Recommendations from the Blue Carbon National Working Group

Based on a workshop convened by Restore America's Estuaries and NOAA's Office of Habitat Conservation held May 20-21, 2015

Prepared by Restore America's Estuaries (January 2016)

Background

Coastal wetlands – salt marsh, seagrass and tidal forests including mangroves – sequester and store significant amounts of carbon dioxide (CO_2), while their destruction can result in the emission of CO_2 and other greenhouse gases (GHG). This newly recognized ecosystem service, referred to as 'blue carbon', has the potential to support coastal restoration and conservation efforts and influence management of these ecosystems to mitigate the impacts of climate change. Over the past few years, local and regional efforts to better understand and incorporate coastal wetland climate change benefits into coastal management have increased, and there is a growing network of blue carbon related activities building within federal and state agencies. Additionally, the U.S. is taking part in international blue carbon efforts, such as the International Blue Carbon Initiative and the North American Commission for Environmental Cooperation (CEC) blue carbon project. To maximize the efficiency of these efforts and build upon lessons learned, there is a need for a coordinated network in the U.S. In early 2015, Restore America's Estuaries (RAE) and its partners at the National Oceanic and Atmospheric Administration's (NOAA) Office of Habitat Conservation, along with wetland scientist, Dr. Steve Crooks, began forming a Blue Carbon National Working Group (BCN). The first meeting of the BCN occurred May 20-21, 2015, with the following objectives:

- Increase communication on past, current, and future blue carbon work (at the national, regional, and local scales);
- Increase coordination on future blue carbon projects, including identifying funding opportunities and pilot projects; and
- Provide a platform for discussion of science needs, information gaps, and blue carbon priorities.

Working group members included leaders and innovators with decades of experience from state and federal agencies, non-profits, carbon markets, academia, and the private sector (see Appendix I for full participant affiliation list). BCN members include scientists working to increase our understanding of carbon sequestration and storage in wetlands, restoration practitioners, coastal managers, state and federal agency staff working to expand understanding of coastal ecosystem benefits, engineering firms that focus on restoration, and carbon market project developers. The following recommendations are based on the results of this meeting.

Priority Recommendations

The BCN priority recommendations for advancing blue carbon are:

1. **Develop a database of blue carbon storage, sequestration and emission factors that can support landscape level carbon accounting on coastal lands.**
2. **Develop pilot projects that demonstrate how to implement blue carbon projects and policy, and develop lessons learned from these actions; and**
3. **Integrate blue carbon benefits into existing and emerging ecosystem service models and descriptions to more fully account for the full suite of benefits provided by these ecosystems.**

These recommendations will help to build experience to support the development and implementation of additional blue carbon projects.

Overview of Blue Carbon Progress to date

Market opportunities:

One mechanism to utilize blue carbon ecosystem services of climate mitigation is via the carbon market. Currently, there is no national carbon market in the U.S.; however, California voluntarily implemented a carbon cap-and-trade system in 2012, designed by the CA Air Resources Board (CARB). Although the CARB does not currently include coastal wetlands protocols for compliance offsets, $25 million from allowance proceeds in 2013 were invested in wetland projects that have a climate mitigation benefit, recognizing this valuable ecosystem service.

Without a national compliance market, an alternative method for coastal wetlands to gain carbon finance is through inclusion in the voluntary carbon market. This opportunity for including coastal wetlands in the voluntary carbon market depends upon the development of methodologies (protocols), like those developed previously for wetland creation and restoration activities, enabling these ecosystems to generate carbon credits and receive funding from the carbon market. In November 2015, the *VM0033 Methodology for Tidal Wetland and Seagrass Restoration,* received final approval by the Verified Carbon Standard. This globally applicable methodology allows coastal restoration projects with climate benefits to earn carbon credits. Other methodologies have been developed for wetland creation and restoration activities, enabling these ecosystems to generate carbon credits as well. A project developed by Tierra Resources in Luling, Louisiana, is expected to transact credits through the American Carbon Registry in 2016.

The primary barrier to blue carbon projects is inexperience with carbon project development in the coastal sector. Additional challenges include a lack of regional carbon sequestration and storage data, as well as the cost of restoration that can exceed potential carbon revenues, requiring carbon finance to be leveraged with conventional restoration program dollars.

Awareness and capacity building:

Regional and local capacity have grown across the country with blue carbon workshops in the Northeast, Southeast, Gulf Coast, and Pacific Northwest, and newly formed working groups in the Northeast and Pacific Northwest. Current outreach efforts in the Gulf region include a series of workshops followed by the formation of regional working groups to identify local blue carbon application opportunities. This type of outreach followed up with technical assistance builds capacity to utilize blue carbon, enhancing habitat management and conservation regionally.

Expanding the science:

Many regions have also been working to expand blue carbon science. The Waquoit Bay National Estuarine Research Reserve (NERR) in western Massachusetts conducted a three-year research project funded by the NERR System Science Collaborative. This study utilized data from salt marsh habitats to develop a model that predicts GHG fluxes (CO_2 and CH_4) using more accessible data variables, such as soil temperature, soil salinity, and light. The model created showed strong predictive capability for net sequestration of CO_2 and CH_4 emission rates. Such a model can greatly reduce project costs of bringing restoration projects into the carbon market. A recently-funded follow-on study will test the model's robustness across wider environmental and spatial gradients regionally.

In addition, blue carbon landscape assessments lead to new regional storage and sequestration data and demonstrate the climate mitigation potential of coastal wetland restoration and conservation efforts. These assessments also serve as an effective way to foster community support and connect with the coastal management community. For example, a landmark landscape assessment in the Snohomish Estuary of Puget Sound, Washington shows a high carbon sequestration potential of current and planned restoration projects in the area[1]. This assessment has led to webinars and workshops in the Pacific Northwest, and more recently, discussions to hold a blue carbon summit in the region. As coastal wetlands are dynamic in nature, varying across regions and habitat types, additional assessments are needed to account for regional differences in carbon storage, sequestration and other GHG emissions.

At the national level:

Coastal wetland climate benefits are increasingly recognized by federal agencies. NOAA, the U.S. Fish and Wildlife Service (FWS), U.S. Geological Survey (USGS), and the Environmental Protection Agency (EPA) are currently investing in various blue carbon projects, aimed at increasing our understanding of GHG fluxes in coastal habitats, and examining the effects management and restoration activities have on GHG budgets. In 2014, the White House released its *Priority Agenda for Enhancing the Climate Resilience of America's Natural Resources*, which includes blue carbon ecosystems as important mechanisms for mitigating the effects of climate change. Even with this recognition, many agencies lack the capacity and expertise to support incorporating blue carbon into federal and state policies and regulations. An analysis of federal policies shows that the incorporation of blue carbon services into existing federal regulations (e.g., Clean Water Act, Natural Resource Damage Assessment, National Environmental Policy Act) could lead to more habitat conservation without additional statutory changes[2,3]. The next step would be to fully assess the impacts of incorporating blue carbon into policies to determine what specific outcomes this could lead to (positive or negative) and what expertise would be required of agency staff.

This past year, efforts have begun to incorporate coastal wetland emissions and removals into the U.S. National Greenhouse Gas Inventory based on the latest guidance from the Intergovernmental Panel on Climate Change (IPCC) Wetlands Supplement and research funded by the National Aeronautics and Space Administration (NASA), NOAA, USGS and FWS. Including coastal wetlands into the National GHG Inventory

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[1] **Crooks, S.**, J. Rybczyk, K. O'Connell, D.L. Devier, K. Poppe, and S. Emmett-Mattox. 2014. *Coastal Blue Carbon Opportunity Assessment for the Snohomish Estuary: The Climate Benefits of Estuary Restoration*. Report by Environmental Science Associates, Western Washington University, EarthCorps, and Restore America's Estuaries. February 2014.

[2] **Pendleton, L.H.**, A.E. Sutton-Grier , D.R. Gordon , B.C. Murray , B.E. Victor , R.B. Griffis , J.A.V. Lechuga and C. Giri. 2013. Considering "Coastal Carbon" in Existing U.S. Federal Statutes and Policies, Coastal Management, 41:5, 439-456, DOI: 10.1080/08920753.2013.822294

[3] **Sutton-Grier, A.E.**, A.K. Moore, P.C. Wiley, and P.E.T. Edwards. 2014. Incorporating ecosystem services into the implementation of existing U.S. natural resource management regulations: The case for carbon sequestration and storage. *Marine Policy*. 43:246-253. DOI

will not only draw attention to the causes and impacts of coastal habitat degradation, but it will also recognize the significant mitigation potential of coastal restoration and conservation (avoided loss) activities.

Finally, as an outcome from the BCN meeting, BCN members collaborated to develop a proposal for establishing a global science and data network for blue carbon to support carbon and GHG flux science in coastal ecosystems. The USGS/Carbon Cycle Interagency Working Group is funding a workshop (scheduled for early 2016) to guide development of the data network and provide an initial design for the global data archive. This is an important step in expanding blue carbon science and improving access to this science, both nationally and internationally; however increased resources (funding and otherwise) will be required for implementation and operation of the network.

BCN Working Group Findings

The following is a summary of findings and recommendations from the BCN Working Group 2015 meeting. These findings include the major gaps to be addressed, and key recommendations to achieve market, policy and management gains in utilizing blue carbon effectively.

Advances in our understanding of blue carbon science and additional data collection will enable further assessment of coastal wetland climate mitigation benefits, incorporation of these benefits into management and policy goals, and market project development. Specific data needs include:

- Baseline data for natural, degraded and restoring habitats for tidal forests, salt marsh and seagrass including more regional and local data for carbon storage and sequestration rates for varying regions and habitat types;
- Peer-reviewed models and field-validated proxies for GHG emissions and removals;
- Improved understanding of the fate of soil carbon during wetland loss (i.e. sea-level rise impacts on soil carbon, submergence, erosion, etc.);
- Emissions (including methane and nitrous oxide emissions) from healthy, degraded and restored coastal ecosystems; and
- Assessment of total coastal wetland restoration potential, rates of restoration and conservation, and rates of habitat loss.

In addition to advancing blue carbon science, ***demonstration projects are needed to show proof-of-concept for market applications.*** Blue carbon projects are needed to demonstrate how the restoration and conservation of coastal wetlands can earn offset credits using approved methodologies.

The working group also identified gaps that need to be addressed to better ***support blue carbon incorporation into policy and management*** decisions. Limitations include: lack of capacity and expertise in assessing blue carbon benefits at the project level in a regulatory setting, precedent for leveraging carbon finance with government restoration dollars, limited availability of protocols and tools to measure coastal carbon, and lack of guidance and procedures for valuing carbon benefits. Improved mapping of U.S. coastal habitats would increase understanding of habitat trends, how much restoration is possible, and how coastal ecosystems can contribute to the Nation's capacity to reduce greenhouse gas pollution. Additional assessment is needed to fully understand the impact of policy/regulatory changes before implementing such changes.

Increased outreach and capacity building for blue carbon science and its applications are also needed to educate coastal communities and build local expertise to support project development. Workshops, webinars and general outreach would increase stakeholder capacity to manage wetlands more efficiently for the impacts of climate change and build community support for developing projects.

Additionally, ***there is a new opportunity to integrate climate mitigation values with the suite of ecosystem benefits that tidal wetland and seagrass ecosystems provide***, such as critical fisheries habitat, storm surge reduction and improved water quality. For example, estuaries provide habitat for more than 75% of the nation's commercial fish catch[4]. Climate mitigation is an often undervalued ecosystem service, as seen by the considerably low price of carbon in the voluntary market – carbon credits are sold for an average $4 per ton[5] of carbon dioxide equivalents (t CO_2e) on the voluntary carbon market, yet the social cost of carbon is estimated to be $37 a ton[6] by the EPA. The value of coastal wetlands lies beyond climate mitigation; therefore additional data are needed to link blue carbon benefits to other ecosystem services, such as fisheries habitat, coastal resilience, water quality improvement and flood control. In regions with challenging political cultures, linking climate mitigation to other valued ecosystem services can enable blue carbon to play a supporting role in management and policy decisions impacting coastal habitats.

Recommendations

The BCN meeting discussions centered on four core areas: science, policy, management, and pilot projects. The following priority recommendations will achieve advancements in each of these areas.

1. **Develop a database of blue carbon storage, sequestration and emission factors that can support landscape-level carbon accounting on coastal lands.**

   A database will have multiple benefits, including supporting state and federal activities to balance GHG emissions with other management needs. Incorporating the GHG fluxes of coastal ecosystems into land-use management can lead to a more resilient coast that both adapts to and mitigates for the effects of climate change. In addition, having access to accurate sequestration and storage data will greatly reduce cost for projects seeking carbon offset credits (as field collected data can be labor and cost intensive). A blue carbon database would provide a means of assimilating new data and identifying data gaps, while allowing access to information. The BCN recommends forming a subcommittee to identify existing data as well as data needs and paths forward for addressing these needs. The BCN also recommends that a federal agency, such as USGS or NOAA, lead this endeavor. The database should be a forum for analyzing existing data and provide a means to identify data gaps to be addressed. Early efforts to accomplish this task have already begun with the aforementioned global blue carbon science and data network proposal; however additional follow-up tasks will be required.

   Tasks to create a national database include: 1) analysis of data (i.e. what is currently available vs. data gaps); 2) categorize the data (i.e. emission factors by habitat type and region); 3) identify a platform to host this data (and a host agency/organization to manage it); 4) design a process for data input; 5) develop query criteria (to aid in data use and search functions); and 6) plan a process for database backups on a regular basis.

   Specific data to be included are carbon storage and sequestration values for natural, degraded and restored habitats across different regions and habitat types; methane and nitrous oxide emissions; and the fate of carbon following submergence.

[4] Pendleton, LH. 2008. The economic and market value of coasts and estuaries: what's at stake? Produced by Restore America's Estuaries. Arlington, VA. https://www.estuaries.org/images/stories/docs/policy-legislation/final-econ-with-cover-5-20-2008.pdf

[5] As reported by the Ecosystem Marketplace and Forest Trends report: "Ahead of the Curve: State of the Voluntary Carbon Market 2015", Hamrick and Goldstein, June 2015. Available at: http://forest-trends.org/releases/uploads/SOVCM2015_FullReport.pdf. Accessed 2015 August 10.

[6] United States Government (USG) (2013, revised 2015) Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. United States Environmental Protection Agency website. Available at: http://www.epa.gov/climatechange/EPAactivities/economics/scc.html. Accessed 2015 August 10.

The BCN also recommends new research to increase blue carbon data and support new landscape assessments. Landscape assessments are comprehensive analyses of the climate mitigation benefits of estuary restoration and conservation efforts. Several federal land management agencies are ideal agents for supporting blue carbon assessments: the National Wildlife Refuge System, the NERR System, the National Estuary Programs, and the Department of Defense, for example. Data gathered through a blue carbon assessment can lead to improved management, integrating conservation and adaptation planning to improve carbon storage and sequestration, while supporting all other important ecosystem services wetlands provide.

2. **Develop pilot projects that demonstrate how to implement blue carbon projects and policy, and develop lessons learned from these actions.**

Demonstration or pilot projects will show proof-of-concept for market, policy and management applications of blue carbon benefits. Implementation of a successful coastal wetland carbon project (i.e. one that generates carbon finance) can further incentivize additional project development and provide valuable lessons learned. Successful demonstration projects should include the following key features:

- Stakeholder involvement – partnering with a local government, non-profit or coastal management agency can help to build community support;
- Examination of local or regional policy opportunities to determine where specific interests (such as fisheries, water quality, or tourism) could be linked with blue carbon projects to demonstrate the co-benefits;
- Connection to management goals such as increasing coastal resiliency and adaptation planning; and
- Assessment of market feasibility – conduct a cost-benefit analysis and assess opportunities to leverage restoration funding, etc.

A successful blue carbon project will also have strong partnerships with an identified project proponent to lead project documentation, address key issues, such as land and credit ownership, and clearly define roles and responsibilities. Stakeholder meetings are a vital part of project planning to engage the local community and increase public awareness of the benefits coastal wetland restoration provides, including climate mitigation and coastal resiliency. Areas that have already been the target of blue carbon research and capacity building are ideal when identifying pilot projects. These areas include Puget Sound, Washington; Sacramento-San Joaquin Valley, California; Tampa Bay, Florida; Southeast Louisiana; and Cape Cod, Massachusetts. When assessing whether a project would make a good pilot project for blue carbon, project developers should consider which potential projects could yield the most climate benefit. Projects that will have the greatest GHG benefit will likely include a methane reduction or avoided conversion component, as methane has a greater global warming potential than carbon dioxide, and projects that conserve stored carbon in existing wetlands can prevent emissions from long-term soil carbon stores.

Pilot projects are needed to demonstrate how the restoration and conservation of coastal wetlands can lead to additional carbon sequestration and storage which can then earn offset credits and generate revenue from carbon finance. As sites are targeted for estuary landscape assessments and pilot projects, blue carbon workshops, webinars and general outreach will increase stakeholder capacity to manage coastal wetlands more efficiently for the impacts of climate change.

3. **Integrate blue carbon benefits into existing and emerging ecosystem service models and descriptions to more fully account for the full suite of benefits provided by these ecosystems.**

Linking blue carbon climate benefits to other ecosystem services provided by coastal wetlands will expand the role of blue carbon to support management goals and influence policy decisions. However this will only be possible as the science and understanding of blue carbon is expanded to different regions and habitats (recommendation #1). Science and market experts can then work together to link the various benefits of coastal wetland habitats (carbon sequestration and storage, fisheries habitat, shoreline stabilization, etc.) to leverage other funding and policy opportunities. The EPA's National Estuary Programs (NEPs), FWS's National Wildlife Refuge system, NOAA-funded NERRs and Dept. of Defense lands could make a good starting point for integrating the more traditional ecosystem benefits (e.g. water quality and fish habitat) with climate benefits of carbon sequestration and storage. For example, the NERRs system employs use of long term monitoring programs to provide data on water quality and land use, among others. Including carbon storage and sequestration/emission data in reserve research site data can increase understanding of climate linkages to other ecosystem benefits, informing management and policy decisions.

These three priority blue carbon recommendations – increasing data availability, developing projects, and integration with other ecosystem benefits – will ultimately increase our understanding of blue carbon application and build local, regional and national experience in utilizing blue carbon as a tool for conserving, restoring and managing these critical habitats. In all three areas, continued outreach and education will be critical for success. To achieve these recommendations, communication and collaboration are key. National level working groups like the BCN should maintain open lines of communication with regional and local efforts to leverage resources and avoid duplicative efforts. As with any project, broad support and funding are needed to make advances through these core recommendations. Particularly, support for working groups like the BCN to continue to collaborate on these initiatives and others will lead to greater gains in blue carbon science, understanding and application.

Coastal blue carbon concepts have reached a critical point where climate benefits are better understood and gaining momentum. **It is the conclusion of the Blue Carbon National working group that the above recommendations provide the means to substantially advance blue carbon as a tool for increased restoration and conservation of the Nation's coastal wetlands**.

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