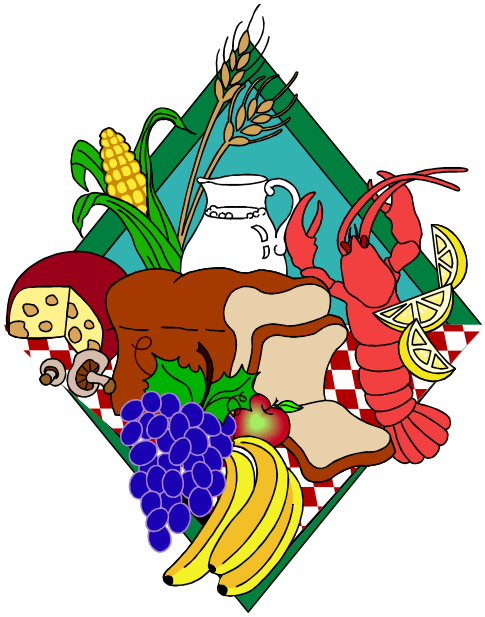
Organics: Food Residuals

COMMODITY PROFILE

North Carolina Department of Environment and Natural Resources
DIVISION OF POLLUTION PREVENTION AND ENVIRONMENTAL ASSISTANCE

MARKETS ASSESSMENT 1998



OVERVIEW

The nation's food supply is the most varied and abundant in the world. Americans spend a smaller share of their disposable income on food than citizens of any other country and choose from an average of 50,000 different food products on a typical outing to the supermarket.[1] This abundance of food has offset motivations to monitor or reduce food residuals.

Food residuals are generated at every step in the distribution chain from farm to dinner table. Examples include:

- Farm produce that does not meet supermarket purchase specifications.
- Diseased animals that are condemned at slaughterhouses.
- Waste from industrial food processing establishments.
- Discards of blemished perishables and out-of-date foods at supermarkets.
- Foods prepared by service establishments that are not served to guests.
- Plate scraps from commercial and residential sources.

Mechanisms for recovery of food residuals differ depending on whether these foods are suitable for human consumption. Recovery efforts for edible foods include gleaning programs, food banks, and food rescue programs. Recovery efforts for inedible foods include animal feed (either direct or remanufactured into an animal feed product) and composting.

In 1997, estimated food residuals generation in North Carolina was 862,500 tons from commercial and residential sources (or 11 percent of the total municipal solid waste stream). This total does not include farm losses before foods enter the distribution system or wastes from industrial food processors sent directly to rendering and animal feed production facilities. The estimated recovery rate of food re-

Figure 1: North Carolina Food Residuals Generation Estimates[1]

Source	Annual Tonnage	Percent of Total MSW Stream	Pounds Per Capita Per Day
USDA-ERS, 1996[1]	1,318,844	17.1	1.0
Luboff/Newell, 1993 [3,4]	1,145,225	14.8	0.87
EPA, 1994[5]	644,338	8.0	0.48
Orange Co., 1996[6]	551,735	7.1	0.42
EPA, 1997[2]	586,360	8.0	0.45
Mean	849,300	11.0	0.64
Standard Deviation	356,278	4.6	0.27

*Estimates based on North Carolina's proportion of total United States population.

siduals in North Carolina is less than two percent. Insufficient data exist to develop more accurate recovery estimates.

North Carolina recovery organizations include eight food banks, four food rescue programs, 117 licensed food waste animal feeders, several animal feed manufacturers, and three programs that compost food processing waste. Also, several small-scale food residuals composting efforts are underway, including institutional efforts at correctional and military facilities, and events-oriented activities, such as the annual Festival for the Eno River in Durham.

SUPPLY

Generation

Estimates of food residuals generation are limited and inconsistent. The U.S. Department of Agriculture (USDA) and the U.S. Environmental Protection Agency (EPA) have conducted national-scale studies.[2, 3] Curbside studies have been conducted in Seattle, Washington; Crawford County, Illinois; and Orange County, North Carolina.[4, 5, 6] Based on these studies, estimates of food residuals generation in North Carolina have been compiled and are presented in Figure 1.

Data presented above reflect the wide variation in estimates of food residuals generation, as shown by the substantial standard deviation around the mean. Extrapolating these data to 1997 and 2002, generation of food residuals in North Carolina is estimated to be 862,500 tons and 915,300 tons, respectively. (See Figure 2.)

Recovery

Food donor programs are the primary recovery mechanisms for edible food, while animal feeds and composting are the primary recovery mechanisms for inedible food. Food donor programs provide edible foods to the needy through food banks and prepared and perishable food rescue programs (PPFRPs).[7] Food banks focus on distributing large volumes of nonperishable food (i.e., canned, dried, or prepackaged). Much of the food distributed by food banks is diverted from the landfill; however, they also distribute foods donated by citizens that otherwise would not have been discarded. Currently, North Carolina has seven operational food banks. PPFRPs also are known as food rescue or surplus food distribution programs. These programs distribute freshly prepared foods and perishables to the needy. There are five food rescue programs operating in North Carolina. In 1997, food donor programs in North Carolina provided about 6,962 tons of edible food to the needy.[8] This number is expected to rise significantly in future years as efforts of the new USDA Food Recovery and Gleaning Initiative begin to show results. This program has a goal of a 33-percent increase in the amount of food recovered nationally by the year 2000. This goal translates to a projected year 2002 recovery of 11,100 tons in North Carolina.

Inedible foods can be recycled into animal feeds in two ways: (1) feeding them directly to animals (livestock) or (2) reprocessing them into animal feeds. Hog, cattle, and poultry producers often are interested in collecting food residuals to use as direct animal feed. Dairy products and bread may be fed to hogs without further handling, but other food residuals or mixed food residuals must be cooked before being fed to hogs. Farmers who use other or mixed food materials must be licensed garbage feeders. Currently, 117 garbage feeders are licensed by the USDA / Animal and Plant Health Inspection Service (USDA/APHIS) to approximately 3,000 hogs. In 1997, these licensed farmers diverted approximately 6,700 tons of food residuals to direct animal feed. The number of livestock in North Carolina is expected to remain relatively constant through the year 2002 because the total numbers of cattle, sheep, and chickens are declining, but the number of hogs is rising.[9] As

a result, the amount of food residuals diverted to direct animal feed is expected to remain relatively constant (6,500-7,000 tons per year).

Some North Carolina animal feed producers use industrial food processing residuals as all or a portion of their incoming raw materials.[10] Estimates of food residuals generation in North Carolina do not include food residuals generated by "industrial" food processors, therefore the processing quantities listed above are excluded from recovery estimates.

Another diversion technique for food residuals is composting. A recent study determined that the United States has 214 composting facilities that accept food residuals.[11] More than half of these are smaller-scale, on-site facilities, such as those serving correctional facilities, other institutional facilities, or on-farm operations. Eight facilities are operational in North Carolina, including a ninth one that came on-line during summer 1998.[12] Several composting efforts are described below.

- Five operational facilities compost industrial processing wastes from aquaculture, seafood, and fruit processing industries.
- Two correctional institutions compost post-consumer food waste.
- One facility, operated by the Eastern Band of the Cherokee Indians, composts food residuals from a casino in western North Carolina.
- A composting operation at a military installation is permitted to accept source-separated materials and currently accepts food residuals, sludge, and paper. Although this operation is permitted to accept mixed waste as well, it does not.
- The National Institute for Environmental Health Sciences in Research Triangle Park uses worms to compost about 100 pounds of food residuals from its cafeteria each week.
- The North Carolina Zoo in Asheboro incorporates food residuals into its composting program.
- In addition, two of the commercial composting facilities in North Carolina indicated they were capable of accepting food residuals, but were not receiving any at present.[13, 14]

Some food residuals composting is being practiced at special events, like the annual Festival for the Eno River in Durham each July. In addition, 14 North Carolina communities have begun sponsoring backyard composting programs. These programs will contribute to the diversion of food residuals from landfills, but the quantities diverted are unknown. Quantities of food residuals recovered through composting are estimated to be insignificant for commercial and residential food residuals. In summary, the relationship between generation and recovery is shown in Figure 2.

Figure 2: North Carolina Food Residuals Generation versus Recovery (tons)

	1997	2002
Generation	862,500	915,300
Recovery	13,662*	17,800*

*Does not include food residuals composting; quantities are limited

DEMAND

Elements of demand for food residuals consist of edible food donations to the needy, animal stock farmers seeking either direct or processed animal feeds, and users of composted feedstocks (i.e. landscapers, nurseries, soil blenders, the public, etc.).

Food Donor Programs

Demand for donated edible foods is estimated to be in excess of the 6,962 tons per year recovered in North Carolina, however more quantifiable estimates are not available. It is estimated that in the United States four million children under 12 and about 30 million adults go hungry at least once per month.[15] According to the 1990 census, 13 percent of the population (or 830,000 persons) in North Carolina lives in poverty.[16] Demand for food donor programs in North Carolina has grown consistently during the past several years.[17] Recently, USDA announced a new Food Recovery and Gleaning Initiative.[18] This initiative arose from an inaugural National Summit on Food Recovery and Gleaning in September 1997. This Summit set a goal of a 33-percent increase in the amount of food recovered nationally by the year 2000. Meeting this goal would produce an additional 250,000 tons of food per year to feeding organizations.[19]

One obstacle to growth in food donor programs has been concern about potential liability to the donor if a problem occurs. To protect food donors, "Good Samaritan" laws that specifically address food donations have been enacted in all states. North Carolina's model "Good Samaritan" law was enacted in 1989 and revised in 1991. On a federal level, the Bill Emerson Good Samaritan Food Donation Act went into effect in October 1996. These laws limit the potential civil or criminal liability exposure to a donor unless gross negligence, recklessness, or intentional misconduct of the donor causes injury. The federal law also establishes basic uniform definitions pertaining to donation and distribution of foods and helps ensure donated foods meet

all quality and labeling standards of federal, state, and local laws and regulations. This law facilitates donations of food by large, multi-state restaurants, and eating establishments and by chain hotels.

Animal Feeds

For industrial, commercial, and residential food residuals, the demand for food residuals-based animal feeds is driven by these factors: avoided costs (farmers not having to spend money on commercial animal feeds), proximity to sources of good-quality food residuals, and lack of contamination with non-food residuals. For animal feeds produced by industrial companies using industrial food processing residuals, an additional economic driver is the cost of the food residuals relative to the cost for other feedstocks (e.g., grains).

The potential demand for direct animal feeds from food residuals from garbage feeders is considered to be relatively constant. This is because of the limitations noted above and the trend towards more Concentrated Animal Feed Operations (CAFOs). For these larger operations, the potential for using food residuals as direct animal feeds is hindered by the lack of a source-separated collection infrastructure. As food residuals collection is labor-intensive, it seems to be cost-effective only for small-scale collection efforts supporting local garbage feeding operations.

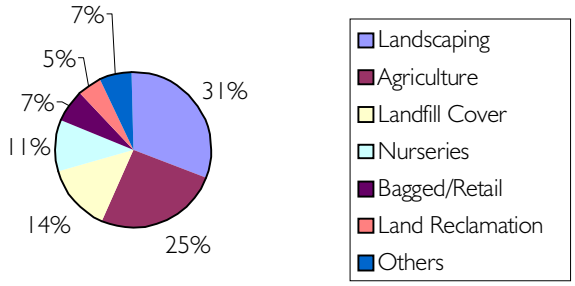
The potential demand for processed animal feeds derived from food residuals is similarly constrained by economies of scale. Existing processed animal feed companies use large volumes of food residuals from large-scale industrial food processing companies. Some smaller food processing companies have been unable to divert their food processing residuals to animal feed producers because quantities were too small and collection costs were not cost-effective.[20] Instead, these residuals are being diverted to direct animal feed efforts at local farms.

For these reasons, it is estimated that direct animal feed recovery programs in North Carolina will remain at or about the same size through 2002 (6,500 to 7,000 tons per year). As noted previously, the processed animal feeds industry is not included in these estimates of generation, recovery, or demand.

Food Residuals Composting

The markets for composts can be divided into six main sectors, with several other markets in emerging status. The more mature markets sectors are agriculture, landscaping, nurseries, public agencies, residential use, and land reclamation/landfill cover.[21] Emerging markets include:

Figure 3: Compost Markets



- Bioremediation of contaminated sites.
- Stormwater runoff filtration and treatment.
- Vapor-phase biofiltration of contaminated exhaust air streams.
- Reforestation of denuded sites.
- Revegetation of sites for habitat restoration.
- Restoration of damaged wetlands.
- Erosion control at construction sites.
- Control of plant disease problems (biopesticides).
- Remediation of damaged turf grasses and soil compaction problems.[22]

Each market has specific requirements for compost consistency and quality. The most stringent standards apply to horticultural uses (i.e., nurseries, greenhouses, golf courses, athletic fields, landscaping). Markets such as agriculture, sod farms, municipal greenspaces, and field-grown nursery crops would have somewhat less stringent standards. The least restrictive standards would apply to landfill cover and land reclamation markets.

Quality standards of emerging markets have not yet been fully defined. A recent study[23] concluded that food residuals composts were a consistent source of slow-release nitrogen during the second and third years after application.

A 1996 study surveyed market distribution for compost facilities in seven states (California, New Jersey, Ohio, Washington, Minnesota, Florida, and Massachusetts).[24] That survey estimated compost market distribution, as illustrated in Figure 3, with landscaping and agriculture being the largest markets.

Previous studies estimate the demand for compost in North Carolina to be 13,483,000 tons per year, with the vast majority going to agricultural uses (98 perecnt).[24] Remaining markets were believed to absorb 232,000 tons annually. The current demand for compost is believed to exceed the current available supply (estimated at 177,680 tons in 1996), although specific demand estimates currently are not available.

North Carolina modified its Solid Waste Management regulations effective May 1, 1996, to establish requirements for Solid Waste Compost Facilities (15A NCAC 13B, Section .1400). These regulations allow four different types (I-IV) of compost facilities, depending on the nature of the incoming feedstocks. These regulations will likely make it easier to construct new composting facilities, especially Type I and Type II facilities, which use clean, non-pathogenic residuals.

Prices for finished compost vary throughout the United States and in the Southeast. Bulk sale prices for leaf compost, yard trimmings compost, manure compost, mixed solid waste compost, and biosolids compost in the Southeast ranged from $3 per cubic yard to $25 per cubic yard in a 1997 survey.[26] Average values for these various products varied from $6 to $15 per cubic yard ($24 to $60 per ton). In Charlotte, North Carolina, bagged compost is sold for $3.50 to $4 for a 45-pound bag ($155 to $177 per ton), while bulk sales are $18.50 per cubic yard ($74 per ton).[27]

SUPPLY / DEMAND RELATIONSHIP

The supply of food residuals is considerably greater than the current or projected demand (although demand estimates are cursory, at best). Estimated food residuals generation quantities have risen drastically in recent years due to greater attention to this fraction of the solid waste stream. Recovery of food residuals is inherently constrained by ongoing concerns about food safety and by overabundance of food supply.

One obstacle to the diversion of edible food residuals to food recovery and rescue programs is concern about liability issues, even with the passage of Good Samaritan laws in many states (including North Carolina). These concerns may be exaggerated. In a legal opinion, one law firm noted, "North Carolina also has one of the most favorable liability standards for donors of any state in the country."[28] This law, in combination with the recent USDA Food Recovery and Gleaning Initiative, will likely result in increased edible food residuals diversion during the next several years.

Diversion of inedible food residuals to animal feeds and food composting operations is constrained by the lack of a sophisticated source-segregation and collection infrastructure and by the lack of adequate composting capacity within a reasonable distance from high concentrations of generators. Direct animal feed recovery efforts will continue where there is proximity between generators and farmers and where farmers are willing to put effort into running a food residuals collection program. Processed animal feeds derived from food residuals will continue focusing on industrial food processors, simply because of economies of scale. Composting facilities will continue focusing on small, localized institutional settings and will be easier to permit and build now that North Carolina has specific regulations for solid waste compost facilities.

Challenges with regard to food residuals composting include: [29]

- The need for a more widely available, cost-competitive composting infrastructure.
- Increasing the awareness of local government solid waste and recycling officials to food residuals composting.
- Providing greater volumes of source-separated food residuals to composting facilities with fine-tuned processes and developed markets for high-quality compost.

CONCLUSION

The amount of food residuals in North Carolina diverted from landfill disposal is very small. It is believed that adequate demand exists for recovered edible foods, animal feeds and food residuals-based compost to significantly increase the diversion rate. Efforts are needed in several areas to improve food residuals recycling rates.

North Carolina already has decided to support one full-time staff person dedicated to the area of recycling organic materials (including food residuals). This position is focused on creating linkages between sources of organic materials, processing facilities and technologies, and end-user markets and outlets.

The best opportunities for entrepreneurs and investors appear to be in the conversion to animal feeds and composting. Edible food recovery programs are governed by non-profit charitable organizations. Once more detailed and reliable information is available, the geographic locations for animal feed and composting opportunities should become apparent. Both products (animal feeds and composts) are perceived as low-value commodities, which favor the development of larger, centralized facilities that can take advantage of economies of scale. However, the geographic constraints of sources versus processors versus demand favors development of smaller-scale, decentralized facilities.

Development of a viable collection, processing, and marketing infrastructure for food residuals will have a significant impact on North Carolina's recycling goals. The following recommendations are designed to support development of such an infrastructure.

RECOMMENDATIONS

- North Carolina should sponsor a food residuals generation study focusing on developing current and accurate data on food residuals quantities, sources, and locations. As curbside studies (such as the Seattle study) produce the most accurate estimates, North Carolina should conduct these types of studies in several different communities representative of North Carolina municipalities.
- Similarly, more detailed information should be gathered on existing and planned recovery programs, particularly with regard to direct animal feeds, processed animal feeds, and food residuals composting. This effort should focus on the geographic relationship between recovery programs and sources of food residuals.
- North Carolina also should develop programs to work with the USDA Food Recovery and Gleaning Initiative so that greater quantities of edible foods are diverted to the needy.
- A more accurate estimate of demand also is needed for composts, animal feeds, and food recovery/ rescue programs. North Carolina should conduct a study assessing market demands for composts in both established and emerging markets. The agricultural community should be surveyed to assess its demand for food residuals-based animal feeds and obstacles for developing that market.

[1] Kantor, L.S., et.al. "Estimating and Addressing America's Food Losses." USDA-ERS. *Food Review*. Vol. 20, No. 1. January - April 1997.
[2] U.S. Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1997 Update*. Report No. EPA530-R-98-007. May 1998.
[3] Luboff, C. and May, K. "Measuring Generation of Food Residuals." *Biocycle*. Vol. 36, No. 7. July 1995. p. 66-68.
[4] Newell, T., et.al. "Commercial Food Waste From Restaurants and Grocery Stores." *Resource Recycling*. February 1993. p. 56-61.
[5] U.S. Environmental Protection Agency. *Waste Prevention Recycling and Composting Options, EPA Report No. EPA530-R-92-015*. February 1994.
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[7] Sherman, R. L. "Food Recovery & Waste Reduction." *Water Quality & Waste Management*, North Carolina Cooperative Extension Service. February 1998.
[8] Estimate based on telephone surveys of food bank and food rescue programs in North Carolina.
[9] North Carolina Dept. of Agriculture and Consumer Services. *Livestock and Poultry Inventory.* July 8, 1997. http://www.agr.state.nc.us/stats/livestoc/aniinvyr.htm.
[10] Examples include dehydrating seafood processing residuals (110,000 tons per year) and collection and processing of meat scraps and restaurant greases (1,135,000 tons per year). The total amount of commercial animal feed distributed in North Carolina during 1996 was 5,092,535 tons, but it is not known how much of this quantity was derived from food residuals. It is also not known how much, if any, was derived from food residuals being diverted from landfill disposal.
[11] Goldstein, N. and Block, D. "Nationwide Inventory of Food Residuals Composting." *BioCycle*. Vol. 38, No. 8. August 1997. p. 46-57.
[12] Personal Communication, Mr. Ted Lyon. North Carolina Division of Solid Waste Management. May 28, 1998.
[13] Personal Communication, Mr. Frank Franciosi. RT Soil Sciences, Rocky Mount, North Carolina. May 21, 1998.
[14] Personal Communication, Ms. Annette Tyson. McGill Environmental Systems, Rose Hill, North Carolina. May 27, 1998.
[15] U.S. Department of Agriculture, National Hunger Clearinghouse. http://www.iglou.com/why/glean/
[16] North Carolina Department of Health and Human Services, Office of Economic Opportunity. *About N.C.'s Poor*. http://www.state.nc.us/DHR/OEO/poor.htm.
[17] Personal Communication, Mr. Greg Kirkpatrick, former Executive Director of North Carolina Food Bank. April 28, 1998.
[18] U.S. Department of Agriculture. Food Recovery and Gleaning Initiative Fact Sheet. May1998.
[19] Recent steps taken by the USDA to meet this goal include: working with the National Restaurant Association to produce a food recovery handbook for their members, helping hunters donate venison to food banks, empowering schools to donate excess food from the National School Lunch Program, encouraging airlines to donate unserved meals, working with the U.S. Department of Transportation to develop a comprehensive way to transport recovered foods, facilitating the donation of excess food from the Department of Defense, and providing technical assistance to community-based groups and private citizens.
[20] Personal Communication, Mr. Norman Brown. Bruce Foods Corp., Wilson, North Carolina. June 23, 1998.
[21] North Carolina Department of Environment, Health, and Natural Resources, Office of Waste Reduction. *Assessment of The Recycling Industry and Recycling Materials in North Carolina, 1995 Update*. November 1995. p. 4-168.
[22] U.S. Environmental Protection Agency. *Innovative Uses of Compost*, Report Nos. EPA530-F-97-042 through 046. October 1997.
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[24] U.S. Environmental Protection Agency, *Characterization of Municipal Solid Waste in the United States: 1997 Update*, Report No. EPA530-R-98-007, May 1998, p. 149.
[25] NCDEHNR/OWR, November, 1995, *op.cit.*, p. 4-169.
[26] National Composting Prices, *Composting News,* Vol. 5, No. 12, February, 1997, p.4.
[26] Farrell, M., "Municipal Experiences with Marketing Compost," *Biocycle*, Vol. 38, No. 9, September, 1997, p. 39.
[28] Letter from Ann McColl, Richard Schwartz and Associates, Raleigh, NC, to Jill Bullard, Interfaith Food Shuttle, November 25, 1992.
[29] Goldstein, N. and Block, D., "Nationwide Inventory of Food Residuals Composting," *BioCycle*, Vol. 38, No. 8, August 1997, p. 46-57.