STUDENT FEATURE

Mulema Mataa

A multidisciplinary approach to assess groundwater-surface water interactions in the Barotse Floodplain

Mulema is enrolled in a Master of Science in Integrated Water Resource Management at the Integrated Water Resources Management Centre, University of Zambia, Lusaka, Zambia. His thesis title is "A multidisciplinary approach to assess groundwater-surface water interactions in the Barotse Floodplain ".

Figure 1: Mulema taking onsite measurement of physiochemical parameters from a perennial surface water body in the dry season

What contribution Mulema wants to make with his study?

The degradation and loss of wetlands is a worldwide phenomenon and seems to progress faster than in other ecosystems.

In order to understand the wetland ecosystem, we need to know the wetland hydrological cycle. The interaction between groundwater and surface water is a key element of the hydrological cycle. Previous studies have treated these water resources separately, understanding their interaction provides insight into responses to both natural dynamics and global change. The focus of this study is to evaluate groundwater-surface water interactions in the Barotse Floodplain.

The study methodology

The approach of this study utilises a multidisciplinary approach involving remote sensing, field observations, hydrochemistry and isotopic analysis. Remote sensing was employed to identify a possible groundwater discharge point in the wetland using normalised difference in vegetation index (NDVI) green island analysis in Google Earth Engine. The Modified Normalised Difference Water Index (MNDWI) in Google Earth Engine was exploited to identify perennial land surface water bodies. NDVI and NDWI were derived using Copernicus satellite data Sentinel-2 in Google Earth Engine platform. The combination of the two indices establish areas that

FUNDED BY

WeMAST PARTNERS

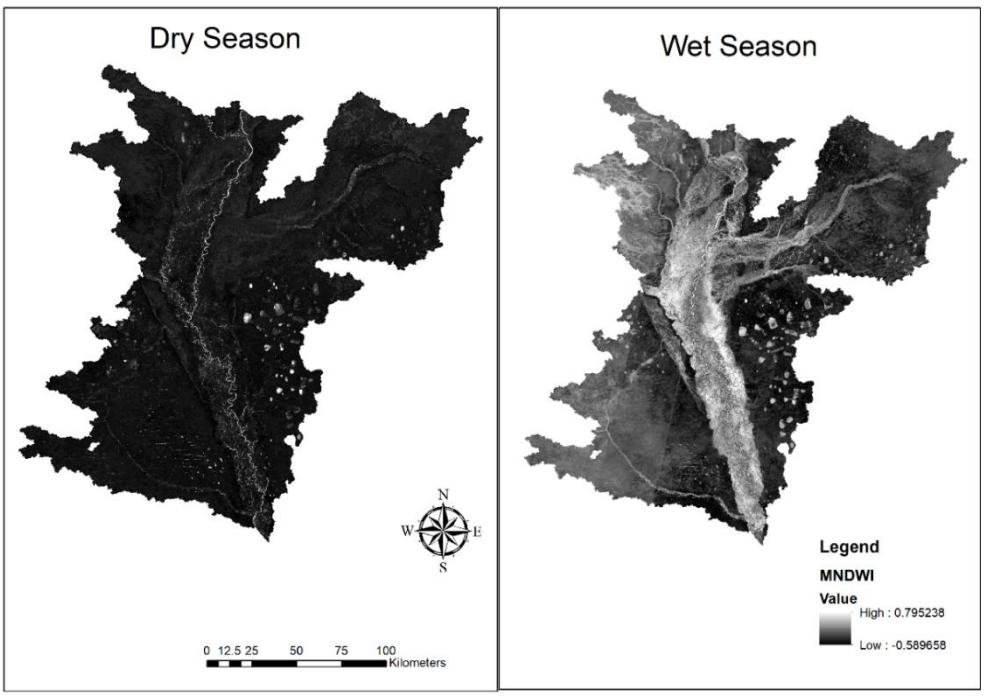

Figure 2: The MNDWI highlights the surface water in the Barotse floodplain for the dry season and wet season when it floods

remain green during the dry season, known as green island areas. These green islands areas, perennial water bodies and ground water will be analysed hydro chemically and isotopically in order to study groundwater surface water interactions in the Barotse floodplains.

Hydrochemistry will be utilised to determine the composition of the different water sources and identify the genetic link between in the local and regional flow of ground water and interactions with perennial surface waters. Water samples collected from various water sources will be analysed for stable isotope chemistry [deuterium (H2) and oxygen (O18)] to determine the origin of the water sources. The results from the multidisciplinary approach will feed into the final objective of this study, to formulation of a groundwater flow conceptual model for the Barotse floodplain.

Dry and wet season data collection

Field work has already been conducted for both the dry and wet seasons. During these two seasons, various water sources where sampled including hand pumps, deep wells, shallow water wells, perennial water bodies and the Zambezi River.

Groundwater loggers have been installed in three monitoring boreholes, one in each district Lukulu, Mongu and Senanga respectively.

Surface flows on the Zambezi River and its major tributaries including Kabompo, Luanginga and Lungwebungu and the Little Zambezi were measured for the dry period using an Acoustic Doppler Current Profiler (ADCP).

Figure 3: Mulema and other students sampling a perennial water surface body in the wetland

FUNDED BY

WeMAST PARTNERS