Vegetation indices derived from a modified digital camera in combination with different blocking filters

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We compared vegetation measurements done with a hyperspectral spectro-radiometer and a modified digital camera (IR band elimination filter removed). By removing this filter, the camera sensor became sensitive for IR radiation besides the visible spectrum.

We determined the potential of such a camera to measure different vegetation indices. To this end we compared 71 vegetation indices derived from spectro-radiometer data with 63 indices derived from the modified digital camera.

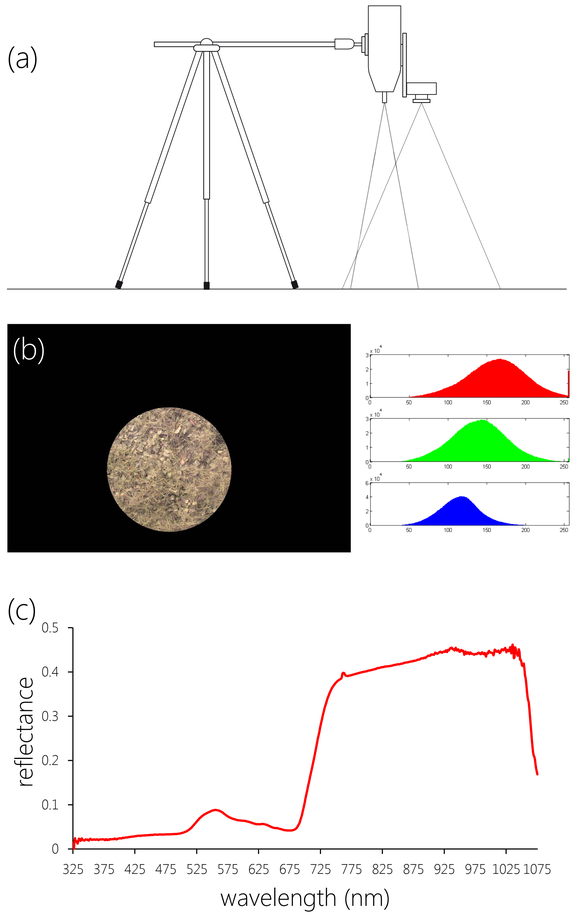
Here we …

(I) present the experimental setup used

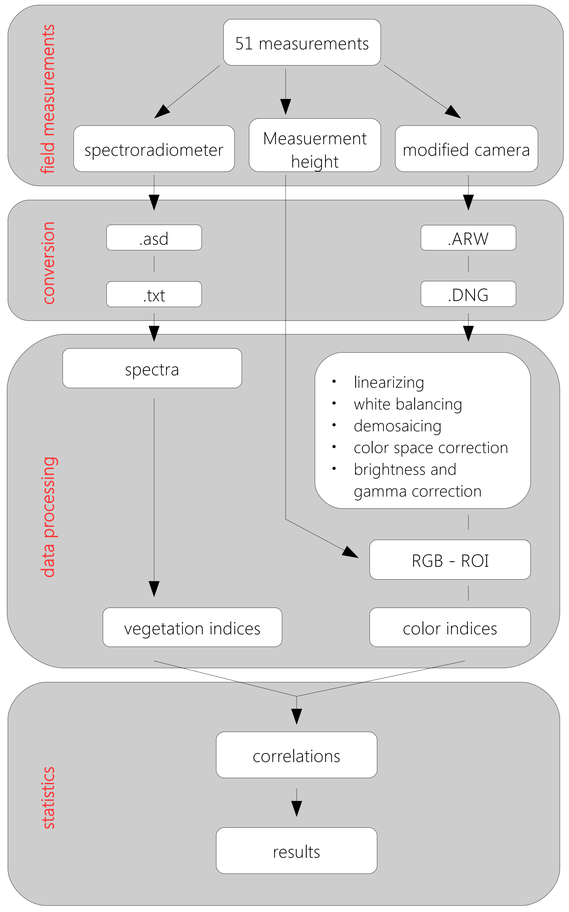
(II) display the data processing workflow

(III) show three detailed examples of camera derived indices correlating with established vegetation indices derived from hyperspectral measurements

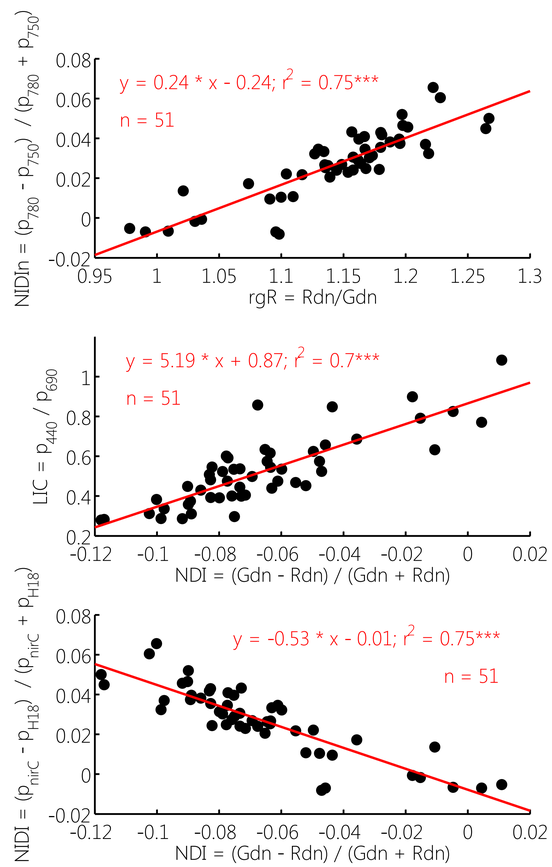
(IV) give an outlook on further experiments including different band elimination filters to improve the information content of the digital images



(I) (a) Schematic setup for parallel measurements with a spectro-radiometer (ASD FieldSpec) and a modified commercially available digital camera (Sony DIKA NEX 5RKB). (b) Digital image including field of view filter and RGB histograms. (c) Corresponding hyperspectral reflectance spectrum

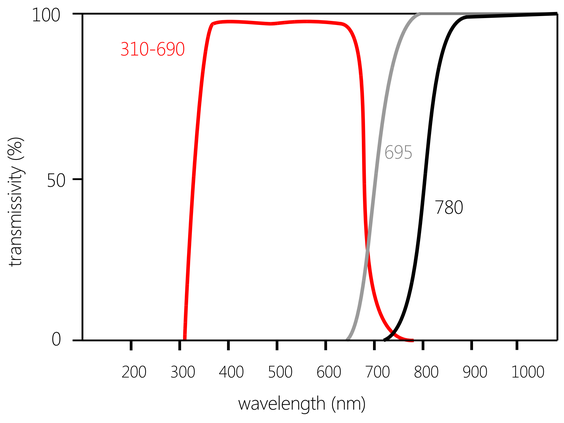


(II) Data processing workflow for spectral and digital image data starting with field measurements, data conversions, indices calculations and correlation statistics.



(III) Three examples of good correlations of digital camera derived RGB indices with spectro-radiometer derived indices including correlation statistics.

PROBA-1 CHRIS Bands:
p_{nirC} Band H25 863-881 nm
p_{H18} Band H18 745-752 nm



(IV) The modified digital camera was sensitive to the visible spectrum as well as the near infra-red region. Using different band elimination filters allows for selective band passes.

Given these additional information we found that substituting different wavelengths logically in different VIs yielded very good correlations (e.g NDVI). Furthermore an "exhaustive search" revealed several more very good correlations, for reasons yet under investigation.

In total we compared 71 vegetation indices derived from spectro-radiometer data with 63 indices derived from the modified digital camera (n=4473). Many of these different indices featured relatively high correlations. Especially indices that are known for representing the amount and vitality of green biomass, as these are the NIDI (normalized infrared vegetation index) and the LIC (curvature index).

Applying different band elimination filters further improved the potential of the camera to act as a proximal sensing tool.

We thus conclude from this experiment, that given a proper inter-calibration, a commercially available digital camera can be modified and used as a reasonable alternative tool to determine vegetation biomass and/or vitality