Learning Objectives:

By the end of this lab, students will be able to

* evaluate whether the trends between tree cover and socioeconomic factors observed in other cities also apply to Dallas, Texas.
* draw conclusions about the relationships between socioeconomic factors and tree cover in Dallas, TX.
* Suggest methods by which disparities in access to ecosystem services provided by trees can be eliminated

# Introduction:

Social justice is the concept that relationships between individuals and society should be fair. It is the idea that individuals or groups of individuals should not be singled out or treated unjustly by society because of their characteristics. Environmental justice is the concept that the distribution of environmental benefits (e.g., clean water) and burdens (e.g., air pollution) should also be fair. Similar to social justice, the central idea to environmental justice is that no individual nor group should bare a greater environmental burden nor receive more environmental benefits than others. The ecosystem functions that benefit humans, such as clean air and reduced runoff, are referred to as *ecosystem services*. Research conducted in cities across the U.S. has shown that lower income communities, especially communities of color and immigrants, tend to have less tree cover (Locke et al. 2021), and therefore have reduced access to ecosystem services provided by trees. Tree cover has been shown to improve both mental and physical health for urban residents by improving air quality and decreasing air temperatures in cities (McDonald et al. 2020). Trees also provide habitat for organisms, so biodiversity is higher in urban areas with higher tree cover (Schell et al. 2020).

In this lab, we will examine whether tree cover and the ecosystem services that they provide, are fairly distributed across the city of Dallas, Texas. **We will be addressing three questions: 1) Is tree cover equitably distributed with in this urban community? 2) does tree cover positively impact life expectancy in this urban community? and 3) what other factors might contribute to the health trends observed in this urban community?**

# Background

During the early to mid-twentieth century, federal and local governmental policies promoted the racial and economic segregation of communities in Dallas and other cities across the United States. These policies also ensured that the bulk of available resources were partitioned to white, middle-class communities. The discriminatory practice of allocating resources and benefits to primarily white and wealthy communities has come to be called “redlining,” a reference to a mapping system that dates back to the 1930s that was used to demarcate neighborhoods by the race, income and immigration status of their inhabitants. The Fair Housing Act of 1968 made it illegal to base sales, rental or mortgage lending decisions based on race or ethnicity, however the environmental, economic and social legacies of these practices are persistent in our cities today.

The term “land use” refers to the conversion of natural habitats to human use. Land use types are classified by their economic importance to humans (e.g., forest, agriculture, urban). Within urban landscapes land use cover is usually classed as vegetation or impervious (water does not pass through it, and it absorbs and remits solar heat energy). For the purpose of this lab, we are interested in the amount of tree cover as a percent of the total area of the census tracts that we are investigating. Census tracts are areas containing neighborhoods that have been grouped for the collection and compilation of Census data, including income and demographic data. Because the U.S. Census Bureau publishes demographic data for Census Tracts, we will be using the Census tract boundaries as our sampling areas for our tree cover estimates.

You have been provided an Excel spreadsheet that contains U.S. Census Economic and Demographic data (population size, race and ethnicity data) and Centers for Disease Control (CDC) life Expectancy data. Your job during this lab is to determine the *tree cover* for each of the Census tracts for which we have data in the Excel sheet or Dallas. You will then graph these data and draw conclusions about the distribution tree cover within the city of Dallas.

Each student will use the web-based App, iTree Canopy, to estimate the cover types by land use represented within two Census tracts within the City of Dallas. All students will share their tree cover data in a collaborative data sheet. Students will then use simple linear regression in Excel to evaluate the strength and the nature of the relationships between land use cover and two socioeconomic factors across all of the Census tracts for which we have data. You will submit your graphs, analysis and conclusions as a worksheet. You will also submit the Excel file containing your analyses.

# Lab Exercise Instructions

## iTree Canopy Instructions

Open the Collaborative Excel Spreadsheet available in Canvas. Find the numbers for the census tracts that you will be evaluating for Tree Cover and Ecosystem services.

Navigate to the iTree Canopy website (<https://canopy.itreetools.org>). Once at the iTree Canopy website, follow the directions below to estimate tree cover for your assigned census tracts:

1. Click on the blue “Get Started Button”
2. *Configuration step 1 of 3:* You should now be looking at a Google Maps Satellite Image. On the right there is a dialogue box. From the dropdown menu labeled “Load Shapefile Boundary.” Click on the “Browse” button to choose the shapefile for your assigned census tract. These shapefiles will be provided by your instructor.



Figure 1 Screenshot of Configuration for Step 1 of 3 showing the imported shapefile (red polygon) over a satellite image. Click on “Load Shapefile” circled in red, and then upload the shapefile for your assigned census tract. Once you have done so you should be able to see your shapefile outlined as is shown here.

1. Once you have uploaded the shapefile for your census tract your census tract, click on the “Select” button.
2. Once you have your Census tract selected, click on the blue “Next” button in the lower right of the page.
3. *Configuration step 2 of 3*: Select the “Tree/Non-Tree” blue button. We will only be classifying surfaces within in our transects as being tree or not. Click on the blue “Next” button.
4. *Configuration step 3 of 3*. Select “United States” for “Available Locations.” Then, Select “Urban” for “Selected Locations.”
5. Click on the “Next” Button. You are now ready to conduct your survey!
6. Conduct your survey: To add survey points, click on the + button below the View Results table. The program will randomly select a point for you to classify as “Tree” or “Non-tree.” Once you have determined whether the location is a tree or not, make your selection from the dropdown menu and click the blue” Save” button.
7. Repeat this for **100 locations** within your Census Tract.
8. Once you have classified your 100 locations within the census tract, click on the blue “Report Button at the top of the View Result stable.
9. The report will show the percent tree cover as a bar graph, and lists all of the ecosystem services that the estimated tree cover in that Census tracts are performing, including an estimated dollar value for those ecosystem services.
10. Print your report as a PDF. You will submit your PDF of the report with your assignment submission.
11. Repeat this process for the other census tract that you have been assigned.
12. Now that you have estimated the tree cover in your census tracts, you will enter those data into the collaborative spreadsheet.

## Entering your Tree Cover and Ecosystem Service Data into the Excel File:

1. Once you have opened the Collaborative Excel file, you will enter the Tree Cover estimates that you generated using iTree Canopy.
2. Once your lab mates have entered their data, you will conduct your analyses using these data.

Conducting Simple Linear Regression in Excel:

1. We will be analyzing our data graphically using scatter plots. The first scatter plots that we will make will test whether household income is correlated with tree cover in Dallas. The second set of scatter plots will test for correlation between two variables of your choosing.
2. Download the Excel file containing Census Data and the Tree Cover data that our class has generated. Save a copy with your name in the file name. You will submit this as part of your assignment submission.
3. Answer question 1 in the *Tree Cover, Ecosystem Services and Socioeconomics Worksheet*.
4. Select the “Dallas” tab in the Excel file.
5. Now, use your curser to highlight/ select the two columns containing the ***Household Mean Income*** and the ***Tree Cover*** data. Just highlight the cells containing the titles and the data, not the entire columns.
6. Once you have selected those two columns, click on the ***Insert*** tab at the top of the screen and select the ***scatterplot*** button to create a scatter plot graph. The resulting graph should have ***Mean Household Income ($/ year)*** data on the x-axis and the ***% Tree Cover*** data as the y-axis.
7. Click on your graph. A tab labeled “***Design***” will appear at the top of the Excel window. Using the “Design” tab and the “***Add Chart Element”*** button on the left-hand side of the “***Design***” tab, add axis labels to your graph. Include a graph title as well.
8. Now, right click on one of the data points in your scatter plot. Select “***Add trend Line”*** from the drop-down menu that appears. If there is a “**Format Trendline”** dialogue box to the right, click on the boxes next to “***Display Equation on Chart”*** AND “***Display R-squared value on chart***.” If “**Format Trendline**” dialogue box is not visible, then right click on the trendline in your graph, and select “***Format Trendline***” from the drop-down menu that appears. Now, you can select the equation and R-squared options.
9. Complete Questions 2 – 5 in the worksheet.
10. Create scatter plots for Dallas using the variables that you chose to test.
11. Answer Questions 6 – 9 in the Worksheet.

References cited:

Locke, D.H., Hall, B., Grove, J.M. *et al.* Residential housing segregation and urban tree canopy in 37 US Cities. *npj Urban Sustain* **1,**15 (2021). [https://doi.org/10.1038/s42949-021-00022-0 (Links to an external site.)](https://doi.org/10.1038/s42949-021-00022-0)

McDonald, R.I., Kroeger, T., Zhang, P. *et al.* The Value of US Urban Tree Cover for Reducing Heat-Related Health Impacts and Electricity Consumption. *Ecosystems* **23,**137–150 (2020). [https://doi.org/10.1007/s10021-019-00395-5 (Links to an external site.)](https://doi.org/10.1007/s10021-019-00395-5)

Schell, C.J., *et al.* 2020. The ecological and evolutionary consequences of systemic racism in urban environments. *Science* 369(6510): 4497. http://doi.org/10.1126/science.aay4497