

# Environmental Value of Trees in the City of Holland

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## Abstract

As urban development continues to replace natural forests at a rapid pace, urban forests are becoming increasingly important in providing beneficial ecosystem services to people. Trees remove carbon dioxide and pollutants from the atmosphere, they mitigate erosion and stormwater runoff, and they reduce the costs of heating and cooling. This project aims to quantify the benefits that urban trees in the City of Holland provide through completion of a tree inventory. So far, we have surveyed 3,662 trees and identified 94 different tree species, just over half of which are native to Michigan. The mean tree diameter is 13.97 in. A sugar maple this size would provide \$5.17 of benefits yearly. Climate- and pollution-related benefits of native and non-native species are similar, except for the largest trees. The total annual value of the inventoried trees (as of 27 June 2018) is \$16,166. In the future, the ability of this population to sequester carbon will increase by 8.7 tons as the trees increase in mass. In addition, the City of Holland has potential to further increase the Urban Tree Canopy's benefits through new plantings of particular species with high environmental value.

## Introduction

- Trees provide many benefits such as mitigating droughts and floods, stabilizing climate conditions and purifying air and water.
- As urban areas increase and natural forest cover declines, we will rely even more on urban forests for their ecosystem services.
- The City of Holland initiated this project to census all urban trees on public property. We want to determine current and future environmental values of trees, compare the values of different species, recommend species for future plantings, and develop a Holland tree mobile app to share our findings with the public.

## Methods

### Inventory

- Census public trees in the City of Holland on rights of ways and parks (Fig. 1)
- Measure tree diameter (DBH; 1.37m high) and identify species
- Record size and species on a Geographic Information System (GIS; Fig. 2)

### Analysis

- iTree software developed by USDA
- Integrates local weather and pollution data with tree DBH and species
- Calculates:
  - Carbon sequestration
  - Pollution removal
  - Stormwater runoff intercepted
  - Total environmental value of trees

### App development

- A mobile app is being developed by Professor Mike Jipping (Hope Dept. of Computer Science) so Holland citizens can use collected data and learn about the local trees.

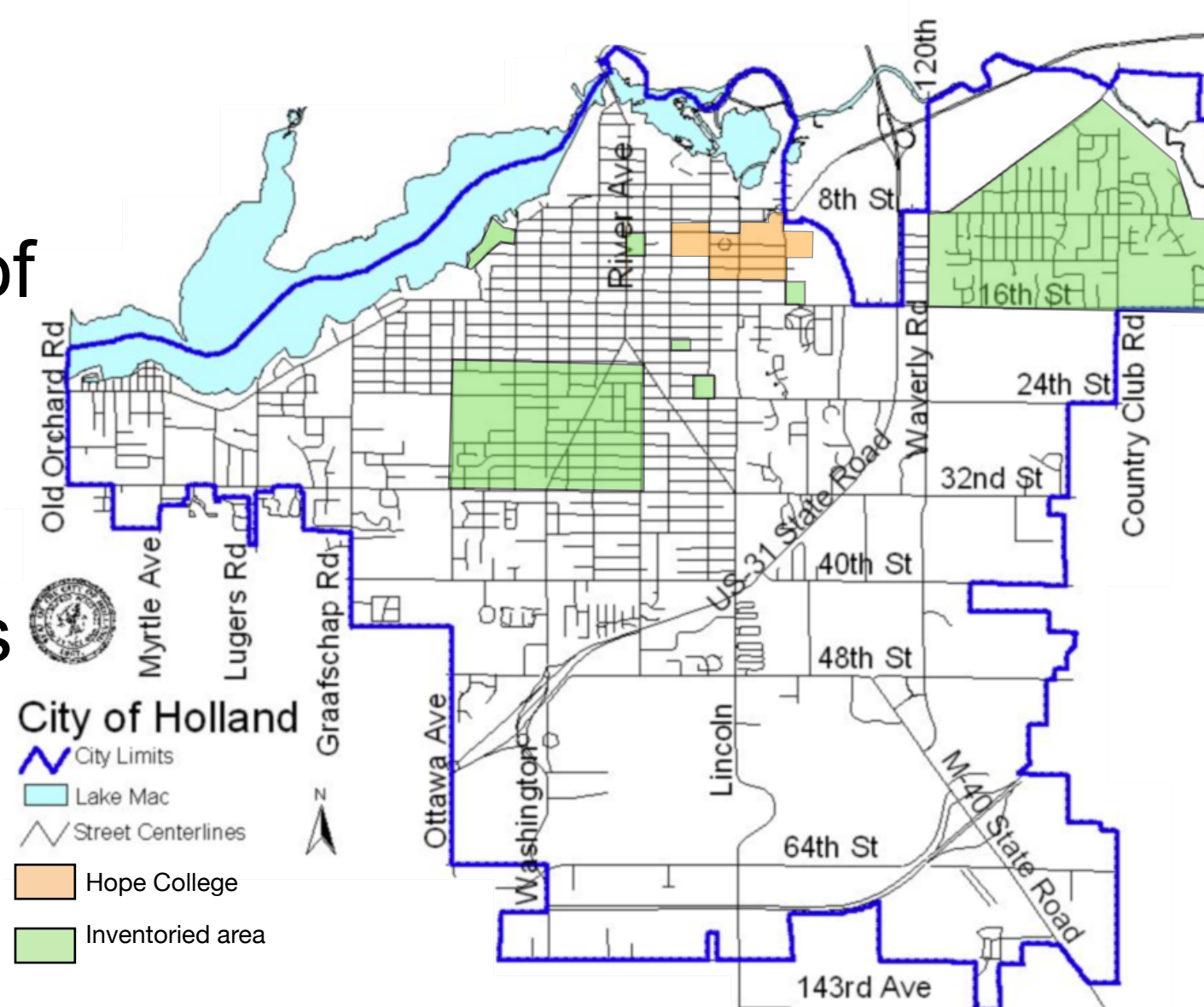


Fig. 1. Map of census area

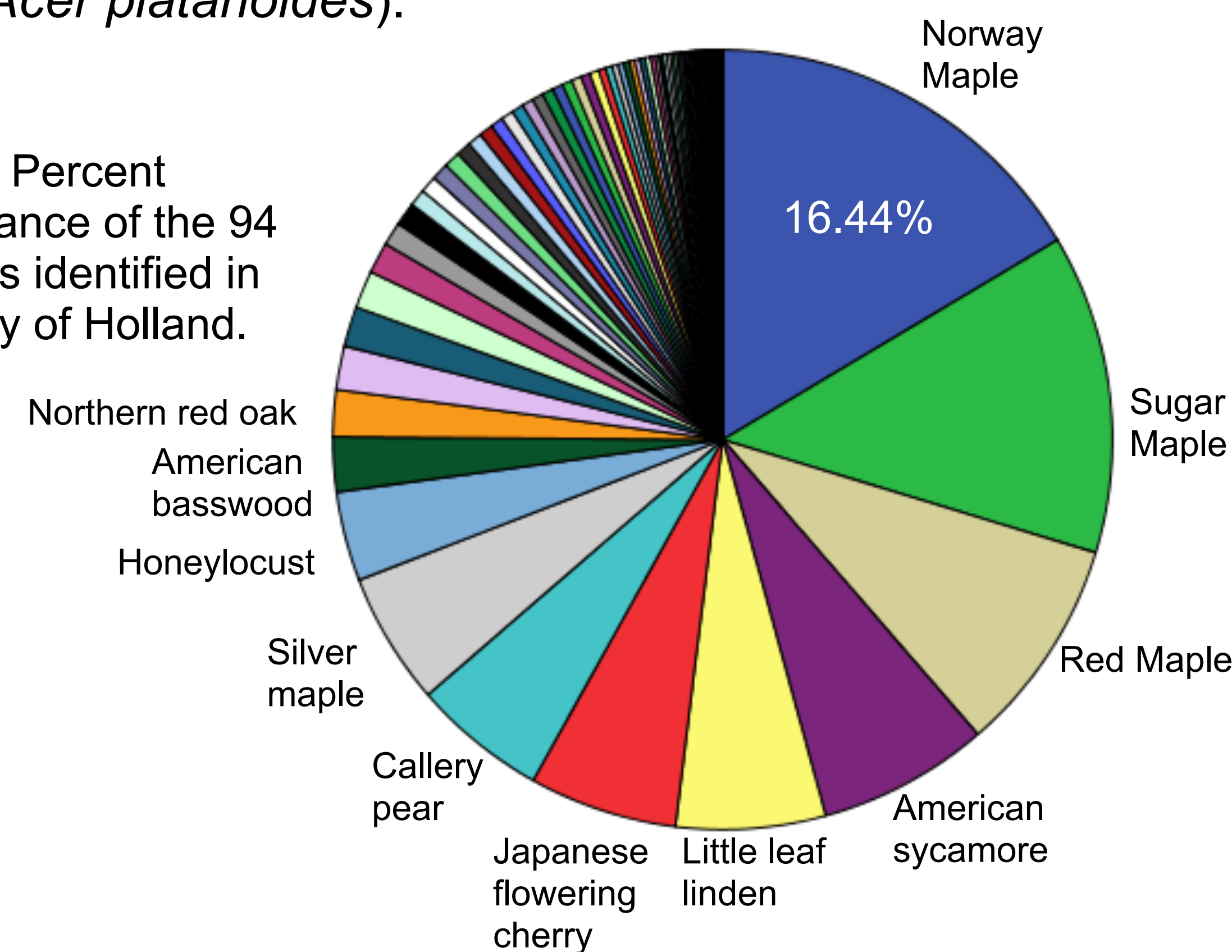


Fig. 2. Taking inventory of trees

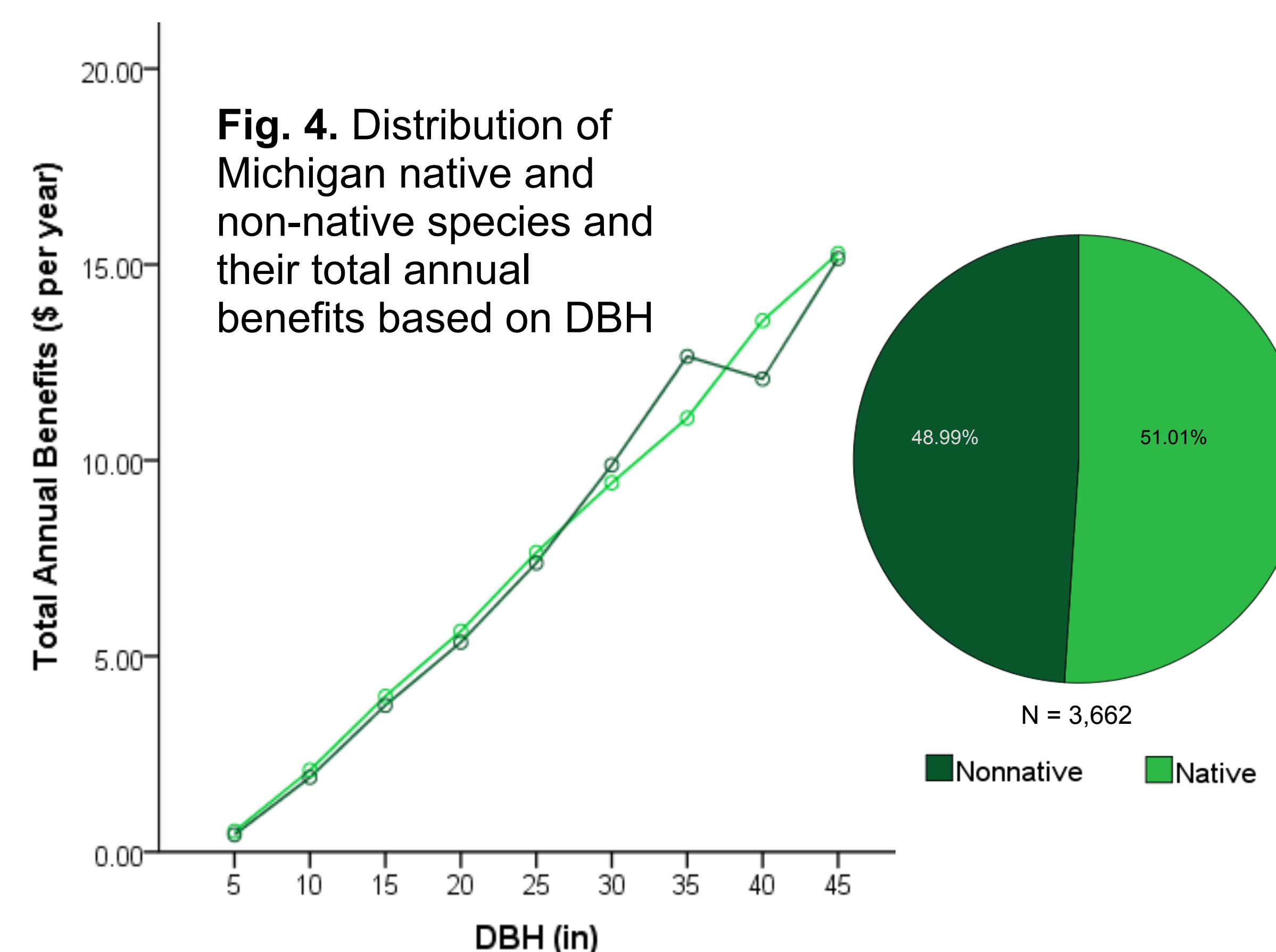
## Results

- There are 3,662 trees inventoried as of 27 June 2018.
- 94 different species were identified (Fig. 3). Many of the species are found in few numbers. The most common species is Norway maple (*Acer platanoides*).

Fig. 3. Percent abundance of the 94 species identified in the City of Holland.



- Michigan native trees (n=1,868) only slightly outnumber non-natives (n=1,794). A significant difference in annual benefits is not found between the groups until the larger DBHs are reached. This difference may be due to a different species composition in the larger size group (Fig. 4).



- The mean tree size is 13.97 inches and ranges from 0.4 inches, to a silver maple (*Acer saccharinum*) with a DBH of 59.01 inches. (Fig. 5; Fig. 6).
- Inventoried trees have a total annual value of \$16,166. Gross carbon sequestration is \$4,249, avoided runoff is \$6,793 and pollution removal is \$5,142. About 2/3rds of the value received from pollution removal is by removing PM2.5 (particulate matter <2.5  $\mu$ m in diameter; Fig. 7) which has negative health effects on humans.

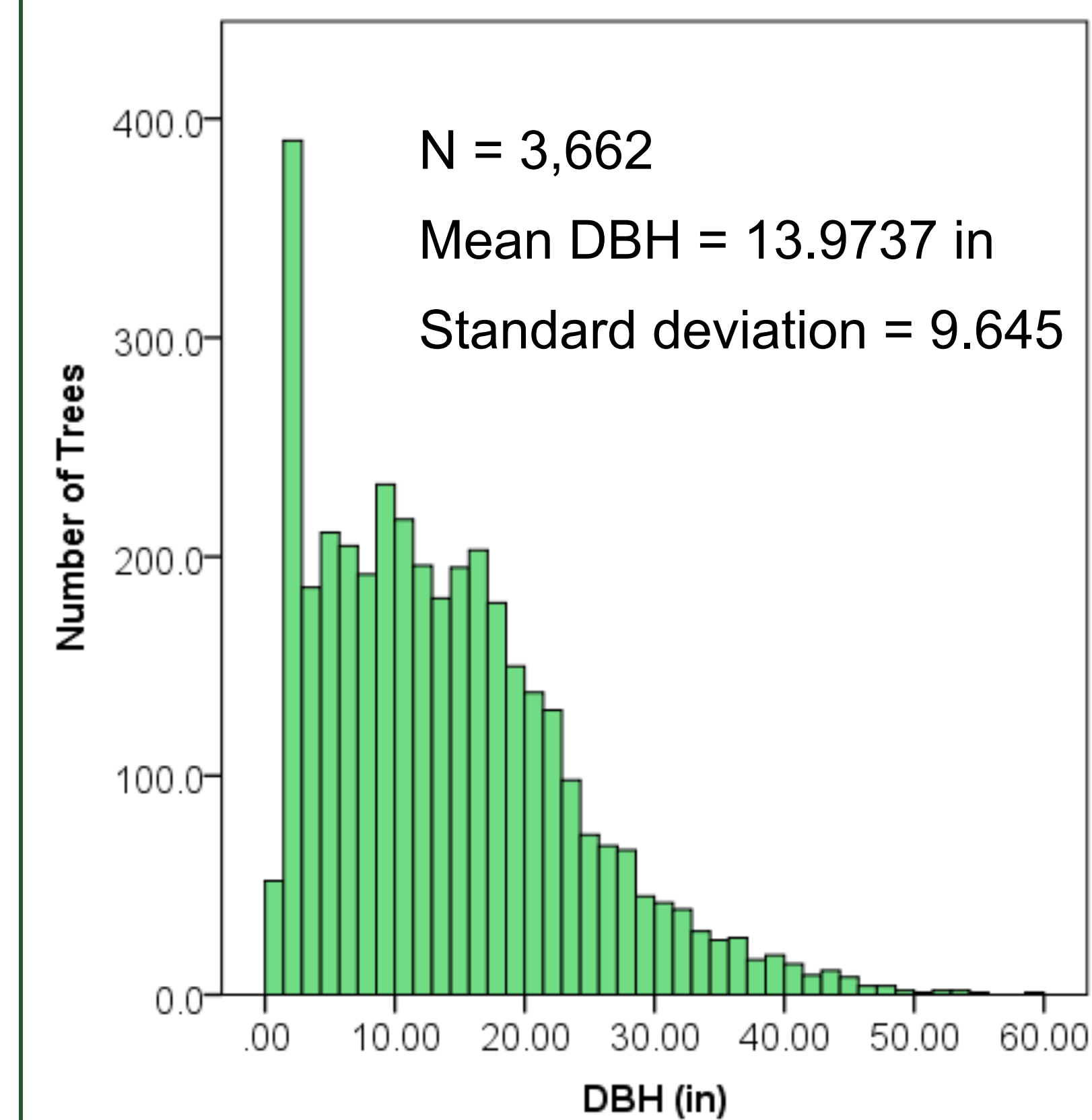


Fig. 5. Size distribution of all inventoried trees

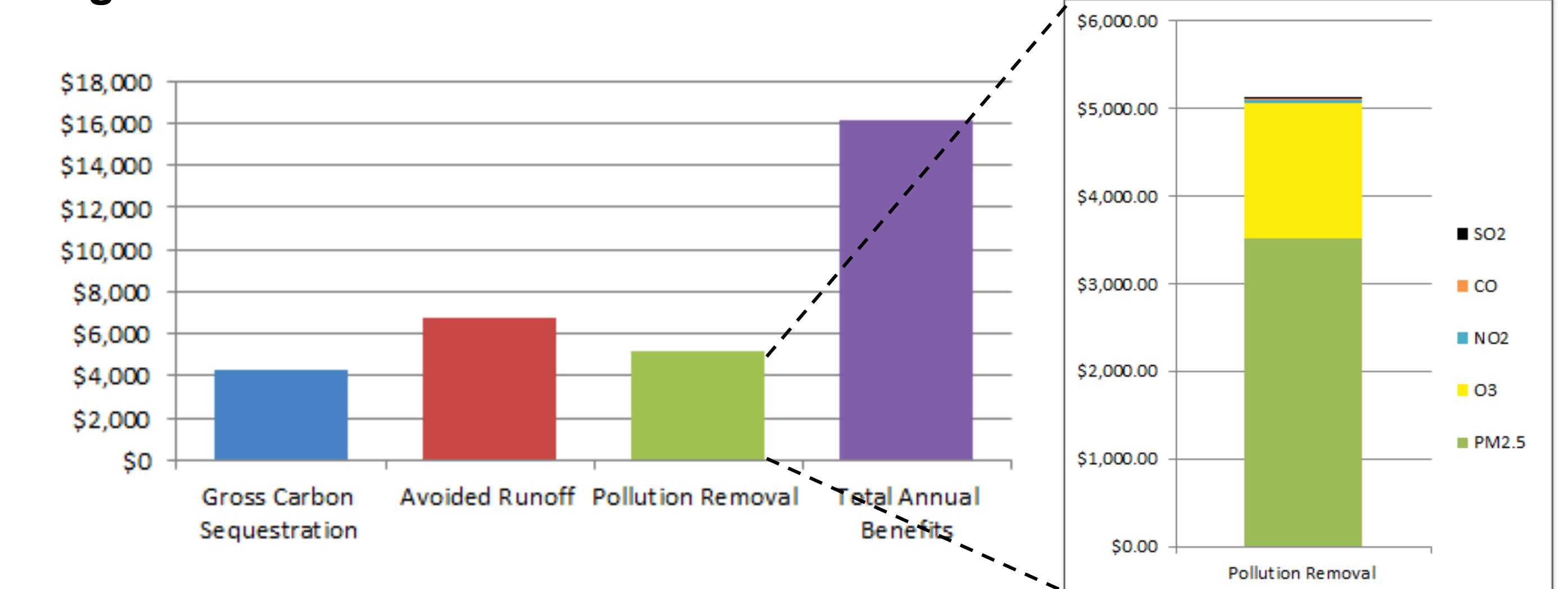
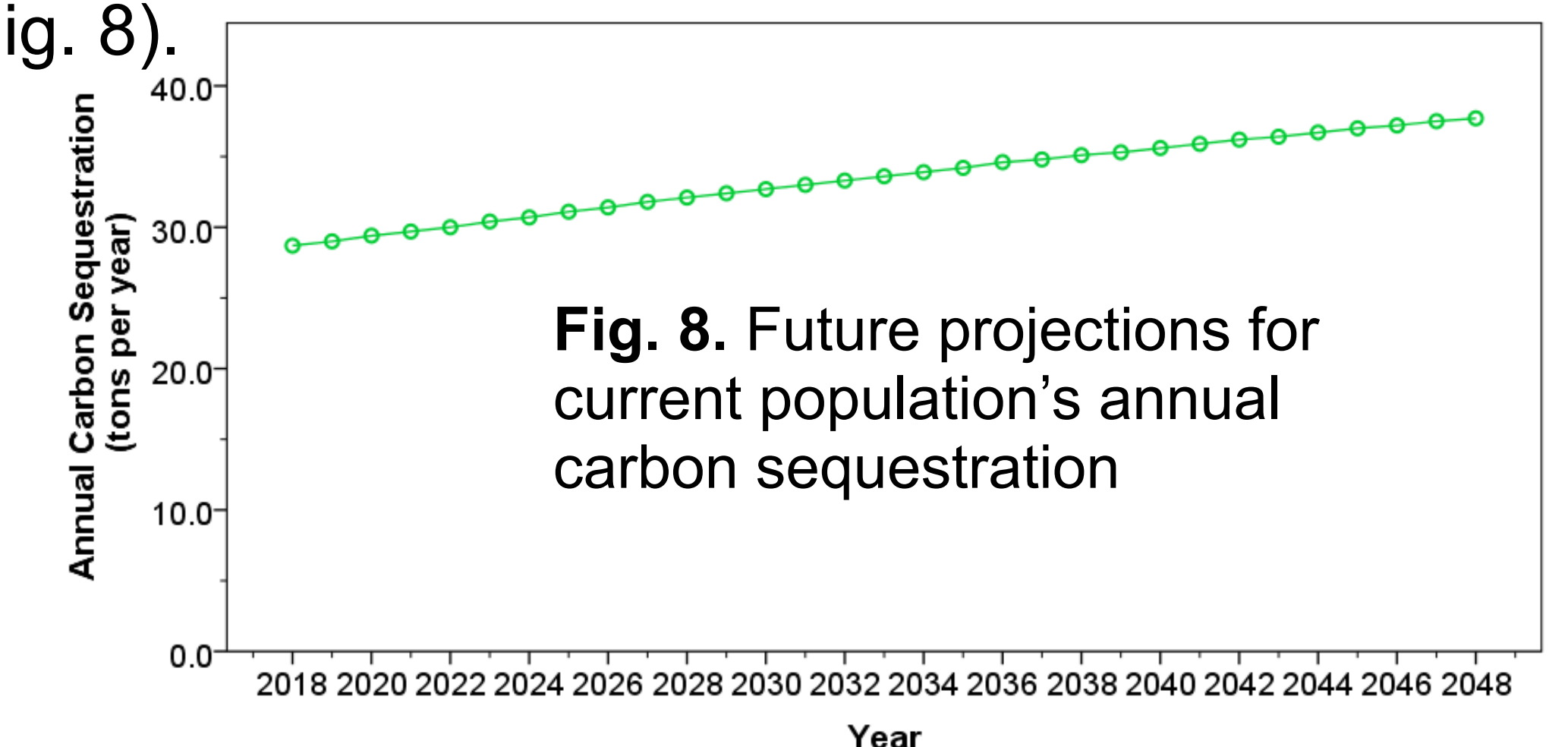


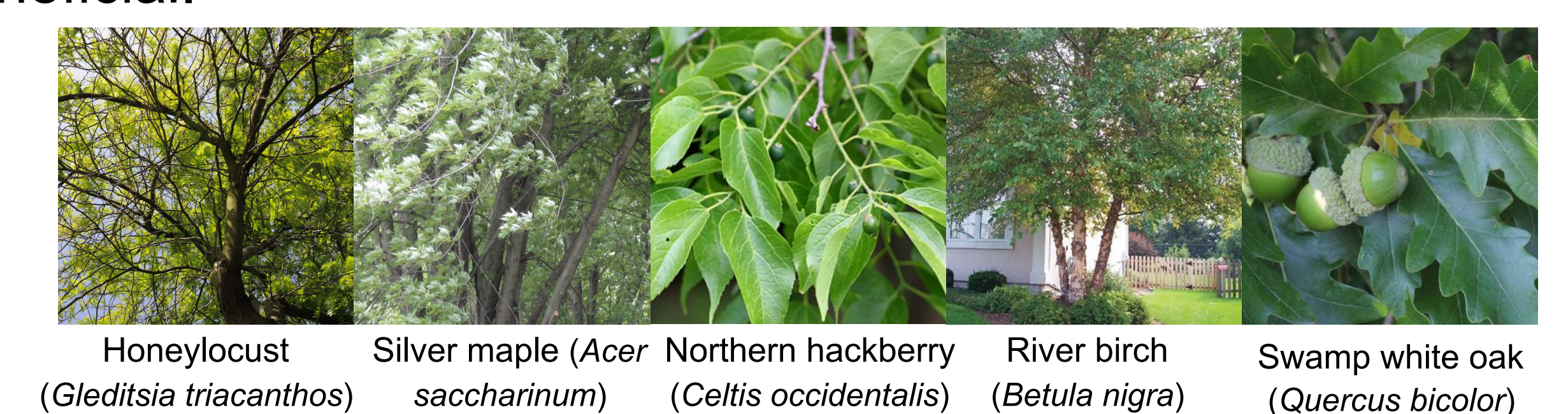
Fig. 7. The total annual benefits of the population (n=3,662) is \$16,166 including benefits from gross carbon sequestration, avoided runoff and pollution removal. Holland trees remove more PM2.5 than they do other pollutant.

## Conclusions

- Planting trees is an investment. Even if no new trees are planted and no inventory trees die, the current population's ability to sequester carbon will increase by 8.7 annual tons over the next 30 years (Fig. 8).



- To further enhance the benefits of Holland's urban trees, new plantings could include selected species (Fig. 9.) with high ecological value. Maintaining a diverse population is also highly beneficial.



- This project will help to enable Holland residents and tourists to understand and appreciate the value of the trees in their own community. We want to encourage the notion that trees are our partners in enhancing environmental health. Trees improve both the City of Holland's environmental impact and its attractiveness.