The Role of Mangrove Ecosystems in Offsetting Carbon Emissions from Coastal Hospitality in Sri Lanka

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The hospitality sector is a significant contributor to greenhouse gas (GHG) emissions due to its energy-intensive operations, while coastal mangrove ecosystems provide important blue carbon benefits through carbon sequestration. This study assessed the carbon offset potential of mangrove ecosystems associated with selected coastal hotels in Sri Lanka by comparing annual hotel GHG emissions with mangrove blue carbon sequestration capacity within a carbon balance assessment framework. Nineteen coastal hotels were purposively selected from Colombo, Negombo, Kalutara, Galle, and Matara districts based on hotel classification, coastal location, and data availability. Among them, two mangrove-associated hotels were selected to assess the contribution of blue carbon sequestration. Scope 1 and Scope 2 emissions were quantified using operational activity data and DEFRA 2025 emission factors. Mangrove carbon stocks were estimated using fixed-area vegetation plots (5 m×5 m quadrats and 10 m×3 m rectangular plots), while soil organic carbon was determined using the Loss on Ignition (LOI) method. Total blue carbon stocks were converted to carbon dioxide equivalents (CO_2e) using a conversion factor of 3.67, and annual blue carbon sequestration was expressed as kg CO_2e $year^{-1}$ to facilitate comparison with hotel emissions. The results indicated that electricity consumption was the primary source of GHG emissions across the hotel sector. Total emissions from the 17 non-mangrove hotels amounted to 300.12 million kg CO_2e $year^{-1}$**,** whereas the two mangrove-associated hotels generated 31.89 million kg CO_2e $year^{-1}$**.** Natural mangroves recorded a total blue carbon stock of 487.98 Mg C ha^{-1}**,** compared with 157.42 Mg C ha^{-1} in restored mangroves. The estimated blue carbon sequestration capacity was 223.86 kg CO_2e $year^{-1}$ for natural mangroves and 86.66 kg CO_2e $year^{-1}$ for restored mangroves. Although mangrove ecosystems contributed to reducing hotel emissions through carbon sequestration, their sequestration capacity was insufficient to fully offset annual operational emissions. The findings highlight the importance of integrating mangrove conservation and restoration with energy-efficiency measures and greenhouse gas reduction strategies to enhance climate mitigation and promote sustainable coastal tourism development in Sri Lanka.

Keywords: *Blue carbon, Mangroves, Greenhouse gas emissions, Carbon sequestration, Coastal hotels, Climate change mitigation, Sri Lanka.*