Gets Managed" — It's Wrong and Drucker Never Said It*, CTR. FOR PUBLIC IMPACT (Apr, 8, 2019).

[178] JAMES C. SCOTT, SEEING LIKE A STATE: HOW CERTAIN SCHEMES TO IMPROVE THE HUMAN CONDITION HAVE FAILED (1998).

[179] Press Release, U.S. EPA, EPA Publishes 30th Annual U.S. Greenhouse Gas Inventory (Apr. 21, 2023).

[180] U.S. EPA, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990-2021 (2023).

[181] *See generally id*. Ch. 6 (Land Use, Land-Use Change, and Forestry).

Greenhouse Gas Inventories,[182] and the 2013 *Wetlands Supplement* to those guidelines.[183] As discussed above, the international framework for climate change response is focused on national actions, and rules for national inventories focus on resources under national control, meaning particularly terrestrial ecosystems like forests, and wetlands, including coastal wetlands, but missing many other resources relevant to blue carbon measurement. Currently, EPA explains that its inventory "includes all privately- and publicly-owned coastal wetlands (i.e., mangroves and tidal marsh) along the oceanic shores of the conterminous United States, [except] in Alaska, Hawaii, or any of the United States Territories. Seagrasses are not currently included within the Inventory due to insufficient data …." The inventory's coastal wetlands carbon values are determined by a NOAA data tool developed in NOAA's Coastal Change Analysis Program (C-CAP).[184] Future updates may incorporate data from the Smithsonian's Coastal Wetland Carbon Research Coordination Network (CCRN),"[185] add seagrass values, reconcile differences between the NOAA C-CAP and other federal resource inventories.[186] There are many other wetlands inventories, including most importantly the National Wetlands Inventory Plus (NWI+ or NWIPlus), which among other things can be used to extrapolate carbon sequestration values of various wetlands types.[187]

Most of the legal initiatives discussed above, from crediting to impact assessment and mitigation, require accurate data. As the value of carbon sequestration resources increase, so should the value of public wetlands and blue carbon inventories. To the extent that the U.S. federal government cannot be moved to support the development of such inventories for the public good, it may

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[182] IPCC TASK FORCE ON NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TFI), 2006 IPCC GUIDELINES FOR NATIONAL GREENHOUSE GAS INVENTORIES (2006); IPCC TFI, 2019 REFINEMENT TO THE 2006 IPCC GUIDELINES FOR NATIONAL GREENHOUSE GAS INVENTORIES.
[183] IPCC TFI, 2013 SUPPLEMENT TO THE 2006 IPCC GUIDELINES FOR NATIONAL GREENHOUSE GAS INVENTORIES: WETLANDS (2013).
[184] *Id.* at 6-103 to 6-121. *See also Coastal Change Analysis Program (C-CAP) Land Cover Atlas*, U.S. CLIMATE RESILIENCE TOOLKIT (June 21, 2021).
[185] IPCC TFI, *supra* note 183, at 6-111. *See also Coastal Carbon Network*, SMITHSONIAN (last visited Feb. 15, 2024). The CCN published a report in 2021 reviewing state-level availability of state-level wetlands inventories.
[186] IPCC TFI, *supra* note 183, at 6-24, 6-111.
[187] RALPH W. TINER, *USA Wetlands: NWI-Plus Classification System*, *in* THE WETLAND BOOK 1555 (C. Max Finlayson et al. eds. 2018).

be more wiling to do so in order to promote private gain – with, hopefully, some attendant public benefit.

ii. Natural Resource Damages Valuation

Natural Resource Damages (NRD) are payments recoverable in lawsuits under certain environmental laws, intended to compensate for degraded value of natural resources caused by pollution.[188] In the marine context, NRD are available under the Oil Pollution Act of 1990 (OPA),[189] which governs polluter liability for oil spills in coastal areas and jurisdictional navigable waters.[190] Enormous potential liability for impairing an ecosystem's carbon sequestration services could serve as a strong incentive against such action, and thus NRD assessment and valuation laws could also, arguably, qualify under this Article's definition of blue carbon law.

Again, this is not a new idea, with blue carbon in NRD Assessment (NRDA) first examined in 2013, in the context of NOAA programs that have been used to support NRDA.[191] As of 2013 NOAA NRDA had not incorporated carbon sequestration services valuation into its damage assessments, although it appears to have authority to do so.[192] A review of post-2013 assessments reveals that this has not changed since then.[193] For example, the NRDA for the *Deepwater Horizon* oil spill in the Gulf of Mexico, did not assess impact to carbon sequestration services,[194] although such impacts have been argued to be have

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[188] *See generally* BRIAN D. ISRAEL ET AL., NATURAL RESOURCE DAMAGES: A GUIDE TO LITIGATING AND RESOLVING NRD CASES (2019)
[189] 33 U.S.C. § 2706 (OPA NRD statute). NRD are also recoverable under CERCLA, 42 U.S.C. § 9607, and the Clean Water Act, 33 U.S.C. § 1321, but the assessment processes and concepts are similar enough in those statutes that this Article focuses only on OPA.
[190] 33 U.S.C. § 2702.
[191] Pendleton et al., *supra* note 116, at 443-44.
[192] *Id.*
[193] *Damage Assessment, Remediation, and Restoration Program*, NOAA (last visited Feb. 16, 2024).
[194] *See* Folder 5 (Preassessment/Assessment) at Restoring the Gulf of Mexico After the Deepwater Horizon Oil Spill- Administrative Record, U.S. DEP'T OF THE INTERIOR (last visited Feb. 16, 2024).

occurred.[195] NRDA for other more recent spills also do not include carbon sequestration valuation components.[196] A recent review confirms that inclusion of ecosystem services in marine NRDA is not simply theoretical, but does not discuss carbon sequestration valuation.[197]

NRD have also been assessed by the International Court of Justice, which rendered its first environmental compensation decision in 2018.[198] In that case, Costa Rica claimed damages equivalent to NRD, including for "gas regulation and air quality services, such as carbon sequestration, which was allegedly caused by Nicaragua's unlawful activities."[199] Ultimately, the court included impaired ecosystem services – including "gas regulation," meaning carbon sequestration services – in its award, although the exact basis for its valuation was left unclear.[200] Nonetheless, this appears to have been the first-ever judicial recognition of and award granted for carbon sequestration damages.

On the specific question of valuation, emerging pricing mechanisms may prove useful for incorporating carbon sequestration into NRDA. The international community and the United States federal government have been working to develop a "social cost of carbon" to set a regulatory (rather than market-based)

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[195] Melissa Rohal et al., *The Effect of the Deepwater Horizon Oil Spill on Two Ecosystem Services in the Northern Gulf of Mexico*, 133 ENV'T MODELLING & SOFTWARE 104793 (2020) (finding decrease in subsurface particulate organic carbon sequestration).
[196] *E.g.*, NOAA, BAYPORT CHANNEL COLLISION OIL SPILL WATER COLUMN INJURY ASSESSMENT REPORT (2021), available at https://www.diver.orr.noaa.gov/web/guest/diver-admin-record/12302; Consent Decree for Natural Resources Damages, U.S. v. Kirby Marine, Dkt. 9, Case No. 21-CV-00180 (S.D. Tex. Sep. 1, 2021) (same case, does not discuss carbon or ecosystem services damages).
[197] Robin Kundis Craig, *Re-Valuing the Ocean in Law: Exploiting the Panarchy Paradox of a Complex System Approach*, 41:3 STAN. ENV'T L. J. 3, 49 (2022) ("Other examples of ecosystem function injuries include impaired cycles of organic matter and nutrients from the water column to oil-contaminated bottom sediments").
[198] Certain Activities Carried Out by Nicaragua in the Border Area (Costa Rica v. Nicaragua), INT'L CT. JUST. (last visited Feb. 16, 2024); *See also* Nilufer Oral, *ICJ Renders First Environmental Compensation Decision: A Summary of the Judgment*, IUCN (Apr. 9, 2018) (summarizing decision).
[199] INT'L CT. JUST., *Compensation Owed by the Republic off Nicaragua to the Republic of Costa Rica, Costa Rica v. Nicaragua* ¶¶64-65 (Feb. 2, 2018).
[200] *Id.* at ¶ 75 (affirming gas regulation harm), ¶¶ 76-77 (criticizing parties' valuation methodologies), ¶¶ 78-86 (awarding $120,000 aggregate).

carbon price.[201] The U.S. has also recently created a tax incentive for carbon sequestration that arguably acts as a price signal,[202] although at this time the credit is applicable only to direct air capture and geologic sequestration activities, and does not include nature-based sequestration activities.[203] Finally, of course, the carbon markets themselves are developing methodologies for carbon sequestration valuation, although market pricing integration into damages assessments should be done carefully, given that many factors other than resource value influence pricing in current markets.

V. CONCLUSION: O BRAVE BLUE WORLD

The prior Part demonstrated that many laws already impact and govern human interventions into the marine carbon cycle, and that the profit incentives of emerging carbon markets and blue carbon crediting methodologies might be incorporated into some of those laws, proactively or reactively. But ultimately, intelligent management of carbon resources is also likely to require new national legislation. In the United States, proposals for this have started to emerge, and, particularly given the interest from resource-rich states, some may even have bipartisan support.

The first federal legislative proposal appeared in 2019, as Sens. Whitehouse (D-RI) and Murkowski (R-AK) proposed to create research and development prizes "to catalyze the rapid development and deployment of data collection and monitoring technology related to … oceans … and coasts," among other things to enhance ocean carbon sequestration. [204] In the same year, Sens. Whitehouse, Reed (D-RI), and Sullivan (R-AK) proposed setting aside funds for

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[201] E.g., *EPA's "Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances"*, U.S. EPA (Dec. 2, 2023); INTERAGENCY WORKING GROUP ON SOCIAL COST OF GREENHOUSE GASES, UNITED STATES GOVERNMENT, TECHNICAL SUPPORT DOCUMENT: SOCIAL COST OF CARBON, METHANE, AND NITROUS OXIDE INTERIM ESTIMATES UNDER EXECUTIVE ORDER 13990 (2021).
[202] 26 U.S.C. § 45Q.
[203] CONG. RSCH. SERV., THE SECTION 45Q TAX CREDIT FOR CARBON SEQUESTRATION (updated Aug. 23, 2023); *Alert: Inflation Reduction Act Expands the Carbon Capture and Sequestration Tax Credit*, JONES DAY (Aug. 2022).
[204] Bolstering Long-Term Understanding and Exploration of the Great Lakes, Oceans, Bays, and Estuaries (BLUE GLOBE) Act, S. 933, 116th Cong. § 13 (2019).

the department of defense to investigate the development of technologies that remove carbon from sea water.[205] This latter proposal was ultimately passed in the 2020 Defense Budget,[206] while the other died in committee.

More comprehensive legislative initiatives have gotten closer to passage in the 117th Congress, 2021-2022. In early 2022, the House passed the America COMPETES Act,[207] which would require a NOAA-National Academies blue carbon assessment to study the impacts of marine species decline on ocean carbon sequestration potential, the mitigation potential of fish and marine mammal population recovery, a literature review on geologic and deep sea carbon storage, and the potential for human activities to impact blue carbon storage.[208] The House bill also included the Blue Carbon For Our Planet Act,[209] which would have established an interagency working group on coastal blue carbon tasked with developing a national blue carbon resource map, establish national coastal blue carbon conservation and research priorities, and a strategic plan for federal research and development. The Senate, however, passed a competing version of the law that did not include these provisions, and the competing versions of the bill went to conference, where they languished for some time before finally exiting conference without the blue carbon provisions.[210]

Also in 2022, the House Committee on Natural Resources held hearings on a bill that would have called for NOAA to develop methods for incorporating carbon sequestration ecosystem services considerations into existing conservation policies, inventory national blue carbon stocks and fluxes, support the

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[205] Securing Energy for our Armed Forces Using Engineering Leadership (SEA FUEL) Act, S. 1679, 116th Cong. (2019).
[206] National Defense Authorization Act for FY 2020, Pub. L. 116-92 § 223 (2019).
[207] America Creating Opportunities for Manufacturing, Pre-Eminence in Technology, and Economic Strength (America COMPETES) Act, H.R. 4521, 117th Cong. (as engrossed in House Feb. 4, 2022).
[208] *Id.* § 71002.
[209] *Id.* §§ 71801-71806, originally H.R. 2750, 117th Cong. (2021).
[210] U.S. Innovation and Competition Act, H.R. 4521, 117th Cong. (as amended and engrossed in Senate, Mar. 28, 2022); Brian Mosley, *USICA and Competes Act Update: Legislation is Stalled and its Future is Uncertain*, COMPUTING RSCH. POL'Y BLOG (Jun. 15, 2022); Brian Molsey, *"Chips and Science" NSF Legislation, Formerly the USICA and COMPETES Acts, Heads Towards Passage into Law*, COMPUTING RSCH. POL'Y BLOG (Jul. 28, 2022); CHIPS and Science Act, H. R. 4346, 117th Cong. (2022), *enacted* Pub. L. 117-167 (Sep. 8, 2022).

development of marketable carbon credits for blue carbon protection and restoration initiatives, assess national blue carbon storage potential, "[a]ssess legal issues of landownership and leases in blue carbon markets," and even "protect and restore habitats, waters, and organisms that are long-term carbon sinks or will be subject to habitat change as a result of climate change and development;" as well as operating a state conservation grant program with a goal of protection or restoration 1.5 million acres over ten years, these last two funded at nearly a billion dollars over five years.[211] This proposal, however, died in committee. A Senate bill proposed directing the Department of Energy to undertake a technology research program that would have included carbon mineralization in the shallow oceans, and would have made DOE responsible for developing ocean carbon removal strategies, including coastal blue carbon sequestration enhancement, direct ocean capture, algae cultivation, and ocean alkalinity enhancement. [212] It died in committee as well, as did a proposal for a living shorelines grant program.[213]

Legislative proposals relating to blue carbon have not yet become highly polarized, and there has been some indication that the revenue potential could allay some conservative opposition. Nonetheless, it should never be forgotten that there is a significant partisan divide on federal environmental legislation that prevents a great deal of creativity at the national level. To that end, Rep. Bruce Westerman (R-AR) began developing a conservative antiregulatory opposition to blue carbon law in a "dissenting view" appended to a House Report on the Ocean-Based Climate Solutions Act of 2022,[214] which would have incorporated several of the above proposals and which also died in committee. In his words:

> [This bill] should be called the "Blue New Deal" because it reflects a broad list of Democratic big government "solutions" that would eliminate inland and offshore jobs and increase bureaucratic red tape. …

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[211] Blue Carbon Protection Act, H.R. 3906, 117th Cong. (2022).
[212] Carbon Removal and Emissions Storage Technologies (CREST) Act, S. 4420 § 121, 117th Cong. (2022) (adding oceanic carbon removal activities to EPAct 2005 § 969D).
[213] Living Shorelines Act, H.R. 4235, 117th Cong. (2021).
[214] H.R. 3764, 117th Cong. (2022).

> For example, the national blue carbon ecosystem map mandated in the bill would require that the National Oceanic and Atmospheric Administration (NOAA) identify upstream structures or pollution sources that affect the watershed and potential for blue carbon sequestration. This requirement has no limits on how far upstream that process might reach. … A Republican amendment … was offered to strike this mapping requirement but was rejected by the Democratic Majority.
>
> Additional red tape H.R. 3764 would create includes new consultation requirements for all federal agencies where a proposed action has the potential to cause an adversarial impact to "blue carbon areas of significance" or "marine mammal climate impact management plans." … [T]hese requirements would undoubtedly create yet another layer of environmental bureaucracy and potential litigation that will be used to block federal actions, such as maintaining or building new infrastructure of all kinds near water … A Republican amendment offered by Mr. Bentz of Oregon sought to protect inland water infrastructure but that was also rejected by the Democratic Majority.
>
> … This bill is a federal government-knows-best partisan exercise rammed through Committee without consideration of its impacts to the economy and those who depend on our working oceans and rivers. For this reason, it passed on a party-line vote. Even then, it has shown itself to be too radical for even the House Democratic Caucus since it was never considered as a stand-alone measure on the House floor in the 117th Congress.[215]

In other words, the polarization of blue carbon law has begun. If this opposition gains traction, it may make it impossible for the U.S. Congress to act, leaving federal agencies to make do within existing statutory authorities. In that case, emerging scientific knowledge about blue carbon will no doubt be integrated

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[215] H.R. Rep. No. 117-695, at 266-67 (Dec. 30, 2022). NB: Rep. Westerman was the primary proponent of the Trillion Trees Act, H.R. 5859, 116th Cong. (2021).

to some degree into federal regulatory programs as discussed in Part III, but it is likely that the frontlines in the development of blue carbon law will remain elsewhere, particularly in the development of voluntary carbon market accreditation methodologies, international carbon market frameworks, and responsive subnational programs integrated with the carbon markets, as discussed in Part II.

Even so, it is worth pausing to reflect on Rep. Westerman's novel color-coded play on words, and what a "Blue New Deal" could entail. Perhaps, it would ensure that the harms of any coming transition are minimized, and the benefits shared equitably across and within societies. Perhaps, it would integrate carbon concepts into existing laws in a rational fashion. Perhaps, it would promote the highest possible offset credit quality in the emerging international carbon market framework, to hold state actors seeking to produce revenues accountable to these very high standards, and call for the consideration of blue carbon consequences in the operation and implementation of any law that governs human interventions into the marine carbon cycles. Perhaps, it would ensure that U.S. ocean carbon management policy contributed only positively to global efforts to combat climate change and protect ocean biodiversity.

Ultimately, the criteria along which blue carbon law should be judged will be familiar ones. Do these laws accomplish what they should? Are they cost effective? Are they fair? In this regard, evidence from the terrestrial carbon management offsetting programs and the state of forests might be worthwhile to consider. Despite LULUCF efforts, despite REDD+, and despite recent recommitments to halt it, worldwide deforestation has continued at a rapid pace, contributing enormously to global greenhouse gas emissions. Is this because these efforts are fundamentally flawed, or because the opposition to them has rendered them less effective than they could otherwise have been? Has the money spent on these programs produced results and bought time for technological innovations and direct emissions reductions to do their work, or has it been wasted on boondoggles and distractions while the climate clock ticks down? And have these funds benefited vulnerable people in any way, or been captured primarily by the wealthy in extractive economies and governments, cementing existing power structures and the disenfranchisement of the many to the benefit of the few?

These questions have dominated the debates over terrestrial carbon management for decades, and, with the rise of blue carbon, are now poised to dominate debates over coastal and marine ecosystem protection for years to come. While appearing new, blue carbon is law is, in fact, an extension of existing ideas applied in a new way. It is hoped that the above exploration, by tying together the disparate-seeming threads, will contribute to the development of a more comprehensive body of rules to protect the environment and the people in it – ever the goals of environmental law.

MIRANDA:

O, wonder!
How many goodly creatures are there here!
How beauteous mankind is! O brave new world,
That has such people in't!

PROSPERO:

... 'Tis new to thee.[216]

[216] WILLIAM SHAKESPEARE, THE TEMPEST, Act 5, Scene 1, lines 182-86 (~1611).

Appendix 1: UNFCCC / Kyoto Protocol Decisions on Crediting Forestry Sinks Activities

Year	Decision	Title
Afforestation/Reforestation Decisions		
1997	1/CP.3	*Adoption of the Kyoto Protocol to the United Nations Framework Convention on Climate Change*
1998	9/CP.4	*Land-use, land-use change and forestry*
1999	16/CP.5	*Land-use, land-use change and forestry*
2001	11/CP.7	*Land use, land-use change and forestry*
2001	15/CP.7	*Principles, nature and scope of the mechanisms pursuant to Articles 6, 12 and 17 of the Kyoto Protocol [joint implementation, clean development mechanism, and emissions trading]*
2001	16/CP.7	*Guidelines for the implementation of Article 6 of the Kyoto Protocol [joint implementation]*
2001	17/CP.7	*Modalities and procedures for a clean development mechanism as defined in Article 12 of the Kyoto Protocol*
2001	18/CP.7	*Modalities, rules and guidelines for emissions trading under Article 17 of the Kyoto Protocol*
2001	19/CP.7	*Modalities for the accounting of assigned amounts under Article 7, paragraph 4, of the Kyoto Protocol*
2002	21/CP.8	*Guidance to the Executive Board of the clean development mechanism [Article 12]*
2003	13/CP.9	*Good practice guidance for land use, land-use change and forestry in the preparation of national greenhouse gas inventories under the Convention*
2003	19/CP.9	*Modalities and procedures for afforestation and reforestation project activities under the clean development mechanism [Article 12] in the first commitment period of the Kyoto Protocol [2008-2012]*
2005	2/CMP.1	*Principles, nature and scope of the mechanisms pursuant to Articles 6, 12 and 17 of the Kyoto Protocol [joint implementation, clean development mechanism, and emissions trading]*

2005	5/CMP.1	*Modalities and procedures for afforestation and reforestation project activities under the clean development mechanism [Article 12] in the first commitment period of the Kyoto Protocol [2008-2012]*
2005	6/CMP.1	*Simplified modalities and procedures for small-scale afforestation and reforestation project activities under the clean development mechanism [Article 12] in the first commitment period of the Kyoto Protocol [2008-2012[and measures to facilitate their implementation*
2008	9/CMP.1	*Guidelines for the implementation of Article 6 of the Kyoto Protocol*
2008	11/CMP.1	*Modalities, rules and guidelines for emissions trading under Article 17 of the Kyoto Protocol [emissions trading]*
2008	16/CMP.1	*Land use, land-use change and forestry*
2008	17/CMP.1	*Good practice guidance for land use, land-use change and forestry activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol*
REDD+ Decisions		
2007	2/CP.13	*Reducing emissions from deforestation in developing countries: approaches to stimulate action*
2009	4/CP.15	*Methodological guidance for activities relating to reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries*
2010	1/CP.16	*The Cancun Agreements: Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention*
2011	2/CP.17	*Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention*
2011	12/CP.17	*Guidance on systems for providing information on how safeguards are addressed and respected and modalities relating to forest reference emission levels and forest reference levels as referred to in decision 1/CP.16*
2012	1/CP.18	*Agreed outcome pursuant to the Bali Action Plan*
2013	9/CP.19	*Work programme on results-based finance to progress the full implementation of the activities referred to in decision 1/CP.16, paragraph 70*

2013	10/CP.19	*Coordination of support for the implementation of activities in relation to mitigation actions in the forest sector by developing countries, including institutional arrangements*
2013	11/CP.19	*Modalities for national forest monitoring systems*
2013	12/CP.19	*The timing and the frequency of presentations of the summary of information on how all the safeguards referred to in decision 1/CP.16, appendix I, are being addressed and respected*
2013	13/CP.19	*Guidelines and procedures for the technical assessment of submissions from Parties on proposed forest reference emission levels and/or forest reference levels*
2013	14/CP.19	*Modalities for measuring, reporting and verifying*
2013	15/CP.19	*Addressing the drivers of deforestation and forest degradation*
2013	16/CP.19	*Alternative policy approaches, such as joint mitigation and adaptation approaches for the integral and sustainable management of forests*
2013	17/CP.19	*Further guidance on ensuring transparency, consistency, comprehensiveness and effectiveness when informing on how all the safeguards referred to in decision 1/CP.16, appendix I, are being addressed and respected*
2013	18/CP.19	*Methodological issues related to non-carbon benefits resulting from the implementation of the activities referred to in decision 1/CP.16, paragraph 70*
2015	16/CP.21	*Alternative policy approaches, such as joint mitigation and adaptation approaches for the integral and sustainable management of forests*
2015	17/CP.21	*Further guidance on ensuring transparency, consistency, comprehensiveness and effectiveness when informing on how all the safeguards referred to in decision 1/CP.16, appendix I, are being addressed and respected*
2015	18/CP.21	*Methodological issues related to non-carbon benefits resulting from the implementation of the activities referred to in decision 1/CP.16, paragraph 7*

BLUE CARBON AND WETLANDS COMPENSATORY MITIGATION: FITTING A CLIMATE-SIZED PEG INTO A WATERSHED-SIZED HOLE

Katie Hill[1] and Amanda C. Spivak[2]

This Article seeks to provide policymakers and coastal resource managers with detailed insights into the challenges and opportunities for incorporating considerations of "blue carbon" into compensatory mitigation required under Clean Water Act Section 404. As our understanding of blue carbon systems deepens, so too does the urgency of responding to the global climate crisis. Commentators have encouraged the inclusion of blue carbon into existing domestic policies, including Clean Water Act Section 404. It is the authors' hope that focused articles such as this can shine a light on which approaches might be most tenable under existing law, directing efforts towards workable solutions.

I. INTRODUCTION

As global efforts to mitigate climate change intensify, the ability of natural resources to sequester and store carbon has received much attention. Some natural systems can remove carbon dioxide from the atmosphere and store it for some time. In recent years, scientific research has identified a category of natural system that has significant sequestration and storage potential: coastal blue carbon.[3] (Throughout this article, we utilize the term "storage" to refer to blue

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[3] The term "blue carbon" may also be used to refer to carbon captured by the world's oceans. *See* *What is Blue Carbon?*, NOAA NAT'L OCEAN SERV. (Aug. 24, 2023). In this article we focus on carbon captured by coastal ecosystems.

carbon systems' ability to not only sequester carbon dioxide from the atmosphere, but also potentially store it for geologically significant periods of time.)[4]

Coastal blue carbon typically refers to three types of coastal ecosystems: mangrove forests, seagrass beds, and tidal marshlands. These systems, which are all found in the U.S., are important carbon sinks and can store carbon at much higher rates than terrestrial forests.[5] They can also provide a wide variety of other services, including community protection from storms, provision of habitat and resources for species, water quality improvements, social and cultural values, and other benefits.[6] In the U.S., policy makers and other actors have incorporated coastal blue carbon into a variety of climate-related actions in recent years, including swelling scientific research,[7] the National Climate Assessment,[8] proposed legislation,[9] carbon offsetting methodologies,[10] and other activities.

In the U.S., many existing statutes are in some way related to coastal blue carbon resources.[11] Commentators have broadly examined ways that these laws can protect or improve the carbon storage potential of coastal blue carbon systems, whether through conservation, restoration, or other means. One potential

[4] *See* Coastal Blue Carbon, NOAA NAT'L OCEAN SERV. (Aug. 16, 2023) (describing the difference between carbon sequestration – the process of capturing carbon dioxide from the atmosphere – and carbon storage – the long-term confinement of carbon in plant materials or sediment). *But see* Sophia Johannessen & James Christian, *Why blue carbon cannot truly offset fossil fuel emissions*, 4 Communications Earth & Env't 411 (2023) (describing a communications gap concerning the timescale differences involved when coastal blue carbon, part of the dynamic modern carbon cycle, is described as offsetting the introduction of ancient fossil fuels into the modern carbon cycle).
[5] *See* Christine Bertram et al., *The blue carbon wealth of nations*, 11 Nature Climate Change 704-709 (2021).
[6] *See* Christine L. May et al., *Focus on Blue Carbon*, in *Fifth National Climate Assessment* (Crimmins, A.R. et al., eds. 2023).
[7] *See, e.g.*, Chongming Zhong et al., *A systematic overview, trends and global perspectives on blue carbon: A bibliometric study* (2003-2021), 148 Ecological Indicators 110063 (2023).
[8] May et al., *supra* note 6.
[9] Blue Carbon for Our Planet Act, H.R. 2750, 117th Congress (2021-2022); Blue Carbon Protection Act, H.R. 3906, 117th Congress (2021-2022).
[10] *See, e.g.*, VERRA, METHODOLOGY FOR TIDAL WETLAND AND SEAGRASS RESTORATION (VM0033), Version 2.1 (2023).
[11] *See* Adam Orford, *Blue Carbon Law*, 13:1 SEA GRANT L. & POL'Y J. 9 (2024).

tactic recommended by some is the inclusion of carbon metrics into compensatory mitigation standards under Section 404 of the Clean Water Act.

Topically speaking, including carbon into Section 404 mitigation standards appears appropriate. Section 404 requires permits for many physical impacts to U.S. waters, including coastal waters, and permittees must compensate for the impacts they cause, typically through restoration of another resource of the same kind in the same watershed. The amount of mitigation required is determined by measuring aquatic functions lost at an impact site. Requiring permittees and mitigation project developers to also measure the carbon storage function lost and gained at impact and mitigation sites, respectively, could help ensure Section 404 does not inadvertently compromise the net carbon storage services of our nation's coastal blue carbon systems.

A closer examination, however, reveals serious challenges to the incorporation of carbon storage metrics into Clean Water Act Section 404. Here, we have identified three. First, it is entirely possible that courts examining the inclusion of carbon storage into the Section 404 program through a separation of powers lens could find that Congress clearly did not intend for the program to cover emissions of carbon dioxide or other greenhouse gases. On this question, we examine both the inclusion of carbon in Section 404 under the lens of existing doctrine and note trends and forthcoming rulings at the U.S. Supreme Court that may make such inclusion even less likely. Second, rules developed for the Section 404 program include a pervasive practicability qualifier that could disqualify data-intensive comprehensive carbon storage analyses. Finally, we note that the decentralized nature of the U.S. Army Corps of Engineers, which administers the Section 404 program, would likely act as a barrier to incorporating carbon storage at a nationwide scale.

Despite these challenges, there may be other methods for protecting the carbon storage values of coastal blue carbon systems through Clean Water Act Section 404. Here, we describe four. First, we note that the National Environmental Policy Act may be an avenue for including carbon storage into Section 404 permitting decisions. Second, we discuss inexact proxies for carbon storage that could be permissible as Section 404 mitigation metrics. Third and

fourth, we describe the use of in-kind mitigation and higher mitigation ratios, both provided for by Section 404 regulations, to require more mitigation for coastal blue carbon systems and, presumably, protect against a net loss of carbon storage values.

II. COMPENSATORY MITIGATION UNDER CLEAN WATER ACT SECTION 404

The primary purpose of the Clean Water Act (CWA) is "to restore and maintain the chemical, physical, and biological integrity of the nation's waters."[12] Among other regulatory programs the CWA established to achieve this goal, Section 404 regulates the discharge of dredge or fill material into U.S. waters, including many blue carbon systems.[13] These aquatic resources "perform critical ecological functions in the landscape, including protecting water quality, regulating water quantity and flows, and providing important habitat for fish and wildlife."[14] By requiring permits for discharges of dredge or fill material – which covers many physical impacts to aquatic resources associated with development and other activities – Section 404 helps to protect important aquatic resource functions and support the purpose of the CWA.

The U.S. Army Corps of Engineers (Corps) and the U.S. Environmental Protection Agency (EPA) share responsibility for the Section 404 program, with permitting authority vested in the Corps.[15] When issuing permits, the Corps must abide by what are known as the "Section 404(b)(1) Guidelines."[16] Under the 404(b)(1) Guidelines' "sequencing" approach, the Corps must first avoid impacts

[12] 33 U.S.C. § 1251(a).
[13] *Id.* § 1344. The recent Supreme Court decision in Sackett v. EPA has greatly limited the scope of the CWA, *Sackett v. EPA*, 598 U.S. 651 (2023). Impacts to blue carbon resources may, however, be limited as the opinion appears to retain CWA coverage over tidally influenced waters. *Id.* at 678-79.
[14] Palmer Hough & Rachel Harrington, *Ten Years of the Compensatory Mitigation Rule: Reflections on Progress and Opportunities*, 49 ENV'T L. REP. NEWS & ANALYSIS 10018 (2019).
[15] 33 U.S.C. § 1344(d).
[16] 33 C.F.R. Part 332; 40 C.F.R. Ch. 1, Subch. H, Pt. 230 (2024). *See also* J.B. Ruhl & James Salzman, *No Net Loss? The Past, Present, and Future of Wetlands Mitigation Banking*, 73 CASE W. RES. L. REV. 411, 417 (2022).

to the aquatic resource at issue, then minimize unavoidable impacts.[17] Finally, the Corps is required to ensure that compensatory mitigation is provided for any remaining impacts.[18] Required mitigation is either incorporated into Section 404 permits by reference to an approved mitigation plan or included as permit conditions.[19]

Before proceeding with a brief overview of the nuts and bolts of the mitigation program, it may be useful to briefly explain how mitigation works in layperson's terms. Generally speaking, compensatory mitigation under CWA Section 404 is accomplished through data collection and measuring. Prospective permittees measure their proposed impacts to an aquatic resource, depending on data required by their Corps district's mitigation standards. Through those standards, these measured data will translate into a certain amount and kind of mitigation the permittee must perform (or pay for) at a certain general location (i.e., mitigation debits accrued). As noted below, this mitigation requirement is incorporated into the Section 404 permit. On the other side of the equation, mitigation project providers also collect data and measure the resource improvements of their projects, which are translated through a Corps district mitigation program into credits that can be used to satisfy Section 404 permit mitigation requirements. Commentators advocating for inclusion of carbon storage into CWA Section 404 standards are, in essence, asking for measurement of another parameter at permit and mitigation sites that will impact the amount of mitigation debits and credits permittees and mitigation providers will accrue, respectively. This could, in theory, ensure that Section 404 permits do not result in a net loss of carbon storage.

[17] 33 C.F.R. § 332.1(c)(2); 40 C.F.R. § 230.91(c)(2).
[18] 33 C.F.R. § 332.1(c)(2); 40 C.F.R. § 230.91(c)(2). Compensatory mitigation is supposed to ensure that the national policy of "no net loss" of wetlands is met. *See* Ruhl & Salzman, *supra* note 16. *See also* Katie Hill et al, *No Net Loss in the U.S. Army Corps Savannah District* 10 (Georgia Environmental Restoration Assoc. 2017).
[19] 33 C.F.R. § 332.4(c)(1); 40 C.F.R. § 230.94(c)(1). For compensatory mitigation required pursuant to a general permit – a class of Section 404 permit for activities that have minimal adverse effects and issued according to an expedited process – a third option exists for the district engineer to approve a conceptual or detailed plan to meet required time frames. Before the permittee begins work covered by the permit, a final plan must be approved by the district engineer. 33 C.F.R. § 332.4(c)(1)(ii).

Mitigation standards – how much mitigation each Section 404 permittee must conduct and how it will be measured, what counts as a valid mitigation project, and other policies – are established by each of the Corps' 39 districts according to national guidelines (see Section IV.C, below). These guidelines are found in the 2008 Compensatory Mitigation Rule (2008 Rule),[20] developed jointly by the Corps and EPA.[21] The 2008 Rule states that compensatory mitigation may be accomplished by restoring, establishing (i.e., creating), enhancing, or preserving aquatic resources, preferably the same kind as those impacted (i.e., "in-kind" mitigation), and preferably in the same watershed in which impacts occur.[22] A Section 404-permitted project that fills in a coastal marsh in the Altamaha River watershed in coastal Georgia could, for example, be compensated for by restoring another marsh in that watershed. The Corps can require higher mitigation-to-impact ratios in a number of circumstances, including for difficult-to-replace resources[23] or when mitigation of lost functions occurs after permitted impacts (otherwise known as "temporal loss").[24] In our example, if the marsh impacted was difficult to replace, or if the aquatic functions lost at the impact site were restored at the mitigation site after the permitted impacts occurred, the permittee could be required to restore more acres of marsh.

The 2008 Rule requires that all compensatory mitigation projects have "objective and verifiable" ecological performance standards that "may be based on variables or measures of functional capacity described in functional assessment methodologies, measurements of hydrology or other aquatic resource characteristics, and/or comparisons to reference aquatic resources of similar type and landscape position."[25] A marsh mitigation project recently approved in coastal Georgia, for example, is governed by four vegetative and three hydrologic

[20] 40 C.F.R. §§ 230.91-98; 33 C.F.R. § 332.
[21] *See* Hough & Harrington, *supra* note 14.
[22] 33 C.F.R. § 332.3; 40 C.F.R. § 230.93.
[23] 33 C.F.R. § 332.3(e)(3); 40 C.F.R. § 230.93(e)(3).
[24] 33 C.F.R. § 332.3(f)(2); 40 C.F.R. § 230.93(f)(2).
[25] 33 C.F.R. § 332.5(b); 40 C.F.R. § 230.95(b).

performance standards.[26] The 2008 Rule also requires monitoring to determine if performance standards are being met.[27]

III. COASTAL BLUE CARBON STORAGE ANALYSES

As this article focuses on whether carbon storage can be incorporated into CWA Section 404 mitigation metrics, a basic understanding of what a carbon storage analysis entails is appropriate. Storage by coastal blue carbon systems is a product of biologic carbon sequestration, whereby plants turn atmospheric carbon dioxide into biomass which then persists for long time periods as either woody products or detritus in soils.[28] There are three primary reasons why coastal blue carbon systems have the potential to be significant carbon sinks. First, coastal blue carbon plants have generally high productivity (i.e., fast growth), sequestering a lot of carbon dioxide in the process.[29] Second, plant detritus accumulates rapidly and decomposes very slowly in soils because, in part, the soil environment is largely anaerobic (without oxygen); this allows plant carbon to persist for hundreds or even thousands of years.[30] Third, regular inundation with sulfate-rich seawater means that these systems emit negligible methane[31] (an issue with their freshwater counterparts).

Although coastal blue carbon systems have *the potential* to store large amounts of carbon, the exact amount stored in a particular system is highly site

[26] MAPACHE, LLC, BANKING INSTRUMENT ISLA DE MAPACHE MITIGATION BANK, CAMDEN COUNTY, GEORGIA 16 (2023).
[27] 33 C.F.R. § 332.6(a)(1); 40 C.F.R. § 230.96(a)(1). Monitoring for the Georgia marsh mitigation project referenced here is primarily conducted with drones and automated data recorders. MAPACHE, LLC, *supra* note 26.
[28] *Frequently Asked Questions, What's the difference between geologic and biologic carbon sequestration?*, U.S. GEOLOGICAL SURV. (USGS) (last visited Feb. 22, 2024).
[29] *Coastal Blue Carbon*, *supra* note 4.
[30] *Id.*
[31] *See* REBECCA SANDERS-DEMOTT ET AL., USGS DATA RELEASE, CARBON DIOXIDE AND METHANE FLUXES WITH SUPPORTING ENVIRONMENTAL DATA FROM COASTAL WETLANDS ACROSS CAPE COD, MASSACHUSETTS (2022).

specific.[32] Coastal wetlands are incredibly dynamic, and their connection to both inland waters and marine systems means that scientifically rigorous carbon storage analyses must examine the "mass balance" of the system, i.e., how much carbon is going into the system, how much is stored in the system, how much is going out into the atmosphere, and how much of that carbon is stored elsewhere.[33] This entails examining factors such as aboveground biomass (i.e., plants), stored soil carbon,[34] emissions of other greenhouse gases from the system, such as methane,[35] and lateral fluxes (how much carbon is coming into the system from upland sources such as sediment in creeks and rivers and how much is leaving the wetland to become part of the marine environment).[36] (There are, however, methods for estimating some of the vital components of a comprehensive carbon storage analysis that are simpler and less expensive to conduct. We discuss the potential for incorporating two of these in Section V.B, below).

[32] *See* Carson Miller et al, *Carbon accumulation rates are highest at young and expanding salt marsh edges*, 3 COMMUNICATIONS EARTH & ENV'T 173 (2022) (showing a range of 14-323 g C m^{-2} yr^{-1} at seven salt marsh sites in North Carolina and noting that "the large range of salt marsh [carbon accumulation rates] creates uncertainty in upscaling measurements, monetizing carbon credits, appraising the value of restoration and conservation projects, and would add speculation to the carbon market").

[33] *See* Forbrich, I., A. E. Giblin, & C. S. Hopkinson, *Constraining Marsh Carbon Budgets Using Long-Term C Burial and Contemporary Atmospheric CO2 Fluxes*, 123 J. GEOPHYS. RES. BIOGEO. 867 (2018). *See also* WETLAND CARBON AND ENVIRONMENTAL MANAGEMENT (Ken W. Krauss et al. eds., 2022).

[34] *See* Amanda Spivak et al, *Global-change controls on soil-carbon accumulation and loss in coastal vegetated ecosystems*, 12 NATURE GEOSCIENCE 685 (2019) (noting that the uncertainty surrounding disturbance effects on soil organic carbon in blue carbon ecosystems "makes it difficult to predict [their] sustainability … and incorporate them into global budgets and management tools," and proposing a conceptual framework to improve predictions of blue carbon soil organic carbon storage).

[35] Methane and other GHG emissions may be reduced due to increased salinity or changing land use at project sites. *See* VERRA, METHODOLOGY FOR TIDAL WETLAND AND SEAGRASS RESTORATION (VM0033), Version 2.0 (2021).

[36] *See* Forbrich, Giblin & Hopkinson, *supra* note 33. *See also* WETLAND CARBON AND ENVIRONMENTAL MANAGEMENT, *supra* note 33.

IV. CHALLENGES TO INCORPORATING CARBON INTO CLEAN WATER ACT SECTION 404

Coastal blue carbon systems can store a significant amount of carbon, and some commentators have suggested that carbon storage should be included as a variable in Corps standards governing Section 404 compensatory mitigation.[37] They note that compensatory mitigation is based on the accrual of aquatic functions that "represent the chemical, biological, and physical integrity of a wetland,"[38] the mitigation rule requires "performance criteria based on the ecological performance of the site,"[39] and carbon "clearly is an important component and characteristic of both soils and vegetation."[40] Because carbon storage is a function that could take some time to restore at mitigation sites, they argue that higher compensation ratios could be justified to account for temporal loss.[41]

Although a laudable goal, incorporating carbon storage into Section 404 mitigation standards may be a rather complicated affair. Legal principles and practical considerations unearth several challenges: separation of powers principles, the mitigation program's focus on practicability, and the decentralized nature of the Corps. We discuss each of these challenges below.

A. Separation of Powers

The first challenge to incorporating carbon storage into mitigation metrics is that a court may find this is not a power authorized by the CWA. This question originates in separation of powers principles enshrined in the U.S. Constitution.

The constitutional principle of separation of powers prohibits federal agencies from acting outside of the authorities granted to them by Congress via

[37] Linwood Pendleton et al, *Considering "Coastal Carbon" in Existing U.S. Federal Statutes and Policies*, 41 COASTAL MGMT. 439, 445 (2013); *see* ALSO RESTORE AMERICA'S ESTUARIES, A NATIONAL BLUE CARBON ACTION PLAN: OPPORTUNITIES AND RECOMMENDATIONS 8 (2022).
[38] Pendleton et al., *supra* note 37, at 445.
[39] *Id.*
[40] *Id.*
[41] *Id.*

statute.[42] The constitution lays out clear and distinct roles for each branch of government, and it is only the legislative branch – Congress – that may set national policies via the adoption of law.[43] The executive branch, which includes federal agencies, is limited to executing policy when given authority under the law.[44] Over the course of our nation's history, numerous disputes have arisen concerning an agency's interpretation of its statutory powers. When these disputes arise, courts are the final arbiters concerning what authorities a statute confers.[45]

When considering the statutory authority of an agency, courts use principles of statutory construction to determine what Congress intended, and will strike down clearly contrary agency interpretations[46] If the intent of Congress is clear, it "is the end of the matter,"[47] and the court and agency "must give effect to the unambiguously expressed intent of Congress."[48] In the case of an ambiguous statute, where the question of whether Congress meant to provide an agency with a particular power is less than clear, existing legal doctrine requires courts to defer to the agency's reasonable interpretation.[49]

Separation of powers considerations pose potentially significant challenges for incorporating carbon storage into CWA Section 404 compensatory mitigation standards. Convincing a court that Congress clearly intended to give EPA and the Corps (or individual Corps districts; see Sec. IV.C, below) power to include carbon storage in compensatory mitigation standards could be a tough row to hoe. If congressional intent on the matter was deemed ambiguous, there is also a real possibility that such an agency interpretation could be deemed unreasonable. Furthermore, the recent tenor of Supreme Court cases suggests that

[42] *See* Whitman v. American Trucking Assoc., 531 U.S. 457 (2001). Separation of powers principles also prohibit Congress from delegating its legislative powers to agencies or the courts. *See* A.L.A. Schechter Poultry Corp. v. United States, 295 U.S. 495, 529 (1935).
[43] U.S. CONST. art. I, § 1.
[44] U.S. CONST. art. II, § 2.
[45] Fed. Election Comm'n v. Democratic Senatorial Campaign Comm., 454 U.S. 27, 32 (1981).
[46] *Id.* (noting that "the courts are the final authorities on issues of statutory construction [and] must reject [agency] constructions of the statute, whether reached by adjudication or rule-making, that are inconsistent with the statutory mandate or that frustrate the policy that Congress sought to implement").
[47] Chevron v. Nat. Res. Def. Council, 467 U.S. 837, 842 (1984).
[48] *Id.*
[49] *Id.*

attempts to broaden the reach of the CWA (or any environmental law) will be met with heightened scrutiny and are more likely to fail.

As described above, long-standing Supreme Court precedent controls judicial interpretation of the extent of statutorily-granted agency authorities. The seminal case in this doctrine is *Chevron v. NRDC*, where the Court first established the principle that courts should defer to reasonable agency interpretations of ambiguous statutes.[50] As we describe below, there is a real possibility that the *Chevron* doctrine may soon be curtailed or even overruled,[51] but as of the writing of this article it is still valid precedent and is used with regularity by lower courts.[52] It therefore deserves consideration when determining whether courts would uphold agency inclusion of carbon storage into CWA Section 404 compensatory mitigation standards.

The initial question posed by *Chevron* is whether congressional intent on agency interpretation of its authority is clear.[53] In other words, did Congress clearly mean to provide the agency with the particular authority at issue when it adopted the guiding statute?

The CWA does not include mention of climate change or carbon, but Congress' failure to name a particular environmental phenomenon or impact in a statute does not necessarily mean that it did not intend to provide authority to address it. Indeed, in *Massachusetts v. EPA* the Supreme Court found clear authority in the Clean Air Act (CAA) for EPA to regulate greenhouse gas emissions from motor vehicles even though the CAA does not reference such pollutants or climate change and, when drafting the law, Congress "might not have appreciated the possibility that burning fossil fuels could lead to global warming."[54] In that case, the Court noted that the Congress that drafted the CAA showed, through its broad language defining pollutants that EPA must regulate in

[50] *Id.*
[51] *See* Kristin Hickman & Aaron Nielson, *The Future of Chevron Deference*, 70 DUKE L. J. 1015 (2021).
[52] *See* Kent Barnett & Christopher Walker, Chevron *in the Circuit Courts*, 116 MICH. L.R. 1 (2017).
[53] *Chevron*, 467 U.S. at 842 (1984).
[54] Mass. v. Env't Prot. Agency, 549 U.S. 497, 532 (2007).

new motor vehicles, that it did "understand that without regulatory flexibility, changing circumstances and scientific developments would soon render the [CAA] obsolete."[55] It quoted another of its decisions, *Pennsylvania Dept. of Corrections v. Yeskey*,[56] where the Court noted that "the fact that a statute can be applied in situations not expressly anticipated by Congress does not demonstrate ambiguity. It demonstrates breadth."[57]

Like the CAA, the CWA does not mention greenhouse gases or climate change. But do the CWA's provisions clearly indicate congressional intent to create flexibility and breadth supporting the inclusion of carbon storage in Section 404 compensatory mitigation standards? Historical accounts of the CWA's development show that a diverse set of interest groups were involved in its creation, and indicate that it was intended to be a comprehensive, broadly applicable law.[58] Indeed, until recently the CWA has been broadly interpreted to authorize a variety of agency programs and policies that support the Act's "guiding star" [59] – "the intent of Congress to improve and preserve the quality of the Nation's waters." [60] The CWA has even been interpreted to apply to discharges to groundwater in certain situations,[61] and the mitigation program itself is an agency-created program that relies on the broad authorities provided by the Act.[62]

Despite the CWA's historically broad interpretation, a reading of its provisions suggests that, when considering carbon storage impacts from Section 404 permits, courts may not find clear statutory authority as in *Massachusetts v. EPA.* Unlike the CAA, the CWA narrowly defines pollutants to include an exclusive list of substances,[63] and only covers the introduction of pollutants from

[55] *Id.*
[56] Pa. Dept. of Corr. v. Yeskey, 524 U.S. 206, 212 (1998).
[57] *Mass. v. Env't Prot. Agency*, 549 U.S. at 532 (quoting *Pa. Dept. of Corr.*, 524 U.S. at 212).
[58] *See* PAUL MILAZZO, UNLIKELY ENVIRONMENTALISTS: CONGRESS AND CLEAN WATER, 1945-1972 (2006).
[59] American Petroleum Institute v. EPA, 540 F.2d 1023, 1028 (1976).
[60] *Id.*
[61] Cnty. of Maui v. Haw. Wildlife Fund, 590 U.S. __, 140 S.Ct. 1462 (2020).
[62] The CWA does not include the term "mitigation."
[63] 33 U.S.C. § 1362(6).

point sources[64] into surface waters.[65] As carbon storage is long-term avoidance of emissions into the atmosphere, we have a mismatch between the medium into which the pollutant is emitted (air or the atmosphere) and where the impacts occur (water).[66] Scholars have described the difficulties this mismatch poses for utilizing the CWA to contend with ocean acidification caused by climate change, noting that CWA permit programs are not applied to other airborne pollutants that clearly impact water quality, such as mercury.[67] Incorporation of carbon storage into CWA Section 404 compensatory mitigation standards could be interpreted as another medium mismatch for which no statutory authority exists.

Adding to this mismatch issue is the fact that regulators have themselves narrowed the applicable medium for CWA Section 404 mitigation. The 2008 Rule mandates that mitigation occurs according to a "watershed approach," where, to the greatest extent practicable, mitigation should occur in the same watershed as

[64] The CWA defines a point source as "any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural stormwater discharges and return flows from irrigated agriculture." 33 U.S.C. § 1362(14).
[65] 33 U.S.C. § 1344(a) (the Corps "may issue permits … for the discharge of dredge or fill material into the navigable waters at specified disposal sites"); 33 U.S.C. § 1362(12) (defining "discharge of a pollutant" and "discharge of pollutants" as "(A) any addition of any pollutant to navigable waters from any point source, (B) any addition of any pollutant to the waters of the contiguous zone or the ocean from any point source other than a vessel or floating craft").
[66] *See* Robin Kundis Craig, *Dealing with Ocean Acidification: The Problem, the Clean Water Act, and State and Regional Approaches*, 6 WASH. J. ENVTL. L. & POL'Y 387, 408 (2016) (describing the challenge with U.S. environmental law's tendency to regulate pollution based on the "medium into which a source emits," including the CWA's application to only pollutants that are discharged into the water).
[67] *Id.* at 414 (stressing that pollutants in air do not trigger CWA permit programs, stating that "even if an ocean acidification hot spot like Puget Sound were surrounded by coal-fired power plants emitting thousands of tons of carbon dioxide into the atmosphere every year, and even if it could be proven that those emissions were exacerbating ocean acidification within the Sound itself, the power plants would not need CWA regulatory … permits").

the permitted impacts.[68] This requirement is based on the scientific reality that watersheds are interconnected aquatic systems where impacts at one location in a watershed can positively or negatively influence aquatic functions in another location in that watershed. Under Section 404, the agencies have indicated concerns not only with pollutant discharges to waters in general, but pollutant discharges to a particular watershed. Including carbon storage in Section 404 compensatory mitigation standards, on the other hand, would require permittees to compensate for pollutant discharges into the air that indirectly impact water quality globally, not at a watershed scale.

Even if a court found that the CWA was ambiguous concerning the authority to include carbon storage in Section 404 compensatory mitigation standards, it seems unlikely that EPA and/or the Corps' decision to so interpret that it did would be deemed "reasonable." As described above, the agencies themselves have already focused the compensatory mitigation program on watershed-scale impacts. Furthermore, as described in Section IV.B below, the implementation of such a requirement may not meet the practicability standards imposed by the 2008 Rule.

Recent decisions also suggest that, generally speaking, the current Supreme Court will be more skeptical when agencies expand the scope of programs and policies under environmental statutes. In *West Virginia v. EPA*, the Court struck down the Obama Administration's Clean Power Plan because it found the plan's method of viewing emissions reductions at the grid rather than the individual facility level was not authorized by Congress under the CAA.[69] In doing so, the Court relied on the newly-enunciated "major questions doctrine," under which "clear congressional authorization" must exist for agency exercises

[68] 33 C.F.R. § 332.3(c) ("The district engineer must use a watershed approach to establish compensatory mitigation requirements in [CWA Section 404] permits to the extent appropriate and practicable… The ultimate goal of a watershed approach is to maintain and improve the quality and quantity of aquatic resources within watersheds through strategic selection of compensatory mitigation sites."); 33 C.F.R. § 332.2 (defining "watershed approach" as "an analytical process for making compensatory mitigation decisions that support the sustainability or improvement of aquatic resources in a watershed … [that] involves consideration of watershed needs, and how locations and types of compensatory mitigation practices address those needs").
[69] W. Va. v. Env't Prot. Agency, 597 U.S. 697 (2022).

of authority that are broader than those historically asserted and possess "economic and political significance."[70] Although it seems unlikely that a court would view the inclusion of carbon storage into Section 404 compensatory mitigation standards as a "major question," this case has been viewed by some as evidence of the current Supreme Court's heightened scrutiny of broadening of agency authorities under environmental statutes in general.[71]

More pointedly, the Supreme Court recently limited the scope of the CWA, with particular implications for the Section 404 program. In *Sackett v. EPA*,[72] the Court held that the Act's definition of "waters of the United States," for purposes of determining coverage of a water body under the act, was limited to "only those relatively permanent, standing or continuously flowing bodies of water forming geographic[al] features that are described in ordinary parlance as streams, oceans, rivers, and lakes,"[73] and wetlands that are "indistinguishably part of a body of water that itself constitutes 'waters' under the CWA."[74] This decision, the most recent in a series of cases concerning the scope of CWA coverage,[75] limits the instances in which a Section 404 permit will be required, although it appears to maintain CWA coverage over tidally-influenced waters.[76] Even before *Sackett*, commentators emphasized the Court's shift in CWA interpretation from a focus on legislative history and the Act's purpose to one rooted in textualism and state's rights.[77] Post-*Sackett*, it would appear that the Court may be even less likely to uphold an expansion of CWA agency authority without clear textual support in the Act.

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[70] *Id.* at 700.
[71] *See* Michael Burger & Cynthia Hanawalt, *The Major Questions Doctrine is a Fundamental Threat to Environmental Protection. Should Congress Respond?*, COLUM. L. SCH., SABIN CTR. FOR CLIMATE CHANGE L.: CLIMATE L. BLOG (Oct. 19, 2023).
[72] Sackett v. Env't Prot. Agency, 598 U.S. 651 (2023).
[73] *Id.* at 671.
[74] *Id.* at 676.
[75] United States. v. Riverside Bayview Homes, Inc., 474 U.S. 121 (1985); Solid Waste Agency of Northern Cook Cnty. v. U.S. Army Corps of Eng'rs, 531 U.S. 159 (2001); Rapanos v. United States, 547 U.S. 715 (2006).
[76] *Sackett*, 598 U.S. at 678.
[77] *See* Stephen Johnson, *From Protecting Water Quality to Protecting States' Rights: Fifty Years of Supreme Court Clean Water Act Statutory Interpretation*, 74 SMU L. REV. 359 (2021).

Finally, it is well worth mentioning that the ways courts interpret agency authorities may soon change, limiting or even eliminating judicial deference to agency decision making. As of the writing of this article, the Supreme Court is poised to hear two cases concerning *Chevron* deference,[78] and legal scholars suggest that the Court may curtail, or even overrule, that seminal decision.[79] Depending on the Court's ruling, agencies may find it even more challenging to respond to emerging issues under existing environmental laws.

B. Practicability

A second challenge for incorporating carbon storage into CWA Section 404 mitigation standards stems from the rule governing compensatory mitigation. This challenge is practicability. Although practicability may only be a challenge for a subset of carbon accounting methodologies, it does bear mentioning here.

Practicability is a "fundamental underpinning" of the 2008 mitigation rule.[80] The term "practicable," which appears in the rule 36 times,[81] is defined as "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes."[82] Practicability considerations can impact Section 404 mitigation in many ways. The 2008 Rule states that compensatory mitigation required for a Section 404 permit must be based not only on the "aquatic resource functions that will be lost," but also on "what is practicable."[83] Practicability is also an element of compensatory

[78] The Court will consider *Loper Bright Enterprises v. Raimondo* and *Relentless, Inc., v. Department of Commerce* in tandem, only addressing the question of whether *Chevron v. NRDC* should be overruled. 601 U.S. 22-1219 (Oct. 13, 2023) (order granting certiorari).
[79] *See* Ethan Leib & Nora Donnelly, *Statutory Interpretation in the 2020s: A View of the Cathedral*, 97 S. CAL. L. REV. Postscript 11, 20 (2024) (noting the repeated dismissal of the *Chevron* doctrine by the Supreme Court and stating that this shows the doctrine's "looming death); Hickman & Nielson, *supra* note 51.
[80] Royal Gardner et al., *Compensating for Wetland Losses Under the Clean Water Act (Redux): Evaluating the Federal Compensatory Mitigation Regulation*, 38 STETSON L. REV. 213 (2009).
[81] 33 C.F.R. § 332; 40 C.F.R. §§ 230.91-98.
[82] 33 C.F.R. § 332.1(c)(2); 40 C.F.R. § 230.91(c)(2).
[83] 33 C.F.R. § 332.3(a)(1); 40 C.F.R. § 230.93(a)(1).

mitigation site selection,[84] amount of mitigation,[85] mitigation timing,[86] ecological performance standards,[87] site management,[88] and standards for particular types of mitigation programs.[89] For our purposes, the 2008 Rule's practicability considerations for ecological performance standards warrant further attention.

Mitigation plans for Section 404 permits "must contain performance standards that will be used to assess whether the project is achieving its objectives."[90] These standards should allow for an objective evaluation of the project,[91] and, importantly, "must be based on the best available science that can be measured or assessed in a practicable manner."[92] Across Corps districts, the practicability qualifier for ecological performance standards has largely been incorporated through the use of rapid assessment methods – notably, the Hydrogeomorphic Approach for Assessing Wetland Functions (HGM Approach).[93] Notably, the HGM Approach uses regional reference sites to compare wetland functions at Section 404 project and mitigation sites, and is designed to "maintain compatibility with the time and resource framework of [Section 404]"[94] by "being timely, accurate and cost-effective."[95]

Practicability could be a barrier to the incorporation of some carbon storage analysis methodologies into Section 404 compensatory mitigation

[84] 33 C.F.R. § 332.3(d); 40 C.F.R. § 230.93(d).
[85] 33 C.F.R. § 332.3(f)(1); 40 C.F.R. § 230.93(f)(1).
[86] 33 C.F.R. § 332.3(m); 40 C.F.R. § 230.93(m).
[87] 33 C.F.R. § 332.5(b); 40 C.F.R. § 230.95(b).
[88] 33 C.F.R. § 332.7; 40 C.F.R. § 230.97.
[89] 33 C.F.R. § 332.8; 40 C.F.R. § 230.98 (practicability standard applies to mitigation banking and in-lieu fee programs).
[90] 33 C.F.R. § 332.5(a); 40 C.F.R. § 230.95(a).
[91] 33 C.F.R. § 332.5(a); 40 C.F.R. § 230.95(a).
[92] 33 C.F.R. § 332.5(b); 40 C.F.R. § 230.95(b).
[93] The National Action Plan To Implement the Hydrogeomorphic Approach To Assessing Wetland Functions**,** 62 Fed. Reg. 33607 (June 20, 1997) [hereinafter HGM Approach]; *see also* *Hydrogeomorphic Approach*, U.S. ARMY CORPS OF ENG'RS (Jan. 18, 2013).
[94] HGM Approach, *supra* note 93, at 33610.
[95] *Id.* at 33611. Commentators have noted the impact of practicability considerations for mitigation ecological performance standards, explaining that "one should distinguish between a research project that is intended to dissect wetland functions at a fine-grained level and performance measures that assess functions at a coarsely grained level," and noting that the former is likely not practicable. Gardner et al, *supra* note 80, at note 115.

standards. The most comprehensive analyses, such as those required for carbon offsetting projects,[96] are complex and data-heavy endeavors. Requiring this type of costly study for Section 404 compensatory mitigation would likely fail to meet the practicability standard. These intensive analyses are, however, utilized to assess how much carbon an individual system can store for the purpose of mitigating global climate change; this purpose would potentially disqualify the use of these analyses due to separation of powers issues even in absence of any practicability standard.

As described in Section V below, there may be other ways of incorporating some level of carbon-related function into CWA Section 404 compensatory mitigation standards that, while falling short of a full carbon storage accounting, can provide reasonable and regionally appropriate estimates. As we will now describe, however, it would be incumbent upon individual Corps districts to develop and implement such methodologies.

C. The Decentralized Nature of the Corps

As if issues of constitutional legitimacy and regulatory practicability weren't enough, there exists a third challenge to the incorporation of carbon storage into Section 404 mitigation standards. Though it may be a small consolation, this barrier does only pertain to the ability to incorporate carbon storage into mitigation standards at a *nationwide* scale.

The Army Corps regulatory program is "highly decentralized,"[97] with most permitting authority, including that for CWA Section 404, delegated to 39 domestic district engineers and 9 division engineers.[98] Although all Corps districts and divisions operate under the same general regulatory principles in the implementation of their Section 404 responsibilities, district engineers maintain significant discretion in program development and permit issuance decision

[96] *See* VERRA, *supra* note 35. *See also* S. SETTELMYER, E. SWAILS & J. EATON, TERRACARBON, HERRING RIVER CARBON PROJECT FEASIBILITY STUDY V.1.7 (2019).
[97] 33 C.F.R. § 320.1(a)(2).
[98] The current regulation appears to use old district and division totals. *Id.* For a current accounting, *see* *Where We Are*, U.S. ARMY CORPS OF ENG'RS (last visited Feb. 26, 2024).

making. Indeed, the "autonomous culture" of Corps districts has been cited in government reports as an impediment to organizational realignment efforts and project cooperation.[99] Corps district discretion is incorporated throughout the 2008 Rule.

The 2008 Rule provides general parameters for mitigation under Section 404 permits.[100] District engineers must "determine the compensatory mitigation to be required in a [Section 404] permit, based on what is practicable and capable of compensating the aquatic resource functions that will be lost as a result of the permitted activity."[101] Importantly, district engineers have discretion in the methods used to determine loss and gain of aquatic resource functions, including the parameters they may measure.

The 2008 rule states that the amount of compensatory mitigation for Section 404 permits "must be, to the extent practicable, sufficient to replace lost aquatic resource functions."[102] The rule establishes a preference for "functional or condition assessment methods" over ratio methods (i.e., those that require at least a one-to-one acreage or linear foot compensation), but only "when practicable."[103] Although the 2008 rule defines the terms "functions" ("the physical, chemical, and biological processes that occur in ecosystems"[104]) and "condition" ("the relative ability of an aquatic resource to support and maintain a community of organisms having a species composition, diversity, and functional organization comparable to reference aquatic resources in the region"[105]), it does not identify specific functional or conditional attributes that must be included in "functional or condition assessment methods." And while EPA and the Corps have endorsed methods such as the HGM Approach, they are by no means required.

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[99] U.S. GOV'T ACCOUNTABILITY OFF., ARMY CORPS OF ENGINEERS: ORGANIZATIONAL REALIGNMENT COULD ENHANCE EFFECTIVENESS, BUT SEVERAL CHALLENGES WOULD HAVE TO BE OVERCOME 21 (2010).
[100] 33 C.F.R. 332. *See also* Hough & Harrington, *supra* note 14.
[101] 33 C.F.R. § 332.3(a)(1); 40 C.F.R. § 230.93(a)(1).
[102] 33 C.F.R. § 332.3(f)(1); 40 C.F.R. § 230.93(f)(1).
[103] 33 C.F.R. § 332.3(f)(1); 40 C.F.R. § 230.93(f)(1).
[104] 33 C.F.R. § 332.2; 40 C.F.R. § 230.92.
[105] 33 C.F.R. § 332.2; 40 C.F.R. § 230.92.

More detail is provided in the 2008 Rule concerning the selection of mitigation sites and evaluation of mitigation plans, but district engineers are still provided with discretion in how they fashion their individual programs. The 2008 Rule lists factors that the district engineer must consider when assessing the "ecological suitability" of mitigation sites.[106] These factors include "soil characteristics… and other physical and chemical characteristics," but do not specifically identify any particular parameters.[107] Likewise, in its consideration of "ecological performance standards" that are used to determine whether the mitigation project is achieving its objectives, the 2008 Rule does not specifically identify any particular performance standard that must be part of a district's Section 404 program.[108] Rather, it states that these standards "may be based on variables or measures of functional capacity described in functional assessment methodologies, measurements of hydrology or other aquatic resource characteristics, and/or comparisons to reference aquatic resources of similar type and landscape position."[109] In practice, mitigation standards and approaches vary across Corps districts based on local conditions and preferences.[110]

It appears unlikely that Section 404 rules would be amended to either require inclusion of one specific parameter – carbon storage – in national

[106] 33 C.F.R. § 332.3(d)(1); 40 C.F.R. § 230.93(d)(1).
[107] 33 C.F.R. § 332.3(d)(1)(i); 40 C.F.R. § 230.93(d)(1)(i).
[108] 33 C.F.R. § 332.5; 40 C.F.R. § 230.95.
[109] 33 C.F.R. § 332.5(b); 33 C.F.R. § 230.95(b). A lack of comparable reference sites can impact the performance standards selected for mitigation sites. *See* MAPACHE, LLC, *supra* note 26 ("Both the Bank Sponsor and the IRT recognize that calibrating performance standards is an imperfect science at this point in time. Statistically valid sets of reference data for the types of habitats being targeted by mitigation sites are not known to comprehensively exist for the State of Georgia. Additionally, it is not practicable for a project sponsor to collect this amount of information on a project by project basis. Therefore, the Bank Sponsor and IRT have worked together to jointly select the best available reference sites and have used best-professional-judgement in order to set performance standards that are believed to be specific, measurable, attainable, realistic, and timely.").
[110] *See* INST. FOR WATER RES., THE MITIGATION RULE RETROSPECTIVE: A REVIEW OF THE 2008 REGULATIONS GOVERNING COMPENSATORY MITIGATION FOR LOSS OF AQUATIC RESOURCES 98 (2015) (showing the large range of mitigation documents for each Corps district).

mitigation standards or standardized mitigation requirements nationwide,[111] which would be contrary to the historically autonomous and decentralized nature of the Corps. If carbon storage or any other measure of carbon is going to make it into Section 404 mitigation standards, it will probably be at the district or division level.

V. OTHER METHODS FOR INCORPORATING CARBON INTO SECTION 404 COMPENSATORY MITIGATION: NEPA, STORAGE PROXIES, AND RATIOS

Although incorporating carbon storage into CWA Section 404 mitigation standards may not be feasible, other options exist that could, in some fashion, help ensure that Section 404-permitted impacts compensate for the loss of carbon storage in coastal wetlands. Here, we consider three methods: National Environmental Policy Act (NEPA) permit conditions, proxies for storage, in-kind mitigation, and mitigation ratios.

A. Permit conditions via NEPA

Although separation of powers principles may prevent inclusion of carbon storage into CWA Section 404 mitigation standards, it may be possible to incorporate it via individual permit decisions. The most likely method would be through NEPA.[112]

NEPA is a procedural statute that requires federal agencies to evaluate the environmental impacts of proposed agency actions, including issuance of permits.[113] Often called the "hard look" law, NEPA's central requirement is that

[111] It should be noted that, as recently as 2019, there was consideration of amending the 2008 rule, though these amendments did not appear to include national standardization of mitigation assessment frameworks. *See* *EPA & Army Corps requests comments on potential changes to compensatory mitigation regulations*, NAT'L ASS'N OF COUNTIES (June 15, 2019).
[112] 42 U.S.C. § 4331 – 4370m. Some commentators have argued that NEPA and other environmental impact assessment laws "provide an important … opportunity for immediate global action on climate change." Caleb W. Christopher, *Success by a Thousand Cuts: The Use of Environmental Impact Assessment in Addressing Climate Change*, 9 VT. J. ENV'T L. 549, 552 (2008).
[113] Sabine River Auth. v. U.S. Dep't of Interior, 951 F.2d 669, 676 (5th Cir. 1992).

agencies prepare a comprehensive (and often expensive) environmental impact statement (EIS) "for any major federal action significantly affecting the quality of the human environment."[114] Agencies often first prepare an Environmental Assessment (EA) to determine whether an EIS is necessary.[115] If the EA leads the agency to determine that the proposed action would result in "significant"[116] environmental impacts, an EIS is required.[117] If the EA shows that the proposed action would not result in significant environmental impacts, the agency issues a Finding of No Significant Impact (FONSI)[118] and has no further obligations under NEPA.

In reality, it is rarely the federal agency that foots the bill for preparation of an EA or EIS. In the case of federal permits, including those issued under Section 404, the permit applicant is responsible for funding the NEPA analysis. Because the preparation of an EIS is a lengthy and expensive endeavor, permit applicants may be willing to agree to less expensive permit conditions that would result in a FONSI. Indeed, courts and the Council for Environmental Quality (CEQ), which administers NEPA, have sanctioned the use of what some call a "mitigated FONSI,"[119] where a project's impacts are "reduced to a less-than-significant level via mitigation conditions attached to the permit."[120]

In January of 2023, the CEQ released the interim "[NEPA] Guidance on Consideration of Greenhouse Gas Emissions and Climate Change" (CEQ GHG Guidance).[121] It states that agencies "should quantify the reasonably foreseeable direct and indirect [greenhouse gas] emissions of their proposed actions and reasonable alternatives,"[122] and notes that "NEPA requires more than a statement

[114] 42 U.S.C. § 4332(2).
[115] 40 C.F.R. § 1508.9.
[116] *See* 40 C.F.R. § 1508.27 (defining the term "significantly").
[117] 42 U.S.C. § 4332.
[118] 40 C.F.R. § 1508.13.
[119] Matthew D. Ross, *Fresh Down the Pipeline: An Analysis of the Fifth Circuit's Decision in Atchafalaya Basinkeeper v. United States Army Corps of Engineers*, 93 TUL. L. REV. 1057, 1064 (2019).
[120] O'Reilly v. U.S. Army Corps of Eng'rs, 477 F.3d 225, 229 (5th Cir. 2007).
[121] National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change, 88 Fed. Reg. 1196 (Jan. 9, 2023) [hereinafter NEPA GHG Guidance].
[122] *Id.* at 1201.

that emissions from a proposed Federal action or its alternatives represent only a small fraction of global or domestic emissions"[123] because "this approach does not reveal anything beyond the nature of the climate change challenge itself."[124] The guidance encourages agencies "to mitigate GHG emissions associated with their proposed actions to the greatest extent possible."[125] It makes clear that difficulties in quantifying GHG emissions are not viewed as insurmountable, and agencies "should seek to present a reasonable estimated range of quantitative emissions for the proposed action and alternatives."[126] It also advises agencies that the "rule of reason" that is "inherent in NEPA and the CEQ regulations"[127] and the "concept of proportionality" should guide their determinations on how to consider environmental impacts and prepare NEPA analyses.[128]

The CEQ GHG Guidance provides specific detail concerning "biogenic" emissions that result from land management practices, including changes to biological GHG sources and sinks from wetlands management.[129] For biogenic emissions, the Guidance states that:

> agencies should include a comparison of net GHG emissions and carbon stock changes that are anticipated to occur, with and without implementation of the proposed action and reasonable alternatives. The analysis should consider the estimated GHG emissions…, carbon sequestration potential, and the net change in relevant carbon stocks in light of the proposed actions and timeframes under consideration, and explain the basis for the analysis.[130]

[123] *Id.*
[124] *Id.*
[125] *Id.* at 1197.
[126] *Id.* at 1202.
[127] *Id.* at 1198.
[128] *Id.* at 1202.
[129] *Id.* at 1207.
[130] *Id.*

Recognizing that "[i]dentifying and analyzing potential mitigation measures is an important component of the NEPA process,"[131] including in how agencies "assess the potential climate change effects of proposed actions and reasonable alternatives,"[132] the CEQ GHG Guidance "encourages agencies to mitigate GHG emissions to the greatest extent possible."[133] It includes carbon sequestration and land management practices as examples of potential mitigation measures.[134]

NEPA and the CEQ GHG Guidance could offer a mechanism for introducing carbon storage considerations into Section 404 permit conditions.[135] Permittees seeking to avoid an expensive and time-consuming EIS[136] could agree to permit conditions requiring compensatory mitigation that would be sufficient to offset estimated biogenic emissions from impacts to coastal wetlands. In practice, this type of mitigated FONSI could be accomplished via mitigation ratios – precisely what commentators suggested could occur through inclusion of carbon storage in mitigation standards. Ratios could be used to account for the uncertainty in carbon storage lost at an impact site and gained via compensatory mitigation, and in-kind mitigation could be required to account for the risk of other wetland types actually acting as a source of GHGs.[137]

Interestingly, there could be potential for the CEQ GHG Guidance to support emerging blue carbon markets. The Guidance notes that agencies should utilize mitigation that meets "appropriate performance standards" to ensure it is "verifiable, durable, enforceable, and will be implemented."[138] Mitigation banks authorized under Section 404 regulations would qualify here, and verified blue carbon projects may as well. If the CEQ GHG Guidance results in more coastal

[131] *Id.* at 1206.
[132] *Id.*
[133] *Id.*
[134] *Id.*
[135] To be fair, this mechanism already existed under NEPA, but CEQ has made it a mandate.
[136] The CEQ GHG Guidance specifically notes that "mitigation can be particularly effective in helping agencies reduce or avoid significant effects." NEPA GHG Guidance, 88 Fed. Reg. at 1206.
[137] *But see* Michael J. Osland et al., *Migration and transformation of coastal wetlands in response to rising seas*, 8 SCI. ADVANCES eabo5174, 2 (2022) (showing the potential for saline coastal wetlands to migrate landward as seas rise and the threats to freshwater wetlands (and the services they provide) this may represent).
[138] NEPA GHG Guidance, 88 Fed. Reg. at 1206.

wetland mitigation being included in Section 404 permits, it could bolster the development of domestic blue carbon projects and markets.

B. Proxies

As described above, comprehensive carbon storage analyses for coastal wetlands are complex endeavors that are unlikely to be included in compensatory mitigation standards because of separation of powers concerns and practicability issues. There are, however, simpler measurements and methods that, while not accounting for the full carbon storage potential of a blue carbon system, do provide useful information about stocks that could be a general proxy for carbon storage. If these measurements were both directly related to water quality and/or aquatic function and were relatively low effort and cost, they could survive the separation of powers and practicability challenges described above. Two potential proxies may deserve attention here: soil carbon content and vertical accretion.

i. Soil Carbon Content

Most of the carbon stored by coastal blue carbon systems is in the soil,[139] and soil carbon can be a measure of aquatic resource function. Soil organic carbon is sometimes referred to as the "glue and sponge" of soils for its ability to stick together soil aggregates,[140] retain water,[141] and provide habitat and energy to soil microorganisms.[142] These physical and biogeochemical services can result in increased water infiltration and nutrient removal,[143] both of which are key components of aquatic resource function. Although measuring soil carbon stocks does not tell you whether the carbon is actually stored long-term,[144] it is a

[139] Ken Krauss, The Blue Carbon Resource: Budget and Vulnerabilities, Presentation at the 2023 Blue Carbon Law Symposium, Athens, GA, May 18, 2023.
[140] D.C. Reicosky, *Conservation Agriculture: Global Environmental Benefits of Soil Carbon Management*, *in* CONSERVATION AGRICULTURE 3, 4 (L. Garcia-Torres et al., eds., 2003).
[141] *See* Dianna Bagnall et al., *Carbon-sensitive pedo-transfer functions for plant available water*, 86 SOIL SCI. SOC'Y OF AMERICA J. 612 (2022).
[142] Reicosky, *supra* note 140, at 4.
[143] *See Grounded in Soil: Water Quality Benefits from Healthy Soils*, PENN STATE EXTENSION (May 11, 2020).
[144] *See* Gabriel Popkin, *A Soil-Science Revolution Upends Plans to Fight Climate Change*, QUANTA MAG. (July 27, 2021).

relatively simple process and can be a useful stand-in.[145] Studies have examined soil carbon stocks in tidal wetlands across the conterminous U.S.,[146] and a global consortium of researchers and land managers has compiled a Coastal Carbon Data Library and a Coastal Carbon Atlas that could be used to identify regional reference sites for soil carbon stocks.[147]

Soil carbon typically takes longer to establish than frequently utilized indicators of aquatic function at Section 404 impact and mitigation sites. Other commonly used indicators respond very quickly following a restoration or other management action. Plant species composition and biomass, for example, can often reach levels of a natural site within 2-5 years (excluding trees). Soil carbon, on the other hand, may take much longer to restore.[148] Higher mitigation ratios, based on temporal loss, could be appropriate here and help ensure that the carbon storage balance of the permitted impact would tend towards a carbon sink rather than a source.

Research on soil carbon content's impacts on water quality and aquatic function does, however, appear to be limited in scope and generally applied to agricultural contexts. This could make it an awkward fit for compensatory mitigation standards. In addition, selection of representative reference sites for comparison would be required to ensure target soil carbon content was reasonable. This may be challenging given the dynamic nature of coastal systems.

ii. Vertical accretion

Vertical accretion essentially refers to a coastal blue carbon system "building up" over time.[149] Historic diking and drainage of coastal marshes and

[145] *See* James R. Holmquist et al., *Accuracy and Precision of Tidal Wetland Soil Carbon Mapping in the Conterminous United States*, 8 SCI. REP. 9478 (2018); Spivak et al., *supra* note 34, at 685-692.
[146] Holmquist et al., *supra* note 145.
[147] *Coastal Carbon Research Network*, SMITHSONIAN ENV'T RSCH. CTR. (last visited Feb. 26, 2024).
[148] Pendleton et al., *supra* note 37, at 445.
[149] Judith Drexler et al., *Carbon accumulation and vertical accretion in a restored versus historic salt marsh in southern Puget Sound, Washington, United States*, 27 RESTORATION ECOLOGY 1117 (2019).

other coastal blue carbon systems – once common practices for flood control, infrastructure management, waterfowl benefits, and agricultural conversion[150] – separated them from tidal action and made them vulnerable to various forms of degradation that limit accretion and other processes.[151] Coastal wetland restoration projects, including those utilized as Section 404 mitigation sites, often involve techniques designed to restore tidal inundation, which should result in an increase in vertical accretion.[152] Other restoration techniques, such as sediment stabilization via revegetation, can also increase vertical accretion.[153]

Accretion can be indicative of healthy coastal wetland systems and is a key element in determining their vulnerability to submergence from sea level rise.[154] It can also show how these systems are *responding* to sea level rise: higher water levels can actually cause coastal wetland vegetation to increase biomass higher in the water column, which can trap sediment and cause other processes

[150] *Id.*
[151] *Id.*; Christopher Craft et al., *Twenty-five years of ecosystem development of constructed spartina alterniflora (loisel) marshes*, 9 ECOLOGICAL APPLICATIONS 1405 (1999); D. Burdick et al., *Ecological responses to tidal restorations of two northern New England salt marshes*, 4 WETLANDS & ECOLOGY MGMT. 129 (1996); Christopher Craft et al., *Fifteen Years of Vegetation and Soil Development after Brackish-Water Marsh Creation*, 10 RESTORATION ECOLOGY 248 (2002); Megan Eagle et al., *Soil carbon consequences of historic hydrologic impairment and recent restoration in coastal wetlands*, 848 SCI. TOTAL ENV'T 157682 (2002).
[152] Drexler et al., *supra* note 149; Craft et al., *Twenty-five years of ecosystem development of constructed spartina alterniflora (loisel) marshes*, *supra* note 151; Burdick et al., *supra* note 151; Craft et al., *Fifteen Years of Vegetation and Soil Development after Brackish-Water Marsh Creation*, *supra* note 151; Eagle et al., *supra* note 151.
[153] Drexler et al., *supra* note 149; Craft et al., *Twenty-five years of ecosystem development of constructed spartina alterniflora (loisel) marshes*, *supra* note 151; Burdick et al., *supra* note 151; Craft et al., *Fifteen Years of Vegetation and Soil Development after Brackish-Water Marsh Creation*, *supra* note 151; Eagle et al., *supra* note 151; G. Curado et al., *Vertical sediment dynamics in* Spartina maritima *restored, non-restored and preserved marshes*, 47 ECOLOGICAL ENG'G 30 (2012).
[154] Simon M. Mudd et al., *Impact of dynamic feedbacks between sedimentation, sea-level rise, and biomass production on near-surface marsh stratigraphy and carbon accumulation*, 82 ESTUARINE, COASTAL, & SHELF SCI. 377 (2009); Torbjörn E. Törnqvist et al., *Coastal Wetland Resilience, Accelerated Sea-Level Rise, and the Importance of Timescale*, 2 AGU ADVANCES e2020AV000334 (2021); KATHLEEN GOODIN ET AL., NATURESERVE, ECOLOGICAL RESILIENCE INDICATORS FOR FIVE NORTHERN GULF OF MEXICO ECOSYSTEMS 56 (2018).

that will increase accretion and "build up" the wetland system.[155] As such, it may be a legally defensible measure of aquatic function appropriate for inclusion in Section 404 standards. Additionally, accretion can also be a proxy for soil carbon accumulation in restored coastal wetlands; studies indicate that as restored coastal wetlands vertically accrete they also accumulate soil carbon.[156] Research also suggests that carbon accumulation rates are highest at young and expanding marsh edges.[157]

Accepted methods for measuring vertical accretion could meet the practicability requirements of the 2008 Rule. Short-term deposition can be measured using white feldspar clay as a marker horizon – essentially, something placed on top of the marsh sediment that acts as a point of reference when later measuring soil cores.[158] Such methods are rather inexpensive,[159] and while short-term deposition is not a suitable proxy for soil carbon it can be indicative of the restoration of aquatic function. The "gold standard" for measuring longer-term accretion, using radioisotopes to create geochronological models,[160] may also fall within the parameters of practicability depending on overall project costs. Depending on the number of samples analyzed, total costs could range somewhere between a few hundred to a few thousand dollars. A lack of reference sites could be a challenge with measurement of vertical accretion, but tools such as the Coastal Carbon Data Library and Coastal Carbon Atlas could potentially be used to find regionally appropriate values.

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[155] *See* News Release, National Science Foundation, Wetlands' ability to overcome sea level rise threatened (Dec. 4, 2013).
[156] Drexler et al., *supra* note 149.
[157] Miller et al., *supra* note 32.
[158] *See* Marker Horizons, TIDAL MARSH MONITORING (last visited Feb. 26, 2024).
[159] For a ~100-acre site, feldspar deposition monitoring could cost in the hundreds of dollars for equipment and measurements, personnel costs excluded. Email communication with Amanda Spivak, Associate Professor, Univ. of Ga. Dep't of Marine Sci. (June 29, 2023) (on file with author).
[160] James T. Morris & William B. Bowden, *A Mechanistic, Numerical Model of Sedimentation, Mineralization, and Decomposition for Marsh Sediments*, 50 SOIL SCI. SOC'Y AM. J. 96 (1986); James T. Morris et al., *Contributions of organic and inorganic matter to sediment volume and accretion in tidal wetlands at steady state*, 4 EARTH'S FUTURE 110 (2016).

Whether or not mitigation ratios would be influenced by accretion measurements would depend on how they were linked to performance standards for the mitigation site. If performance standards focused on the *rate* of accretion – i.e., whether the site was gaining sediment at a speed that indicated it was "on track" to reach reference site levels – standards could be met rather quickly. If, on the other hand, performance standards focused on the *level* of accretion – i.e., a goal for total amount of accretion desired – it could take long enough (in the order of decades) such that higher ratios could be warranted.

C. In-Kind Mitigation with Higher Mitigation Ratios

As noted in Section IV above, some commentators have suggested that an environmental benefit of including carbon storage in Section 404 mitigation standards is that it may justify higher mitigation ratios based on the temporal loss of carbon storage functions. And as noted in Section V.B, proxies for carbon storage could also trigger higher ratios based on temporal loss. These mechanisms all, however, involve varying degrees of additional (and potentially unwelcome) data collection and analysis for Section 404 permittees, mitigation professionals, and regulators. There may, however, be a much simpler mechanism for achieving the same ends.

The 2008 Rule states a preference for in-kind mitigation, where the mitigation project is conducted in "a resource of similar structural and functional type to the impacted resource."[161] When discussing this preference, it uses coastal wetlands as an example, noting that "tidal wetland compensatory mitigation projects are most likely to compensate for unavoidable impacts to tidal wetlands."[162] Although district engineers may use out-of-kind mitigation when it "will serve the aquatic resource needs of the watershed,"[163] the preference for in-kind mitigation and significant discretion afforded to district engineers indicates that a stringent focus on in-kind mitigation for specific resource types could be justifiable.

[161] 33 C.F.R. § 332.2; 40 C.F.R. § 230.92.
[162] 33 C.F.R. § 332.3(e)(1); 40 C.F.R. § 230.93(e)(1).
[163] 33 C.F.R. § 332.3(e)(2); 40 C.F.R. § 230.93(e)(2).

The 2008 Rule also requires that district engineers use mitigation ratios greater than one-to-one in a number of situations, including where necessary to account for the likelihood of success and the difficulty of restoring the desired aquatic resource type and functions.[164] Importantly, there is no medium limitation on this provision; the likelihood of success and the difficulty in restoring the resource type and functions could be caused by a wide range of factors, including global climate change. As global climate change causes seas to rise, coastal wetlands of all kinds will be vulnerable to its effects. Some coastal blue carbon systems will be inundated, and some will migrate landward, displacing freshwater wetlands and upland land covers.[165] Indeed, these threats suggest that higher mitigation ratios for *all* types of coastal wetland classes, including freshwater wetlands that may not qualify as blue carbon, could be warranted.[166]

If Corps districts required in-kind mitigation and higher mitigation ratios for coastal blue carbon resources, carbon storage functions lost at Section 404 permit sites would be more likely to be replaced by compensatory mitigation. In-kind mitigation could help Corps districts avoid situations in which a coastal blue carbon system is mitigated for with restoration of a different resource type that may be a source of carbon dioxide and other greenhouse gases (for example, when impacts to a coastal marshland are mitigated by restoring a freshwater wetland). Higher mitigation ratios could help account for the variability in carbon storage among blue carbon resource sites; if a mitigation site stored less carbon per acre than an impact site, requiring a higher ratio may still result in no net loss, or even a net gain, in carbon storage function.

VI. CONCLUSION

Incorporation of carbon metrics into Section 404 compensatory mitigation standards appears to be a losing proposition if the purpose is to mitigate global climate change by replacing lost carbon storage functions of blue carbon

[164] 33 C.F.R. § 332.3(f)(2); 40 C.F.R. § 230.93(f)(2).
[165] *See* Osland et al., *supra* note 137, at 2; Nathan McTigue et al., *Sea Level Rise Explains Changing Carbon Accumulation Rates in a Salt Marsh Over the Past Two Millennia*, 124 J. GEOPHYSICAL RSCH.: BIOGEOSCIENCES 2945 (2019).
[166] At the very least, regulators should be paying close attention to the potential of "barriers, opportunities, and trade-offs for wetland landward migration." Osland et al., *supra* note 137, at 5.

resources. Separation of powers principles are the most significant hurdle here, with practicability concerns and the decentralized nature of the Corps also limiting the potential scope of such a proposal. These barriers do not, however, completely preclude any consideration of carbon storage in the context of Section 404 permitting and compensatory mitigation. Other avenues exist that could survive judicial scrutiny, including mitigation pursuant to NEPA, carbon storage proxies that are also elements of aquatic function, and a focus on in-kind mitigation with higher mitigation ratios for coastal wetlands under existing Section 404 regulations. There may be other opportunities beyond those included here. Global climate change is testing the adaptability of existing environmental laws, and interdisciplinary cooperation among lawyers, scientists, and other experts will be required to understand what is legally possible in the U.S. as we contend with a warming world.

LEGAL CONSIDERATIONS FOR COASTAL BLUE CARBON PROJECTS IN GEORGIA AND LOUISIANA

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I. INTRODUCTION

Restoration of coastal wetlands and natural carbon sequestration are global priorities. Yet, there are currently no carbon credits being generated by coastal wetlands blue carbon offset projects in the United States. The best available science increasingly indicates the potential for a financially viable blue carbon offset program for coastal wetlands. A financially viable blue carbon accreditation mechanism has the potential to partially fund valuable wetland restoration and maintenance critical to coastal regions in Louisiana, Georgia, and other states with extensive coastal wetlands. In addition to carbon sequestration, wetlands provide a plethora of ecosystem services, including providing wave attenuation, bird and wildlife habitat, fishery benefits, recreation, and improved water quality.

There are currently no federal or state laws related specifically to blue carbon markets. However, states like Georgia can serve as a model, based on its Carbon Sequestration Registry for forest-based carbon sequestration. Georgia has legislation that is not explicitly about coastal blue carbon but does lay the groundwork for it. Likewise, Louisiana has made legislative changes to use the funds generated by state-sponsored coastal blue carbon projects to finance coastal restoration activities. Louisiana has also produced the first climate action plan within the United States that specifically calls for action on blue carbon.

This article examines legal and policy considerations for voluntary blue carbon markets in Louisiana and Georgia and stems from Sea Grant's Blue

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Carbon Law Symposium, which included a Blue Carbon Network Meeting. The Blue Carbon National Working Group also held a workshop at State of the Coast 2023.[4] Further, this article reviews the role of ecosystem services as co-benefits in coastal blue carbon verification and valuation.

A. Meeting International Climate Goals

Climate change is a global challenge that has led to unprecedented global attention on solutions. The Paris Agreement, originally adopted in 2015, calls on countries to reduce their emissions of greenhouse gases (GHGs), or nationally determined contributions (NDCs). The Biden Administration has set a target to reduce carbon emissions by 50-52% compared to 2005 levels by 2030.[5] The United States and other developing countries have also pledged to mobilize a combined $100 billion to finance climate sustainability efforts for developing countries under the United Nations Framework Convention on Climate Change (UNFCCC).[6] The Oxford Principles for Net Zero Aligned Carbon Offsetting urged voluntary carbon markets to implement a higher standard for quality, nature-based carbon sequestration projects.[7]

Likewise, corporations are making bold net zero carbon pledges, motivated by consumer and shareholder demands. These corporations have created a demand for high-quality carbon offsets, which can often be of higher value.[8]

The conversation has grown from not just cutting emissions but also using the natural environment to sequester GHGs. The 2009 Manado Oceans

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[4] *Sea Grant Blue Carbon Law Symposium*, SOUTH CAROLINA SEA GRANT CONSORTIUM (last visited Jan. 22, 2024). *See also Blue Carbon National Working Group*, RESTORE AMERICA'S ESTUARIES (last visited Mar. 6, 2024).
[5] THE WHITE HOUSE, FACT SHEET: PRESIDENT BIDEN'S LEADERS' SUMMIT ON CLIMATE (2021).
[6] Julie Bos & Joe Thwaites, *Technical Note: A Breakdown of Developed Countries' Public Climate Finance Contributions Towards the $100 Billion*, WORLD RES. INST. (Oct. 5, 2021).
[7] M. ALLEN, K. AXELSSON, B. CALDECOTT, T. HALE, C. HEPBURN, C. HICKEY, E. MITCHELL-LARSON, Y. MALHI, F. OTTO, N. SEDDON. & S. SMITH, S., UNIVERSITY OF OXFORD, THE OXFORD PRINCIPLES FOR NET ZERO ALIGNED CARBON OFFSETTING 15 (2020).
[8] *Carbon Offset Market Could Reach $1 Trillion With Right Rules*, BLOOMBERG NEF (Jan. 23, 2023).

Declaration stressed the importance of nations to develop strategies for sustainable management of coastal ecosystems for both their benefits as buffer zones and "significant potential for addressing the adverse effects of climate change."[9]

The Intergovernmental Panel on Climate Change (IPCC) assessed the potential of using coastal ecosystems as a tool to mitigate climate change and found that these coastal ecosystems can sequester an estimated 2% of current global emissions.[10] The IPCC stressed the importance of protecting coastal ecosystems and the additional benefits that "blue carbon ecosystems" have on water quality, biodiversity, and fisheries.[11] Likewise, the United States has released the Ocean Climate Action Plan, which stressed the importance of blue carbon and the need to restore and protect coastal wetlands.[12]

B. Blue Carbon Overview

The term "blue carbon" describes the ability of marine ecosystems to capture and store carbon in a manner that is amenable to management.[13] The component relevant for Louisiana and Georgia is carbon captured in coastal blue carbon ecosystems, the IPCC defines as tidal marshes, mangroves, and seagrasses. Managing coastal blue carbon presents an opportunity to generate revenue for and from coastal restoration by generating greenhouse gas offset credits from restoration or preserving these coastal habitats to incentivize private investment in coastal restoration. Coastal blue carbon ecosystems have potential to offset greenhouse gas emissions that industries cannot otherwise reduce.[14]

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[9] Manado Oceans Declaration, ¶ 2 (May 14, 2009) (World Ocean Conference).
[10] Nerilie Abram et al., *Summary for Policymakers*, *in* IPCC SPECIAL REPORT ON THE OCEAN AND CRYOSPHERE IN A CHANGING CLIMATE 3, 30 (C.2.4.) (H.-O. Pörtner et al., eds., Cambridge University Press, 2019). *See also* Amro Abd-Elgawad et al., *Technical Summary*, *in* IPCC SPECIAL REPORT ON THE OCEAN AND CRYOSPHERE IN A CHANGING CLIMATE 39 (H.-O. Pörtner et al., eds., Cambridge University Press, 2019).
[11] Abram et al., *supra* note 10.
[12] OCEAN POLICY COMM., THE WHITE HOUSE, OCEAN CLIMATE ACTION PLAN (2023).
[13] *Annex I: Glossary*, *in* IPCC SPECIAL REPORT ON THE OCEAN AND CRYOSPHERE IN A CHANGING CLIMATE (Nora M. Weyer ed., Cambridge University Press, 2019).
[14] Daniel Friess, Jen Howard, Mark Huxham, Peter Macreadie & Finnley Ross, *Capitalizing on the Global Financial Interest in Blue Carbon*, 1:8 PLOS CLIMATE e0000061 (2022).

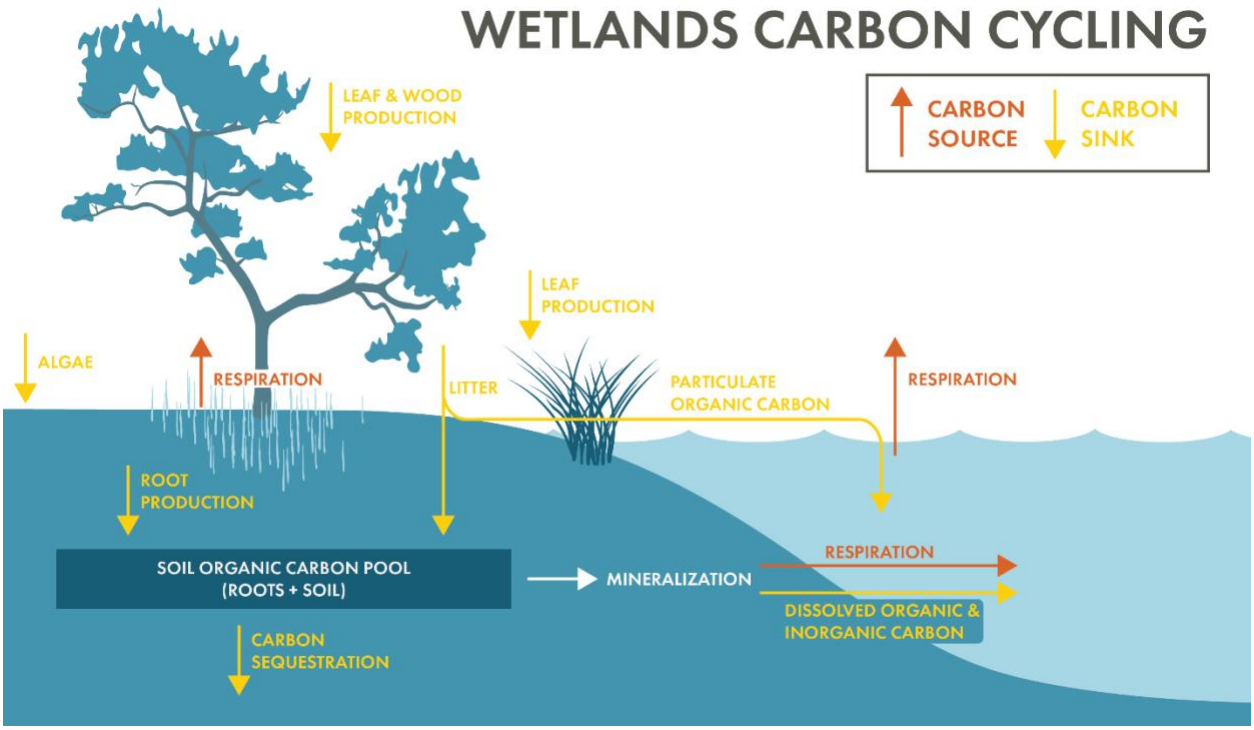

Figure 1. This illustration provides a high-level overview of how carbon is naturally sequestered in a coastal blue carbon environment.[15]

Until recently, most of the focus on natural carbon sequestration has been on forests and mangroves. However, the National Ocean Service has estimated that mangroves and coastal wetlands are ten times more efficient at sequestering carbon than certain forests.[16] Forest conservation and its contribution to carbon sequestration is important. However, the potential coastal wetlands have for sequestrating carbon and creating a funding mechanism for restoration should not be overlooked.

Voluntary carbon markets provide an opportunity for companies to buy different types of credit to offset their greenhouse gas emissions. The value of global voluntary carbon markets surpassed $2 billion in 2021, with the average

[15] Figure created by the Water Institute.
[16] *Coastal Blue Carbon*, NAT'L OCEAN SERV. (August 16, 2023).

price per ton for Forestry and Land Use being $5.80.[17] The types of carbon credit also showed natural carbon sequestration is growing in relevance, as 46% of the traded volume in 2021 was Forestry and Land Use.[18] This shows there is a demand for nature-based carbon credits, and a voluntary blue carbon market has the potential to generate substantial funding.

The Biden Administration has pushed for climate action, and specifically, advancing nature-based restoration projects.[19] However, the expansion of voluntary blue carbon markets could be accelerated with additional federal support by way of providing a tax credit or other incentive to keep naturally sequestered GHGs in the ground (i.e., protect existing wetlands) and an additional incentive for restoring wetlands.

The science surrounding blue carbon continues to advance due to the urgent need for climate solutions. If coastal blue carbon is to be capitalized on as a mitigation solution, there is an urgent need for the parallel advancement of blue carbon laws and policies.

II. ADDITIONAL BENEFITS OF BLUE CARBON ECOSYSTEM RESTORATION AND PROTECTION

As stated above, there is international interest in not just reducing carbon emissions, but also in protecting coastal ecosystems due to the community benefits gained from coastal ecosystems, such as reducing erosion and improving water quality, biodiversity, bird habitat, recreation, and fisheries.[20] The term often used to reference the economic and socio-cultural benefits natural ecosystems

[17] FOREST TRENDS' ECOSYSTEM MARKETPLACE, THE ART OF INTEGRITY: STATE OF VOLUNTARY CARBON MARKETS, Q3 INSIGHTS BRIEFING (2022).
[18] *Id.*
[19] THE WHITE HOUSE, NATURE BASED SOLUTIONS RESOURCE GUIDE (2022). *See also* THE WHITE HOUSE, A REPORT TO THE NATIONAL CLIMATE TASK FORCE: OPPORTUNITIES FOR ACCELERATING NATURE-BASED SOLUTIONS: A ROADMAP FOR CLIMATE PROGRESS, THRIVING NATURE, EQUITY, AND PROSPERITY (2022).
[20] Abram et al., *supra* note 10, at C.2.4; MILLENNIUM ECOSYSTEM ASSESSMENT, ECOSYSTEMS AND HUMAN WELL-BEING: CURRENT STATE AND TRENDS, VOLUME 1 (Rashid Hassan, Robert Scholes & Neville Ash, eds., 2005).

provide is "ecosystem services."[21] Coastal blue carbon ecosystems across the United States are critically important for conservation and resilience efforts. These ecosystems provide important nursery ground for fisheries, bird nesting habitat, protection for communities against coastal erosion and a range of ecological, economic, and cultural benefits.[22]

The economic benefit of restoring and protecting coastal wetlands is also proving to be incredibly high. The cost of coastal land loss without restoration and resilience projects could increase in Louisiana alone by up to $19 billion annually.[23] These benefits in and of themselves provide economic drivers for restoration; however, of growing interest is the capacity of wetlands to naturally sequester carbon. Blue carbon ecosystems play a critical role in helping the global community reach its carbon reduction goals.[24]

The loss of coastal habitat has significant biodiversity, economic, and social consequences. For example, coastal wetland degradation and loss has reduced the size and diversity of fish populations, affecting the sustainability of commercial and recreational fisheries.[25] Estuaries, including tidal wetlands, generate approximately half of the commercially harvested seafood in the United States.[26] One 2019 study indicated that U.S. fisheries supported 1.8 million jobs and contributed $255 billion to the economy.[27]

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[21] JORDAN R. FISCHBACK, SOUPY DALYANDER, TIM CARRUTHERS, COLLEEN MCHUGH, ALLISON DEJONG, BRETT MCMANN, ABBY LITTMAN, ALLISON HAERTLING, PATRICK KANE & CRAIG A. BOND, WATER INST. OF THE GULF, ENHANCING BENEFITS EVALUATION FOR WATER RESOURCES PROJECTS: CASE STUDY ANALYSIS RESULTS AND RECOMMENDATIONS (2023).
[22] INTERAGENCY COASTAL WETLANDS WORKGROUP, RECOMMENDATIONS FOR REDUCING WETLAND LOSS IN COASTAL WATERSHEDS OF THE UNITED STATES (2022); Betsy Von Holle et al., *Effects of Sea Level Rise on Coastal Species*, 83 J. WILDLIFE MGMT. 694 (2019).
[23] Xinyu Fu & Jie Song, *Assessing the Economic Costs of Sea Level Rise and Benefits of Coastal Protection: A Spatiotemporal Approach*, 9 SUSTAINABILITY 1495 (2017); LA. COASTAL PROT. & RESTORATION AUTH., LOUISIANA'S COMPREHENSIVE MASTER PLAN FOR A SUSTAINABLE COAST 39 (2023) (Without restoration and resilience projects "flood damages could increase by up to $19 billion annually.").
[24] PEW CHARITABLE TRUST, COASTAL 'BLUE CARBON': AN IMPORTANT TOOL FOR COMBATING CLIMATE CHANGE (2021).
[25] *Id.* at 21; *See also* Lindsay Wylie, Ariana E. Sutton-Grier & Amber Moore, *Keys to Successful Blue Carbon Projects: Lessons Learned from Global Case Studies*, 65 MARINE POL'Y 76 (2016).
[26] LA. COASTAL PROT. AND RESTORATION AUTH., *supra* note 23.
[27] NAT'L MARINE FISHERIES SERV., FISHERIES ECONOMICS OF THE UNITED STATES 2019 (2022).

The nation is losing an average of 80,160 acres of coastal wetlands each year due to sea level rise, subsidence, erosion, drainage, and development.[28] Further, when wetlands are lost, not only are their ecosystem services lost, but GHGs are released. [29] It is estimated that up to 1.02 billion tons of carbon dioxide equivalent is released from degraded coastal wetlands on an annual basis.[30] Thus, while it is of global significance to restore coastal blue carbon ecosystems from a sequestration standpoint, it is also critical to protect intact blue carbon systems so as not to release GHGs.

Within the voluntary blue carbon market, projects vary in value, based on the amount of carbon sequestered. Projects that have co-benefits are considered high quality and usually have a higher value.[31] For example, certain projects can be certified as a Verra Climate, Community & Biodiversity (CCB) Gold project. This qualification would require alignment with the CCB Standards.[32] Projects that meet these higher standards due to verifiable co-benefits will be of higher value than if the same project did not verify the co-benefits.

[28] THOMAS E. DAHL & SUSAN-MARIE STEDMAN, U.S. FISH & WILDLIFE SERV. & NAT'L MARINE FISHERIES SERV., STATUS AND TRENDS OF WETLANDS IN THE COASTAL WATERSHEDS OF THE CONTERMINOUS UNITED STATES 2004 TO 2009 (2013) (on-file with author).
[29] Yongjiu Feng, Shurui Chen, Xiaohua Tong, Zhenkun Lei, Chen Gao & Jiafeng Wang, *Modeling Changes in China's 2000–2030 Carbon Stock Caused by Land Use Change*, 252 J. CLEANER PROD. 119659 (2020).
[30] Linwood Pendleton, Daniel C. Donato, Brian C. Murray, Stephen Crooks, W. Aaron Jenkins, Samantha Sifleet, Christopher Craft, James W. Fourqurean, J. Boone Kauffman, Nu´ ria Marba`, Patrick Megonigal, Emily Pidgeon, Dorothee Herr, David Gordon & Alexis Baldera, *Estimating Global "Blue Carbon" Emissions from Conversion and Degradation of Vegetated Coastal Ecosystems*, 7:9 PLoS ONE no. e43542 (2012).
[31] CONSERVATION INTERNATIONAL ET AL., HIGH-QUALITY BLUE CARBON PRINCIPLES AND GUIDANCE (2022).
[32] VERIFIED CARBON STANDARDS (VCS) PROGRAM, THE CLIMATE, COMMUNITY & BIODIVERSITY STANDARDS (3rd Ed. 2017).

III. BLUE CARBON PROJECTS IN THE UNITED STATES

As of 2020, roughly 2.15 billion people live within 100 kilometers (about 62.14 miles) of the coastline, in the near coastal zone.[33] More than 600 million people live in a coastal area less than ten meters above sea level.[34] In the United States, 127 million people live in coastal communities, accounting for a population density over five times greater in coastal shoreline communities than the U.S. average.[35] Because of dense coastal populations, it is imperative to protect the coasts. However, restoring and maintaining coastal environments requires funding. Blue carbon markets have the potential to raise capital to fund coastal restoration projects that in turn, provide a range of ecosystem services.

The United States does not have blue carbon standards in law or policy at this time. However, the Ocean Climate Action Plan outlines the need for more research, monitoring, and standards for blue carbon management.[36] An independent carbon credit entity, such as Verra, American Carbon Registry, or Gold Standard, verifies the project. The credits sold to buyers come with the understanding that the carbon credit certification has an accurate methodology to determine the credits being sold actually deliver the said carbon offsets.

The federal government is also looking holistically at project benefits. For example, studies have shown that focusing exclusively on project cost and a limited set of economic benefits from nature-based solutions fails to capture the full impacts of these projects.[37]

There has also been an emergence of valuing the ecosystem services that blue carbon ecosystems provide. The federal agencies have been working with

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[33] Lena Reimann, Athanasios T. Vafeidis & Lars E. Honsel, *Population development as a driver of coastal risk: Current trends and future pathways*, 1 CAMBRIDGE PRISMS: COASTAL FUTURES e14, 1–12 (2023).
[34] Kytt MacManus, Deborah Balk, Hasim Engin, Gordon McGranahan & Rya Inman, *Estimating population and urban areas at risk of coastal hazards, 1990–2015: How data choices matter*, 13 EARTH SYS. SCI. DATA 5747 (2021).
[35] *What percentage of the American population lives near the coast?*, NAT. OCEANIC & ATMOSPHERIC ADMIN. (Jan. 18, 2024).
[36] OCEAN POLICY COMM., *supra* note 12.
[37] FISCHBACK ET AL., *supra* note 21.

partners to reevaluate their value metrics to include the value of ecosystem services.[38] These quantification studies and awareness of the ecosystem service values can and should be considered when valuing blue carbon credits.

When thoughtfully designed, these projects protect biodiversity, promote the sustainable economic development of communities, and can have a myriad of other positive impacts. Such projects can bring sustainable livelihoods to local people through sustainable fishing, soil and water protection, direct employment, and the use and sale of outdoor recreational activities.[39] During the planning process for these projects, communities can be involved to provide input on priority concerns that shapes and supports decision-making, as well as increasing their understanding of the effects of climate change and the community's capacity to adapt.[40]

Certifiers of carbon credits also value the co-benefits of carbon-reduction projects. The co-benefits can be disclosed and valued within standard verification projects. Of relevance is the Blue Carbon Project Gulf of Morrosquillo, in Columbia, which is registered as a Verra Verified Carbon Standard (VCS) project and utilized the VM0007 methodology.[41] The focus of the project is sequestering carbon; however, the project has co-benefits that include habitat restoration for endangered species and community participation in sustainable management practices.[42] There are also some verification processes that highlight specific ecosystem services as part of the verification methodology. For example, many of the projects in the CCB Verra Registry are coupled with GHG reduction projects. As the name suggests, the projects tend to benefit the community, climate, and biodiversity. Several programs include training or educating local communities on sustainable practices and income opportunities. There is also an opportunity to

[38] *Id.*
[39] LASSE KRANTZ, SWEDISH INT'L DEV. COOP. AGENCY, THE SUSTAINABLE LIVELIHOOD APPROACH TO POVERTY REDUCTION (2001); Wylie, Sutton-Grier & Moore, *supra* note 25.
[40] Scott A. Hemmerling et al., *Elevating local knowledge through participatory modeling: active community engagement in restoration planning in coastal Louisiana*, 22 J. GEOGRAPHICAL SYS. 241 (2019).
[41] *The Blue Carbon Project Gulf of Morrosquillo: Protecting Mangroves and Marshes in Colombia*, VERRA (last visited Mar. 6, 2024).
[42] *Id.*

have projects that fall under the Sustainable Development Program (SD Vista Projects). Projects here often have a positive climate and community impact, with the objective of reaching SDGs. SD Vista project examples include electric bike projects, equipping and training households with cooktop stoves, water management and rice cultivation, and safe water access.

While these projects are often sited in undeveloped areas, there is the possibility to have certified projects in the United States. Not only has the impact of naturally sequestering carbon been gaining attention, but so has the cost of GHGs to communities. The Biden Administration has reinstituted an Interagency Working Group, which determines the Social Cost of Greenhouse Gas Emissions.[43] The Administration has directed federal agencies to consider whether projects increase or reduce GHGs as part of their benefit-cost analysis.[44] Considering GHGs and their social costs will likely cause regulatory agencies to approve more nature-based projects and limit the approval of projects that degrade blue carbon environments. This change in policy may increase the value of projects in the voluntary blue carbon market. The guidance also supports the notion that there is value in reducing GHGs.[45] The methodology and standards for project certification in the voluntary carbon market are based on the environment (e.g. forest, boreal, wetland) and not the geographic location or jurisdiction. Thus, the methodology for a tidal wetland project in the United States would be similar to the methodology for a tidal wetland project in another country, with the most applicable methodology being VM0033.[46] There are not necessarily legal obstacles to a voluntary blue carbon market at the federal level, and the U.S. Securities and Exchange Commission (SEC) takes a neutral position on the use of carbon credits. However, the SEC may finalize a proposed rule that would require companies to disclose whether their net carbon emissions are being reduced through actual emissions reductions or through purchasing offsets.[47] Some

[43] THE WHITE HOUSE, FACT SHEET: BIDEN-HARRIS ADMINISTRATION ANNOUNCES NEW ACTIONS TO REDUCE GREEN HOUSE GAS EMISSIONS AND COMBAT THE CLIMATE CRISIS (2023).
[44] *Id.*
[45] *Id*.
[46] VERRA, METHODOLOGY FOR TIDAL WETLAND AND SEAGRASS RESTORATION (VM0033), Version 2.1 (2023).
[47] The Enhancement and Standardization of Climate Related Disclosures for Investors, 87 Fed. Reg. 21334 (April 11, 2022).

comments to the proposed rule support disclosure of which offsets were purchased for increased transparency and integrity.[48]

At the time of this writing, Virginia is the only state to have a blue carbon project in the validation and verification process. [49] The Virginia Seagrass Restoration Project (VSRP) used a seed-dispersal technique that has led to 10,000 acres of eelgrass in the Virginia Coast Reserve.[50] The VSRP started as a conservation effort that has improved the water quality in the area and created a higher fish population. [51] The VSRP and its partners also began to monitor the project's sequestration capacity and determine whether the VSRP successfully captured and stored carbon dioxide into the aquatic ecosystems' soil and plants.[52] Over the course of twenty years, the project is estimated to capture 5,000 tons of carbon, which equates to the yearly carbon dioxide emissions of 3,500 cars.[53]

Similar to other coastal states, neither Georgia nor Louisiana has a coastal blue carbon project submitted for accreditation in a voluntary blue carbon market. However, Georgia is the site for a remediation project in salt marsh habitat with environmental monitoring that focuses on carbon sequestration and other ecosystem services, including coastal resiliency, water quality, and biodiversity.[54]

A. Blue Carbon Action in Louisiana

Louisiana is home to 37% of the estuarine wetlands in the United States, providing a plethora of ecosystem services.[55] In Louisiana the main drivers toward a blue carbon market are to provide the opportunity and resources to

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[48] Letter from The Integrity Council for the Voluntary Carbon Market to the Sec'y of the U.S. Sec. Exchange Comm'n (June 17, 2022).
[49] Jill Bieri, *Virginia Seagrass Restoration Project Establishes a Model for Similar Action Worldwide*, U.S. NATURE4CLIMATE (Nov. 6, 2022).
[50] *Id.*
[51] *Id.*
[52] *Id.*
[53] *Id.*
[54] *Deepverge secures Blue Carbon Resilience project in Georgia and South Carolina worth £2.4m*, MOD. WATER (Sept. 13, 2022).
[55] BRAD R. COUVILLION ET AL., U.S. GEOLOGICAL SURV., LAND AREA CHANGE IN COASTAL LOUISIANA FROM 1932 TO 2010 (2011).

protect the state's coast while also providing incentives for industries and organizations to reduce their net carbon output.

Louisiana's Climate Action Plan aims to reduce carbon emission levels by 40-50% by 2030 and to net zero by 2050.[56] The plan lays out strategies to reduce carbon emissions, including Action 15.3 which details the need to develop a crediting mechanism and market for blue carbon.[57] Action 15.3 of Louisiana's Climate Action Plan, states in relevant part:

> The natural carbon sequestration potential of Louisiana's coastal habitats is too valuable to be entirely precluded from market-based systems that can support the conservation and restoration of these important ecosystems. With the assistance of blue carbon experts, carbon verifiers, and coastal ecologists, Louisiana should evaluate the longevity of coastal carbon pools, the design and market interest for the creation of a specialized carbon credit, and the market specific to Louisiana's coastal wetland habitats. This potential Louisiana credit and market would more directly take into account the sequestration potential of coastal wetland habitats as well as the shorter time scales that conservation or restoration efforts would be expected to offer given the dynamic nature of deltaic systems. This credit and market would attempt to match the local and global demand for natural carbon credits with the urgent need to protect and restore Louisiana's wetland ecosystems for the preservation of the state's culture, communities, economy, and environment.

However, many of the coastal restoration projects carried out by the Coastal Protection and Restoration Authority (CPRA) are funded by settlement funds from the BP Deepwater Horizon Oil Spill. This funding source will be depleted by 2032, with certain coastal restoration projects incomplete and others in need of funding for maintenance.[58] Thus, Louisiana is particularly motivated to

[56] CLIMATE INITIATIVE TASK FORCE, LOUISIANA CLIMATE ACTION PLAN (2022).
[57] *Id.*
[58] LA. COASTAL PROT. & RESTORATION AUTH., *supra* note 23.

participate in a voluntary blue carbon market to fund restoration and maintenance projects necessary to reach its climate and resilience goals.

B. Co-Benefits of Blue Carbon in Louisiana

Louisiana has the potential to produce high quality and high impact blue carbon projects with SDG benefits. The IPCC reported climate change will cause adverse effects upon salt marshes, mangroves, and low-lying coastal systems.[59] These various systems are plentiful across the state of Louisiana. Participation in a voluntary blue carbon market in Louisiana will provide the opportunity to protect vulnerable coastal systems.[60] Since 1932, more than 5,196 square kilometers, or 25%, of Louisiana's coastal marsh has been submerged under water.[61] As the barrier islands of Louisiana disappear, these coastal marshes no longer have the protection they once had.[62] Funds generated from coastal blue carbon projects have the potential to increase the support for protecting, managing, and restoring the United States' coast.

Louisiana develops a master plan every five years, which contains comprehensive coastal restoration and risk reduction projects. The Louisiana Coastal Master Plan has several projects that have elements that do not sequester carbon. These projects include: building boat launches; Campground Improvements; Hydrological Restoration; Science & Education Complex; Land Bridges; Earthen Levees; and Other Programmatic Restoration Projects.[63] While these projects do not generate blue carbon credits they do compliment blue carbon projects, benefit the local community, and in some instances, may also have biodiversity benefits.[64] Thus, the opportunity exists for these projects to still generate credits under the Verra CCB Program or the SD Vista Program.

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[59] Nathaniel L. Bindoff, William W.L. Cheung & James G. Kairo, *Changing Ocean, Marine Ecosystems, and Dependent Communities*, *in:* IPCC SPECIAL REPORT ON THE OCEAN AND CRYOSPHERE IN A CHANGING CLIMATE 447 (H.-O. Pörtner, et al. 2019).
[60] Manado Ocean Declaration, *supra* note 9.
[61] Paige Byerly, Bethann G. Merkle & Megan Hepner, *Renewed Hope for Coastal Marshes in Louisiana*, 107:2 AM. SCIENTIST 98 (2019).
[62] *Id.*
[63] LA. COASTAL PROT. & RESTORATION AUTH., *supra* note 23.
[64] *Id.*

Louisiana's coastal area supports extensive infrastructure associated with the energy and chemical industry, placing sensitive structures in an increasingly risky environment as the coastline faces degradation and erosion.[65] In Louisiana there are 388 chemical facilities that contain highly hazardous material within fifty miles of the coast and are at increased risk of flooding and hurricane damage.[66] Damage to the infrastructures would not only be economically harmful to the corporations, but also potentially devasting to neighboring communities.[67] Louisiana-based industries have the opportunity to mitigate weather-related risk by purchasing offset credits generated by coastal blue carbon projects based in Louisiana.

C. Louisiana's Legal Pathway to a Blue Carbon Market

Louisiana has a legal framework to participate in a voluntary blue carbon market. There is a statutory pathway for which projects would be undertaken by the state, and in that case, the state's CPRA would own the derived monetary benefits of the projects.[68] Likewise, a property owner may also enter the voluntary carbon market and either receive monetary compensation or contractually assign it to another party.[69]

Despite the straightforward statutory language, Louisiana's coast is mostly tidal marshes which creates complex boundary issues and scientific gaps for optimal methodologies. Coastal property boundaries are ambulatory and whether land is submerged or not changes the legal ramifications of the property. This complex environment has spurred verification challenges and conservative

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[65] HEMMERLING, S.A., CARRUTHERS, T.J.B., HIJUELOS, A.C., RILEY, S., BIENN, H.C., WATER INST. OF THE GULF, TRENDS IN OIL AND GAS INFRASTRUCTURE, ECOSYSTEM FUNCTION, AND SOCIOECONOMIC WELLBEING IN COASTAL LOUISIANA (2016).
[66] Susan C. Anenberg & Casey Kalman, *Extreme Weather, Chemical Facilities, and Vulnerable Communities in the U.S. Gulf Coast: A disastrous combination*, 3:5 GEOHEALTH 122 (2019).
[67] Tristan Baurick & Jeff Adelson, *740 toxic sites in Louisiana are at risk from storms. Are they ready?*, NOLA.COM (June, 16, 2023).
[68] LA. STAT. ANN. § 3:1221. *See also id.* §9:1103.
[69] *Id.* §9:1103.

assumptions that prevent Louisiana from having a lucrative voluntary blue carbon market.[70]

Louisiana law establishes the monetary framework for natural carbon sequestration:

> Any monetary compensation derived from the sequestration of carbon on the surface of land or water bottoms through biological processes, including but not limited to the growth of plants or animals or other natural or induced processes, is the property of the owner of the land or water bottom upon which such sequestration occurs, unless (a) contractually assigned to another party; or (b) the sequestration, uptake, or prevention of emission of greenhouse gases is directly related to the avoided conversion or avoided loss attributable to a project carried out or sponsored by the [CPRA] or the [CPRA] Board, including use of public resources as provided in R.S. 49:214.5.4. In such instance, the monetary compensation is the property of the state.[71]

The statute allows for circumstances in which landowners may benefit collectively or individually from natural carbon sequestration on privately owned lands. If the project is done by or on behalf of CPRA, the landowner would not directly receive the monetary compensation from the blue carbon market. However, the landowner would be the beneficiary of other benefits such as storm surge protection, reduced rate of land loss, hurricane protection, and reduced risk of infrastructure damage.

The Coastal Protection & Restoration Fund (CPRF) is an established trust fund in Louisiana's state treasury created to provide a dedicated, recurring source

[70] Tim Carruthers et al., *Filling critical knowledge gaps can reduce uncertainty to improve viability of blue carbon crediting mechanisms for tidal marshes*, FRONTIERS IN ENV'T SCI. (in review). *See also* Sarah K. Mack et al., *Chapter 23. Status and Challenges of Wetlands in Carbon Markets*, *in* WETLAND CARBON AND ENVIRONMENTAL MANAGEMENT (K. W. Krauss, Z. Zhu & C. L. Stagg eds., 2021).
[71] LA. STAT. ANN. §9:1103.

of revenues for the Louisiana Coastal Master Plan through the CPRA. Louisiana law provides for the allocation of certain revenues dedicated to CPRA's Trust Fund:

> Revenues derived from integrated coastal protection programs, projects, or activities shall be deposited in and credited to the fund.[72]

This language was added to CPRA's enabling legislation in 2009 specifically to address the potential for the generation of carbon credits from CPRA projects and ensure that any revenues gained from such projects were dedicated back to CPRA's Trust Fund.[73] However, Section 9:1103 may need to be modified to include ecosystem services that are separate from the sequestration of carbon.

D. The Blue Carbon Potential in Georgia

The National Wetland Inventory has documented over 804,200 acres of wetlands in coastal Georgia. Fifty-four percent are freshwater, palustrine wetlands and 351,236 acres (44%) are saltwater, estuarine intertidal emergent.[74] The National Wetland Inventory conducted a preliminary assessment of wetland functions on the various wetland types.[75] The functions measured included surface water detention, coastal storm surge detention, provisions of flora and fauna, and carbon sequestration.[76] The assessment determined that nearly all of the wetlands were deemed important for carbon sequestration and wildlife habitat.[77] Georgia lost approximately 25% to 30% of its wetlands prior to protection efforts in the 1980s.[78] Of the remaining wetlands in Georgia the U.S. Environmental Protection Agency characterized 50% of the present wetlands to

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[72] *Id.* § 49:214.5.4(F).
[73] Act 523, 2009 Regular Session of the Louisiana Legislature.
[74] GA. DEP'T NAT. RES., WETLANDS OF COASTAL GEORGIA: RESULTS OF THE NATIONAL WETLANDS INVENTORY AND LANDSCAPE-LEVEL FUNCTIONAL ASSESSMENT (2012).
[75] *Id.*
[76] *Id.*
[77] *Id.*
[78] Elizabeth Kramer, *Wetland Value and Protection Strategies*, *in* ENCYCLOPEDIA OF WATER 1 (2019).

be in fair to poor condition.[79] Thus, there is ample opportunity to have coastal blue carbon projects in Georgia while restoring the state's wetlands.

Georgia, like other coastal states, face an existential crisis posed by climate change. Specifically, factors linked to our changing climate, such as coastal flooding, increased severe weather risk, sea level rise, land erosion, and temperature changes, are changing the established environmental and societal structures of coastal communities. Georgia does not have a climate action plan to date, however, the state has received funding through the Climate Pollution Reduction Grant and will be utilizing the funds to develop a climate action plan.[80] Once a plan is developed there will likely be accelerated motivation to utilize natural carbon sequestration programs, including a voluntary blue carbon market.

E. State Legal Framework and Barriers in Georgia

Georgia has a legal framework specifically designed for carbon projects, though it has primarily focused on forestry-based carbon sequestration. [81] The Georgia Forestry Commission (GFC), in partnership with the Georgia Superior Court Clerk's Cooperative Authority (GSCCA), has established a voluntary carbon sequestration registry.[82] The registry is a platform that facilitates buying carbon credits from forest landowners.[83] At the time of this writing, the registry does not have a process for coastal blue carbon projects and no blue carbon projects were found on the registry.[84] Still, Georgia is arguably further along in enabling Georgia landowners to participate in a voluntary blue carbon market than other states because Georgia has an established registry with government buy-in to support the buying and selling of carbon credits. Also, the majority of

[79] U.S. ENV'T PROT. AGENCY, NATIONAL WETLAND CONDITION ASSESSMENT 2011: A COLLABORATIVE SURVEY OF THE NATION'S WETLANDS (2016).
[80] Drew Kann, *Georgia is creating its first ever climate plan. Here's what to expect*, ATLANTA J. CONSTITUTION (July 14, 2023).
[81] GA. CODE ANN. § 12-6-223.
[82] *Id.* § 12-6-229.
[83] *Georgia Carbon Sequestration Registry*, GA. FORESTRY COMM'N (last visited Feb. 20, 2024).
[84] *Id.*

Georgia's coastal lands are state owned through Georgia's Protection of Tidewaters Act.[85]

The Georgia Department of Natural Resources (GADNR) Coastal Resources Division manages and engages in wetland projects. Under the Georgia Coastal Marshlands Protection Act of 1970, the State recognizes that:

> the coastal marshlands of Georgia comprise a vital natural resource system. The estuarine area … is the habitat of many species of marine life and wildlife and, without the food supplied by the marshlands, such marine life and wildlife cannot survive. The estuarine marshlands of coastal Georgia are among the richest providers of nutrients in the world. Such marshlands provide a nursery for commercially and recreationally important species of shellfish and other wildlife, provide a great buffer against flooding and erosion, and help control and disseminate pollutants. The coastal marshlands provide a natural recreation resource which has become vitally linked to the economy of Georgia's coastal zone and to that of the entire state. This … system is costly, if not impossible, to reconstruct or rehabilitate once adversely affected … [86]

The Georgia Coastal Management Program (GCMP) has a mission to balance economic development, preserve the natural environment, and promote sustainable development for the benefit of the public.[87] It is because of this legislative charge, that it is recommended here that the GCMP become involved in incorporating a coastal blue carbon credit pathway into Georgia's existing Carbon Sequestration Registry. The GCMP already serves as a liaison among various agencies and provides forums for local governments, developers, and citizens to discuss potential resource issues, environmental impacts, and permit requirements with the appropriate agencies.[88] The methodologies and certification

[85] GA. CODE ANN., § 52-1-1, *et. seq.*
[86] *Id.* §12-5-280 *et seq.*
[87] *Id.* § 12-5-321.
[88] *Id.* § 12-5-325.

procedures for the coastal blue carbon sequestration program could be incorporated with the body of laws for the forestry carbon sequestration program, in accordance with Ga. Code Ann. § 12-6-225. The path for state coordination of blue carbon projects in Georgia could begin with coordination efforts from the Coast Resource Division's GCMP, and the involvement of the GFC, Georgia Environmental Protection Division, and GSCCA. The GFC would need to update its regulations and procedures through its administrative process to include coastal blue carbon in its Carbon Sequestration Registry.

IV. CONCLUSION

While Georgia and Louisiana are on different coasts, they both have ecosystems that are naturally sequestering carbon and the potential to quantify and monetize the amount of carbon being naturally sequestered. Coastal states can learn and borrow from each other to help foster a voluntary blue carbon market. Louisiana has a state framework that overcomes many of the legal hurdles and property right conflicts other coastal states may encounter. Louisiana also has a monetary pathway that would allow blue carbon credits to fund coastal projects. Georgia has the mechanics and interagency cooperation of a market figured out through its forest program.

Georgia and Louisiana should consider folding in ecosystem services and co-benefits as part of their voluntary blue carbon market programs. Coupling the benefits of coastal blue carbon sequestration with other ecosystem services would increase the economic value of the blue carbon projects and also have tangible economic benefits for local communities and states.

Coastal states should also continue to invest in the science necessary to propel voluntary blue carbon markets forward on a solid scientific foundation. Lastly, it is necessary to build alignment between coastal communities, social and environmental needs, and coastal protection and restoration efforts. If there is thoughtful and meaningful engagement, blue carbon projects could be immensely beneficial to local communities, the nation, and globally.

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OVERCOMING LEGAL AND CARBON MARKET CHALLENGES TO BLUE CARBON PROJECTS ON PUBLIC LANDS

Read D. Porter[1]

I. INTRODUCTION

"Blue carbon" is an emerging method of mitigating greenhouse emissions that uses carbon markets to fund conservation and restoration of coastal wetlands. Public land management agencies are important partners for blue carbon projects. Many coastal wetlands appropriate for blue carbon projects are owned by governments and controlled by their land management agencies. The responsible agencies often lack the resources to restore degraded wetlands or undertake the active management activities necessary to conserve and maintain areas threatened by sea level rise and other stressors. Blue carbon projects can offer financial resources to support immediate restoration and ongoing maintenance of wetland ecosystems over a century-long scale.

While promising, blue carbon projects on public lands face both legal and carbon market challenges. Blue carbon projects can proceed only if agencies and their partners can design projects in compliance with public lands law and in conformity with carbon market standards. As few laws authorize and define how land managers can participate in blue carbon projects, most agencies are left to rely on general enabling legislation for authorization. In the absence of specific mandates, such as those originating in protected species laws, agencies generally have broad discretion in managing public lands. This discretion cuts two ways: it authorizes them to engage in the land management activities needed for successful blue carbon projects, but does not require them to do so or to maintain efforts over time. As a result, a commitment by an agency today can provide little

[1] Deputy General Counsel, Executive Office of Energy and Environmental Affairs, Commonwealth of Massachusetts. The views in this article represent solely the views of the author and not those of the Commonwealth of Massachusetts or the Executive Office of Energy and Environmental Affairs. This article draws on ideas developed in a prior study, *Legal Issues Affecting Blue Carbon Projects on Publicly Owned Coastal Wetlands*, which was authored by Read Porter, Cody Katter, and Cory Lee, and published by Restore America's Estuaries and the Marine Affairs Institute using Federal funds under awards NA16NMF4630113 from NOAA, U.S. Department of Commerce. The current study is the independent work of the author, however, and does not represent the views of the coauthors or publishers of this earlier work. An early version of this research was presented at the 2020 symposium of the Vermont Journal of Environmental Law.

confidence that the agency will continue to support conservation and restoration activities over the long term. Indeed, the ability of future elected leaders to change course is a foundational principle of U.S. governance. Credible carbon markets will need to require more substantial commitments to ensure the permanence of blue carbon activities in this sector given heightened risk of reversal associated with sea level rise. These commitments are likely to come from contractual arrangements between government agencies and non-governmental funding partners.

In contrast to their discretion in managing the use of public lands, agency enabling legislation often constrains the authority of agencies to enter into property or commodity agreements with non-governmental entities. Without sufficient authority, agencies cannot demonstrate the permanence of projects on public lands or guarantee their partners unambiguous ownership of carbon offsets in exchange for project funding, stopping blue carbon projects before they begin. Limitations on alienation of property rights or sale of commodities from public lands presents a trenchant legal challenge for public land managers seeking to participate in blue carbon projects.

Creative transaction structure may allow some projects to proceed under current law, but legislative reform is needed to clarify whether and how agencies can participate in blue carbon projects. To reach this conclusion, this article examines how current law enables and poses structural challenges for blue carbon projects on public lands. Part I introduces blue carbon as a concept and examines its status under carbon market regimes. Part II considers the few existing laws authorizing blue carbon projects on public lands. Part III considers how the broad agency discretion provided by most land management statutes enables participation in blue carbon project activities in the short term, while simultaneously undermining project permanence and conformity with carbon market standards, resulting in a need for agencies to commit to action by agreement. Part IV considers how limitations on agency authority to alienate public lands affect their ability to enter into those agreements to transfer carbon rights and credits, and presents four transaction structures that may address these challenges and enable successful blue carbon project implementation. Part V concludes that existing models for blue carbon legislation do not address the issues likely to arise in blue carbon projects in sufficient detail, and specific legislation would serve a useful role in clarifying agency authority to contract for and carry out blue carbon projects.

II. BLUE CARBON PROJECT RATIONALE AND STRUCTURE

Coastal wetlands are a diverse and valuable type of habitat worthy of conservation and restoration. Salt marshes, mangrove forests, seagrass meadows, and other coastal wetlands provide a range of ecosystem services valued at over $20 trillion per year on the global scale.[2] These services take a variety of forms.[3] For example, salt marshes play an important role in filtering nitrogen and other pollutants from runoff, mitigating the development of hypoxic areas in estuaries and nearshore coastal waters.[4] Mangroves, like other coastal wetlands, provide well-recognized flood protection benefits valued at $65 billion per year globally in 2020, including over $11 billion in property damage averted per year in the U.S. alone.[5] Seagrass meadows provide a critical nursery habitat for bay scallops and other important fishery species.[6] And healthy coastal wetlands sequester a staggering amount of greenhouse gases—as much as 20% to 30% of total stored soil carbon on the planet, though agreement with such estimates is not universal.[7]

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[2] Nick C. Davidson et al., *Worth of wetlands: revised global monetary values of coastal and inland wetland ecosystem services*, 70 MARINE & FRESHWATER RES. 1189, 1191 (2019).
[3] *See* Edward B. Barbier et al., *The Value of Estuarine and Coastal Ecosystem Services*, 81 ECOLOGICAL MONOGRAPHS 169, 170 (2011) (describing the three categories of ecosystem services).
[4] Joanna L. Nelson & Erika S. Zavaleta, *Salt Marsh as a Coastal Filter for the Oceans: Changes in Function with Experimental Increases in Nitrogen Loading and Sea-Level Rise*, 7 PLOS ONE no. e38558, 1-2 (2012).
[5] Pelayo Menéndez et al., *The Global Flood Protection Benefits of Mangroves*, 10 SCI. REP. no. 4404, 2-4 (2020); *see also, e.g.*, Fanglin Sun & Richard T. Carson, *Coastal Wetlands Reduce Property Damage During Tropical Cyclones*, 117 PROC. NAT'L ACAD. SCI. 5719, 5720 (2020) (showing an example of how coastal floodplains reduced flood damage from Hurricane Sandy by $625 million); *see also, e.g.*, Siddharth Narayan et al., *The Value of Coastal Wetlands for Flood Damage Reduction in the Northeastern USA*, 7 SCI.REP. no. 9463, 1-2 (2017) (describing how coastal floodplains could have mitigated $430 million in damages across nineteen counties in Florida alone).
[6] Robert J. Orth et al., *Restoration of Seagrass Habitat Leads to Rapid Recovery of Coastal Ecosystem Services*, 6 SCI. ADVANCES no. eabc6434, 1, 3, 6–7 (2020).
[7] A.M. Nahlik & M.S. Fennessy, *Carbon Storage in US Wetlands*, 7 NATURE COMM.no. 13835, 2 (2016) (citing WETLAND SOILS (M. J. Vepraskas & C. B. Craft, eds., 2nd ed. 2016)); *but see* Sophia C. Johannessen & James R. Christian, *Why Blue Carbon Cannot Truly Offset Fossil Fuel Emissions*, 4 COMMC'N EARTH & ENV'T 411 (2023) (noting methodological issues in global estimates).

Recognizing these benefits, government and private actors increasingly support conservation and restoration of these ecosystems.[8]

Coastal wetland conservation and restoration efforts are badly needed. Estimates suggest that 40% to 85% of coastal wetlands have been lost globally due to anthropogenic drivers, including coastal development and agriculture.[9] Voluntary and required restoration and mitigation efforts to address wetland losses have not been sufficient to replace the acreage or the services provided by natural wetlands.[10] Moreover, sea level rise and other emerging threats pose challenges to the continued survival and health of remaining coastal wetlands.[11] Active, ongoing management actions will be needed in addition to restoration efforts to conserve coastal wetlands and support their adaptation to climate change.[12] These efforts will not succeed without ongoing, consistent political will and funding over long periods—a condition that will likely require funding from non-governmental sources in addition to public contributions.[13]

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[8] *See, e.g.*, Rachel K. Gittman et al., *Voluntary Restoration: Mitigation's Silent Partner in the Quest to Reverse Coastal Wetland Loss in the USA*, 6 FRONTIERS IN MARINE SCI. no. 511, 1-2 (2019) (reviewing history of No Net Loss policies).

[9] *Id.*

[10] *Id.* at 5.

[11] *See* Sarah C. Crosby et al., *Salt Marsh Persistence is Threatened by Predicted Sea-Level Rise*, 181 ESTUARIES, COASTAL & SHELF SCI. 93 (2016) (discussing development of shorelines' effect on saltwater marshes); Donald R. Cahoon et al., *Evaluating the Relationship Among Wetland Vertical Development, Elevation Capital, Sea-Level Rise, and Tidal Marsh Sustainability*, 42 ESTUARIES & COASTS 1, 13 (2019) (discussing marsh elevation and degradation under sea-level rise conditions).

[12] A range of interventions may be needed. In the context of salt marsh elevation, interventions may include, for example, thin-layer deposition to increase the elevation of salt marshes or acquisition and protection of upland areas for marsh migration corridors. *See, e.g.*, Christine M. VanZomeren et al., *Restoring a Degraded Marsh Using Thin Layer Sediment Placement: Short Term Effects on Soil Physical and Biogeochemical Properties*, 120 ECOLOGICAL ENG'G 61, 62 (2018) (discussing thin-layer deposition using dredged sediment); Elizabeth R. Van Dolah et al., *Marsh Migration, Climate Change, and Coastal Resilience: Human Dimensions Considerations for a Fair Path Forward*, 40 WETLANDS 1751 (2020) (discussing social dimensions of interventions to allow shoreward movement of tidal marshes).

[13] *See* Winnie W.Y. Lau, *Beyond Carbon: Conceptualizing Payments for Ecosystem Services in Blue Forests on Carbon and Other Marine and Coastal Ecosystem Services*, 83 OCEAN & COASTAL MGMT. 5 (2013) ("[A] common and frequent barrier to achieving full effectiveness and wider adoption of [marine and coastal resource management] tools is the lack of adequate financing.").

Blue carbon markets are an emerging mechanism for generating resources and support for long-term wetland conservation and restoration projects by monetizing their carbon sequestration benefits. While healthy coastal wetlands sequester substantial volumes of soil carbon, they may also emit greenhouse gases, including methane and nitrous oxide, especially when degraded.[14] Active conservation and restoration of coastal wetlands can avoid or reduce future GHG emissions and/or actively sequester carbon in soils and vegetation, in either case producing net carbon sequestration benefits.[15] Sequestered carbon or avoided emissions can be monetized through carbon markets,[16] providing an external source of funding to enable wetland conservation and mitigation.

Carbon markets enable buyers wishing to reduce their net greenhouse gas emissions to purchase credits (also known as "offsets") from sellers who demonstrate that they are sequestering greenhouse gases.[17] Carbon markets take two basic forms. "Compliance markets" allow regulated entities to meet legal compliance obligations (such as cap-and-trade programs) through credit purchases.[18] The California Emissions Trading Program (ETP), for example, limits emissions by covered entities, but allows those entities to offset up to 8% of their emissions via purchase of carbon credits issued in accordance with Program

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[14] *See* Judith A. Rosentreter et al., *Methane and Nitrous Oxide Emissions Complicate Coastal Blue Carbon Assessments*, 35 GLOBAL BIOGEOCHEMICAL CYCLES no. e2020GB006858, 1 (2021) (discussing coastal wetland emission of greenhouse gases); Lishan Tan et al., *Conversion of Coastal Wetlands, Riparian Wetlands, and Peatlands Increases Greenhouse Gas Emissions: A Global Meta‐Analysis*, 26 GLOBAL CHANGE BIOLOGY 1638, 1639 (2020).

[15] *See, e.g.*, Stephen Crooks, et al., *Coastal wetland management as a contribution to the US National Greenhouse Gas Inventory*, 8 NATURE CLIMATE CHANGE 1109, 1111-12 (2018) (describing the impact of coastal wetlands on the U.S. National Greenhouse Gas Inventory); Matthew P.J. Oreska et al., *The greenhouse gas offset potential from seagrass restoration*, 10 SCIENTIFIC REPORTS no. 7325 (2020).

[16] VERRA, METHODOLOGY FOR TIDAL WETLAND AND SEAGRASS RESTORATION (VM0033), Version 2.1 (2023) [hereinafter VM0033].

[17] Roger Ullman et al., *Introducing Blue Carbon in Climate Market Mechanisms*, 83 OCEAN & COASTAL MGMT. 15, 15 (2013).

[18] *See id.* at 15 ("a central authority sets a limit, or cap, on the amount of a greenhouse gas that can be emitted, and the cap is allocated or sold to entities in the form of credits which represent the right to emit a specific volume of the gas. The emitting entities are required to hold a number of credits equivalent to their actual emissions, and the total amount of existing credits cannot exceed the cap. Entities may then trade credits among themselves if they need to increase their emissions or have been able to reduce emissions.").

protocols.[19] A "voluntary market," by contrast, is not based on a compliance mandate, but on purchase of offsets by willing participants. The Verified Carbon Standard (VCS) is an example of a standard enabling a voluntary market.[20] Regardless of the type of market, market providers only issue credits for projects that comply with the associated standards and protocols.

The structure of carbon markets may be illustrated by an example. A California Court of Appeal explained the structure of the ETP system:

> Under cap-and-trade, offset projects must comply with rules and procedures—called compliance offset protocols (CARB Protocols), which CARB adopts and administers through an Offset Project Registry (OPR). OPRs facilitate "the listing, reporting, and verification of offset projects developed using the [CARB Protocols], and issue registry offset credits." OPRs must be approved by CARB and "shall use [CARB Protocols] to determine whether an offset project may be listed . . . for issuance of registry offset credits."[21]

In the ETP, the CARB Protocols provide the mandatory conditions that projects must meet for listing by an OPR. Other carbon market systems, such as the VCS, establish their own standards and detailed methodologies, authorize assessors to evaluate projects for conformity with those standards, and provide markets for generated credits.

Credible carbon market standards include provisions to mitigate the risk of failed or fraudulent claims of sequestration. Among other requirements, these standards require project proponents to demonstrate: (1) that a project will produce sequestration additional to that under business as usual; (2) that the sequestration will be permanent; and (3) that the proponent is the sole and

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[19] CAL. CODE. REG. tit. 17 § 95856(h)(1)(A); *See also* *Compliance Offset Program*, CAL. AIR RES. BD. (last visited Feb. 28, 2024).

[20] *See* *Verified Carbon Standard*, VERRA (last visited Feb. 28, 2024) (providing an overview of the VCS program); *See* Golden Door Properties, LLC. v. County of San Diego, 50 Cal. App. 5th Supp. 467, 511–12 (Cal. Ct. App. 2020) (striking down county climate action plan authorizing compliance via purchase of offsets via voluntary registries but noting process for CARB approval of standards).

[21] *Golden Door Properties, LLC.*, 50 Cal. App. 5th Supp. at 485 (internal footnotes and citations omitted).

unambiguous owner of the project and has the right to receive credits.[22] Once an assessor verifies that a project will satisfy all conditions (as detailed in the relevant standard and protocols), the market provider will approve the project and periodically issue credits representing the carbon as it is sequestered. Project proponents can then trade these credits on the relevant market exchange or directly with a specific trading partner.

Blue carbon projects have been unable to access voluntary carbon markets until recently, and remain unable to access compliance markets, due to challenges in quantifying their effects on carbon flux. Unlike activities such as afforestation, for which calculations of sequestered carbon have long been accepted,[23] blue carbon projects, like other forms of soil carbon sequestration projects, have faced substantial technical challenges.[24] In recent years, however, characterization of carbon sequestration on coastal wetlands has advanced sufficiently to enable quantification of the effects of project activities on carbon storage.

As researchers have begun to overcome technical challenges, protocols for blue carbon project registration in carbon markets have been developed, with the voluntary market leading the way. VCS has approved a "Wetlands Restoration and Conservation" (WRC) project category[25] and methodologies and guidance for specific WRC activities, including for creation of coastal wetlands (issued in 2014 and inactivated in 2023 due to a lack of use) and tidal wetland and seagrass

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[22] Additional market requirements also apply broadly to all credible markets. *See, e.g., id.* ("GHG offsets 'must be real, additional, quantifiable, permanent, verifiable, and enforceable.'"); HAW. REV. STAT. § 342B-72(c)(1) ("Any rule adopted by the director . . . shall ensure . . . [t]he greenhouse gas emission reductions achieved are real, permanent, quantifiable, verifiable, and enforceable by the director."); GORDON SMITH, CLIMATE ACTION RESERVE, FOREST OFFSET PROJECTS ON FEDERAL LANDS 5 (2012).

[23] *See* Emily Hope et al., *A financial analysis of four carbon offset accounting protocols for a representative afforestation project (Southern Ontario, Canada)*, 51 CAN. J. FOREST RES. 1015 (2021) (comparing multiple afforestation protocols).

[24] *See* Lauren Bernadett, *Agricultural Soil Carbon Sequestration Offset Programs: Strengths, Difficulties, and Suggestions for Their Political Use in AB's 32 Cap and Trade Program*, 31 UCLA J. ENV'T L. & POL'Y 199, 221–23 (2013) (noting acceptance of soil carbon by offset programs has been limited due in part to technical challenges affecting soil carbon sequestration).

[25] VERRA, VERIFIED CARBON STANDARD METHODOLOGY REQUIREMENTS §§ A1.16–A1.22, Version 4.0 (2019).

restoration (issued in 2015 and last updated in 2023).[26] In September 2020, VCS also approved a REDD+ (Reducing Emissions from Deforestation and Forest Degradation Plus1) methodology for wetlands,[27] allowing blue carbon projects to contribute to meeting Nationally Determined Contributions under the Paris Agreement.[28] Other market providers have also established standards under which blue carbon projects may qualify.[29] Blue carbon-specific project methodologies thus are now available to voluntary market participants. By contrast, the author is aware of no existing protocol for blue carbon projects in any compliance markets. However, an effort to develop a blue carbon protocol under the California ETP was undertaken beginning in 2014,[30] and other efforts are underway elsewhere.[31]

Despite increasing availability of blue carbon market protocols, few projects have been approved to date. Recent data indicates that only 11 blue carbon projects were registered or near registration under the VCS globally between 2014 and 2022.[32] The author is aware of no coastal wetland projects completed in the U.S. under any Verra-registered standard or methodology to date, though at least one project—the Virginia Seagrass Reserve Seagrass

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[26] VCS, APPROVED VCS METHODOLOGY VM0024, METHODOLOGY FOR COASTAL WETLAND CREATION Version 1.0 (2014); VM0033, *supra* note 16 (tidal wetland and seagrass restoration); *see also Methodologies*, VERRA (last visited Feb. 28, 2024) (collecting approved methodologies by project category).

[27] VCS, VM0007: REDD+ METHODOLOGY FRAMEWORK (REDD+ MF) Version 1.6 (2020).

[28] *See* Conference of the Parties, United Nations Framework Convention on Climate Change, Paris Agreement, art. 5.2, *in* Decision 1/CP.21(Adoption of the Paris Agreement) U.N. Doc. FCCC/CP/2015/L.9/Rev. 1 (Dec. 12, 2015) (encouraging parties to use "results-based payments" to support emissions reductions); TILL NEEF ET AL., FOOD & AGRIC. ORG. OF THE U.N., FROM REFERENCE LEVELS TO RESULTS REPORTING: REDD+ UNDER THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE 1 (2019) (providing overview of REDD+ and its relationship to Nationally Determined Contributions under the Paris Agreement); Albert C. Lin, *Carbon Dioxide Removal After Paris*, 45 ECOLOGY L. Q. 533, 554–57 (2018) (discussing implementation of REDD+ under the Paris Agreement).

[29] Moritz von Unger, Silvestrum Climate Associates, Voluntary Carbon Markets: Opportunities for Blue Carbon, Presentation at the Blue Carbon Law Symposium, University of Georgia School of Law (May 17, 2023) (noting availability of standards and methodologies from markets including Plan Vivo, American Carbon Registry, and Climate Action Reserve).

[30] Ullman et al., *supra* note 17, at 16. The state has not approved a protocol to date. *See also Compliance Offset Program*, CAL. AIR RES. BD. (last visited Mar. 1, 2024).

[31] *See, e.g.*, Tomohiro Kuwae et al., *Implementation of blue carbon offset crediting for seagrass meadows, macroalgal beds, and macroalgae farming in Japan*, 138 MARINE POL'Y 104996, at § 3.3 (2022) (discussing intention to transition J-Blue Credit pilot to compliance markets).

[32] INT'L FIN. CORP., DEEP BLUE: OPPORTUNITIES FOR BLUE CARBON FINANCE IN COASTAL ECOSYSTEMS § 2.1 (2023).

Restoration Project—is under development.[33] While difficulty in overcoming scientific challenges on project sites may explain some of the slow uptake of blue carbon projects,[34] legal challenges represent an important additional stumbling block that requires attention for blue carbon projects to proceed.

Blue carbon projects in the U.S. generally must occur, in whole or in part, on public lands. Coastal wetlands are located primarily on submerged and intertidal lands, as well as some emergent lands. Seagrass meadows are located primarily in shallow subtidal and intertidal environments,[35] while mangroves and the communities they support are largely restricted to intertidal and adjacent areas.[36] Similarly, salt marshes are located primarily in intertidal and adjacent upland areas subject to regular and occasional flooding.[37] States exert ownership over submerged lands pursuant to the Submerged Lands Act.[38] The shoreward property boundary differs by state, but includes (with limited exceptions) subtidal lands in all states and some intertidal areas in most states.[39] Thus, states own and control a substantial proportion of the area suitable for coastal wetland habitat in the U.S. Moreover, government ownership has played an important role in avoiding the development of coastal wetlands over time, such that many of the remaining intact coastal wetlands (particularly in upland areas) are protected under state or federal government ownership.[40]

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[33] *Virginia Reserve Seagrass Restoration Project, VSC Project 2360*, VERRA (last visited Mar. 1, 2024).
[34] *See* *Blue Carbon Activities*, BLUE CARBON INITIATIVE (last visited Mar. 1, 2024) (noting science, policy, and management challenges and links to related efforts).
[35] Frederick T. Short et al., *Global Seagrass Distribution*, *in* GLOBAL SEAGRASS RESEARCH METHODS 5, 5–7 (FREDERICK T. SHORT & ROBERT G. COLES, EDS. 2001).
[36] *See* P. BARRY TOMLINSON, THE BOTANY OF MANGROVES 11–14 (Cambridge Univ. Press, 2d ed. 2016) (discussing distribution of mangroves and associated communities).
[37] *See* Mark D. Bertness & Aaron M. Ellison, *Determinants of Pattern in a New England Salt Marsh Plant Community*, 57 ECOLOGICAL MONOGRAPHS 129, 130 (1987) (noting differentiation between low and high marsh species and characteristics).
[38] 43 U.S.C. § 1311 (1953).
[39] 78 AM. JUR. 2D *Waters* § 303 (2021) ("The lands within the territorial limits of a state below ordinary high-water marks of navigable waters is the property of the state by virtue of its sovereignty. Some states, however, have chosen to resign to riparian proprietors rights which properly belong to them and hold that the title of the riparian owner extends to the low-water mark on tidewaters …. Other states, however, retain full ownership of the submerged land and hold that the riparian owner's title extends only to the high-water mark in tidal waters or tidelands …") (internal footnotes omitted).
[40] Rebecca Epanchin-Niell et al., *Threatened Protection: Sea Level Rise and Coastal Protected Lands of the Eastern United States*, 121 OCEAN & COASTAL MGMT. 118 (2017).

Public lands are also well-suited to blue carbon projects due to funding limitations associated with carbon markets. While blue carbon projects have been shown to produce substantial carbon mitigation benefits, and they are currently trading at a higher price than agriculture or forestry credits,[41] studies have found that the market price of credits produced has been insufficient to fully fund necessary project activities.[42] In the absence of private investment incentives, projects will proceed "only when project partners are motivated not only by a project's climate mitigation benefits, but also by co-benefits such as habitat conservation, fisheries enhancement, or water pollution control."[43] Government landowners are likely to value these co-benefits to meet policy or regulatory goals or mandates and may be able to leverage resources in addition to carbon credit transactions to support project activities. The involvement of government agencies may also increase market confidence in the credits produced, yielding higher credit prices and reducing the subsidy required for projects to advance.

Publicly-owned coastal wetlands are ideal locations to pioneer blue carbon projects. Governments generally own appropriate blue carbon project sites in whole or part. Further, government land managers value co-benefits of carbon sequestration, as evidenced by substantial public funding for successful, long-

[41] von Unger, *supra* note 29, at 20 (citing OPIS Nov. 2, 2022) (noting that blue carbon credits trade at an average of $28/mt, while agriculture and forestry credits trade at an average of $15/mt). *See also* INT'L. FIN. CORP., *supra* note 32, at § 3.1 ("Blue carbon projects could fetch prices at the higher end of [the range of market prices]").

[42] Oreska et al., *supra* note 15 (noting that the financial benefit from carbon markets for a successful long-term seagrass restoration project was sufficient to cover roughly 10% of the project cost); Sebastian Thomas, *Blue Carbon: Knowledge Gaps, Critical Issues, and Novel Approaches*, 107 ECOLOGICAL ECON. 22, 32 (2014).

[43] READ PORTER ET AL., LEGAL ISSUES AFFECTING BLUE CARBON PROJECTS ON PUBLICLY-OWNED COASTAL WETLANDS 6 (2020) (citing Thomas, *supra* note 42, at 32). *See also* Oreska et al., *supra* note 15 ("Rather than rely solely on carbon offset-credits to finance meadow restoration, coastal managers should think holistically about the other values that seagrass systems provide, including fisheries *support*, nutrient removal, and reduced marsh erosion, among other services. Quantifying these values, even absent markets for co-benefit 'credits,' would provide further incentive for seagrass restoration, in addition to carbon sequestration."). Changes in carbon credit valuation may alter this calculus in the future, particularly if and when blue carbon protocols are accepted by compliance markets, which may lead to increased prices for carbon credits. *Id.*; Mathew A. Vanderklift et al., *Constraints and opportunities for market-based finance for the restoration and protection of blue carbon ecosystems*, 107 MARINE POL'Y 103429 (2019).

term wetland restoration projects.[44] Despite these apparent advantages, wetland restoration efforts on U.S. public lands have yet to translate into blue carbon projects for consideration by carbon markets. Legal challenges are undoubtedly one of many contributing reasons for this delay. The following sections illustrate these challenges.

III. CURRENT LAWS ADDRESSING CARBON PROJECTS ON PUBLIC LANDS

Legislatures have rarely spoken explicitly on whether agencies may participate in carbon markets. To the contrary, current federal and state law are marked by silence on the use of public lands for market-funded carbon mitigation activities: no federal laws or regulations speak explicitly to this use of lands, and only a few states have explicitly addressed the participation of state lands and agencies in carbon market transactions. This section reviews the few laws that speak directly to the issue.[45] Despite their rarity, these laws illustrate key legal challenges affecting the development of blue carbon projects on public lands.

Many states have enacted legislation allowing or considering their participation in carbon markets in roles other than landowner. Notably, California and northeast state participants in the Regional Greenhouse Gas Initiative regulate operation of carbon markets.[46] Other states have taken non-regulatory, administrative roles in carbon market programs. For example, Georgia and Pennsylvania have enacted legislation to create carbon sequestration registries to track in-state, voluntary emissions reductions.[47] Other states, including Hawaii, Connecticut, New Hampshire, and Maryland, have enacted legislation endorsing carbon market programs or calling for studies on the feasibility of participating in carbon markets, but have not yet followed up with substantive legislative or

[44] *See, e.g.* Oreska et al., *supra* note 15 (describing long-term seagrass restoration project). *See also* Lindsey Sheehan et al., *Blue Carbon: an Additional Driver for Restoring and Preserving Ecological Services of Coastal Wetlands in Tampa Bay (Florida, USA)*, 39 WETLANDS 1317, 1321–22 (2019) (describing blue carbon assessment for Tampa Bay).
[45] This summary is current as of May 2023.
[46] JoAnne L. Dunec, *The Clean Air Act Handbook*, 31 NAT. RESOURCES & ENV'T 60 (2016).
[47] GA. CODE ANN. § 12-6-220 – 12-6-232 (2004); 71 PA. CONS. STAT. § 1361.6 (2008).

regulatory action based on these studies.[48] States thus are adopting multiple perspectives on carbon market participation, though many are focused on program administration roles rather than on direct participation in markets as landowners.[49]

A few states, however, have enacted or considered legislation that contains some form of explicit authorization to use public lands for carbon market projects. These authorizations include one or more of five elements, including:

1. Clarification that carbon market projects are consistent with land management mandates;

2. Authorization for agencies to enter into agreements necessary for carbon market projects on state lands;

3. Delineation of carbon credit ownership derived from projects on state lands;

4. Authorization for agencies to acquire public carbon rights easements on private lands; and

5. Direction for the use of funds derived from the sale of carbon credits on state lands.

In 2020, Virginia enacted the first state law to date explicitly authorizing blue carbon projects on state lands. Under this new authority, the Department of Environmental Quality (VDEQ) can "participate in any carbon market for which submerged aquatic vegetation restoration qualifies as an activity that generates carbon offset credits."[50] The law further authorizes VDEQ to "enter into

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[48] *See* CONN. GEN. STAT. § 23-32a(b) (2011) (discussing plans to sustain harvesting of forests); MD. CODE ANN., NAT. RES. § 5-102(b)(8) (2021); N.H. REV. STAT. ANN. § 485-G:3 (2016); HAW. REV. STAT. § 225P-6 (2018) (repealed 2022). The New Hampshire program, uniquely, specifically required consideration of a blue carbon market program focused on seagrass and oyster bed conservation and restoration. N.H. REV. STAT. § 485-G:3 (2016).

[49] Hawaii's feasibility study explicitly warned against participating in offset programs as both administrator and project developer. HAW. STATE OFF. PLAN., FEASIBILITY AND IMPLICATIONS OF ESTABLISHING A CARBON OFFSET PROGRAM FOR THE STATE OF HAWAI'I 35 (2019).

[50] VA. CODE § 10.1-1186.6.

agreements necessary" to participate in markets, provides that VDEQ holds "exclusive title to [carbon] credits until sold," and requires that funds received from the sale of credits must be used for further restoration.[51] While brief, this law explicitly incorporates the second, third, and fifth elements that have drawn attention in the other states considering the use of state lands for carbon projects, while the first element is implied.

As in Virginia, other state laws on carbon projects on state lands have been focused on specific sectors or lands — in a few cases involving coastal wetlands.

1. Louisiana law provides that "revenues from the sale of carbon credits" associated with coastal protection projects are deposited in the Coastal Protection and Restoration Fund.[52] State statutes do not otherwise address state use of coastal lands in carbon market projects, though the Coastal Protection and Restoration Authority has been active in development of market protocols. While other necessary elements of blue carbon approvals are implied, this section explicitly covers only the fifth element.

2. The Florida Forever Act provides that lands acquired under the Act must be managed for "multiple-use" and defines "multiple-use" to include "carbon sequestration, carbon mitigation, or carbon offsets."[53] This is the clearest extant example of a law explicitly and unambiguously confirming that state lands can be used for offset projects.

3. Oregon established an offset program for carbon mitigation on state forest and other nonfederal forest lands.[54] This legislation authorizes enrollment of acquired state forest lands and certain other state-owned forest lands in the program and authorizes the state forester to "execute

[51] *Id.*
[52] LA. STAT. ANN. § 56:799 (2011). For further discussion of Louisiana law, see Valerie Black et al., *Legal Considerations for Coastal Blue Carbon Projects in Georgia and Louisiana* in this edition of the SEA GRANT LAW & POLICY JOURNAL.
[53] *See* FLA. STAT. ANN. § 259.105 (2020) (permitting "multiple-use" for offset projects).
[54] *See* OR. REV. STAT. §§ 526.780 – .789 (2001) (establishing an offset program for carbon mitigation).

any contracts or agreements necessary" to create offset opportunities on these lands.[55]

4. The Reinvest in Minnesota – Clean Energy program authorizes the state Board of Soil and Water Resources to acquire easements on private lands for soil carbon storage, as well as other purposes.[56] While carbon sequestration is among the purposes of the Reinvest in Minnesota program,[57] the law does not explicitly authorize the Board to participate in carbon markets or indicate ownership of carbon rights on easements.

5. Proposed legislation in Nebraska would have authorized the Board of Educational Lands and Funds to "enter into contracts for the sale of carbon sequestration rights" for soil carbon on state-owned school lands, though this provision was dropped from the bill before its passage.[58]

The limited, patchwork approaches to authorization for carbon market projects on any type of public lands suggests that most states have yet to grapple with potential legal issues associated with carbon market participation at all, let alone to address the unique challenges presented by blue carbon projects. As a result, blue carbon projects in states other than Virginia (and there, projects involving activities other than seagrass restoration) will require agencies to rely on existing, general authority to determine whether and how they can participate in blue carbon projects. The few existing laws indicate that projects relying on general authority may face questions on some or all of the five issues addressed by state legislatures to date. Two of these issues reflect particular challenges to agency participation in blue carbon projects, as opposed to restrictions on project implementation. These include: (i) whether agencies can promise ongoing support for blue carbon project activities for the full project duration; and (ii) whether agencies can enter into agreements for the sale of carbon credits derived from blue carbon projects on public lands. Each of these questions, and their

[55] *Id.* § 530.050 (acquired state forest lands); *id.* § 530.500 (Common School Forest Lands and Elliott State Forest Lands).
[56] MINN. STAT. § 103F.518 (2020).
[57] *Id.* § 103F.505.
[58] L.B. 235, 101st Leg. (Neb. 2009). *See also* Sale or transfer of carbon sequestration rights on land owned and managed by the Board of Educational Lands and Funds, Neb. Op. Att'y. Gen. No. 10005 (Jan. 25, 2010) (reviewing legality of soil carbon provision).

relationship to conformity with carbon market standards, is addressed in the sections below.

IV. HOW DISCRETIONARY LAND MANAGEMENT AUTHORITY AFFECTS PERMANENCE

Public lands agencies face a myriad of challenges on managed lands and often have insufficient funding or other resources to address them, leading to difficult resource allocation decisions. Current laws offer agencies broad mandates that provide substantial discretion in making these decisions. This section considers the double-edged nature of this discretion with respect to blue carbon project development and credit integrity. In particular, agencies may be willing to participate in the development of a blue carbon project, but have limited authority to constrain their future decisions. As a result, subsequent administrations can change their mind and decline to invest in costly active management or take other actions with the effect of undermining the project. After considering how agency mandates support participation in blue carbon project activities, this section suggests that discretion may need to be limited to mitigate the risk of project failure and satisfy market requirements for project permanence.

A. Agency Authority to Conduct Blue Carbon Project Activities

Most land management agencies must rely on enabling legislation or other general land management authority when developing blue carbon projects. In such cases, it may be reasonable to ask whether those authorities are sufficiently broad to allow agencies to conduct the activities necessary for a blue carbon project to successfully sequester greenhouse gases. In practice, however, there is little doubt that most blue carbon project activities are fully consistent with existing land management mandates. A recent study considering the issue found few limitations on the ability of federal, state, or tribal land management agencies to conduct the wetland conservation and recreation activities necessary to implement blue carbon projects.[59] To the contrary, blue carbon project activities appear to be squarely within statutory mandates governing land management.

[59] PORTER ET AL., *supra* note 43, at 16–20. This article focuses on federal and state authority, but legal issues related to tribal participation in blue carbon merit closer consideration.

Most land management laws do not require agencies to undertake specific types of activities, but rather to meet broad goals. These laws allow agencies substantial discretion in interpreting these goals and in how they manage lands to achieve them. For example, the National Park Service (NPS) Organic Act requires NPS to "conserve park resources while providing for their enjoyment, and ensure that all park resources are left 'unimpaired for the enjoyment of future generations.'"[60] A lack of specific definitions of key terms and judicial acceptance of changing interpretations of this mandate over time led Biber and Esposito to find that the NPS has "very broad management discretion under the statute" and there is "little basis to conclude that the Organic Act really does constrain management choices in a significant way."[61] Similar analysis can be applied to other land management mandates, including those focused on wetland conservation, such as the National Wildlife Refuge (NWR) system.[62] Wetland conservation and restoration activities appear fully consistent with these broad mandates, as reflected in the fact that many agencies conduct these activities today, albeit without funding via carbon markets.

If agency authority to conduct blue carbon activities is clear, why then might legislatures wish to explicitly endorse these activities? In most states with carbon market legislation, statutory language has implicitly endorsed the use of state lands for project activities. The Florida Forever Act is an exception, however, explicitly authorizing offsets as an acceptable land use. Explicit endorsement of the use of land for blue carbon activities may arise from a desire to avoid uncertainty or from questions about whether these activities produce sufficient financial return to be consistent with multiple-use frameworks. For example, Florida "'sovereignty lands' are to be managed to produce proceeds for

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[60] Eric Biber & Elisabeth L. Esposito, *The National Park Service Organic Act and Climate Change*, 56 NAT. RES. J. 193, 205 (2016).

[61] *Id.* at 204, 229 ("[T]he significant changes in the Park Service's position over the years gives little basis to conclude that the Organic Act really does constrain management choices in a significant way.").

[62] 16 U.S.C. § 668dd (1998) (requiring FWS to manage NWRs "for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."). *See also* PORTER ET AL., *supra* note 43, at 17 ("Blue carbon projects are congruent with NWRSIA directives, such as habitat conservation, biological integrity, and water quality.").

the state, unless leased to a state agency for a more specific use,"[63] and other lands may be designated for a single use that is incompatible with blue carbon work.[64] Such provisions could limit blue carbon projects if agencies interpret them to prefer or require activities that produce maximum or net fiscal benefits. Explicit authorization may also be politically beneficial to agencies as it provides clear evidence of approval of the activity by both the legislative and executive branches and may thus avoid challenges to carbon market initiatives in the form of oversight or bills seeking to prohibit this activity.

Recent experience with compensatory mitigation on federal multiple-use lands provides an example of how political factors, combined with agency interpretation, could limit blue carbon activities. Section 404 of the Clean Water Act requires compensation for unavoidable loss of wetlands, which can be accomplished by restoring or enhancing existing wetlands, including on public lands.[65] The federal Bureau of Land Management (BLM) is not explicitly authorized to participate in compensatory mitigation, but it participated in these compensatory mitigation projects, including under a solicitor's opinion finding authority based on its general land management mandate.[66] However, the Trump administration issued an opinion reversing this policy and asserting instead that it lacked the authority to conduct compensatory mitigation on its lands.[67] In turn, the

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[63] PORTER ET AL., *supra* note 43, at 18 (citing FLA. STAT. § 253.03 (2018)); FLA. STAT. § 253.03(2) (2018)) ("It is the intent of the Legislature that the board of trustees continue to receive proceeds from the sale or disposition of the products of lands and the sale of lands of which the use and possession are not subsequently transferred by appropriate lease or similar instrument from the board of trustees to the proper using agency.").

[64] FLA. STAT. § 253.034(2)(b) (2014).

[65] SANDRA S. NICHOLS ET AL., ENV'T L. INST., THE FEDERAL WETLAND PERMITTING PROGRAM: AVOIDANCE AND MINIMIZATION REQUIREMENTS 1 (2012) ("for a project to be permitted … compensation [must] be provided for any remaining unavoidable impacts.") (citing 33 U.S.C. § 1344); Compensatory Mitigation for Losses of Aquatic Resources, 73 Fed. Reg. 19594, 19605 (Apr. 10, 2008) (authorizing public lands mitigation projects despite criticism based on unfair competition with private mitigation banks and expectation of conservation without banking income).

[66] The Bureau of Land Management's Authority to Address Impacts of its Land Use Authorizations through Mitigation, Solicitor Mem. M-37039 (Dec. 21, 2016). *See also* Justin Pidot, *The Bureau of Land Management's Infirm Compensatory Mitigation Policy*, 30 FORDHAM L. REV. 1, 8 (2019) (describing that the FLPMA has no explicit mandate for BLM to condition use of public land on implementing compensatory mitigation).

[67] Withdrawal of M-37039, "The Bureau of Land Management's Authority to Address Impacts of its Land Management Authorizations Through Mitigation", Solicitor Mem. M-37046 (June 30, 2017); BUREAU OF LAND MGMT., COMPENSATORY MITIGATION, INSTRUCTION MEMORANDUM 2019-018 (2018).

Biden administration has reinstated the prior regime.[68] This back-and-forth illustrates how, in the current political environment, agency leadership may use a lack of explicit authority to prevent participation in activities to which they are hostile for policy reasons — and may become an issue of greater salience as a result of the recent judicial retreat from deference to agency interpretations of broad statutory mandates.[69] Similar rationales could prevent agencies from participating in blue carbon projects in the future.

These concerns remain primarily hypothetical in the context of blue carbon markets, however: most agencies have justifiably taken an expansive view of their authority in this area. In most jurisdictions and for most agencies, blue carbon project activities are consistent with public land management legislation on both conservation and multiple-use lands, and they are likely to continue to do so where project participation will not only support coastal wetland conservation, but also associated ecosystem services and other co-benefits that enhance public use and enjoyment of these lands.

B. Market Requirements for Specific Land Management Mandates

Carbon market approval of public lands blue carbon projects depends, in part, on whether agencies can demonstrate that they will maintain the carbon sequestered in wetlands permanently — generally defined by carbon markets as at least a century. This demonstration is difficult without a legal obligation to continue project activities for the duration of the project. However, public lands statutes rarely incorporate such obligations, instead retaining substantial flexibility for agencies to manage lands in line with evolving budgetary and policy priorities. Carbon markets thus must determine whether this flexibility is consistent with permanence requirements, and what legal mechanisms — such as contracts or property rights transactions, as discussed in the following section — may be necessary to reduce the impermanence risks.

Carbon markets require projects to demonstrate permanence by considering various natural and anthropogenic risks that may result in reversal.

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[68] Withdrawal of M-37046 and Reinstatement of M-37039, "The Bureau of Land Management's Authority to Address Impacts of its Land Use Authorizations Through Mitigation", Solicitor Mem. M-37075 (Apr. 15, 2022).

[69] *See* Thomas B. Griffith & Haley N. Proctor, *Deference, Delegation, and Divination: Justice Breyer and the Future of the Major Questions Doctrine*, 132 YALE L.J. FORUM 693 (2022) (considering development of major questions doctrine).

For example, the VCS requires land use projects to complete a "Non-Permanence Risk Tool" to assess internal, external, and natural risks that affect the likelihood that the project will achieve the projected mitigation benefits.[70]

Climate risks are perhaps the most obvious form of permanence risk for blue carbon projects because sea level rise is likely to degrade or destroy many coastal wetlands, increase land area losses due to erosion, and otherwise reduce or reverse sequestration. Active habitat management interventions are likely to be necessary during the project period to address these climate risks, and availability of funding or plans for these interventions when and where necessary should be a key element of credible permanence risk analysis. The VCS Non-Permanence Risk Tool requires consideration of certain "natural risks," including extreme weather. This analysis is based on historical return periods but allows (but does not require) forward-looking predictions that may affect these risk factors to capture the changing profile of natural risks in a changing climate.[71] WRC projects also must consider additional climate risks, including changes in the depth of the water table and deposition of wrack due to storm surge.[72] In addition, WRC projects must consider sea level rise as an "external risk" and are subject to an automatic risk increase unless proponents can "demonstrate that potential upstream and sea impacts that could undermine issued credits in the next 10 years are irrelevant or expected to be insignificant, or that there is a plan in place for effectively mitigating such impacts."[73]

The VCS approach to evaluating climate risk for blue carbon projects appears relatively permissive — particularly for projects that are certain to require active management within the crediting period but beyond a 10-year timeframe for mitigation planning. For example, salt marsh ecosystems can migrate with changes in sea level, but they are now threatened by the rapid pace of sea level rise and limitations in their landward spread due to development along the shore.[74] Active management of salt marsh ecosystems will be needed to maintain salt marshes over the next century, such as by modifying sediment accumulation or freshwater inputs (e.g., thin-layer deposition) or acquiring coastal property to

[70] VERRA, AFOLU NON-PERFORMANCE RISK TOOL, Version 4.0 (2019).
[71] *Id.* § 2.4.1.
[72] *Id.*
[73] *Id.* §2.3.1.
[74] *See* Crosby et al., *supra* note 11, at 62 (discussing threats to coastal wetlands).

enable marsh migration into upland areas.[75] Such interventions are likely to be needed beyond the ten-year timeframe required for consideration of sea level rise for WRC projects under the VCS Non-Permanence Risk Tool. Despite this critique, however, the requirement to consider these risks demonstrates the importance of active mitigation planning to avoid reversal and mitigate climate risk.

Protection from development that is incompatible with carbon sequestration is a second key risk for blue carbon projects that include upland areas. The Risk Tool specifically requires consideration of the difference in net present value (NPV) between project activities and other potential land uses of the project site.[76] Where the NPV of alternative land uses is substantially higher than for project activities, projects must mitigate risks through means including a legally-binding commitment to continue management practices during the project crediting period and/or at least 100 years.[77] Acceptable commitments include "any legally enforceable agreement or requirement, such as a conservation easement or protected area law that would require the continuation of the management practice that sequesters carbon or avoids emissions for the entire project longevity."[78] The same definition also provides an example, explicitly authorizing reliance on forestry legislation "where allowing re-growth of harvested areas is required by law" and such re-growth is "common practice."[79] Public lands projects have satisfied non-permanence risk assessment requirements in part by citing enabling legislation and practice.[80] However, it is far from clear that public lands statutes offer effective mitigation for wetlands under the VCS standard and others using similar language. Development risks are substantial for project areas that rely on uplands as a migration corridor for coastal salt marsh or

[75] *See, e.g.*, Donald R. Cahoon et al., *Evaluating the Relationship Among Wetland Vertical Development, Elevation Capital, Sea-Level Rise, and Tidal Marsh Sustainability*, 42 ESTUARIES & COASTS 1, 12 (2019) (discussing marsh elevation and degradation under sea-level rise conditions); VanZomeren et al., *supra* note 12, at 62 (discussing thin-layer deposition using dredged sediment); Van Dolah et al., *supra* note, at 12 (discussing social dimensions of interventions to allow shoreward movement of tidal marshes).
[76] VERRA, *supra* note 70, at § 2.2.3.
[77] *Id.*
[78] *Id.* § 2.2.4(5). Internal document citations do not directly refer to this definition due to apparent scrivener's error. Prior versions of the Risk Tool refer to this definition; *See* VERRA, AFOLU NON-PERMANENCE RISK TOOL § 2.2.3 (Table 3) (Version 3.3 2016).
[79] VERRA, *supra* note 70, at § 2.2.4(5).
[80] *Id.*

mangroves in response to sea level rise, as uplands adjacent to coastal areas retain high value for incompatible development.

Public lands blue carbon projects will struggle to credibly rely on legislative mandates to satisfy market permanence requirements because public lands laws cannot guarantee the publicly-owned portion of the project area will remain protected or that active mitigation will occur. Some laws and regulations explicitly protect coastal wetlands from development. For example, the Rhode Island Coastal Resources Management Council's coastal management program calls for the preservation and enhancement of coastal wetlands, and activities other than those explicitly authorized (including restoration activities) are prohibited.[81] Permits are also restricted, as under other permitting programs, in areas where submerged aquatic vegetation (such as eelgrass) may be present.[82] However, as discussed below, many public lands laws allow or encourage the sale of public lands in fee, or interests in those lands (e.g., mineral rights), particularly on multiple-use lands. In many countries, national parks and other areas seemingly designated for conservation are even less protected than in the U.S. due to government policies favoring development and limited management and enforcement capacity — factors which have produced the well-recognized phenomenon of the "paper park."[83] Agencies thus may undermine sequestration without violating legislative conservation mandates, and market providers accept reversal risk if they accept statutory requirements as effective mitigation of development-related non-permanence risk.

Similarly, even where public lands laws offer strong protections against development, they do not include explicit, affirmative requirements requiring management practices to maintain habitats, as called for in the non-permanence risk tool. Public lands laws governing wetlands are permissive: agencies can conduct activities (including blue carbon project activities), including those that

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[81] 650 20-00 R.I. CODE R. §1.2.2(C).
[82] *See generally id.* § 20-00-1.3.1(R) (approving limited view restoration projects).
[83] *See, e.g.*, David Takacs, *Are Koalas Fungible? Biodiversity Offsetting and the Law*, 26 NYU ENV'T L. J. 161, 215–18 (2018) (noting debate); Xiao Recio-Blanco, *Protecting Marine Biodiversity in Latin America Through Area-Based Fisheries Regulation*, 28 GEO. ENV'T L. REV. 75, 83 (2015) (noting paper park issue in context of marine protected areas); Rebecca Nelson, *Regulating Grassland Degradation in China: Shallow-Rooted Laws?*, 7 ASIAN-PAC. L. & POL'Y J. 385, 400–06 (2006) (noting paper park issues in context of grasslands); Veronica Relano & Daniel Pauly, *The 'Paper Park Index': Evaluating Marine Protected Area Effectiveness Through a Global Study of Stakeholder Perceptions*, 151 MARINE POL'Y 105571 (2023) (finding that 27% of marine protected areas are likely 'paper parks').

are not explicitly authorized, but they are not required to follow particular management strategies or meet measurable benchmarks for ecosystem health or carbon sequestration. By contrast, laws governing forestry and other natural resource extraction activities establish requirements governing specific management practices, such as prohibitions on clear-cutting, that are clearly linked to carbon sequestration.[84] Wetlands laws do not include analogous requirements: agencies are not required to maintain sequestered carbon on their lands in general, let alone on specific tracts. As a result, these laws do not appear to provide the "legally enforceable requirements" needed to reduce permanence risk. Relatedly, agencies generally cannot commit in advance to conduct active management or maintain ecosystems in a particular form in perpetuity, as such commitments would require dedication of financing in violations of laws such as the federal Antideficiency Act.[85]

Project assessors are in the difficult position of needing to determine whether statutes or regulations limiting or preventing development, and non-binding statements of intent by agencies to conduct necessary interventions in the future, are sufficient to protect carbon sequestration on project areas for the project duration. Reliance on such intentions is particularly fraught for blue carbon projects intended to restore wetlands that have become degraded under agency management, as relying on that same management to guarantee permanence is optimistic at best. Land management agencies face not only funding limitations but also increasing demands due to the expected need for ongoing, active management to maintain ecological function in an era of climate change. Governments are unlikely to have the consistent resources, or the political will to dedicate them, to conduct these activities on project areas consistently over the long term without both binding legal commitments and adequate dedicated

[84] *See, e.g.*, 16 U.S.C. § 1604(g)(3) (limits on clearcutting in management plans); *Id.* § 539d (requiring riparian buffers); *Id.* § 668dd (showing an example of the specific management practices required by laws concerning resource extraction).

[85] 31 U.S.C. § 1341 (prohibiting government obligation of funds that have not been appropriated by Congress). Agency actions may be constrained by the Endangered Species Act, but these constraints may change over time and may have unpredictable effects on the ability of agencies to carry out their intended actions. *See* 16 U.S.C. § 1536(a) ("Each Federal agency shall, in consultation with . . . the Secretary, insure that any [agency action] . . . is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of [critical] habitat . . . ").

funding streams over time.[86] Blue carbon funding so far has not covered the full cost of projects, so additional funding will likely be needed over time to maintain promised sequestration benefits. Under these conditions, reliance on agency intention and general directives for conservation appear unrealistically optimistic.

This analysis suggests that laws governing the management of public wetlands are rarely sufficient to demonstrate that blue carbon projects will offer permanent mitigation as defined by carbon markets, and credible carbon markets should demand more affirmative commitments to ensure that risks such as upland development and sea level rise are adequately mitigated. Public lands agencies are not explicitly required to undertake specific management activities contemplated as part of blue carbon projects — if they were, project sites might not require restoration and conservation in the first place. Moreover, fiscal realities suggest that public lands projects are unlikely to be successfully maintained over the long term absent non-statutory, enforceable legal commitments. As a result, carbon markets risk reversal if they do not require governments to commit to projects through measures beyond statutory compliance. These commitments, created through property or commodity agreements, raise separate challenges discussed in the next section.

V. HOW LIMITATIONS ON ALIENATION OF PUBLIC LANDS LIMIT BLUE CARBON TRANSACTION STRUCTURE

Transfer of property rights or commodities from public lands is likely to be necessary for blue carbon projects both to conform to carbon market standards and protect the interests of project partners. Such transfers are an issue of close concern to legislators and the public, however, so they are often constrained by public lands laws. This section reviews agency authority to enter into agreements to transfer carbon rights or credits before considering whether and how four types of transaction agreement structures may satisfy both legal requirements and market standards.

[86] EPA and USACE have recognized the insufficiency of current budgets as one justification for the compensatory mitigation rule. Compensatory Mitigation for Losses of Aquatic Resources, *supra* note 65, at 19612 ("Credits secured by private developers [via mitigation banks or in-lieu fee projects] can provide a source of income for public entities to conduct . . . activities that could not be done under their current budgets.").

A. Agency Authority to Enter into Agreements to Transfer Carbon Rights or Credits

Blue carbon projects on public lands generally require land management agencies to transfer carbon rights or carbon credits to non-governmental entities. In most public lands carbon market transactions, a non-governmental funding partner will provide part or all of the resources needed to conserve and/or restore the project area in exchange for the right to claim the value of the carbon sequestered. If an agency cannot transfer that value to the funding partner, the transaction cannot occur. However, agencies commonly lack explicit authority to enter into contracts or agreements necessary for carbon market transactions, and their general authority to alienate public lands or associated natural resources is often limited. Such prohibitions or limitations on carbon value transfers may be the most substantial legal hurdle to completing blue carbon transactions.

i. The nature of carbon rights and credits

Carbon rights are the source of value underpinning carbon market transactions. Carbon rights have been defined as "the right to benefit from sequestered carbon and/or reduced greenhouse gas emissions."[87] These rights "flow from either the ownership of the asset or the control of the activity that lead to [sequestration]."[88] While few courts have been called upon to consider the nature of carbon rights to date, they may be generally understood as a property right that can be characterized as an entitlement of the landowner to the benefits associated with sequestration occurring on land.[89] Carbon rights from blue carbon

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[87] Charlotte Streck, *Who Owns REDD+? Carbon Markets, Carbon Rights and Entitlements to REDD+ Finance*, 11 FORESTS 959, at 1, 6 (2020) (quoting ANNA KNOX ET AL., FOREST CARBON RIGHTS GUIDEBOOK: A TOOL FOR FRAMING LEGAL RIGHTS TO CARBON BENEFITS GENERATED THROUGH REDD+ PROGRAMMING (2012)).

[88] *Id.*

[89] Roseland Plantation, L.L.C. v. U.S. Fish & Wildlife Serv., No. 05-0793, 2006 U.S. Dist. LEXIS 29334, at *3 (W.D. La. Apr. 5, 2006) (holding that potential to sell carbon credits derived from trees on plaintiff's land "make[s] up a portion of the bundle of rights in the real property."). Whether carbon rights have been transferred by past agreements may be disputed, as in the case of credits generated on lands subject to a conservation easement or timber sale that is silent on carbon rights. *Id.* (resolving motion to dismiss case over whether carbon rights were included in conservation easement); Aaron M. Schutt, *ANCSA Section 7(I): $40 Million Per Word and Counting*, 33 ALASKA L. REV. 229, 268–69 (2016) (assessing whether carbon credits are part of timber resource).

projects therefore generally accrue to the landowner — and thus, in the context of public lands projects, to the government.[90]

Carbon rights produce carbon credits when part of an approved mitigation project. Carbon credits are not property rights, but rather are fungible commodities representing a fixed amount of greenhouse gas emissions mitigated by an approved project.[91] Credits are issued or certified by a carbon market registry as mitigation benefits are realized; once issued, they can be traded or used to offset emissions.[92]

The owner of carbon rights on land has several options: (1) they may themselves claim and consume the credits generated on the land; (2) transfer the rights to another party or for a term of years via a carbon rights lease, easement or other property transaction, allowing the third party to claim credits produced from the land; or (3) continue to hold the rights but convey the credits to another party

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[90] Disputes may arise as to whether blue carbon rights accrue to the owner of the surface or mineral estate, as in the context of pore space used for carbon capture and storage. *See generally* A. Bryan Endres, *Geologic Carbon Sequestration: Balancing Efficiency Concerns and Public Interest in Property Rights Allocations*, 2011 U. ILL. L. REV. 623 (2011) (discussing ownership of pore space). For this and other reasons, blue carbon projects on split estate lands may be particularly complex. However, in most cases, the government may be assumed to be the holder of the carbon rights on public lands.

[91] HAW. STATE OFF. PLAN, *supra* note 49, at 25 ("An offset or offset credit . . . is a credit for mitigating 1 metric ton carbon dioxide (CO2) equivalent by paying someone else to avoid 1 metric ton CO2 equivalent. Offset credits are monetarily tradeable and must be evaluated and certified by an offset standard . . . ."). The law of timber sales appears to present a useful model for understanding carbon rights and credits. The sale of standing timber is a property transaction, as it is part of the land, whereas the sale of cut timber or timber to be cut imminently is considered a contract for the sale of goods. *See generally* William A. Thomas, *Natural Resources and the Uniform Commercial Code*, 7 NAT. RES. Law. 439, 440 (1974) (noting treatment of timber sales in the Uniform Commercial Code).

[92] *See, e.g.*, Laurie Ristino, *Conservation Easements in an Ecosystem Services Age*, 24 WATER RES. & ENV'T 56, 56 (2010) (credits are "issued by a regulatory body"); *see* John Monterubio, *Recognition of Property Rights in Carbon Credits under California's New Greenhouse Gas Cap-and-Trade Program*, 12 SUSTAINABLE DEV. L. & POL'Y 32, 32 (2012) (noting distinction in the nature of carbon rights and credits); Maron Greenleaf, *Using Carbon Rights to Curb Deforestation and Empower Forest Communities*, 18 N.Y.U. ENV'T L. J. 507, 539 (2011) ("Carbon rights (the right to the benefits of a specified pool of carbon) should be distinguished from carbon offsets (commodities that can be traded internationally")).

as they are produced.[93] A land management agency developing a blue carbon project on its lands may select any of these options, subject to legal constraints discussed below. Depending on which option is selected, a conveyance may require a property instrument (e.g., conservation easement) or commodity contract (e.g., sale of carbon credits).[94] The choice of transaction structure may depend on multiple factors, not least the nature of the agency's authority to transfer rights and credits on its lands.

ii. Limitations on alienation of public lands

Public lands laws vary widely in authorization of property and commodity transactions by responsible agencies. The extent of agency authority to alienate property interest in coastal lands and waters plays a critical role in whether and how an agency can structure blue carbon projects on its lands.

Agencies managing multiple-use lands (including many state lands agencies) often have broad mandates for exploitative use of public lands and are authorized to participate in a range of transactions involving both property and commodity interests in land for grazing, timber, mineral extraction, and other purposes.[95] As a recent study noted, for example, that "any Louisiana land-management entity, including but not limited to the Office of State Lands, can lease state lands under their jurisdiction 'for trapping, grazing, hunting, agricultural, and any other legitimate purposes' other than mineral development."[96] Broad authority of this nature is not uncommon at the state level

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[93] Fishing rights provide a useful analogy. Under a rights-based fishery management system such as an individual fishing quota (IFQ) system, a fisherman has the right to catch a fixed percentage of the catch each year. *see e.g.*, 50 C.F.R. § 622.21(a) (describing IFQ system for Gulf of Mexico red snapper fishery). The fisherman can sell that right in perpetuity or the annual allocation that it generates. *Id.* at § 622.21(b)(6) (distinguishing between permanent "share transfers" and one-year "allocation transfers"). Similarly, a carbon rights holder may sell the rights themselves or an offset generated by those rights in a given year.

[94] *See* Ristino, *supra* note 92 (noting the use of "contracts and real property instruments" for transactions processed on the Chicago Climate Exchange).

[95] SMITH, *supra* note 22, at 16.

[96] PORTER ET AL., *supra* note 43, at 25 (emphasis in original) (citing LA. STAT. ANN. §§ 41:1211–12 (covered agencies and authorizing leases)). Other states have similarly broad authorization for alienation of state lands not set aside for specific (often conservation) purposes. *See e.g.*, FLA. STAT. § 253.03(2) (2014) (directing the Board of Trustees of the Internal Improvement Trust Fund to "continue to receive proceeds from the sale or disposition of the products of lands and the sale of lands"); WASH. REV. CODE ANN. §§ 79.11–.13 (providing for sale and lease of all or property rights to certain emergent state lands).

for lands not dedicated to particular purposes or uses and provides maximum flexibility for blue carbon project structure.

In contrast to multiple-use lands, broad alienation authority is the exception, rather than the rule, for conservation lands. Agencies that manage lands dedicated to a specific (conservation) purpose are often subject to strict limitations on transfer of rights on those lands, whether by property or contract transaction. For example, the NPS cannot lease or sell property interests in lands within the National Park system, and it can only enter into contracts for a few purposes identified in the Organic Act.[97] FWS governing statutes similarly strictly limit the agency's authority to transfer property interests or sell commodities on NWR lands.[98] While not universal, state conservation agencies also face similar limits on both property and commodity transactions arising from the use of their managed lands.[99] Transfer of carbon rights or credits from conservation lands thus is usually, though not always, more legally constrained than such transfers on multiple-use lands.

iii. Public trust limitations on alienation of submerged lands

Public trust limitations may impose additional limitations on alienation of carbon rights on coastal submerged lands. The public trust doctrine requires that

[97] *See, e.g.*, 54 U.S.C. § 101925 (commercial use authorizations); *id.* § 101925 (authorizing commercial use). S*ee also id.* § 100753 (2018) ("The Secretary . . . may sell or dispose of timber in cases where . . . the cutting of timber is required."). NPS can, however, sell or lease specific lands not in national parks or national monuments under certain conditions. 36 C.F.R. § 17.3 (authorizing commercial uses).

[98] 16 U.S.C. § 668dd (comparing the strict limits that the FWS has concerning transferring property on NWR land with the NPS); PORTER ET AL., *supra* note 43, at 24 (discussing FWS authority).

[99] *See* PORTER ET AL., *supra* note 43, at 25 (citing WASH. REV. CODE § 79.70.040 (2021)) (stating natural area preserves "shall be held in trust and shall not be alienated except to another public use upon a finding by the department of natural resources of imperative and unavoidable public necessity."); *but cf.* LA. STAT. §§ 56:1687(6) (2020), 36:204 (2020) (authorizing Office of State Parks to sell, lease, or sublease managed lands "when [the agency] believes it advantageous to the state to do so.").

states manage submerged lands, including coastal wetlands,[100] for the benefit of their citizens and prohibits them from violating their citizens' rights to use those lands.[101] Protected uses generally include at least fishing, commerce, and navigation, but some states have expanded protections to cover other uses, such as recreation.[102] Many states prohibit sale of submerged lands or rights to land — for example, Washington has prohibited sale of "state-owned tidelands and shorelands" to nonpublic entities since 1971.[103] However, states often allow lesser conveyances, such as a lease for a particular purpose, provided that they further a public interest and do not interfere with trust uses.[104]

Where state public trust law does allow leases of submerged lands, leases of carbon rights appear to be the type of transaction that would pass muster. Carbon rights lessees may require the power to prohibit or restrict activities that may result in reversal (e.g., dredging or mineral development), but such restrictions are unlikely to affect public access or use of the project area for navigation or recreation. Permanent alienation of submerged lands or carbon rights are not necessary in the lease context, though the length of the lease term is commonly limited by statute.

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[100] The boundaries of the areas subject to the public trust and the protected activities differ by state. In most states, the boundary between private ownership and public trust lands is mean high water, but some states have established different standards. Boundaries of public trust waters do not necessarily track property boundaries — to the contrary, states including Massachusetts and Louisiana "extend public trust rights to the high-water mark even though they recognize upland private ownership down to the low-water mark." Robin Kundis Craig, *A Comparative Guide to the Eastern Public Trust Doctrines: Classifications of States, Property Rights, and State Summaries*, 16 PENN. ST. ENV'T L. REV. 1, 15 (2007).

[101] *See* Illinois Central R.R. Co. v. Illinois, 146 U.S. 387, 458 (1892) (explaining the public trust doctrine); Shively v. Bowlby, 152 U.S. 1, 49–50 (1894) (establishing equal footing doctrine, so that each state owns submerged lands and is subject to public trust doctrine on joining union); Phillips Petroleum Co. v. Mississippi, 484 U.S. 469, 476, 493 (1988) (O'Connor, J., dissenting) (reaffirming that the public trust applies to all submerged lands subject to tides) (noting that the sale of mineral rights in submerged lands by a state violates the public trust).

[102] *See* Craig, *supra* note 100, at 17–18 (discussing protected uses by state for eastern states); Robin Kundis Craig, *A Comparative Guide to the Western States' Public Trust Doctrines: Public Values, Private Rights, and the Evolution Toward an Ecological Public Trust*, 37 ECOL. L. Q. 53 (2010) (characterizing elements of public trust doctrine in western states).

[103] WASH. REV. CODE § 79.125.200(2) (2021) ("Notwithstanding any other provision of law, from and after August 9, 1971, all state-owned tidelands and shorelands . . . shall not be sold except to public entities as may be authorized by law and they shall not be given away.").

[104] Tim Eichenberg & Barbara Vestal, *Improving the Legal Framework for Marine Aquaculture: The Role of Water Quality Laws and the Public Trust Doctrine*, 2 TERRITORIAL SEA. J. 339, 353–54 (1992).

In states with broader public trust restrictions, however, leases may not be possible and alternative approaches may be needed. Alternatives include statutory amendment to authorize carbon rights leases or other property transactions on submerged or intertidal lands for blue carbon use or the sale of carbon credits over time to avoid burdening the surface estate.

Public land management mandates establish a range of authority for agencies to transfer carbon rights and/or carbon credits. On multiple-use lands, transfers up to and including sale of fee simple lands may be authorized, subject to limitations imposed by the public trust. On conservation lands, however, authority to transfer rights and credits is often far more constrained, and existing law largely prohibits agencies from entering into property and/or commodity transactions that are not explicitly authorized. This explicit authorization is usually lacking in the case of carbon rights and credits — a serious issue for blue carbon projects, which are often best suited to lands managed by conservation-oriented agencies. Expansion of agency transactional authority thus has unsurprisingly been included in several state legislative reforms — most notably in Virginia. However, most agencies continue to lack such authority.

States and agencies lacking explicit authority to enter into blue carbon project agreements may wish to find a transaction structure that complies with the limited authority they have under existing law. The next section identifies four options that agencies may use for structuring blue carbon projects. Each structure raises different legal issues, but also has implications for conformity with carbon market standards.

B. Options for Transferring Carbon Rights and Credits

Given the array of authorities governing alienation of carbon rights and carbon credits on public lands, different transaction structures will be needed to comply with the law, conform to carbon market standards, and set forth the obligations of project participants. Ensuring unambiguous ownership of carbon rights or credits is likely to be a central concern for both funding partners and assessors evaluating conformity with market standards. The VCS, for example, requires project proponents to "demonstrate that they have the legal right to control and operate project . . . activities."[105] Where proponents do not own or

[105] VERRA, *supra* note 25, at § 3.6.

control the land, an "enforceable and irrevocable agreement" is required with the holder of the land rights "which vests project ownership in the project proponent."[106] This language appears to require the project proponent to control the carbon rights, including the ability to control activities on the land that may affect those rights. This language leaves room for a variety of arrangements in which the public agency, funding partner, or another partner may be the project proponent. The sections that follow explore how four transaction structures — including (i) sale or lease of carbon rights; (ii) sale of carbon credits as a commodity; (iii) transfer via memoranda of agreement; and (iv) retention of rights on acquired lands — are affected by both legal and carbon market requirements.

i. Lease or sale of carbon rights to public lands

Where agencies have the requisite authority, they may structure transactions around sale, lease, or other conveyance of carbon rights to a funding partner for the duration of the project period. As discussed previously, some agencies responsible for management of multiple-use lands have broad authority to engage in such transactions, up to and including fee simple sale of property rights. For such agencies and lands, a lease of carbon rights to enable a blue carbon transaction is likely a relatively simple process with ample precedent in natural resource extraction contexts.[107]

Carbon rights leases or other property transactions do not pose substantial issues for meeting the unambiguous ownership requirements of market standards. The property nature of a carbon right lease or sale means that such transactions are enforceable and irrevocable for their term. Thus, provided that the lease or sale document contains terms addressing other market requirements (such as obligation to perform management activities and monitoring), carbon rights transactions appear capable of satisfying carbon market standards.

Carbon rights transactions raise policy concerns independent of legal authority and market standards, both within and beyond the U.S. These concerns are similar to those implicated in public-private partnerships, which have been used in a variety of non-natural resource contexts. For example, a substantial number of state and local governments have monetized or funded development of

[106] *Id.* § 3.6.1(6).
[107] Leases are commonly used to monetize publicly-owned natural resources, such as oil, gas, and renewable energy. *See* 43 U.S.C. § 1337 (2018) (lease provisions for offshore energy development on the Outer Continental Shelf).

public infrastructure through leases of future revenues, such as tolls or parking fees, to private enterprises.[108] Public-private partnerships have also been attempted in public lands contexts, with varying results.[109] Commentators have critiqued such arrangements on multiple grounds, such as a loss of sovereign control over public assets resulting in management solely for profit and in opposition to other values.[110] These critiques likely also apply to some degree to blue carbon projects, as carbon rights holders may be able to demand or undertake actions to maximize carbon storage in ways that negatively affect co-benefits. While hypothetical, such actions might include limits on public access or maximizing growth of particular species rather than maintaining a balanced ecosystem. Careful consideration is needed to avoid unintended negative consequences of rights leases and to ensure that carbon rights leases contain terms to protect the broader interests of land managers and the public.

Agencies with existing leasing authority may be able to design leasing provisions on a project-by-project basis to address these considerations and include terms such as limitations on lease duration and the obligations of parties. However, a more comprehensive review of lease program design may be more appropriate to not only ensure compliance with legal requirements and conformity with carbon market standards, but also to establish when, where, and how these transactions are in the public interest.

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[108] *See generally* Ellen Dannin, *Crumbling Infrastructure, Crumbling Democracy: Infrastructure Privatization Contracts and Their Effects on State and Local Governance*, 6 Nw. J. L. & SOC. POL'Y 47, 51 (2011) (discussing challenges related to provisions in transportation infrastructure leasing contracts).

[109] *See, e.g.*, Tom Ribe, *An Experiment in Privatizing Public Land Fails After 14 Years*, HIGH COUNTRY NEWS (Feb. 12, 2015) (discussing history of Valles Caldera National Preserve); Alex Brown, *Privatizing State Parks Can Save Them – Or Wreck Them*, STATELINE (Dec. 3, 2019) (discussing benefits and pitfalls associated with public-private partnerships on state private lands).

[110] *See, e.g.*, Ribe, *supra* note 109 and Brown, *supra* note 109. *See also* Jon D. Michaels, *We the Shareholders: Government Market Participation in the Postliberal U.S. Political Economy*, 120 COLUM. L. REV. 465, 489–90 (2020) (critiquing government market participation across multiple subject matter areas); Mary Grant, *Water Privatization Overview: A Public Interest Perspective on for-Profit, Private Sector Provision of Water and Sewer Services in the United States*, 14 J. L. SOC'Y 167, 176–77 (2013) (discussing concession arrangements for maintenance and provision of water and sewer services). The forces prompting privately-funded carbon sequestration projects on public lands are similar, and reflect a similar policy outlook, to forces driving public-private partnerships in other contexts. Critiques of public-private partnerships and of neoliberal approaches to governance thus apply to some degree to public lands carbon credit projects. This article recognizes but does not directly evaluate critiques of public-private partnerships in the context of carbon sequestration transactions.

ii. Sale of carbon credits without transferring underlying carbon rights

Agencies without authority to lease or otherwise convey property rights on public lands may be authorized to enter into commodities contracts for the sale of carbon credits. Agencies may have broader legal authority to sell commodities than property rights, though for some agencies and lands, this too will be prohibited. Where authorized, transactions based on the sale of carbon credits would involve agency receipt of capital from the funding partner in exchange for the transfer of carbon credits as they are produced during the project, with the government retaining the underlying carbon rights. The agency, as carbon rights owner, would remain the project proponent responsible for both initial restoration and continuing maintenance of the project area, subject to commitments to the carbon credit purchaser. The carbon credit sale contracts would undoubtedly set out these obligations, whether they are to be carried out by the land manager or by a third-party implementation partner.

There is ample precedent for sale of commodities from public lands. Notably, timber sales on National Forest lands are required to be executed as sales contracts with a maximum of a ten-year term.[111] These contracts are subject to a wide range of specific terms and conditions set out in Forest Service regulations, such as a requirement that timber and forest products be paid for in advance of cutting and requirements for appraisal of the value of the timber to be cut.[112] With adequate legal authority, similar blue carbon transactions would involve contracts between the agency and funding partner, providing the funding partner with a contract for the term of the project, likely with an initial payment for restoration and additional payments for maintenance in advance of annual issuance of carbon credits.[113]

Revenue bonds are a second potential model for carbon credit sales, though they are only beginning to be used in the natural resource context. Municipalities and other government entities commonly issue revenue bonds to

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[111] 16 U.S.C. § 472a (2011).
[112] 36 C.F.R. Part 223, subpart B; *id.* § 223.34 (advance payment); *id.* §§ 223.60–.66 (appraisal).
[113] Unless specifically exempted, agency carbon credit sales contracts would need to comply with the Antideficiency Act, 31 U.S.C. § 1341, and similar laws and regulations governing government contracting.

raise capital for revenue-generating infrastructure projects, such as toll roads.[114] These bonds provide their government issuers with capital for use in construction or maintenance projects, which is repaid to investors over time as those projects produce revenue. For example, Rhode Island sold $600 million in bonds as part of the RhodeWorks program, to be repaid from future toll revenues.[115]

Like toll roads, carbon projects produce future revenue in the form of carbon credits. Future carbon credits therefore could be used to support interest payments on a green bond. The first such transaction was completed in 2016, when the International Finance Corporation (IFC), an arm of the World Bank, issued a "forestry bond" that allows investors to be paid interest in the form of REDD+ carbon credits.[116] This bond — apparently the first financial instrument payable in carbon credits — originated in the Kasigau Corridor Programme in Kenya and has been sufficiently successful for IFC to develop a similar "Multi-Country Forests Bond Programme" for private-sector REDD+ projects in the Democratic Republic of Congo, Madagascar, and Peru.[117] Both programs have been criticized on numerous grounds — tied in particular to governance issues and whether they are producing real and additional mitigation[118] — but they illustrate the potential for bonds to provide restoration funding to government

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[114] *See* Christine Sgarlata Chung, *Rising Tides and Rearranging Deckchairs: How Climate Change is Reshaping Infrastructure Finance and Threatening to Sink Municipal Budgets*, 32 GEO. ENV'T L. REV. 165, 182–84 (2020) (noting shift by municipalities to use revenue bonds rather than general-obligation bonds).

[115] Ted Nesi, *New Questions About $595M Savings from Raimondo Truck-toll Plan*, WPRI.COM (Dec. 10, 2015). *See also* Am. Trucking Ass'ns v. Alviti, 944 F.3d 45, 47 (1st Cir. 2019) ("Rhodeworks imposes a daily limit on such tolls of $40 per truck and a $20 limit on border-to-border trips along Interstate 95. Within those limits, RIDOT determines both the locations of toll collection and the amounts of the tolls. Under RIDOT's authority, the Rhode Island Turnpike and Bridge Authority ("RITBA") collects the tolls and deposits the revenue into a special account. This account, called the "Rhode Island bridge replacement, reconstruction, and maintenance fund," can be used only "to pay the costs associated with the operation and maintenance of the toll facilit[ies]" and to fund the "replacement, reconstruction, maintenance, and operation of Rhode Island bridges."). The Rhodeworks program was subsequently determined to violate the dormant commerce clause for reasons other than its use of revenue bonds. Am. Trucking Ass'ns v. Alviti, 630 F.Supp.3d 357 (2022), *appeal docketed* No. 22-1795 (1st Cir. Oct. 19, 2022).

[116] Hamza Ali, *IFC Launches Forestry Bond That Can Pay its Coupon Using REDD+ credits*, ENV'T FIN. (Oct. 17, 2016); Jennifer Hughes, *Bonds – From Carbon Credits to Chinese Central Bankers*, FIN. TIMES (June 1, 2017).

[117] NORAH BERK & JOE EISEN, RAINFOREST FOUNDATION UK, GOOD MONEY AFTER BAD? RISKS AND OPPORTUNITIES FOR THE GREEN CLIMATE FUND IN THE CONGO BASIN RAINFORESTS 1, 18–21 (2019).

[118] *Id.*

entities in advance, while compensating investors through carbon credits that accrue over time — without requiring conveyance of an ownership interest in the underlying carbon rights. These bonds may thus avoid some of the public policy challenges associated with carbon rights leases.

Carbon credit transactions appear consistent with carbon market requirements for unambiguous ownership and other requirements of carbon markets. In these transactions, the government continues to serve as the unambiguous owner of the rights and will commit to undertake certain management actions on behalf of the purchaser of the carbon credits. These commitments will be set out in the sales contract and can be drafted to be irrevocable and enforceable for the duration of the contract. Carbon credit sales therefore appear to pose few challenges to carbon market approval.

Agencies with authority to sell future commodity revenues may be able to complete credit sale transactions without violating legal restrictions preventing conveyance of carbon rights. However, only agencies with broad authority to divest resources on public lands are likely to have sufficiently broad authority to sell carbon credits — particularly when those credits are sold in the form of a bond transaction. Authorizing carbon credit transactions by other agencies is likely to require an appetite for legal reform.

iii. Transfers of carbon rights or credits by MOA

Even agencies that face substantial restrictions on transfer of rights to or commodities derived from public lands can enter into nonbinding agreements regarding the use of those lands. However, these legally-unenforceable mechanisms, such as Memorandum of Agreement (MOA), appear to clearly violate carbon market standards for unambiguous ownership and are not a credible means of allocating carbon rights or credits.

There is precedent for the use of MOAs to establish carbon sequestration projects on public lands in the U.S. where contracting authority is limited — most notably, FWS afforestation projects in the lower Mississippi River basin. As described in Porter et al., for example, the "Restoration of Bottomland Hardwood Forests at National Wildlife Refuges in the South Central US" project used MOAs to describe the relationship of project partners, including ownership of carbon credits:

> The project restored planted areas of four NWRs in Arkansas and Louisiana, some but not all of which were in the Refuge system prior to the project. Carbon offset rights were claimed by Entergy, and other project partners acknowledged and agreed not to claim the carbon rights, via a series of MOAs for each Refuge. While the complete MOAs are not available to the public, the project documentation includes excerpts, including the following language for lands in Overflow NWR owned by FWS prior to the project:
>
> This Agreement documents the understanding of the parties regarding the transfer of the Acquired Reforestation Tract to the Service, the planting and management of the Acquired Reforestation Tract, management of the Refuge Reforestation Tract by the Service, and the donations made and to be made by Entergy and The Conservation Fund under the Fish and Wildlife Act of 1956. The donations from Entergy are made expressly subject to the condition that Entergy reserves the right to report and may report, on its behalf and for its affiliates, sequestered carbon associated with the trees planted on the Acquired Reforestation Tract and the Refuge Reforestation Tract.[119]

This and other MOA-based projects were accepted by the American Carbon Registry, though the purported reservation of carbon rights on NWR lands by Entergy in this instance appears unenforceable, since FWS lacks legal authority to transfer those rights.[120]

MOAs, such as the one quoted above, do not appear to satisfy the VCS standard requirement that agreements used to transfer rights to projects be legally enforceable and irrevocable. To the contrary, such agreements are nonbinding and unenforceable, and they can be dissolved at any time by any party with little recourse for counterparties. Termination or breach of an MOA in a blue carbon transaction could leave the project proponent with no legal right to claim any carbon credits produced on the site. In addition, unenforceable agreements allow landowners to modify land use practices at any time during a project without recourse, increasing the risk of reversals (i.e., permanence failures), which must

[119] PORTER ET AL., *supra* note 43, at 8–9 (internal footnotes and citations omitted) (quoting TERRACARBON LLC, ENTERGY CORP., RESTORATION OF BOTTOMLAND HARDWOOD FORESTS AT NATIONAL WILDLIFE REFUGES IN THE SOUTH CENTRAL U.S. 80 (2011)).
[120] *See supra* note 98 and associated text.

be covered by other projects for the market to remain viable. Non-enforceable agreements thus pose substantial risks not only to project proponents but to market stability.

It is tempting, but ultimately misguided, to suggest that carbon markets should allow the use of MOAs by public lands agencies. Public agencies appear to present lesser risks of non-permanence than non-governmental entities because of the very restrictions on transfer of property rights discussed above. However, these restrictions are themselves impermanent. Over even relatively short time periods (as the last few presidential administrations clearly indicate), government policy preferences can change drastically, and those preferences could lead to termination of MOAs. Markets must also consider the issue from an international perspective, recognizing the wide array of paper parks for which protections on development exist on paper but not in practice. As a result, markets are justified in holding a firm line against the use of unenforceable agreements by public agencies.

iv. Retention of carbon rights on acquired lands

Agencies without authority to transfer carbon rights or carbon credits appear to have only one option to participate in blue carbon projects on their existing lands at this time. That option is to accept donations of private lands from which carbon rights have been separated prior to the donation. Most FWS afforestation projects completed to date have used this "acquired lands" strategy to avoid transfer of property rights on existing NWR lands.[121] The credits for these projects were generated on lands not yet owned by the government, but donated to the government at closing without carbon rights.[122] The MOAs used for these projects note that the funding partner had acquired and explicitly reserved the carbon rights on the donated lands, so that they never passed to the government, and the funding partner therefore retained continuing rights to claim credits generated on those lands without the government needing to convey them.[123]

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[121] *See* PORTER ET AL., *supra* note 43, at 7–9 (reviewing past projects). The MOA quoted above at *supra* note 119 and associated text is the sole example known to the author of a project covering lands already in the NWR system.
[122] *Id.* at 20.
[123] *Id.*

This strategy is available to most public land agencies. Most agencies have some form of authority to accept donations of land, including encumbered land, though "the extent and conditions on acquisitions and gifts differ from agency to agency."[124] Limitations on donation authority and the availability of a quasi-governmental foundation able to act as fiscal agent are important considerations for this type of blue carbon project.[125] However, most agencies appear to have some legal authority to accept or acquire lands, allowing blue carbon projects dependent on donation or acquisition to proceed as long as the agency is willing to do so.[126]

Acquired lands projects appear capable of satisfying carbon market requirements. In these transactions, there is no doubt that the funding partner is the unambiguous, irrevocable, and enforceable owner of the carbon rights to project lands, and therefore of the resulting credits. Conveyance of the lands by a nongovernmental partner to the public can also ensure that the funding partner retains the right to conduct project activities on those lands for the duration of the project (or conversely, establish the duty of the agency to conduct those activities). Under these conditions, this transaction structure does not appear to limit acceptance by a credible market.

The downside of the 'acquired lands' project structure is that it is possible only for a small subset of potential blue carbon projects. Blue carbon projects are commonly conducted on submerged or intertidal lands, most of which are already in public hands. However, some submerged and intertidal lands are owned by private entities due to subsidence, conveyance prior to statehood, state coastal

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[124] *Id.* at 21, 21–24.

[125] *See id.* (discussing potential utility of National Park Foundation for blue carbon projects).

[126] Agencies may hesitate to accept donated lands on which carbon rights have been withheld for policy reasons. For example, NPS initially refused to take title to lands now within Everglades National Park because mineral rights on those lands had been separated from the surface estate and remained in private ownership. ALICIA BURTNER, NAT'L PARK SERVICE, MARJORY STONEMAN DOUGLAS WILDERNESS CORE ELEMENTS: 2010 5 (2010). Instead, the federal government accepted these lands as a NWR until the mineral rights issues could be resolved to NPS's satisfaction. *Id.* Split estates are in fact common on both NPS lands and NWRs, so NPS may not consistently refuse split estate lands in the future. *See* Andrew C. Mergen, *Surface Tension: The Problem of Federal/Private Split Estate Lands*, 33 LAND & WATER L. REV. 419, 431 (1998) (noting private ownership of mineral rights, including oil and gas rights, on public lands are present on two-thirds of NPS units and more than 100 NWRs). While blue carbon activities do not raise the same potential for environmental degradation as mining or oil and gas extraction, NPS or other agencies could potentially object to accepting lands on which carbon rights had been severed.

property boundaries, or other reasons.[127] Conveyance of private tidelands to public ownership may be desirable to land managers and well-suited to a carbon market transaction. Acquisition of some privately-owned uplands projected to become salt marsh in the future may similarly be desirable to enable marsh migration. Unlike submerged and intertidal areas, future marsh areas are often owned by private entities, but are poorly suited to development due to their current exposure to storm-induced flooding and the increasing regularity of tidal flooding that they will experience as sea level continues to rise. Donation of these lands to public ownership may be essential to enable marshes to migrate inland and protect the carbon sequestration and other co-benefits that these ecosystems provide. These examples indicate that while not appropriate in all cases, blue carbon projects on acquired lands may play an important role in conserving and restoring coastal wetlands.

VI. BLUE CARBON LEGISLATION: A NEEDED STEP

Coastal wetlands are threatened and require restoration and active conservation, but responsible agencies lack the resources necessary to maintain them. Blue carbon projects may provide badly-needed funding to support the continued functioning of these ecosystems as carbon sinks. While public wetlands are often ideal sites for blue carbon projects, projects on existing public lands face substantial challenges. As methodological and scientific issues are resolved, agencies and partners are facing increasingly urgent questions about how to overcome inter-related legal and market challenges.

This article suggests that agencies cannot rely on existing public lands law to support participation in blue carbon projects on public coastal wetlands. Although existing enabling legislation provides adequate discretion for agencies to conduct wetland conservation and restoration activities necessary for blue carbon projects, this discretion undermines project permanence and conformity with carbon market standards. Under these conditions, enforceable agreements among project partners are needed to provide confidence in the longevity of blue carbon projects and provide the resources for future management action necessary

[127] *See, e.g.*, Jacques Mestayer, *Saving Sportsman's Paradise: Article 450 and Declaring Ownership of Submerged Lands in Louisiana*, 76 LA. L. REV. 889, 896 (2016) (discussing private ownership of coastal marsh bottoms in Louisiana); Erin J. Bryant & Kristin M. Fletcher, *Exploring a New Strategy for Marine Protection: Private Conservation of Tidelands in Massachusetts*, 12 OCEAN & COASTAL L. J. 15 (2006) (discussing private ownership of submerged lands and tidelands).

in the face of sea level rise. Agreements between agencies and nongovernmental project partners also serve other roles — notably, by clarifying ownership of carbon rights to the project area and of the carbon credits that will be produced during the project. Some agencies already have broad authority to enter into agreements for carbon transfers on public lands. However, many agencies — particularly those focused on conservation, which may be most interested in the success of blue carbon projects — cannot enter into carbon rights leases or sell carbon credits on managed lands, preventing them from entering into the legally-binding commitments that are necessary for projects to be credible and satisfy carbon market requirements. Current law related to agency authority to transfer carbon rights or credits therefore poses a substantial legal challenge that must be addressed for blue carbon projects to occur on public lands at scale.

Statutory reform appears necessary to enable blue carbon projects to meet both legal and carbon market requirements. As discussed in Part III, a few states have enacted legislation to enable agencies to participate in carbon market projects on public lands. This legislation addresses one or more of five issues relevant to carbon market participation:

1. Clarification that carbon market projects are consistent with land management mandates;

2. Authorization for agencies to enter into agreements necessary for carbon market projects on state lands;

3. Delineation of carbon credit ownership derived from projects on state lands;

4. Authorization for agencies to acquire public carbon rights easements on private lands; and

5. Direction for the use of funds derived from the sale of carbon credits on state lands.

Each of these elements is important to agencies interested in participating in blue carbon projects. However, these elements have been addressed in a patchwork fashion by individual states, which have generally responded to only one or a few

of these issues, often with little detail to support effective implementation. Even the most comprehensive such statute, enacted in 2020 in Virginia, addresses only a subset of these issues and only in broad outline. For example, while it authorizes agencies to "enter into agreements necessary" for blue carbon projects, this authorization is limited to projects for submerged aquatic vegetation and does not address the character of those agreements — for example, whether the agency can transfer carbon rights and/or carbon credits. While existing legislation points to the need for legislative clarification of agency roles in carbon market projects on public lands, it does not appear to be sufficiently broad or detailed to address the full range of legal and market challenges.

New federal and state legislation will be needed to address legal and market challenges in a systematic, rather than piecemeal, fashion. This legislation would not only authorize each of the necessary types of activities, but also resolve questions related to blue carbon project implementation in more detail than any existing law. For example, systematic legislation would not only authorize agencies to enter into agreements, but would also clarify the types of transfers that are approved (e.g., carbon rights leases versus carbon rights sales or securitization) and other limits on agency authority desired to protect the public interest. Legislatures have often established such limits in other public lands contexts, for example by setting the maximum duration and renewal of agreements for natural resource leases or sales.[128] While imperfect, existing laws governing natural resource extraction and compensatory mitigation on public lands are useful models for the potential scope and questions that blue carbon legislation will need to address.

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[128] Explicit limits on lease duration are common but vary by agency and the purpose of the lease. For example, NPS can lease historic properties for up to 60 years. 36 C.F.R. § 18.10 (2001). However, grazing privileges issued by BLM are limited to a maximum term of 10 years, though permittees and lessees have first priority to renew their privileges. 43 U.S.C. § 1752 (2021) ("the holder of the expiring permit or lease shall be given first priority for receipt of the new permit or lease," provided listed conditions are satisfied). State leases are similarly subject to a range of lease duration and renewability conditions. *See* PORTER ET AL., *supra* note 43, at 29 (discussing need to address lease duration); VERRA, *supra* note 70, AT § 2.2.4 (allowing projects that can demonstrate that "project ownership . . . can be maintained for the entire project longevity (e.g. where control is secured through a concession that is shorter than the project longevity, such concession is renewable for the full longevity period being claimed)."). Where laws specify a maximum lease duration that is shorter than the longevity period, leases will need to be renewable to safeguard the interests of funding partners, laws will need to change for carbon projects to allow longer terms or renewability, or market providers will need to waive or weaken requirements for longevity for public land projects.

While models from related contexts can support development of blue carbon legislation, the content of this legislation will need to be built on a nuanced consideration of the desired character of blue carbon transactions. Additional analysis will be needed in order to understand in detail the benefits and drawbacks of different approaches to issues such as transaction structure (e.g., carbon rights leases versus carbon credit sales) as well as how to address practical considerations most effectively. Carbon market providers are important partners in identifying preferred models, as legislation must enable conformity with market standards for the effort to be worthwhile. Blue carbon legislation that effectively supports agency, public, and carbon market needs can support new funding and long-term commitments for coastal wetlands conservation and restoration — a critical need for ecosystems facing increasing challenges due to climate change.