(099)

Integrating UAV- Based Mapping with Soil Organic Carbon and Nitrogen Analysis of Coastal Sand Dunes in Kalpitiya, Sri Lanka

Senanayaka, B.M.M.M.[1*], Fernando, T.S.P.[1], Thilakarathne, E.P.D.N.[1], Ratnayake, A.S.[2], Gunathilaka, W.G.I.T.[3]

[1]Department of Animal Science, Uva Wellassa University of Sri Lanka, Badulla, Sri Lanka
[2]Department of Applied Earth Sciences, Uva Wellassa University of Sri Lanka, Badulla, Sri Lanka
[3]State Key Laboratory of Tropical Oceanography, South China Sea Institute of Oceanology, Chinese Academy of Sciences, Guangzhou, China
[*]mahela20063@gmail.com

Abstract

Coastal sand dunes, abundant aeolian landforms shaped by wind-transported sediments along coastlines, are vital ecosystems. They give valuable functions and play a crucial role in understanding aeolian landform evolution. The Kalpitiya coastal sand dune is located on the northwestern coast of Sri Lanka. However, a lack of comprehensive data on the morphology, extent, distribution, and carbon sequestration and nitrogen storage of coastal sand dunes limits knowledge for assessing the dynamics, effective conservation, and management strategies in the country. Therefore, this study integrated UAV-based mapping with elemental analysis of Soil Organic Carbon (TOC) and nitrogen to characterize dune morphology and biogeochemical properties in the Kalpitiya coastal system. The DJI Air 2S drone, equipped with a 20-megapixel camera, captured aerial images at an altitude of 50 m. The Orthomosaic maps and a Digital Elevation Model (DEM) were created using the Drone Deploy website. Dune morphology (mean elevation, slope, aspect, and contour) was analyzed, and spatial data visualized using ArcGIS 10.8 software. For elemental analysis, sand samples were collected by placing four 30 m transects perpendicular to the shoreline. A total of 12 sand samples (40 cm depth) were collected. TOC and nitrogen contents of samples were determined using a CHNS elemental analyzer. The results show that the Kalpitiya coastal sand dune system has a moderate slope (8.30°), southward orientation (mean aspect=180.7°), and low mean elevation (6.17 m) with a mean contour value of 6.2 m. The elemental analysis results indicated 24.15±10.57 Mg C ha^{-1} of mean TOC content and 1.15±0.21 Mg N ha^{-1} mean nitrogen content. These results signify a dynamic yet stable aeolian regime, with energy levels sufficient for dune formation but preventing extreme segregation. The observed low organic carbon and nitrogen storage is characteristic of the Kalpitiya dune system. This study thus provides valuable information on dune morphology, distribution, and organic carbon and nitrogen storage, which can aid in the effective conservation and management of the coastal sand dunes in Sri Lanka.

Keywords: *Coastal sand dunes, Digital elevation model, Morphology, Total organic carbon, Unmanned aerial vehicles*