Consumer Perceptions of the Connection Between Food Production and Climate Change at Five Farmers’ Markets in North Carolina

by

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Abstract

Farmers’ markets have been increasing in number across the United States since the 1970s, rising to 4, 685 in 2008. An alternative form of agriculture has increased along with the rise in farmers’ markets, focused on sustainable farming practices and civic engagement. Many reasons have been identified for increased support of alternative food systems, including the ability to purchase fresh foods of high quality, to support local farmers, to address environmental concerns, and to avoid mass production that can lead to food security problems. This study examines the main reasons for shopping locally that were identified by respondents at five farmers’ markets in North Carolina. In particular, focus is placed on environmental reasons for shopping and on whether an effort to limit personal or household climate footprints is part of the decision to shop at farmers’ markets. In 2005, the agricultural sector in the United States was responsible for 7% of total greenhouse gas emissions of carbon dioxide, methane, and nitrous oxide (7260 Tg CO\textsubscript{2} eq). Sustainable agriculture is capable of lessening greenhouse gas contributions to global climate change through farming practices that avoid petro-chemical pesticides and fertilizers, that adopt reduced tillage techniques, and that limit fossil fuel-based inputs. Survey results showed that most respondents did not shop at farmers’ markets to reduce climate footprints, but did state that environmental concerns were important in the decision to shop locally at markets. Evidence of support for sustainable farming practices from respondents could encourage more farmers in the state to adopt sustainable farming practices. The most significant reasons given for shopping at farmers’ markets were to purchase fresh foods of high quality that were healthy for consumers, and to support local farmers. Information from and education by farmers about their farming practices may help inform more market customers of agricultural effects on the environment.
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Introduction

Farmers’ markets have been becoming more numerous across the United States. As of August 2008, a 6.8 percent increase in the number of farmers’ markets from 2006 (Figure 1) has resulted in 4,685 total markets throughout the country (Shaffer and Cox 2008). A farmers’ market is “a recurrent market at a fixed location where farm products are sold by farmers themselves, i.e. some, if not all, of the vendors must be producers who sell their own products” (Brown 2001; Guthrie, Guthrie et al. 2006). Simultaneously, there has been the growth of an entire alternative form of agriculture that is considered to be sustainable and focused on civic communities. This agriculture is adopted by certain small-scale farms that use fewer fossil fuel-based inputs for production, and that attempt to decrease environmental impacts while selling products directly to consumers through marketing strategies such as community-supported agriculture (CSA), farmer cooperatives, and farmers’ markets (Horrigan, Lawrence et al. 2002). The purpose of this study was to investigate the perceptions of consumers who shop at farmers’ markets in North Carolina about the connection between food production and a significant environmental concern - climate change.

![Number of Operating Farmers Markets](image)

Figure 1: Number of farmers’ markets in the United States (USDA A&MS 2008)
Many reasons exist for the growing market for alternative food systems, including the desire for high quality produce and unusual and unique foods (Fernandez-Arnesto 2001), support for local food production (Halweil 2004), concerns for animal welfare, and the environment (Szmigin 2003), food scares (Guthrie, Guthrie et al. 2006), and the intention to protect farmland (Prince 2002) (Guthrie, Guthrie et al. 2006). Conventional food agriculture has increased in industrialization, with a few dominant corporations controlling the industry and supplying products to several large retailers (Guthrie, Guthrie et al. 2006). Conventional (or industrial) food production has become associated with large quantities of inputs such as chemical pesticides and fertilizers, genetic modification of crops for improved yields, and high-energy processing techniques (Green and Foster 2005). Additionally, environmental impacts such as water contamination from agricultural runoff, pesticide poisoning, and climate change exacerbation have become concerns.

One of these concerns for environmental managers is the contribution of agriculture to greenhouse gas emissions. In 2005, agriculture specifically was responsible for 7% of the total greenhouse gas emissions within the United States, at 7,260 Tg CO\textsubscript{2} eq. (teragrams of carbon dioxide equivalents) (USDA 2008). Since 1750, the three most significant greenhouse gases (carbon dioxide (CO\textsubscript{2}), methane (CH\textsubscript{4}), and nitrous oxide (N\textsubscript{2}O)) have increased in concentration within the atmosphere by 35%, 155%, and 18%, respectively (USDA 2008). For critical greenhouse gas sources (the major greenhouse gases CO\textsubscript{2}, CH\textsubscript{4}, and N\textsubscript{2}O), cropped and grazed soils were responsible for 263 Tg CO\textsubscript{2} eq. of N\textsubscript{2}O emissions, enteric fermentation for 112 Tg CO\textsubscript{2} eq. of CH\textsubscript{4} emissions, and managed livestock waste for 41 Tg CO\textsubscript{2} eq. of CH\textsubscript{4} emissions (Figure 2) (USDA 2008). Additionally, energy use in the agriculture sector was responsible for 13% of CO\textsubscript{2} emissions, or 69 Tg CO\textsubscript{2} eq. (Figure 2) (USDA 2008). Agricultural land was also
found to be a sink of 306 Tg CO$_2$ eq. for removing greenhouse gases from the atmosphere (Figure 3) (USDA 2008). In light of these numbers, food that is grown and marketed locally, and that uses less oil-based inputs, has the potential to play a part in reducing the climate footprint of the food system.

Agricultural Sources of Greenhouse Gas Emissions in 2005

Figure 2: United States Department of Agriculture 2008

Agricultural Sinks of Carbon Dioxide in 2005

Note: Parentheses indicate net sequestration.

Figure 3: United States Department of Agriculture 2008
Foods pass through three agriculture processing stages before human consumption (Figure 4). At all stages the greenhouse gases CO$_2$, CH$_4$, and N$_2$O are emitted, beginning with the production stage (Figure 4). During production, farm machinery cultivates crops and harvests foods, animals are raised for meat and dairy products, fertilizers and pesticides are applied to farmland, and tillage techniques are performed on soils (Figure 4). Foods are then transported for processing, and undergo canning, drying, packaging, and freezing procedures (Figure 4). Packaged and prepared products are then transported from processing facilities to large distribution centers, retail stores, and consumer households (Figure 4). Although not shown in Figure 4, subsequent to transportation, additional impacts occur in household storage and preparation of food. Of these stages, household storage and preparation and food production use the most energy and have the greatest impacts on greenhouse gas emissions (Figure 5) (Heller and Keoleian 2003).
In North Carolina, approximately 75% of the landscape is managed for farm or forestry activities (Environmental Defense 2007; Roberson 2008). The agriculture industry is also responsible for 19% of North Carolina’s total income, and 17% of the state’s total work force (NCDA 2007; Roberson 2008). In 2007, agricultural land totaled 8,474,671 acres and included 52,913 farms in North Carolina (USDA 2007). About half of the State’s agricultural land is productive; in 2007, 4,188,658 acres of cropland were actually harvested (USDA 2007). Of the nearly 53,000 farms in the State, only 418 farms were acknowledged by North Carolina as being organically certified (USDA 2007). Organic production describes agriculture that raises animals in natural conditions, avoids antibiotics and drugs when tending livestock, and bypasses chemical pesticide and fertilizer use on agricultural lands (Seyfang 2006).

Many research studies have been undertaken to determine reasons for the recent shift in purchasing local and/or sustainable foods. For example, a study in the Midwestern United States surveyed consumers at farmers’ markets and retail grocery stores to determine household values
placed on locally grown produce and on freshness (Darby, Batte et al. 2008). It was determined that consumers from both groups placed a higher value on locally grown food than on food grown in the United States and that the demand for local food was independent of other attributes such as freshness (Darby, Batte et al. 2008). In North Carolina, a study was conducted at one farmers’ market, and at several other shopping venues away from farmers’ markets, to determine main reasons individuals had for shopping and what made the farmers’ markets successful (Andreatta 2003). Andreatta reported that consumers in the State are willing to visit a farmers’ market regularly, and mostly shop to buy fresh foods that are produced locally where they are able to meet the people who grew their food (Andreatta 2003).

My study was developed to add to the knowledge gained from Andreatta’s research, by visiting multiple farmers’ markets in the State while asking market visitors about their main reasons for shopping. Results indicating that North Carolinians shop at farmers’ markets in part because they believe local food production follows sustainable farming practices could inspire more farmers to adopt sustainable practices in the State. Learning the extent of understanding participants have regarding global warming and the connection it has with food production has not been studied in North Carolina in the past, and could add to the knowledge of consumer purchasing decisions in the State. Respondents not yet shopping locally at farmers’ markets to reduce climate footprints may begin to think more about personal decisions to limit climate impacts after receiving information from farmers about farming practices already adapted in response to global warming.
Research Objectives

This study had four research objectives:

- Determine what factors scientific literature identifies as significant contributions of greenhouse gas emissions from the United States agricultural sector.
- Evaluate the number of times over the past decade that media sources have identified a connection between food production and global warming to inform the American public.
- Determine why consumers choose to shop at the five farmers’ markets studied in North Carolina.
- Gain an understanding of respondents’ knowledge of agricultural contributions towards climate change and whether such information influences the decision to shop locally at farmers’ markets.

Background

The issue of climate change began to be stressed as a significant concern after the NASA scientist James Hansen presented testimony of its severity to the Senate Committee on Energy and Natural Resources in 1988 (Block 2008). Further awareness was raised after Al Gore’s book “An Inconvenient Truth” was published in 2006, and after Al Gore won the Nobel Peace Prize with the Intergovernmental Panel on Climate Change (IPCC) in 2007. Knowledge of the particular influence that conventional agriculture has on climate change has become increasingly studied and presented to the American people. Recent publications of the popular books “The Omnivore’s Dilemma” by Michael Pollan in 2006, and “Animal, Vegetable, Miracle” by Barbara Kingsolver in 2007 have clearly informed of the connection to readers. Through these books and other sources of information, scientific data of global climate change has been presented to the wider public for digestion.
For this research, five farmers’ markets were selected as study locations based on United States census data of population density. Each farmers’ market was located in a county within North Carolina that had a large population per square mile by census tract (Figure 6). Each farmers’ market chosen was identified through the North Carolina Department of Agriculture and Consumer Services Division of Marketing website, which lists all North Carolina state-owned farmers’ markets and community farmers’ markets (NCDA 2009). The selected farmers’ markets were the Asheville City Market in Asheville, NC (Buncombe County), Charlotte Regional Farmers’ Market in Charlotte, NC (Mecklenburg County), Pitt County Farmers’ Market in Greenville, NC (Pitt County), Riverfront Farmers’ Market in Wilmington, NC (New Hanover County), and State Farmers’ Market in Raleigh, NC (Wake County) (Figure 7).

![Population Density by Census Tract]

**Figure 6:** Counties in which study markets were located (United States Census Bureau 2000)
Asheville City Market

The market is located on the edge of downtown Asheville, with vendor stands set up outside in the parking lot of the Public Works Building (ASAP 2009). Approximately sixty vendors sell fresh produce, farm-raised meats, jams and preserves, plants and herbs, breads and pastries, herbal body care products, and hand-made crafts and other products (ASAP 2009). No wholesalers are permitted at the Asheville City Market, and several organic sellers certified by the state of North Carolina are present during market days (Mike McCreary, interview, April 21, 2009). The market closes during the winter season from late December to early April (ASAP 2009). When open, market hours extend on Saturdays from 8:00am – 1:00pm during April 18th – November 15th, and 10:00am – 4:00pm during November 29th – December 20th (ASAP 2009). Dogs are allowed at the market, and live music and chef demonstrations of food preparation and cooking are promoted.
Charlotte Regional Farmers’ Market

The farmers’ market includes four retail buildings of seller stands and a greenery shed selling flowers, and is located away from the Charlotte city center (NCDA 2009). The market is owned by the state of North Carolina, and is operated by the North Carolina Department of Agriculture and Consumer Services (NCDA 2009). Each building has approximately 15,000 square feet of space for selling products such as fresh produce, farm-raised meats, baked goods, handmade crafts, and assorted plants, and contains numerous seller stands along the total inside length (NCDA 2009). The market is open year-round, and has hours of 8:00am – 6:00pm Tuesday through Saturday (March to September), 12:30pm – 6:00pm Sundays (May to August), and 8:00am – 5:00pm Tuesday through Saturday (October to February) (NCDA 2009). There were no organically-certified sellers at the market during my study period, however some sellers followed sustainable or organic farming practices and advertised their products as being grown in that manner (Frank Suddreth, interview, November 20, 2008). Also, a few wholesalers who sell products that are not their own (and may not have been grown in North Carolina) are located at the market throughout the year (Frank Suddreth, interview, November 20, 2008). Special events are encouraged but pets are not allowed in the buildings, and the market did not promote live music or chef demonstrations at the time of my study.

Pitt County Farmers’ Market

Located in a rural area of Greenville, the market consists of a single building housing seller stands (approximately twenty sellers at the time of my study). The farmers’ market is surrounded by farmland, and is near the Wintergreen Elementary School. Fresh produce, baked goods, pastries, cheeses, and homemade crafts are sold at the market, and the hours of operation are from 8:00am – 1:00pm Tuesdays, Thursdays, and Saturdays, and 8:00am – 3pm Fridays from
March to December (NCSU 2007). Vendors are required to produce a portion of Pitt County produce at their stands and may advertise any sustainable farming practices they have adopted as long as such statements are not misrepresentative of actual followed practices (NCSU 2007). The market does not permit dogs inside the building, and does not promote live music or chef demonstrations (NCSU 2007).

Riverfront Farmers’ Market

The farmers’ market is located in historic downtown Wilmington, along the waterfront. At the time of my study, approximately twenty sellers had stands set up along North Water Street selling products such as fresh produce, eggs and cheeses, farm-raised meats, plants, herbs, flowers, and handmade crafts (City of Wilmington 2009). The market is open from mid-April to mid-December on Saturdays from 8:00am – 1:00pm (City of Wilmington 2009). During my study visits, only one vendor was organically certified and no wholesale sellers were permitted to sell at the market (R.T. Jones, interview, November 20, 2008). All vendors are required to sell at least 60% of their own foods to market visitors, with the other 40% of foods allowed to be grown or raised from other areas of North Carolina (R.T. Jones, interview, November 20, 2008). Additionally, dogs are allowed at the market, and live music and special events are encouraged (City of Wilmington 2009).

State Farmers’ Market

In Raleigh, the market is located away from the city center with several retail buildings housing vendors and seller stands. It is owned by the state of North Carolina, and is operated by the North Carolina Department of Agriculture and Consumer Services (NCDA 2009). Over 35,000 spaces are open to vendors, selling products such as fresh produce, farm-raised meats, breads, pastries, flowers, herbs, cheeses, and plants (NCDA 2009). The market is open year-
round, with operating hours of 5:00am – 6:00pm Monday through Saturday and 8:00am – 6:00pm on Sundays (NCDA 2009). During my study, there were no organically certified sellers, although some practiced organic or sustainable farming practices (Ronnie Best, interview, December 2, 2008). There is also a large wholesale element at the market, especially during times of the growing season (Ronnie Best, interview, December 2, 2008). The market does not permit dogs inside the retail buildings and live music was not present during my study, but special events are encouraged throughout the year (NCDA 2009).

**Methods**

*Tradition of Inquiry*

My research was a comparison case study of five farmers’ markets in North Carolina. Data collection occurred through several sources of information, such as literature and website documents, observations, and survey responses. Each case consisted of a study farmers’ market, and the research as a whole was bounded in time from the period of September to December of 2008. An assumption when using the tradition of case study is that results gathered are particularly characteristic of the cases focused on, such that my qualitative data cannot be considered representative of other farmers’ markets in the state unless the markets are incredibly similar to those studied (Creswell 1998). Additionally, because the case studies are bounded in time, data gathered represent only a snapshot of what people at the markets are thinking at the particular time period when studied (Creswell 1998).

*Literature Review*

Literature sources such as books and scientific research journals were studied to gather information on farming practices used in conventional agriculture and resulting environmental impacts from the agricultural process. Sustainable agricultural practices were also examined for
production techniques and environmental effects at the local level in the United States. The environmental concern of global climate change was particularly researched, to determine how the scientific literature identified the contribution agriculture has on climate change and whether sustainable practices on a local level contribute less to the problem. Previous agricultural surveys and qualitative studies were also examined to guide the creation of my survey questions and overall structure.

*LexisNexis Database Search*

To evaluate the frequency with which various media informed the public of a connection between food production and climate change in the United States, data searches were conducted in the LexisNexis Academic Database. Two different search phrases were entered into the database to generate results; “global warming and farmers’ markets” and “global warming and food production.” The phrase “global warming” was searched instead of “climate change” based on the belief that it may have been introduced more frequently to the general public over the years, and was a phrase that had more familiarity with individuals. Media sources searched included combined magazine stories, United States newspapers and wires, television and radio broadcast transcripts, web blogs, and combined web publications. Sources that made a direct connection between food production and climate change were identified over the previous ten years, from 1998-2008.

*Survey Design and Implementation*

As described above, surveys were conducted at five farmers’ markets in different regions and counties of North Carolina; Appendix 2 shows the questionnaire that was administered at the markets. Surveying can be a very useful method of data collection through the generation of information that illuminates opinions, characteristics, beliefs, and concerns of a wide range of
individuals (O'Leary 2005). Qualitative research within survey designs can derive meaning from complex responses that cannot easily be evaluated through statistical analysis (O'Leary 2005). In my survey research design, both quantitative and qualitative research methods were used to structure questions on physical surveys that were provided to respondents for completion at the farmers’ markets.

My survey was structured as a mixed design of twenty-two questions, both quantitative and qualitative - four of which were open-ended (Appendix 2). A test survey was initially designed and provided to respondents at the State Farmers’ Market in Raleigh, North Carolina to determine where weaknesses in my study design were located. The market at Raleigh was selected because I had the greatest familiarity with its manager in comparison to the other markets I planned on visiting. I modified the initial survey to increase the validity of my research based on the results of the pilot phase in Raleigh, and the final survey design (Appendix 2) was subsequently introduced to five farmers’ markets across North Carolina. At each market, a consent form was provided to inform respondents of my study purpose and of the confidential nature of any responses that would be provided (Appendix 1).

I selected five farmers’ markets to visit around the state of North Carolina based on regional location, county census data, and population density. In order to collect data that were aimed at being representative of the state of North Carolina and of a diverse population, the Asheville City Market, Charlotte Regional Farmers’ Market, Pitt County Farmers’ Market in Greenville, Riverfront Farmers’ Market in Wilmington, and State Farmers’ Market in Raleigh were chosen as study locations in counties with differing statistics of total population, median household income, and per capita money income from the United States Census Bureau. These particular markets were selected based on the degree of population density of the county where
they were located (Buncombe, Mecklenburg, Pitt, New Hanover, and Wake counties, respectively) so that on study field days a large number of people were possible for participation. They were also chosen based on the amount of information that was available about the markets on the North Carolina Department of Agriculture and Consumer Services Marketing Division website. Each market was visited two times, with several weeks elapsing in between visits. The State Farmers’ Market was the exception, with three study days occurring with the addition of the initial test survey data collection. The visits to farmers’ markets occurred from September 5th to December 4th of 2008.

At each farmers’ market, I was situated at a table among the sellers and provided surveys on clipboards for individuals to complete. Through my location adjacent to seller stands, I was able to distribute my surveys to consumers who were moving between sellers to observe and buy produce. Market managers determined the locations where I set up my table and chair so that I remained out of the way of consumer and producer interactions. A sign was affixed to my table to inform individuals of my study and the need for participants. I also provided a bowl of mixed snack foods, such as dried fruits and crackers, to further attract participants to fill out the survey.

Data Analyses

After the data collection period ended, the surveys were transcribed into a digital spreadsheet for evaluation. The quantitative questions that could be statistically analyzed were separated from the qualitative data into separate spreadsheets, with each farmers’ market being represented in one file that included both days of study. The test survey data collected at the State Farmers’ Market in Raleigh, North Carolina were not evaluated for this study. The quantitative data were then analyzed and presented in frequency distribution graphs to show the frequency with which responses were given for each survey question (Rea and Parker 2005).
The qualitative data from the surveys were analyzed with Computer-Aided Qualitative Data Analysis Software (CAQDAS) with the program NVIVO™, and coding was performed to determine the words or phrases that were mentioned most frequently in responses to particular questions. Using the NVIVO™ program permitted the analysis of large amounts of qualitative data that had been collected through the surveys. The coding results were then graphed for observation, along with the frequency distribution graphs of LexisNexis search results.

In addition to distributing surveys to participants at the markets, observational data were recorded in a research journal on each study day. These data were not analyzed, but were looked to for understanding of the characteristics of the farmers’ markets I visited. For example, it was noted where the farmers’ markets were located (in an urban center or in a rural area), what activities the markets promoted (live music or chef demonstrations), and the total number of individuals counted who were present at the markets on study days. The entries were dated and time-stamped along with notes on my thoughts, insights, and questions that formed as a result of research findings.

NVIVO™ was very useful for analyzing my qualitative research questions. The large number of surveys completed by respondents made organization without the software difficult, and the computer program enabled all of the qualitative research questions to be distinguished as separate nodes of analysis. Each research question node was established as a tree node, with the five different study locations classified under each central node as a sub-node. For example, the research question node labeled “Production Affected” represented the research question “How do you think food production in North Carolina will be affected by global warming?,” and contained the five nodes “Asheville,” “Charlotte,” “Greenville,” “Raleigh,” and “Wilmington” within it. Thus, each research question node contained coding of important words and phrases
provided to answer the research question, divided into the farmers’ market locations. In this way I was able to organize survey responses by farmers’ market in relation to the research questions answered.

Researcher bias must be particularly considered and acknowledged in qualitative research studies. With such research, interesting data is analyzed because it has been determined by the researcher to be of importance to answering research questions. My personal positionality may have caused my analysis to be more sympathetic to study participants because of my own background of growing up in a rural community which frequented farmers’ markets for foods. I have an understanding of farming culture and an affection and deep respect for farmers, individuals who support local farmers through the purchase of products, and the important work that farmers do in providing food for a community. Although I noted this bias at the time of data gathering and analysis, it may have caused my interpretations to be more supportive of the reasoning individuals have for shopping at farmers’ markets than other researchers may have determined through similar study.

Another impact on my study may have resulted from my presence at the farmers’ markets during survey completion. Distributing surveys by mail or email could have elicited different responses to my questions than those that were provided when I directly provided surveys. Participants may have exaggerated their knowledge or beliefs about global climate change and their environmental concerns about food production in my presence after learning of my affiliation with the Nicholas School of the Environment at Duke University. The ability of respondents to talk and form a brief relationship with me may have led some responses to be worded so as to leave me with favorable impressions of the markets and the participants. In
addition to these influences on my study, I acknowledge that there are most likely other personal biases and impacts on my research that may have affected my results.

**Results**

*LexisNexis: Media Sources*

The LexisNexis Academic database search was performed to determine the frequency with which United States media sources have been identifying a connection between food production and impacts on global climate change for the American public over the past decade. Searching for the phrase “global warming and farmers’ markets” identified 89 total media sources which explicitly explained how food production contributes towards global warming, and suggested that individuals seek out farmers’ markets to support production that has a lesser impact on the environment. Of those sources, the majority (62) were from United States newspapers and wires, and the frequency with which such information was relayed increased dramatically after the year 2005 (Figure 8). The search for “global warming and local food” returned 93 sources, with the majority again being from U.S. newspapers and wires (48). Again, there was a spike in sources after 2005 that made an explicit connection between food production and global warming, suggesting more local food consumption to lessen impacts (Figure 9). No media made a mention of such a connection prior to the year 2004 from this search (Figure 9). It is important to note that each media search returned tens to hundreds of sources, however the only ones included in this paper are those that actually identified for the public ways in which food production is responsible for contributions towards climate change.
Figure 8: LexisNexis Database search, number of sources (N = 89)

Figure 9: LexisNexis Database search, number of sources (N = 93)
Survey: Background Information

Several questions were designed to gather background information on survey participants. Some of them were formed with the assistance of a market manager who suggested questions that would help all five market managers better understand consumers. Information gathered from the survey questions were later presented at the studied markets to inform managers and market visitors of my research findings. The questions were designed with provided responses that participants could circle as answers, with some questions having an “other” category for additional information to be written in (Appendix 2). As background questions, respondents were asked how far they traveled to arrive at the farmers’ market, if they traveled to the area specifically to shop at the market, and what mode of transportation they used to arrive. Participants were also asked how often they shopped at the farmers’ market, what they usually bought at the market, how much money they usually spent, and how many years they had been shopping at farmers’ markets in general. Three questions were then asked to identify other sources where respondents purchased their food, questioning what other farmers’ markets they shopped at, if they shopped at any natural food stores such as Whole Foods, and if they grew any of their own food. In total, 427 surveys were completed by respondents and later analyzed for this study.

The majority of respondents lived within 15 miles of the farmers’ market they visited, and over 60% of shoppers at the Asheville and Greenville markets traveled five miles or less to arrive at the markets (Figure 10). Most of the participants traveled specifically to shop at the farmers’ markets (Figure 11), and respondents overwhelmingly used motor vehicle transportation to reach them (Figure 12). The only markets to which respondents walked or
biked were located in Asheville and Wilmington, where the markets were located in downtown districts within easy walking distance of residential areas (Figure 12).

Figure 10: Survey responses (N = 427)

Figure 11: Survey responses (N = 427)
On average, respondents mainly traveled to the farmers’ markets on a weekly basis (Figure 13). However, there was also a large percentage who visited the markets every other week or approximately twice a month, especially at the Greenville farmers’ market (Figure 13). The majority of respondents spent between $10 and $30 in one shopping trip, with consumers at the large Charlotte market spending $30 to $50 or over $50 in greater number than other survey participants (Figure 14). It was further found that most respondents had shopped at farmers’ markets for over 10 years or had begun to shop more recently within the past five years (Figure 15), and that vegetables and fruits were the most numerous responses provided by participants at all farmers’ markets when asked what items were usually bought during shopping trips (Figure 16). The farmers’ markets had distinct differences in what kinds of products were sold to consumers, with the Greenville market having fewer respondents who purchased meats and the Raleigh market supporting limited purchases of dairy products and eggs (Figure 16). My study
had a weakness in its design, in that some questions with responses that could be circled had overlapping ranges, potentially confusing some survey participants (Appendix 2).

Figure 13: Survey responses (N = 427)

Figure 14: Survey responses (N = 427)
Figure 15: Survey responses (N = 427)

Figure 16: Survey responses
Most participants only shopped at the farmers’ market where they were surveyed, or at most frequented a single other market (Figure 17). Out of the five markets surveyed, the Greenville and Raleigh markets appeared to have the most people dependent on the market alone for purchasing items from local farms (Figure 17). Most respondents also shopped for food and other products at natural grocery stores in addition to farmers’ markets, with the Asheville market supporting the most people who did so at approximately 90% (Figure 18). The Greenville market had the lowest number of people who shopped at natural food stores, and it was brought to my attention that there were limited options in the area for shopping for such choices (Figure 18). Additionally, at each farmers’ market there were more respondents who grew their own food than those who did not, with the most people growing their own food located at the Charlotte farmers’ market (approximately 73% of respondents) (Figure 19).

![Other Farmers' Markets Visited](image)

Figure 17: Survey responses (N = 427)
Figure 18: Survey responses (N = 427)

Figure 19: Survey responses (N = 427)
Survey: Reasons for Shopping

I also asked participants about their reasons for shopping at farmers’ markets, asking why they liked shopping at farmers’ markets, if any environmental reasons influenced their decision to shop at farmers’ markets, what information sources helped them decide to shop at the markets, and if there were any additional comments they wished to make to improve my survey or to help the farmers’ market. Most of these questions had responses that could be circled by participants; open-ended responses were required for questions asking for a respondent’s principal reasons for shopping at farmers’ markets and for further comments (Appendix 2). For all questions, respondents were able to add additional information to their answers for provided responses in an “other” category that was included among the choices (Appendix 2).

The main reasons respondents shopped at the five farmers’ markets were to purchase high quality and fresh foods, support local farmers, and purchase healthy foods with limited chemicals, antibiotics, preservatives, and hormones added during stages of production and processing (Figure 20, 21). From those, the principle (or top five) reasons people had for shopping at the farmers’ markets were dominated by factors such as the freshness and quality of foods, organic and locally grown foods, the ability to support local farmers, and foods that were diverse and healthy (Table 1). Respondents identified numerous environmental reasons for shopping at farmers’ markets when the question posed listed responses that could be circled. The main reasons were focused on the ideas that local food traveled less distance to markets with limited fossil fuel inputs and transportation emissions, foods were seasonal so extensive production inputs were unnecessary for helping products grow, and less packaging was used with resulting waste and energy-intensive production methods (Figure 22). Many respondents at the
Asheville market listed numerous environmental reasons for influencing their decision to shop at farmers’ markets (Figure 22).

Additionally, respondents overwhelmingly decided to shop at the farmers’ markets based on personal contacts and personal values (such as growing up on a farm or believing that supporting local food production was important) (Figure 23). Sources such as newspapers and books had less impact on inspiring people where to shop for their food, however it is important to note that the wording of the question may have caused respondents to interpret it as asking what sources helped them shop at the particular farmers’ market surveyed instead of at farmers’ markets in general (Figure 23). Several respondents mentioned that books written by Michael Pollan and Barbara Kingsolver helped them decide to shop at farmers’ markets, particularly the books “The Omnivore’s Dilemma” by Pollan and “Animal, Vegetable, Miracle” by Kingsolver. Media sources such as radio, television, and magazines did not have much impact on inspiring respondents to shop at the markets (Figure 23).
Figure 21: Aggregate survey responses

Table 1: Number of survey responses

Principals Reasons for Shopping at Farmers’ Markets

<table>
<thead>
<tr>
<th>Reason</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshness</td>
<td>137</td>
</tr>
<tr>
<td>Locally Grown</td>
<td>99</td>
</tr>
<tr>
<td>Support Local Farmers</td>
<td>89</td>
</tr>
<tr>
<td>Quality</td>
<td>29</td>
</tr>
<tr>
<td>Organic Food</td>
<td>25</td>
</tr>
</tbody>
</table>
Environmental Reasons for Shopping

![Bar chart showing various reasons for shopping with a focus on environmental aspects.](chart1.png)

Figure 22: Survey responses

Information Sources for Shopping

![Bar chart showing sources of information for shopping.](chart2.png)

Figure 23: Survey responses
Survey: Climate Change

Additional questions focused on the topic of global climate change, and asked respondents if they believed that global warming was occurring, how concerned they were that their lives would be directly affected from it, if global warming would directly affect future generations, if there was a connection between food production and global warming, and if they shopped at farmers’ markets in part because they believed there was a connection. These questions were all posed with responses that could be circled by respondents (Appendix 2). Participants were also asked how they thought that food production in North Carolina would be affected by global warming, and how they thought food production was connected to the phenomenon. These last two questions were left open-ended for respondents to write answers in as much detail as preferred (Appendix 2).

Participants overwhelmingly believed that global warming was occurring, with only approximately 4% believing it was not in the Raleigh and Wilmington, 5% in Asheville and Greenville, and 6% in the Charlotte markets (Figure 24). The majority of respondents also felt very concerned or concerned that they would observe the effects of global warming in their lifetimes (Figure 25). Individuals believed strongly that future generations would feel effects of global warming, with 81-91% indicating so on the surveys (Figure 26). Large percentages of respondents also thought there was a connection between how food was produced and global warming, with approximately 66% in Wilmington, 68% in Greenville, 70% in Charlotte, and 80% in Asheville and Raleigh indicating so (Figure 27). Despite these beliefs, the majority of respondents did not shop at farmers’ markets in part from the knowledge that food production has impacts on global warming (Figure 28). The Asheville market was an exception, with approximately 44% of participants shopping in part because of the connection (Figure 28).
Figure 24: Survey responses (N = 427)

Figure 25: Survey responses (N = 427)
Global Warming will Affect Future Generations

Connection Between Food Production and Global Warming

Figure 26: Survey responses (N = 427)

Figure 27: Survey responses (N = 427)
Participants at each market identified similar ways in which food production in North Carolina would be affected by global warming in the future. Drought and the need for more irrigation for production were cited frequently, as well as changes in the foods that could be grown in the state and shifting agricultural zones (Table 2). A decline in food productivity was repeatedly identified, along with the loss of farmland and a reduction in the quality of foods grown (Table 2). Changes in weather patterns were also cited, with extreme and erratic events occurring more frequently along with an increased risk of flooding (Table 2). Changes in growing seasons would also occur, either becoming longer or shorter in length or being affected by changes in temperature (Table 2). Many diverse responses were provided in answer to this question on the survey, however these five impacts on agriculture in North Carolina were the most frequently cited at all study markets.
When respondents were asked how they thought food production and global warming were connected, transportation was cited as a critical issue through fuel use and exhaust emissions (Table 3). Fossil fuel use in general was also cited, due to inputs and energy use in food production (Table 3). Respondents mentioned greenhouse gas emissions resulting from the agricultural sector, particularly the gases carbon dioxide and methane (Table 3). Conventional agriculture was identified for the extensive environmental impacts it creates, and respondents used terms such as “factory farms”, “industrial farming”, “commercial farming”, and “mass production” to describe the practice (Table 3). Fertilizer was also cited for its base of fossil fuels and its waste and pollution impacts on the environment (Table 3). Again, many other responses were provided by respondents, but these five topics were the most frequently cited.

Table 2: Number of survey responses

**How Production will be Affected by Global Warming**

<table>
<thead>
<tr>
<th>Drought</th>
<th>lack of rain</th>
<th>more irrigation</th>
<th>107</th>
</tr>
</thead>
<tbody>
<tr>
<td>What Can Grow</td>
<td>shifting agriculture zones</td>
<td>new or different varieties</td>
<td>75</td>
</tr>
<tr>
<td>Decline in Production</td>
<td>farmland loss</td>
<td>poorer quality</td>
<td>64</td>
</tr>
<tr>
<td>Weather Changes</td>
<td>extreme and erratic events</td>
<td>more flooding</td>
<td>47</td>
</tr>
<tr>
<td>Growing Season Changes</td>
<td>longer</td>
<td>shorter</td>
<td>45</td>
</tr>
</tbody>
</table>

changes in temperature
How Production is Connected to Global Warming

<table>
<thead>
<tr>
<th>Category</th>
<th>Item</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation</td>
<td>fuel use</td>
<td>97</td>
</tr>
<tr>
<td></td>
<td>exhaust emissions</td>
<td></td>
</tr>
<tr>
<td>Fossil Fuel Use</td>
<td>inputs</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>energy use</td>
<td></td>
</tr>
<tr>
<td>Greenhouse Gases</td>
<td>carbon dioxide</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>methane</td>
<td></td>
</tr>
<tr>
<td>Conventional Agriculture</td>
<td>factory farms</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>commercial, industrial</td>
<td></td>
</tr>
<tr>
<td></td>
<td>mass production</td>
<td></td>
</tr>
<tr>
<td>Fertilizer</td>
<td>petroleum-based</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>pollution, waste</td>
<td></td>
</tr>
</tbody>
</table>

Discussion

From this research, a picture was developed of shoppers’ thoughts, beliefs, and priorities at the farmers’ markets I studied in North Carolina. Survey participants shopped at farmers’ markets primarily to support local farmers and to buy products for their freshness and quality to aid in health. In the words of one respondent focused on purchasing foods from farmers in her community:

“The food is delicious and fresh. The people are nice and they care about physical health and the environment.”
~ Charlotte Regional Farmers’ Market

Environmental reasons were listed by many individuals in each market, though they were not in the top three categories for reasons for shopping at markets. When asked further about
environmental reasons for shopping, nearly all survey participants had some environmental concerns that influenced their decision to shop at farmers’ markets. These results were interesting, because not all of the farmers selling at these farmers’ markets adopt sustainable or organic farming practices, and some do not sell their own products but instead sell items wholesale that are from other states. Buyers purchase products from local farmers as an act of faith in the hope that such products are locally grown and produced through healthy and safe practices. This point of view was observed in the following survey response:

“I don't know [the] practices of all [the] farmers.”
~ Riverfront Farmers’ Market

When questions were posed that focused on global warming, survey respondents expressed a strong belief that global warming was occurring and that it would directly affect future generations as well as themselves. Survey respondents felt that there was a definite connection between food production and global warming, with approximately 75% of respondents at each market providing responses in answer to the questions of how food production would be affected in North Carolina from global warming and how food production adds to the problem of global climate change. Participants focused on the critical issue of drought affecting food production in the State, possibly as a result of the severe drought North Carolina recently experienced last year.

In identifying how production in North Carolina was connected to global warming, participants provided various responses but focused on factors such as the transportation of food and the emissions of greenhouse gases throughout the production process. This may suggest that the current discussion in the United States about carbon dioxide emissions from transportation
contributing to climate change is a very familiar concern to most survey participants. Another interesting finding of this study is that fertilizer use was frequently identified as contributing to global warming. The impact of fertilizers is actually quite profound in agriculture, as approximately two-thirds of energy use in the production stage of agriculture goes towards the creation of fertilizers and mechanization (Pimental, Doughty et al. 2002) (Pimental and Pimental 2008). Another interesting finding is that transportation was a frequent response to agricultural impacts on global warming, but fossil fuel use and greenhouse gas emissions associated with meat production were hardly mentioned by respondents. In fact, almost twice as much fossil fuel use is associated with a non-vegetarian diet than with a vegetarian diet (Pimental and Pimental 2008), and switching a diet away from meat consumption can be more effective at lowering personal or household climate footprints than buying local food in an effort to limit transportation miles (Weber and Matthews 2008).

When asked what information sources helped survey participants decide to shop locally at farmers’ markets, the overwhelming responses regarded personal contacts and personal values. Word of mouth is a dominant way in which information about farmers’ markets is relayed between individuals. Through my study, I found that many survey participants feel that the markets could do more to advertise their existence, and could provide more entertainment and promotional activities to attract people and expand the diversity of individuals shopping each week. Through my search of media sources identifying the connection between food production and global warming, I noticed that information about environmental benefits of shopping at farmers’ markets was lacking. It may be useful to provide information about the environmental benefits of shopping at farmers’ markets to visitors while they are shopping at the markets.
This idea was promoted by a respondent who stated:

“Maybe a booth on the effects of food production like yours would teach and inform people of global climate change...”
~ State Farmers’ Market

Learning of sustainable practices and current climate change effects on agriculture from farmers or market managers may help persuade more individuals to shop locally to lower their personal and household climate footprints.

**Conclusion**

In conclusion, North Carolinians have many diverse reasons for shopping at farmers’ markets. Environmental concerns are one aspect affecting individuals’ decisions of where to buy foods, but they are hardly the most important reasons in most minds. The individuals I surveyed care about critical issues such as helping local farmers sustain their livelihoods, and of buying foods that are healthy, fresh, and of high quality for consumption for themselves and their families. They are concerned about global climate change and believe that it will have serious effects on lives now and in the future. However, few people are currently connecting their purchase of food with the impact that production has on global warming. That may not be the case in the future, as more media sources and popular books are presenting the information in a straight-forward manner for the public to digest. The United States media has only recently identified for the American public ways in which food production is connected to global warming. At this time, other pressing concerns such as local economic stability, farm employment protection, and production of high quality and healthy foods are dominant issues on peoples’ minds. Due to the high degree of respect and concern individuals expressed for local farmers on the surveys, information about the sustainable farming practices adopted by farmers
and current changes to agricultural lands from climate change may better inform market visitors of environmental impacts from agriculture. Information relayed by these personal sources may inspire more market consumers to shop for environmental reasons and to limit their personal and household climate footprints.

**Literature Cited**


Appendices

Appendix 1: Consent for Handout Survey

Consent for Handout Survey

Consumer Survey at Local Farmers’ Markets in North Carolina

Duke University Nicholas School of the Environment

This survey is part of my research study at Duke University for my master’s degree in environmental management. I am studying why consumers buy products at local farmers’ markets, and what role environmental issues play in influencing the decision to shop locally. If you would like to participate in my research, please answer the survey questions. There are several questions that should only take about 5 minutes to complete. You may skip any questions that you don’t want to answer. You may stop taking the survey at any time.

Thank you for your participation,

Krista Hozyash
484-400-5252
kah49@duke.edu
Appendix 2: Farmers’ Market Survey Questions

I have read the provided informed consent form and agree to participate in this survey.

Signature: ____________________________

First Name __________________________
Gender______________________________
Age ________________________________
Farmers’ Market ______________________

1. How far did you travel to this farmers’ market today?
   - Less than 5 miles
   - 5 - 15 miles
   - 15 - 30 miles
   - More than 30 miles
   - Other: _______________

2. Did you travel here specifically for the farmers’ market?
   - Yes
   - No

3. How did you travel to this farmers’ market?
   - Car
   - Other: _______________

4. How often do you shop at this farmers’ market?
   - Two or more days a week
   - Once a week
   - Every other week
   - Once a month
   - Once every few months
   - Other: _______________

5. What do you usually buy at this farmers’ market? (Please circle all that apply)
   - Fruits
   - Vegetables
   - Meat
   - Dairy/Eggs
   - Plants/Herbs/Flowers
   - Bread
   - Other: _______________

6. How much money do you usually spend at this market in one day?
   - Less than $5
   - $5 - $10
   - $10 - $30
   - $30 - $50
   - Over $50
   - Other: _______________

7. How many years have you been shopping at farmers’ markets?
   - Less than 1 year
   - 1 – 5 years
   - 5 – 10 years
   - Over 10 years
   - Other: _______________

8. How many farmers’ markets do you shop at besides this one?
   - No others
   - 1
   - 2
   - More than 2

9. Do you also shop for food and products at organic or natural grocery stores (e.g. Whole Foods, Fresh Market)?
   - Yes
   - No

10. Why do you like to shop at farmers’ markets? (Please circle all that apply)
    - Affordable Prices
    - Convenience
    - Environmental reasons
    - Freshness/Quality
    - Healthy food
    - Helping local farmers
    - Helping the community
    - Other: _______________

     Questionnaire Number____________________
     Date ____________________

8. How many farmers’ markets do you shop at besides this one?
   - No others
   - 1
   - 2
   - More than 2

9. Do you also shop for food and products at organic or natural grocery stores (e.g. Whole Foods, Fresh Market)?
   - Yes
   - No

10. Why do you like to shop at farmers’ markets? (Please circle all that apply)
    - Affordable Prices
    - Convenience
    - Environmental reasons
    - Freshness/Quality
    - Healthy food
    - Helping local farmers
    - Helping the community
    - Other: _______________
11. What would you say is your #1 reason for shopping at farmers’ markets?

12. Do you grow any of your own food?
   Yes
   No

13. What environmental reasons do you have for shopping at this farmers’ market?
   (Please circle all that apply)
   - None
   - Buying seasonal foods
   - Food travels less distance to you
   - Healthier/Pasture-fed animals
   - Less distance to travel to buy food
   - Less fertilizer used
   - Less irrigation used
   - Less packaging waste
   - Less pesticides used
   - Less soil erosion
   - Natural/Unmodified fruits and vegetables
   - Other: ___________________

14. Do you believe in global warming?
   Yes
   No
   Not Sure

15. Are you concerned that global warming will directly affect your life in the future?
   Very Concerned
   Concerned
   Somewhat Concerned
   Not Concerned

16. Do you think global warming will directly affect future generations?
   Yes
   No
   Not Sure

17. Do you think that there is a connection between food production and global warming?
   Yes
   No (go to question 21)
   Not Sure

18. How do you think food production in North Carolina will be affected by global warming?

19. Do you shop at farmers’ markets because of a connection between food production and global warming?
   Yes
   No

20. How do you think the process of food production is connected to global warming?

21. What information sources have helped you decide to shop at this farmers’ market?
   (Please circle all that apply)
   - Television
   - Internet
   - Magazines
   - Newspapers
   - Books
   - Personal Contacts
   - Personal Values
   - Other: ___________________

22. Do you have any other comments that may help this farmers’ market or my study?

Thank you for your participation!