# Abstract

High quality data consisting of imagery with a high spatial and temporal resolution can support existing environmental monitoring in freshwater, marine and terrestrial settings and by advanced image analysis, processes and ecosystem services can be assessed. Developments in collecting and analyzing this type of data are important and need to be further investigated. In MS1 a UAV-based (Unmanned Aerial Vehicles) method of estimating the physical state of Danish streams is compared to the traditional method. The study revealed a significant correlation ($R^2$ = 0.75, $P < 0.001$) between the Physical-Index values of the two methods, identified both weak and strong points, and showed a possibility of covering extended stream-sections compared to the traditional method. Extending the analysis workflow to include advanced object-based image analysis and biomass estimation, temporal development and stress-processes were studied in selected coastal, marine zones in Odense Fjord (described in MS2). Focusing on the species *Zostera marina* and *Fucus vesiculosus* it was possible to delineate, separate and classify both species at different scales at accuracies of 86 – 92 %. Measurement of temporal growth/loss in both area and biomass was achievable for both species, and statistically significant area-biomass correlations could be made with an $R^2$ value of 0.96 and $P < 0.001$ (*F. vesiculosus,* specific $DWm^{-2}$) and 0.89, $P < 0.001$ (*Z. marina*, $DWm^{-2}$ at 80% coverage). In MS3 these findings were applied in a long-term, 6-year monitoring of an eelgrass population in Odense Fjord, showing the spatial and temporal change in different subsets of the eelgrass population both on landscape and patch scale. This revealed an evident stress-gradient in the eelgrass beds on a selection of fragmentation parameters and very local growth/loss and macroalgae mobility was assessed. Conducting traditional, manual monitoring is often a demanding task, covering relatively limited areas and limiting performance assessment of restored eelgrass beds. In MS4 it is shown that UAV-based monitoring of a large-scale eelgrass transplantation is a feasible method for surveying patch expansion and estimate shoot density both on species and landscape scale.

The UAV-based methods - either by itself or coupled to advanced image analysis - have shown great potential in extracting valuable, ecological information increasing ecosystem understanding on variable spatial scales while limiting both workload and time-use and revealing new exciting areas of use.