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STUDENT FEATURE

Botlhe Matlodi

Evaluating Land Use Land Cover Change Effect on Streamflow Dynamics in the Gaborone Dam Catchment, Botswana



Botlhe is enrolled in a PhD in Environmental Science (Hydrology and Water Resources) at the Department of Environmental Science, University of Botswana. His thesis title is “Evaluating Land Use Land Cover Change Effect on Streamflow Dynamics in the Gaborone Dam Catchment, Botswana “.

What contribution Botlhe wants to make with her study?

Land use land cover (LULC) change is one of the major environmental changes occurring around the globe today, hindering sustainable management of the earth’s surface. These changes are driven by both natural and human forces, with the human forces being unprecedented. It is noted that, between 39% and 50% of the terrestrial ecosystems have undergone modification due to anthropogenic influence. Such changes have potential impacts that manifest in climatological, hydrological and biodiversity responses. Thus, LULC change is a key factor affecting water resources through modification of flow regimes and water availability.



Figure 1: Meteorological data download at the Ranaka automated Weather Station

The Gaborone dam catchment in the headwaters of the Limpopo River Basin is a major water source to the city of Gaborone and its surrounding areas and has been subject to fluctuating water levels, despite good rains.

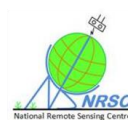
Changing LULCs such as farmland expansion, urbanisation and small dams’ construction upstream in the catchment have been attributed to the fluctuating water levels.

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In addition, hydro-metrological observations are spatially and temporally sparse, limiting the application of physically based hydrological models in assessing catchment responses.

Therefore, this study seeks to evaluate the effects of LULC change on streamflow's of the Gaborone dam catchment from 1984 to 2015.

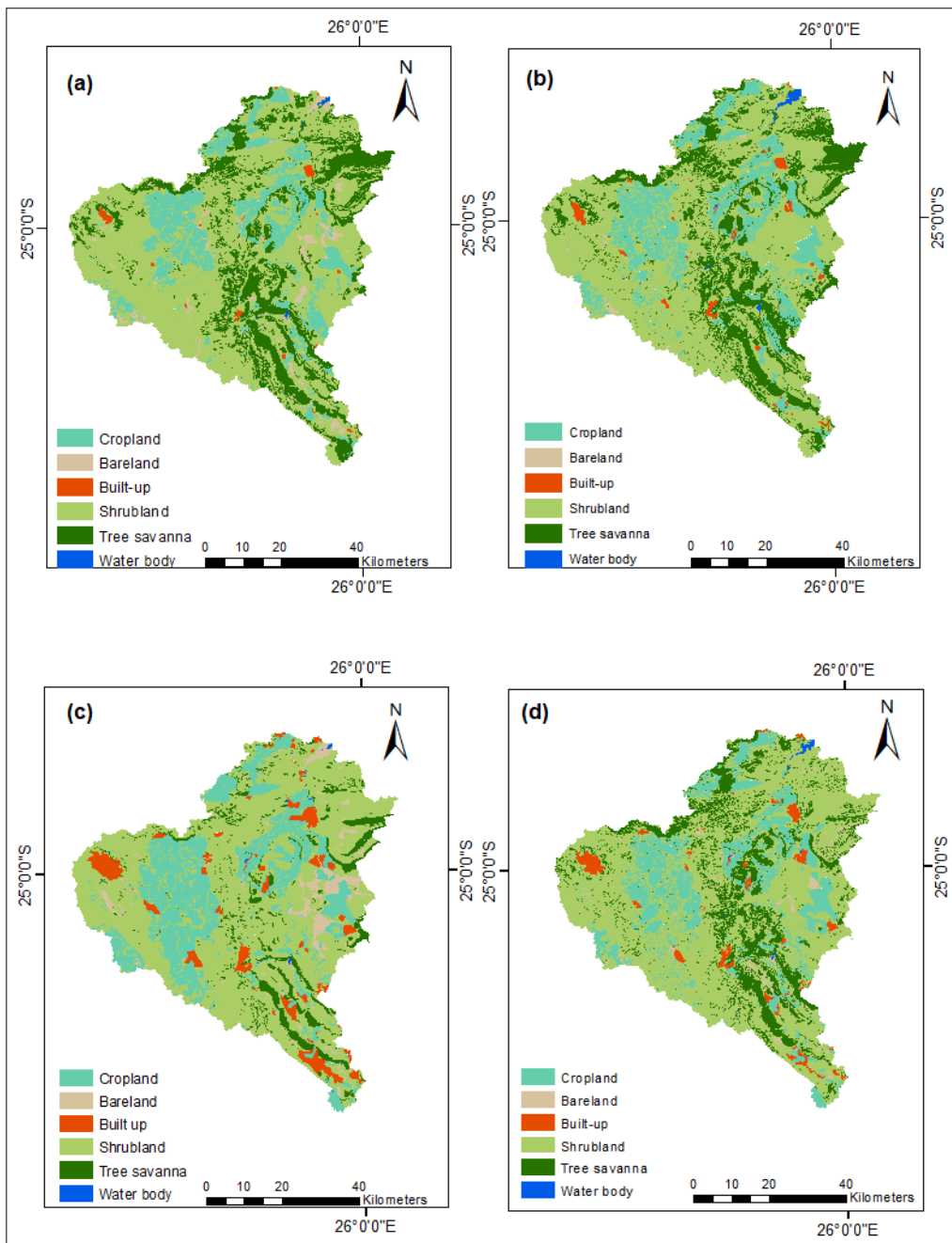
To achieve this, LULC changes in the catchment have been assessed through the application of geospatial techniques using the freely available Landsat datasets (1984, 1995, 2005 & 2015) (Figure 2 and 3).

In addition, trend analysis of hydro-meteorological datasets, using the Mann-Kendal trend test,

hydrological modelling of the catchment processes using a semi-distributed Soil and Water Assessment Tool (SWAT) model, taking into consideration the heterogenic characteristics of the catchment through Hydrological Response Units (HRUs) and prediction of the Likely LULC changes and streamflow's through CA-Markov model are ongoing.

The study is expected to generate knowledge on the past LULC patterns in the Gaborone dam catchment and also assist in designing future catchment management strategies in minimizing LULC change impacts on hydrological processes (streamflow) in Botswana. Further, the study will present

Figure 2: LULC of the Gaborone dam catchment; (a) 1984; (b) 1995; (c) 2005 & (d) 2015



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insights on the use of high spatial and temporal resolution meteorological data in a semi-arid catchment for better simulation and representation of hydrological processes and testing of the SWAT model in these areas.

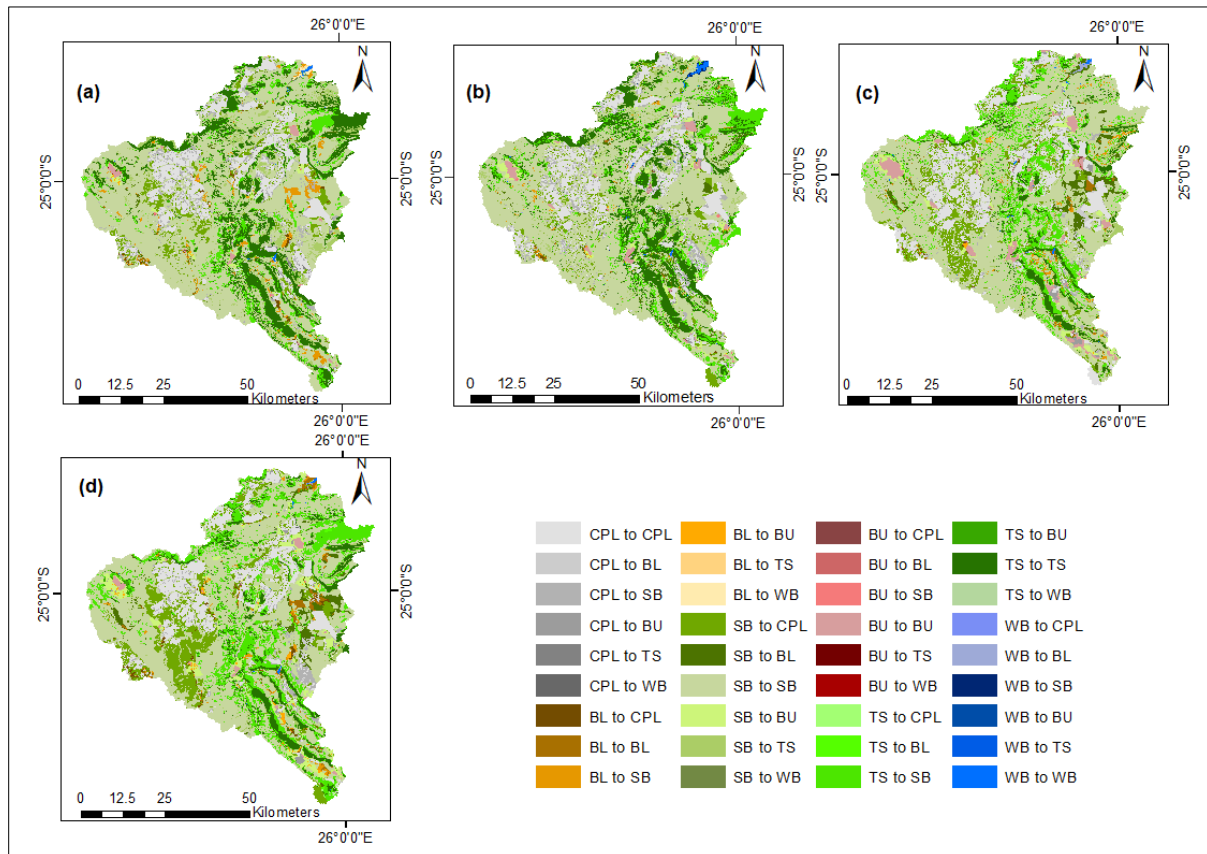


Figure 3: LULC loss and gains from (a) 1984 to 1995; (b) 1995 to 2005 (c) 2005 to 2015 and (d) 1984 to 2015. (Note: CPL-Crop land; BL-Bare land; SB- Shrub land; BU-Built up; TS- Tree savanna; WB- Water bodies.)

Academic Achievements

1. Matlhodi, B., Kenabatho, P. K., Parida, B. P., & Maphanyane, J. G. (2019). Evaluating Land Use and Land Cover Change in the Gaborone Dam Catchment, Botswana, from 1984–2015 Using GIS and Remote Sensing. *Sustainability*, 11(19), 5174.
2. Ditiro B. Moalafhi, Piet Kenabatho*, Bhagabat P. Parida, and Botlhe Matlhodi, (2018). Predictability of daily precipitation using data from newly established automated weather stations over Notwane catchment in Botswana, *Climate change and adaptive land management in southern Africa - assessments, changes, challenges, and solutions*, edited by Rasmus Revermann, Kristin M. Krewenka, Ute Schmiedel, Jane M. Olwoch, Jörg Helmschrot & Norbert Jürgens, Volume 6, pages 46-51, April 2018
3. Kenabatho P.K, Parida B.P, Moalafhi D.B, Matlhodi B, (2017). Linking Scientific Research for Development Agenda: The case of a Hydro-meteorological Project in the Notwane Catchment, Botswana. *Handbook of Research on Geospatial Science and Technologies*, pg 374-391; Doi: 10.4018/978-1-5225-3440-2.Ch023

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