

Michael Nims

GIS 5003-999

Dr. Koch

08/02/21

Term Project:

Social Inequality and Recreation Access in the Nation's Capitol

Abstract:

This project examines the relationship between neighborhood income and proximity to public parks in the two wealthiest and two poorest wards of the District of Columbia. Access to public parks and recreation resources among poor and minority communities has become an important issue in contemporary city planning. Members of poor and minority communities often get less physical exercise and have worse health outcomes than inhabitants of wealthier, whiter neighborhoods. Access to affordable outdoor recreation facilities is an important aspect of facilitating a healthier population. This report examines and compares the economic characteristics of D.C.'s most prosperous and underprivileged wards and assesses demographic and social variables such as per-capita and family income, and percentage of the population of each ward that lives in poverty. It examines the racial makeup of the wards as well, showing the percentage of members of various racial and ethnic groups that comprise the population of each ward. The project then assesses relative access of these community to public parks and recreational facilities maintained by the Washington D.C. government. It measures the number and relative area of national and city parks in each ward as well as comparing the length of bike trails and number of community gardens in each. The results of this study show that expected

significant disparity in the allocation of public recreational resources between wealthier and poorer wards of Washington D.C. was not found. Parklands and cycling paths are distributed relatively equitably among the wards, with the lower income wards having a preponderance of the city's community gardens.

Introduction:

Our Nation's Capitol is a beautiful city, designed in 1790 by Pierre Charles L'Enfant to rival the capitols of any of the great European powers of the time. Unlike those cities however, Washington D.C.'s many parks and avenues were not intended solely for landed aristocrats, but for ordinary citizens as well to enjoy. American citizens from all over the country and tourists from all over the world have visited many of the parks, monuments, and museums of Washington D.C., the vast majority of which are free of charge for entry. Beautiful as D.C. is, however, it is also a city of deep and abiding inequality. Although the two wealthiest districts in the city have median family incomes greater than \$200,000 per year, the two poorest wards have greater than 25% of their populations living below the poverty line. It is worth noting, that the wealthiest two wards, 2 and 3, are the only districts in the city where more than 75% of the total population is white. In Ward 7 and 8, by contrast, the two poorest districts, more than 89% of the total population is black. Parks are a public resource, created and maintained by government agencies ranging from Federal to Municipal, and access to these spaces is theoretically equal. Public parks are meant to be open outdoor spaces, where people from all backgrounds can enjoy a few minutes of outdoor recreation during the course of their busy lives. Parks are especially important for children, and current national recommendations are for at least 60 minutes of outdoor exercise each day (1). In this study, I will examine the relationship between the number type, and size of parks available in the two highest income and the two lowest income wards of

the city. I will examine the number of bike trails and community gardens as well and assess whether these resources are equitably distributed throughout the city.

Research Context/Background:

Access to public resources at large, and public recreation in particular by low-income communities and communities of color has become an increasingly important topic to researchers, parks and recreation managers, and other public officials. (2) Few American children today get the US Department of Health' and Human Services recommended 60 minutes of exercise every day. "Only 42% of 6- to 11-year-olds and 8% of 12- to 19-year-olds are meeting these guidelines, and children of color and those from poor families are less likely than others to meet the standards (1). A lack of physical exercise among young people leads to worse health outcomes later in life and a decreased sense of overall well-being. Some researchers have hypothesized "that disparities in health outcomes and behaviors may be partially explained by neighborhoods that are poor in resources that could support healthy behaviors." (3) **Income and Racial Disparities in Access to Public Parks and Private Recreation Facilities.** Although access to parks is important to childhood development, having nearby access to a local public park is not the only important factor. Parks must be perceived to be safe enough for recreational use by the local community, the use type of the park must be aligned with local preferences and popular activities, (2). and possibly most importantly, local people must have available leisure time to access local facilities.

Materials and Methods:

Information regarding the District of Columbia's demographic makeup, parks infrastructure, and municipal boundaries were the basis of this project. Accurate and up to date data on these metrics was obtained through the Washington D.C. City Government's OpenDataDC portal. This portal allows users to access demographic and economic records collected by the American Community Survey (ACS) branch of the U.S. Census Bureau. Additionally, OpenDataDC provides users with datasets containing all the National and Municipal Parks within the District of Columbia, as well as community gardens and cycling trails. Prior to examining the relationship between neighborhood and ward demographics to public parks and recreation this study examines the characteristics of the city as a whole in order to provide context to its findings and identify the wards where economic and social disparities are most pronounced.

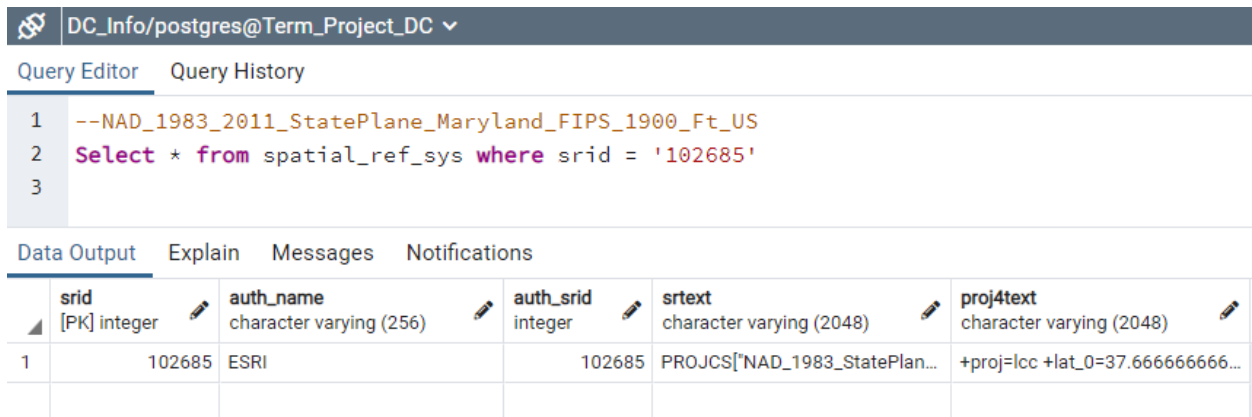
This study utilizes PostGIS queries to analyze the demographic and economic datasets on the eight wards which comprise the District of Columbia. Key economic characteristics such as per-capita income, median family income, and percentage of families living below the poverty line have been used as a primary basis of comparison. The Economic contrast between the two wealthiest wards, (wards two and three) against the two poorest (wards seven and eight) was notable. Ward 3 had a per capita income of \$94,054 with a median family income of \$234,126 and a 7.6% poverty rate. Ward 2 had a per capita Income of \$81,080, a median family income of \$208,526 and a 14.0% poverty rate. By contrast, Ward 7 had a per capita income of \$26,917 a median family income of \$52,859 and a poverty rate of 26.3%. Ward 8 was the most economically disadvantaged overall, with a per capita income of 22,568 a median family income of \$40,746 and a poverty rate of 32.9%. The study then analyzes the demographics of each ward of the city, calculating the percentage of White, Black, Hispanic, Native, Asian, and Pacific Islander residents out of the total population. There is a corresponding difference in demographic

makeup between the wealthiest two wards and the poorest. Ward 3, the wealthiest, is 78.56% White. Ward 2, the second wealthiest, is 73.27% White. Ward 8, the poorest is 89.22% Black, Ward 7, the second poorest is 92.44% Black.

This information demonstrates a basic economic and racial inequality present within the city. It also identifies Wards 2,3,7and 8 as the most significant for analysis on the interaction between economic and racial inequality and access to public parklands. The study uses PostGIS to identify the number of parks within each ward, and compares the percentage of each ward’s land area comprised of National and Municipal parks. The study also compares the mileage of bike trails available in each ward and examines the number of community gardens available. The results of these queries as well as those specifying economic and demographic information are included in my results section below.

Results:

Map Projection Data: All shapefiles used in this project have been projected using the NAD 1983 2011 State Plane Maryland FIPS 1900 Ft US projection.



The screenshot shows a PostgreSQL Query Editor interface. At the top, the connection is identified as 'DC_Info/postgres@Term_Project_DC'. Below this, there are tabs for 'Query Editor' and 'Query History'. The query editor contains the following SQL code:

```
1 --NAD_1983_2011_StatePlane_Maryland_FIPS_1900_Ft_US
2 Select * from spatial_ref_sys where srid = '102685'
3
```

Below the query editor, there are tabs for 'Data Output', 'Explain', 'Messages', and 'Notifications'. The 'Data Output' tab is active, displaying a table with the following columns and data:

	srid [PK] integer	auth_name character varying (256)	auth_srid integer	srtxt character varying (2048)	proj4text character varying (2048)
1	102685	ESRI	102685	PROJCS["NAD_1983_StatePlan...	+proj=lcc +lat_0=37.666666666...

DC_Info/postgres@Term_Project_DC

Query Editor Query History

```

1 Select ST_Srid(geom) from acs_economic_characteristics_dc_census_tract
2

```

Data Output Explain Messages Notifications

	st_srid integer	
1	0	
2	0	

DC_Info/postgres@Term_Project_DC

Query Editor Query History

```

1 ALTER TABLE acs_economic_characteristics_dc_census_tract
2     ALTER COLUMN geom
3     TYPE Geometry(Multipolygon, 102685)
4     USING ST_SETSRID (geom, 102685)
5

```

Data Output Explain Messages Notifications

ALTER TABLE

Query returned successfully in 85 msec.

Demographic results

I used the following table to assess the wards which had the highest and lowest per-capita and family income for my analysis. The poorest ward (Ward 8) has a per capita income that is 23.99% of that in the wealthiest district. The poverty rate in Ward 8 is also 4.32 times higher than in Ward 3.

(Figure: D.C. Economic Characteristics by ward)

DC_Info/postgres@Term_Project_DC

Query Editor Query History

```

1 Select
2     name,
3     DP03_0088E as Per_capita_income_dollars,
4     DP03_0086E as Median_Family_Income_dollars,
5     dp03_0128p as Percentage_of_Families_Below_The_Poverty_line
6 From acs_economic_characteristics_dc_ward
7 ORDER BY per_capita_income_dollars
8

```

Data Output Explain Messages Notifications

	name character varying (35)	per_capita_income_dollars double precision	median_family_income_dollars double precision	percentage_of_families_below_the_poverty_line numeric
1	Ward 8 (2018), District of Co...	22568	40746	32.9000000000
2	Ward 7 (2018), District of Co...	26917	52859	26.3000000000
3	Ward 5 (2018), District of Co...	42567	95216	15.7000000000
4	Ward 4 (2018), District of Co...	50441	121094	9.5000000000
5	Ward 1 (2018), District of Co...	63624	146974	12.2000000000
6	Ward 6 (2018), District of Co...	69470	164446	12.0000000000
7	Ward 2 (2018), District of Co...	81080	208526	14.0000000000
8	Ward 3 (2018), District of Co...	94056	234126	7.6000000000

In Washington D.C. African American residents account for a majority of the population in 3 out of 8 wards, and for 49.38% of the population in Ward 4. It is for this reason that the significance of the demographic imbalance in Wards 2 and 3 is notable. In a majority black city, the two wealthiest wards have a less than 10% African American population.

Ward 3, the wealthiest, is 78.56% White. The remaining portion of the population being comprised of 11.0% Hispanic, 7.6% Black, 7.25% Asian, 4.0% Multiracial, 0.22% native and

0.04% pacific islander. Ward 2, the second wealthiest, is 73.27% White. The remainder of the population being comprised of Hispanic 12.07% Asian 10.02%, Black 9.57%, Multiracial 3.4% Native, 0.33% and pacific Islander 0.12%.

Ward 8, the poorest is 89.22% Black, the remainder of the population is comprised of White 6.13%, Hispanic, 4.22% Multiracial 1.64%, Native 0.39%, and pacific Islander 0.03%

Ward 7, the second poorest is 92.44% Black with the remainder comprised of 3.13% Hispanic, 3.04% white, 1.64% Multiracial and 1.084 from other groups.

(Figure: D.C. Demographic Characteristics by Ward)

Query Editor Query History

```

1 Select
2   name,
3   100.0 * Sum(DP05_0037E) / Sum(DP05_0001E) as White_pct,
4   100.0 * Sum(DP05_0038E) / Sum(DP05_0001E) as Black_pct,
5   100.0 * Sum(DP05_0071E) / Sum(DP05_0001E) as Hisp_Lat_pct,
6   100.0 * Sum(DP05_0039E) / Sum(DP05_0001E) as Native_pct,
7   100.0 * Sum(DP05_0044E) / Sum(DP05_0001E) as Asian_pop,
8   100.0 * Sum(DP05_0052E) / Sum(DP05_0001E) as Pac_islander_pct,
9   100.0 * Sum(DP05_0035E) / Sum(DP05_0001E) as Multiracial_pct
10
11
12 from acs_demographic_characteristics_dc_ward
13 GROUP BY name
14 ORDER BY name
15

```

Data Output Explain Messages Notifications

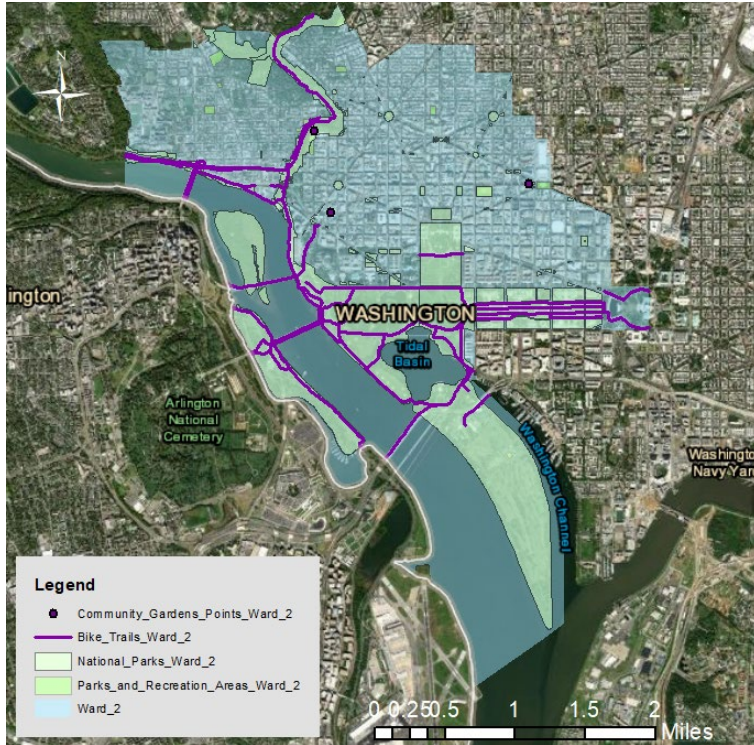
	name character varying (35)	white_pct double precision	black_pct double precision	hisp_lat_pct double precision	native_pct double precision	asian_pop double precision	pac_islander_pct double precision	multiracial_pct double precision
1	Ward 1 (2018), District of Co...	52.600493968572145	27.816157783584494	18.712340862177996	0.20641681879466894	5.284509193303982	0.05846487931178485	3.8825452506234264
2	Ward 2 (2018), District of Co...	73.27082396763214	9.571639586410635	12.076295677862694	0.3326697065056836	10.022477682872006	0.12844390212574658	3.457709845225098
3	Ward 3 (2018), District of Co...	78.56581698635435	7.68942552908614	11.177586811221099	0.22360008218813832	7.254311855638952	0.04834596371635423	4.005463093899948
4	Ward 4 (2018), District of Co...	30.221575251133434	49.38216730376033	21.80082674015468	0.24113254511512133	2.1757489554627076	0.014445728509200818	3.433638545648502
5	Ward 5 (2018), District of Co...	26.833163287938607	62.92751630217806	9.586124295790267	0.6764849398926496	2.5728607550015528	0.1097901787694628	2.995386594508273
6	Ward 6 (2018), District of Co...	60.66081414226445	29.73864069107891	7.392820636161385	0.19341390575832282	4.1899665283707135	0.044094361934539916	3.4473773876094844
7	Ward 7 (2018), District of Co...	3.04956922851634	92.44380445659337	3.1337710199399607	0.39660264076342955	0.6528689624874917	0.034168842896541624	1.870744148585654
8	Ward 8 (2018), District of Co...	6.136553065382478	89.22022596777181	4.22531950361178	0.1493332098536766	0.4213743285793666	0.00347286534543434	1.6449805519540657

Park Area Results

D.C. Ward 2 Results Summary: Ward 2 has an area of 5559.69 Acres and a perimeter of 18.40 Miles. Ward 2 has 48 National Park Service sites and 19 city park sites. National Park land

covers **26.0%** of Ward 2's Area. City parks cover **5.03%** of the ward. Ward 2 has **22.65** miles of bike trail and **three** community gardens.

(Figure: D.C. Ward 2 Map)



(Figure: D.C. Ward 2 total area, perimeter)

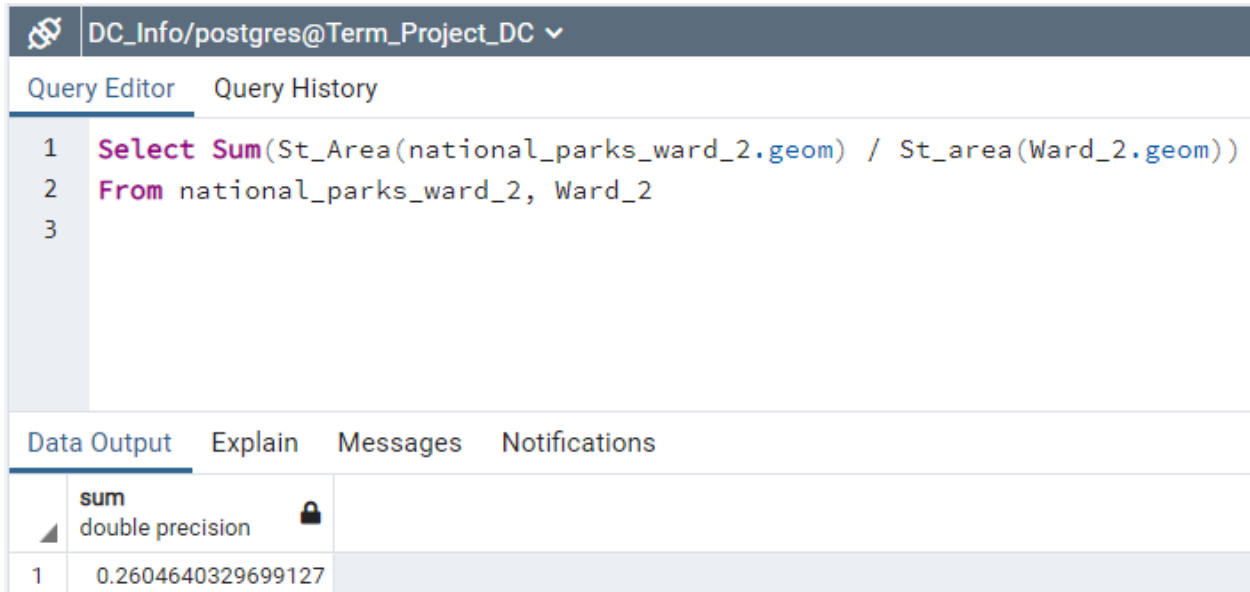
Query Editor Query History

```
1  Select (ST_Area(geom)/43560), (ST_perimeter(geom) / 5280)
2  from ward_2
3
```

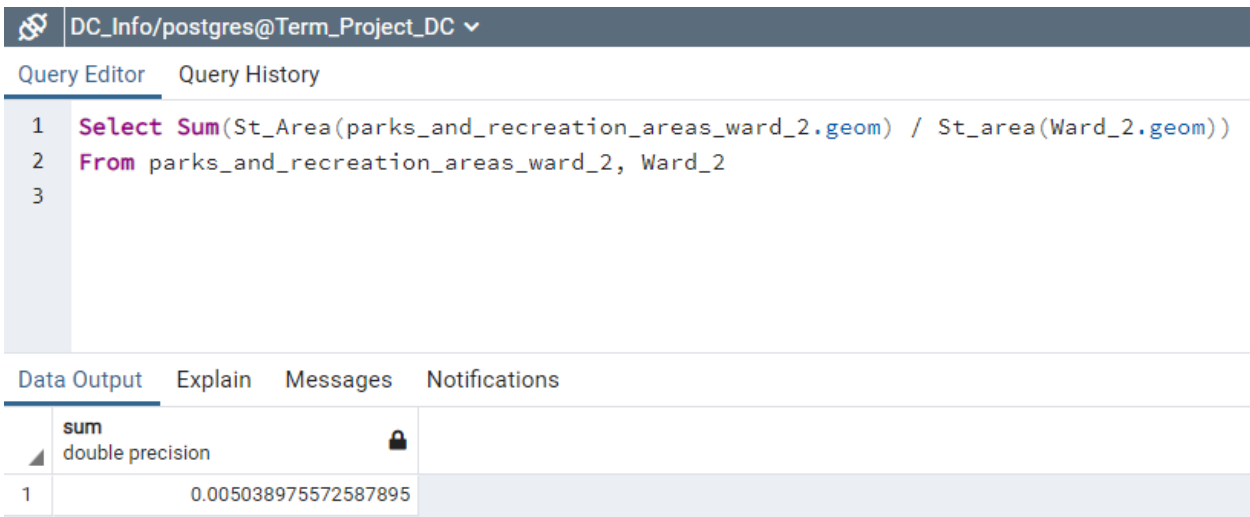
Data Output Explain Messages Notifications

	?column? double precision	?column? double precision	
1	5559.699381703897	18.400193291246406	

(Figure: D.C. Ward 2 percentage surface area, National Parks)



(Figure: D.C. Ward 2 percentage surface area, City Parks)



(Figure: D.C. Ward 2 total length of bike trails)

DC_Info/postgres@Term_Project_DC ▾

Query Editor Query History

```
1 -- Bike Trails length (miles)
2 Select Sum(ST_Length(geom)/5280)
3 from bike_trails_ward_2
4
```

Data Output Explain Messages Notifications

	sum	
	double precision	
1	22.65453386672957	

(Figure: D.C. Ward 2 Community Gardens Points)

Query Editor Query History

```
1 Select ST_AsEWKT(geom) from community_gardens_points_ward_2
```

Data Output Explain Messages Notifications

	st_asewkt text	
1	POINT(130525...	
2	POINT(129781...	
3	POINT(129717...	

(Figure: D.C. Ward 2 community gardens locations)

Query Editor Query History

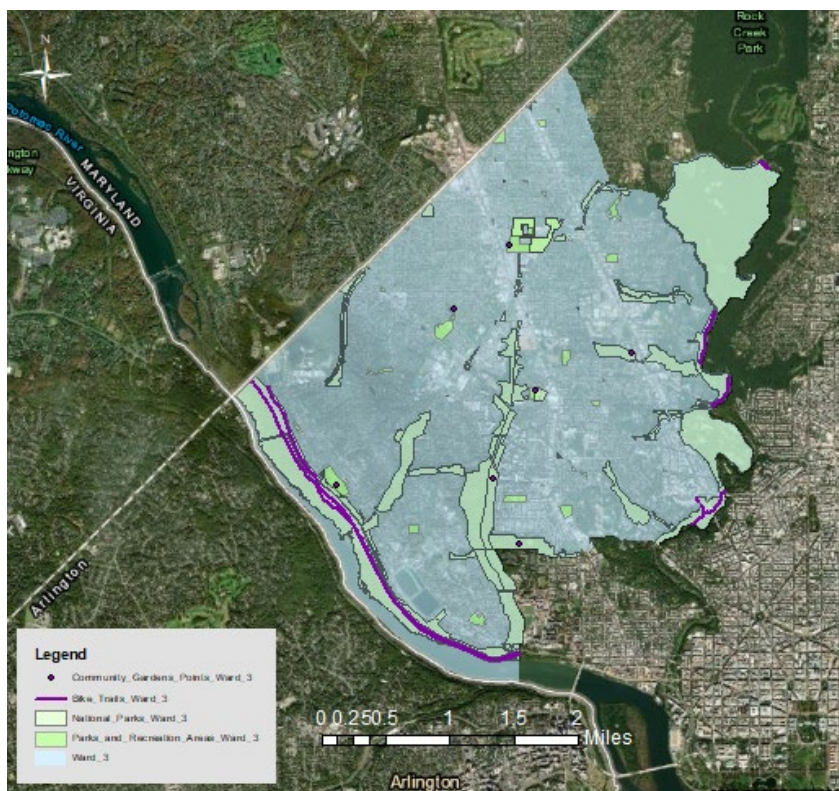
```
1 Select name, ST_X(geom),ST_Y(geom)
2 from community_gardens_points_ward_2
```

Data Output Explain Messages Notifications

	name character varying (61)	st_x double precision	st_y double precision
1	Brainfood Youth Garden	1305258.880639881	450135.3575273156
2	GroW Garden (GW University)	1297816.7554323077	449054.2143483907
3	West End Garden	1297170.1497701406	452113.57666797936

D.C. Ward 3 Results Summary: Ward 3 has an area of 6983.17 acres and a perimeter of 17.59 miles. Ward 3 has 26 National Park Service sites and 34 city park sites. National Park land covers 20.59% of the area of Ward 3's Area. City parks cover 1.68% of the ward. Ward 3 has 7.60 miles of bike trail and seven community gardens.

(Figure: D.C. Ward 3 map)



(Figure: D.C. Ward 3 total area, perimeter)

The screenshot shows a SQL query editor with two tabs: "Query Editor" and "Query History". The query is as follows:

```
1 Select (ST_Area(geom)/43560), (ST_perimeter(geom) / 5280)
2 from ward_3
3
```

Below the query editor, there are four tabs: "Data Output", "Explain", "Messages", and "Notifications". The "Data Output" tab is active, showing a table with two columns and one row of data.

	?column? double precision	?column? double precision
1	6983.173265019438	17.59208954076345

(Figure: D.C. Ward 3 percentage surface area, National Parks)

The screenshot shows a SQL query editor with a dark header bar containing a database icon and the text "DC_Info/postgres@Term_Project_DC". Below the header are two tabs: "Query Editor" and "Query History". The query is as follows:

```
1 Select Sum(St_Area(national_parks_ward_3.geom) / St_area(Ward_3.geom))
2 From national_parks_ward_3, Ward_3
3
```

Below the query editor, there are four tabs: "Data Output", "Explain", "Messages", and "Notifications". The "Data Output" tab is active, showing a table with one column and one row of data.

	sum double precision
1	0.20597778035295902

(Figure: D.C. Ward 3 percentage surface area: City Parks)

DC_Info/postgres@Term_Project_DC

Query Editor Query History

```

1 Select Sum(St_Area(parks_and_recreation_areas_ward_3.geom) / St_area(Ward_3.geom))
2 From parks_and_recreation_areas_ward_3, Ward_3
3

```

Data Output Explain Messages Notifications

	sum	
	double precision	
1	0.016858570740650326	

(Figure: D.C. Ward 3 total length of bike trails)

DC_Info/postgres@Term_Project_DC

Query Editor Query History

```

1 -- Bike Trails length (miles)
2 Select Sum(ST_Length(geom)/5280)
3 from bike_trails_ward_3
4
5

```

Data Output Explain Messages Notifications

	sum	
	double precision	
1	7.608372413621638	

(Figure: D.C. Ward 3 community gardens points)

Query Editor Query History

```
1   Select ST_AsEWKT(geom) from community_gardens_points_ward_3
```

Data Output Explain Messages Notifications

	st_asewkt text	
1	POINT(128967...	
2	POINT(128734...	
3	POINT(128900...	
4	POINT(129465...	
5	POINT(129071...	
6	POINT(128258...	
7	POINT(129008...	

(Figure: D.C. Ward 3 community gardens locations)

[Query Editor](#) [Query History](#)

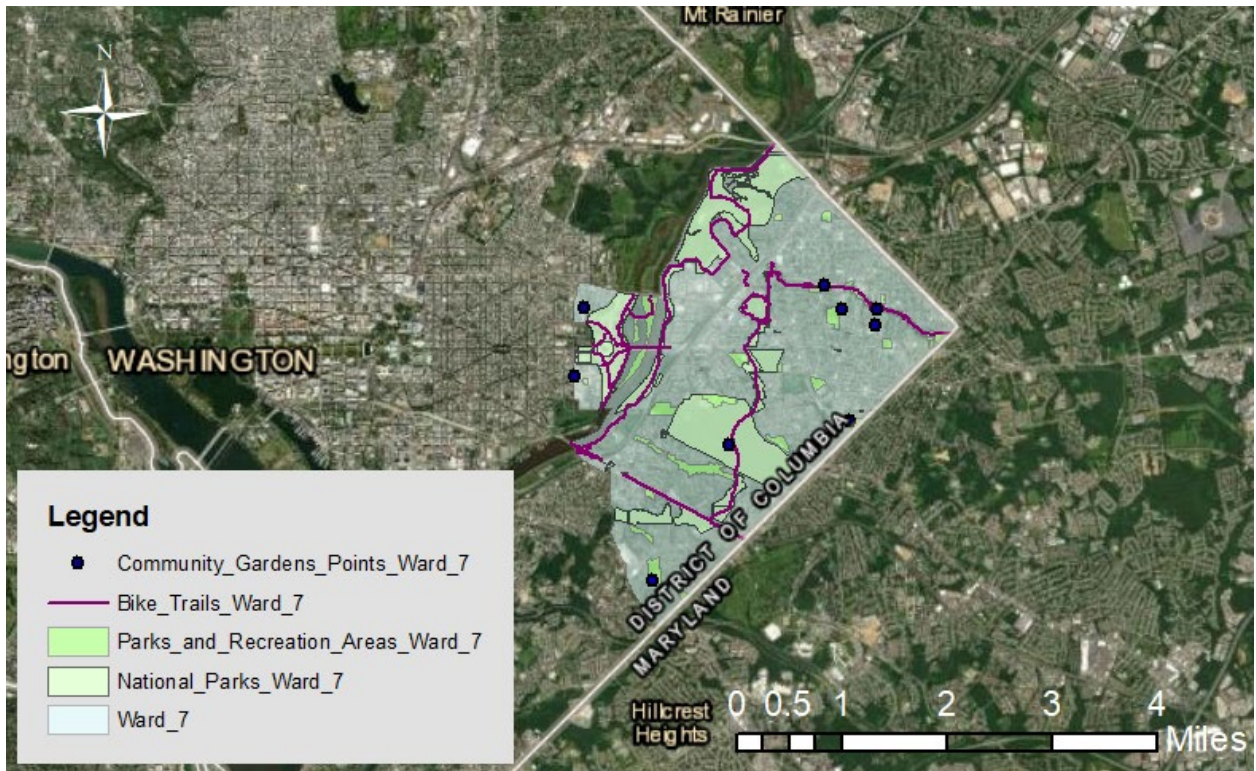
```
1 --Coordinate Points (community Gardens)
2 Select name, ST_X(geom),ST_Y(geom)
3 from community_gardens_points_ward_3
4
5
6
```

[Data Output](#) [Explain](#) [Messages](#) [Notifications](#)

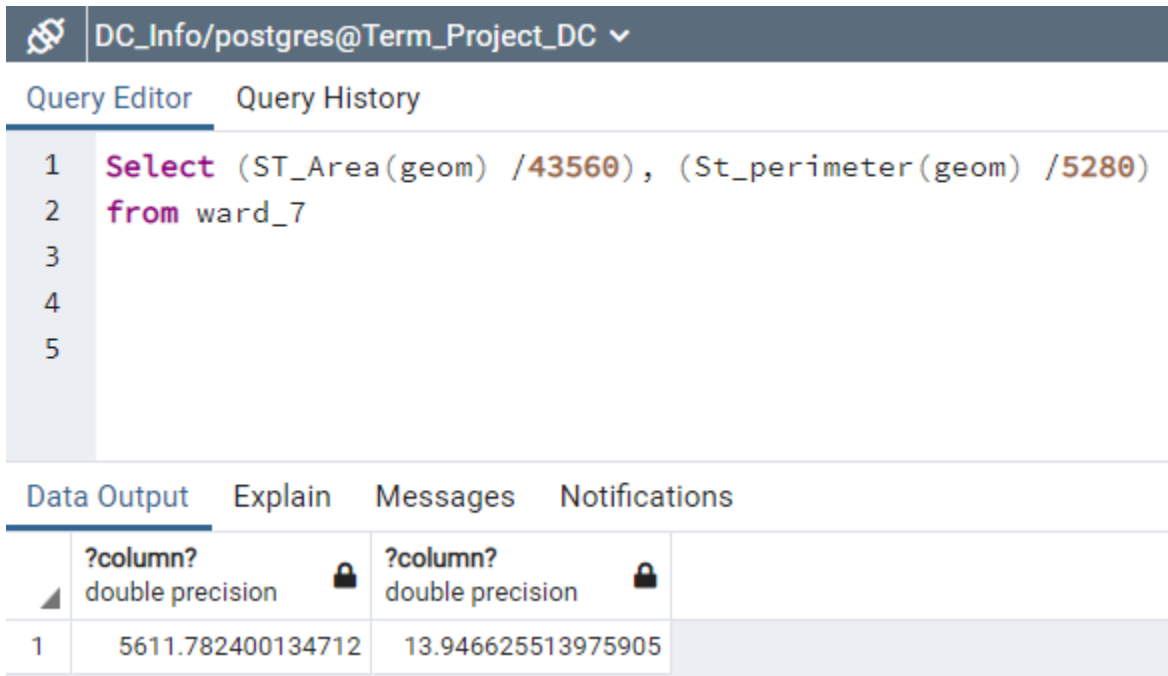
	name character varying (61)	st_x double precision	st_y double precision
1	Fort Reno Garden	1289670.75302355	467977.49277472496
2	Friendship Garden	1287345.5857578814	465342.346142143
3	Glover Archbold Garden	1289005.423317477	458369.2925029844
4	Melvin Hazen Garden	1294657.903482303	463520.6841030568
5	Newark Street Community G...	1290716.5635959655	462019.979099229
6	Palisades Garden	1282582.596924305	458123.44424138963
7	Whitehaven Garden	1290083.6301505566	455730.7452866435

D.C Ward 7 results summary: Ward 7 has an area of 6983.17 Acres and a Perimeter of 17.59 miles. Ward 7 has 17 National Park Sites and 24 City Park sites. National Park land covers 21.51% of Ward 7's area. City parks cover 4.90% of the ward. Ward 7 has 18.18 Miles of bike trail and nine community gardens.

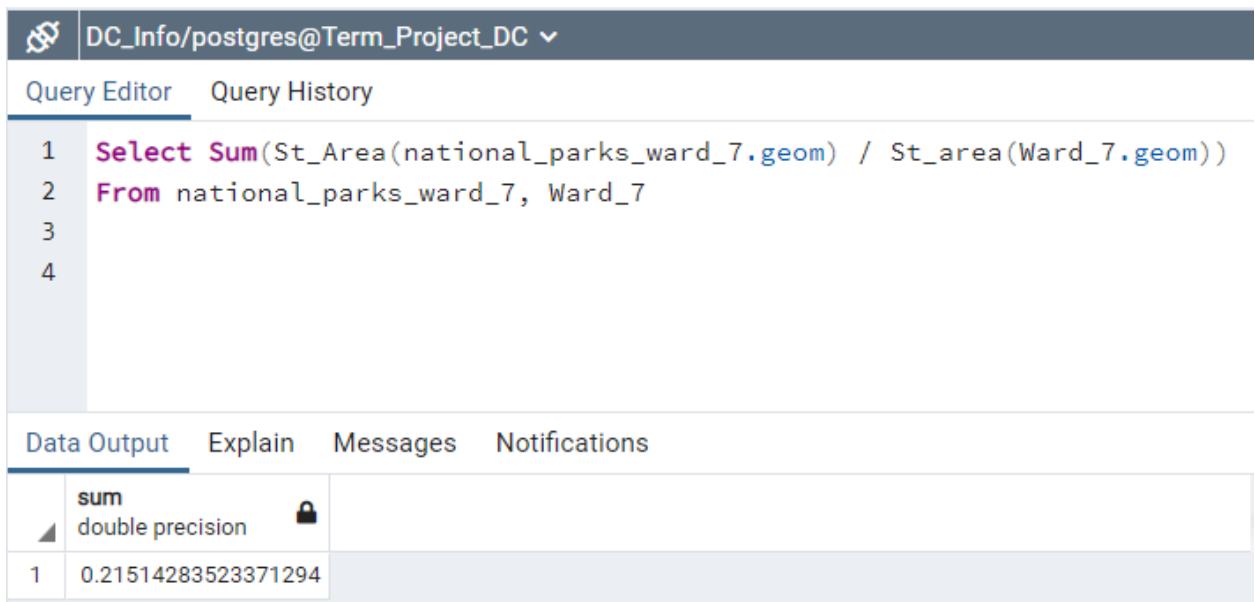
(Figure: D.C. Ward 7 map)



(Figure: D.C. Ward 7 total surface area, perimeter)



(Figure: D.C. Ward 7 percentage surface area, National Parks)



(Figure: D.C. Ward 7 percentage surface area, City Parks)

DC_Info/postgres@Term_Project_DC

Query Editor Query History

```

1 Select Sum(St_Area(parks_and_recreation_areas_ward_7.geom) / St_area(Ward_7.geom))
2 From parks_and_recreation_areas_ward_7, Ward_7
3
4

```

Data Output Explain Messages Notifications

	sum	
	double precision	
1	0.04909408010339087	

(Figure: D.C. Ward 7, total length of bike trails)

DC_Info/postgres@Term_Project_DC

Query Editor Query History

```

1 -- Bike Trails length (miles)
2 Select Sum(ST_Length(geom)/5280)
3 from bike_trails_ward_7
4
5
6

```

Data Output Explain Messages Notifications

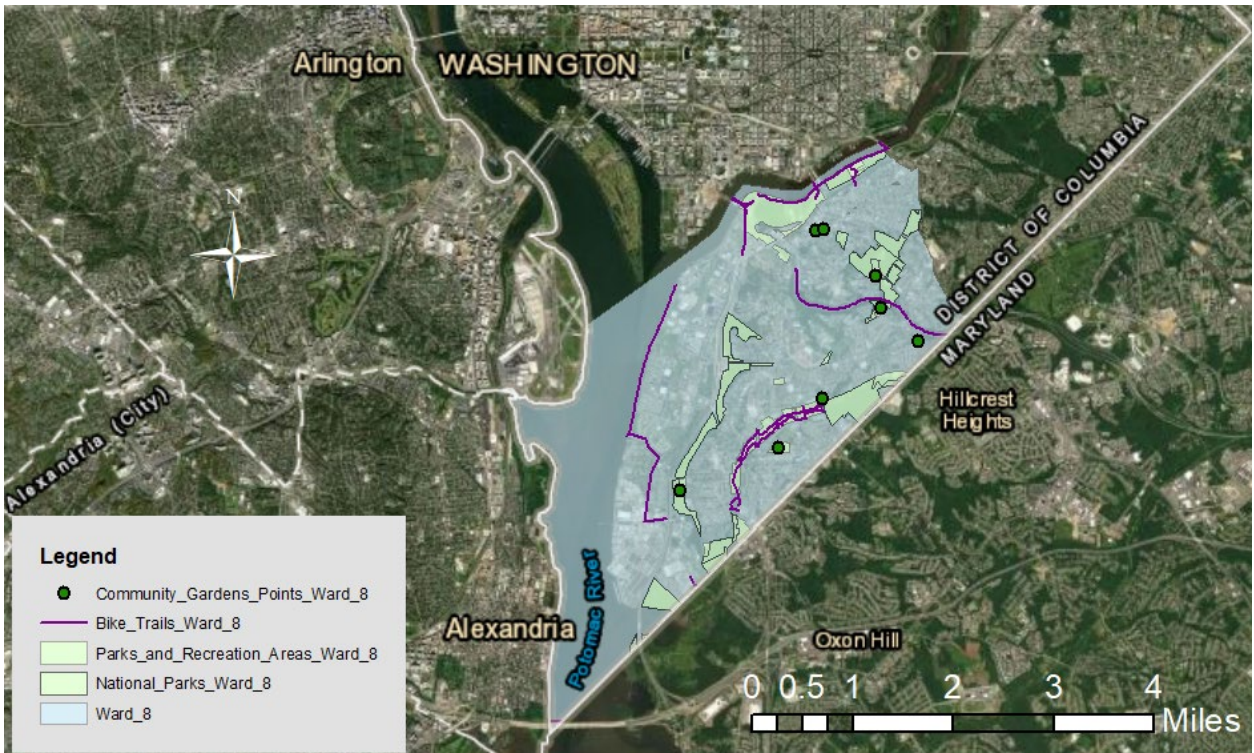
	sum	
	double precision	
1	18.19170783324106	

(Figure: D.C. Ward 7, community gardens locations)

DC_Info/postgres@Term_Project_DC			
Query Editor		Query History	
1	--Coordinate Points (community Gardens)		
2	Select name, ST_X(geom),ST_Y(geom)		
3	from community_gardens_points_ward_7		
4			
5			
6			
Data Output			
	name	st_x	st_y
	character varying (61)	double precision	double precision
1	Beet St Garden - Richardson ...	1333954.6998885572	446572.00737056136
2	Benning Garden	1332717.377888143	441779.3929400593
3	Dix St Garden (SoilFul Garde...	1334052.900807634	447386.093668893
4	Fort Dupont Park Gardens	1326588.3392932266	440624.19708772004
5	Hillcrest Garden	1322796.3166935593	433837.4586927295
6	Kingman Park-Rosdale Com...	1319293.7354441434	447514.01926605403
7	Lederer Youth Garden	1331422.3371711373	448601.10075330734
8	Lincoln Heights	1332280.6015307158	447389.6005516499
9	RockStAr Garden	1318866.7510618865	444056.3411420584

D.C Ward 8 results Summary: Ward 8 has an area of 7635.46 Acres and a Perimeter of 17.89 Miles. Ward 8 has 9 national Park Sites and 15 City Park Sites. National Park land covers 6.92% of Ward 8's area. City parks cover 4.38% of the ward. Ward 8 has 11.78 miles of bike trail and eight community Gardens.

(Figure: D.C. Ward 8 map)



(Figure: D.C. Ward 8 total surface area, perimeter)

DC_Info/postgres@Term_Project_DC ▾

Query Editor Query History

```

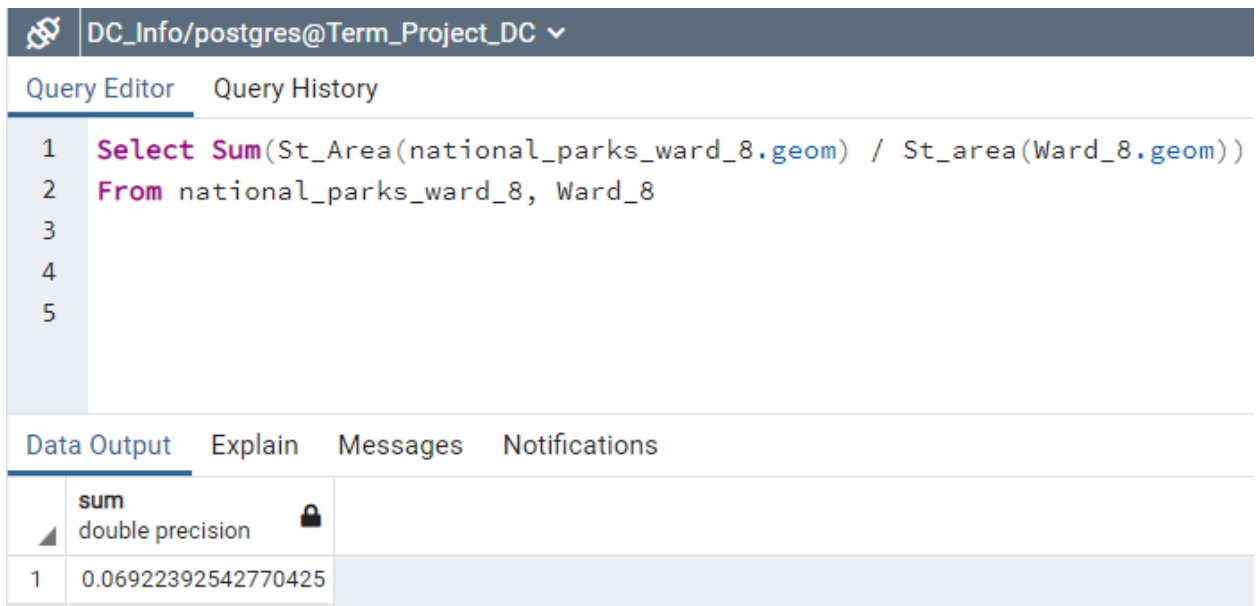
1  Select (ST_Area(geom) /43560), (St_perimeter(geom) /5280)
2  from ward_8
3
4
5
6

```

Data Output Explain Messages Notifications

	?column? double precision	?column? double precision
1	7635.461914718672	17.789468424824395

(Figure: D.C. Ward 8 percentage surface area, National Parks)



DC_Info/postgres@Term_Project_DC

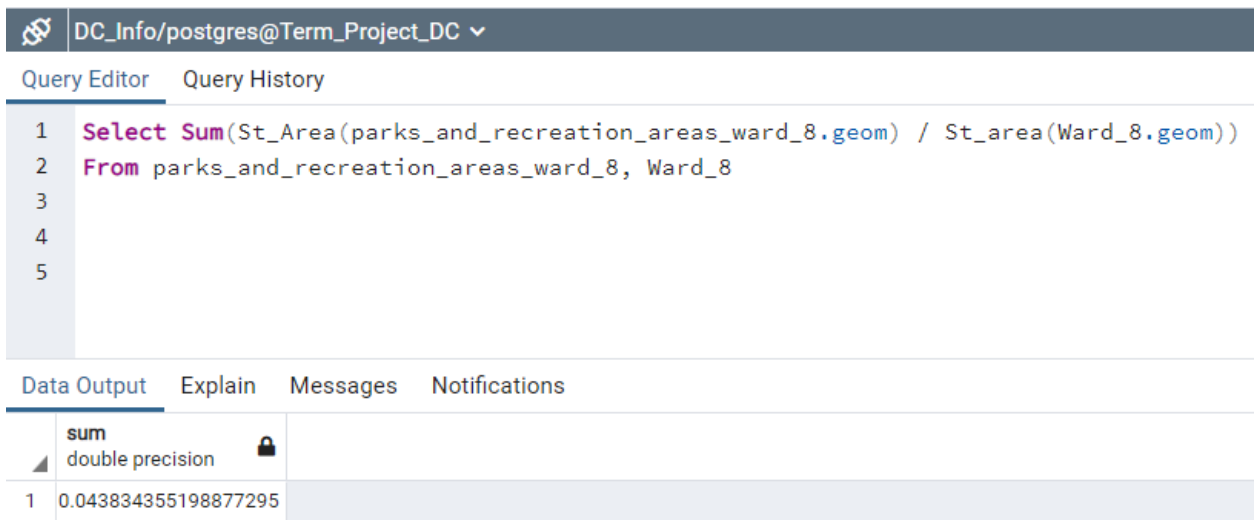
Query Editor Query History

```
1 Select Sum(St_Area(national_parks_ward_8.geom) / St_area(Ward_8.geom))
2 From national_parks_ward_8, Ward_8
3
4
5
```

Data Output Explain Messages Notifications

	sum	
	double precision	
1	0.06922392542770425	

(Figure: D.C. Ward 8 percentage surface area, City Parks)



DC_Info/postgres@Term_Project_DC

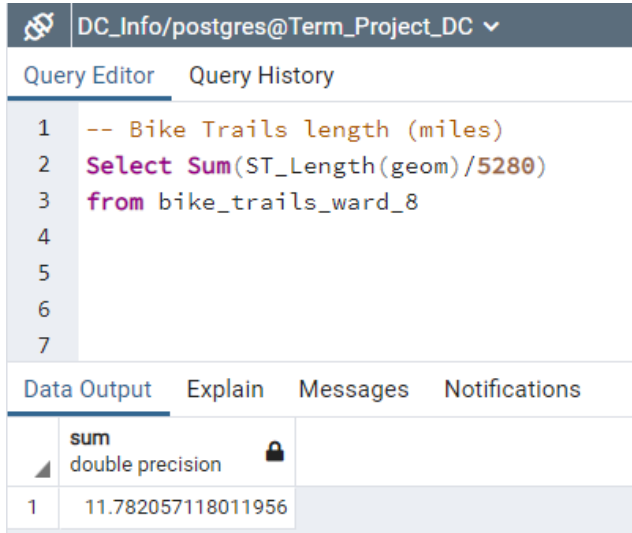
Query Editor Query History

```
1 Select Sum(St_Area(parks_and_recreation_areas_ward_8.geom) / St_area(Ward_8.geom))
2 From parks_and_recreation_areas_ward_8, Ward_8
3
4
5
```

Data Output Explain Messages Notifications

	sum	
	double precision	
1	0.043834355198877295	

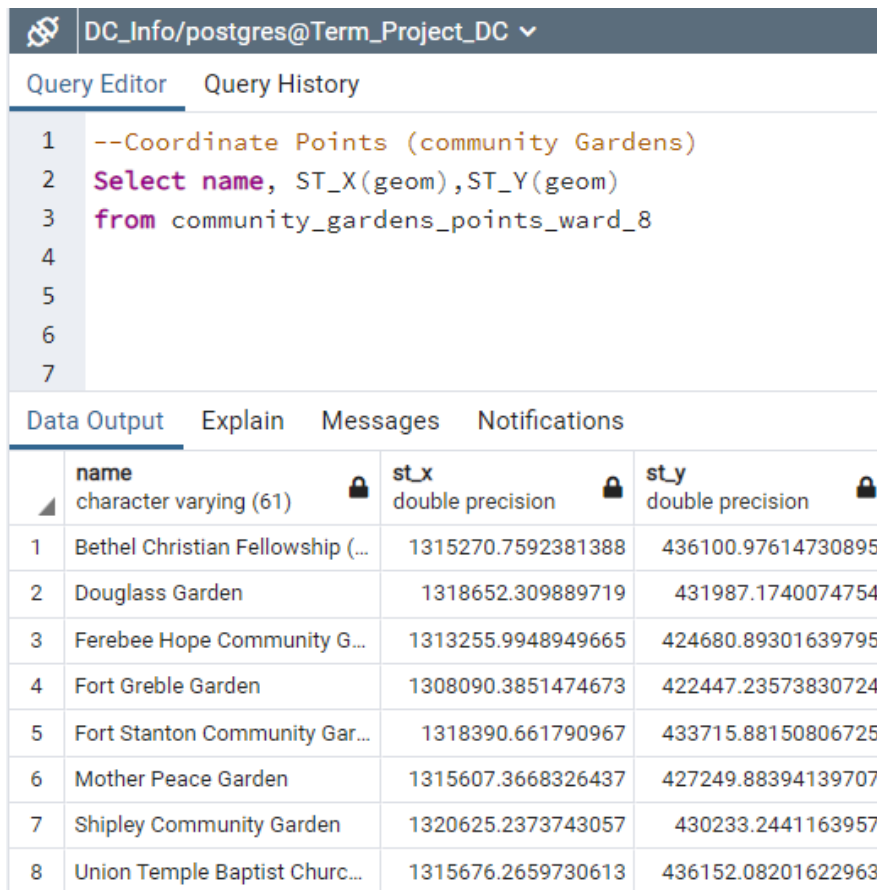
(Figure: D.C. Ward 8 total length of bike trails)



```
1 -- Bike Trails length (miles)
2 Select Sum(ST_Length(geom)/5280)
3 from bike_trails_ward_8
4
5
6
7
```

	sum
	double precision
1	11.782057118011956

(Figure: D.C. Ward 8 community gardens locations)



```
1 --Coordinate Points (community Gardens)
2 Select name, ST_X(geom),ST_Y(geom)
3 from community_gardens_points_ward_8
4
5
6
7
```

	name	st_x	st_y
	character varying (61)	double precision	double precision
1	Bethel Christian Fellowship (...)	1315270.7592381388	436100.97614730895
2	Douglass Garden	1318652.309889719	431987.1740074754
3	Ferebee Hope Community G...	1313255.9948949665	424680.89301639795
4	Fort Greble Garden	1308090.3851474673	422447.23573830724
5	Fort Stanton Community Gar...	1318390.661790967	433715.88150806725
6	Mother Peace Garden	1315607.3668326437	427249.88394139707
7	Shiplay Community Garden	1320625.2373743057	430233.2441163957
8	Union Temple Baptist Churc...	1315676.2659730613	436152.08201622963

Overall Results Table:

Ward	% White	% Black	Per-Capita Income	# Natl Parks	% Area Natl Park	# City Parks	% Area City Park	Bike Trail Miles	Community Gardens
3	78.56	7.68	\$ 94,056.00	26	20.59	34	1.69	7.6	7
2	73.27	9.57	\$ 81,080.00	48	26	19	5.03	22.65	3
7	3.04	92.44	\$ 26,917.00	17	21.51	14	4.9	18.18	9
8	6.13	89.22	\$ 22,568.00	9	6.92	15	4.38	11.78	8

Discussion:

When we sort the results by per-capita income, there seems to be a correlation between income in each ward and the overall number of City Parks present in each ward, however this correlation does not carry over to the overall percentage of land in each ward dedicated to city parks. The differences in percentage of land area devoted to National Parks appears relatively equitable in wards 2, 3, and 7, but ward 8 has significantly fewer National Park Sites and less National Park land overall than the other districts. Bike trails seem to be relatively egalitarian in their distribution, with no clear advantage in bike trail miles in wealthier wards. Community gardens are slightly more prevalent in the poorer districts. This is a direct policy choice made by the city government in order to combat the lack of available fresh produce in poor and minority areas of the city.

Conclusion:

Recreation access in poor communities and communities of color has been a prevalent issue in many U.S. cities, particularly those with stark economic and racial divides. In Washington D.C. There is a notable difference in park area between the wealthiest (ward 3) and the poorest (ward 8), however when we include the second wealthiest and second poorest, this distinction becomes less clear. Ward 7 has a greater percentage of National Park land by area than Ward 3, and only has 4.49% less national Park area than Ward 2. This is particularly notable due to the fact that Ward 2 contains the National Mall, and other large tourist attractions. Additionally, both Wards 7 and 8 have a greater portion of their area devoted to city parks than the wealthiest ward. Therefore, the expected disparity in parks access between wealthy and poor districts of Washington D.C. cannot be conclusively established in this case. This outcome is to be desired, and puts Washington D.C. well ahead of many other comparable U.S. cities in terms of public recreation access, in spite of other stark economic and racial inequalities present in the city.

References:

(1) Thomas L. McKenzie, Jamie S. Moody, Jordan A. Carlson, Nanette V. Lopez, and John P. Elder *Neighborhood Income Matters: Disparities in Community Recreation Facilities, Amenities, and Programs*, PubMed Central, National Institute of Health, National Library of Medicine, July 2014

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4082954/>

(2) Myron F. Floyd PhD, Wendell C. Taylor PhD, MPH, Milicia Whitt-Glover PhD, *Measurement of Park and Recreation Environments That Support Physical Activity in Low-Income Communities of Color: Highlights of Challenges and Recommendations*, American Journal of Preventive Medicine, Volume 36, Issue 4, Supplement, April 2009, Pages S156-S160

<https://www.sciencedirect.com/science/article/pii/S0749379709000178>

(3) Lauren C. Abercrombie MPH, James F. Sallis PhD, Terry L. Conway PhD, Lawrence D. Frank PhD, Brian E. Saelens PhD, James E. Chapman MA. *Income and Racial Disparities in Access to Public Parks and Private Recreation Facilities*, American Journal of Preventive Medicine, Volume 34, Issue 1, January 2008 Pages 9-15.

<https://www.sciencedirect.com/science/article/pii/S0749379707006502>

(4) Nicholas Dahman, Jennifer Wolch, Pascale Joassart-Marcelli, Kim Reynolds, Michael Jerrett, *The active city? Disparities in provision of urban public recreation resources*, *Health & Place*, Volume 16, Issue 3 May 2010

<https://www.sciencedirect.com/science/article/abs/pii/S135382920900135X>

(5) District of Columbia, Office of the Chief Technology Officer, GIS Data Coordinator, *Parks and Recreation Areas*, [vector digital data] published March 15 2019, Information last updated April 28,2021
<https://opendata.dc.gov/datasets/DCGIS::parks-and-recreation-areas/about>

(6) District of Columbia, Office of the Chief Technology Officer, GIS Data Coordinator, *National Parks* [vector digital data] published March 03 2014, Information last updated June 25 2019
<https://opendata.dc.gov/datasets/DCGIS::national-parks/about>

(7) District of Columbia, Office of Planning, *ACS Economic Characteristics DC Ward*, [vector digital data] published January 27, 2021. Information last updated January 28, 2021.
<https://opendata.dc.gov/datasets/DCGIS::acs-economic-characteristics-dc-ward/about>

(8) District of Columbia, Office of Planning, *ACS Demographic Characteristics DC Ward* [vector digital data] published January 27, 2021. Information last updated January 28, 2021.
<https://opendata.dc.gov/datasets/DCGIS::acs-demographic-characteristics-dc-ward/about>

(9) District of Columbia, Office of Planning, *ACS Demographic Characteristics DC Census Tract* [vector digital data] published January 27, 2021. Information last updated April 20, 2021.
<https://opendata.dc.gov/datasets/DCGIS::acs-economic-characteristics-dc-census-tract/about>

(10) District of Columbia, Office of the Chief Technology Officer, GIS Data Coordinator, *Bike Trails* [vector digital data] published February 27, 2015, information last updated June 25 2019.

<https://opendata.dc.gov/datasets/DCGIS::bike-trails/about>

(11) District of Columbia, District of Columbia, Office of the Chief Technology Officer, GIS Data Coordinator, *Community Gardens*, [vector digital data] published February 23 2018.

<https://opendata.dc.gov/datasets/DCGIS::community-gardens-points/about>