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Examining The Prospect of Remote Sensing Imagery to detect Sand Rivers with Water Extraction Potential

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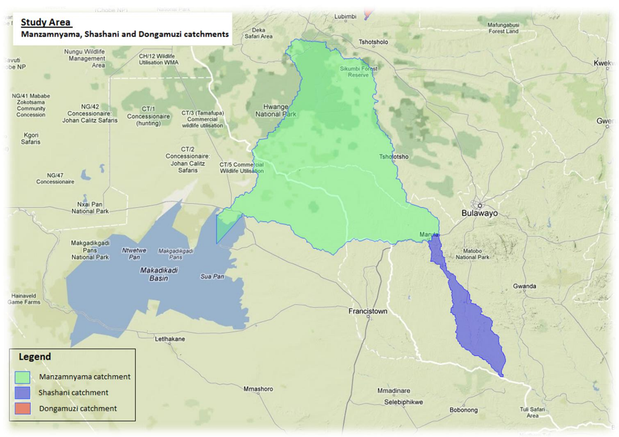
Scientific Problem

This paper concerns sand rivers, also called dry riverbeds, *luggas* or *wadis,* ephemeral (seasonal) watercourses containing sand that are flooded with rainwater run-off from higher elevated catchment areas once or a few times in a year (Hussey 1997; Herbert 1998; Nissen-Petersen 1998; Hussey 2003). Even though the riverbed is dry for most of the year (Figure 1), there is perennial groundwater flow in the sand-rivers (Herbert 1998). However, this resource is not fully exploited in many areas where it could provide an essential water supply and it is not clear what the size of the resource is in comparison with traditional surface and groundwater resources.

Objectives

The objective of this paper is to develop and implement remote sensing techniques that can be used to identify alluvial rivers with potential for a year-long sustainable water supply. Such techniques based on remote sensing technology would help cutting down survey costs for water supply developers and NGOs investigating water resources as most of the initial survey work would be done in the office with ground verification being done only for sites that have shown signs of potential.

Study Area



The study area is in the Matabeleland Region of Zimbabwe, in the South West of the country where sand rivers are widely used as an alternative clean water source by the communities.

Research Questions

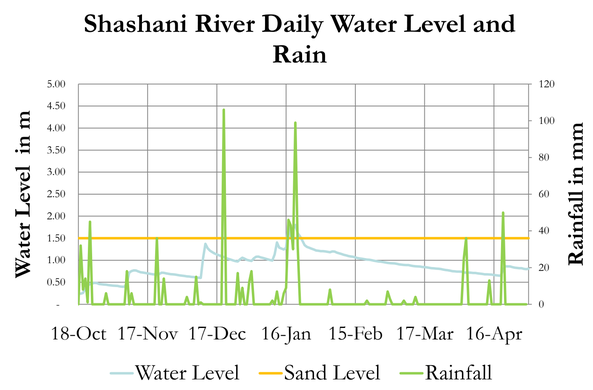
Sand rivers in Zimbabwe are fully recharged during the rainy season (November – March). After the rains the sand-rivers gradually discharge and it is this recharge and discharge that is being investigated. In the dry season, surface water recedes and the sand river transforms into an alluvial aquifer, with the water hidden from view. The researchers are at first interested at being able to see the water below the sand using any form of satellite data. Thereafter, satellite data will be compared with water level in the river which in turn is linked to the weather, with a particular emphasis on predicting how the rainfall pattern affects the water level in the river.

Data and Methods

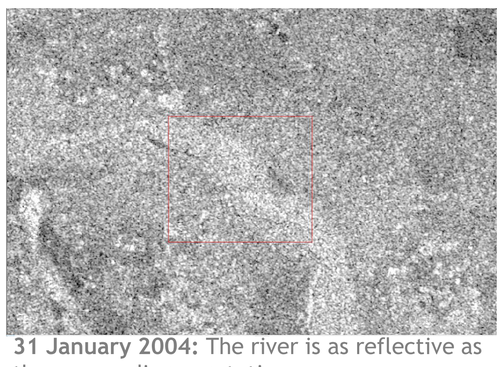
For the purposes of this research 3 types of data are being compared:

1. Hydrological data – this is through daily measurements of water level in the river sand. A water level logger has been collecting this water level data since October 2012 on the Shashani River.

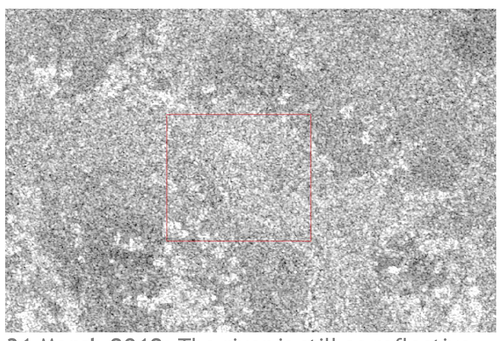
2. Meteorological data – Daily rainfall and temperature data are being obtained from the local meteorological office. Comparison is being made on how rainfall events affect the water level in the sand.



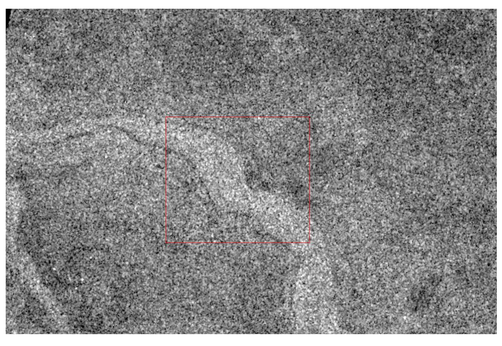
3. Satellite Image Data – Available satellite images (Landsat optical images and ESA ASAR radar images). Analysis of the ESA ASAR data is on-going. Currently all the images have been incorporated into ArcGIS where the reflectance of the study area is being studied against time. It is interesting to note that there is high reflectance from the sand river during the rainy season, and it is almost impossible to separate the river channel from surrounding vegetation as shown in Fig (a) below. The contrast between the vegetation and the river channel is highest in June (Fig (b)) which is two months after the rains and the contrast is also relatively high during the month of October (Fig (c)) which is the hottest and driest month.



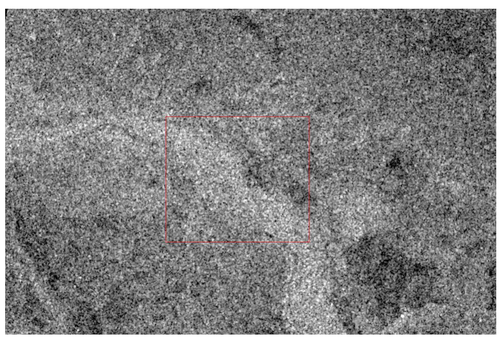
31 January 2004: The river is as reflective as the surrounding vegetation



31 March 2012: The river is still as reflective as the surrounding vegetation



18 June 2004: The river can be clearly seen as the darker line on this image



17 October 2003: The river can almost be clearly seen on this image although the contrast with the surrounding vegetation is not as vivid as in June

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