



A GIS-Based Accessibility and Equity Analysis of Urban Park Distribution

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Overview



Research Question



Objective of The Study



Literature review



Study Area Profile



Methodology



Result and Discussion



Recommendations and Planning Implication

Research Question

How equitable is the **distribution** and **accessibility** of urban parks in Dallas, Texas, in relation to population density and spatial need?

Objective of the Study

To identify **service areas** for different park categories and evaluate their accessibility within **walking distance** using **network analysis**

To investigate **equity in park accessibility**, highlighting potential disparities in green space access for different population segments through **Lorenz curve**

Literature Review

Importance of Urban Parks

Types of Urban Parks

Accessibility to Urban Parks

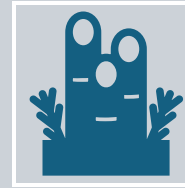
Methods of Accessibility Analysis

Methods of equity analysis

Importance of Urban Parks



Essential for creating **sustainable and livable cities.**



Provide designated open spaces focused on **plants and water for public use.**



Vary in **size and function**, from small pockets to large municipal spaces.



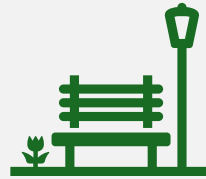
Enhance community well-being by offering **recreational and social opportunities.**

Types of Urban Parks



Pocket Parks

Small, accessible areas typically less than one acre. Offer greenery, seating, and playgrounds. Often created on vacant lots or integrated into private developments. Became popular as urban land prices increased.



Civic Plaza Parks

Flexible public gathering spaces for civic purposes and commercial activities. Minimum size of one acre. Feature hardscape elements, trees, seating, public art, and water features. Originated from traditional town squares used for civic gatherings and events.



Linear Parks

Connect urban elements, providing a green corridor. Include multi-use trails, seating areas, fitness stations, and recreational components. Size varies depending on the urban context. Serve as a resource for both recreation and environmental protection.

Types of Urban Parks



Neighborhood Parks

Serve residential neighborhoods, typically ranging from 2 to 5 acres. Include playgrounds, playfields, picnic facilities, and sometimes sports courts. Service radius of 1/4 to 1/2 mile, serving 3,000 to 6,000 people. Track funding and land availability for park development



Community Parks

Larger recreational facilities serving a 1- to 2-mile radius. Typically range from 5 to 20 acres. Feature ball diamonds, playfields, tennis courts, shelters, restrooms, and natural areas. Cater to broader community needs beyond neighborhood parks.



Special Purpose Parks

Designed for specific activities (e.g., aquatic centers, ice skating, golf courses). Serve the entire park district and attract visitors from beyond the local area. Size varies based on the facility's requirements. Include historical sites, community centers, theme parks, and water

Criteria for Effective Urban Parks

Size and Capacity

- Must be **large enough** to accommodate the local population
- Provide sufficient amenities to meet community needs

Proximity and Reachability

- Located within reasonable **walking distance** for pedestrians.
- Designed to be easily accessible from surrounding areas.

Design and Distribution

- Consideration of park **geometry and connectivity**
- Strategic placement to **avoid clustering** and ensure equitable access across the city (La Rosa, 2014; Wright Wendel et al., 2012)

Methods of Spatial Accessibility Analysis

✓ Euclidean Buffer Method

- Calculates service areas based on linear distance ("as-the-crow-flies").

Limitations:

- ☐ **Overestimates** accessibility
- ☐ **Ignores physical barriers** and the park's actual entry points.
- ☐ **Does not consider park shape** or urban infrastructure.

✓ Network Analysis Approach

- Uses actual **travel routes** and **network connectivity**

Advantages:

- ☐ Reflects **real-world scenarios**
- ☐ Provides **precise boundaries** for park accessibility within given distances.
- ☐ Accounts for impedances like **traffic, crossings, and terrain** (Nicholls, 2001).

Methods of Distributional Equity Analysis

✓ Lorenz Curve and Gini Coefficient:

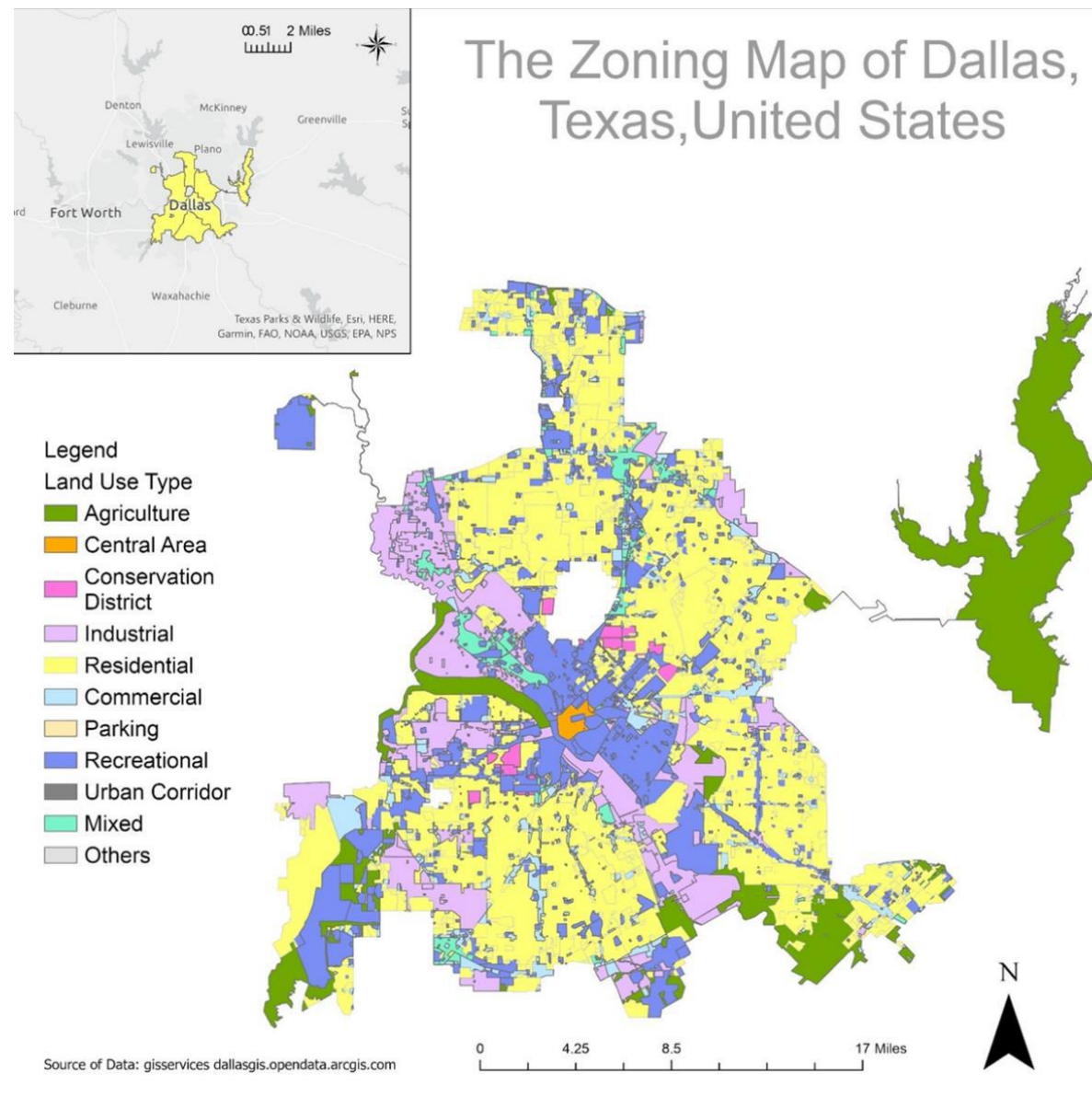
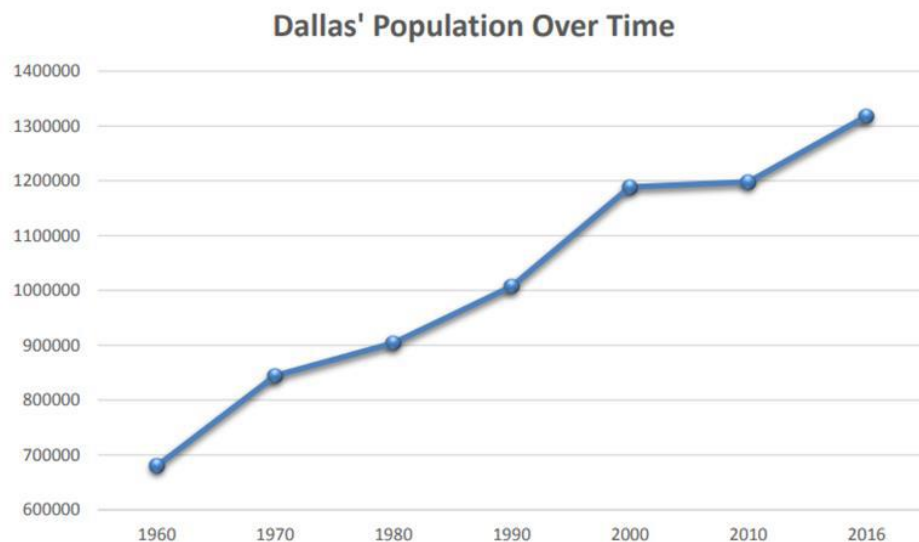
- The Lorenz curve plots the cumulative share of **transportation benefits** (e.g., transit service hours, accessibility) against the **cumulative population share**.
- The **Gini coefficient**, which ranges from **0 (perfect equality)** to **1 (maximum inequality)**, quantifies the level of disparity.

✓ Cost-Benefit Analysis (CBA):

- How the benefits (e.g., **reduced travel times, increased access to jobs**) and costs (e.g., **construction disruption, fares**) are distributed across different income or racial groups.

Study Area Profile

- Dallas, the **third** most populous city in Texas and the **ninth** most populous in the United States
- A population of around **1.3** million people up to 2022.



Methodology

This study used four data sources

1. Geographical distribution of urban parks, which was obtained from Google Earth Pro. Then it was converted to the shapefiles in ArcGIS pro.
 2. The city's street network(City of Dallas GIS Services, n.d.)
 3. Land use data of Dallas(City of Dallas GIS Services, n.d.)
 4. Census Data of population of 2021 (Census Bureau Data, n.d.)
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1

Using Google Earth Pro to find the park

2

Selecting the service area by reviewing the literatures

3

Using network analysis for parks' service regions

4

Identifying accessibility and spatial sufficiency

5

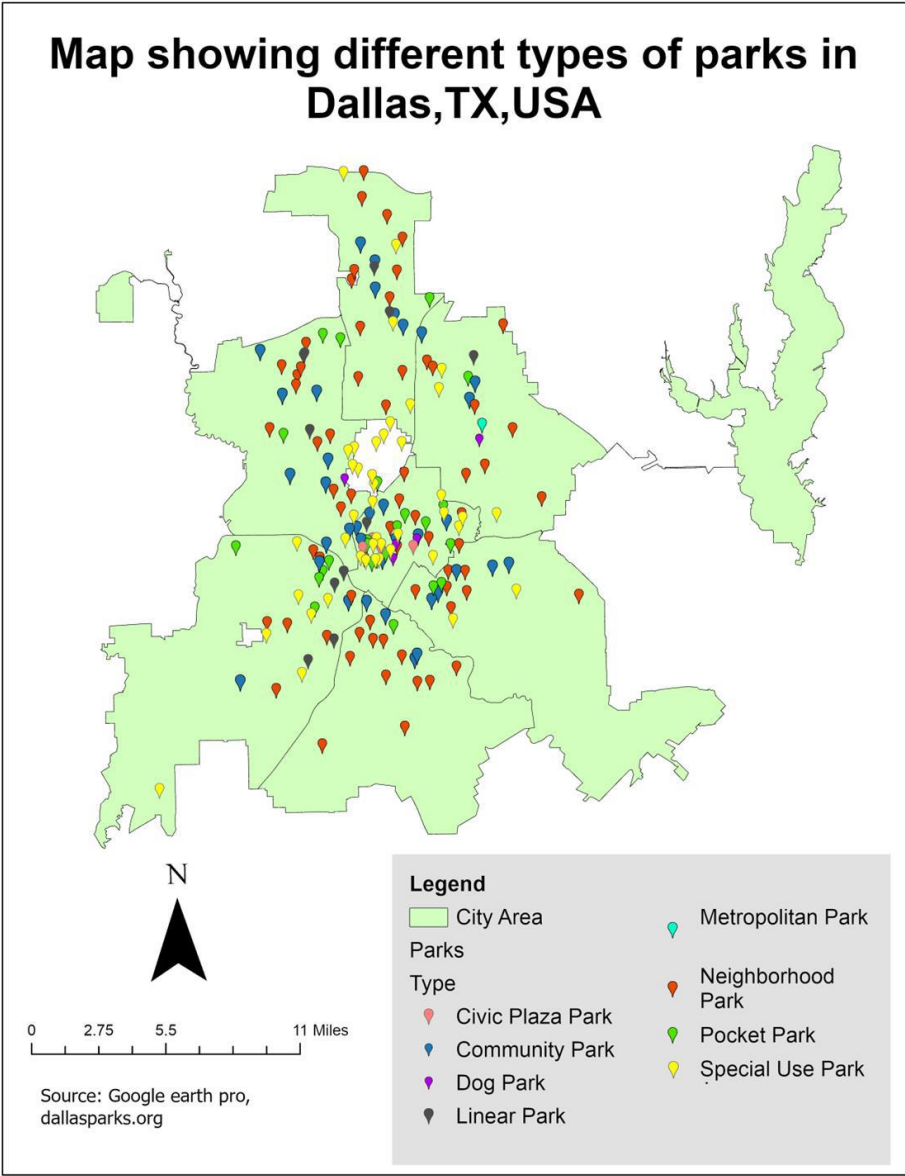
Suggesting recommendation and planning implication

Methodology



Result and Discussion

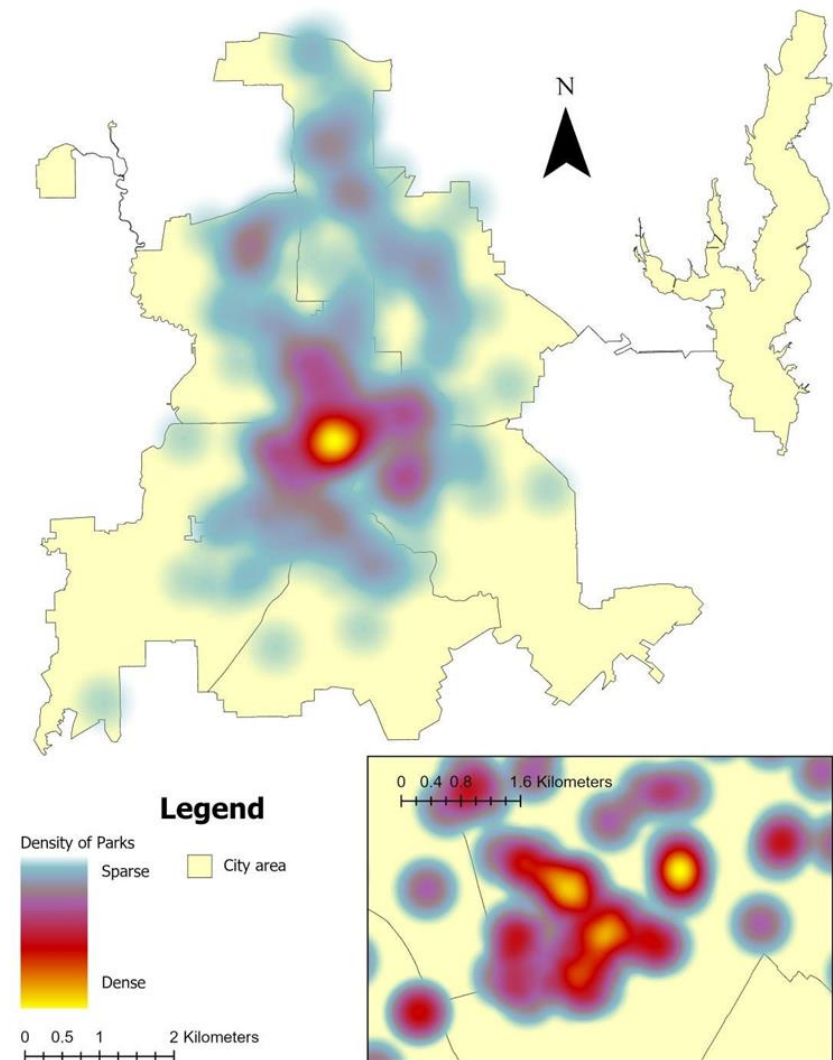
Type	Number	Standard Service area
Pocket/Mini Parks	25	Within a ¼ mile
Civic Plaza Parks	4	Entire city
Linear Parks	11	Not defined
Neighborhood Park	62	¼ to ½ mile radius
Community Park	42	Within a ½ mile to over 3 miles radius.
Special Purpose Park	44	Beyond the boundaries of the District.
Metropolitan Park 1		The entire city
Dog Park	6	Not defined



Parks in Dallas

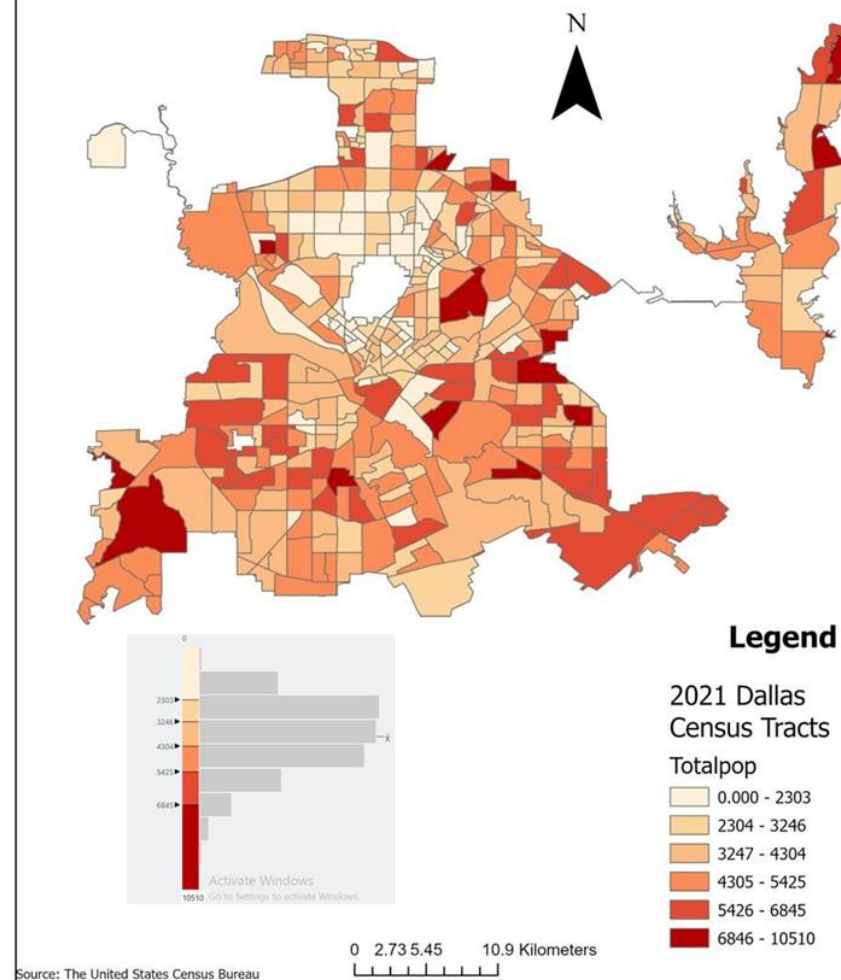
Distribution of Population and Parks

Density Maps of Parks in the City of Dallas



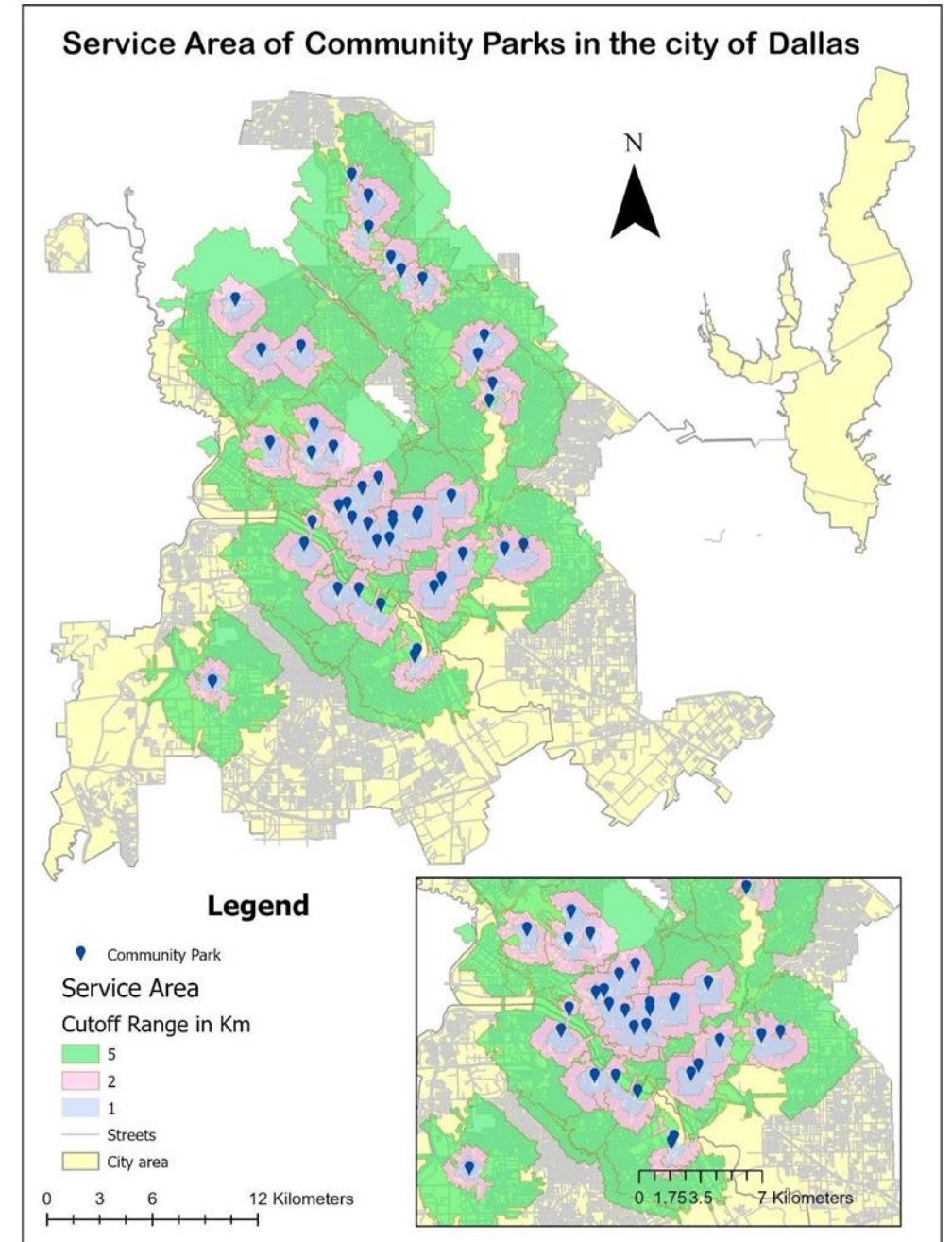
- The density map of parks shows that most of the parks are concentrated in the **center part** of the city.
- Population distribution is **not concentrated** in center area
- **Many special use parks** are situated in Dallas which serve not only the people of the city but also people from outside of the city

Population of City of Dallas



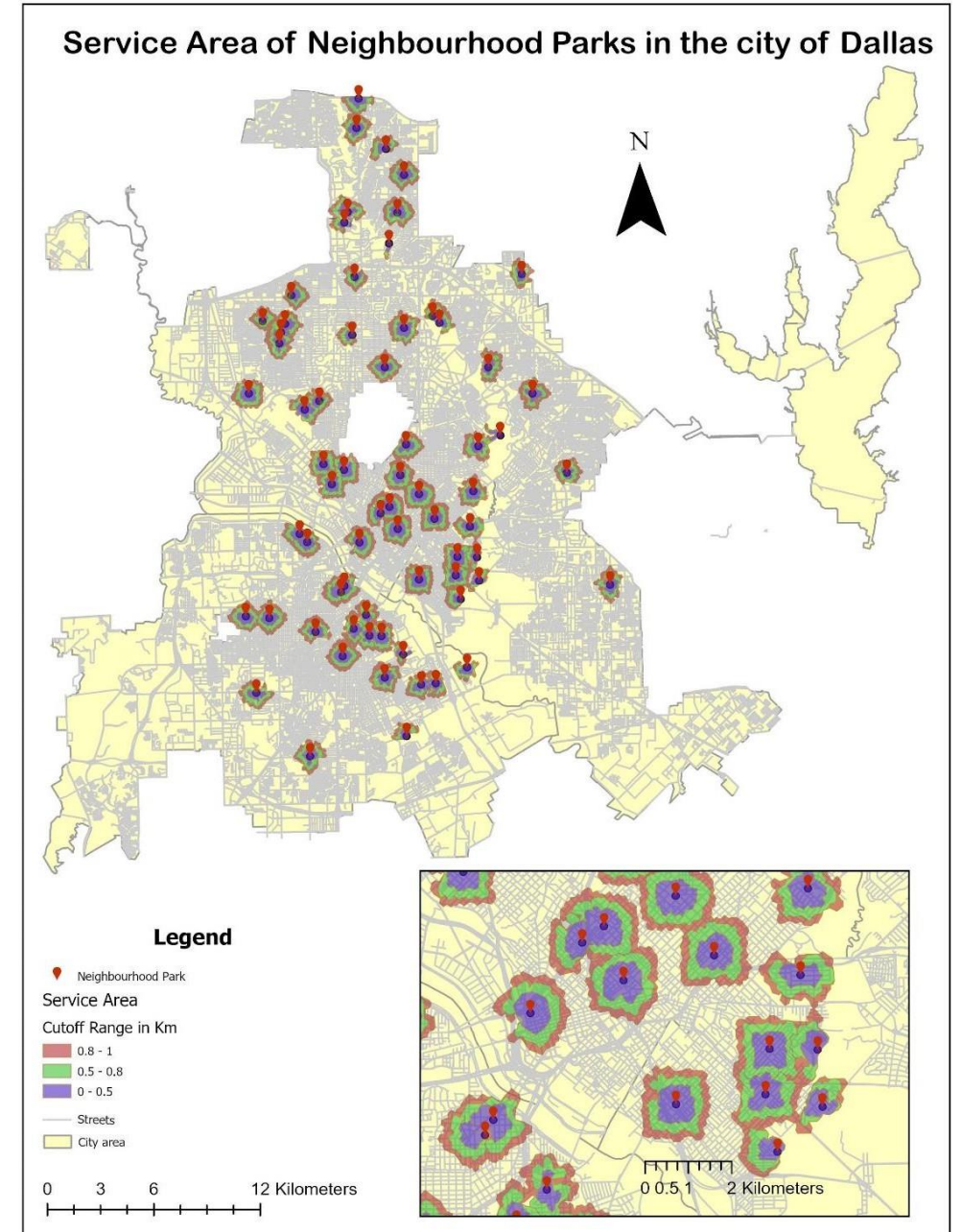
Accessibility of Community parks

- The **driving distance of 1,2 and 5 km** has been identified.
- the community parks throughout the city are **accessible by most of the city population**.
- The **southern part** of the city is deprived of community parks
- Some portions do not have any coverage of service of any community park.



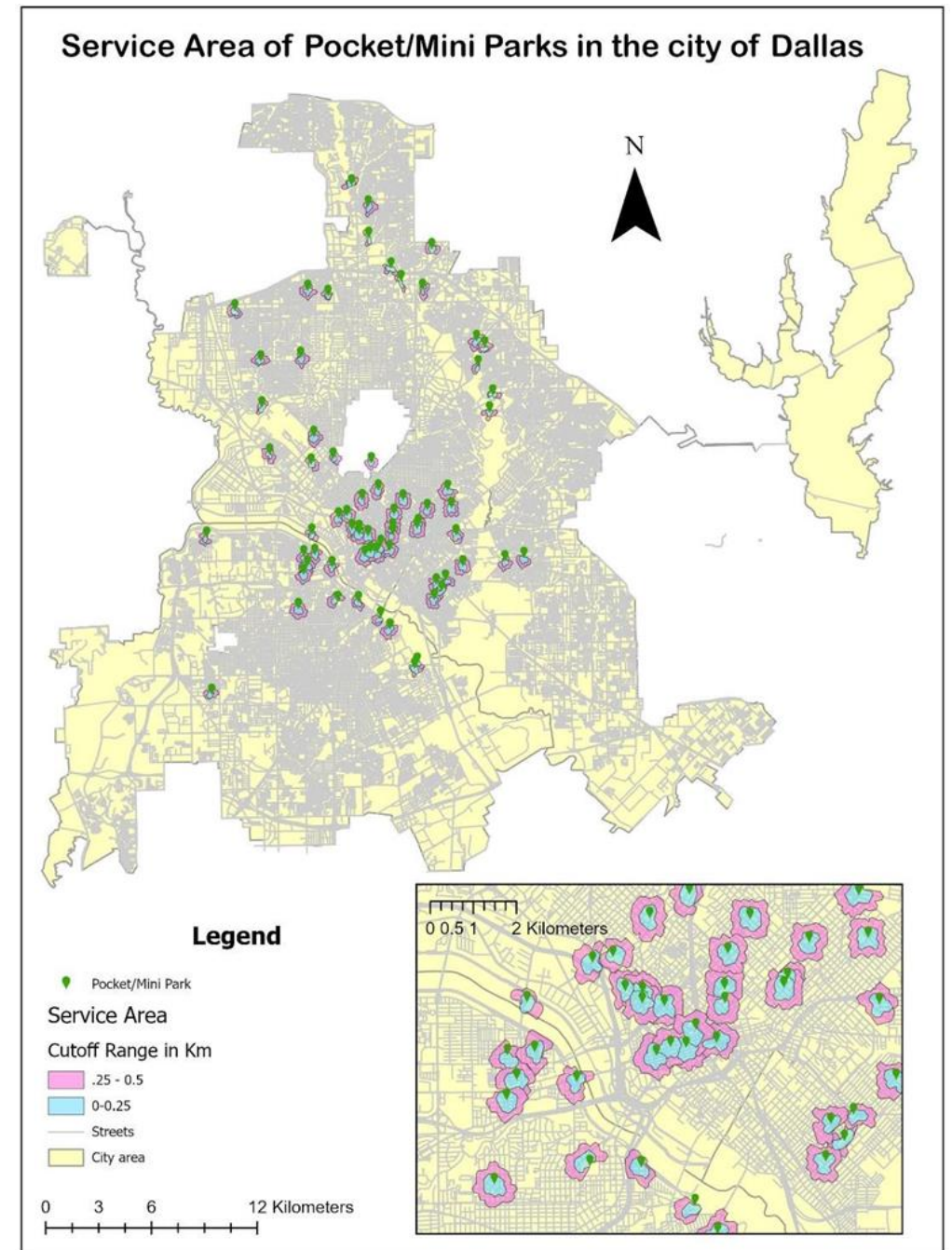
Accessibility of Neighborhood parks

- Neighborhood parks should be situated **within walking distance**.
- A network analysis of **0.5, 0.8 and 1 km walking distance** service area has been undertaken
- The **insufficiency** of neighborhood parks all around the city.
- **Most of the areas** of the city **do not have coverage** of neighborhood parks
- Indicates less accessibility of people to the parks.



Accessibility of mini/pocket parks

- Mini parks can be **more than one** in any neighborhood is more like **a playground or tiny green space** for the people
- Should be accessible by people **within walking distance**.
- The service area of **0.25 and 0.5 km walking distance** has been identified.
- **High insufficiency** of mini parks all over the city.
- Mini parks are **concentrated in the center** of the city whereas it should be distributed throughout the city evenly.



Recommendations and Planning Implication

Strategic Expansion of Neighborhood Parks

- Identify and prioritize **underprivileged areas** lacking green spaces.
- Ensure equitable distribution across **socio-economic zones** for better access.

Mini Parks for Micro- Communities

- Partner with **local businesses, schools, and residents** to establish flexible spaces.
- Provide seating, small play areas, and greenery tailored to micro-community needs.

Multi-Functional Design

- Include **walking trails, exercise zones, playgrounds, and cultural installations.**
- Cater to the varied interests of **different community demographics.**

Recommendations and Planning Implication

Green Corridors and Connectivity

- Develop **green corridors** connecting centralized parks to neighborhoods.
- Promote **sustainable transportation options** and pedestrian/cyclist-friendly pathways.

Community Engagement and Participation

- Involve residents in neighborhood park **planning and decision-making**.
- Conduct **surveys and establish volunteer programs** for maintenance and improvements
- **Foster ownership**, community pride, and long-term stewardship of local parks.

Policy and Investment Focus

- Policies should support **targeted investments** in park development in **underserved areas**.
- **Strategic budgeting** and funding for implementing recommendations effectively.



Thank You !