New Jersey Food Desert Community Designation Methodology

As approved by the Board of the New Jersey Economic Development Authority on February 9, 2022

New Jersey faces a crisis of food insecurity that has only been exacerbated by the COVID-19 pandemic and its economic impacts on families across the state. A January 2022 US Census Bureau survey found that nearly one in 13 New Jersey households reported not having enough to eat in the last seven days.[1] In January 2021, Governor Phil Murphy signed into law the Food Desert Relief Act ("The Act" or "FDRA"), part of the Economic Recovery Act of 2020. The FDRA directs the New Jersey Economic Development Authority (NJEDA) to address the food security needs of communities across New Jersey by providing up to $40 million per year for six years in tax credits, grants, loans, and technical assistance to increase access to nutritious foods and develop new approaches to alleviate food deserts. The Act required that the NJEDA, in consultation with the Departments of Community Affairs (NJDCA) and Agriculture (NJDA), develop criteria for designation of up to 50 Food Desert Communities (FDCs) that have limited access to nutritious foods.

This report outlines the data and methodology used to develop 50 proposed FDC designations that will be used to direct resources for FDRA programs and potential future NJEDA food security programs.

The methodology to designate proposed FDCs can be summarized in six steps, as detailed in this document:

- **A literature review, a Request for Information process, and guidance from the Food Desert Relief Act** were used to identify concepts and candidate variables that could signal a food desert in New Jersey;

- **Data were collected** on the candidate variables and transformed to the block group level;

- **A proximity analysis was performed** to score block groups on their proximity to larger supermarkets in comparison to areas similar in population density and vehicle access, but higher in income;

- **The candidate variables and supermarket proximity metrics were analyzed** using factor analysis to score block groups on how much they resemble a food desert as emergent from New Jersey data;

- **The ranked food desert factor analysis scores were used to identify contiguous clusters of block groups as the proposed 50 FDCs,** while implementing minimum (1,000) and maximum (70,000) population thresholds. Counties without any food deserts from this process (Hunterdon and Sussex) received single FDCs for the areas in their county with the highest food desert factor analysis scores; and

- **Additional areas were added to the FDCs** from a new supermarket proximity analysis utilizing 2022 data and after removing larger supermarkets with below average user ratings from the analysis.

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[1]US Census Bureau, Household Pulse Survey conducted December 29, 2021 - January 10, 2022.

This comprehensive analysis resulted in the proposed designation of 50 FDCs, ordered below based on their final Composite Food Desert Factor Score, detailed in Appendix A.

New Jersey Food Desert Communities

Rank	Food Desert Community	Rank	Food Desert Community	Rank	Food Desert Community	Rank	Food Desert Community
1	North, Central & South Camden/Woodlynne*	14	New Brunswick City	27	Pleasantville/Absecon	40	Egg Harbor City*
2	Atlantic City*/Ventnor	15	Paterson North	28	Red Bank Borough	41	Burlington City
3	Newark South	16	Irvington Township	29	Lakewood North	42	Linden/Roselle
4	Newark West	17	Asbury Park City	30	Jersey City North	43	Vineland City
5	Camden East/Pennsauken	18	Jersey City South	31	Woodbine Borough*	44	Phillipsburg town
6	Trenton West	19	East Orange City	32	Long Branch City	45	Bayonne City
7	Newark North and Central	20	Penns Grove*/Carneys Point*	33	Millville/Commercial Twp*	46	Dover Town
8	Newark East	21	Elizabeth City	34	Prospect Park/Haledon/Hawthorne	47	Bound Brook Borough
9	Salem City*	22	Orange/West Orange/Montclair	35	Keansburg Borough*	48	Union City
10	Passaic City	23	Jersey City Central	36	Paulsboro Borough	49	High Bridge Borough
11	Trenton East	24	Perth Amboy City	37	Lakewood South	50	Montague Township*
12	Bridgeton/Fairfield Twp/Lawrence Twp*	25	Lindenwold/Clementon*	38	North Bergen/West New York/Guttenberg		
13	Paterson South	26	Plainfield City	39	Fairview Borough		

* Whole municipality included in FDC

Conceptualizing Food Desert Communities in New Jersey

Defining New Jersey's Food Desert Communities (FDCs) began with identifying from the food desert definition literature what concepts and variables are typically associated with the existence of a food desert. Food desert definition reports released by the Reinvestment Fund and United States Department of Agriculture (Dutko, Ver Ploeg, and Farrigan, 2012; The Reinvestment Fund, 2012; Ver Ploeg et al, 2009) and several peer-reviewed articles and studies on the topic (Jiao et al., 2012; Mulangu and Clark, 2012; Leete, Bania and Sparks-Ibanga, 2012; Walker, Keane, and Burke, 2010) were collected and reviewed. That literature review revealed several factors that influence the existence of food deserts including education, income, health outcomes, transportation access, employment, and most importantly, access to healthy food options. These were used to develop a conceptual basis for defining food deserts in New Jersey through a series of signaling variables. Forty variables were identified aligning with the concepts from the literature review, falling within twelve broad categories. Supplementing these variables were nine variables specified by the Food Desert Relief Act.

To gather grounded, locally sourced intelligence on the possible characteristics of food deserts, information from organizations and individuals with direct hands-on experience with food insecurity and healthy food access was collected through a Request for Information (RFI) process coordinated by the NJEDA.[2] Dozens of responses were received from on-the-ground stakeholders. That feedback resulted in the addition of four variables not already captured from the statute and the literature review.

Collecting Data for Analysis

After identifying the variables, data were collected from several public sources including the US Census Bureau, the NJ Department of Health, the NJ State Police, the Centers for Disease Control, the NJ Department of Labor and Workforce Development, the US Department of Agriculture, and the NJ Department of Community Affairs. Data from the 2020 Municipal Revitalization Index, which incorporates municipal poverty statistics, were also collected. The data corresponded to Census block group boundaries whenever possible, however some data was only available for census tracts, municipalities, groupings of municipalities, or school districts. Block groups are divisions of census tracts and are the smallest neighborhood geography for which American Community Survey Census data are available. The data were transformed to the block group level based on the intersection of block groups with census tract, municipal, school district, and regional boundaries. This was done to ensure that food desert areas could be more precisely identified when they appear at very small levels of geography. A full list of the data and variables collected can be found in Appendix B.

Measuring Supermarket Access

An essential component of defining Food Desert Communities (FDCs) is measuring geographic access to healthy food options. The food desert literature review revealed that access to larger supermarkets with a wider array of fresh and nutritious food options can be a good indicator of access to healthier food. Therefore, an analysis was performed to generate metrics of healthy food access based on proximity to larger supermarkets. The methodology for this analysis is derived heavily from methods used by the Reinvestment Fund in its highly respected analyses of limited supermarket access. In addition, as noted below, the ability to afford and access food – separate from geographic proximity – was also incorporated through economic factors including Supplemental Nutrition Assistance Program (SNAP), Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), and public assistance participation, income levels, poverty, and the area cost of living.

Supermarket data were purchased from a commercial data provider known as TDLinx, current as of May 2021 and January 2022. Data on a wide array of food retailers were obtained, however the scope was limited to food retailers defined as conventional supermarkets, limited assortment stores, natural/gourmet food stores, warehouse stores, military commissary stores, and conventional/wholesale clubs. To this data were added Walmart stores with a full-service grocery section, as denoted on the retailer's website. Target stores were also identified and examined but excluded due to the limited size of their grocery options.

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[2] View the RFI, "Addressing Food Insecurity in New Jersey's Food Deserts" at https://www.njeda.com/expired-rfis/

A proximity analysis was performed calculating the distance from the centroid of every block to the nearest major supermarket. Major supermarkets were defined as food retailers in one of the above categories with at least 20,000 square feet of selling area. This roughly corresponds to the average supermarket selling area size in New Jersey and was evaluated against the size of limited-selection supermarkets and grocery stores serving areas noted in the press as known food deserts.

The block-supermarket proximities were then converted to a population-weighted block group average based on the populations of the blocks. Each population-weighted block group average was divided by the average for similar block groups in terms of vehicle access and population density, but a median household income at least 20% above the area median[3]. The block group similarities were based on sixteen categories derived from sixteen different combinations of population density and vehicle access (low, moderately low, moderately high, high). These classifications aligned with the 0-25th, 25th-50th, 50th-75th, and 75th-100th percentiles on density and vehicle access. This essentially measures the degree to which a block group lacks major supermarket access based on its income profile.

Ratios of less than one were recoded as zero, as these block groups had better supermarket access than their higher-income counterparts. The ratios were then transformed into a zero to 100 scale using a regression technique to calculate **Low Access Scores**. Block groups with a Low Access Score greater than 28 (equivalent to the block group average rounded up to the nearest digit) were designated as **Limited Supermarket Areas**.

Defining a New Jersey Food Desert Community

Low Access Scores and Limited Supermarket Areas were then combined with the other identified candidate variables in a factor analysis to develop a metric that would define how much a block group resembles a food desert, as signaled by New Jersey specific data. The factor analysis process is described in detail in Appendix A. The factor analysis resulted in the identification of 24 variables that together signal the presence of a food desert.

Food Desert Factor Components

Food Retail Environment	Demographics	Economic Factors	Health Factors	Community Factors
2021 Limited Supermarket Area	% of Households with a Single-Mother Head	Unemployment Rate (block group)	% of Adults that are Obese (Health Dept. area)	% of Households with Internet Access
2021 Low Access Score	% Non-Hispanic White	Poverty Rate	% of Adults Rating Health as Poor or Fair	% of Non-seasonally Vacant Housing
Food Swamp Area	% African-American	Per Capita Income		% of Households with No Vehicle
CDC Modified Retail Food Environment Index	% Hispanic	% of Households Receiving Public Assistance		DCA Walkability Score
	% of Adults with a High School Diploma	% of Households Receiving SNAP Benefits		% of Households that are Housing Cost Burdened
		WIC Participation Rate		Municipal Violent Crime Rate, 2016-18
		Cost of Living Difference Score		

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[3]According to HUD's FY2021 Income Limits utilizing 2014-18 data

Using the results of the factor analysis, factor scores were then generated for every block group to create "Food Desert Factor Scores". The Scores for those block groups that were not Limited Supermarket Areas were adjusted to zero. The practical effect of this was to limit designation to areas not immediately adjacent to major supermarkets with at least 20,000 square feet of selling area. Moreover, block groups that were low-income or were otherwise distressed as measured by other metrics were not automatically eligible to be Food Desert Communities, given the essential qualification in the Act that a Food Desert Community be an area with limited access to food outlets that offer expansive access to nutritious foods, such as fresh fruits and vegetables.

Designating New Jersey's Food Desert Communities

The block groups with the highest Food Desert Factor Scores were selected until 50 municipalities were represented amongst the selections. All other Limited Supermarket Area block groups within the initially qualifying municipalities were selected as well. These block groups were then mapped and connector block groups added to connect non-contiguous areas. Connectors with the highest Food Desert Factor Scores were selected whenever possible. When this was not possible, the most direct connections were generally made. Food deserts with a population less than 1,000 were dropped from the listing to maintain a suitable minimum population size for each desert. Counties without any food deserts from this process had the block group (or combination of block groups) exceeding 1,000 population with the highest Food Desert Factor Scores designated as their single Food Desert Community (FDC). Hunterdon and Sussex Counties received proposed designations in High Bridge Borough and Montague Township through this process.

Next, measures were taken to ensure a maximum food desert population of 70,000. Running scenarios at multiple population thresholds determined that a maximum of 70,000 would ensure an adequate number of FDCs in larger municipalities without compromising the ability to designate multiple FDCs in less densely populated parts of the state. Adjoining FDCs in separate municipalities were combined into single FDCs where the combined FDC would have a combined population of less than 70,000. The open designation slots from this process were then assigned to the next highest ranking block groups on the Food Desert Factor Score that would meet the 1,000 population threshold either alone or in conjunction with other bordering block groups. FDCs within single municipalities that had more than 70,000 persons were then divided into separate food deserts that totaled no more than 70,000 persons each. Divisions were made based on ward and neighborhood boundaries whenever possible. With the addition of these additional FDCs, the FDCs closest to the cutoff threshold were removed until the 50 FDCs maximum was obtained again.

Additional bordering eligible block groups (meeting the Low Access Score and Limited Supermarket Area thresholds) in adjacent municipalities were then added to the existing FDCs where they would not cause the FDC population to rise above 70,000. Following the public comment period on the preliminary designations, it became clear that some supermarkets had closed since the initial analysis was conducted, some had opened, and some undesignated areas had major supermarkets that nevertheless offered limited or lower qualify food offerings. To ensure the designations included these transition areas that had strong food desert characteristics, the supermarket proximity analysis was re-run with newly opened and closed supermarkets taken into account as of January 2022. Moreover, otherwise qualifying block groups that were not

designated solely based on their lack of Limited Supermarket Area status were added to Food Desert Communities if there was evidence that their nearby major supermarkets were lower quality. This was determined by a review of the average Google rating for each supermarket relative to the average for all such supermarkets. At least 100 reviews per supermarket were required in the analysis to mitigate the influence of outlier ratings and possible duplicate reviews. This process resulted in the addition of 142 block groups to the Food Desert Communities within 14 municipalities. The Communities were ranked by the average of their highest block group Food Desert Factor Score and the populated-weighted Factor Score average for the entire FDC.

Appendix A: Factor Analysis

A series of factor analyses was performed to determine what combination of variables signal the existence of a Food Desert Community in New Jersey. Factor analysis is generally used to identify variables that are linked by a common latent, unobserved variable. In this case, that latent variable is the existence of a food desert.

To start, the data were collected corresponding to relevant variables taken from a review of the food desert literature, the language of the Food Desert Relief Act, and the Request for Information process. The data were transformed to the block group level where they were not already reported at that level. The following candidate variables were used in the factor analyses:

From statutory guidance:
- Poverty
- CDC Modified Retail Food Environment Index
- USDA Low Access Score
- Supermarket access
- SNAP enrollment
- Vehicle access
- 2020 Municipal Revitalization Index Score
- Unemployment rate
- Obesity rate
- Density

From EDA Request for Information (RFI) public feedback:
- Access to unhealthy food retailers
- Income relative to cost of living
- 2016-18 Municipal Violent Crime Rate
- % of households with internet access

From literature review/other:
- Access to transportation
- Education levels
- Health indicators
- Income and employment
- WIC and public assistance enrollment
- Housing quality
- Race and ethnicity
- Limited English proficiency
- Swingle mother % of households
- Urbanicity and geography
- Walkability
- % of students with free or reduced-price lunch
- % under age 18

The specific analytic method was an iterated principal factor analysis with orthogonal varimax rotation on all the candidate variables. Iterated principal factors have an advantage over principal component and principal factors in that they use the fitted model to generate better estimates of the latent variable through an iterative (repeating) process. Varimax rotation was selected in order to force convergence on a selective group of factors, specifically avoiding the case of a given variable loading on too many factors. After conducting the analysis, six factors emerged with Eigen Values over 1.0, the threshold for retaining a factor under the oft-cited Kaiser criterion (Kaiser, 1960).

Factor Analysis/Correlation Results

Factor	Variance	Difference	Proportion	Cumulative
Factor1	11.546	6.915	0.436	0.436
Factor2	4.631	1.122	0.175	0.611
Factor3	3.509	1.014	0.133	0.744
Factor4	2.495	0.216	0.094	0.838
Factor5	2.280	0.273	0.086	0.924
Factor6	2.006	--	0.076	1.000

Of these factors, one factor emerged as a distinctive "food desert" factor, with the highest loadings for the food swamp and retail food environment variables as well as other health, demographic, economic, educational, housing, and transportation indicators that are well-linked to food deserts in the literature. These included some racial and ethnic population variables that implicated underlying racial disparities in access to healthier food outlets.

Rotated factor loadings (pattern matrix) and unique variances – Initial factor analysis*

Variable	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	
Description	*Food Desert*	*High density, diverse, low English proficiency, walkable, transit-oriented*	*Larger households, younger population, diverse, single-mother concentration*	*Poor health outcomes*	*African-American, low educational attainment, low English proficiency*	*Vehicle commuter, shorter commutes*	**Uniqueness**
2021 Limited Supermarket Area	0.123	-0.089	-0.002	-0.029	-0.077	-0.021	0.970
2021 Low Access Score	0.177	-0.132	-0.020	0.009	-0.102	-0.014	0.940
USDA Low Access Score	-0.298	-0.270	-0.083	-0.047	-0.160	0.109	0.792
CDC Modified Retail Food Environment Index	-0.214	-0.154	-0.082	-0.057	-0.032	-0.003	0.919
Food Swamp Score	-0.019	0.043	-0.027	0.015	0.010	-0.008	0.997
Food Swamp Area	0.263	0.077	0.074	0.054	-0.043	-0.061	0.911
Housing Density (per sq. mi.)	0.263	**0.658**	-0.007	0.059	0.203	-0.154	0.429
Average Household Size	0.076	-0.268	**0.669**	-0.005	0.290	-0.061	0.387
% of Occupied Housing Units Overcrowded	**0.397**	0.252	0.261	0.035	0.351	0.042	0.585
% of Households with a Single Mother Head	**0.581**	0.079	**0.328**	-0.001	-0.026	0.075	0.543
Median Age	-0.280	-0.200	**-0.840**	-0.031	-0.063	-0.072	0.167
% Under Age 18	0.193	-0.132	**0.702**	-0.100	0.063	-0.051	0.436
% Age 65 and Older	-0.086	-0.153	**-0.837**	-0.020	-0.036	0.013	0.267
% Non-Hispanic White	**-0.628**	**-0.331**	**-0.297**	-0.093	-0.252	0.146	0.315
% African-American	**0.452**	0.223	0.194	0.022	**0.723**	0.050	0.183
% Hispanic	**0.573**	0.129	0.153	0.187	-0.315	-0.135	0.480
% with Limited English Proficiency (Age 5 and Older)	**0.420**	**0.306**	0.100	-0.026	**0.706**	-0.006	0.220
% of Population with a Disability	**0.410**	-0.189	**-0.355**	0.076	-0.061	0.054	0.658
% of Adults with a High School Diploma	**-0.711**	-0.103	-0.019	-0.029	**-0.428**	-0.068	0.295

Rotated factor loadings (pattern matrix) and unique variances – Initial factor analysis*

Variable	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	
Description	*Food Desert*	*High density, diverse, low English proficiency, walkable, transit-oriented*	*Larger households, younger population, diverse, single-mother concentration*	*Poor health outcomes*	*African-American, low educational attainment, low English proficiency*	*Vehicle commuter, shorter commutes*	**Uniqueness**
% of Adults with a Bachelor's Degree	**-0.711**	0.142	0.068	-0.283	-0.214	-0.243	0.284
Homeownership Rate	**-0.595**	-0.581	-0.102	-0.002	-0.127	-0.113	0.269
% of Housing Non-Seasonally Vacant	**0.404**	0.069	0.012	0.106	-0.182	0.013	0.787
Multifamily % of Housing	**0.351**	**0.674**	-0.044	0.012	0.024	0.000	0.420
% of Households that are Housing Cost Burdened	**0.618**	0.197	0.023	0.015	0.145	0.142	0.537
Poverty Rate	**0.765**	0.223	0.116	-0.056	-0.008	0.117	0.335
Per Capita Income	**-0.657**	0.022	-0.113	-0.250	-0.190	-0.250	0.394
% of Students with Free or Reduced-Price Lunch	**0.691**	0.277	0.097	0.395	0.190	0.034	0.243
% or Workers Walking to Work	0.249	0.501	0.039	-0.052	0.078	0.231	0.623
% with Health Insurance	**-0.389**	-0.006	**0.542**	-0.073	-0.253	-0.106	0.475
Unemployment Rate (Block Group)	**0.425**	0.000	0.032	0.056	-0.199	0.005	0.775
% of Adults with Diabetes	**0.436**	-0.045	-0.019	**0.707**	-0.040	0.046	0.305
% of Adults that are Obese	**0.480**	-0.118	-0.019	**0.676**	-0.076	0.035	0.291
% of Adults with High Blood Pressure	0.133	-0.208	-0.120	**0.544**	-0.100	0.214	0.573
% of Adults with High Cholesterol	-0.028	-0.161	-0.098	0.217	0.178	0.203	0.844
% of Adults with Heart Disease	0.045	-0.124	-0.164	**0.367**	0.021	0.233	0.766
% of Adults Rating Health as Poor or Fair	**0.546**	0.196	0.045	**0.580**	0.210	-0.024	0.280
% of Households Receiving Public Assistance	**0.439**	0.018	0.078	-0.030	-0.042	0.037	0.797
% of Households Receiving SNAP Benefits	**0.800**	0.163	0.116	-0.012	0.079	0.058	0.310

Rotated factor loadings (pattern matrix) and unique variances – Initial factor analysis*

Variable	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Uniqueness
Description	*Food Desert*	*High density, diverse, low English proficiency, walkable, transit-oriented*	*Larger households, younger population, diverse, single-mother concentration*	*Poor health outcomes*	*African-American, low educational attainment, low English proficiency*	*Vehicle commuter, shorter commutes*	**Uniqueness**
WIC Participation Rate	**0.672**	0.171	0.190	0.252	0.165	0.041	0.391
% of Households with No Vehicle Access	**0.678**	0.524	-0.086	-0.029	0.059	-0.093	0.245
% of Workers with a Commute <25 Minutes	0.184	-0.138	0.009	0.041	0.005	**0.683**	0.479
% of Workers with a Commute >45 Minutes	-0.293	0.137	-0.020	-0.090	-0.075	**-0.686**	0.410
% of Workers Commuting by Vehicle	-0.210	-0.769	-0.091	0.082	-0.068	**0.356**	0.218
% of Workers Commuting by Public Transit	0.094	**0.656**	0.084	-0.067	0.000	**-0.578**	0.215
% Population Change, 2010-19	-0.025	0.038	0.178	-0.005	0.089	0.021	0.958
Change in % Minority (Non-White) 2010-19	-0.113	-0.060	0.104	-0.067	0.184	-0.032	0.934
Change in Poverty Rate 2010-19	0.056	-0.048	0.032	-0.132	-0.036	0.054	0.972
Urban Census Tract	0.055	0.292	0.108	-0.041	0.091	0.039	0.889
DCA Walkability Score	0.317	**0.723**	0.097	0.013	0.231	0.130	0.297
2020 Municipal Revitalization Index Distress Score	**0.826**	0.155	0.091	0.360	0.098	0.034	0.145
Central City (federal 2015 Definition)	**0.519**	0.221	0.091	0.139	-0.116	-0.141	0.620
Shore Municipality	-0.032	0.007	-0.224	0.146	-0.107	0.220	0.868
% of Households with Internet Access	**-0.691**	-0.091	0.206	-0.020	-0.087	-0.082	0.458
Cost of Living Difference Score	**0.791**	0.195	0.089	0.049	0.123	-0.012	0.312
Municipal Violent Crime Rate, 2016-18	**0.759**	0.178	0.139	0.201	-0.048	-0.080	0.324

*Loading >0.30 or <-0.30 in bold

This "food desert" factor was then reduced to 24 variables, removing variables with lower factor loadings and ones with low uniqueness (not contributing much unique explanatory power to the factor). The final refined factor included the two supermarket access variables, variables signaling prevalence of healthy and unhealthy food options, and those with factor loadings exceeding 0.30 (or falling below -0.30), a common criterion in factor analysis for gauging variables of real practical significance to a factor (Peterson, 2000). The final factor, its constituent variables, and their respective loadings are shown below:

Rotated Factor Loadings (Pattern Matrix) and Unique Variances– Final Factor Analysis

Variable	Factor Loading	Uniqueness
2021 Limited Supermarket Area	0.231	0.9467
2021 Low Access Score	0.2569	0.934
Food Swamp Area	0.3004	0.9098
CDC Modified Retail Food Environment Index	-0.2775	0.923
% of Households with Internet Access	-0.6504	0.5769
% of Households with a Single Mother Head	0.6047	0.6343
% Non-Hispanic White	-0.7527	0.4335
% African-American	0.5592	0.6873
% Hispanic	0.5931	0.6482
% of Adults with a High School Diploma	-0.7492	0.4386
Unemployment Rate (Block Group)	0.3809	0.8549
Poverty Rate	0.777	0.3963
Per Capita Income	-0.6784	0.5397
% of Households Receiving Public Assistance	0.4102	0.8318
% of Households Receiving SNAP Benefits	0.8187	0.3297
WIC Participation Rate	0.746	0.4434
% of Housing Non-Seasonally Vacant	0.3819	0.8542
% of Adults that are Obese (Health Dept. area)	0.4954	0.7546
% of Adults Rating Health as Poor or Fair	0.678	0.5404
% of Households with No Vehicle	0.7435	0.4471
DCA Walkability Score	0.5178	0.7319
% of Households that are Housing Cost Burdened	0.6575	0.5676
Cost of Living Difference Score	0.833	0.3061
Municipal Violent Crime Rate, 2016-18	0.7871	0.3805

Finally, the factor loadings were converted to scoring coefficients to generate Food Desert Factor Scores.

Food Desert Factor Scoring Coefficients

(method = regression; based on varimax rotated factors)

Variable	Coefficient
2021 Limited Supermarket Area	0.039
2021 Low Access Score	0.010
Food Swamp Area	0.015
CDC Modified Retail Food Environment Index	-0.018
% of Households with Internet Access	-0.044
% of Households with a Single Mother Head	0.049
% Non-Hispanic White	-0.184
% African-American	-0.037
% Hispanic	-0.045
% of Adults with a High School Diploma	-0.092
Unemployment Rate (Block Group)	0.025
Poverty Rate	0.088
Per Capita Income	-0.086
% of Households Receiving Public Assistance	0.018
% of Households Receiving SNAP Benefits	0.133
WIC Participation Rate	0.084
% of Housing Non-Seasonally Vacant	0.025
% of Adults that are Obese (Health Dept. area)	0.041
% of Adults Rating Health as Poor or Fair	0.070
% of Households with No Vehicle	0.083
DCA Walkability Score	0.025
% of Households that are Housing Cost Burdened	0.066
Cost of Living Difference Score	0.135
Municipal Violent Crime Rate, 2016-18	0.113

Taken together, these variables signal many of the challenges associated with food deserts−lack of access to a vehicle (signaling lack of easy transportation access to healthy food options), high rates of obesity (signaling a dependence on unhealthy food), housing vacancy (historical population loss making presence of neighborhood markets less economically viable), high dependence on SNAP benefits (low discretional income for food purchases, limitation to purchasing only from stores that accept SNAP benefits), income, and unemployment (lower resident purchasing power). In addition, the demographic characteristic variables−high concentrations of single-mother headed households and African-Americans, signal the presence of groups most likely to live in food desert areas or experience food insecurity (Bower et al, 2014; Pine and Bennett, 2014; Tolzman, 2013).

Appendix B: Data Sources and Definitions

Metric	Source	Description
Supermarket	DCA analysis of 2021 and 2022 TDLinx data	Following the Reinvestment Fund's definition, stores defined as "supermarkets" are conventional supermarkets, limited assortment stores, natural/gourmet food stores, warehouse stores, military commissary stores, and conventional/wholesale clubs. This does not include superettes and small grocery stores
Major Supermarket	DCA analysis of 2021 and 2022 TDLinx data	A supermarket with a gross selling area of 20,000 SF or more, roughly equivalent to the median for all New Jersey supermarkets
Food Desert Factor Score	2021 DCA analysis	The Food Desert Factor Score is the result of a statistical technique known as factor analysis. Factor analysis reduces a large number of variables into a fewer number of factors based on the joint correlation of the variables. A series of factor analyses resulted in the identification of 24 variables that together signal the presence of a food desert. The Factor Scores were generated from the factor analysis results and demonstrate the extent to which a block group has food desert characteristics.
Population-Weighted Average Food Desert Factor Score	2021 DCA analysis	The Pop. Weighted Avg Food Desert Factor Score is computed by applying population weights (2020 Census population) for every constituent block group within a Food Desert Community to the individual block group Food Desert Factor Scores and aggregating them to obtain a Food Desert Community average
Composite Food Desert Factor Score	2021 DCA analysis	The Composite Food Desert Factor Score is the average of the Highest Block Group Food Desert Factor Score for the Food Desert Community and the Population-Weighted Average Food Desert Factor Score for that Community
Food Swamp Score	DCA analysis of 2021 and 2022 TDLinx data and NJDOL 2020 business establishment subject to UI law data	The ratio of the shortest difference to a food swamp outlet to the shortest difference to a major supermarket (20,000 SF or more), with 100 being the maximum score. Food swamp outlets are defined as convenience stores, limited-service restaurants, liquor stores, dollar stores, and grocery stores with 6,000 SF of sales area of less (the maximum size for a NJ convenience store in the TDLinx data). Measures the degree to which food outlets with limited healthy food options are closer than ones with greater options
Food Swamp Area	DCA analysis of 2021 and 2022 TDLinx data and NJDOL 2020 business establishment subject to UI law data	An area with a Food Swamp Score that is greater than zero and is a Limited Supermarket Area
2016-18 Mun. Violent Crime Rate	NJ State Police 2016-2018 Uniform Crime Reports; US Census Bureau 2016-2018 Population Estimates	Average municipal violent crime rate for 2016-2018, violent crimes per 100,000 persons
CDC Modified Retail Food Environment Index	CDC Children's Food Environment State Indicator Report, 2011	The mRFEI measures the number of healthy and less healthy food retailers within census tracts across each state as defined by typical food offerings in specific types of retail stores (e.g., supermarkets, convenience stores, or fast-food restaurants). Out of the total number of food retailers considered healthy or less healthy in a census tract, the mRFEI represents the percentage that are healthy. Data were converted from 2000 to 2010 census tract boundaries using Brown University's Longitudinal Tract Data Base conversion utility, utilizing land area as the conversion weight.

Metric	Source	Description
Cost of Living Income Difference Score	MIT Living Wage Calculator; US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	A measure of the degree to which neighborhood incomes would need to be increased to earn a living wage for the metropolitan area. Computed as the average of: 1) the percentage difference between the living wage for a single adult and the median household income for one-person households AND 2) the percentage difference between the living wage for a two-parent family with one child and one working parent and the median household income for households with own children under 18
% of Households with Internet Access	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	The percentage of households with internet access
Low Access Score (2021)	DCA analysis of 2021 and 2022 TDLinx data	The population-weighted average percent by which a block group's distance to the nearest major supermarket (as of May 2021) must be reduced to equal the reference distances for that LSA Area's block groups' population density and car ownership classes. Low Access Scores indicate the degree to which residents are underserved by supermarkets due to the lower income profile of their neighborhood. Residents of a block group with a higher Low Access Score typically travel longer distances to access a major supermarket than residents of a block group with a lower Low Access Score. Low Access Scores range from zero to 100; block groups with a Low Access Score of zero have a distance to the nearest supermarket that is less than or equal their population density and car ownership class's reference distance. Block groups with a Score of 100 have a distance to the nearest supermarket that is at least two times higher than the population density and car ownership class's reference distance.
Limited Supermarket Area (2021)	DCA analysis of 2021 and 2022 TDLinx data	Limited Supermarket Areas are defined by having a Low Access Score of at least 28, the average block group score
WIC Participation Rate	NJ Department of Health, 2019 Census Population Estimates	WIC participants divided by 2019 population, by municipality
Population	US Census Bureau, 2020 Decennial Census Summary File 1	2020 Census Block population matched to 2010 block group boundaries
Housing Density (per sq. mi.)	US Census Bureau, 2010 Decennial Census (Land Area) and 2015-19 American Community Survey 5-Year Estimates	Number of housing units (2015-19) divided by land area
Average Household Size	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Average household size
% of Occupied Housing Units Overcrowded	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Number of housing units with more than one person per room divided by all occupied housing units
Single Mother % of Households	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Female householder with no husband present and own children divided by total households
% Under Age 18	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Number of persons under age 18 divided by total population
% Non-Hispanic White	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Number of non-Hispanic white persons divided by total population

Metric	Source	Description
% African-American	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Number of African-American persons divided by total population
% Hispanic	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Number of Hispanic persons divided by total population
% of Population with a Disability	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Total population with at least one disability divided by civilian noninstitutionalized population
% of Adults with a High School Diploma	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Adults with a High School diploma or GED divided by total population aged 25 and older
% of Adults with a Bachelor's Degree	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Adults with a bachelor's degree or higher divided by total population aged 25 and older
Homeownership Rate	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Owner-occupied housing units divided by all occupied housing units
% of Housing Non-Seasonally Vacant	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Housing units not seasonally occupied divided by all housing units
Multifamily % of Housing	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Housing units in three or more unit structures divided by all housing units
% of Households that Are Housing Cost Burdened	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Number of households with housing costs in excess of 30% of income divided by total households
Poverty Rate	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Persons below the poverty level divided by total population for which the poverty level is determined
Per Capita Income	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Per capita income
% Walking to Work	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Number of persons walking to work divided by all workers age 16 and over
% of Population with Health Insurance	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Number of persons with health insurance coverage divided by total population
Unemployment Rate (Block Group)	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Number of persons unemployed divided by civilian labor force
% of Adults with Diabetes	NJ Department of Health, New Jersey State Health Assessment Data, 2011-17	Percentage of adults with doctor-diagnosed diabetes. Data covers the period between 2011 and 2017 and is for the area covered by the local Health Department the block group is served by.
% of Adults that are Obese	NJ Department of Health, New Jersey State Health Assessment Data, 2011-17	Percentage of adults with obesity. Data covers the period between 2011 and 2017 and is for the area covered by the local Health Department the block group is served by.

Metric	Source	Description
% of Adults with High Blood Pressure	NJ Department of Health, New Jersey State Health Assessment Data, 2011-17	Percentage of adults with doctor-diagnosed high blood pressure. Data covers the period between 2011 and 2017 and is for the area covered by the local Health Department the block group is served by.
% of Adults with High Cholesterol	NJ Department of Health, New Jersey State Health Assessment Data, 2011-17	Percentage of adults with doctor-diagnosed high cholesterol. Data covers the period between 2011 and 2017 and is for the area covered by the local Health Department the block group is served by.
% of Adults with Heart Disease	NJ Department of Health, New Jersey State Health Assessment Data, 2011-17	Percentage of adults with doctor-diagnosed angina or coronary heart disease. Data covers the period between 2011 and 2017 and is for the area covered by the local Health Department the block group is served by.
% of Adults Rating Health as Poor or Fair	NJ Department of Health, New Jersey State Health Assessment Data, 2011-17	Percentage of adults rating their general health as poor or fair. Data covers the period between 2011 and 2017 and is for the area covered by the local Health Department the block group is served by.
% of Households Receiving Public Assistance	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Households receiving public assistance income divided by total households
% of Households Receiving Snap Benefits	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Households receiving SNAP benefits divided by total households
% of Households with No Vehicle Access	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Households with no vehicle access divided by total households
% of Workers with a Commute <25 Minutes	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Workers with a commute less than 25 minutes divided by total workers age 16 or older
% of Workers with a Commute >45 Minutes	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Workers with a commute greater than 45 minutes divided by total workers age 16 or older
% of Workers Commuting by Vehicle	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Workers with commuting by vehicle divided by total workers age 16 or older
% of Workers Commuting by Public Transit	US Census Bureau, 2015-19 American Community Survey 5-Year Estimates	Workers with commuting by public transit divided by total workers age 16 or older
% of Students with Free or Reduced-Price Lunch	NJ Department of Education, 2019-20 Enrollment Data	% of students in school district schools (not including charters) that receive a free or reduced-price lunch
DCA Walkability Score	NJ Department of Community Affairs	DCA-computed walkability score consisting of median block size, % walking to work, and population density
2020 Municipal Revitalization Index Score	NJ Department of Community Affairs	New Jersey's official metric of municipal distress, current as of 2020
Urban Census Tract (>= 40% Urban)	US Census Bureau, 2010 Decennial Census	Census Tracts that are at least 40% urban according to the US Census Bureau

Metric	Source	Description
Central City Municipality	NJ Department of Community Affairs	DCA community classification. Principal city of a metropolitan area as identified by the US Census Bureau
Shore Municipality	NJ Department of Community Affairs	Municipalities that border the Atlantic Ocean or Sandy Hook Bay

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