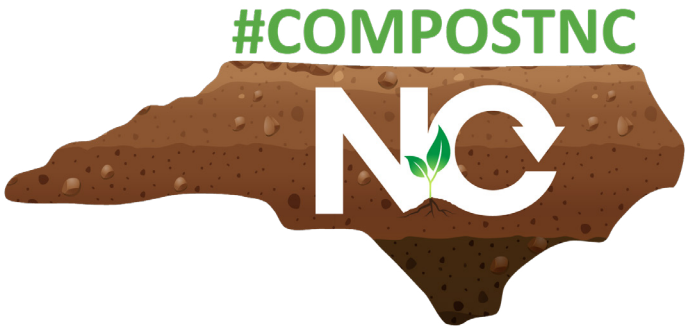
NORTH CAROLINA ORGANICS RECYCLING STUDY

Materials Managed 2011 – 2020 and Food Recovered 2019



North Carolina Department of Environmental Quality
Division of Environmental Assistance and Customer Service
January 2021

ACKNOWLEDGMENTS

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ABOUT NCDEQ DEACS RAMMS

The N.C. Department of Environmental Quality's Division of Environmental Assistance and Customer Service (DEACS) offers assistance to local and state agencies, businesses, and residents throughout North Carolina for a wide range of environmental issues. Through its technical services, DEACS helps its customers: navigate regulatory and permitting challenges; become more environmentally efficient and make the most of available resources; achieve and be recognized for environmental excellence; contribute to economic growth; and understand how to address environmental problems.

NCDEQ's DEACS Recycling and Materials Management Section assists private and public sectors through technical support and grant funding. The Recycling Business Assistance Center provides assistance to start-up, existing, or relocating recycling businesses, and works one-on-one with recycling companies to assess needs and provide direct and indirect assistance. The Local Government Recycling Assistance Team supports NC municipalities and counties in operating cost-efficient and effective recycling programs.

CONTACT

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For additional resources, please visit: https://deq.nc.gov/conservation/recycling/composting.

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EXECUTIVE SUMMARY

This study highlights the materials managed at commercial composting facilities over the past decade and analyzes the food recovery efforts through four strategies: food rescue, animal feeding operations, commercial composting and anaerobic digestion. North Carolina established a number of solid waste statutes in the early 1990s that drove the development of the regulated commercial composting industry. This early state government encouragement (including a yard waste landfill ban effective January 1993) in combination with strong private sector investment has created a healthy commercial composting industry with 79 composting operations statewide that service the needs of millions of residents. In 2020, 52 facilities (permitted by the N.C. Department of Environmental Quality's Division of Waste Management) reported receiving more than 772,000 tons of organic material, creating approximately 277,321 tons of compost and 161,753 tons of mulch, and selling approximately 64 percent of all material processed to the public.

The U.S. Environmental Protection Agency, U.S. Food & Drug Administration and U.S. Department of Agriculture are encouraging states to reduce food waste through organic waste diversion by 50 percent by 2030. Fortunately, North Carolina has a growing food recovery infrastructure, consisting of commercial composting facilities with enough total permitted capacity to process the majority of the excess food to meet the EPA/FDA/USDA's goal. Additionally, it has a large, growing network of food rescue organizations, animal feeding operations, anaerobic digestion facilities, and private sector sustainability and zero-waste goals in place. The combination of all these pieces — support from state and local governments as well as corporate commitments coupled with non-profit and private sector diversion services — is crucial to diverting organic materials from the landfill, creating jobs, improving soil health, reducing hunger and meeting the federal food waste reduction goal.

INTRODUCTION

This study analyzes the materials received and products created at permitted composting facilities from 2011 through 2020 as well as the impact of various food recovery activities in 2020.

North Carolina has been composting for decades with some communities composting food scraps commercially since the 1990s. Materials received and composted at commercial composting facilities have been reported to the state since the late 1990s. Overall, this study addresses the need for citizens, as well as the public and private sectors, to understand the commercial composting infrastructure and how it helps better manage organic material streams.

Support from the public and private sectors has been instrumental in increasing the existing infrastructure. Other contributing factors influencing the development of the infrastructure are these four NC General Statutes:

§ 130A-309.04. State solid waste management policy and goals.

(a) It is the policy of the State to promote methods of solid waste management that are alternatives to disposal in landfills and to assist units of local government with solid waste management. In furtherance of this State policy, there is established a hierarchy of methods of managing solid waste, in descending order of preference:
(1) Waste reduction at the source;
(2) Recycling and reuse;
(3) Composting;

§ 130A-309.09B. Local government waste reduction programs.

(a) Each unit of local government shall establish and maintain a solid waste reduction program. The following requirements shall apply:
(3) Units of local government are encouraged to separate marketable plastics, glass, metal, and all grades of paper for recycling prior to final disposal and are further encouraged to recycle yard trash and other organic solid waste into compost available for agricultural and other acceptable uses.

§ 130A-309.10. Prohibited acts relating to packaging; coded labeling of plastic containers required; disposal of certain solid wastes in landfills or by incineration prohibited.

(b) No person shall knowingly dispose of the following solid wastes in landfills:
(3) Yard trash, except in landfills approved for the disposal of yard trash under rules adopted by the Commission. Yard trash that is source separated from solid waste may be accepted at a solid waste disposal area where the area provides and maintains separate yard trash composting facilities.

§ 130A-309.11. Compost standards and applications.

(a) In order to protect the State's land and water resources, compost produced, utilized, or disposed of by the composting process at solid waste management facilities in the State must meet criteria established by the Department.

General Statutes 130A-309.04 and 130A-309-09B both affirm the state's support for alternative disposal methods for solid waste and encourage local governments to compost. **General Statute 130A-309.10** banned yard waste from municipal solid waste landfills. (Yard waste is still allowed to be disposed of in land clearing and inert debris (LCID) landfills; although, many of the LCID landfills recycle the yard waste and sell it as mulch or compost.) Lastly, **General Statute 130A-309.11** provides the guidance necessary for the N.C. Department of Environmental Quality's Division of Waste Management (NCDEQ DWM) to develop the composting rules (**15 NCAC 13B .1400 Rules**), which were issued in 1996 and re-adopted in 2019. This has created a path to regulate the production of soil amendment products manufactured from byproducts (organic solid waste material) from other processes, such as agricultural and manufacturing operations, city yard waste collection programs, leftover food, manures from animal operations, grease trap from restaurants and other organic materials. The 2019 re-adopted composting rules (**RULE .1402 (g)(2)**) include a new permitting exemption for small compost facilities accepting certain Type 1, 2 or 3 feedstocks, provided that specific conditions are met.

Besides the initial North Carolina legislative support to divert organic material from the landfills, recent international and national governmental support comes from a United Nations agreement released in September 2015 and a similar joint agreement released in 2018 and renewed in December 2020 by the EPA, FDA and USDA establishing a food waste reduction goal of 50 percent by 2030. Hunger and greenhouse gas emissions can be decreased dramatically by improving the effectiveness of managing food by reducing losses, rescuing it or diverting it. According to Feeding America, 54 million people in the United States (or 15 percent of the population) currently live in food insecure households.[1] Additionally, according to the Natural Resources Defense Council, 40 percent of food produced goes uneaten and just a 15 percent reduction in food losses would be enough to feed 25 million Americans every year.[2] Lastly, according to the EPA, 17 percent of U.S. methane emissions (the most prevalent greenhouse gas with the highest global warming potential) came from organic waste decomposing in landfills in 2018.[3] Organic waste reduction and diversion as well as effectively managing excess food have multiple economical, societal and environmental benefits.

There is an increasing statewide interest in composting organic waste, specifically food scraps. Established public and private commercial composting operations are seeking new ways to improve their composting processes and the marketability of their compost products. Businesses that generate excess food are requesting information on food scrap collection as well as on-site composting systems to meet corporate sustainability and zero-waste-to-landfill goals. Schools and higher education institutions are increasingly interested in diverting material from the landfill through off-site facilities or doing it themselves to meet their sustainability initiatives, typically with some level of help from students. Additionally, several corporate grocery stores have established programs throughout their locations to donate food or divert it from the landfill. Some of these grocery stores include Walmart, Food Lion, Harris Teeter, Publix, Whole Foods, Weaver Street Market and Kroger.

[1] Feeding America – Hunger and Poverty Facts and Statistics.
[2] Natural Resources Defense Council – Wasted: How America is Losing Up to 40 Percent of Its Food from Farm to Fork to Landfill (published August 2012).
[3] US Environmental Protection Agency – Methane Emissions.

The demand for composting services has increased in the past few years, and as citizens and consumers request lower carbon footprints and improved environmental practices, the demand for organics recycling services will only continue to grow. Fortunately, North Carolina is poised to increase the processing of organic material, add value to different waste types and increase collection of wholesome food.

OBJECTIVES

The following study was developed to understand the following:

- the flow of incoming feedstocks through composting facilities;
- the flow of products created at composting facilities;
- the ability of the current commercial composting infrastructure to handle increasing amounts of organic material, especially food scraps;
- the impact of the existing strategies to divert excess food from the landfill; and
- the need for additional data and research.

METHODOLOGY

Data was compiled from the annual composting facility reports collected by the DWM Solid Waste Section and the Division of Water Resources (DWR). It is important to note the information presented in the study's GENERAL, INPUTS/FEEDSTOCKS and OUTPUTS/PRODUCTS sections is derived from the 52 permitted composting facilities under DWM. Unless otherwise noted, it does not include materials managed by composting operations under landfill permits or materials managed by DWR permitted facilities. The FOOD RECOVERY section consists of DWM and DWR data as well as data obtained from email and phone interviews with several non-profit organizations and private businesses. Microsoft Access and Excel software were used to analyze the data and generate the figures. Due to the limited sampling and diverse types of data, averages are primarily used, as advanced statistical analysis would not provide dependable information. As the dataset grows, additional statistical analyses should be explored.

RESULTS AND DISCUSSION

The following section consists of four major components:

- GENERAL: information about composting facilities, capacity and tipping fees;
- INPUTS / FEEDSTOCKS: analysis of the incoming materials received at composting facilities;
- OUTPUTS / PRODUCTS: analysis of the products created at the composting facilities; and
- FOOD RECOVERY: analysis of four strategies used to rescue wholesome food to feed people and animals, and with the rest generate soil amendment and electricity.

A discussion of the findings is provided with each figure or table to describe trends and supply additional information that may come from other sections.

General

This section provides information related to permitted composting facilities, permitted capacity and tipping fees. Overall, the industry has diverse operations, including both public and private facilities, which charge varying tipping fees per ton of materials received. Additionally, many of these facilities have sufficient permitted capacity available to significantly increase the amount of organic materials they process. The following four figures and table will illustrate each of these topics in greater detail.

Figure 1 - Locations of NCDEQ DWM permitted composting facilities.

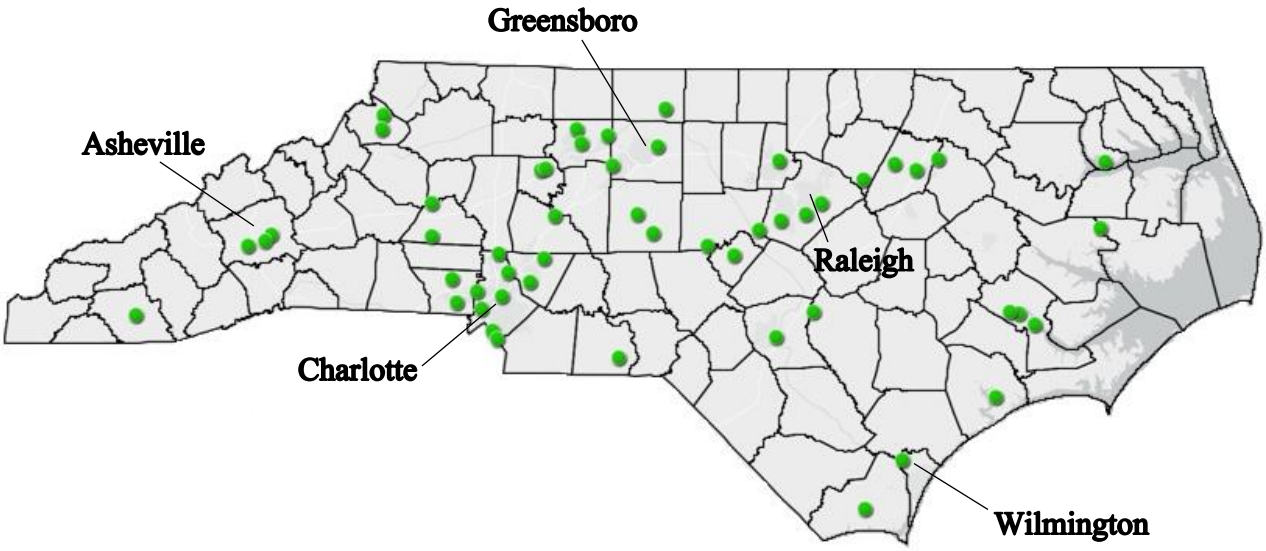


Figure 2 – Number of NCDEQ DWM permitted composting facilities.

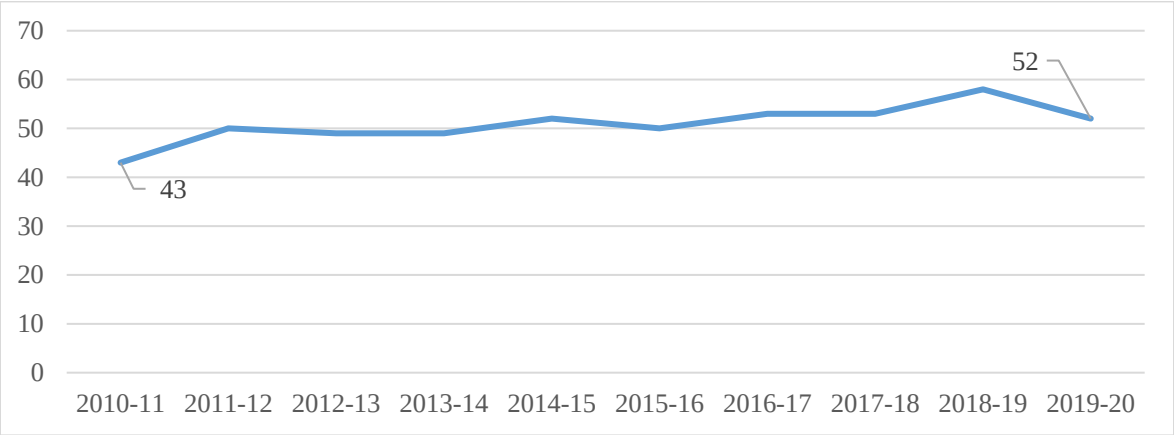


Figure 2 (above) shows an increasing trend in the number composting facilities permitted by DWM's Solid Waste Section. This number excludes the composting demonstration approvals that DWM previously issued through 2019. The total number of facilities that reported composting tonnages in Fiscal Year 2019-20 is 52, consisting of 24 private operations, 25 publicly-operated sites and three higher education institutions. The decrease in permitted facilities from 58 in FY 2018-19 to 52 in FY 2019-20 results from the establishment of the new compost rules, which exempts permit requirements for small facilities meeting certain conditions. It is important to note this figure does not include other DWM regulated facilities, which manage yard waste (such as 226 yard waste notification sites and 64 LCID landfills), nor DWR regulated facilities.

Figure 3 – Fiscal Year 2019-20 Total Permitted Capacity: 2.59 Million Tons
(by NCDEQ DWM permitted composting facilities)

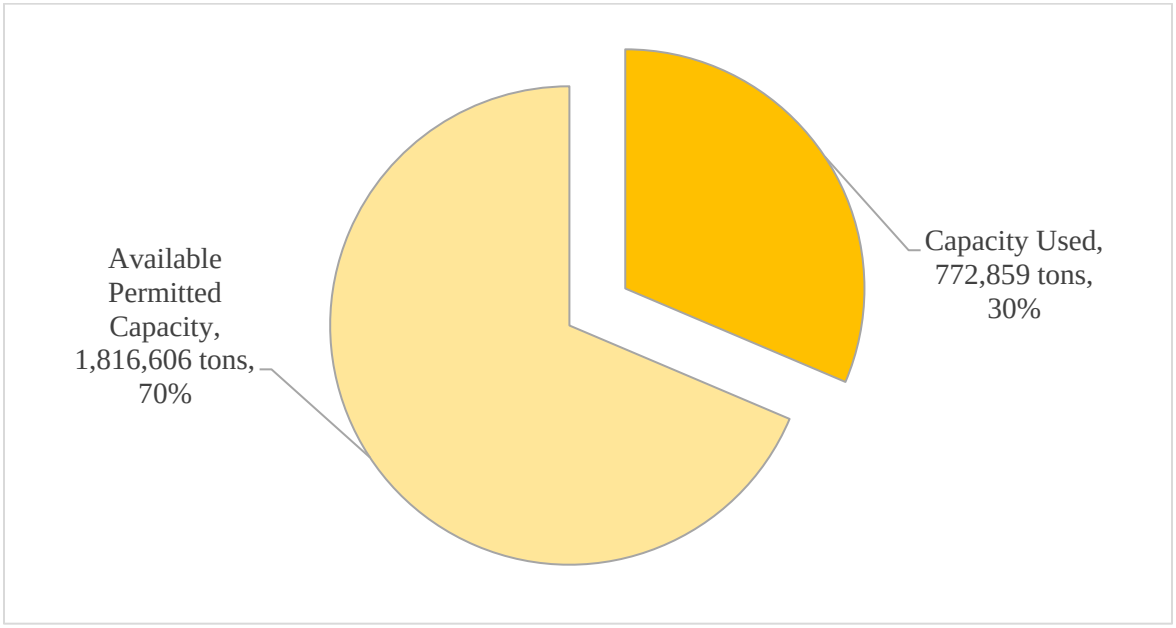


Figure 3 (above) shows that North Carolina is using 30 percent of its available permitted capacity to process organic material (by NCDEQ DWM composting facilities) and has enough remaining capacity to

process an additional 1.82 million tons of organic material. It is important to note this is an approximation based on available data from NCDEQ DWM composting facility permits. For instance, when a given permit did not list the permitted tonnage, the previous year's reported tonnage was used. Additionally, when a facility's permitted capacity was specified in cubic yards, the bulk density factor used to convert the data to tons was 0.5 tons for each cubic yard (based on average bulk densities for yard waste). This approximation is conservative because it does not assume higher values than those found through available documentation.

Composting tipping fees are used to cover capital, operational, and maintenance costs, as many operations use heavy machinery such as tractors, loaders, mixers, turners, screeners, bagging equipment, spreaders and trucks. They also use vehicles to transport incoming feedstock and outgoing finished products. Other costs include employee salaries, personal protective equipment, restroom facilities, scales, electricity, water, permits and engineering design. In general, the revenue from the sale of finished products (compost or mulch) is not able to cover all of the expenses incurred, either because not enough is sold, markets demand lower prices, or because the finished products were simply given away or used on-site. For these reasons and others, many composting facilities rely on tipping fees to cover the majority of their expenses. **Figure 4** (below) shows the average tipping fees among composting facilities which charge them.

Figure 4 – Average tipping fees ($ per ton) as reported by NCDEQ DWM permitted composting facilities.

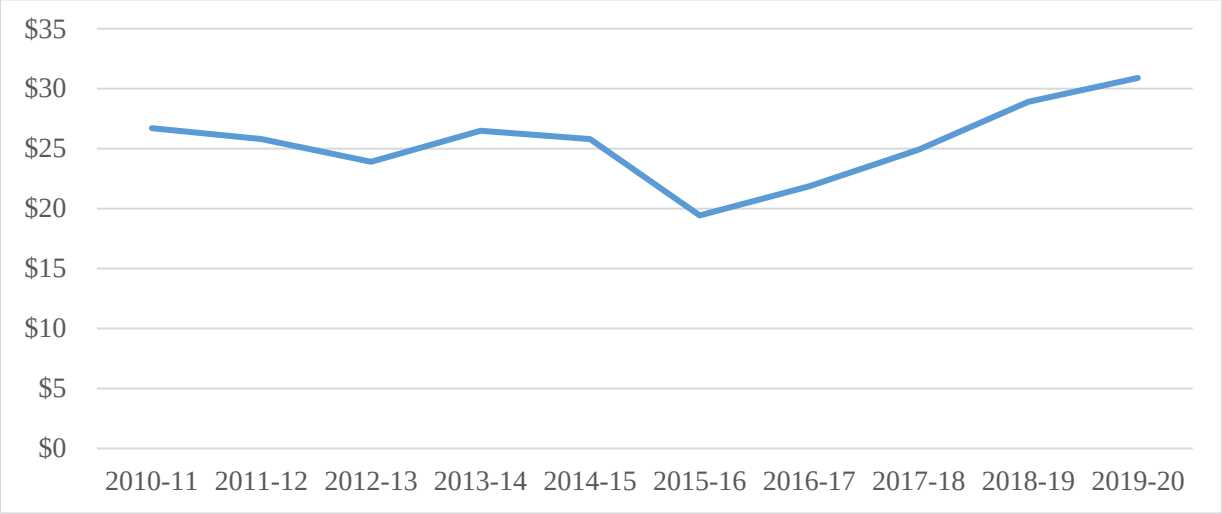


Figure 4 shows an average tipping fee of $26 per ton for the past 10 years. Most recently, in FY 2019-20, 24 commercial composting facilities reported tipping fees, with an average fee of $31 per ton. **Table 1** (next page) shows a breakdown of FY 2019-20 tipping fees by 11 privately and 13 publicly operated facilities. It is important to note that different facilities will charge varying tipping fees per client depending on the frequency, amount and type of material that is received. **Figure 4** displays annual averages and does not reflect the variety of tipping fees which may exist throughout the state. Composting facilities accept a variety of feedstocks in accordance with established "compost recipes," similar to baking or cooking; therefore, the tipping fee will change if a composting facility is in need of a certain feedstock or if the supply is short. For comparison, North Carolina's average landfill tipping fee for municipal solid waste was $42.60 in FY2018-19.

Table 1 – Breakdown of reported tipping fees ($ per ton) by different composting facilities for Fiscal Year 2019-20.

Tipping Fee	Private (11)	Public (13)
High	$105	$40
Average	$36.26	$26.62
Low	$25	$17

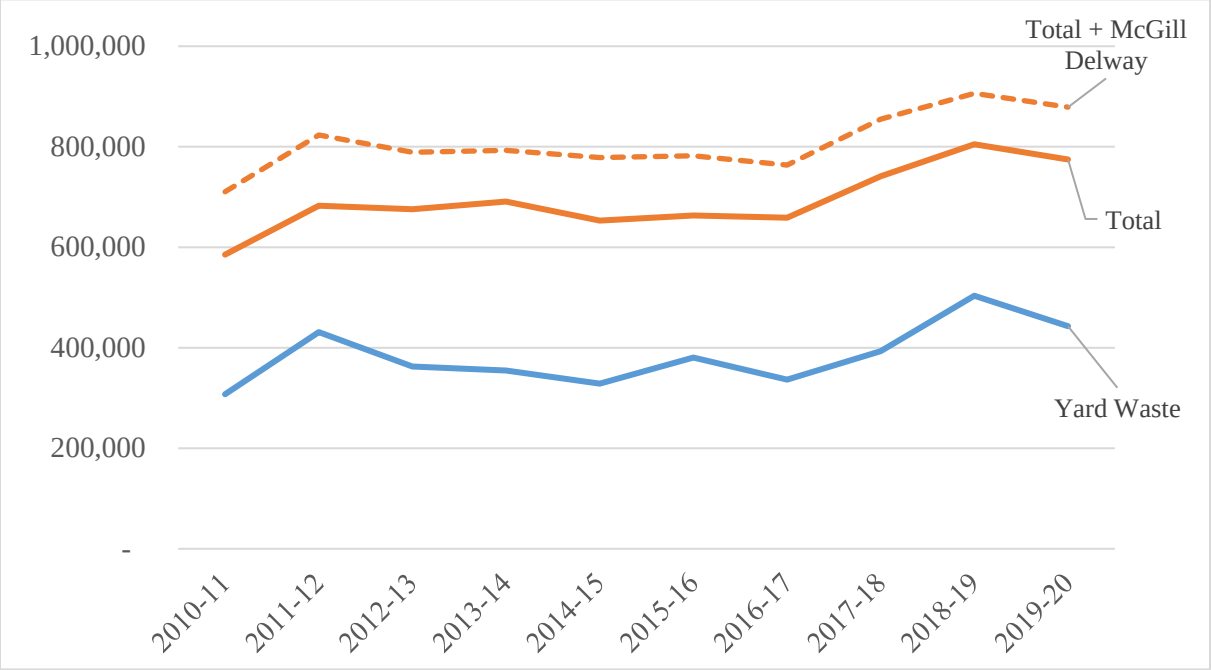
Lastly, several facilities provided information about the number of jobs their operations generated. Nine private permitted composting facilities reported employing a total of 251 people, handling approximately 362,000 tons of materials in FY 2019-20. Based on this sample, 7 jobs were generated per 10,000 tons of material composted. Comparatively, a 2016 study by ICF International found that Massachusetts' composting facilities generated approximately nearly 11 jobs per 10,000 tons of material they received. In Maryland, the Institute for Local Self-Reliance (ILSR) reported in 2013 that composting facilities generated 4 jobs per 10,000 tons of material composted while landfilling in Maryland generated roughly 2 jobs per 10,000 tons of material landfilled per year.[4] The ILSR's research has found that, on a per ton basis, composting employs twice the number of workers as landfills and four times as many workers as incinerators.[5] Although North Carolina's composting industry appears to generate and sustain a meaningful number of jobs, additional data is needed to assess employment trends among all permitted facilities.

Inputs / Feedstocks

This section provides an analysis of the incoming materials received at permitted composting facilities in the past 10 years. The next six figures show the amount of materials received, breakdown of the types of feedstocks, and composting facilities that processed the largest amounts of material.

[4] Institute for Local Self-Reliance – Pay Dirt: Composting in Maryland to Reduce Waste, Create Jobs & Protect the Bay (published May 2013).
[5] Institute for Local Self Reliance – Composting Creates Jobs

Figure 5 – Total materials and yard waste received (in tons).



The solid lines on **Figure 5** above show a fairly similar trend year-to-year between the total amount of materials managed and the amount of yard waste managed by composting facilities permitted by NCDEQ DWM. Since 2010, the total material received has increased by 32 percent, or 3.2 percent per year. The amount of yard waste received also has increased by 44 percent since 2010, or a 4.4 percent increase per year. On average, yard waste has constituted approximately 55 percent of the total materials received and made up 57 percent of composted materials during each of the last ten fiscal years. The dashed line shows the total tonnage from all DWM-permitted facilities and includes materials managed by one DWR permitted facility (McGill-Delway's composting facility). It is important to emphasize that there are other facilities that manage organic materials (mainly grinding yard waste materials, such as Yard Waste Notification Sites, LCID, Construction and Demolition (C&D), and Municipal Solid Waste (MSW) landfills) that may report their tonnages through non-DWM reporting forms and were not included as part of this report. Future research areas include compiling the additional reports to create a more accurate picture of the composting activities in North Carolina.

Figure 6 (next page) shows relatively steady levels of pallets and sawdust received at composting facilities and a fluctuating supply of clean wood feedstocks. The latter was down 48 percent since 2015 but has steadily trended upward over the last several years. The three private composting facilities responsible for the sharp increase in processed clean wood between 2012-2015 – Earth Farms Organics, Wallace Farms, and Henson's – have processed significantly less clean wood in recent years.

Figure 6 – Non-yard waste high-carbon materials received (in tons) by NCDEQ DWM permitted composting facilities.

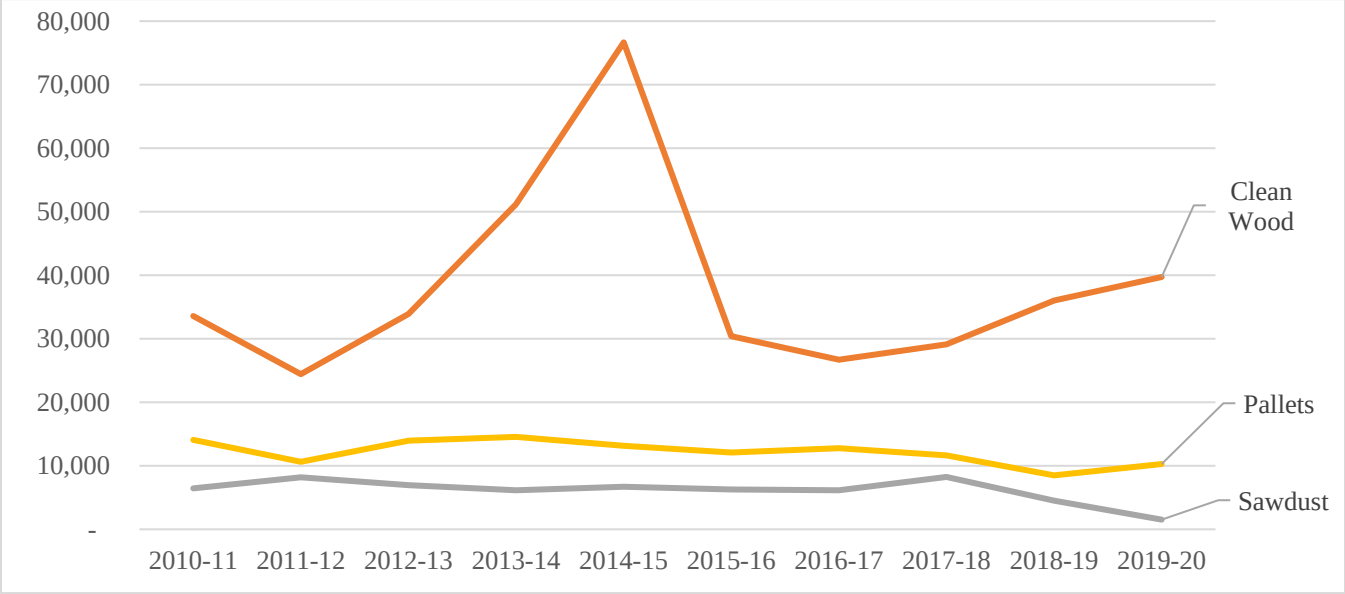


Figure 7 below shows the trends for the other materials processed at composting facilities with high nitrogen content, such as sludge or biosolids, animal waste, food scraps, grease trap waste and agricultural waste. It shows upwards trends for sludge/biosolids (106 percent increase since 2010, or 10.6 percent per year) and grease (93 percent increase since 2010, or 9.3 percent per year). Additionally, food scraps have increased 61 percent since 2010, possibly as a result of the increasing number of residential and commercial compost collection businesses throughout the state. The declining trend of animal waste feedstocks (14 percent decrease since 2010, or 1.4 percent per year) has been punctuated by several volatile years since 2015, while agricultural waste (99 percent decrease since 2010) has declined considerably in the past five years.

Figure 7 – High-nitrogen materials received (in tons) by NCDEQ DWM permitted composting facilities.

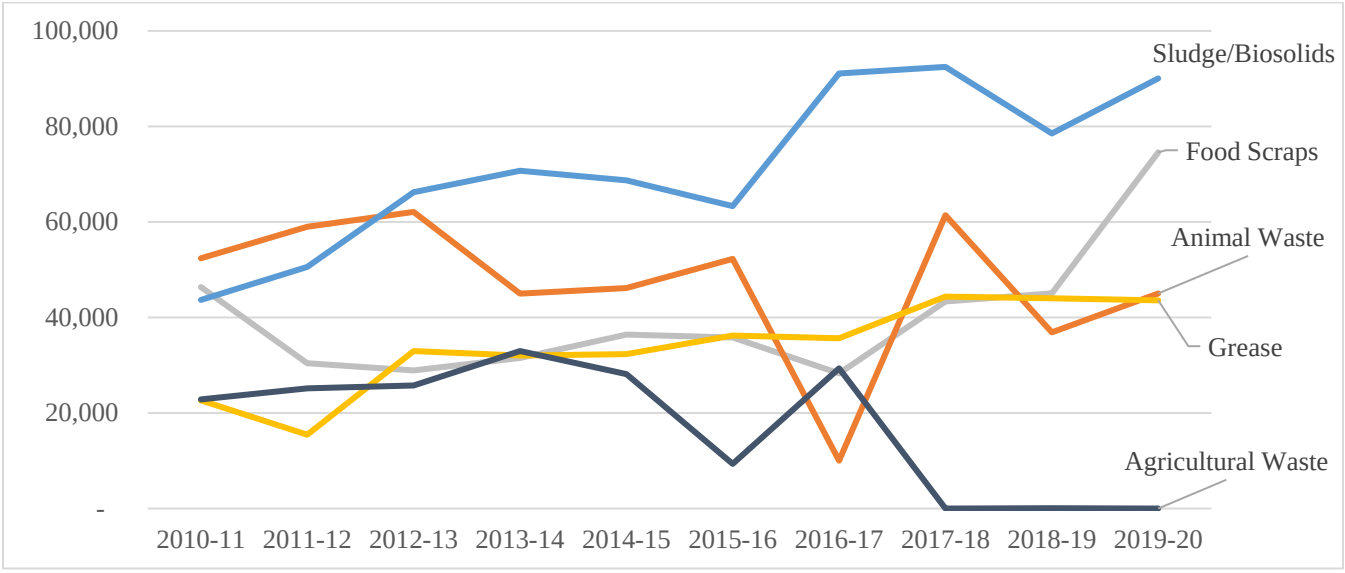


Figure 8 below shows the evolution of each reported material received at all of the NCDEQ DWM composting facilities during the last 10 years. High-carbon materials such as yard waste, clean wood, sawdust and pallets make up approximately two-thirds of all received materials, of which yard waste is the most prevalent. High-nitrogen materials (food scraps, animal waste, sludge/biosolids, agricultural waste, and mortalities) make up 30 percent, while inerts, soils and other organic materials account for roughly five percent on average.

Figure 8 – Materials received by NCDEQ DWM permitted composting facilities (in tons).

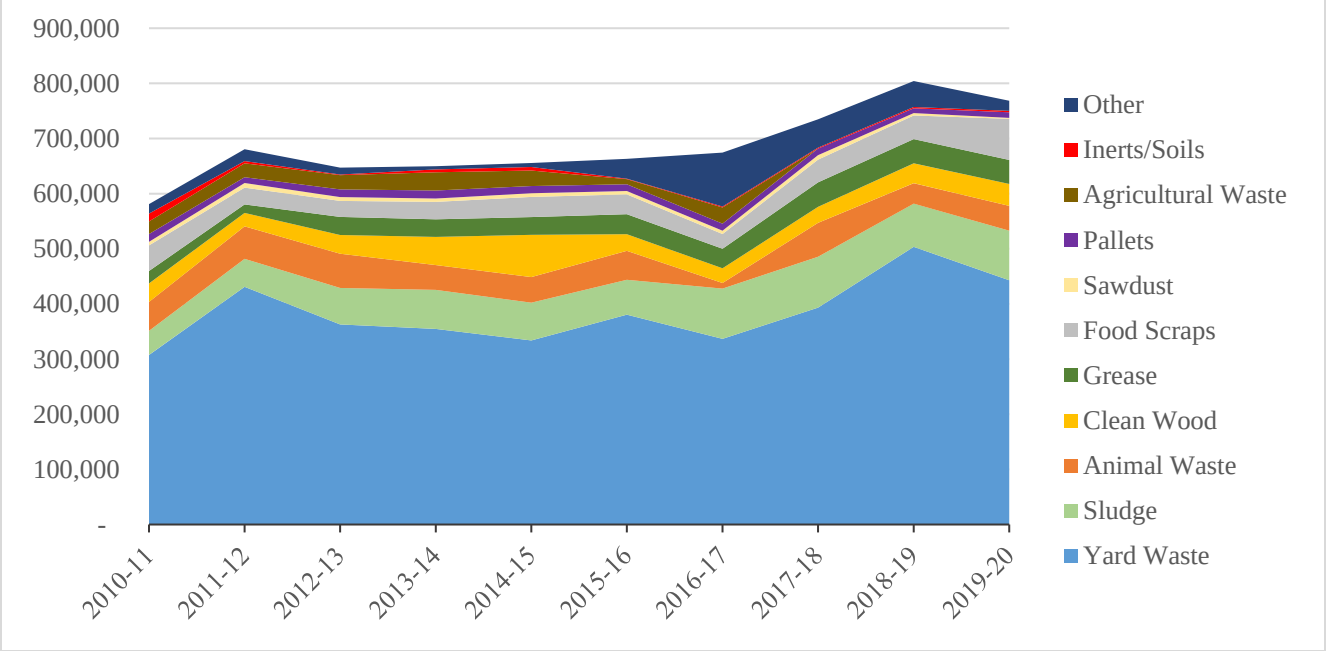


Figure 9 (next page) shows 11 facilities, 10 permitted by DWM and one by DWR, that received the most material in FY 2019-20. The amount of material they received is 65 percent of the total material received by all facilities (876,845 tons including McGill – Delway). Of these 11 facilities, four of them are publicly operated Type 1 composting facilities (permitted to process mainly high-carbon/woody material): Mecklenburg County Compost and Recycling Facility, City of Raleigh Yard Waste Facility in Wake County, Wilkes Road Yard Waste Facility in Cumberland County, and the Mecklenburg County Landfill. The other seven facilities are privately operated Type 3 and 4 composting facilities (multi-feedstock): McGill-Delway in Sampson County, McGill-Merry Oaks and Dean Brooks Farm in Chatham County, Earth Farms Organics in Gaston County, Rose Acre Farm in Hyde County, Wallace Farms in Mecklenburg County, and Wallace Farms in Davie County.

Figure 9 – Permitted composting facilities that received the most material in Fiscal Year 2019-20.

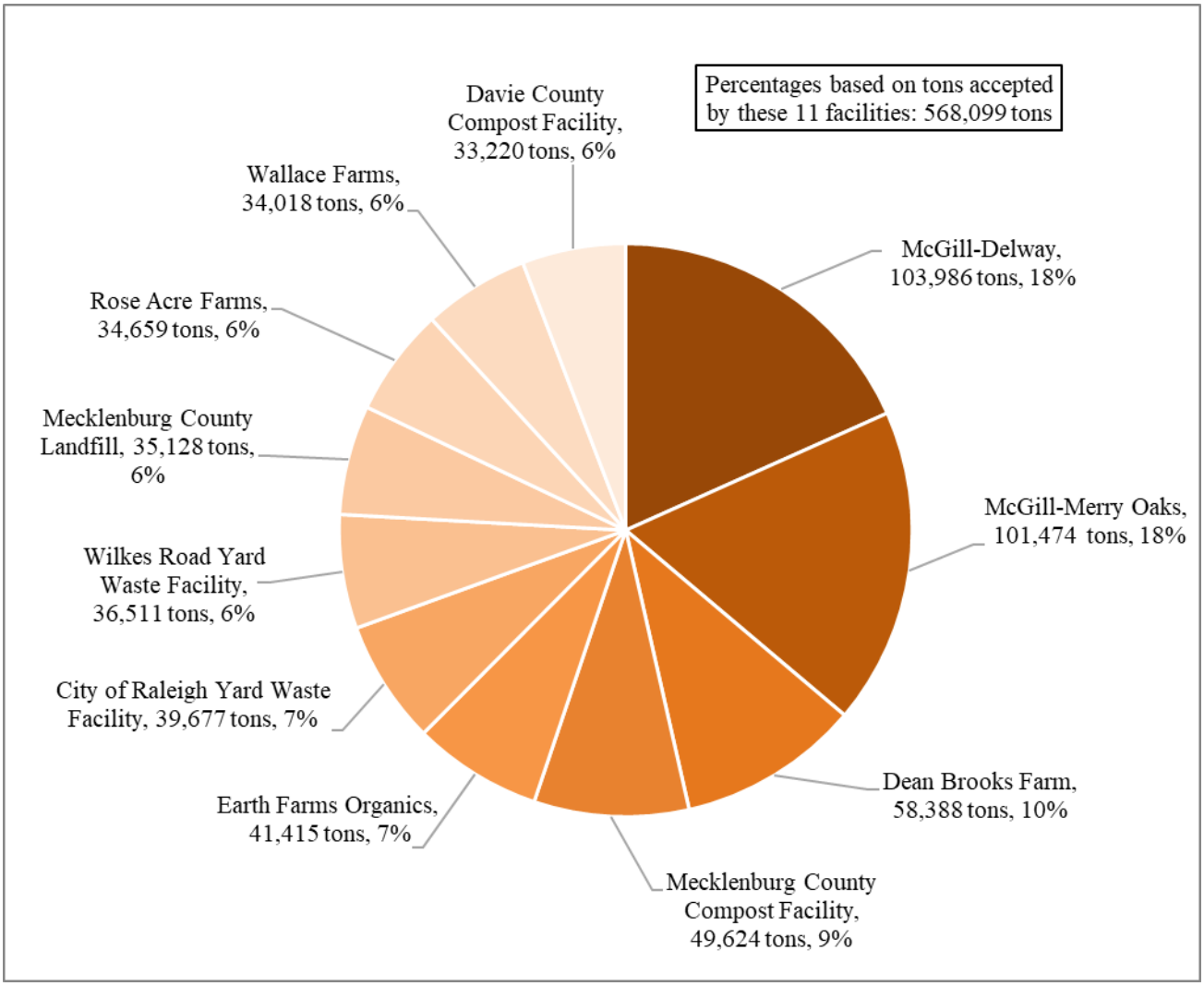


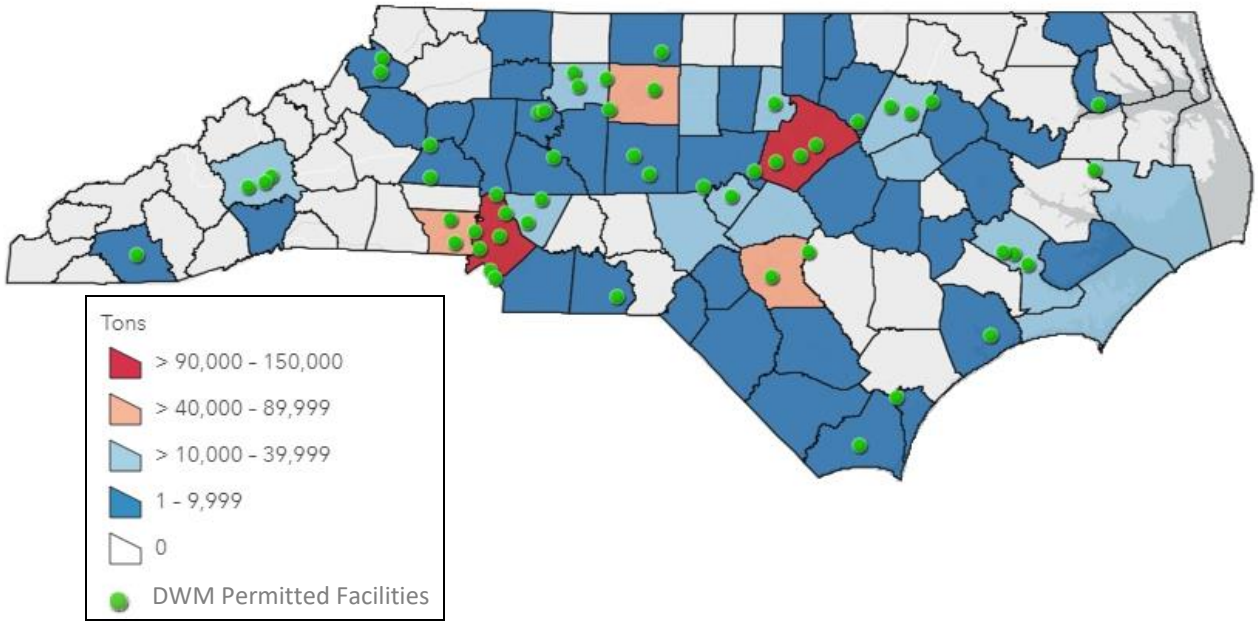
Table 2 (below) and **Figure 10** (following page) show the counties which generated the most organic waste in FY 2019-20 as reported by composting facilities. The counties which contributed the most are Mecklenburg, Wake, Guilford, Gaston, Cumberland, Forsyth and Hyde. The first three align with the locations of the largest public composting operations as well as several significant private operations. Hyde County, although extremely rural, ranks highly due to the large amount of organic material generated and processed at Rose Acre Farms.

It is important to note that this only accounts for the materials received at NCDEQ DWM permitted composting facilities. It does not include the organic material managed by the 226 NCDEQ DWM Yard Waste Notification sites, the DWR-permitted McGill-Delway facility or the others mentioned earlier, which could include small mulching or processing operations. If these values were taken into account, it would provide a more accurate assessment of the total amount of organic material contributed by each county.

Table 2 – County origins of organic waste processed
(as reported by the NCDEQ DWM permitted composting facilities in FY 2019-20).

<table>
<tr><th>County</th><th>Material %</th><th>County</th><th>Material %</th></tr>
<tr><td>Mecklenburg</td><td>19%</td><td rowspan="4">Brunswick, Catawba, Edgecombe, New Hanover, Orange, Randolph, Wilkes</td><td rowspan="4">1 % each</td></tr>
<tr><td>Wake</td><td>18%</td></tr>
<tr><td>Guilford</td><td>7%</td></tr>
<tr><td>Gaston</td><td>6%</td></tr>
<tr><td>Cumberland, Forsyth, Hyde</td><td>5% each</td><td rowspan="4">Alexander, Anson, Bladen, Caldwell, Chatham, Chowan, Columbus, Davidson, Davie, Franklin, Gates, Granville, Henderson, Hoke, Iredell, Johnston, Lenoir, Macon, Martin, Onslow, Pamlico, Pitt, Robeson, Rockingham, Scotland, Surry, Union, Vance, Watauga, Wayne, Yadkin</td><td rowspan="4">less than 1% each</td></tr>
<tr><td>Craven</td><td>4%</td></tr>
<tr><td>Cabarrus, Durham, Wilson</td><td>3% each</td></tr>
<tr><td>Alamance, Buncombe, Carteret, Harnett, Lee, Moore, Nash</td><td>2% each</td></tr>
</table>

Figure 10 – County origins of organic waste processed (as reported by the NCDEQ DWM permitted composting facilities in FY 2019-20).



Outputs / Products

This section contains seven figures showing products manufactured at composting facilities over the last 10 years. These products are mulch, compost, engineered soils, client-specific soil mixtures and others. Although Grade A and Grade B compost were formerly distinct categories (based on soil quality and composition) of compost products, both were consolidated into a single category, *compost*, in 2019 when the N.C. Solid Waste Compost Rules were last updated. Solid Waste Compost Rule .1407 outlines the following requirements to manufacture compost: (1) contain no sharp particles, (2) undergo a temperature-controlled composting method to meet the Process to Further Reduce Pathogens (PFRP), and (3) meet the metal concentrations set forth by federal regulations (40 CFR 503). On the other hand, mulch is made from grinding yard waste, creating piles, turning it a few times and creating a product that is not as carefully managed as compost. Compost is much richer in plant available nutrients than mulch because compost has decomposed to a greater degree, though mulch is typically used to protect soil or compost. They are both useful products which serve different purposes.

Figure 11 (next page) shows a sharp increase in the amount of products created and sold to the public in FY 2019-20, reversing the negative trend of the previous four years. Overall, the amount of products created at DWM permitted facilities has increased 27 percent since 2010 – an increase of about 125,000 tons.

Figure 11 – Total products created and sold to the public (in tons) at NCDEQ DWM permitted composting facilities.

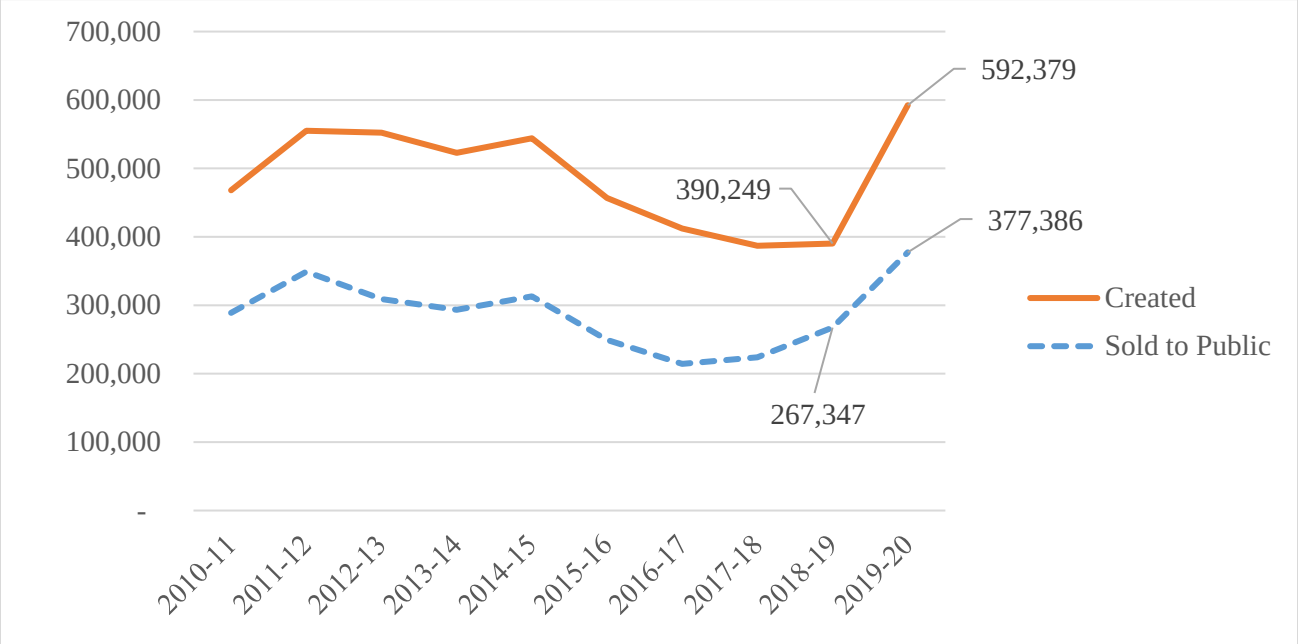


Figure 12 (below) shows several other uses of created products, such as using it onsite (primarily for erosion control or landscaping), giving it for free to the public, stockpiling for future use or allowing it to cure, disposing of the material due to contamination, or other unspecified uses. On-site use of compost products has increased steadily in recent years, while the amount of products stockpiled, given to the public, disposed of, or used for other purposes have fluctuated sharply.

Figure 12 – Other end uses of total products created (in tons) at NCDEQ DWM permitted composting facilities (excludes products sold to public).

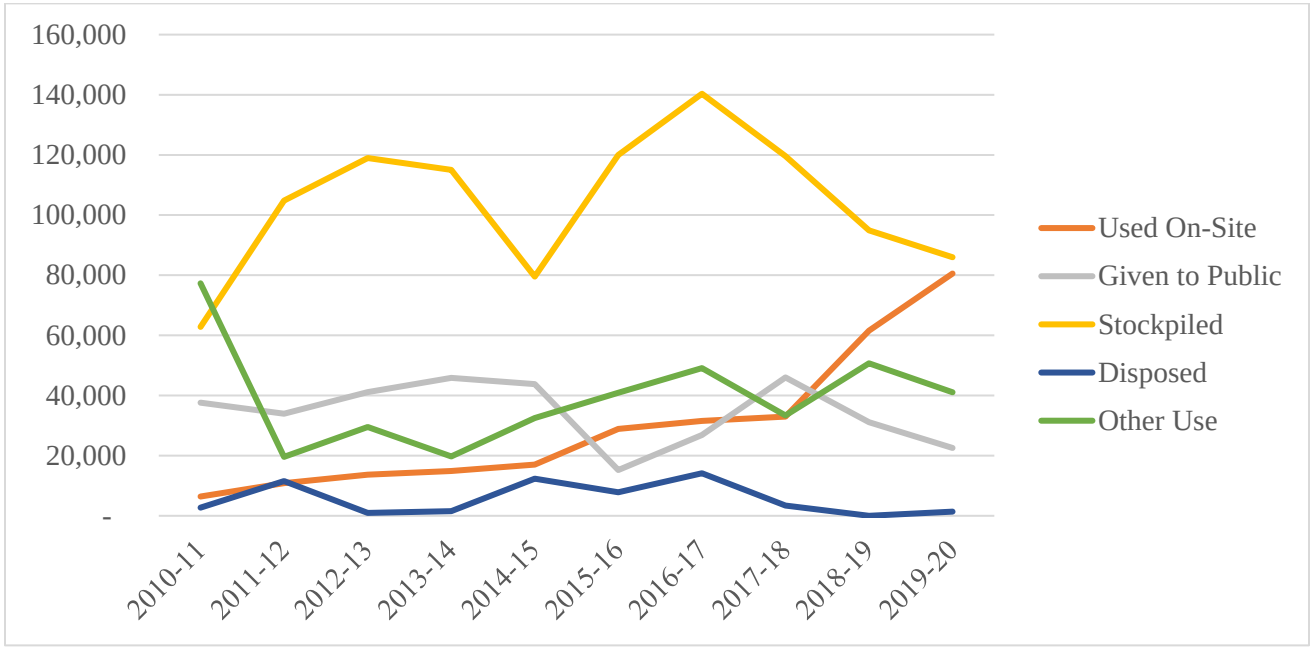


Figure 13 shows a breakdown of the end uses of the materials created by composting facilities. It shows a steadily increasing amount of products were sold to the public and used on-site in recent years, while the "other uses" category (e.g. material sold as boiler fuel, used as landfill alternative daily cover, etc.) remained fairly stable. In contrast, the amount of stockpiled products and products given for free to the public have diminished gradually since 2018. The largest variances in end uses over the last decade are products stockpiled and sold to the public; however, these two categories appear to have an inverse relationship; stockpiled tonnage tends to increase when fewer tons are sold to the public, and vice versa.

Figure 13 – Products created by end use at NCDEQ DWM permitted composting facilities (in tons).

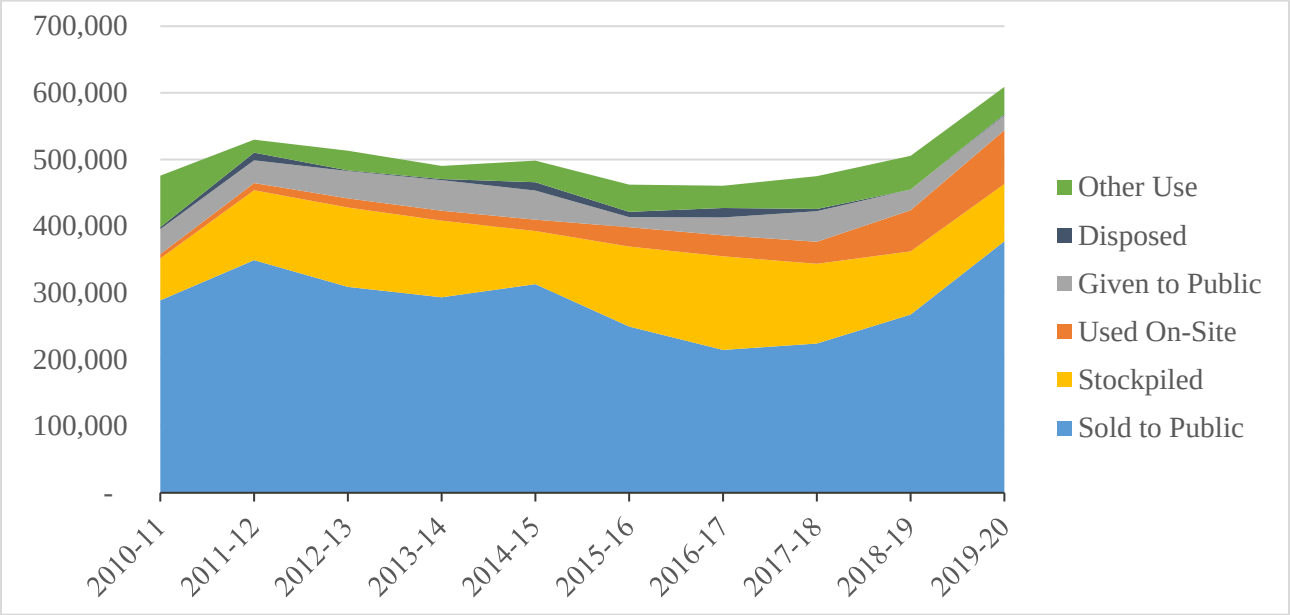


Figure 14 – Mulch created at NCDEQ DWM permitted composting facilities (in tons).

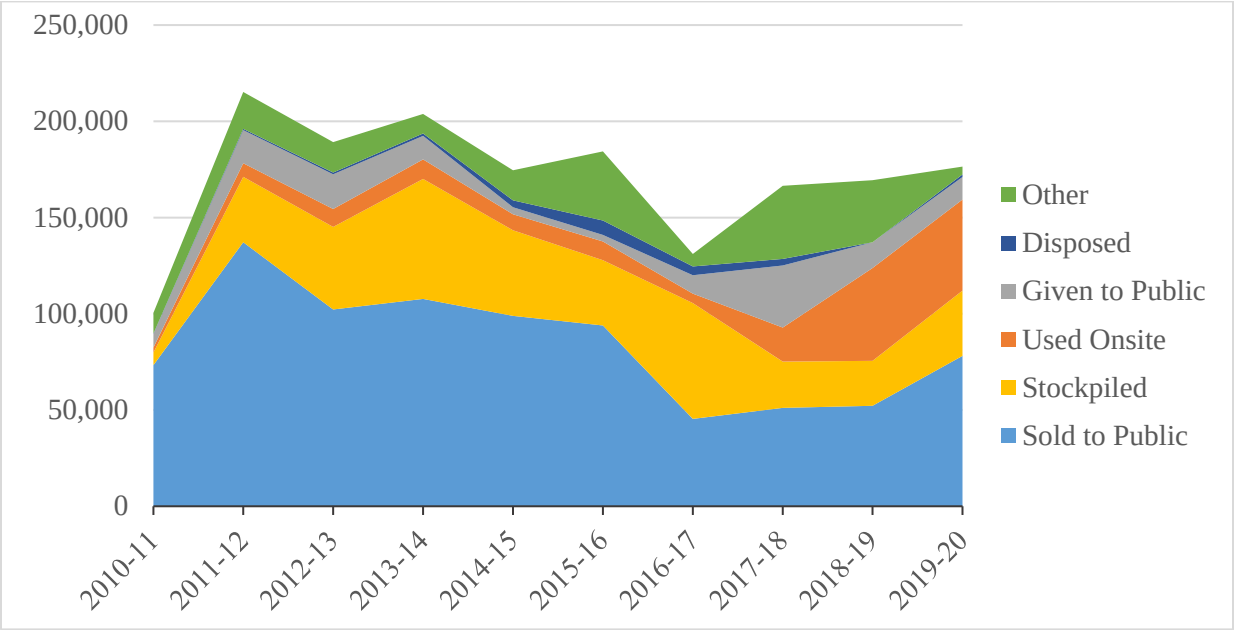
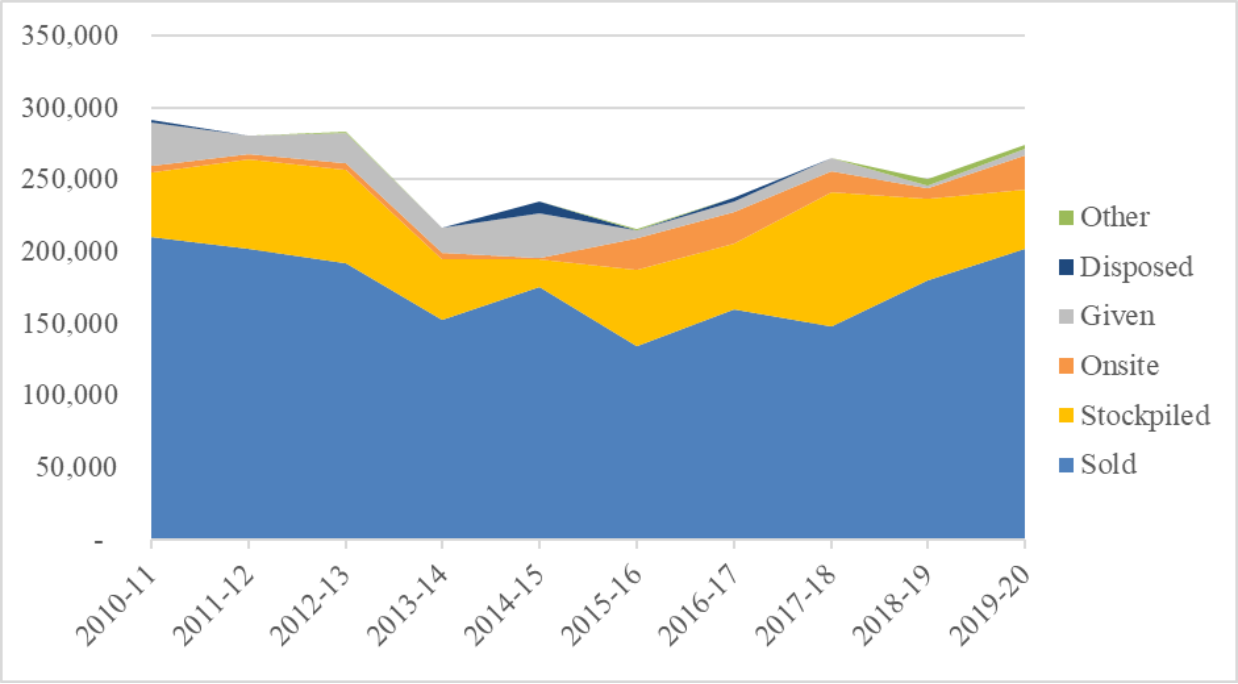


Figure 15 – Compost created at NCDEQ DWM permitted composting facilities (in tons).

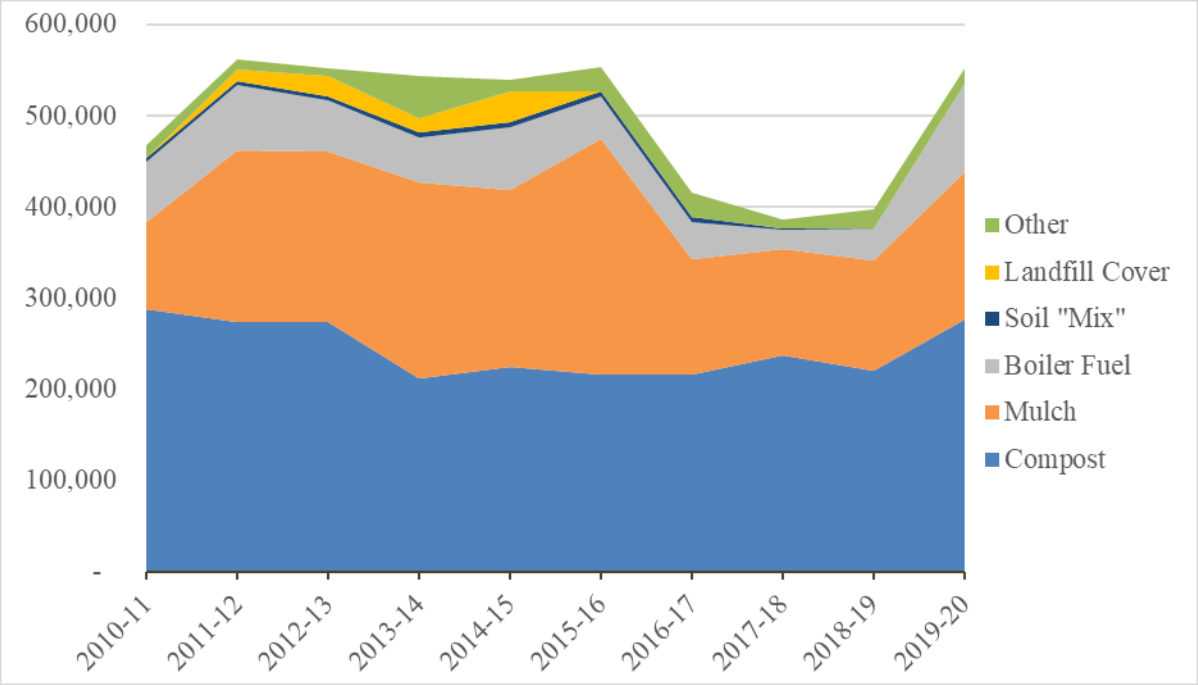


Figures 14 and **15** (above) show the distributions of mulch and compost, respectively, in regards to their end uses. Figure 14 shows that the amount of mulch sold to the public has declined significantly in the last decade, while the majority of compost was sold. A possible explanation for the comparatively smaller amount of mulch sales involves yard waste – a key ingredient in mulch production. Local government composting facilities generally receive the largest amounts of yard waste thanks to seasonal residential collection, although they generally sell a minority of the mulch they create in favor of using it at local

government properties. Comparatively, the amount of compost used on-site is much lower than mulch considering it has a higher market value and can generally be sold for a larger profit.

Figure 16 shows the tonnage distribution of the different products created at DWM permitted composting facilities. Mulch and compost make up the majority of the materials manufactured. A healthy infrastructure is typically represented by a larger amount of compost generated compared to mulch, mainly because compost has a higher market value than mulch. Facilities manufacturing mulch should consider converting mulch into compost to increase their revenue as long as they have a suitable market.

Figure 16 – Products created at NCDEQ DWM permitted composting facilities (in tons).



Food Recovery

The FOOD RECOVERY section focuses on food rescue, anaerobic digestion, animal feeding, and commercial composting. For purposes of this study, food waste is defined as excess food (edible and inedible) from different generators, such as grocery stores, catering companies, restaurants, and food manufacturing facilities. **Figure 17** shows the amount of food waste diverted from landfills by North Carolina chapters of the Food Recovery Network, a national student movement fighting food waste and hunger at higher education institutions. **Figure 18** illustrates the total amount of food waste diverted from landfills via food rescue activities, animal feeding operations, anaerobic digestion and NCDEQ composting facilities. The additional two figures (**Figures 19 and 20**) focus on the five-year trend of food scraps being composted at DWM's permitted composting facilities and one DWR permitted facility.

Food Rescue in the Community

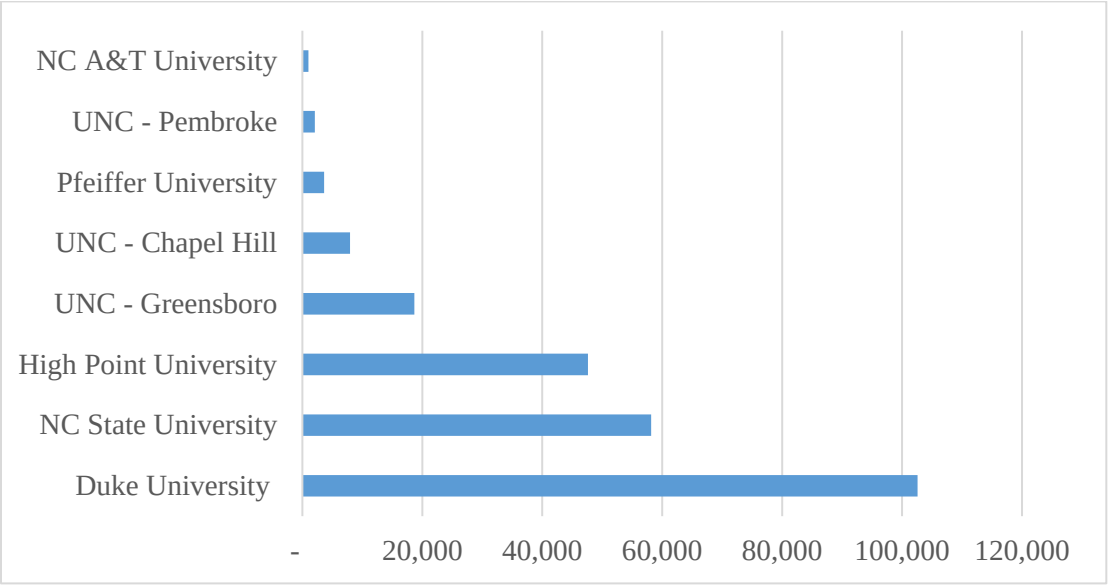
There are five food rescue non-profit organizations that serve all 100 North Carolina counties, including:

- MANNA Food Bank of Western NC
- Second Harvest Food Bank (Northwest NC, Metrolina, and Southeast NC)
- Inter-Faith Food Shuttle
- Food Bank of Central and Eastern NC
- Food Bank of the Albemarle

Food Recovery at College Campuses

In addition to non-profit food banks, the Food Recovery Network (FRN) unites students on college campuses to fight food waste and hunger by recovering perishable food that would otherwise go to waste from their campuses and donating it to people in need. To date, North Carolina chapters have diverted 241,704 pounds (121 tons). The number of FRN chapters and their food recovery capacities continue to increase. **Figure 17** (below) shows the eight post-secondary education institutions in North Carolina which have active FRN chapters and the amount of food each chapter has rescued to date:

Figure 17 – Food Recovered by NC FRN Chapters Since Inception (in pounds).



Composting at Educational Institutions

There are two school districts actively diverting food scraps through composting: Charlotte-Mecklenburg Schools (25 schools in 2019) and Chapel Hill-Carrboro City Schools (divert roughly 125 tons of food scraps annually). A third public high school, the N.C. School of Science and Mathematics, also diverted 13.7 tons of food waste in 2019. Additionally, there are 11 public and seven private higher educational institutions actively collecting food scraps at sports venues, dining facilities (pre- and/or post-consumer) and special events. They are either composting on-site or partnering with private composters to process their organic materials:

Public Higher Educational Institutions

1. Appalachian State University
2. Eastern Carolina University
3. Fayetteville State University
4. Central Piedmont Community College
5. Guilford Technical Community College
6. James Sprunt College
7. NC State University
8. UNC-Asheville
9. UNC-Chapel Hill
10. UNC-Charlotte
11. UNC-Greensboro

Private Higher Educational Institutions

1. Davidson College
2. Duke University
3. Elon University
4. Guilford College
5. Meredith College
6. Penland School of Crafts
7. Warren Wilson University

Commercial Composting by Local Governments

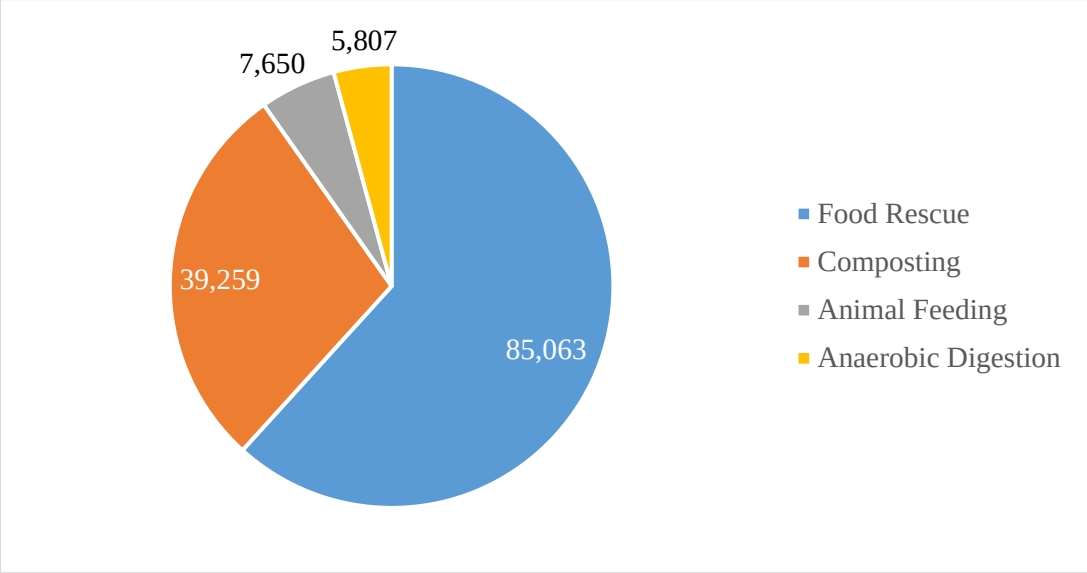
In the public composting sector, Orange County, in partnership with Brooks Compost, has continued its subsidized commercial food scraps collection program and provided a drop off location at one of its residential solid waste convenience centers. Wake County has expanded its residential food scraps collection program to four convenience centers in partnership with CompostNow. New Hanover County has a food scraps drop-off program located at the county's landfill, which uses an in-vessel composting system and accepts food scraps from the University of North Carolina at Wilmington, local restaurants and residents. Henderson County has a food scraps drop-off program, in partnership with Atlas Organics, located at its county convenience center. Henderson County also is in the process of constructing a county-owned- and-operated Type 3 compost facility. Currently, there are no publicly operated residential curbside food scraps collection programs operating in North Carolina.

Food Scraps Collection by Private Collection Companies

In the private sector, there are three food scraps collection companies focusing on both residential and commercial areas: CompostNow (Triangle and Asheville), Crown Town Compost (Charlotte) and Wilmington Compost Company (Wilmington). Focusing exclusively on commercial food scraps, there are two hauling companies that operate statewide: Organix Recycling and Valley Proteins. In addition to these haulers, five composting facilities offer food scraps collection services: Brooks Compost (Chatham County), McGill Compost (Chatham and Sampson counties), Earth Farms Organics (Gaston County), Danny's Dumpster (Buncombe County) and Gallins Family Farms (Davie County). Additionally, at least two waste management companies partner with composting facilities to haul food scraps: Republic Services and Waste Management. This is driven by businesses requesting food scraps collection services.

Figure 18 (below) breaks down the 131,972 tons of food waste diverted from landfills in 2019. Of this total, 64 percent was diverted through food rescue efforts, 30 percent via composting, 6 percent by animal feeding, and 4 percent through anaerobic digestion.

Figure 18 – Food diverted from landfilling in 2019 through food rescue/donations, anaerobic digestion, animal feeding and permitted commercial composting facilities (total 131,972 tons diverted).



Note: This aggregated data was compiled from reports, surveys, phone conversations, and limited information from various statewide organizations, businesses, state and federal governmental offices.

In 2012, NCDEQ's Division of Environmental Assistance and Customer Service published a food waste study[6] estimating residential and commercial food waste totals approximately 1.2 million tons each year. That number does not include food losses during agricultural processing, as presently there are no reliable estimates of agricultural food losses in North Carolina. The food recovered by food rescue organizations consists of perishable foods (produce from farmer's markets and grocery stores, excess food from catered events, and restaurants). Based on the limited information available, it can be assumed that North Carolina generates 1.2 million tons of food waste per year (not including agricultural losses), meaning 11 percent of excess food was diverted from landfilling in 2019 through these four strategies. This leaves 1.07 million tons of food destined for the landfill. **Figures 19** and **20** illustrate which facilities processed the most food scraps, and **Table 3** briefly outlines the infrastructure required to expand each effort to reach the EPA/FDA/USDA goal to reduce food waste by 50 percent by 2030.

[6] NC DEACS – North Carolina 2012 Food Waste Generation Study

Figure 19 – NCDEQ permitted compost facilities that received the most food scraps annually (1,000 tons or greater) between 2016-2020.

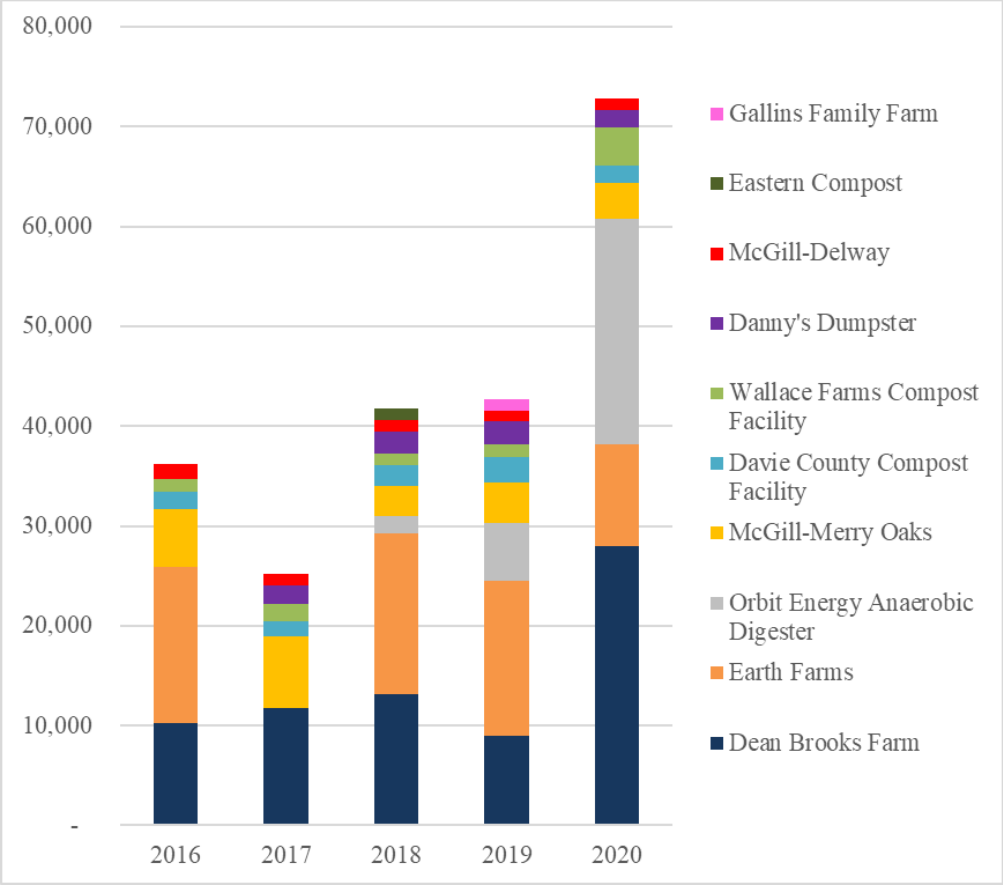


Figure 20 – NCDEQ permitted compost facilities that received the most food scraps between 2016-2020.

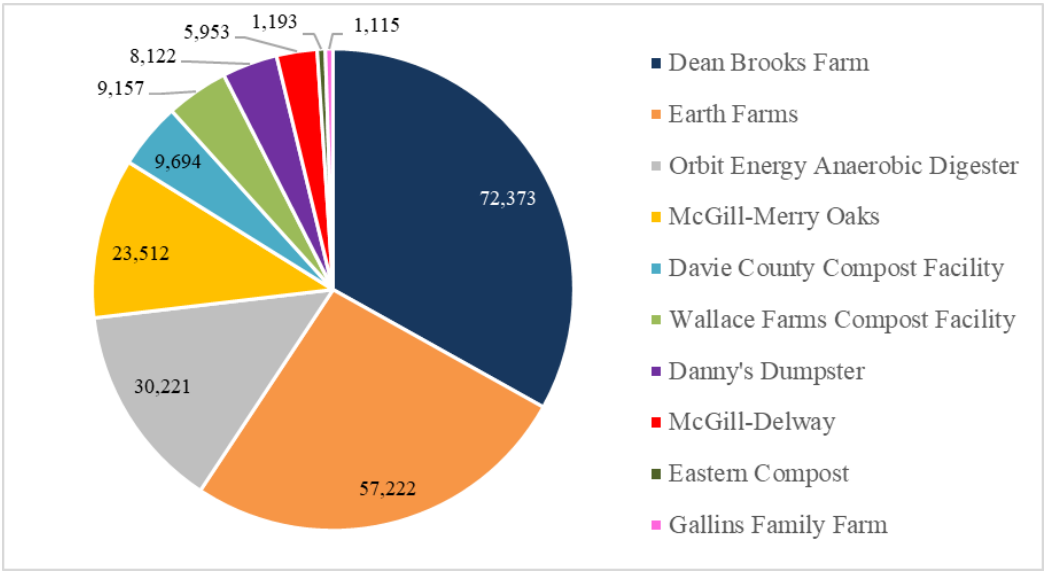


Figure 19 and **Figure 20** show 10 composting facilities which received more than 1,000 tons of food scraps per year between 2016-2020. These facilities processed 96 percent of all food scraps received at permitted composting facilities, compared to only 4 percent received by small facilities (defined as receiving less than 1,000 tons per year). While the facilities include both DWM and DWR permitted facilities, only one DWR permitted facility received food scraps during the five-year period (McGill-Delway). In FY 2019-20, Dean Brooks Farm received the most food scraps at 28,027 tons, while Earth Farms and Orbit Energy Anaerobic Digestion each received more than 10,000 tons. Orbit Energy, which began processing food scraps at its anaerobic digestion facility in Charlotte in 2017, has processed increasing amounts of food scraps during its first four years of operation, receiving 22,610 tons in 2020 after receiving 5,807 tons in 2019, and 1,804 tons in 2018.

Table 3 – Infrastructure needed to meet 50 percent food waste reduction goal (divert 1.1 million tons).

FOOD RESCUE: Expansion of refrigerated vehicles, refrigerated storage and pickup locations.
COMMERCIAL COMPOSTING: **Figure 3** (pg. 10) shows there are approximately 1.82 million tons of permitted composting capacity currently available at commercial composting facilities. Even though the available permitted capacity to process organic materials exists, it would be beneficial to have the major publicly operated commercial composting facilities integrate food scraps into their operations and permits. Additionally, collection clusters of food scraps generators will be needed to make it economically feasible to reach areas that fall outside of the normal 25- to 40-mile radius range to collect food scraps. Lastly, medium-sized food scraps composting operations will be necessary in areas that are more than 50 miles from existing composting facilities. This further decentralization would make it economically feasible for composting to be cost-competitive with landfilling at these farther places, and it would also decrease the carbon footprint of hauling food scraps.
ANAEROBIC DIGESTION: A permitted food scraps-based anaerobic digester, Orbit Energy in Charlotte, Mecklenburg County, is currently in operation with enough design capacity (500 tons per day of food scraps) to process a significant amount of food scraps. Additionally, another anaerobic digester currently receiving and processing food scraps, Full Circle Recycling in Zebulon, Johnston County, has available capacity. Unlike composting facilities that are spread throughout the state, these two anaerobic digesters are located next to two large urban metropolitan areas and will benefit from well-developed collection routes and clusters of food scraps generators to improve economic efficiency of collection.
ANIMAL FEEDING OPERATIONS: Expansion of vehicles and pickup locations.

Each of these four food waste reduction strategies require additional resources and infrastructure to expand their processing capacity. Additionally, improvements in food purchasing and procurement methods, storage techniques, and consumer behaviors can eliminate unnecessary food waste at the points of production and sale. For additional information on food waste reduction strategies and additional details on the economics of other food recovery strategies, please refer to the *Rethinking Food Waste through Economics and Data: A Roadmap to Reduce Food Waste* report, published March 2016.

KEY FINDINGS

General

1. The overall number of permitted commercial composting facilities has grown steadily in the last decade (**Figure 2**).
2. There are 24 private, 25 public and three higher education commercial composting facilities that reported materials managed in FY 2019-20 (**Figure 2**).
3. There is an available permitted capacity of 70 percent (able to process an additional 1.82 million tons of material) at existing composting facilities (**Figure 3** and **Table 3**).
4. The 10-year average tipping fee of NCDEQ DWM permitted composting facilities is $26 per ton (**Figure 4**).
5. Limited data signals that composting operations create 7 jobs per 10,000 tons of material composted per year.

Inputs / Feedstocks

6. Yard waste accounted for more than half of the total materials processed at NCDEQ DWM permitted composting facilities for each year since 2010 (**Figure 5**).
7. The supply of clean wood, a non-yard waste high-carbon feedstock, processed by NCDEQ DWM permitted composting facilities varied dramatically over the last decade but has been gradually trending upward since 2016 (**Figure 6**).
8. Biosolids processed at NCDEQ DWM permitted composting facilities have increased by 106 percent since 2010, or 10.6 percent per year (**Figure 7**).
9. Grease trap waste processed at NCDEQ DWM permitted composting facilities has increased by 93 percent since 2010, or 9.3 percent per year (**Figure 7**).
10. Animal waste processed at NCDEQ DWM permitted composting facilities has decreased by 14 percent since 2010, or 1.4 percent per year (**Figure 7**).
11. Food scraps processed at NCDEQ DWM permitted composting facilities have increased by 61 percent since 2010, or 6.1 percent per year (**Figure 7**).
12. High carbon feedstocks processed at NCDEQ DWM permitted composting facilities consist of roughly 68 percent and high nitrogen feedstocks roughly 32 percent of the total materials received since 2010 (**Figure 8**).
13. Of the 11 NCDEQ DWM permitted compost facilities that received the majority of the materials in FY 2019-20, four are public Type 1 (woody waste) composting facilities and seven are private Type 3 and 4 (multi-feedstock) composting facilities (**Figure 9**).
14. Fifty percent of materials received at the 52 NCDEQ DWM permitted composting facilities originated from Mecklenburg, Wake, Guilford and Gaston counties (**Table 2 and Figure 10**).

Outputs / Products

15. NCDEQ DWM permitted composting facilities sold an average of 64 percent of the material they created in FY 2019-20 (**Figure 11**).

16. Stockpiling of finished products at NCDEQ DWM permitted composting facilities has increased 37 percent since 2010 but has declined sharply in the last four years (**Figure 12**).
17. The amount of products used on site by NCDEQ DWM permitted composting facilities increased from 6,412 tons in 2010 to 80,554 in 2020 (an average annual increase of 116 percent), while the amount given to the public has declined steadily (**Figure 13**).
18. Mulch production at NCDEQ DWM permitted composting facilities has increased by 71 percent over the last decade, while compost production has declined modestly (3.2 percent) since 2010 (**Figures 14, 15 and 16**).

Food Recovery

19. The North Carolina Association of Feeding America Food Banks consists of five major non-profit organizations, which rescued approximately 85,063 tons of wholesome food through farmers, restaurants, catering companies and grocery stores in 2019.
20. Eight colleges are North Carolina chapters of the national Food Recovery Network and have rescued 121 tons of wholesome food as of 2019 **(Figure 17)**.
21. Eleven public and seven private higher education institutions collected food scraps from sport venues, dining facilities (pre- and/or post-consumer) and/or at special events.
22. Five counties (Durham, Henderson, New Hanover, Orange and Wake) offer drop-off food scraps collection programs.
23. No local governments presently offer residential curbside collection of food scraps.
24. Six hauling companies are exclusively dedicated to food scraps collection (for composting and/or animal feeding), and two waste companies offer food scraps collection services.
25. In 2019, 131,972 tons of food were diverted from landfills via food rescue organizations (64 percent), commercial composting (30 percent), anaerobic digestion (6 percent), and animal feeding (4 percent) (**Figure 18**).
26. Fourteen NCDEQ DWM permitted composting facilities and one NCDEQ DWR permitted anaerobic digestion facility accepted food scraps in 2020: seven of them accepted more than 1,000 tons and composted 96 percent of total food scraps while eight accepted less than 1,000 tons (4 percent of total food scraps composted) (**Figures 19 and 20**).

FUTURE RESEARCH AREAS

Many questions remain that need to be addressed to expand organic waste recycling; increase the services to reduce the production of excess food; and move any excess food to plates, farms, soils and the electricity grid. Some future research areas include:

1. Quantify the current transportation capacity by the different food recovery strategies;
2. Identify the location and amount of excess food generated to improve collection routes;
3. Quantify the capital costs required to expand the various diversion efforts;
4. Evaluate higher-end markets for final compost products to make these services more cost-competitive with landfilling or boiler fuel plants; and
5. Compare job creation between landfilling and private and public composting operations.

CONCLUSIONS

The NCDEQ DWM annual composting facility reporting requirement was essential to developing this study. Through data analysis, it can be seen that North Carolina's composting industry has shown healthy signs of growth over the past 10 years, including a stable amount of overall organic material received, a consistent number of facilities spread throughout the state, available permitted capacity to handle more material, steady product demand, and competitive tipping fees.

Within the available permitted capacity, the composting industry has the ability to compost much of the excess food that is currently landfilled with only a few modifications to existing permits needed to allow existing composting operations to process food scraps. Additional small food scrap composting operations are needed in some areas of the state to decrease the distance between existing composting facilities and generators. The ability of composting facilities to handle excess food should not overshadow the ability to expand existing food rescue, animal feeding and anaerobic digestion operations.

The biggest challenge remains the collection of organic waste material, specifically agricultural food losses, excess prepared food, food scraps and food manufacturing byproducts. The distance between the generators of excess food and the users is a key factor in making the economics of the system work. These distances can increase costs to the point of making the aforementioned landfill alternatives cost-prohibitive. The creation of dense collection service routes, often times anchored by a few large generators, is also critical to improving system economics and reducing collection service costs to all generators. Many food waste generating businesses are willing to evaluate savings on waste disposal and shift those funds towards landfill alternatives, and sometimes even pay more for the services. The creation of these business commitments is driven by customers and citizens, and are shown through corporate and institutional zero waste goals—crucial steps towards the advancement of organics recycling in North Carolina.

Unlike other states with active food waste bans from landfills (California, Connecticut, Vermont, Massachusetts and Rhode Island) or local governments with supportive food diversion ordinances or programs (such as Austin, TX; Boulder, CO; New York City, NY; Portland, OR; San Francisco, CA; and Seattle, WA), North Carolina and most of its local governments do not have a landfill ban or recycling mandates on food waste. North Carolina does have a supportive state government recycling program found in NCDEQ that provides technical assistance and grant funding for the diversion of organic material as well as local government recycling offices that offer technical advice or funding. The state also has active networks of food rescue, compost and organics recycling professionals, as well as a growing commitment to zero waste in its industrial sector.

The combination of public/private partnerships—support from state and local governments as well as corporate commitments coupled with non-profit and private sector diversion services—is critical to diverting organic materials from landfills, creating jobs, improving soil health, reducing hunger, and meeting the EPA/FDA/USDA food waste reduction goal.