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## Monitoring Sand Encroachment on Agricultural Land in White Nile State, Sudan, during 1975–2008 using Remote Sensing and GIS

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### Abstract

Wind erosion is an important soil degradation process affecting arid and semi-arid regions worldwide. This process is destructive and damaging; covering fertile lands, bushes, trees, roads and buildings. Sand encroachment in the White Nile State has been recognised as the most serious environmental problem, thus also facing the study area 50 km south of Khartoum, including the El Geteina and Ed Duim localities, which are part of the Gezira agricultural scheme. The objective of this study is to monitor and assess the encroachment of sand dunes and vegetation degradation in the study area during a period of 34 years using remotely sensed imagery and GIS techniques as well as to evaluate the efficiency of remote sensing and GIS in achieving these objectives. For this purpose four satellite images (MSS 1974, TM 1986, ETM+ 2000 and 2008) were analysed in addition to field information, soil analysis and other existing information (topographical and geological maps). The study was based on visual interpretation, digital analysis, laboratory analysis and field work, whereupon geometric and radiometric correction, image enhancement, visual interpretation of colour composites, unsupervised and supervised classifications as well as change detection were applied. The results revealed that during the study period the shifting dunes increased 11 % (annual rate 0.32%/year) and the vegetation cover decreased by 20 % (annual rate 0.58%/year) while the cultivated areas (rain-fed agriculture on sandy soils, rain-fed agriculture on clay soil and irrigated agriculture) increased 2 %, 10 % and 7 % (annual rate 0.05%/year, 0.29%/year and 0.20%/year) respectively. This trend indicates accelerated land degradation as the result of regional climatic change and human misuse of land. The study proves that remotely sensed image and geographic information system techniques provide detailed results which should be further exploited in similar studies.

**Keywords:** Remote sensing, GIS, sand encroachment, White Nile State, wind erosion