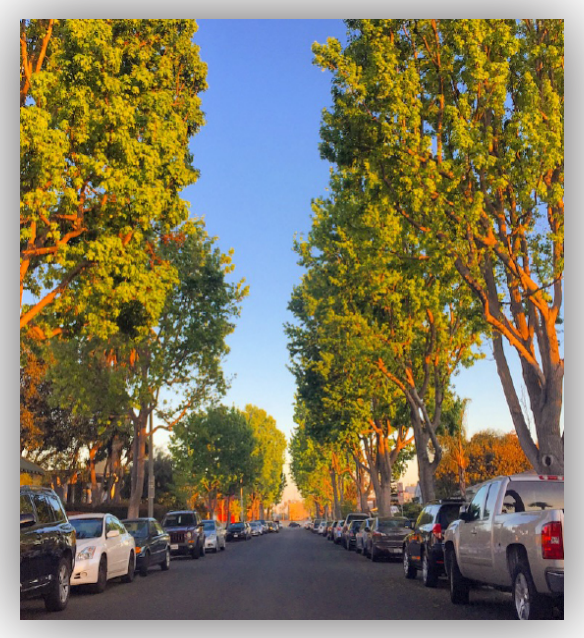
City of Santa Monica
Public Works Department
Public Landscaping Division

Street Tree Planting Priority Model
(2017 – 2021)



A presentation by

City of
Santa Monica®

John K. Pedersen

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Disclaimer

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Santa Monica's Urban Forest and a Planting Priority Plan

The purpose of this study is to answer the following question: *where should the replanting of Santa Monica's approximately 2,000 vacant street-tree sites be prioritized, over a period of five years and at a rate of 400 trees per year?*

The planting priority results evaluated in this paper provide a blueprint for addressing the future replanting of street trees for the next five years, and operationalizes a method for a planting priority plan to be put into action.

In Santa Monica, an extensive urban forest system consists of both publicly and privately owned trees. Privately owned trees are maintained by residents and businesses, whereas publicly owned trees are maintained by the city. In this study we do not account for privately owned trees and instead focus only on public trees on city streets.

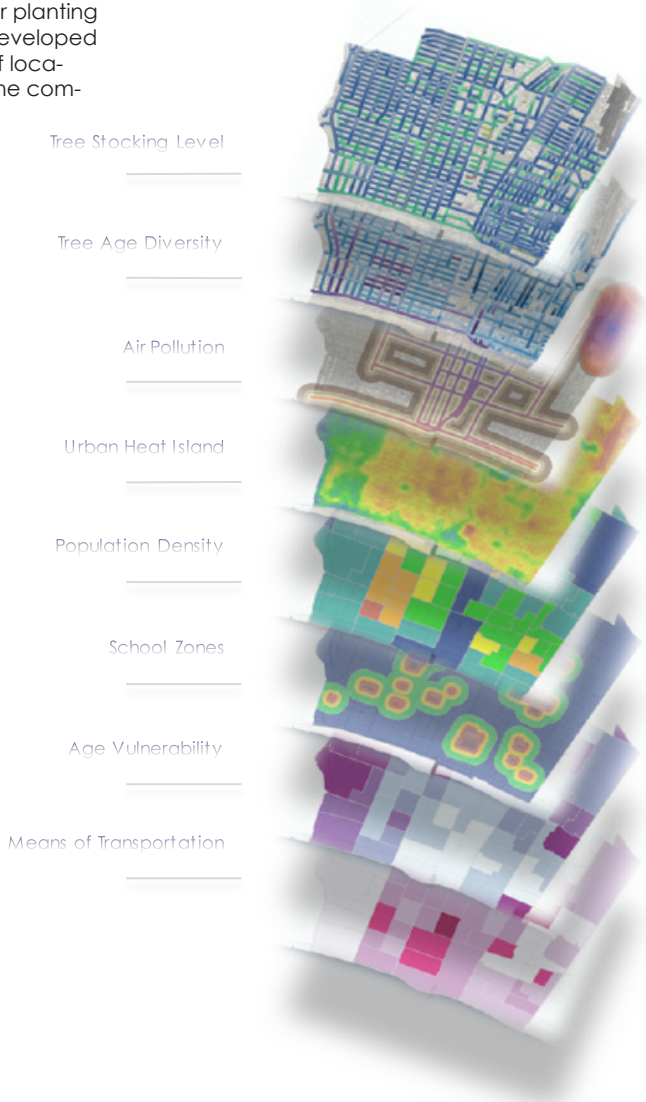
The City has approximately 36,000 suitable locations for city trees, of which there are roughly 33,700 trees currently planted with 2,300-2,400 sites suitable for planting. Of these sites, about 350 are located within public spaces, like parks, that may be planted with fewer constraints

The remaining 2,000 plus trees are located on city streets where the City of Santa Monica's Urban Forest Task Force has expressed concern over planting priorities. This exercise focuses on these remaining trees to develop a five-year planting program that aims to plant 400 trees per year in these locations.

To find the most suitable locations for planting priority, a computer model has been developed in this study to assess the significance of locations based on a variety of concerns. The computer model is created with the use of a geospatial information system – a "GIS" – to create, manage, and manipulate geographic data in a desktop environment.

The GIS model developed in this analysis is contingent upon data inputs specified by the user. In the model, a weighted analysis of three inputs is performed: urban forest assessments, environmental need, and population vulnerability indices.

Each input is weighted equally to create a fair and balanced report on where planting should occur first. This study has strived to be objective in scope and certain subjective inputs, such as land use and incomes, were omitted from this exercise to eliminate subjectivity with regard to preferences.



Santa Monica, CA

Welcome to Santa Monica!

The City of Santa Monica is surrounded by Los Angeles neighborhoods, including Pacific Palisades and Brentwood to the north, West Los Angeles to the east, and Venice and Mar Vista to the south, with the Pacific Ocean to the west.

Santa Monica is a part of Los Angeles County and the greater Los Angeles area, the second-largest urban region in the US. The region has a mild Mediterranean climate with moderate weather conditions year-round, making it a major local, and regional, tourist destination.

The City is approximately 8.4 square miles, is serviced by a municipal airport (SMO), the Santa Monica freeway (10), the Pacific Coast Highway (State Route 1), and the recently opened Expo line of the LA Metro, connecting the city to the greater metropolitan area by transit rail. Santa Monica has its own bus system, the Big Blue Bus, is one of the top 10 most bike-friendly cities in the US, and its city streets receive high walk-ability scores.[1]

Notable attractions include the Santa Monica Pier, Pacific Park, the 3rd Street Promenade shopping district, Main Street and Montana Avenue shops, the Bergamot Station art district, Downtown Santa Monica, and the Santa Monica State Beach.

The Greater Los Angeles Area and Santa Monica

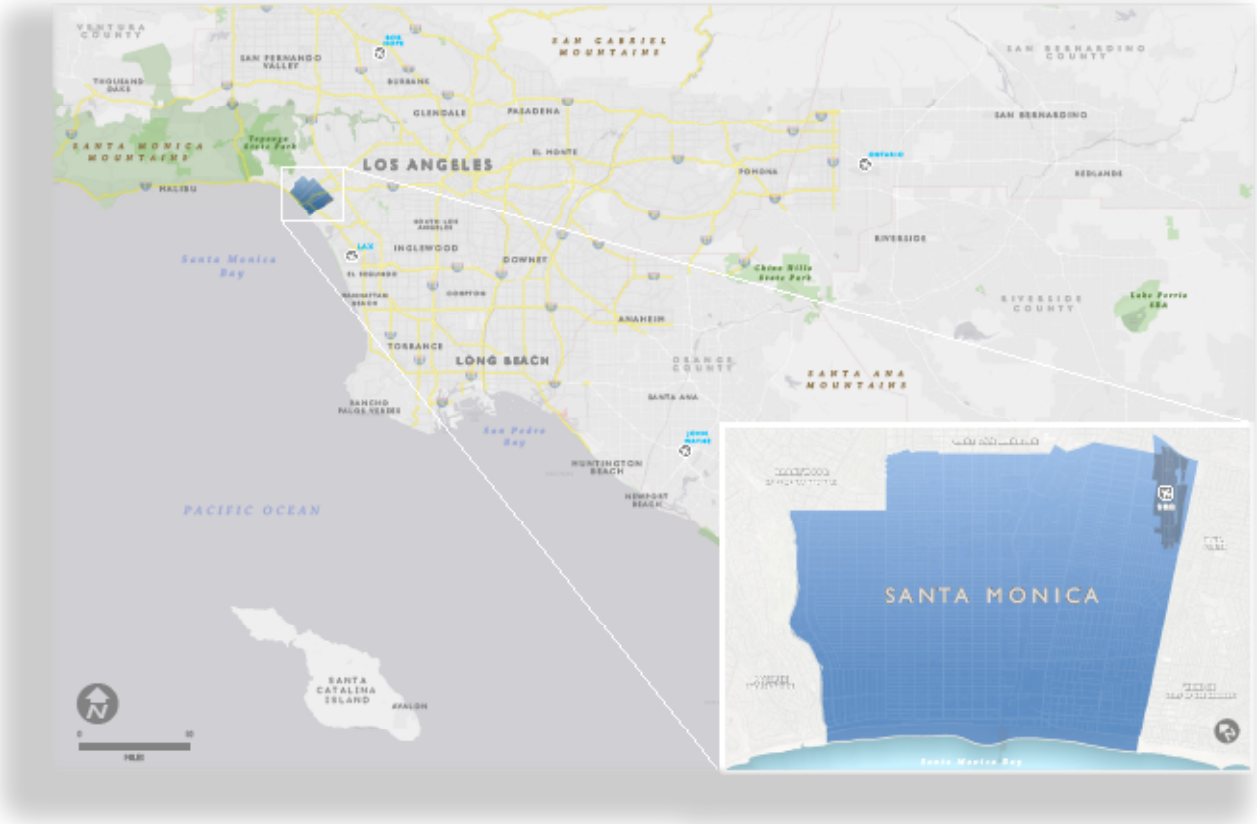


Figure 1. An overview of Santa Monica and the greater Los Angeles area.

Image credits. Esri, Inc.

A Brief History of the Urban Forest in Santa Monica

The terrain of Santa Monica and its tree species are vastly different today than a few hundred years ago. Prior to exploration and colonization by the Spanish, in the 16th and 18th centuries, respectively, the Tongva people lived amongst grassland and coastal sage scrub, where tree species such as sycamores, cottonwood, and willow grew on the river banks, and oak woodland resided inland.

Following Spanish rule, the Mexican Republic established land grants, and under private ownership the land was eventually sold to Colonel Robert S. Baker and U.S. Senator John P. Jones of Nevada. Soon after, in 1886, the City of Santa Monica was incorporated; residential lots were sold, the land was developed, and a grid of streets were laid out.

The first city trees were planted in the 1880s, including palm, fig, and eucalyptus species. Abbot Kinney, a Chairman of the State Forestry Board and developer of the Venice canals, served as an integral figure in Santa Monica's urban forest. Street tree planting soon began on Ocean Avenue and a Master Street Tree Planting Program was implemented in 1953.[2]

The first five-year tree planting program commenced in 1956 with thousands of trees planted on city streets. In years since, inventories of city trees were established and additional planting projects have added canopy cover to city streets and parks.

The urban forest today is an important environmental resource and a green element of its city infrastructure. Trees provide numerous environmental benefits including: improvement of air quality, a reduction in storm water runoff, a reduction in the urban heat island effect by providing canopy shade, sequestration of carbon (a greenhouse gas) from the atmosphere, and lower irrigation usage in places of lawns or water-intensive landscapes.[3]

The U.S. Forest Service's Center for Urban Forest Research conducted a benefit-cost analysis in 2001, finding that municipal funds spent on Santa Monica's urban forest receive higher returns (for each $1 spent, residents attain $1.62 in environmental benefits). Annual environmental benefits of city trees are calculated at a value of over $5 million. [4] Today, Santa Monica is recognized by the Society of Municipal Arborists with highest honors for their tree care and comprehensive management practices. [5]

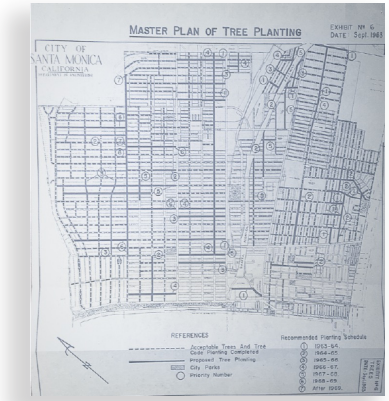


Figure 2a. One of the first original tree planting plans from the 1960s. [6]

Figure 2b. Urban Forest Master Plan document, 2011

The Urban Forest Master Plan

An Urban Forest Master Plan was created by the City of Santa Monica to address concerns of the city's public tree canopy system. [7] A Task Force Panel was appointed by City Council in 2009, and today conducts periodic meetings with City staff, community members and residents, and professional experts, to ensure the urban forest remains healthy for generations in the future.

The urban forest master plan of 2011 has recently been revised and a new draft plan will be sent to City Council for approval in January 2017. The findings of this study will be incorporated into the updated Urban Forest Master Plan.

Districts of Santa Monica

The City of Santa Monica consists of various permitted zoning areas, including, but not limited to: commercial, industrial, transportation, city designated parks, and residential developments. Planned land use sets a general direction of the overall zoning ordinance for the city, where housing, commercial space, industrial parks, and public use space is designated proper for certain habitations, economic activities, or infrastructure.

Planned Land Use

Figure 3a. Plannned land use map for Santa Monica.

The Land Use and Circulation Element (LUCE) is a component of Santa Monica's General Plan. [8] The city document pertains to the establishment of a more direct vision of urban design, transit goals, and a general plan for the next 20 years, reflecting concerns of the community.

The map displayed below shows the City of Santa Monica's LUCE districts. Each district is defined by a common set of activities or uses within its boundaries, whether it is shopping, manufacturing, leisure, healthcare, transportation, open space, or civic, in nature.

Land Use and Circulation Element "LUCE"

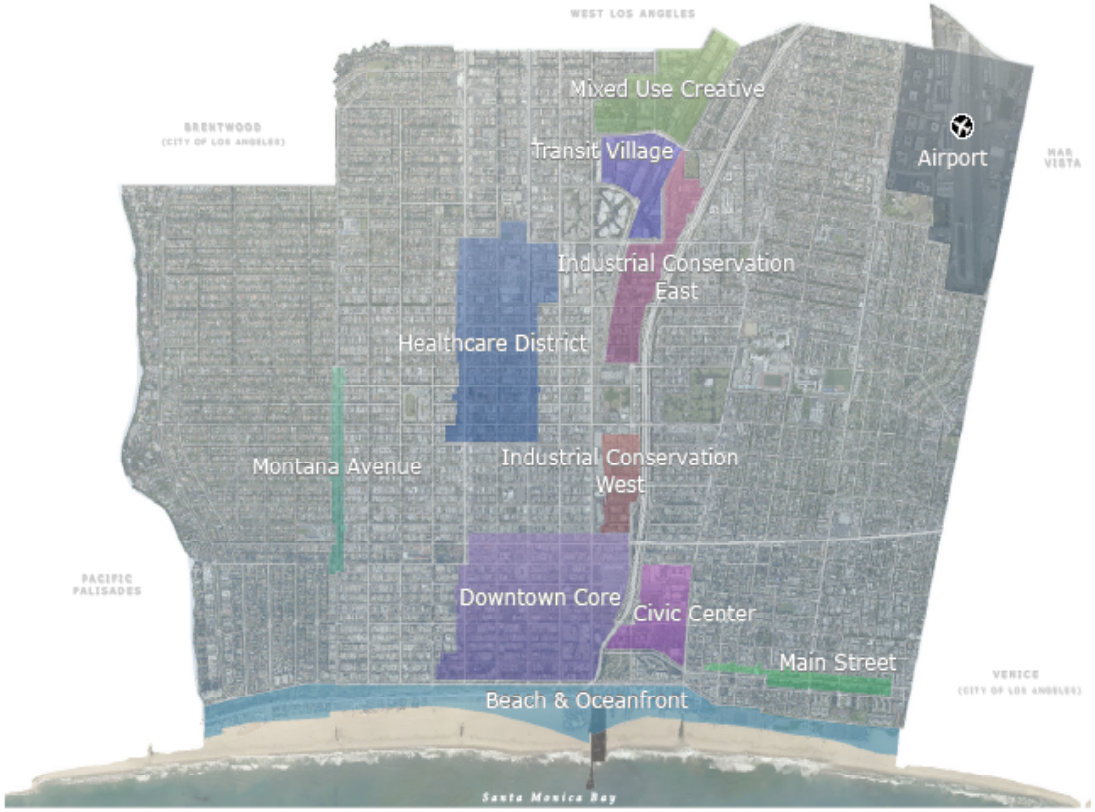


Figure 3b. City of Santa Monica official Land Use and Circulation Element.

Neighborhoods in Santa Monica

Although there exist many unofficial districts and smaller neighborhoods within the city confines, the City of Santa Monica recognizes just seven neighborhood associations. [9] Each is a non-profit organization represented by a group of volunteers to address concerns of the community and work for the public benefit of their resident neighbors.

Some common issues discussed in committee meetings typically include: land use and development, parking and traffic, public health, safety, historical preservation, and the local environment.

Table 1. City of Santa Monica neighborhood associations.

NEIGHBORHOOD ASSOCIATIONS
Friends of Sunset Park
North of Montana Association
Northeast Neighbors Association
Ocean Park Association
Pico Neighborhood Association
Santa Cruz Mid-City Neighbors
Wilshire/Montana Neighborhood Coalition

Neighborhood associations often meet with the Public Landscape Division to ensure their respective neighborhoods and streets are given equal representation in regards to tree planting, tree maintenance, and the benefits of Santa Monica's urban forest considerations.

The downtown district has recently formed a neighborhood association, known as "DNA" (Downtown Neighborhood Association). However, the organization is still in its formative stage and overlaps other neighborhoods, including Pico.

Neighborhood Associations in Santa Monica

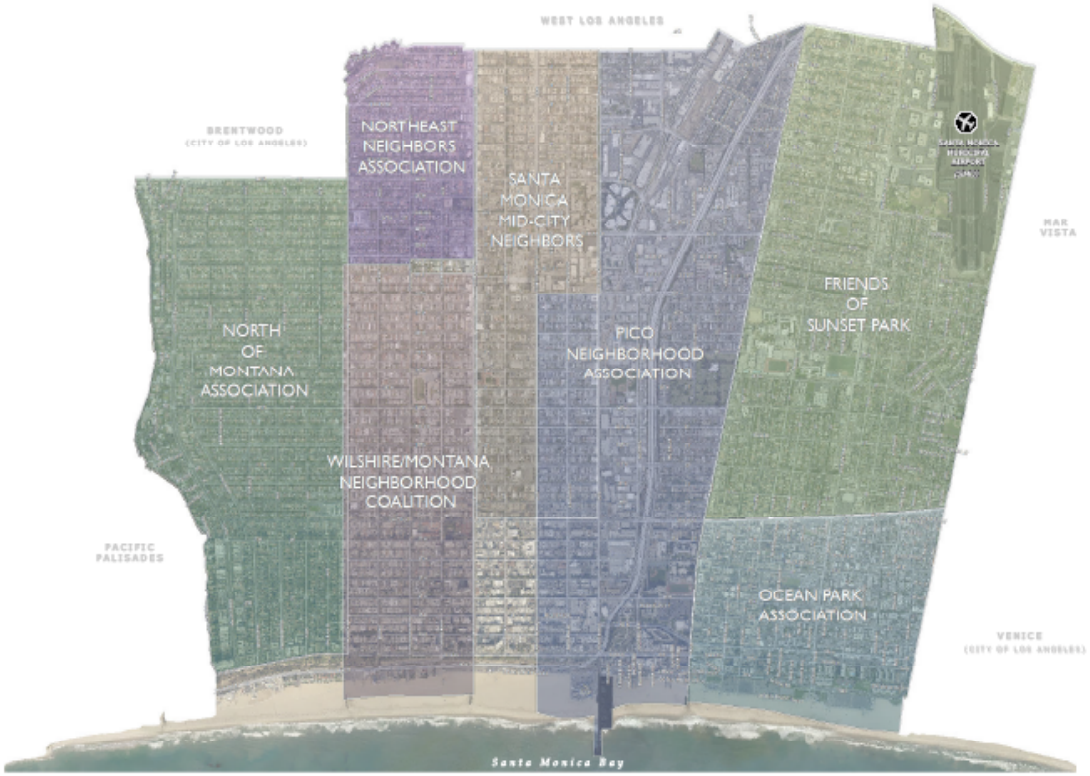


Figure 4b.. Neighborhood associations recognized by the City of Santa Monica.

MATERIALS AND METHODS

Resources

In this paper, data has been derived from the City of Santa Monica Information Systems Department, the US Census Bureau, the NASA/USGS Landsat Satellite program, West Coast Arborists, Inc., Google Maps, Google Earth, and the Los Angeles Region Imagery Acquisition Consortium (LARIAC) Program.

Computer Programs

The following programs were used in this study: ESRI ArcGIS 10.2.1, ArcGIS ModelBuilder, Python 2.7, ENVI, Adobe Photoshop, InDesign and Acrobat, MS Word, Excel, PowerPoint, Google Maps, Google Earth, Google Street view, and Instagram photo editor.

Data

URBAN FOREST METRICS

Tree Stocking Level

West Coast Arborists, a professional tree maintenance and management company, keeps a running inventory of both planted and vacant tree sites for the City of Santa Monica.[10] This data may be accessed online through their inventory software program, ArborAccess.[11] The stocking inventory is frequently updated with new plantings and tree removals and a list of current vacant sites can be queried and downloaded in tabular format.

Upon download, the data fields must be managed before insertion into a GIS for analysis. A city data file containing the approximately 400 street segments required for this analysis can be accessed through the City of Santa Monica Information Systems Department (ISD). To filter the tree sites that fall within public spaces, a feature class containing public facilities (government buildings, parks, hospitals, etc.) is used for selection purposes.

Tree Age Diversification

To access tree age, a feature class containing the geographic locations and attribute data can be accessed through the Santa Monica ISD. The feature class contains two attribute fields that represent tree age: tree height and diameter at breast height (DBH) values.

From these two attribute fields, classifications can be assigned to trees in ranges based on age metrics, from six to seven classes. Additionally, feature classes that represent street segments and public facilities are required for this exercise.

ENVIRONMENTAL INDEX

Air Pollution Zones

The data for the air pollution metric has been derived from the City of Santa Monica ISD, and includes: major truck routes, freeways, and the Santa Monica airport feature classes.

Sources for approximate pollution extents were compiled from reports of air quality recommendations from Los Angeles County and the State of California, and studies from the University of California, Los Angeles and University of Southern California.[12]

The recommendations and studies were previously used in a report titled, "Using Ecosystem Benefits to Prioritize Infrastructure Improvements in Santa Monica," by Grace S. Phillips, Chair, Urban Forest Task for City of Santa Monica.[13]

Urban Heat Island

The urban heat island metric uses satellite images to derive temperature data for the study area. The data is publically available and may be accessed from the USGS Earth Explorer website.[14]

Images used in this study are from the Landsat 8 - OLI/TIRS satellite sensor - band 11 (thermal infrared). Data can be accessed and downloaded upon request with an active USGS account and is available for the public. The study area, City of Santa Monica, is within the designated Landsat zone – path 41, row 36.

To ensure consistency for the heat index and control for random temperature fluctuations in regions across the city, three separate dates were chosen for this exercise: all dates are within the summer of 2015 (20 Jun 2015, 07 Aug 2015, and 08 Sep 2015).

An average of the three images are used for further processing. The spectral resolution of the image is: band 11 - thermal - 11.50 - 12.51 nm. Spatial resolution of the Landsat thermal band is 100 meters (resampled to 30).

VULNERABILITY INDEX

Population Density

Data for population density is derived from the US Census Bureau and based on estimates of current residents in Santa Monica living in homes.[15] Density is based on figures from 2010 US Census block data and denoted in population per square mile estimates in each census block. There are a total of 86 census blocks in the City of Santa Monica.

Proximity to Schools

The school zone metric includes data for public, private, and pre-schools with enrollment above 50 children. These schools are primarily attended by children under the age of 18, with the exception of Santa Monica College locations (attendance by youth under the age of 18 is not uncommon).

In total, there are 28 school sites in the city. The data for public schools is derived from the City of Santa Monica database and contains the boundaries of each public school site. Data for private schools and preschools has been acquired through an online search to find the locations, addresses, and enrollment profiles.[16]

Age Vulnerability Index

The age vulnerability index includes concentrated populations of younger and older age groups. Data for this metric is derived from the US Census Bureau and is based on 2010 US Census block data.[17] Estimates of populations have been selected for the following age groups: those under 18 and over 65 years of age (children and elderly individuals).

Means of Transportation

The transit index is calculated by finding areas in the city where citizens use alternative means of transportation to commute to work – walking or public transit. Data for this metric is derived from the US Census Bureau and is based on 2010 US census block data.[18]

The data selected includes populations that primarily use either walking or public transportation (bus) to commute to work.

The census information has been acquired before the LA Metro Expo line completion, whereby public transit ridership may increase in the next census in 2020. Data for this analysis is based on populations that work away from home, not total populations.

FINAL ANALYSIS

The analysis for each metric relies upon data acquisition, and the final analysis requires the data produced in these exercises. Prior to performing the final analysis, processing of all metrics for data production must be performed - each metric produces a final rasterized image to be used for further processing.

There are eight total raster images used in this analysis - tree stock performance, tree age diversity, air pollution, urban heat island, population density, proximity to schools, age index, and means of transportation. In addition, the following feature classes are required - Santa Monica city boundary, public facilities boundaries, an updated vacant tree sites file, and street segments.

Methodology

URBAN FOREST METRICS

Tree Stocking Level

A list of vacant tree sites must be downloaded from the West Coast Arborists website and converted into a feature class format for GIS analysis. In ESRI ArcGIS, a ModelBuilder tool was built to convert the new vacant tree site feature class into a final image that can be used for further processing in the exercise.

The tool is designed to be self-perpetuating, in that upon downloading a new file from the West Coast Arborists website, insertion into the tool will generate a new stocking rate based on current planting conditions.

Essentially the tool matches the vacant tree sites to an associated street segment and generates a frequency count table of current stocking levels per segment. The table is added to a segment feature class and classified according to its current stocking level. The following classifications were used in this model: less than 50%, 50 - 70%, 70 - 90%, and greater than 90%.

A buffer area "radius" was designed for the street medians and the street segments separately. Based on the four classes listed above, two rasterized datasets were developed and later combined to properly represent each street segment value accounting for both medians and streets.

Tree Age Diversification

To compute tree age diversity values, two separate tools were designed in ESRI ArcGIS ModelBuilder and combined to generate an output populated with both palm tree age and non-palm tree age values. The model is repeatable.

To find palm tree species age values, the palm tree dominant street segments must be queried and filtered from the exercise to perform a separate calculation based on height conditions. Dominant palm tree species segments consist of those segments populated with a majority of larger palm tree species.

Most dominant segments in this analysis are populated over 40% with palm species. Palm dominant segments are then selected by classification of their height values and a frequency count table is generated to find the percentage of height classifications per segment.

The resulting tables are then joined to an existing segment feature class where height classifications are grouped into three categories – A, B, C – where A represents young trees, B represents adult trees, and C represents mature trees.

To further evaluate the classification range, an algorithm is applied to determine the proper amount of young versus adult versus mature trees on each street - weighting A, B, C classifications.

With a final classification performed, a weighting range of 1 - 6 is applied to the classes to rank them in an ordinal arrangement for further analysis. The weighting numbers are then used to perform a rasterization of the palm segments where palm tree ages are displayed on a scale of 1 - 6.

To find non-palm tree species age values, the first step is to query and remove the segments that were calculated in the previous palm tree dominant segments exercise as well as, trees that fall within public facilities, vacant tree sites, and the large palm species on non-palm tree dominant segments – so as not to skew the data.

The segments are then selected by their DBH values and a frequency table of each class range is computed for each segment in the city. To find the percentage of each class, the frequency tables are calculated to get a ratio that represents the percent of each class on each segment.

Three categories - A, B, C - will represent the young, adult, and mature trees, similar to the palm species exercise above. The tree segments are updated with the new class values and split into medians and street segments where an algorithm to classify each segment according to its percentage of young/adult/mature trees is computed.

Based on classifications, a weight of 1 - 10 is applied and used to rasterize the dataset. Both the palm species and non-palm species raster datasets are merged together to create a final product that represents all 400 street segments accounting for medians and streets.

ENVIRONMENTAL INDEX

Air Pollution Zones

Based upon the referenced materials, a set of buffer zones is generated for each of the feature classes. The airport uses a 250 meter single radius zone; the truck routes and the 10 freeway use multiple zones with the following four classes: within 75 m, 150 m, and 300 m, and beyond 300 m.

For purposes of display in US standard measures, meters have been converted to approximate feet in the legend display on the map. With the four classes, a reclassification process calculates numbers (1 - 4) to compute for further analysis.

The buffer areas are clipped to the extent of Santa Monica and then merged together to create a final air pollution rasterized dataset for the environmental index analysis.

Urban Heat Island

Upon accessing the data for this study, the images must be evaluated for display errors and clipped to a smaller extent to focus on the study area of our exercise. Once the images are set to the extent of Santa Monica, a reclassification of the data is performed to group the temperatures into ten classes.

The minimum and maximum numbers of the three images are used to find class breaks and the range of data is set to ten classes. A weighted overlay is performed with the three reclassified images using equal influence to generate a classified raster image with a balance between all three dates. The image is now prepared for further analysis.

VULNERABILITY INDEX

Population Density

Upon collecting census data in tabular format, relevant fields should be filtered for analysis, including fields for population density per square mile in each census block in 2010. The data fields in the tabular dataset should be then matched to a feature class with census block boundaries and joined together. Determining the break values in classification is necessary for creating divisions in the dataset.

The minimum population density count is 2,074, the maximum is 38,783, and the mean is 12,383. After examining the data with a histogram, there is evidence of one outlier - 38,783 – while most numbers range from 2,074 – 27,950.

For classification purposes, I have used five classes with a natural breaks method, although I have given the outlier its own additional classification on the map.

Proximity to Schools

There are four classifications for this exercise based on the proximity surrounding each school site – within 75 feet, 75 – 150 feet, 150 – 300 feet, and beyond 300 feet from any school location. A few overlapping areas are dissolved in the analysis.

These boundary zones are modeled after the air pollution boundary zones in the previous exercise to approximate the areas where respiratory effects, especially asthma, are prevalent in susceptible populations, especially children.[19]

After acquiring the addresses of each school, the sites were georeferenced on Google Maps to find their location and check the accuracy of online reporting. Following location confirmation, the boundaries of each school site were drawn by finding their parcel extent within a city parcel feature class. The parcels were selected and combined together to create a feature class with public, private, and preschools.

Age Index

After acquiring the census data in tabular format, younger and older population groups were added together, and the percentage of the total populations in each census block were calculated to determine the distribution of age index values.

The minimum value of vulnerable populations in census blocks is 12%, the maximum value is 43%, and the mean value is 27%. By examining the distribution of the data with a histogram, it was determined there are no outliers.

For classification methods, I chose to use a natural breaks classification scheme that divides the classes accordingly.

Means of Transportation

Following the acquisition of census data, the numbers of populations in each census block that use either walking or public transit have been added together. The total population that works away from home is divided by this number to achieve a percentage used for the transit index.

The minimum value of those taking alternative means of transportation is 0%, the maximum value is 24%, and the mean value is 5%. Examining the distribution of the data with a histogram, most of the values are between 0 - 14%, yet there are two higher values of 23 - 24%. The data has been classified with a natural breaks classification scheme.

FINAL ANALYSIS

The final analysis model relies on eight raster data sets as inputs, so each must be completed prior to insertion into the model. Each metric must be examined for proper classification and reclassified if necessary. With all classification set, three initial overlays are performed based on input categories – urban forest, environmental, and population vulnerability.

Each overlay is performed with equal weighting, depending on the number of metrics (2 = 50/50, 4 = 25/25/25/25). The output results in three separate raster images. A final overlay is performed with the three overlay images as inputs, with each weighted equally, resulting in a final overlay image. The image needs to be clipped to the extent of Santa Monica and converted to a polygon feature class for further processing.

A recent feature class with vacant tree sites is added to the model and each site is matched to its respective location on the final overlay image. This results in the assignment of a grid code value of 1 -10 for each vacant site, based on its location. Tree sites in public spaces are removed from the exercise. A street segment's feature class is added to the model and split into medians and street types.

Each vacant tree site with its grid code value is joined to its proper segment type (median or street). A frequency count is performed on medians and street segments separately to generate a table with the vacancies per segment - then merged together.

The grid code values and the vacancy frequency counts are multiplied together resulting in a sum of each grid code value per segment. To consolidate values, a final frequency count of these sums is performed to output a table with the sum of vacancy values for each segment. This table can now be joined to a segment feature class.

A portion of street segments have no vacancies, and null values have been generated. These null values are converted to zero. To control for segment length, an ordinary least squares regression analysis is performed on the feature class, with the segment length as the independent variable and the sum of grid code values as the dependent variable.

Prior to this exercise a new field is added with an object ID for each row in the table to perform the computation with a unique identifier. The regression analysis results are joined to a street segments feature class and an output table is generated for further processing in Microsoft Excel.

In Excel, the table is sorted by its regression analysis values based on sum and segment length adjustment. A cumulative sum function is then performed on the total vacancies per segment field to populate a new field with a progressing sum of values in order of segment priorities. Vacancies equal to zero are filtered out and added back in after final calculations.

The total number of vacant sites (approximately 2,000) are then divided by five (for a five-year planting plan). A new field is generated and populated with years based on equal class breaks; approximately 400 plantings each year.

A final field is generated and populated with ordinal numbers based on the current pecking order, for report generation and reference. A list of tree species on each segment is added to the table, including current planted species, and primary and secondary species for the updated Urban Forest Master Plan.

Final processing is finished in ModelBuilder to join the table results to a segment feature class. Cartographic elements are created for display and a report is generated to list the planting priority results in a printable format based on a five-year planting program.

The Urban Forest Street Segment System

Prior to this exercise, Santa Monica had developed an urban forest street segment system for selecting, maintaining, and planting publicly owned trees on city streets to better serve the needs of the community. This study uses these street segments as the essential corridors where planting concerns are addressed.

The remainder of this paper will refer to these "segments" as those making up the urban forest street segment system. The street tree planting program aims to find all locations of vacant tree sites along these corridors and develop a plan for replanting.

A few street segments are currently unavailable for planting at present, while others have a full stocking capacity. Based on the results of the analysis, the five-year planting program lists and displays which segments to plant first, according to their rank in the report.

Figure 5. The City of Santa Monica uses a system of street segments to keep track of its inventory of city trees

Urban Forest Street Segments Not Suitable for Planting

Before further analysis, streets must be evaluated for planting suitability. A few street segments have been selected for having unsuitable planting conditions; these segments must be addressed, evaluated and then omitted from the model.

A portion of the unsuitable streets are located in industrial business zones, include parkways that are too small or narrow to accommodate tree planting, or have no medium space between the street and a commercial business property.

Table 2.. A list of segments to remove from model.

Unsuitable Planting Conditions
152: Designated city landmark, no existing street trees.
160: Business park with no existing spaces.
213A: Business park.
284: Parkway too small to plant trees.
307: Industrial business zone, overhead wires.
372: Narrow parkway, no room for trees.

Upon removing these individual street segments, the model will then require the removal of trees that are within city parks, as this model concerns street tree planting.

Street Segments to Omit from Model

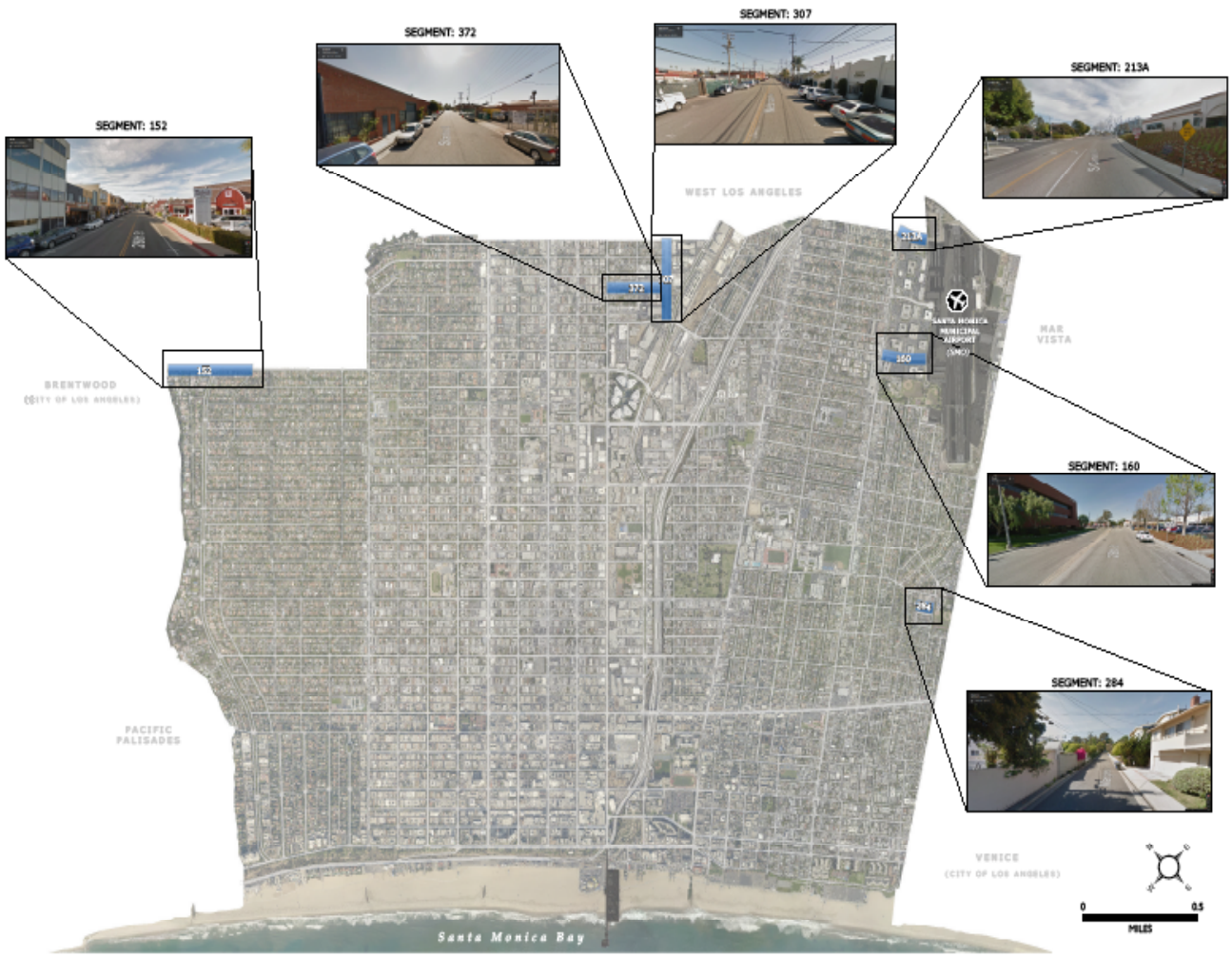


Figure 6.. The street segments pictured above will be removed from the model.

Image sources: Google Street View.

City Park Sites

The planting priority model is designed for the replanting of "street trees," so first order will require the elimination of trees that do not fit within the boundaries of our areas of interest. By selecting out the vacant tree sites that are within these public facilities, like parks and government buildings, we can direct our model to focus on street trees. The trees within public spaces may be used for separate models, if needed in the future.

Vacant Tree Sites

Figure 7a. The black points represent the locations of each vacant tree site in the city.

Public Facilities

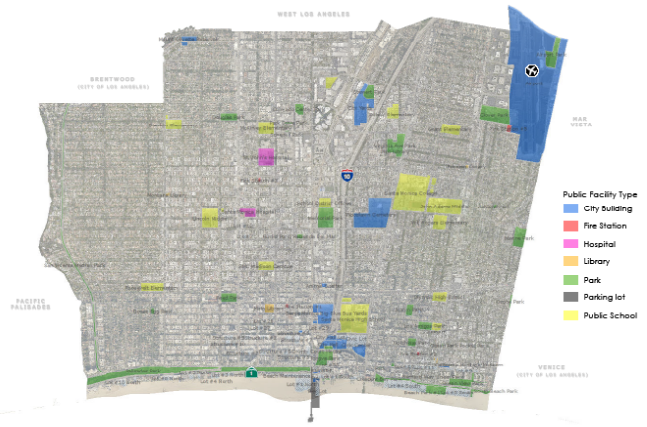
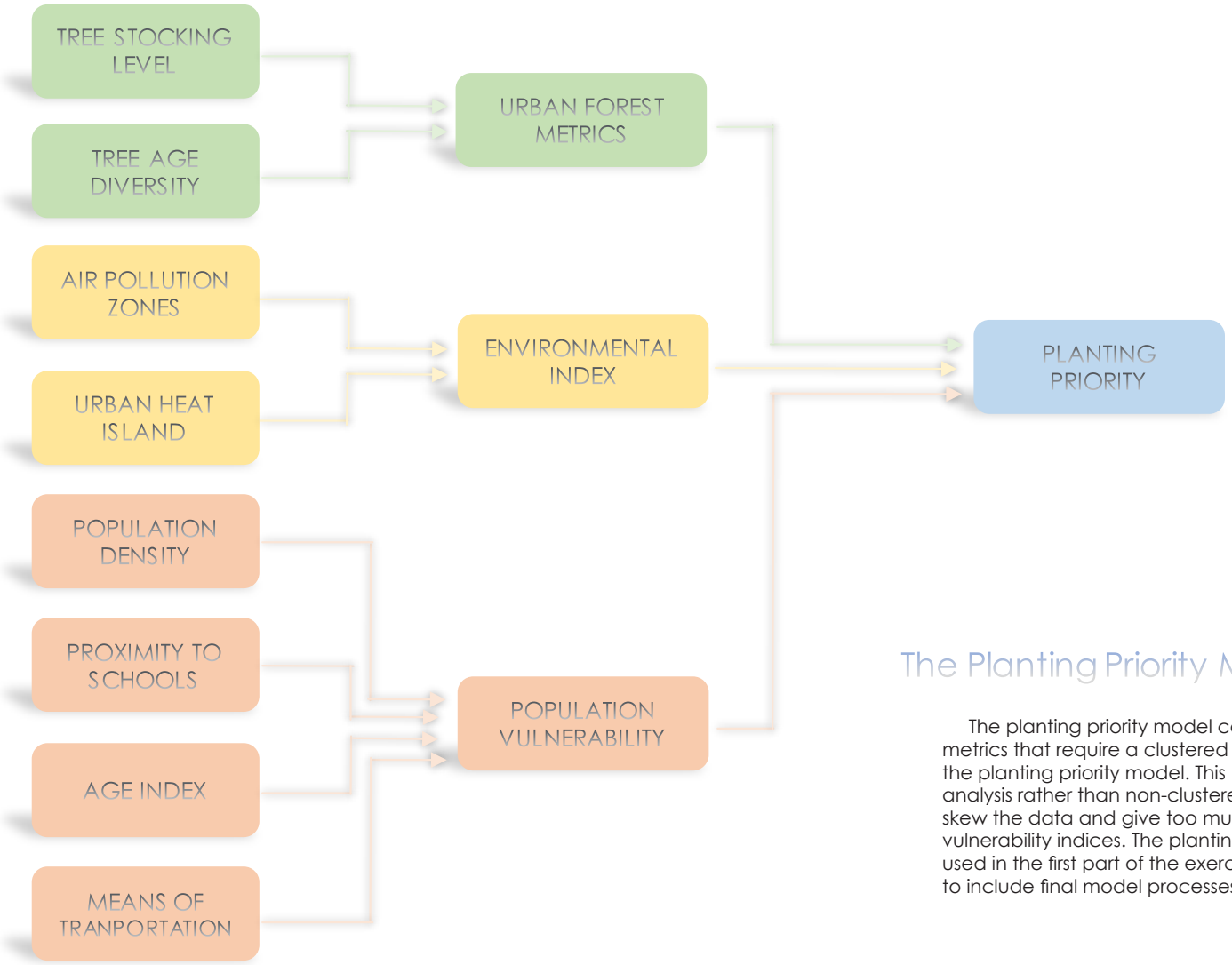


Figure 6.. Location of City of Santa Monica's public facilities, including parks, parking lots, government buildings, etc.

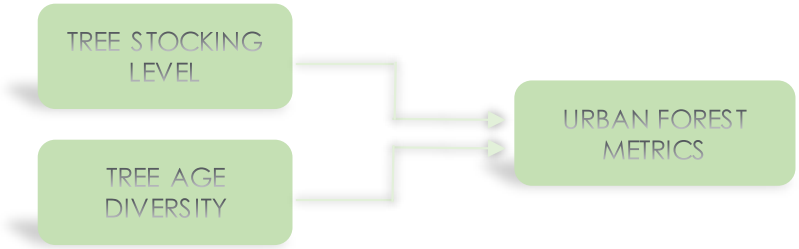
Tree Sites within Public Facilities

Figure 6.. Vacant tree sites denoted in black are street trees; tree sites in yellow are located within City of Santa Monica's public facilities.



The Planting Priority Model Flowchart

The planting priority model consists of eight conditional metrics that require a clustered format into three inputs for the planting priority model. This model relies on clustered analysis rather than non-clustered analysis, so as not to skew the data and give too much weight to population vulnerability indices. The planting priority flowchart will be used in the first part of the exercise, and later be expanded to include final model processes.



What is included in the urban forest input?

The urban forest input is a measure of need-based accounting for two concerns: the current level of planted trees versus vacant tree sites, and the relative age of trees in close proximity to each other. These two factors will be used to account for both present inventories and projected future inventories.

The tree stocking level is used to assess the current rate of planted trees in the city and provide a detailed analysis of which streets are well-stocked, moderately-stocked, and those that are inadequately-stocked. An account of current vacant tree sites makes up the foundation of where planting should occur, but to establish when planting should occur requires an analysis of each street segment's relative stocking level.

The tree age diversity metric provides the approximate age of street tree populations based on tree height and diameter at breast height values. All tree species are factored into the assessment to find which streets have a healthy, moderately-healthy, or aging tree stock.

The tree age assessment will provide an estimate of which street segments have higher or lower percentages of trees approaching the end of their lifespan. The estimates are based on median values of all trees on a given street segment.

Tree Stocking Level

The tree stocking level is based on the percentage of trees currently planted on each street segment. The raw data for the stocking level calculations were derived from the arborist contractor website and computed using ArcGIS software.

Out of a total of 400 street segments, only 3 have below a 50% stocking count – 12 segments are within a 50 - 70% stocking count, 103 segments are within 70 - 90%, 198 segments are above 90% and 84 segments are fully stocked. Overall, 282 segments are above 90% stocking rates and are evenly distributed throughout the city. There is no single neighborhood that is considerably deficient in comparison to another.

Tree Stocking Level of Street Segments

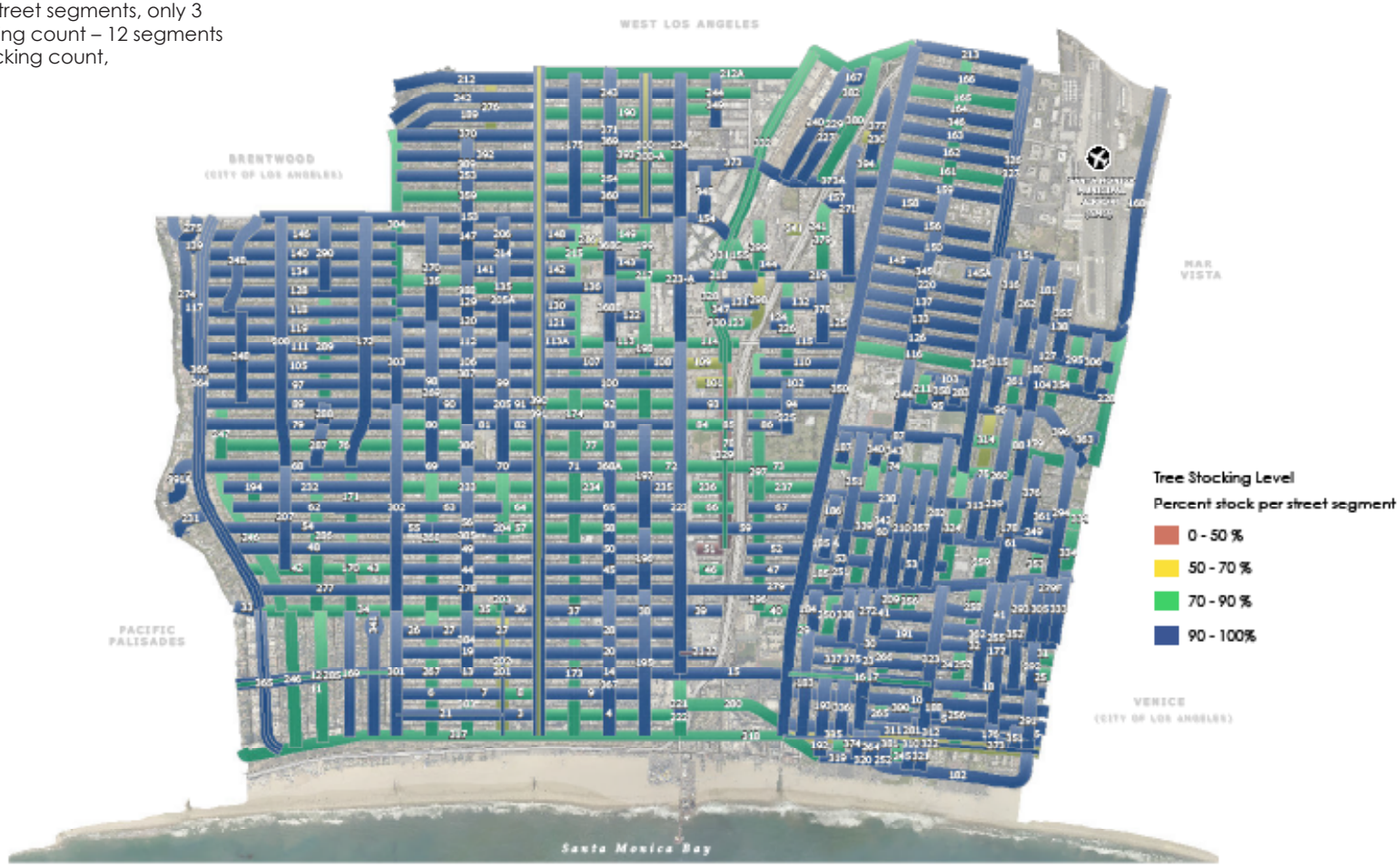


Figure 8. The urban forest tree stocking level metric is based on the percent values of each street segment's trees currently planted.

Palm Species Age Diversity

To best represent the age diversity of palm trees, the map below displays palm tree heights with graduated symbols that are proportional to the height of each tree. By displaying the trees with graduated symbols, certain trends become apparent. A few street segments have a high number of mature palm trees, such as 4th, 5th, 6th, 9th, 19th, 21st, and Bay St.

Most of the trees on these streets are 60' + and may soon approach the end of their useful lifespan. These streets will require future planting commitments that may be first addressed by locating the areas where clusters of large palm trees are found, from early street tree planting programs.

Palm Tree Age Diversity, by Location

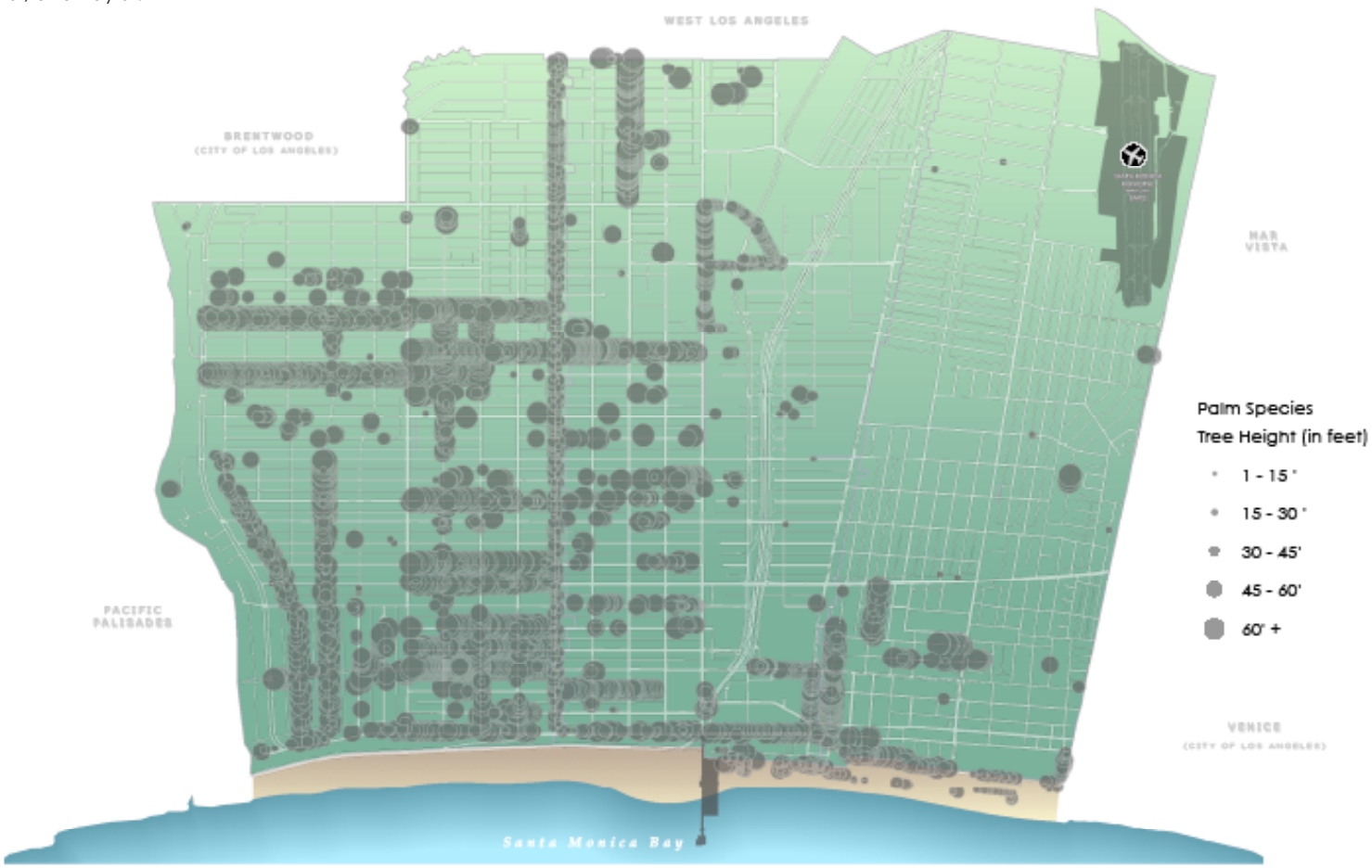


Figure 9. Palm tree age diversification is represented by applying graduated symbols to each representative tree, for display purposes.

Non – Palm Species Age Diversity

To better represent age diversity for non – palm tree species, trees are displayed with their diameter at breast height "DBH" measurements. A map that displays these values with graduated symbols representative of their DBH ranges demonstrates how certain areas of the city may be overrepresented by mature trees and will soon require replanting.

Some street segments, like La Mesa Drive, San Vicente Blvd, Olympic Blvd, 21st, and 22nd will require planning for future replanting as the trees approach the end of their useful lifespan.

This map displays the age of trees by using graduated symbols. Although representative of tree age, this map does not indicate the current stocking levels.

Non - Palm Tree Age Diversity, by Location

Figure 10. Non – palm tree age diversification is represented by applying graduated symbols to each representative tree, for display purposes.

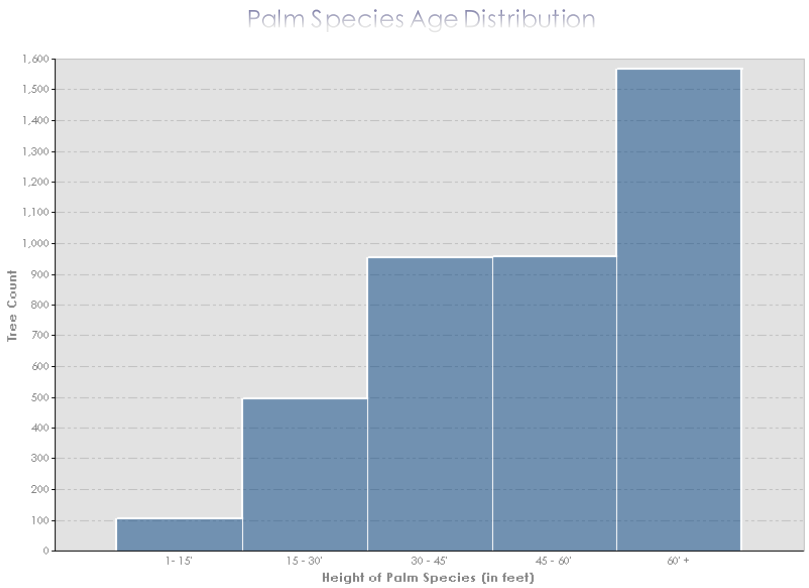
Palm Species Age Diversity Algorithms

Two separate algorithms were used in calculating tree age diversity. To best represent age groupings, three age categories were created: A, B, and C, where A= young trees, B = adult trees, and C = mature trees.

The palm tree model first uses the three age categories, A, B, and C, to classify the data range. Date palm and fan palm tree species must be divided, then combined after classification is complete. Each palm tree is classified according to its height value into five classifications: (1 – 15', 15 – 30', 30 – 45', 45 – 60', 60'+) and grouped into the following: date palms (A = 1 – 15', 15 – 30'; B = 30 – 45', C = 45 – 60', 60'+), and fan palms (A = 1 – 15', 15 – 30', 30 – 45'; B = 45 – 60', C = 60'+).

With classifications of young, adult, and mature, values of 1 – 6 must be assigned to find the ideal ratios to group the trees, where street segments with a higher percentage of younger palm trees is given a higher score "A" than segments with a higher percentage of mature palm trees "C."

By examining the distribution of data in a histogram, it is evident there is a greater percentage of mature palm species in the urban forest system. The histogram displays the distribution of data where five categories of palm tree height are represented on the horizontal axis and tree count is on the vertical axis.



Graph 1. The distribution of palm tree species age is skewed to the right, suggesting a higher percentage of mature palm species.

	CLASSIFICATION VALUE					
AGE CATEGORY	1	2	3	4	5	6
A	> 50%	0 – 10%	0 – 20%	0 – 12%	0 – 13%	0 – 10%
B	0 – 25%	20 – 40%	> 50%	0 – 15%	0 – 35%	0 – 33%
C	0 – 3%	0 – 15%	0 – 10%	20 – 30%	30 – 50%	> 50%

Table 3. Algorithm for tree age diversity model based on palm tree height values.

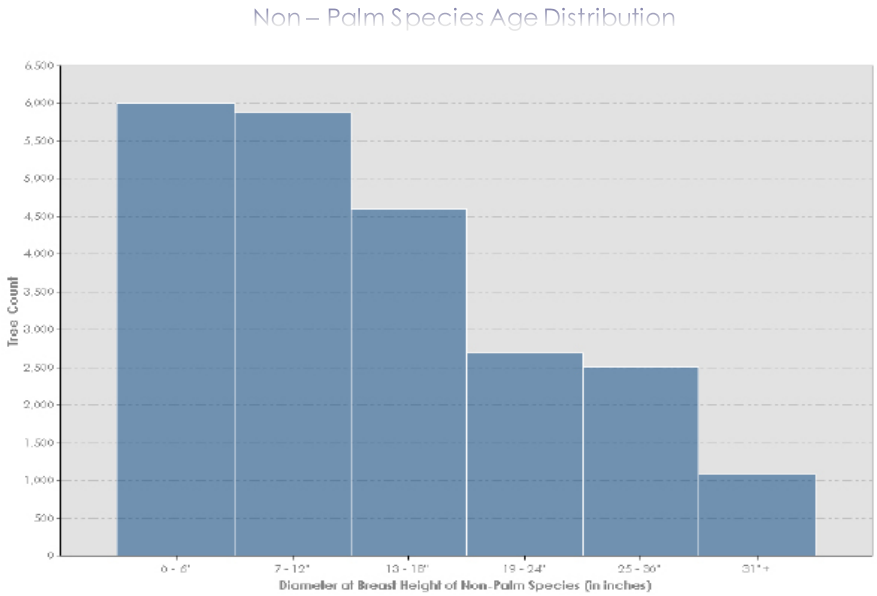
Non – Palm Species Age Diversity Algorithms

Non-palm tree species age values are determined by finding the diameter at breast height "DBH" for each tree and using the range of values to determine groupings based on the following classifications: (0 – 6", 7 – 12", 13 – 18", 19 – 24", 25 – 30", 31" +).

The non-kpalm tree species do not require division into separate groups such as the previous exercise, yet larger palm tree species must be excluded from the exercise so as not to skew the data. The trees are grouped into the following classifications: (A = 0 – 6", 7 – 12"; B = 13 – 18", 19 – 24"; C = 25 – 30", 31" +).

Given these groupings, of young, adult, and mature, a matrix of values (1 – 10) will assign each street segment to its proper location on the table, based on where a higher percentage of younger trees "A" versus mature trees "C" gives greater weight.

The distribution of non-palm tree data is displayed in a histogram, where there appears to be a greater percentage of younger non-palm species in the urban forest system. The graph displays the distribution of data where six categories of non-palm tree DBH are represented on the horizontal axis and tree count is on the vertical axis.



Graph 2. The distribution of non-palm tree species age is skewed to the left, suggesting a higher percentage of younger non palm species.

	CLASSIFICATION VALUE									
AGE CATEGORY	1	2	3	4	5	6	7	8	9	10
A	> 70%	> 70%	> 50%	20 – 45%	10 – 50%	10 – 50%	10 – 50%	< 10%	< 10%	< 10%
B	> 20%	0 – 20%	0 – 50%	20 – 45%	5 – 50%	> 50%	0 – 40%	40 – 100%	25 – 50%	0 – 30%
C	<= 10%	0 – 15%	0 – 33%	20 – 45%	5 – 50%	0 - 35%	> 50%	0 – 50%	> 50%	> 70%

→ Increasing priority

Table 4. Algorithm for tree age diversity model based on diameter at breast height values for non-palm species.

Tree Age Diversity

Tree age is represented by palm tree height and non-palm tree diameter at breast height values. To represent both age groupings in a single map, two colors (blue and purple), are used to properly display graduated shades of age grouping. The darker-shaded segments of each color represent street segments with considerable mature tree populations.

The mature tree street segments coincide with the previous maps displaying tree age in graduated symbols. Calculations are based on diameter at breast height (DBH) and palm tree height index values to give equal weight to street segments consisting of either tree species.

Urban Forest Tree Age Diversity

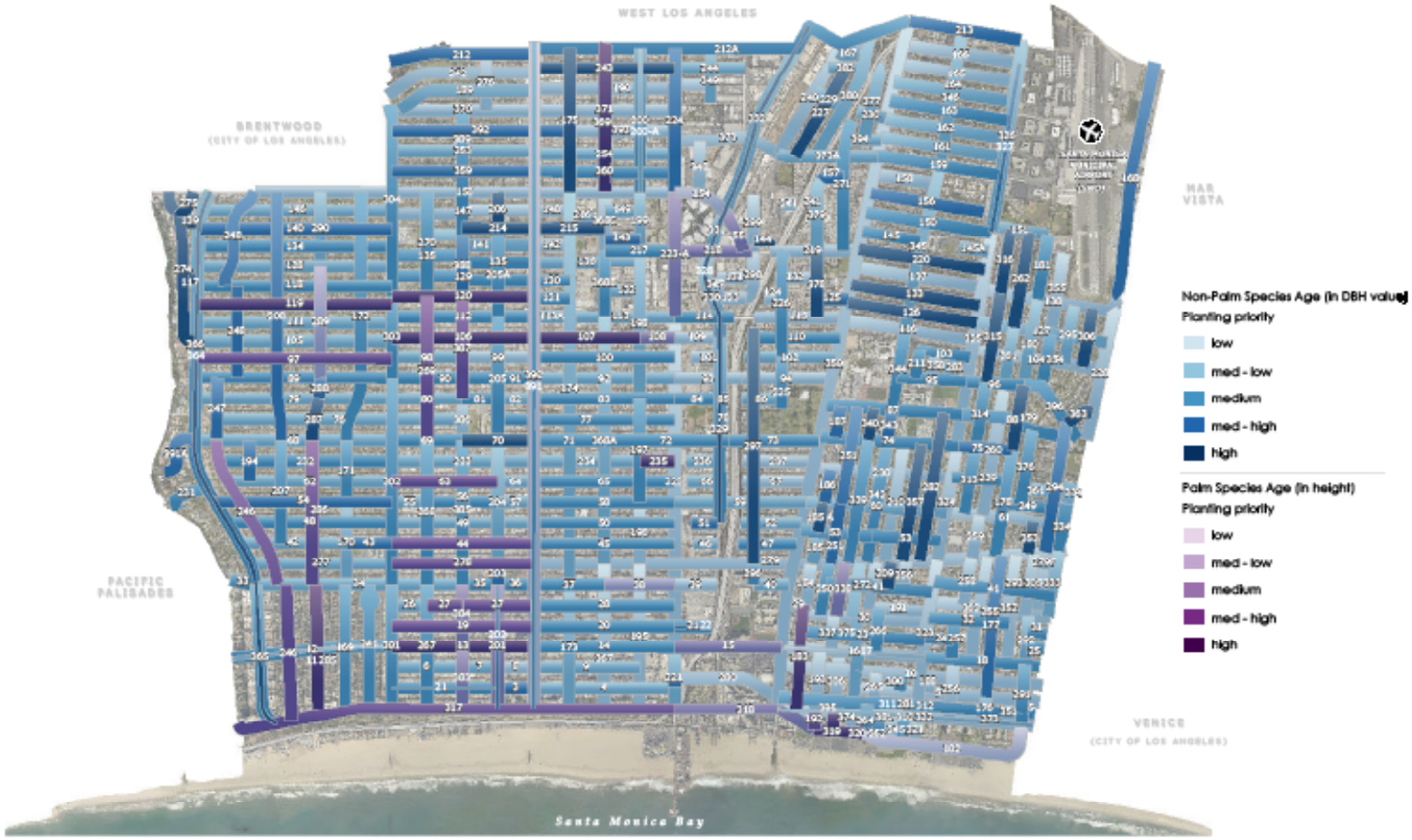


Figure 11. Tree age diversification metric based on ratio of young/adult/mature trees per segment, including both segments with and without palm tree dominant segments

Urban Forest Overlay

The tree stocking level and tree age diversity metrics are combined to create an urban forest input that displays areas of greatest need based on current trends of the urban forest and estimated future stocks of trees. The output from this calculation will serve as an input for further priority analysis. The resultant image displays areas in the city that are in need of trees based on current levels of stocking percentage and projected future populations due to age.

Tree Stocking Level

Figure 12a. Tree stocking level is based on percent values of each street segment's tree stock.

Tree Age Diversity

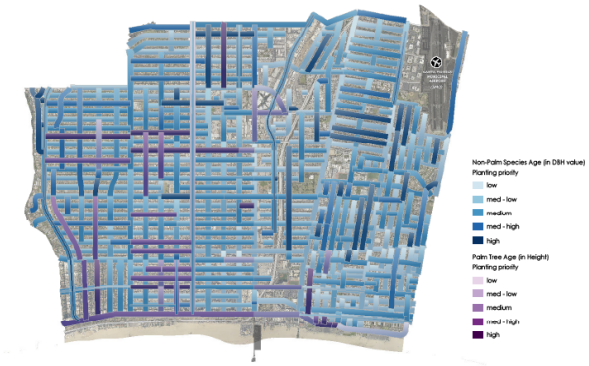


Figure 12b. Tree age diversification metric is based on ratio of young/adult/mature trees per segment.

Urban Forest Overlay Image

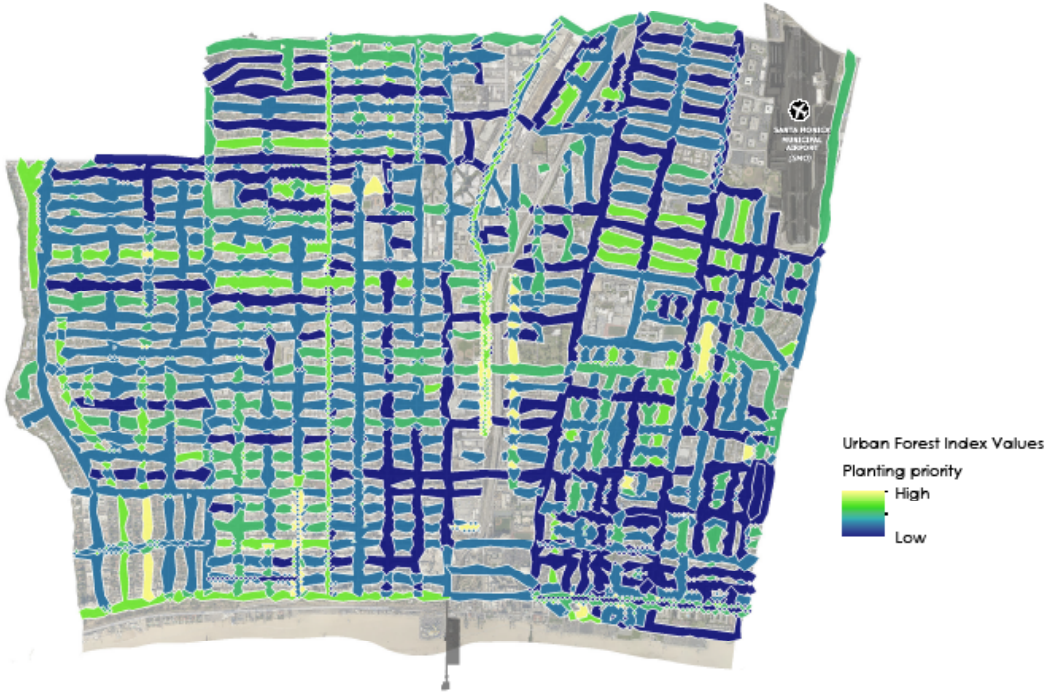
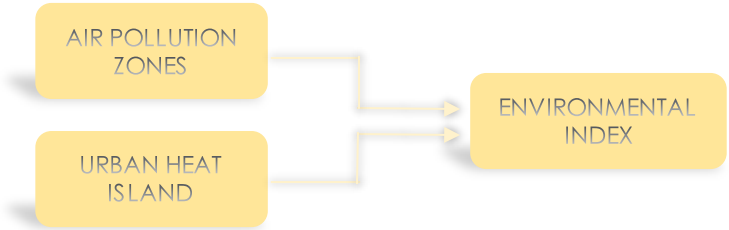


Figure 12c. The urban forest index is calculated by applying equal weighting to the tree stock performance index and the tree age diversification values.



What is included in the environmental index input?

The environmental input is a measure of the demands placed on the city by both air pollution conditions and temperature variations attributed to manmade surfaces in an urban environment. The urban landscape of Santa Monica creates environmental concerns that ultimately impact the population, as residents may suffer respiratory ailments from air pollution or heat exhaustion from excessive temperatures.

The air pollution metric addresses readily identifiable environmental conditions, where particulate matter is produced, distributed, and deposited into communities. The extent of the city impacted by air pollution includes: major truck routes, the 10 freeway, and the Santa Monica Municipal Airport.

The urban heat island effect, in comparison to air pollution, is less readily identifiable and more difficult to measure. Urban heat island measures the temperature variations that occur within a city due to its alteration of the environment and use of manmade materials. Satellite imagery has made it possible to measure these effects; a typical thermal image will display locations in the city affected by excess warming from manmade structures, including: roadways, buildings, rooftops, and concrete surfaces.

These two metrics combined provide for an input that marks the best locations for planting based on environmental need.

Air Pollution in Santa Monica

The development of air pollution buffer zones are based on the paper, *Using Ecosystem Benefits to Prioritize Infrastructure Improvements in Santa Monica*, by Grace S. Phillips.[20] The indices and studies used in the paper are derived from Los Angeles County Public Health, California Air Resources Board, University of California, Los Angeles, and University of Southern California.

The single largest zone of pollution is the Santa Monica Municipal Airport, yet its impact on the surrounding Sunset neighborhood only spans a small portion of the city. The central city zone has the highest concentrations of air pollution from truck routes with most of the area having a value of 1 - 3. The North of Montana neighborhood, in contrast, has minimal air pollution impacts, due to its lack of major transportation infrastructure, such as truck routes and highways.

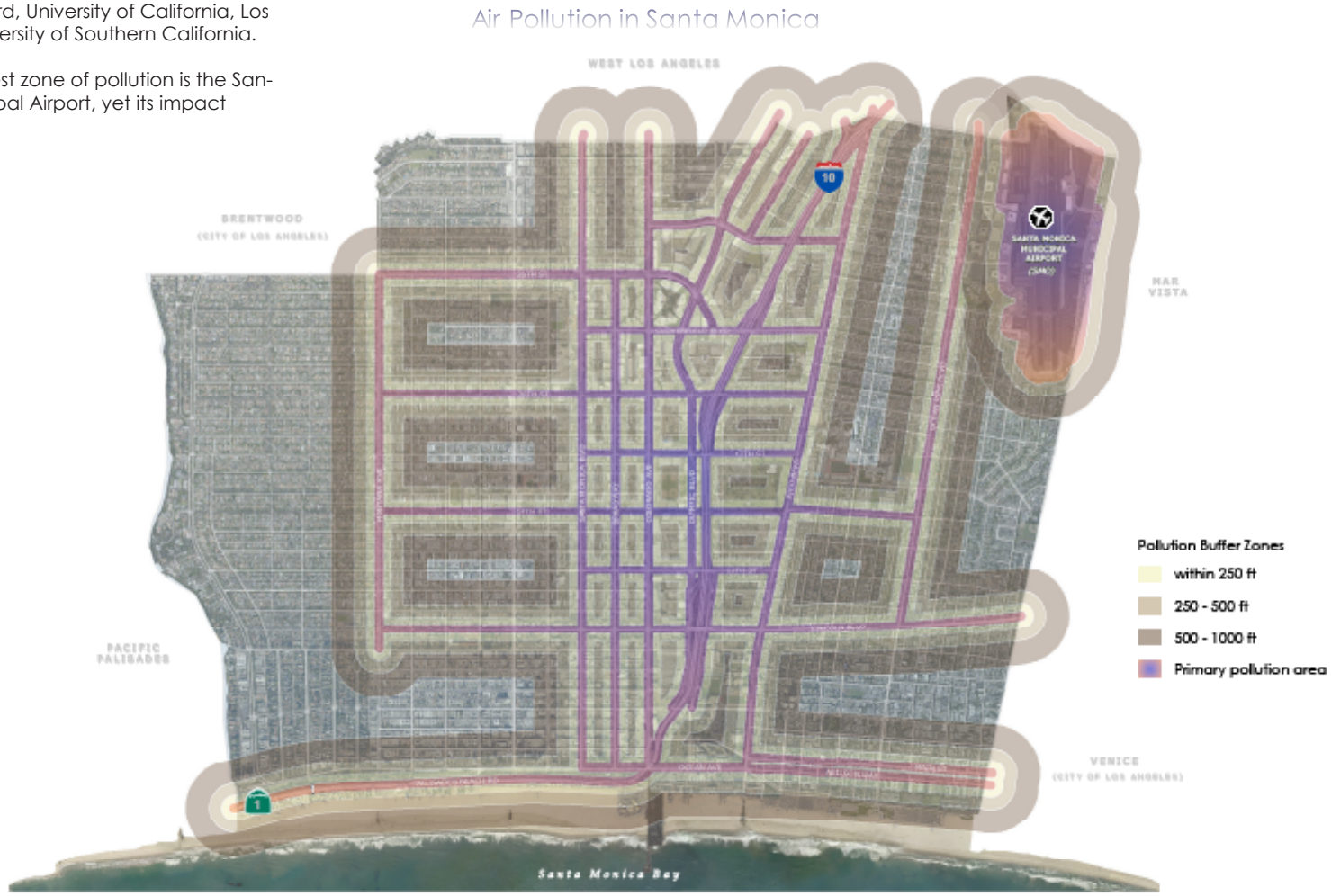


Figure 13. Air pollution buffer zones in Santa Monica.

Urban Heat Island Effect

The urban heat island effect is based on satellite-derived imagery from the Landsat 8 Operational Land Imager (OLI) thermal band (band 11). The image displays heat values for the period of August 2015. For display purposes, I have placed the boundaries of city parking lots, public schools, and parks on the map image. The image is colored according to the temperature index.

A few trends are immediately noticeable: the city is generally divided by temperature pockets, where the Santa Monica airport, the Pico industrial neighborhood, and the central city are hot, and the North of Montana neighborhood is much cooler. There are also small pockets of temperature variation where microclimates exist, giving evidence to the urban heat island effect.

The Urban Heat Island in Santa Monica

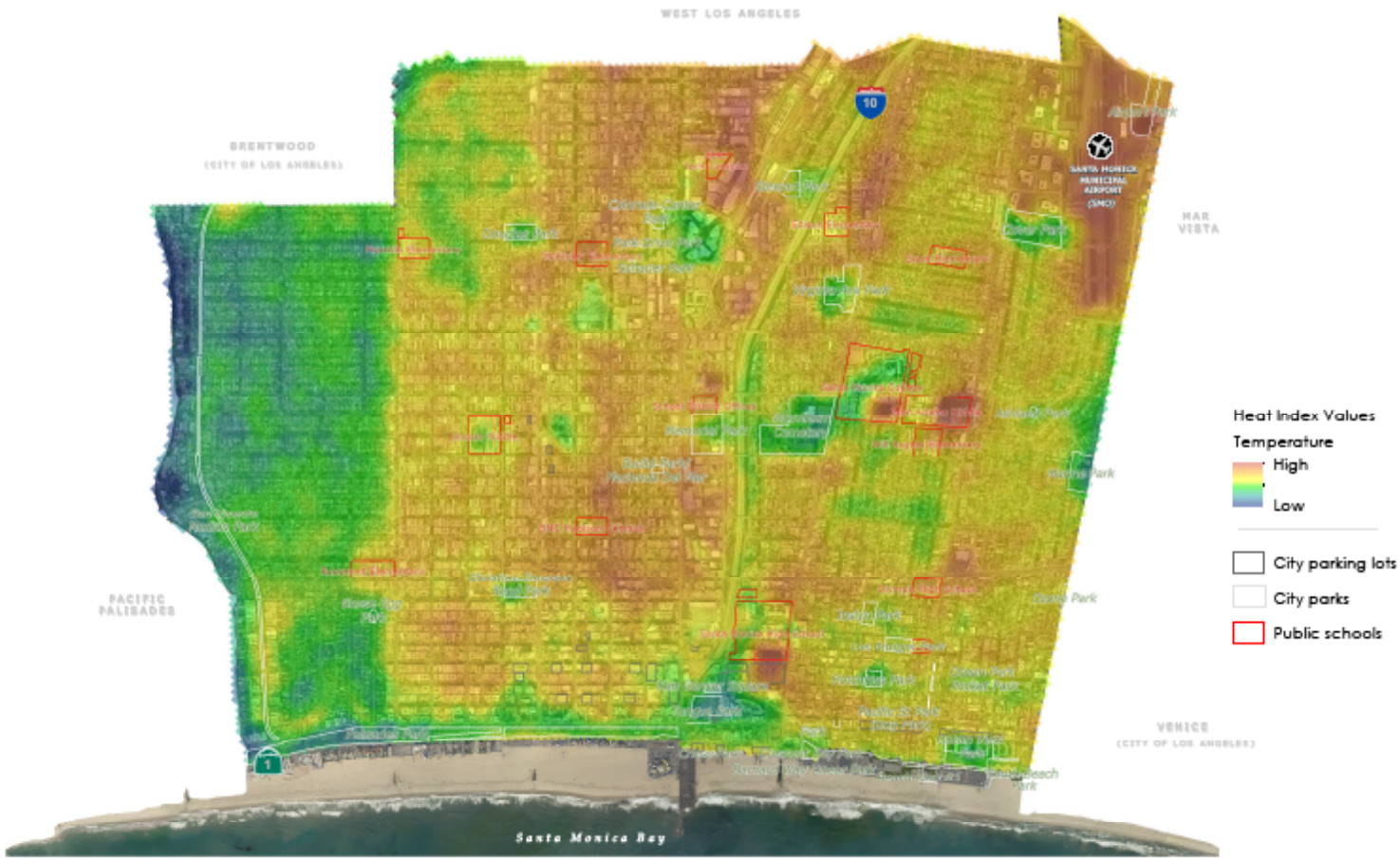


Figure 14. The urban heat island effect in Santa Monica is displayed with city parking lots, city parks, and public schools

Air Pollution

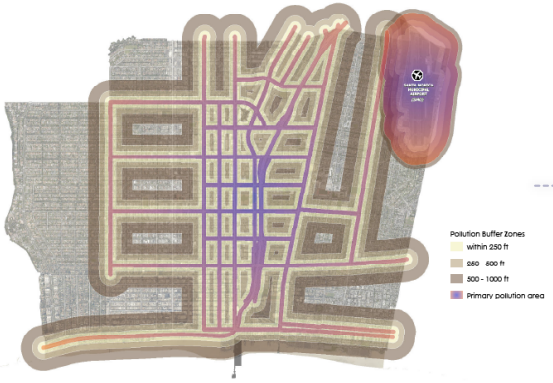


Figure 15a. Air pollution buffer zones in Santa Monica.

Urban Heat Island

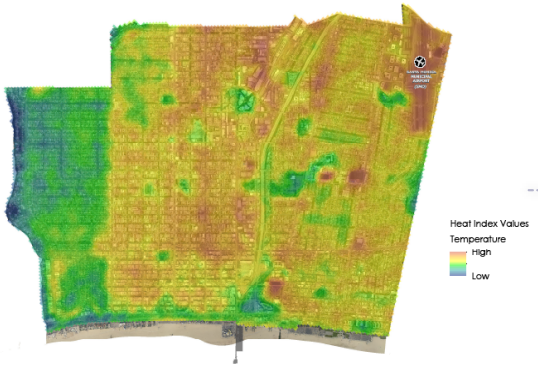


Figure 15b. The urban heat island effect in Santa Monica.

Environmental Index Overlay

The air pollution zones and urban heat island metrics are combined to create an environmental index input that displays areas of greatest need, based on current environmental conditions and trends. The output from this calculation will serve as an input for further priority analysis. The resultant image depicts the areas in the city that could benefit the most from an environmental priority input.

Environmental Index Overlay Image

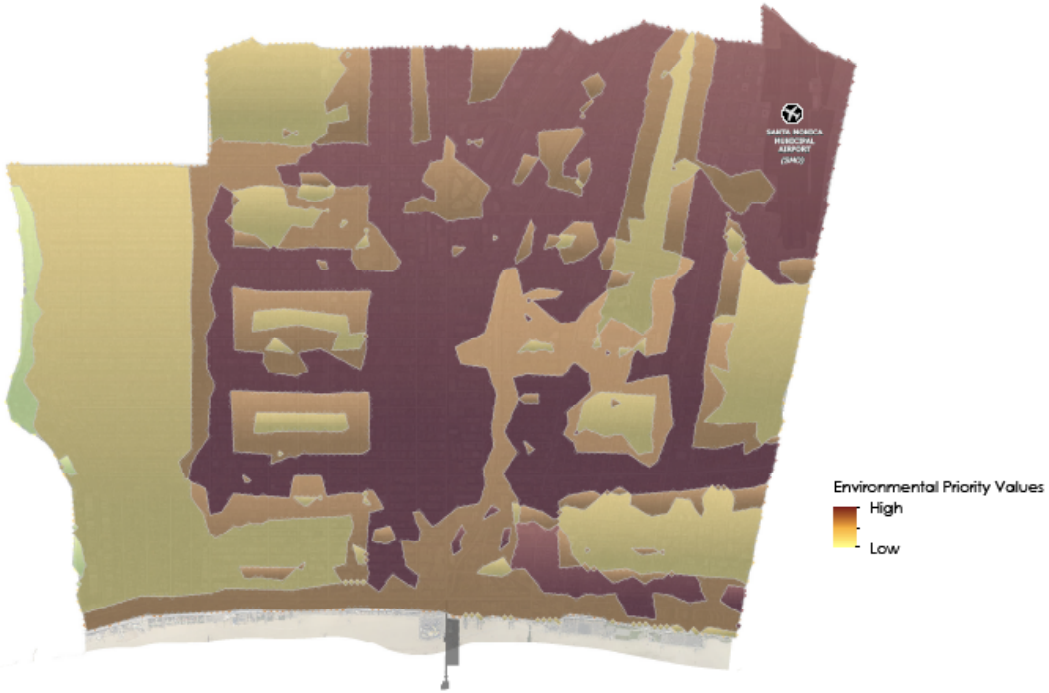
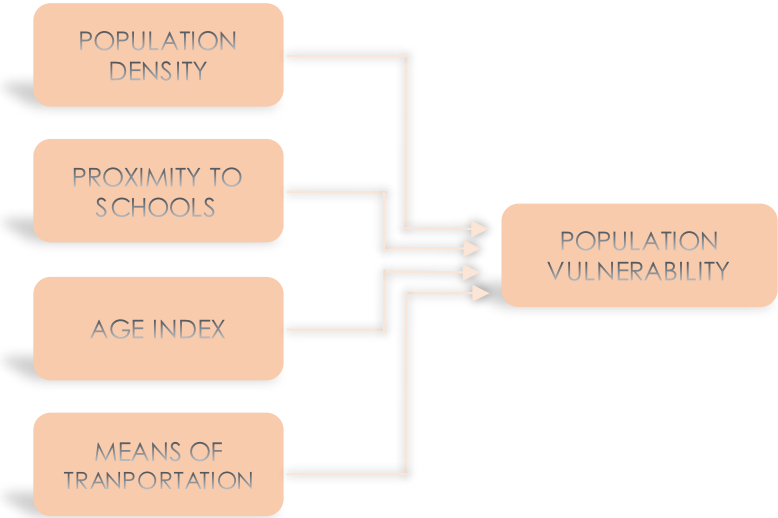


Figure 15c. The environmental index is calculated by applying equal weighting to the pollution index and the urban heat island index values.



What is included in the population vulnerability input?

The vulnerability index consists of a set of four metrics that relate to demographic conditions in Santa Monica. The metrics will be combined to create an index that provides a measure of suitability for specific areas in the city where populations would benefit from the addition of trees.

Rather than suggest the planting of trees throughout the city by equal distribution, a set of demographic concerns were raised to create a more equitable distribution based on populations that are need-based. To remain fair, this exercise relies upon only these four demographic conditions and clusters them together to create one overlay image.

The set of demographic inputs include: population density, which accounts for areas of the city with a greater number of residents; proximity to school zones, a measure of where younger children spend their weekdays in attendance and traverse to and from school; an age vulnerability index, to denote those populations most at risk of weakened immunities; and means of transportation to work, a metric that designates those populations using streets at a greater share than others. Combined, these inputs provide a fair and balanced approach to population vulnerability.

Population Density

When exploring the distribution of population in the city, there are a few trends of note: populations are highest in the Wil-Mont neighborhood, a small portion of the Pico neighborhood across from Santa Monica College, and in a small pocket of the Ocean Park neighborhood.

Populations are lowest in the area adjacent to the Civic Center district, along the 10 freeway corridor, the industrial area of the Pico neighborhood, the Santa Monica Airport, and the Northeast corner of the North of Montana neighborhood. Overall, the North of Montana and the Sunset neighborhoods have the lowest population densities.

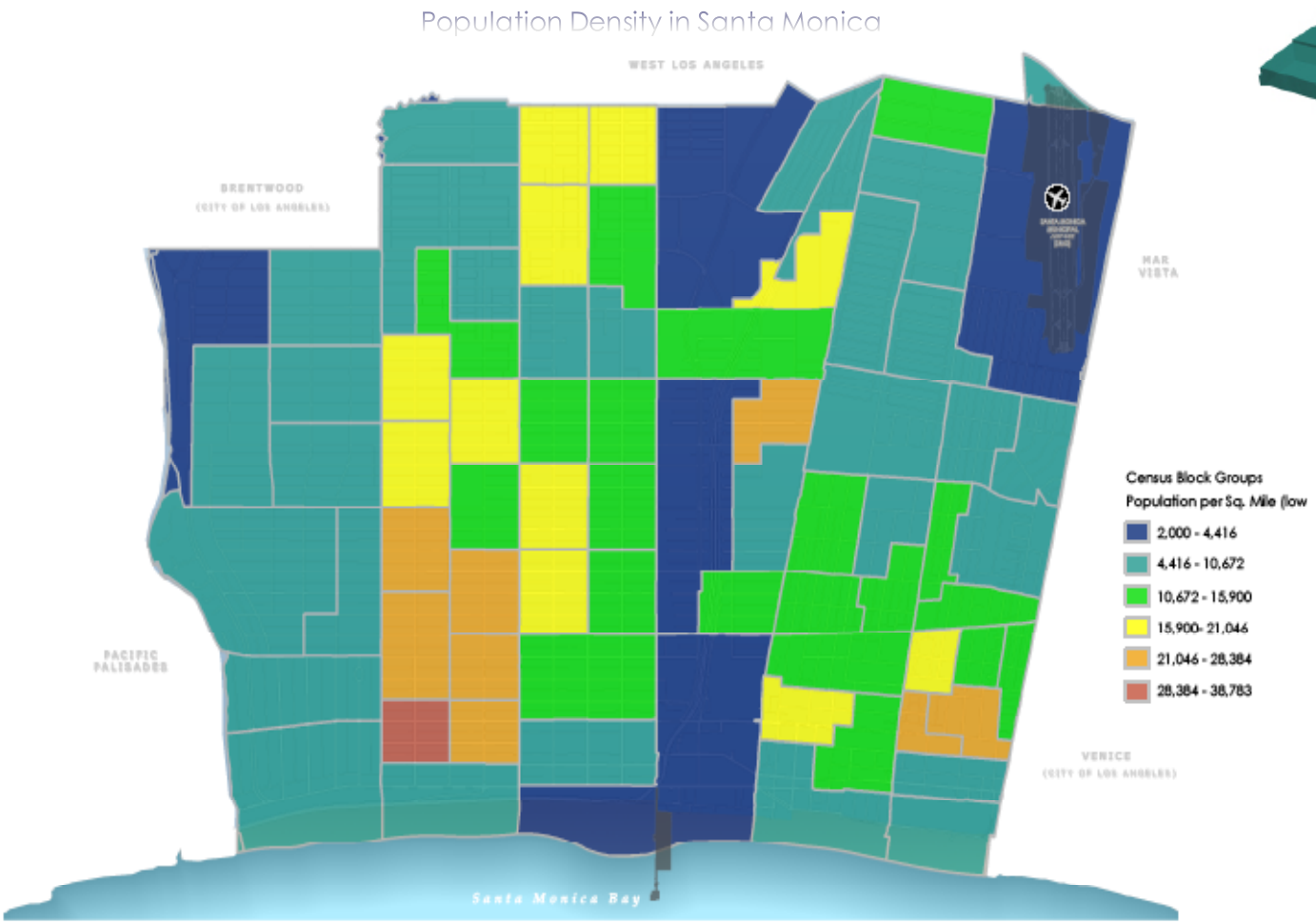
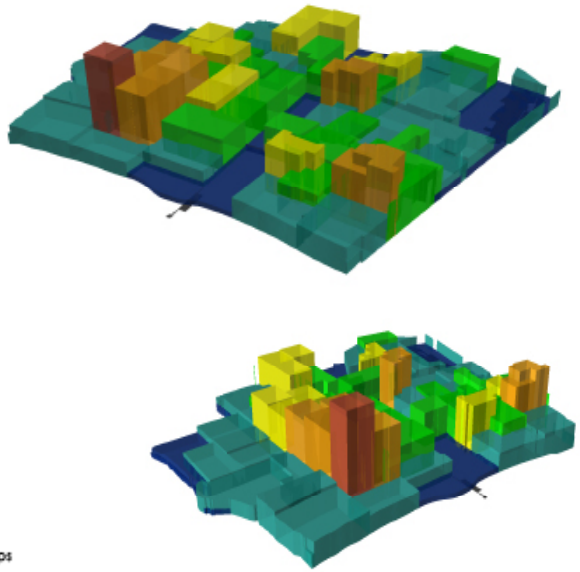


Figure 16a. Population density values are derived from 2010 US Census Bureau data, based on population counts per census block group.



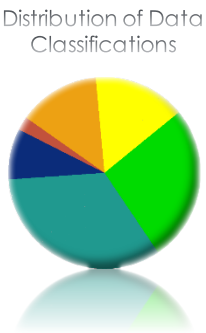


Figure 16b. The images above display the population density index in a 3-D representation for visual purposes. The pie chart below shows the distribution of data classifications.

School Zones in Santa Monica

The school zone metric consists of boundary zones surrounding both public and private schools, and preschools with enrollment of at least 50 students. Boundary zones are based on Los Angeles County public health indices. In total, there are 28 school zones in Santa Monica, which are represented in the map below.

The boundary zones are modeled after air pollution constraints to approximate the areas where respiratory effects, especially asthma, are prevalent in susceptible populations, especially children. [21] The planting of trees nearby school zones will also improve the walkability of streets where children walk to school.

Table 5. List of private schools and preschools.

PRIVATE SCHOOLS AND PRESCHOOLS
Carlthorp School
Crossroads School for Arts and Sciences
First United Methodist Daycare/Preschool
Garden of Angels Alternative School
Lighthouse Christian Academy
New Roads School
Pacifica Christian High School
PS1 Pluralistic School
Saint Anne Roman Catholic School
Santa Monica Montessori School
SmartStart Developmental Learning Center
St. Monica Catholic Elementary School
Washington West Preschool

Table 6. List of public schools.

PUBLIC SCHOOLS
Edison Elementary
Franklin Elementary
Grant Elementary
John Adams Middle
John Muir Elementary
Lincoln Middle
McKinley Elementary
Olympic High School
Roosevelt Elementary
Santa Monica College
Santa Monica High School
SMASH
SMC Madison Campus
SMC Tech. Campus
Will Rogers Elementary

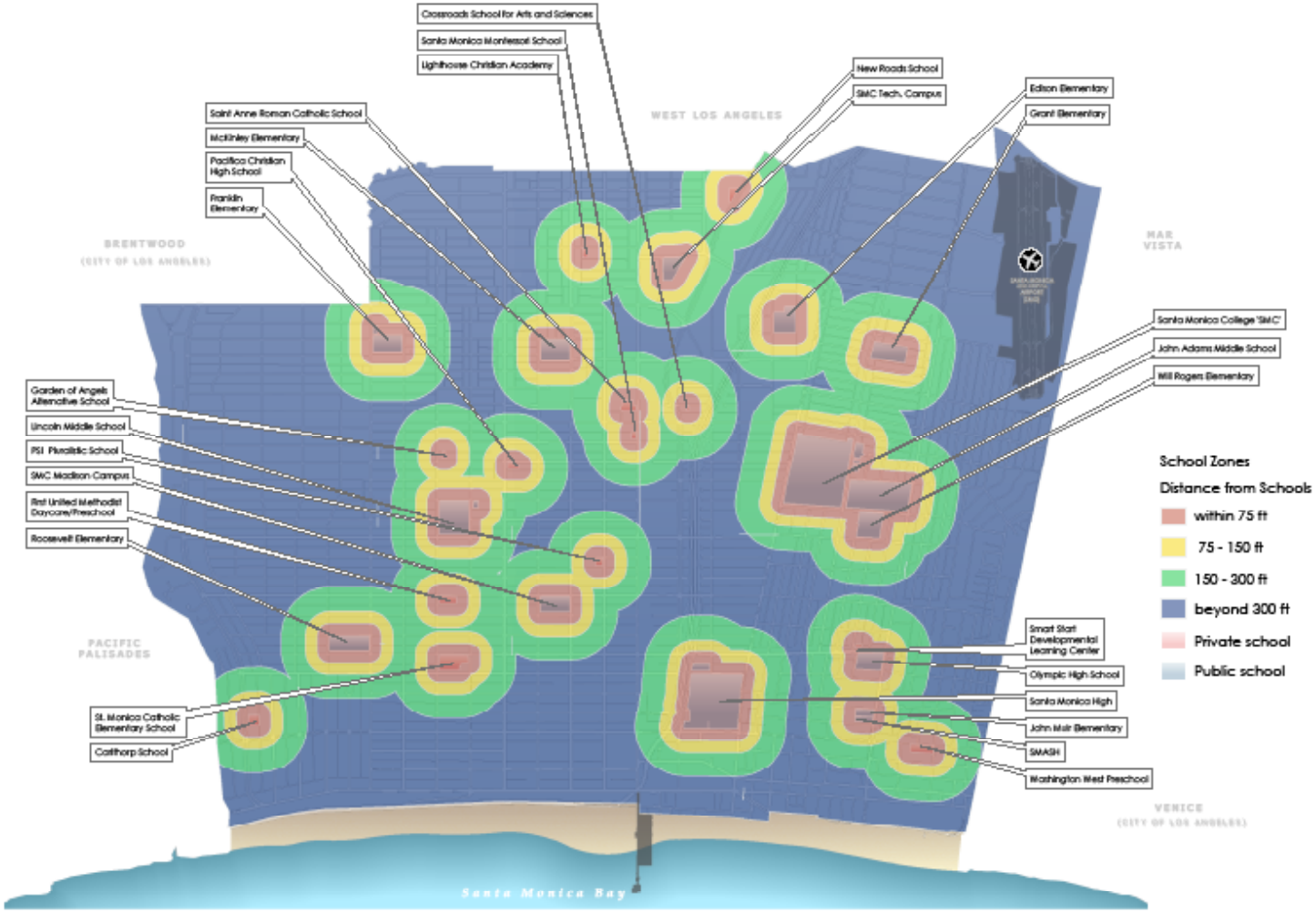


Figure 17. The school zone metric displays locations of public and private schools, and pre-schools with enrollment greater than 50 students.

Population Vulnerability Age Index

The age index values are based on 2010 US Census Bureau data in census block groups. This map displays vulnerable populations in the city, in two age groups - under 18 years and over 65 years of age. Both age groups are added together to create an age index. Looking at the distribution of the age index values on the map, there are a few areas of low populations of young/older citizens – notably the Downtown/Civic Center and 10 freeway corridor, an industrial pocket in the Pico neighborhood, and an area in the adjacent Ocean Park neighborhood.

The Sunset neighborhood contains a notable population of younger/older citizens, and there are pockets in Ocean Park, Northeast, and Mid-city. Yet, the greatest concentration of young/older populations is in the North of Montana neighborhood.

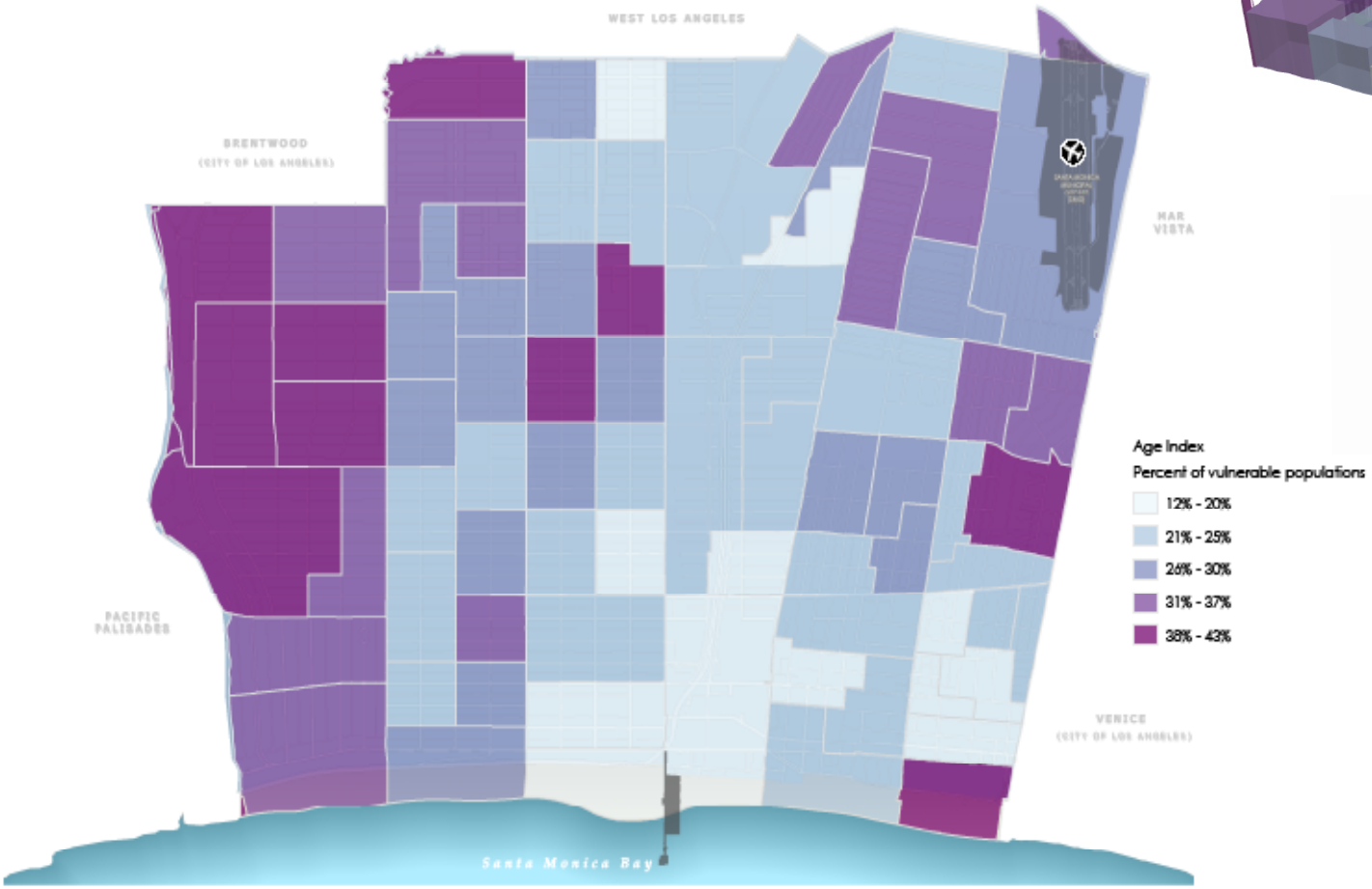
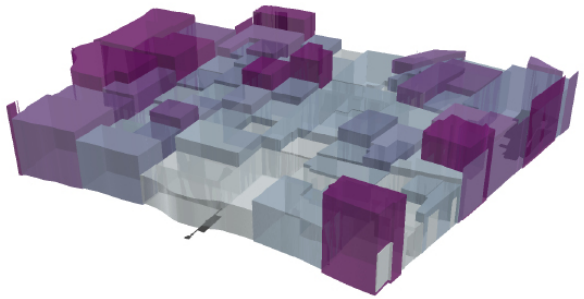
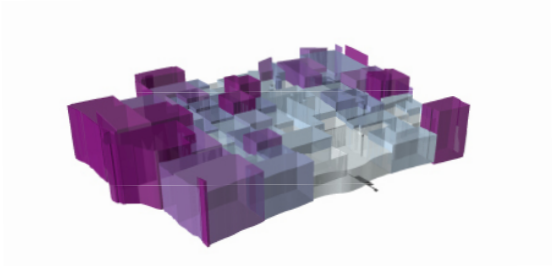
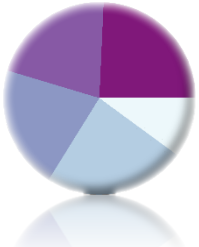


Figure 18a. The age index displays areas in the city where vulnerable populations are concentrated.





Percent of Vulnerability in Census Blocks



Figures 18b. The images above display the population density index in a 3-D representation for visual purposes. The pie chart below shows the distribution of percent of vulnerable populations in census blocks.

Means of Transportation to Work

The means of transportation metric is based on 2010 US Census Bureau data using census block groups. This data emphasizes areas where populations use either public transit or walking as a primary means of commuting to work. The calculations derive from populations with employment outside of residence. There are two areas of highest concern: one in the area immediately adjacent to Santa Monica College, and the other in an area between Lincoln and 12th and Colorado and Santa Monica Boulevards.

The downtown area and the Pico neighborhood have the highest rates of alternative means of transportation, most of the Sunset neighborhood has a generally low alternative transportation index, and the entire North of Montana neighborhood is between 0 - 2%.

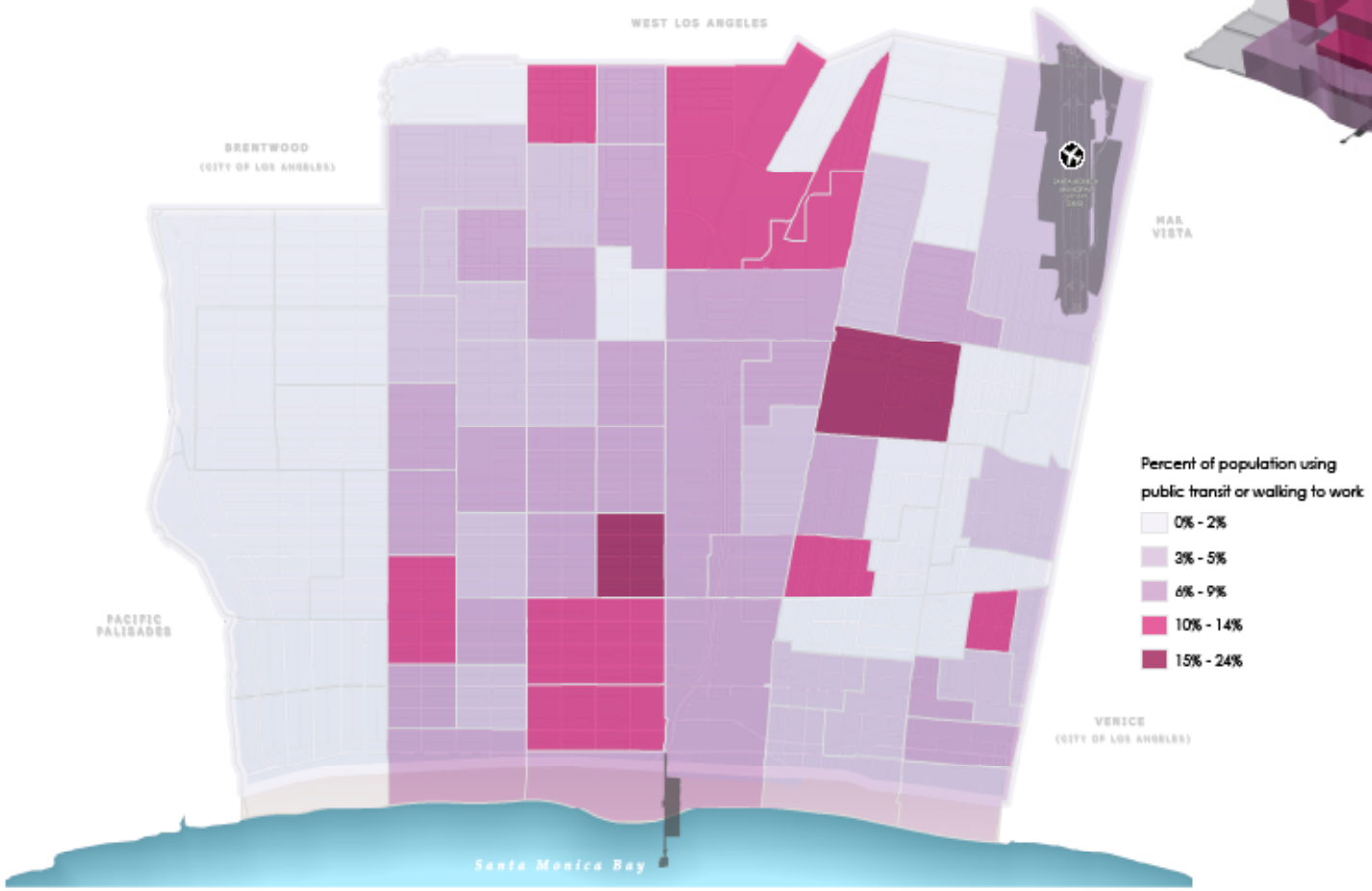
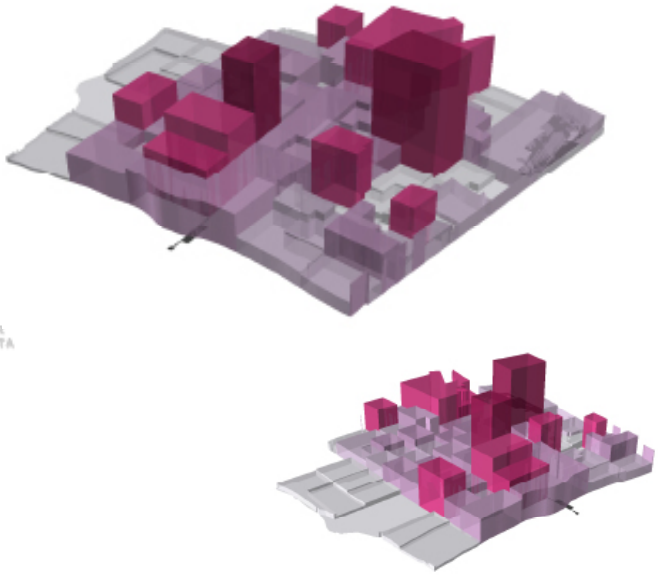
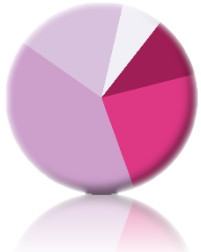


Figure 19a. The means of transportation to work metric displays areas in the city where concentrations of residents use alternative means to commute to work.



Percent of Population using Public Transit



Figures 19b. The images above display the population density index in a 3-D representation for visual purposes. The pie chart below shows the distribution of percent of population using public transit.

Population Density

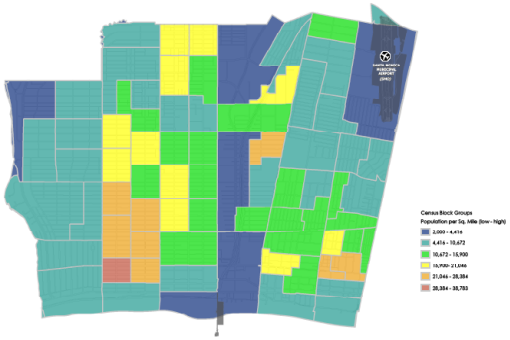


Figure 20a. Population density values are derived from 2010 US Census Bureau data, based on population counts per census block group.

School Zones

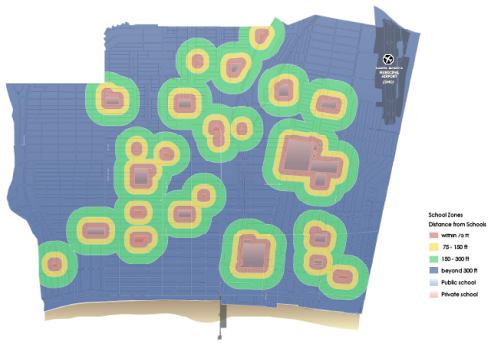


Figure 20b. The school zone metric consists of boundary zones surrounding both public and private schools, and preschools with enrollment

Age Index

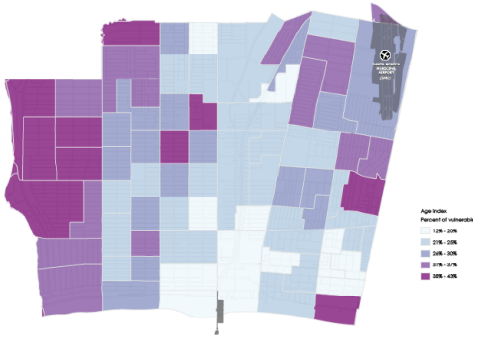


Figure 20c. The age index displays vulnerable populations in the city in two age groups - under 18 years and over 65 years. Both age groups are added together to create an age index.

Transit Index

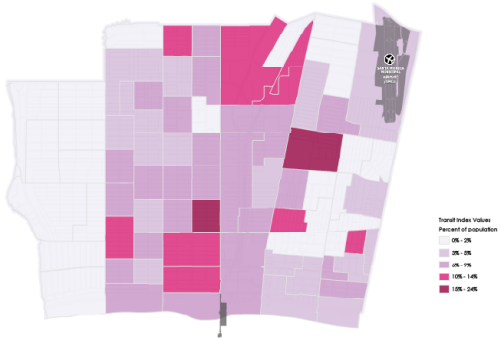


Figure 20d. The means of transportation data emphasizes areas where populations use either public transit or walking as a primary means of commuting to work.

Population Vulnerability Overlay

The four population metrics are combined to create a population vulnerability overlay that displays areas of greatest need. based on demographic conditions. The output from this calculation will serve as an input for further priority analysis.

Population Vulnerability Overlay Image

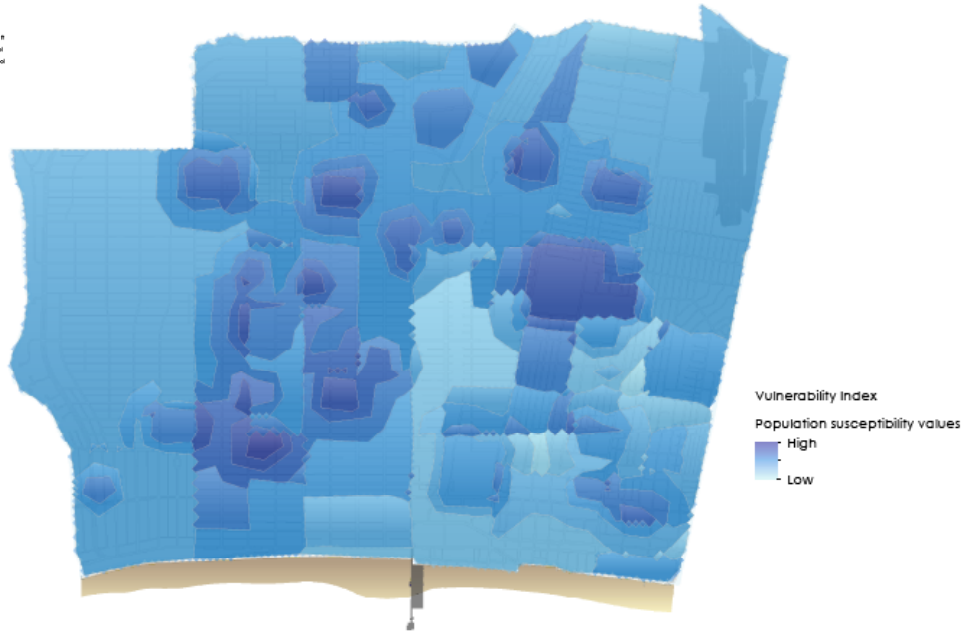
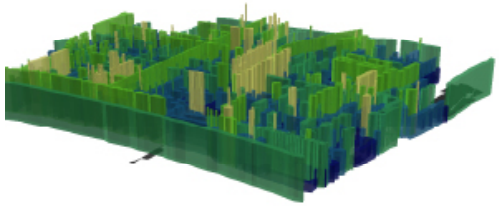


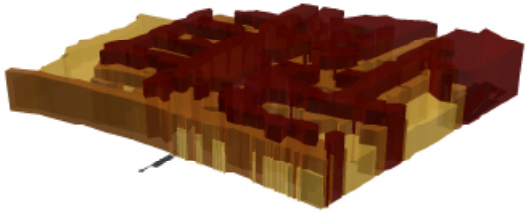
Figure 20e. The population vulnerability index is calculated by applying equal weighting to the population density index, school zones, age index, and transit index values.

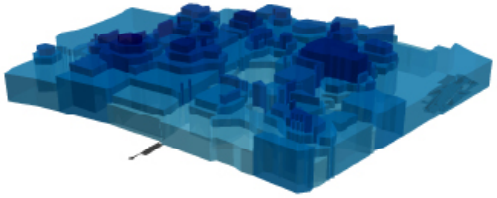
What is included in the final overlay analysis?

The final overlay consists of the three inputs calculated in the model processes: urban forest, environmental need, and population vulnerability. Combined, these inputs will represent the eight various concerns of the community and the city presented in this paper. The final output image will demonstrate what areas within the city would benefit most from the addition of trees.

The input maps are rasterized images. A raster image means that the map is split into an x, y grid and each square within the grid is assigned a value based on its x, y location. A final rasterized image can then be used to match with vacant tree sites and attribute a value to each site based on a grid-code value.







Urban Forest

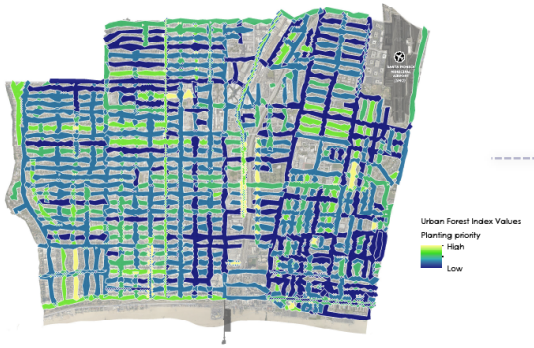


Figure 21a. The urban forest index is calculated by applying equal weighting to the tree stock performance index and the tree age diversification values.

Environmental Index

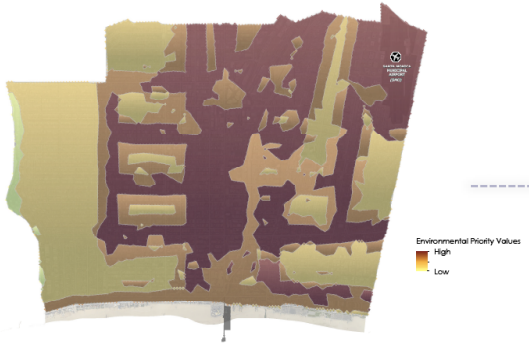


Figure 21b. The environmental index is calculated by applying equal weighting to the air pollution index and the urban heat island values.

Population Vulnerability

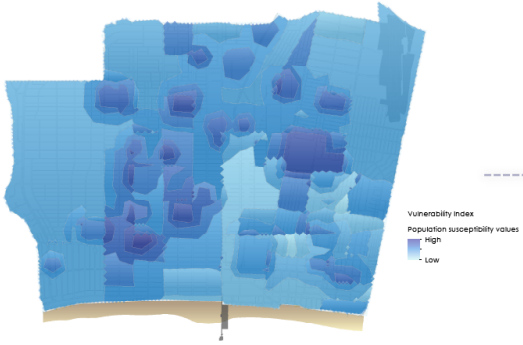


Figure 21c. The population vulnerability index is calculated by applying equal weighting to the population density index, school zones, age index, and transit index values.

Final Overlay

The final overlay image consists of an equal weighting of each of the three inputs, which is clustered to more accurately represent the interests of individual metrics rather than an equal weighting of all metrics in an un-clustered approach. This overlay image displays areas of the city where planting should occur first and can then be used to run further analysis to determine the proper grid codes for each street tree.

Final Overlay Image

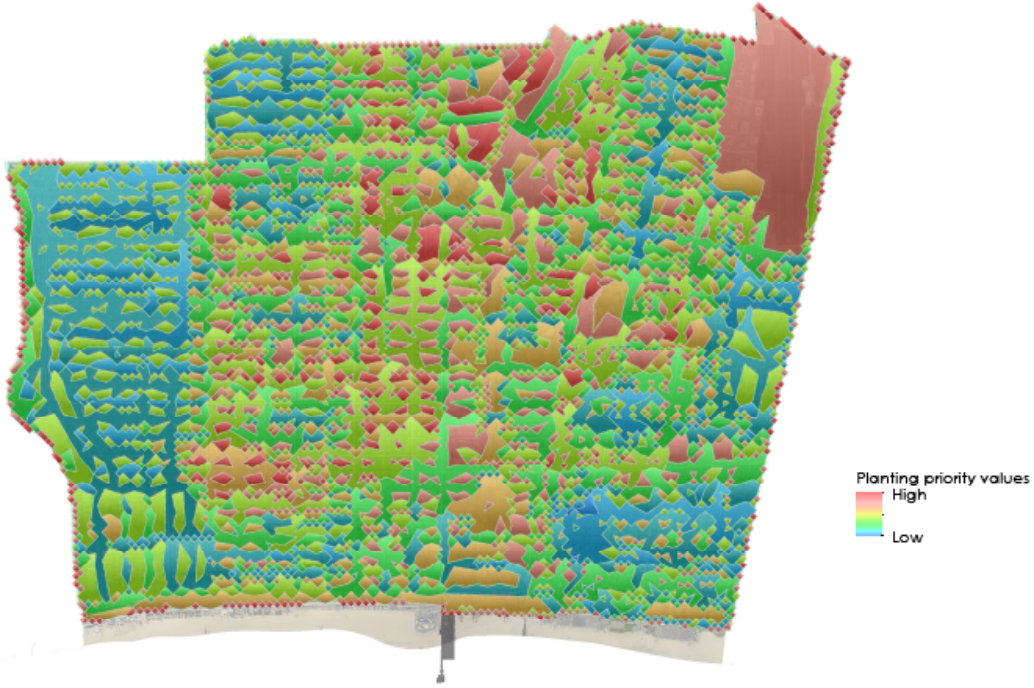
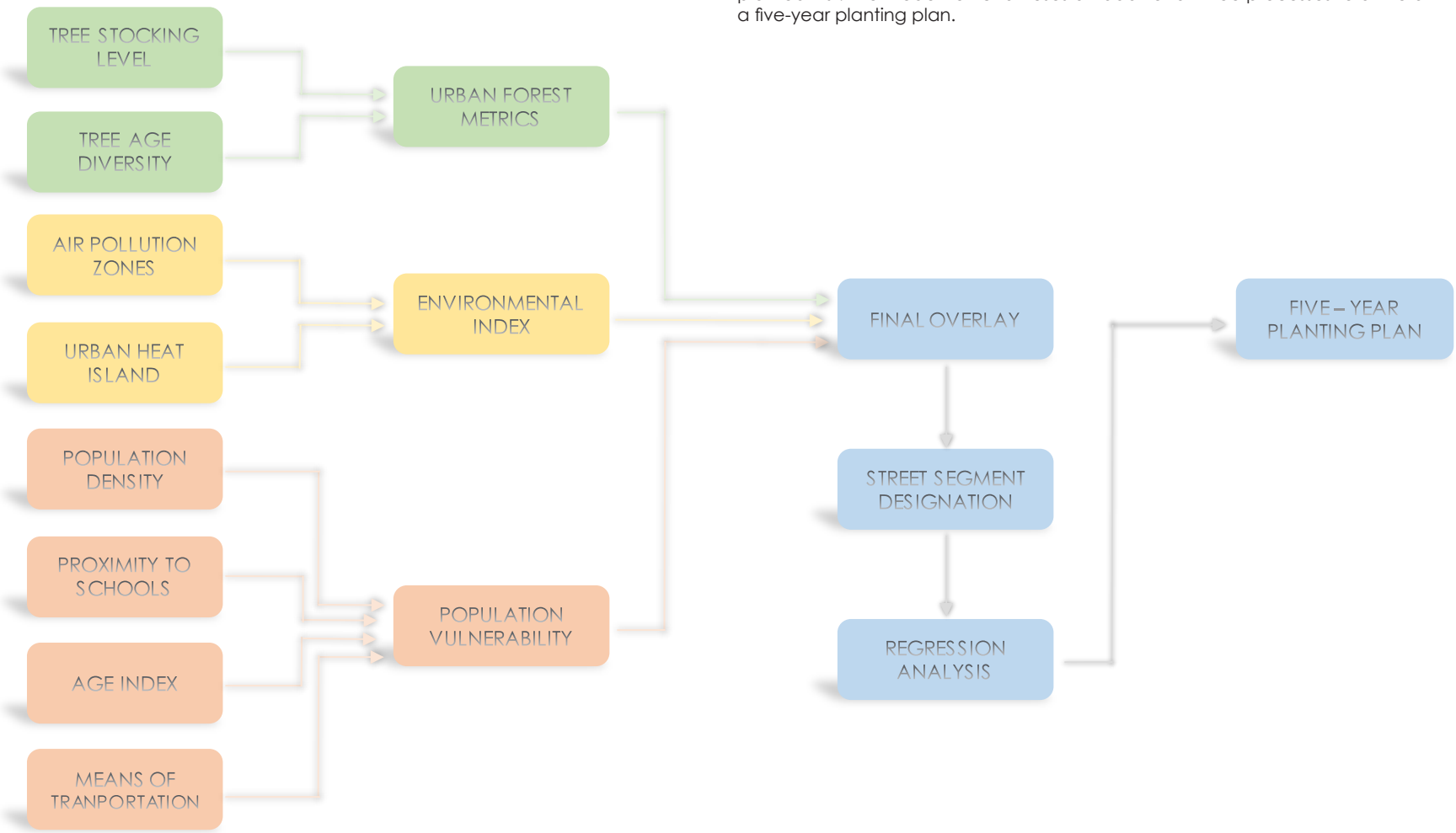


Figure 21d. The final overlay is calculated by applying equal weighting to the three inputs: urban forest, environmental need, and population vulnerability index.

Expanding on the Planting Priority Model Flowchart

The planting priority model has advanced to the final overlay stage, where additional steps must be performed to find which street segments should be planted first. The model flowchart uses an additional three processes to arrive at a five-year planting plan.



Final Overlay Image

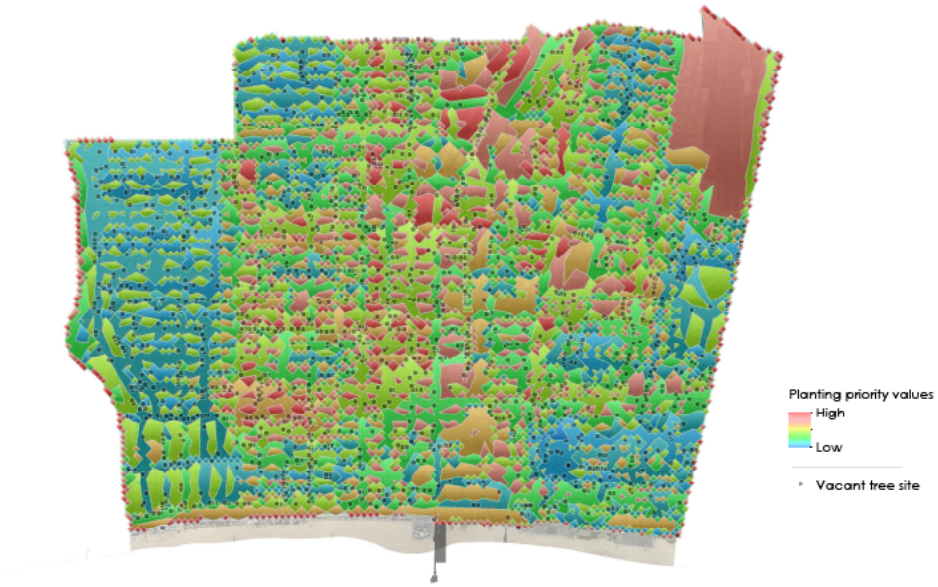
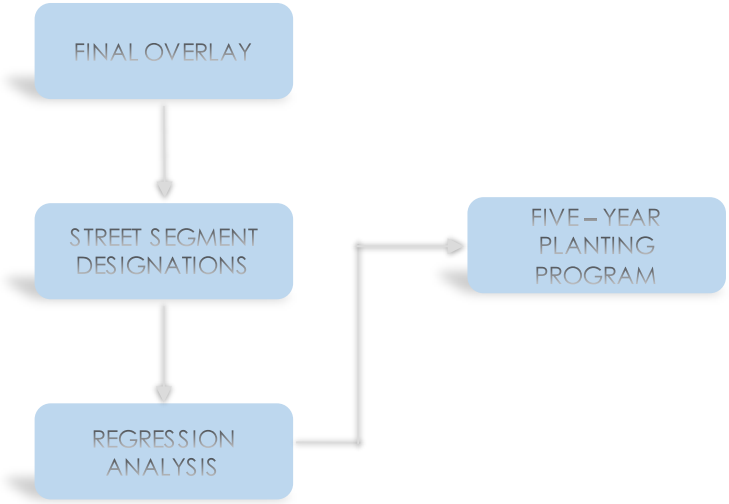
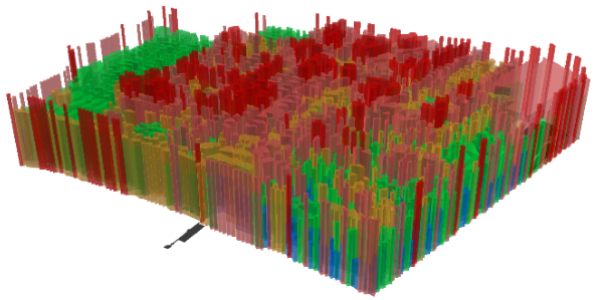


Figure 22. The final overlay is displayed with vacant tree sites and will be used as an input for the final analysis processes.



3-D Model of Final Overlay Image



Final Overlay Interpretation

The final overlay image can now be used in further analysis. I will first assign grid code values to each tree based on its location on the overlay image and calculate the frequency and sum total of values of each street segment. Each segment will be assigned a value based on the sum total.

To control for segment length, a linear regression analysis will be performed to find the residual values of disproportionate street lengths and adjust as necessary. Following an adjustment, the segments can be divided by five, for a five-year planting program, and grouped into their corresponding year.

Linear Regression Analysis Results

For a measure of statistical accuracy I have first produced a set of scatterplot graphs to visualize the sum of street segment values and the segment lengths. The graphs shown below suggest the data contains a few residual values of street segments (points lying far away from a trend line) that will require adjustment.

The graphs shown in Figures 23a and 23b display the street segments labeled with their segment numbers. The colors of the points in the graph denote the residual values depending on their position in the graph (see legend).

Following the initial graphical observation, a linear regression analysis is performed to find the street segments that require adjustment and revision. The results of a least squares linear regression analysis determines the residual properties of all points on a regression line (line of best fit) and note their placement values.

The analysis first considers the length of each street segment and then predicts its sum of vacancy values. Based on the estimation of point values and difference between each point and the trend line, a standard residual number is produced for each point. The results provide an updated list of street segments in ascending order of adjusted values of their planting priority and in relation to streets with the same values, but shorter lengths.

Segment Adjustment Values

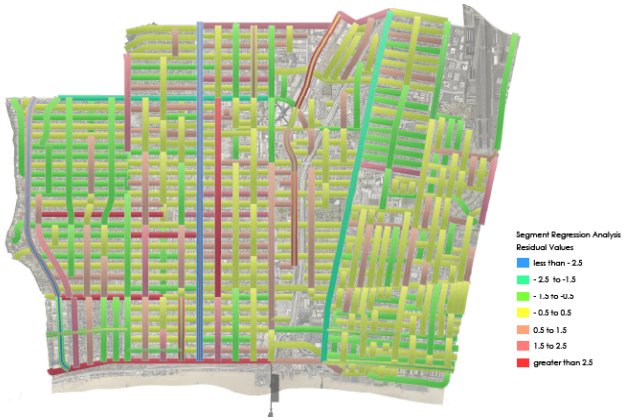


Figure 23c. The segment adjustment analysis produces a new map with consideration to segment length.

Street Segment Analysis w/ Residual Values

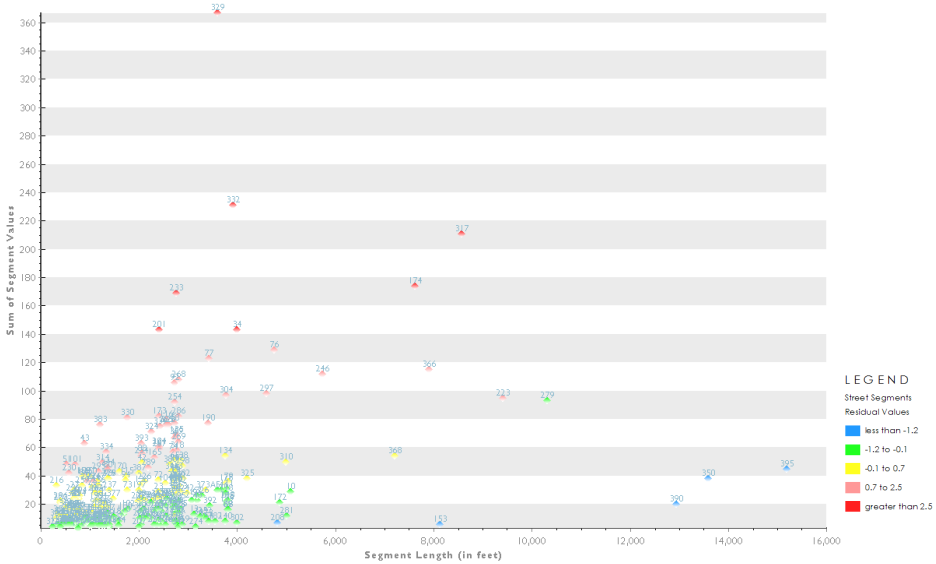


Figure 23a. The graph above displays street segments calculated against length.

Median Segment Analysis w/ Residual Values

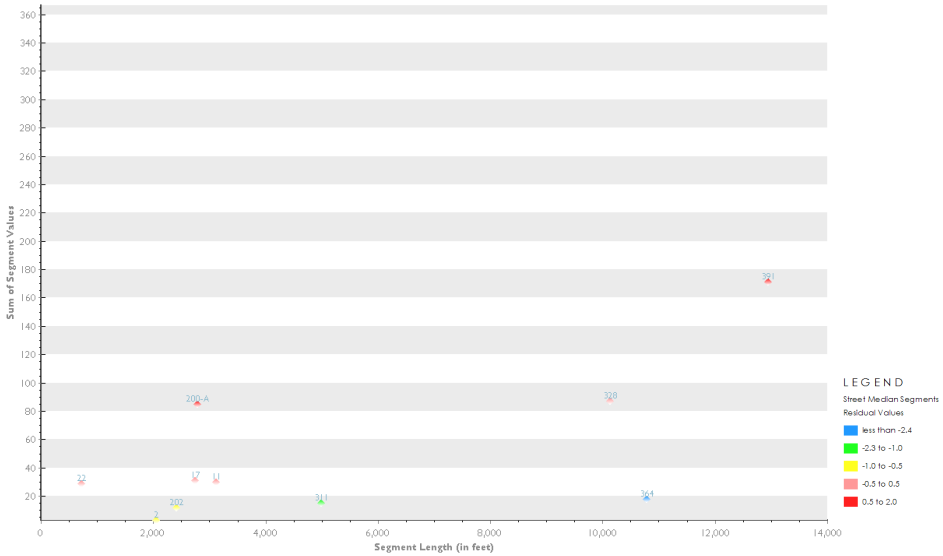


Figure 23b. The graph above displays median street segments calculated against length.

Final Overlay Image

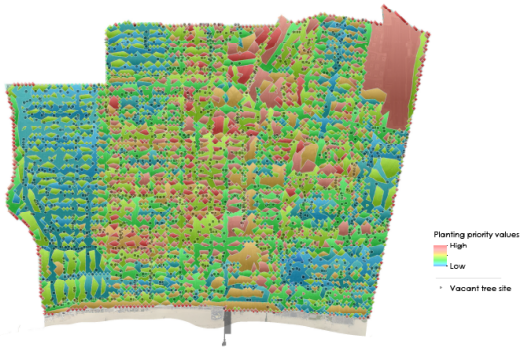


Figure 24a. The final overlay is calculated by applying equal weighting to the three inputs: urban forest, environmental need, and population vulnerability index.

Segment Analysis

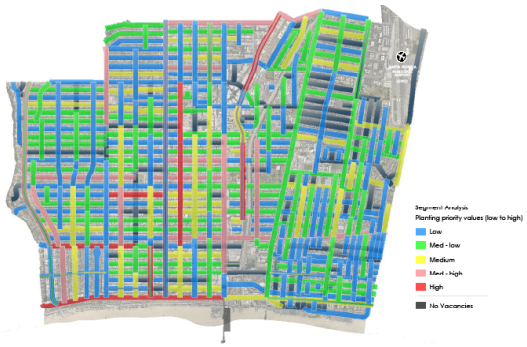


Figure 24b. The segment. analysis displays the calculated designations for each street segment based on a sum value derived from a suitability index

Regression Analysis

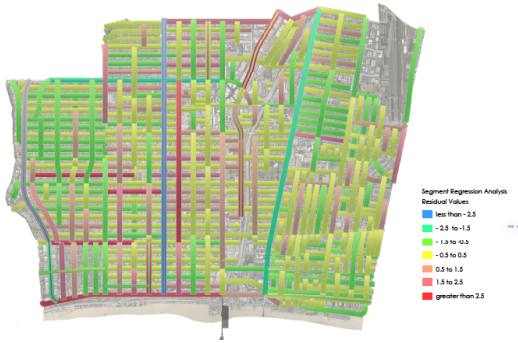


Figure 24c. To better assess the segment analysis, a regression analysis is performed to reduce the impact of the length of street segments on the final product.

Planting Schedule

The final overlay image is used to determine the values for each street tree and find the sum of values for each street segment. Each street segment must be adjusted for length in relation to segments with similar values for proper analysis. A five-year planting schedule is determined by dividing the total number of vacant sites by five, resulting in an estimated 400 trees per year. Based on these projections the map displays a fiveyear planting plan for all street segments.

Five - Year Planting Schedule

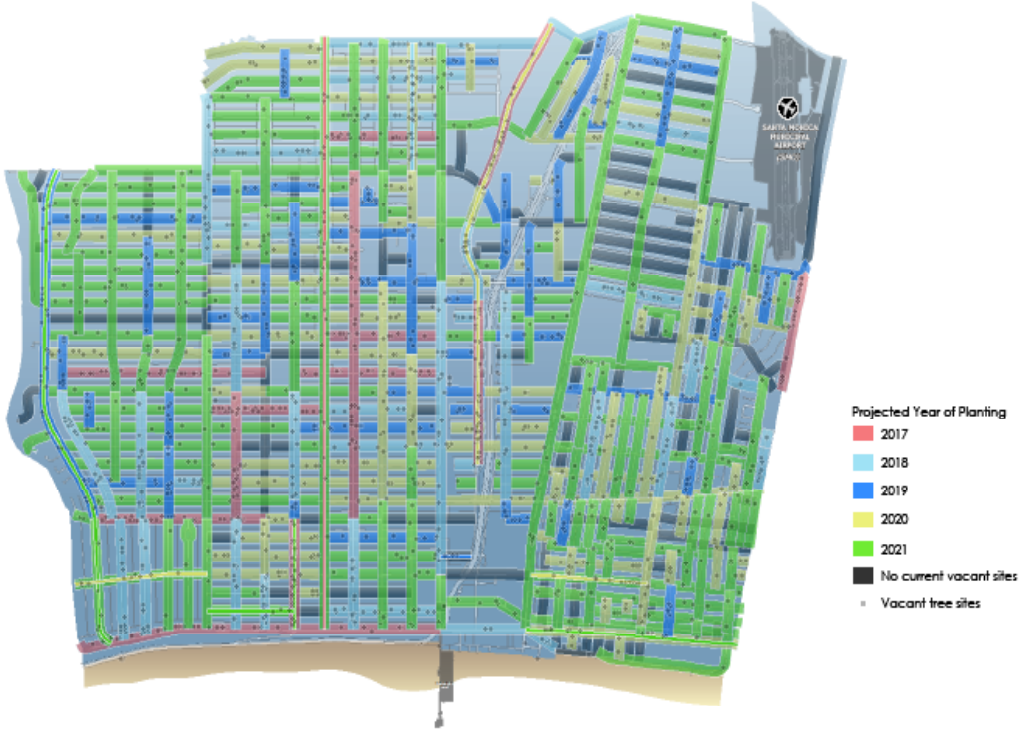


Figure 24d. The tree planting priority schedule displays street segments and their associated projected year of planting.

The Five – Year Planting Schedule

The final output results in a projected planting schedule that may be used to determine where to focus efforts on replanting. With these results, a survey will be conducted on foot to assess the "ground-truth" on the street segments for the next fiscal year, to better determine planting issues that may be of concern. The survey will also aim to find additional locations where street trees may be planted, such as in locations where sidewalk cutting is feasible.

The same number of street trees will be planted each year, yet the number of street segments where planting will occur will be lower, initially. As the years progress, the urban forest will have a higher stocking level overall, and planting will be on streets with stocking levels already above 90%.

Number of Segments Requiring Planting

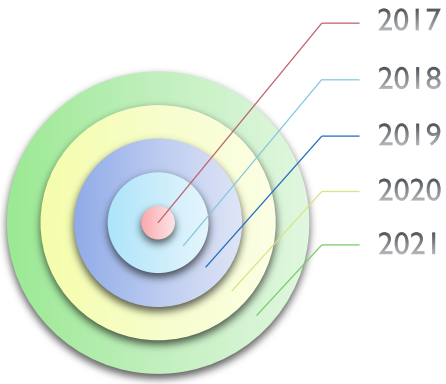


Figure 25b. This figure represents the number of segments that require planting each year.

Five - Year Planting Schedule

Figure 25a. A five-year planting schedule is the final output for the priority planting exercise.

Making the Planting Program Operational

The planting priority model is complete and now a planting plan can begin. To properly use the information generated in this report, an operational plan is compiled to better visualize the program with a set of maps, note the vacant sites and associated planting schedule in a table, and develop a procurement list to aid in annual nursery stock requirements.

A set of maps is generated to operationalize the process and aid the field crews in assessing each planting year with its projected street segments that require planting. The current locations of vacant tree sites are included in the map, on each street segment. The maps include street segment numbers and street names to facilitate proper reference, as they will be used in the field.

A tree planting priority schedule lists each urban forest street segment to be planted, by year, in tabular format. The schedule includes: the species currently planted on each street, the primary species to be planted based on the revised 2017 Urban Forest Master Plan, and the secondary species to be planted in place of the primary species (based on nursery stock availability, planting conditions or other unforeseen factors).

A proposed species procurement list will serve to provide the Public Landscape Division staff with anticipated nursery stock required for each year. The list can be used to find nursery stocks of each tree in anticipation of the fiscal year, to find local specimens, guarantee availability, and reduce costs.

A set of close-up maps are generated using data-driven pages to zoom in on our features at a closer extent and display each street segment at an individual scale. These close-up maps will not be included in this paper, but will be available for viewing and download on the City of Santa Monica Urban Forest website.

The remainder of this study focuses on an operational program to effectively implement the five-year planting plan and aid the Urban Forestry Department. The maps, planting schedule, and species procurement list are the primary documents.

Map Series

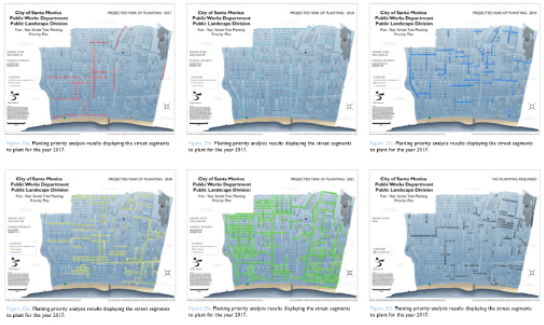
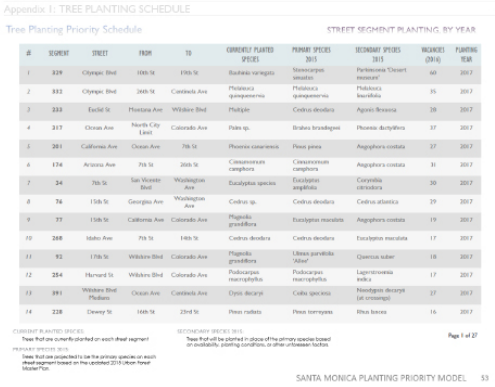


Figure 26a. A set of the planting priority plan maps is generated to provide the operations team with a reference that may be used in the field.

Planting Priority Schedule



Appendix I: TREE PLANTING SCHEDULE

Tree Planting Priority Schedule

STREET SEGMENT PLANTING BY YEAR

#	SEGMENT	STREET	FROM	TO	CURRENTLY PLANTED SPECIES	PRIMARY SPECIES 2015	SECONDARY SPECIES 2015	VACANCIES (2014)	PLANTING YEAR
1	329	Olympic Blvd	10th St	19th St	Bauhinia variegata	Stenocarpus sinuatus	Parkinsonia 'Desert museum'	60	2017
2	332	Olympic Blvd	26th St	Cloverdale Ave	Melaleuca quinquenervia	Melaleuca quinquenervia	Melaleuca linariifolia	35	2017
3	233	Euclid St	Montana Ave	Wilshire Blvd	Multiple	Cedrus deodara	Agonis flexuosa	28	2017
4	317	Ocean Ave	North City Limit	Colorado Ave	Palm sp.	Brahea brandegeei	Phoenix dactylifera	37	2017
5	201	California Ave	Ocean Ave	7th St	Phoenix canariensis	Pinus pinea	Angophora costata	27	2017
6	174	Arizona Ave	7th St	26th St	Cinnamomum camphora	Cinnamomum camphora	Angophora costata	31	2017
7	34	7th St	San Vicente Blvd	Washington Ave	Eucalyptus species	Eucalyptus amplifolia	Corymbia citriodora	30	2017
8	76	15th St	Georgina Ave	Washington Ave	Cedrus sp.	Cedrus deodara	Cedrus atlantica	29	2017
9	37	15th St	California Ave	Colorado Ave	Magnolia grandiflora	Eucalyptus maculata	Angophora costata	19	2017
10	268	Idaho Ave	7th St	14th St	Cedrus deodara	Cedrus deodara	Eucalyptus maculata	17	2017
11	92	17th St	Wilshire Blvd	Colorado Ave	Magnolia grandiflora	Ulmus parvifolia 'Allee'	Quercus suber	18	2017
12	254	Harvard St	Wilshire Blvd	Colorado Ave	Podocarpus macrophyllus	Podocarpus macrophyllus	Lagerstroemia indica	17	2017
13	391	Wilshire Blvd Median	Ocean Ave	Cloverdale Ave	Dysis decaryi	Cotha speciosa	Neodypsis decaryi (at crossings)	27	2017
14	228	Dewey St	16th St	23rd St	Pinus radiata	Pinus torreyana	Rhus lancea	16	2017

CURRENT PLANTED SPECIES
Trees that are currently planted on each street segment

PRIMARY SPECIES 2015
Trees that are projected to be the primary species on each street segment based on the updated 2015 Urban Forest Master Plan

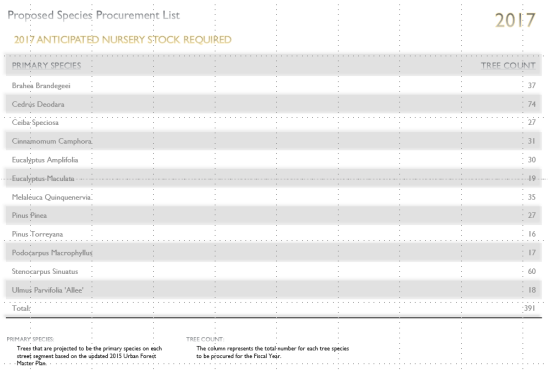
SECONDARY SPECIES 2015
Trees that will be planted in place of the primary species based on availability, planting conditions, or other unforeseen factors

Page 1 of 27

SANTA MONICA PLANTING PRIORITY MODEL 53

Figure 26b. A tree planting priority schedule lists the urban forest street segments to be planted, by year.

Proposed Species Procurement



Proposed Species Procurement List

2017

2017 ANTICIPATED NURSERY STOCK REQUIRED

PRIMARY SPECIES	TREE COUNT
Brahea Brandegeei	37
Cedrus Deodara	74
Cotha Speciosa	27
Cinnamomum Camphora	31
Eucalyptus Amplifolia	30
Eucalyptus Maculata	19
Melaleuca Quinquenervia	35
Pinus Pinea	27
Pinus Torreyana	16
Podocarpus Macrophyllus	17
Stenocarpus Sinuatus	60
Ulmus Parvifolia 'Allee'	18
Total:	391

PRIMARY SPECIES
Trees that are projected to be the primary species on each street segment based on the updated 2015 Urban Forest Master Plan.

TREE COUNT
The column represents the total number for each tree species to be procured for the Fiscal Year.

Figure 26c. A proposed species procurement list provides the anticipated nursery stock required, by year.

Operational Maps

With the results of the planting priority program, a set of maps is made to operationalize the process and aid the field crews in assessing each planting year with its projected street segments that require planting, and highlight the current locations of vacant tree sites. The maps displayed here will be used in the field. In the following pages, each of these maps displays where planting will occur during the fiscal year.

2017

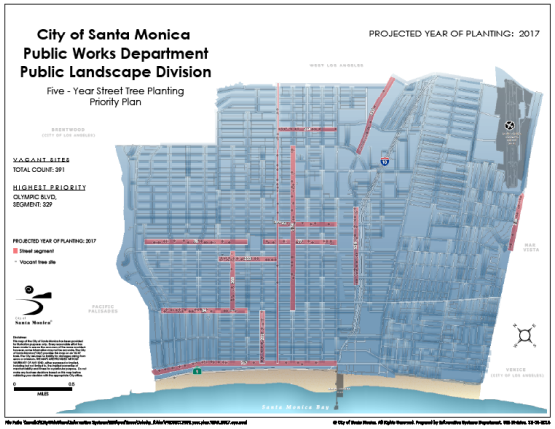


Figure 27a. Planting priority analysis results displaying the street segments to plant for the year 2017.

2018

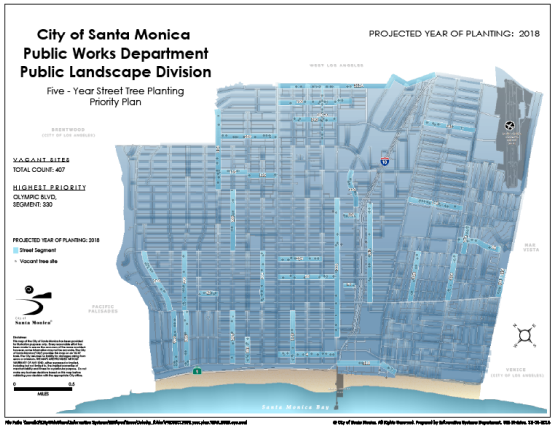


Figure 27b. Planting priority analysis results displaying the street segments to plant for the year 2018.

2019

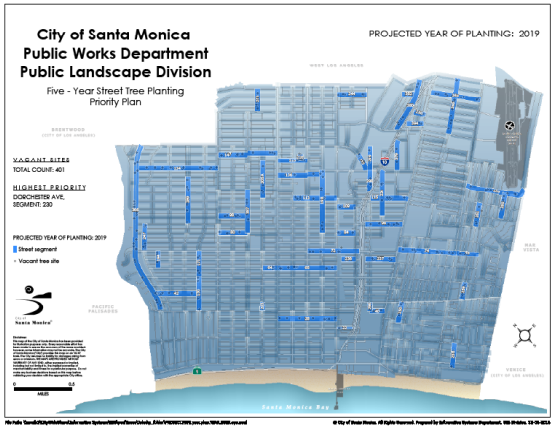


Figure 27c. Planting priority analysis results displaying the street segments to plant for the year 2019.

2020

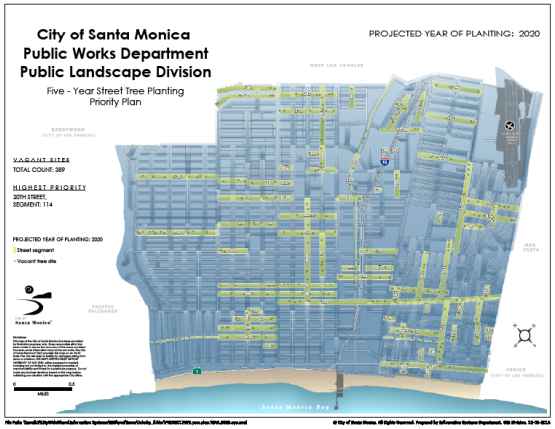


Figure 27d. Planting priority analysis results displaying the street segments to plant for the year 2020.

2021

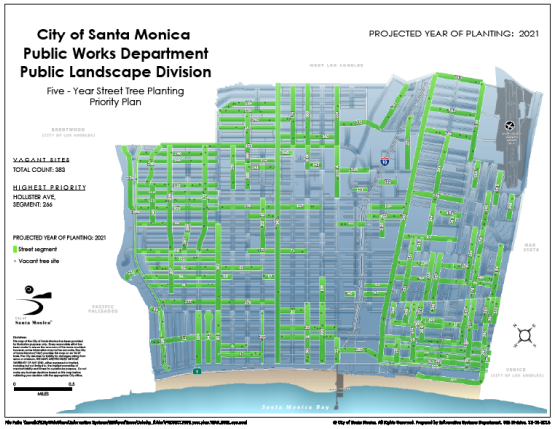


Figure 27e. Planting priority analysis results displaying the street segments to plant for the year 2021.

NO PLANTING

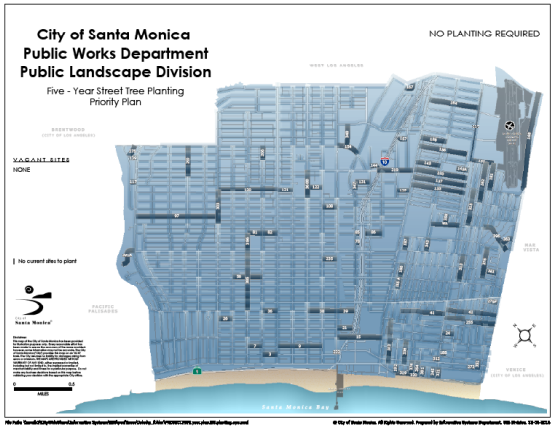


Figure 27f. Planting priority analysis results displaying the street segments with no planting required.

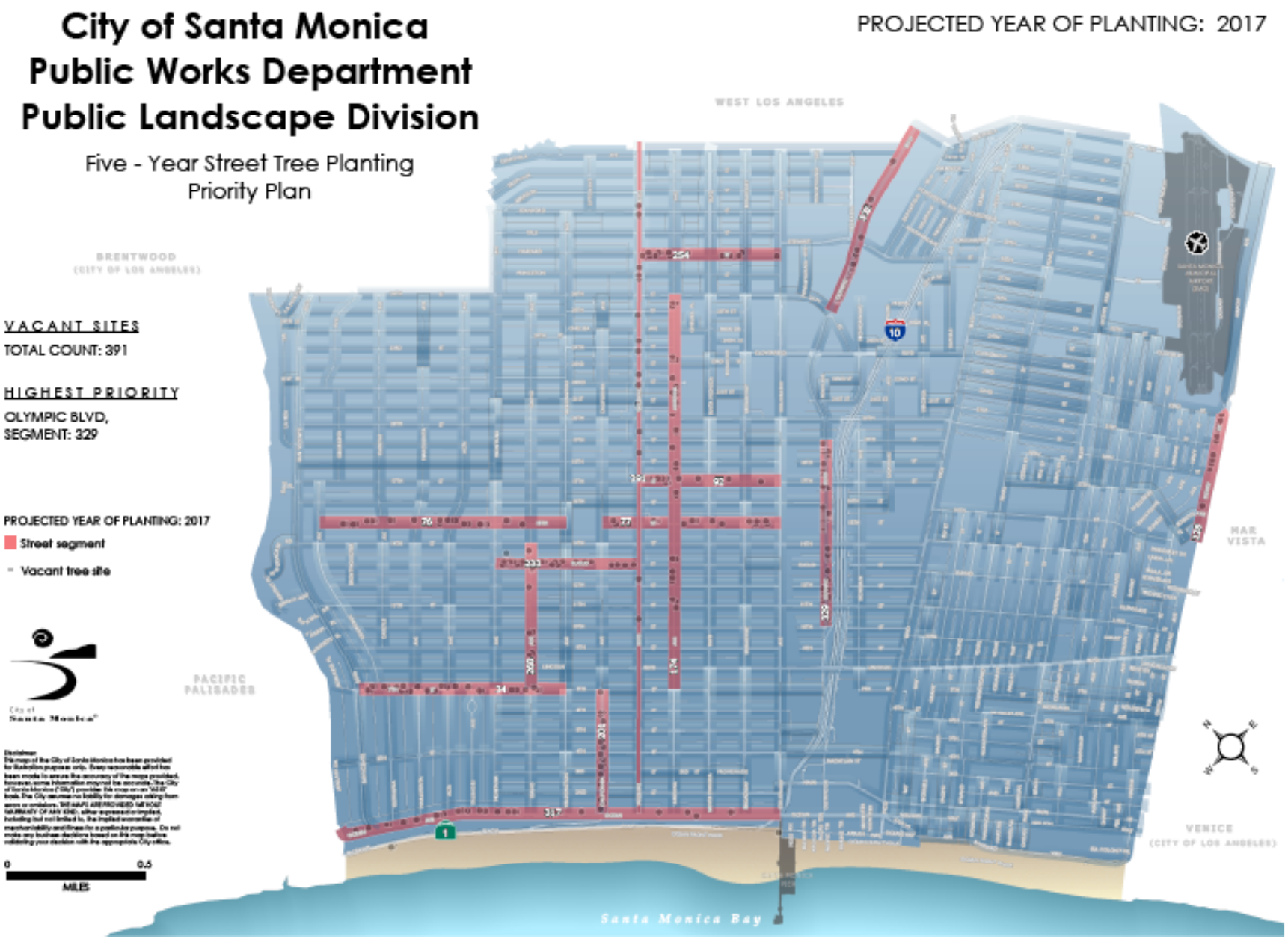


Figure 28. Planting priority analysis results displaying the street segments to plant for the year 2017.

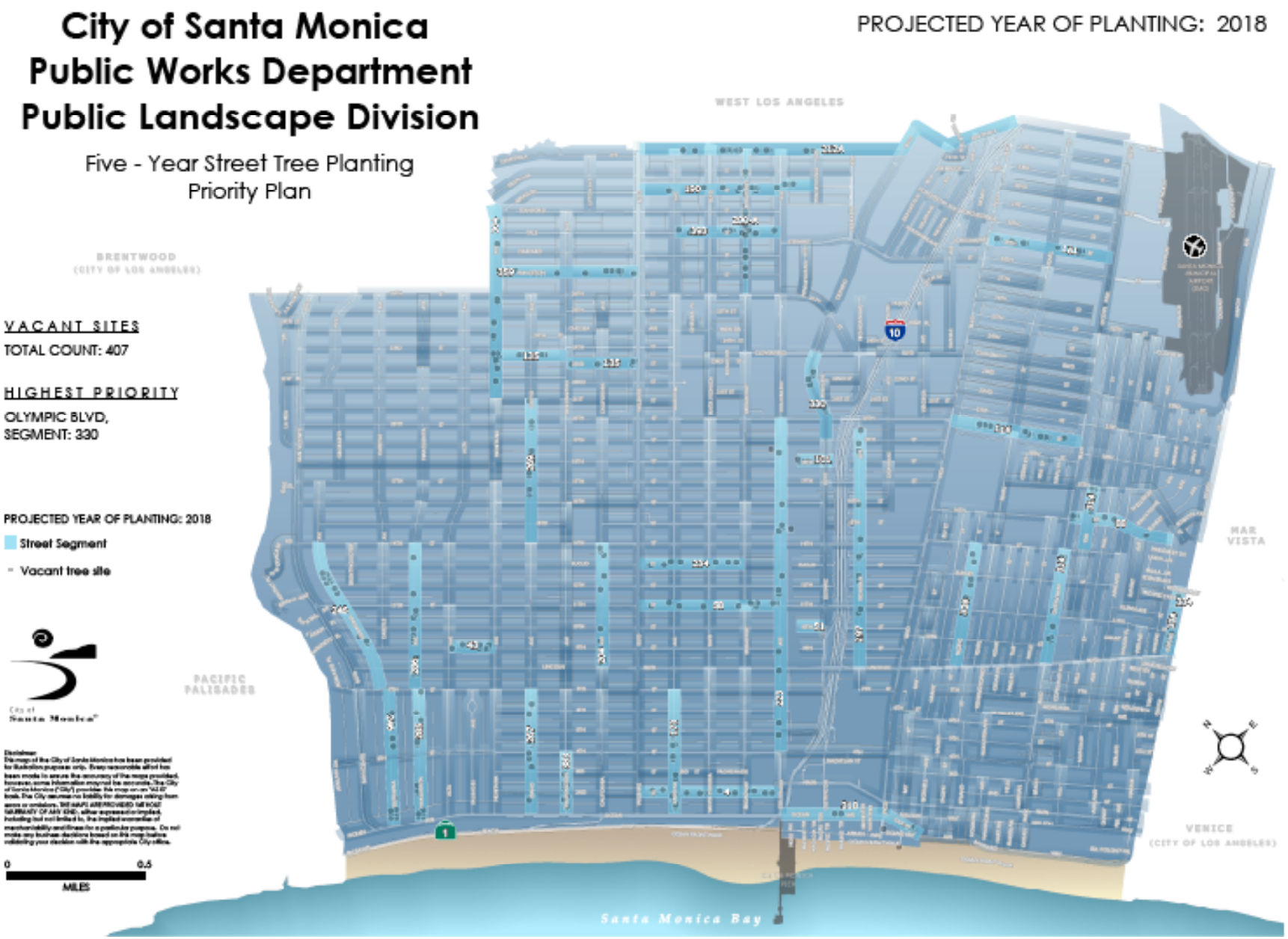


Figure 29. Planting priority analysis results displaying the street segments to plant for the year 2018.

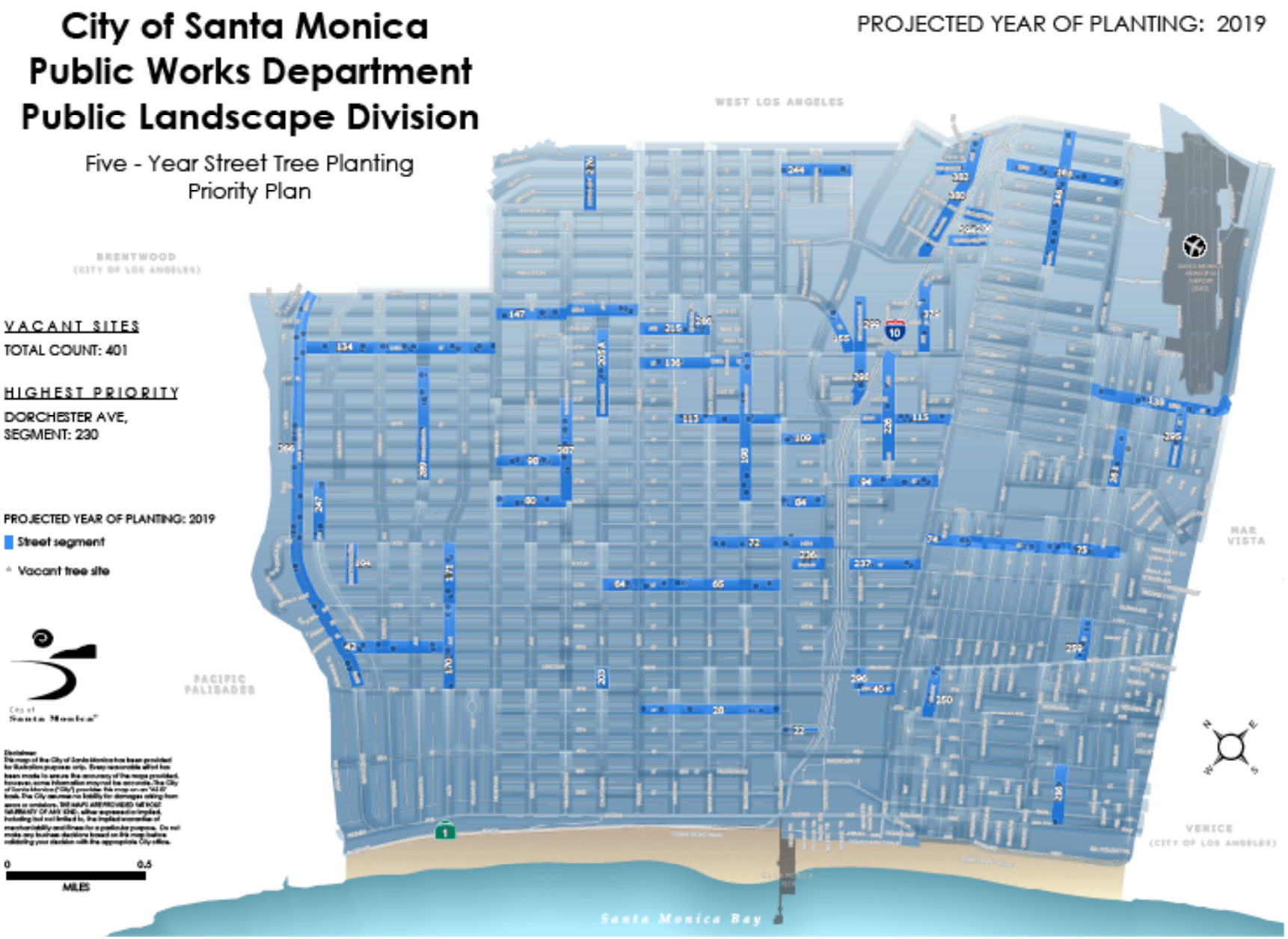


Figure 30. Planting priority analysis results displaying the street segments to plant for the year 2019.

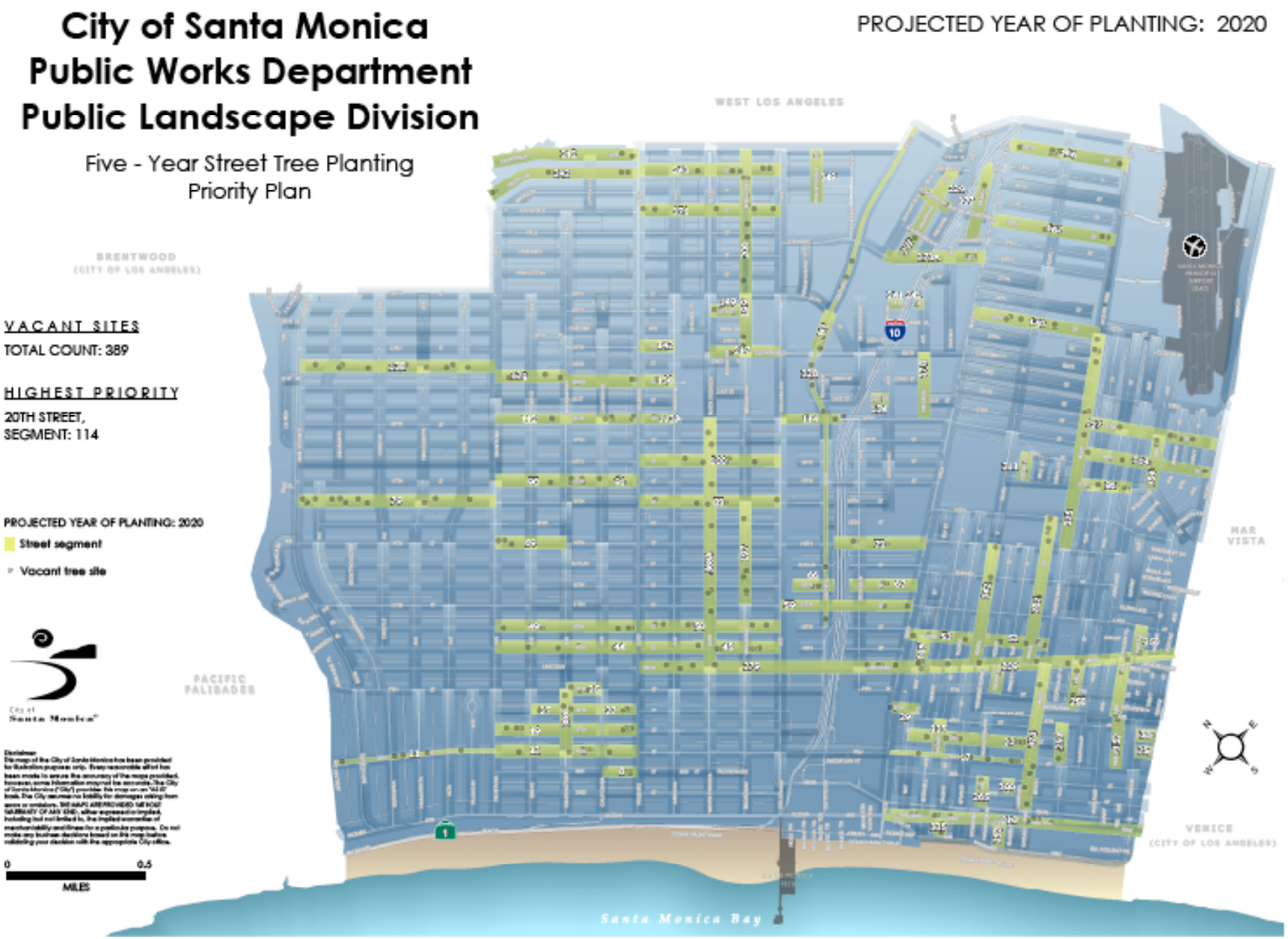


Figure 31. Planting priority analysis results displaying the street segments to plant for the year 2020.

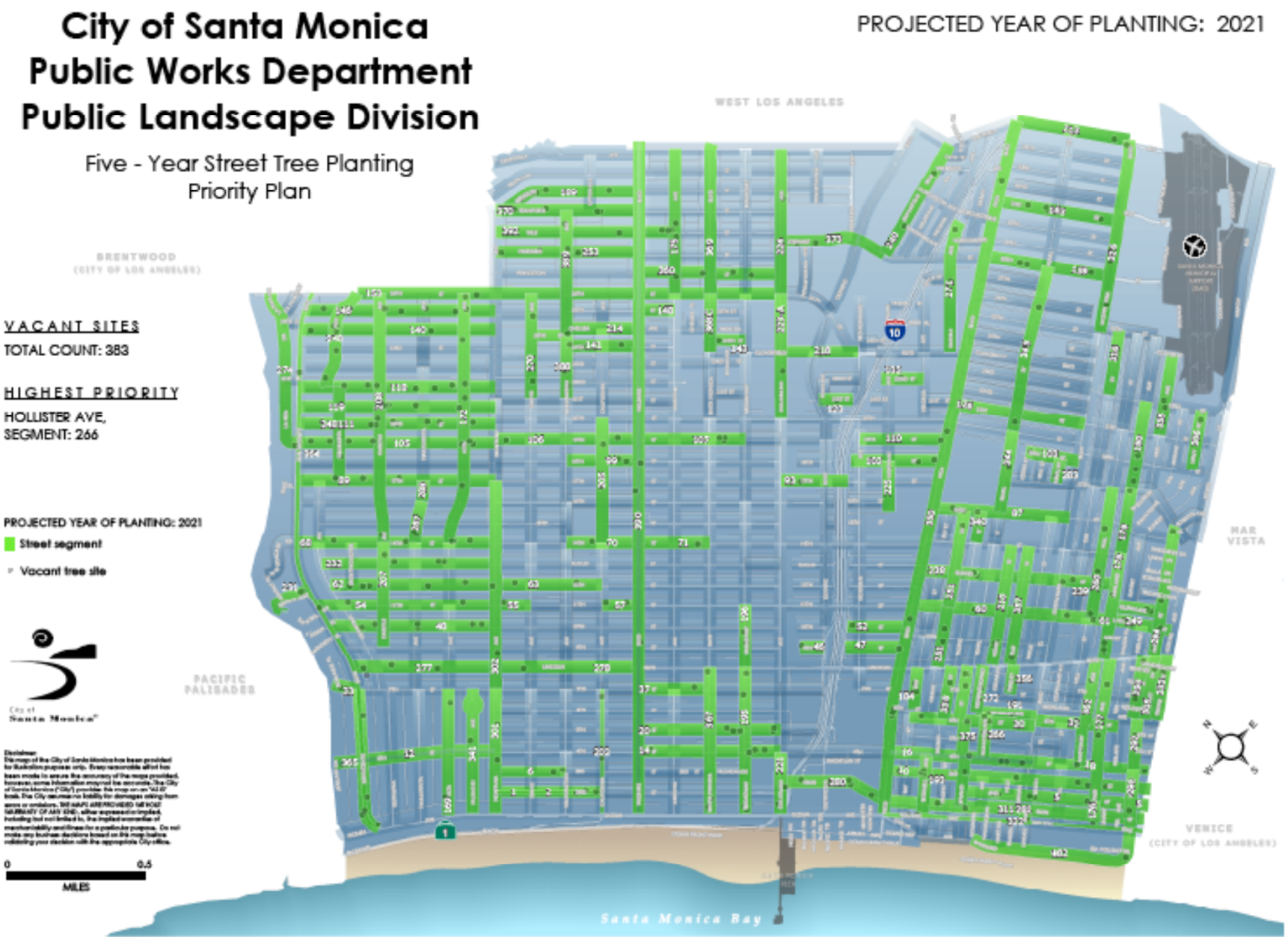


Figure 32. Planting priority analysis results displaying the street segments to plant for the year 2021.

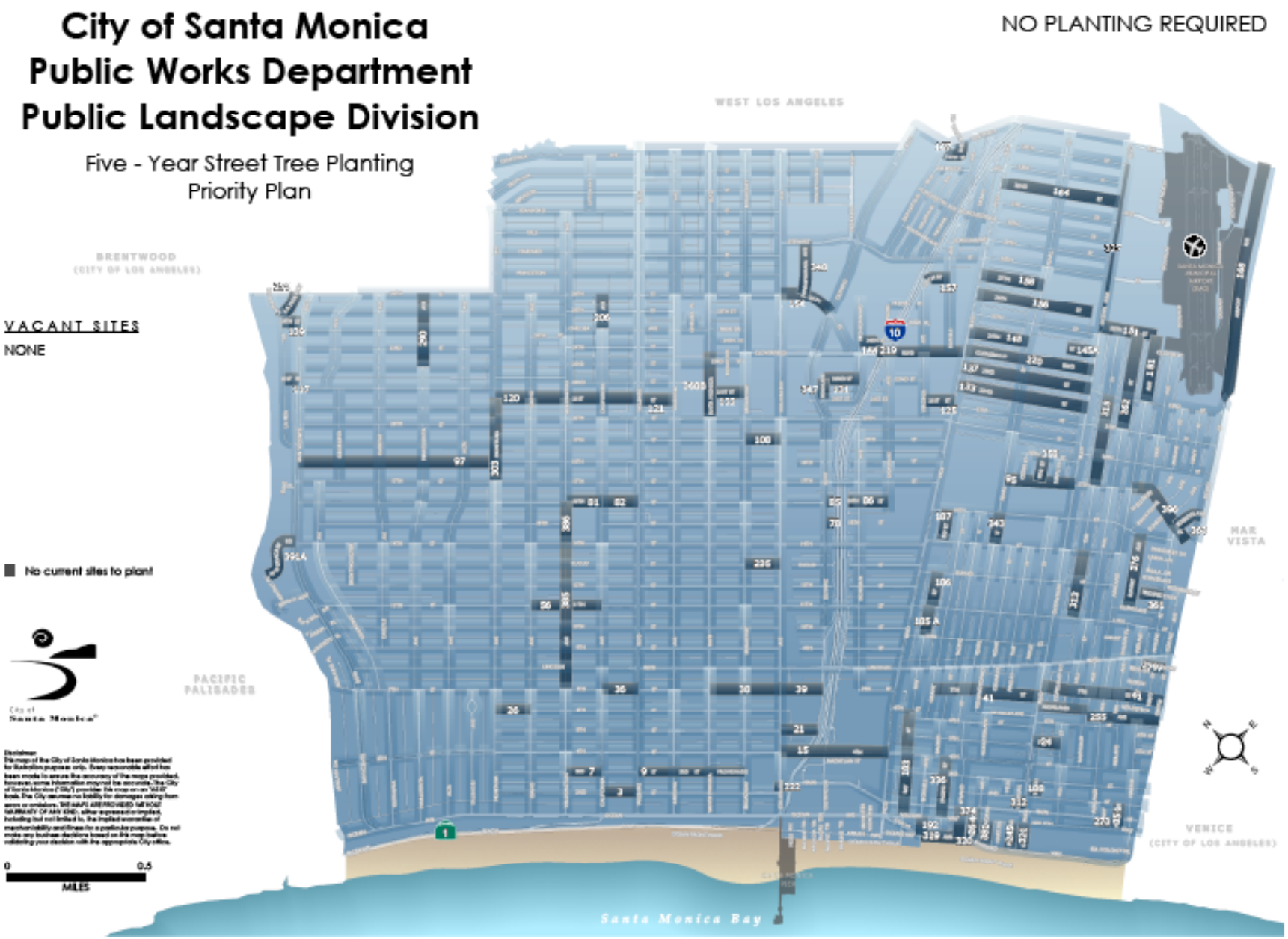


Figure 33. Planting priority analysis results displaying the street segments with no planting required.

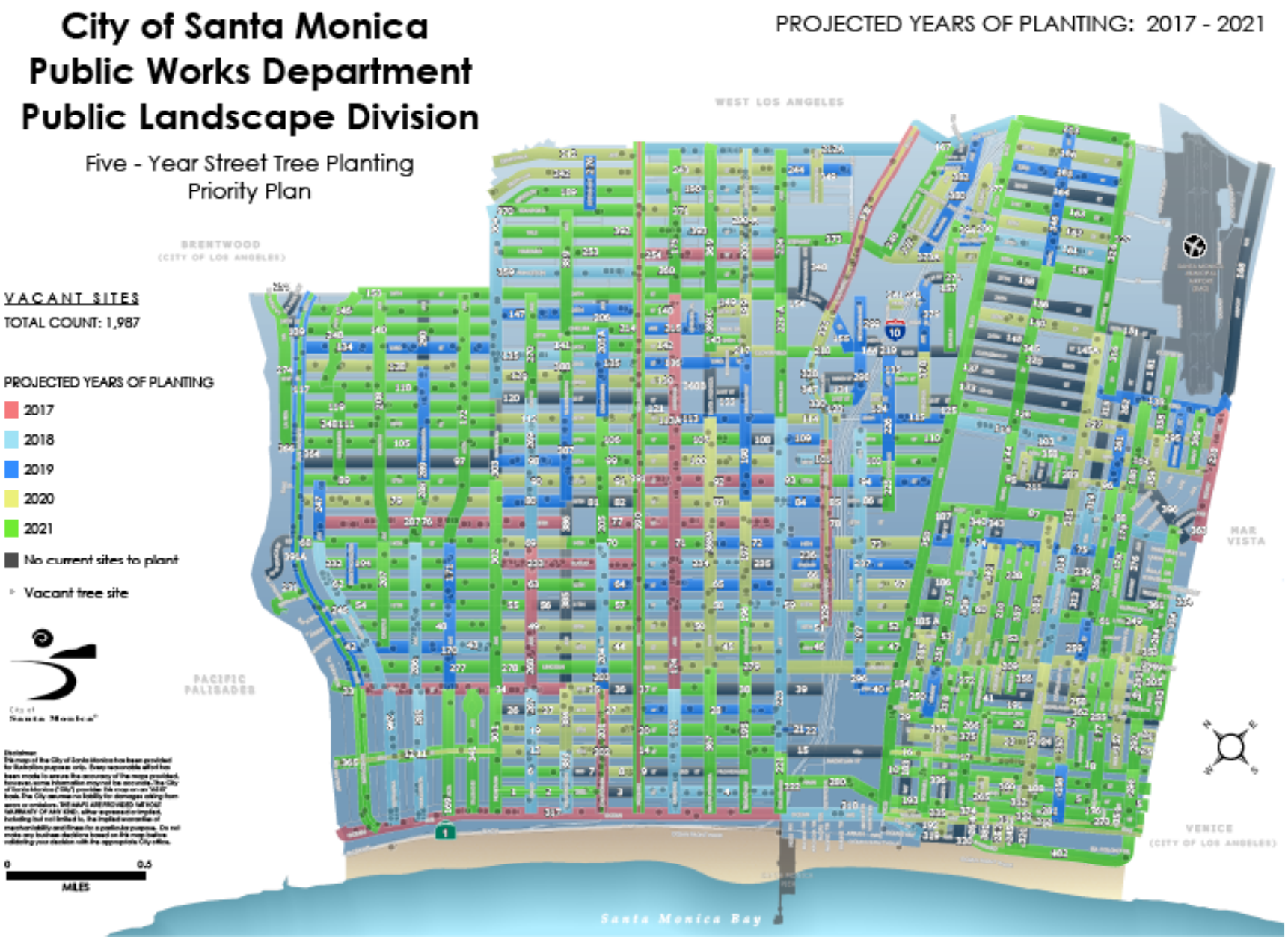


Figure 34. Planting priority analysis results displaying the street segments with all vacant tree sites.

Close-up Images of Individual Street Segments, by Year

To better aid in finding the exact locations of planting per street segment, a map series is created using data-driven pages in the ArcGIS software program. Each urban forest street segment is displayed individually with a close-up view of its location in Santa Monica.

The map series will be of benefit when field crews perform site surveys or conduct field work, or for residents to access documentation online regarding their particular street or neighborhood.

Each street segment image was exported to its own individual pdf document, to create approximately 400 unique pages of pdf printable documents. The map pages are compiled into map books which include all the planting priority street segments by year.

Each page displays an aerial view of an urban forest street segment, the locations of vacant tree sites, the number of current vacant sites on each street, and the stocking level percentage.

These maps can be annually updated as planting occurs to demonstrate the effects of the planting priority plan.

These documents will be posted to the City of Santa Monica Urban Forest website, available for public viewing and download, in pdf format.

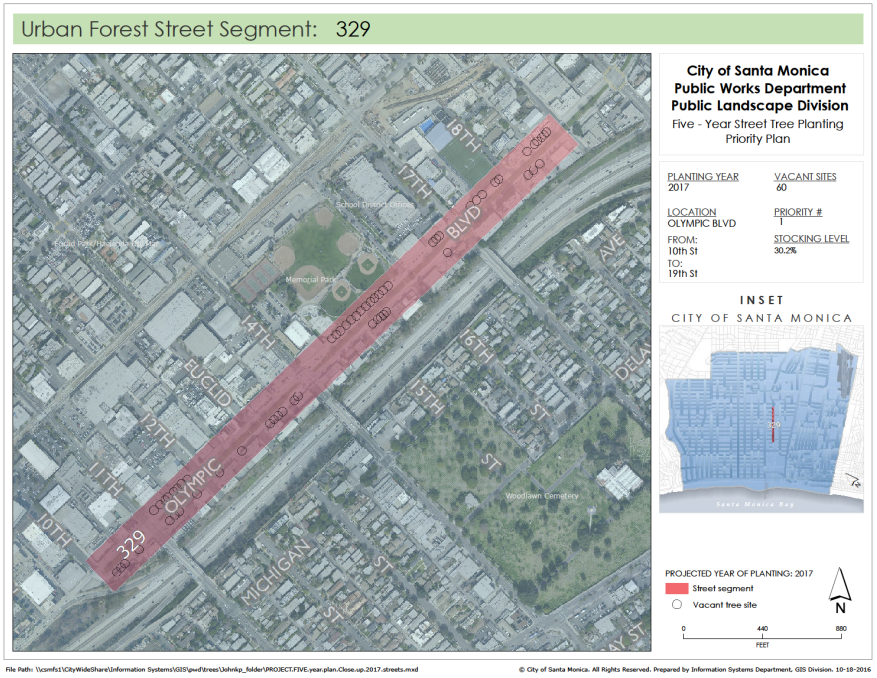


Figure 35a. Close-up image of street segments with highest planting priority in 2017.

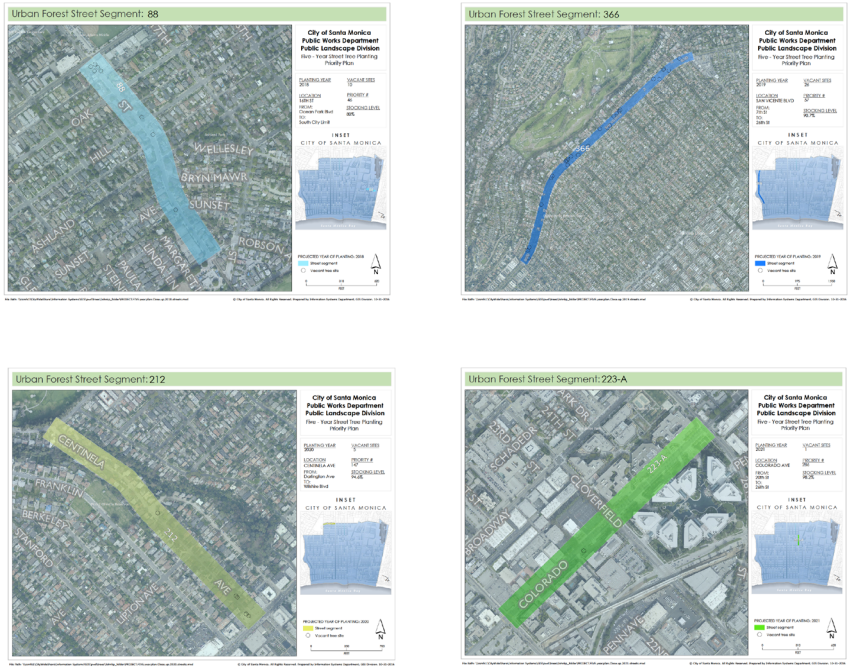


Figure 35b. Planting priority close-up images of street segments in 2018, 2019, 2020, and 2021

TREE PLANTING SCHEDULE*

* Please note that Appendix I is subject to change. For the most up-to-date planting schedule, please see the 2017 revised Urban Forest Master Plan and tree planting schedule maps.

Tree Planting Priority Schedule

STREET SEGMENT PLANTING, BY YEAR

#	SEGMENT	STREET	FROM	TO	CURRENTLY PLANTED SPECIES	PRIMARY SPECIES 2015	SECONDARY SPECIES 2015	VACANCIES (2016)	PLANTING YEAR
1	329	Olympic Blvd	10th St	19th St	Bauhinia variegata	Stenocarpus sinuatus	Parkinsonia 'Desert museum'	60	2017
2	332	Olympic Blvd	26th St	Centinela Ave	Melaleuca quinquenervia	Melaleuca quinquenervia	Melaleuca linariifolia	35	2017
3	233	Euclid St	Montana Ave	Wilshire Blvd	Multiple	Cedrus deodara	Agonis flexuosa	28	2017
4	317	Ocean Ave	North City Limit	Colorado Ave	Palm sp.	Brahea brandegeei	Phoenix dactylifera	37	2017
5	201	California Ave	Ocean Ave	7th St	Phoenix canariensis	Pinus pinea	Angophora costata	27	2017
6	174	Arizona Ave	7th St	26th St	Cinnamomum camphora	Cinnamomum camphora	Angophora costata	31	2017
7	34	7th St	San Vicente Blvd	Washington Ave	Eucalyptus species	Eucalyptus amplifolia	Corymbia citriodora	30	2017
8	76	15th St	Georgina Ave	Washington Ave	Cedrus sp.	Cedrus deodara	Cedrus atlantica	29	2017
9	77	15th St	California Ave	Colorado Ave	Magnolia grandiflora	Eucalyptus maculata	Angophora costata	19	2017
10	268	Idaho Ave	7th St	14th St	Cedrus deodara	Cedrus deodara	Eucalyptus maculata	17	2017
11	92	17th St	Wilshire Blvd	Colorado Ave	Magnolia grandiflora	Ulmus parvifolia 'Allee'	Quercus suber	18	2017
12	254	Harvard St	Wilshire Blvd	Colorado Ave	Podocarpus macrophyllus	Podocarpus macrophyllus	Lagerstroemia indica	17	2017
13	391	Wilshire Blvd Medians	Ocean Ave	Centinela Ave	Dysis decaryi	Ceiba speciosa	Neodypsis decaryii (at crossings)	27	2017
14	228	Dewey St	16th St	23rd St	Pinus radiata	Pinus torreyana	Rhus lancea	16	2017

CURRENT PLANTED SPECIES:

Trees that are currently planted on each street segment

PRIMARY SPECIES 2015:

Trees that are projected to be the primary species on each street segment based on the updated 2015 Urban Forest Master Plan.

SECONDARY SPECIES 2015:

Trees that will be planted in place of the primary species based on availability, planting conditions, or other unforeseen factors.

Tree Planting Priority Schedule

STREET SEGMENT PLANTING, BY YEAR

#	SEGMENT	STREET	FROM	TO	CURRENTLY PLANTED SPECIES	PRIMARY SPECIES 2015	SECONDARY SPECIES 2015	VACANCIES (2016)	PLANTING YEAR
15	330	Olympic Blvd	19th St	Cloverfield Blvd	Melaleuca quinquenervia	Melaleuca quinquenervia	Banksia integrifolial	12	2018
16	200-A	Broadway Ave Median	26th St	Centinela Ave	Calodendrum capense	Ceiba speciosa	Eucalyptus amplifolia	16	2018
17	304	Montana Ave	21st St	Stanford St	Brachyciton populneus	Eucalyptus amplifolia	Agathis robusta	15	2018
18	383	Washington Ave	Ocean Ave	4th St	Washingtonia robusta	Eucalyptus amplifolia	Eucalyptus maculata	15	2018
20	246	Georgina Ave	Ocean Ave	14th St	Phoenix canariensis	Jubaea chilensis	Phoenix dactylifera	23	2018
21	173	Arizona Ave	Ocean Ave	7th St	Trachycarpus fortunei	Ulmus parvifolia 'Allee' & 'Drake' (mix)	Lophostemon confertus	17	2018
22	116	20th St	Pico Blvd	Ocean Park Blvd	Lagerstroemia indica	Lagerstroemia indica	Tristaniopsis laurina	14	2018
23	286	Marguerita Ave	7th St	14th St	Phoenix canariensis	Washingtonia filifera	Phoenix reclinata	16	2018
24	297	Michigan Ave	Lincoln Blvd	20th St	Ficus microcarpa	Afrocarpus falcatus	Geijera parviflora	17	2018
25	324	Ocean Park Blvd	Lincoln Blvd	14th St	Liquidambar styraciflua	Tipuana tipu	Albizia julibrissin	14	2018
26	43	9th St	Alta Ave	Montana Ave	Eucalyptus ficifolia	Eucalyptus ficafolia	Ficus rubiginosa	9	2018
27	339	Pacific St	Lincoln Blvd	14th St	Casuarina cunninghamiana	Casuarina cunninghamiana	Allocasuarina verticiliata	14	2018
28	190	Berkeley St	Wilshire Blvd	Pennsylvania Ave	Pyrus kawakamii	Rhus lancea	Pyrus kawakamii	13	2018
29	285	Marguerita Ave	Ocean Ave	7th St	Phoenix canariensis	Jubaea chilensis	Phoenix dactylifera	13	2018
30	393	Yale St	Arizona Ave	Colorado Ave	Hymenosporum flavum	Callistemon viminalis	Leptospermum petersonii	11	2018

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Tree Planting Priority Schedule

STREET SEGMENT PLANTING, BY YEAR

#	SEGMENT	STREET	FROM	TO	CURRENTLY PLANTED SPECIES	PRIMARY SPECIES 2015	SECONDARY SPECIES 2015	VACANCIES (2016)	PLANTING YEAR
31	101	18th St	Dead End North of Olympic	Dead End @ Freeway	Pyrus kawakamii	Tristaniopsis laurina	Pyrus kawakamii	8	2018
32	58	11th St	Wilshire Blvd	Colorado Ave	Liquidambar styraciflua	Platanus racemosa	Eucalyptus maculata	12	2018
33	4	2nd St	Wilshire Blvd	Colorado Ave	Ficus microcarpa	Afrocarpus falcatus	Corymbia aparrerinja (I)	13	2018
34	318	Ocean Ave	Colorado Ave	Bicknell Ave	Palm sp.	Brahea armata	Brahea brandegeei	12	2018
35	135	23rd St	Montana Ave	Wilshire Blvd	Podocarpus sp	Melaleuca linariifolia	Podocarpus macrophyllus	13	2018
36	359	Princeton St	Montana Ave	Wilshire Blvd	Ficus microcarpa	Tipuana tipu	Cupaniopsis anacardioides	13	2018
37	51	10th St	Dead End	Olympic Blvd	Ulmus parvifolia	Ulmus parvifolia	Pistacia chinensis	6	2018
38	204	California Ave	Lincoln Blvd	14th St	Cinnamomum camphora	Cinnamomum camphora	Ficus rubiginosa	11	2018
39	334	Ozone Ave	Lincoln Blvd	Frederick St	Schinus molle	Tristaniopsis laurina	Geijera parviflora	10	2018
40	223	Colorado Ave	4th St	20th St	Cupaniopsis anacardioides	Cupaniopsis anacardioides	Albizia julibrissin	16	2018
41	161	29th St	Pico Blvd	Ocean Park Blvd	Cupaniopsis anacardioides	Cupaniopsis anacardioides	Tristaniopsis laurina	11	2018
42	269	Idaho Ave	14th St	21st St	Washingtonia robusta	Pinus pinea	Pinus halepensis	11	2018
43	267	Idaho Ave	Ocean Ave	7th St	Liquidambar styraciflua	Liquidambar styraciflua 'Rotundiloba'	Eucalyptus leucoxylon	12	2018
44	314	Oak St	14th St	17th St	Magnolia grandiflora	Callistemon citrinus	Rhus lancea	7	2018

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STREET SEGMENT PLANTING, BY YEAR

#	SEGMENT	STREET	FROM	TO	CURRENTLY PLANTED SPECIES	PRIMARY SPECIES 2015	SECONDARY SPECIES 2015	VACANCIES (2016)	PLANTING YEAR
45	234	Euclid St	Wilshire Blvd	Broadway Ave	Palm sp. & magnolias	Eucalyptus nicholii	Albizia julibrissin	8	2018
46	88	16th St	Ocean Park Blvd	South City Limit	Podocarpus sp	Afrocarpus falcatus	Stenocarpus sinuatus	10	2018
47	230	Dorchester Ave	Dead End	Pico Blvd	Lagerstroemia indica	Lagerstroemia indica	Banksia integrifolial	6	2019
48	276	Lipton Ave	Stanford St	Centinela Ave	Trachycarpus fortunei	Trachycarpus fortunei	Banksia integrifolial	9	2019
49	74	14th St	Pico Blvd	Ocean Park Blvd	Liquidambar styraciflua	Liquidambar styraciflua	Ulmus parvifolia 'Allee'	9	2019
50	244	Franklin St	Colorado Ave	Nebraska Ave	Ulmus parvifolia	Ulmus parvifolia 'Drake'	Tipuana tipu	8	2019
51	109	19th St	Colorado Ave	Olympic Blvd	Washingtonia robusta	Pinus canariensis	Cedrus atlantica	6	2019
52	289	Marguerita Ave	17th St	22nd St	Phoenix canariensis	Jubaea chilensis	Phoenix dactylifera	11	2019
53	165	33rd St	Pico Blvd	Ocean Park Blvd	Cupaniopsis anacardioides	Cupaniopsis anacardioides	Melaleuca linarifolia	12	2019
54	298	Michigan Ave	21st St	Cloverfield Blvd	Platanus racemosa	Lophostemon confertus	Platanus racemosa	6	2019
55	295	Marine St	18th St	23rd St	Ficus microcarpa	Ulmus parvifolia 'Drake'	Tipuana tipu	8	2019
56	80	16th St	Montana Ave	Washington Ave	Lophostemon confertus	Ulmus parvifolia 'Allee'	Lophostemon confertus	7	2019
57	366	San Vicente Blvd	7th St	26th St	Magnolia grandiflora	Corymbia citriodora	Quercus suber	26	2019
58	42	9th St	San Vicente Blvd	Alta Ave	Pine sp.	Pinus torreyana	Cedrus deodara	11	2019
59	259	Hill St	Lincoln Blvd	11th St	Podocarpus macrophyllus	Callistemon viminalis	Podocarpus macrophyllus	7	2019

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Tree Planting Priority Schedule

STREET SEGMENT PLANTING, BY YEAR

#	SEGMENT	STREET	FROM	TO	CURRENTLY PLANTED SPECIES	PRIMARY SPECIES 2015	SECONDARY SPECIES 2015	VACANCIES (2016)	PLANTING YEAR
60	216	Chelsea Place	Chelsea Ave	Dead End	Callistemon viminalis	Callistemon viminalis	Leptospermum petersonii	4	2019
61	170	Alta Ave	7th St	11th St	Eucalyptus ficifolia	Eucalyptus amplifolia	Agonis flexuosa	9	2019
62	98	18th St	Montana Ave	Washington Ave	Washingtonia robusta	Quercus agrifolia	Quercus suber	8	2019
63	155	26th St	Olympic Blvd	Cloverfield Blvd	Phoenix dactylifera	Phoenix dactylifera	Washingtonia filifera	6	2019
64	250	Grant St	6th St	Lincoln Blvd	Cinnamomum camphora	Cinnamomum camphora	Tipuana tipu	8	2019
65	138	23rd St	Ocean Park Blvd	South City Limit	Lagerstroemia indica	Lagerstroemia indica "Muskogee"	Rhus lancea	11	2019
66	84	16th St	Colorado Ave	Olympic Blvd	Magnolia grandiflora	Platanus racemosa w/s	Pinus torreyana - e/s of street	7	2019
67	380	Virginia Ave	Stewart St	Centinela Ave	Podocarpus macrophyllus	Pinus canariensis	Pinus halepensis	8	2019
68	147	25th St	Montana Ave	Wilshire Blvd	Nerium oleander	Tristaniopsis laurina	Geijera parviflora	10	2019
69	379	Virginia Ave	Cloverfield Blvd	27th St	Podocarpus macrophyllus	Geijera parviflora	Pinus canariensis	6	2019
70	113	20th St	Arizona Blvd	Colorado Ave	Jacaranda mimosifolia	Jacaranda mimosifolia	Melaleuca quinquenervia (new cutouts on e/s)	8	2019
71	247	Georgina Ave	14th St	17th St	Casuarina cunninghamiana	Casuarina cunninghamiana	Allocasuarina verticillata	8	2019
72	65	12th St	Wilshire Blvd	Colorado Ave	Lophostemon confertus	Lophostemon confertus	Callistemon viminalis	9	2019
73	215	Chelsea Ave	Wilshire Blvd	Santa Monica Blvd	Ficus microcarpa	Afrocarpus falcatus	Pistachia chinensis	5	2019
74	75	14th St	Ocean Park Blvd	Ashland Ave	Ficus microcarpa	Afrocarpus falcatus (8")	Podocarpus macrophyllus (3")	5	2019

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Trees that are currently planted on each street segment

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Tree Planting Priority Schedule

STREET SEGMENT PLANTING, BY YEAR

#	SEGMENT	STREET	FROM	TO	CURRENTLY PLANTED SPECIES	PRIMARY SPECIES 2015	SECONDARY SPECIES 2015	VACANCIES (2016)	PLANTING YEAR
75	256	Hill St	Neilson Way	4th St	Trachycarpus fortunei	Trachycarpus fortunei	Howea forsteriana	6	2019
77	115	20th St	Freeway	Pico Blvd	Callistemon citrinus	Lagerstroemia indica "Muskogee"	Stenocarpus sinuatus	7	2019
78	198	Broadway Ave	16th St	Cloverfield Blvd	Magnolia grandiflora	Ulmus parvifolia 'Drake'	Lophostemon confertus	8	2019
79	22	5th St Median	Colorado Ave	Dead End	Corymbia citriodora	Corymbia citriodora	Agathis robusta	6	2019
80	299	Michigan Ave	Cloverfield Blvd	Dead End @ Bergamont Station	Trachycarpus fortunei	Lophostemon confertus 'Variegata'	Lagerstroemia indica	5	2019
81	236	Euclid St	Dead End	Olympic Blvd	Magnolia grandiflora	Corymbia citriodora	Pistachia chinensis	5	2019
82	28	6th St	Wilshire Blvd	Colorado Ave	Cupaniopsis anacardioides	Cinnamomum camphora	Koelreuteria bipinnata	10	2019
83	94	17th St	Dead End @ Freeway	Pico Blvd	Melaleuca quinquenervia	Melaleuca quinquenervia (e/s)	Platanus racemosa (w/s)	8	2019
84	134	23rd St	San Vicente Blvd	Montana Ave	Cinnamomum camphora	Cinnamomum camphora	Lophostemon confertus	15	2019
85	346	Pearl St	28th St	Centinela Ave	Brachyciton populneus	Melaleuca linariifolia	Geijera parviflora	11	2019
86	387	Washington Ave	16th St	21st St	Multiple	Ficus rubiginosa	Eucalyptus amplifolia	7	2019
87	261	Hill St	17th St	21st St	Podocarpus macrophyllus	Podocarpus macrophyllus	Lagerstroemia indica	6	2019
88	194	Brentwood Terrace	12th St	14th St	Cedrus deodara	Cedrus deodara	Cedrus atlantica	6	2019
89	64	12th St	California Ave	Wilshire Blvd	Phoenix canariensis	Cedrus deodara	Pinus halepensis	5	2019
90	226	Delaware Ave	18th St	Cloverfield Blvd	Cupaniopsis anacardioides	Eucalyptus maculata	Cupaniopsis anacardioides	6	2019

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#	SEGMENT	STREET	FROM	TO	CURRENTLY PLANTED SPECIES	PRIMARY SPECIES 2015	SECONDARY SPECIES 2015	VACANCIES (2016)	PLANTING YEAR
91	237	Euclid St	Dead End @ Freeway	Pico Blvd	Quercus ilex	Quercus suber	Quercus agrifolia	6	2019
92	296	Michigan Ave	7th St	Lincoln Blvd	Schinus molle	Pinus torreyana	Agonis flexuosa	4	2019
93	382	Warwick Ave	Exposition Blvd	Virginia Ave	Callistemon citrinus	Callistemon citrinus	Ulmus parvifolia 'Drake'	4	2019
94	40	7th St	Michigan Ave	Pico Blvd	Cinnamomum camphora	Cinnamomum camphora	Jacaranda mimosifolia - w/s of street	4	2019
95	171	Alta Ave	11th St	14th St	Ficus microcarpa	Platanus racemosa	Quercus suber	7	2019
96	203	California Ave	7th St	Lincoln Blvd	Magnolia grandiflora	Cinnamomum camphora	Cedrus deodara	3	2019
97	394	Yorkshire Ave	Pico Blvd	Dead End	Podocarpus gracilior	Podocarpus macrophyllus	Parkinsonia 'Desert museum'	4	2019
98	136	23rd St	Wilshire Blvd	Broadway Ave	Crytomeria japonica	Melaleuca linariifolia	Geijera parviflora	6	2019
99	72	14th St	Santa Monica Blvd	Freeway	Magnolia grandiflora	Melaleuca quinquenervia	Melaleuca styphelioides	6	2019
100	114	20th St	Colorado Ave	Freeway	Callistemon citrinus	Callistemon viminalis	Callistemon citrinus	4	2020
101	200	Broadway Ave	26th St	Centinela Ave	Eucalyptus ficifolia	Corymbia citriodora	Geijera parviflora	7	2020
102	368A	Santa Monica Blvd	Lincoln Blvd	20th St	Ficus microcarpa 'nitida'	Corymbia citriodora	Cupaniopsis anacardioides	9	2020
103	104	18th St	Ocean Park Blvd	South City Limit	Nerium oleander	Arbutus marina	Lophostemon confertus 'Variegata'	8	2020
104	35	7th St	Washington Ave	California Ave	Brachychiton populneus	Corymbia citriodora	Lophostemon confertus	3	2020

CURRENT PLANTED SPECIES:

Trees that are currently planted on each street segment

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#	SEGMENT	STREET	FROM	TO	CURRENTLY PLANTED SPECIES	PRIMARY SPECIES 2015	SECONDARY SPECIES 2015	VACANCIES (2016)	PLANTING YEAR
105	45	9th St	Wilshire Blvd	Colorado Ave	Magnolia grandiflora	Ulmus parvifolia	Quercus engelmannii	7	2020
106	197	Broadway Ave	11th St	16th St	Lophostemon confertus & Corymbia ficifolia	Ulmus parvifolia 'Drake'	Lophostemon confertus	5	2020
107	29	6th St	Pico Blvd	Dead End	Washingtonia robusta	Tristaniopsis laurina	Allocasuarina verticillata	3	2020
108	373A	Stewart St	Exposition Blvd	Pico Blvd	Lophostemon confertus & Eucalyptus amplifolia	Lophostemon confertus	Eucalyptus amplifolia	4	2020
109	19	5th St	Montana Ave	Wilshire Blvd	Washingtonia robusta	Brahea edulis	Tristaniopsis laurina	8	2020
110	49	10th St	Montana Ave	Wilshire Blvd	Certonia siliqua	Pinus canariensis	Quercus agrifolia	7	2020
111	199	Broadway Ave	Cloverfield Blvd	26th St	Lophostemon confertus	Ulmus parvifolia 'Drake'	Lophostemon confertus	4	2020
112	185	Bay St	Lincoln Blvd	10th St	Lyonothamnus floribundus asplenifolius	Callistemon viminalis	Tristaniopsis laurina	3	2020
113	377	Urban Ave	Pico Blvd	Yorkshire Ave	Callistemon citrinus	Callistemon citrinus	Parkinsonia 'Desert museum'	4	2020
114	53	10th St	Pico Blvd	Ocean Park Blvd	Allocasuarina verticillata	Allocasuarina verticiliata	Rhus lancea	7	2020
115	229	Dorchester Ave	Exposition Blvd Blvd	Virginia Ave	Podocarpus macrophyllus	Podocarpus macrophyllus	Banksia integrifolial	3	2020
116	149	25th St	Santa Monica Blvd	Broadway Ave	Washingtonia robusta	Callistemon viminalis	Koelreuteria bipinnata	3	2020
117	50	10th St	Wilshire Blvd	Colorado Ave	Magnolia grandiflora	Quercus suber	Lophostemon confertus 'Variegata'	6	2020

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Tree Planting Priority Schedule

STREET SEGMENT PLANTING, BY YEAR

#	SEGMENT	STREET	FROM	TO	CURRENTLY PLANTED SPECIES	PRIMARY SPECIES 2015	SECONDARY SPECIES 2015	VACANCIES (2016)	PLANTING YEAR
118	243	Franklin St	Wilshire Blvd	Colorado Ave	Ficus microcarpa	Albizia julibrissin	Tipuana tipu	6	2020
119	13	4th St	Montana Ave	Wilshire Blvd	Washingtonia robusta	Angophora costata	Eucalyptus maculata	8	2020
120	353	Pier Ave	Lincoln Blvd	11th St	Ficus microcarpa	Afrocarpus falcatus	Cupaniopsis anacardioides	3	2020
121	66	12th St	Dead End	Dead End @ Freeway	Lagerstroemia indica	Tipuana tipu	Lagerstroemia indica	3	2020
122	337	Pacific St	4th St	6th St	Podocarpus macrophyllus	Podocarpus macrophyllus	Lagunaria patersonii	4	2020
123	241	Frank St	Delaware Ave	Virginia Ave	Tristania laurina	Tristaniopsis laurina	Pyrus kawakamii	2	2020
124	8	3rd St	California Ave	Wilshire Blvd	Prunus kawakamii	Rhus lancea (I)	Pyrus kawakamii	4	2020
125	25	5th St	Marine St	Dewey St	Melaleuca quinquenervia	Melaleuca quinquenervia	Callistemon viminalis	2	2020
126	129	22nd St	Montana Ave	Wilshire Blvd	Schinus molle	Koelreuteria bipinnata	Leptospermum petersonii	6	2020
127	112	20th St	Montana Ave	Wilshire Blvd	Ficus microcarpa	Afrocarpus falcatus	Koelreuteria bipinnata	6	2020
128	73	14th St	Freeway	Pico Blvd	Magnolia grandiflora	Pinus canariensis	Pinus halepensis	6	2020
129	282	Maple St	Lincoln Blvd	16th St	Ficus microcarpa	Eucalyptus maculata	Lophostemon confertus 'Variegata'	6	2020
130	23	5th St	Bay St	Ocean Park Blvd	Ficus microcarpa	Afrocarpus falcatus	Pistacia chinensis	8	2020
131	209	Cedar St	7th St	Lincoln Blvd	Ficus microcarpa	Cupaniopsis anacardioides	Geijera parviflora	2	2020
132	258	Hill St	Highland Ave	Lincoln Blvd	Trachycarpus fortunei	Trachycarpus fortunei	Howea forsteriana	3	2020

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133	354	Pier Ave	17th St	21st St	Ceratonia siliqua	Quercus ilex	Quercus suber	4	2020
134	142	24th St	Wilshire Blvd	Arizona Ave	Chionanthus retusus	Tristaniopsis laurina	Callistemon viminalis	3	2020
135	384	Washington Ave	4th St	7th St	Washingtonia robusta	Cinnamomum camphora	Tipuana tipu	4	2020
136	96	17th St	Ocean Park Blvd	Ashland Ave	Certonia siliqua	Cinnamomum camphora	Koelreuteria bipinnata	4	2020
137	100	18th St	Wilshire Blvd	Colorado Ave	Cinnamomum camphora	Cinnamomum camphora	Tipuana tipu	6	2020
138	27	6th St	Idaho Ave	Wilshire Blvd	Washingtonia robusta	Platanus racemosa	Melaleuca stypheloides	5	2020
139	17	4th St Median	Pico Blvd	Ocean Park Blvd.	Syragrus romanzoffianum	Syragrus romanzoffianum	Parkinsonia 'Desert museum'	8	2020
140	300	Mills St	2nd St	3rd St	Melaleuca quinquenervia	Melaleuca quinquenervia	Melaleuca stypheloides	2	2020
141	335	Pacific St	Ocean Ave	Neilson Way	Palm sp.	Brahea brandegeei	Banksia integrifolial	2	2020
142	83	16th St	Wilshire Blvd	Colorado Ave	Magnolia grandiflora	Corymbia citriodora	Magnolia grandiflora	6	2020
143	31	6th St	Marine St	Dewey St	Melaleuca quinquenervia	Melaleuca quinquenervia	Podocarpus macrophyllus	2	2020
144	252	Hart Ave	Barnard Way	Neilson Way	Metrosideros excelsus	Brahea armata	Metrosideros excelsus	2	2020
145	378	Virginia Ave	20th St	Cloverfield Blvd	Ficus microcarpa	Ulmus parvifolia	Pistachia chinensis	3	2020
146	90	17th St	Montana Ave	California Ave	Pinus sp.	Pinus pinea	Platanus racemosa	6	2020
147	212	Centinela Ave	Darlington Ave	Wilshire Blvd	Casuarina cunninghamiana	Casuarina cunninghamiana	Allocasuarina verticillata	5	2020

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148	113A	20th St	Wilshire Blvd	Arizona Ave	Washingtonia robusta	Jacaranda mimosifolia	Tipuana tipu	2	2020
149	91	17th St	California Ave	Wilshire Blvd	Brachychiton populneus	Eucalyptus amplifolia	Platanus racemosa	3	2020
150	310	Neilson Way	Pico Blvd	South City Limit	Multiple	N/a	N/a	11	2020
151	352	Pier Ave	4th St	Lincoln Blvd	Podocarpus macrophyllus	Tristaniopsis laurina	Podocarpus macrophyllus	6	2020
152	257	Hill St	4th St	6th St	Melaleuca quinquenervia	Melaleuca linariifolia	Melaleuca styphelioides	3	2020
153	331	Olympic Blvd	Cloverfield Blvd	26th St	Melaleuca quinquenervia	Melaleuca linariifolia	Melaleuca quinquenervia	2	2020
154	79	16th St	San Vicente Blvd	Montana Ave	Cedrus sp.	Cedrus deodara	Cedrus alantica	12	2020
155	349	Pennsylvania Ave	Stanford St	Centinela Ave	Multiple	Jacaranda mimosifolia	Lagerstroemia indica	2	2020
156	67	12th St	Dead End @ Freeway	Pico Blvd	Jacaranda mimosifolia	Jacaranda mimosifolia	Tipuana tipu	4	2020
157	211	Cedar St	17th St	18th St	Schinus terebinthifolius	Metrosideros excelsus	Quercus suber	2	2020
158	371	Stanford St	Wilshire Blvd	Colorado Ave	Cercis occidentalis	Rhus lancea	Leptospermum petersonii	6	2020
159	227	Delaware Ave	Stewart St	Warwick Ave	Ficus microcarpa	Afrocarpus falcatus	Cupaniopsis anacardioides	3	2020
160	11	4th St Median	Adelaide Dr	Montana Ave	Syragrus romanzoffianum	Pinus pinea	Eucalyptus delgupta	9	2020
161	162	30th St	Pico Blvd	Ocean Park Blvd	Podocarpus sp	Podocarpus macrophyllus	Albizia julibrissin	5	2020
162	166	34th St	Pico Blvd	Ocean Park Blvd	Podocarpus sp	Podocarpus macrophyllus	Albizia julibrissin	7	2020

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163	59	11th St	Colorado Ave	Pico Blvd	Jacaranda mimosifolia	Jacaranda mimosifolia	Tipuana tipu	5	2020
164	325	Ocean Park Blvd	14th St	25th St	Podocarpus macrophyllus	Corymbia citriodora	Podocarpus macrophyllus	7	2020
165	328	Olympic Blvd Median	10th St	Centinela Ave	Erythrina caffra	Quercus agrifolia	Platanus racemosa	14	2020
166	130	22nd St	Wilshire Blvd	Arizona Ave	Cupaniopsis anacardioides	Cupaniopsis anacardioides	Koelrueuteria bipinnata	2	2020
167	150	25th St	Pico Blvd	Ocean Park Blvd	Schinus molle	Metrosideros excelsus	Koelreuteria bipinnata	5	2020
168	323	Ocean Park Blvd	Main St	Lincoln Blvd	Arbutus marina	Geijera parviflora	Rhus lancea	7	2020
169	265	Hollister Ave	Main St	3rd St	Lagerstroemia indica	Lagerstroemia indica	Tristaniopsis laurina	2	2020
170	242	Franklin St	Montana Ave	Wilshire Blvd	Geijera parviflora	Geijera parviflora	Lagerstroemia indica "Muskogee"	7	2020
171	69	14th St	Montana Ave	Washington Ave	Cedrus deodara	Cedrus deodara	Cedrus atlantica	3	2020
172	44	9th St	Montana Ave	Wilshire Blvd	Washingtonia robusta	Cedrus deodara	Pinus torreyana	4	2020
173	342	Pearl St	Lincoln Blvd	14th St	Ficus microcarpa	Quercus agrifolia	Cinnamomum camphora	5	2020
174	128	22nd St	San Vicente Blvd	Montana Ave	Magnolia grandiflora	Ulmus parvifolia 'Allee'	Tipuana tipu	9	2020
175	127	21st St	Ocean Park Blvd	South City Limit	Jacaranda mimosifolia	Ulmus parvifolia 'Allee'	Jacaranda mimosifolia	7	2020
176	124	21st St	Dead End @ Freeway	Delaware Ave	Lagerstroemia indica	Lagerstroemia indica	Tristaniopsis laurina	1	2020
177	217	Cloverfield Blvd	Santa Monica Blvd	Colorado Ave	Melaleuca quinquenervia	Phoenix dactylifera	Howea forsteriana	2	2020

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178	279	Lincoln Blvd	Wilshire Blvd	South City Limit	Lophostemon confertus	Multiple species	Multiple species	17	2020
179	266	Hollister Ave	4th St	Beverly Ave	Metrosideros excelsus	Metrosideros excelsus	Leptospermum petersonii	3	2021
180	184	Bay St	6th St	Lincoln Blvd	Callistemon citrinus	Callistemon citrinus	Banksia integrifolial	2	2021
181	176	Ashland Ave	Neilson Way	2nd St	Cupaniopsis anacardioides	Cupaniopsis anacardioides	Lophostemon confertus	1	2021
182	260	Hill St	11th St	17th St	Lagerstroemia indica	Lagerstroemia indica	Cupaniopsis anacardioides	6	2021
183	287	Marguerita Ave	14th St	16th St	Ficus microcarpa	Ulmus parvifolia	Pinus halepensis	2	2021
184	57	11th St	California Ave	Wilshire Blvd	Magnolia grandiflora	Eucalyptus maculata	Angophora costata	2	2021
185	178	Ashland Ave	Lincoln Blvd	14th St	Cinnamomum camphora	Koelreuteria bipinnata	Pistachia chinensis	5	2021
186	14	4th St	Wilshire Blvd	Colorado Ave	Ficus microcarpa	Afrocarpus falcatus, Gingko biloba	Tristaniopsis laurina	5	2021
187	46	9th St	Dead End	Olympic Blvd	Ficus microcarpa	Ulmus parvifolia	Platanus mexicana	1	2021
188	283	Maple St	17th St	18th St	Podocarpus garcilior	Callistemon viminalis	Rhus lancea	1	2021
189	102	18th St	End of St South of Freeway	Pico Blvd	Liquidambar styraciflua	Liquidambar styraciflua	Lophostemon confertus	3	2021
190	33	7th St	Adelaide Dr	San Vicente Blvd	Cedrus deodara	Cedrus deodara	Platanus racemosa	2	2021
191	107	19th St	Wilshire Ave	Broadway Ave	Washingtonia robusta	Washingtonia robusta	Cedrus deodara	3	2021
192	123	21st St	Olympic Blvd	Michigan Ave	Liquidambar styraciflua	Metrosideros excelsus	Quercus suber	1	2021

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193	195	Broadway Ave	Ocean Ave	Lincoln Blvd	Koelreuteria bipinnata	Koelreuteria bipinnata	Koelreuteria paniculata	5	2021
194	356	Pine St	7th St	Lincoln Blvd	Podocarpus macrophyllus	Podocarpus macrophyllus	Parkinsonia 'Desert museum'	1	2021
195	388	Washington Ave	21st St	24th St	Grevillea robusta	No wires: Ulmus parvifolia 'Drake'/ wires: Corymbia citriodora	No wires: Albizia julibrissin/ wires: Eucalyptus maculata	3	2021
196	180	Ashland Ave	17th St	23rd St	Callistemon citrinus	Callistemon citrinus	Lophostemon confertus	5	2021
197	20	5th St	Wilshire Blvd	Colorado Ave	Ficus microcarpa	Corymbia citriodora	Albizia julibrissin	5	2021
198	322	Ocean Park Blvd	Neilson Way	Main St	Metrosideros excelsus	Metrosideros excelsus	Brahea edulis	1	2021
199	71	14th St	Wilshire Blvd	Santa Monica Blvd	Magnolia grandiflora	Eucalyptus maculata	Melaleuca styphelioides	2	2021
200	61	11th St	Ocean Park Blvd	South City Limit	Prunus caroliniana	Metrosideros excelsus	Lagerstroemia indica	5	2021
201	111	20th St	San Vicente Blvd	Montana Ave	Cedrus deodara	Cedrus deodara	Cedrus atlantica	10	2021
202	146	25th St	San Vicente Blvd	Montana Ave	Cedrus sp.	Cedrus atlantica	Cedrus deodara	9	2021
203	191	Beverley Ave	Kensington Rd	Ocean Park Blvd	Magnolia grandiflora	Corymbia citriodora	Corymbia citriodora	3	2021
204	55	11th St	Montana Ave	Idaho Ave	Eucalyptus species	Eucalyptus amplifolia	Angophora costata	1	2021
205	143	24th St	Santa Monica Blvd	Broadway Ave	Ficus microcarpa	Cupaniopsis anacardioides	Melaleuca linarifolia	1	2021
206	249	Glenn Ave	Marine St	Ashland Ave	Callistemon viminalis	Callistemon viminalis	Callistemon citrinus	2	2021
207	196	Broadway Ave	Lincoln Blvd	11th St	Magnolia grandiflora	Ulmus parvifolia 'Drake'	Koelreuteria bipinnata	2	2021

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208	292	Marine St	4th St	Highland Ave	Podocarpus macrophyllus	Metrosideros excelsus	Tristaniopsis laurina	2	2021
209	239	Euclid St	Ocean Park Blvd	Ashland Ave	Liquidambar styraciflua	Liquidambar styraciflua	No alternate	2	2021
210	280	Main St	Colorado Ave	Pico Blvd	Podocarpus macrophyllus	Corymbia citriodora	Tipuana tipu	5	2021
211	340	Pacific St	14th St	16th St	Ficus microcarpa	Tristaniopsis laurina	Allocasuarina verticiliata	1	2021
212	316	Oak St	23rd St	25th St	Ficus microcarpa	Metrosideros excelsus	Afrocarpus falcatus	2	2021
213	288	Marguerita Ave	16th St	17th St	Casuarina cunninghamiana	Casuarina cunninghamiana	Allocasuarina verticillata	1	2021
214	62	12th St	Georgina Ave	Montana Ave	Certonia siliqua	Quercus agrifolia	Ficus rubiginosa	7	2021
215	93	17th St	Colorado Ave	Dead End @ Freeway	Magnolia grandiflora	Ficus rubiginosa	Lophostemon confertus	2	2021
216	221	Colorado Ave	Ocean Ave	4th St	Platanus mexicana	Platanus mexicana	No alternate	2	2021
217	148	25th St	Wilshire Blvd	Arizona Ave	Chionanthus retusus	Stenocarpus sinuatus	Callistemon citrinus	1	2021
218	293	Marine St	Highland Ave	Lincoln Blvd	Podocarpus garcilior	Stenocarpus sinuatus	Parkinsonia 'Desert museum'	2	2021
219	277	Lincoln Blvd	San Vicente Blvd	Montana Ave	Certonia siliqua	Quercus agrifolia	Quercus suber	6	2021
220	218	Cloverfield Blvd	Colorado Ave	Michigan Ave	Phoenix dactylifera	Phoenix dactylifera	Tipuana tipu (median)	2	2021
221	231	Esparta Way	San Vicente Blvd	Dead End	Magnolia grandiflora	Metrosideros excelsus	Tipuana tipu	2	2021
222	110	19th St	Michigan Ave	Pico Blvd	Liquidambar styraciflua	Quercus suber	Quercus agrifolia	2	2021

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223	291	Marine St	Neilson Way	4th St	Metrosideros excelsus	Metrosideros excelsus	Tristaniopsis laurina	2	2021
224	193	Bicknell Ave	Neilson Way	4th St	Pyrus kawakamii	Metrosideros excelsus	Lagunaria patersonii	2	2021
225	5	2nd St	Strand St	South City Limit	Callistemon citrinus	Callistemon citrinus (I)	Tristaniopsis laurina	6	2021
226	132	22nd St	Dead End @ Freeway	Virginia Ave	Podocarpus sp	Koelreuteria bipinnata	Podocarpus macrophyllus	1	2021
227	163	31st St	Pico Blvd	Ocean Park Blvd	Jacaranda mimosifolia	Jacaranda mimosifolia	Callistemon viminalis	4	2021
228	370	Stanford St	Montana Ave	Wilshire Blvd	Cercis occidentalis	Podocarpus macrophyllus	Parkinsonia 'Desert museum'	5	2021
229	362	Raymond Ave	4th St	Lincoln Blvd	Callistemon citrinus	Callistemon citrinus	Parkinsonia 'Desert museum'	4	2021
230	159	28th St	Pico Blvd	Ocean Park Blvd	Schinus molle	Koelreuteria bipinnata	Koelreuteria paniculata	4	2021
231	272	Kensington Rd	Beverly Ave	Lincoln Blvd	Podocarpus macrophyllus	Podocarpus macrophyllus	Eucalyptus leucoxylon	2	2021
232	355	Pier Ave	21st St	Clover St	Nerium oleander	Melaleuca linariifolia	Pyrus kawakamii	2	2021
233	6	3rd St	Montana Ave	Washington Ave	Cinnamomum camphora	Cinnamomum camphora	Angophora costata	2	2021
234	87	16th St	Pico Blvd	Ocean Park Blvd	Magnolia grandiflora	Tipuana tipu	Ulmus parvifolia 'Allee'	4	2021
235	225	Delaware Ave	15th St	18th St	Casuarina cunninghamiana	Casuarina cunninghamiana	Allocasuarina verticillata	1	2021
237	99	18th St	Washington Ave	Wilshire Blvd	Podocarpus macrophyllus	Podocarpus macrophyllus	Rhus lancea	2	2021
238	389	Washington Ave	24th St	Stanford St	Grevillea robusta	Corymbia citriodora	Koelreuteria bipinnata	4	2021

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239	294	Marine St	Lincoln Blvd	17th St	Ficus microcarpa	Afrocarpus falcatus	Cupaniopsis anacardioides	4	2021
240	103	18th St	Cedar St	Ocean Park Blvd	Metrosideros excelsus	Metrosideros excelsus	Leptospermum petersonii	1	2021
241	52	10th St	Dead End North of Michigan	Pico Blvd	Ficus microcarpa	Pinus canariensis	Cedrus altantica	1	2021
242	48	10th St	San Vicente Blvd	Montana Ave	Quercus agrifolia	Quercus agrifolia	Agathis robusta	6	2021
243	375	Strand St	Main St	Lincoln Blvd	Podocarpus macrophyllus	Podocarpus macrophyllus	Banksia integrifolial	4	2021
244	189	Berkeley St	Stanford St	Wilshire Blvd	Podocarpus macrophyllus	Podocarpus macrophyllus	Melaleuca linarifolia	5	2021
245	210	Cedar St	Lincoln Blvd	14th St	Cassia leptophylla	Lophostemon confertus	Allocasuarina verticillata	3	2021
246	360	Princeton St	Wilshire Blvd	Colorado Ave	Cupaniopsis anacardioides	Cupaniopsis anacardioides	Stenocarpus sinuatus	3	2021
247	47	9th St	Dead End	Pico Blvd	Ficus microcarpa	Cinnamomum camphora	Eucalyptus amplifolia	1	2021
248	338	Pacific St	6th St	Lincoln Blvd	Washingtonia robusta	Quercus agrifolia	Melaleuca styphelioides	1	2021
249	240	Exposition Blvd	Stewart St	Centinela Ave	Geijera parviflora	Geijera parviflora	Podocarpus macrophyllus	3	2021
250	37	7th St	Wilshire Blvd	Santa Monica Blvd	Podocarpus sp	Afrocarpus falcatus	Podocarpus macrophyllus	1	2021
251	305	Navy St	Highland Ave	Lincoln Blvd	Podocarpus gracilior	Podocarpus macrophyllus	Arbutus 'Marina'	1	2021
252	333	Ozone St	Highland Ave	Lincoln Blvd	Melaleuca quinquenervia	Melaleuca quinquenervia	Geijera parviflora	1	2021
253	63	12th St	Montana Ave	California Ave	Washingtonia robusta	Cedrus deodara	Cedrus atlantica	2	2021

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254	306	Navy St	18th St	23rd St	Ficus microcarpa	Ulmus parvifolia 'Drake'	Tristaniopsis laurina	1	2021
255	251	Grant St	Lincoln Blvd	16th St	Ficus microcarpa	Afrocarpus falcatus	Arbutus 'Marina'	4	2021
256	213	Centinela Ave	Pico Blvd	Ocean Park Blvd	Ficus microcarpa	Afrocarpus falcatus	Cupaniopsis anacardioides	2	2021
257	32	6th St	Ocean Park Blvd	Pier Ave	Melaleuca quinquenervia	Melaleuca quinquenervia	Podocarpus macrophyllus	2	2021
258	106	19th St	Montana Ave	Wilshire Ave	Washingtonia robusta	Washingtonia robusta	Brahea brandegeei	3	2021
259	70	14th St	Washington Ave	Wilshire Blvd	Ficus microcarpa	Metrosideros excelsus	Melaleuca styphelioides	1	2021
260	175	Arizona Ave	26th St	Centinela Ave	Ficus microcarpa	Afrocarpus falcatus	Pistachia chinensis	3	2021
261	373	Stewart St	Colorado Ave	Exposition Blvd	Lophostemon confertus	Lophostemon confertus	Eucalyptus amplifolia	2	2021
262	179	Ashland Ave	14th St	17th St	Ficus microcarpa	Afrocarpus falcatus	Cupaniopsis anacardioides	1	2021
263	270	Idaho Ave	21st St	26th St	Cinnamomum camphora	Cinnamomum camphora	Ficus rubiginosa	2	2021
264	238	Euclid St	Pico Blvd	Ocean Park Blvd	Metrosideros excelsus	Metrosideros excelsus	Tipuana tipu	4	2021
265	141	24th St	Idaho Ave	Wilshire Blvd	Schinus molle	Koelreuteria bipinnata	Geijera parviflora	3	2021
266	326	Ocean Park Blvd	25th St	Centinela Ave	Liquidambar styraciflua	Corymbia citriodora	Afrocarpus falcatus	5	2021
267	16	4th St	Pico Blvd	Ocean Park Blvd.	Callistemon citrinus	Callistemon citrinus	Banksia integrifolial	4	2021
268	118	21st Pl	San Vicente Blvd	Montana Ave	Casuarina cunninghamiana	Allocasuarina verticiliata	Pinus radiata	7	2021

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STREET SEGMENT PLANTING, BY YEAR

#	SEGMENT	STREET	FROM	TO	CURRENTLY PLANTED SPECIES	PRIMARY SPECIES 2015	SECONDARY SPECIES 2015	VACANCIES (2016)	PLANTING YEAR
269	214	Chelsea Ave	Washington Ave	Wilshire Blvd	Ficus microcarpa	Metrosideros excelsus	Pistachia chinensis	1	2021
270	105	19th St	San Vicente Blvd	Montana Ave	Cedrus deodara	Cedrus deodara	Cedrus altantica	6	2021
271	202	California Ave Median	Ocean Ave	7th St	Eucalyptus sideroxylon	Eucalyptus sideroxylon	Corymbia citriodora	2	2021
272	271	Kansas Ave	Cloverfield Blvd	Dead End	Podocarpus garcilior	Afrocarpus falcatus	Geijera parviflora	2	2021
273	367	Santa Monica Blvd	Ocean Ave	Lincoln Blvd	Koelreuterias bipinnata	Koelreuteria bipinnata	Lophostemon confertus	3	2021
274	365	San Vicente Blvd	Ocean Ave	7th St	Magnolia grandiflora	Corymbia citriodora	Metrosideros excelsus	4	2021
275	344	Pearl St	16th St	20th St	Eucalyptus species	Albizia julibrissin	Jacaranda mimosifolia	1	2021
276	18	4th St	Ocean Park Blvd.	South City Limit	Ficus microcarpa	Koelreuteria paniculata	Rhus lancea	2	2021
277	253	Harvard St	Montana Ave	Wilshire Blvd	Jacaranda mimosifolia	Jacaranda mimosifolia	Albizia julibrissin	4	2021
278	392	Yale St	Montana Ave	Arizona Ave	Ficus microcarpa	Tipuana tipu	Ulmus parvifolia 'Drake'	4	2021
279	1	2nd St	Montana Ave	California Ave	Ficus microcarpa	Quercus agrifolia	Corymbia aparrerinja (I)	2	2021
280	205	California Ave	14th St	20th St	Ficus microcarpa	Ficus microcarpa	Cupaniopsis anacardioides	2	2021
281	30	6th St	Bay St	Ocean Park Blvd	Podocarpus macrophyllus	Podocarpus macrophyllus	Stenocarpus sinuatus	3	2021
282	10	3rd St	Pico Blvd	South City Limit	Podocarpus sp	Podocarpus macrophyllus	Melaleuca linarifolia	7	2021
283	301	Montana Ave	Ocean Ave	7th St	Liquidambar styraciflua	Liquidambar styraciflua 'Rotundiloba'	Ulmus parvifolia 'Allee'	2	2021

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284	248	Georgina Ave	17th St	26th St	Ficus microcarpa	Ficus microcarpa	Ulmus parvifolia	6	2021
285	207	Carlyle Ave	9th St	14th St	Liquidambar styraciflua	Liquidambar styraciflua 'Rotundiloba'	Agathis robusta	1	2021
286	223-A	Colorado Ave	20th St	26th St	Washingtonia robusta	Phoenix dactylifera	Washingtonia filifera	1	2021
287	2	2nd St Median	Montana Ave	California Ave	Melaleuca quinquenervia	Melaleuca quinquenervia (I)	Corymbia citriodora (I)	1	2021
288	357	Pine St	Lincoln Blvd	14th St	Ficus microcarpa	Metrosideros excelsus	Afrocarpus falcatus	1	2021
289	169	Alta Ave	Ocean Ave	7th St	Magnolia grandiflora	Magnolia grandiflora	Ficus rubiginosa	2	2021
290	12	4th St	Adelaide Dr	Montana Ave	Metrosideros excelsus	Metrosideros excelsus	Eucalyptus delgupta	3	2021
291	60	11th St	Pico Blvd	Ocean Park Blvd	Ficus microcarpa	Quercus agrifolia	Quercus ilex	2	2021
292	177	Ashland Ave	2nd St	Lincoln Blvd	Ficus microcarpa	Afrocarpus falcatus	Cupaniopsis anacardioides	2	2021
293	68	14th St	San Vicente Blvd	Montana Ave	Pinus canariensis	Pinus canariensis	Pinus halepensis	5	2021
294	345	Pearl St	20th St	28th St	Brachyciton populneus	Albizia julibrissin	Jacaranda mimosifolia	3	2021
295	119	21st St	San Vicente Blvd	Montana Ave	Phoenix canariensis	Jubaea chilensis	Pheonix dactylifera	5	2021
296	126	21st St	Pico Blvd	Ocean Park Blvd	Ficus microcarpa	Afrocarpus falcatus	Cupaniopsis anacardioides	1	2021
297	278	Lincoln Blvd	Montana Ave	Wilshire Blvd	Washingtonia robusta	Quercus agrifolia	Quercus suber	1	2021
298	369	Santa Monica Blvd	26th St	East City Limit	Washingtonia robusta	Washingtonia robusta	Corymbia citriodora	1	2021

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299	224	Colorado Ave	26th St	Centinela Ave	Ficus microcarpa	Corymbia citriodora (3 ft)	Eucalyptus maculata (8ft)	1	2021
300	232	Euclid St	Georgina Ave	Montana Ave	Magnolia grandiflora	Magnolia grandiflora	Ficus rubiginosa	3	2021
301	89	17th St	San Vicente Blvd	Montana Ave	Magnolia grandiflora	Ficus rubiginosa	Magnolia grandiflora	4	2021
302	341	Palisades Ave	Ocean Ave	7th St	Magnolia grandiflora	Magnolia grandiflora	Ficus rubiginosa	1	2021
303	182	Barnard Way	Hollister Ave	Neilson Way	Washingtonia robusta	Brahea edulis	Brahea armata	1	2021
304	54	11th St	San Vicente Blvd	Montana Ave	Magnolia grandiflora	Magnolia grandiflora	Ficus rubiginosa	2	2021
305	172	Alta Ave	14th St	26th St	Pinus canariensis	Pinus canariensis	Pinus halepensis	6	2021
306	274	La Mesa Dr	19th St	26th St	Ficus macrophylla	Ficus macrophylla	Ficus rubiginosa	1	2021
307	311	Neilson Way Median	Pico Blvd	South City Limit	Cassia leptophylla	Koelreuteria paniculata	Ceiba speciosa	3	2021
308	140	24th St	San Vicente Blvd	Montana Ave	Pinus canariensis	Pinus canariensis	Pinus halepensis	2	2021
309	302	Montana Ave	7th St	17th St	Ficus microcarpa	Corymbia citriodora	Lophostemon confertus	1	2021
310	281	Main St	Pico Blvd	South City Limit	Ficus microcarpa	Corymbia citriodora	Afrocarpus falcatus	3	2021
311	208	Carlyle Ave	14th St	26th St	Pinus canariensis	Pinus canariensis	Pinus halepensis	2	2021
312	153	26th St	Georgina Ave	Colorado Ave	Podocarpus macrophyllus	Podocarpus macrophyllus	Corymbia citriodora	1	2021
313	364	San Vicente Blvd Median	Ocean Ave	26th St	Erythrina caffra	Erythrina caffra	N/a	4	2021

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314	350	Pico Blvd	Ocean Ave	Centinela Ave	Platanus acerifolia	Eucalyptus maculata	Jacaranda mimosifolia (median)	7	2021
316	390	Wilshire Blvd	Ocean Ave	Centinela Ave	Washingtonia robusta	Washingtonia robusta	Washingtonia hybrid	3	2021
317	85	16th St	Olympic Blvd	Delaware End @ Freeway	Casuarina cunninghamiana	Allocasuarina verticiliata	Cedrus deodara	0	N/A
318	78	15th St	Olympic Blvd	Dead End @ Freeway	Cedrus deodara	Cedrus deodara (s/s fwy)	Platanus racemosa (n/s fwy)	0	N/A
319	222	Colorado Ave - Sears Triangle	2nd St	Main St	Washingtonia robusta	Phoenix dactylifera	Eucalyptus deglupta	0	N/A
320	273	Kinney St	Neilson Way	Main St	Cupaniopsis anacardioides	Cupaniopsis anacardioides	Tristaniopsis laurina	0	N/A
321	320	Ocean Ave	Strand St	Hollister Ave	Washingtonia robusta	Brahea armata	Brahea brandegeei	0	N/A
322	312	Norman Pl	Main St	2nd St	Metrosideros excelsus	Lagerstroemia indica 'Natchez'	Metrosideros excelsus	0	N/A
323	117	21st Pl	La Mesa Dr	San Vicente Blvd	Ficus macrophylla	Ficus macrophylla	Ficus rubiginosa	0	N/A
324	188	Beach St	2nd St	3rd St	Lagunaria patersonii	Parkinsonia x 'Desert Museum'	Rhus lancea	0	N/A
325	139	24th St	La Mesa Dr	San Vicente Blvd	Ficus macrophylla	Ficus macrophylla	Ficus rubiginosa	0	N/A
326	347	Pennsylvania Ave	21st St	22nd St	Melaleuca quinquenervia	Melaleuca quinquenervia	Melaleuca styphelioides	0	N/A
327	144	24th St	Michigan Ave	Delaware Ave	Cinnamomum camphora	Lophostemon confertus	Cupaniopsis anacardioides	0	N/A
328	192	Bicknell Ave	Ocean Ave	Neilson Way	Washingtonia robusta	Phoenix dactylifera	Melaleuca linarifolia	0	N/A
329	157	27th St	Virginia Ave	Kansas Ave	Podocarpus sp	Podocarpus macrophyllus	Geijera parviflora	0	N/A

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331	361	Prospect Ave	Marine St	Dead End	Podocarpus macrophyllus	Podocarpus macrophyllus	Leptospermum petersonii	0	N/A
332	351	Pier Ave	Neilson Way	2nd St	Metrosideros excelsus	Metrosideros excelsus	Leptospermum petersonii	0	N/A
333	381	Wadsworth Ave	Barnard Way	Neilson Way	Metrosideros excelsus	Brahea armata	Metrosideros excelsus	0	N/A
334	358	Pine St	17th St	18th St	Jacaranda mimosifolia	Jacaranda mimosifolia	Tipuana tipu	0	N/A
335	245	Fraser Ave	Barnard Way	Neilson Way	Metrosideros excelsus	Brahea edulis	Metrosideros excelsus	0	N/A
336	167	34th St	Exposition Blvd	Centinela Ave	Cupaniopsis anacardioides	Ulmus parvifolia 'Drake'	Ulmus parvifolia 'Allee'	0	N/A
337	24	5th St	Ocean Park Blvd	Hill St	Melaleuca quinquenervia	Melaleuca quinquenervia	Callistemon viminalis	0	N/A
338	321	Ocean Park Blvd	Barnard Way	Neilson Way	Syagrus romonzoffianum	Brahea edulis	Metrosideros excelsus	0	N/A
339	275	La Mesa Way	La Mesa Dr	26th St	Ficus macrophylla	Ficus macrophylla	Ficus rubiginosa	0	N/A
340	185 A	Bay St	10th St	11th St	Ficus microcarpa	Cupaniopsis anacardioides	Afrocarpus falcatus	0	N/A
341	363	Robson Ave	17th St	Dewey St	Ficus microcarpa	Eucalyptus amplifolia	Agonis flexuosa	0	N/A
343	125	21st St	Virginia Ave	Pico Blvd	Ficus microcarpa	Afrocarpus falcatus	Pistacia chinensis	0	N/A
344	374	Strand St	Ocean Ave	Main St	Metrosideros excelsus	Metrosideros excelsus	Leptospermum petersonii	0	N/A
345	187	Bay St	14th St	16th St	Ficus microcarpa	Cupaniopsis anacardioides	Afrocarpus falcatus	0	N/A
346	343	Pearl St	14th St	16th St	Ficus microcarpa	Quercus agrifolia	Eucalyptus amplifolia	0	N/A

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347	26	6th St	Montana Ave	Idaho Ave	Magnolia grandiflora	Quercus suber	Metrosideros excelsus	0	N/A
348	235	Euclid St	Broadway Ave	Colorado Ave	Washingtonia robusta	Platanus racemosa	Corymbia aparrerinja	0	N/A
349	122	21st St	Santa Monica Blvd	Broadway Ave	Jacaranda mimosifolia	Jacaranda mimosifolia	Rhus lancea	0	N/A
350	206	California Ave	Chelsea Ave	26th St	Ficus microcarpa	Albizia julibrissin	Pyrus kawakamii	0	N/A
351	108	19th St	Broadway Ave	Colorado Ave	Washingtonia robusta	Pinus canariensis	Pinus torreyana	0	N/A
352	186	Bay St	11th St	Euclid St	Ficus microcarpa	Afrocarpus falcatus	Cupaniopsis anacardioides	0	N/A
353	81	16th St	Washington Ave	California Ave	Pinus canariensis	Pinus canariensis	Pinus torreyana	0	N/A
354	7	3rd St	Washington Ave	California Ave	Callistemon citrinus	Callistemon citrinus (I)	Stenocarpus sinatus	0	N/A
355	121	21st St	Wilshire Blvd	Arizona Ave	Jacaranda mimosifolia	Jacaranda mimosifolia	Tipuana tipu	0	N/A
356	131	22nd St	Pennsylvania Ave Ave	Michigan Ave	Pyrus kawakamii	Koelreuteria bipinnata	Pyrus kawakamii	0	N/A
357	82	16th St	California Ave	Wilshire Blvd	Cinnamomum camphora	Ulmus parvifolia 'Allee'	Cinnamomum camphora	0	N/A
358	3	2nd St	California Ave	Wilshire Blvd	Ficus microcarpa	Afrocarpus falcatus	Eucalyptus nicholii	0	N/A
359	36	7th St	California Ave	Wilshire Blvd	Cedrus deodara	Cedrus deodara	Platanus racemosa	0	N/A
360	319	Ocean Ave	Bicknell Ave	Strand St	Palm sp.	Brahea armata	Brahea brandegeei	0	N/A
361	21	5th St	Colorado Ave	Dead End	Tristaniopsis laurina	Tristaniopsis laurina	Leptospermum petersonii	0	N/A

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362	264	Hollister Ave	Ocean Ave	Main St	Metrosideros excelsus	Not in UFMP	Not in UFMP	0	N/A
363	86	16th St	Freeway	Delaware Ave	Cedrus deodara	Cedrus deodara	Cedrus atlantica	0	N/A
364	386	Washington Ave	14th St	16th St	Cupaniopsis anacardioides	Cedrus deodara	Ficus rubiginosa	0	N/A
365	39	7th St	Colorado Ave	BBB Main Campus	Arbutus marina	Arbutus marina	Angophora costata - e/s of street	0	N/A
366	348	Pennsylvania Ave	26th St	Stewart St	Platanus racemosa	Platanus racemosa	Cupaniopsis anacardioides	0	N/A
367	154	26th St	Colorado Ave	Olympic Blvd	Washingtonia robusta	Washingtonia robusta	Pheonix dactylifera	0	N/A
368	151	25th St	Ocean Park Blvd	Ashland Ave	Liquidambar styraciflua	Eucalyptus maculata	Lophostemon confertus	0	N/A
370	145	24th St	Pico Blvd	Pearl St	Podocarpus sp	Corymbia citriodora	Podocarpus macrophyllus	0	N/A
371	336	Pacific St	Neilson Way	4th St	Podocarpus macrophyllus	Podocarpus macrophyllus	Pyrus kawakamii	0	N/A
372	158	27th St	Pico Blvd	Pearl St	Lagerstroemia indica	Lagerstroemia indica "Muskogee"	Rhus lancea	0	N/A
373	181	Ashland Ave	23rd St	25th St	Jacaranda mimosifolia	Jacaranda mimosifolia	Callistemon viminalis	0	N/A
374	368B	Santa Monica Blvd	20th St	Cloverfield Blvd	Eriobotrya deflexa	Ulmus parvifolia 'Allee'	Corymbia citriodora	0	N/A
375	313	Oak St	11th St	14th St	Metrosideros excelsus	Metrosideros excelsus	Pyrus kawakamii	0	N/A
376	95	17th St	Pearl St	Ocean Park Blvd	Magnolia grandiflora	Quercus agrifolia	Quercus suber	0	N/A
377	38	7th St	Santa Monica Blvd	Colorado Ave	Phoenix canariensis	Podocarpus macrophyllus	Washingtonia filifera	0	N/A

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378	56	11th St	Idaho Ave	California Ave	Pinus canariensis	Pinus canariensis	Cedrus deodara	0	N/A
379	290	Marguerita Ave	22nd St	26th St	Cinnamomum camphora	Cinnamomum camphora	Tipuana tipu	0	N/A
380	376	Sunset Ave	Glenn Ave	16th St	Callistemon citrinus	Washingtonia robusta	N/a	0	N/A
381	396	17th St	Ashland Ave	South City Limit	Erythrina caffra	Not in UFMP	Not in UFMP	0	N/A
382	303	Montana Ave	17th St	21st St	Podocarpus macrophyllus	Afrocarpus falcatus	Geijera parviflora	0	N/A
383	219	Cloverfield Blvd	Freeway	Pico Blvd	Lophostemon confertus	Lophostemon confertus	Lagerstroemia indica	0	N/A
384	315	Oak St	17th St	23rd St	Ficus microcarpa	Afrocarpus falcatus	Cupaniopsis anacardioides	0	N/A
385	262	Hill St	21st St	25th St	Ficus microcarpa	Quercus ilex	Quercus suber	0	N/A
386	9	3rd St	Wilshire Blvd	Broadway Ave	Jacaranda mimosifolia	Washingtonia robusta (I)	Jacaranda mimosifolia	0	N/A
387	15	4th St	Colorado	Pico Blvd	Washingtonia robusta	Brahea armata	Howea forsteriana	0	N/A
388	183	Bay St	Ocean Ave	6th St	Washingtonia robusta	Brahea armata	Brahea edulis	0	N/A
389	156	26th St	Pico Blvd	Dead End	Casuarina cunninghamiana	Allocasuarina verticiliata	Parkinsonia 'Desert museum'	0	N/A
390	164	32nd St	Pico Blvd	Ocean Park Blvd	Ficus microcarpa	Afrocarpus falcatus	Cupaniopsis anacardioides	0	N/A
391	255	Highland Ave	Ocean Park Blvd	South City Limit	Callistemon citrinus	Callistemon citrinus	Callistemon viminalis	0	N/A
392	220	Cloverfield Blvd	Pico Blvd	Ocean Park Blvd	Ficus microcarpa	Afrocarpus falcatus	Cupaniopsis anacardioides	0	N/A

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393	137	23rd St	Pico Blvd	Ocean Park Blvd	Cassia leptophylla	Corymbia citriodora	Arbutus 'Marina'	0	N/A
394	133	22nd St	Pico Blvd	Ocean Park Blvd	Ficus microcarpa	Cupaniopsis anacardioides	Afrocarpus falcatus	0	N/A
395	120	21st St	Montana Ave	Wilshire Blvd	Washingtonia robusta	Phoenix dactylifera	Washingtonia filifera	0	N/A
396	385	Washington Ave	7th St	14th St	Magnolia grandiflora	Pinus pinea	Cinnamomum camphora	0	N/A
397	327	Ocean Park Blvd Median	25th St	34th St	Pinus canariensis	Pinus canariensis	Quercus agrifolia	0	N/A
398	97	18th St	San Vicente Blvd	Montana Ave	Washingtonia robusta	Jubaea chilensis	Washingtonia robusta	0	N/A
399	41	7th St	Grant St	South City Limit	Podocarpus sp	Callistemon citrinus (I)	Tristaniopsis laurina	0	N/A
400	168	Airport Ave	City Limits	Centinela Ave	Multiple	Quercus agrifolia	Quercus suber	0	N/A

CURRENT PLANTED SPECIES:

Trees that are currently planted on each street segment

PRIMARY SPECIES 2015:

Trees that are projected to be the primary species on each street segment based on the updated 2015 Urban Forest Master Plan.

SECONDARY SPECIES 2015:

Trees that will be planted in place of the primary species based on availability, planting conditions, or other unforeseen factors.

ANTICIPATED NURSERY STOCK REQUIRED

Proposed Species Procurement List

2017

2017 ANTICIPATED NURSERY STOCK REQUIRED

PRIMARY SPECIES	TREE COUNT
Brahea brandegeei	37
Cedrus deodara	74
Ceiba speciosa	27
Cinnamomum camphora	31
Eucalyptus amplifolia	30
Eucalyptus maculate	19
Melaleuca quinquenervia	35
Pinus pinea	27
Pinus torreyana	16
Podocarpus macrophyllus	17
Stenocarpus sinuatus	60
Ulmus parvifolia 'Allee'	18
Total:	391

PRIMARY SPECIES:

Trees that are projected to be the primary species on each street segment based on the updated 2015 Urban Forest Master Plan.

TREE COUNT:

This column represents the total number for each tree species to be procured for the Fiscal Year.

Proposed Species Procurement List

2018

2018 ANTICIPATED NURSERY STOCK REQUIRED

PRIMARY SPECIES	TREE COUNT
Afrocarpus falcatus	40
Brahea armata	12
Callistemon citrinus	7
Callistemon viminalis	11
Casuarina cunninghamiana	14
Ceiba speciose	16
Cinnamomum camphora	11
Cupaniopsis anacardioides	27
Eucalyptus amplifolia	30
Eucalyptus ficafolia	9
Eucalyptus nicholii	8
Jubaea chilensis	36
Lagerstroemia indica	14

PRIMARY SPECIES:

Trees that are projected to be the primary species on each street segment based on the updated 2015 Urban Forest Master Plan.

TREE COUNT:

This column represents the total number for each tree species to be procured for the Fiscal Year.

Proposed Species Procurement List

2018

2018 ANTICIPATED NURSERY STOCK REQUIRED

PRIMARY SPECIES	TREE COUNT
Liquidambar styraciflua 'Rotundiloba'	12
Melaleuca linariifolia	13
Melaleuca quinquenervia	12
Pinus pinea	11
Platanus racemosa	12
Rhus lancea	13
Tipuana tipu	27
Tristaniopsis laurina	18
Ulmus parvifolia	6
Ulmus parvifolia 'Allee' & 'Drake' (Mix)	17
Washingtonia filifera	16
Not In Ufmp	15
Total:	407

PRIMARY SPECIES:

Trees that are projected to be the primary species on each street segment based on the updated 2015 Urban Forest Master Plan.

TREE COUNT:

This column represents the total number for each tree species to be procured for the Fiscal Year.

Proposed Species Procurement List

2019

2019 ANTICIPATED NURSERY STOCK REQUIRED

PRIMARY SPECIES	TREE COUNT
Afrocarpus falcatus	5
Afrocarpus falcatus (8')	5
Callistemon citrinus	4
Callistemon viminalis	11
Casuarina cunninghamiana	8
Cedrus deodara	11
Cinnamomum camphora	40
Corymbia citriodora	37
Cupaniopsis anacardioides	12
Eucalyptus amplifolia	9
Eucalyptus maculate	6
Ficus rubiginosa	7
Geijera parviflora	14

PRIMARY SPECIES:

Trees that are projected to be the primary species on each street segment based on the updated 2015 Urban Forest Master Plan.

TREE COUNT:

This column represents the total number for each tree species to be procured for the Fiscal Year.

Proposed Species Procurement List

2019

2019 ANTICIPATED NURSERY STOCK REQUIRED

PRIMARY SPECIES	TREE COUNT
Jacaranda mimosifolia	8
Jubaea chilensis	11
Lagerstroemia indica	6
Lagerstroemia indica "Muskogee"	18
Liquidambar styraciflua	9
Lophostemon confertus	15
Lophostemon confertus 'Variegata'	5
Melaleuca linariifolia	17
Melaleuca quinquenervia	6
Melaleuca quinquenervia (E/S)	8
Phoenix dactylifera	6
Pinus canariensis	14
Pinus torreyana	15

PRIMARY SPECIES:

Trees that are projected to be the primary species on each street segment based on the updated 2015 Urban Forest Master Plan.

TREE COUNT:

This column represents the total number for each tree species to be procured for the Fiscal Year.

Proposed Species Procurement List

2019

2019 ANTICIPATED NURSERY STOCK REQUIRED

PRIMARY SPECIES	TREE COUNT
Platanus racemosa	7
Platanus racemosa W/S	7
Podocarpus macrophyllus	10
Quercus agrifolia	8
Quercus suber	6
Trachycarpus fortune	15
Tristaniopsis laurina	10
Ulmus parvifolia 'Allee'	7
Ulmus parvifolia 'Drake'	24
Total:	401

PRIMARY SPECIES:

Trees that are projected to be the primary species on each street segment based on the updated 2015 Urban Forest Master Plan.

TREE COUNT:

This column represents the total number for each tree species to be procured for the Fiscal Year.

Proposed Species Procurement List

2020

2020 ANTICIPATED NURSERY STOCK REQUIRED

PRIMARY SPECIES	TREE COUNT
Afrocarpus falcatus	20
Albizia julibrissin	6
Allocasuarina verticiliata	7
Angophora costata	8
Arbutus marina	8
Brahea armata	2
Brahea brandegeei	2
Brahea edulis	8
Callistemon citrinus	4
Callistemon viminalis	10
Casuarina cunninghamiana	5
Cedrus deodara	19
Cinnamomum camphora	14

PRIMARY SPECIES:

Trees that are projected to be the primary species on each street segment based on the updated 2015 Urban Forest Master Plan.

TREE COUNT:

This column represents the total number for each tree species to be procured for the Fiscal Year.

Proposed Species Procurement List

2020

2020 ANTICIPATED NURSERY STOCK REQUIRED

PRIMARY SPECIES	TREE COUNT
Corymbia citriodora	32
Cupaniopsis anacardioides	4
Eucalyptus amplifolia	3
Eucalyptus maculate	6
Geijera parvifolia	14
Jacaranda mimosifolia	13
Koelreuteria bipinnata	6
Lagerstroemia indica	3
Lophostemon confertus	4
Melaleuca linariifolia	5
Melaleuca quinquenervia	6
Metrosideros excelsus	7
Phoenix dactylifera	2

PRIMARY SPECIES:

Trees that are projected to be the primary species on each street segment based on the updated 2015 Urban Forest Master Plan.

TREE COUNT:

This column represents the total number for each tree species to be procured for the Fiscal Year.

Proposed Species Procurement List

2020

2020 ANTICIPATED NURSERY STOCK REQUIRED

PRIMARY SPECIES	TREE COUNT
Pinus canariensis	13
Pinus pinea	15
Platanus racemosa	5
Podocarpus macrophyllus	19
Quercus agrifolia	19
Quercus ilex	4
Quercus suber	6
Rhus lancea	6
Rhus lancea (L)	4
Syragrus romanzoffianum	8
Tipuana tipu	3
Trachycarpus fortune	3
Tristaniopsis laurina	14

PRIMARY SPECIES:

Trees that are projected to be the primary species on each street segment based on the updated 2015 Urban Forest Master Plan.

TREE COUNT:

This column represents the total number for each tree species to be procured for the Fiscal Year.

Proposed Species Procurement List

2020

2020 ANTICIPATED NURSERY STOCK REQUIRED

PRIMARY SPECIES	TREE COUNT
Ulmus parvifolia	10
Ulmus parvifolia 'Allee'	16
Ulmus parvifolia 'Drake'	9
Multiple Species	17
Total:	389

PRIMARY SPECIES:

Trees that are projected to be the primary species on each street segment based on the updated 2015 Urban Forest Master Plan.

TREE COUNT:

This column represents the total number for each tree species to be procured for the Fiscal Year.

Proposed Species Procurement List

2021

2021 ANTICIPATED NURSERY STOCK REQUIRED

PRIMARY SPECIES	TREE COUNT
Afrocarpus falcatus	20
Afrocarpus falcatus, Gingko biloba	5
Albizia julibrissin	4
Allocasuarina verticiliata	7
Brahea edulis	1
Callistemon citrinus	15
Callistemon citrinus (L)	6
Callistemon viminalis	3
Casuarina cunninghamiana	2
Cedrus atlantica	9
Cedrus deodara	20
Cinnamomum camphora	5
Corymbia citriodora	30

PRIMARY SPECIES:

Trees that are projected to be the primary species on each street segment based on the updated 2015 Urban Forest Master Plan.

TREE COUNT:

This column represents the total number for each tree species to be procured for the Fiscal Year.

Proposed Species Procurement List

2021

2021 ANTICIPATED NURSERY STOCK REQUIRED

PRIMARY SPECIES	TREE COUNT
Corymbia citriodora (3 Ft)	1
Cupaniopsis anacardioides	5
Erythrina caffra	4
Eucalyptus amplifolia	1
Eucalyptus maculate	11
Eucalyptus sideroxylon	2
Ficus macrophylla	1
Ficus microcarpa	8
Ficus rubiginosa	6
Geijera parvifolia	3
Jacaranda mimosifolia	8
Jubaea chilensis	5
Koelreuteria bipinnata	21

PRIMARY SPECIES:

Trees that are projected to be the primary species on each street segment based on the updated 2015 Urban Forest Master Plan.

TREE COUNT:

This column represents the total number for each tree species to be procured for the Fiscal Year.

Proposed Species Procurement List

2021

2021 ANTICIPATED NURSERY STOCK REQUIRED

PRIMARY SPECIES	TREE COUNT
Koelreuteria paniculata	5
Lagerstroemia indica	6
Liquidambar styraciflua	5
Liquidambar styraciflua 'Rotundiloba'	3
Lophostemon confertus	5
Magnolia grandiflora	8
Melaleuca linariifolia	2
Melaleuca quinquenervia	3
Melaleuca quinquenervia (L)	1
Metrosideros excelsus	31
Phoenix dactylifera	3
Pinus canariensis	16
Platanus mexicana	2

PRIMARY SPECIES:

Trees that are projected to be the primary species on each street segment based on the updated 2015 Urban Forest Master Plan.

TREE COUNT:

This column represents the total number for each tree species to be procured for the Fiscal Year.

Proposed Species Procurement List

2021

2021 ANTICIPATED NURSERY STOCK REQUIRED

PRIMARY SPECIES	TREE COUNT
Podocarpus macrophyllus	31
Quercus agrifolia	25
Quercus suber	2
Stenocarpus sinuatus	3
Tipuana tipu	8
Tristaniopsis laurina	1
Ulmus parvifolia	3
Ulmus parvifolia 'Allee'	1
Ulmus parvifolia 'Drake'	3
Washingtonia robusta	10
No Wires: Ulmus parvifolia 'Drake'/ Wires: Corymbia citriodora	3
Total:	383

PRIMARY SPECIES:

Trees that are projected to be the primary species on each street segment based on the updated 2015 Urban Forest Master Plan.

TREE COUNT:

This column represents the total number for each tree species to be procured for the Fiscal Year.

WORKFLOW AND MODELS

The ModelBuilder Tool

The models designed and performed in this exercise were built with the ModelBuilder tool in the ArcGIS software package, made by Esri, Inc.[22] These models allow a participant to design a string of operations and manage a flowchart that may be saved and executed at will.

The implementation of these models in manipulating geographic data were crucial to this study and were a time-saving advantage for the processes involved in the planting priority analysis.

The models have been saved in a shared geodatabase in the City's information systems department and may be opened, edited, and re-used in the future for later implementations. If and when, environmental or population conditions change, the models can be executed by future City employees.

In the following pages, I have included a sample of the models designed for this program.

Figure 36. An example of the final analysis workflow model used in the planting program.

Tree Stocking Level Model

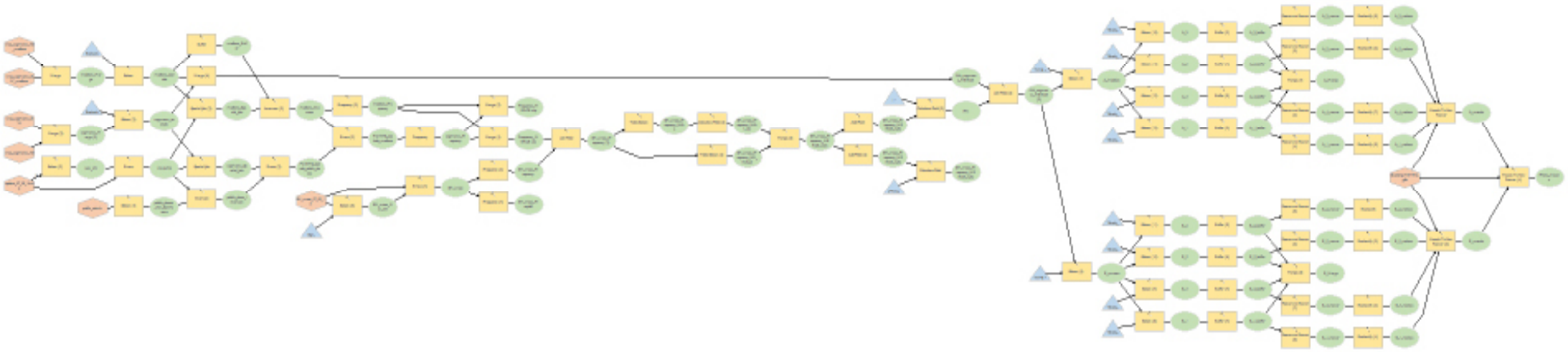

Figure 37. The urban forest tree stocking level model.

The Urban Forest tree stocking level model is based on the current inventory of trees planted throughout the city. This model uses seven inputs to output a feature class containing the tree stocking level of every street segment in the city.

Palm Tree Selection Model

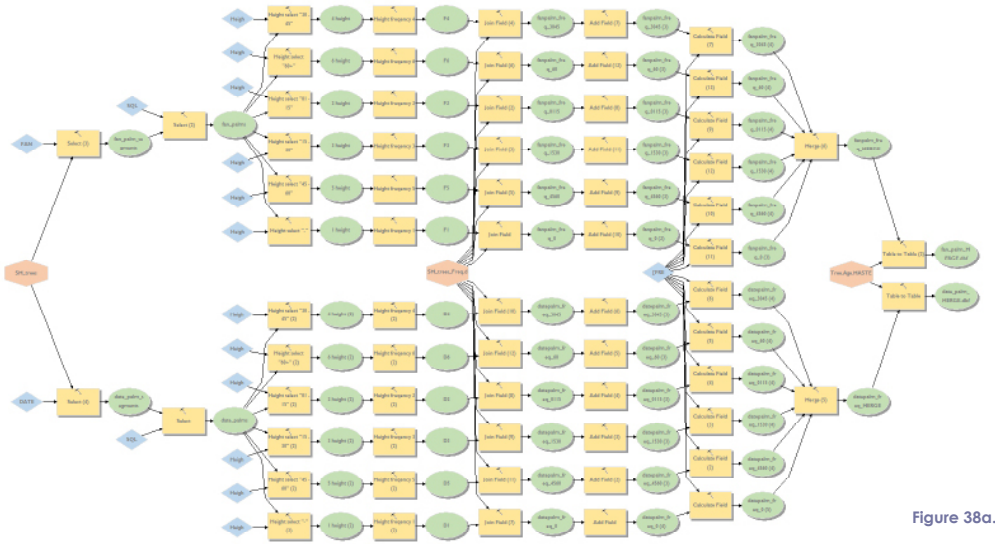

Figure 38a. The palm tree selection model.

The palm tree selection model uses a query function to find the current age of palm trees on street segments, by height, find the frequency of age groupings on each street segment, and populate new fields with values for further analysis. This tool outputs a set of tables that must be consolidated in a spreadsheet program for further analysis.

Palm Species Classification Model

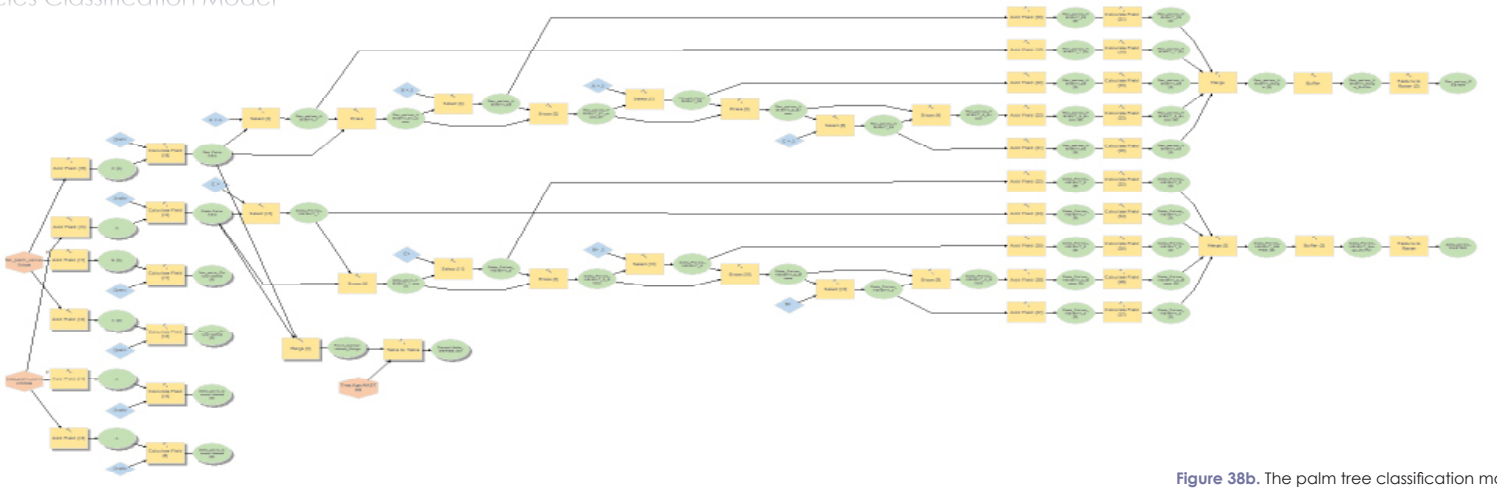

Figure 38b. The palm tree classification model.

The palm tree classification tool classifies palm trees into six age groups and gives each street segment a weighted value with an algorithm that uses a classified scoring system.

Non – Palm Species Classification Model

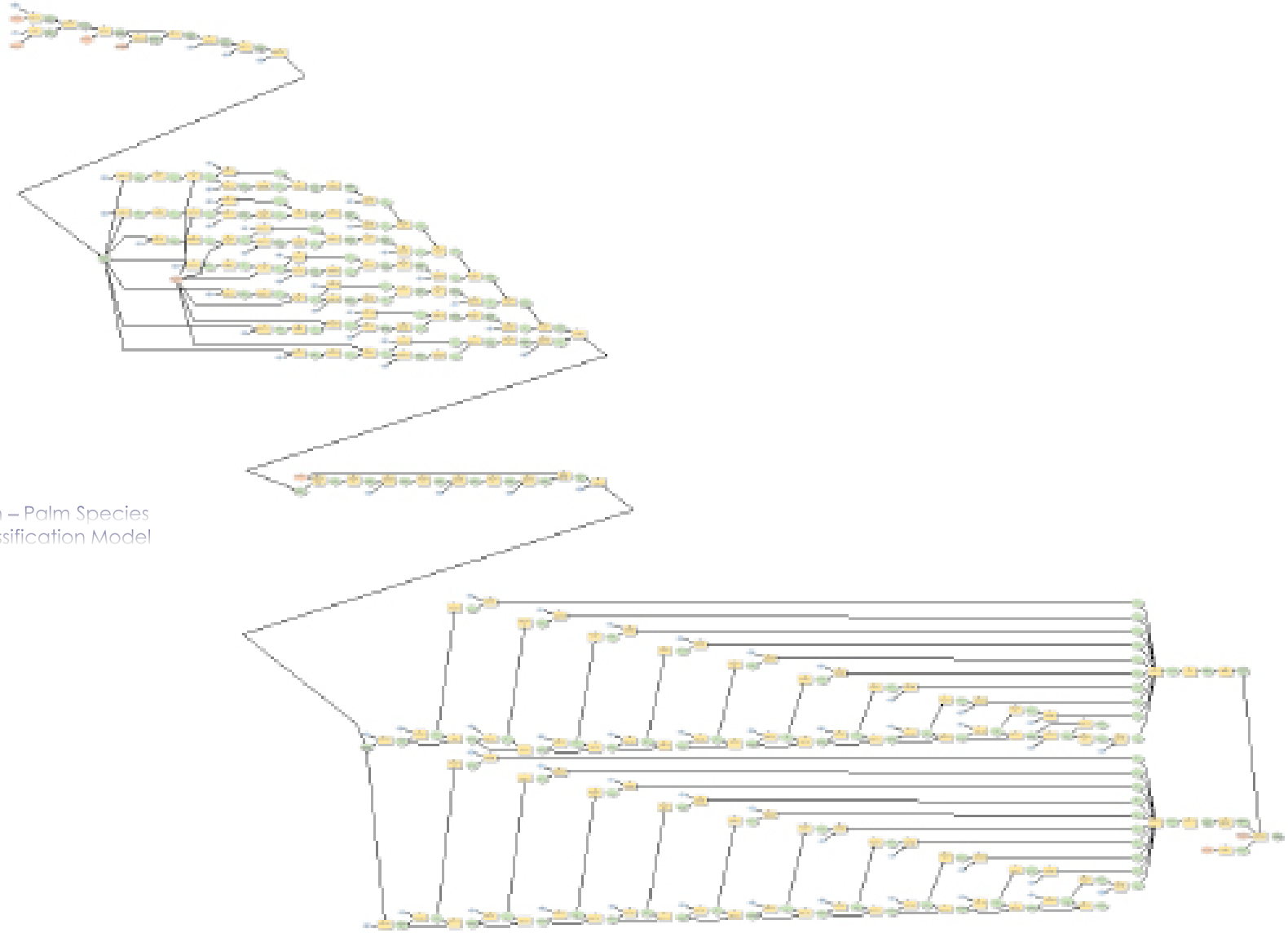

Figure 39. The non-palm tree species classification model.

This model uses a query function to find the current age of non-palm tree species on street segments, by DBH values, to find the frequency of age groupings on each street segment, and to populate new fields with values for further analysis. Next, the model classifies non-palm tree species into ten age groups and gives each street segment a weighted value with an algorithm that uses a classified scoring system. The output is a set of raster images to use in further analysis.

Final Output Model

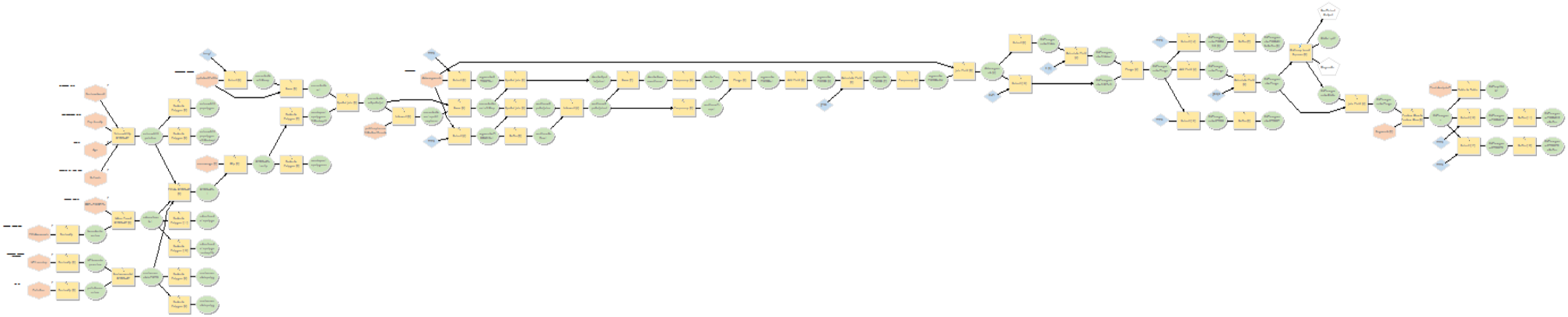

Figure 40. The Final output model is used to make final calculations for the priority planting plan.

The final output model computes three initial weighted analyses for the three inputs to the final overlay. Next, the model performs a final weighted overlay from these resultant images, assigns the output grid-code values to their respective street segment, computes a regression analysis on street segment length, and outputs a set of tables to be used in further analysis.

ENDNOTES

1. Musiker, Rachel, "Bike Score 2015 Supplemental Data: Full Ranking and New Cities," Redfin Corporation, May 14, 2015, https://www.redfin.com/blog/2015/05/bike-score-2015-supplemental-data-full-ranking-and-new-cities.html#.VVTd5dNViko

2. Santos, Robert L., "The Eucalyptus of California: Seeds of Good or Seeds of Evil?," California State University, Stanislaus (Denair, California: Alley-Cass Publications, 1997), 48.

3. Dwyer, John F., et. al., "Assessing the Benefits and Costs of the Urban Forest," Journal of Arboriculture 18 (5): (September 1992): 227 – 233.

4. McPherson, E. Gregory, "Benefit-Cost Analysis of Santa Monica's Municipal Forest," Center for Urban Forest Research, USDA Forest Service, University of California, Davis, CA (November, 2001): 36.

5. City of Santa Monica News, "The City of Santa Monica Forestry Program Receives Accreditation by the Society of Municipal Arborists," City of Santa Monica, (March 3, 2016), https://newsroom.smgov.net/2016/03/30/the-city-of-santa-monica-forestry-program-receives-accreditation-by-the-society-of-municipal-arborists

6. This historical document is an original copy of the Santa Monica Urban Forest Master Plan for Tree Planting. (Sept. 1963). The item is stored in the City of Santa Monica Urban Forest Department's offices.

7. City of Santa Monica, Santa Monica Urban Forest Master Plan – Draft, December 2011, https://www.smgov.net/uploadedFiles/Portals/UrbanForest/UFMP_ADOPTED_FINAL.pdf

8. City of Santa Monica, "Santa Monica Land Use and Circulation Element," City of Santa Monica Planning and Community Development, Adopted July 6, 2010.

9. City of Santa Monica, "Neighborhood Organizations," City of Santa Monica (2016), http://www.smgov.net/content.aspx?id=4241

10. West Coast Arborists, http://westcoastarborists.com/

11. West Coast Arborists, "ArborAccess," (2016), http://westcoastarborists.com/arbor-access/

12. California Environmental Protection Agency, California Air Resources Board, "Air Quality and Land Use Handbook: A Community Health Perspective." (April 2005), 6 – 10; County of Los Angeles Public Health, "Air Quality Recommendations for Local Jurisdictions," (January 22, 2013), 1 – 2; Hu, Shishan, et. Al, "Aircraft Emissions in a Neighborhood Adjacent to a General Aviation Airport in Southern California," Environmental Science and Technology, Vol 43, No 21, American Chemical Society, (2009): 8039 – 8045; McConnell, Rob, et al, "Traffic, Susceptibility, and Childhood Asthma," Environmental Health Perspectives 114, no. 5 (February 16, 2006): 766–772.

13. Phillips, Grace S., "Using Ecosystem Benefits to Prioritize Infrastructure Improvements in Santa Monica," (master's thesis, University of California, Los Angeles, April 2012), 46.

14. USGS Earth Explorer, U.S. Geological Survey, (2016), http://earthexplorer.usgs.gov/

15. U.S. Census Bureau, "Total Population, in Census Block Groups," American Factfinder, (2010 Census), Accessed March 2016, http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

16. Private School Review, "Santa Monica Private Schools," Private School Review, Accessed April 2016, http://www.privateschoolreview.com/california/santa-monica; Great Schools, "Santa Monica Schools," Accessed April 2016, http://www.greatschools.org/california/santa-monica/schools/?gradeLevels=p

17. U.S. Census Bureau, "Sex by Age, in Census Block Groups," American Factfinder, (2010 Census), Accessed March 2016, http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

18. Ibid, "Means of Transportation to Work, in Census Block Groups."

19. McConnell, Rob, et al, "Traffic, Susceptibility, and Childhood Asthma," 766–772.

20. Phillips, Grace S., "Using Ecosystem Benefits to Prioritize Infrastructure Improvements in Santa Monica," 46.

21. McConnell, Rob, et al, "Traffic, Susceptibility, and Childhood Asthma," 766–772.

22. Esri, Inc., "What is ModelBuilder?," ArcGIS for Desktop, Esri, Inc. (2016), http://desktop.arcgis.com/en/arcmap/10.3/analyze/modelbuilder/what-is-modelbuilder.htm

REFERENCES

California Environmental Protection Agency, California Air Resources Board. "Air Quality and Land Use Handbook: A Community Health Perspective." (April 2005).

City of Santa Monica News. "The City of Santa Monica Forestry Program Receives Accreditation by the Society of Municipal Arborists." City of Santa Monica, (March 3, 2016). https://newsroom.smgov.net/2016/03/30/the-city-of-santa-monica-forestry-program-receives-accreditation-by-the-society-of-municipal-arborists

City of Santa Monica. Santa Monica Urban Forest Master Plan – Draft, December 2011. https://www.smgov.net/uploadedFiles/Portals/UrbanForest/UFMP_ADOPTED_FINAL.pdf

City of Santa Monica. "Neighborhood Organizations." City of Santa Monica (2016), http://www.smgov.net/content.aspx?id=4241

City of Santa Monica. "Santa Monica Land Use and Circulation Element." City of Santa Monica Planning and Community Development, Adopted July 6, 2010.

County of Los Angeles Public Health. "Air Quality Recommendations for Local Jurisdictions." (January 22, 2013).

Dwyer, John F., et. al. "Assessing the Benefits and Costs of the Urban Forest." Journal of Arboriculture 18 (5): (September 1992).

Esri, Inc. "What is ModelBuilder?" ArcGIS for Desktop, Esri, Inc. (2016). http://desktop.arcgis.com/en/arcmap/10.3/analyze/modelbuilder/what-is-modelbuilder.htm

Great Schools. "Santa Monica Schools." Accessed April 2016. http://www.greatschools.org/california/santa-monica/schools/?gradeLevels=p

Hu, Shishan, et. al. "Aircraft Emissions in a Neighborhood Adjacent to a General Aviation Airport in Southern California." Environmental Science and Technology, Vol 43, No 21. American Chemical Society, (2009).

McConnell, Rob, et al. "Traffic, Susceptibility, and Childhood Asthma." Environmental Health Perspectives 114, no. 5 (February 16, 2006).

McConnell, Rob, et al. "Traffic, Susceptibility, and Childhood Asthma." Environmental Health Perspectives 114, no. 5 (February 16, 2006).

McPherson, E. Gregory, "Benefit-Cost Analysis of Santa Monica's Municipal Forest." Center for Urban Forest Research, USDA Forest Service. University of California, Davis, CA (November, 2001).

Musiker, Rachel. "Bike Score 2015 Supplemental Data: Full Ranking and New Cities." Redfin Corporation, May 14, 2015. https://www.redfin.com/blog/2015/05/bike-score-2015-supplemental-data-full-ranking-and-new-cities.html#.VVTd5dNViko

Phillips, Grace S. "Using Ecosystem Benefits to Prioritize Infrastructure Improvements in Santa Monica." Master's thesis, University of California, Los Angeles, April 2012.

Private School Review. "Santa Monica Private Schools." Private School Review. Accessed April 2016. http://www.privateschoolreview.com/california/santa-monica

Santos, Robert L. "The Eucalyptus of California: Seeds of Good or Seeds of Evil?" California State University, Stanislaus (Denair, California: Alley-Cass Publications, 1997).

U.S. Census Bureau. "Means of Transportation to Work, in Census Block Groups." American Factfinder, (2010 Census). Accessed March 2016. http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

U.S. Census Bureau. "Sex by Age, in Census Block Groups." American Factfinder, (2010 Census). Accessed March 2016. http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

U.S. Census Bureau. "Total Population, in Census Block Groups." American Factfinder, (2010 Census). Accessed March 2016. http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

USGS Earth Explorer. U.S. Geological Survey, (2016). http://earthexplorer.usgs.gov/

West Coast Arborists. http://westcoastarborists.com/

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