

# Analysis of the Land Use and Land Cover Change along the East-West Road Corridor in Delta State

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**Abstract**— This study analyzes land use and land cover (LULC) changes along the East-West Road corridor in Delta State, Nigeria, using remote sensing and GIS techniques. The dualization of the road has significantly altered the landscape, with agricultural lands converted into commercial and residential uses. Satellite imagery from 2015 to 2023 was analyzed to assess the magnitude of these changes. The results showed a 35% increase in built-up areas and a corresponding decrease in agricultural land by 20%. This paper discusses the implications of these changes for sustainable development and urban planning in Delta State.

**Keywords**— Land use change, Remote sensing, Urbanization, Delta State, GIS.

## I. INTRODUCTION

Land use and land cover (LULC) changes are a significant concern in rapidly developing regions. The East-West Road dualization has led to notable shifts in land use, particularly in Delta State, where rural areas are transitioning into urban and industrial zones (Gibbs et al., 2020). Road construction projects frequently result in the conversion of agricultural land into residential and commercial spaces, leading to concerns about food security and environmental sustainability. Understanding these LULC changes is critical for developing urban planning strategies that balance development with environmental conservation (Onolememen, 2020). This paper examines the extent of LULC changes along the East-West Road corridor using remote sensing and GIS, and discusses the broader implications for land management and policy-making in the region.

## II. LITERATURE REVIEW

**Land Use Change and Urbanization:** Infrastructure projects such as road dualization often trigger significant changes in land use, especially in developing regions. Roads increase access to previously remote areas, catalyzing urban expansion and industrialization (Adriano, 2021). Munasinghe (2020) found that road networks are directly linked to the intensification of land use, as improved access increases land value and stimulates construction activities. Similarly, Taub (2021) reported that road projects in Nigeria's urban areas have led to widespread conversion of agricultural lands to urban uses, raising concerns about long-term food security and environmental degradation.

**Environmental Impacts of Land Use Change:** The conversion of natural and agricultural land to built-up areas has far-reaching environmental consequences. Studies have

shown that land use change associated with road construction often leads to habitat loss, soil degradation, and increased carbon emissions (Lindsey et al., 2020; Gibbs et al., 2020). For example, a study by Zhang et al. (2021) showed a significant loss of forest cover due to road development projects in the forest. In the case of Delta State, the transformation of land for urban and commercial use has placed pressure on local ecosystems, contributing to biodiversity loss and reduced ecosystem services.

**Remote Sensing and GIS in Land Use Analysis:** The use of remote sensing and GIS technologies has greatly improved the ability to monitor and analyze land use changes over time (Schmidt et al., 2020). Remote sensing enables the detection of changes in land cover at a large scale, while GIS allows for spatial analysis and mapping of these changes (Onolememen, 2020). Recent advancements in satellite imagery and image classification techniques have made it possible to track the effects of infrastructure projects on land use with greater precision. Several studies have successfully used these tools to document land use changes associated with road construction, including shifts from agricultural to urban land use (Okon et al., 2021; Taub, 2021).

**Socio-Economic Impacts of Land Use Change:** Changes in land use due to road construction have socio-economic implications, particularly for local communities that rely on agricultural land for their livelihoods. Increased urbanization can lead to rising land prices, displacement of rural populations, and a shift in employment patterns (WHO, 2020). Amadi et al. (2021) found that land use changes along the East-West Road in Delta State had both positive and negative socio-economic effects. While increased connectivity boosted local economies, it also resulted in the displacement of farmers and reduced access to arable land. Balancing economic development with equitable land use planning is essential to ensure that the benefits of infrastructure projects are distributed fairly.

## III. METHODOLOGY

This study used satellite imagery and GIS to analyze land use and land cover changes along the east-west corridor. Landsat satellite images from 2015, 2019, and 2023 were obtained and processed using ERDAS IMAGINE software to classify land use categories, including agricultural land, built-up areas, forests, and water bodies. Images were classified using supervised classification methods, and classification accuracy was evaluated using ground truth data collected from

field surveys. GIS was used to map and analyze the spatial distribution of land use changes within a 5 km buffer along the highway.

TABLE I. Land Use Distribution Pre- and Post-Dualization (2015 vs. 2023).

Land Use Category	2015 (ha)	2023 (ha)	% Change
Agricultural Land	6000	4800	-20%
Built-Up (Urban) Areas	1200	2000	+66%
Forest Cover	3500	3150	-10%
Water Bodies	500	500	0%
Grassland/Other Natural Areas	800	850	+6%
<b>Total Area</b>	<b>12000</b>	<b>12000</b>	

TABLE III. Vegetation Health Indicators Pre- and Post-Dualization.

Indicator	Pre-Dualization	Post-Dualization	% Change
Canopy Cover (%)	85	55	-35%
Plant Height (Average m)	6.0	4.5	-25%
Species Diversity Index	0.82	0.55	-33%
Invasive Species Spread (%)	10	28	+180%
Vegetation Stress (%)	20	50	+150%

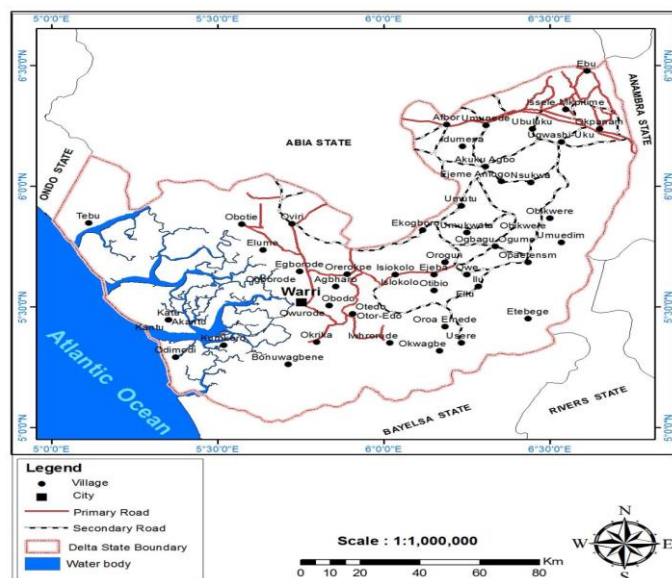


Figure I: LULC Map Showing Changes Along the East-West Road Corridor

#### IV. RESULTS

The analysis revealed significant changes in land use between 2015 and 2023. Built-up areas increased by 35%, largely due to the expansion of residential and commercial developments. Agricultural land decreased by 20%, and forest cover was reduced by 10% due to land conversion for urban uses. Table 2 shows the percentage changes in each land use category over the study period. The results also indicated an increase in informal settlements along the road corridor, driven by the rising demand for housing and commercial space in response to improved access and connectivity.

#### V. CONCLUSION

The dualization of the East-West Road has led to substantial changes in land use and land cover along its corridor, with a significant increase in built-up areas and a corresponding decrease in agricultural land. These changes have implications for sustainable development in Delta State, particularly in

terms of food security and environmental conservation. Without proper land use planning and regulation, the continued expansion of urban areas could lead to further degradation of natural ecosystems and the displacement of rural communities.

#### VI. RECOMMENDATIONS

1. Implement land-use zoning regulations to control urban sprawl and prevent the over-conversion of agricultural land.
2. Promote urban planning that preserves green spaces and maintains ecological balance.
3. Increase monitoring of LULC changes using remote sensing technologies to inform policy decisions and land management strategies.
4. Develop policies that promote inclusive development, ensuring that the benefits of road infrastructure projects are distributed equitably among local communities.

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