

**EMPLOYMENT TRENDS IN
NORTH CAROLINA'S
RECYCLING INDUSTRY**

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ABSTRACT

While the environmental benefits of recycling are well known and understood, there is less understanding of the economic contributions of recycling to local and state economics. The objective of this study is to quantify the impacts of recycling on jobs in North Carolina. This was accomplished by collecting survey data on the current employment status in public and private sector recycling businesses and then comparing current data with information from 1994 and 2000 to determine the employment trends. Employment data from the recycling industry is also compared with other industries' employment over the same time period.

Survey data indicates that recycling is a significant employer in North Carolina supporting approximately 14,000 employees, or 0.35% of North Carolina's workforce. The private sector supports ten times the number of recycling employees as the public sector. In contrast to most other industries, recycling employment has increased over the last 10 years. While traditional industries such as textiles and manufacturing have lost significant numbers of jobs over the past decade, recycling has created jobs and increased its share of the labor market. North Carolina has approximately 1.2% of the nation's recycling jobs.

This study points to the economic importance of continuing and expanding recycling programs in North Carolina, which adds to the environmental benefits of recovering as much waste as possible. At the state and local levels, there is need for policies that encourage participation in recycling programs and discourage waste disposal. This can be accomplished through a variety of methods, including for example, environmentally preferable purchasing standards, enacting landfill bans on specific commodities, or enacting a bottle-bill system.

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SECTION I: BACKGROUND

While the environmental benefits of recycling are well known and understood, there is less understanding of the economic contributions of recycling to local and state economics. The objective of this study is to quantify the impacts of recycling on jobs in North Carolina. This was accomplished by collecting survey data on the current employment status in public and private sector recycling businesses and then comparing current data with information from 1994 and 2000 to determine the employment trends. Employment data from the recycling industry is also compared with other industries' employment over the same time period.

The North Carolina Division of Pollution Prevention and Environmental Assistance (DPPEA), a division of the Department of the Environment and Natural Resources (DENR), is the agency charged with "providing technical assistance on the elimination, reduction, reuse and recycling of wastes and pollutants" (NCDENR 2004). DPPEA works with local governments and recycling businesses throughout the state. Quantification of the impact of recycling programs on employment in NC will be useful for DPPEA as the agency works with both the private and public sectors to encourage more recycling.

SOLID WASTE REDUCTION HIERARCHY

In the early history of the United States, household trash was discarded out windows into the streets or dumped in the ocean (USEPA 2003c). Waste management began to change with the advent of the Industrial Revolution and the shift to a consumer-based society. The Industrial Revolution brought about an increase in production, which led to an increase in wealth and an increase in household input, which subsequently led to an increase in household output. As trash began to pile in the streets, pollute water supplies and produce unpleasant odors, it became quite apparent that garbage and solid waste were social and environmental problems. In response, garbage collection became the charge of municipalities (Carlson 2001 p.1255).

Although garbage collection is still the charge of local government units in most of the United States, the municipal solid waste management industry has changed dramatically since the Industrial Revolution. Presently, waste disposal is highly regulated while waste minimization is highly encouraged. For example, both Former Presidents George H. Bush and Bill Clinton issued Executive Orders while in office, mandating waste reduction, recycling and the purchasing of recycled products (USEPA 2003c). More recently, the Environmental

Protection Agency issued the Resource Conservation Challenge, a voluntary program aimed at waste reduction and energy conservation (USEPA 2004b).

Solid waste reduction strategies have been ranked into what is referred to as the 'Solid Waste Hierarchy' (USEPA 2004a). The highest rank in the hierarchy is source reduction: the best way to reduce the amount of waste is to prevent the generation of waste. The EPA defines source reduction as "any change in the design, manufacture, purchase or use of materials or products to reduce the amount or toxicity of trash created" (USEPA 2003e). This includes activities at the individual level as well as the industry level. At the individual level, practices such as using double-sided paper or re-using grocery bags count as source reduction. However, the industry level has the potential to make the most significant gains in source reduction (USEPA 2003d). Product stewardship, extended producer responsibility and supply chain management are concepts gaining in popularity and have the potential to make major reductions in the amount of waste produced. The basic premise is that the product manufacturer can redesign the product to minimize its environmental impact throughout its life cycle. This could be through using less toxic ingredients, designing the product for reuse or recycling, or using less packaging materials.

Recycling or composting waste that could not be reduced is next in the hierarchy. The Merriam-Webster dictionary defines recycling as "1: to pass again through a series of changes or treatments, a: to process in order to regain material for human use, 2: to adapt to a new use, and 3: to bring back". The EPA defines recycling as a "series of activities that includes collecting recyclable materials that would otherwise be considered waste, sorting and processing recyclables into raw materials such as fibers, and manufacturing raw materials into new products" (USEPA 2003e). Common recyclable materials include commodities such as paper, plastic, glass, and metal products.

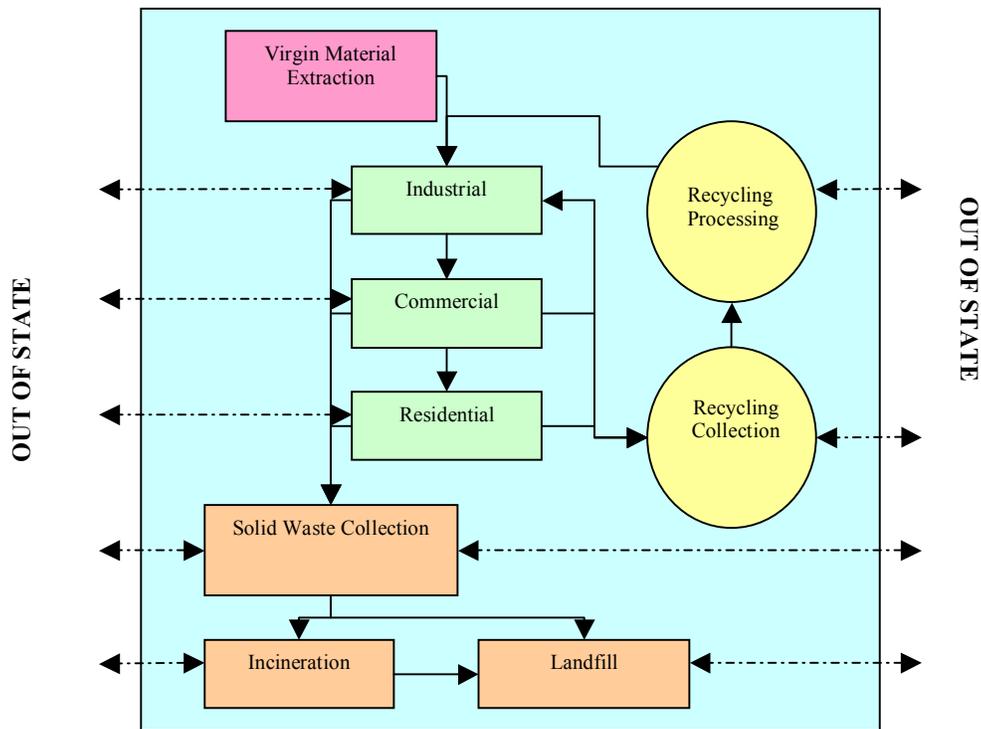
Composting is the "natural recycling" of organic materials. In nature, organic materials, such as a fallen tree limb or apple, naturally decompose to release nutrients back into the ecosystem. Composting is applying this process to 'household' organics, such as yard trimmings and food waste, and can be done at a household level or via larger scale commercial or municipal operations (NCDENR 2004a). The finished compost is a high quality soil that can be used for various landscaping projects. Composting thus serves to divert yard and food waste from the waste stream and turns it into a usable product.

Finally, the last rank in the hierarchy and the least desirable is disposing of the remaining waste in an incinerator or landfill (Schall et. al. 1998). Incineration is the burning of waste prior to sending it to a landfill. The combustion of the waste reduces the volume and weight of the waste and simultaneously creates a source of energy. However, incinerators are highly regulated, due in part to the release of air pollutants, and many have closed due to high operation costs.

RECYCLING IN-DEPTH

Solid waste management can be seen as an integrated system which links virgin

Figure 0. Materials Flow Diagram



Adapted from Kirkpatrick et. al. 1994

materials, solid waste disposal and recycling. Virgin material represents the extraction of natural resources into a usable product by industries and consumers. The material eventually becomes a waste product. The waste product can be collected and then disposed in a unidirectional path, directly into a landfill or incinerated and then disposed into a landfill, where the product's life cycle essentially ends. Alternatively, the waste can be collected and then recycled into a new product, continuing and extending a product's life cycle. Once collected, the 'waste' is processed, or transformed into a usable product. This process adds value to the product, and may

include many repetitive stages, such as sorting, removing contamination, heating, decomposing, and so forth. The processing stage continues until the material is a usable product made available as an input for industry or consumers. The input of the recycled product may replace the input of a virgin resource, reducing extraction demands. It may also reduce the solid waste disposal demands. All of these processes can occur inside and outside state boundaries (see Figure 1).

The flow of waste through the system is also indicative of the flow of jobs in the waste system. Each arrow, box and circle indicates areas that require labor inputs. To illustrate, labor is required to collect the waste from industrial, commercial and residential sources, whether the material is going to be collected for recycling or for disposal. On the unidirectional disposal side of the diagram, there is then labor required to transport the waste to an incinerator, landfill, or out of state. Labor is then needed again whether the waste goes directly to a landfill or goes to a landfill via an incinerator. Eventually, the flow stops when the waste arrives at a landfill. However, on the recycling side of the diagram, there are several more paths where the material can cycle. These paths not only indicate the increased lifetime of a recycled material, it indicates the need for labor inputs. As more materials follow the recycling path, jobs may be created or transformed in the recycling sector, or jobs may be lost in the unidirectional disposal path due to the decreased demands in areas such as resource extraction and solid waste disposal (Shore 1995).

Recycling: Collection, Processing, End-Use

Solid waste recycling can be separated into three stages: collection, processing and end-use. Recyclable commodities are usually collected at the local government level through several methods that can be utilized individually or simultaneously. Curbside recycling collection programs are synonymous with curbside trash collection programs. The frequency of pick-up depends on the size of the locality and the quantity of materials, but usually occurs on a weekly basis. Many local governments use the same staff to collect recyclables and trash. Communities may also provide central drop-off centers to collect recyclables, which may or may not be staffed. In addition, there are also buy-back centers and deposit/refund programs, such as the 'bottle bill' program. Currently, ten states operate bottle bill programs. On average, 'bottle-bill' states boast recycling rates two to three times higher than other states (Gitlitz and Franklin 2004

5). In addition to local governments, recyclables are also collected by private companies directly from waste generators.

Once collected, the materials are ready for processing. The processing stage varies widely depending on the commodity, community and market. Generally, the first processing stage involves sorting and separating the commodities. Some communities may require sorting at the household level, although more communities are moving to commingled collection programs as technology increases the ability to sort large waste streams (NCDENR 1997). Material Recovery Facilities (MRFs) are becoming increasingly popular. MRFs use different technologies (ie magnets or blowing) to sort recycling waste streams into distinct categories, allowing for commingled collection. The separated commodities are then baled, crushed, or otherwise densified and shipped to the next market outlet.

Some commodities are relatively simple to process back into a product. For example, glass bottles are color sorted and then melted into cullet, which is then added into the feedstock stream to make more glass bottles (NSDA 2003). Aluminum cans are melted and flattened into large coils to be transported to manufacturers for use in more cans, furniture, building or even airplane construction. The different plastic types can go through several varying processes to be used in several very different products.

The end-use or manufacturing, or more accurately, re-manufacturing phase occurs when the recycled product becomes an input into the process of making another product. An example of this phase is when cullet (melted recycled glass) is added to sand, soda ash and limestone to make glass containers (GPI 2004). In recycling industry terms, this is the end-user phase (R. W. Beck 2000).

Table 1. (NSDA 2003)

Commodity	Processing Stages	End Products
Aluminum Cans	Shredded, heated, melted into ingots, flattened	Cans, fans, planes, pans
Plastic #1 (PETE)	Color sorted, washed and ground into small pieces, dried into pellets	Rugs, carpet, clothing, bottles
Glass	Color sorted, heated	Glass bottles, roads, marbles, fiberglass

Environmental Benefits of Recycling

The environmental benefits of recycling extend beyond reducing the amount of waste sent to landfills. Recycling decreases the demand for natural resources, and therefore decreases

the demand for extracting natural resources. For example, one ton of recycled glass displaces 1.18 tons of virgin sand in glass production (Shore 1995). This results in benefits ranging from energy savings to less land and wildlife impacts. When compared over entire life cycles, recycled content products result in a net reduction in 18 major categories of air and water pollutants as compared to products using only new materials (USEPA 1998). For example, the EPA has documented that recycling decreases greenhouse gas emissions by lowering the energy requirement in many manufacturing processes relative to using virgin materials. Another environmental benefit of recycling may come in the form of carbon sequestration, by decreasing the demand for virgin wood products and subsequently decreasing the need for deforestation (Freed, Driscoll and Stafford 1998 12).

Economic Benefits of Recycling

Recycling programs have the potential to create significant cost savings at the public and private levels, in a variety of ways. Local governments operating recycling programs have the potential to reduce the number of trash pickups required or to streamline their collection routes, improving operational efficiency and leading to cost savings (USEPA 1998). For example, a community in Wisconsin was able to decrease net annual cost of solid waste services by twenty dollars and triple waste diversion upon the inception of a recycling collection program (USEPA 1998).

In the private sector, firms using recycled feedstock as an input into their manufacturing process often reduce production costs, through decreased energy costs or materials acquisition. According to the Glass Packaging Institute, every ten percent of recycled glass used to make glass containers saves up to 2-3 percent of the total energy used (GPI 2004). In addition, using recycled glass is much less expensive than mining the sand from the Earth.

LITERATURE REVIEW

Previous N.C. Recycling Employment Research

In 1994, DPPEA commissioned a research study to determine the recycling related employment in North Carolina. The study concluded that the NC recycling industry supported over 8,700 jobs (Kirkpatrick, Rosen and Shore 1994). The research was updated in 2000 and

showed a twelve percent growth in the private sector, supporting approximately 12,000 jobs (NCDENR 2000). This research surveyed the public and private sectors to obtain recycling employment figures for 2003 that are then compared with the two previous studies to assess changes in recycling employment over the last ten years.

Research on the Economic Impact of Recycling

One of the first studies to examine economic impacts of recycling was reported by Jim Quigley in 1988. This landmark study divided the number of recycling jobs per ton of material recycled. Additionally, Quigley commented on the trade-off between recycling jobs and jobs in other industries. For example, as recycling tonnage increases, the demand for solid waste services and mineral extraction services decreases, resulting in a loss of jobs in those sectors. In addition, Quigley discussed that recycling jobs are increasingly becoming a viable source of employment for the “poor, economically disadvantaged and handicapped” (Quigley 1988 p46).

More recent studies have attempted to capture the full economic impact of recycling, including the direct, indirect and induced impacts (USEPA 2004c). The number of establishments and employment in a given sector are examples of direct economic impacts. Indirect economic impact values are inter-industry linkages as measured by purchase of intermediate commodities, such as recycling equipment. Induced economic values are the broader impacts, such as personal spending of the employees of direct and indirect establishments. These indirect and induced economic benefits often require the use of sophisticated economic analysis computer software programs.

The Recycling Economic Information Studies were initiated 2000 by the Northeast Recycling Coalition (R.W.Beck, Inc 2000). To date, a Recycling Economic Information (REI) study has been conducted for the entire US and several states to document the direct, indirect and induced economic impacts of recycling. The primary goal of the REI studies is to document the size of the recycling and reuse industry through direct, indirect and induced economic measures. One stated purpose of the REIs is to show the contribution recycling makes to the economy for the benefit of public and private sector decision makers. According to the US REI report, recycling is not only stronger than waste management as an industry; the recycling industry is competitive with other major industries such as machinery and automobile/truck manufacturing (USEPA 2004c).

Each REI uses approximately the same methodology. Twenty-six different reuse and recycling industries were measured by number of establishments, total jobs, annual payroll, annual receipts and annual throughput. Three different methods were used to collect this data. Public sources of information were collected from existing sources such as the US Census Bureau Economic Census, the US Geological Survey's Mineral Commodity Reports, and trade organization reports. Additional data was collected through a survey of recycling and reuse businesses. The rest of the data was derived in a variety of methods. Indirect and induced economic benefits were measured using several different economic analysis software programs. The results of all available REI studies are presented in Table 2.

Although the economic analyses in the REI studies go beyond the scope of this study, they do provide helpful information on the classification of recycling and reuse industries as a framework for analysis. In addition, the REI studies demonstrate how to extrapolate data that is not readily available, which was useful to fill in gaps that occurred in this project's survey results. While the REI studies are useful as comprehensive economic studies, the reports are highly technical and difficult to understand, making them less useful as policy tools for decision makers. In addition, most of the REI studies do not analyze the movement of material, which would be helpful information, although Iowa's REI does present some commodity flow analysis and the imbalances between supply and demand (R.W. Beck, Inc 2001).

Table 2. Recycling Economic Information Study Results (USEPA 2003a, USEPA 2004c)

	Establishments	Total Employees	Annual Payroll	Annual Revenues
United States	56,061	1,121,804	\$36,712,482,000	-
California	5,342	84,245	\$2,249,919	\$14,182,174
Florida	3,683	32,138	\$765,176,000	\$4,374,479,000
Illinois	2,412	56,249	\$1,849,637	\$12,267,184
Indiana	1,709	74,970	\$3,086,333,000	\$18,908,934,000
Iowa	-	26,781	\$906,926,888	\$3,630,669,572
Nebraska	417	4,323	\$109,192,000	\$683,132,000
Northeast Recycling Council ¹	13,218	206,506	\$6,820,225,000	\$44,204,372,000
Ohio	3,177	98,302	\$3,602,743,000	\$22,514,778,000
Pennsylvania	3,247	81,322	\$2,886,264,000	\$18,398,776,000

¹ The Northeast Recycling Council consists of Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island and Vermont.

In addition to the REI studies, there have been other statewide efforts to document the economic impact of recycling. Minnesota's Office of Environmental Assistance published Minnesota's Value-Added Recycling Manufacturing Industries: An Economic and Environmental Profile (Gjerde et.al. 1997). They surveyed 90 manufacturing companies that used recycled feedstock as an input. Direct economic impacts were measured as well as indirect impacts using an economic analysis software program. However, unlike the REI studies, the Minnesota report also provided environmental benefits such as avoided materials consumption, avoided energy consumption, and avoided air and water pollutants. Finally, the report also gave business profiles for recycling industries, including development opportunities and barriers. An interesting figure reported as that 44% of the survey respondents indicated that they had the potential to increase their use of recycled feedstock, indicating a supply shortage. By showing environmental and economic benefits, the Minnesota report covers a broader spectrum than the REI studies and this project, however the report does highlight that there are benefits to recycling that cannot easily be measured in dollars.

The Economic Impact of Waste Disposal and Diversion in California study compared recycling economic impacts to disposal economic impacts (Goldman and Ogishi 2001). The report showed that recycling has more of a positive economic impact than disposal. Direct and indirect impacts were measured, and data was either collected through existing databases or a survey of selected waste and recycling businesses. In addition, the report estimated regional volumes and flows of waste materials with cost and revenue information. This report is helpful because it demonstrates the balance between the recycling and waste disposal industries.

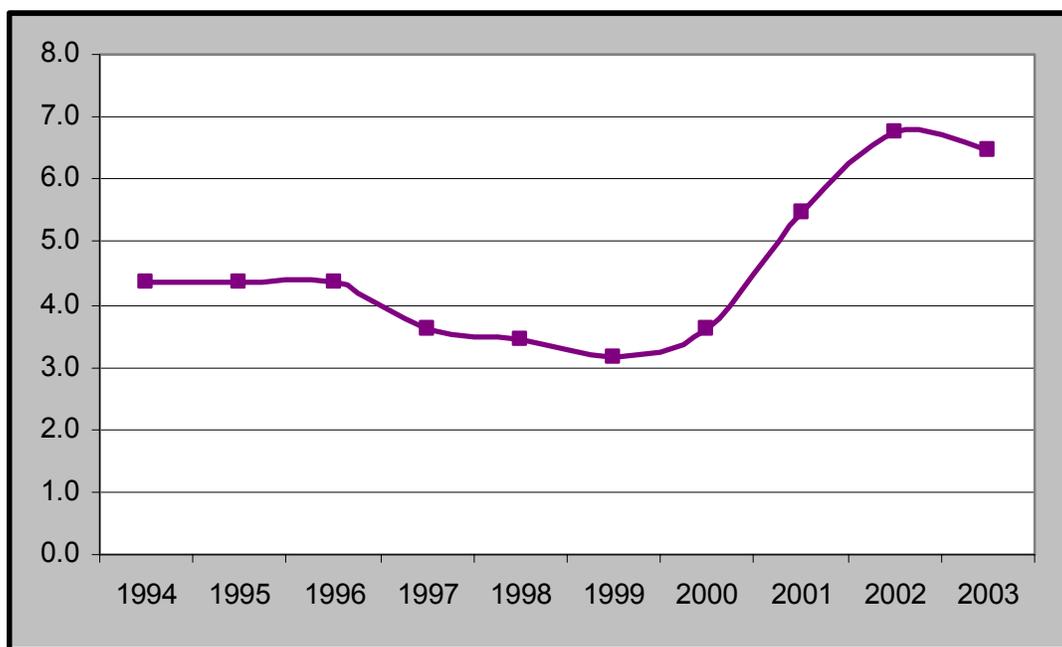
Finally, a case study by the EPA Jobs Through Recycling program demonstrated how a community in California created an 'eco-industrial park' by citing new recycling businesses in close proximity to an existing Materials Recovery Facility (CIWMB 2003). In five years, nine businesses were established along with over 100 low, medium and highly skilled jobs which diverted 140,000 tons of waste from disposal.

SECTION II: OBJECTIVE

North Carolina's economy has suffered many losses in the past few years. For example, the North Carolina unemployment rate has risen approximately 3% since the late 1990's (ESC 2001). In 2001, nearly 50,000 jobs were lost due to lay-offs or business closings. NC's traditional industries – manufacturing, textiles, and agriculture – have decreased employment by over 30% from 1994 to 2003. Partially compensating for the loss of employment in those sectors are the growth in tourism and service industry employment. The accommodations and food service industry has increased employment 8% from 1994 to 2003 (ESC 2001).

The most popular natural attraction in NC is the Blue Ridge Parkway, and nearly half of the 25 top NC attractions are beaches, parks or other outdoor areas (NCDOC 2004). Visiting beaches and other outdoor activities were tied for the second most popular tourism activities in North Carolina in 2003 (NCDOC 2004). This indicates that one of the reasons visitors come to NC is to appreciate the environment. Efforts to improve and stabilize NC's economy should take advantage of this and work to improve the environment. Local government recycling programs can capitalize on two objectives: provide employment for the unemployed and work towards enhancing NC's environmental quality and tourism appeal.

Figure 1. NC Unemployment Rate



In 1989, North Carolina made a commitment to reduce solid waste generation by enacting the North Carolina Solid Waste Management Act (SWMA), which pledged to “promote the reduction, recycling, reuse, or treatment of solid waste ... in lieu of disposal of the waste” (NCGA 1989). In a 1991 Amendment to the SWMA, a waste reduction goal of 40% by 2001 was established (measured using FY 91-92 as base year and measured per capita). The NC Annual Solid Waste Report for fiscal year 2002-2003 concluded that although individual counties in NC achieved the waste reduction goal set forth in 1991, statewide it was a failure. The report cited waning commitment to waste reduction and lack of funding as factors contributing to not achieving the goal: “the primary finding of this comparison shows an apparent decrease in both commitment to solid waste priorities and the corresponding decrease in funding” (NCDENR 2003). Other factors cited were increased commercial, industrial, and institutional waste, natural disasters and the impacts of tourism.

Despite commitments to waste reduction and recycling, North Carolina has not managed continues to maintain approximately the same recycling rate from year to year. Using the data provided by the 2002-2003 Annual Solid Waste Report (NCDENR 2003), calculations show that the local government per capita recycling rate has increased by only one percent since 1996. During the same time period, the local government per capita disposal rate has increased fifteen percent. The implication is NC's increasing waste generation is not being mitigated by an increased recovery rate, resulting in a net increase of waste disposal. Meanwhile, the nation's recovery rate is increasing and disposal rate is decreasing, demonstrating the nationwide achievement of waste.

The NC Division of Waste Management estimates less than 16 years of remaining landfill capacity, without accounting for population changes or changes in disposal patterns (NCDENR 2003 p7). Considering the difficult and time consuming process of opening a landfill (which includes citing, permit approvals, public participation, and construction) this could be perceived as a looming crisis. However, with the ability to transport waste out of state, this is not as distressing to policy makers and local government officials as it should be.

North Carolina's lackluster recycling performance, combined with the current unfavorable economic climate and subsequent budgetary shortfalls, makes local government recycling programs vulnerable to being discontinued. When recycling programs are discontinued

or scaled back, the supply of recyclable commodities decreases, causing a ripple effect throughout the industry. To begin, the recycling businesses that directly rely on local governments as a source of household recyclables face a decreasing supply of inputs, potentially threatening the viability of the business. In turn, processing and end-use businesses will also face a decrease in supply as the negative impacts flow downstream.

Recycling impacts on NC's economy are not easily seen, and a way to demonstrate the impact is needed. The objective of this study is to quantify the impacts of recycling on jobs in North Carolina. This was done by collecting information on the recycling related employment in the state and making comparisons with information from ten years previous. A commonly used indicator of economic viability is the number of jobs in an industry (Investopedia 2004). Therefore, the results of this study may be used to indicate the economic viability of recycling.

SECTION III: METHODOLOGY

For this study, a recycling business is defined as a company involved in the recovery, reuse or remanufacture of materials. This includes the collection, processing, manufacturing, reusing or composting of post-consumer or post-industrial materials. Recycling related employees are defined as an employee who dedicates any time to recycling related activities, or whose position would not exist without the recycling component of the business.

STUDY BOUNDS

This study is bound in two major ways: First, since the goal of this research is to quantify the impact of recycling on North Carolina's economy, only material flows and jobs that occur within state borders were considered. Second, the study only included direct economic impacts, and excluded indirect or induced measurements. This means that businesses such as recycling equipment manufacturers were not included.

DATA COLLECTION

A multitude of strategies were used to collect the most comprehensive and accurate information, including a combination of primary and secondary data collection methods.

Primary Data

The private and the public sector recycling industries in North Carolina were surveyed separately as sources of primary data for this research. The private sector received the Business Survey, and the public sector received the Local Government Survey.

Business Survey: Sample Selection

The Recycling Business Assistance Group of DPPEA maintains a free, on-line database of recycling markets and businesses to facilitate finding markets for recyclables. The Directory of Markets for Recyclable Materials (DMRM) was developed in 1992. The DMRM has now advanced to allow self-registration for any recycling business or organization by simply completing an on-line form. This has allowed the DMRM to expand to include a multitude of recyclable commodities and cover a larger geographic area. The DMRM is a powerful tool for the recycling industry. Private citizens and businesses may use the DMRM to find outlets for

their waste, while recycling businesses in turn use the DMRM as an advertising tool to receive the recyclable commodities they use as inputs in their business. This makes it in the self-interest of recycling businesses to register with the directory.

Unlike industries such as agriculture or manufacturing, the recycling industry is not easily collected under one umbrella category, so tools such as the North American Industrial Classification System (NAICS, formerly SIC) was not helpful in identifying businesses to survey. Therefore, by narrowing down the DMRM to only North Carolina businesses or organizations, that database became the sample frame for the Recycling Business Survey.

Every recycling business or organization in North Carolina listed in the DMRM in May of 2004 received the Recycling Business Survey. In addition, since the DMRM is updated continuously with new entries, the sample frame was expanded twice to include new NC listings in July, 2004 and August, 2004. Each registrant in the DMRM provided contact information, such as postal address, email address, and telephone number when registering with the DMRM. However, not all of the registrants provided email addresses. For ease of implementation and cost, those who provided email addresses were contacted via email, whereas those who did not provide an email address received the survey documents in the mail. The final sample frame included 532 potential respondents, with 292 receiving the web survey and 240 receiving the survey via mail.

Business Survey: Instrument Design

Since the objective of the study was to obtain an accurate and complete portrayal of recycling related employment, two separate survey instruments were designed: one for a mail-based implementation and the other for a web-based implementation. The surveys were identical in question content and order; however, layout was slightly different to facilitate completion in both mediums.

The survey was drafted to obtain information on total full-time equivalent employment and employment specifically related to recycling. The survey went through several drafts; with representatives from DPPEA contributing significantly and approving the final survey draft (see Appendix A for final survey). The survey was divided into four sections:

- Section A: Facility & Company Information.

- Section B: Recycling Services. This section asked the respondents to characterize their activities in the four main recycling functions: collection, processing, brokering, and manufacturing. The respondent was asked to indicate each sector they participate in and the total number of full-time equivalent employees that perform that function. As another measure of employment, respondents were also asked to report the weekly labor hours spent performing this function. Finally, to obtain an estimate of employment per function per ton, respondents were asked to list the annual tonnage of recycled materials that they use in that particular function.
- Section C: Employment & Wage Information. In Section C, respondents were asked in a closed-ended question to report the average wages of their recycling relating employment. Respondents were given six (6) categories of wages to choose from, starting at minimum wage and increasing in two dollar per hour increments. This was done to compensate for the sensitivity of the question and mitigate non-responses (Dillman 2000 ch.2). In addition, respondents were asked how their employment profile has changed since 2000 and their future projections. These questions were asked to obtain a more concise indication of employment change over a short period of time in the private sector of the recycling industry to contrast with the ten year time period. Finally, Section C also asked respondents to indicate how much of their business is reliant on recycling.
- Section D: Commodity Information. The final section asked respondents to indicate which commodities they use to obtain commodity specific statistics.

Business Survey: Survey Implementation

Survey implementation followed the structure set forth in Dillman's Tailored Design Method (Dillman 2000 ch.4). A pre-notification letter was sent one week prior to the survey (see Appendix A). The pre-notification letter informed the respondents that they would be receiving the survey, the purpose of the survey, and the sponsors of the survey. For the web-based survey, a pre-notification email containing identical text was emailed approximately 4 business days prior to sending the survey.

The survey was sent with a cover letter, which again described the purpose of the research, the rights of the respondents, contact information and instructions to complete and return the survey (see Appendix A). A stamped, pre-addressed return envelope was included to

minimize any costs inflicted on the respondent. The cover page of the survey instrument also included a purpose statement, instructions, and again listed the respondents' rights.

Each respondent was assigned a unique Survey Identification Number (ID). Once a survey had been submitted, the contact information associated with that particular ID number was erased to ensure respondent confidentiality. The ID number was listed on the cover letter and cover page of the survey.

The web-based survey received the cover letter as an email, with a link to the web page containing the survey (see Appendix A). The rights of the respondent were listed in the email invitation and on the opening web-page of the survey. Along with the link, respondents were provided a unique number to serve as a password to entire the site. The unique number corresponded to the ID number assigned to the respondent, and again served as a signal to show which respondents had completed the survey. The password also protected the survey results from contamination from outside responses. If an invalid password was entered, the user was directed to an error page.

The mail-based respondents who had not completed the survey then received a follow-up postcard approximately four weeks after receiving the survey (see Appendix A). The web-based respondents received up to four follow-up emails and requests to complete the survey, due to the low-cost and easy implementation of using e-mail.

After eight weeks, the DPPEA staff began contacting the non-responders via email, telephone or site visits. Using their network of contacts, the DPPEA staff was able to obtain 39 additional responses. In addition, secondary data sources (discussed below) were used to obtain an additional 134 responses . However, it must be noted that many of these responses were limited to the subjects of highest priority: total employment, employment related to recycling, and wages. Therefore, the response rate varies by question and is reported as such.

Local Government Survey: Sample Frame

Out of the 640 local government units in North Carolina, 386 operate recycling programs. Sixty-five percent of those use private contractors to run the recycling program, and that employment was captured in the private sector survey. Therefore, only the local government units operating recycling programs using public employees received the survey.

The Local Government Assistance Team (LGAT) of DPPEA maintains a database of all local government units in the state of North Carolina. The database contains information regarding the solid waste management activities performed in each particular unit, including the existence of a recycling program. This database served as the sample frame for the Local Government Survey. Each local government unit that had a (public) recycling program operational as of 2004 received a survey.

Local Government Survey: Design

The local government survey went through a similar design process as the business survey. Also like the business survey, not all of the local governments had e-mail access so therefore two surveys were designed: one for a mail-based implementation and the other for a web-based implementation. The surveys were identical in question content and order; however, layout was slightly different to facilitate completion in both mediums.

The survey was drafted to ensure information such as total full-time equivalent employment related specifically to recycling was captured in addition to employment related specifically to solid waste management. The survey went through several drafts, with representatives from DPPEA contributing significantly and approving the final survey draft (see Appendix B). The survey was divided into four sections:

- Section A: Contact Information.
- Section B: Recycling Services. This section asked the local government respondent to characterize their recycling activities into services: collection, processing, brokering, composting, education/marketing, and administration. The local government respondent was asked to indicate each recycling service they perform, and for each service the total number of full-time equivalent employees, the weekly labor hours, and the annual tonnage of recycled materials. Additionally, respondents were asked in a closed-ended question to report the average wages of their recycling relating employment. Respondents were given six (6) categories of wages to choose from, starting at minimum wage and increasing in two dollar per hour increments. This was done to compensate for the sensitivity of the question and mitigate non-responses (Dillman 2000 ch.2). In addition, respondents were asked how their employment profile has changed since 2000 and their future projections. These questions were asked to obtain a more concise

indication of employment change over a short period of time in the public sector recycling industry to contrast with the ten year time period.

- Section C: Solid Waste Services. Section C is identical to Section B, except the questions relate to solid waste management services, including trash collection, processing, disposal, education/marketing, and administration.
- Section D: Materials. The final section asked respondents to indicate which recycling commodities they collect, and ask the respondent to indicate the market or outlet for the commodity. This information may be used to trace specific commodity paths in future studies.

Local Government Survey: Implementation

Implementation of the local government survey was identical to the implementation of the business survey. However, unlike the recycling business survey where DPPEA staff directly contacted respondents, different methods were used to obtain figures for those local government units that did not complete the survey and will be discussed the in Secondary Data Collection section.

Secondary Data: Recycling Employment

Employment Security Commission of North Carolina

DPPEA acquired access to the Employment Security Commission of NC (ESC) database. The database listed company name, employment, and address for North Carolina businesses as reported in the first quarter of 2004. One hundred randomly selected businesses from the non-respondents in the Recycling Business Survey were accessed in the ESC database. Employment estimates were obtained for 94 of the 100 random businesses that had not answered the survey. Using their expertise and industry knowledge, DPPEA staff estimated the percentage of those employees which were recycling related. Information could not be obtained for the eleven other businesses under the business name listed in the Directory of Markets for Recyclable Materials (DMRM). This may have occurred because sometimes business operate under names other than their legal name. In total, 1,649 of the 3,906 full-time equivalent employees (FTE) reported for 94 companies with the ESC data are estimated to be dedicated entirely to recycling (see Appendix A).

Harris Directory

Operated by Dun & Bradstreet, the Harris Directory is a comprehensive database of US company profiles. Dun & Bradstreet maintains information about more than 64 million worldwide companies, including 13 million American companies. The Harris Directory is targeted towards sales and marketing professionals and is available through subscription. DPPEA has access to information for North Carolina companies only. The profiles include company size (number of employees), and are searchable by over thirty different topics. A company name search was performed for a randomly selected sample of 25 companies. Once the overall employment number was obtained, industry experts in DPPEA estimated the percentage of those employees which are recycling-related. Approximately 1,615 full-time equivalent employees dedicated entirely to recycling were reported for 25 companies using the Harris Directory (see Appendix A).

NCSU Pallet Study

Data from a North Carolina State University (NCSU) research project was also used to supplement the recycling employment data. NCSU completed research for DPPEA in May of 2004 on pallet recycling in North Carolina (Buehlmann and Fluhary 2004). The research surveyed NC wood pallet companies and collected total full-time equivalent employment (FTE) and recycling related full-time equivalent employment (FTE-R) data. Thirty-four companies responded to the survey, and a total of 1,131 FTE-R employees were reported. The employment numbers were presented in aggregate, not by individual company. By comparing the respondents to the NCSU survey with the respondents to the Recycling Business Survey, eleven companies were identified that had not been listed in the DMRM and thus were added to the sample frame. Ten companies did respond to the NCSU survey but did not respond to this survey, resulting in data for this survey on an additional 21 companies (11 new companies plus 10 non-respondents). Thirteen responded to both surveys, and reported a total of 269 FTE-R to the Recycling Business Survey. Then, by subtracting the 269 FTE-R of the Recycling Business Survey from the 1,131 FTE-R from the NCSU study resulted in an estimate of 862 FTE-R between the 21 additional companies ($1,131 - 269 = 862$). Although data could not be reported at

the individual business level, data was reported in aggregate: the 21 companies contributed a total of 862 FTE-R to this research (see Appendix A).

Secondary Data: Industry Comparisons

Most business establishments have been classified by industry and then grouped into the North American Industry Classification System (NAICS) to simplify data collection and comparisons (USCB 2004). In 1997, NAICS replaced the out-dated US Standard industrial Classification (SIC) system. The NAICS system not only provides for additional industry categories such as information technology, it is standardized across Mexico, the United States and Canada (USCB 2004).

NAICS is a hierarchal six-digit numerical system. Two digits represent the business sector and then the third digit represents the subsector. The fourth digit is the industry group, the fifth digit is the NAICS industry, and the sixth digit is reserved for individual classifications at the national level. The more digits in the NAICS number, the more specialized the classification. Table 3 lists some different 2 and 3 digit NAICS codes and their associated descriptions. For example, to obtain the classification for Turkey Production, first the 2 digit Sector is identified as 11: Agriculture, Forestry and Fishing. Since turkey production is an animal operation, the classification is further narrowed to 112: Animal Production. The next NAICS level is 1123: Poultry and Egg Production. Finally, Turkey Production is represented by the 5 digit code 11233 (USCB 2004).

The recycling industry is not easily represented by the NAICS system. Although Waste Management & Remediation is represented by NAICS code 562, the further classifications do not include recycling. Therefore, information on the recycling industry is not as readily accessible as most other industries. This is one reason that studies such as this one are important.

Several state and federal government websites provide access to industry information according to NAICS codes, including the NC Employment Security Commission and United States Bureau of Labor Statistics. Additional information is also available through the Harris Directory, a private subscription service. This study used industries at the 2 and 3 digit NAICS level for comparisons (see Appendix C).

Table 3. Select NAICS Codes and Descriptions

NAICS	Description	NAICS	Description
11	Agriculture, Forestry, Fishing	44	Retail
111	Agriculture: Crop Production	51	Information
112	Agriculture: Animal Production	52	Finance & Insurance
1123	Poultry and Egg Production	53	Real Estate
11233	Turkey Production	54	Professional, Technical, Scientific
21	Mining	61	Educational Services
23	Construction	6113	Colleges, Universities & Professional Schools
31	Manufacturing	62	Health Care & Social Assistance
313	Textile Mills	6212	Dentist Offices

SECTION IV: RESULTS***RECYCLING BUSINESS SURVEY RESULTS²***

Respondents received the survey either through regular postal mail, or through an email containing a link to the online survey website. After approximately 4-5 weeks, most respondents who had not completed the survey were contacted by telephone. Due to time constraints, only 20% of non-respondents were contacted by phone. After the web, mail, and telephone phase of survey implementation concluded, various other methods of collecting secondary data were used to supplement the employment calculations. These data sources were only used to calculate the total full-time equivalent employees (FTE) and the full-time equivalent employees dedicated entirely to recycling (FTE-R) and were not used for any other question.

Table 4. Recycling Business Survey Response Statistics

		Completed	Sent	Removed	Added	Adjusted Response Rate
Survey	Web	122	292	-22		45.2%
	Mail	63	240	-26		29.4%
	Phone	39		-1		
Other Sources	NCSU	21			+11	
	Harris	25				
	ESC	94			+3	
TOTAL		364	532	-49	+14	73.2%

As shown in Table 4, forty-nine respondents were removed from the sample frame. Twenty-seven respondents had incorrect contact information and could not be located; 8 refused to complete the survey for various reasons, 6 were duplicate listings in the DMRM, 4 relocated out of North Carolina, and 4 said they were not recycling businesses.

Eleven businesses, which completed the NCSU pallet study, were not listed in the DMRM and therefore were added to the sample frame. In addition, there were 3 businesses which were not listed in the DMRM but were identified through the ESC data as recycling businesses and therefore were also added to the sample frame.

Industrial or commercial recycling collection is the largest employer in NC's private recycling sector, with 2,633 employees. This result reflects the fact that local governments typically do not collect from industrial or commercial businesses. Processing is the next largest employer (1,829) and also has the greatest number of establishments in the state (146). The large

² For complete survey results, refer to Appendix A.

number of processing establishments could be explained by processing being the most diverse activity in that there are many different processing stages. Re-manufacturing/End-use employs 1,315 workers. Curbside collection, drop-off collection and brokering each contribute 1% of the total employment with 75, 63, and 62 employees, respectively.

The total full-time equivalent employees reported was 15,254, of which just under half (8,817) are dedicated entirely to recycling. A net total of 757 jobs have been created by recycling businesses since the year 2000, and 54% of the businesses forecast creating more positions in the next two years. The mean average wage reported falls in the range of \$8.51-\$10.50, the median average wage is \$10.51-\$12.50, and the mode is \$8.51-\$10.50. The three measures of central tendency suggest that the actual average wage falls towards the higher end of the \$8.51-\$10.50 range.

No single commodity dominates the market. An interesting result was that besides aluminum cans, few establishments worked with the common household recyclables. Only 30 establishments worked with plastics and 19 with glass. Either NC is not capturing enough of these commodities out of the waste stream to support a private sector in these materials, or the commodities are going out of state, which is a loss to NC. Common answers in the "other" category were: tires, chemicals, stone, oil/grease, batteries, toner, carpet, and furniture.

LOCAL GOVERNMENT RECYCLING SURVEY RESULTS³

Respondents received the survey either through regular postal mail or through an email containing a link to the online survey website. There were no removals or additions to the sample frame, no local governments cancelled or began publicly operating recycling programs during the implementation of the survey.

Table 5. Local Government Recycling Survey Response Statistics

	# Surveys Completed	# Surveys Sent	# Surveys Removed/Added	Adjusted Response Rate
Web	60	96	0	62.5%
Mail	15	39	0	38.5%
TOTAL	75	135	0	55.6%

³ Refer to Appendix B for complete Local Government Survey results.

The public recycling service with the most employees is staffed drop-off centers, exceeding the next service by more than 100 employees⁴. In addition, the most local governments (38) offered staffed drop off centers. This result is somewhat surprising, but can be explained. Staffed drop-off centers require employees for more than 8 hours a day, 5 days a week, since many drop-off centers are open on the weekends and into the evenings. Additionally, many landfills also have recycling centers, so it is possible that there is some overlap.

Many local government units allow their residents to commingle their recyclables in the bin, and then the employees sort the recyclables into the collection truck. This could explain the large number of public processing employees.

Seventy-seven percent of the responding local government units collect aluminum, the most common commodity collected. This is expected, because aluminum is a common household waste product, easy to collect, light and easy to transport, and has fairly consistent market outlets. The next commodities include the two types of plastic and newspaper, which are also expected. However, less than half of the local government units collect paper products (besides newspaper). This suggests that it is an area that needs more research and education. Perhaps developing more efficient collection methods would enable more local government units to implement paper recycling programs. The large difference between recycling and solid waste employment can be explained by the increased frequency of trash collection versus recycling collection. Trash is collected at least once a week, although many local government units may collect trash twice a week. However, recycling may only be collected once or twice a month.

Recycling employs only half the people that solid waste services employ, although recycling materials makes up much less than half of the solid waste tonnage. This suggests that recycling services requires more employees per ton. For example, increasing the recycling tonnage by 10,000 tons would create 6.5 FTE positions, whereas increasing the solid waste tonnage by the same amount would only create 0.71 FTE positions.

⁴ These conclusions are only applicable to the North Carolina local governments that operate recycling programs with public employees, not those local government units that do not operate any recycling programs are those that use private contractors to perform recycling services.

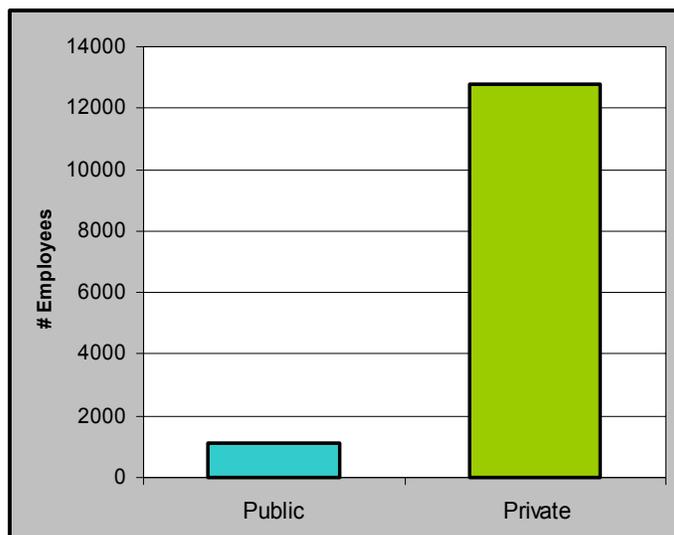
Solid waste employees earn a higher average hourly wage (\$10.51-\$12.50) than recycling employees (\$8.51-\$10.50) although both are lower than the North Carolina average wage (\$16.12/hour). This is an area that could be explored with further research.

SECTION V: DISCUSSION

PUBLIC AND PRIVATE EMPLOYMENT COMPARISONS

The results of the two surveys indicate that the private sector currently employs nearly

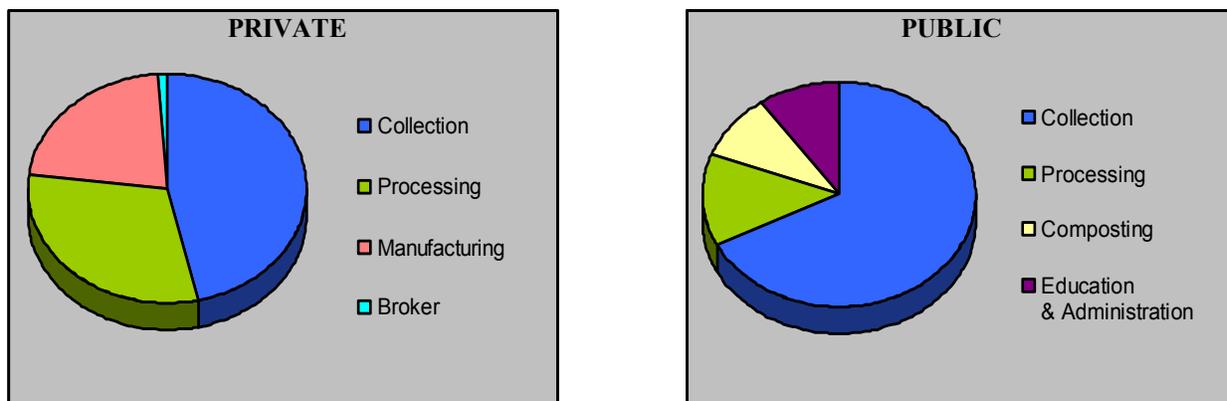
Figure 1. 2003 NC Recycling Employment



ten

times the number of employees as the public sector (Figure 3). One possible explanation for this is that the primary goal of local governments is to provide a service. The majority of their employment comes from performing that service; collecting recyclables from the public. The private sector is interested in adding value back to the commodities, then capturing that value as a profit. In addition, the private sector encapsulates a larger portion of the commodities life

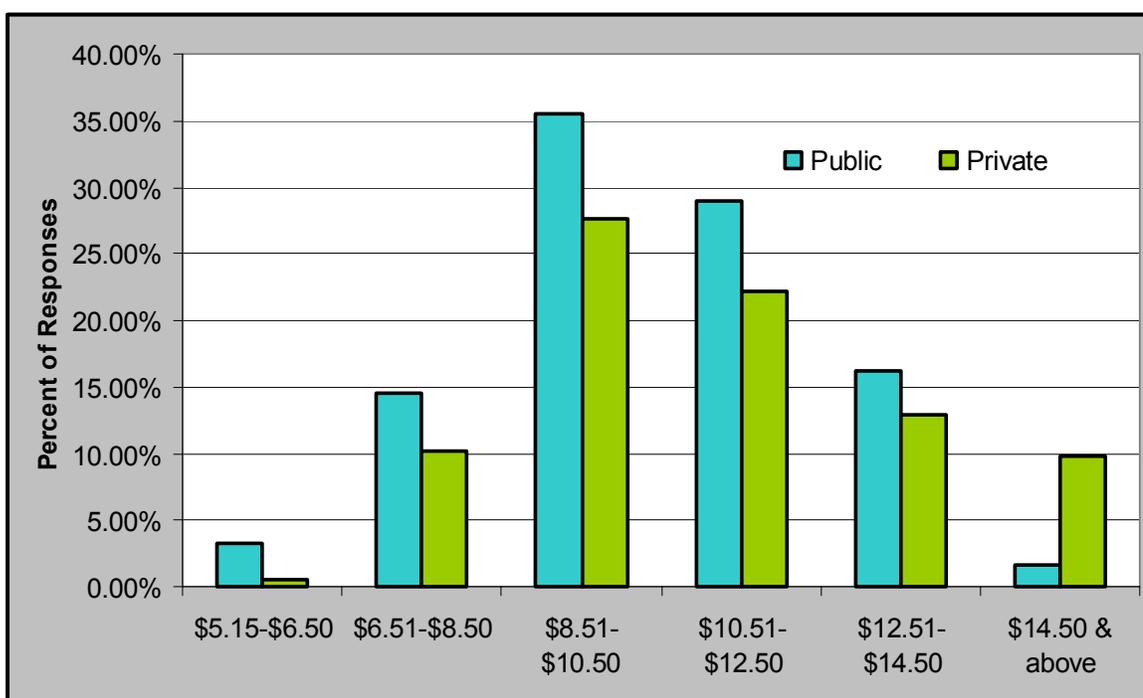
Figure 1. Recycling Employment Distribution



cycle – they handle the commodities from the first collection stage all the way through end-use, which has resulted in a much larger pool of employment.

For both the public and private sectors, collection is the largest employer. Processing is the next largest employer for both as well. However, collection is 68% of the public employment, compared to 46% of the private employment. Processing is only 13% of the public employment, whereas 31% of the private employment. This demonstrates how collection is the primary activity at the local government level, whereas the private sector is more diversified. In addition, manufacturing or end-use is nearly one quarter of the private employment, but none of the public sector. This again demonstrates that the private sector follows the commodities throughout the different stages, whereas the public sector is simply concerned with collection.

Figure 2. Distribution of Responses to Wage Questions



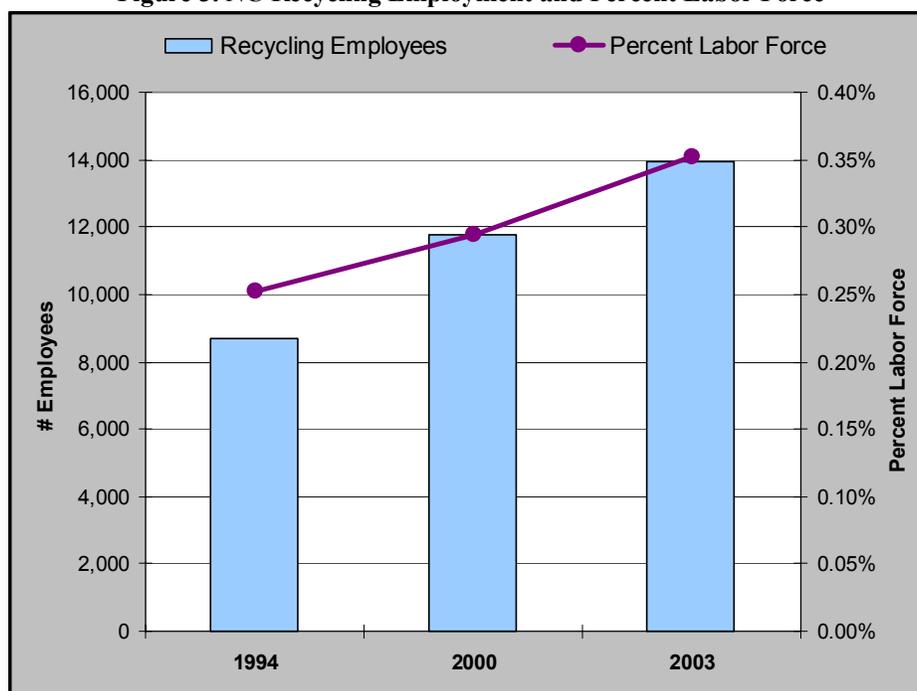
The mean hourly wage for both the public and private sectors falls in the range of \$8.51-\$10.50. The private sector wage is most likely slightly higher than the public sector, because the median hourly wage for the private sector was higher. Looking at the frequency of responses, the private sector has many more responses in the highest category, \$14.50 and above. Both distributions look to approximate normal, although the private sector shows a strong upwards skew.

STATEWIDE EMPLOYMENT ESTIMATES

Table 6. Statewide Recycling Employment Estimates

	1994			2000			2003		
	Reported	Response Rate	Estimate	Reported	Response Rate	Estimate	Reported	Response Rate	Estimate
Private	6,154	81%	7,597	8,721	74%	11,762	8,817	69%	12,776
Public	850	77.5%	1,096	-	-	-	631	55.6%	1,137
	TOTAL		8,694	TOTAL		11,762	TOTAL		13,913

Figure 3. NC Recycling Employment and Percent Labor Force



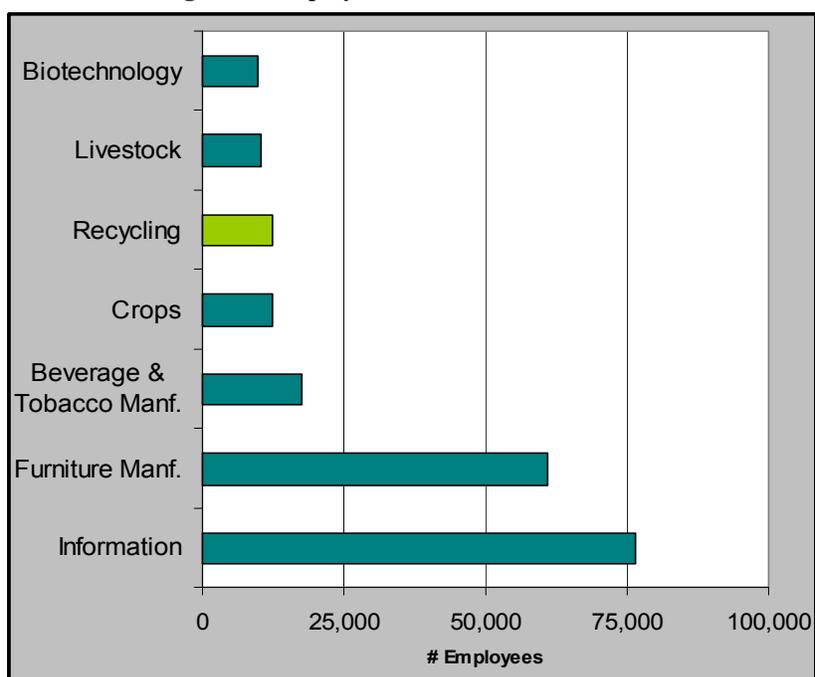
Assuming that the survey responses are representative of the state, an estimate for the statewide recycling employment can be obtained by dividing the reported FTE by the response rate. The data from this study, compared to data from 1994 (see Table 6 above) indicates that recycling employment has increased sixty percent from 1994 to 2003. However, North Carolina's labor force has also increased. Therefore, a more accurate measure of the employment trends in the recycling industry is to examine how recycling has changed as a percent of North Carolina's labor force. Figure 6 indicates that in 1994, recycling was 0.25% of North Carolina's total labor force. In 2000, recycling was 0.29% of the labor force. In 2003, recycling continued its growth and was 0.35% of the labor force, a 19% increase from 2000 and nearly a forty percent increase from 1994. This demonstrates that North Carolina's recycling

employment is increasing at a faster rate than its work force. Therefore, the increase in recycling employment cannot be explained by an increase in population and labor force and represents a growth in the industry.

INDUSTRY COMPARISONS

The NC recycling industry is similar in employment size to the biotechnology, agricultural livestock and agricultural crops industries (Figure 7). However, industries such as

Figure 3. Employment in Select NC Industries



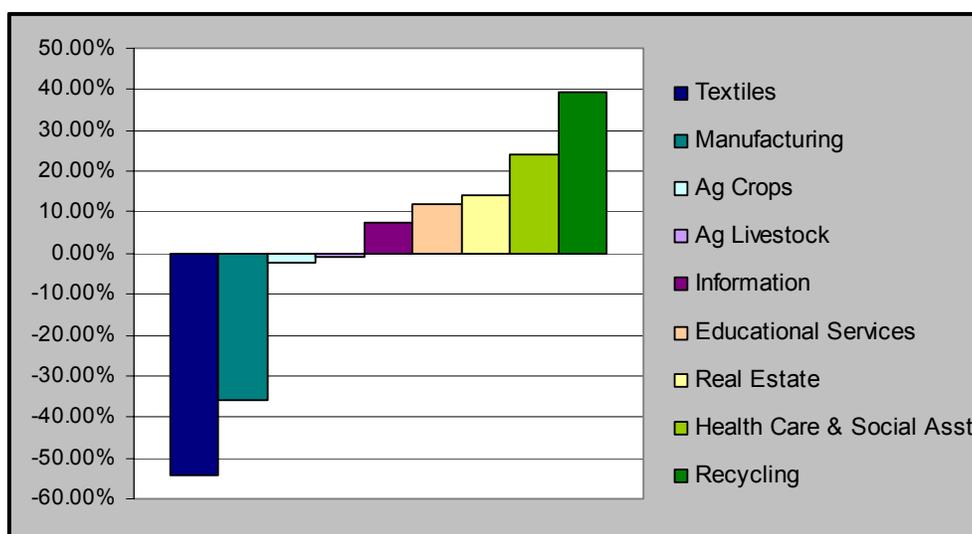
manufacturing and textiles are significantly larger. Directly comparing recycling to industries such as manufacturing is difficult due to the sheer size difference. However, direct comparisons can be made by examining the percent change across industries in their share of the labor market.

Comparing the change in percentage of workforce across several industries further indicates that recycling is growing. In the ten year period between 1994 and 2003, industries such as textiles and manufacturing showed a large decrease in employment (Figure 8). Agriculture saw no significant change, whereas industries such as health care, professional and real estate all grew. However, recycling employment gained the largest percentage over the time period.

Table 7. Employment in Selected NC Industries

	% Labor Force	# Employees
Manufacturing	15%	600,000
Health Care	11%	450,000
Textiles	2%	81,000
Information	1%	76,000
Agriculture	0.76%	30,000
Recycling	0.35%	14,000

Figure 4. Percent Change in Percent Labor Force from 1994-2003



NATIONAL VIEWPOINT

The REI study estimated that the United States has over 1.1 million recycling employees (USEPA 2003a). This means that North Carolina contributes only 1.2% of the national recycling employment, even though North Carolina contributes 3% of the national employment. In addition, NC’s recycling employment is a lower percentage of the state labor force when compared to some of the other states that have completed Recycling Economic Impact Studies. Florida’s recycling employment is 0.40% of their labor force, which is not that much larger than North Carolina’s. However, Indiana, Iowa, and Pennsylvania each have recycling industries with greater than 1% of their labor force. Although this study used a simplified version of the

REI methodology, which may explain a portion of the difference, it still may suggest that NC is under-performing compared to other states and the nation.

Table 8. Nation and Statewide Recycling Employment

	Recycling Employment	Labor Force	% Labor Force
United States	1,121,801	142,583,000	0.79%
California	84,000	16,892,000	0.50%
Florida	32,138	8,020,000	0.40%
Indiana	74,970	3,210,100	2.34%
Iowa	26,781	1,586,000	1.69%
Nebraska	4,323	951,125	0.45%
North Carolina	13,913	4,229,772	0.33%
Pennsylvania	81,322	6,078,900	1.34%

Another important note is that California and Iowa are both “bottle-bill” states (they have a deposit/refund system in place for containers). Considering Iowa’s recycling employment boasts such a large percentage of its workforce, this may indicate that the increased supply generated by bottle bills results in an increased recycling infrastructure and employment.

SECTION VI: CONCLUSIONS

The two surveys conducted for this study reveal that:

- **Recycling is a significant employer in North Carolina.** Recycling employs approximately 14,000 employees, or 0.35% of North Carolina's workforce. At a time when unemployment is high, recycling provides employment opportunities.
- **Public investment in recycling leads to downstream benefits in private employment.** The private sector supports ten times the number of recycling employees as the public sector. Public recycling programs, however, probably provides a large amount of the supply for the private sector. This suggests that as more public recycling programs increase their collection, the private sector will have access to a larger supply of materials, perhaps providing for growth and expansion.
- **Recycling employment has grown while employment in many other industries has not.** While traditional industries such as textiles and manufacturing have lost significant numbers of jobs over the past decade, recycling has created jobs and increased its share of the labor market from 0.25% to 0.35% of the labor market.
- **North Carolina recycling employment is a lower percentage of the state's labor force than other states.** As shown through the REI studies, NC supports approximately 1.2% of the nation's recycling employment. Compared to other states, NC's recycling employment is low. For example, Indiana, Iowa and Pennsylvania each have a recycling industry with more than 1% of their states labor force. Iowa is a bottle-bill state, which may contribute to its higher level of employment.

RECOMMENDATIONS

There is a demand for recycled materials in North Carolina. Forty percent of the businesses surveyed either collect, process or re-use paper products (such as office paper, cardboard, etc). However, the state estimates that those same paper products may comprise nearly one quarter of the residential waste stream in NC (NCDENR 2004b). If more of that

paper was recovered, there will be an increased supply of materials for those companies, presumably providing them with more work and employment opportunities.

In its most fundamental form, this is an example of market failure. The market for recyclable commodities is not performing optimally, for a variety of reasons. The reasons for market failure are complex, interrelated and compounding. For example, prices should ideally reflect the costs and benefits to society. Recycling, like many other environmental goods, however, has many benefits that accrue to the public and are not readily translated into financial figures, resulting in market prices below their true value. Concurrently, market players are not being informed of those benefits, reflecting an imperfect flow of information, another form of market failure. Lack of information may also lead to uncertainty, affecting investors and further destabilizing the market. Government intervention is one way to correct market failures. Government intervention can stabilize the markets, facilitate communication between market players, and otherwise correct the information imbalances.

North Carolina needs to develop policies that will stabilize the recycling markets, primarily through encouraging participation in recycling programs and discouraging waste disposal. These policies also need to be focused on building the statewide recycling infrastructure and providing a stable base for an emerging recycling industry. This can be accomplished through a variety of methods, included environmentally preferable purchasing standards, landfill bans, or enacting a 'bottle bill'.

Currently, NC offers a tax exemption on equipment and facilities used exclusively for recycling and resource recovery. Financial assistance is also available through loans and grants (NCDENR 2004c). However, state policy makers need to look for ways to provide additional incentives for recycling businesses to locate in the state.

The take home message is that by allowing recyclable commodities to remain in the waste stream, we are simply throwing away jobs.

Future Research Needs

There is much research that could be done to reveal information that could provide added support for recycling. For example, determining if there is difference in recycling employment in 'bottle-bill' states could help NC determine if a bottle bill is something to consider. Also, studying how a state's economic characteristics could impact recycling could help state's

determine where best to focus their efforts. Another interesting research area would be determining if there is a correlation between legislative support (funding) for recycling and recycling rates.

SECTION VII: ACKNOWLEDGEMENTS

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Appendix A

Recycling Business Survey

2004

**Pre-Notification Letter
Cover Letter
Survey
Follow-up Postcard
Survey Results and Discussion**

Recycling Business Survey Pre-Notification Letter

The mail survey sample received this pre-notification letter approximately one week prior to receiving the survey. The web survey sample received a pre-notification email with similar text two days prior to receiving the survey.

Dear «First_Name1»«Last_Name1»:

A few days from now you will receive in the mail a request to fill out a brief questionnaire for an important research project being conducted by Duke University in conjunction with the North Carolina's Department of Environment & Natural Resources' Division of Pollution Prevention and Environmental Assistance (DPPEA).

I am writing in advance because we have found many people like to know ahead of time that they will be contacted. Results from the survey will be used to help the state government strengthen recycling in NC, including making a case of policies and incentives that may help your business.

If you have access to the internet, you may complete the survey by going to http://www.p2pays.org/LGAT_Survey/ and entering your unique invitation code in the Businesses section (*your unique invitation code is «SurveyID»*). Otherwise, you will receive the survey in the mail in the next few weeks.

If you have any questions or comments about this study, I would be happy to talk with you. The toll-free number to DPPEA customer service is 800-763-0136 or you may also email me at katie.alvarado@ncmail.net.

Thank you for your time and consideration. It's only with the generous help of people like you that our research can be successful.

Sincerely,

Katie Hoover Alvarado
Principal Investigator
Duke University

James L. Hickman
NC Division of Pollution Prevention
& Environmental Assistance

Recycling Business Survey Cover Letter

This cover letter was included with the survey sent to the mail survey sample, along with a postage paid and addressed return envelope. The email survey sample received an email with similar text, along with a link to the survey website and a password (their survey identification number) to enter the site.

«First_Name1»«Last_Name1»

Survey ID: «SurveyID»

I am writing to ask for your help in a study on recycling for the state of North Carolina. This study is part of an effort by Duke University and the N.C. Division of Pollution Prevention & Environmental Assistance to learn how recycling contributes to North Carolina's economy.

It is my understanding that your business involves recycling. We are contacting every business in the state that involves recycling. We are asking for information on the type of recycling functions your company may perform, the number of employees dedicated to recycling, and some information about wages.

Results from the survey will be used to help the state government strengthen recycling in NC, including making a case of policies and incentives that may help your business.

If you have access to the internet, you may complete the survey by going to http://www.p2pays.org/LGAT_Survey/ and entering your unique invitation code in the Businesses section (*your unique invitation code is «SurveyID»*).

Your answers are completely confidential and will be released only as summaries in which no individual's answers can be identified. This survey is voluntary. However, you can help us very much by taking a few minutes to share your experiences working in the recycling industry. If for some reason you prefer not to respond, please let us know by returning the blank questionnaire in the enclosed stamped envelope.

If you have any questions or comments about this study, I would be happy to talk with you. The toll-free number to DPPEA customer service is 800-763-0136 or you may also email me at katie.alvarado@ncmail.net.

Thank you very much for helping with this important study!

Sincerely,

Katie Hoover Alvarado
Principal Investigator
Duke University


James L. Hickman
NC Division of Pollution Prevention
& Environmental Assistance

Recycling Business Survey

This is the survey the mail sample received. The content of the web survey is identical; however the layout of some of the questions is different.

North Carolina Recycling Business Survey



The recycling industry is an important, yet often overlooked sector of North Carolina's economy. The following survey will help to document both the effects recycling has on employment and the business needs of recycling firms. Therefore, the North Carolina Division of Pollution Prevention and Environmental Assistance very much appreciates your completion of this survey.



Please answer all questions to the best of your knowledge. This survey should take approximately ten minutes to complete. Your participation is voluntary and all answers will be kept confidential. Please mail completed survey using the enclosed envelope. If you have any questions, please call Katie Alvarado at (919) 733-4396.

Thank you very much for your contribution to this important research!!
«SurveyID»

NC Recycling Business Survey

Section A. Facility & Company Information

1. Your name: _____
2. Company Name: _____
3. Facility Name: _____
4. Telephone Number: _____ 5. Email Address: _____
6. Does your company have other facilities in North Carolina? Yes No
7. NACIS or SIC code (if known/applicable): _____

Section B. Recycling Services

Please complete the following table by indicating if your facility performs the listed functions, the number of full-time equivalent employees dedicated to performing that function, the labor hours per week dedicated to performing that function and the tons per year of material used in that function which come from **North Carolina sources**.

Full-time equivalent employees include all full-time employees and those employees who work part-time. To calculate the full-time equivalency of a part-time employee, divide the employee's average weekly hours by 40. For example, an employee that works 20 hours/week would count as 1/2 of a full-time equivalent employee (20÷40=0.50), and an employee that works 25 hours/week would count as 0.625 (5/8) of a full-time equivalent employee [25÷40=0.625]. You may use fractions or decimals.

		# full-time equivalent employees	Labor hours per week	Tons per year from NC*
8. Collection				
Does your facility directly collect recyclable materials from <i>RESIDENTIAL CURBSIDE PICK-UP PROGRAMS</i> ?	<input type="checkbox"/> Yes <input type="checkbox"/> No			
Does your facility directly collect recyclable materials from <i>RESIDENTIAL DROP-OFF PROGRAMS</i> ?	<input type="checkbox"/> Yes <input type="checkbox"/> No			
Does your facility directly collect recyclable materials from <i>INDUSTRIAL OR COMMERCIAL SOURCES</i> ?	<input type="checkbox"/> Yes <input type="checkbox"/> No			
9. Processing				
Does your facility <i>SORT, BALE, DENSIFY, SHRED</i> or otherwise <i>PROCESS</i> recyclable materials?	<input type="checkbox"/> Yes <input type="checkbox"/> No			
10. Brokering				
Does your facility <i>BROKER</i> recycled materials?	<input type="checkbox"/> Yes <input type="checkbox"/> No			
11. Manufacturing/End-Use				
Does your facility make products from recycled materials?	<input type="checkbox"/> Yes <input type="checkbox"/> No			
What product(s) does your facility produce using this recycled material? _____				

***It is very important to report figures based only on materials received from North Carolina sources.** For example, if your facility processes 1,000 tons of recyclable materials per year and 75% of the materials are from an NC collection center, but the other 25% is from Virginia and South Carolina, only report 750 tons/year.

NC Recycling Business Survey

Section C. Employment & Wage information

12. How many full-time equivalent employees currently work at your facility? _____
13. How many full-time equivalent employees at your facility are dedicated to recycling? _____
- a. If you do not know the number of employees dedicated to recycling, please estimate the percentage of your business devoted to recycling:
 Less than 25% 25%-50% 50%-74% 75%-99% 100%
- b. How many full-time equivalent employee positions at your facility have been CREATED since the year 2000? _____
- c. How many full-time equivalent employee positions at your facility have been TERMINATED since the year 2000? _____
- d. Do you forecast the creation of more employee positions dedicated to recycling at your facility anytime in the next two years? Yes No
14. What is the average hourly wage of the employees at your facility that are dedicated to recycling?
- | | |
|---|--|
| <input type="checkbox"/> \$5.15-\$6.50 | <input type="checkbox"/> \$10.51-\$12.50 |
| <input type="checkbox"/> \$6.51-\$8.50 | <input type="checkbox"/> \$12.51-14.50 |
| <input type="checkbox"/> \$8.51-\$10.50 | <input type="checkbox"/> \$14.50 & above |
15. Is your facility's existence dependent solely on recycling? Yes No

Section D.

Please check each material that your facility collects, processes or utilizes in manufacturing.

- | | |
|---|--|
| <input type="checkbox"/> Aluminum Cans | <input type="checkbox"/> Other Paper |
| <input type="checkbox"/> PETE Plastic (#1) | <input type="checkbox"/> Magazines |
| <input type="checkbox"/> HDPE Plastic (#2) | <input type="checkbox"/> Textiles |
| <input type="checkbox"/> Other Plastic | <input type="checkbox"/> Other Metal Scrap |
| <input type="checkbox"/> Glass | <input type="checkbox"/> Electronics |
| <input type="checkbox"/> Newspaper | <input type="checkbox"/> Construction & Demolition |
| <input type="checkbox"/> Corrugated Cardboard | <input type="checkbox"/> Woody & Organic Material |
| <input type="checkbox"/> Office Paper | <input type="checkbox"/> Other: |
| <input type="checkbox"/> Mixed Paper | |



Thank You
for completing the survey!



Recycling Business Survey Follow-up Postcard

Approximately four weeks after receiving the survey, the mail survey sample received this follow-up postcard. The web survey sample received several follow-up emails, all with similar text.

«FIRST_NAME1»,

Earlier this month Duke University & NC DENR-DPPEA sent you a survey concerning your company's recycling related employment. However, our records indicate that you have not yet completed the recycling jobs survey!!

Please take a few minutes to complete the survey – your input is vital to developing a better understanding of how the recycling industry contributes to the NC economy and will help your state government strengthen recycling in NC, including making a case of policies and incentives that may help your business.

You also have the option of completing the survey on-line, by going to http://www.p2pays.org/LGAT_survey and entering your unique invitation code («*SurveyID*») in the box next to “businesses”.

If you never received the survey or have any other questions or comments about the survey, please contact Katie Alvarado at 800-763-0136 or katie.alvarado@ncmail.net.

Thank you so very much for your time & effort!
Katie Hoover Alvarado



Recycling Business Survey Results and Discussion

Respondents received the survey either through regular postal mail, or through an email containing a link to the online survey website. After approximately 4-5 weeks, respondents who had not completed the survey were contacted by telephone. Approximately 10% of the non-respondents were contacted by telephone, and 39 completed the survey. Due to time constraints, not all respondents were contacted by phone.

Table A-9

	# Surveys Completed	# Surveys Sent	# Surveys Removed	Adjusted Response Rate
Web	122	292	-22	45.2%
Mail	63	240	-26	29.4%
Phone	39		-1	
TOTAL	224	532	-47	46.4%

After the web, mail, and telephone phase of survey implementation concluded, various other methods of collecting secondary data were used to supplement the employment calculations. These data sources were only used to calculate the total full-time equivalent employees (FTE) and full-time equivalent employees dedicated entirely to recycling (FTE-R) and were not used for any other question.

Table A-10

		# Completed	# Sent	# Removed/Added	Adjusted Response Rate
Survey	Web	122	292	-22	45.2%
	Mail	63	240	-26	29.4%
	Phone	39		-1	
Other Sources	NCSU	21		+11	
	Harris	25			
	ESC	94		+3	
TOTAL		364	532	-35	73.2%

As shown in Table A-2, forty-nine respondents to my survey were removed from the sample frame. Twenty-seven respondents had incorrect contact information and could not be located; 8 refused to complete the survey for various reasons, 6 were duplicate listings in the DMRM, 4 relocated out of North Carolina, and 4 said they were not recycling businesses.

Eleven businesses, which completed the NCSU pallet study, were not listed in the DMRM and therefore were added to the sample frame. In addition, there were 3 businesses which were not listed in the DMRM but were identified through the ESC data as recycling businesses and therefore were also added to the sample frame.

Survey Section B Results. Recycling Services⁵

Table A-11

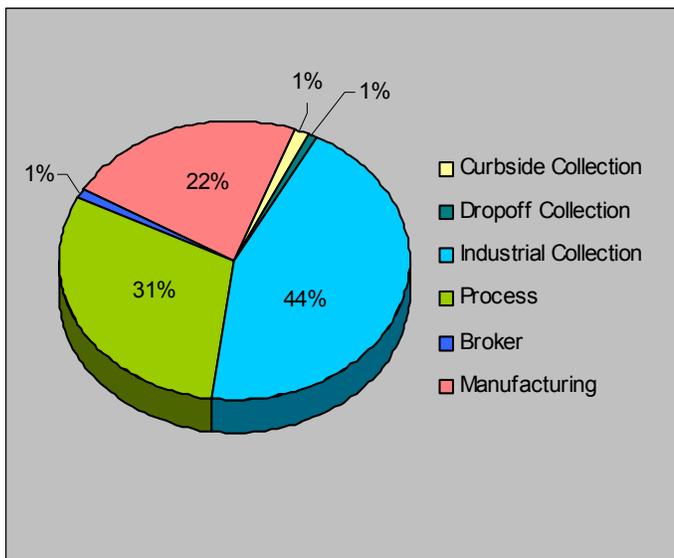
	NC Totals			Per Establishment				N ⁶ (number of responses)
	Total FTE	Total Labor Hours/wk	Total Tons/yr from NC	# Est.	Mean FTE	Mean Labor Hours/wk	Mean Total Tons/yr from NC	
8. Collection								
<i>RESIDENTIAL CURBSIDE PICK-UP PROGRAMS</i>	75	1,303.0	129,876.0	14	5.36	93.07	9,276.86	193
<i>RESIDENTIAL DROP-OFF PROGRAMS</i>	63.9	2,313.7	65,961.4	24	2.66	96.40	2,748.39	185
<i>INDUSTRIAL OR COMMERCIAL SOURCES</i>	2,633.08	2,1437.3	19,734,143.8	128	20.57	167.48	154,173.00	183
9. Processing								
<i>SORT, BALE, DENSIFY, SHRED or otherwise PROCESS</i>	1,829.46	43,353.0	25,327,457.1	146	12.53	296.94	173,475.73	197
10. Brokering								
<i>BROKER</i>	62.68	1,659.5	348,272.8	69	0.91	24.05	5,047.73	182
11. Manufacturing/End-Use								
Does your facility make products from recycled materials?	1,315.55	52,115	784,862.7	59	22.30	883.31	13,302.76	188

⁵ The first seven questions of the survey were identifying questions that are no longer accessible.

⁶ Not all respondents answered all questions. Therefore, data such as mean values are reported according to the number of responses to that particular question.

Industrial or commercial recycling collection is the largest employer in NC's private recycling sector, with 2,633 employees. This result reflects the fact that local governments typically do not collect from industrial or commercial businesses. Processing is the next largest employer (1,829) and also has the greatest number of establishments in the state (146). The large number of processing establishments could be explained by processing being the most diverse activity in that there are many different processing methods and some commodities go through many different processing stages. Manufacturing/End-use employs 1,315 workers. Curbside collection, dropoff collection and brokering each hold 1% of the total employment with 75, 63, and 62 employees, respectively.

Figure A-1. Private Sector Recycling Employment by Function



Survey Section C Results. Employment & Wage Information

12. How many full-time equivalent employees currently work at your facility?	Industry Total	Number of Responses
	7,752.63	207
13. How many full-time equivalent employees at your facility are dedicated to recycling?	Industry Total	Number of Responses
	4,690.63	205

These results indicate that over half of the private sector recycling employees in NC are fully dedicated to recycling. This number could be greater, due to the potential to mis-understand question #13. Some respondents asked if question #13 included administrative or managerial staff positions, indicating that there may have been some confusion with the wording of the question and instructions.

a. If you do not know the number of employees dedicated to recycling, please estimate the percentage of your business devoted to recycling.	Mean	Median	Mode	Number of Responses
	25-49%	50-74%	100%	191

The results show that the mean response falls between 25-50%. The median answer was the range between 50-74% and the most common answer (mode) was 100%, indicating that the majority of the respondents were businesses related entirely to recycling.

b. How many full-time equivalent employee positions at your facility have been CREATED since the year 2000?	Industry Total	Number of Responses
	1,153.00	196
c. How many full-time equivalent employee positions at your facility have been TERMINATED since the year 2000?	396.00	192

A net total of 757 full-time equivalent employee positions have been created since 2000, demonstrating the growth in the private sector of the recycling industry.

d. Do you forecast the creation of more employee positions dedicated to recycling at your facility anytime in the next two years?	# Yes	# No	N
	98	82	180

These results suggest that the private sector of the recycling industry will continue to grow during the next few years, although perhaps not significantly. This could be another indication of difficult economic times in North Carolina.

14. What is the average hourly wage of the employees at your facility that are dedicated to recycling?	Mean	Median	Mode	Number of Responses
	\$8.51-\$10.50	\$10.51-\$12.50	\$8.51-\$10.50	209

The mean falls in the range of \$8.51-\$10.50, the median average wage is between \$10.51-\$12.50, and the mode is between \$8.51-\$10.50.

15. Is your facility's existence dependent solely on recycling?	# Yes	# No	Number of Responses
	105	76	181

This result reveals that just over half (58%) of the survey sample frame are businesses whose primary service is recycling related, which is comparable to the results from question #13a.

Survey Section D Results. Commodity Information

In this section, each respondent was asked to mark *each* commodity which it either collects, processes, brokers or uses in manufacturing. Only 185 businesses completed this section. No single commodity dominates the market. An interesting result was that besides aluminum cans, few establishments worked with the common household recyclables (see Table A-4). Only 30 establishments worked with plastics and 19 with glass. Either NC is not capturing enough of these commodities out of the waste stream to support a private sector in these materials, or the commodities are going out of state, which is a loss to NC. Common answers in the "other" category were: tires, chemicals, stone, oil/grease, batteries, toner, carpet, and furniture.

Table A-12

<i>Commodity</i>	<i># establishments that collects, processes or utilizes in manufacturing</i>	<i>% of Respondents</i>
Aluminum Cans	55	30%
Other	55	30%
Corrugated Cardboard	54	29%
Other Metal Scrap	53	29%
Office Paper	39	21%
Mixed Paper	39	21%
Other Plastic	33	18%
Newspaper	32	17%
HDPE Plastic (#2)	31	17%
Woody & Organic Material	30	16%
PETE Plastic (#1)	29	16%
Magazines	28	15%
Other Paper	27	15%
Construction & Demolition	22	12%
Glass	19	10%
Electronics	19	10%
Textiles	17	9%

Statewide Private Recycling Employment Calculation

The reported recycling employment in the state comes from combining the estimates from the survey and the other data sources (NCSU pallet study, the Harris Directory and the NC ESC). A total of 343 companies report 8,817 FTE-R. Those 343 companies represent 69% of the survey sample (343/497=69%). Estimating the total FTE for the state can be accomplished by dividing the FTE reported in Table A-5 by the percent of companies with estimates, assuming that those who responded to the survey are representative of those who did not respond (Table A-6). Therefore, approximately 12,775 employees in the state of NC are estimated to be directly related to recycling.

Table A-13. NC Reported FTE-R

	FTE-R	Number of Companies
Survey Question #13	4,691	205
NCSU Pallet Study	862	21
Harris Directory	1,615	24
NC ESC	1,649	94
TOTAL	8,817	343

Table A-14. Statewide Recycling Employment Estimate

FTE-R	8,817
Percent of surveyed (343/497)	69%
Extrapolated to state of NC	12,775

Appendix B

Local Government Recycling Survey

2004

**Pre-Notification Letter
Cover Letter
Survey
Follow-up Postcard
Survey Results and Discussion**

Local Government Survey Pre-Notification Letter

The mail survey sample (39 local government units) received this pre-notification letter approximately one week prior to receiving the survey. The web survey sample (96 local government units) received a pre-notification email with similar text two days prior to receiving the survey.

Dear «First_Name1»:

A few days from now you will receive in the mail a request to fill out a brief questionnaire for an important research project being conducted by Duke University in conjunction with North Carolina's Department of Environment & Natural Resources' Division of Pollution Prevention and Environmental Assistance.

The survey concerns the impact of local government recycling programs on the North Carolina economy.

I am writing in advance because we have found many people like to know ahead of time that they will be contacted. The study is an important one that will help your local government assistance team develop ways to better serve you.

Thank you for your time and consideration. It's only with the generous help of people like you that our research can be successful.

Sincerely,

Katie Hoover Alvarado
Principal Investigator
Duke University

James L. Hickman
NC Division of Pollution Prevention
& Environmental Assistance

PS: If you would like to complete the survey on the web, please send an email to katie.alvarado@ncmail.net (include your name and local government unit)!

Local Government Survey Cover Letter

This cover letter was included with the survey sent to the mail survey sample, along with a postage paid and addressed return envelope. The email survey sample received an email with similar text, along with a link to the survey website and a password (their survey identification number) to enter the site

«First_Name1»: Survey ID: «SurveyID1»
I am writing to ask for your help in a study on recycling for the state of North Carolina. This study is part of an effort by Duke University and the N.C. Division of Pollution Prevention and Environmental Assistance to learn how recycling programs contribute to North Carolina's economy.

It is my understanding that *Pequimans, Chowan & Gates Counties* operate a recycling program. We are contacting all North Carolina local government units with recycling programs and asking questions about recycling services offered, number of employees and wage information.

Results from the survey will be used to help your state government better serve you and other local government units.

You also have the option of completing the survey on-line, by going to http://www.p2pays.org/LGAT_survey and entering your unique invitation code «SurveyID1» in the box next to "businesses".

Your answers are completely confidential and will be released only as summaries in which no individual's answers can be identified. Your contact information will never be connected to your answers in any way. This survey is voluntary. However, you can help us very much by taking a few minutes to share your experiences working in «AreaName1». If for some reason you prefer not to respond, please let us know by returning the blank questionnaire in the enclosed stamped envelope.

If you have any questions or comments about this study, I would be happy to talk with you. The toll-free number to DPPEA customer service is 800-763-0136 or you may also email me at katie.alvarado@ncmail.net.

Thank you very much for helping with this important study.

Sincerely,

Katie Hoover Alvarado
Principal Investigator
Duke University

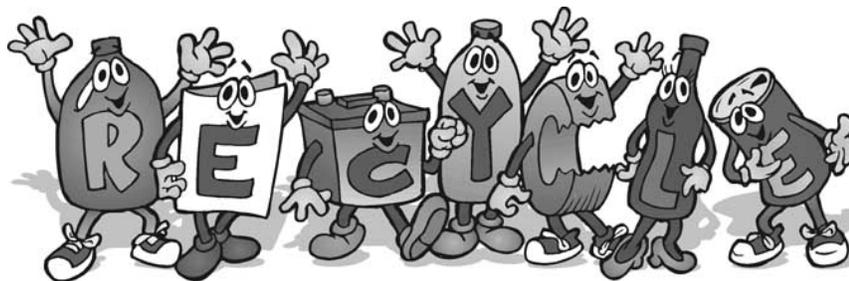
James L. Hickman
NC Division of Pollution Prevention
& Environmental Assistance

Local Government Survey

This is the survey the mail sample received. The content of the web survey is identical, however the layout of some of the questions is different.

North Carolina Local Government Recycling Survey

The recycling industry is an important, yet often overlooked sector of North Carolina's economy. This survey will help to document the effects recycling has on employment. Therefore, the North Carolina Division of Pollution Prevention and Environmental Assistance very much appreciate your completion of this survey.



Please answer all questions to the best of your knowledge. This survey should take approximately ten minutes to complete. Your participation is voluntary and all answers will be kept confidential. Once completed, simply place the survey in the enclosed envelope and send in the mail!

If you have any questions, please call Katie Alvarado at (919) 733-4396.

Thank you for your contribution to this important research!

Survey ID#: «**SurveyID**»

NC Local Government Recycling Survey

Section A.

1. County or Municipality: _____
2. Your Name: _____ 3. Phone Number: _____

Section B. Recycling Services

Please complete the following table by indicating the number of full-time equivalent employees dedicated to performing the listed service and the labor hours per week dedicated to performing that service. If your local government does not perform the service, please leave blank. Do not include services which are performed by contractors.

Full-time equivalent employees include all full-time employees and those employees who work part-time. To calculate the full-time equivalency of a part-time employee, divide the employee's average weekly hours by 40. For example, an employee that works 20 hours/week would count as ½ of a full-time equivalent employee (20÷40=0.50), and an employee that works 25 hours/week would count as 0.625 (25÷40=0.625). You may use fractions or decimals.

	# full-time equivalent employees	Labor hours/week
4. Recycling Collection		
A. RESIDENTIAL CURBSIDE PICK-UP		
B. (un-staffed) RESIDENTIAL DROP-OFF COLLECTION CENTER(S)		
C. (staffed) RESIDENTIAL DROP-OFF COLLECTION CENTER(S)		
D. INDUSTRIAL OR COMMERCIAL RECYCLING		
5. Recycling Processing (sort, bale, densify, shred or otherwise process)		
6. Composting/Mulching		
7. Recycling Education/Marketing		
8. Recycling Administration		

9. In total, how many full-time equivalent employees in your local government are dedicated to performing RECYCLING services? _____
10. What is the average hourly wage earned by the RECYCLING EMPLOYEES of your local government?
- \$5.15-\$6.50 \$8.51-\$10.50 \$12.51-14.50
 \$6.51-\$8.50 \$10.51-\$12.50 \$14.50 & above
11. What is the estimated annual RECYCLING tonnage managed? _____
12. What percent, if any, of the annual recycling tonnage is sent out of NC? _____

NC Local Government Recycling Survey

Section C. Solid Waste Services

Please complete the following table by indicating the number of full-time equivalent employees dedicated to performing the listed service and the labor hours per week dedicated to performing that service. If your local government does not perform the service, please leave blank. Do not include services which are performed by contractors

	# full-time equivalent employees	Labor hours/week
13. Solid Waste Collection		
A. RESIDENTIAL CURBSIDE PICK-UP program		
B. (un-staffed) RESIDENTIAL DROP-OFF COLLECTION CENTER(S)		
C. (staffed) RESIDENTIAL DROP-OFF COLLECTION CENTER(S)		
14. Solid Waste Disposal		
A. LANDFILL		
B. INCINERATION		
15. Solid Waste Education/Marketing		
16. Solid Waste Administration		

17. In total, how many full-time equivalent employees in your local government are dedicated to performing SOLID WASTE services? _____

18. What is the average hourly wage earned by the SOLID WASTE EMPLOYEES of your local government?

- | | | |
|--|--|--|
| <input type="checkbox"/> \$5.15-\$6.50 | <input type="checkbox"/> \$8.51-\$10.50 | <input type="checkbox"/> \$12.51-14.50 |
| <input type="checkbox"/> \$6.51-\$8.50 | <input type="checkbox"/> \$10.51-\$12.50 | <input type="checkbox"/> \$14.50 & above |

19. What is the estimated annual SOLID WASTE tonnage managed? _____

20. What percent, if any, of the estimated annual solid waste tonnage is sent out of NC? _____

21. Briefly describe any changes your local government Recycling or Solid Waste program may experience in the next two years.

NC Local Government Recycling Survey

Section D. Materials

22. In the table below,
- a. Check the materials that your local government collects (do not check materials which are collected by contractors), and
 - b. Give the name of the market/outlet which receives the material.

Material	Market/Outlet Name
<input type="checkbox"/> Aluminum Cans	
<input type="checkbox"/> PETE Plastic (#1)	
<input type="checkbox"/> HDPE Plastic (#2)	
<input type="checkbox"/> Other Plastic	
<input type="checkbox"/> Glass	
<input type="checkbox"/> Newspaper	
<input type="checkbox"/> Corrugated Cardboard	
<input type="checkbox"/> Office Paper	
<input type="checkbox"/> Mixed Paper	
<input type="checkbox"/> Other Paper	
<input type="checkbox"/> Magazines	
<input type="checkbox"/> Electronics	
<input type="checkbox"/> White goods	
<input type="checkbox"/> Metal scrap	
<input type="checkbox"/> Other:	



Thank You
for completing the survey!



Local Government Survey Follow-up Postcard

Approximately four weeks after receiving the survey, the mail survey sample received this follow-up postcard. The web survey sample received several follow-up emails, all with similar text.

«FIRST_NAME1»,
Earlier this month Duke University & NC DENR-DPPEA sent you a survey concerning your company's recycling related employment. However, our records indicate that you have not yet completed the recycling jobs survey!!

Please take a few minutes to complete the survey – your input is vital to developing a better understanding of how the recycling industry contributes to the NC economy and will help your state government strengthen recycling in NC, including making a case of policies and incentives that may help your business.

You also have the option of completing the survey on-line, by going to http://www.p2pays.org/LGAT_survey and entering your unique invitation code («SurveyID») in the box next to "businesses".

If you never received the survey or have any other questions or comments about the survey, please contact Katie Alvarado at 800-763-0136 or katie.alvarado@ncmail.net.

Thank you so very much for your time & effort!
Katie Hoover Alvarado



Local Government Survey Results and Discussion

Respondents received the survey either through regular postal mail or through an email containing a link to the online survey website.

Table B-15

	# Surveys Completed	# Surveys Sent	# Surveys Removed/Added	Adjusted Response Rate
Web	60	96	0	62.5%
Mail	15	39	0	38.5%
TOTAL	75	135	0	55.6%

There were no removals or additions to the sample frame, no local governments cancelled or began publicly operating recycling programs during the implementation of the survey.

Survey Section B. Recycling Services⁷

Table B-16

	Local Government Totals		Per LGU ⁸		
	Total FTE Reported	Total Labor hr/wk	# LGUs	Mean FTE	Mean Labor hr/wk
4. Collection					
RESIDENTIAL CURBSIDE PICK-UP	111.18	5,075.40	24	4.76	211.47
(un-staffed) DROP-OFF CENTERS	25.60	1,144.00	14	2.04	80.71
(staffed) DROP-OFF CENTERS	240.50	8,788.50	38	6.46	237.53
INDUSTRIAL OR COMMERCIAL RECYCLING	36.75	1,344.50	17	1.98	89.63
5. Recycling Processing					
SORT, BALE, DENSIFY, SHRED or otherwise PROCESS	72.89	3,232.88	25	3.32	134.70
6. Composting/Mulching					
COMPOSTING/MULCHING	62.37	2,307.75	28	2.23	88.76
7. Recycling Education/Marketing					
EDUCATION/MARKETING	16.08	753.00	28	0.68	27.89
8. Recycling Administration					
ADMINISTRATION	46.46	1,811.00	45	1.02	42.17

The public recycling service with the most employees is staffed drop-off centers, exceeding the next service by more than 100 employees⁹. In addition, the most local governments (38) offered staffed

⁷ The first three questions of the survey were identifying questions that are no longer accessible.

⁸ LGU: local government unit

drop off centers. This result is somewhat surprising, but can be explained. Staffed drop-off centers require employees for more than 8 hours a day, 5 days a week, since many drop-off centers are open on the weekends and into the evenings. Additionally, many landfills also have recycling centers, so it is possible that there is some overlap.

Many LGU's allow their residents to commingle their recyclables in the bin, and then the employees sort the recyclables into the collection truck. This could explain the large number of public processing employees.

Figure B-5

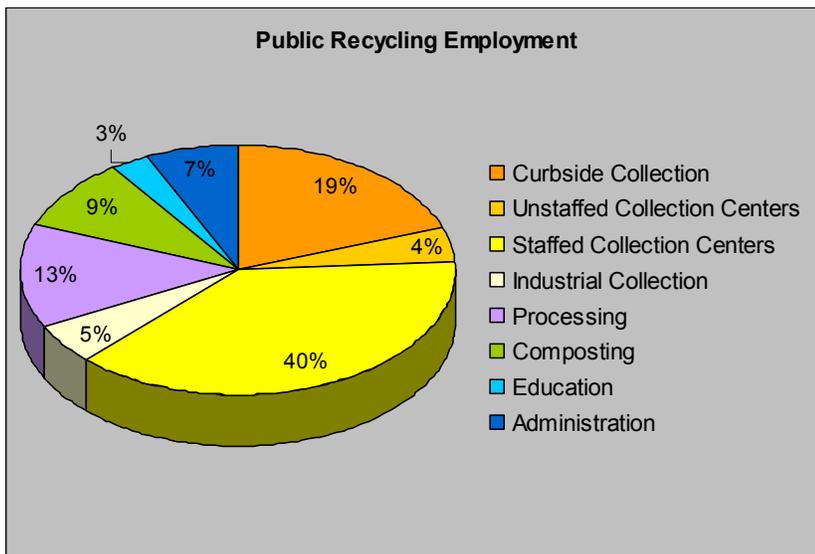


Table B-17

	Total	Mean	Median	Mode	Number of Responses
9. # FTE dedicated to performing recycling services	570.40	9.05	5	1	63
10. What is the average hourly wage earned by the Recycling Employees of your local government?		\$8.51-10.50	\$8.51-10.50	\$8.51-10.50	62
11. What is the estimated annual recycling tonnage managed?	922,674.00	14,195.00	1,500	1,500	65
12. How much of the annual recycling tonnage is sent out of NC?	52,243.00	1,024.40	0	0	51

⁹ These conclusions are only applicable to the North Carolina local governments that operate recycling programs with public employees, not those LGU's that do not operate any recycling programs are those that use private contractors to perform recycling services.

The agreement between the measures of central tendency (mean, median, mode) in Question #10 strongly suggests that the majority of local government recycling employees earn a wage in the range of \$8.51-10.50.

Questions 11 & 12 serve two purposes: one to measure accuracy of reporting, and two to determine the amount of recycling commodities that remain in the NC economy. The 2002-2003 Annual Solid Waste Report estimated the local government recovery to be just over 1 million tons. Although only half of the local governments surveyed answered this question (65 out of 135), they reported they collect over 90% of the statewide recycling tonnage. This suggests that the local governments who did respond either collect the vast majority of the recycling, or they overestimated the responses to this question. The respondents also reported approximately 5% of the recycling collected was sent out of NC, suggesting that the majority of recycling collected in North Carolina remains in North Carolina for downstream benefits.

Survey Section C. Solid Waste Services

Table B-18

	LGU Totals		Per LGU ¹⁰		
	Total FTE	Total Labor Hours/wk	# LGUs	Mean FTE	Mean Labor Hours/wk
13. Collection					
RESIDENTIAL CURBSIDE PICK-UP	536.05	18,586.60	32	16.75	580.83
(un-staffed) DROP-OFF CENTERS	8.5	340	5	1.7	68
(staffed) DROP-OFF CENTERS	294.72	9,693.5	35	8.42	276.96
14. Solid Waste Disposal					
Landfill	300.45	1,1183	32	9.39	349.47
Incineration	43	0	2	8.6	0
15. Solid Waste Education/Marketing					
	14.85	591	23	0.65	25.70
16. Solid Waste Administration					
	81.78	3,111	51	1.60	61

The service with the largest employment is residential curbside solid waste collection, which is not surprising. However, during data collection, I realized that staffed drop-off centers and landfills could be considered the same thing and is a potential source of error. Although two local governments reported operating waste-to-energy facilities, only one local government in North Carolina actually operates such a facility.

Table B-19

¹⁰ LGU: local government unit

	Total	Mean	Median	Mode	N
17. # FTE dedicated to performing SW services	1,111.03	16.58	10.5	4	67
18. What is the average hourly wage earned by the SW employees of your local government?		\$10.51-12.50	\$10.51-12.50	\$10.51-12.50	62
19. What is the estimated annual solid waste tonnage managed?	15,829,856	247,341.50	20,165.56	19,000	64
20. How much of the solid waste tonnage is sent out of NC?	128,269	2,068.85	0	0	62

The agreement between the measures of central tendency in question #18 strongly suggests that the majority of local government solid waste employees earn a wage in the range of \$10.50-\$12.50.

Similar to questions 11 &12, questions 19 & 20 were asked to measure the accuracy of reporting.

Survey Section D. Materials

Table B-20

Commodities	N
Aluminum	57
Plastic #2 (HDPE)	54
Plastic #1 (PETE)	53
Newspaper	53
White Goods	52
Corrugated Cardboard	51
Glass	50
Scrap metals	44
Magazines	38
Mixed Paper	36
Office Paper	29
Other	19
Other Paper	14
Other Plastic	13
Electronics	13

Seventy-seven percent of the LGU's who responded to this question collect aluminum, the most common commodity collected (see table B-6). This is expected, because aluminum is a common household waste product, easy to collect, light and easy to transport, and has fairly consistent market outlets. The most frequently collected commodities include the two types of plastic and newspaper, which are also expected. However, less than half of the LGUs collect paper products (besides newspaper). This suggests that it is an area that needs more research and education. Perhaps developing more efficient collection methods would enable more LGUs to implement paper recycling programs.

Comparison between Recycling and Solid Waste Employment

The survey asked the respondent to report three different measurements of full time equivalent employment. The respondent reported the number of employees by service, then by weekly labor hours, and then question #9 asked for the total number of employees. Table B-7 shows these responses for recycling and solid waste and the average of the measurements, which was used for obtaining a statewide estimate. The agreement between the three measurements suggests that the reporting was fairly consistent.

Table B-21

	<i>Recycling</i>	<i>Solid Waste</i>
#FTE by service	713.73	1,279.35
Weekly Labor Hours ÷ 40	570.34	1,111.03
Total #FTE	611.43	1,087.63
Average	631.83	1,159.33

The large difference between recycling and solid waste employment can be explained by the increased frequency of trash collection versus recycling collection. Trash is collected at least once a week, although many LGU's may collect trash twice a week. However, recycling may only be collected once or twice a month.

Recycling employs only half the people that solid waste services employ, although recycling materials makes up much less than half of the solid waste tonnage. This suggests that recycling services require more employees per ton. For example, increasing the recycling tonnage by 10,000 tons would create 6.5 FTE positions, whereas increasing the solid waste tonnage by the same amount would only create 0.71 FTE positions.

Solid waste employees earn a higher average hourly wage (\$10.51-\$12.50) than recycling employees (\$8.51-\$10.50) although both are lower than the North Carolina average wage (\$16.12/hour). This is an area that could be explored with further research.

Statewide Public Recycling Employment Calculation

Estimating the total FTE for the state can be accomplished by dividing the average total FTE reported in the surveys by the response rate, assuming that those who responded to the survey are representative of those who did not respond (table B-8). However, this estimate does not include the LGUs that use private contractors to perform their recycling services. It is quite possible that although most of the services are performed by employees of private companies, there are one or two FTE related to recycling in the LGU that should be included.

Table B-22 Estimated Total Public Recycling Employment in NC

Average recycling FTE reported in survey	631.83
Survey Response Rate	55.6%
Extrapolated to State of NC	1,137.23

Appendix C

Secondary Data Sources and Tables

The data used in the following tables were obtained from the following sources:

NCESC

The Employment Security Commission of North Carolina website (<http://www.ncesc.com>). The Labor Market Information section of the website provides access to the Employment and Wages Program. The information is provided through the Employment Security Law of North Carolina. The information includes the number of firms, employment levels (monthly or annual average), total wages, taxable wages, contributions due and average wages for industries under the North American Industry Classification System.

NCSDC

North Carolina State Data Center website (<http://sdc.state.nc.us/>). The NC State Data Center (SDC) provides access to a variety of public websites and databases with information about several different aspects of North Carolina, including population and employment statistics by economic development region (see Figure C-1).

USBLS

United States Department of Labor, Bureau of Labor Statistics website (www.bls.gov). The Bureau of Labor Statistics (BLS) collects a broad range of labor information on the state, local and federal level, as well as information on measures such as the consumer price index (CPI), productivity, and work related injuries and deaths.

USEPA REI

United States Environmental Protection Agency, Recycling Economic Information (REI) Project Website (<http://www.epa.gov/jtr/econ/rei-rw/rei-rw.htm>) . This website provided links to the national REI study as well as to the individual state's studies.

Table C-23. North Carolina Industry Statistics (source: NCESC)

	Agriculture, Forestry, Fishing & Hunting	Agriculture Crops	Agriculture Livestock	Construction	Manufacturing	Textile Mills	Pulp, Paper, Paperboard Mills	Paper Mills	Wood Container & Pallet Manufacturing	Newsprint Mills	Paper Mills	Retail Trade
NAICS code	11	111	112	23	31	313	3221	322121	32192	32213	322121	44
Units	2,424			20,665	11,595	940	21	9	117	8	9	32,055
Average Employees	27,000	11,031	9,190	168,100	818,595	153,504	8,393	4,040	3,400	3,454	4,040	386,715
Average Annual Wage	\$16,935.95	\$12,986.59	\$21,351.03	\$23,010.50	\$26,337.43	\$22,203.84	\$45,759.57	\$44,598.35	\$20,035.33	\$46,968.86	\$44,598.35	\$15,997.91
2003 dollars	\$20,947.10	\$16,064.41	\$26,411.23	\$28,460.36	\$32,575.24	\$27,462.64	\$56,597.36	\$55,161.12	\$24,780.54	\$58,093.06	\$55,161.12	\$19,786.89
Average Hourly Wage	\$10.07	\$7.72	\$12.70	\$13.68	\$15.66	\$13.20	\$27.21	\$26.52	\$11.91	\$27.93	\$26.52	\$9.51
Units	3,087			28,685	12,486	926	41	18	118	12	18	35,508
Average Employees	31,096	12,323	10,848	229,975	757,723	109,006	7,327	3,402	3,617	3,082	3,402	457,021
Average Annual Wage	\$21,448.80	\$17,075.94	\$25,432.91	\$30,697.31	\$36,661.49	\$27,205.66	\$54,257.54	\$49,261.56	\$25,601.12	\$58,924.09	\$49,261.56	\$20,561.41
2003 dollars	\$23,018.53	\$18,322.48	\$27,289.51	\$32,943.90	\$39,344.56	\$29,196.71	\$58,228.38	\$52,866.77	\$27,474.74	\$63,236.45	\$52,866.77	\$22,066.20
Average Hourly Wage	\$11.07	\$8.81	\$13.12	\$15.84	\$18.92	\$14.04	\$27.99	\$25.42	\$13.21	\$30.40	\$25.42	\$10.61
Units	2,921			27,453	11,567	754	48	26	115	12	26	33,974
Average Employees	30,440	12,368	10,460	211,163	602,020	81,282	5,619	2,224	2,721	2,616	2,224	436,680
Average Annual Wage	\$23,455.11	\$17,815.11	\$28,249.14	\$32,658.90	\$39,574.60	\$29,335.89	\$56,462.04	\$47,791.63	\$24,690.82	\$63,120.52	\$47,791.63	\$21,922.91
2003 dollars	\$23,455.11	\$17,815.11	\$28,249.14	\$32,658.90	\$39,574.60	\$29,335.89	\$56,462.04	\$47,791.63	\$24,690.82	\$63,120.52	\$47,791.63	\$21,922.91
Average Hourly Wage	\$11.28	\$8.56	\$13.58	\$15.70	\$19.03	\$14.10	\$27.15	\$22.98	\$11.87	\$30.35	\$22.98	\$10.54

Table C-1. North Carolina Industry Statistics, continued (source: NCEC)

	NAICS code	Retail Trade	Transportation	Information	Telecommunications	Finance & Insurance	Real Estate	Professional Technical, Scientific	Biotechnology	Waste Mgmt & Remediation Services	Educational Services	Health Care & Social Assistance	Statewide Total All Industries
1994		44	48	51	517	52	53	54	541710	562	61	62	
	Units Average	32,055	5,245	2,290	621	8,113	6,336	12,660	213	388	2,803	12,382	174,812
	Employees Average	386,715	121,377	61,847	21,221	107,987	35,962	109,045	6,645	5,267	252,814	317,878	3,325,039
	Annual Wage	\$15,997.91	\$27,142.76	\$31,465.53	\$39,776.09	\$31,991.64	\$20,010.41	\$33,875.00	\$40,838.62	\$24,136.26	\$23,830.09	\$25,586.29	\$23,504.00
	2003 dollars Average Hourly Wage	\$19,786.89	\$33,571.31	\$38,917.89	\$49,196.74	\$39,568.61	\$24,749.72	\$41,898.03	\$50,510.93	\$29,852.74	\$29,474.06	\$31,646.21	\$29,070.74
		\$9.51	\$16.14	\$18.71	\$23.65	\$19.02	\$11.90	\$20.14	\$24.28	\$14.35	\$14.17	\$15.21	\$13.98
2000		35,508	6,693	3,429	964	11,367	8,088	20,802	397	456	3,792	16,113	222,316
	Units Average	457,021	144,809	83,136	29,753	126,462	47,825	148,064	8,624	6,033	301,543	403,773	3,856,193
	Employees Average	\$20,561.41	\$35,006.77	\$44,387.08	\$50,322.25	\$49,186.15	\$27,337.07	\$47,538.06	\$57,829.42	\$31,087.79	\$30,336.24	\$31,419.00	\$31,096.00
	Annual Wage	\$22,066.20	\$37,568.74	\$47,635.55	\$54,005.08	\$52,785.84	\$29,337.73	\$51,017.13	\$62,061.67	\$33,362.95	\$32,556.40	\$33,718.40	\$33,371.76
	2003 dollars Average Hourly Wage	\$10.61	\$18.06	\$22.90	\$25.96	\$25.38	\$14.10	\$24.53	\$29.84	\$16.04	\$15.65	\$16.21	\$16.04
2003		33,974	6,249	3,631	1,133	12,077	8,705	22,225	477	558	4,053	17,265	228,706
	Units Average	436,680	132,203	76,525	24,412	138,120	47,201	148,202	9,881	6,297	325,170	453,879	3,720,642
	Employees Average	\$21,922.91	\$36,790.78	\$48,101.99	\$53,586.30	\$58,069.35	\$29,713.66	\$49,741.61	\$63,132.12	\$33,356.68	\$32,525.08	\$34,218.03	\$33,538.10
	Annual Wage	\$10.54	\$17.69	\$23.13	\$25.76	\$27.92	\$14.29	\$23.91	\$30.35	\$16.04	\$15.64	\$16.45	\$16.12
	2003 dollars Average Hourly Wage												

Table C-24. US Consumer Price Index, all urban consumers (source: USBLS)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
1994	146.3	146.7	147.1	147.2	147.5	147.9	148.4	149	149.3	149.4	149.8	150.1	148.2
2000	169.3	169.9	171	170.9	171.2	172.2	172.2	172.7	173.6	173.9	174.2	174.6	170.8
2003	182.2	183.2	184	183.4	183.3	183.5	183.8	184.5	185.1	184.9	184.6	184.9	183.3
													148.05
													171.92
													183.86

Table C-25. North Carolina Population and Labor Force Information, 1994-2003 (source: NCSDA)

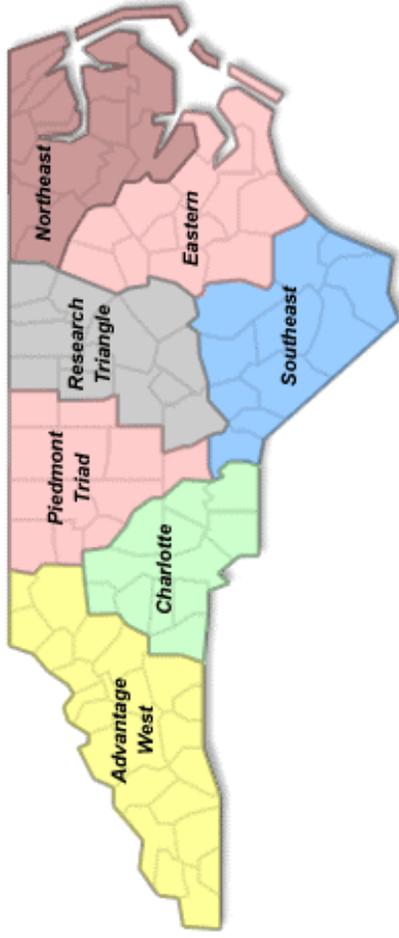
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	10 year Change
Population	7,180,525	7,336,228	7,490,812	7,645,512	7,797,501	7,938,062	8,046,485	8,196,195	8,307,748	8,417,255	17.22%
Labor Force	3,596,932	3,630,801	3,782,544	3,842,024	3,798,193	3,868,374	4,145,152	4,201,714	4,171,462	4,229,772	17.59%
Employed	3,439,864	3,473,478	3,618,202	3,702,936	3,667,122	3,746,412	3,995,484	3,971,115	3,890,025	3,956,946	15.03%
Unemployed	157,068	157,323	164,342	139,088	131,071	121,962	149,668	230,599	281,437	272,826	73.70%
Unemployment Rate	4.367	4.333	4.345	3.620	3.451	3.153	3.611	5.488	6.747	6.450	47.71%

TableC-26. REI Study Results and Labor Force (source: USEPA REI)

	Recycling Employment	Year Published	Estimated Data Year	Labor Force Data Year	% Labor Force
United States	1,121,801	2001	2000	142,583,000 ¹¹	0.79%
California	84,000	2001	2000	16,892,000 ¹²	0.50%
Florida	32,138	2001	2000	8,020,000 ¹³	0.40%
Indiana	74,970	2001	2000	3,210,100 ¹⁴	2.34%
Iowa	26,781	2001	2000	1,586,000 ¹⁵	1.69%
Nebraska	4,323	2002	2001	951,125 ¹⁶	0.45%
North Carolina	13,913	2004	2003	4,229,772	0.33%
Pennsylvania	81,322	2001	2000	6,078,900 ¹⁷	1.34%

¹¹ Pennsylvania Labor Market Information Database System website, <<http://www.palimids.state.pa.us/>>
¹² State of California, Employment Development Department website, <<http://www.calmis.ca.gov/htmlfile/county/calif.htm.htm>>
¹³ Labor Force Statistics by County – Florida website <<http://www.southalabama.edu/mcob/cber/CO-labor-florida.htm>>
¹⁴ Indiana's New Economy Workforce Statistics, <<http://www.in.gov/>>
¹⁵ Iowa Workforce Development website, <<http://www.iowaworkforce.org/lmi/laborforce/>>
¹⁶ Nebraska Workforce Development, Department of Labor website, <<http://www.dol.state.ne.us/nwd/index.cfm>>
¹⁷ Pennsylvania Labor Market Information Database System website, <<http://www.palimids.state.pa.us/>>

Figure C-6 North Carolina Economic Development Regions



Source: www.nccommerce.com

Table C-27. NC Employment Statistics by Economic Development Region (source: NCEC)

	Labor Force		Unemployment		Unemployment Rate		Business Closings		Mass Layoffs		Total	
	Employed	Unemployed	Events	Jobs Lost	Events	Jobs Lost	Events	Jobs Lost	Events	Jobs Lost	Events	Jobs Lost
Advantage West	497,359	467,021	30,338	6.1	55	4,000	25	1,826	55	4,000	25	1,826
Charlotte Regional	1,025,444	953,788	71,656	7.0	128	10,371	54	4,826	128	10,371	54	4,826
East Global Transpark	426,723	397,534	29,189	6.8	26	3,249	17	1,253	26	3,249	17	1,253
Southeast	447,167	415,626	31,541	7.1	66	1,823	22	612	66	1,823	22	612
Northeast	162,530	151,858	10,672	6.6	13	1,318	7	462	13	1,318	7	462
Piedmont Triad Partnership	789,162	736,791	52,371	6.6	99	6,007	39	2,860	99	6,007	39	2,860
Research Triangle Park	881,389	834,329	47,060	5.3	235	5,100	81	3,118	235	5,100	81	3,118
Statewide Total	4,229,774	3,956,947	272,827		622	31,868	245	14,957	622	31,868	245	14,957
												46,825