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Analysis of Vegetation Changes in High Andean Wetlands Using Remote Sensing as a Contribution to Environmental Planning in Southern Peru

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Abstract

Wetlands of the high Andean mountains are exceptional ecosystems due to their hydrological characteristics in a surrounding arid environment. This group of tropical peat lands is situated in southern Peru, Bolivia and northern Chile and known as 'Bofedales'.

Bofedales provide a natural habitat which serve as grass land for South-American cameloids like Alpaca (*Vicugna pacos*) as a domesticated form of wild South American cameloid Vicuña (*Vicugna vicugna*) and Guanaco (*Lama guanicoe*).

The study area includes some of the greatest Bofedales of southern Peru as part of a national reserve (La Reserva Nacional Salinas y Aguada Blanca). One problem for reserve managers and decision makers of communities is the need of low cost, current and accurate information upon which they can base their decisions. Important questions are e.g.: 'What are the effects of pasturing, irrigation and drainage and how effective is protection of Bofedales?' 'What are the services which they provided and how could they be evaluated?'

The availability of no-cost data (e.g. MODIS) and automated data processing techniques can provide a cost effective tool to answer those questions.

The study shows that using high resolution data like Landsat ETM+ combined with elevation models derived from SRTM data (Shuttle Radar Topography Mission) clearly improves existing wetland classifications. It shows Bofedales as an inhomogeneous land cover type due to different characteristics mostly depending on relief, geology and climate. To investigate this inhomogeneity time analysis using the vegetation index (NDVI) is applied and compared with other vegetation cover types situated in the same study area.

Due to the different geometric resolution of the data (Landsat, MODIS, SPOT Vegetation) the potentials of subpixel classification for improving the accuracy of time analysis is investigated.

Dependencies between climate, hydrological conditions and changes of vegetation are examined by using reanalysed climate data sets combined with hydrologic models.

Recommendations and conclusions are aimed to emphasise the need for research because much more work is required to develop resource management and conservation programs based on scientific research to ensure protection and sustainable use of Bofedales and therefore to ensure the future livelihoods of the indigenous peoples who depend on them.

Keywords: Landsat, MODIS, NDVI, remote sensing, SPOT Vegetation, SRTM, time analysis, vegetation change, wetlands

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