# A seascape approach to blue carbon data synthesis for climate change mitigation

## OVERVIEW

Promoting the conservation and restoration of blue carbon ecosystems -- salt marshes, peatland swamps, mangroves, and seagrasses -- is a critical component of climate mitigation strategies. The postdoctoral researcher will advance our understanding of blue carbon-relevant carbon cycling and the role of these ecosystems as natural climate solutions, through their unparalleled ability to capture and sequester carbon when preserved or restored. In addition, Blue Carbon ecosystems provide critical cultural, economic, and biodiversity benefits to coastal communities globally. Engaging blue carbon ecosystems in nature-based solutions to climate change requires that we understand how carbon cycles through and between them. A strong scientific understanding provides the foundation for unraveling the climate benefits, both mitigation and adaptation, in addition to unlocking financing for conservation and restoration.

## IMPORTANCE

Blue Carbon ecosystems are recognized as one of our most strategic opportunities for mitigating climate change, as natural climate solutions. When preserved or restored Blue Carbon ecosystems remove carbon from the atmosphere, but when destroyed they become a source of carbon emissions. In addition, Blue Carbon ecosystems provide other critical ecosystem services that extend past carbon sequestration to offer coastal protection, fisheries nursing grounds, and livelihood benefits to coastal communities across the globe.. By improving our scientific understanding of carbon stocks and flows we can build greater confidence in stock estimates, which has the potential to bolster investment in the carbon markets, inherently leading to investment in conservation and restoration of these ecosystems. These markets can unlock finances to support the management of these ecosystems and provide dividends to coastal communities. On a larger scale, increasing understanding of carbon in coastal wetlands is essential to integrating these ecosystems into global climate models and greenhouse gas budgets across the land-sea interface, ensuring that their climate importance is fully recognized and leveraged for meaningful actions.

## POTENTIAL RESEARCH THEMES

The Smithsonian Institution seeks to support a postdoctoral researcher interested in pursuing innovative science to advance the understanding of blue carbon stocks and flows. These research themes have direct implications for the conservation and restoration of blue carbon ecosystems through supporting blue carbon project decision-making and climate mitigation. Potential research themes include, but are not limited to:

- *Quantification of carbon stocks or fluxes*: New observations, synthetic analyses, or tools that yield improved local, regional, or global estimates of blue carbon stock and fluxes. The focus can be on soils, vegetation, or full ecosystems.
- *Mapping blue carbon ecosystems*: Maps or mapping techniques that improve the accuracy of the spatial distribution or temporal change of current or former blue carbon ecosystems.
- *Deeper understanding of processes*: New observations or analyses that relate spatial or temporal variability in blue carbon stocks and fluxes to drivers such as temperature, productivity, porewater chemistry, or remotely sensed quantities.
- *Improved models*: New or refined models or model components that advance any aspect of blue carbon science. Models can be statistical or numerical, and can operate at spatial scales ranging from ecosystems to global or temporal scales from minutes to years.
- *Quantification of greenhouse gas budgets*: New observations, synthetic analyses, or models that provide improved local, regional, or global estimates of methane and/or nitrous oxide emissions.

## PROGRAMS AND ASSETS

The Fellow will have access to the scientific expertise, data resources, and professional networks of the Smithsonian Institution, which is a center of excellence in blue carbon science. The Smithsonian Environmental Research Center operates the Global Change Research Wetland which supports multi-decadal experiments to forecast coastal wetland responses to climate change, with the ultimate goal of improving Earth-scale models. The Coastal Landscape Ecology Lab leads multiple projects dedicated to increasing the amount, quality, and accessibility of blue carbon data, including leadership of the Coastal Carbon Network which curates the Coastal Carbon Atlas. The Marine Conservation Lab conducts applied research that is integrated into management strategies and restoration initiatives of mangroves, supporting decision makers at local, national and regional levels. The Collin Lab at the Smithsonian Tropical Research Institute (STRI) has expertise in tropical coastal ecosystems and is working with Panama to map and quantify mangroves in support of Panama's nationally determined contributions. STRI's Biogeochemistry lab provides facilities for analytical analyses. We work in close collaboration with a diverse community of scientists, policy makers, and blue carbon ecosystem practitioners, partnering with organizations such as Conservation International, USGS, Pew Charitable Trusts, and Silvestrum Climate Associates, and global programs such as the Blue Carbon Initiative and the Global Mangrove Alliance.

## ADVISORS

The following scientists commit to advise fellows, providing datasets and guidance to link their research to broader conservation and restoration goals: Pat Megonigal, Jim Holmquist, Steve Canty, Hannah Morrissette (SERC), and Rachel Collin, and Tania Romero (STRI).