Draft – Discriminating Seagrasses From Green Macroalgae in European Intertidal areas using high resolution multispectral drone imagery – Draft

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Abstract

Coastal areas support seagrass meadows, which offer crucial ecosystem services including erosion control and carbon sequestration. However, these areas are increasingly impacted by human activities, leading to habitat fragmentation and seagrass decline. In situ surveys, traditionally performed to monitor these ecosystems face limitations on temporal and spatial coverage, particularly in intertidal zones, prompting the addition of satellite data within monitoring programs. Yet, satellite remote sensing struggles with spatial and spectral resolution, making it difficult to discriminate seagrass from other macrophytes in highly heterogenous meadows. Drone (unmanned aerial vehicles – UAV) images at a very high spatial resolution offer a promising solution to address challenges related to spatial heterogeneity and intrapixel mixture. This study focuses on using drone acquisitions with a ten spectral band sensor mirroring those of Sentinel-2, for mapping intertidal macrophytes and effectively discriminating between seagrass and green macroalgae. Nine drone flights were conducted at two different altitudes (12 m and 120 m) across heterogeneous intertidal European habitats in France and Portugal. Low altitude flights were used to train a Deep Learning classifier based on Neural Networks to discrimintate among five taxonomic classes of intertidal vegetation: Magnoliopsida (Seagrass), Chlorophyceae (Green macroalgae), Phaeophyceae (Brown algae), Rhodophyceae (Red

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macroalgae) and benthic Bacillariophyceae (Diatoms). Classification of drone imagery resulted in an overall accuracy of 94% across all the sites and images, covering a total area of 467 000 m². The model exhibited an accuracy of 96.4% in identifying seagrass. Importantly, seagrass and green algae can be discriminated, although they share the same pigment composition. As the algorithm was developed for a multispectral camera with ten spectral bands in the visible and near-infrared, it could be adapted to the Multi-Spectral Instrument (MSI) onboard Sentinel-2 thus offering promising perspectives for satellite remote sensing of intertidal biodiversity over lager scales.

References