Geophysical Research Abstracts
Vol. 14, EGU2012-7052, 2012
EGU General Assembly 2012

High resolution mapping of Normalized Difference Vegetation Indices (NDVI) of biological soil crusts

T. Fischer (1), M. Veste (2), A. Eisele (3), O. Bens (3), W. Spyra (4), R.F. Hüttl (3,5)

(1) Central Analytical Laboratory, Brandenburg University of Technology, Cottbus, Germany, (2) Centre for Energy Technology Brandenburg e.V., Cottbus, Germany, (3) GFZ German Research Centre for Geosciences, Potsdam, Germany, (4) Chair of Chemical Engineering and Hazardous Wastes, Brandenburg University of Technology, Cottbus, Germany, (5) Chair of Soil Protection and Recultivation, Brandenburg University of Technology, Cottbus, Germany

Normalized Difference Vegetation Indices (NDVI) are typically determined using satellite or airborne remote sensing, or field portable spectrometers, which give an averaged signal on centimetre to meter scale plots. Biological soil crust (BSC) patches may have smaller sizes, and ecophysiological, hydrological as well as pedological processes may be heterogeneously distributed within this level of resolution. A ground-based NDVI imaging procedure using low-cost equipment (Olympus Camedia 5000z digital camera equipped with a Hoya R72 infrared filter) was developed in this study to fill this gap at the level of field research, where carrying costly and bulky equipment to remote locations is often the limiting factor for data collection. A commercially available colour rendition chart (GretagMacbeth ColorChecker®) with known red (600-700 nm) and NIR (800-900 nm) reflectances was placed into each scene and used for calibration purposes on a per-image basis. Generation of NDVI images involved (i) determination of red and NIR reflectances from the pixel values of the red and NIR channels, respectively, and (ii) calculation and imaging of the NDVI, where NDVI values of -1 to +1 were mapped to grey values of 0 to 255. The correlation between NDVI values retrieved from these images and NDVI values determined using conventional field spectrometry (ASD FieldSpec 3 portable spectroradiometer) was close (r^2 =0.91), the 95% confidence interval amounted to 0.10 NDVI units. The pixel resolution was 0.8 mm in the field and 0.2 mm in the laboratory, but can still be improved significantly with closer distance to the crust or with higher camera resolution. Geostatistical analysis revealed that both spatial variability as well as size of individual objects characterized by the NDVI increased with crust development. The latter never exceeded 4 mm in the investigated crusts, which points to the necessity of high resolution imaging for linking remote sensing with ecophysiology. Perspectively, the new method could be used for field monitoring of both biological soil crusts and vascular vegetation.

Literature:

Fischer, T., Veste, M., Eisele, A., Bens, O., Spyra, W., Hüttl, R.F. (2012) Small Scale Spatial Heterogeneity of Normalized Difference Vegetation Indices (NDVI) and Hot Spots of Photosynthesis in Biological Soil Crusts. Flora (accepted) DOI: 10.1016/j.flora.2012.01.001

Spröte, R., Fischer, T., Veste, M., Raab, T., Wiehe, W., Lange, P., Bens, O., Hüttl, R.F. (2010): Biological topsoil crusts at early successional stages on Quaternary substrates dumped by mining in Brandenburg, NE Germany. Géomorphologie: relief, processus, environnement 4/2010: 359-370