Effect of Temperature and Rainfall on Above-ground Biomass in Kumana and Bundala Ramsar Wetlands, Sri Lanka (1993–2023)

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Wetlands are climate-sensitive, highly productive ecosystems that play an important role in carbon sequestration, flood regulation, and biodiversity conservation. This study investigated the effects of land surface temperature (LST) and precipitation (PRCP) on above-ground biomass (AGB) in the Kumana and Bundala Ramsar Wetlands, Sri Lanka, over the period 1993–2023 using Landsat imagery, CHIRPS precipitation data, and GIS-based regression analysis. The climate-AGB relationship was strongest in 1993 (R^2=0.526), with LST showing a significant negative influence (coefficient=-2.55, $p < 0.0001$) and precipitation showing a significant positive influence (coefficient=0.033, $p < 0.0001$) in Kumana. The explanatory power of the model declined in 2003 and 2013, while LST remained negatively associated with AGB and precipitation became less significant. Model performance improved in 2023 (R^2=0.399), with both LST and precipitation identified as significant negative predictors, indicating changing climate–biomass relationships over time. In Bundala, climate variables showed weaker relationships with AGB, suggesting that additional environmental or anthropogenic factors may have influenced biomass dynamics. LST consistently exhibited a negative relationship with AGB and was statistically significant in 1993 and 2023. In 1993, precipitation exhibited a significant negative coefficient (coefficient=-0.082, p=0.0127), which transitioned into a mildly positive relationship (coefficient=0.035, p=0.0454) by 2023, indicating improved water utilisation over time. Overall, increasing temperature was associated with reduced biomass productivity, while the effects of precipitation varied between sites and over time. These findings highlight the importance of adaptive management strategies, including improved water management and habitat restoration, to enhance the resilience of internationally important Ramsar wetlands.

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