Clarification of relationships between coastal dune vegetation and landforms based on ALS and UAS-SfM photogrammetry for nature conservation and restoration: Tottori Sand Dunes, Southwest Japan

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Coastal dunes are often subject to human activities. The landward sides of dunes are often modified by the development of farmlands, erosion control forests, and residential areas. On the sea-sides of dunes, coastal structures tend to be installed to prevent wave erosion. Therefore, the total area of natural coastal sand dunes in Japan has significantly decreased, and the ecosystem therein has been greatly affected by human modifications. For the conservation and restoration of such dunes and their ecosystem, investigating both natural and human-affected dunes is indispensable. This study focuses on relationships between coastal dune landforms and vegetation, the primary producer in the ecosystem. Although previous studies suggested that the accretion of sand greatly affect the distribution of vegetation, detailed geomorphological studies on the dynamic environment with frequent sand movement have been limited. Here we investigate spatial relationships between landforms and vegetation in the coastal Tottori Sand Dunes, Southwest Japan, using high-resolution ground surface information obtained from airborne laser scanning (ALS) and unmanned aerial system-based structure-from-motion (UAS-SfM) photogrammetry. Vegetation was classified into several communities, and their distribution was mapped based on orthorectified aerial images by using UAS-SfM. We analyzed the spatial correlation using the Jacobs Index. The results indicate that the distribution of vegetation is influenced by western to northern wind in winter and southern wind in other seasons. We found that coastal dune vegetation usually create sand accumulation areas. We also found that short and low vegetation cover communities tend to occur on gentle dunes, whereas tall and high vegetation cover communities tend to occur on steep dunes.

Keywords: Coastal dune vegetation, Landform, Restoration, UAS-SfM, ALS

