Metro Providence Climate-Smart Region

Model Criteria
October 26, 2017

Goal	Goal Weights	Criteria	Criteria Weights	Methodology	Data (Description, Date, Resolution)	Data Source
Connect	16.67%					
		Connect people to Job Centers	20.00%	This model identifies the most direct routes with potential for active transportation demand for the following scenarios: 1) from center of block groups to anchor institutions (businesses with greater than 1000 employees), 2) from center of block groups to employment centers (areas with high density of large businesses of greater than 50 employees and less than 1000). No routes are longer than 2 miles. All routes were assigned moderate priority (3). Routes overlapping areas with dense population were assigned additional priority high (4) and very high (5) using natural breaks classification.	Businesses	Esri
		Create Connections to Regional Greenway trails	15.00%	This model identifies the most direct route from block group centroids to access points of the regional bike trails. First we find access points to the bike trails by intersecting them with the road layer, then routes from block group centroids are created to the access points. The routes are weighted based on the population of the block group, using Natural Breaks. No routes are longer than 2 miles.	Block Group Pop	Census
		Create Safe Routes to Schools	20.00%	Routes from the block centroids, with increasing priority for larger number of overlapping routes. In addition, routes from high school to the nearest 3 bus stops are added and given a priority of 3. No routes are longer than 2 miles.	major RIPTA stops	RTA
		Enhance Pedestrian and Bicycle Safety	0.00%	Bike and pedestrian accidents are selected from collision data from RIDOT. After geocoding the points, a kernel density surface is created and then reclassified using Natural Breaks 3 to 5. No routes are longer than 2 miles.	Existing Trails	Statewide Planning
		Reduce Bus Frequency Gaps	15.00%	Used the Park Serve tools to prioritize the gaps in public transit service areas. Used the median of the median HH income for all the zip codes (not clipped to study area) = 51728. Erased out block groups with greater than one standard deviation above the mean of the median income (51678), which is 75538. Then the gaps themselves are done with ParkServe tools, and the 10-minute walk to a bus that runs less frequently than 30 mins are given a 3	Parks, Block Groups	TPL ParkScore, Census
		Create Routes to Regional Parks	15.00%	Routes are modelled between block group centroids and the nearest major nature park. Major nature parks were determined by the TAT and are Blackstone park, Neutaconkanut, Riverside, Roger WIlliams, Merino, Slater Memorial, City, Goddard Memorial, Goddard. Routes are no longer than 2 miles, and are weighted by the population of the block group from which they originate. Natural Breaks 3 to 5.	RIPTA Bus Stops	RTA
		Improve Access to Parks (10 minute walk)	15.00%	This model identifies areas where residents do not live within at least a 10-minute walk (half-mile) of a park. All areas outside of a 10-minute walk were given a very high (5) priority.	Parks	TPL ParkScore

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Cool	16.67%					
		Reduce Daytime Urban Heat Islands (Landsat)	100.00%	This model identifies urban heat islands within the Providence Metro planning area with elevated daytime land surface temperature (LST) averaging at least 1.25 degrees Fahrenheit above the mean daily temperature during July and August. Mean temp over the whole study area is 83.7 degrees Farenheit. Above this mean the pixels are sliced into Moderate, High, and Very High priorities using Slice and Natural Breaks. The model results were derived from Landsat sateillite data, which provides a 30m downscaled average land surface temperature. Historical records show the warmest months in Providence are July and August. The model used an average of 2 Landsat scenes from July 14, 2016 and August 15, 2016	Landsat Land Surface Temperature	USGS Land Process Distributed Active Archive Center (LP DAAC)
Absorb	16.67%					
		Preserve Flood Zones (FEMA)	10.00%	This model identifies low exceedance flood areas based on the November 2016 Flood Advisory Zones developed by FEMA. Priority was assigned as follows: Very High priority (5) was is given to those areas within the 100 year floodplain (classes AE,VE) High priority (4) is given to those areas within the 500 year floodplain (.2% annual chance) Moderate priority (3) is given to those areas protected by levee	Flood Hazard Zones from National Flood Hazard Layer published by FEMA (updated 11/16). These data are a compilation of FEMA Flood Insurance Rate Maps (FIRM) and Letters of Map Revision (LOMR).	FEMA
		Reduce Potential Stormwater Runoff	35.00%	This model identifies those areas where there is potential for runoff and estimates runoff volume for a 1.2" storm event using the NRCS Curve Number methodology, which considers soil and land use characteristics combinations in estimating runoff. The 1.2" storm event was chosen to highlight water quality priorities. Small events account for transport of most pollutants in an urban landscape. (Sansalone and Cristina, 2004) Runoff levels were scored based on projected runoff using a natural breaks slice as follows: Very High Priority (5) = 0.415 - 0.673" High Priority (4) = 0.275" - 0.415" Moderate Priority (3) = 0.134" - 0.275"	SSURGO Soil Hydrologic Groups NLCD 2011 land cover Purdue Runoff Curve Number Table	NRCS NLCD Purdue University
		Improve Water Quality (TMDL)	35.00%	This model identifies priority basins based on the completion of Total Maximum Daily Load (TMDL) reports. The ratio of the number of TMDLs completed to the number of impairments is calculated. 3 = No TMDLs Complete 4 = Some TMDLs Complete 5 = All TMDLs Complete	Rhode Island TMDLs	RIDEM
		Protect Wetlands & Streams	10.00%	This model identifies wetland areas and waterbodies that can store or absorb local rainfall. All features were buffered by 200 feet. Very High priority (5) is given to all buffered features.	Wetlands and Lakes Coastal Features Rivers/Streams	RIGIS RIGIS RIDEM
		Protect Flood Prone Areas (Sinks)	10.00%	This model takes the LiDAR-derived 1m DEM, which was resampled to 10', and uses the Fill tool. This tool finds and fills Sinks. A Sink is a pixel with an undefined drainage direction - no cells surrounding it are lower. These indicate areas in which water will pool. To isolate the sinks, the raster with the filled sinks is subtracted from the original DEM. Lake areas are subtracted from this result. Sinks are given priority based on depth: Moderate: 0.01ft - 2ft High: 2ft - 29ft Very High > 29ft	10' Digital Elevation Model	RIGIS

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Protect	16.67%					
		Minimize Land Loss (Sea-Level Affecting Marshes Model)	10.00%	This model identifies priority based on land loss due to sea level rise using Rhode Island's STORMTOOLS model. The SLAMM model examines not only inundation but also looks at sediment and organic matter accumulation on the marshes, as well as erosion, to predict changes in coastal wetlands and shorelines. Wetlands are critical natural infrastructure that can minimize the impacts of storm surge. This model prioritizes where new tidal habitat is predicted in 1ft, 3ft, and 5ft sea level rise scenarios: 1ft new tidal habitat = 5 (very high), 3ft new tidal habitat = 4 (high), 5ft new tidal habitat = 3 (moderate) "STORMTOOLS is a method to illustrate and display storm inundation, with and without sea level rise, for different types of storms that could occur along Rhode Island's coast line. The mapping application is available in two forms, Beginner and Advanced." (http://www.beachsamp.org/stormtools/)	SLAMM Land Loss (i.e Sea-Level Affecting Marshes Model)	RI Stormtools
		Preserve Coastal Flood Zones (0' SLR)	20.00%	This model identifies priority based on coastal inundation due to major storms under current sea level (0-ft SLR). Priorities were identified for the following snearios: 100-yr storm inundated area = 5 (very high), 500-yr storm inundated area = 4 (high).	Current Flood Zones	RI Stormtools
		Protect Future Flood Areas (2035, 100-yr flood depths)	15.00%	This model identifies priority based on coastal flood risk from a 100-yr storm under a 1-ft SLR (2035) scenario. Priorities were assigned based on the following flood depths: 0.01 ft - 1.5ft predicted flood depth = very high (5) 1.51 ft - 2.5ft predicted flood depth = high (4) 2.51ft - 3.5ft predicted flood depth = moderate (3) 3.51ft - 4.5ft predicted flood depth = low (2) >4.5ft predicted flood depth = very low (1)	Future Flood Scenario, 1' SLR, 100-yr flood	RI Stormtools
		Protect Future Flood Areas (2055, 100-yr flood depths)	15.00%	This model identifies priority based on coastal flood risk from a 100-yr storm under a 3-ft SLR (2055) scenario. Priorities were assigned based on the following flood depths: 0.01 ft - 1.5ft predicted flood depth = very high (5) 1.51 ft - 2.5ft predicted flood depth = high (4) 2.51ft - 3.5ft predicted flood depth = moderate (3) 3.51ft - 4.5ft predicted flood depth = low (2) >4.5ft predicted flood depth = very low (1)	Future Flood Scenario, 3' SLR, 100-year flood	RI Stormtools
		Protect Future Flood Areas (2100, 100-yr flood depths)	10.00%	This model identifies priority based on coastal flood risk from a 100-yr storm under a 7-ft SLR (2100) scenario. Priorities were assigned based on the following flood depths: 0.01 ft - 1.5ft predicted flood depth = very high (5) 1.51 ft - 2.5ft predicted flood depth = high (4) 2.51ft - 3.5ft predicted flood depth = moderate (3) 3.51ft - 4.5ft predicted flood depth = low (2) >4.5ft predicted flood depth = very low (1)	Future Flood Scenario, 7' SLR (year 2100) , 100-yr flood	RI Stormtools
		Reduce Nuisance Coastal Flooding (1, 3, 5, 10 yr floods, 0' SLR)	20.00%	This model identifies priority based on coastal flood risk due to more common storms (1, 3, 5, and 10-yr storms). Priorities were assigned based on the following flood depths: 1-yr storm inundation area = very high (5) 3- and 5-yr storm inundation area = high (4) 10-yr storm inundation area = moderate (3)	Nuisance Flooding (1, 3, 5, 10 yr floods)	RI Stormtools
		Reduce Mid Exceedance (25 & 50 yr floods, 0' SLR)	10.00%	This model identifies priority based on coastal flood risk due to mid-exceedance storms (25 and 50-yr storms). Priorities were assigned based on the following flood depths: 25-yr storm inundation area = very high (5) 50-yr storm inundation area = high (4)	Mid Exceedance (25 & 50 yr floods)	RI Stormtools

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Climate Equity	16.67%					
		Low Income HH	14.29%	This model identifies 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 natural breaks slice classification. The break points for the moderate to very high priority classes were as follows: Moderate (3) = 36% - 49% High (4) = 50% - 67% Very High (5) = 68% - 100% The airport area is removed from the analysis. The model is based on data collected for the EPA Environmental Justice Screening Tool. (http://www.epa.gov/sites/production/files/2015-05/documents/ejscreen_technical_document_20150505.pdf)"	Low Income HH	EPA 2016
		Minority Population	14.29%	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 natural breaks slice classification.The break points for the moderate to very high priority classes were as follows: Moderate (3) = 42% - 59% High (4) = 59% - 77% Very High (5) = 77% - 100% The airport area is removed from the analysis. The model is based on data collected for the EPA Environmental Justice Screening Tool. (http://www.epa.gov/sites/production/files/2015-05/documents/ejscreen_technical_document_20150505.pdf)"	Minority Population	EPA 2016
		Linguistic Isolation	14.29%	This model identifies 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 natural breaks slice classification. The break points for the moderate to very high priority classes were as follows: Moderate (3) = 14% - 22% High (4) = 23% - 34% Very High (5) = 35% - 70% Block groups with less than 100 people and parks and natural areas were removed. The model is based on data collected for the EPA Environmental Justice Screening Tool. (http://www.epa.gov/sites/production/files/2015-05/documents/ejscreen_technical_document_20150505.pdf)"	Linguistic Isolation	EPA 2016

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		Less than High School Education	14.29%	This model identifies vulnerable populations based on the percent of individuals age 25 and over with less than high school degree. Block groups with individuals age 25 and over with less than high school degree were broken into 0 to 5 priority classes using a natural breaks slice classification. The break points for the moderate to very high priority classes were as follows: Moderate (3) = 16% - 25% High (4) = 26% - 38% Very High (5) = 39% - 79% The airport area is removed from the analysis. The model is based on data collected for the EPA Environmental Justice Screening Tool. (http://www.epa.gov/sites/production/files/2015-05/documents/ejscreen_technical_document_20150505.pdf)"	Less than High School Education	EPA 2016
		Age over 64	14.29%	This model identifies 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 natural breaks slice classification. The break points for the moderate to very high priority classes were as follows: Moderate (3) = 15% - 20% High (4) = 21% - 29% Very High (5) = 29% - 61% The airport area is removed from the analysis. The model is based on data collected for the EPA Environmental Justice Screening Tool. (http://www.epa.gov/sites/production/files/2015-05/documents/ejscreen_technical_document_20150505.pdf)"	Age over 64	EPA 2016
		Age under 5	14.29%	This model identifies 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 very high priority classes were as follows: Moderate (3) = 7% - 10% High (4) = 11% - 14% Very High (5) = 14% - 24% The airport area is removed from the analysis. The model is based on data collected for the EPA Environmental Justice Screening Tool. (http://www.epa.gov/sites/production/files/2015-05/documents/ejscreen_technical_document_20150505.pdf)"	Age under 5	EPA 2016
		People with a Disability	14.29%	This model identifies areas with a high percentage of population with a disability. The input data is from American Community Survey 5 year estimates of percent of the population with a disability. Percent of the population was calculated using disability estimates and total population by tract. The airport is removed from the analysis. The break points for the moderate to very high priority classes were as follows: Moderate (3) = 13% - 15% High (4) = 16% - 18% Very High (5) = 18% - 36%	People with a Disability	US Census Bureau

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Critical Infrastructure	16.67%					
		Essential emergency services	20.00%	This model assigns critical infrastructure risk based upon density of locations of critical emergency services. Key emergency services are EMS stations, police stations, hospitals, and fire stations. A Kernel Density of facilities was derived using 1/4 mile search radius. The resulting point density raster was broken into priority classes using reclassify tool and a natural breaks classification using scale of 0 and 3 to 5.	EMS Stations, Fire Stations, police stations, hospitals	RIGIS
		Critical transportation infrastructure	20.00%	This model assigns critical infrastructure risk based upon density of locations of critical transportation infrastructure. Key transportation infrastructure includes evacuation routes, bridges, railroads, airports, and major transit routes and stops. Kernel density of critical transportation infrastructure lines including ramps, bridges, evacuation routes, public transportation routes, and railroads were derived using 1/8 mile search radius. The resulting density raster was broken into priority classes using reclassify and a natural breaks classification using a scale of 3 to 5. A Kernel Density of bus stops was derived using a search radius of 1/4 mile and classified into 3 to 5. The airport was reclassified as 5. All rasters were combined using cell maximum.	railroads, major roads bus routes, bus stops, airports Hurricane evacuation routes	Esri RIGIS/RIPTA RIDOT
		Key utility infrastructure	20.00%	This model assigns critical infrastructure risk based upon density of locations of utility infrastructure. Utility facilities include wastewater treatment facilities, sewer pumping stations, wastewater outfall locations, sewer overflow locations, landfills, gas lines, and electric lines. Kernel Density of utility facilities was derived using 1/4 mile (equivalent to 5 minute walk) radius. The resulting density raster was reclassified into a priority scale of 3 to 5. Point and line kernel density surfaces were combined using call maximum.	Wastewater treatment facilities, sewer pumping stations, wastewater outfall locations, sewer overflow locations, landfills, gas lines, and electric lines.	RIGIS
		Dependent population facilities	10.00%	This model assigns critical infrastructure risk based upon density of locations of dependent population facilities. Dependent Population facilities include prisons, Assited Living facilities, Nursing homes, temporary shelters (i.e. homelss shelters), pet shelters, childcare locations, ambulatory care facilities. Kernel Density of dependent population facilites was derived using 1/4 mile (equivalent to 5 minute walk) circular radius. The resulting density raster was broken into priority classes using reclassify and a natural breaks scale of 3 to 5.	prisons, Assited Living facilities, Nursing homes, temporary shelters (i.e. homelss shelters), pet shelters, childcare locations, ambulatory care facilities	RIGIS
		Cultural and institutional facilities	10.00%	This model assigns critical infrastructure risk based upon density of locations of institutional facilities. Institutional facilities include colleges, universities, historic facilities, and libraries. Kernel Density of institutional facilities was derived using 1/4 mile (equivalent to 5 minute walk) circular radius. The resulting density raster was broken into priority classes using a natural breaks reclassification to a scale of 3 to 5.	Universities, historical locations, city and town halls, libraries, major state government facilities and muncipal police facilities including higher educational institutions, RIDOT storage and maintenance facilties and RIDEM division locations.	RIGIS

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		High potential loss facilities	10.00%	This model assigns critical infrastructure risk based upon density of locations of high potential loss facilities. High potential loss facilities include dams and point-source pollution sites. Kernel Density of high potential loss facilities was derived using 1/4 mile (equivalent to 5 minute walk) circular radius. The resulting density raster was broken into priority classes using a natural breaks reclassification to a scale of 3 to 5.	dams, RIDEM permitted discharge points	RIGIS
		Other emergency facilities	10.00%	This model assigns critical infrastructure risk based upon density of locations of other emergency facilities. Other emergency facilities include community centers, dialysis centers, and schools. Kernel Density of high potential loss facilities was derived using 1/4 mile (equivalent to 5 minute walk) circular radius. The resulting density raster was broken into priority classes using a natural breaks recalassification to a scale of 3 to 5.	public and private schools, community Centers, Dialysis Centers	RIGIS