WASCAL
West African Science Service Centre on Climate Change and Adapted Land Use

Federal Ministry of Education and Research

POLICY BRIEF

URBANISATION-INDUCED LAND USE AND LAND COVER CHANGES IN BURKINA FASO:

A threat for land surface temperature trend and public health

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EXECUTIVE SUMMARY

This research examines the interplay between urban Land Use and Land Cover changes, Land Surface Temperature, and public health in Ouagadougou and Bobo-Dioulasso, Burkina Faso. Employing ground observations, remote sensing, and climatic data, the study reveals urban expansion as a catalyst for rising temperatures, with urban core areas experiencing pronounced surface urban heat island effects. These temperature spikes pose significant challenges to urban sustainability. Notably, the correlation between land surface temperature and meningitis is robust in Bobo-Dioulasso, while malaria and dengue fever exhibit weaker associations in both cities, underscoring the complex relationship between surface temperature and public health.

INTRODUCTION

Burkina Faso is witnessing a rapid transformation of its urban landscape, particularly in cities like Ouagadougou and Bobo-Dioulasso, driven by a combination of population growth, migration (INSD, 2022), and rampant land speculation. This urban expansion has led to profound Land Use/Land Cover (LULC) changes, marked by the proliferation of built-up areas at the expense of natural vegetation and water features. Consequently, densely urbanised areas exhibit elevated Land Surface Temperature (LST) compared to vegetated and aquatic regions. With Africa experiencing unprecedented rates of urbanisation (Schug et al., 2018), particularly in countries like Burkina Faso (United Nations, 2019), the anticipated rise in LST poses significant challenges exacerbated by the impacts of climate change. These rising temperatures compromise the cooling effects of vegetation, posing grave risks to public health (Jaiye, 2020). Drawing from empirical research, this summary seeks to furnish decision-makers with evidence-based insights to facilitate sustainable urban land use planning, fostering the development of resilient cities and communities

RESEARCH APPROACH

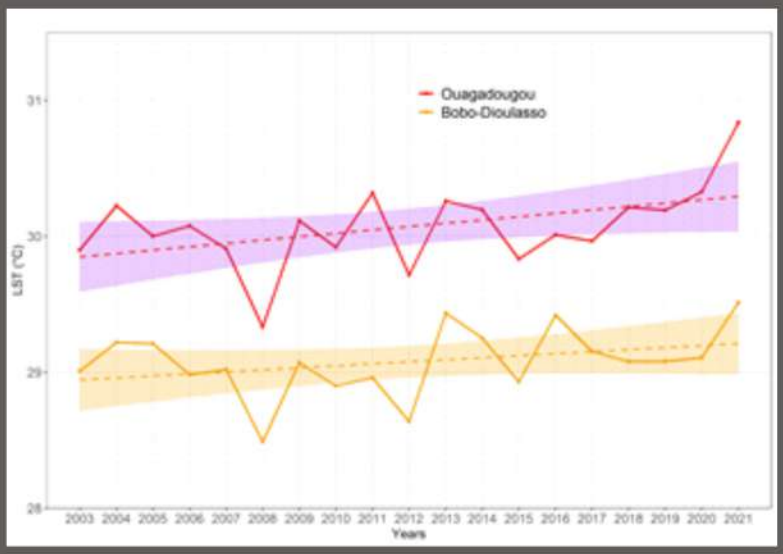
Through an integrated approach leveraging diverse data types and analytical methodologies, this study elucidated the complex interplay between Land Use and Land Cover (LULC) changes, Land Surface Temperature (LST) trends, and their repercussions on public health in Ouagadougou and Bobo-Dioulasso. Utilizing Landsat satellite imagery captured over four time periods (2003, 2009, 2015, and 2021), advanced algorithms including Random Forest, Support Vector Machine, and Gradient Tree Boost were deployed within the Google Earth Engine (GEE) environment to delineate LULC changes. Furthermore, analysis of MODIS/Aqua LST data and air temperature data from the European Centre for Medium-Range Weather Forecasts Reanalysis (ERA5) using the Mann Kendall trend test provided insights into LST dynamics. Spatial correlation analyses elucidated the relationship between LULC and LST at the pixel level, while correlation analyses explored connections between LST and air temperature, as well as LST and selected public health diseases. Predictive modelling employing Markov chain and Multiple linear regression techniques facilitated the projection of future LULC and LST trends.

KEY FINDINGS

1. In Ouagadougou, built-up areas dominate, signalling rapid urban expansion, while Bobo-Dioulasso's landscape is predominantly agricultural, albeit with fluctuating patterns. Intensity analysis underscores accelerated annual changes in both cities, notably from 2015 to 2021 in Ouagadougou and from 2009 to 2015 in Bobo-Dioulasso, with conversions favouring built-up surfaces.

2. Future projections suggest that without intervention, urban expansion will persist in both cities, encroaching on peripheral areas while diminishing agricultural and forested regions by 2050 under the Business As Usual scenario.

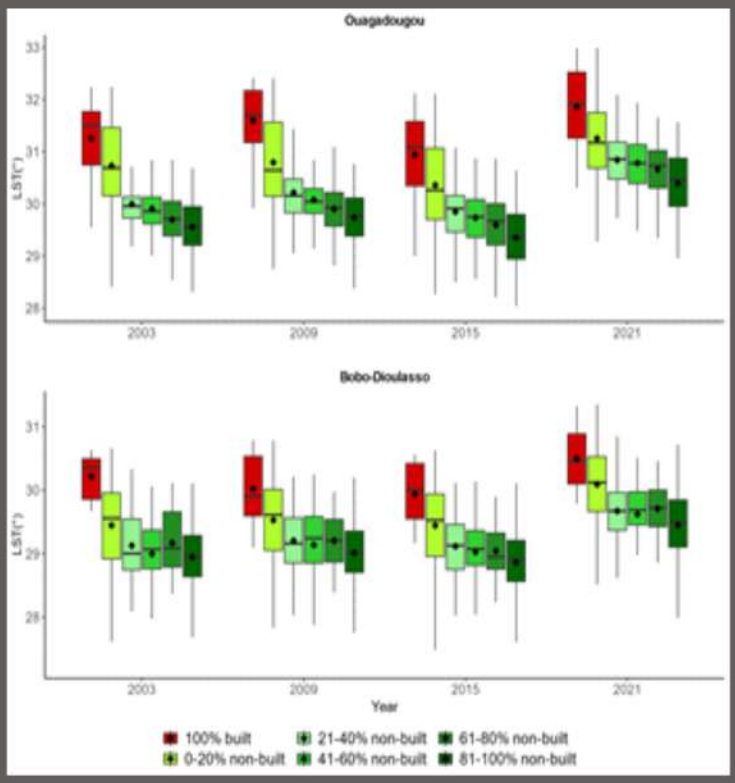
3. Both cities experience a notable uptrend in LST and air temperature, with the March-April-May season exhibiting a significant increase, particularly pronounced in Ouagadougou. This seasonal pattern underscores its suitability for LST trend analysis in the region.



4. Bobo-Dioulasso displays a stronger positive correlation between LST, and air temperature compared to Ouagadougou. Both cities exhibit pronounced surface urban heat island intensities, particularly evident in urban cores, with higher night-time values observed in Ouagadougou. This pattern is projected to persist if current trends in LULC changes persist.

5. Across the study area, a positive correlation between Land Surface Temperature (LST) and built-up areas is evident, while non-built-up surfaces display a negative correlation with LST. Particularly noteworthy is the contribution of non-built-up surfaces to environmental cooling, with Ouagadougou exhibiting a more pronounced effect than Bobo-Dioulasso.

6. In both cities, Plasmodium falciparum malaria and dengue cases demonstrate a weak correlation with LST. However, meningitis displays a moderate to strong positive correlation with LST, particularly evident in Bobo-Dioulasso. Given the persistent LST trends, an escalation in meningitis cases is forecasted in both cities.



IMPLICATION OF RESULTS

The rapid urbanization is evidenced by the proliferation of built-up areas, driving up land surface and air temperatures. Continuation of this pattern suggests a future marked by intensified atmospheric warming, worsening living conditions for urban inhabitants and amplifying the risk of disease outbreaks.

POLICY RECOMMENDATIONS

Based on the findings of the LULC maps for Ouagadougou and Bobo-Dioulasso, the following policy recommendations are proposed to foster sustainable urban development and mitigate the adverse effects of land conversion and urbanization:

1. Utilize LULC Maps for Informed Decision-Making:

- Encourage the utilization of LULC maps by urban planners in Ouagadougou and Bobo-Dioulasso to assess the pace of land conversion into built-up areas.
- Empower municipalities to develop targeted urban greening projects aimed at restoring and expanding urban green belts and green spaces.

2. Promote Collective Low-Income Green Housing:

- Advocate for the promotion and implementation of collective low-income green housing developments by the Ministry of Urban Planning in both cities.
- Emphasize the benefits of collective housing initiatives in mitigating urban sprawl, reducing Land Surface Temperature (LST) increase, and enhancing affordability for residents.

3. Incorporate Green Areas into Urban Development:

- Ensure that real estate development agencies integrate green areas, such as street trees and house trees, into urban settings to augment non-built-up surface coverage.
- Facilitate afforestation activities within urban areas, particularly along tarred roads, to mitigate solar radiation and reduce current and future Land Surface Temperature (LST) levels.
- Promote collaboration between the Ministry of Environment and urban development stakeholders to implement green initiatives aimed at reducing the rate of built-up coverage per surface unit, thereby mitigating air temperature, and advancing the goal of sustainable cities.

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