Introduction

Urban forests are an important part of community infrastructure and offer benefits such as carbon capture & storage, runoff reduction, and temperature moderation\(^1,2\) (Fig. 1). Comprehensive tree population information can be used to understand urban forest structure and function and to develop management plans to:

- improve human health
- enhance environmental quality
- improve building energy dynamics
- contribute to city-wide sustainability

Objectives

- Determine percent canopy cover in the Capitol East neighborhood of Des Moines
- Use complete tree inventory approach to link individual tree data with canopy analysis
- Run simulation with i-Tree software to determine benefits provided by urban trees

Methods

- Conduct canopy cover assessment using GIS and high resolution land cover maps
- Collect tree inventory data in Capitol East neighborhood (Fig. 2)
- Calculate benefits from urban forest using i-Tree software\(^3\)
- Assess effects of urban forest on building energy dynamics and sustainability using computational fluid dynamics models and an Urban Modeling Interface (umi) platform

Canopy Cover Analysis

Canopy cover is a useful measure of an urban forest\(^4\). The Capitol East Neighborhood has an average of 26.2% canopy cover (Fig. 3) made up of several species (Table 1).

<table>
<thead>
<tr>
<th>Species Name</th>
<th>Percent of Population</th>
<th>Percent of Leaf Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>American sycamore</td>
<td>9.2</td>
<td>22.1</td>
</tr>
<tr>
<td>Silver maple</td>
<td>9.2</td>
<td>16.5</td>
</tr>
<tr>
<td>Tree of heaven</td>
<td>12.7</td>
<td>7.2</td>
</tr>
<tr>
<td>Norther hackberry</td>
<td>9.2</td>
<td>8.1</td>
</tr>
<tr>
<td>Sugar maple</td>
<td>7.7</td>
<td>6.6</td>
</tr>
<tr>
<td>Black walnut</td>
<td>4.2</td>
<td>6.1</td>
</tr>
</tbody>
</table>

Table 1: Common species contributions to tree canopy.

Inventory Results

Tree data collected: Land use, tree location, species, DBH, crown size, tree condition rating, risk assessment, utility conflicts (for each tree, Fig. 4)

Total Trees: 155 (43 species)
- Street Trees: 48 (13 species)
- Yard Trees: 107 (38 species)

Most common street trees: Sugar maple, northern hackberry, Amur corktree, American sycamore

Most common yard trees: Eastern red cedar, American elm, sugar maple, tree of heaven

Sustainability Modeling

The spatially explicit tree inventory data will next be incorporated into computational fluid dynamics models and an Urban Modeling Interface (umi) platform by members of the Iowa State University Sustainable Cities research group\(^5\). In these models, additional benefits of trees (such as vegetative cooling and evapotranspiration) will be integrated with data on building energy use (Fig. 5) to create decision-support tools and frameworks that can lead to more sustainable urban environments.

References


Acknowledgements

The research has been funded through Iowa State University’s Presidential Initiative for Interdisciplinary Research in Data-Driven Science for the project: “Big Data for Sustainable Cities Decision-Making.”