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Detection of an introduced tree species in protected river islands with UAV remote sensing

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The island mosaic of Mareau-aux-Prés (Loiret, France) on the Loire river is host to the European beaver (*Castor fiber*) which is a protected species. The four islands, with a total area of 10 ha, are mainly dominated by black poplar (*Populus nigra*). Due to its impact on poplar, the presence of beaver indirectly favors ashleaf maple (*Acer negundo*), which is an introduced specie.
Due to the accessibility constraints of protected river islands, remote sensing appears as a promising tool to monitor the dynamics of ashleaf maple in a conservation perspective. Unmanned Aerial Vehicules (UAV) make it possible to survey small areas more frequently and with very high spatial resolution.

The objective of this work is to evaluate the potential of lidar and multispectral UAV remote sensing for the detection of ashleaf maple. Lidar data was acquired by a YellowScan surveyor and orthophotos with 4 bands were generated from aerial images. A reference dataset was created by manually classifying 300 discs of 1 m diameter as poplar or maple in the orthophotos.
Two workflows were compared for maple detection. In the pixel-based workflow, lidar and optical metrics are computed for each pixel at 1 m resolution, and for the reference discs. A species classification model is built from the reference discs with all metrics as predictors. The model is then applied to all pixels for species mapping. The object-based workflow is similar, except that a preliminary single tree segmentation is performed on the canopy height model derived from lidar data. Lidar and optical metrics are computed for each segment instead of pixels.
The two approaches yield similar classification accuracy (approx. 90%). However, pixel-based maps appear noisier which may hinder the use by practitioners. Moreover, this approach seems more prone to errors in shadow areas.

This work showed the applicability of UAV remote sensing for species classification in riparian environments. Research perspectives are to further take advantage of the very high spatial resolution of UAV data to detect signs of decay in poplar trees affected by beavers and monitor its temporal evolution.