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Using remote sensing in support of environmental management: A framework for selecting products, algorithms and methods

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ABSTRACT:

Traditionally, to map environmental features using remote sensing, practitioners will use training data to develop models on various satellite data sets using a number of classification approaches and use test data to select a single 'best performer' from which the final map is made. We use a combination of an omission/commission plot to evaluate various results and compile a probability map based on consistently strong performing models across a range of standard accuracy measures. We suggest that this easy-to-use approach can be applied in any study using remote sensing to map natural features for management action. We demonstrate this approach using optical remote sensing products of different spatial and spectral resolution to map the endemic and threatened flora of quartz patches in the Knersvlakte, South Africa. Quartz patches can be mapped using either SPOT 5 (used due to its relatively fine spatial resolution) or Landsat8 imagery (used because it is freely accessible and has higher spectral resolution). Of the variety of classification algorithms available, we tested maximum likelihood and support vector machine, and applied these to raw spectral data, the first three PCA summaries of the data, and the standard normalised difference vegetation index. We found that there is no 'one size fits all' solution to the choice of a 'best fit' model (i.e. combination of classification algorithm or data sets), which is in agreement with the literature that classifier performance will vary with data properties. We feel this lends support to our suggestion that rather than the identification of a 'single best' model and a map based on this result alone, a probability map based on the range of consistently top performing models provides a rigorous solution to environmental mapping.