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Sustainable land use interpretation of remote sensing data of the Modder, Seekoei and upper Orange River catchment areas, Eastern Free State, South Africa

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As part of the Inkaba ye Africa 'Living Africa' project (De Wit and Horsfield, 2006) this remote sensing investigation aims at determining aspects of sustainable land use such as soil recognition, water management and suspension material budget of the Modder, Seekoei and upper Orange River catchment areas, Eastern Free State, South Africa. Soil, agricultural and water studies (De Wit and Stankiewicz, 2006) of these drainage systems have to address aspects of flooding, water management, catchment areas, biodiversity, soil erosion, climatology. In order to obtain a representative overview, Landsat imagery later in combination with hyperspectral scans and field validation appear to be the appropriate methods of investigation. Hauff et al. (2002) point out that the advantages and disadvantages of using high-resolution sensors are that they detect far more detail in earth surface materials. This presents a problem to processors accustomed to working with only mathematical anomalies. The anomalies now adapt specific identities such as mineral species, soils and lithologies, cultural objects such as buildings and roads; environmental hazards such as mine waste and hydrocarbon contamination and agricultural and forestry applications where plant and tree species have more consistent identities. Space borne sensors e.g. Landsat, Aster, Spot normally record data as reflectance from the earth's surface in about five to 14 bands in parts of the electromagnetic spectrum. These wavelengths vary between the short wavelengths of the visible part of the spectrum to near Infra-red and thermal Infrared. Hyperspectral sensors on the other hand can record reflectance in over 200 bands. According to Lillesand et al. (2004), hyperspectral systems can aid in the identification of features for which the diagnostic absorption and reflection characteristics are lost in the coarse bandwidths of multispectral scanners. Application of hyperspec-

tral data varies from geology to vegetation and soil studies. The areas proposed for the acquisition of hyperspectral data, the Modder and/or Seekoei River catchments, form part of continuous studies in the field of land use management. Gaps in the current knowledge concerning the catchments are vegetation cover and detailed soil mapping (see inter alia Lumme, 2004). It is possible that, given the right data and technology, these problems can be solved with remote sensing and that it can pave the way for applications elsewhere in southern Africa. Remote sensing data compilation for the upper Orange River catchment area will give an indication of paleo river terraces, geomorphology, vegetation, soil erosion, rock alteration, CO2 budget and the water situation along the inland escarpment at the western margin of Lesotho. Measurements could allow detection of epeirogenetic movements and calculation of erosion rates (m/My) and material budgets during denudation of the upper Orange River catchment area. A further aim is to compare mineralogy and geochemistry of suspension load, provenance studies, quantification of components, material circles, and carbon cycle with hyperspectral data and to calibrate them. In order to find out how the climate change does affect processes, climate data can be draped onto Digital Terrain Models. The outcome of this research are recommendations for sustainable land use of soil and forest, public infrastructure, and a forecast of mineral resources and biodiversity. The strategy for the hyperspectral scan project is planned to be as follows: 1. Reconnaissance with Landsat imagery, identifies potential targets using reflectance. 2. Follow up with field infrared spectroscopy (ASD), ground checks of targets. 3. Hyperspectral airborne survey using high-resolution ARES scanner, creating a detailed surface cover/water, land use, and material/mineral, map.

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