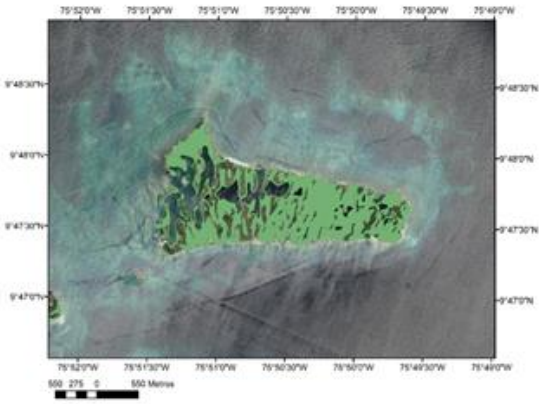
5.14 Carbon & Forest Research Center Corporation (C&B)

Partners	CARBONO & BOSQUES
Main objective	Join efforts to evaluate the capacity of capture, storage and flows of greenhouse gases -GHG- in mangrove ecosystems through the experimental validation of natural climate solutions, aimed at meeting the GHG reduction goals of Ecopetrol S.A. and its Business Group in areas of influence of its operations.
Scopes	1. Development, adaptation and experimental validation of methods of capture, storage and carbon fluxes between the different compartments to estimate the capture potential of CO2eq and other GHGs (CH4 and N2O) in inland, coastal and island mangrove ecosystems in the central Caribbean. 2. Experimental designs and demonstrations based on Natural Climate Solutions (CNS) in mangrove ecosystems, which validate the capacity for storage, capture and use of GHGs in the Caribbean region to meet the GHG emission reduction goals committed by Ecopetrol and its Business Group through the potential achievement of high quality carbon credits. 3. Strengthening of innovation and technology ecosystems that enrich the scientific knowledge, capacities and competencies of knowledge-generating institutions as part of the implementation of the Sustainability and Decarbonization strategy of Ecopetrol and its Business Group. 4. Development of strategies for the integration of local knowledge systems to the study, which contribute to the design, establishment and monitoring of experiments in Natural Climate Solutions
Geographical location	Departments of Córdoba, Sucre and Bolívar: Conglomerates: La Caimanera Swamp

	    
Ecosystems on which actions are developed	Mangroves in insular areas and coastal lagoons of the Departments of Córdoba, Sucre and Bolívar.

Social participation scenarios	**Participatory community monitoring:** • Monitoring plan that involves the forest governance structure for the follow-up to the conservation strategies of mangrove ecosystems. • Development of Monglar Application, with open access to data for community forest monitoring and the detection of early warnings that negatively impact the mangrove. **Community training:** • Within the framework of socializations and workshops carried out with the communities that live near mangrove ecosystems, which the study addresses, strategies are developed that promote the co-construction of knowledge on: climate change, the preservation of mangroves and their importance for the mitigation of climate change, the mangrove in the carbon cycle **Strategy for technical and scientific strengthening** • Strategy for technical-scientific strengthening in two (2) Regional Knowledge Management Institutions on research on adaptation to climate change
Main results	**Expected results under the Convention** 1. Adaptation of the Technical Field Protocol for the estimation of carbon and other GHG contents in national monitoring plots, established in mangrove ecosystems in the Gulf of Morrosquillo and other strategic areas for the company, in a gradient between littoral and interior. 2. Zoning proposal based on the evaluation of the forest cover trend of mangrove ecosystems in prioritized areas of the study, through the spatial and temporal analysis of satellite images. 3. Analysis and spatial georeferencing of mangrove ecosystems in prioritized areas of the study, for the implementation of Natural Climate Solutions with emphasis on restoration, rehabilitation, ecological recovery and conservation strategies in areas of influence of the ECOPETROL operation. 4. Quantification of carbon stocks and fluxes in the areas identified for forest carbon monitoring, which complements the Protocol for the estimation and monitoring of carbon stocks in mangrove forests in Colombia. 5. Modeling of the spatial dynamics of deforestation in mangroves over time in prioritized areas of the study where the risks associated with actions in Natural Climate Solutions for Ecopetrol and its GE are evaluated. 6. Estimation of greenhouse gas emissions associated with the future loss of mangrove forests in priority areas for Ecopetrol that allows decision-making to avoid GHG emissions. 7. Monitoring plan involving forest governance to follow up on conservation strategies for mangrove ecosystems. 8. Four (4) research articles and one (1) book about the scientific knowledge generated to validate standardized methods of forest carbon capture and storage through actions in Natural Solutions

Main results to date

1. An estimated 9,684 hectares of forest have been obtained in the sectors Bahía de Cispatá - Sector Estuarino, Ciénaga de Cispatá: Sector Río Sinú - Caño Sicará, Sector Tinajones, Bocas Mireya, Tinajones, Core, Bahía de Cispatá - Sector litoral and Sector de la Balsa: Caño La Balsa, in the municipalities of San Antero and San Bernardo.
2. The analyses carried out for the period between 2010 and 2020 allowed to identify:
    a. In the department of Bolivar 7,336 hectares of forest in the continental area. Among the most important areas are the Canal del Dique - SFF El Corchal in Arjona, Bahía de Barbacoas - Canal del Dique in Turbana, Barú, Juan Polo - La Virgen in Cartagena de Indias, while in the insular zone there are about 572 hectares of forest where the largest areas are in Tierra Bomba and PNNCRSB - Subsector "Isla Tintipan
    b. In the department of Sucre, 7,821 hectares of forest were found, mostly in the municipality of San Onofre. The largest mangrove sectors are Ciénaga de la Caimanera, El Corchal, Punta Commissioner - Punta de San Bernardo - Sector Balsillas, Santa Ana, Boca Matuna and Ciénaga de Pablo.
3. The work carried out has made it possible to propose an environmental zoning proposal for a possible project to generate carbon credits and for the management and decision-making of the use of the territory. Proposing 29,874 hectares in preservation, 5,129 hectares in active restoration, 2,782 hectares in passive and 56,705 hectares in sustainable uses.

4. **Quantification of carbon stock and flux:** The remeasurements and estimates made so far based on the monitoring plots in the mangrove forests of Cispatá, suggest that they continue to grow, and store carbon in their biomass (aerial and roots). Additionally, it is highlighted that due to the mortality process, the carbon content in the soil continues to be the one that contributes the most to the overall balance. A record of information on the stocks and flows of carbon and methane emission was made, such as the analysis of relevance and improvement of field monitoring protocols and laboratory analysis through the implementation of 20 plots (grouped in the form of a conglomerate), according to the IDEAM protocol, in Galerazamba. Canal del Dique, La Caimanera Swamp and Tintipan Island.

5. **Development of the Monglar App: Development** of an application with open access data for community forest monitoring and the detection of early warnings that negatively impact the mangrove.

    200 reports have been made corresponding to 14 species of Fauna and 6 species of Flora. Among these reports the most abundant fauna species were the Grey Heron (Ardea alba), Cuca Heron (Ardea cocoi), Tricolor Heron (Egretta tricolor) and Grey Heron (Egretta caerulea).

Generation of new knowledge	Strategy for technical-scientific strengthening in two (2) Regional Knowledge Management Institutions on research on adaptation to climate change. Integration of scientific knowledge and local knowledge systems
Social appropriation of knowledge	**Development of presentations and workshops in the environment of the communities neighboring the mangrove on:** Climate change, preservation of mangroves and their importance for the mitigation of climate change, the mangrove in the carbon cycle, management of GPS technology by the community for community monitoring of mangroves. 
Communication Parts	Photographs: Monitoring plots in the mangrove forests of Cispatá.