Developing a remote sensing protocol as a cost effective tool to monitor contamination of wetlands

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The health of mangrove wetlands is of critical importance to society in tropical marine regions. Mangrove wetlands serve, as coastal protection, as wild life refuge, and as nurseries for marine life. Mangrove detritus is an important source of nutrition for aquatic eco-systems, heavy metals taken up in mangrove biomass will enter the food chain and can affect the quality of fishery products making the danger of contamination of mangrove areas of utmost importance to the economy of coastal regions.
Vegetation may take up metals in their roots, stems and leaves, and serve as sensors of contamination that integrate pollution over longer time periods, less dependant on daily or seasonal fluctuations. The characteristic that vegetation reacts to the geochemical conditions of the substrate has found a use in the remote sensing techniques applied to mineral exploration, where large areas can be efficiently surveyed without expensive field studies.

The proposed study tries to apply the remote sensing techniques of mineral exploitation to the monitoring of mangrove wetlands for the presence of metal contamination. Mangrove wetlands are specially, well suited for this technique, because vegetation in mangrove wetlands is not very diverse. Similar as in mineral exploration, a cost effective technique that does not require costly field studies, will make an excellent tool for government agencies in charge of monitoring the health of wetlands and the possible contamination of wetland forests.

Johannes H. Schellekens from the Department of Geology of the University of Puerto Rico aims to develop a protocol that will help monitoring agencies determine the health or possible contamination of a mangrove wetland applying remote sensing techniques that are currently used in mineral exploration. Anomalous metal concentrations in the substrate will influence the growth, including leave reflectance, of the plants on this anomalous substrate. Leave reflectance of trees growing on the deposit are compared to leave reflectance of trees outside the mineralized area. The Normalized Difference Vegetation Index (NDVI) derived from the reflectance is then compared to the NDVI determined using the spectral bands of multispectral scanners in satellite images.

NDVI for mangroves will be correlated to metal contents of substrate leaves. NDVIs for heavy metal contaminated mangroves will be determined and distinguished from NDVIs of pristine areas. The numbers for the NDVI is then used to delineate areas on the images by adding and subtracting the red and near infra red bands and importing these to GIS to

make a map of the affected areas. These areas can then be visited and sampled to determine the extent of the contamination and thus provide a cost effective method of monitoring by focusing the field visits to certain areas.