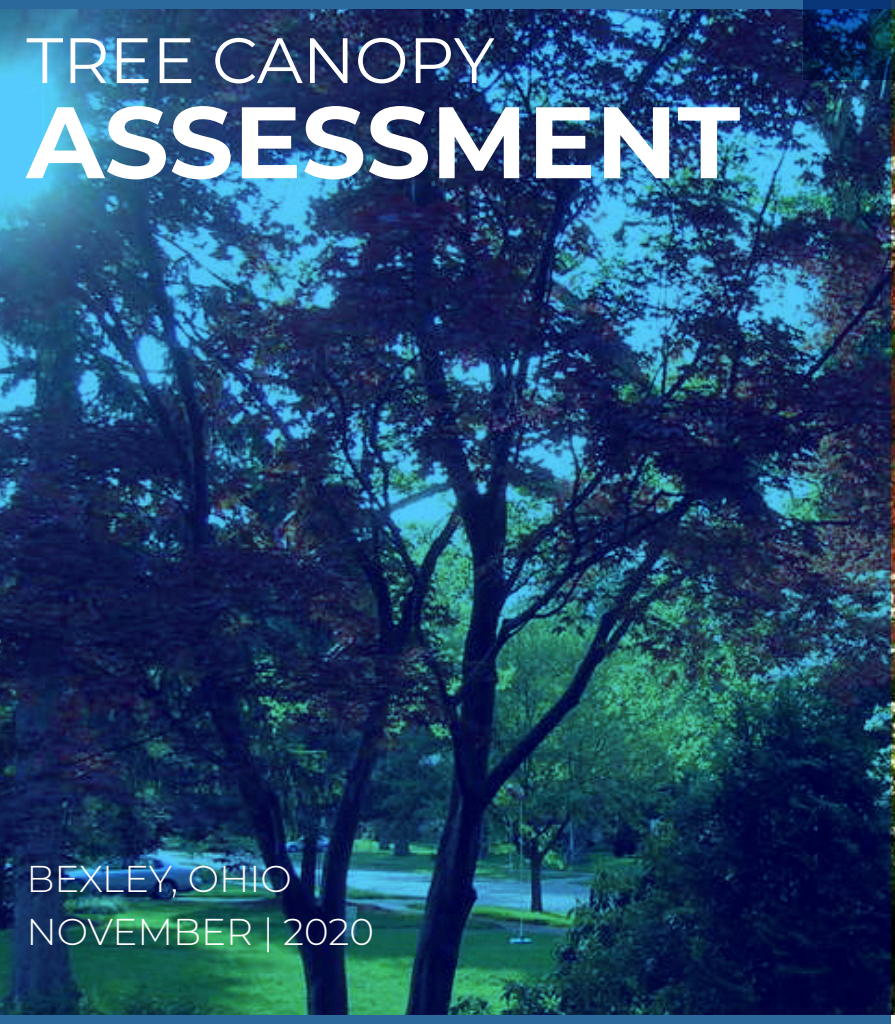
TREE CANOPY ASSESSMENT



BEXLEY, OHIO
NOVEMBER | 2020

THE CITY OF BEXLEY OHIO EST. 1908

PLANIT GEO™
mapping a greener future

Susan Quintenz
Bexley Tree and Public Gardens Commission
2242 East Main Street
Bexley, OH 43209

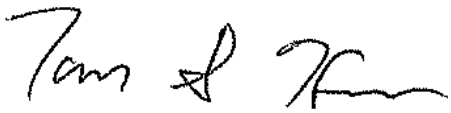
Dear Susan,

PlanIT Geo, LLC is pleased to submit our qualifications in response to the Commission's request to provide urban tree canopy mapping and assessment services. We look forward to this collaborative opportunity to work with the Commission and its partners on this important project. The PlanIT Geo team will provide the Commission with the following benefits for this project:

- The best combination of urban forestry and geospatial analysis experience to provide the Commission and City of Bexley with professional, customized, scientifically sound services and data.
- The most experience in urban tree canopy assessments of any firm. Our key staff have conducted more than 300 similar studies, combined, in nearly 100 municipalities across the country and Canada, leading the way in Urban Tree Canopy (UTC) Assessments through the integration of i-Tree ecosystem services, geospatial desktop software, and web-browser-based technologies.
- Cost-effective tools, workflows, and project management processes as well as options for delivering understandable, easy-to-use products and services based on listening to and learning from our clients and contacts.
- Proven commitment to data quality, communications, and professionalism. We go above and beyond to improve the accuracy, usefulness, and reliability of the products for the benefit of our clients.
- We are fully committed and resourced to complete every aspect of this project on time and in a format that will allow for incorporation into further urban forest management and planning.

We are genuinely excited to provide the Commission with analysis, tools, reports, and data to establish a benchmark of the County's public and private trees. This project provides an opportunity to bring the City's tree canopy into the forefront for city officials, developers, managers, planners, and the general public in order to promote and expand the City's community forest resource. On behalf of the PlanIT Geo team, we are pleased to have this opportunity to submit our qualifications and solutions approach. If you have any questions regarding our submittal, please feel free to call me directly at the phone number listed below.

Respectfully submitted by,



Ian S. Hanou
CEO/Founder, PlanIT Geo, LLC
ianhanou@planitgeo.com | (303) 503-4846

Prepared by,

Jeremy Cantor
Director of Geospatial Services
PlanIT Geo, LLC
jeremycantor@planitgeo.com
(970) 648-0630

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PROJECT UNDERSTANDING

The City of Bexley has a population of roughly 13,000 residents, covers approximately 2.5 square miles, and has a thriving urban forest providing myriad benefits to residents, businesses, and visitors. The urban forest constitutes thousands of street, park, and yard trees and trees in open spaces and other natural areas. It is perhaps the most important component of the City's green infrastructure, contributing to improving air quality, public health, wildlife habitat, local property values, and community beautification.

The City of Bexley has placed priority on enhancing urban forest management as an important part of improving the urban ecosystem. Effective management requires accurate and actionable information, including an understanding of baseline conditions before significant management actions and planning initiatives are undertaken. It is our understanding that, in recognition of this fact, the City's Tree and Public Gardens Commission requires the services of a qualified and experienced urban forest management and geospatial analysis consultancy to undertake a comprehensive geospatial assessment of its existing urban tree canopy (UTC) and a performance assessment of all aspects of the urban forest and its management.

The tree canopy assessment will provide the City's decision makers with a top-down view of canopy cover across various spatial scales. It will enable City staff to use accurate and up-to-date Urban Tree Canopy (UTC) and Potential Plantable Area (PPA) metrics to establish canopy cover targets at various geographic scales and to develop the strategies necessary to achieve these goals. An assessment of Relative Canopy Cover will ensure that the City's current canopy status is weighed against its own biophysical potential, and not an arbitrary "optimal" canopy cover cited by municipalities or agencies in other contexts.

Working in close partnership with the Commission, PlanIT Geo will develop an accurate baseline of tree canopy extent and available planting areas across the City, categorized by various planning scales such as land use/zoning, riparian corridors, and tax parcels. The project team will provide GIS data and maps along with a report with methods, findings, maps, and general recommendations. The process and outcomes will support land development and growth planning strategies that protect and enhance tree canopy.

Ultimately, it is anticipated that the results of this project will directly integrate with and complement the City's other ongoing and forthcoming urban forest management and planning initiatives. The data and assessments garnered through this project will be central to future management plans and can lay the groundwork for setting goals, objectives, targets, and strategies by highlighting challenges, opportunities, and areas for improvement.

PlanIT Geo commits to working collaboratively with Commission staff to ensure that this challenging and important project fulfills all of the City's stated objectives and requirements. With the data, tools, and assessments provided, Bexley will be emboldened with timely, comprehensive, and accurate information about its urban forest resources and management approaches and fully ready to take the next step toward a healthy, diverse, and expanding urban forest.

TEAM SKILL SET & EXPERIENCE

Ian Hanou, Founder, Owner, and Senior Reviewer
Ian is PlanIT Geo's founder and owner. He has 18 years of experience in the geospatial industry, has received project management training, and has managed 200 similar urban forestry projects involving land cover classification & LiDAR, GIS analysis, ecosystem services analysis, reporting, training, and software tool development. Ian has also managed projects in forest health, wildfire risk assessment, green infrastructure planning, water conservation analysis, and stormwater. In 2011, the Society of Municipal Arborists gave Ian an Award of Achievement, "For his innovative urban tree canopy solutions and tree planting applications that have greatly benefited members of the Society and advanced the profession of urban forestry."

Jeremy Cantor, Director of Geospatial Services and Project Manager
Jeremy has over 13 years of experience in geospatial analysis, data processing, object-based image analysis (OBIA), Python scripting, LiDAR manipulation, and cartography. He has served as the lead geospatial analyst and overall project manager of over 40 urban tree canopy assessments during his 5 years at PlanIT Geo. Jeremy previously worked for the U.S. National Park Service for 7 years. For this project, he will be the primary remote sensing analyst and manager of all GIS tasks, reporting, and final delivery.

Maegan Blansett, GIS & Natural Resources Specialist
Maegan has 5 years of experience specializing in GIS and data analysis. She has a background in Geography, Forestry, Natural Resources, and Environmental Science and Management. Maegan will support this UTC assessment by preparing background data, conducting accuracy assessments, and assisting with administrative duties such as task management, data preparation, and review.

Ben Wittman, GIS Software Specialist
Ben has over 4 years of experience in GIS and data processing. He has a background in GIS, Geography, and Environmental Studies. At PlanIT Geo, Ben applies natural resource and forestry concepts to manage environmental and geographic (GIS) data sets. He reviews geographically modeled data using geoprocessing tools and provides QA/QC to review, organize, and process aerial imagery and remotely sensed land cover data. He will perform quality assurance/quality control (QA/QC) on the remote sensing land and canopy cover data and lead the production of maps, and assist in data preparation, organization, and visualization.

Carrie Asselmeier, GIS & Natural Resources Specialist
Carrie has 4 years of experience in Natural Resource Management and GIS data analysis. At PlanIT Geo, Carrie assists with urban tree canopy assessments by performing (QA/QC) on remote sensing land cover classification data, hydrologic modeling, map making, and report writing. She will perform quality assurance/quality control (QA/QC) on the remote sensing canopy cover data to ensure our accuracy goals are met.

IAN HANOU

CEO & Founder

Ian has 18 years of experience applying innovative geospatial, software, and business solutions in forestry, urban forestry, planning, natural resources, and water resources. His work involves human resources, GIS, ecosystem services, technical writing, software design, and business development with all levels of government agencies, private sector, nonprofits and universities. He has presented at 100+ conferences on the use of technology for urban forestry, mapping, and green infrastructure. He is proficient in contract administration, spatial analysis, training, public speaking, marketing, employee development, and project management.

EDUCATION

Bachelor of Science in Forest Management, GIS & Remote Sensing Minor | Colorado State University, 2001

PROFESSIONAL AFFILIATIONS

Society of American Foresters | Front Range Urban Forestry Council | GIS Colorado

URBAN TREE/FOREST CANOPY ASSESSMENTS AND PROJECTS

Washington State Urban Tree Canopy (UTC) Assessments
Since 2007, managed GIS/RS canopy studies in Seattle, Kirkland, Vancouver, Thurston County, Shoreline, Bothell, Snoqualmie, Issaquah, and others, including canopy change analysis, reporting, Council presentation, and i-Tree.

Calgary, Alberta: Tree Canopy Assessment
Managed a GIS/RS assessment of canopy and priority planting areas analysed for 292 communities, 67 land use types, and 300,000 parcels; developed a GIS-based suitability model to prioritize tree planting.

Mississauga, Ontario: Mississauga Urban Forest Canopy Re-Assessment 2007-2014 and City Council Presentation
Managed a follow-up UTC to a 2007 study. Mapped updated land cover and urban forest canopy distribution for 2014, and evaluated canopy cover changes over time, as well as historical canopy trends since 1992. Included data analysis, custom maps and tools, and broad recommendations for setting and achieving canopy objectives.

Oakville, Ontario: Canopy Assessment, EAB Risk Management Mapping, and Goal Setting Scenarios
Managed multiple UFC analysis and scenario planning studies since 2010. Included a hyperspectral imaging analysis of ash/EAB risk management and mapping of current canopy and available planting area town-wide, by communities, and by land use types. Lead GIS/RS consultant on a team to re-analyze Oakville's canopy in 2015/2016.

Columbus, OH: Urban Tree Canopy Assessment, i-Tree Hydro Analysis, and Custom Canopy Planner Tool
Managed this 250 square mile study, created planting prioritization and scenario tools, and provided training.

Treasure Valley, Idaho: Urban Tree Canopy Assessment, i-Tree Eco Analysis, and Scenario Tool Development
Conducted a 265 square mile study and created planting prioritization and scenario tools using CommunityViz (Esri land use planning extension) and i-Tree Eco data values. Classified land cover using remote sensing, summarized data at a variety of assessment scales, analysed ecosystem services, and reported all methods and findings. Provided training in Boise to 30+ attendees from the region (planners, GIS, foresters, park managers, etc.).

JEREMY CANTOR

Director of Geospatial Services

Jeremy contributes to GIS modeling, remote sensing analysis of multispectral and LiDAR imagery, data production, IT, cartography, task management within the geospatial team, Urban Tree Canopy (UTC) assessment reports and delivery, and web/mobile mapping app design. Prior to joining Plan-It Geo in 2016, Jeremy worked in the Ocean & Coastal Resources Branch of the National Park Service Water Resources Division for seven years focusing on coastal systems, geospatial analysis, and website design/online mapping applications.

EDUCATION

Master of Natural Resources Stewardship in Spatial Information Systems | Colorado State University, 2010
Bachelor of Arts in Geography; Economics Minor | University of Vermont, 2006

GEOSPATIAL PROJECTS

Urban Tree Canopy Assessments

Jeremy has led and managed accurate and comprehensive analyses to assess the current status of tree canopy and available planting space. Tasks managed included remote sensing classification, canopy analysis, GIS mapping, tree planting prioritization, summary reports, and web-map design. Communication, training, and presentations of project deliverables were provided throughout the project and upon completion. Project locations include: West Palm Beach, FL (58 mi², 2019); Charlotte, NC (308 mi², 2018); Colorado Springs, CO (194 mi², 2018); King County, WA (12 cities, 170 mi², 2018); Richmond Hill, ON (39 mi², 2018); Wichita, KS (160 mi², 2018); Snake River Valley, ID (15 cities, 160 mi², 2017); Jacksonville, FL (508 mi², 2017); Snoqualmie, WA (7 mi², 2016); Washington, DC (62 mi², 2016); and Denton, TX (115 mi², 2016).

Million Trees Miami: Miami-Dade County Canopy Action Plan and Interactive Online Tree Tool

Served as a GIS analyst and web designer to provide an online engagement tool for the public and tree managers to view existing canopy, plan priority reforestation efforts based on environmental, health, and socioeconomic data, and track newly planted trees as a means to achieve local and regional canopy goals. (https://pg-cloud.com/MillionTreesMiami/)

Denver, Colorado: South Platte River Urban Waters Partnership Natural Capital Grant Project

Served as a GIS analyst to map and evaluate the regional network of green infrastructure in Colorado's South Platte River watershed (6,000 square miles). Derived spatial data were used to develop a tool to prioritize key areas for conservation and restoration based on the ecosystem services that the natural resources provide (https://pg-cloud.com/NaturalCapital/).

Washington, D.C.: Community Forestry Resource Guide, Canopy Strategy, and Management Handbook

Contributed textual content, graphics, and styling to this document which provided a strategy for managing the region's urban forest and a handbook to guide Metro Washington Council of Government's approach to community engagement and outreach as it relates to education and encouraging tree planting, protection, and engagement strategies. The handbook also included an i-Tree demonstration project and user guide for i-Tree Canopy.

TreePlotter™ CANOPY Product Owner Since 2016

Jeremy has managed an iterative re-design of our interactive canopy mapping and decision support web application formerly known as Canopy Planner. Over the course of the last three years, various GIS functionality has been added and graphic design elements have provided a fresh look to make the software more user-friendly with additional features and smoother functionality.

MAEGAN BLANSETT

GIS and Natural Resources Specialist

Maegan graduated from the University of California, Santa Barbara with a Master's in Environmental Science and Management, where she specialized in Conservation Planning and Strategic Environmental Communications. She has a Bachelor's in Physical Geography with a minor in Forestry and Natural Resources from the University of California, Berkeley.

Maegan supports Plan-It Geo's urban tree canopy assessments with data management, spatial analysis, QA/QC of remote sensing products, client communication, reporting, proposals, and task management. Prior to joining the geospatial services team, she coordinated a water quality testing program at the Goleta Water District in Southern California and served a year as an AmeriCorps member focused on expanding urban gardens at public housing communities in New York City.

EDUCATION

M.E.S.M. in Conservation Planning, University of California - Santa Barbara, 2017
B.A. in Geography, Minor in Forestry & Natural Resources, University of California - Berkeley, 2014

GEOSPATIAL PROJECTS

Urban Tree Canopy Assessment and Change Analysis, Colorado Springs, Colorado
Provided a baseline and benchmark of the City's tree canopy and possible planting areas for the first time, and also assessed canopy cover at two past time periods using a point-based sampling method. High resolution aerial imagery from three time periods was utilized to map current tree canopy cover and perform a change analysis. Performed the change analysis, designed a public opinion survey to launch the project, and assisted with data preparation and analy-.sis, project management, reporting, public presentations, and client communications

Urban Tree Canopy Assessments and iTree Hydro study, King County, Washington
Provided an updated baseline and benchmark of tree canopy and other land cover types for over a dozen municipalities in the county, as well as three additional pilot communities' tree canopy as it relates to stormwater benefits. High resolution aerial imagery and LiDAR was utilized to map current tree canopy cover, as well as perform a change analysis from a previous year's study where municipalities had previous study data available. Contributed to data gathering, QA/QC of remote sensing products, project management/client communications, and all reporting.

Urban Tree Canopy Assessment and Data Preparation, Snake River Valley, ID
This assessment of five study areas throughout the state of Idaho provided a benchmark of tree canopy and other land cover types, identified areas suitable for future tree plantings, and prioritized planting sites based on a number of environmental and social criteria in order to update the state's existing Canopy Planner software app with the most recent canopy and planting space metrics. Performed the planting site suitability analysis and assisted with reporting, metadata, and delivery of final products.

Urban Tree Canopy Assessment and Change Analysis, Shoreline, Washington
Provided an updated baseline and benchmark of the City's tree canopy and other land cover types using remote sensing of high-resolution 2017 imagery and LiDAR, and compared changes in canopy since a previous study conducted in 2010. Assisted with QA/QC of remote sensing products, change analysis, accuracy assessment, project management, client communications, and report writing.

BEN WITTMAN

GIS & Software Specialist

Ben has a background in the fields of GIS/GPS analysis, GPS data collection, forestry, geomorphology, remote sensing and cartography. He has experience managing large and complex geospatial datasets, creating GIS data, performing land cover classification quality control, writing technical reports, and using and managing SQL databases. Ben joined PlanIT Geo as a GIS Technician in 2016 and has taken a larger role in managing geospatial projects and associated tasks.

As a GIS Specialist with PlanIT Geo, Ben takes a lead role in supporting and configuring web-based CANOPY applications using data from tree canopy assessment projects. He also analyzes geospatial data to provide clients with and understanding of the relationships between tree canopy, socioeconomic/demographic, environmental and general land cover data.

EDUCATION

Bachelor of Arts in Geography & Environmental Studies; GIS Certificate | University of Colorado at Colorado Springs, 2014

GEOSPATIAL PROJECTS

Urban Tree Canopy Assessments

Ben has performed different tasks for urban tree canopy assessment projects across the U.S. and Canada such as GIS mapping, tree planting prioritization, summary reports, creation and quality control of land cover classification data, remote sensing and data analysis. These projects include Cupertino, CA (11.3 mi^2 2019), Issaquah, WA (12 mi^2, 2019); Wichita, KS (164 mi^2, 2018); Colorado Springs, CO (195 mi^2, 2018); King County, WA (203 mi^2, 2018); Cambridge, ON (44 mi^2, 2018); Jacksonville, FL (588 mi^2, 2017); Rowlett, TX (51 mi^2, 2017); Richmond Hill, ON (40 mi^2, 2017); Washington, D.C. (68 mi^2, 2016); Snoqualmie, WA (7 mi^2, 2016); and Denton, TX (116 mi^2, 2016);

SOFTWARE PROJECTS

TreePlotter INVENTORY applications

Configured and tested Tree Plotter applications for use in tree inventory collection and management for clients including and not limited to: Texas Tree Foundation; Tree Doctors (AZ); Nels Johnson; Sims Tree Health; City of Jacksonville, FL; City of Cheyenne, WY; City of Bowie, MD; CoTreeView (Colorado Statewide Inventory); Wisconsin Department of Natural Resources; Deerfield Beach, FL; Homewood Consulting (AUS); and South Suburban Parks and Recreation (CO).

TreePlotter CANOPY applications

Managed migration of tree canopy data derived from urban tree canopy assessments to a customized, web-based software, CANOPY, for Cambridge, ON; Colorado Springs, CO; Rowlett, TX; Wichita, KS; and Jacksonville, FL.

CARRIE ASSELMEIER

GIS & Natural Resources Specialist

Carrie has a background in ArcGIS analysis, urban forestry, i-Tree tools, natural resources, and conservation. Carrie joined Plan-It Geo in 2017 to assist with urban tree canopy assessments by performing quality assurance/quality control (QA/QC) on remote sensing land cover classification data, GIS analysis, hydrology modeling, map making, and report writing. Most recently, Carrie contributed a year of her time at Plan-It Geo to a large stormwater management and analysis project for the Puget Sound region in Washington State. She also assists with marketing, inventory and management plan tasks. Prior to Plan-It Geo, Carrie interned with Chicago Wilderness working on conservation issues and GIS. After moving to Colorado, she worked for Cherry Creek State Park to educate park visitors and prevent the spread of aquatic nuisance species.

EDUCATION

Bachelor of Arts in Geographical and Sustainbility Science | University of Iowa, 2014

GEOSPATIAL PROJECTS

Puget Sound Urban Tree Canopy and Stormwater Analysis

As Plan-IT Geo's primary point of contact and GIS analyst for this comprehensive, multi-city project, Carrie conducted background research, collected data, performed hydrological modeling, and contributed to the technical report and handbook. Carrie modeled six tree canopy scenarios in four pilot communities (Kent, Kirkland, Snohomish and Tacoma, WA) in i-Tree Hydro at 4 different scales. Both i-Tree Hydro and a local hydrological modeling program (Western Washington Hydrology Model, or WWHM) were used to estimate the amount of stormwater runoff present in various land cover change scenarios across a six-year time span. The results of the modelling were then used to create both a technical report of the findings and a handbook designed to provide advice to communities wishing to make use of these tools.

Other Urban Tree Canopy Assessments

As a GIS Technician, Carrie has performed a variety of different tasks for urban tree canopy assessment projects across the U.S. and Canada, such as land cover classification quality control, data/spreadsheet analysis, cartography, ESRI ArcGIS spatial analysis, canopy change analysis, socioeconomic impact analysis, technical report writing, metadata, and delivery of final data to clients.

Project locations included:

- Downtown Denver (1 mi², 2018) and Colorado Springs (195 mi², 2019), CO
- Dallas County (966 mi², 2019) and Rowlett (20 mi², 2017), TX
- King County (203 mi², 2018) and Shoreline (11.5 mi², 2017), WA
- Jacksonville (588 mi², 2017) and West Palm Beach (58 mi², 2017), FL
- Richmond Hill (40 mi², 2017) and Cambridge (44 mi², 2018), Ontario, Canada
- Snake River Valley, ID (80 mi², 2017) and Chelan (10 mi², 2018) WA
- Wichita, KS (165 mi², 2018) and Cupertino (11 mi², 2018) CA
- Charlotte, NC (308 mi², 2019)

PROJECT REFERENCES

Cupertino, California UTC Assessment & Report (Summer 2019)

Teri Gerhardt | GIS Manager | TeriG@cupertino.org | (408) 777-3311

Imagery/LiDAR-based remote sensing classification of the land and canopy cover of the City of Cupertino in 2018 and 2009; analysis of distribution of tree canopy and plantable space throughout various geographic planning scales; recommendations for policy, planning, and priority planting areas; calculated ecosystem service benefits of the canopy; analyzed correlations between tree canopy and socio-demographic indicators to prioritize new tree plantings; measured canopy change over the last decade

Read the Report

TreePlotter INVENTORY and CANOPY

West Palm Beach, Florida UTC Assessment & Report (Winter 2019)

Penni Redford | Sustainability Manager | predford@wpb.org | (561) 804-4981

Accurate and comprehensive land and canopy cover analysis; assessment of the distribution of canopy cover and plantable space at various scales; analysis and mapping of canopy in correlation to four sustainability and STAR ratings including socioeconomics/demographics, public health, urban heat island, and stormwater; evaluation of percent of population within walking distance of areas of "localized cooling", develop planting scenarios to achieve canopy goals; summary final report; fact sheet.

Read the Report

Salem, Oregon UTC Assessment & Report (Spring 2019)

Patricia Farrell | Parks & Natural Resources Planning Manager | pfarrell@cityofsalem.net | (503) 588-6211

Accurate and comprehensive land cover and canopy change analysis; calculation of ecosystem service benefits of the tree canopy; prioritization of planting sites using six environmental, demographic, and socioeconomic factors; summary final report.

Read the Report

TreePlotter CANOPY

Colorado Springs, Colorado UTC Assessment & Report (Summer 2018)

Karen Palus | Director of Parks, Recreation and Cultural Services | kpalus@springsgov.com | (719) 385-6501

Assessment of tree canopy and land cover; imagery/LiDAR classification; point-based canopy change over a 20-year period; public survey to gauge interest and understand community forest issues; street tree inventory sampling; calculated ecosystem service benefits of the canopy; correlations between tree canopy and environmental and socio-demographic indicators; map development.

Read the Report

TreePlotter INVENTORY and CANOPY

PROJECT APPROACH & METHODOLOGY

This Urban Tree Canopy (UTC) Assessment in the City of Bexley represents an important step in better understanding conditions of tree canopy, its distribution and value, and the importance of urban forestry during planning processes. The study will encompass approximately two-and-a-half square miles. It will involve the use of high-resolution aerial imagery, LiDAR data, GIS and remote sensing technology, and a report to summarize local urban tree canopy and plantable space within the Commission's desired assessment scales. The products and outcomes will support developing and monitoring of future urban tree canopy cover goals, provide key information on plantable spaces, and inform stakeholders on the importance of the urban forest resource. The following sections describe the management and technical approaches that we will employ to successfully complete this project.

Project Management, Initiation, and Communications

We believe that transparency between our staff and Commission staff regarding expectations, timelines, and project execution is essential for creating the best possible products. Therefore, our management approach from the project kick-off to reporting will focus on discussion, customization of scope, and quality. Upon approval, we will work with the Commission to finalize the Scope of Services including any best and final offer. A project kickoff meeting date will be determined. A memo will be sent following the commencement meeting outlining action items for all stakeholders and any impact to the project timeline. Upon completion of land cover mapping and UTC assessment, we will have a mid-project review meeting to present and review the initial results.

Data Collection

We have developed a data collection checklist for streamlining data collection, as well as review/organization for UTC processing. This checklist includes data we will provide, data we will need from the City to complete the assessment, and data that are not required but can help improve our final product by adding additional details. Data collection and management will be performed by our GIS data specialists with review by project management staff. We are prepared to sign data sharing agreements; however, any costs/fees for access to data have not been included in our cost proposal. Note that prior to summarizing UTC metrics, we will screen for topology issues such as polygon overlap for the GIS assessment boundaries (city, land use, etc.).

Urban Tree Canopy Assessment

Our technical approach will include mapping the City's land and tree canopy cover, QA/QC of derived data, analysis of canopy cover and plantable space distribution within various planning scales, and an accuracy assessment following protocols developed by the U.S. Forest Service. This land cover map will serve as the foundation of all other tasks included in this project.

Land Cover Mapping

PlanIT Geo is an industry leader in spectral and spatial remote sensing analysis, particularly using object-based image analysis (OBIA) for various land cover classifications. This is a critical technique for accurately and cost-effectively mapping tree canopy, other vegetated areas, bare earth, water, and impervious surfaces. We utilize Feature Analyst software v5.2 for the OBIA classification which uses spectral and textural analysis and pattern recognition through an iterative machine-learning approach. The latest available high-resolution (1-meter), multispectral (4-band), leaf-on aerial imagery and LiDAR elevation data will be used to map land cover. NAIP imagery (U.S. Department of Agriculture National Agriculture Imagery Program) from 2019 and 2019 USGS LiDAR will be used. A normalized digital surface model (nDSM) will be created from the LiDAR point cloud by extracting first and last return elevations and subtracting the last return (ground) from the first return (top of object) to create a canopy height model.

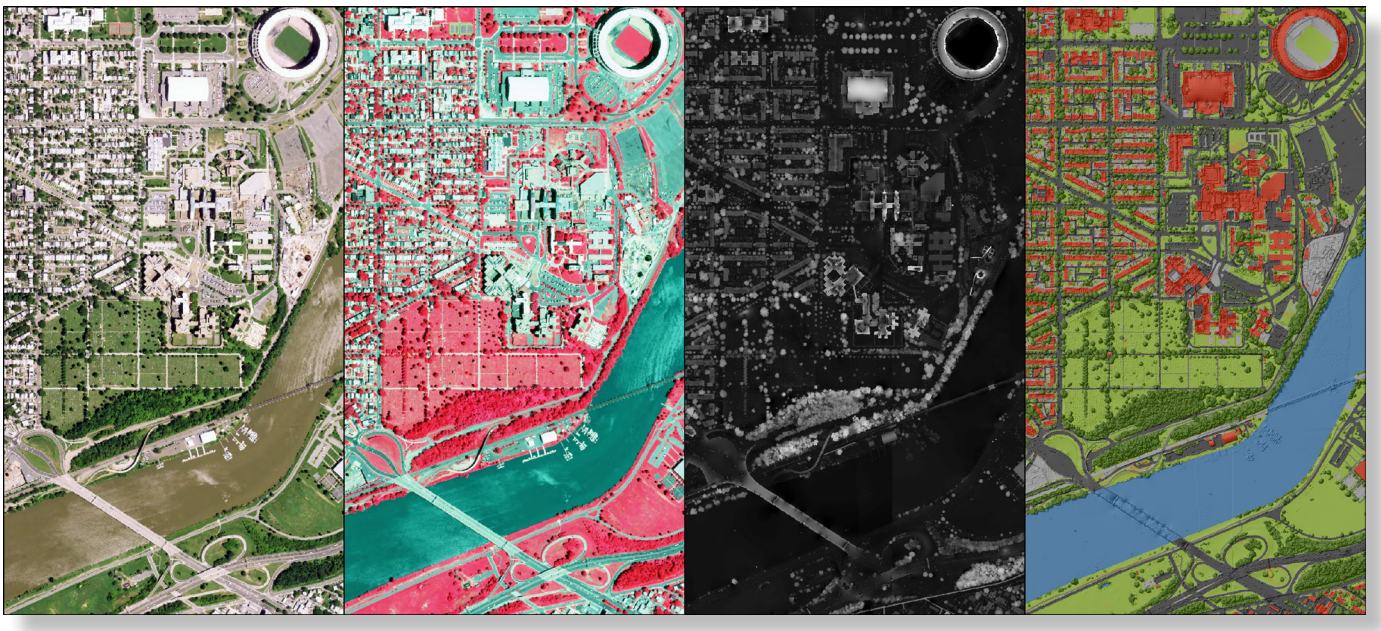
We employ a statistically and functionally rigorous protocol for classification and quality assurance and control (QA/QC). Our GIS technicians will manually correct errors in the automated classification at a scale of 1:1,250, repeating until targeted accuracies are reached. We have budgeted to achieve at least 90% overall mapping accuracy with at least 94% user's accuracy specifically for tree canopy with a minimum mapping unit (MMU) of 3x4 meters. The canopy layer will be provided for review and acceptance prior to other steps in the project. FGDC-compliant metadata will be provided for all spatial datasets created. All datasets will be delivered in GIS vector (shapefile or geodatabase) or raster (TIF) formats that will be compatible with the City's current GIS. Each land cover class that will be included is listed below including our methods for the deliverables.

Land Cover Classes

Urban tree canopy mapping will include all vegetation generally greater than 10-15' tall based on multispectral imagery, LiDAR height values, and object-based classification techniques. This OBIA classification technique uses an analyst-trained model to extract features based on contextual information from spectral reflectance (visible and near-infrared bands), object heights, spatial orientation (shape), textural analysis (shadowing), and pattern recognition. On-the-ground images from Google Street View may be used for training of the remote sensing classification inputs and for verification/refinement of the classification outputs. It may also be useful to obtain photos from the City of any areas where vegetation type cannot be identified in the aerial imagery.

Other (non-canopy) vegetation will include shrub/scrub vegetation, turf grass, and open space. Following the remote sensing classification and final QA/QC of the tree canopy data layer, the output will be used as a mask to extract all other types of vegetation using a Normalized Difference Vegetation Index (NDVI) analysis and pattern recognition. Results will map all areas of healthy grass and vegetative cover, based on the time of the imagery capture, with a focus towards plantable areas for the purpose of this study and intended use of the data. The results will be at an individual pixel level and will be smoothed and aggregated to a reasonable size for forestry and other planning applications. The MMU will be 5x5 meters with individual class accuracy of at least 92%.

As part of our land cover mapping process, we will digitize areas that are unsuitable for tree planting to ensure that the plantable spaces presented to the City are accurate and realistic. These unsuitable areas include, but are not limited to, cemeteries, above-ground utility corridors, recreation fields, and other features desired by the City. All remaining vegetation will be considered possible planting area (PPA).



Impervious surfaces will include all paved surfaces and hardscapes and can be broken out (sub-categorized) using existing planimetric data that the City can provide including buildings, roads, parking lots, sidewalks, and driveways. These digitized impervious surface polygons will be incorporated into the land cover classification by overlaying them "on top of" the impervious surface areas that are extracted through remote sensing classification techniques. We will also provide a GIS data layer on the amount of impervious surface that is covered by tree canopy. Parking lots, sidewalks, and other impervious areas such as patios, driveways, trails, and other miscellaneous hardscape surfaces will be categorized as "Other Impervious". The MMU will be 5x5 meters with individual class accuracy of at least 92%.

Bare soil will include barren soil, gravel pits, exposed dirt/open construction, rock, and sand as well as dry (non-photosynthetic) vegetation. The MMU will be 5x5 meters with individual class accuracy of at least 92%.

Water will be mapped from the base imagery and available hydrologic, surface water features provided by the City such as lakes, rivers, ponds, and streams. The MMU will be 5x5 meters with individual class accuracy of at least 92%.

After remote sensing classification and QA/QC of all land cover classes, we will conduct a point-based accuracy assessment. The result will be a standard error (confusion) matrix which we include routinely on land cover and UTC assessments. Once the tree canopy layer has 94% user's accuracy or higher and overall accuracy reaches 90%, we will send samples of the results to the City for review and approval before proceeding with the GIS-based modeling of land cover and UTC metrics.

The following land cover GIS raster layers will be produced:

1. 5-class (tree canopy, other vegetation, impervious, bare soil, and water);
2. All-class (same classes but with more specific impervious classes provided by the City);
3. UTC-class (existing tree canopy, areas suitable for planting trees, unsuitable areas for planting trees).

In addition, separate raster and vector files will be delivered for tree canopy, all impervious surfaces, and tree canopy overhanging impervious surfaces. The final land cover products will be delivered in vector and raster format (shapefile, TIFF, or ESRI geodatabase) in the UTM Zone 17 coordinate system (or the City's locally used projection) and meet the Federal Geographic Data Committee (FGDC) metadata guidelines.

Possible Planting Area

As part of our land cover mapping process, we will digitize areas that are unsuitable for tree planting to ensure that the plantable spaces presented to the City are accurate and realistic. These areas include, but are not limited to, above-ground utility corridors, recreation fields, and other features desired by the City. We refer to this as Possible Planting Area – Vegetation. Several impervious surface types such as parking lots, sidewalks, and driveways may also offer planting opportunities with enhanced ecosystem benefits. These areas can be labeled as Possible Planting Area – Impervious if available as slight modification of the landscape or adjacent tree plantings could result in plantable space with enhanced ecosystem benefit value.

Urban Tree Canopy Metrics & Maps

We will then conduct the land cover and UTC assessment and analysis. This includes GIS-based modeling processes to calculate the area (acres) and percent of each land cover type as well as possible planting area and unsuitable areas within five desired boundaries including the city boundary and up to four others (e.g. zoning/land use, riparian corridors, parcels, etc.). Area and percent values will be added in new GIS table fields to the following geographic assessment boundaries.

These GIS files will be provided by the City with any topological errors corrected. Area and percent values will be added in new GIS table fields for each scale. Maps, in MXD, PNG, and PDF formats, will include the following: City-wide land cover, City-wide UTC/PPA/unsuitable, UTC coverage by all other scales (4), and PPA distribution by all other scales (4). Key maps and tables will be included in the summary report. All maps and spreadsheet tables will be delivered in our data delivery.

Ecosystem Service Benefits

While trees are commonly appreciated for their aesthetic value, the true benefits of trees and forests are often underestimated or undervalued. This survey will quantify some of the benefits of the City's trees on both public and private properties using the latest scientific modeling tools from the U.S. Forest Service i-Tree suite. These benefits are referred to as "ecosystem services". Current values will be estimated for the following four ecosystem service types:

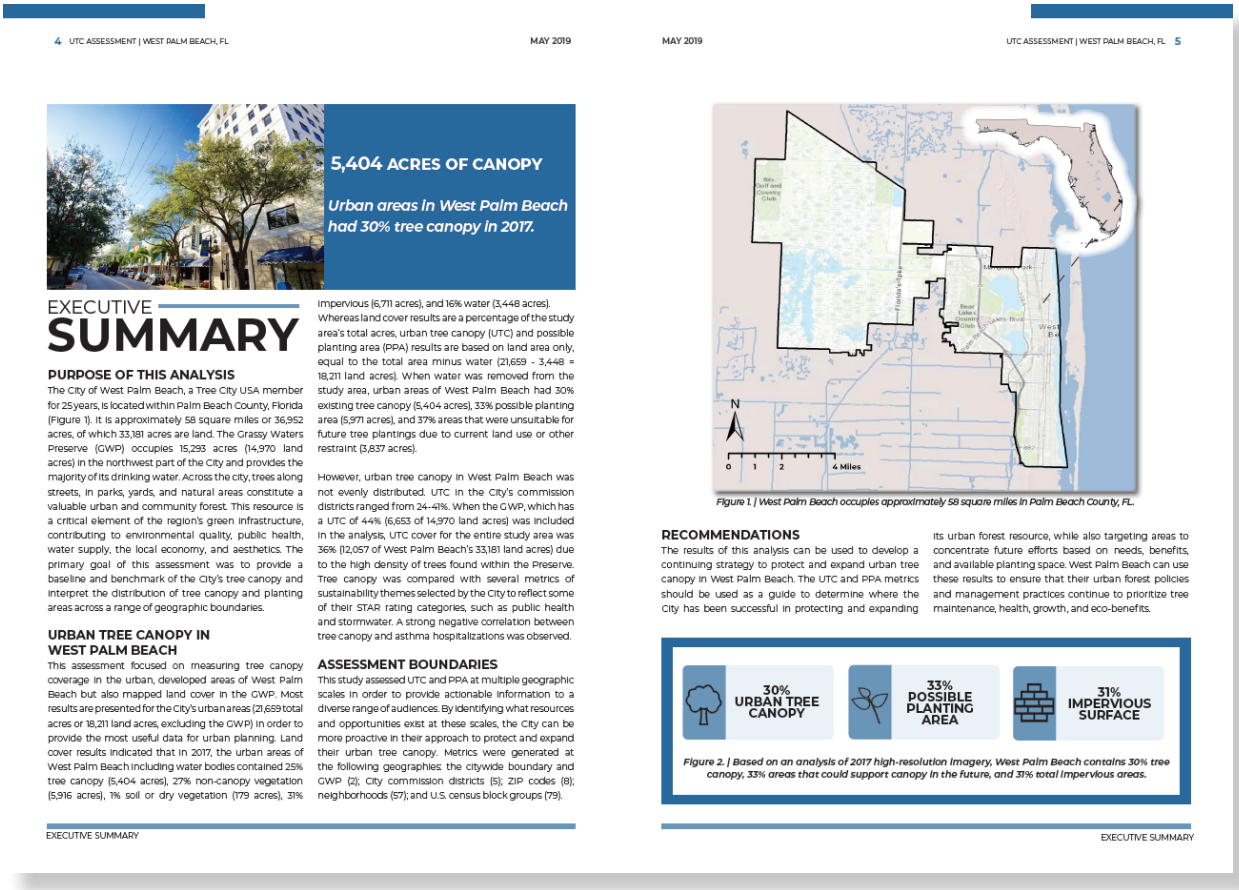
- Air quality - Trees naturally remove pollutants and reduce air temperature;
- Water quality - Trees promote soil stability which reduces sedimentation and absorbs pollutants;
- Stormwater mitigation - Trees intercept stormwater, reduce runoff, diminish erosional forces, and filter out harmful pollutants and nutrients that would otherwise enter our waterways;
- Carbon sequestration and storage - Through photosynthesis, trees absorb atmospheric carbon and use it for new growth (stems, branches, roots and leaves), acting as a natural carbon sink.

Summary Report

Our team has a strong background and expertise in writing forestry reports that are customized, attractive, and professional, include revision and input from multiple stakeholders, and successfully tie into existing plans or initiatives. We take pride in delivering custom reports tailored specifically for each project, to the intended audience, and with client/stakeholder input. We have learned from years of experience with tree canopy assessment projects that the final report, whether to a technical audience or to the general public, can be the most important aspect of a successful project. The report will be concise and readable to the untrained citizen, using pull-out information boxes, bulleted lists of items, and shorter clear speak paragraphs. We generate creative graphics and provide insightful, locally specific recommendations through discussions with clients on the results/findings.

We anticipate that the summary report will include a cover, acknowledgments/logos, a table of contents, executive summary, findings, recommendations, and an appendix with an accuracy assessment for the city-wide land cover data. We suggest that the Commission have two (2) reviews of the draft report which will be sent in an editable electronic version. When the review is complete, we will schedule a meeting to discuss edits/comments prior to the final draft. The final report will be provided in PDF format with the source InDesign files available if desired. No hard copies have been included in our cost. All supporting tables, data, graphs/charts, graphics, spreadsheets, and maps will be included in the final delivery. The Commission will be asked to contribute text, photos, logos, and other graphic elements to support the report development.

In addition to the summary report, we will provide a two-page summary fact sheet as a condensed version of the process, key findings, and deliverables. The Commission will have input on the content and style of the fact sheet, as well as two (1) reviews of a draft.



4 UTC ASSESSMENT | WEST PALM BEACH, FL MAY 2019

5,404 ACRES OF CANOPY

Urban areas in West Palm Beach had 30% tree canopy in 2017.

EXECUTIVE SUMMARY

PURPOSE OF THIS ANALYSIS

The City of West Palm Beach, a Tree City USA member for 25 years, is located within Palm Beach County, Florida (Figure 1). It is approximately 58 square miles or 36,952 acres, of which 33,181 acres are land. The Grassy Waters Preserve (GWP) occupies 15,293 acres (14,970 land acres) in the northwest part of the City and provides the majority of its drinking water. Across the city, trees along streets, in parks, yards, and natural areas constitute a valuable urban and community forest. This resource is a critical element of the region's green infrastructure, contributing to environmental quality, public health, water supply, the local economy, and aesthetics. The primary goal of this assessment was to provide a baseline and benchmark of the City's tree canopy and interpret the distribution of tree canopy and planting areas across a range of geographic boundaries.

URBAN TREE CANOPY IN WEST PALM BEACH

This assessment focused on measuring tree canopy coverage in the urban, developed areas of West Palm Beach but also mapped land cover in the GWP. Most results are presented for the City's urban areas (21,659 total acres or 18,211 land acres, excluding the GWP) in order to provide the most useful data for urban planning. Land cover results indicated that in 2017, the urban areas of West Palm Beach including water bodies contained 25% tree canopy (5,404 acres), 27% non-canopy vegetation (5,916 acres), 1% soil or dry vegetation (179 acres), 31% impervious (6,711 acres), and 16% water (3,448 acres). Whereas land cover results are a percentage of the study area's total acres, urban tree canopy (UTC) and possible planting area (PPA) results are based on land area only, equal to the total area minus water (21,659 - 3,448 = 18,211 land acres). When water was removed from the study area, urban areas of West Palm Beach had 30% existing tree canopy (5,404 acres), 33% possible planting area (5,971 acres), and 37% areas that were unsuitable for future tree plantings due to current land use or other restraint (3,837 acres).

However, urban tree canopy in West Palm Beach was not evenly distributed. UTC in the City's commission districts ranged from 24-41%. When the GWP, which has a UTC of 44% (6,653 of 14,970 land acres) was included in the analysis, UTC cover for the entire study area was 36% (12,057 of West Palm Beach's 33,181 land acres) due to the high density of trees found within the Preserve. Tree canopy was compared with several metrics of sustainability themes selected by the City to reflect some of their STAR rating categories, such as public health and stormwater. A strong negative correlation between tree canopy and asthma hospitalizations was observed.

ASSESSMENT BOUNDARIES

This study assessed UTC and PPA at multiple geographic scales in order to provide actionable information to a diverse range of audiences. By identifying what resources and opportunities exist at these scales, the City can be more proactive in their approach to protect and expand their urban tree canopy. Metrics were generated at the following geographies: the citywide boundary and GWP (2); City commission districts (5); ZIP codes (8); neighborhoods (57); and U.S. census block groups (79).

EXECUTIVE SUMMARY

MAY 2019 UTC ASSESSMENT | WEST PALM BEACH, FL 5

Figure 1. | West Palm Beach occupies approximately 58 square miles in Palm Beach County, FL.

RECOMMENDATIONS

The results of this analysis can be used to develop a continuing strategy to protect and expand urban tree canopy in West Palm Beach. The UTC and PPA metrics should be used as a guide to determine where the City has been successful in protecting and expanding its urban forest resource, while also targeting areas to concentrate future efforts based on needs, benefits, and available planting space. West Palm Beach can use these results to ensure that their urban forest policies and management practices continue to prioritize tree maintenance, health, growth, and eco-benefits.

Figure 2. | Based on an analysis of 2017 high-resolution imagery, West Palm Beach contains 30% tree canopy, 33% areas that could support canopy in the future, and 31% total impervious areas.

EXECUTIVE SUMMARY

PROJECT PRICING

We propose the following tasks be performed to provide the Bexley Tree and Public Gardens Commission and City of Bexley with a comprehensive assessment of their tree canopy. Each proposed task is described below with an associated cost. This proposal is valid for 30 days.

Task	Description	Cost
Tree and land cover mapping of Bexley, OH (2.5 mi^2)	Classify all tree canopy and land cover using LiDAR (if available) and high-resolution imagery. Deliverables include GIS layers for tree canopy and land cover.	$8,000
Possible planting areas	Delineation and exclusion of unsuitable areas. Deliverable includes a GIS layer showing tree canopy, possible planting areas, and unsuitable areas.	$500
Maps and metrics	Includes assessment of up to four assessment scales plus the main area of interest (city boundary). Additional geographies may be added at $500/each. Each assessment boundary includes GIS data, maps, an assessment spreadsheet, and inclusion in the report.	$1,500
Summary report	Summary report of methods, findings, and broad recommendations. Includes two drafts and one final. Ecosystem service benefits are quantified and detailed in the report.	$5,000
Fact sheet	Two-page fact sheet including key findings. Includes two drafts and one final.	$1,500
Total		**$16,500**

SCHEDULE OF AVAILABILITY

All staff listed, in addition to our GIS technician team, are available to complete all tasks and ensure a successful completion of the Bexley, Ohio Tree Canopy Assessment on time and on budget. Project management provides the framework for communication between PlanIT Geo and Commission staff and is central to a successful project from the organization of this proposal to the final project deliverables. Our Schedule of Availability shows general completion dates for each task listed.

Task	Month 1	Month 2	Month 3
Contract award			
Project kickoff meeting			
Land cover mapping			
Mid-project review meeting			
Maps and metrics, report			
Final delivery			

NOVEMBER | 2020

BEXLEY, OHIO

TREE CANOPY ASSESSMENT

PLANIT GEO™
mapping a greener future