

Blockchain-Based Blue Carbon Registry and MRV System

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Abstract: Blue carbon ecosystems, such as mangroves, seagrass meadows, and salt marshes, are valuable tools for combating climate change through their ability to sequester and store atmospheric carbon dioxide. Due to their rate of carbon dioxide fixation, blue carbon ecosystems trap carbon dioxide emissions to a significantly higher degree than terrestrial forests. While blue carbon ecosystems serve as carbon stores, when they degrade, carbon is released back into the atmosphere and contributes to rising global temperatures. Blockchain technology facilitates environmentally-conscious conservation and restoration practices through a Monitoring, Reporting, and Verification (MRV) system. This transparent and community-based carbon accounting system utilizes the Internet of Things (IoT), drones, and artificial intelligence to gather real-time environmental data in the field. The environmental data are bound into an immutable ledger, with automated issuance of verified carbon credits, through smart contracts, provided by blockchain technology. Tokenized carbon credits are sold/traded in carbon markets, thereby economically incentivizing sustainably conscious local communities and organizations to restore blue carbon ecosystems. Additional challenges exist, such as standardization, cost, and integration of all data collected; decentralized governance, and energy-efficient blockchain systems promote reliability and scalability. Digital innovation bridges blue carbon restoration and leads to a new positive model for carbon management on a global scale while enabling ecological resiliency, community sovereignty, and transparently allocating climate finance mechanisms.

Keywords: Blue Carbon, Blockchain, MRV, IoT, AI, Carbon Credits, Mangroves, Sustainability, Smart Contracts, Climate Change

