

## A High-Resolution Global Map of Giant Kelp (*Macrocystis pyrifera*) Forests and Intertidal Green Algae (*Ulvophyceae*) with Sentinel-2 Imagery

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First published 19<sup>th</sup> May 2020

Imagery from our [Coastal Habitat Mapping Project](#) is being put to work. It has been used to validate a global giant kelp model derived from Sentinel 2 imagery. You can read the full article online [here](#).

### Abstract

Giant kelp (*Macrocystis pyrifera*) is the most widely distributed kelp species on the planet, constituting one of the richest and most productive ecosystems on Earth, but detailed information on its distribution is entirely missing in some marine ecoregions, especially in the high latitudes of the Southern Hemisphere. Here, we present an algorithm based on a series of filter thresholds to detect giant kelp employing Sentinel-2 imagery. Given the overlap between the reflectances of giant kelp and intertidal green algae (*Ulvophyceae*), the latter are also detected on shallow rocky intertidal areas. The kelp filter algorithm was applied separately to vegetation indices, the Floating Algae Index (FAI), the Normalised Difference Vegetation Index (NDVI), and a novel formula (the Kelp Difference, KD). Training data from previously surveyed kelp forests and other coastal and ocean features were used to identify reflectance threshold values. This procedure was validated with independent field data collected with UAV imagery at a high spatial resolution and point-georeferenced sites at a low spatial resolution. When comparing UAV with Sentinel data (high-resolution validation), an average overall accuracy  $\geq 0.88$  and Cohen's kappa  $\geq 0.64$  coefficients were found in all three indices for canopies reaching the surface with extensions greater than 1 hectare, with the KD showing the highest average kappa score (0.66). Measurements between previously surveyed georeferenced points and remotely-sensed kelp grid cells (low-resolution validation) showed that 66% of the georeferenced points had grid cells indicating kelp presence within a linear distance of 300 m. We employed the KD in our kelp filter algorithm to estimate the global extent of giant kelp and intertidal green algae per marine ecoregion and province, producing a high-resolution global map of giant kelp and intertidal green algae, powered by Google Earth Engine.

