

URBAN HEAT ISLANDS



LESSON OVERVIEW			
Grades 6-12			
Students will: <ul style="list-style-type: none"> • explore the causes and effects of urban heat islands. • explore how tree planting can reduce and mitigate the urban heat island effect. 			
Approximate Time	Activities	Websites/Apps	Materials
30	<ul style="list-style-type: none"> • Introduction Video - What is the “Urban Heat Island Effect”? 	<ul style="list-style-type: none"> • YouTube Video • Tree Plotter • Arbor Day Foundation 	<input type="checkbox"/> Laptop, iPad, Android tablet, or smartphone with internet connection
60	<ul style="list-style-type: none"> • Urban Heat Islands Discussion • Tree Plotter Field Study 	<ul style="list-style-type: none"> • PlantSnap - App • iNaturalist - App 	<input type="checkbox"/> Measuring tape or string and ruler <input type="checkbox"/> Calculator
90 Minutes			

INTRODUCTION

Large cities like Dallas have long been known to exhibit higher temperatures than the surrounding countryside, at times in excess of 10°F, due to the intensity of heat-absorbing materials in their downtown districts and the relative sparseness of tree canopy and other vegetative cover, which provides evaporative cooling and shading.

The **urban heat island (UHI) effect** is the displacement of trees and other natural vegetation by the construction materials of urban development that increases the amount of heat energy that is absorbed from the sun and stored in urban materials, such as concrete, asphalt, and roofing shingle.

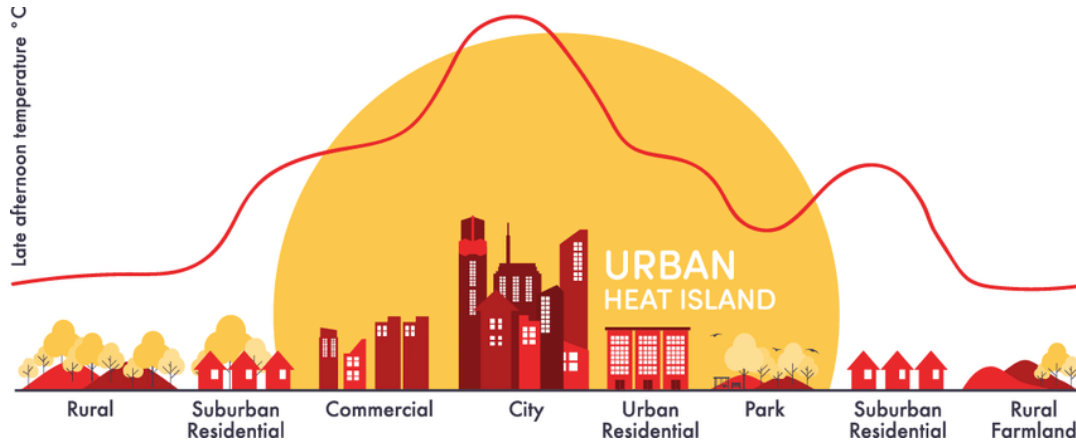
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BACKGROUND INFORMATION

What is an Urban Heat Island (UHI)?

An **urban heat island** means that an urban area or metropolitan area is significantly warmer than its surrounding rural areas due to human activities.



(Figure is a courtesy of Kamyar Fuladlu)

Four specific changes in urban environments drive the urban heat island effect: **1)** the loss of natural vegetation; **2)** the introduction of urban construction materials that are more efficient at absorbing and storing thermal energy than the natural landscape; **3)** high-density urban morphology that traps solar radiation, and **4)** the emission of waste heat from buildings and vehicles.

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The Benefits of Tree Planting

- **TREE PLANTING** and **PRESERVATION** in Dallas can change the weather by producing more cooler days and nights which is the opposite of what will occur if tree canopy continues to be lost.
- The benefits of **greening strategies** can be as high as 15°F of cooling in some areas on hot summer days.

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- **TREE PLANTING** and **PRESERVATION** can save lives when implemented in concert with more reflective roofing and paving materials. These combined strategies can reduce the number of deaths from hot weather by more than 20%.
- **TREE PLANTING** and **PRESERVATION** are more than 3.5 times as effective in lowering temperatures as **cool materials strategies**.
- Dallas can achieve significant cooling and health benefits by planting 250,000 trees.

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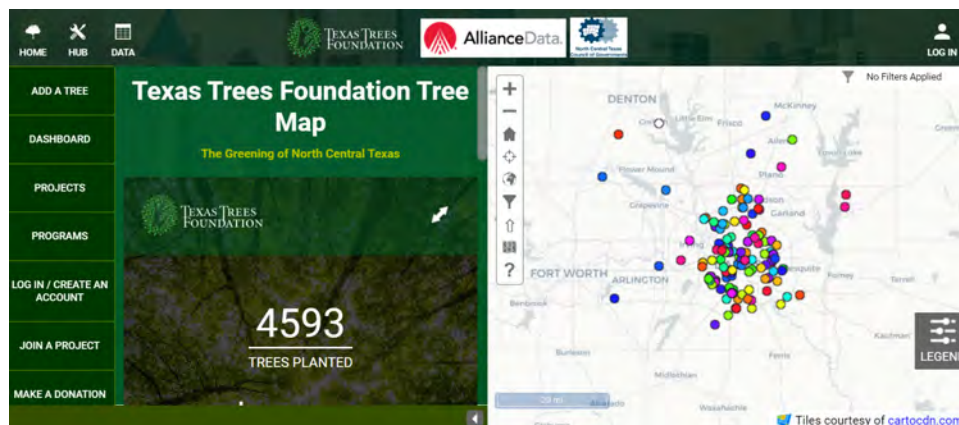
Discussion Questions

1. Why do urban heat islands occur?
2. How can we reduce and mitigate the urban heat island effect?
3. How does climate change contribute to the urban heat island effect?

TREE PLOTTER

The Texas Trees Foundation TreePlotter map, custom built by PlanIT GEO, is a free tool that quantifies the benefits and values of trees, aids in tree and urban forestry management and advocacy, and shows potential risks to trees and overall urban forestry health.

Tree Plotter is used to create a database of trees that can be used for science, research, and education all over the world. It started in Dallas but Texas Trees Foundation would like to see it spread throughout Texas, the United States, and the world.



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FIELD STUDY DESCRIPTION

Citizen Science is the process by which people in the community take measurements, make observations, and record data that can be used for the greater “scientific good”. This information is key for many successful urban forests around the United States. In this activity, students will aid Texas Trees Foundation by adding trees in their community to the Tree Plotter database. Tree Plotter takes several easy measurements and pieces of data about trees to help plan urban areas better, determine where mitigation should occur, and show how to best allocate funds and resources in the places that need them most.

To get started:

1. Find a location at your school, neighborhood, or local park with trees.
2. Go to your location with your measuring tools (measuring tape or string and ruler), calculator, and electronic device with an internet connection.
3. Once you pick a tree, start by determining the diameter at breast (DBH).

Determine Diameter at Breast (DBH)

The DBH is the diameter at the breast height of your tree. “Breast height” is measured differently around the world. In the United States, DBH is measured at 4.5 feet (54 inches or 1.4 meters) above ground level. To calculate the DBH of your tree:

- At 4.5 feet above ground level, wrap a measuring tape or a piece of string completely around the tree and measure this distance and record the number below.

Circumference = _____ inches

- You just measured the circumference of the tree. To calculate the diameter of the tree, use this formula:

Diameter = circumference/ π (**enter in inches**)

Diameter = _____ inches

Example: If your circumference was 10 inches, you would divide that by 3.14 and get a diameter of approximately 3.18 (3.2) inches in diameter. So, your DBH would be 3.2 inches.

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Add Tree to Tree Plotter

Once Tree Plotter opens:

- a. Go to the upper right-hand corner of the screen and click **“LOG IN”**.
- b. It will ask you to enter an email and create a password.
- c. Using the small toolbar on the left-hand side of the map, you can click the globe to Find an address (type your address here, or it may locate you automatically). You can also enter trees that are not at your address if you so choose.
- d. In the upper left corner of the “home “ tab, select **“Add a Tree”**
- e. A box will appear where you can then:
 - i. Enter the Common name of your tree. This you may not know. If you don't know what type of tree it is, you can use one of the following websites for assistance.
 1. <https://www.arborday.org/trees/whattree/> (the Arbor Day Foundation)
 2. <http://texastreeid.tamu.edu/> (for Texas tree species - Texas A&M University)
 3. <https://www.inaturalist.org/> (App for nature ID including trees, plants, insects, etc.)
 4. <https://www.plantsnap.com/> (App for nature ID including trees, plants, insects, etc.)
 - ii. Enter DBH
 - iii. Enter the Land Use of the land on which your tree is planted.
 - iv. Enter the Tree type of your tree. This will be **“inventory”** for all existing trees.
 - v. Lastly, click on “Optionally select a project to link your tree to”
 1. When you get the pop-up screen, type **“Citizen Science Inventory”**
 2. Click on this project below, and your tree has been added! Thank you!
 3. Click **“explore map”** to see other trees people have added in your area.

You can also click on your own tree to see more information about the ecosystem services your tree provides, and its value.

Once you have completed these steps, you have plotted a tree! **CONGRATULATIONS!** Please feel free to do this for any other trees that you can! Texas Trees Foundation would LOVE to see their map populated with trees from all over!

Adapted from Citizen Science: Tree Plotting & Measuring Activities from Texas Trees Foundation