TREE CANOPY COVER ASSESSMENT



Funding for this project was provided in part through an Urban & Community Forestry Grant from the North Carolina Forest Service, Department of Agriculture and Consumer Services, in cooperation with the USDA Forest Service, Southern Region.











Figure 1. The Town of Leland occupies approximately 21.8 square miles in southeastern North Carolina.

EXECUTIVE **SUMMARY**

PURPOSE OF THIS ANALYSIS

The Town of Leland is one of the fastest growing towns in southeastern North Carolina, known for its warm weather, wooded walking trails, and winding waterways. Located within Brunswick County, Leland is approximately 21.8 square miles, or 14,870 acres, in size. The canopy cover in Leland is a valuable asset providing residents and visitors with many environmental, social, and economic benefits. This assessment mapped tree canopy cover, possible planting area (PPA), and tree canopy change from 2014 to 2020 and analyzed how they are distributed throughout Leland's town boundary, zoning, right-ofway (ROW), and census block groups.

FINDINGS

In 2020, Leland had 51% tree canopy cover and 23% possible planting area, not including any surface water

bodies within the town. Leland's total land cover contained 50% tree canopy, 24% non-canopy vegetation; 5% soil/dry vegetation; 15% impervious surfaces, and 3% water. The 7,369 acres of tree canopy in Leland provide ecosystem benefits valued at over \$2.6 million per year through air quality improvements, stormwater runoff prevention, and carbon sequestration. Results from this assessment found that canopy cover changed from 48% to 51% from 2014 to 2020 (+3% or 459 acres) using the current town boundary. Planned Unit Development-zoned areas make up about half of the town's area and experienced an 8% gain in tree canopy cover.

RECOMMENDATIONS

This assessment produced a wealth of information that can be used by the Town to set a community-wide tree canopy cover goal. The information were also provided within several subdivisions of the town that will allow for setting goals and targeting priority areas for specific regions of the community based on existing tree canopy cover, available planting space, sociodemographics, and nature accessibility.



PROJECT-

METHODOLOGY

DATA SOURCES AND MAPPING LAND COVER

The land cover data set is the foundation of a tree canopy assessment. This assessment utilized high-resolution (60-centimeter) multispectral imagery from the U.S. Department of Agriculture's National Agriculture Imagery Program (NAIP) collected in 2020 to derive the land cover data set. The EarthDefine US Tree Map (https://www. earthdefine.com/treemap/) is produced using a modern machine learning technique to extract tree canopy cover and other land cover types to provide a six-class land cover data set. These classes were then further categorized into tree canopy cover, possible planting area (PPA), and unsuitable for planting. Unsuitable areas, are areas where it was not feasible to plant trees due to biophysical or land use restraints (e.g. golf course playing areas, recreation fields, utility corridors, etc.).

DEFINING ASSESSMENT LEVELS

The tree canopy and other land cover analyses were tabulated within four geographic boundary areas. These bounded areas include the town boundary, the town right-of-way, zoning districts, and census block groups.



TOWN BOUNDARY

Leland's town boundary is the one (1) main area of interest over which all metrics are summarized.



Seventeen (17) census blocks groups were assessed

to show the relationship between tree canopy and

TOWN RIGHT-OF-WAY

Public rights-of-way along streets the Town is responsible for managing. This measure is useful for quantifying Leland's street tree canopy cover and identifying tree planting opportunities.



ZONING

Twenty (20) **zoning** types were assessed to further dissect tree canopy cover on different types of land use.

Figure 3. Four (4) distinct geographic boundaries were explored in this analysis: the town boundary, right-ofway, zoning, and census blocks groups.

sociodemographics.

STATE OF THE CANOPY AND **KEY FINDINGS**

12% TREE CANOPY COVER IN THE RIGHT-OF-WAY

NEARLY HALF OF ALL LELAND'S CENSUS BLOCK GROUPS HAVE GREATER THAN 50% CANOPY COVER THE PLANNED UNIT DEVELOPMENT DISTRICT (LE-PUD) HAD THE HIGHEST TREE CANOPY COVER AND THE SPECIAL DISTRICT (LE-SD) HAD THE LOWEST.

<1% OF TREE CANOPY SHADES IMPERVIOUS SURFACES

This study mapped and quantified tree canopy, plantable space, and canopy change throughout the Town of Leland. These metrics help inform a strategic approach for identifying existing canopy to preserve as well as areas suitable to plant trees in the future. Tree canopy cover, possible planting area, and areas unsuitable for planting are presented as percentages of the Town's land area with bodies of water excluded.

51% 23% Tree Canopy Possible

Possible Planting Area

26% +3%

suitable (Areas

Canopy Changi 2014 - 2020

TOWNWIDE TREE CANOPY COVER

Within the town of Leland, 7,369 acres were covered with tree canopy, making up 51% of the town's 14,355 land acres; 3,283 acres were covered with other vegetation where it would be possible to plant trees (PPA), making up 23% of the town; and the other 3,703 acres were considered unsuitable for tree planting, making up 26% of the town. Unsuitable areas include impervious surfaces, soil and dry vegetation, scrub/shrub, and any vegetated areas that are not suitable for trees because of their land use.

Over the six-year study period, there was an increase in Leland's tree canopy cover. Tree canopy increased by approximately 459 acres townwide, yielding a 3% raw increase since 2014. The city's 7,369 acres of tree canopy were further divided into subcategories based on whether the canopy was shading pervious or impervious surfaces. Tree canopy shading an impervious surface can provide many benefits through ecosystem services such as localized cooling provided by shading and increased stormwater absorption. Leland's canopy was predominantly shading pervious surfaces at 99.6%, while 0.4% was shading impervious surfaces.



23%



Figure 5. Distribution of land cover throughout the town boundary.

Town of Leland	Total Area	Land Area	2014 Tree Canopy		2020 Tree Canopy		Canopy Change	
	Acres	Acres	Acres	%	Acres	%	Acres	%
Tree Canopy	14,870	14,355	6,910	48%	7,369	51%	459	3%





Figure 6. Distribution of land cover throughout Leland. (Percentages based on total acres.)



Figure 7. Distribution of existing and potential tree canopy cover throughout the Town.

TREE CANOPY COVER BY RIGHT-OF-WAY

The assessment was also conducted within the Town's rights-of-way. The right-of-way (ROW) includes the Town's sidewalks, roadways, and medians that are publicly owned and maintained. This metric helps quantify the Town's street tree resources, as trees in this area provide an especially valuable service in terms of air pollution control, stormwater interception and absorption, and shading. Tree canopy covered 12% of the ROW, far less than the townwide average of 51%. Another 24% of the ROW consists of plantable space where trees could be planted to provide shade to the Town's transportation corridors. 63% of the ROW was unsuitable for planting, primarily consisting of impervious surfaces. Tree canopy cover in the ROW decreased by 3% from 2014 to 2020.



Figure 8. Tree canopy cover in Leland's right-of-way.

TREE CANOPY COVER BY ZONING

Tree canopy and PPA were assessed for Leland's 20 zoning types. Nearly half of the town is within the Planned Unit Development zone (LE-PUD). These areas contained 51% of Leland's total canopy cover. Within this zone, there was 58% tree canopy and 27% plantable space (46% of all PPA in the Town). This zone experienced the greatest increase in canopy cover acres, gaining 476 acres (8%) from 2014 to 2020. Residential Medium Density (LE-R-6) zones contained 23% tree canopy (21% of all tree canopy in the town) and 26% of all PPA. Eleven of the 20 zoning types had greater than 50% tree canopy cover. Eight of the zoning types gained canopy, six lost canopy, and six remained nearly unchanged. The Innovation District (LE-ID) experienced the greatest increase in tree canopy cover, gaining 33% (74 acres). The greatest loss of tree canopy cover occurred in the Civic zone (LE-CIVIC), losing 16% but just 1 acre within the six-year study period.



Figure 9. Tree canopy change percent by zoning in Leland from 2014-2020.



Figure 10. Tree canopy cover by Leland's zoning districts.

Table 2.	Tree canopy coverage,	potential pl	lanting area	, and tree	canopy change by
		zoning di	istricts.		

Zoning Districts	Total Area	Land Area	2020 Tree Canopy		2020 PPA		Canopy Change	
Zoning Districts	Acres	Acres	Acres	%	Acres	%	Acres	%
LE-C-1	214	211	94	44%	80	38%	2	1%
LE-C-2	368	343	76	22%	112	32%	3	1%
LE-C-3	12	11	2	15%	5	42%	1	7%
LE-CD	521	461	193	42%	37	8%	-4	-1%
LE-CIVIC	10	9	4	48%	3	30%	-1	-16%
LE-ID	222	220	194	88%	23	10%	74	33%
LE-M-F	997	980	625	64%	180	18%	19	2%
LE-O&I	10	10	6	61%	2	18%	-1	-7%
LE-PUD	6,501	6,278	3,641	58%	1,317	21%	476	8%
LE-R-15	665	651	385	59%	172	26%	9	1%
LE-R-20	347	317	142	45%	61	19%	-7	-2%
LE-R-6	2,894	2,789	1,484	53%	745	27%	-39	-1%
LE-RMH	86	85	47	56%	25	29%	0	0%
LE-SD	14	14	1	8%	5	33%	0	3%
LE-T1	7	7	6	91%	0	7%	0	-1%
LE-T3	64	64	34	53%	19	29%	0	1%
LE-T4	58	58	40	69%	12	20%	1	2%
LE-T-40	237	236	108	46%	69	29%	0	0%
LE-T-4O-CZ	9	9	6	72%	2	26%	0	1%
LE-T5	80	79	17	21%	16	20%	-3	-3%

TREE CANOPY COVER BY CENSUS BLOCK GROUPS

Understanding tree canopy cover and PPA at the census block group scale is valuable for assessing the equitable distribution of tree canopy as these boundaries can be linked to all demographic and socioeconomic U.S. census data. Nearly half of all block groups ranged from 50-100% canopy cover and 47% ranged from 30-50%. One block group (37-019-020105-2) had 16% canopy cover but experienced a 6% increase from 2014 to 2020. An 88% majority of blocks ranged from 10-30% PPA. The others had over 30% PPA. All canopy loss occurred within four census block groups in northern and western parts of town. Canopy in one census block group remained nearly unchanged, and the other seven census block groups had an increase in canopy ranging from 1-13%.



Figure 11. Tree canopy change by Leland's census block groups. See IDs in Table 3 on the next page.

ID	GEOID	Total Area	Total Land 2014 Tree Area Area Canopy		Tree opy	2020 Tree Canopy		Canopy Change	
		Acres	Acres	Acres	%	Acres	%	Acres	%
1	37-019-020108-2	635	606	222	37%	287	47%	65	11%
2	37-019-020205-3	530	514	230	45%	248	48%	18	4%
3	37-019-020105-3	889	801	83	10%	128	16%	45	6%
4	37-019-020102-2	760	750	419	56%	425	57%	6	1%
5	37-019-020107-2	998	991	631	64%	606	61%	-25	-3%
6	37-019-020107-1	67	67	36	53%	45	67%	9	13%
7	37-019-020105-2	798	792	377	48%	422	53%	45	6%
8	37-019-020107-3	439	430	240	56%	184	43%	-56	-13%
9	37-019-020108-1	624	590	262	44%	247	42%	-15	-2%
10	37-019-020205-1	581	521	159	31%	162	31%	2	0%
11	37-019-020205-2	47	47	15	31%	15	33%	1	2%
12	37-019-020201-1	915	887	381	43%	445	50%	64	7%
13	37-019-020201-2	1,831	1,793	1,293	72%	1,384	77%	91	5%
14	37-019-020203-1	2,128	2,026	712	35%	783	39%	72	4%
15	37-019-020602-2	1,443	1,415	508	36%	670	47%	162	11%
16	37-019-020106-1	1,253	1,204	685	57%	742	62%	57	5%
17	37-019-020105-1	932	923	659	71%	576	62%	-83	-9%

Table 3. Tree canopy coverage, potential planting area, and tree canopy change by Leland's census block groups.



ASSESSMENT OF ECOSYSTEM BENEFITS

Using the best available science from i-Tree tools, values were calculated for some of the benefits and functions provided by the tree canopy in Leland. The canopy cover holds millions of dollars of savings in avoided infrastructure costs, pollution reduction, and stored carbon. The following values were calculated using the USDA Forest Service's i-Tree Landscape tool with Leland's total acres of tree canopy cover as the input data.

AIR QUALITY

Trees produce oxygen, indirectly reduce pollution by lowering air temperature, and improve public health by reducing air pollutants which cause death and illness. The existing tree canopy in Leland removes approximately 634,000 pounds of air pollution annually, valued at over \$600,000.

STORMWATER AND WATER QUALITY

Trees and forests mitigate stormwater runoff which minimizes flood risk, stabilizes soil, reduces sedimentation in streams and riparian land, and absorbs pollutants, thus improving water quality and habitats. The tree canopy in Leland absorbs 48 million gallons of water per year. Extrapolated townwide, this means that Leland's existing canopy provides over \$435,000 annually in stormwater benefits.

CARBON STORAGE AND SEQUESTRATION

Trees accumulate carbon in their biomass; with most species in a forest, the rate and amount increase with age. Leland's trees store approximately 240,000 tons of carbon, valued at over \$41 million, and each year the tree canopy absorbs and sequesters approximately 9,600 tons of carbon dioxide, valued at over \$1.6 million.



Figure 12. Ecosystem service benefits of Leland's canopy cover.

TREE PLANTING PRIORITIZATION Increased tree canopy cover can provide a wide array of benefits to a local comm

Increased tree canopy cover can provide a wide array of benefits to a local community and its residents and visitors. To locate specific areas in need, several socioeconomic, demographic, and accessibility data sources were analyzed at the census block group scale and each was ranked. Rankings are sorted from high (dark blue) to low (light yellow) and were calculated for each individual criteria as well as overall to show where multiple needs overlap.



People of Color Populations: Tree canopy is often negatively correlated with the percentage of residents of color. Planting trees in communities with higher percentages of people of color can support environmental equity. This criteria highlights areas with greater numbers of residents of color.



Median Household Income: Income inequality often occurs with environmental inequality where lower-income residents live in highly impervious areas with limited numbers of trees, parks, and other greenspaces. This criteria highlights areas with lower median household income.



Median Home Value: Mature trees can increase home and property values. This criteria highlights areas with lower median home value.



Poverty Rate: Trees provide many environmental and health benefits to nearby residents. This criteria shows the percentage of residents with income below 150% of the poverty level.



NatureScore[™]: NatureScore, created by NatureQuant, is a measure of nature and human health created through the use of machine learning to identify correlations between environmental data sets and health outcomes. Through these correlations, NatureScore determines what beneficial nature is, where it is present, and where it is lacking. This criteria highlights areas with less access to nature.



Table 4. Prioiritization scores by census block groups.

ID	GEOID	People of Color Populations (%)	Median Household Income (\$)	Median Home Value (\$)	Poverty Rate (%)	NatureScore™
1	37-019-020108-2	68	44,831	131,600	38	95
2	37-019-020205-3	3	102,500	385,500	4	88
3	37-019-020105-3	12	64,973	242,300	22	89
4	37-019-020102-2	18	62,514	180,000	21	84
5	37-019-020107-2	17	90,064	159,000	18	94
6	37-019-020107-1	85	No data	No data	93	97
7	37-019-020105-2	6	81,813	330,600	6	54
8	37-019-020107-3	5	61,343	199,000	18	88
9	37-019-020108-1	6	61,681	275,400	29	89
10	37-019-020205-1	7	81,673	366,000	11	71
11	37-019-020205-2	25	94,286	224,400	18	90
12	37-019-020201-1	26	64,868	233,400	36	62
13	37-019-020201-2	41	56,181	182,000	27	86
14	37-019-020203-1	9	60,938	168,300	18	94
15	37-019-020602-2	12	55,588	138,400	21	97
16	37-019-020106-1	11	58,734	171,000	19	95
17	37-019-020105-1	3	72,546	270,700	14	87



Low Density of natural elements. Effort required for immersive nature exposure opportunities.



Moderate to low density of natural elements. Effort may be required for immersive nature exposure opportunities.

Balanced mix of natural and built environmental

elements. Modest effort may be required for

NATURE RICH

immersive nature exposure opportunities.

Significant natural elements. Modest effort may be required for immersive nature exposure opportunities.



Abundant natural elements and nature exposure opportunities.

Figure 13. NatureScore™ by census block groups.

CONCLUSIONS AND RECOMMENDATIONS

Leland has demonstrated that it values its natural resources and wants to maintain a healthy and sustainable urban environment. Recurring assessments of the Town's tree canopy represent important steps in ensuring the long-term health of its local canopy. As the Town grows, it will be able to use these data to ensure that its canopy policies and management practices prioritize its maintenance, health, and growth. An even greater percent of canopy cover can be achieved with proper planning, investment, and care of existing trees. The Town should continue to monitor the health of the local forest and implement the following recommendations to ensure the canopy is considered during future town planning and development to sustain and enhance the benefits that trees provide to the community.



LEVERAGE THE RESULTS OF THIS ASSESSMENT TO PROMOTE TREE CANOPY

Encourage investment in urban forest monitoring, maintenance, and management; prepare supportive information for local budget requests/grant applications; help establish new canopy cover goals; engage the community and develop an urban and community forest plan to guide the management, conservation, and renewal of the Town's trees; repeat assessment at least every five years to track progress towards goals.

IDENTIFY AREAS TO PRIORITIZE CANOPY EXPANSION

Plantable space in the right-of-way is often found close to high concentrations of impervious surfaces. The Town of Leland can develop a proactive street tree maintenance program to take on the responsibility of planting and managing street trees, ensuring healthy trees are distributed equitably across the town. Leland's right-of-way contained only 12% tree canopy cover compared to the town-wide average of 51%. An additional 24% of the ROW was plantable space.





DEVELOP OUTREACH PROGRAMS TOWARDS PRIVATE LANDOWNERS

Community outreach and education programs can better inform citizens and private landholders of the environmental, health, social, and financial benefits that trees provide. Tree canopy in Leland provides over \$2.6 million in annual ecosystem service benefits. Tree giveaways, tree planting programs, and tree maintenance events can help to promote new tree plantings.

FOCUS NEW PLANTINGS IN HIGH PRIORITY AREAS

This report and the State's TreePlotter CANOPY application can be used to locate priority areas based on tree canopy cover, available planting space, sociodemographic factors, and nature accessibility. Efforts should focus on outreach to the residents of these neighborhoods, as well as local business and land owners, in order to promote new tree plantings and continued maintenance of existing trees.





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TREE CANOPY COVER **ASSESSMENT** LELAND, NORTH CAROLINA









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