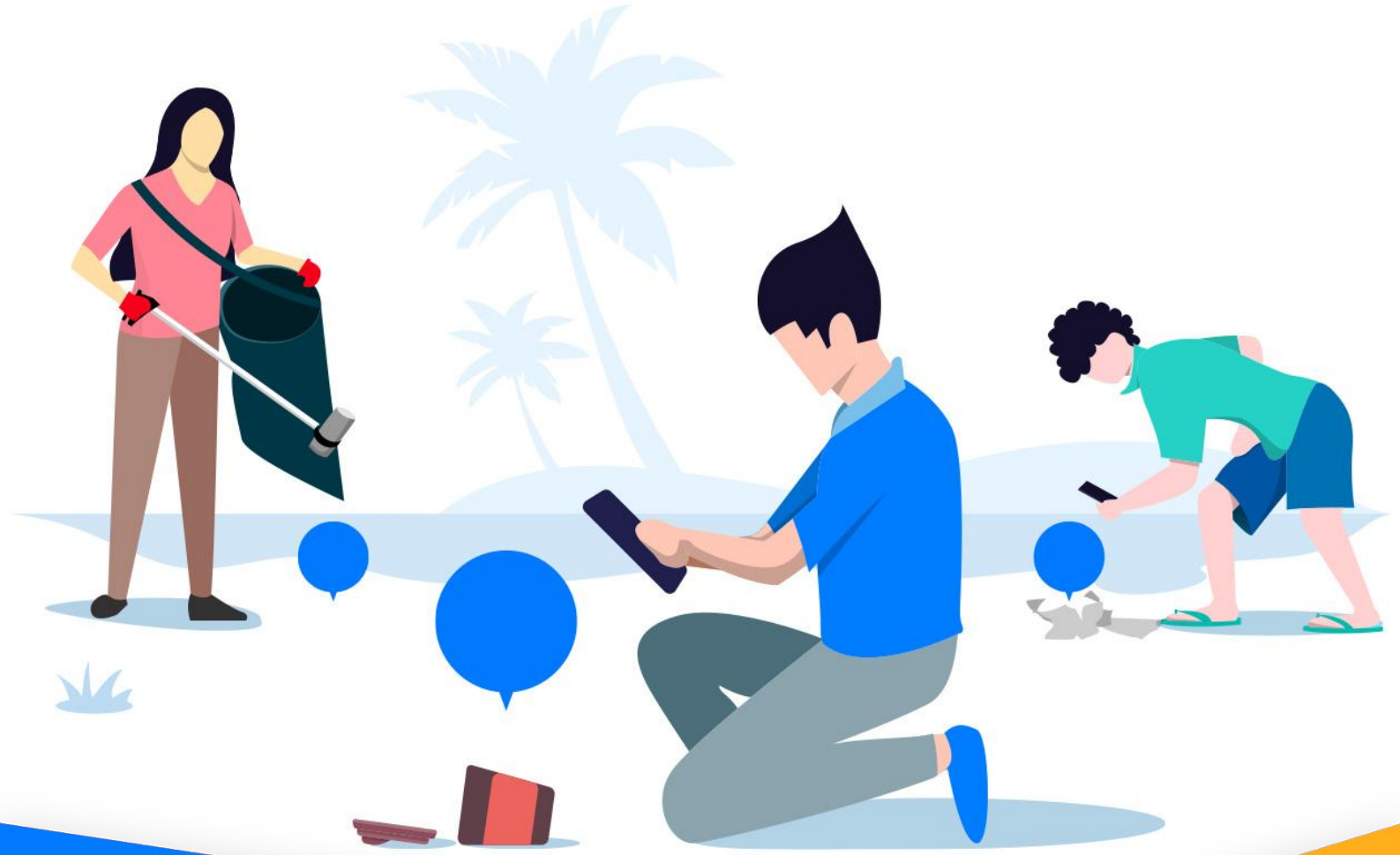
LITTERATI



Empowering People to Clean the Planet

www.litterati.org

Litterati 2020

Wake County Final Report

December 2020

Index

Executive Summary

Executive Summary

The Wake County Environmental Services/Solid Waste Management Division engaged with Litterati to conduct a “fingerprint” study of litter trends and composition throughout Wake County. The Wake County Environmental Services Division concentrates on environmental concerns and is made up of divisions that work to educate the public and regulate and enforce activities in the environmental and health arenas. Litterati is a global litter intelligence company that is on a mission to eradicate litter throughout the world using a machine learning enabled app and dashboard to provide insights into litter composition by using geo location and tagging of materials, objects and brands to better understand littering trends.

This initial research was conducted over October 17th-19th, 2020 using six Litterati certified researchers. These researchers conducted litter surveys at 60 locations for a total of 120 segments (two segments at each location). These areas were selected with the goal to survey areas in all twelve municipalities that comprise Wake County. The Litterati team also used historical data based on 86it Pledge addresses and 86it Cleanup addresses as well as a variety of demographic and land use data to identify the most diverse location selection possible. The researchers used the Litterati app to document and identify the litter by object, material and brand composition at each segment over the 60 locations.

The results of the study are captured in this final report, which lays the foundation of a data-driven action plan to prevent litter in Wake County. This study will provide an overview of the results and findings from the initial research as well as mapping and data that Wake County can continue to use and build upon to identify and evaluate strategies to combat the littering trends analyzed in this study.

The Litterati team employed our behavioral science, data science, and cities teams to analyze the data and synthesize patterns. This report provides insights into the littering behaviors, and trends throughout Wake County based on the data collected. The team found six insight areas that reveal interesting observations based on historical data and site selection. As behavioral science studies of littering have shown, littering behavior is highly contextual. Research indicates there is no one type of person that always litters or always avoids littering. So it was of the utmost importance that a large diversity of land use types and demographic areas were surveyed and cross referenced with the litter composition data collected by researchers. The results were illuminating and expansive and the Litterati team intend that Wake County Environmental Services/Solid Waste Management Management Staff will be able to build on these patterns and insights to formulate new strategies or build off existing strategies to combat litter in Wake County.

To support this effort, the Litterati team worked on a set of recommendations based on the patterns and insights as well as the current policy, legislative and budget conditions of Wake County. The Litterati team strived to make sure these recommendations are effective, realistic and sustainable to reduce and prevent litter in Wake County. These recommendations correspond to the patterns and insights section and are organized into the following areas:

1. **Targeted Litter Reduction of Cigarettes and Beverage Containers**
2. **Targeted 86it Program Improvements**
3. **Targeted Demographic Interventions**
4. **Targeted Land Use Interventions**
5. **Targeted Bus Stop Platforms and Roadways Interventions**
6. **Targeted Fast Food Interventions and Partnerships**

Finally, the Litterati team also formulated next steps where more focused research analysis or community engagement could be conducted by the Litterati team to expand the impact the Environmental Services/Solid Waste Management Management Staff can achieve with Litterati to create a cleaner Wake County.

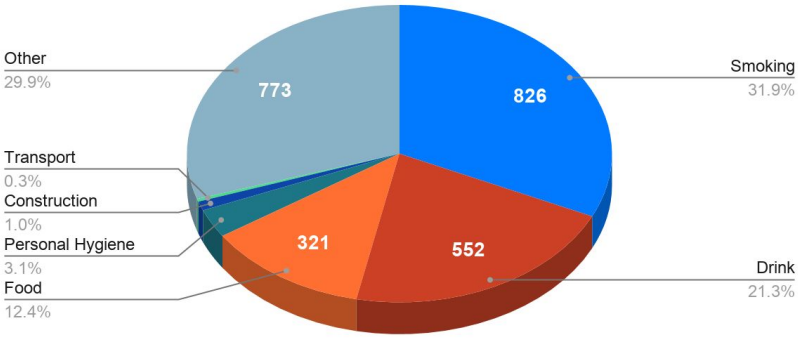
Results & Findings

Results & Findings

Research was conducted in a total of 60 locations, comprising forty-one (41) across the 12 municipalities and nineteen (19) in unincorporated areas of Wake County.

During the research period, 2,588 pieces of litter were collected and identified by object type and material type. Of these pieces of litter, 452 were attributable to a specific commercial brand.

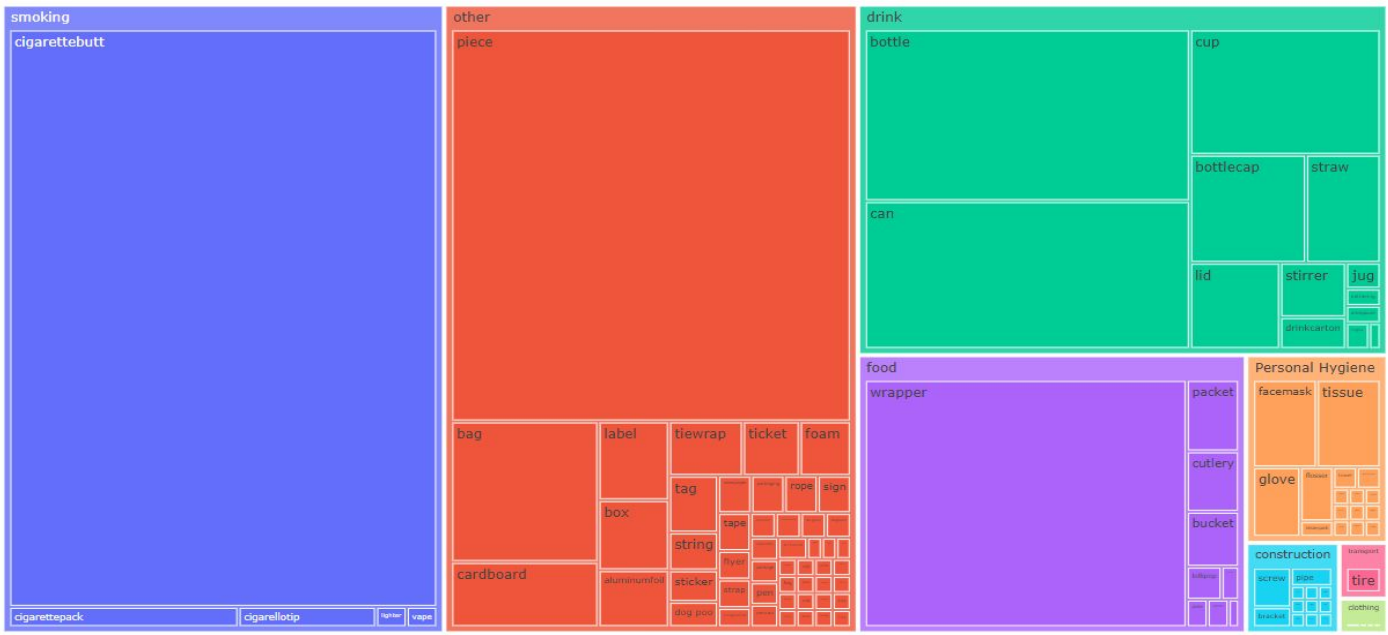
Number of items collected by Category



- Most littered items were in one of three object categories; 31.9% smoking, 21.3% drink, 12.4% food.
- The most littered material type was plastic and cellulose acetate (cigarette butts)

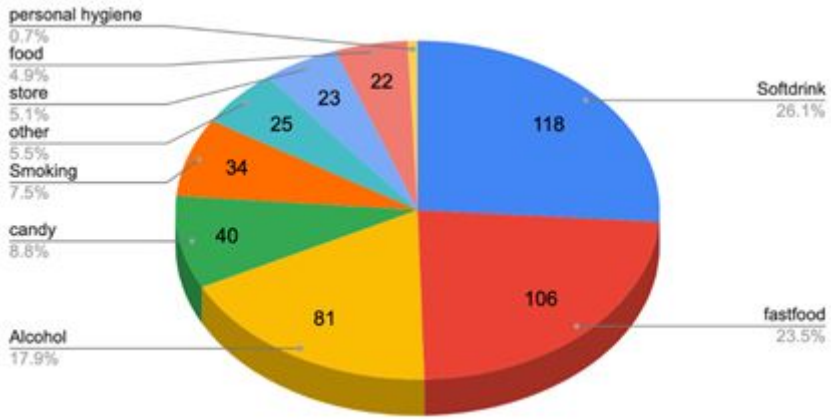
While not all litter found can be directly connected to a brand, 17% of the all litter collected were attributable to a either a consumer packaged goods or restaurant brands. Of that litter attributed to brands, 52.8% were consumer packaged goods and 23.5% were fast food restaurant packaging.

Items found by category, subcategories



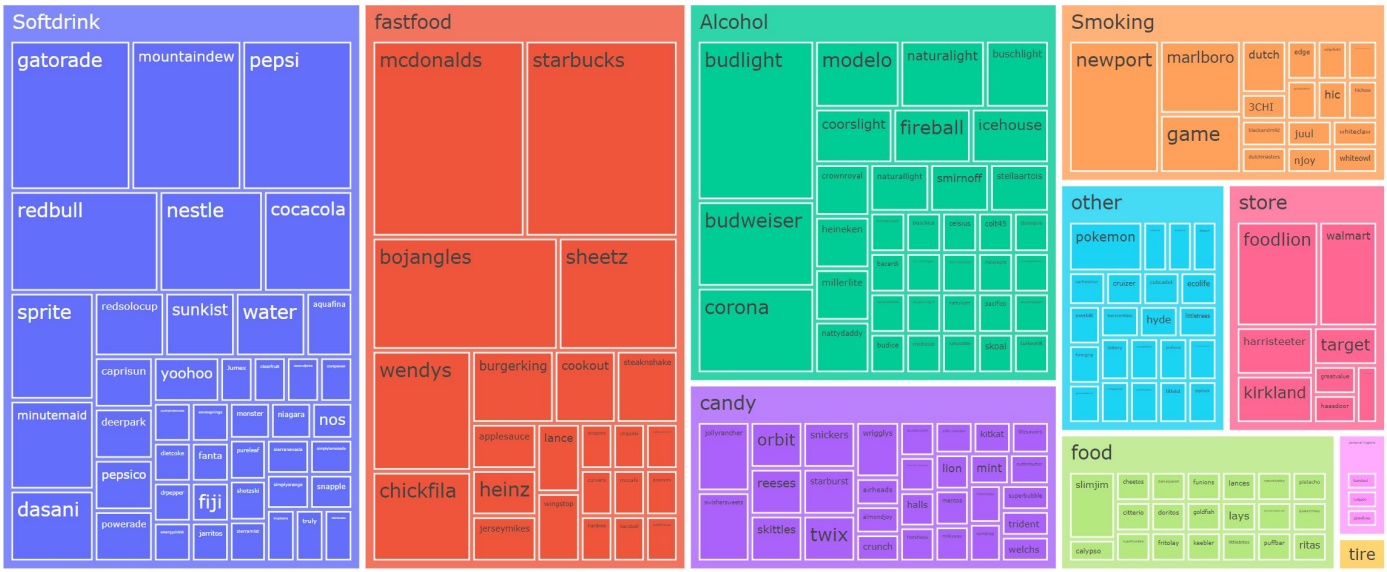
Cigarette butts, items connected to drinks/beverage consumption, and food were found most frequently. Items that were not easily identified or attributed to a category were tagged as ‘other’. While a large percentage of these items were small pieces of debris, a notable portion of these items were bags (generally plastic bags).

Number of brands identified by Category



Of the 202 brands that were identified, items from the following brands were littered most: PepsiCo, McDonald's, Starbucks, and Anheuser-Busch.

Items found by category, brands

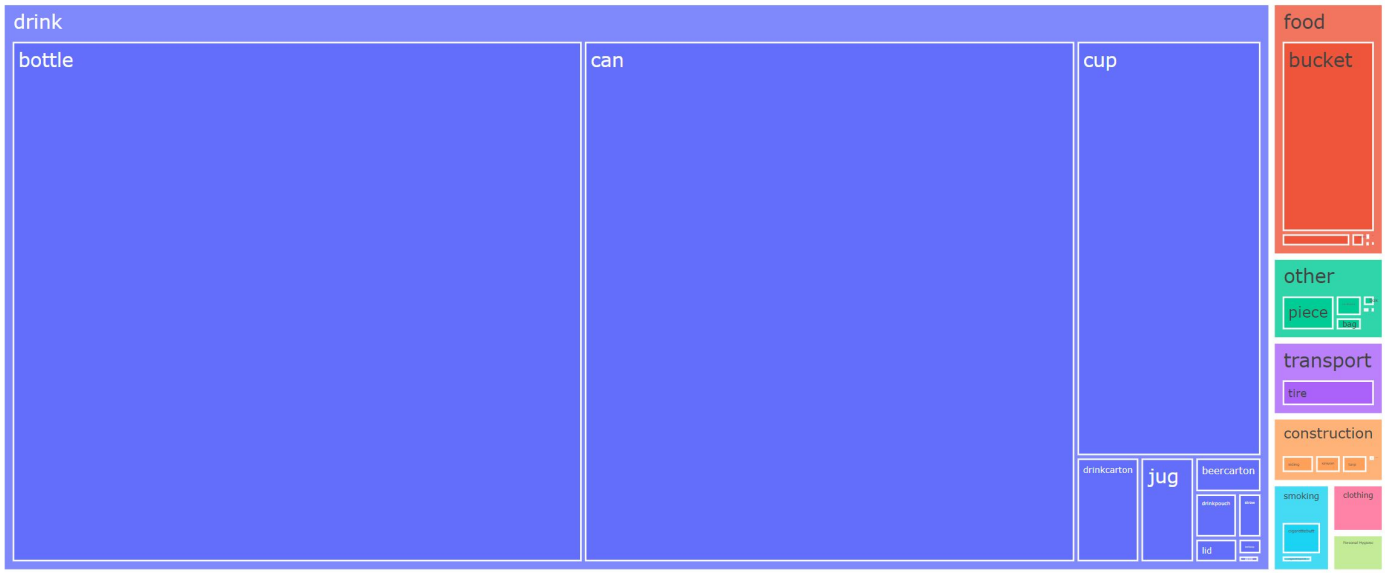


Identified brands within each category, allow for a deeper understanding of the type of litter found most frequently, inviting an opportunity to connect with establishments where items are sold.

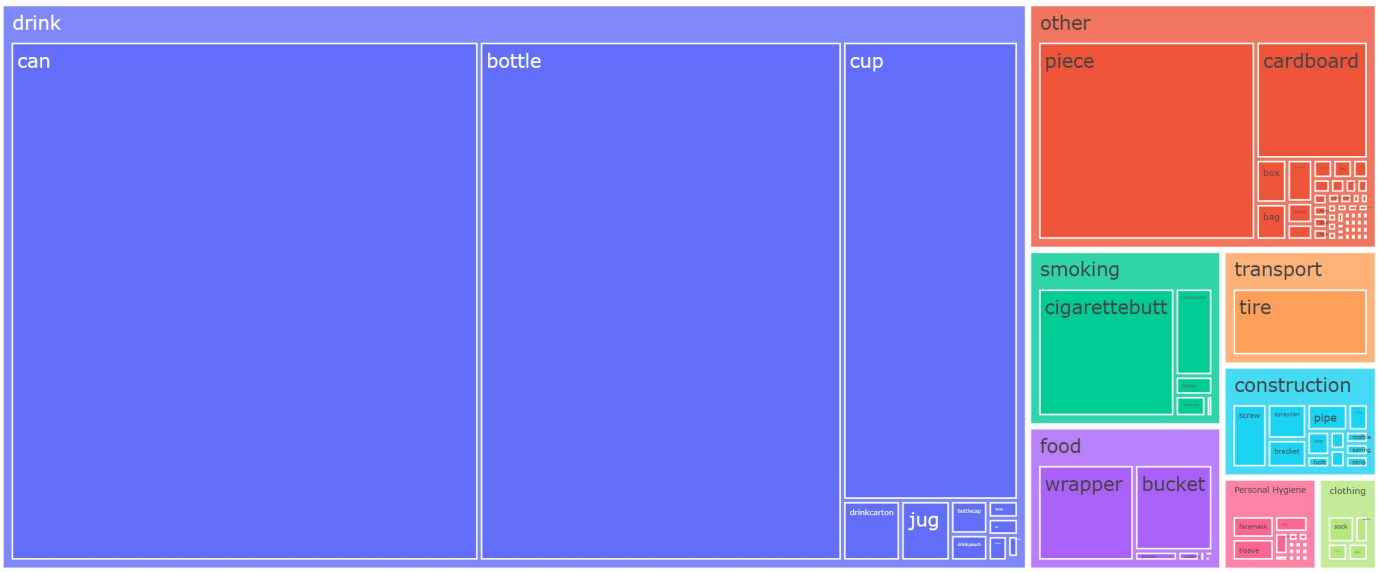
The most commonly found litter with an identifiable brand were items from soft drinks, fast food, alcohol, candy, and smoking categories.

Of all items found, items in the drink category were ranked highest by weight as well as volume.

Items found by category, weight



Items found by category, volume

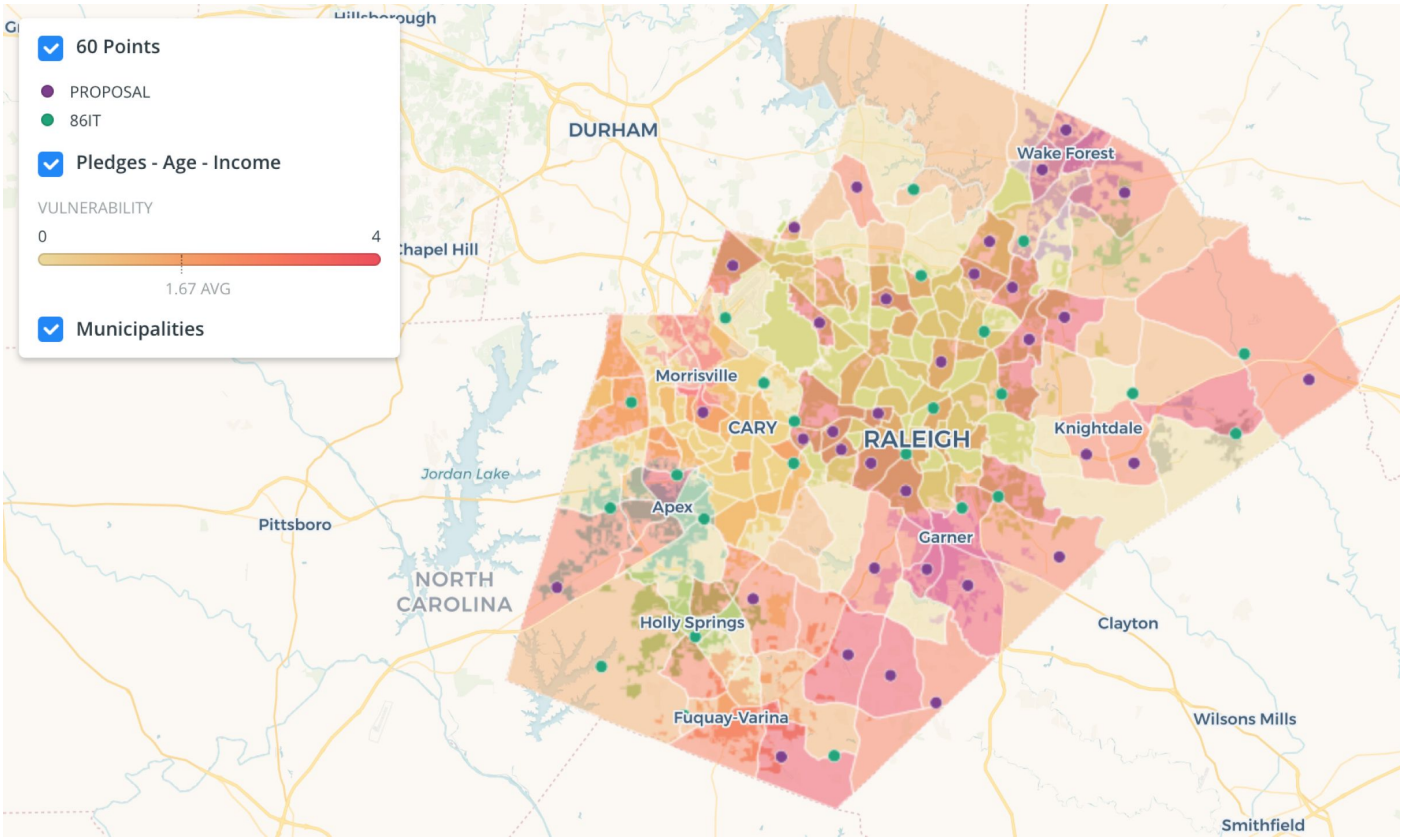


Maps

Maps

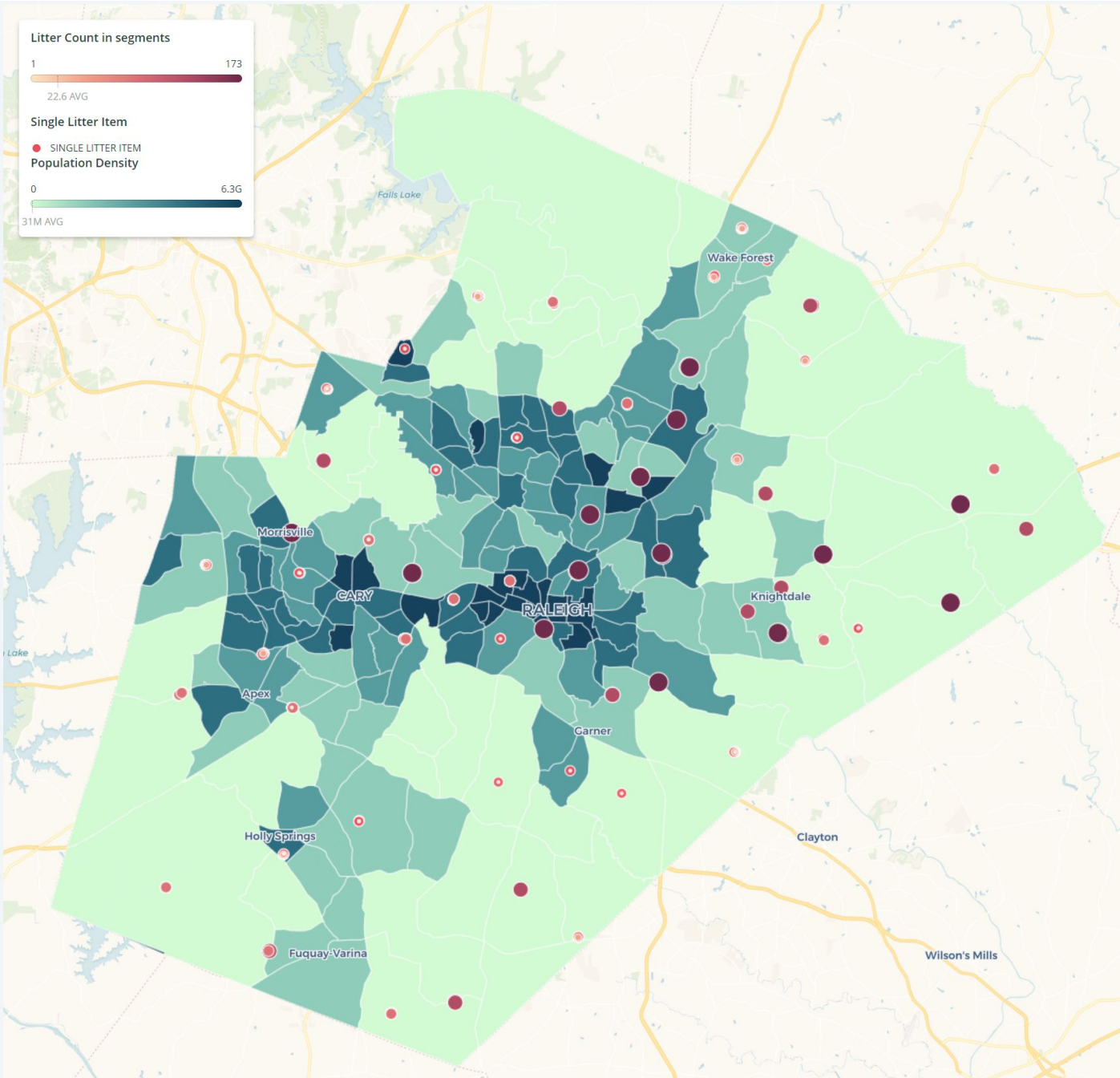
Litterati partnered with CARTO to generate a visual representation of the data collected, layered with additional insights from open data sources. The maps provide an interactive view of the locations and litter found at each location.

Research locations for Wake County Fingerprint Study (link)



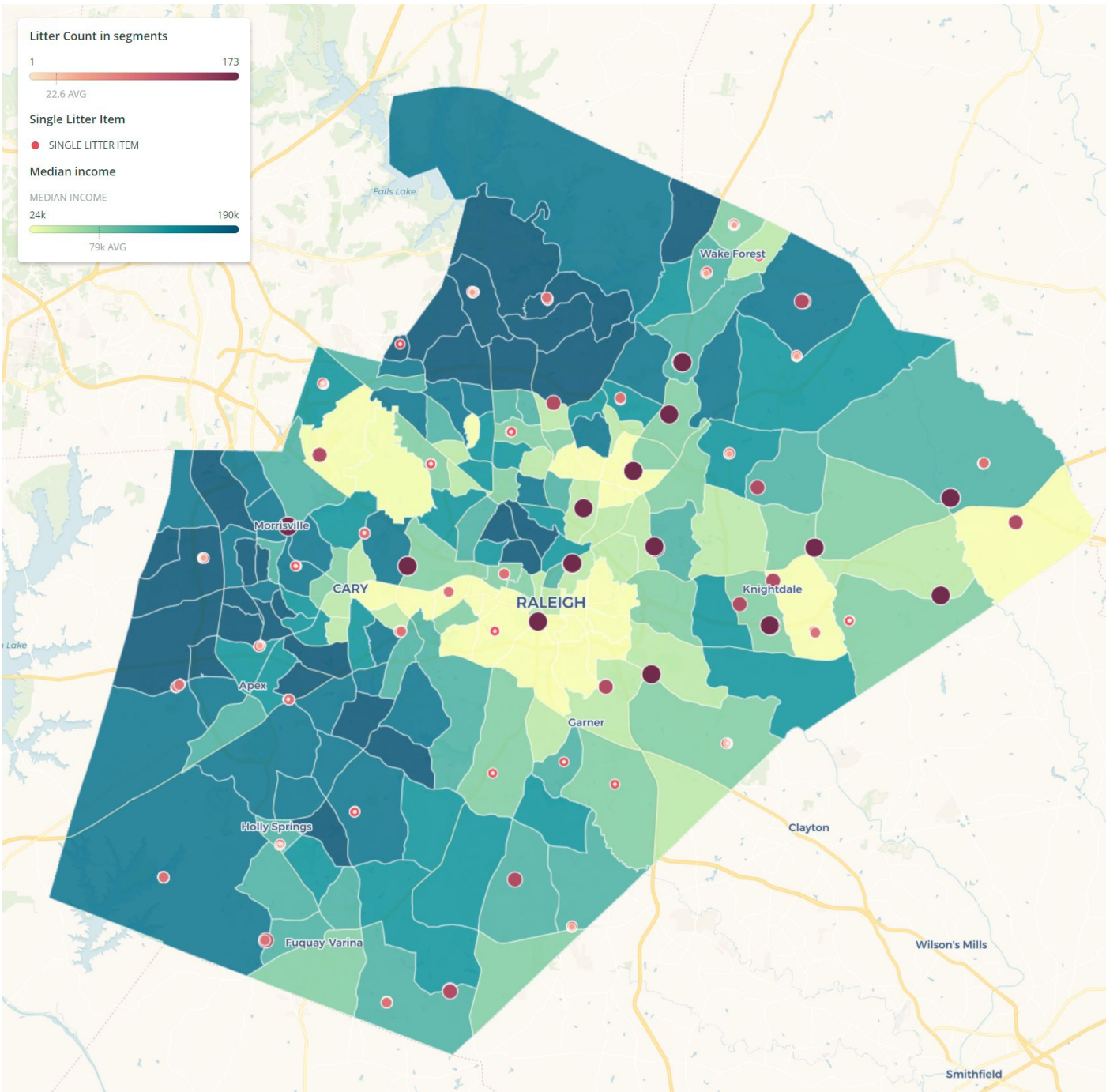
1. Litter vs Population density
2. Litter vs Income
3. Commercial, Parking, Bus Platforms & Population Density - Cigarette Butts
4. Commercial, Parking, Bus Platforms & Median Income - Cigarette Butts
5. Vacant lots & Population Density - Plastic bottles/Aluminum Cans
6. Vacant lots & Income - Plastic bottles/Aluminum Cans
7. 86it Cleanup Locations & Population Density
8. 86it Cleanup Locations & Income

1. Litter vs Population Density



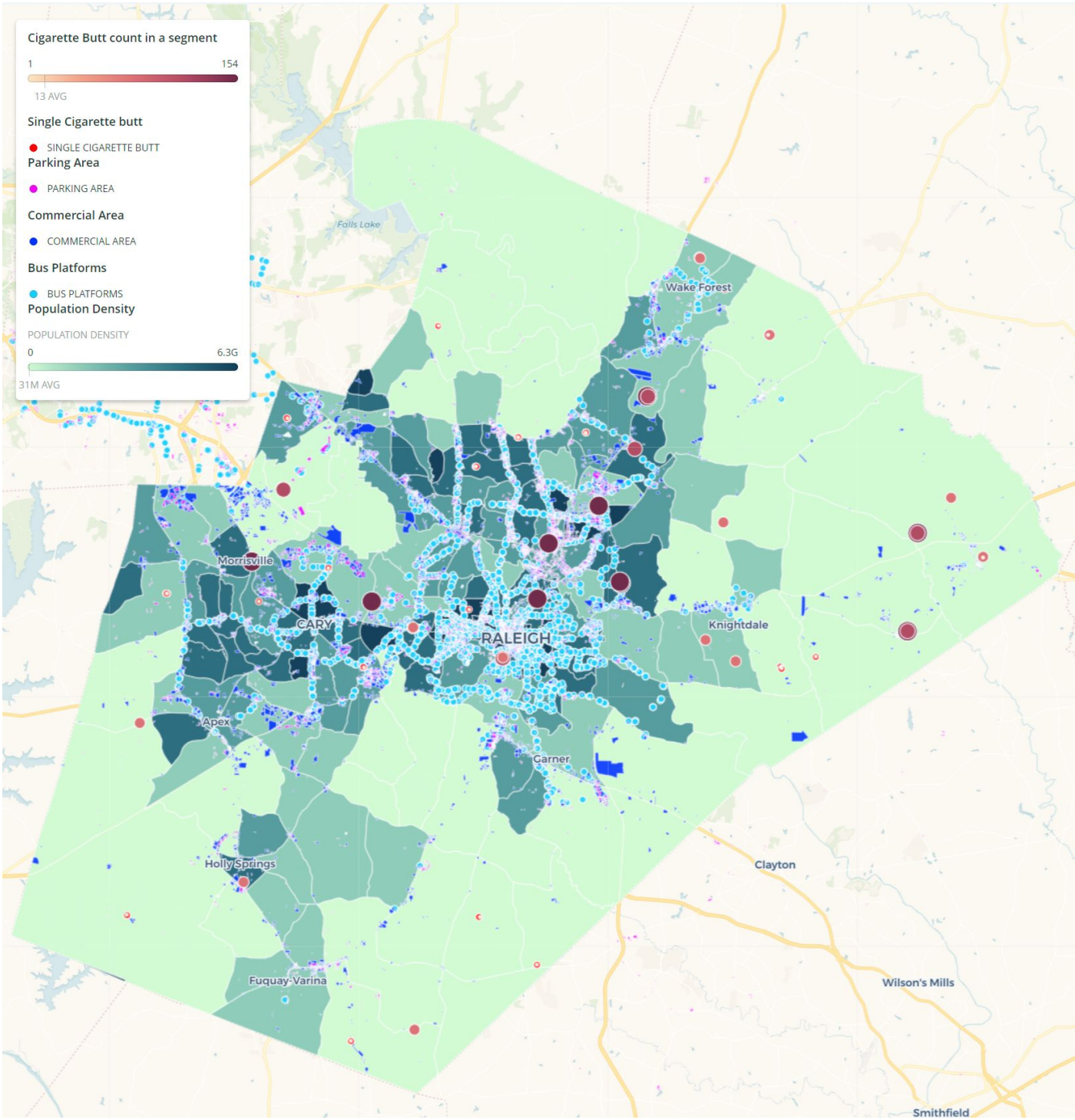
There is a correlation between population density and higher volumes of litter. Darker red circles represent the greatest litter contamination in or adjacent to densely populated municipal corridors.

2. Litter vs Income



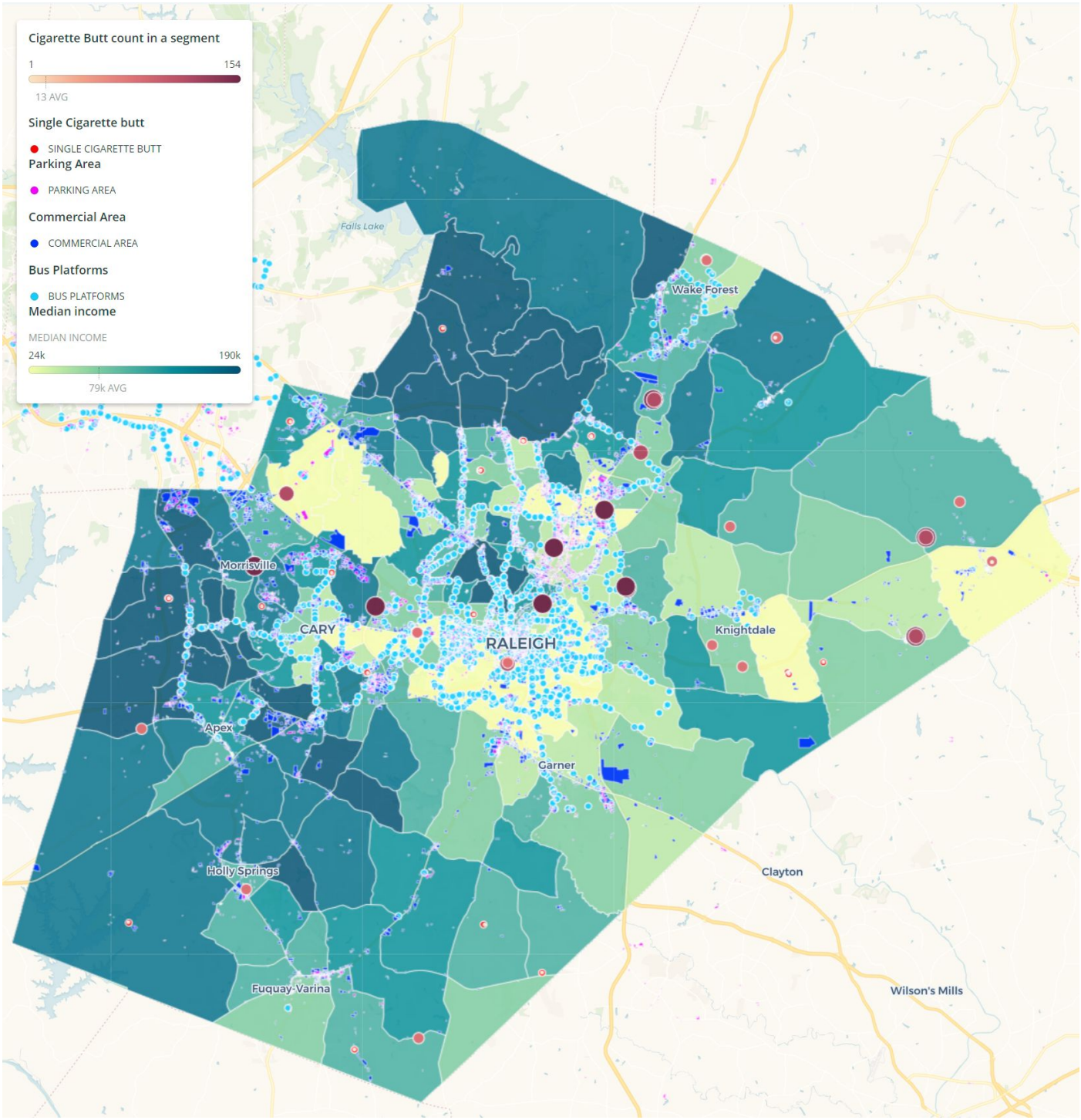
Lower income neighborhoods and geographies indicated by light yellow, have a higher concentration of litter according the the litter data collected through Litterati research..

3. Commercial, Parking, Bus Platforms & Population Density-Cigarette Butts



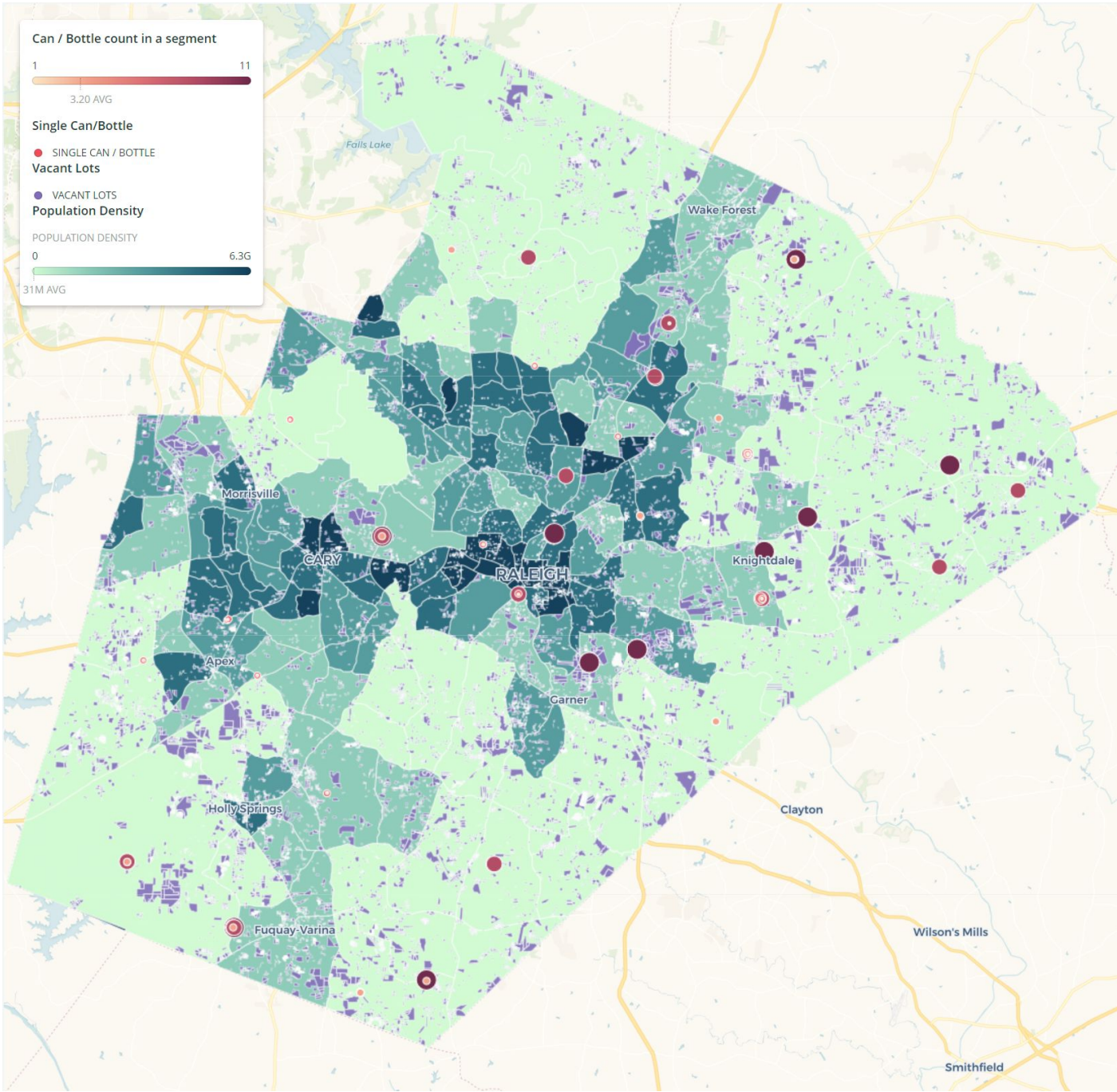
While transport hubs demonstrate a high concentration of litter in central locations that are also densely populated, not all transportation hubs have a high representation of litter.

4. Commercial, Parking, Bus Platforms & Median Income - Cigarette Butts



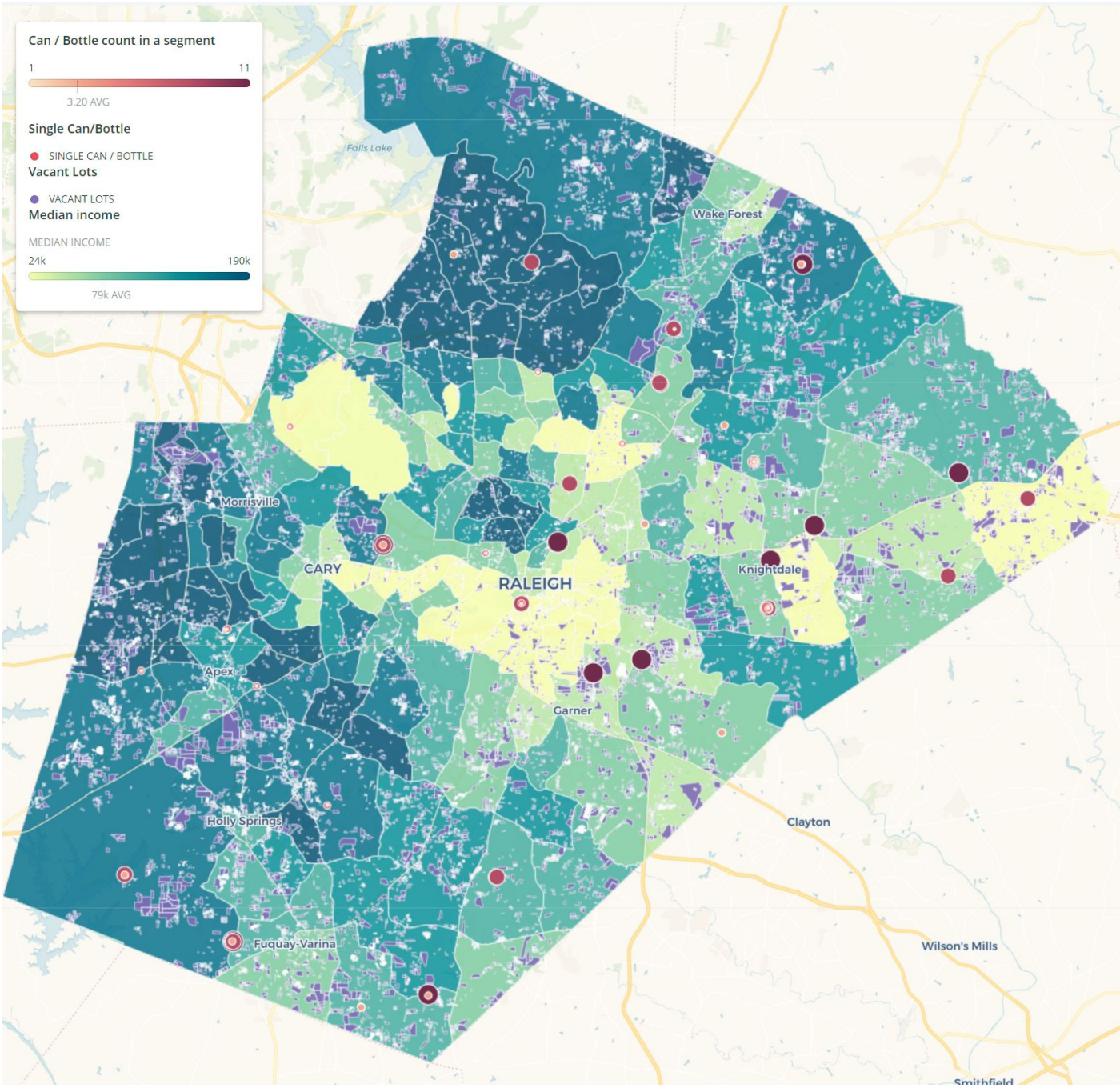
Segments near all three of the commercial areas, parking areas and bus platforms had more litter compared to other segments (particularly cigarette butts). When plotted on top of each other a high number intersections can be observed. This could be driven by the higher number of transport facilities in commercial areas. It leads to an insight that cigarette butts are found at a higher frequency near commercial areas which have good transport facilities (either through parking or buses).

5. Vacant lots & Population Density - Plastic bottles/Aluminum Cans



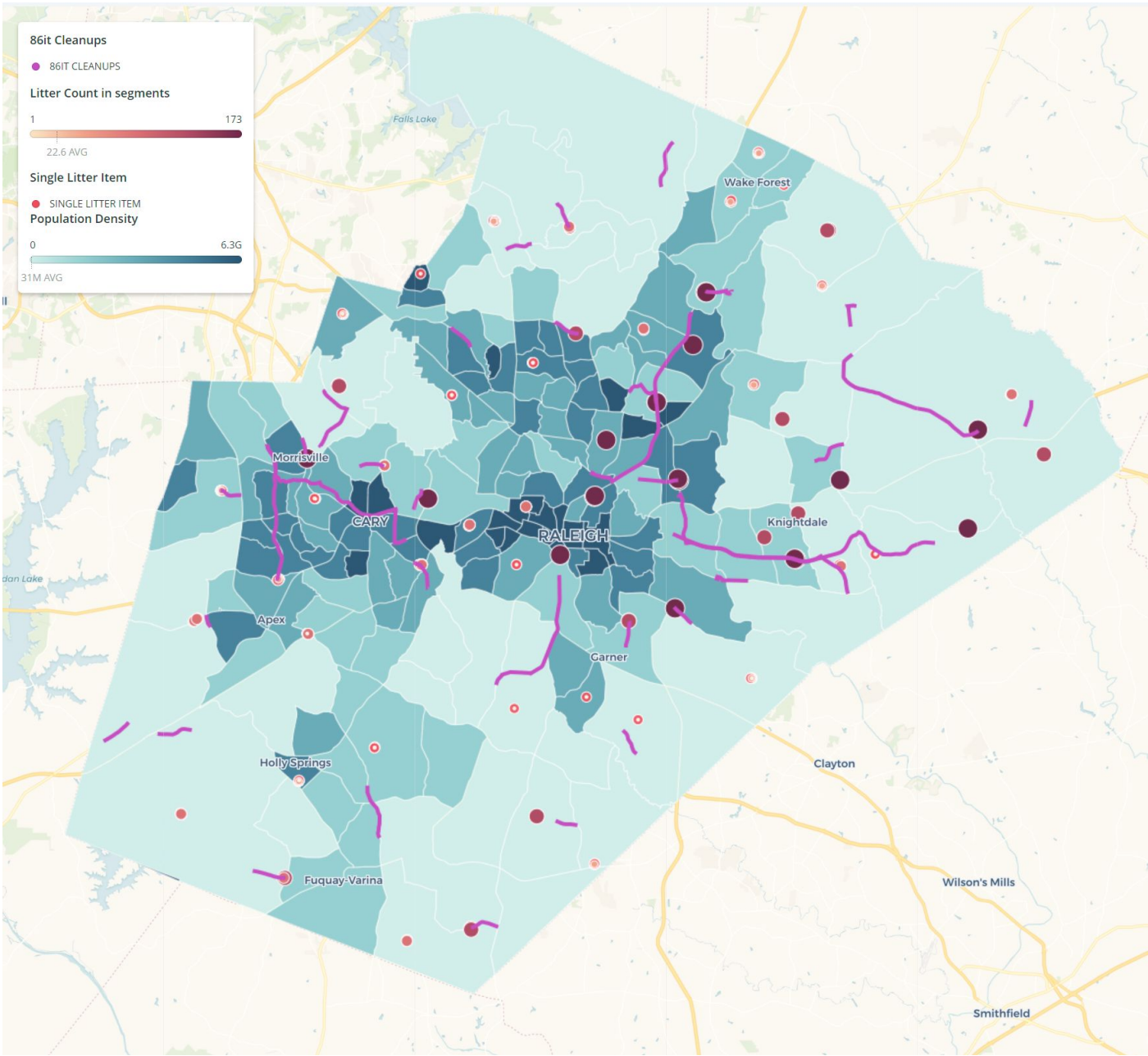
More bottles/cans (bigger and darker red circles) are found more frequently in segments near vacant lots compared to other segments. Also vacant lots themselves are found more in suburban/rural areas (less population density) compared to urban areas (more population density).

6. Vacant lots & Income - Plastic bottles/Aluminum Cans



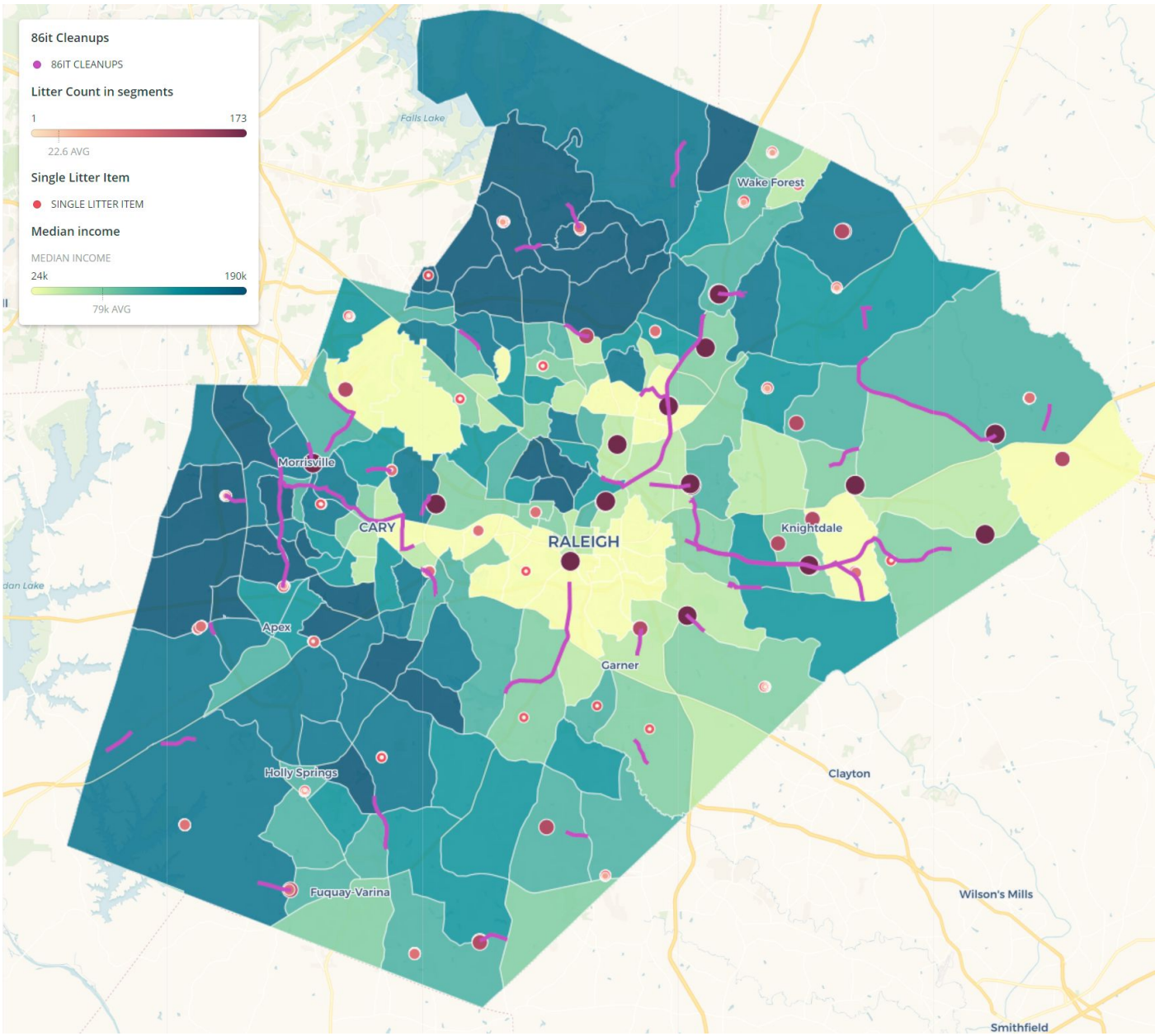
Vacant lots are found more in mid-higher income areas (suburban/rural areas generally have higher income) compared to lower income areas (urban areas generally have lower income).

7. 86it Cleanup Locations & Population Density



In reviewing 86it locations relative to litter concentration, Litterati research confirmed that 86it locations are hot spots for litter concentration and need continued effort for litter abatement.

8. 86it Cleanup Locations & Income



More litter items (bigger & darker red circles) are found more frequently in segments near 86it cleanups compared to other segments. The county should increase the waste infrastructure in these locations and raise awareness about it.

Insights & Patterns

Insights & Patterns

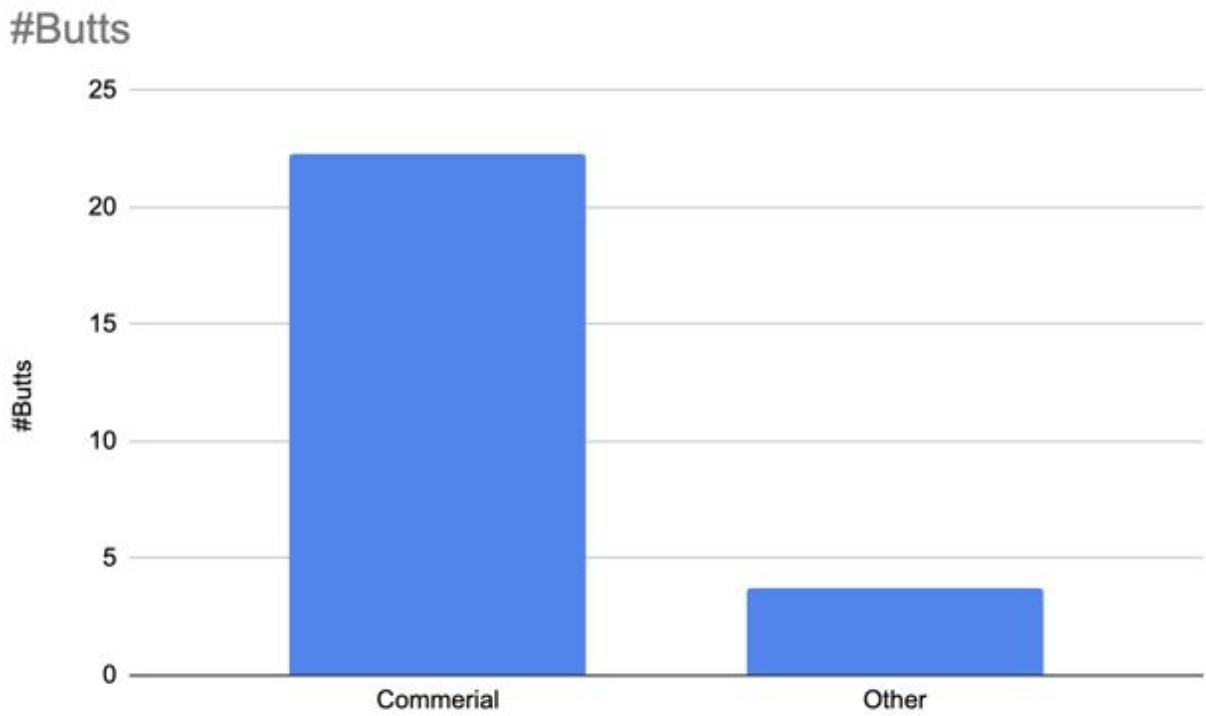
The Litterati team has identified six insights based on the results and findings that are integral to our understanding of litter in Wake County. This section includes data and points of insight for further analysis to understand where Wake County can focus efforts to make sustainable and impactful change in litter conditions.

Insight 1: Top Littered Objects by Incidence, Weight and Volume

1a. Cigarette Butts were found to be the top littered object by incidence meaning that in the 60 areas that were researched, cigarette butts were most commonly found. This tracks with studies by entities such as Keep America Beautiful that identify cigarette butts as one of the most littered objects on the planet.
However, our data has also found occurrences of other cigarette products related to vaping and cigar tips which have become more popular with younger people. Below is data showing where cigarette related litter was found in relation to commercial and residential areas as well as other data on the types of cigarette material found.

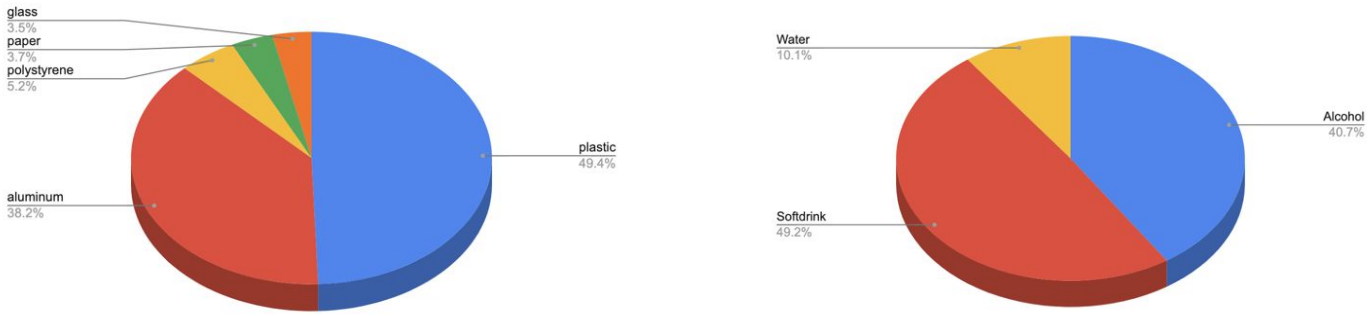
1b. Drink containers were identified as the top objects found by weight and volume. Although there were less incidents of this litter than cigarette butts, beverage containers are much larger than cigarette butts and thus are more visible to the general public.

Prevalence of Smoking Related Litter on Commercial Sites Vs. Other Sites



- 52% of commercial segments had smoking related litter “butts, packs & tips.”
- Five times the amount of cigarette butts were found within 500m of commercial land vs other
- In commercial areas, cigarette butts accounted for 98.55% of smoking related litter while cigar tips and vaping products accounted for 1.45% of smoking related litter.
- In non-commercial areas, cigarette butts accounted for 99.15% of smoking related litter while cigar tips and vaping products accounted for 0.85% of smoking related litter.

Litter Composition of Beverage Containers



- Drinks objects identified as “bottles, cans, and cups” were found at 54% of the segments (64 of 120).
- 92% of these materials are recyclable (Plastic/PET, Aluminum, Glass).
- Cans and bottles are more likely to be found near vacant lots.
    - 4.625 aluminum cans were found per segment within 150m of a vacant lot versus 1.88 aluminum cans within 150m land types.
    - 3.91 plastic bottles were found per segment within 150m of a vacant lot versus 2.96 plastic bottles within 150m other land types.
    - 22.414% (52/232) of bottles near vacant lots were alcohol related compared to 13.3% (29/218) of alcohol related bottles found near other locations
- 10% of the beverage litter found was related to water containers.

Insight 1 Takeaways:

- Some cigarette smokers wrongly believe that cigarette butts are nontoxic and highly biodegradable.
- Generally, smokers report fearing that cigarette butts will ignite trash within normal waste receptacles and few outdoor ashtrays are available.
- People are most likely to litter while on the move, either on foot or in a vehicle. Beverage consumption is easy to do while on the move including while driving.

- Although cigarette butts were more prevalent, given that beverage containers are larger and more visible, they lead a greater perception of littered conditions.
- Beverage containers such as aluminum cans and PET bottles are recyclable in Wake County, however, people are still littering at greater rates than non-recyclable containers.
- There is a higher incidence of alcohol related bottle litter near vacant lots than other land use types.
- Although water related containers were just 10% of the litter, it's still a large percentage of a product that can easily be consumed through drinking tap water.

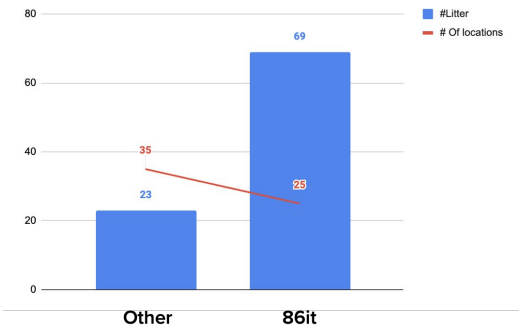
Insight 2: Litter Conditions Across 86it Pledge Locations and 86it Cleanup Locations

A major dataset Litterati used to guide the selection of the 60 areas for research was the locations of 86it Clean Up Locations and 86it Pledges. The 86it Program is a unique and innovative program to engage community members in pledging to keep their communities clean and to contribute to the physical work required to keep the community clean.

As per the Wake County provided data and information on the 86it Website, 86it Clean Up Locations were defined as areas where residents in coordination with Wake County government conducted clean ups on areas identified as litter hot spots. 86it Pledge Locations were defined as segments in close proximity (under 800m) to a recorded address where a resident has taken the 86it Pledge not to litter and receive "swag" to prevent litter and promote the program.

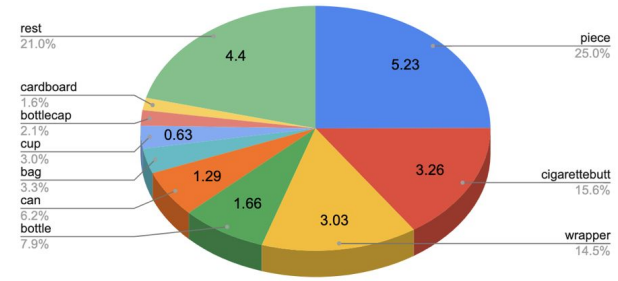
Below are graphs, charts and insights to assess the 86it Campaign's effectiveness for both pledges and clean ups in relation to Litterati research data.

Prevalence of Litter Across Non 86it Cleanup Locations Vs. 86it Clean Up Locations

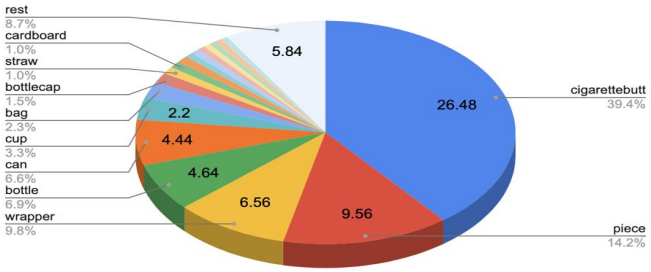


- Litter was more prevalent at locations where 86it Cleanups had occurred.
- 86it Clean Up Locations have a higher incidence of litter possibly due to the fact that these are high littered areas to begin with, which inspires more people to want to clean them up.
- While this inspiration is important, volunteers quickly can become frustrated with not seeing their cleaning efforts sustained. These areas will benefit from identification of the root causes of the littering in order to create and implement long-lasting solutions.

Litter Composition of Non 86it Cleanup Locations Vs. 86it Cleanup Locations



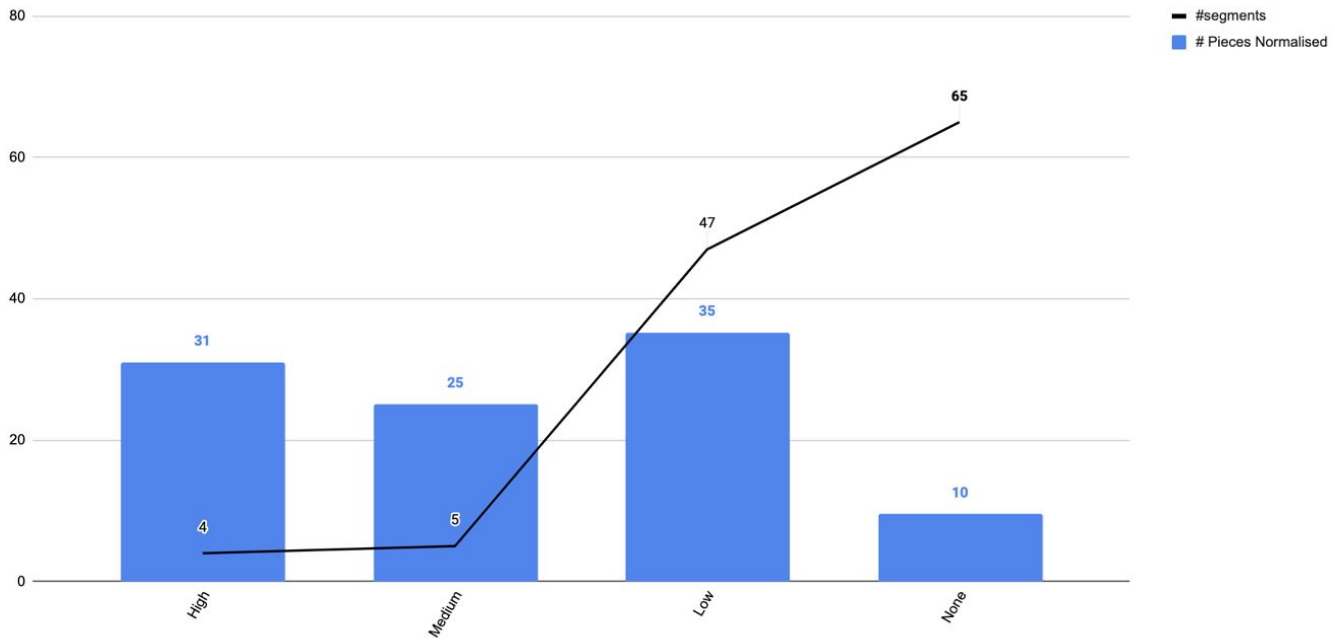
Other



86it

- 86it Cleanup Locations had more smoking, beverage and food litter
- Again, the visibility of objects like beverage and food litter lead to a great perception of a littered area and thus, more of a need to clean up.

Litter conditions of 86it Pledge Locations Vs. No Pledges Locations



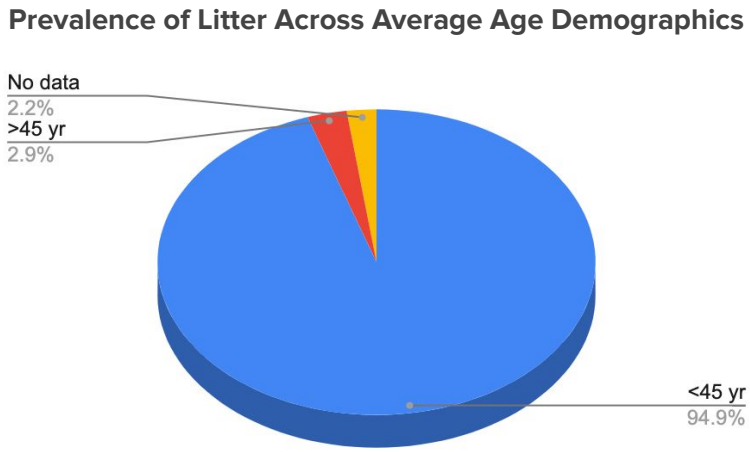
- The areas labeled high, medium and low represent varying degrees of 86it pledge locations within 800 meters of the pledge location. The areas labeled none were where there were no 86it locations within 800 meters.
- Research areas with high, medium and low numbers of 86it Pledges all had higher occurrences of litter rather than areas with no 86it pledges.
- Once again, this could be due to a pledge taker's perceptions of a littered area and the desire to do something about this littered area.

Insight 2 Key Takeaways:

- Community members participating in both 86it Cleanups and taking 86it Pledges are doing so in highly littered areas, thus responding to a perceived need for litter clean up in these areas.
- Food and beverage containers are once again highlighting the perception of littered areas and spurring people to take action.
- While this action is inspiring, continued littered conditions in these areas and perceived lack of progress can lead to demoralization amongst volunteers and less interaction with 86it Cleanups and Pledges over time.
- The 86it Pledge Campaign is highly dependent on offering “swag” to a participant, which has an associated budget cost. It was not determined in this study if this investment in “swag” actually made a difference in litter reduction in areas where residents took the pledge.

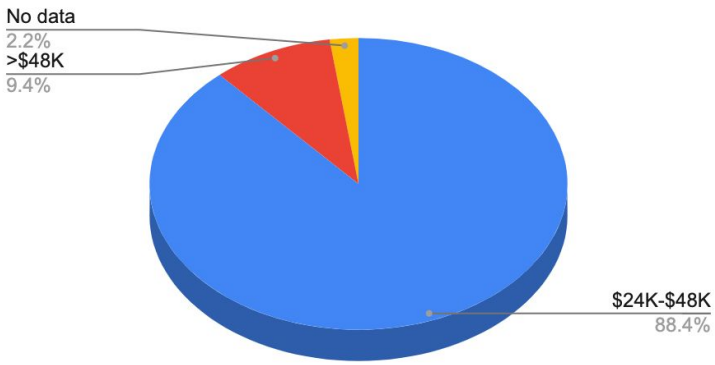
Insight 3: Litter Conditions Across Demographics

In the beginning of Wake County’s engagement with Litterati, the Wake County Environmental Services/Solid Waste Management staff expressed a desire to understand the litter conditions across different demographics across the county. These demographics included age, income, population density, housing type and municipality. Below are charts and graphs that display data across these different demographic categories.



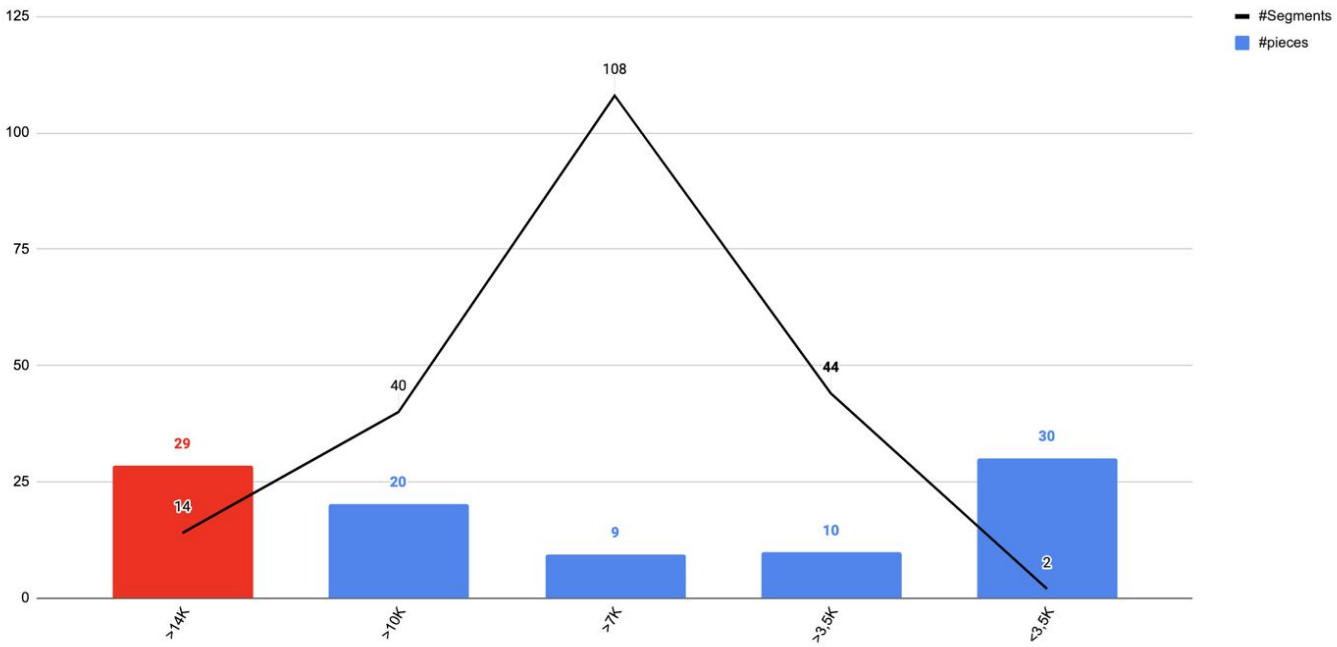
- A majority of littering was found in areas that were predominantly under the age of 45 years old.

Prevalence of Litter Across Average Income Demographics



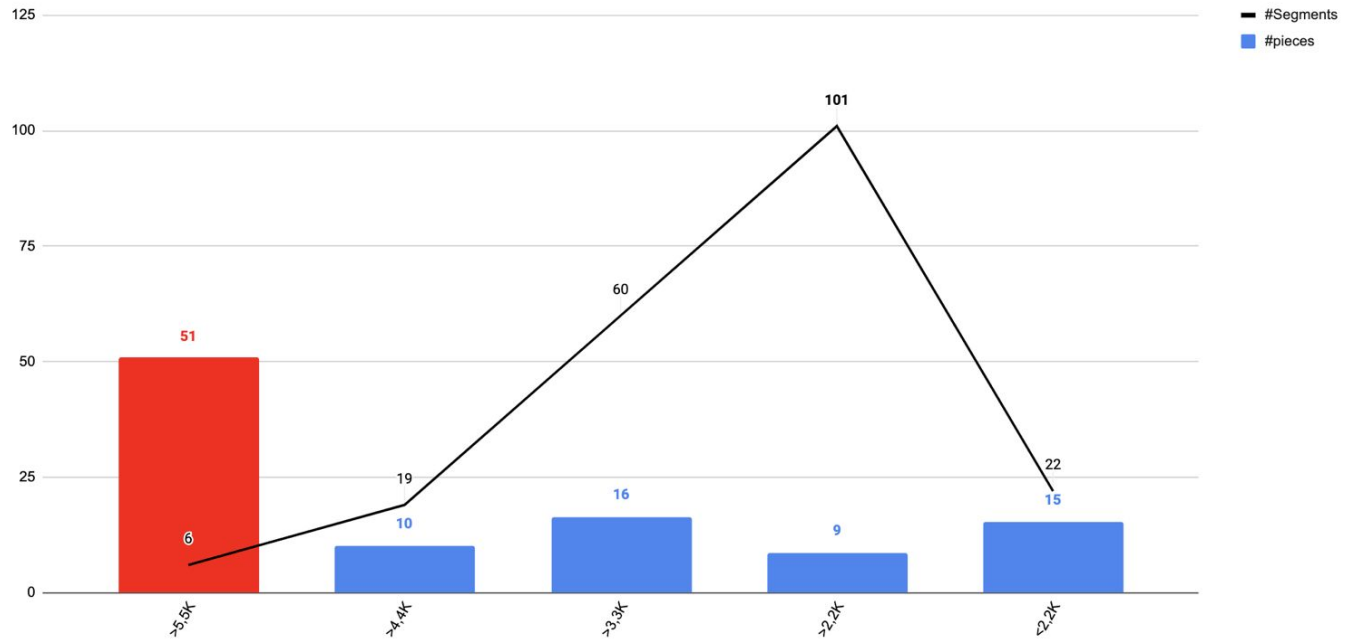
- Areas with income less than $48k reported higher litter levels
- There were 7.63 waste bins for every 10,000 people in areas with income less than $48k versus 11.43 waste bins for every 10,000 people in areas with income more than $48k

Prevalence of Litter Across Population Density



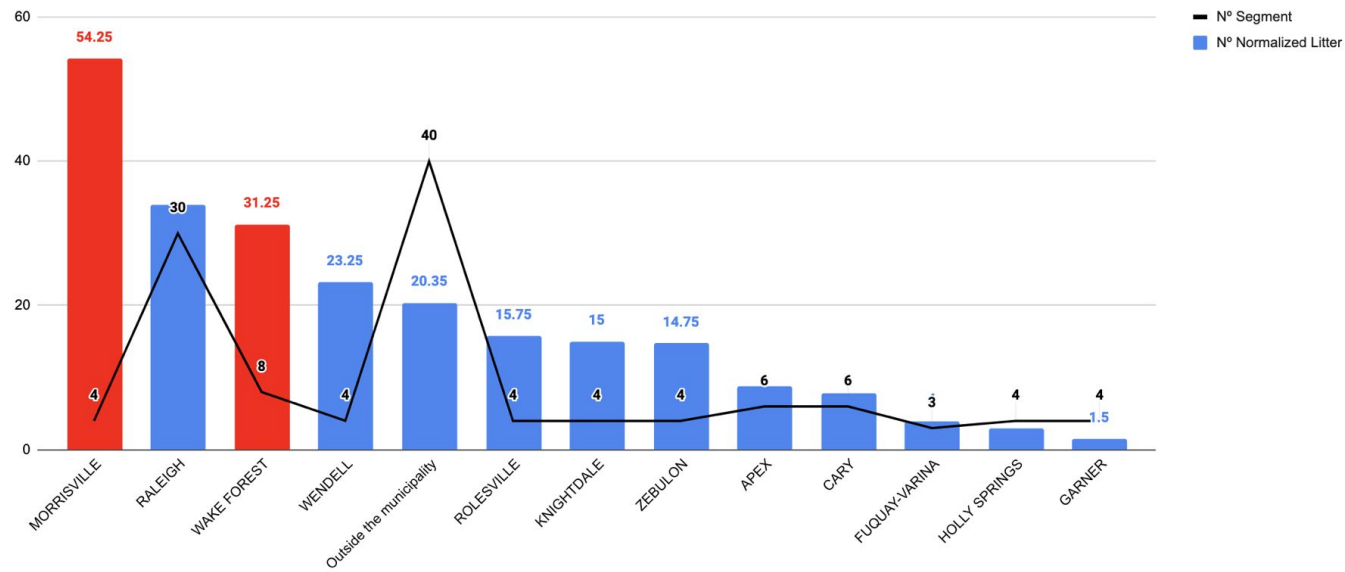
- Areas with population density greater than 14,000 people per census tract reported higher litter levels.

Prevalence of Litter Across Housing Distribution



- Areas with housing density greater than 5,500 units per census tract (link) reported higher litter levels.

Average Litter Across Wake County Municipalities



- Morrisville and Wake Forest reported higher incidences of litter than the other municipalities in Wake County.
- This data tracks with Morrisville's growth and the local government's own recognition via their community newsletters that litter is a problem in Morrisville.

Insight 3 Key Takeaways

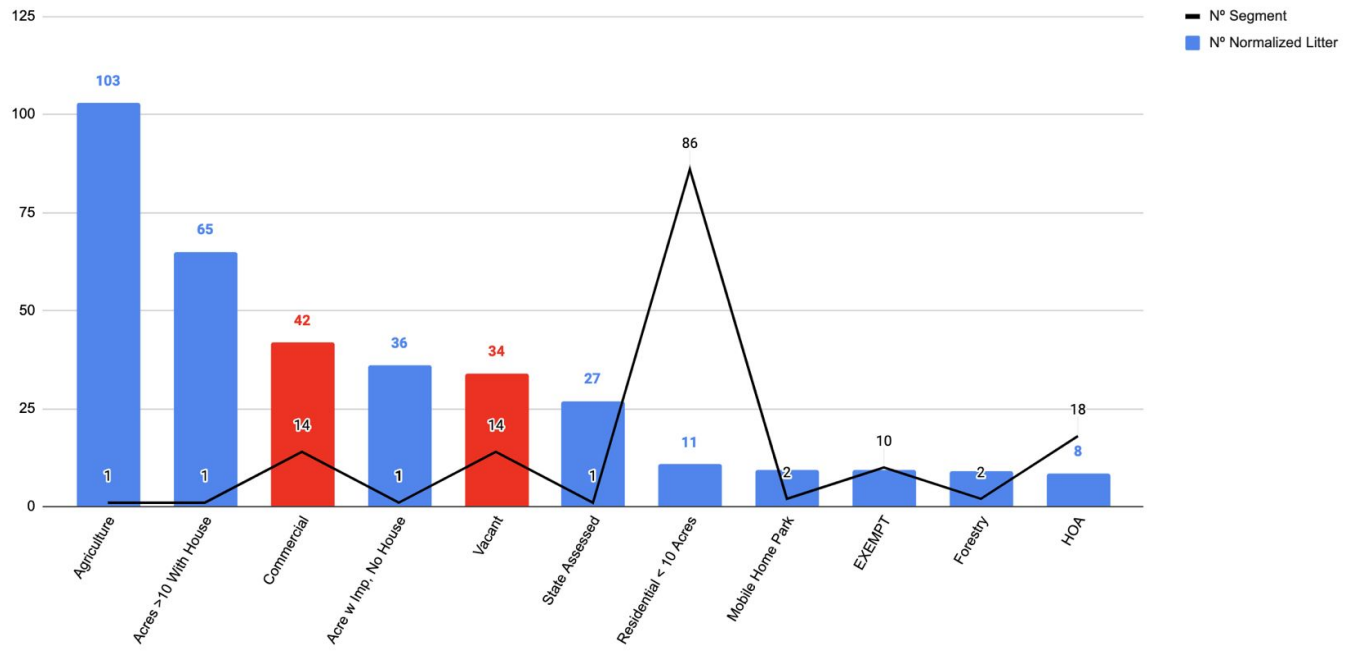
- People in the demographic groups and areas studied may have less control over timing, location, and amount of travel intersecting with mealtimes and/or smoking breaks, which could lead to more cigarette butt littering.
- Areas with the following demographic reported the highest levels of litter:
    - Containing or most accessible to people under the age of 45
    - Median incomes under $48K
    - Mid-density housing of greater thank 5,500 houses per census tract
    - Mid-density populations of greater than 14,000 per census tract
- Wake County would benefit from an investigation to determine if these areas report significant differences in waste infrastructure, municipal and commercial priorities, resources, and/or budgets.
- Further investigation may be needed to determine how commercial development (type, size, spread, proximity) differs in areas with populations predominantly under the age of 45 with median incomes under $48,000 as compared to areas with differing demographics.
- What amount of mobility is there in these areas/populations?
    - Littering is most likely when people are on the move.
- Morrisville and Wake Forest had more instances of litter than other municipalities in Wake County and may benefit from review of this report as well as deeper collaboration with Wake County government to address litter.

Insight 4: Litter Conditions Across Land Use Types

Wake County has a rich diversity of urban, suburban and rural land use types as well as a substantial amount of vacant properties throughout the county. As has been discussed within this report, litter is a very circumstantial and opportunistic issue. Thus, land use types play a major role in the circumstances and opportunities to litter.

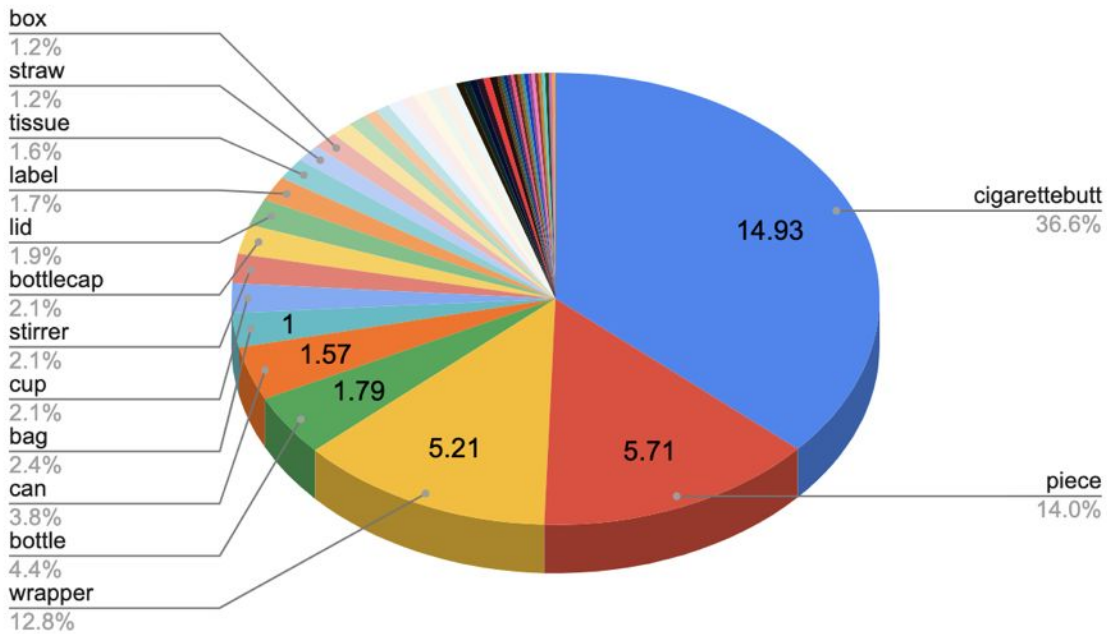
The following insight looks at amounts of litter across land use types as well as the litter composition. As Litterati research shows, vacant and commercial land had the highest incidences and amounts of litter across land use types. These littered areas also correlated with the top objects of cigarette and beverage container litter found throughout the study. However, the data suggests that vacant land suffers more from beverage container litter while commercial land suffers more from cigarette butt litter.

Litter Conditions Across Land Use Types



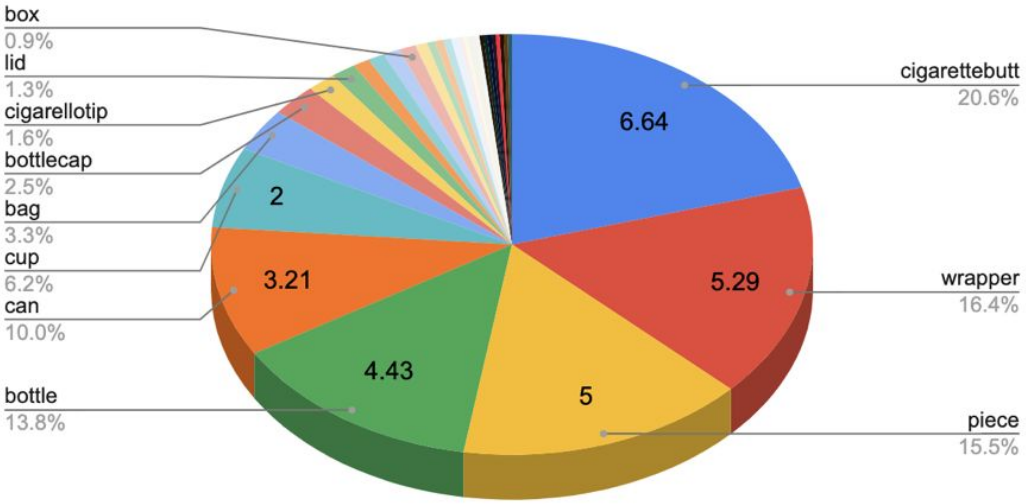
- Commercial land and vacant land were the top two highly littered areas in relation to the amount of segments researched.
- Although agricultural land and residential lots greater than 10 acres had the highest amounts of litter, there was only one segment researched for each of these sites. Future research on these land use types may be beneficial to understanding litter on these sites.

Litter Composition Across Commercial Land Sites

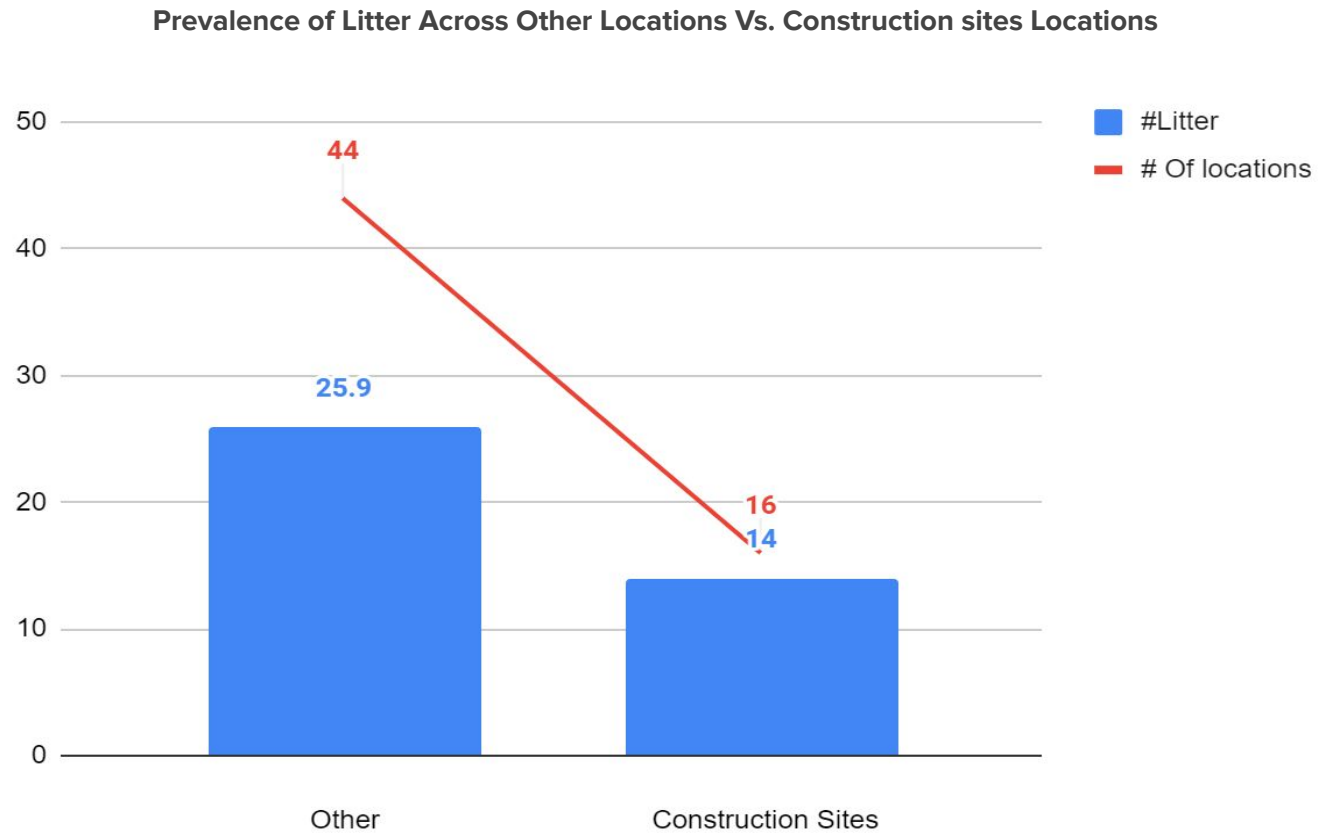


- Cigarette butts, beverage containers, food, and single use plastic items are most recurrent items across commercial land use types.
- Cigarette butts are much more common around commercial areas than non-commercial areas
    - 22.63 cigarette butts were found within 500m of a commercial property vs. 3.77 cigarette butts found within 500m of other land use types.
- Researchers reported seeing a majority of discarded items on commercial sites in parking lots near where people enter and exit vehicles.
- Data suggests limited or no waste infrastructure at point of disposal in the parking lots.
- 36.57 cigarette butts were found near parking lots in commercial areas compared to 10.4375 near other areas in commercial areas.

Litter Composition Across Vacant Land Use



- There were 50% less cigarette butts on vacant land as opposed to commercial land.
- Beverage containers were two times more likely to be found on vacant land than other types.
    - 4.625 aluminum cans were found per segment within 150m of a vacant lot versus 1.88 aluminum cans within 150m land types.
    - 3.91 plastic bottles were found per segment within 150m of a vacant lot versus 2.96 plastic bottles within 150m other land types.
- Vacant lots contained more aged litter as observed by Litterati researchers (judged by the wear and fading of the litter).



- Post research, Wake County Environmental Services/Solid Waste Management Staff requested Litterati to analyze existing data to determine the prevalence of litter in proximity to construction sites as compared to other locations.
- As the above graph shows, there was less litter in relation to active construction sites as compared to other types of land use locations.

Insight 4 Key Takeaways:

- Cigarette butts are six times more likely to be littered in commercial areas than non-commercial areas.
- Beverage containers (aluminum and plastic) were two times more likely to be found on vacant land than other types.
- Residents may not feel a sense of ownership of commercial and vacant land since there may be a lack of a strong sense of community in these areas**.**
- Studies[1] show that if the built environment is in disrepair (structures, pavement, tables, chairs, landscaping, signage, etc.) people may be encouraged or feel that they have the license to litter.
- Waste management infrastructure in vacant land areas may be nonexistent, hidden, inaccessible, or insufficient thus leading to more littering.

[1] Weaver, Russell. "Littering in context (s): using a quasi-natural experiment to explore geographic influences on antisocial behavior." *Applied Geography* 57 (2015): 142-153.

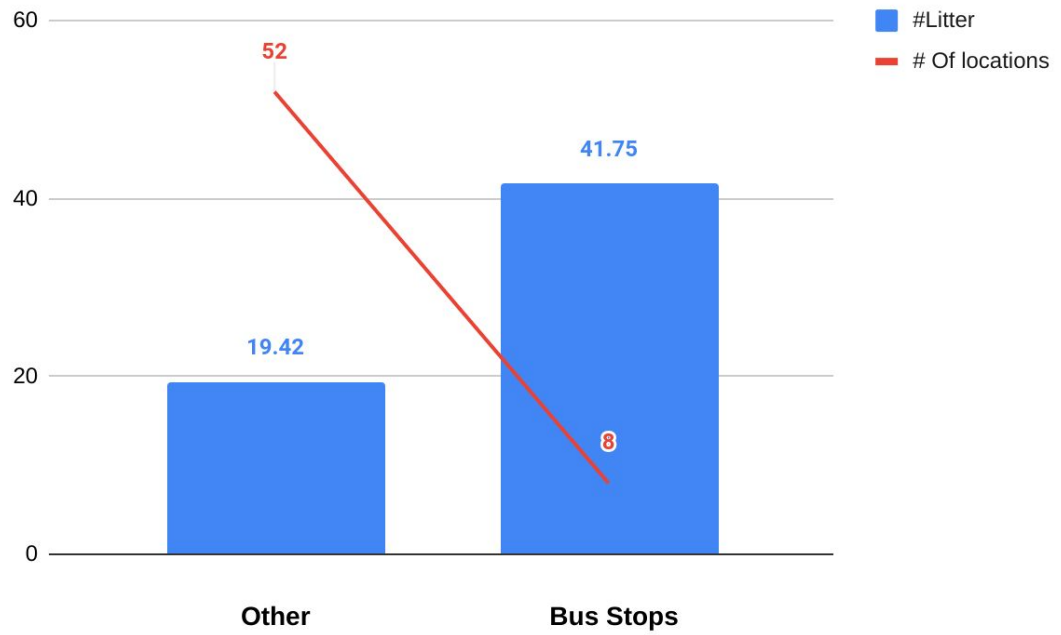
- There was less street litter in areas in close proximity to active construction sites as opposed to other land use types including vacant lots. This may indicate that areas where there is a commercial type activity such as construction but not actual commercial customers indicated less opportunity for littering.
    - Being that this was an area that Wake County Environmental Services/Solid Waste Management staff had identified as potential problem sites, Litterati research indicates that these sites may not be as large of a problem as perceived when generating litter in communities.
    - However, the appearance of waste on the ground may be due to substandard waste disposal practices on site, which may have to be addressed within the building community's practices of on site waste management.

Insight 5: Litter Conditions and Composition at Bus Stop Platforms and Roadways

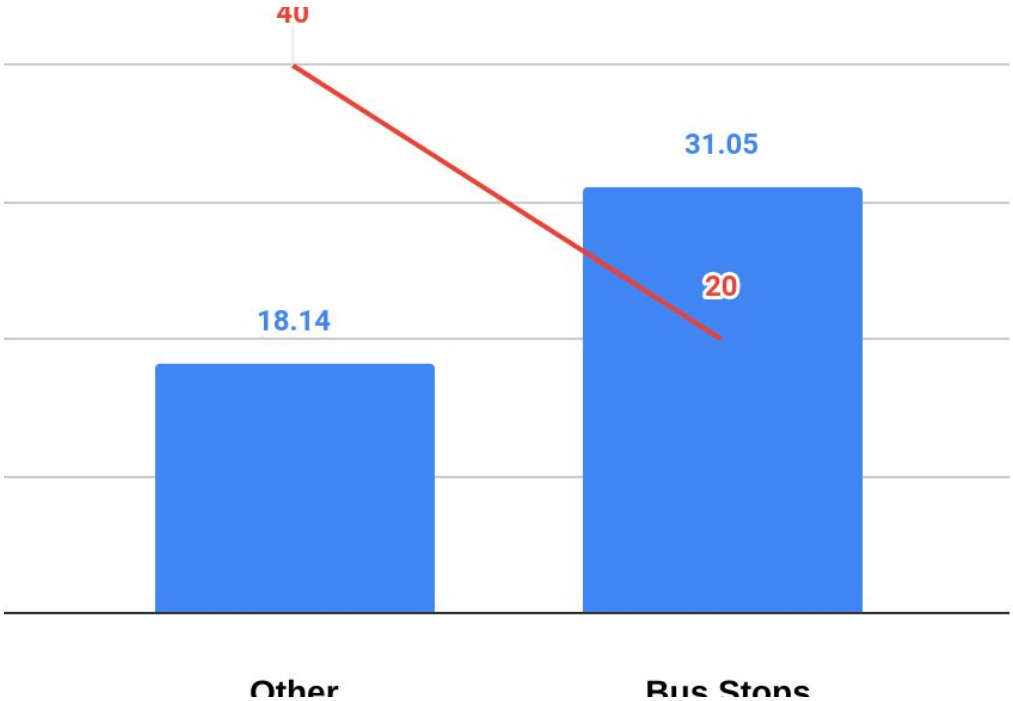
Wake County Environmental Services/Solid Waste Management staff expressed interest in comparisons between Litterati research data and bus shelter locations. This section breaks down the amount of litter recorded within 250m of bus platforms and within 1km of bus stops. Please note that this data does not include all bus locations such as side stops that could be more frequent along a route. This data only includes bus platforms, which are located at larger transit nodes.

Litterati also used qualitative data collected from our researchers to assess litter conditions at the approach to stop signs and along highways to give greater insights into the patterns of litter on these land use types.

Prevalence of Litter Across Other Locations Vs. Bus Stop Platforms (within 250m)

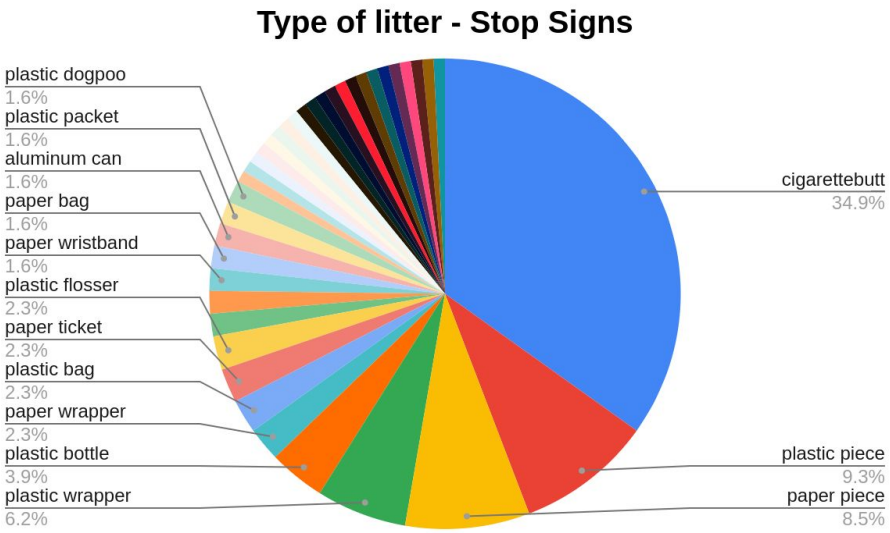


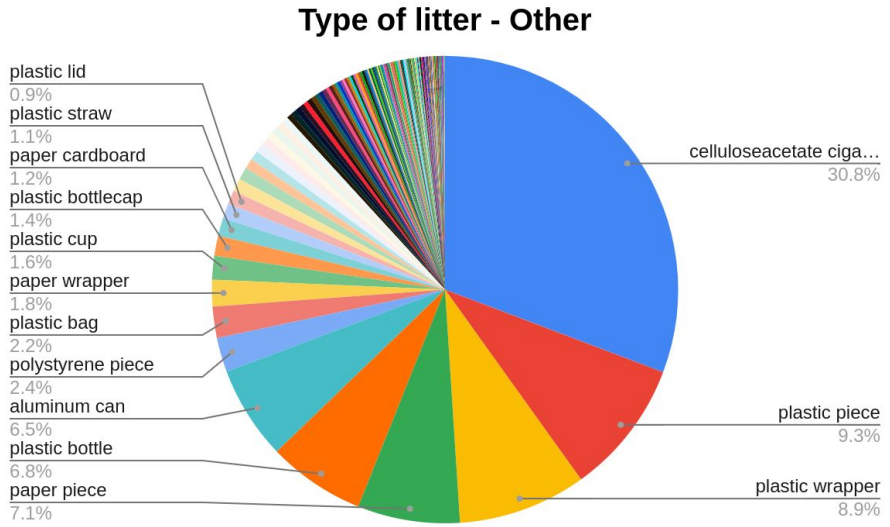
Prevalence of Litter Across Other Locations Vs. Bus Stop Platforms (within 1 km)



- Although there were less locations studied within 250m of a bus platform, there was, on average, substantially more litter documented closer to bus stops than 1km from bus stops.
- At both the 250m and 1km vicinity of a bus platform, there was substantially more litter than at research locations not in the vicinity of a bus stop.
- Cigarette butt litter was the most prevalent litter found near bus platforms. For segments within 250m of bus platforms cigarette butts accounted for 24.69% of litter per segment vs 9.89% of litter per segment at other sites. For segments within 1000m of bus platforms cigarette butts accounted for 16.35% of litter per segment vs 10.6% of litter per segment at other sites.
    - Being that most bus platforms were near commercial land use types, the prevalence of cigarette butt litter at bus platforms also correlated to the prevalence of cigarette butt litter at commercial sites.

Litter Conditions on Roads, Highways and Stop Signs





- Litterati researchers observed;
  - high rates of littering on approach to and directly at stop signs.
  - on roadsides that aged litter was mixed in with new litter, eg. bottles, cans.
  - aged litter accumulations in unkept and uncut grass.
  - litter accumulations near exit signs & off ramps

Insight 5 Key Takeaways

- Litterati research shows a great deal of litter in the vicinity of both 250m and 1km from a bus stop than other research locations not in the vicinity of a bus platform.
- There was substantially more litter within 250m as opposed to 1km in relation to bus platforms.
- Bus platforms appear to be located in larger transportation nodes, which service more people as opposed to the smaller side stops along a route. This is important because it allows Wake County Environmental Services/Solid Waste Management to focus infrastructure and collections at larger transportation hubs rather than at every stop.
- The research is showing that there is a high level of litter accumulating at bus stops and Wake County could benefit from a deeper study of bus stop litter as well as strategize interventions to reduce bus stop litter.
- Government infrastructure e.g. stop signs equates to a perceived cleanup/maintenance responsibility by municipality, thus alleviating responsibility for residents to not litter.
- Stop signs and off-ramps reduce speed to a point where occupants may have fewer fears that litter thrown from a car window will re-enter or damage a vehicle.
- Infrequent mowing hides litter and allows for more litter build up
- Studies[2] show that the presence of litter normalizes litter in the area and begets more litter**.**

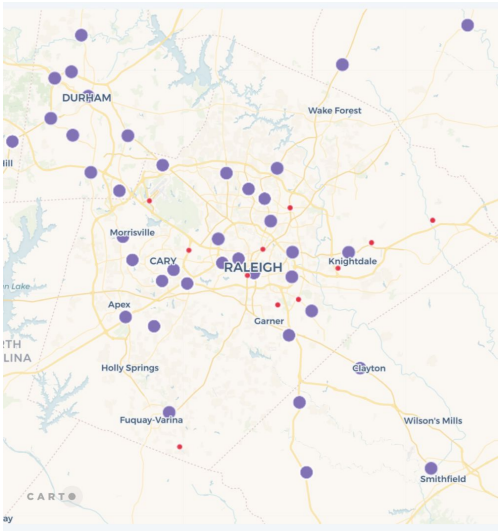
**As a note, the NCDOT was not doing roadside litter clean up during this time due to Covid-19.*

Insight 6: Litter Conditions and Composition at Fast Food Sites

A major benefit of the Litterati platform is the ability to identify the brands that are contributing to litter. Although there were many brands that were identified through our research, two major recurring brands in the fast food category were McDonald's and Starbucks, followed closely by Bojangles, Sheetz and Wendy's. Below are two deeper research analyses into the litter proximity and composition of McDonald's and Starbucks litter.

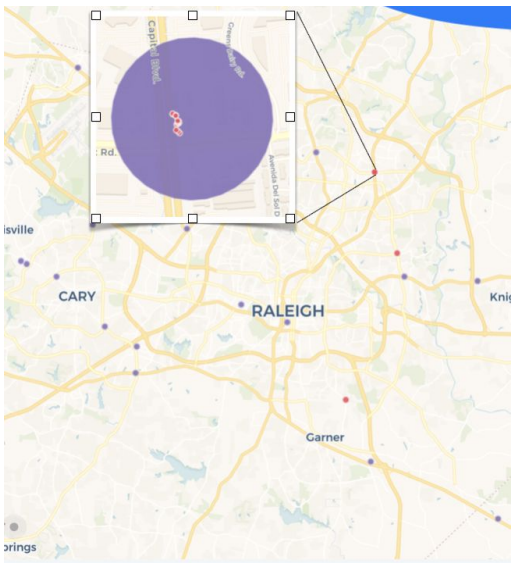
[2] Dur, Robert, and Ben Vollaard. "The power of a bad example: A field experiment in household garbage disposal." *Environment and Behavior* 47, no. 9 (2015): 970-1000.

Litter Conditions in Proximity to McDonald's Restaurants (link)



- 21 items of McDonald's litter found across 13 segments, always >1km from a store
  CAUTION; This may be due to sample size, further measurements required

Litter Conditions in Proximity to Starbucks (link)



- In one segment, 85% of Starbucks litter was found within 200m of the Starbucks store.
- A major source of the litter observed were single use plastic items, most notably, the green stirrers/caps for drink lids.
- Although bins are right outside of the store, litter is building up in parking lot
  CAUTION; This may be due to sample size, further measurements required

Insight 6 Key Takeaways

- McDonald’s litter appears to occur more than 1km from a McDonald's store possibly due to people beginning to eat McDonald's once they leave a drive thru and then littering the remnants of their meal as they continue to drive and eat.
- Starbucks stirrers seem to be taken out of the drink lid and littered once consumers are settled in their car with their drinks.
- Both studies need more investigation for conclusive evidence. But the initial results indicate preliminary litter behaviors.

Recommendations

Recommendations

Based on the Patterns and Insights section, Litterati worked with our behavioral science team and consulted the Litterati database of litter prevention strategies to supply Wake County with a set of recommendations for each insight that could be explored, implemented and further evaluated to address the patterns of littering found in the Litterati research. While this list is not exhaustive of every possibility, Litterati was intentional about ensuring that recommendations were based on existing Wake County litter programs and/or took into consideration current North Carolina law and waste management capacity.

Recommendation 1: Targeted Litter Reduction of Cigarettes and Beverage Containers

- Beverage Containers represented the highest volume of litter identified. Solution options include reducing the usage of disposable beverage containers, increasing the usage of reusable beverage containers, and recapturing recyclable materials.
    - Plastic PET bottles were the highest percentage of beverage container litter, so consider revisiting the bottle deposit law that has been introduced on a few occasions in the North Carolina State legislature, most recently in 2012. Also consider partnering with soft drink brands to boost public awareness of plastic bottle recyclability.
    - The second highest makeup of beverage container litter was aluminum cans, so work with brands and/or distributors to promote awareness of the recyclability of aluminum cans.
    - Polystyrene was the third most littered beverage container, though they are not recyclable so consider bans of the material, promotion of compostable or recyclable material, or other methods of reducing usage of polystyrene cups.
    - Consider programs to provide residents with reusable bottles and periodic promotions to encourage their use.
    - Promote water drinking among residents to reduce need for single use containers
        - Map and promote places where a resident can refill a reusable bottle.
            - Ask fast food establishments to allow people to use a reusable bottle at their water refill stations.
        - Ask private sector water companies (Nestle) to sponsor public water refill stations.
            - Absent interest in sponsored stations, develop policies and infrastructure to accommodate the placement of water refill vending machines on public land or within commercial structures (see usage in Phoenix, AZ).

        - Consider Philadelphia's DrinkTapPhilly program that seeks to inspire more residents to drink tap water as opposed to bottled water.
            - Important to take into consideration actual AND perceived water quality when doing so to ensure that people have safe access to public drinking water.
        - Consider partnering with other municipal agencies, such as the Public Health Department, to promote drinking water vs sweetened beverages.
- Cigarette butts accounted for the majority of litter by count. Solution options include waste receptacle improvements, private sector partnerships, signage, and resident education campaigns.
    - Since Litterati data showed that cigarette buts were the most littered objects on or around bus platforms, Wake County may consider installing cigarette butt receptacles on bus platforms to provide safe and visible options to extinguish and dispose of cigarette butts (explore cigarette butt recycling program by Terracycle).
        - Consider sharing data with business owners to promote placement of cigarette butt receptacles at private property entrances and exits.
        - Signs encouraging proper disposal of cigarette butts will enhance effects.
    - Create signage or informational campaigns to dispel myths and communicate to the public that discarded cigarette butts brings toxic chemicals into the environment and they take years to biodegrade. This campaign can also identify litter from cigar and/or vaping usage and address these pieces of litter.

Recommendation 2: Targeted 86it Program Improvements

- Behavioral research[3] indicates that reframing pledge messaging to highlight what individuals *should do* to actively reduce litter will result in greater follow-up behavior. Rather than focusing on avoidance, this proactive messaging puts citizens in the right mindset and gives them easy instructions to remember, increasing the likelihood they will follow through on their pledge.
    - For example, the 86it pledge could be behaviorally optimized by using the following text that reflects all 3 tenets of 86it culture:
        - *I am an 86er because I care deeply about keeping my community clean! I will show this in my actions by:*
            - *Asking store staff to show me the recycle/waste bin when it is not obvious*
            - *Walking a few extra steps to put trash in a recycle/waste bin that is not close to me.*

[3] Gollwitzer, Peter M., and Paschal Sheeran. "Implementation intentions and goal achievement: A meta-analysis of effects and processes." Advances in experimental social psychology 38 (2006): 69-119.

        - *Holding onto my trash until I find a recycle/waste bin, when I do not see one nearby.*
        - *Keeping a small bag for trash in my car/bookbag/purse so I can discard it properly later.*
        - *Encouraging my family and friends to 86 their trash responsibly.*
        - *Participating in local litter cleanup campaigns.*
- If not already done, provide 86it pledge submitters with a certificate proclaiming “I’m an 86er!” and including the text of the pledge they signed.
- Periodically communicate benefits of litter-free areas in ways that individuals can relate to, using positive and respectful language:
    - Increased community morale/pride
    - Increased interest in economic development and local engagement
    - Decreased taxes spent on cleanup
    - Increased tax usage on more critical issues
    - Enhanced livability of Wake County neighborhoods
    - Aesthetically pleasing buildings, landscaping, and outdoor furniture due to increased maintenance
    - Increased property values
    - Improved water quality and healthier plant life and wildlife
- Consider adding an option to the website specifically for soliciting waste management/infrastructure improvement suggestions through 86it. Submitters may provide innovative ideas, highlight previously unknown community concerns, and will feel more civically engaged.
- Continue to use the Litterati app and evaluation tools to conduct litter research in areas with 86it Pledges to see if they are becoming less littered than areas that received only general “don’t litter’ advertisements or where no outreach was conducted. This will allow Wake County to formulate return on investment estimates to determine what type of media is most effective and where that media is effective.
- Use the Litterati research data and future data to assess the ROI of the “swag” that is provided as part of the 86it Pledge Campaign.

Recommendation 3: Targeted Demographic Interventions

- Wake County could benefit from a more focused study on how waste management infrastructure differs for areas with populations predominantly with people under the age of 45, with median incomes under $48K, with mid-density housing, and mid-density populations. Some areas to study would include:
    - How many trash receptacles are in these demographic areas as compared to other demographic areas?
    - Are the trash receptacles an appropriate size to avoid overflowing conditions?
    - How frequently are the trash receptacles emptied or found to be overflowing?
    - How close are the trash receptacles to foot traffic or parking areas?
    - Are the trash receptacles usable by the general public or are they locked, hidden from view, or otherwise inaccessible?
    - Are the trash receptacles in good condition and clearly labeled?
- Utilize the LitteratiED programs to introduce anti-littering and litter study into classrooms and after school clubs. Also looks into boy scouts/girl scouts.

Recommendation 4: Targeted Land Use Interventions

- Install more cigarette butt receptacles and signage near commercial buildings and encourage building managers to engage staff and businesses in these commercial centers to spread the message that cigarette butts need to be extinguished and disposed of correctly. The Terracycle Cigarette Butt Recycling Program could be a good fit.
- Wake County may benefit from a deeper study of waste management on construction sites, Litterati research indicates that areas near construction sites experienced less street litter. Being that vacant land reported higher rates of street litter in relation to these areas, Wake County may benefit from holding vacant land holders to certain standards of fencing and site security that gives the appearance of commercial activity to deter littering near these sites.
    - Sites that appear to have activity give the perception that these areas are being monitored and tend to deter illegal waste disposal behaviors.
- Since areas that appear to lack oversight/management and that are already littered attract more litter, hold landowners of these sites accountable to ensure that the sites are clean. Also work with these landowners to create the appearance of activity on the space even if the land is vacant.
    - In Philadelphia, a local law called the Doors and Windows Ordinance was passed to make it a law that owners of vacant buildings needed to ensure functioning doors and windows in all vacant properties to give the appearance of an occupied building. Maybe something similar could be done to ensure that all vacant properties are equipped with attractive fences and other beautification efforts such as low grade landscaping to make the vacant lots appear to be occupied, in use and/or maintained.

Recommendation 5: Targeted Bus Stop Platforms and Roadways Interventions

- As Wake County considers adding more trash cans to bus shelters, this decision could benefit from a more focused research project on the bus platforms with a higher likelihood of littering. The decision to add more trash cans has associated infrastructure and labor costs for maintenance and collection. So an understanding of what areas experience the most litter and/or anticipation of litter, i.e. bus shelters in close proximity to commercial areas especially with fast food chains, would be a good investment to ensure success of adding trash cans to bus shelters.
    - This study could also benefit on exploring how to communicate to transit riders where trash cans are located at bus platforms so in case there final destination at a smaller route, they either use the trash can at the bus platform or hold on to their trash until they arrive at their final destination close to the side stop.
- As was discussed in the cigarette butt litter recommendations, Wake County may consider investing in cigarette butt receptacles that also collect cigarette butts for recycling (again, explore the Terracycle cigarette butt recycling program).
- Since beverage litter was the second most identified litter in Wake County, bus platforms could benefit from both trash and recycling collections since much of the overall litter researched in the county can be recycled.
- The opportunity for recycling at bus platform locations is also an opportunity for increased signage to engage transit users in recycling, which may increase more awareness of proper waste management, i.e. not littering, in general.
- Highways would benefit from signage indicating which communities are nearby, groups that take responsibility for cleaning the area (ie. Adopt-A-Highway programs), and other messages to promote a sense of human connection. Signs with faces or even just eyes compel humans to feel watched/monitored and trigger socially acceptable behavior.
    - Also, frequent cleaning can indicate a sense of stewardship and lead to less cleaning.
    - Maybe do a contest for cleanest adopted stretch of road and connect it to the 86it Clean Up Campaign.
- Although there were not more occurrences of litter found at bus stops than other locations, Wake County Solid Waste staff did express interest in litter conditions around bus stops. Future research can utilize Litterati data to conduct a deeper study of what bus shelters would benefit from trash receptacles being added to bus shelter infrastructure. Being that maintenance on these sites have associated labor, maintenance and infrastructure costs, this data could reveal the best return on investment.
- Create a deeper collaboration with the municipalities of Wake Forest and Morrisville to align efforts and address litter conditions in these municipalities.

Recommendation 6: Targeted Fast Food Interventions and Partnerships

- The county can approach businesses with excess litter types with requests to change practices.
    - Partner specifically with McDonald's to encourage consumers to eat their meal once their car has come to a stop at a workplace or at home. Maybe this campaign could be connected with a safe driving campaign and indirectly get people to eat their food once they are stationary and hopefully near a trash can.
    - Partner with Starbucks to address single use plastics. Since many Starbucks spill stoppers (green stir-sticks) found on the ground indicates that customers may not actually want/need a spill stopper. Starbucks could reduce litter *and* their own costs using one of the options below:
        - Only distribute spill stoppers upon customer request.
        - Directly asking customers if they want a spill stopper.
- The County could approach Fast Food Chains and request that they assist with advertising to clientele to sign up for the 86it Pledge AND take part in a cleanup since that combination shows results of less littered areas.
        - Encourage Fast Food Chains to participate by designing 86it signs/stickers/magnets that can be attached near or on commercial waste bins. This could be a better funding source for “swag.”
        - Highlight community beautification, increased community pride, increased employee pride, increased business traffic, more positive business perceptions, and other direct/indirect benefits of participation.

Conclusion & Next Steps

Conclusion and Next Steps

Litterati would like to thank the entire Wake County government for the opportunity to conduct this research project. Litterati would also specifically like to thank staff members in the Environmental Services/Solid Waste Management Division for their collaboration, insights and partnerships to make this Litterati research program a success.

Our goal with this research was to create a baseline understanding of the **who, what, where and when** of litter in Wake County. However, the main goal of Litterati is to assist municipalities in understanding the **how** of litter to devise more proactive strategies to litter clean up that lead to sustainable and impactful change.

Litterati has two products for cities that we feel could benefit further studies and/or outreach campaigns in Wake County to eradicate litter in the county. Below are the two platforms and areas of research and outreach that we would like to explore with Wake County.

Municipality Assessment Platform (MAP)

MAP's goal is accurate performance evaluation of your city's current litter solutions & investment.

Through greater accuracy, ease, and scalability than any other litter monitoring tool, the MAP will show you precisely how effective your current litter initiatives are.

As you monitor over time it will become clear where your city is succeeding and why, as well as where a new execution strategy is needed to effectively reach your litter goals.

The MAP includes:

- **A baseline study ("Fingerprint")**:
    - Comprehensive onboarding to identify existing datasets and analysis of current litter initiatives with the Litterati Cities Team to fully understand and identify the MAP opportunities for litter research on pre-selected segments.
    - Baseline location selection OR stratified location selection using available open data and identified proprietary data from the city to achieve a representative sample for the fingerprint.
    - Data mapping and segment research to establish your city's overall baseline or your program/geographic specific baseline of litter conditions in relation to the agreed upon assets, programs or behavioral insights that your city wants to study. Litterati will work with its staff and partners to conduct this initial data mapping, segment identification and on the ground research. This is the first step in ongoing monitoring of the efficacy of city litter programs, behavioral change & investments.
    - A final report for your city's "Fingerprint" that will include an executive summary, data results, initial insights & patterns with recommendations. Also included are data analysis and strategic insights into your city's litter conditions as well as strategies to prevent litter.

- **Ongoing evaluation plan:**
    - Logistical information including mapping, segment id's and links to training documents to support your city to continue to regularly benchmark progress & change over time. Your yearly subscription will include a set of research licenses that you can provide to existing staff to continue to research the segments that were researched in the original fingerprint. This ongoing analysis will reveal what is working well and what needs to improve to meet (and exceed) your litter related KPIs.
    - Regular communication with the Litterati Cities Team to discuss logistical and operational needs for continued evaluation projects as well as insights into further strategies to prevent litter.
    - Quarterly meetings with the Litterati experts to discuss your city's ongoing evaluation research to provide more insights and guidance on how to effectively evaluate the efficacy of the litter prevention strategies identified in your initial Fingerprint Report as well as the new strategies you may want to test.

Although this is very similar to the baseline study for Wake County, Litterati can now do a more targeted MAP on the following research areas to do a deeper analysis of the following litter conditions to create even more targeted strategies to prevent litter:

- A Deeper Assessment of the 86it Program's Pledge and Clean Up Effectiveness
    - This study could be used to better determine where the 86it Campaign should invest resources to get people to take a more active role in keeping their communities clean, especially in regards to the investment in "swag."
- A Larger Study on the Occurrence of Plastic Bottle Littering
    - This data could be used to make a case for a bottle deposit system in the state of North Carolina
- A System-wide Transit Study of Littering
    - Although our initial study showed less littering near bus stops, this issue has been identified by Wake County Environmental Services/Solid Waste Management staff and a more focused study on this issue could lead to better allocations of resources to prevent public transit and private transit (roads and highways) litter throughout the county.
- A Study of Waste Management Infrastructure Across Demographics
    - Litterati data suggested that demographics of mid-size population and housing density, under 45 years of age and under $48,000 median income had less access to waste management infrastructure than other demographic groups.
- A Focused Study on Fast Food Litter
    - This subject area could benefit from a more focused composition and geospatial study of where fast food litter is being observed in relation to locations of fast food restaurants.

Resident Engagement Platform (REP)

REP's goal is civic engagement that converts more & more of your residents into active ambassadors who work with city government to take better care of the city.

The REP package is a powerful tool for cities that are primarily concerned with civic engagement and are looking to engage its residents, schools, and volunteers by bringing them together into one connected platform to build off of existing programs or create something new to build a hands on campaign of action that is more powerful than any stand alone anti-littering media campaign.

The REP includes:

- **A City Profile**: allowing your administrator team to create unlimited challenges in your city (citywide challenges, local challenges) as well as identify key partners to add as "sub-accounts" to also make challenges and amplify your engagement. The City Profile then gets access to all of the overall impact and aggregated data on the City Dashboard.
- **Partner Sub-accounts:** provides your partners with separate profiles in the Litterati app with the ability to create and run their own campaigns and access their own data, thus empowering them to engage residents on your city's behalf.
- **Researcher accounts:** provides your account with two researcher licenses that will allow you to engage your staff and/or volunteers to assess pre-determined hot spots or segments to evaluate the efficacy of your campaign.

The REP can be applied most easily to the 86it Campaign to enhance the pledge and cleanup activities by engaging more partners through the sub-accounts to sign up more community members for 86it as well as create the following digital value-adds to enhance participation:

- Work with Litterati to send push notifications to all North Carolina and/or all Wake County Litterati users to take the 86it Pledge.
- Work with Litterati to send push notifications to all North Carolina and/or all Wake County Litterati users to educate residents on what objects, brands and materials are most littered in the county.
- Add a link on 86it to Litterati to encourage citizens to be inspired by a global community of people with the same goal.
- Post Litterati campaign achievement badges to share accomplishments of past cleanups.
- REP is a great tool to increase and better manage virtual cleanups, allowing County staff to better communicate with volunteers and collect their data.

The Litterati team looks forward to continuing the relationship with Wake County to eradicate litter and can discuss continuing with the MAP and/or REP opportunities according to what leadership from Wake County Environmental Services/Solid Waste Management would like to explore.

Annex

Annex

Methodology

To document the impact of litter in Wake County, North Carolina, Litterati carried out a research project considering the following:

1. In total, 60 points were selected throughout the entire Wake County:
2. In the initial instance 60 locations were selected randomly, the feedback from Wake county was that they would like the 86it locations and pledges to be taken into consideration. Wake County Board of Commissioners had already identified for ongoing community clean up efforts for the 86it campaign
3. After a draft review with Wake County & by Litterati, the locations were modified, finally being 41 within the municipalities and 19 outside.
4. The locations were distributed according to the values assigned to Pledges, Median age and Median income, the following document shows the intervals of each variable to assign the value (link)
    a. The following criteria were used for age distribution and income:
    b. Group 1 age 15-30, age 30-45, Group 2 age 30-45, Group 3 45-60
5. Giving more importance to the areas with higher value 3-4 and to a lesser extent in values 0,1 & 2
6. The formula to obtain the final value is: Final = Pledge Value + Median Age Value + Median Income Value, This was done to assure we had coverage across all variance of the main factors
7. The Litterati research team surveyed 60 areas for a total of 120 segments (a sample area contained an average of 2 segments each). A segment is defined as a section of a municipal area that is 100m (328ft) long x 1m (3.28ft) wide.

Locations

The following table contains an overview of the municipal area where research was conducted and the number of segments reviewed in each municipality.

Municipalities	Count
Apex	2
Cary	3
Fuquay-Varina	2
Garner	3
Holly Springs	2
Knightdale	2
Morrisville	2
Raleigh	16
Rolesville	2
Wake Forest	3
Wendell	2
Zebulon	2

Litterati used CARTO for visualization of segments. The following data overlays were used:

- US Census ACS: Demographics (link)
  - https://www.census.gov/programs-surveys/acs
- Transit information and bus platforms:
  - https://wiki.openstreetmap.org/wiki/Tag:public_transport%3Dplatform
- Land use types:
  - http://www.wakegov.com/gis/services/Pages/data.aspx
  - ftp://wakeftp.co.wake.nc.us/gis/Webdownloads/SHAPEFILES/Wake_Property_2020_11.zip

Data

Raw data summary of the 60 locations where Litterati research was conducted. (Link)

The following taxonomy is available for the raw data collected for each item across all segments:

Metadata	Metadata Description
id	Unique object id
photoTimestamp	Timestamp of photo
photo	Image URL
lat	Geographic latitude
long	Geographic longitude
username	Researcher User Name
country	Geography
segmentId	Segment Id
segment	Segment Number, Segment 1 of 2, Segment 2 of 2
Raw Data	Raw tags
user_object	User Tag: Object
user_material	User Tag: Material
user_brand	User Tag: Brand
ml_object	AI Tag: Object
ml_material	AI Tag: Material
ml_brand	AI Tag: Brand
litterati_object	Litterati Tag: Object
litterati_material	Litterati Tag: Material
litterati_brand	Litterati Tag: Brand

Raw data for items collected can be used in a number of ways to enhance your understanding of the litter collected, and geographic areas where the research was conducted.

Litterati Tag data is the consolidated data collected distilling user data and Litterati AI data. Litterati technology enables the Litterati Tag information to be standardized across research for spelling, material and object type, and brand names.

The Litterati Partner Dashboard provided you with a cursory view of the number of items collected, the top contributors to your challenge, or research, volume of materials found over time of collection, and item categories. The Litterati Dashboard Maps illustrate where items were collected and highlight the amount of items collected in an area using color coded range signifiers: 1-10: Yellow, 11-100: Red, 101-1,000: Magenta, 1,001+: Purple. Reports from the dashboard allow you to view data by tags; Category, Object, Material, Brand.

Raw data can also be ingested into your existing reporting tools. For more ways to leverage the data, contact your Customer Success team: support@litterati.org