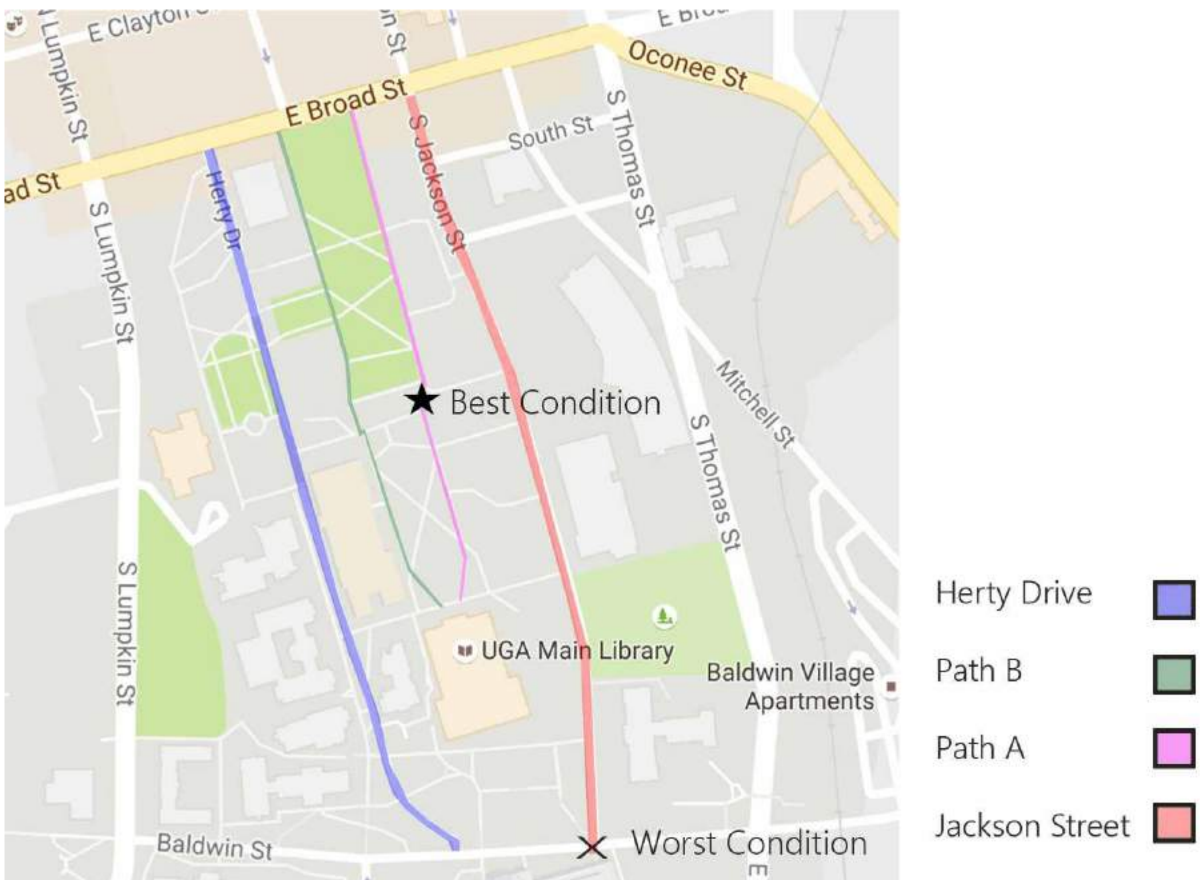
LANDSCAPE MICROCLIMATE ANALYSIS: UGA'S NORTH CAMPUS

Analysis includes details from a field investigation assessing various microclimate elements surrounding a portion of North Campus. Four routes of travel were assessed:

1. Herty Drive between Baldwin Street and Broad Street
2. Jackson Street between Baldwin Street and Broad Street
3. Path A - from the Main Library to Broad Street
4. Path B - from the Arch to the Main Library

Investigation Date: Tuesday, September 6, 2016
Time: 8:00-11:00 am & 4:00 - 5:00 pm
Participants: Katie Sewell, Morgan Landers, Weston Cleveland, Alyssa Harris, Lesa Miller

Location Map:



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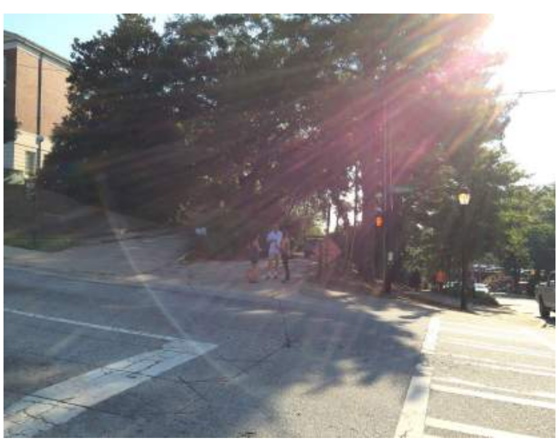
HUMAN COMFORT

1) Best Location: Point AH

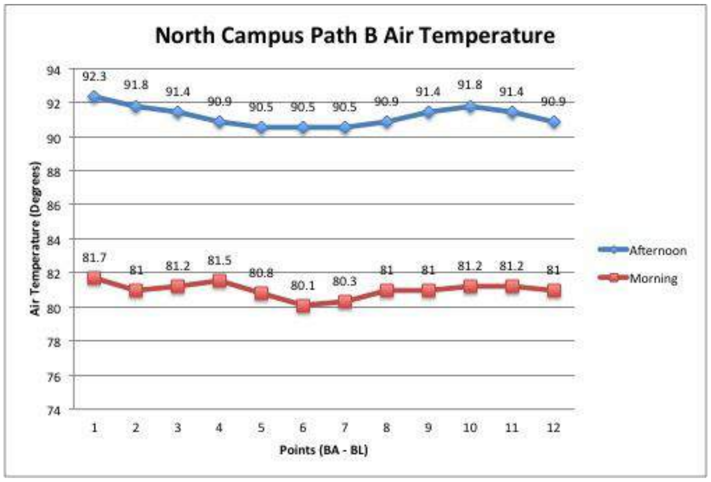
Route: Path A - from the Main Library to Broad Street
Condition: dappled shade, nearby fountain noise, comfortable seating, pedestrian scale
Morning/Afternoon Air Temperature: 79.9 / 93.6
Morning/Afternoon Sidewalk Surface Temperature: 81.3 / 99
Morning/Afternoon Relative Humidity: 61.2% / 34.7%
Morning/Afternoon Wind Speed: 0 mph / 1.34 mph
Tree Shade: 41" Black Oak

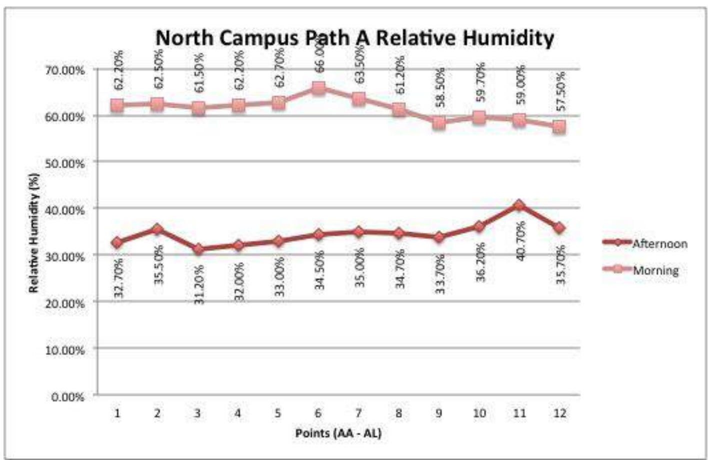
2) Worst Location: Point JA

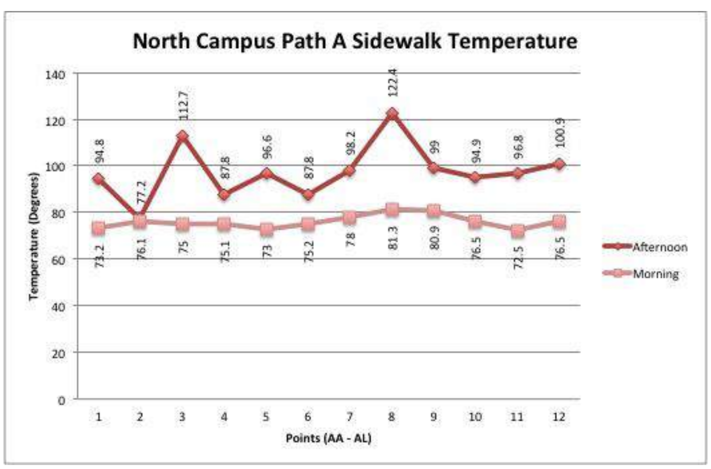
Route: Jackson Street between Baldwin Street and Broad Street
Condition: full sun, narrow sidewalk, road noise, construction, poor lines of sight
Morning/Afternoon Air Temperature: 79.4 / 95
Morning/Afternoon Sidewalk Surface Temperature: 75.5 / 113.7
Morning/Afternoon Relative Humidity: 62.0% / 34.2%
Morning/Afternoon Wind Speed: 0.89 mph / 1.19 mph
Tree Shade: 18.9" Pine



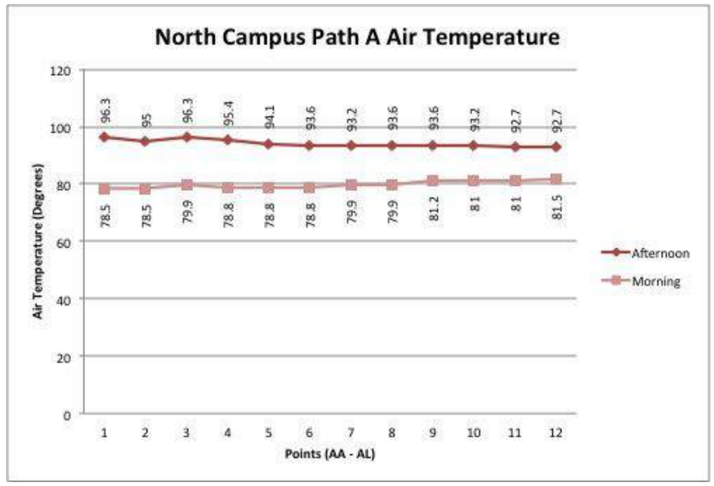
3. Path A Analysis:

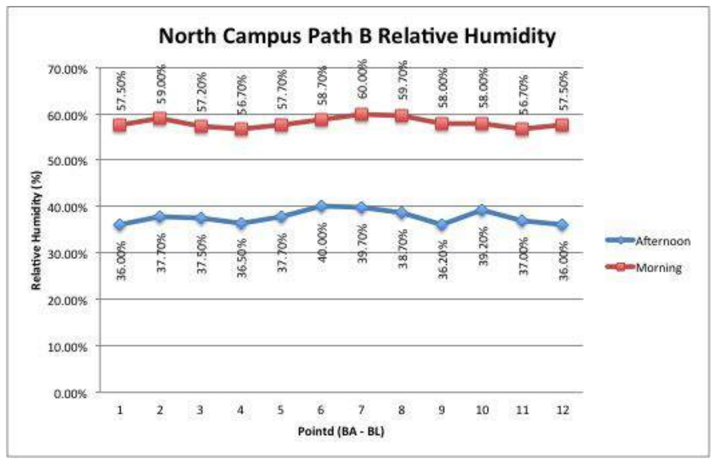


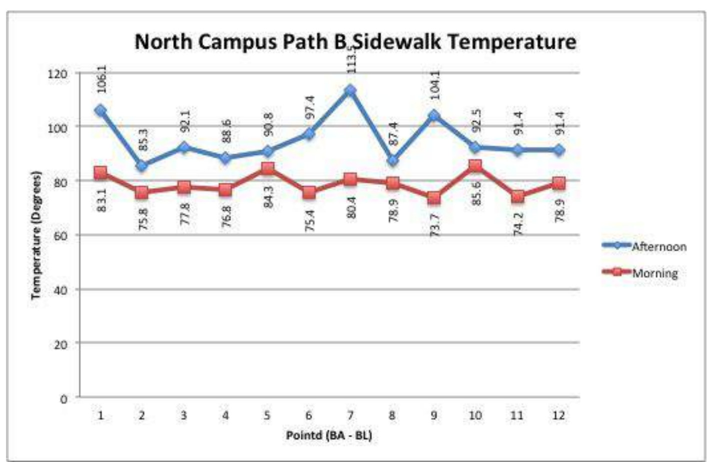




4. Path B Analysis:







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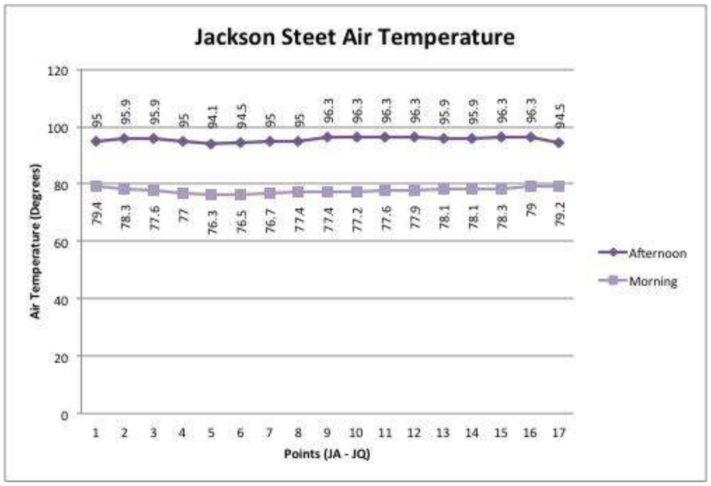
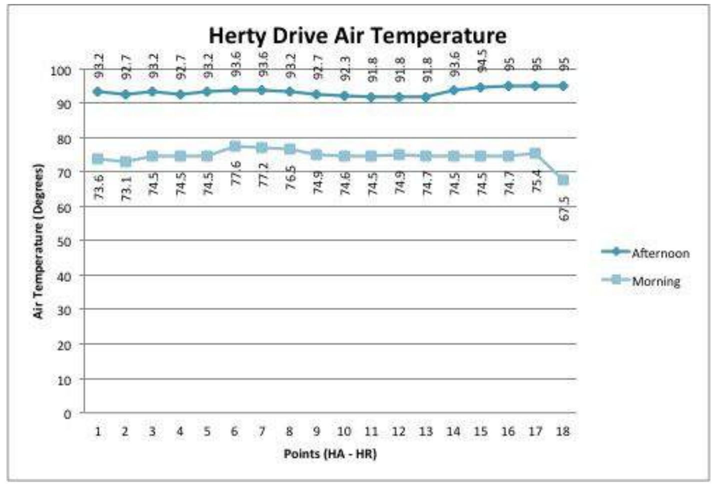
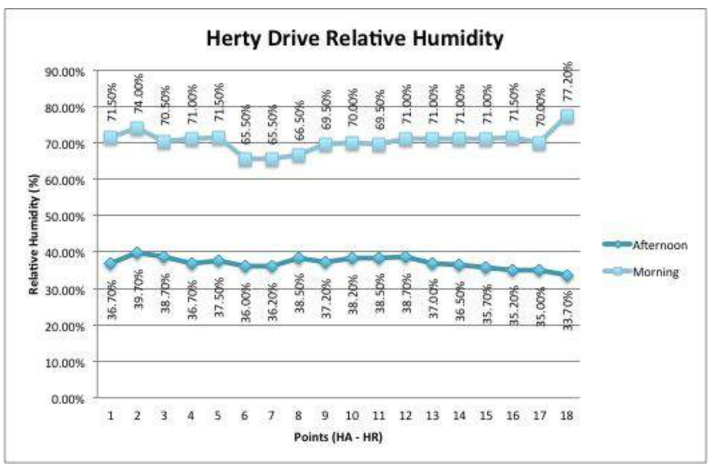
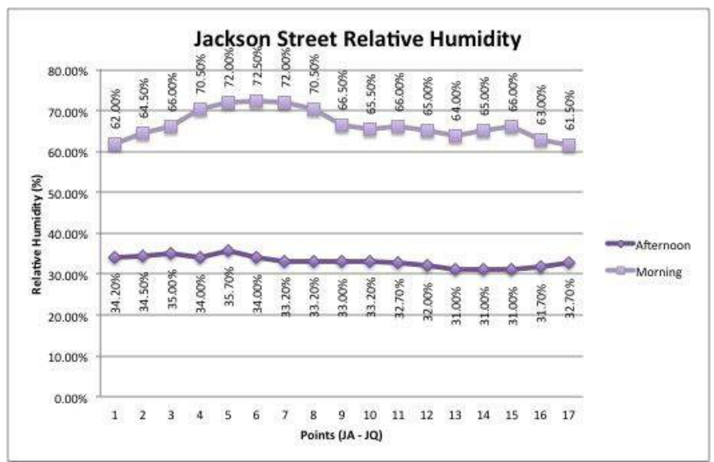
Herty Drive Analysis:

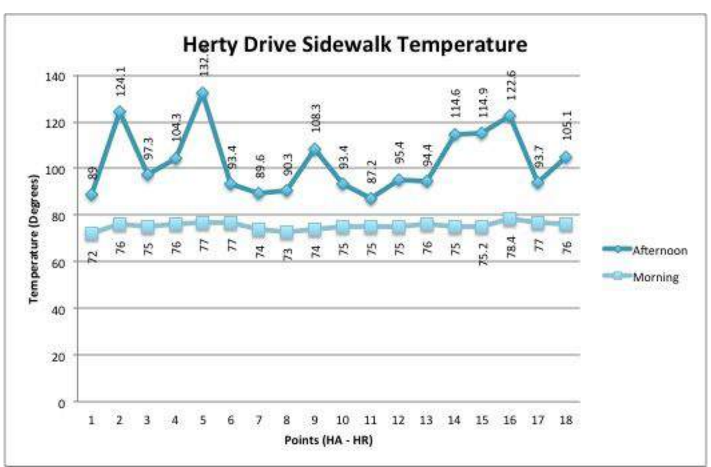
Jackson Street Analysis:

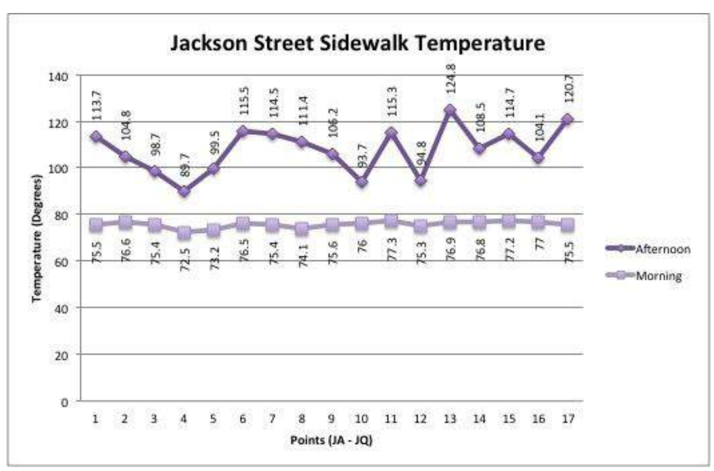












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Landscape and Building Surfaces

- Average Morning Sidewalk Temperature: 76.5 degrees / Average Morning Building Temperature: 73.9 degrees
- Average Afternoon Sidewalk Temperature: 100.7 degrees / Average Afternoon Building Temperature: 93.8 degrees

- Average Morning Air Temperature: 77.76 degrees / Average Afternoon Air Temperature: 95.5 degrees
- Average Morning Relative Humidity: 66.62% / Average Morning Relative Humidity: 33.06%
- Average Morning Wind Speed: 0.98 mph / Average Morning Wind Speed: 0.79 mph

1) **Point JM - Warmest Surface Temperature**

Route: Jackson Street between Baldwin Street and Broad Street
Time of Day: afternoon, 4:45 pm
Condition: full sun
Mulch Temperature: 129.5

2) **Point HA - Coolest Surface Temperature**

Route: Herty Drive between Baldwin Street and Broad Street
Time of Day: morning, 8:30 am
Condition: full shade
Road Temperature: 93.2

LANDSCAPE MICROCLIMATE ANALYSIS: UGA'S NORTH CAMPUS

Principal Trees & i-Tree Reports

1) Point AH: 41" Black Oak

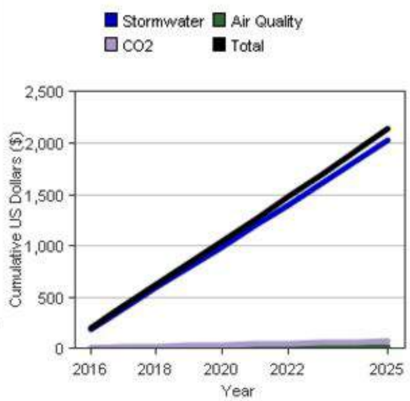
Overall Benefits:

i-Tree Design v6.0 230 S Jackson St, Athens, GA 30602, USA

Start Over
Return to Setup
View Report
Print
Save Result
About

Overall Benefits | Stormwater | Energy | Air Quality | Carbon Dioxide

Current Year (2016) | Future Year (2026) | Total (2016-2026)



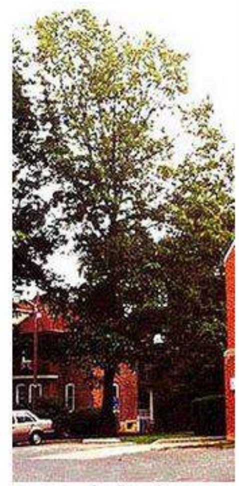
Breakdown of tree benefits

Click on one of the tabs above for more detail

If it is cared for, this black oak will provide a total of $2,136 worth of overall benefits over next 10 years.

While some functional benefits of trees are well documented, others are difficult to quantify (e.g., human social and communal health). Trees' specific geography, climate, and interactions with humans and infrastructure are highly variable and make precise calculations that much more difficult. Given these complexities, the results presented here should be considered initial approximations to better understand the environmental and economic value associated with trees and their placement.

Benefits of trees do not account for the costs associated with trees' long-term care and maintenance.



Black oak
Quercus velutina

Stormwater, Carbon Dioxide, & Air Quality Benefits:

Over the next 10 years, your black oak will intercept a total of 205,157 gallons of stormwater.

Urban stormwater runoff (or "non-point source pollution") washes chemicals (oil, gasoline, salts, etc.) and litter from surfaces such as roadways and parking lots into streams, wetlands, rivers, and oceans. The more impervious the surface (e.g., concrete, asphalt, rooftops), the more quickly pollutants are washed into our community waterways. Drinking water, aquatic life, and the health of our entire ecosystem can be adversely affected by this process.

Trees act as mini-reservoirs, controlling runoff at the source. Trees reduce runoff by:

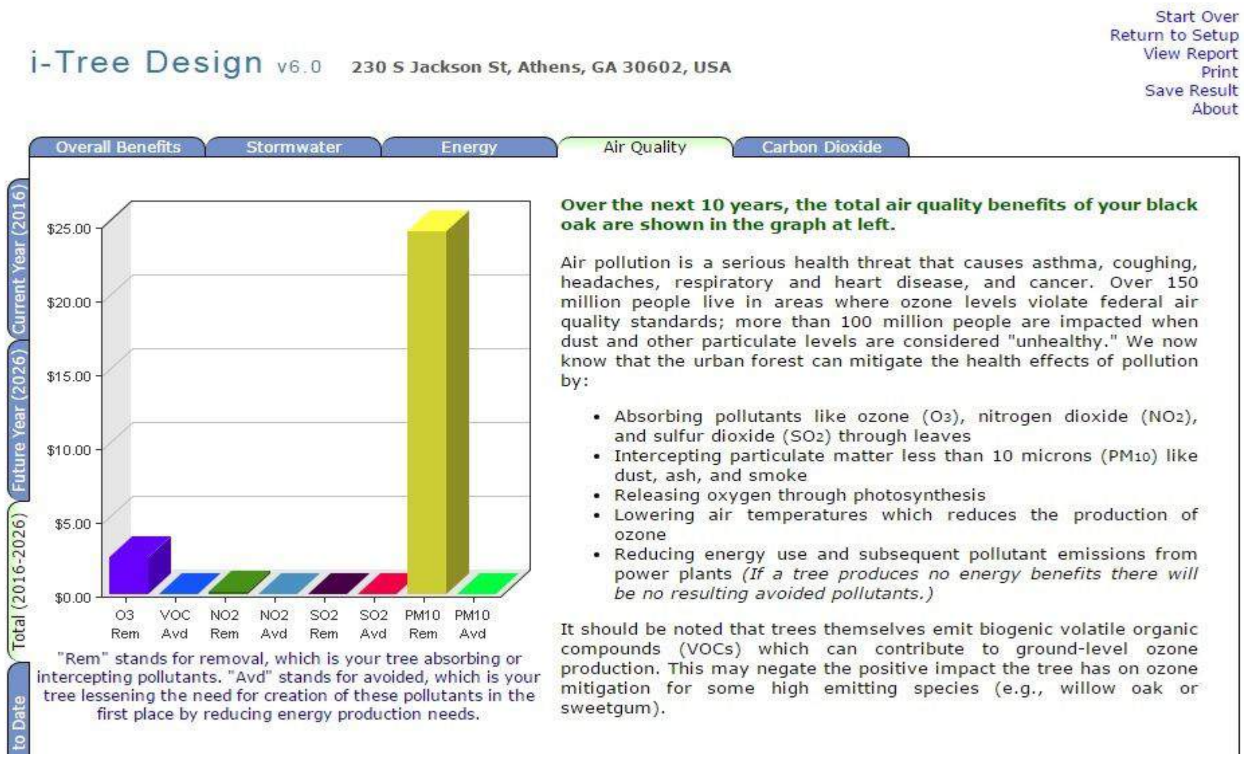
- Intercepting and holding rain on leaves, branches, and bark
- Increasing infiltration and storage of rainwater through the tree's root system
- Reducing soil erosion by slowing rainfall before it strikes the soil

Over the next 10 years, your black oak will reduce atmospheric carbon dioxide (CO_2) by a total amount of 7,987 pounds.

How significant is this number? Most car owners of an "average" car (mid-sized sedan) drive 12,000 miles (19,312 kilometers) generating about 11,000 pounds (4,990 kilograms) of carbon dioxide (CO_2) every year. A flight from New York to Los Angeles adds 1,400 pounds (635 kilograms) of CO_2 per passenger. Trees can have an impact by reducing atmospheric carbon in two primary ways (see figure at left):

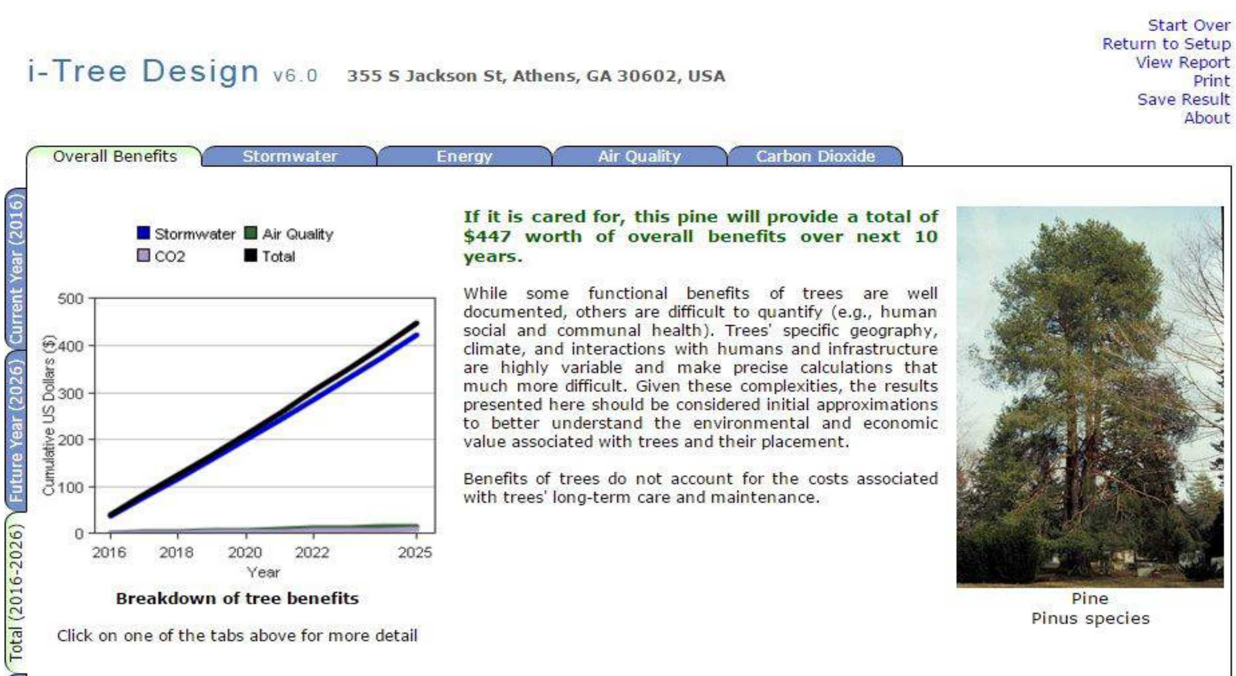
- They sequester ("lock up") CO_2 in their roots, trunks, stems, and leaves while they grow, and in wood products after they are harvested.
- Trees near buildings can reduce heating and air conditioning demands, thereby reducing emissions associated with power production. However, if a tree produces no energy benefits there will be no resulting avoided CO_2.

Combating climate change will take a worldwide, multifaceted approach, but by planting a tree in a strategic location, driving fewer miles/kilometers, or replacing business trips with conference calls, it's easy to see how we can each reduce our individual carbon "footprints".



2) Point JA: 18" Pine

Overall Benefits:



LANDSCAPE MICROCLIMATE ANALYSIS: UGA'S NORTH CAMPUS

Stormwater, Carbon Dioxide, & Air Quality Benefits:

Over the next 10 years, your pine will intercept a total of 42,580 gallons of stormwater.

Urban stormwater runoff (or "non-point source pollution") washes chemicals (oil, gasoline, salts, etc.) and litter from surfaces such as roadways and parking lots into streams, wetlands, rivers, and oceans. The more impervious the surface (e.g., concrete, asphalt, rooftops), the more quickly pollutants are washed into our community waterways. Drinking water, aquatic life, and the health of our entire ecosystem can be adversely affected by this process.

Trees act as mini-reservoirs, controlling runoff at the source. Trees reduce runoff by:

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Over the next 10 years, your pine will reduce atmospheric carbon dioxide (CO_2) by a total amount of 937 pounds.

How significant is this number? Most car owners of an "average" car (mid-sized sedan) drive 12,000 miles (19,312 kilometers) generating about 11,000 pounds (4,990 kilograms) of carbon dioxide (CO_2) every year. A flight from New York to Los Angeles adds 1,400 pounds (635 kilograms) of CO_2 per passenger. Trees can have an impact by reducing atmospheric carbon in two primary ways (see figure at left):

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Combating climate change will take a worldwide, multifaceted approach, but by planting a tree in a strategic location, driving fewer miles/kilometers, or replacing business trips with conference calls, it's easy to see how we can each reduce our individual carbon "footprints".

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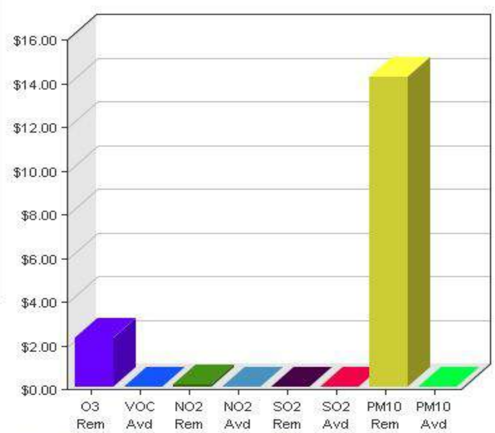
i-Tree Design v6.0 355 S Jackson St, Athens, GA 30602, USA

Overall Benefits | Stormwater | Energy | Air Quality | Carbon Dioxide

Current Year (2016) | Future Year (2026) | Total (2016-2026) | to Date



"Rem" stands for removal, which is your tree absorbing or intercepting pollutants. "Avd" stands for avoided, which is your tree lessening the need for creation of these pollutants in the first place by reducing energy production needs.

Over the next 10 years, the total air quality benefits of your pine are shown in the graph at left.

Air pollution is a serious health threat that causes asthma, coughing, headaches, respiratory and heart disease, and cancer. Over 150 million people live in areas where ozone levels violate federal air quality standards; more than 100 million people are impacted when dust and other particulate levels are considered "unhealthy." We now know that the urban forest can mitigate the health effects of pollution by:

- Absorbing pollutants like ozone (O_3), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2) through leaves
- Intercepting particulate matter less than 10 microns (PM_{10}) like dust, ash, and smoke
- Releasing oxygen through photosynthesis
- Lowering air temperatures which reduces the production of ozone
- Reducing energy use and subsequent pollutant emissions from power plants *(If a tree produces no energy benefits there will be no resulting avoided pollutants.)*

It should be noted that trees themselves emit biogenic volatile organic compounds (VOCs) which can contribute to ground-level ozone production. This may negate the positive impact the tree has on ozone mitigation for some high emitting species (e.g., willow oak or sweetgum).

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Report Conclusion

Based on the measurements and subjective experiences at all 61 locations measured by our group, we decided that the most comfortable location was at point AH on Path A. This point is located next to the Old College building and features dappled shade, nearby fountain noise and cooling effect, and several trees, shrubs, and benches. The area is designed at a pedestrian scale, so it is comfortable both to walk through and linger here. The air temperature did not reach an unpleasant level because of the cooling effect of the fountain and vegetation shade. On the other hand, we found point JA on Jackson Street to be the most uncomfortable location that we measured. This point, located at the intersection of Jackson Street and Baldwin Street, did not encourage us to want to stay there long based on the glaring sun, lack of vegetation, traffic and construction noise, poor lines of site, and high air and surface temperatures in the afternoon.

Overall, our group concluded that areas that people typically consider comfortable often include buffers against the sun, high temperatures, and noise. People also tend to prefer areas with vegetation, water, and seating, and places that are designed with the pedestrian scale in mind. All of these factors contribute to a pleasant area to inhabit based on how they affect the people who are in the space. A quiet area that is cooled by a fountain and tree shade with tables or benches and a sense of enclosure or separation from traffic will be much preferred over an area that receives direct sun for most of the day, contains minimal plantings and is close to the road or in an open, unprotected area. The materials, scale, plantings, and amenities of a space all contribute to the microclimate of the area, and by extension, its level of human comfort and desirability.