**Title**
**Library Accessibility Analysis Using Buffer and Service Area Modelling**

1. Problem Statement

Access to public libraries is uneven across geographic regions. The objective of this analysis was to evaluate spatial accessibility using distance-based buffers and network-based service areas to identify underserved regions.

2. Study Area

The study area covers the State of Arkansas. Public library point locations were used as primary facilities for accessibility modelling.

3. Data Sources

Public library locations
State boundary shapefile
Road network dataset
Base map reference layers

All datasets were projected to a common coordinate system before analysis.

4. Methodology

Step 1: Data Preparation
Library locations were validated and reprojected. The state boundary was used to clip all layers.

Step 2: 10-Mile Buffer Analysis
A 10-mile Euclidean buffer was generated around each library to measure basic geographic coverage.

Step 3: 20-Minute Network Service Area
Using network analysis, a 20-minute drive-time service area was calculated to model realistic accessibility.

Step 4: Spatial Overlay
Service areas and buffers were overlaid with the state boundary to identify gaps in coverage.

5. Results

The 10-mile buffer showed broad spatial coverage; however, the 20-minute service area revealed several underserved rural zones where travel time exceeded accessibility thresholds.

Clustered coverage was observed in urban centers, while peripheral counties demonstrated limited network-based accessibility.

6. Conclusion

Network-based modelling provides a more realistic assessment of accessibility compared to simple distance buffers. The analysis highlights areas where additional library infrastructure or improved transportation networks may enhance service equity.