



THREATS OF CLIMATE AND ENVIRONMENTAL CHANGE ON ECOSYSTEM SERVICES PROVIDED BY MANGROVES IN THE STATE OF ESPIRITO SANTO, BRAZIL.

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Coastal ecosystems fulfill essential ecological and economic functions, contributing to the global carbon cycle and mitigating climate change. Nevertheless, anthropogenic activities are increasingly disrupting the critical ecosystem services provided by these regions. This study aimed to compare greenhouse gas (GHG) fluxes among three estuarine mangrove areas in Guarapari, Brazil, with contrasting levels of deforestation. Carbon dioxide (CO₂), nitrous oxide (N₂O), and methane (CH₄) fluxes were measured at 13 sites: five in the Concha D'Ostra (CD) river, four in the Perocão (P) river, and four in the UNA (U) river. Sites were categorized by three deforestation levels: low (CD), medium (P), and high (U). Statistical differences were evaluated using Kruskal-Wallis and post hoc Dunn tests. Results showed that the Perocão region emitted more CO₂ (7706.76 mg/m²/d) than the Una region (5810.77 mg/m²/d), although this difference was not statistically significant. Regarding N₂O, the CD and P regions acted as sinks (−0.03 and −0.13 mg/m²/d, respectively), whereas Una functioned as a source (0.08 mg/m²/d). All regions were CH₄ sources, with P exhibiting the highest median flux (32.12 mg/m²/d). Notably, the P region (intermediate deforestation) showed the highest CO₂ and CH₄ fluxes, suggesting a nonlinear relationship between deforestation intensity and GHG emissions. The U region (high deforestation) emerged as a net N₂O source, likely due to anthropogenic nitrogen inputs fostering incomplete denitrification — particularly concerning given N₂O's high global warming potential. CH₄ emissions across all regions reflect anaerobic conditions typical of mangrove sediments. These findings should be interpreted with caution, given the limited sample size and the absence of seasonal data. These results reveal the biogeochemical complexity of degraded mangrove ecosystems and reinforce the need for spatially explicit, long-term monitoring. The study supports the implementation of conservation policies that protect mangroves and strengthen their role as nature-based solutions for climate regulation and mitigation.

Palavras-chave: Mangroves, Greenhouse gas fluxes, Deforestation, Biogeochemistry, Coastal ecosystems