



*Student interns from Dalhousie University identified 700 trees that were covered under warranty and, therefore, replaced by contractors at no cost to Halifax Regional Municipality.*

**User**  
Dalhousie University School for  
Resource and Environmental  
Studies

**Partner**  
Esri

**Industry**  
Forestry

**Challenge**  
HRM needed to plant a target of  
1,000 trees per year, while  
holding contractors responsible  
for tree survivorship

**Solution**  
Interns inventoried more than  
80 trees per day with tablets,  
Collector for ArcGIS, and Arrow  
100 to assess survivorship

**Legacy Technology**  
Garmin, Printed paper forms

**Results**  
Interns and contractors  
identified and agreed on more  
than \$270,000 trees that fell  
under warranty for free  
replacement

## HRM IDENTIFIES \$270,000 OF TREES FOR REPLACEMENT WITH ARROW 100, ESRI AND SAMSUNG

Dalhousie University's School for Resource and Environmental Studies (SRES) has been studying urban forests for over a decade. One of their well-known projects includes the Halifax Regional Municipality's (HRM) Urban Forest Master Plan (UFMP). Researchers from SRES work closely with HRM to deploy the plan, which includes inventorying annually planted trees and assessing tree survivorship.

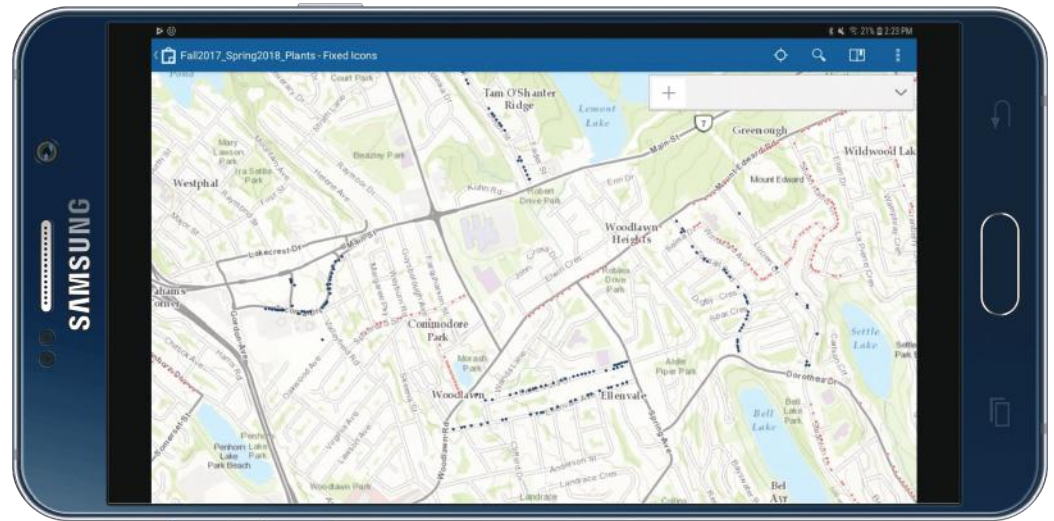
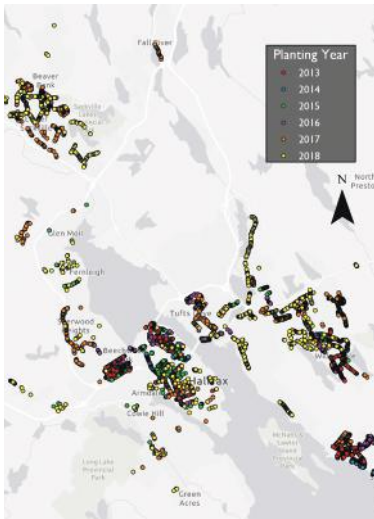
### THE CHALLENGE

To adopt the plan, which recommended neighborhood-level canopy targets, HRM needed to increase planting to 1,000 trees per year. But without the in-house capacity to do so, HRM hired contractors. This enabled more aggressive planting, but came with complications. Primarily, HRM needed to protect itself from premature tree mortality—by holding contractors to a strict two-year warranty.

"But contractors don't typically patrol the streets on their own looking for dead trees to replace," former HRM Urban Forest Superintendent John Simmons said.

### THE PARTNER

The global market leader in geographic information system (GIS) software, Esri offers powerful mapping and spatial analytics technology. This includes popular mobile data-collection apps, such as Collector for ArcGIS and Survey123 for ArcGIS, which streamline field operations. Esri has been helping customers unlock the full potential of data to improve operational and business results since 1969.



Interns mapped urban trees in real-time with submeter accuracy using Samsung tablets, Esri's Collector for ArcGIS app, and Arrow 100 GPS (GNSS) receivers.

“The ultimate goal is not just to reduce the municipal cost associated with tree mortality, but also to use meaningful data and analytics to actually improve how green our cities are.”

David Foster, Ph.D.  
Student and former SRES Intern  
School for Resource  
and Environmental Studies,  
Dalhousie University

## THE SOLUTION

HRM need an inventory of newly planted trees, including each tree's origin, conditions and surroundings. So in 2013, student interns from SRES began visiting each newly planted tree. But their technology couldn't keep up. With just the summer to complete their work, the students found the legacy tablets unusable. The tablets frequently shutdown and also didn't offer complete data-collection options, so students often supplemented data-collection with paper and pen. This made initial data collection time consuming, and re-visiting trees was difficult due to missing or inaccurate data.

“We had instances, especially in large medians with lots of trees, where we were unable to determine which tree was which, based on the inventory,” former SRES intern David Foster said.

So in 2018, the students adopted Android tablets with Esri Collector for ArcGIS app. Configurable Collector dropdowns enabled flexible data collection, and pairing this setup with an Eos Arrow 100 via Bluetooth® enhanced the GPS accuracy. With this solution, the students could collect over 80 trees per day. That fell within the researchers' budget and timeframe.

## THE RESULTS

Since inventorying began in 2013, the students have added over 8,800 trees to the database, with nearly 90% of these having been planted by contractors.

Of those, approximately 800 trees died after planting. Of the 800 dead trees, 700 fell within the warranty period. During rapid drive-by inspections, a student intern, municipal arborist, and the original contractor identified and agreed on which trees needed to be replaced. The ultimate savings, as of 2018, to HRM has been estimated at \$270,000.

“This has proven incredibly valuable as part of asset management in HRM,” Simmons said. “It ensures that contractors provide the service to which they are obligated.”

It also results in significant savings to taxpayers, while providing a healthy urban forestry for the municipality.

The inventory has also been used to provide insights into the spatial relationship between urban trees, their surroundings (e.g., soil, curb distance), and infrastructure (e.g., powerlines).