

ABSTRACT

Land Use/Land Cover (LULC) changes induced by urbanisation constitute a key driver in surface thermal properties modification, which intensifies Land Surface Temperature (LST) in rapidly urbanising areas. The aim of this research was to analyse the patterns of urban LULC changes induced LST and its public health implications in Ouagadougou and Bobo-Dioulasso, Burkina Faso. For this purpose, Landsat images were used to map LULC for four selected years including 2003, 2009, 2015 and 2021, using Random Forest, Support Vector Machine and Gradient Tree Boost algorithms in the Google Earth Engine (GEE) environment. MODIS/Aqua LST and ERA5-Land average air temperature datasets with Mann Kendall trend test were used to assess the LST and air temperature trends respectively. Aggregation was used in combination with correlation to establish the link between LULC and LST at the pixel level. Also, correlation analysis was employed to determine the relationship between LST and air temperature, and between LST and selected public diseases. Markov chain and Multiple linear regression models were employed to predict future LULC and LST. The study revealed that Ouagadougou experienced more rapid changes in LULC than Bobo-Dioulasso, with a maximum annual change intensity of 3.61 percent recorded between 2015 and 2021 as against 2.22 per cent in Bobo-Dioulasso for the period 2009 – 2015. The transition of changes was towards built-up areas, which gains targeted bare land and agricultural lands in both cities. This situation has led to the increase of built-up surface in Ouagadougou by 78.12 per cent, while 42.24 per cent of the agricultural land area was lost. However, in Bobo-Dioulasso, the built-up area has increased far more by 140.67 percent and the agricultural land areas experienced a gain of 1.38 per cent compared with the 2003 baseline. Both cities experienced an increasing trend in LST and air temperature (z value >0) with a greater increase in Ouagadougou than Bobo-Dioulasso, due to urbanisation. The global yearly trend was supported by the March-April-May (MAM) season, which shows a statistically significant trend in Ouagadougou (p -value=0.009). The LST and air temperature exhibited a stronger correlation in Bobo-Dioulasso ($R=0.83$) than in Ouagadougou ($R=0.76$). In the study area, at the pixel level, the built-up proportion showed a moderate positive correlation with the LST ($0.44 \leq R \leq 0.64$ in Ouagadougou, $0.49 \leq R \leq 0.61$ in Bobo-Dioulasso), while the non-built-up proportion was negatively correlated with LST ($-0.41 \leq R \leq -0.6$ in Ouagadougou, $-0.49 \leq R \leq -0.59$ in Bobo-Dioulasso). The difference in LST between a fully built-up pixel and a fully non-built-up pixel decreased from 2003 to 2021 in both cities indicating that the LST increased in all LULC types throughout the study period. The contribution of the non-built-up class to urban cooling was lower in Bobo-Dioulasso (between 0.29°C and 1.39°C) than in Ouagadougou (between 0.74°C and 1.94°C). The research also found that malaria and dengue fever had a weak correlation with LST ($R < 0.4$), while meningitis presented a moderate correlation in the districts of Dafra ($R=0.56$) and Konsa ($R=0.49$) in Bobo-Dioulasso) and Sig-Noghin ($R=0.66$) in Ouagadougou. Only the district of Do in Bobo-Dioulasso showed a strong correlation ($R=0.86$) with the LST. With projected increases in LST under the Business-as-usual scenario, the prevalence of temperature-related diseases may increase. In summary, the study area experienced an increase in human footprint, which contributed to the intensification of the LST which is an environmental threat to urban dwellers. These findings constitute a useful decision support for sustainable urban planning. It is therefore recommended that afforestation should be vigorously

pursued at all governmental levels to step down the LST in the two cities. While sponsored research should be carried out to deepen the knowledge on LST and epidemic in the nation.

Keywords: Urbanisation, LULC, LST, GEE, Public disease, Ouagadougou, Bobo-Dioulasso