A Combined Method for Vegetation Classification Based on Visible Bands from Unmanned Aerial Vehicles (UAV) Images: A Case Study for Wild Parsnip Plants

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Abstract

Wild parsnip is an invasive plant that would bring a serious health risk to a human being due to the toxin in its sap. Monitoring its existence and spreading has been challenging for conservation authorities due to its small size and irregular shape. On traditional remotely sensed images acquired from satellites or airplanes wild parsnip cannot be distinguished from other vegetation due to the low spatial resolution. Unmanned Aerial Vehicles (UAV) can acquire ultra-high resolution imagery, and has been used for vegetation-related monitoring in both environmental and agricultural applications in recent years. In this study, UAV images captured in a conservation area of Cataracqui Region Conservation Authority are used to test the methodology of distinguishing wild parsnip. The challenge is that all processing options are only based on visible bands information (Red, Green and Blue) from digital cameras on UAV. This study presents a combined approach using vegetation indices, texture features and Random Forest algorithm to classify land covers of vegetation, and compare the classification accuracy with traditional methods. Five vegetation indices are compared and analyzed to determine which one shows the most significant difference between vegetation and other land covers based on Red-Green-Blue (RGB) images. Six correlated texture features are extracted and added to original images as supplementary data. A Random Forest containing decision trees is used to distinguish wild parsnip plants from other vegetation. Results show the following: (1) wild parsnip plants can be classified by this combined method with vegetation indices, texture features, and Random Forest algorithm; (2) Random Forest has better performance than traditional methods, such as Maximum Likelihood classifier, in vegetation classification analysis; (3) texture features as additional data can improve the classification accuracy. The results indicate that UAV is an economical and valuable resource for mapping vegetation. The combined method in this study presents effective outcomes in vegetation classification analysis and detecting the invasive plant wild parsnip.