Climate Smart Cities Philadelphia

MODEL CRITERIA

October 10, 2018

Goal	Goal weights	Criteria	Criteria weights	Data interpretation to scale 0 - 5	Methodology	Data (Description, Date, Resolution)	Data source
Cool	**20.0%**						
		Reduce Heat Island Hotspots	70.0%	Natural Breaks Classification: heat islands classified from 3 to 5 increasing in intensity. 95.2 - 97.9 = 3 97.9 - 101.2 = 4 101.2 - 129.1 = 5	This model identifies urban heat islands within the within the Philadelphia planning area with elevated daytime land surface temperature (LST) averaging at least 1.25 degrees Fahrenheit above the mean daily temperature during July 2016. The model results were derived from Landsat satellite data, which provides a 30m downscaled average land surface temperature over 16 day period. Data for the analysis was used from July 27, 2016. This was a cloudless and hot day with recorded temperatures high/low/mean of 94/77/86.	Landsat Land Surface Temperature was derived using a methodology developed by ESRI that converts the thermal bands of the imagery into degrees Fahrenheit using the raster function template editor. A more detailed description of the methodology can be found here - https://blogs.esri.com/esri/arcgis/2014/01/06/deriving-temperature-from-landsat-8-thermal-bands-tirs/	Landsat land surface temperature - NASA 2017
		Increase Tree Canopy Cover	15.0%	Geometrical Interval Classification where the areas with the lowest tree canopy cover are give a score of 5	This model identifies areas with a low density of tree canopy. Trees are 1. Land cover raster data from 2013 is reclassified so all tree canopy types are given value of 1 (tree canopy, tree canopy over structures, tree canopy over other impervious surfaces, tree canopy over roads) 2. Focal statistics are performed with a neighborhood of 1/8 mile (600 ft.) circle and sum statistics 3. Data is inversely reclassified on a scale of 0-5 with geometrical interval such that areas with lowest tree canopy are given value of 5.	a. Land cover, 2013, data is 1m, which was analyzed, then resampled to 7ft at the end to match other results.	a. PASDA
		Decrease Impervious Cover	15.0%	Geometrical Interval Classification where the areas with the highest impervious cover are give a score of 5.	This model identifies areas with high impervious cover. 1. From impervious surface layer, all areas are selected are not equal to '9999' (Grass layer or vegetated natural surface). 2. Resulting impervious surface and building footprints are merged. These data are derived from the same orthoimagery. 3. Focal statistics are performed with a neighborhood of 1/8 mile (600 ft.) circle and sum statistics 4. Data is reclassified on a scale of 0-5 with natural breaks such that areas with the most impervious surface are given a value of 5."	a. impervious surface, 2015, vector b. building footprints, 2015, vector	a. PASDA b. OpenData Philly

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Equity	**22.2%**						
		People of Color	12.5%	Natural Breaks Classification 59.3% - 77.8% = 3 77.9% - 91.9% = 4 92% - 100% = 5	This model identifies socially vulnerable populations based on the percent of individuals within a block group who list their racial status as a race other than white alone and/or list their ethnicity as Hispanic or Latino. The percentage of individuals identifying as a person of color were broken into 0 to 5 priority classes using a quantile slice classification. The break points for the moderate to high priority classes were as follows: Very High (5) = 92% - 100% High (4) = 77.9% - 91.9% Moderate (3) = 59.3% - 77.8% Zero block groups and parks and natural areas were removed. The model is based on data collected for the EPA Environmental Justice Screening Tool. "EPA should pay particular attention to the vulnerabilities of these populations because they have historically been exposed to a combination of physical, chemical, biological, social, and cultural factors that have imposed greater environmental burdens on them than those imposed on the general population. (http://www.epa.gov/sites/production/files/2015-05/documents/ejscreen_technical_document_20150505.pdf)"	EJSCREEN uses demographic factors as very general indicators of a community's potential susceptibility to the types of environmental factors. The EJSCREEN includes people of color, which is referred to as Percent Minority in the EPA dataset. Percent Minority is defined as the percent of individuals in a block group who list their racial status as a race other than white alone and/or list their ethnicity as Hispanic or Latino. That is, all people other than non-Hispanic white-alone individuals. The word "alone" in this case indicates that the person is of a single race, not multiracial. The source of all demographic data used in EJSCREEN is the American Community Survey (ACS) five-year summary file (2008 - 2012).	Environmental Protection Agency
		Households in Poverty	12.5%	Natural Breaks Classification 48.9% - 63.1% = 3 63.2% - 77.7% = 4 77.8% - 100% = 5	This model identifies socially vulnerable populations based on the percent of households within a block group where the household income is less than or equal to twice the federal "poverty level." The percentage of households with incomes less than or equal to twice the federal "poverty level" were broken into 0 to 5 priority classes using a quantile slice classification. The break points for the moderate to high priority classes were as follows: Very High (5) = 77.8% - 100% High (4) = 63.2% - 77.7% Moderate (3) = 48.9% - 63.1% Zero block groups and parks and natural areas were removed. The model is based on data collected for the EPA Environmental Justice Screening Tool. "EPA should pay particular attention to the vulnerabilities of these populations because they have historically been exposed to a combination of physical, chemical, biological, social, and cultural factors that have imposed greater environmental burdens on them than those imposed on the general population. (http://www.epa.gov/sites/production/files/2015-05/documents/ejscreen_technical_document_20150505.pdf)"	EJSCREEN uses demographic factors as very general indicators of a community's potential susceptibility to the types of environmental factors. The EJSCREEN includes low-income households, which is referred to as Percent Low-income in the EPA dataset. Percent Low-Income is defined as the percent of a block group's population in households where the household income is less than or equal to twice the federal "poverty level." The source of all demographic data used in EJSCREEN is the American Community Survey (ACS) five-year summary file (2008 - 2012).	Environmental Protection Agency

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Equity	**22.2%**						
		Linguistic Isolation	12.5%	Natural Breaks Classification 11.7% - 19.3% = 3 19.4% - 30.3% = 4 30.4% - 51.1% = 5	This model identifies socially vulnerable populations based on the percent of people in a block group living in linguistically isolated households. A linguistically isolated household is a household in which all members age 14 years and over speak a language other than English and also speak English less than "very well" (have difficulty with English). Block groups with linguistically isolated households were broken into 0 to 5 priority classes using a quantile slice classification. The break points for the moderate to high priority classes were as follows: Very High (5) = 30.4% to 51.1% High (4) = 19.4% to 30.3% Moderate (3) = 11.7% to 19.3% Zero block groups and parks and natural areas were removed. The model is based on data collected for the EPA Environmental Justice Screening Tool. "EPA should pay particular attention to the vulnerabilities of these populations because they have historically been exposed to a combination of physical, chemical, biological, social, and cultural factors that have imposed greater environmental burdens on them than those imposed on the general population. (http://www.epa.gov/sites/production/files/2015-05/documents/ejscreen_technical_document_20150505.pdf)"	EJSCREEN uses demographic factors as very general indicators of a community's potential susceptibility to the types of environmental factors. The EJSCREEN includes linguistically isolated households, which is referred to as Linguistic isolation in the EPA dataset. Linguistic isolation is defined as the percent of people in a block group living in linguistically isolated households. A household in which all members age 14 years and over speak a non-English language and also speak English less than "very well" (have difficulty with English) is linguistically isolated. The source of all demographic data used in EJSCREEN is the American Community Survey (ACS) five-year summary file (2008 - 2012).	Environmental Protection Agency
		Less than High School Degree	12.5%	Natural Breaks Classification 21.2% - 30.3% = 3 30.4% - 43.2% = 4 43.3% - 76.7% = 5	This model identifies socially vulnerable populations based on the percent of people age 25 and older in a block group that do not have a high school diploma. Block groups with populations without a high school degree were broken into 0 to 5 priority classes using a quantile slice classification. The break points for the moderate to high priority classes were as follows: Very High (5) = 43.3% to 76.7% High (4) = 30.4% to 43.2% Moderate (3) = 21.2% to 30.3% Zero block groups and parks and natural areas were removed. The model is based on data collected for the EPA Environmental Justice Screening Tool. "EPA should pay particular attention to the vulnerabilities of these populations because they have historically been exposed to a combination of physical, chemical, biological, social, and cultural factors that have imposed greater environmental burdens on them than those imposed on the general population. (http://www.epa.gov/sites/production/files/2015-05/documents/ejscreen_technical_document_20150505.pdf)"	EJSCREEN uses demographic factors as very general indicators of a community's potential susceptibility to the types of environmental factors. The EJSCREEN includes block groups with populations age 25 or older that have not obtained a high school diploma which is referred to as Less than high school education n the EPA dataset. Less than high school education is defined as the percent of people age 25 or older in a block group whose education is short of a high school diploma. The source of all demographic data used in EJSCREEN is the American Community Survey (ACS) five-year summary file (2008 - 2012).	Environmental Protection Agency

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Equity	**22.2%**						
		Population Over 64	12.5%	Natural Breaks Classification 18.9% - 26.7% = 3 26.8% - 37.3% = 4 37.4% - 67.3% = 5	This model identifies socially vulnerable populations based on the percent of people in a block group over the age of 64. Block groups with individuals over age 64 were broken into 0 to 5 priority classes using a quantile slice classification. The break points for the moderate to high priority classes were as follows: Very High (5) = 37.4% to 67.3% High (4) = 26.8% to 37.3% Moderate (3) = 18.9% to 26.7% Zero block groups and parks and natural areas were removed. The model is based on data collected for the EPA Environmental Justice Screening Tool. "EPA should pay particular attention to the vulnerabilities of these populations because they have historically been exposed to a combination of physical, chemical, biological, social, and cultural factors that have imposed greater environmental burdens on them than those imposed on the general population. (http://www.epa.gov/sites/production/files/2015-05/documents/ejscreen_technical_document_20150505.pdf)"	EJSCREEN uses demographic factors as very general indicators of a community's potential susceptibility to the types of environmental factors. The EJSCREEN includes block groups with populations over the age of 64 which is referred to as Individuals over age 64 in the EPA dataset. Individuals over age 64 is defined as the percent of people in a block group over the age of 64. The source of all demographic data used in EJSCREEN is the American Community Survey (ACS) five-year summary file (2008 - 2012).	Environmental Protection Agency
		Population Under 5	12.5%	Natural Breaks Classification 7.4% - 10.7% = 3 10.8% - 15.4% = 4 15.5% - 29.4% = 5	This model identifies socially vulnerable populations based on the percent of people in a block group under the age of 5. Block groups with individuals under the age of 5 were broken into 0 to 5 priority classes using a natural breaks slice classification. The break points for the moderate to high priority classes were as follows: Very High (5) = 15.5% to 29.4% High (4) = 10.8% to 15.4% Moderate (3) = 7.4% to 10.7% Zero block groups and parks and natural areas were removed. The model is based on data collected for the EPA Environmental Justice Screening Tool. "EPA should pay particular attention to the vulnerabilities of these populations because they have historically been exposed to a combination of physical, chemical, biological, social, and cultural factors that have imposed greater environmental burdens on them than those imposed on the general population. (http://www.epa.gov/sites/production/files/2015-05/documents/ejscreen_technical_document_20150505.pdf)"	EJSCREEN uses demographic factors as very general indicators of a community's potential susceptibility to the types of environmental factors. The EJSCREEN includes block groups with populations under the age of 5 which is referred to as Individuals under age 5 in the EPA dataset. Individuals under age 5 is defined as the percent of people in a block group under the age of 5. The source of all demographic data used in EJSCREEN is the American Community Survey (ACS) five-year summary file (2008 - 2012).	Environmental Protection Agency

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Goal	Goal weights	Criteria	Criteria weights	Data interpretation to scale 0 - 5	Methodology	Data (Description, Date, Resolution)	Data source
Equity	**22.2%**						
		Unemployment	12.5%	Natural Breaks Classification 21.1% - 31.3% = 3 31.4% - 45.3% = 4 45.4% - 79.8% = 5	This model identifies socially vulnerable populations based on the percent of unemployed people. Block groups were broken into 0 to 5 priority classes using a quantile slice classification. The break points for the moderate to high priority classes were as follows: Very High (5) = 45.4% to 79.8% High (4) = 31.4% to 45.3% Moderate (3) = 21.1% to 31.3% Zero block groups and parks and natural areas were removed. The model is based on data collected by the US Census Bureau. " Because low socioeconomic status often goes hand-in-hand with high unemployment, the rate of unemployment is a factor commonly used in describing disadvantaged communities. On an individual level, unemployment is a source of stress, which is implicated in poor health reported by residents of such communities. Lack of employment and resulting low income often oblige people to live in neighborhoods with higher levels of pollution and environmental degradation.(https://oehha.ca.gov/media/downloads/calenviroscreen/report/ces3report.pdf)"	The American Community Survey (ACS) is an ongoing survey of the US population conducted by the US Census Bureau. Unlike the decennial census, which attempts to survey the entire population and collects a limited amount of information, the ACS releases results annually based on a sub-sample of the population and includes more detailed information on socioeconomic factors such as unemployment.	ACS
		Population Density	12.5%	Natural Breaks Classification 32295.3 - 44743.5 = 3 44743.6 - 65955.2 = 4 65955.3 - 171579.8 = 5	This model identifies areas with the highest population density in people per square mile. 1. Block Groups with 0 population removed from analysis 2. ACS table of population joined with block group geography 3. Block group level data converted to raster 4. Raster is reclassified based on block group level polygon natural breaks. This is so the natural breaks are not skewed by the size of polygons (number of cells) after they are converted to raster Very High (5) = 65955.3 - 171579.8 people/sq. mi. High (4) = 44743.6 - 65955.2 people/sq. mi. Moderate (3) = 32295.3 - 44743.5 people/sq. mi.	ESRI Business Analyst: Businesses represent all registered businesses in the study area	ESRI Business Analyst

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Goal	Goal weights	Criteria	Criteria weights	Data interpretation to scale 0 - 5	Methodology	Data (Description, Date, Resolution)	Data source
Public health	**22.2%**						
		Asthma	25.0%	Natural Breaks Classification 11.2% - 12.2% = 3 12.3% - 13.3% = 4 13.4% - 15.3% = 5	This model identifies areas with the highest percentages of prevalence of asthma based on the CDC 500 Cities data at tract-level. 1. Tracts with 0 population (and 1 tract with population = 4) were removed from analysis, along with tracts that only contain Pennypack Park and Wissahickon Valley Park 2. Tract-level data is converted to raster 3. Raster is reclassified based on tract-level polygon natural breaks. This is so the natural breaks are not skewed by the size of polygons (number of cells) after they are converted to raster Very High (5) = 13.4% to 15.3% High (4) = 12.3% to 13.3%	500 Cities (CDC) - 2017 release	CDC
		Diabetes	25.0%	Natural Breaks Classification 13.1% - 16.3% = 3 16.4% - 19.8% = 4 19.8% - 27.3% = 5	This model identifies areas with the highest percentages of prevalence of diabetes based on the CDC 500 Cities data at tract-level. 1. Tracts with 0 population (and 1 tract with population = 4) were removed from analysis, along with tracts that only contain Pennypack Park and Wissahickon Valley Park 2. Tract-level data is converted to raster 3. Raster is reclassified based on tract-level polygon natural breaks. This is so the natural breaks are not skewed by the size of polygons (number of cells) after they are converted to raster Very High (5) = 19.8% to 27.3% High (4) = 16.4% to 19.7% Moderate (3) = 13.1% to 16.3%	500 Cities (CDC) - 2017 release	CDC

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Public health	**22.2%**						
		Obesity	25.0%	Natural Breaks Classification 30.4% - 35.1% = 3 35.2% - 39.3% = 4 39.4% - 44.9% = 5	This model identifies areas with the highest percentages of prevalence of obesity based on the CDC 500 Cities data at tract-level. 1. Tracts with 0 population (and 1 tract with population = 4) were removed from analysis, along with tracts that only contain Pennypack Park and Wissahickon Valley Park 2. Tract-level data is converted to raster 3. Raster is reclassified based on tract-level polygon natural breaks. This is so the natural breaks are not skewed by the size of polygons (number of cells) after they are converted to raster Very High (5) = 39.4% to 44.9%	500 Cities (CDC) - 2017 release	CDC
		Coronary Heart Disease	25.0%	Natural Breaks Classification 6.6% - 8.1% = 3 8.2% - 11.9% = 4 12% - 18.9% = 5	This model identifies areas with the highest percentages of prevalence of coronary heart disease based on the CDC 500 Cities data at tract-level. 1. Tracts with 0 population (and 1 tract with population = 4) were removed from analysis, along with tracts that only contain Pennypack Park and Wissahickon Valley Park 2. Tract-level data is converted to raster 3. Raster is reclassified based on tract-level polygon natural breaks. This is so the natural breaks are not skewed by the size of polygons (number of cells) after they are converted to raster Very High (5) = 12% to 18.9% High (4) = 8.2% to 11.9% Moderate (3) = 6.6% to 8.1%	500 Cities (CDC) - 2017 release	CDC

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Goal	Goal weights	Criteria	Criteria weights	Data interpretation to scale 0 - 5	Methodology	Data (Description, Date, Resolution)	Data source
Absorb	**22.2%**						
		Reduce flooding in flood-prone areas	20.0%	1% annual chance flood inundation zone with 0 - 4ft sea level rise = 5 1% annual chance FEMA flood zone = 4 2% annual chance FEMA flood zone = 3	This model assigns very high priority (5) to special flood hazards areas subject to inundation by the 1-percent-annual-chance flood event with additional hazards from sea-level rise; high priority to special flood hazard areas subject to inundation by the 1-percent-annual-chance flood event identified by FEMA; and moderate priority to areas identified as flood hazard areas subject to inundation by the 2-percent-annual-chance flood event by FEMA.	100 year flood inundation zones with 0 to 4ft sea level rise FEMA 100-yr and 500-yr flood zones	Growing Stronger (Office of Sustainability) FEMA flood zones
		Restore riparian vegetation	5.0%	nonvegetated areas in riparian areas within non contributing sub-watersheds = 5 nonvegetated areas in riparian areas within contributing sub-watersheds = 4	This model identifies areas along the hydro network that are not forested. Excludes segments of streams that are bridged, culverted, or impounded. 1. From PWD hydrology polygons, selected all stream polygons not bridged, culverted, or impounded 2. Buffer stream polygons 50' each side; dissolve resulting feature 3. Select tree canopy from PASDA layer, convert to polygon 4. Intersect tree canopy with buffered stream polygons 5. Erase the intersect result (areas with tree canopy) from the buffered stream layer to get areas lacking tree canopy 6. Erase roadways/bridges (from impervious surface 2015 layer) to remove areas that cannot be vegetated 7. Areas smaller than 0.01 acres (435.6 sq. ft.) are removed from analysis due to the noise they created (this step was recommended by TAT) 7. From remaining areas lacking tree canopy, assign value of 4 (high priority) to areas within contributing sub-watersheds; give value of 5 (very high priority) to areas within non contributing sub-watersheds	a. PWD Hydrology Polygons b. PASDA Land Cover, 2013 1m c. Impervious Surface, 2015 d. PWD Sewersheds/subwatersheds	a. PWD b. Open Data Philly c. Open Data Philly d. PWD
		Proximity to inlets	5.0%	Priority based on distance from inlet: 5 to 10 ft = 5 10 to 20 ft = 4 20 to 40 ft = 3	This model identifies and prioritizes areas closest to inlets 1. Inlets are buffered at 5', 20', 40' 2. The 5' polygon is erased out of all other buffers so there is a buffer around the inlet that will not receive a priority value 3. Remaining polygons are converted to raster and reclassified: 5-10ft = 5; 10-20ft = 4; 20-40ft = 3; >40ft = 0 Reclassify values area based on PWD GSI Planning Parcel Prioritization Overlay Model performed in summer 2017;	PWD Inlets, 2018	Philadelphia Water Department

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Goal	Goal weights	Criteria	Criteria weights	Data interpretation to scale 0 - 5	Methodology	Data (Description, Date, Resolution)	Data source
Absorb	**22.2%**						
		Protect Wetland Buffers	5.0%	Priority based on distance from wetland 50 ft from wetland = 5 50 to 100 ft from wetland = 4 100 to 150 ft from wetland = 3	1. Existing wetlands from 2005 EPA Wetlands study are buffered by 50', 100', 150' 2. Existing wetland is erased from buffer 3. Buffers for each wetland are cutoff at the boundary of the subwatershed that contains the wetland 4. Buffers are converted to raster and reclassified: 50' = 5; 100' = 4; 150' = 3	2005 EPA wetlands	Environmental Protection Agency (EPA) acquired from PWD
		Reduce Impervious Cover	40.0%	Geometrical Interval Classification where the areas with the highest impervious cover are give a score of 5.	This model identifies areas with high impervious cover. 1. From impervious surface layer, all areas are selected are not equal to '9999' (Grass layer or vegetated natural surface). 2. Resulting impervious surface and building footprints are merged. These data are derived from the same orthoimagery. 3. Focal statistics are performed with a neighborhood of 1/8 mile (600 ft.) circle and sum statistics 4. Data is reclassified on a scale of 0-5 with natural breaks such that areas with the most impervious surface are given a value of 5."	a. impervious surface, 2015, vector b. building footprints, 2015, vector	a. PASDA b. OpenData Philly
		Philadelphia Flooding Study Areas	25.0%		1. Philadelphia flooding study areas are converted to raster and given a value of 5 = very high priority This data was added at the strong recommendation of Marc Cammarata PWD and represent general areas where flooding is a stormwater management issue NOT particular flooding hotspots	Philadelphia Water Department	Philadelphia Water Department

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Spaces to Gather	**13.3%**						
		Low density of spaces to gather	100.0%	Priority based on lowest number of spaces to gather within a half mile of each block group, per 100 people 4.7 - 6.9 = 3 2.5 - 4.6 = 4 0.2 - 2.4 = 5	This model identifies areas with a high density of spaces to gather. 1. All Spaces to gather points are combined into one vector layer. 2. US Census block groups are each buffered by 0.5mi. 3. A count of spaces to gather points within each buffered census block is calculated. 4. The count of spaces to gather within in each buffered block group is divided by the number of people within the block group and multiplied by 100 to get the count of spaces to gather/neighborhood resources per 100 people. 5. Block groups are converted to raster and reclassified on a scale of 1-5 based on the number of resources per 100 people.	a. Cultural Resources b. Farmers Markets, 2017 c. Schools, 2018 d. Libraries, 2016 e. Parks/Open Space, 2017 f. Religious Organizations, 2016 g. Community Gardens, 2016 h. Recreation Centers, 2016	a. Data Arts b. Open Data Philly c. Open Data Philly d. Open Data Philly e. The Trust for Public Land ParkServe f. Open Data Philly g. Philadelhpia Horticultural Society h. Open Data Philly