Spatial distribution of soil erosion and soil organic carbon in a semi-arid environment derived from hyperspectral images

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Rangelands are strongly affected by water erosion processes in semi-arid environments. Together with the mineral topsoil also organic material is lost and the results of these processes result in a highly variable spatial distribution of both erosion affected soils and soil organic matter. This study discusses the results from a field based inventory of the spatial distribution of erosion and the amount of organic material present at the soil surface in comparison to an analyses of high resolution hyperspectral images from the same area, and whether these latter images can be used in rangeland studies. This is important to assess which areas contribute to loss or gain of organic matter for broader scale ranges.

The different stages of degradation are mapped during fieldwork using a predefined classification system. Soil samples were taken from the soil surface to determine soil organic carbon (SOC) for different soil erosion classes and land uses. High resolution hyperspectral images form the DAIS and HYMAP flights were used to assess their application using the field data for validation

Soil organic carbon levels were very low for agricultural fields, and increased for semi-natural areas with decreasing erosion. There was a good correlation between vegetation cover and SOC and between degradation class respectively.

A high negative correlation between SOC and the pixel reflection values was found. It was concluded that the hyperspectral images can well be used to map the spatial distribution of the land degradation classes, using SOC as an indicator. The spectral information regarding organic carbon differs between the HYMAP and DAIS images. Both images thus need a different approach with the classification.