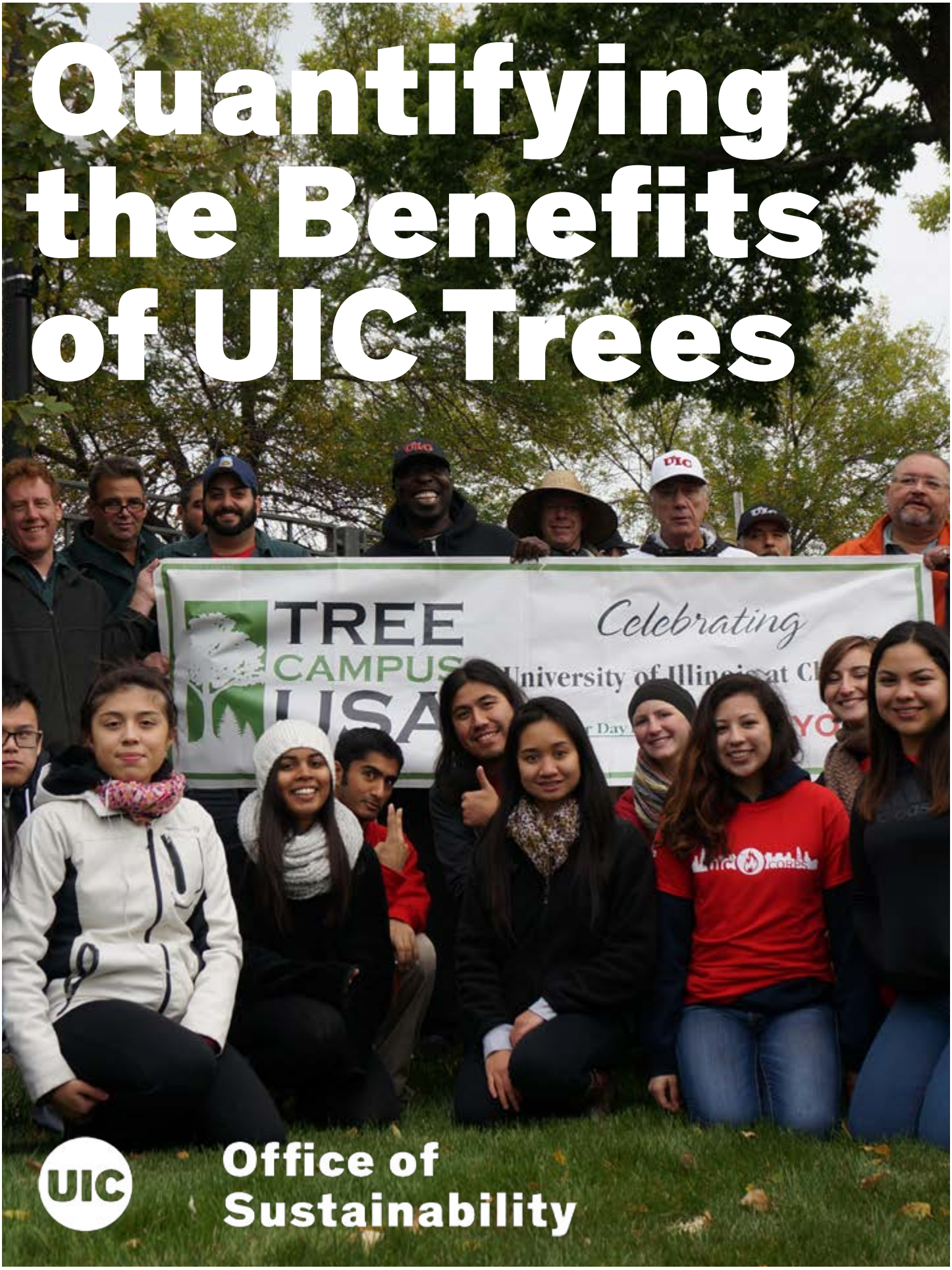
# Quantifying the Benefits of UIC Trees




UIC Office of Sustainability

# UIC is a Tree Campus USA University

The University of Illinois at Chicago is among the few universities that participate in the program called Tree Campus USA, which promotes effective tree management, campus community involvement, and nature connectivity among faculty members and students through forestry efforts. Tree Campus USA is a national program sponsored by Arbor Day Foundation and Toyota that assists nationwide universities and colleges in establishing and sustaining campus forests. It was launched in year 2008, and manages to successfully engage campus communities in progressive tree conservation. Five standards are set forth by Tree Campus USA to guide campuses in obtaining the prestigious recognition:

1. Campus Tree Advisory Committee
2. Campus Tree Care Plan
3. Campus Tree Program with Dedicated Annual Expenditures
4. Arbor Day Observance
5. Service Learning Project

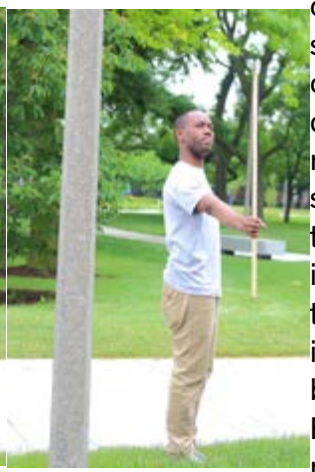
The efforts UIC has committed towards becoming a Tree Campus USA University are extensive. UIC has an active Tree Advisory Committee that had been established to guide tree care, tree planting, and campus education on tree benefits. More than 5,400 trees had also been planted within UIC campuses. On top of that, a tree inventory using i-Tree program had been adopted to manage the campus trees and also record the benefits of these trees, including carbon sequestration, pollutant removal and monetary value. A Tree Care Plan that outlines policies and procedures in managing campus trees had also been established to guide UIC's forestry efforts.

Every year UIC dedicates a certain amount of expenditures for the campus tree programs, and provides students sponsorships in conducting service learning projects. The collaboration among the entire campus community successfully enabled UIC to meet all five core standards by Tree Campus USA, and finally in the year 2011, UIC earned the title of "Tree Campus USA" and has received the prestigious recognition every year since.

This paper will focus primarily on the service learning projects at UIC and reporting of the quantified health impacts derived from these projects. By using an example of a service learning project, this paper provides an overview of the public health metrics for campus trees, and thus facilitates a clearer and better understanding on how tree care initiatives benefit the general health status of the local community.

# Service Learning Project

The most significant student project in year 2014 occurred over the course of the summer and was conducted by two undergraduate students—Hulliams Kamlem and Alyssa Straits. This service learning project called Tree Campus Care aimed to update the existing campus tree inventory and perform quantitative measurement of the health benefits associated with these campus trees using a software called i-Tree. I-Tree was developed by the USDA Forest Service as an adaptation of the Street Tree Resource Assessment Tool for urban forestry analysis. It uses the tree inventory data to calculate the monetary value of the annual environmental and health benefits, which include energy conservation, air quality improvement, and CO2 reduction.



The students recorded the following: tree species, location of existing trees and newly planted trees, diameter at breast height (DBH), tree height, and crown spread. GPS, map, measuring tape, and Biltmore stick were utilized as measuring tools. In total, three hundred trees of more than 39 species were inventoried. Among these trees, the tree species that was among the most common were Elm, Apple, and Burr Oak. They were also among the top five species that are planted on and around UIC campuses in 2014.

The total amount of annual carbon sequestered and structural value were 1,564 lbs. and $14,226 respectively. The tree species that provided the most carbon storage, carbon sequestration rate, and structural tree value is the Elm tree. This is mainly because Elm was the majority of the inventoried trees. The more trees there are, the broader the canopy coverage, and subsequently the more carbon storage they provide. It is important to know that different tree species offer a different rate of carbon sequestration. Factors such as climate, age, and growth rate of the tree may impact the annual carbon sequestration rates. Typically younger, healthier, and faster growing trees have a higher annual carbon sequestration rate.

## Tree Campus Blog Hulliams Kamlem

My summer has been eventful thus far, going around UIC campus equipped with a clinometer, a Biltmore stick, a GPS device and a diameter loggers tape. With my colleague Alyssa, we stop at various locations and take tree measurements. Our task is to update the UIC tree inventory and also use a software named I-Tree to assess the economic and ecological benefits of trees on and around UIC campus. Furthermore, one specific aspect of the software seems particularly appealing to me as a public health undergraduate going in my senior year: the ability to calculate the health benefits provided by trees. I found it interesting to have the possibility to come up with actual numbers expressing the direct impact of trees on the health of individuals and communities.

From my African heritage, I have learned to value issues related to sustainability; I have learned to be conscious about the environment and live in ways that do not undermine the ability of future generations to enjoy healthy and safe living conditions. After five weeks in the program, I'm convinced to have made the right decision, modestly contributing to uphold the status of UIC as a proud member of Tree Campus USA.

Overall, my internship at the UIC Office of Sustainability has helped me to develop practical and technical skills around tree assessment, while getting exposure to a wide range of subjects related to sustainability.

Some of you might see Alyssa and I soon somewhere around campus, measuring trees. Please, feel free to stop by and start a conversation. We are always happy to exchange about tree species, canopies, and how to assess trees' economic and ecological value.

And just so you know, I will remind you that these trees play a vital role in keeping all of us healthy!

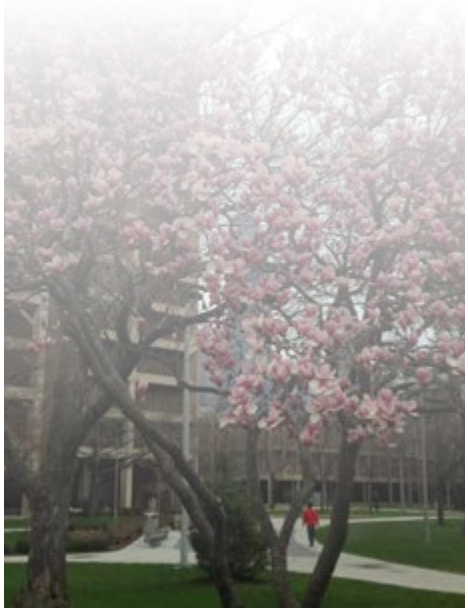
# Public Health Impacts

| Pollutant Removed | CO | $O_3$ | $NO_2$ | $SO_2$ | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|---|---|---|
| Ounces per year | 7.6 | 204.5 | 81.4 | 24.2 | 155.6 | 15.5 |
| Monetary value per year | $0.27 | $83.25 | $5.68 | $0.86 | $284.60 | $286.90 |

In addition to calculating the amount of carbon dioxide reduced by the inventoried trees, other pollutants including carbon monoxide (CO), ozone ($O_3$), nitrogen dioxide ($NO_2$), sulfur dioxide ($SO_2$) and particulate matter ($PM_{10}$ and $PM_{2.5}$) that were theoretically removed were also estimated and represented in ounces per year. These six pollutants are identified by the United States Environmental Protection Agency to be hazardous to human health and have established national standards. For each pollutant removed the annual monetary value associated with the specific pollutant was calculated as well. These amounts of pollutant removed and associated monetary value per unit tree cover were estimated based on the county-level multipliers using i-Tree.

The health care expenses associated with the different pollutants vary due to the specific adverse health outcomes related to a particular pollutant so while a pollutant removal may be higher it may not be the one with the most significant health impact. According to the findings shown in Table 2, ozone had the highest amount of removal was 204.5 ounces per year; however its monetary value was merely $83.25, significantly lesser than the highest monetary value $286.9, which was associated with the 15.5 ounces removal of PM2.5. Among all pollutants removed CO had the least reduction and monetary value.

Following the removal of the pollutants comes an improved overall air quality. **Other than economic benefits, there are a significant number of health benefits derived from improved air quality.** One example is the reduction of respiratory illnesses such as asthma and acute bronchitis. Table 3 provides a list of common illnesses related to air pollutants, and thereby presents the health impacts, which is the reduction of illnesses related to the 300 campus trees, in a quantitative form.



## Tree Campus Blog: Alyssa Straits

In spring of 2014, I took an Honors class about the relationship between culture and the environment. where I gave a presentation on the environmental issue of urban forestry, and why biodiversity in an urban setting is important. I was able to introduce the concept of the Emeral Ash Boer and other invasive species to my peers, and I found it to be a very rewarding experience. Through this internship, I definitely learned something new about trees and sustainability every day, and I feel like these are lessons that I can use throughout the rest of my life to live more sustainably.

# Implications

Many health and climate change literature have extensively studied the environmental, economic, and health benefits of trees. Although the number of campus trees included by the students for benefit analysis was relatively small, this project should be considered as another great starting point to reconnect campus community with tree care, encourage continuous contribution to the maintenance and inventory of the campus trees. It can also serve as baseline data to demonstrate more campus tree and forest effects on health using a larger sample size in subsequent research studies. This additional data and information can be particularly useful in influencing environmental policies and advancing sustainability efforts at the local community level.

As more trees are added to the campus and into the calculation of the campus tree health impact, greater positive changes in the population health status should be anticipated. **The reduction of the illnesses and related symptoms will be clinically important.**

The health impacts as calculated have not yet taken into consideration all the health benefits of the campus trees. Although the calculated results for disease reduction related to improved air quality is very important, it will be extremely beneficial to calculate the reduction of heat-related illnesses and heating distress related to shading effects, and diseases related to storm water runoff. We are hopeful to quantify these benefits in our next step of data analysis.

| Pollutant | NO2 | | O3 | | PM2.5 | | SO2 | |
|---|---|---|---|---|---|---|---|---|
| Factors | Incidence reduction /year | Value ($/year) | Incidence reduction /year | Value ($/year) | Incidence reduction /year | Value ($/year) | Incidence reduction /year | Value ($/year |
| Acute Myocardial Infarction | | | | | 0.000 | $2 | | |
| Acute Respiratory Symptoms | 0.002 | $0 | 0.021 | $2 | 0.012 | $1 | 0.000 | $0 |
| Asthma Exacerbation | 0.033 | $3 | | | 0.009 | $1 | 0.002 | $0 |
| Chronic Bronchitis | | | | | 0.000 | $3 | | |
| Hospital Admissions | 0.000 | $3 | 0.000 | $1 | | | 0.000 | $1 |
| Mortality | | | 0.000 | $80 | 0.000 | $280 | | |
| School Loss Days | | | 0.008 | $1 | | | | |
| Work Loss Days | | | | | 0.002 | $0 | | |

**Table 3**
BenMAP Air Quality Health Impacts and Values in UIC

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