5.12 Pontificia Javeriana University of Bogotá

Partners	
Main objective	Develop standardized methods of capture and storage of Greenhouse Gases-GHG in ecosystems of the Middle Magdalena, the Caribbean and the Orinoquia, as well as experimentally evaluate techniques and / or technologies in Natural Climate Solutions, in regions of interest to the Business and that contribute to the future achievement of high quality carbon credits.
Specific objectives	- Design and implementation of the technological components and instrumentation of the Integrated Carbon Observation System in ecosystems and experimental designs in Natural Climate Solutions in the Caribbean, Middle Magdalena and Orinoquia. - Baseline for the development of Natural Climate Solutions in each ecosystem from spatial analysis with high resolution images and their integration with field data. - Modeling of disturbance regimes in each ecosystem with spatio-temporal analysis of the transformation process of land cover and land use through spatial analysis with high resolution images. - Identification and multidimensional description of reference ecosystems for the design of scopes in Natural Climate Solutions and potential scenarios for their design and experimental implementation. - Baseline of limiting and stressing factors for the design of experiments in Natural Climate Solutions in each ecosystem. - Predictive modeling of the mitigation potential of greenhouse gas emissions and carbon accumulation from high-resolution spatial information of the water surface and soil. - Analysis of ecological trajectories and reference ecosystems for the design of experiments in Natural Climate Solutions in each ecosystem. - Multitemporal modeling and analysis of the relationship between high-resolution remote sensing with 3D models of plants and their biomass in experimental areas including functional geoforms for wetlands and development of GHG emission patterns - The Protocols for estimating the capture, storage and use of GHGs in ecosystems and priority regions for Ecopetrol. - Establishment of management networks and integration structures of local knowledge systems in Natural Climate Solutions. - Validated, systematized and structured knowledge in data management models.

	- Implementation of the Integrated Carbon Observation System using Eddy Covariance towers (systems measuring carbon dioxide exchange, evapotranspiration and energy flow, methane flux and biological and meteorological parameters) - Develop strategies for the generation of scientific ecosystems with the participation of regional and national institutions in the research that, on the capture and storage of Greenhouse Gases-GHG in wetland ecosystems, humid forest, Andean forests, moors, gallery forest and grasslands as well as technological packages in Natural Climate Solutions evaluated experimentally, are developed in the regions of the Orinoquia, Central Caribbean and Middle Magdalena.
Scopes	- Conduct research to estimate the potential capacity for storage, capture and use of Greenhouse Gases (CO_2, CH_4 and N_2O) in ecosystems of the Caribbean regions (wetland); Magdalena medio (wetland; humid forest; Andean forest; páramos), and the Orinoquia (wetland; gallery forest; floodable and non-floodable grassland; Andean-Orinocense forest) for the design of protocols for quantification and monitoring of Greenhouse Gases. - Develop experiments in Natural Climate Solutions at a detailed scale, which validate the capacity of storage, capture and use of Greenhouse Gases (CO_2, CH_4 and N_2O) in strategic ecosystems of the Caribbean, Middle Magdalena and Orinoquia regions, and their potential in achieving high quality carbon credits. - Strengthen the capacities and technical and scientific competences in adaptation and mitigation of climate change of the Regional Knowledge Generating Institutions (GCI) so that they can continue with the development of research in these topics. - Develop strategies for the integration of various knowledge systems to the development of experiments in Natural Climate Solutions and the monitoring of Greenhouse Gases, which favor the development of science, innovation and technology ecosystems in the regions of the Orinoquía, the Caribbean and the Middle Madgalena.
Geographical location	- Magdalena Medio (Santander: Barrancabermeja, Puerto Wilches, Puerto Parra; Bolivar (Cantagallo) - Central Caribbean (Córdoba, Sucre, Bolivar: Gulf of Morrosquillo, Cartagena) - Orinoquía (Meta: Puerto Gaitán; Casanare: Aguazul, Tauramena, Yopal)
Ecosystems on which actions are developed	- Magdalena Medio (wetland, rainforest, Andean forest) - Central Caribbean (wetland) - Orinoquía (wetland, gallery forest, floodable and non-floodable grassland, Andean-Orinocense forest)

Main results	- Institutional, technical and administrative strategy to conduct research to estimate the potential capacity for storage, capture and use of GHGs (CO_2, CH_4 and N_2O) in three ecosystems: wetlands, rainforest and Andean forest. - Design and implementation of the technological components and instrumentation of the Integrated Carbon Observation System for the various spatial scales, in its first phase, with advanced equipment for N_2O flows; spatial analysis-LIDAR; weather stations; CO_2 egm analyzers; limnological sampler; acoustic distance meter; permanent plots; and other processes and developments in the field for the three regions: Orinoquia, the Caribbean and the Middle Magdalena. - Systematization of baseline for the development of Natural Climate Solutions in wetlands rainforest and Andean forest with spatial analysis with high resolution images and their integration with field data in geographical units between 50 and 2000 ha per ecosystem - Modeling of disturbance regimes with spatio-temporal analysis of the transformation process of land cover and land use through spatial analysis with high resolution images. - Identification and multidimensional description of reference ecosystems for the design of scopes in Natural Climate Solutions and potential scenarios for their design and experimental implementation. - Analysis of limiting and stressing factors for the experimental design of Natural Climate Solutions in each of the three study areas and ecosystem and description of adjusted experimental designs. - Predictive analysis of the mitigation potential of greenhouse gas emissions and carbon accumulation from high-resolution spatial information of the water surface and soil, which integrates areas for restoration designs and other Natural Climate Solutions in six ecosystems and three regions. - Implementation of experimental designs (phase I) in restoration by ecosystem and region, with analysis of ecological trajectories and reference ecosystems. - Multitemporal modeling and analysis of the relationship between high-resolution remote sensing with 3D models of plants and their biomass in experimental areas including functional geoforms for wetlands and development of GHG emission patterns. - Protocols for estimating GHG capture, storage and use in six ecosystems and three regions with trend analysis regarding the baseline of degraded and conserved environments, and implementation of experimental designs (phase II)

	- System implemented for measurement, reporting and verification of flows (MRV) in Natural Climate Solutions. - Synthesis document with knowledge generation strategy. - Systematization of the analysis of management networks and structures and strategies to integrate local knowledge systems into Natural Climate Solutions to mitigate GHG emissions. - Synthesis of research (phase I) in Natural Climate Solutions with description of learnings and cost-efficiency analysis. - Effects of restoration as a Natural Climate Solution and its applications for the decarbonization of ECOPETROL experimentally validated and integrating data processed by Eddy Covarianza system, with training spaces and training to IGC and impact publications to validate ECOPETROL capture. - Potential scenarios for action in Natural Climate Solutions in the three regions and their effect on climate change mitigation at the landscape scale that integrates training spaces and training to IGC and impact publications to validate ECOPETROL capture
Social participation scenarios	- **KNOWLEDGE EXCHANGE:** Integration of traditional and ancestral knowledge in the understanding of nature and design of Natural Climate Solutions. - **TRAINING:** Training Strategy on Natural Climate Solutions, climate change, monitoring, and others. - **PARTICIPATORY MONITORING**: Participation model for the registration of data of technologies and techniques implemented in the field, and follow-up to actions in the field. - **ECONOMIC ALTERNATIVE**: People from the community hired for specific actions of the agreement.