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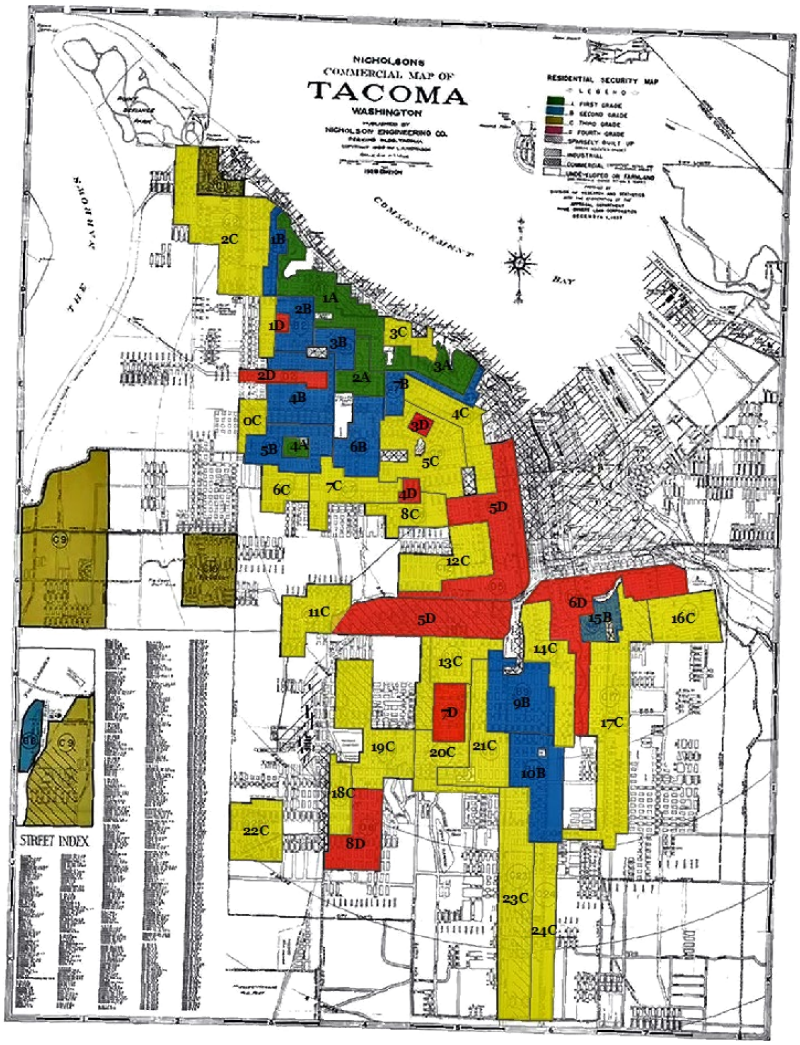
TGIS 415
Final Paper: Colors of Segregation

Introduction

With recent conversation surrounding loan debt and affirmative action, it is important that we reflect on the actions from our past as a nation as we move towards the future. This wealth and race basis were taken into play when the Home Owners' Loan Corporation classified neighborhoods desirability and acceptance for loans. The HOLC was born from the New Deal and promised to alleviate stress from the Great Depression (Jacoby, Dong, Beard, Wiebe, & Morrison, 2018). Neighborhoods were graded for protentional risk for default on a loan and desirability of the overall area. Although these other factors were included in their survey, the determination was heavily race based. Low graded areas had a high number of migrants and people of color. These areas were not eligible for the assistance programs that rolled out with the New Deal. Banks would deny loans based on the areas being risky. This "perpetuate systematic segregation of minority groups in the United States" (Mcclure, et al., 2019). As a result, families have lost out on the generational wealth and real estate that have propelled many different neighborhoods across America for generations. Additionally, this compounded the effects of negative status that African Americans have and still hold today.

Although the HOLC was shut down in 1954, this research examines if there have been long term effects on the long-term positive growth "hazardous" (Red) and "definitely declining" (Yellow) neighborhoods. Do areas graded red or yellow receive a lower score on a neighborhood livability index than those that were marked "Best" (Green) or "Still Desirable" (Blue)?



Original Security Map with Digitized Zones

To answer that question, we will look more into the history of the Home Owners Loan Corporation's practices, examine what make a location desirable or undesirable today, what metrics should be used to determine a neighborhoods health or livability and finally What are the racial and economic make up of these areas today? And are they significant?

Theoretical Foundation

The Home Owner's Loan Corporation was established in 1933 as part of the New Deal, aimed to alleviate stress from the Great Depression as many homes were in foreclosure. Although one of the main goals was to revive farmlands, the HOLC was responsible for helping to refinance up to 20% of non-farm homes (Ryan 2018). However they quickly moved into making security maps, on the service were created to evaluate the leading risk of major cities, these maps were used

by the Federal Housing Administration and Federal Home Loan Bank Board, who both advised private banking companies (Ryan 2018). " These maps were used to indicate the relative likelihood that real estate investments would appreciate over time from the point of view their creators, who were often 'consultants' with local financial interests such as lenders, realtors and appraisers (Jacoby et al., 2018) .The standards to evaluating the financial security of neighborhoods was highly, if not entirely based on the number of the population in the area that was black or of other minority or immigrant groups. Race was once again related to worth and trustworthiness, creating another tool that was propelling the racial and class divide in major cities.

The security maps graded neighborhoods in four main grades, and two grades to describe the landscape.

> "A first-grade or green color zone represented areas assessed to be ideal for investment vis-a-vis affluent home buyers and plentiful space for development. A second-grade or blue zone was assigned to areas deemed well-developed and stable. A third-grade or yellow zone represented areas with evidence of decline and influx of what was termed a "low grade population," with a fourth-grade or red zone reserved for areas with dilapidated or informal housing stock and an "undesirable population" of Blacks, immigrants and Jews" (Jacoby et al., 2018)

Zones grades were also labeled, Green, A or Best, Blue: B or Still Desirable, Yellow: C or Definitely Declining, or Red: D or Hazardous. This is language that will be used to describe steps of this analysis and the results.

Other research has found significant correlation surrounding redline grades and the current physical, financial, and social health of those neighborhoods. By evaluating studies on foreclosure rates and self-reported health McClure finds that the trends have been consistence that post Great Depression financial and housing stress was a strong influence on send order health impacts of a neighborhood (McClure et al. 2019). Even if the findings were related some other influence such as environmental factors that opens the idea that it was a result of environmental racist which locations can be traced back to redlined areas.

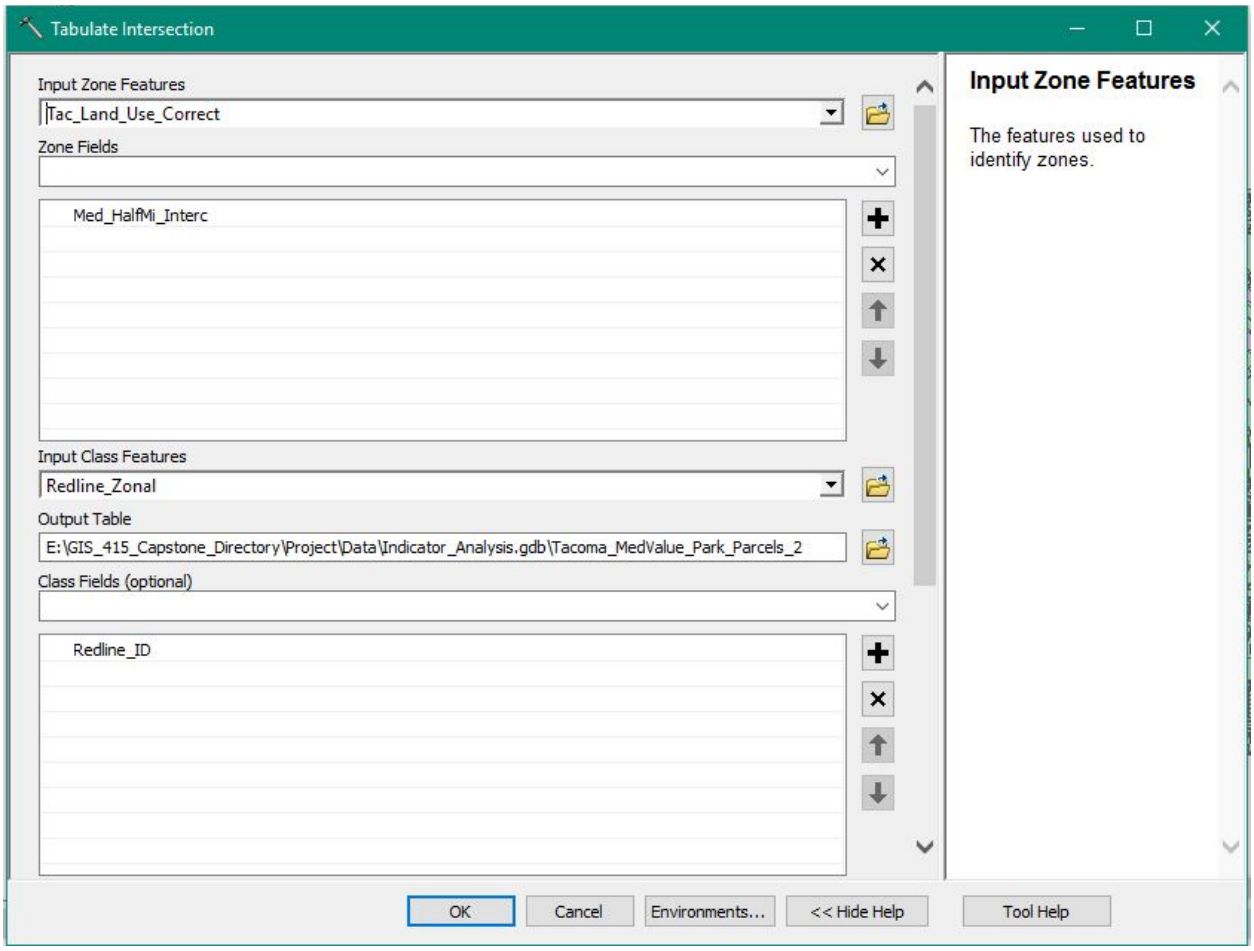
Indicator Methods

To determine if there is any difference in equity or livability within these poorly graded areas an index will be preformed using 9 different factors. The results of that index will be overlaid with the redline polygons to determine results. The datasets were analysis in one of three ways.

1. Data relating to population was joined to block groups, then divided by the population of each block group to receive the rate of occurrences. Those block groups were converted to points. By using the rate field an Inverse distance weight interpolation was performed. Using zonal statistics, the grid was able to be examined for an estimated average of occurrences within the HOLC graded areas as well as the Tacoma boundary to get the rate for the city of Tacoma. Including crime rate, food access, internet service, land use type and homeowner rate.

2. For datasets that were based on proximity, a network analysis was used. This found the total area covered by a particular service, the intersection was tabulated and divided by the shape area of redlined zones to receive the percentage that was covered in each zone.

3. A network analysis won't provide a true representation of the area of access for polygons as they would need to be converted to points, losing the area of impact. Instead a select by location within the prescribed distance will be used on the appropriate tax land use parcels types, those that to meet the distance standard will be selected and a field will be added to mark whether each parcel did or did not meet requirements. The tax land use parcels with the new distance requirement field was added to the Tabulate Intersection tool using the redline zones as the area to base the calculation, resulting the percent coverage of an indicator.



Tabulate Intersection Tool

4. Area Coverage was analyzed similarly, though not requiring a network analysis or parcels. The shape area of the indicator polygons was divided by the total area of Tacoma or Redline Polygons to receive the percent coverage.

Bus stops

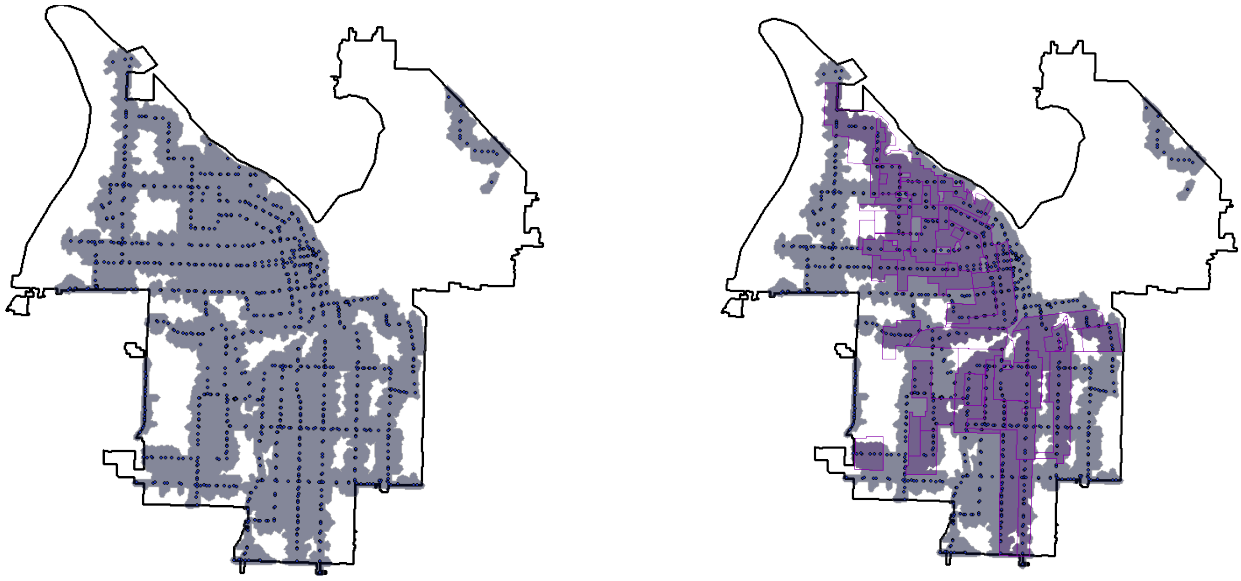
Transit stops are an important factor to the accessibility of a neighborhood, a focus on public transportation in neighborhood development shows a commitment to livable communities and smart growth (Chisholm, 2002). An increase in better planning transit facilities shows a commitment to community and environmental wellbeing, (TCRP Oversight and Project Selection Committee, 1998) however some areas are more primed for these than others. Although the median time for people to walk to transit is roughly 10 to 15 minutes or a half mile to transit

stops (Freeland et al., 2013). A quarter mile, or roughly 5-minute walk is found to be more ideal (Chisholm, 2002).

Transit data were analyzed using only bus and link stops and stations. A network analysis was preformed with a 5-minute walk time radius. California's transit village has found great success in having transit access within a quarter mile of all housing types and mixed used developments that intersects with public facilities, such as libraries and civic centers as well as day cares (TCRP Oversight and Project Selection Committee, 1998). Which provide an opportunity for trips to be consolidated and easy the struggle commuting with small children and groceries.

Analyzed using method 2. Tacoma has 54.66% transit coverage within a 5-minute walk. Because of their proximity to city centers HOLC areas have 93.27% coverage of the transit polygon. The highest amount of average coverage was the Green Blocks at 97.03% and the lowest was Yellow Blocks at 89.3%.

Indicator	Tacoma	Block B (Green)	Difference From Tacoma	Block A (Blue)	Difference From Tacoma	Block C (Yellow)	Difference From Tacoma	Block D (Red)	Difference From Tacoma
Transit Stops	54.66	97.03	**42.36**	94.61	**39.94**	89.3	**34.64**	92.27	**37.61**



Crime Network Analysis. With overlaid redline zones on right.

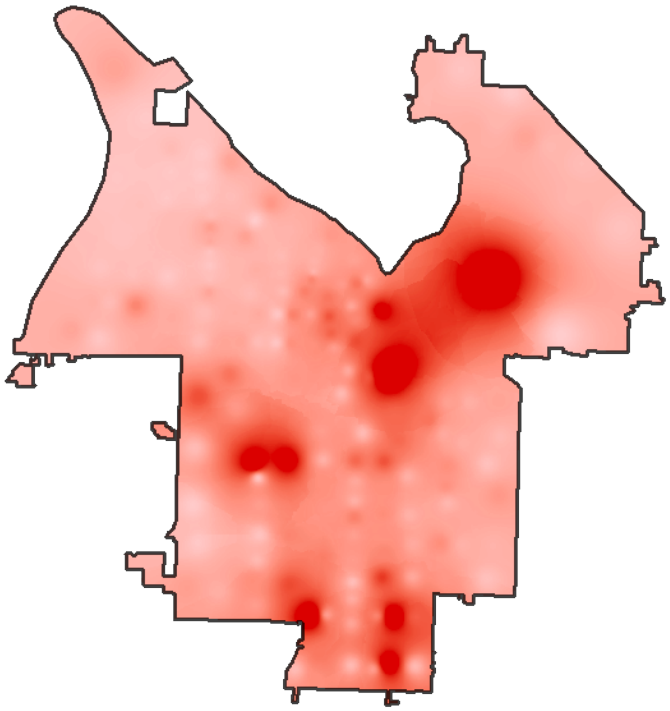
Crime

The safety of an area is a huge factor in both its livability and desirability. Of disammenities or other undesirable factors when looking at neighborhoods crimes is one of the most commonly used (Biagi, B, et al., 2018). This piece of the analysis also draws on some long-term historical context of reinforcing violence. “Recent criminal justice strategies now consider urban places like block-level violence “hot spots” as an ideal target for law enforcement-based violence prevention” (Jacoby et al., 2018). Marking areas are hazardous and undesirable may have had alternative effects in their wording and increase of social and economic inequity enforce neighborhood violence (Jacoby et al., 2018).

Not all crime reported in the area is related to overall neighborhood health and livability, only violent and property crimes were accounted for. According to the FBI’s Uniform Crime Reporting Program, violent crimes included murder, rape, robbery, and aggravated assault, and property crimes included Burglary, larceny, motor vehicle theft and arson. All other reports were filtered out of the analysis.

Analyzed using method 1. The Crime rate was determined by occurrences by population per block group. The city of Tacoma has a crime 12.37%, that is crimes per person. Many property crimes occur in the Port of Tacoma business district where the population is extremely low. The crime rates for all HOLC graded areas is 9.42%. Still below the average for Tacoma, however the crime rate for the lowest rated zones, Yellow and Red both have averages without significant difference from Tacoma while the highest ranking has a significantly lower crime rate than the Tacoma average.

Indicator	Tacoma	Block B (Green)	Difference From Tacoma	Block A (Blue)	Difference From Tacoma	Block C (Yellow)	Difference From Tacoma	Block D (Red)	Difference From Tacoma
Crime Rate	12.37	7.88	**4.48**	6.37	**5.99**	11.76	0.6	11.67	0.7



Crime IDW

Parks

Parks and green spaces are key features in the community, these spaces can lead not only to increase in physical well being and stress reduction (Benita, F. et al., 2019) but also an effect on happiness. Research found that the presences of a park increases happiness additionally that any type of activity or community engagement with increase happiness again, regardless of the type offered (Frash Jr., et al., 2019). As a result, parks analyzed here were ranked on whether they had facilities or community engagement to honor that research.

Analyzed using modified method 3. The standard for distance was residential parcels within a half mile to meet the standard for 10-minute walk time. Additionally, parks were classified into rank 1, being community centers, playgrounds and recreation areas, which provide the most resources, facilities, and opportunity for engagement. Rank 2 are standard local parks, and rank 3 are undeveloped parks, fields, and wildlife habitat which has very limited

facilities and upkeep. Parcels that intersected rank 1 parks are weighted heavier in the index than undeveloped parks.

All areas are above Tacoma average for both undeveloped and local parks. However Green blocks are mildly deficient for community centers and Blue blocks only have 22.69% of a community center compared to Tacoma at 35.78%.

MedValue_Park_Parcels_usethis

OBJECTID *	Redline_ID *	Med_HalfMi_Interc	AREA	PERCENTAGE	MedPark_Prec
2	0C	Yes	2215.171258	67.821012	67.821012
4	10B	Yes	8931.819325	67.018186	67.018186
6	11C	Yes	5346.785054	55.235564	55.235564
8	12C	Yes	7171.236938	62.830827	62.830827
10	13C	Yes	7145.956375	66.862131	66.862131
12	14C	Yes	7931.176341	69.395228	69.395228
14	15B	Yes	2530.057577	67.21445	67.21445
16	16C	Yes	7339.124867	77.567633	77.567633
18	17C	Yes	18096.704804	70.780824	70.780824
20	18C	Yes	3310.514187	68.896539	68.896539
22	19C	Yes	11675.863906	73.049313	73.049313
24	1A	Yes	10840.663556	76.773359	76.773359
26	1B	Yes	2330.413849	69.757702	69.757702
30	1D	Yes	502.638112	66.582262	66.582262
32	20C	Yes	5177.684794	60.945558	60.945558
34	21C	Yes	7451.467726	65.164628	65.164628
36	22C	Yes	6631.763857	73.417193	73.417193
38	23C	Yes	16017.71689	71.718673	71.718673
40	24C	Yes	7957.360666	67.216144	67.216144
42	2A	Yes	3383.554288	67.702202	67.702202
44	2B	Yes	3744.497605	71.76622	71.76622
46	2C	Yes	17817.395115	69.380328	69.380328
48	2D	Yes	2470.354932	68.264459	68.264459
50	3A	Yes	4832.349952	73.191432	73.191432
52	3B	Yes	2607.813058	71.511963	71.511963
54	3C	Yes	2538.981906	67.875309	67.875309
56	3D	Yes	746.855266	73.931935	73.931935
58	4A	Yes	839.345895	65.900101	65.900101
60	4B	Yes	7629.267823	69.141817	69.141817
62	4C	Yes	5686.605407	56.870322	56.870322
64	4D	Yes	976.925211	70.527294	70.527294
66	5B	Yes	5929.051564	67.207277	67.207277
68	5C	Yes	10540.590684	64.733152	64.733152
70	5D	Yes	15957.288186	40.309035	40.309035
72	6B	Yes	5700.028264	66.409858	66.409858
74	6C	Yes	3716.895255	73.336455	73.336455
76	6D	Yes	12903.731328	66.212939	66.212939
78	7B	Yes	3320.96805	69.384455	69.384455
80	7C	Yes	6120.767977	65.83534	65.83534

1 (0 out of 43 Selected)

Table of percent of redlined areas with access to local parks.

Indicator	Tacoma	Block B (Green)	Difference From Tacoma	Block A (Blue)	Difference From Tacoma	Block C (Yellow)	Difference From Tacoma	Block D (Red)	Difference From Tacoma
Undeveloped Parks**	37.09	59.95	22.86	70.89	33.81	53.42	16.34	54.56	17.48
Local Parks**	54.18	69.14	14.96	70.89	16.71	67.45	13.26	66.34	12.16
Community Centers**	35.78	33.25	2.53	13.09	22.69	43.78	8	36.7	0.92

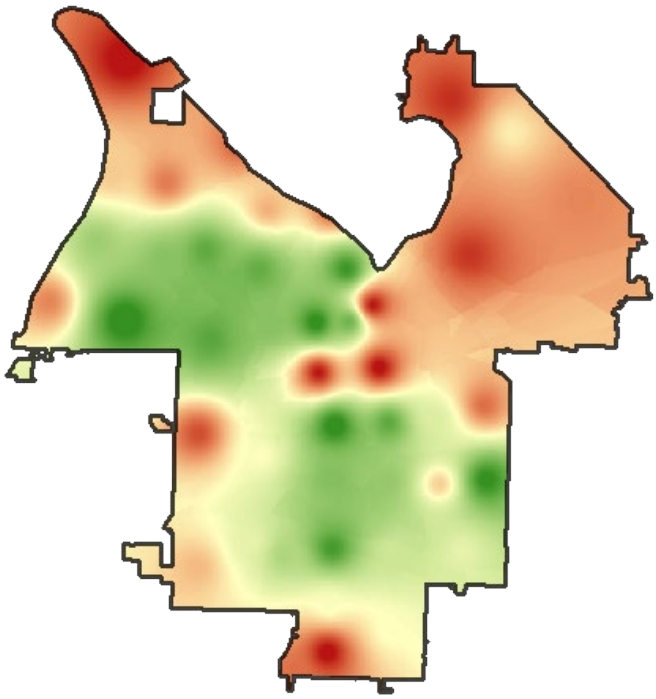
Grocery Access

The City of Tacoma is aware of food deserts and has been looking to combat them in a way that can increase access to fresh produce (Office of Assessment, 2016) citing the health and race issues correlated with lack of access. Though there was a time when this was less of a crisis in Tacoma, "the disappearance of local food businesses was gradual, yet steady. Many local corner stores that used to carry a wide selection of fresh food turned into places to purchase candy, cigarettes and beer." (Office of Assessment,2016) The HOLC could have potentially contributed to the long-term removal of these resources.

Analyzed using method 1. Food Deserts were determined by data from the USDA Food Access Atlas analyzed as percent in each block group with fresh food access. All HOLC areas are below the percentage of Tacoma for fresh food access. With Green and Red blocks having similar results at roughly 40%.

It should be noted that the USDA and the city also classifies food deserts not only by distance from stores, but also the income level of the tract. Meaning that because the North end is low access but, not low income it is barred form being a full food deserts, it is assumed that people with a higher income have better access to personal transportation (Ers.usda.gov, 2017). The North is were they majority of HOLC Green and Blue areas lie.

Indicators	Tacoma	Block B (Green)	Difference From Tacoma	Block A (Blue)	Difference From Tacoma	Block C (Yellow)	Difference From Tacoma	Block D (Red)	Difference From Tacoma
Fresh Food Access	53.86	40.76	13.11	45.86	8	44.68	9.18	40.34	13.52

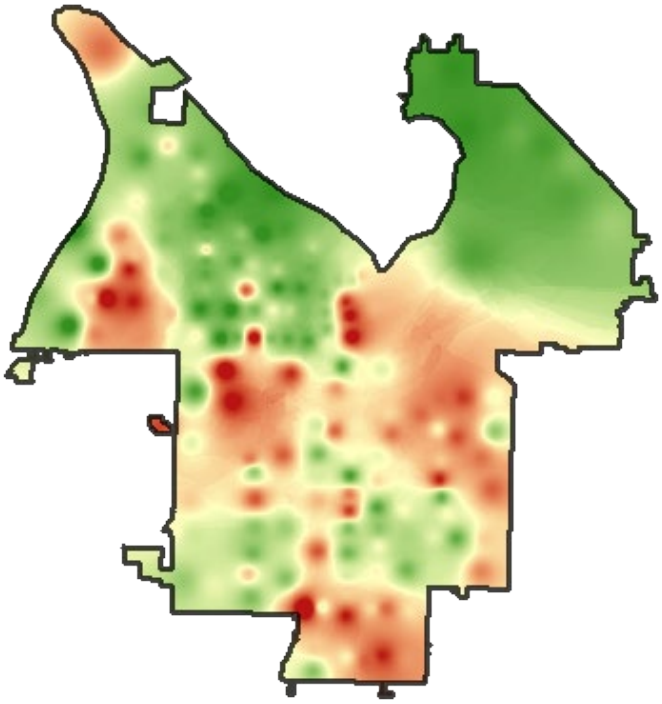


Food Access IDW

Internet Access

National internet access is not yet in place in the United States, since the societal structure is so depended on cyber communications it is increasingly important that people have personal internet access. There are limitations with technology services and access when accessing the internet at a public facility. For that reason, lack internet access is determined using data from American Community Survey as those without any sort of personal internet subscription, including broadband, satellite and cellular.

Analyzed using method 1. Green and Red areas have slightly lower than average percent of those without internet. Blue blocks have the most connectivity overall. While Yellow blocks are within the range for the Tacoma average of 16.98% without internet connection.



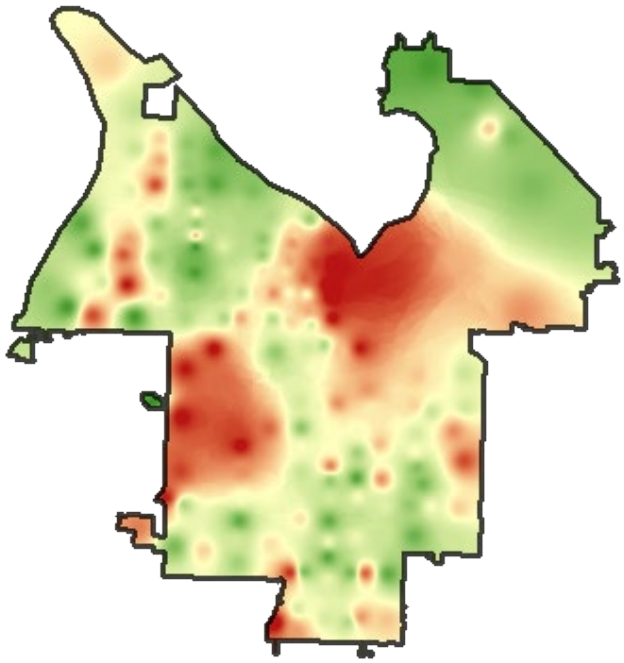
Indicators	Tacoma	Block B (Green)	Difference From Tacoma	Block A (Blue)	Difference From Tacoma	Block C (Yellow)	Difference From Tacoma	Block D (Red)	Difference From Tacoma
Without Internet Access	16.42	12.52	3.9	7.87	8.55	16.98	0.56	13.85	2.57

Home Ownership

"Homeownership has been deemed important in the United States because many consider it an indicator of middle-class status and good citizenship for individuals and an indicator of economic and social stability of neighborhoods due to the historical importance of the ownership of land and the fact that at the nation's founding only landowners could vote"(Anacker, 2018). Even today owning a home is still considered the peak of success and is becoming harder and harder to achieve. Yet the most direct link to the future impacts of these practices and ideals is examining the homeowner rate for each zone. Simply, "places that were disadvantaged eighty years ago may also be disadvantaged now" (Jacoby et al., 2018). The lack of generational wealth is a common factor among low SES neighborhoods, something that is easily provided in the form of real estate.

Analyzed using method 1. The Home Owner's Loan Corporation was started to better control and fund the housing market it is not surpring to find that their findings had clear long

term effects. While Yellow (Definitely Declining) and Red (Hazardous) areas are within the Tacoma average of 54.24& by less than 2%, Green (Best) and Blue (Still Desirable) are 10.81% and 17.18% over the average of Tacoma. Showing that with the loans from the HOLC these areas have had a significance advantage over those in Tacoma that were ineligible for assistance after the great depression.



Home Owner IDW

Indicators	Tacoma	Block B (Green)	Difference From Tacoma	Block A (Blue)	Difference From Tacoma	Block C (Yellow)	Difference From Tacoma	Block D (Red)	Difference From Tacoma
Home Owner Rate	54.24	65.04	**10.81**	71.41	**17.18**	54.81	0.57	55.66	1.42

Canopy Cover

Living in an urban environment it is not often the surrounding vegetation is thought of as a key factor to how a city functions. However, ecosystem services exist even in urban areas, possibly magnifying their importance due to scarcity. Trees and vegetation on streets and in yards provide air filtering, microclimate regulation, noise reduction and stress reduction (Bolund and Hunhammar, 1999).

Analyzed using method 4. Green blocks showed no difference from the Tacoma of average. Blue blocks were the only group to show an improvement above the average at 26.98%. Both red and Yellow areas both are roughly 3% below average.

Canopy_Interce_Diss_5151305

OBJECTID *	Redline_ID *	CanpoyCover_Precent	Shape_Length	Shape_Area
1	0C	19.908984	94801.905661	699939.465621
2	10B	19.073509	340908.838898	2736189.684345
3	11C	16.114481	173579.89834	1679030.572587
4	12C	15.424462	240383.291199	1894958.236974
5	13C	13.486363	217265.027293	1551469.853712
6	14C	16.738149	250462.066704	2059130.050765
7	15B	14.210618	74605.919229	575770.039727
8	16C	23.382343	221601.978812	2381332.887302
9	17C	14.026483	581148.92544	3860121.82646
10	18C	12.374264	110160.234169	640008.534813
11	19C	14.718392	318078.682027	2532220.843642
12	1A	38.29108	400884.115496	5819843.1002
13	1B	29.761586	110610.679347	1070200.863301
14	1C	0.707923	5356.760321	32800.34578
15	1D	18.879306	22937.82612	153409.141183
16	20C	16.469718	170499.624835	1506080.06977
17	21C	16.577749	285727.767901	2040439.91881
18	22C	23.603924	242941.30596	2295005.997603
19	23C	21.050127	566999.137951	5060476.669589
20	24C	19.461767	237173.530959	2479967.81633
21	2A	24.164958	161655.372781	1299944.278448
22	2B	24.463302	137798.40171	1373905.591361
23	2C	23.397475	779443.684763	6467630.498358
24	2D	18.380084	97207.035634	715946.429569
25	3A	32.039495	214873.201399	2276942.857416
26	3B	22.34972	121043.078559	877279.892625
27	3C	27.552485	93043.303164	1109371.240288
28	3D	25.3708	33618.697795	275871.52597
29	4A	13.440609	28273.935761	184264.712901
30	4B	18.147601	298154.148446	2155408.667167
31	4C	12.783807	200621.191187	1375928.749167
32	4D	15.779533	32342.440084	235270.018761
33	5B	16.772745	235160.29894	1592727.273552
34	5C	15.791779	406619.918335	2767818.374834
35	5D	10.714813	512211.470257	4565723.813983
36	6B	17.964356	237446.58105	1659680.384417
37	6C	25.535726	130966.354654	1393082.901059
38	6D	26.441277	319016.580712	5546553.620034
39	7B	24.545413	152346.392231	1264565.115153

0 (0 out of 44 Selected)

Table with percent canopy cover

Indicators	Tacoma	Block B (Green)	Difference From Tacoma	Block A (Blue)	Difference From Tacoma	Block C (Yellow)	Difference From Tacoma	Block D (Red)	Difference From Tacoma
Canopy Cover	21.92	20.38	1.45	26.98	5.07	18.16	3.75	18.5	3.42

Water Bodies

Being in an urban environment often limits access to natural resources as a result water bodies are a huge attraction and a valuable resource to any neighborhood. Water bodies for our

purposes include, lakes, rivers, streams, and shorelines. They provide ecosystem services such as climate regulation, recreation and rainwater drainage (Bolund and Hunhammar, 1999). Additionally, home located within 500 feet of the coast increase the value up to 100%, with a smaller increase in value at 63% when moving farther out to 1000 feet (Sklarz and Miller, 2018). Although river and lakefront homes might not be as valuable there is still a notable difference in price (Sklarz and Miller, 2018). Drawing on this research the criteria for access to water bodies was set at residential parcels within 1000 feet.

Analyzed using method 3.

Indicators	Tacoma	Block B (Green)	Difference From Tacoma	Block A (Blue)	Difference From Tacoma	Block C (Yellow)	Difference From Tacoma	Block D (Red)	Difference From Tacoma
Water Body Access	4.41	0.22	**4.19**	2.94	**1.47**	1.16	**3.26**	0	**4.41**

Land Use

Land use was an important factor determining the make up of each neighborhood. Industrial parcels are less attractive to live by than other single-family homes would be. Industrial and commercial areas do not always have the amenities needed for a residential community and can be a home for pollution.

Analyzed using method 4. All blocked were in range of the Tacoma average for Industrial parcels. With Yellow (Definitely declining) having the most parcel coverage of 1.15% No blocks were under the average for Residential parcels however Green and Blue blocks have 3-4% more residential parcels than Yellow and Red blocks.

Indicators	Tacoma	Block B (Green)	Difference From Tacoma	Block A (Blue)	Difference From Tacoma	Block C (Yellow)	Difference From Tacoma	Block D (Red)	Difference From Tacoma
Industrial Parcels*	13.87	0.05	13.82	0	13.87	1.15	12.73	0.36	13.52
Residential Parcels*	57.9	69.14	**11.24**	70.89	**12.99**	67.58	**9.68**	66.36	**8.47**
Commercial Parcels*	2.67	2.24	0.43	3.48	0.81	3.37	0.7	0.75	1.92

Index Results

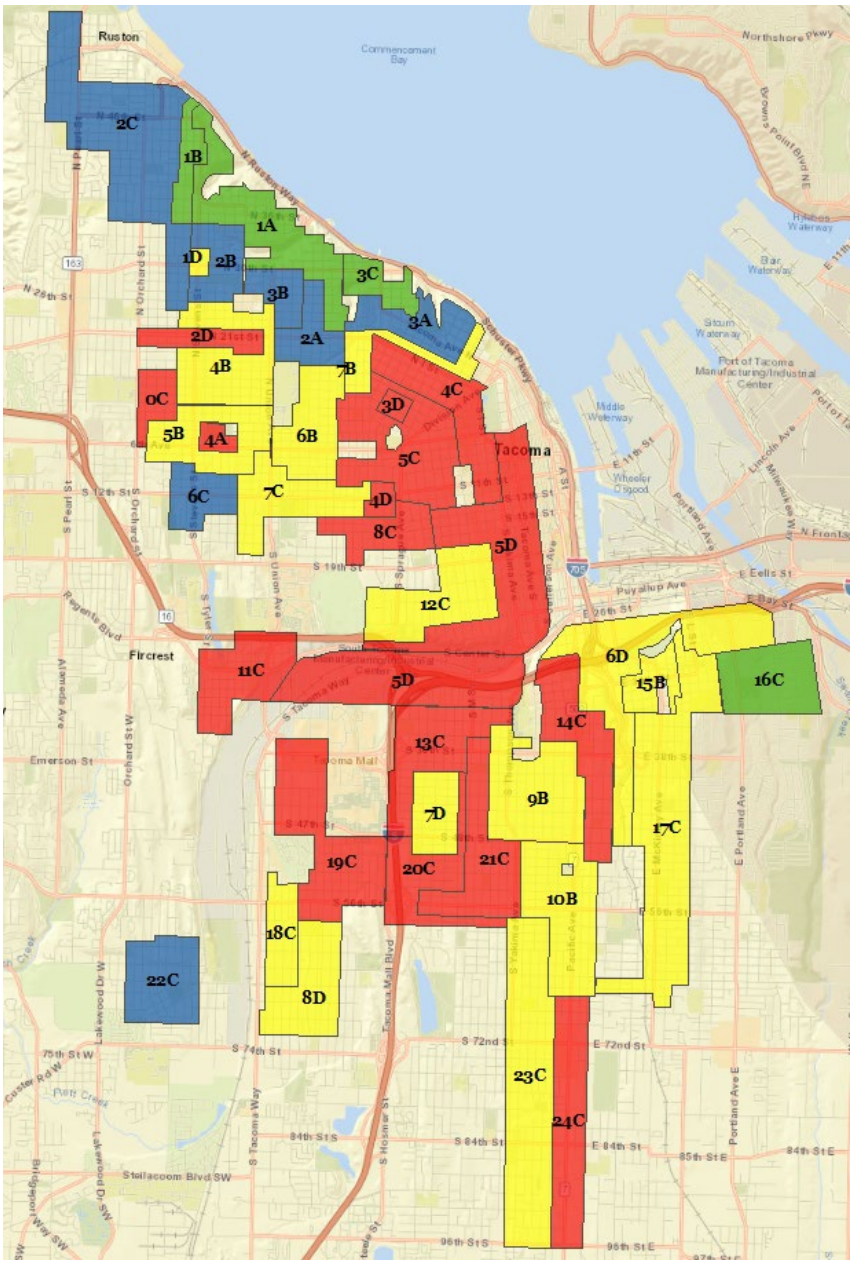
Z scores were created by dividing the mean by the standard deviation for each zone. These steps were repeated with the shape of Tacoma to receive a comparable average. Factors were weighted differently to show importance or prevent representing an over importance of a

particular item. For parks and land use there were three different categories for each. When creating the final scores for the index undeveloped parks had a lower weight than community centers, which were weighed the highest in that category. Similarly, for land use, commercial parcels had the lowest weight. However residential parcels were entered as a positive factor and industrial was listed as a negative factor.

Results show that the redline zone individually have a smaller impact on the livability of the neighborhood, however creating apparent social clusters. Historical redlining appears to be a predictor of future livability, though farther research is needed. There are noticeable differences between livability scores in districts with higher grades.

After calculating each area's score they were contrasted with original grading. Least livable areas, within the lowest standard deviation, were within 52% of all HOLC "Definitely Declining" (Yellow) areas and 50% of all "Hazardous" (Red). While all "Best" (Green) areas included only 25% lowest rated zones and "Still Desirable" (Blue) had no instances of low scoring areas.

Previously "Hazardous" (Red) graded areas showed the lowest overall scores, while "Best" (Green) zones had the highest overall scores. This implies a large gap in services and neighborhood improvements in the area. Visually the data show a clear clustering and divide in livability in the north and south ends of the city. All but two, 80%, high scoring zones are North of the I-5/ SR 16. Similarly, roughly 85% of all "Best" (Green) and "Still Desirable" (Blue) original HOLC grades being clustered within the same North area.



The Historically Green (Best) areas overall Z- score was 3.35 Standard deviations above the mean, suggesting there is a large gap between services or there is an outlier in that block. “Still Desirable” (Blue) had a total Z score of 1.04. “Definitely Declining” (Yellow) had a total Z score of -.73, relatively average for Tacoma. And finally, “Hazardous” (Red) was -1.20.

Indicators	Tacoma	Block B (Green)	Difference From Tacoma	Block A (Blue)	Difference From Tacoma	Block C (Yellow)	Difference From Tacoma	Block D (Red)	Difference From Tacoma
Industrial Parcels*	13.87	0.05	13.82	0	13.87	1.15	12.73	0.36	13.52
Residential Parcels*	57.9	69.14	11.24	70.89	12.99	67.58	9.68	66.36	8.47
Commercial Parcels*	2.67	2.24	0.43	3.48	0.81	3.37	0.7	0.75	1.92
Home Owner Rate	54.24	65.04	10.81	71.41	17.18	54.81	0.57	55.66	1.42
Fresh Food Access***	53.86	40.76	13.11	45.86	8	44.68	9.18	40.34	13.52
Without Internet Access	16.42	12.52	3.9	7.87	8.55	16.98	0.56	13.85	2.57
Crime Rate	12.37	7.88	4.48	6.37	5.99	11.76	0.6	11.67	0.7
Undeveloped Parks**	37.09	59.95	22.86	70.89	33.81	53.42	16.34	54.56	17.48
Local Parks**	54.18	69.14	14.96	70.89	16.71	67.45	13.26	66.34	12.16
Community Centers**	35.78	33.25	2.53	13.09	22.69	43.78	8	36.7	0.92
Canopy Cover	21.92	20.38	1.54	26.98	5.07	18.16	3.75	18.5	3.42
Transit Stops***	54.66	97.03	42.36	94.61	39.94	89.3	34.64	92.27	37.61
Water Body Access	4.41	0.22	4.19	2.94	1.47	1.16	3.26	0	4.41

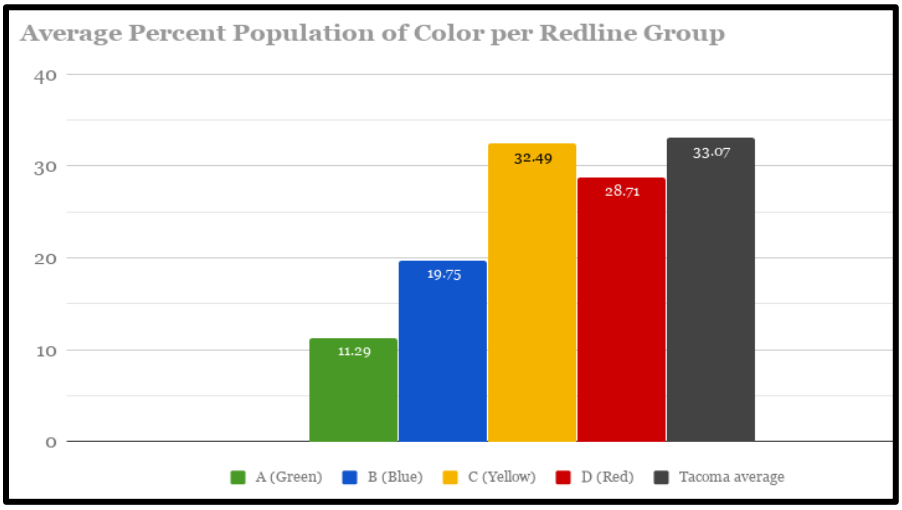
Redline_ID	IndustruialZ	ResidentalZ	CommericalZ	OwnerZ	FoodZ	InternetZ	CrimeZ	LowParksZ	MedParksZ	HighParksZ	CanopyZ	TransitZ	WaterProxZ	Total	Block Average
1A	0.100411536	0.42862627	0.350887081	1.46374704	1.55584206	-1.38658467	0.80265494	0.55239774	0.43261157	-0.2377863	3.25668878	-0.39003513	2.42668284	9.356143757	3.349223255
2A	0.100411536	-0.01573397	0.187982497	0.8445669	-0.14644157	-1.19292329	0.82057395	0.3018142	-0.01237275	0.06298809	0.80028722	0.58869203	-0.25070758	2.089137252	
3A	0.100411536	0.25316178	0.411547578	-0.18065989	0.63836547	-0.61352954	0.35819045	0.45344983	0.25690063	-0.25041733	2.1695961	-0.04967343	0.39125064	3.938593823	
4A	0.100411536	-0.1040121	-1.48116727	1.66369554	-1.19052947	-0.8133372	0.68062926	0.25203258	-0.10077457	-0.26733694	-1.06457762	0.58869203	-0.25070758	-1.986981813	
1B	0.100411536	0.08495772	0.108867243	1.22576488	1.89214736	-0.56255867	1.35417351	0.33010969	0.08845949	-0.14558488	1.7734889	0.3412148	-0.01802929	6.573422287	1.039060835
3B	0.100411536	0.17089088	0.411547578	0.85611747	0.62534582	-1.35443873	0.94603927	0.40705584	0.17451455	-0.26733694	0.48463413	0.58869203	-0.25070758	2.892765854	
2B	0.100411536	0.18334566	0.114012465	1.2530265	0.42273173	-1.51253237	0.85836566	0.41407949	0.18698708	-0.26733694	0.85216639	0.58869203	0.02026529	3.214214511	
4B	0.100411536	0.05478743	0.354959404	0.90062228	-1.08098572	-0.75051752	0.84553565	0.34158241	0.05824733	-0.20903482	-0.24607544	-1.02734628	-0.25070758	-0.908521322	
9B	0.100411536	0.19317276	-0.018112158	-0.24129321	-0.83245822	0.53982345	-0.82399788	0.01745141	0.19682688	0.20639735	-0.53068492	0.56065095	-0.25070758	-0.88251964	
15B	0.100411536	-0.03962662	0.411547578	-0.82154384	0.34265876	1.9601963	-0.79152273	-1.5667387	-0.03629936	0.2162045	-0.93068017	0.56972181	-0.25070758	-0.836378527	
5B	0.018096239	-0.03997784	-0.269534331	1.30404933	-1.17066564	-0.63430843	0.78572242	0.28814228	-0.03665124	-0.21510387	-0.48515003	0.28102034	-0.25070758	-0.425068355	
10B	0.100411536	-0.04924051	-0.534216224	0.45781993	-0.3906127	-0.0742343	-0.31581698	0.28158029	-0.04592705	0.21259864	-0.08506851	0.58191429	-0.25070758	-0.111499163	
6B	0.100411536	-0.07903994	-0.160140494	0.23893495	-1.16637206	-0.0912836	0.77353721	0.17799952	-0.07576854	0.21041625	-0.27793991	0.58508869	-0.25070758	-0.014863963	
7B	0.100411536	0.06667293	0.186869815	-0.55260824	-0.42160964	-0.52781164	0.49019851	0.18428352	0.07014992	-0.0227077	0.86644479	0.58869216	-0.13992927	0.88905667	
16C	0.100411536	0.46753486	0.254751964	-0.09713466	2.16657202	1.22687689	0.46274389	0.44778772	0.47157457	0.2142074	0.66419778	-0.8616056	-0.1430049	5.374913471	-0.728388132
3C	0.089699595	-0.00725392	-0.700403455	0.54366487	1.35313735	-1.2032616	0.57191773	0.30659614	-0.00388102	-0.26733694	1.38934678	0.58672273	2.91240807	5.571356332	
2C	0.100411536	0.15060446	0.257092911	0.19997034	1.90155261	-0.3957217	1.26136524	-0.12807561	0.06994747	0.16311503	0.6668291	-1.08540433	-0.13910715	3.022579898	
6C	0.100411536	0.2602658	0.133788515	0.76955332	-1.38621067	-0.83143076	0.76743601	0.42501905	0.26401473	0.07064102	1.03865108	0.22625561	1.37511926	3.213514492	
22C	0.100411536	0.26422138	0.237718909	-0.06651146	1.48165916	0.11752485	0.80277265	0.45968631	0.26797534	0.26082709	0.70272863	-0.65751909	-0.25070758	3.720787733	
7C	0.100411536	-0.10718365	-0.359569813	0.017654	-1.07434641	-0.41974277	0.53711767	0.13286348	-0.10395142	0.20115556	-0.30895113	0.58010717	-0.25070758	-1.05514319	
12C	-0.610473917	-0.25436306	-0.592862609	0.13540022	2.03302194	0.67531796	-0.30022181	0.15096812	-0.25133737	0.18284916	-0.71960407	0.39150294	-0.25070758	0.589489923	
17C	-0.079512958	0.14494931	0.083269052	0.19079496	0.41643737	0.95529282	0.0261696	0.17143399	0.13864858	0.243311	-0.96269961	-0.24079071	-0.25070758	0.836595831	
23C	0.100411536	0.18101724	0.073760209	0.42698883	0.6432007	1.13023205	-1.46252423	-0.40017495	0.18465464	-0.17538438	0.25864697	0.31514096	-0.25070758	1.025261984	
18C	0.100411536	0.04277198	0.334338376	0.06968534	0.46557742	-0.12589722	0.6365264	0.2884043	0.04621529	0.22830546	-1.2500051	0.58869203	-0.25070758	1.174318224	
24C	0.100411536	-0.03954333	-1.881615358	-0.57547638	0.74154361	1.6242815	-4.02344867	-1.11579257	-0.03621627	-0.17256614	-0.01755417	0.12246075	-0.25070758	-5.524223083	
4C	0.100411536	-0.54634377	0.251617424	-2.625457	-0.67312875	0.37625469	-0.08423574	-0.6509883	-0.54372911	-0.16328142	-1.17878941	0.588692	-0.25070758	-5.399685418	
5C	0.100411536	-0.16117537	-0.122946255	-1.20568628	-1.06448377	-0.66759597	-0.47302732	-0.59218435	-0.15801907	0.04582378	-0.65573096	0.12012907	-0.25070758	-5.08519255	
11C	-1.624536489	-0.62642444	-0.257114225	-2.50948903	1.01475647	2.24318002	-0.75069627	-1.23091153	-0.62392194	-0.19695053	-0.599616	-0.8824347	1.58768943	-4.456469253	
0C	0.100411536	-0.00991372	0.409661902	1.36452979	-1.08607143	-0.53866243	1.01431898	0.30509623	-0.00654454	-0.26733694	0.06021284	-5.11559625	-0.25070758	-4.020601617	
13C	0.047295605	-0.05688518	0.132399521	-0.09318664	-1.26057911	0.63426718	-0.35950865	0.02831327	-0.05358232	0.1965509	-1.05662135	-1.10224144	-0.25070758	-3.194485794	
8C	-0.513983087	-0.02816398	-0.081364697	-0.37949881	-0.96725214	-0.74435702	-0.24812567	0.29265723	-0.02482078	0.21788785	-0.74531688	0.58869203	-0.25070758	-2.884353537	
19C	-0.347688745	0.24620039	0.365193959	-1.93809388	0.34574617	0.87137005	-1.77766094	0.16612403	0.249929	0.15972455	-0.8423831	0.39803411	-0.25070758	-2.35421197	
20C	0.100411536	-0.34464814	-0.675690263	0.06798517	-0.76052717	0.78283481	-0.3242027	-0.16028636	-0.34381899	0.00954147	-0.5378436	0.28885811	-0.25070758	-2.14809372	
14C	0.100411536	0.06720085	0.396631271	-0.90937785	-0.71662158	1.1612856	-1.00458521	-0.5969964	0.0706784	0.12642066	-0.49116592	0.10293457	-0.25070758	-1.943891674	
21C	0.054644227	-0.10031726	-0.681817624	-0.06670143	-0.97351571	0.94055291	-0.27733026	-0.24559774	-0.13685312	-0.07695744	-0.51905803	0.5750422	-0.25070758	-1.758616855	
6D	-0.347123504	-0.08868616	0.376673893	-0.93790157	0.72055107	1.56983513	-1.11981042	-0.49716258	-0.08542837	0.13859877	1.19611799	-0.54818375	-0.25070758	0.126772919	-1.098108806
7D	0.100411536	0.28086611	0.411547578	0.08650364	-0.87189407	0.24272931	-0.24862956	-0.02255138	0.28464364	0.13524077	-0.02456404	0.58869203	-0.25070758	0.71228799	
8D	0.100411536	0.15212699	0.272567397	0.43219568	0.31439811	0.04340653	-0.13649742	0.39647411	0.15572359	0.24436511	-1.13901716	0.39390699	-0.25070758	0.979353882	
1D	0.100411536	-0.07059448	0.411547578	1.27224508	0.43316993	-1.77914431	1.01762259	0.27087675	-0.06731124	-0.26733694	-0.1188386	0.58869203	-0.25070758	1.540632328	
5D	0.100411536	-1.35761525	0.158143884	-1.33906326	0.59448621	1.28316381	-1.37480106	-0.5537247	-1.35614074	-0.00784634	-1.5385682	-0.27678338	-0.25070758	-5.919045062	
4D	0.100411536	0.12265679	-0.105463618	-0.74621409	-1.16074668	-0.61804936	-0.36664947	0.37985512	0.12621172	0.24003712	-0.6578604	0.58869203	-0.25070758	-2.34782688	
2D	0.100411536	0.02127475	0.411547578	0.49775641	-1.12179102	-0.52706797	0.84121143	0.31734611	0.0152087	-0.24222781	-0.20564875	-1.84739792	-0.25070758	-1.990084541	
3D	0.100411536	0.289437	0.411547578	-1.29106484	-0.58605839	-1.01325306	-0.3915303	-0.78029603	0.29322593	-0.26733694	1.00997199	0.58869203	-0.25070758	-1.886961082	

Z score Table

Discussion

Zones were symbolized in the same color system as the HOLC to assist in easily identifying HOLC area in their relation to the results of the index. Showing how these grades might have impacted future health, not to endorse or improve a redlining system. Neither race

nor income were factors in creating the index used to score areas. However, it cannot be ignored that there is a racial component to these results. Areas with the highest livability scores also have a much lower average population of people of color than Tacoma as a whole. Long term, people of color have been socially and economically restricted to areas without high quality recourses. Though we should not necessarily force diversity areas should be equitable amount races. Can we hope that in a comparable market that diversity will occur naturally (Fainstein, 2005)? The results speak to the areas which most opportunities and funding should be directed, such as improving items like food access, canopy cover and home buying loans in the South end of Tacoma.



Critical Analysis:

There were many factors that had been planned for the analysis but were not included because of time, data quality, or flaws in the analysis. The data that was included for health clinics were only public facilities which excluded private and free clinics in the area. These might be used as an alternative to traditional facilities due to other cost and access issues. This also did not include primary care facilities. Additionally, distance to health clinics was established by driving distance, the majority of Tacoma, and all areas were zoned by the HOLC were completely covered within a 5-7-minute drive time. Walk time would not be a good indicator of access, if there is a medical issue walking would be a last resort, as it might become more difficult. As a result health clinics was removed from the final index.

Sidewalks were initially included in analysis however there were concerns with the accuracy of the dataset. It appeared that each road was assigned a line on each side. There was also no way to tell quality if there was indeed a paved sidewalk or just a foot path.

For the future of this project more indicators of equity should be included. Such as public schools, and their quality, whether that be through funding or teach student ratio. Proximity to other public facilities such as libraries should also be included with the extensiveness of the facility and if activities are offered. To replace sidewalks street type should be analyzed, as large arteries are more undesirable in a neighborhood than quite residential streets.

More demographic information should be included in the future, such as income, employment, and education. It would also be interesting to examine the number of arrests per graded areas as opposed to just crime reports.

There were flaws in the data and analysis that should be cleaned up before any additional indicators of livability. Parks should include a more detailed ranking system, would require ground truthing. Owner Rate: “Owner-occupied residences were selected to avoid misrepresenting areas with high renter populations however, this may result in overestimates of foreclosures, as foreclosed homes may be counted in the numerator and not the denominator.” (Mcclure 2019). Land use data was obtained from the Department of Natural Resources and is not as detailed and up to date as local land use parcels are. Food access should also be classified by the type, quality and resources of each grocery store for a better representation of what types of foods are open to each community.

I hope to expand this project in the future.

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