

Consumer perceptions of the safety, health, and environmental impact of various scales and geographic origin of food supply chains

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Executive Summary

Concerns have increased about the environmental impacts and safety of our food supply in the past several years. This public uneasiness has spurred multiple investigations of where and how food is produced and the corresponding impacts on our environment and climate. In addition, the consumer demand for local food products nationwide has risen. Given these developments, the Leopold Center's Marketing and Food Systems Initiative conducted consumer market research in July 2007 to examine the complex relationships among food safety, health, greenhouse gas emissions and climate change, and different food system scales (local, national, global).

Specific objectives for this research were to:

1. Ascertain consumer perceptions regarding food safety, within the context of where their food comes from and how it is grown;
2. Assess consumer understanding of the impact that various scales and production methods of the food system have on greenhouse gas emissions;
3. Determine whether consumers are willing to pay more for a food system that has a net reduction in greenhouse gas emissions; and
4. Gauge consumer perceptions of health benefits from local and organic foods.

Survey questions were designed to address these objectives and elicit consumers' responses regarding food safety and product origin, greenhouse gas emissions in the food system, willingness to pay for food products with lower emissions, and perceptions surrounding health benefits of local and organic food. The survey was designed and administered using Survey Monkey, a web-based survey software suite available at <http://www.surveymonkey.com/>. Survey distribution was contracted to Authentic Response, a third-party company (<http://www.authenticresponse.net/>). Five hundred usable surveys from a representative sample of the U.S. adult population were received.

Respondents to this survey placed high importance on food safety, freshness (harvest date), and pesticide use on fresh produce they purchase, with somewhat lower importance placed on whether the produce was locally grown, the level of greenhouse gas emissions it took to produce and transport the produce, and whether the respondent could contact the farmer who grew it.

The majority of respondents (70 percent) perceived the U.S. food system to be safe. But when asked about the safety of fresh produce based on continent of origin, respondents showed varying levels of confidence. North America was perceived as the most safe (85 percent) followed by Europe (50 percent) and Australia (48 percent). Products originating from Asia and Africa were least likely to be viewed as safe. When asked which specific countries raised the most concern, China was cited most frequently, with 31 percent of respondents singling it out.

Concern with the safety of the global food system was found among the respondents when comparing a global food system to a national (U.S.), regional, or local food system. Eighty-five

and 88 percent of respondents, respectively, perceived local and regional food systems to be somewhat safe or very safe, compared to only 12 percent for the global food system.

Respondents were asked a series of questions about their perceptions of greenhouse gas emissions based on sector of the economy, modes of transportation, and links within food supply chains. Respondent perceptions of these issues did, to considerable extent, mirror existing data published by federal agencies and other organizations. One notable instance of disagreement was the perception of respondents that trucks emitted more greenhouse gases than airplanes on a per pound basis of product transported. In fact, airplane emissions are higher on a per unit weight basis than truck emissions.¹ The amount of food being transported by airplane has been the focus for much debate in Great Britain and elsewhere in Europe because of its potential impact on the environment. For example, only 1.5 percent of fresh fruits and vegetables are transported by air in Great Britain, but that portion produces 50 percent of all emissions from fruit and vegetable transportation.² These findings point to a need for more consumer education on this subject in the United States.

Are consumers willing to pay more for food from supply chains that emit half as much greenhouse gas as conventional chains? Nearly half of respondents were willing to pay a 10 to 30 percent premium, but a similar percentage was not. However, when looking at those respondents who had shopped at venues where locally-grown foods were more likely to be for sale, 58 percent were willing to pay more (compared to those who did not shop at venues where locally-grown foods were likely for sale), and 38 percent indicated they would pay the same. These results have marketing implications for small and midsize farmers and the associated organizations working with them to promote local foods.

There are few peer-reviewed research studies showing that organic products possess additional health benefits when compared to conventional products, but their number are increasing.^{3 4} Fifty-seven percent of respondents in this survey “somewhat” or “strongly” agreed that organic food was healthier than conventional. To the authors’ knowledge, there are no peer-reviewed studies that document increased health benefits related to consumption of locally-grown food when compared to food sourced from conventional locations in national and global markets. However, more than two-thirds of respondents (69 percent) “somewhat” or “strongly” agreed that local food is better for their personal health than food that has traveled across the country. When asked whether they perceived that science had indeed proven that local food was healthier than distant food, 40 percent of respondents “somewhat” or “strongly” agreed.

¹ U.S. Congress, Office of Technology Assessment, Saving Energy in U.S. Transportation, OTA-ETI-589. Washington, D.C.: U.S. Government Printing Office, July 1994, 44.
<http://www.wvs.princeton.edu/ota/disk1/1994/9432/9432.PDF>.

² MacGregor, James, and Bill Vorley. 2006. “Fair Miles The concept of “food miles” through a sustainable development lens.” International Institute for Environment and Development.
<http://www.iied.org/pubs/pdf/full/11064IIED.pdf>.

³ The Organic Center. <http://www.organic-center.org/about.mission.html>.

⁴ A. E. Mitchell, Y-J Hong, E. Koh, D.M. Barrett, D.E. Bryant, R. F. Denison, and S. Kaffka. 2007. Ten-Year Comparison of the Influence of Organic and Conventional Crop Management Practices on the Content of Flavonoids in Tomatoes. *Journal of Agriculture and Food Chemistry*. <http://www.pubs.acs.org/cgi-bin/abstract.cgi/jafcau/2007/55/i15/abs/jf070344+.html>.

With the dramatic rise in popularity of local foods, the farmers who grow these foods and the organizations that champion both the farmers and the foods will be called upon to prove the existence of economic, environmental, and health benefits stemming from these products, and ensure their continued safety as part of the food supply. It is critical that government agencies (at the state and federal level), universities, health professionals, private companies, and non-profit organizations partner with those farmers growing and processing local foods to develop an appropriate research agenda for these food supply chains. This agenda must be focused on and responsive to the public questions that arise as local foods capture an increasing portion of per capita food consumption totals in the United States.

Introduction

The Leopold Center for Sustainable Agriculture is a research and education center with statewide programs to develop sustainable agriculture practices that are both profitable and conserve natural resources. It was established under the Iowa Groundwater Protection Act of 1987 with a three-fold mission: (1) to conduct research into the negative impacts of agricultural practices; (2) to assist in developing alternative practices; and (3) to work with Iowa State University (ISU) Extension to inform the public of Leopold Center findings.

The Center's work is organized in three program areas: Ecology, Marketing and Food Systems, and Policy – each aimed at enhancing the condition and viability of Iowa's natural and social resources in varying, but integrated ways. Within the Center's Marketing and Food Systems Initiative, there are three objectives:

- Research and test new marketing strategies and business structures that allow Iowa's farmers to retain more of the value for food, fiber, or energy produced with high standards of stewardship that protect Iowa's water resources.
- Support education, conduct research, and facilitate partnerships to increase investment and support of local and regional food, fiber, and energy enterprises that protect Iowa's water resources and provide significant economic benefits to Iowa farmers and rural communities.
- Conduct research and education to address challenges that impede farmers and farmer networks from being equal partners with other players in food, fiber, or energy-based value chains.⁵

The initiative accomplishes these objectives through a competitive grants program (in coordination with the Ecology and Policy Initiatives), special projects and collaborations, and in-house research. Since 2001, the Marketing and Food Systems Initiative has completed eight reports on food products and systems. Several of these reports (written in collaboration with faculty and students from the ISU College of Business) focused on consumer perceptions of local, place-based, and organic foods.

Since the last of these reports appeared in 2004, growing concerns about global climate change and food safety have spurred increased investigations of where and how food is produced and the impacts the food system has on our environment and climate. There also has been a growing consumer demand for local food products nationwide. Given these developments, the Marketing and Food Systems Initiative decided to conduct consumer market research in this area to examine the complex relationships among greenhouse gas emissions and climate change, food safety, health, and different food system scales (local, national, global). The results could be used to inform future research efforts in food systems.

Specific objectives for this research were to:

1. Ascertain consumer perceptions regarding food safety, within the context of where their food comes from and how it is grown;

⁵A value chain is a network of businesses cooperating to satisfy market demands for a particular product.

2. Assess consumer understanding of the impact that various scales and production methods of the food system have on greenhouse gas emissions;
3. Determine whether consumers are willing to pay more for a food system that has a net reduction in greenhouse gas emissions; and
4. Gauge consumer perceptions of health benefits of local and organic foods.

Methodology

Survey questions were designed to address the objectives and elicit consumers' responses regarding food safety and product origin, greenhouse gas emissions in the food system, willingness to pay for food products with lower emissions, and perceptions surrounding health benefits of local food. The survey was designed and administered using Survey Monkey, a web-based survey software suite available at <http://www.surveymonkey.com/>. The survey was pre-tested for ease of use and completion by six individuals in academia and non-profit organizations engaged in food systems research.

The survey was then reviewed by the Iowa State University Office of Research Assurances, which houses the university's Institutional Review Board for Human Subjects Research. Leopold Center staff involved in the survey project were required to satisfactorily complete Web Training for Human Subjects Research.

Survey distribution was contracted to Authentic Response, a third-party company (<http://www.authenticresponse.net/>). Authentic Response maintains panels of potential survey respondents who have voluntarily elected to participate by way of a double opt-in process. Invitations to participate in a survey are distributed by e-mail and respondents are directed to Authentic Response's panelist portal called My View, found at <http://portal.myview.com/portal/app>. The panel sample was designed to be representative of the adult U.S. general population (18 years and older). Each response was collected for a flat per-interview fee.

Completed surveys were collected and compiled automatically in July 2007 by Survey Monkey, without gathering any personally identifiable information from the respondents or their computers. The responses were individually inspected for usability by Leopold Center staff, and incomplete responses were discarded. Five hundred usable surveys were received. A print version of the web-administered survey can be found in Appendix 1. Tables containing percent responses to each question appear in Appendix 2. Respondent demographics are presented in Appendix 3.

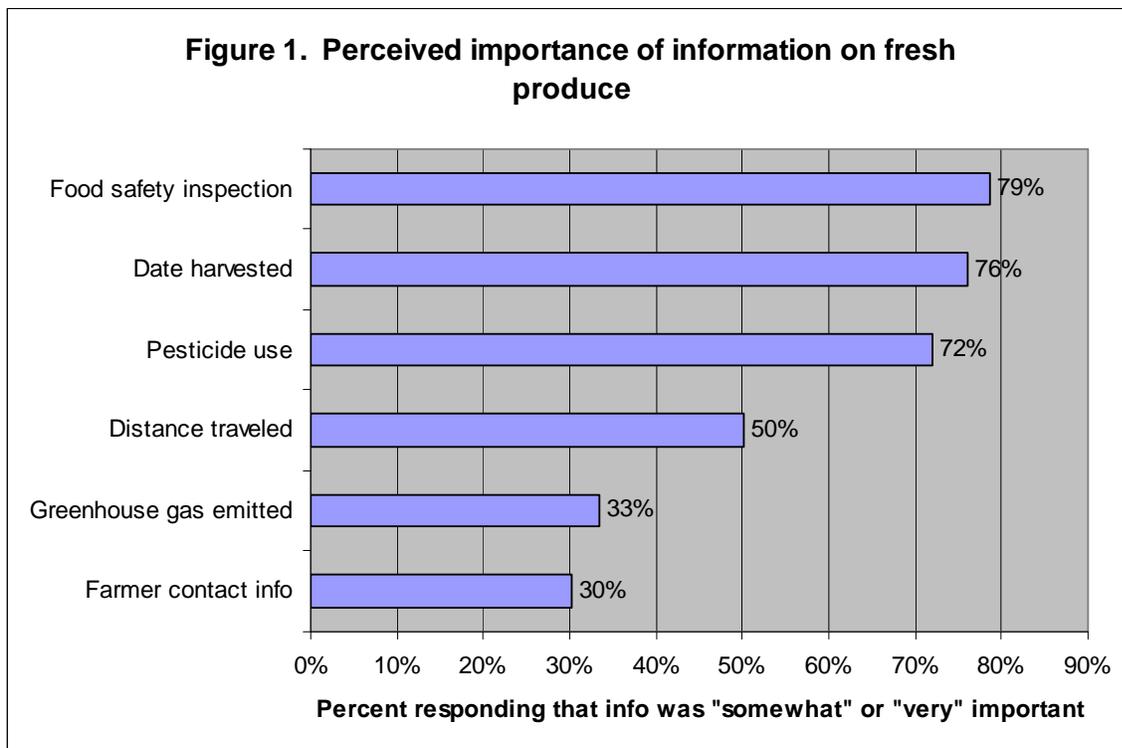
Consumer Survey Analysis

Food safety and origins

Figure 1 examines the relative importance that consumer respondents assigned to various types of information about fresh produce. Responses of "somewhat important" and "very important" were combined. Highest importance (79 percent) was placed on knowing whether or not the

farm of origin had passed a food safety inspection. Clearly, proper on-farm production and handling practices are very important to the consumer respondents. Of the remaining choices, secondary importance was placed upon knowing the date on which the produce was harvested (76 percent), presumably to determine the item’s freshness. Implementing a version of the “born-on” date label might require additional consumer education regarding produce with a long storage life, such as apples and potatoes. Also of great importance (72 percent) was knowledge about the use of pesticides on the produce item. Currently, only accurate and voluntary disclosure by the producer would fully provide that information to the consumer.

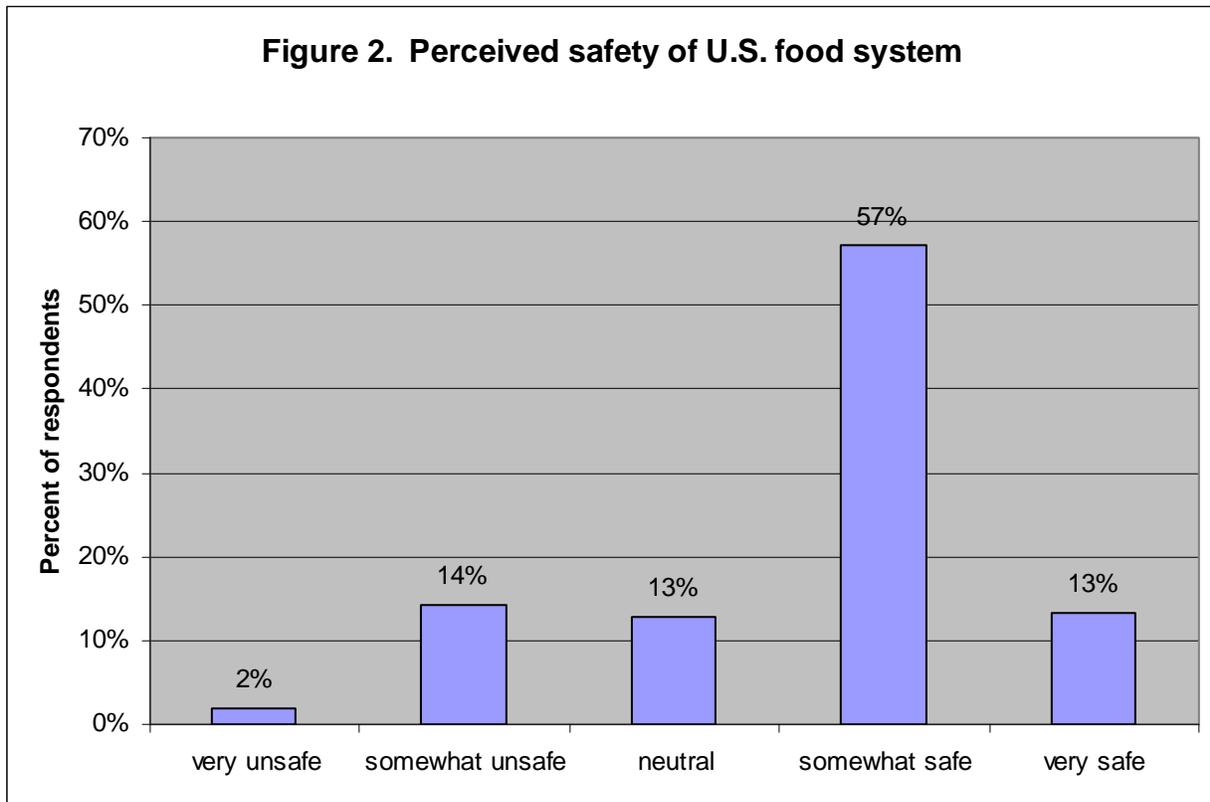
By a margin of 50 percent to 33 percent, respondents rated the distance produce traveled from farm to store as more important than knowing the total amount of greenhouse gases emitted during production and transportation to the store. If the respondents’ foremost consideration with this information was the amount of fuel energy consumed in the supply chain, the latter piece of information would presumably provide a more complete picture. This may be a result of the media penetration of the “food miles” metaphor⁶, or it may mean that distance traveled also is being used as an indicator of freshness, vis-à-vis amount of handling and time in transit. Contact information for the farmer was rated least important of the options presented.



When respondents were asked how safe they perceived the U.S. food system to be, the majority (57 percent) answered “somewhat safe” and 13 percent answered “very safe” (Figure 2). Percentages of respondents answering “somewhat unsafe” and “neutral” were 14 percent and 13

⁶ Food miles refers to the distance a food travels from where it was grown to where it is purchased for consumption. Several Leopold Center reports that calculate food miles for produce and yogurt from local and conventional sources can be found at <http://www.leopold.iastate.edu>.

percent, respectively, and only 2 percent of respondents thought the U.S. food system was “very unsafe.”

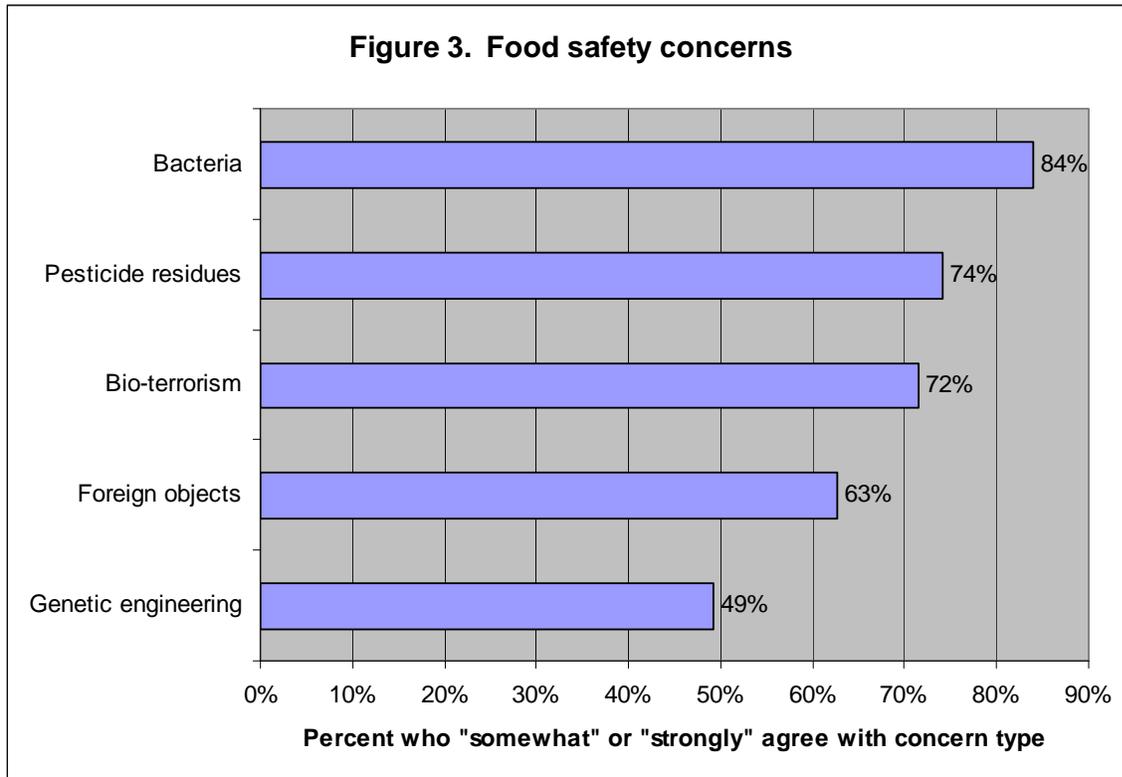


Respondents were asked about their level of agreement or disagreement on major food safety concerns such as pesticide residues, bio-terrorism, bacteria, genetic engineering, and foreign objects (Figure 3). They were then given the opportunity to share any personal experiences regarding food safety (Table 1). Approximately 84 percent of respondents somewhat or strongly agreed that bacteria were a major food safety concern. It is possible that recent food scares involving *e. coli* have contributed to this perception. In addition, food poisoning was the most commonly recalled personal food safety experience, with 30 respondents citing this ailment. Other personal food safety experiences are noted in Table 1.

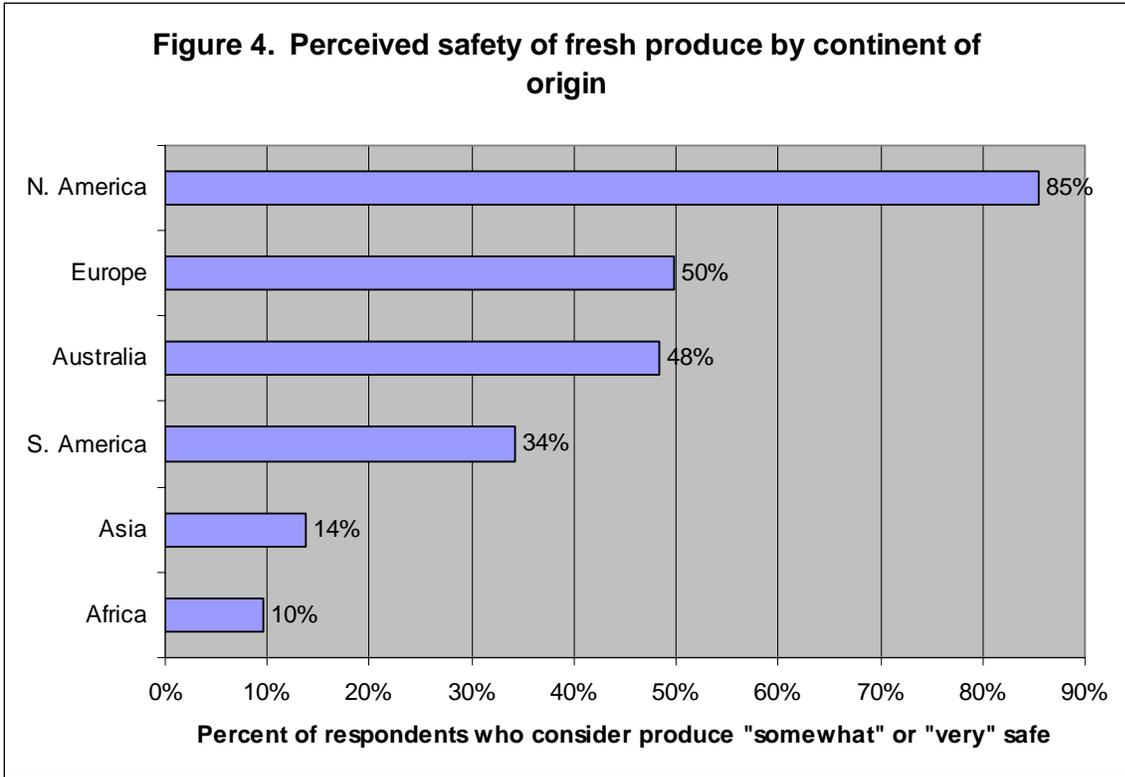
Table 1. Respondents' most frequently cited personal experiences with food safety issues (number of respondents)	
Got food poisoning	30
Found foreign material	20
Involved in a recall	15
Food spoilage	13
Insects in food	5

Nearly three-quarters of respondents “somewhat” or “strongly” agreed that pesticide residues and bio-terrorism are major food safety concerns, although only one respondent cited an allergy

to pesticides and no one reported an experience with bio-terrorism. Sixty-three percent agreed “somewhat” or “strongly” that foreign materials are a major food safety concern; 19 respondents reported specific instances of foreign materials in their food. Genetic engineering attracted the lowest level of concern, with just under half of the respondents calling it a major concern. It should be noted that neither “genetic engineering,” nor any of the other terms, were defined in the question.



Respondents were asked how safe they would consider fresh produce grown on each of the food-producing continents (Figure 4), and then were given the opportunity to identify specific countries about which they were most concerned (Table 2). North America was considered the safest, with 85 percent of respondents answering “somewhat” or “very” safe. Europe (50 percent) and Australia (48 percent) occupied a second tier of safety for respondents with approximately half answering that produce from these continents would be “somewhat” or “very” safe. Roughly one-third of respondents had this perception about produce from South America. Produce from Asia and Africa was ranked lowest, with only 14 percent and 10 percent, respectively, of respondents considering it “somewhat” or “very” safe.



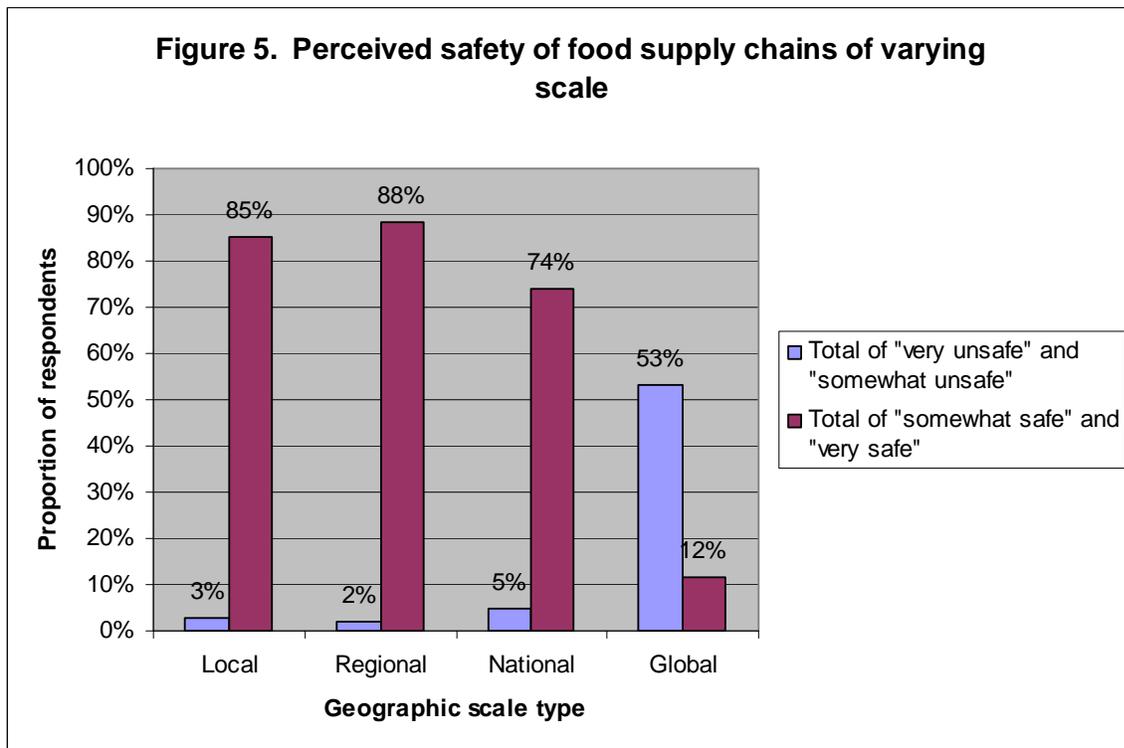
Although Asian produce was perceived as being slightly safer than African-grown produce, China was far and away the country most often targeted for respondents' personal food safety concerns (Table 2). Twenty-one other countries, most of them Asian and South American, were mentioned at least once.

Table 2. Countries about which respondents have food safety concerns	
China	31%
Mexico	5%
Middle East	3%
Other ⁷	6%

Respondents were asked to rate the safety of different scales of food supply chains that operate within the confines of varying geographic areas, including local (occurring entirely within home county and neighboring counties), regional (occurring entirely with home state and neighboring states), national (within the United States), and global (Figure 5). Eighty-five percent indicated that local produce was "somewhat" or "very" safe, with 74 percent indicating they perceived the national food supply chain to be safe. Only 12 percent indicated that the global food supply

⁷ Other countries mentioned: Chile, India, Japan, Russia, North Korea, Thailand, Vietnam, Bangladesh, France, Iraq, Iran, Syria, Guatemala, Belize, El Salvador, Panama, Nicaragua, Nigeria, Peru, United States, Venezuela, and Indonesia.

chain was “somewhat” or “very” safe. More than half of respondents (53 percent) considered the global food supply chain “somewhat” or “very” unsafe.



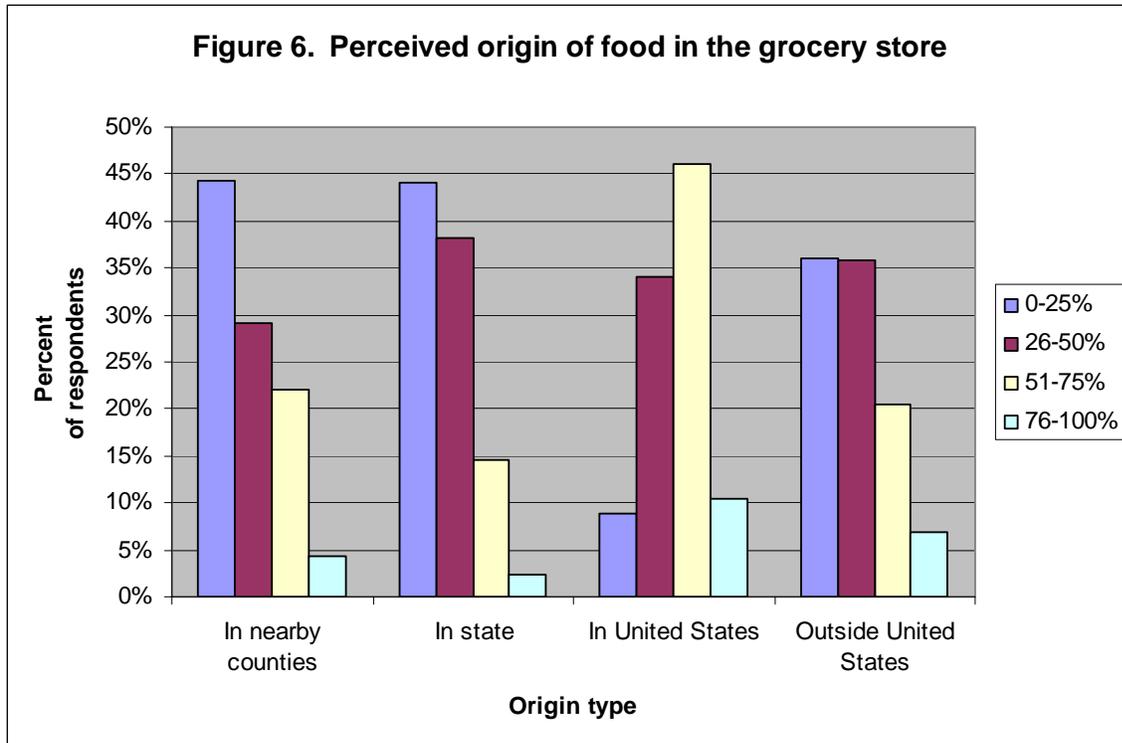
When asked where they thought the food in their grocery store was grown, the majority of respondents indicated that more than half of the food was grown in the United States, while less than half was grown in their home county and nearby counties, in their state, or in another country (Figure 6). According to 2005 consumption data from the USDA’s Economic Research Service, nearly 14 percent of fresh fruit and 17 percent of fresh vegetables consumed are imported, and the dollar sales of fresh fruit imports have risen from \$2.7 billion in 1998 to \$4.8 billion in 2006.⁸ When considering all fruits – fresh, frozen, prepared, and preserved – the United States imported more than \$6.5 billion in 2006, an 11.5 percent increase from 2005. When considering all vegetables – fresh, frozen, prepared, and preserved – the United States imported nearly \$6.9 billion in 2006, a 9.3 percent higher than in 2005.⁹

⁸ USDA Foreign Agriculture Service.

<http://www.fas.usda.gov/http/2007%20US%20Horticultural%20Import%20Situation.pdf>.

⁹ USDA Foreign Agriculture Service, FATUS Commodity Aggregations of U.S. Trade Imports.

<http://www.fas.usda.gov/ustrade/USTImFatus.asp?OI>.



Impacts of food supply chains on climate change

In 2005, the estimated U.S. anthropogenic emission of greenhouse gases was more than 7 billion metric tons carbon dioxide equivalent (a measure equal to total emissions multiplied by global warming potential), which is a 16.9 percent increase from 1990.¹⁰ Respondents were asked to rank, according to their perceptions, the industry, transportation, commercial (non-industrial business), residential, and agriculture sectors from lowest annual emissions of greenhouse gases to highest (Figure 7). Industry had the highest average perceived ranking, with more than half of respondents ranking it as the highest-emitting sector. Transportation was second, commercial business third, agriculture fourth, and residential energy use was ranked as the lowest-emitting sector on average.

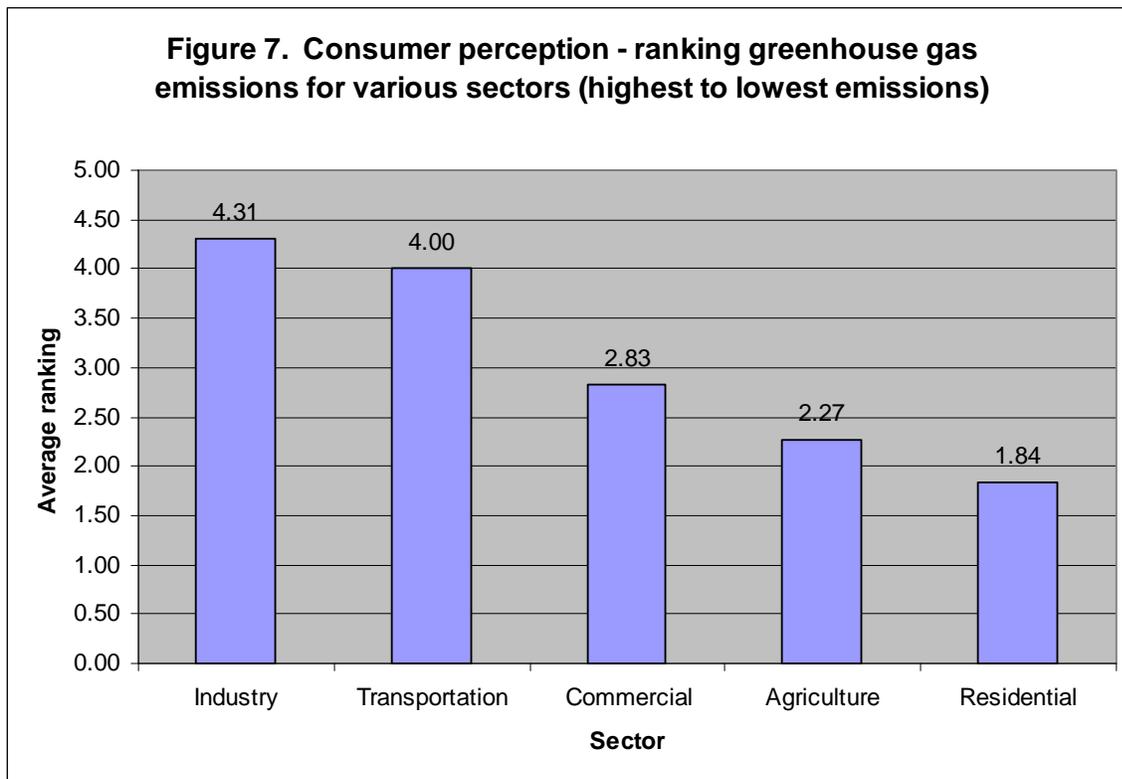
The U.S. Energy Information Administration (EIA), which groups agriculture within the industrial sector¹¹, reports that from 1949 to 2006, the industrial sector has consumed the most energy, followed by the transportation, residential, and commercial sectors in second, third, and fourth places, respectively.¹² Regarding total greenhouse gas emissions, these four sectors of the

¹⁰ Energy Information Administration, Emissions of Greenhouse Gases in the United States 2005, pp. ix-x. <ftp://ftp.eia.doe.gov/pub/oiaf/1605/cdrom/pdf/ggrpt/057305.pdf>.

¹¹ According to 2005 EIA estimates, agriculture's emissions contributions were primarily in the forms of methane and nitrous oxide. Agricultural sources represented 30 percent of total U.S. methane emissions (93 percent of which resulted from livestock management) and 76 percent of nitrous oxide emissions (60 percent of which resulted from nitrogen fertilization). Energy Information Administration, Emissions of Greenhouse Gases in the United States 2005, p. xviii. <ftp://ftp.eia.doe.gov/pub/oiaf/1605/cdrom/pdf/ggrpt/057305.pdf>.

¹² Energy Information Administration, Annual Energy Review 2006. http://www.eia.doe.gov/emeu/aer/pdf/pages/sec2_2.pdf.

U.S. economy are in the same rank order, with industry being the largest emitter, followed by transportation, then commercial, and finally residential.¹³ If agriculture was considered separately from industry, and the resultant emissions from the production of electricity were attributed to the sectors that consume it, agriculture would be in last place behind the other sectors considered in the question.¹⁴

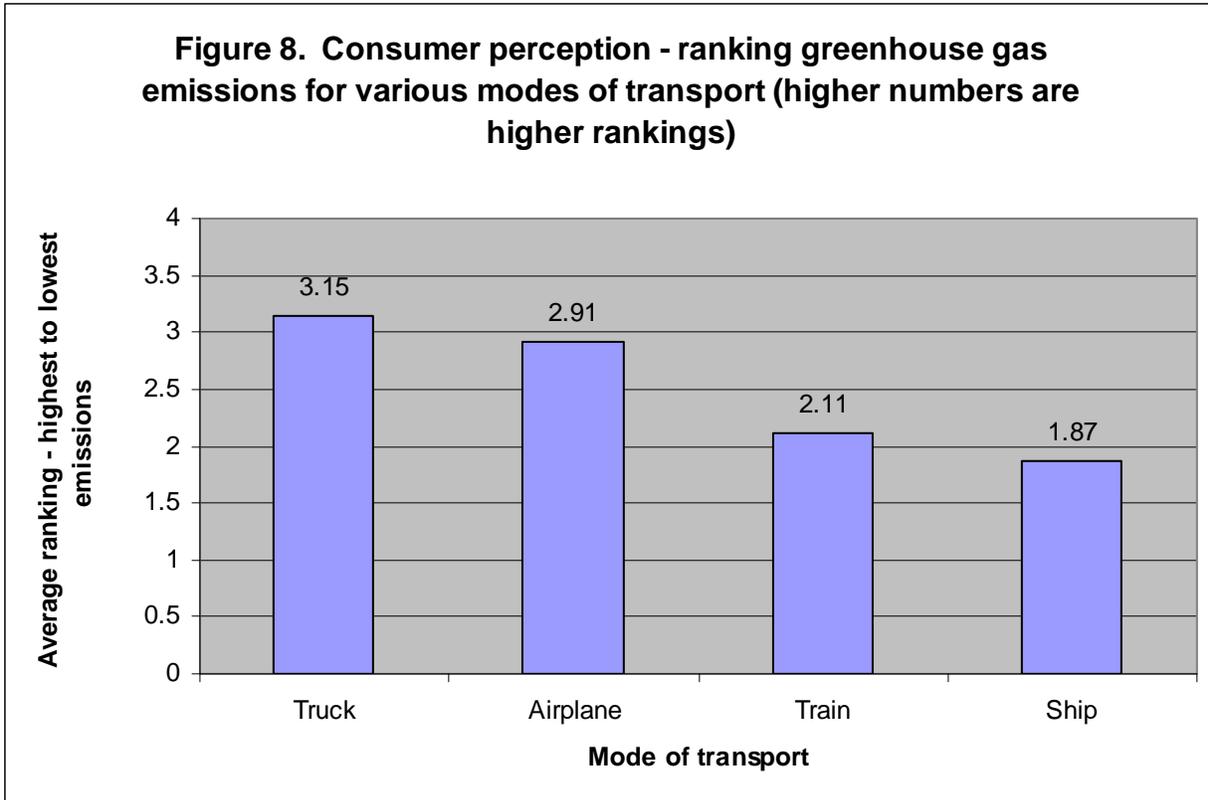


Food distribution is a portion of the transportation sector. Respondents were asked to rank various modes of transport, including truck, airplane, train, and ship, from highest to lowest greenhouse gas emissions per pound of agricultural product transported (Figure 8). Respondents viewed ships as the lowest emitter of greenhouse gases per pound transported, followed closely by trains. Although trucks and airplanes are indeed the two higher greenhouse gas emitters per pound transported, more than half of the respondents ranked trucks as the highest emitter, even though airplanes actually emit more greenhouse gases than trucks.¹⁵

¹³ Energy Information Administration, Emissions of Greenhouse Gases in the United States 2005, p. xvi. <http://ftp.eia.doe.gov/pub/oiaf/1605/cdrom/pdf/ggrpt/057305.pdf>.

¹⁴ U.S. environmental Protection Agency – Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2005. <http://www.epa.gov/climatechange/emissions/downloads06/07CR.pdf>.

¹⁵ U.S. Congress, Office of Technology Assessment, Saving Energy in U.S. Transportation, OTA-ETI-589. Washington, D.C.: U.S. Government Printing Office, July 1994, 44. <http://www.wvs.princeton.edu/ota/disk1/1994/9432/9432.PDF>.

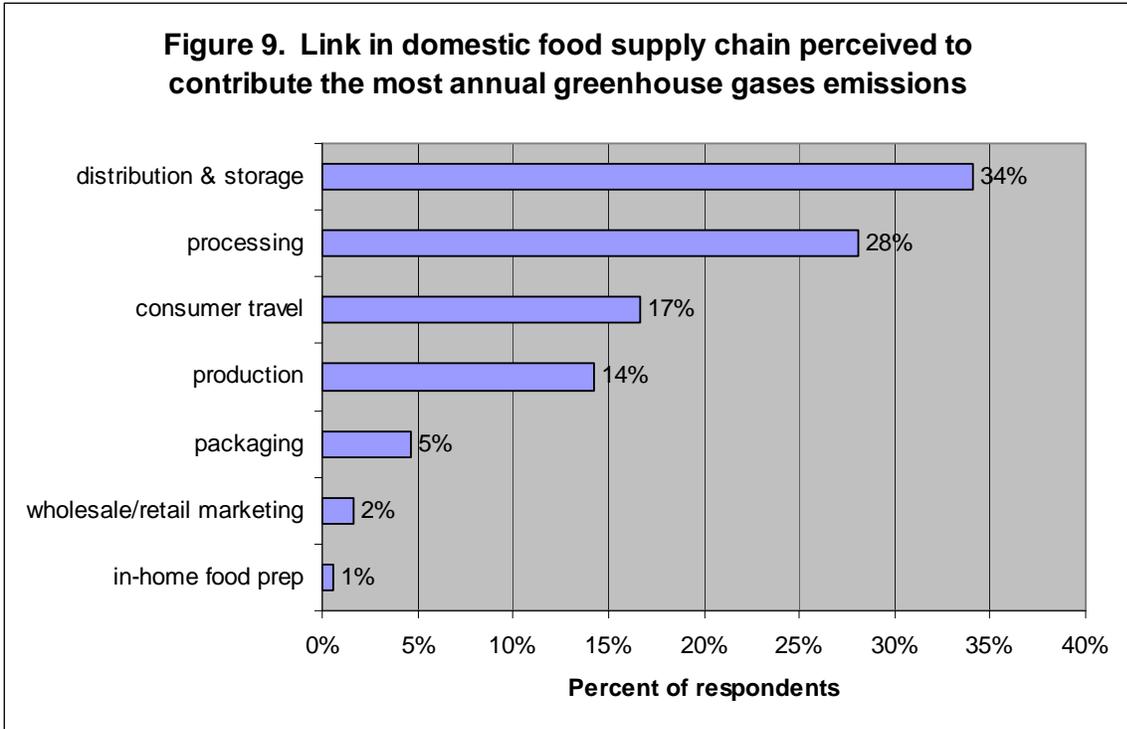


When respondents were asked which link in the food supply chain contributed the most greenhouse gases annually, distribution (which, for the purposes of this survey, includes storage) was the top-ranked selection, with more than one-third of respondents choosing this option (Figure 9). Processing came in second with more than a quarter of the responses. Consumer travel (to and from the food store) came in third, followed very closely by agricultural production of the food. Packaging, marketing, and in-home preparation garnered 5, 2, and 1 percent of the responses, respectively. Actual estimates of greenhouse gases emitted by links in the food supply chain will vary with the particular food chain in question.^{16 17 18}

¹⁶ Annika Carlsson. 1997. "Greenhouse Gas Emission in the Life Cycle of Carrots and Tomatoes." IMES/EESS report. (24 March 1997) Lund University, Sweden.

¹⁷ Annika Carlsson-Kanyama. 1998. "Climate change and dietary choices – how can emissions of greenhouse gases from food consumption be reduced?" *Food Policy* 23 (3/4) 277-93.

¹⁸ Williams, A.G., E. Audsley, and D.L. Sanders. 2006 Determining environmental burdens and resource use in the production of agricultural and horticultural commodities. Main report. Defra Research Project ISO205. Bedford: Cranford University and Defra. <http://www.defra.gov.uk>.



Concerning the greenhouse gas emissions of different forms of food production, respondents were asked to provide rankings from highest to lowest emissions of greenhouse gases for four produce supply chains with different origins and production systems (Figure 10). Two-thirds of respondents ranked local produce grown in an open field in a neighboring county as the supply chain option with the lowest greenhouse gases. Nearly two-thirds of respondents ranked produce grown in a temperature-controlled greenhouse and then shipped cross-country as the food chain with the highest emissions. The preferred ranking of the remaining two chains was less clear, but the supply chain for local produce grown in a temperature-controlled greenhouse was perceived to generate fewer emissions than that for produce grown in an open field and shipped cross-county.

In comparisons between products grown locally in a greenhouse versus cross-country in open fields, factors like distance shipped, irrigation, greenhouse efficiency, and intensity of agrochemical use could potentially contribute to either chain emitting more greenhouse gases. When using life cycle analysis to compare the greenhouse gas emissions across two different food supply chains, higher emissions in food transport (long-distance travel) coupled with low emissions in food production (open field) may in some cases net lower greenhouse gases than lower emissions in food transport (locally grown) coupled with higher emissions in production (greenhouse grown).¹⁹

¹⁹ Carlsson-Kanyama, Annika. 1998. "Food Consumption Patterns and their Influence on Climate Change." *Ambio* 27(7):528-34.

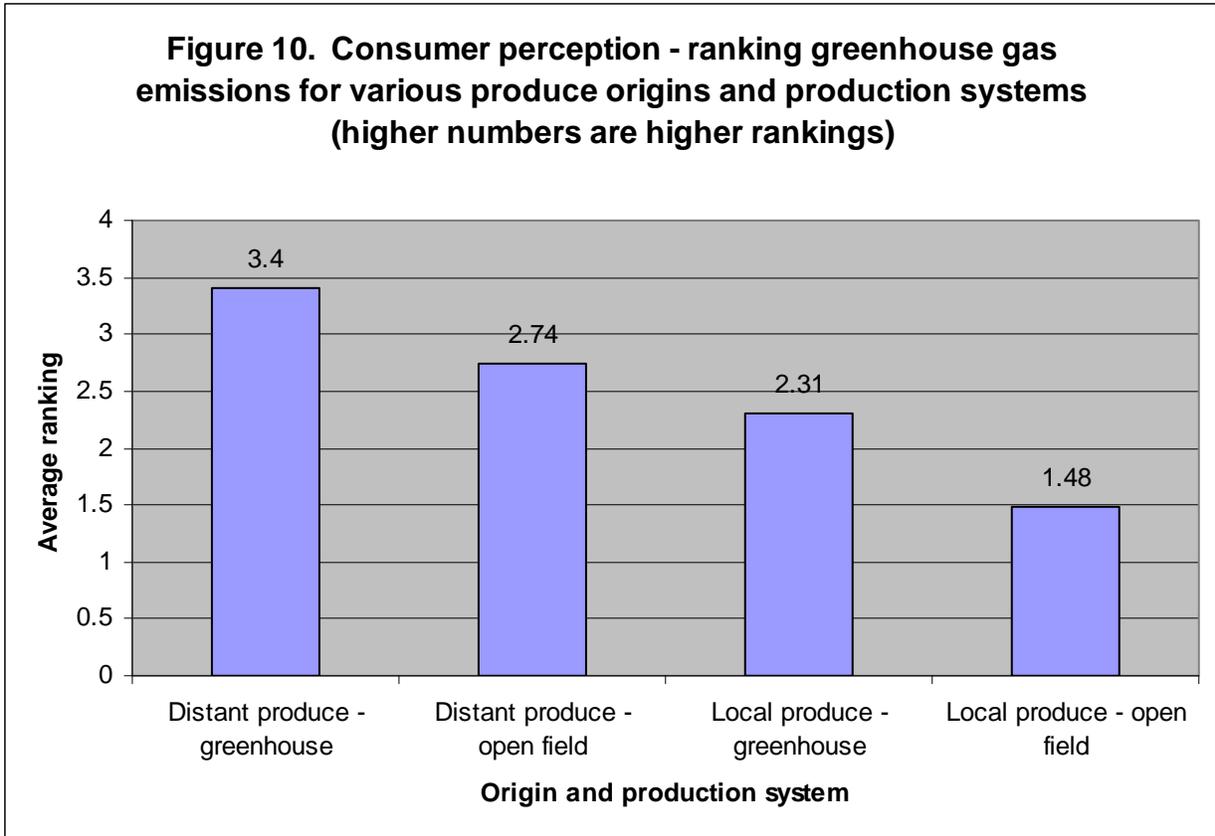
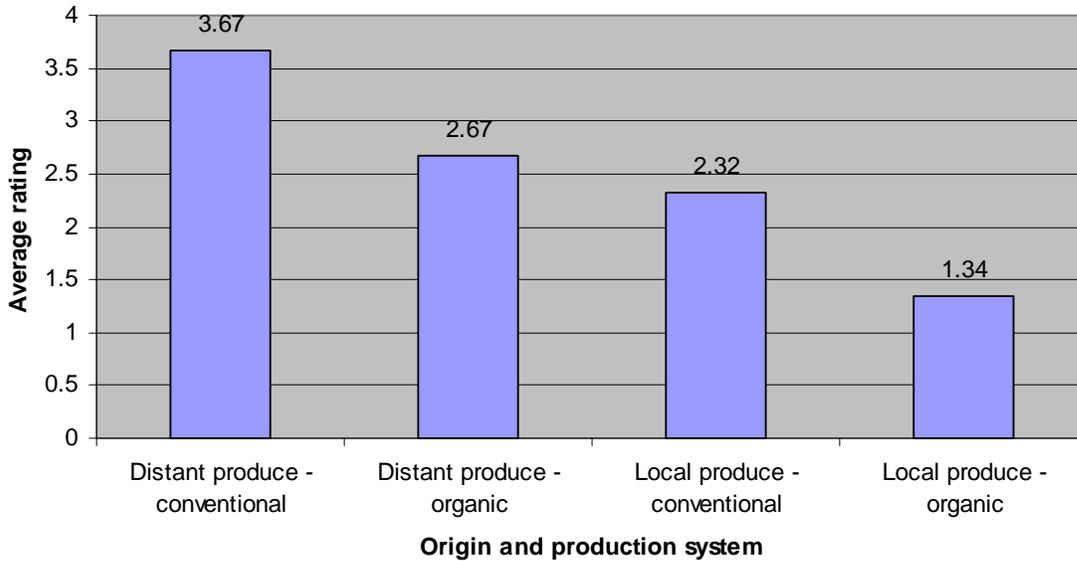


Figure 11 shows the comparisons of greenhouse gas intensity of produce supply chains between organic production and conventional production. This time, approximately 75 percent of the respondents surveyed thought the supply chain that brought organic produce from a neighboring county had the fewest greenhouse gas emissions, and the one that brought conventional produce from across the country was perceived to emit the most. The local supply chain, this time transporting conventional produce, was thought to emit fewer greenhouse gases than the cross-county chain, this time moving organic produce. And once again, the actual situation is not as clear-cut. Available studies show that organic production systems may or may not result in lower greenhouse gas emissions or net energy use than conventional systems, although for many foods the environmental impact of organic agriculture is lower.^{20 21}

²⁰ Pretty, J. N., A.S. Basil, T. Lang, and J.I. L. Morison. 2005. Farm costs and food miles: An assessment of the full cost of the UK weekly food basket. *Food Policy* 30(2005) 1-19.

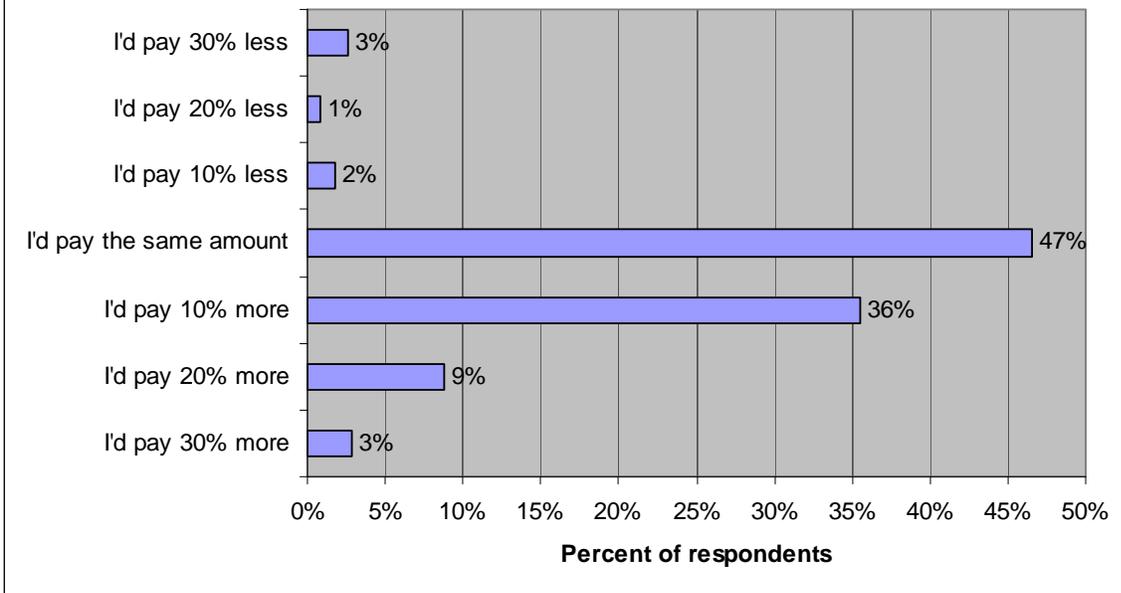
²¹ Foster, C., K. Green, M. Bleda, P. Dewick, B. Evans, A. Flynn, and J. Mylan. 2006. Environmental Impacts of Food Production and Consumption: A report to the Department for Environment, Food, and Rural Affairs. Manchester Business School. Defra, London.

Figure 11. Consumer perception - ranking greenhouse gas emissions for various produce origins and production systems (highest to lowest emissions)



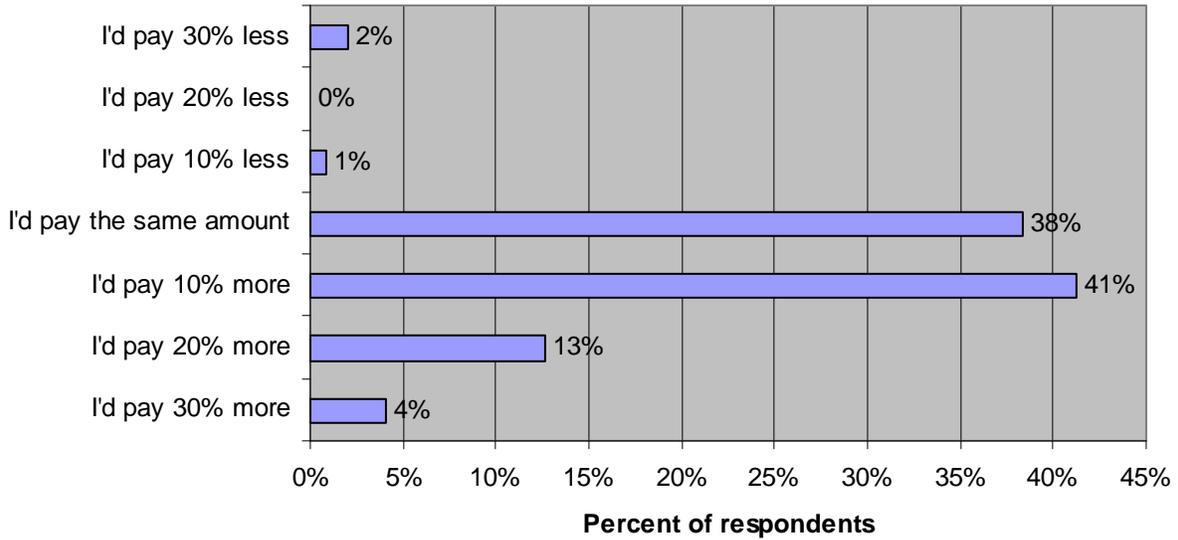
Consumer respondents were asked about their willingness to pay for fresh produce from a supply chain that released half as much greenhouse gas as identical produce that came via a typical supply chain (Figure 12). Nearly half of respondents (47 percent) indicated that they would pay the same amount for produce acquired through either supply chain. More than one-third of respondents (36 percent) said they would pay a 10 percent premium for the lower-emission supply chain, and 9 percent said they would pay a 20 percent premium. Overall, 48 percent of respondents would pay some level of premium. Only a small percentage of respondents (6 percent) indicated they would pay less for produce with lower greenhouse gas emissions.

Figure 12. Willingness to pay for produce that contributes 50 percent less greenhouse gas emissions



We separated out respondents who, in the last month, had shopped at places where they would be more likely to encounter local and non-conventional foods, including farmers markets, community-supported agriculture programs (CSAs), farm stands, food cooperatives, and natural/organic food stores. Then, we tested consumer willingness to pay for foods that generated 50 percent fewer emissions (Figure 13). The two most frequent responses were still “I’d pay the same amount” and “I’d pay 10 percent more”. It is worth noting that in this group, the number of people who were willing to pay the 10 percent premium (58 percent) exceeded the number who would only pay the same amount (38 percent).

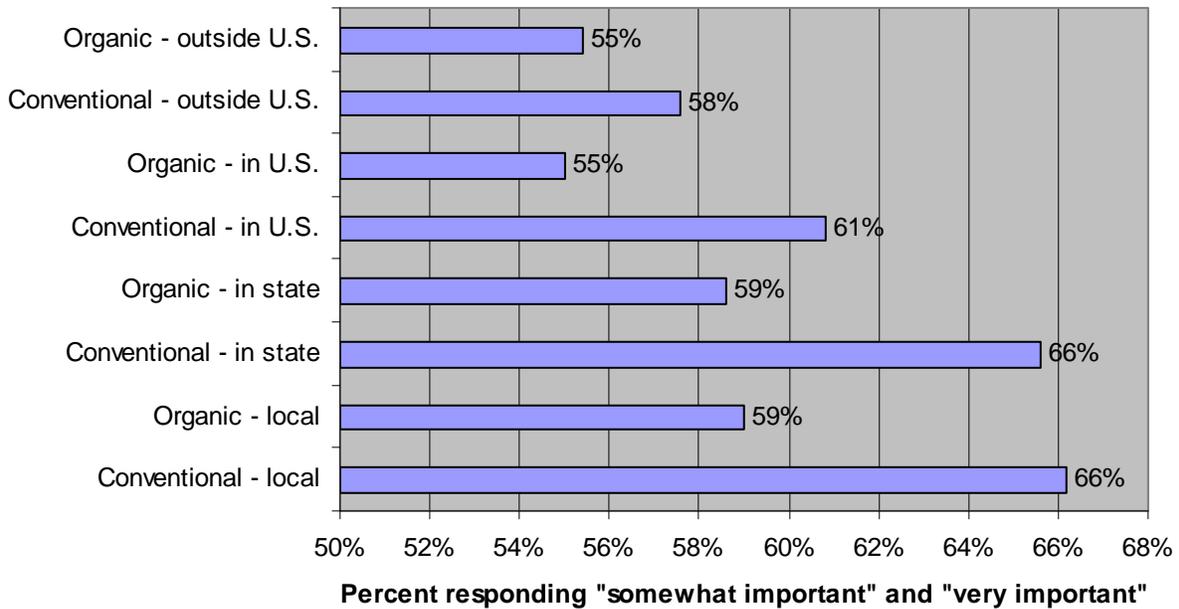
Figure 13. Willingness to pay for produce that contributes 50 percent less greenhouse gas emissions among respondents who have shopped at farmers markets, CSAs, farm stands, food cooperatives, and/or natural/organic food stores



Organic and local food supply chains and health

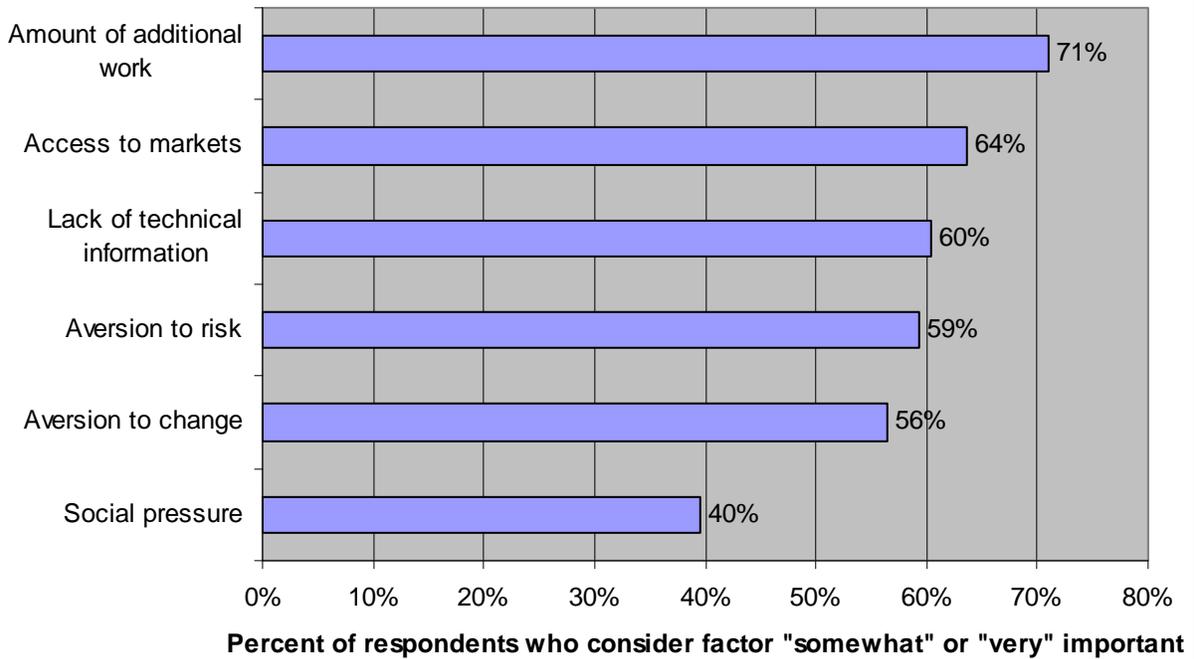
Respondents were asked how information on production system and scale of supply chain would affect their motivation to purchase a fresh produce item (Figure 14). (It is important to note that whether this change in motivation was positive or negative was not specified.) Although overall variability was relatively small, local conventional and in-state conventional produce supply chains had the largest number of respondents who answered “somewhat” or “very” important effects on their motivation. Within each geographic scale – local, in-state, domestic, and international – respondents had a three to seven percent higher overall change in motivation to buy in response to conventional production systems than to organic production systems.

Figure 14. Effect of information about production system and supply chain scale on motivation to buy fresh produce



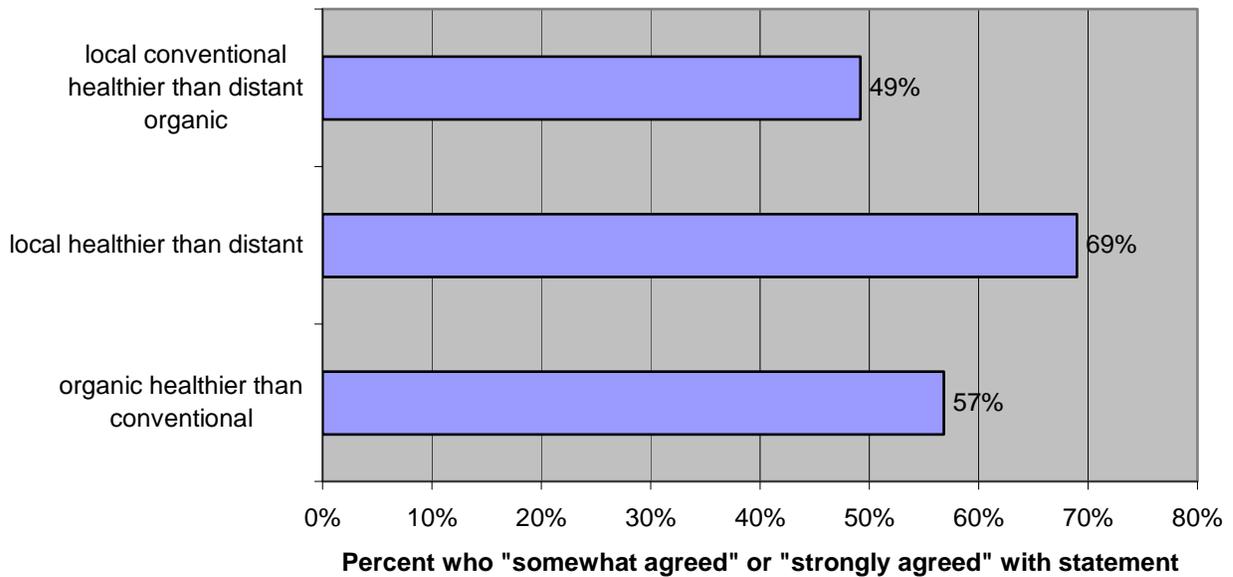
Respondents were asked how important various factors are to farmers considering the transition to organic production (Figure 15), and were allowed to list additional factors they considered important. Seventy-one percent of respondents indicated that the amount of additional work was a “somewhat” or “very” important factor, followed by market access with 64 percent, lack of technical information with 60 percent, aversion to risk with 59 percent, and aversion to change with 56 percent. Only 40 percent of respondents considered social pressure a “somewhat” or “very” important factor in the decision to transition to organic. Cost of organic production was listed as an additional important decision factor by just over 4 percent of respondents; lack of government support, lower yields, pests, and increasing corporate influence on the industry also were mentioned.

Figure 15. Perceived importance of various factors in the choice to transition to organic production



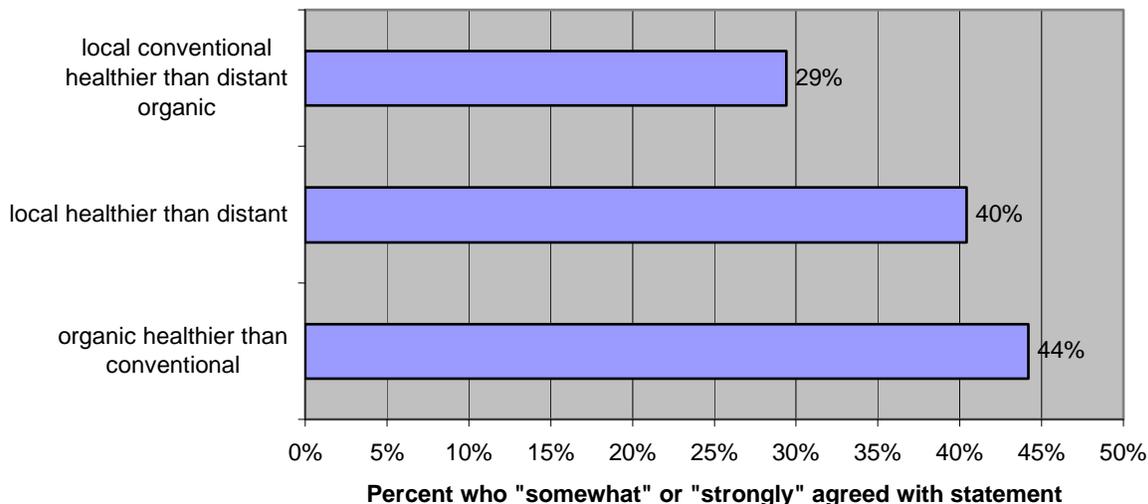
Respondents were asked how the food origin and production system affected their personal health (Figure 16). More than two-thirds of respondents (69 percent) “somewhat” or “strongly” agreed that local food is better for their personal health than food from across the country; 57 percent similarly agreed that organic food was healthier than conventional. Slightly less than half of respondents (49 percent) “somewhat” or “strongly” agreed that conventional food grown locally was better for their health than organic food brought in from across the country. This response is surprising, considering that many people who purchase organic food do so because of perceived health benefits.

Figure 16. Perceptions of health benefits of food by origin and production system



Respondents were asked the same question regarding health benefits of food with different origins grown under different production systems, but this time were asked how strongly they agreed that science actually has proven any such superiority (Figure 17). This time, overall levels of agreement were lower (the minority of respondents in all three cases). The largest number of respondents (44 percent) “somewhat” or “strongly” agreed with the statement that science had proven the benefits of organic food over conventional. The lowest fraction of respondents (29 percent) concurred that local conventional food is better than distant organic food.

Figure 17. Perceptions as to whether science has proven existence of health benefits of foods by origin and production system



Conclusions

Food safety and origins

Respondents to this survey attach high importance to food safety, freshness (harvest date), and pesticide use on fresh produce they purchase, with lower importance placed on whether the produce was locally grown, the level of greenhouse gas emissions it took to produce and transport the produce, and whether the respondent could contact the farmer who grew it. Specific food safety concerns of respondents were more pronounced for bacteria, pesticide residue, and bio-terrorism problems than about genetic engineering.

The majority of respondents (70 percent) perceived the U.S. food system to be safe. But when asked about the safety of fresh produce based on continent of origin, respondents showed varying levels of confidence. North America was perceived as the most safe (85 percent) followed by Europe (50 percent) and Australia (48 percent). Produce originating from Asia and Africa was least likely to be viewed as safe. When asked which specific countries raised the most concern, China was cited most frequently, singled out by 31 percent of respondents. Given the media attention China has received in 2007 for safety problems relating to pet food and human food, as well as toys, it is not surprising to see this type of response.^{22 23}

²² "China shuts down three plants over safety of products." *New York Times*. July 20, 2007. <http://www.nytimes.com/2007/07/21/business/21food.html?ex=1187928000&en=b191e08ac01823ff&ei=5070>.

²³ "Dinner Table Anxiety: As imports rise, so do food safety concerns." *U.S. News and World Report*. July 29, 2007. <http://www.usnews.com/usnews/news/articles/070729/6china.safety.htm>.

The serious concerns expressed by respondents over the safety of from foods imported from certain continents and countries appear to signal a general uneasiness with the global food system. This lack of respondent confidence in the safety of the global food system was further confirmed when they were asked to compare a global food system with a national (U.S.), regional, or local food system. Eighty-five and 88 percent of respondents, respectively, perceived local and regional food systems to be somewhat safe or very safe, compared to only 12 percent for the global food system. The high level of perceived confidence in the safety of local food systems is surprising, given that only 30 percent of respondents had shopped at a farmers market in the past month, and less than 2 percent belong to a community-supported agriculture enterprise.

Impacts of food supply chains on climate change

The impacts that the food supply chain has on greenhouse gas emissions and climate change is a relatively unexplored field of research in the United States. In Europe, however, there is a higher level of interest, as evidenced by the establishment of the Food Climate Research Network based in Great Britain.²⁴

Asking our consumer respondents about the perceived greenhouse gas emissions of various sectors of the U.S. economy, modes of transportation, and the links in the food supply chain may seem less than helpful because we assume these perceptions are not based on scientific study. Their responses, however, can be useful in determining the most effective communications and food systems research needed to answer some of these critical questions. The responses also may provide valuable feedback in the development of dynamic ecolabels that can inform and educate, rather than confuse, consumers.

For example, only 1.5 percent of fresh fruits and vegetable imports are transported by air in Great Britain, but that portion produces 50 percent of all emissions from fruit and vegetable transportation.²⁵ As part of its carbon labeling program in Europe, supermarket chain retailer Tesco is placing a small “airplane” symbol sticker on food items that used airplanes for part of their travel to the store or warehouse.²⁶ The assumption is that Tesco understands that with the amount of information available to the public about environmental impacts of the food system, their customers realize that air transport uses more fuel and releases more greenhouse gases into the atmosphere (on a per unit weight basis) than other forms of transportation such as trucks. However, in our internet survey of American consumers, more respondents perceived truck transport to emit higher levels of greenhouse gas than airplanes. These findings point to a need for more consumer education on this subject in the United States.

In the United States, some food companies are starting to take action after watching the developing documentation of greenhouse gas emissions from various food supply chains in Great Britain and the rest of Europe. For example, the food service management company Bon Appetit`

²⁴ Food Climate Research Network. 2007. <http://www.fcrn.org.uk/>.

²⁵ MacGregor, James, and Bill Vorley. 2006. “Fair Miles: The concept of “food miles” through a sustainable development lens.” International Institute for Environment and Development. <http://www.iied.org/pubs/pdf/full/11064IIED.pdf>.

²⁶ “You’ve checked the price and calorie count, now here’s the carbon cost.” *The Guardian*. January 19, 2007. http://www.guardian.co.uk/uk_news/story/0,,1994034,00.html.

has recently unveiled a “low-carbon diet” that includes plans to reduce the carbon emissions of their food procurement system.²⁷ Also, beginning in April 2008, Bon Appétit Management Company will introduce a carbon point system so that guests can calculate the impact of their personal food choices.²⁸

Are consumers willing to pay more for food from supply chains that emit half as much greenhouse gas as conventional chains? Nearly half of respondents were willing to pay more, but a similar percentage was not. However, when looking at those respondents who had shopped at venues where locally-grown foods were more likely to be for sale, a higher percentage were willing to pay more (compared to the entire respondent sample), and a lower percentage indicated they would pay the same. These results have marketing implications for small and midsize farmers and the associated organizations that promote local foods.

Organic and local food supply chains and health

There are few peer-reviewed research studies showing that organic products possess additional health benefits when compared to conventional products, but their number and documentation are increasing.²⁹ ³⁰ To the authors’ knowledge, however, there are no peer-reviewed studies that document increased health benefits related to consumption of locally-grown food as compared to food sourced from conventional locations in national and global markets. It is interesting to note, however, that a high number of survey respondents perceived that locally grown foods were healthier than foods grown at distant locations, and that science has proven these health benefits.

Previous Leopold Center market research has shown that consumers appreciate local food for its taste, freshness, and quality.³¹ One can argue that healthy foods, such as fresh fruits and vegetables, may be eaten more frequently if taste, freshness and quality are superior to comparable products currently being consumed. Studies that include sensory analysis and consumer behavior patterns would need to be conducted in everyday situations to determine if these qualities would lead to increased consumption of fresh fruits and vegetables (and lowered consumption of less healthy foods) thereby improving nutrition and health.

Linking food safety, environmental impact, and health

Respondents to this internet survey were concerned about the safety of the global food system, and put more confidence in the safety of a U.S. based, regional, or local food system. These respondents perceived that local food supply chains (for produce) were likely to emit fewer greenhouse gases than a comparable distant supply chain, and nearly half were willing to pay more for produce from a system that emitted half as much greenhouse gas. A large number of our survey respondents perceived that locally grown foods were healthier than foods grown at distant locations, and that science has proven these health benefits.

²⁷ Bon Appétit Management Company. <http://www.bamco.com/PressRoom/press-pre-041707.htm>.

²⁸ Ibid.

²⁹ The Organic Center. <http://www.organic-center.org/about.mission.html>.

³⁰ A. E. Mitchell, Y-J Hong, E. Koh, D.M. Barrett, D.E. Bryant, R. F. Denison, and S. Kaffka. 2007. Ten-Year Comparison of the Influence of Organic and Conventional Crop Management Practices on the Content of Flavonoids in Tomatoes. *Journal of Agriculture and Food Chemistry*. <http://www.pubs.acs.org/cgi-bin/abstract.cgi/jafcau/2007/55/i15/abs/jf070344+.html>.

³¹ Pirog, et al. 2004. Ecolabel Value Assessment Phase II: Consumer Perceptions of Local Foods. Ames, Iowa: Leopold Center for Sustainable Agriculture.

With the dramatic rise in popularity of local foods, the farmers who grow these foods and the organizations that champion both the farmers and the foods will be called upon to prove the existence of economic, environmental, and health benefits stemming from these products, and ensure their continued safety as part of the food supply. It is critical that government agencies (at the state and federal level), universities, health professionals, private companies, and non-profit organizations partner with those farmers growing and processing local foods to develop an appropriate research agenda for these food supply chains. This agenda must be focused on and responsive to the public questions that arise as local foods capture an increasing portion of per capita food consumption in the United States.

Appendix 1. Survey Instrument

Print-formatted version of the web-based survey summarized in this report.

Consent to Participate

Hello! This survey has been designed for informal market research into consumer perceptions of our food supply chain, including questions about food safety, production systems, and origin, as well as implications for climate change.

This survey will take 5-10 minutes to complete, depending on your responses, and you must be 18 years of age or older to participate. Participation in this survey is voluntary and you can skip any questions that you do not feel comfortable answering, with the exception of the consent question on this page. You may leave at any time by clicking the "Exit this survey" link at the upper right hand corner of your screen.

Information you provide will be aggregated with other responses and cannot be traced back to you personally. If you have any questions about the rights of research subjects or research-related injury, please contact the IRB Administrator, (515) 294-4566, IRB@iastate.edu, or Director, Office of Research Assurances, (515) 294-3115, 1138 Pearson Hall, Ames, IA 50011.

Please indicate your eligibility to participate in this survey.

I am at least 18 years of age and consent to participating in this survey.

I am under 18 and/or do not wish to participate in this survey.

Food Safety and Origins

These questions will help us determine your opinions and perceptions about the sources and safety of our food supply.

How important would you consider the following pieces of information if they appeared on a fresh produce item in your grocery store?

	very unimportant	somewhat unimportant	neutral	somewhat important	very important
How far the item has traveled from farm to store	<input type="radio"/>				
Whether or not the farm has passed a food safety inspection	<input type="radio"/>				
Whether or not pesticides were used on the item	<input type="radio"/>				
The date on which the produce item was harvested	<input type="radio"/>				
Contact information for the farmer (name, address, phone)	<input type="radio"/>				
The amount of greenhouse gas emitted during production and transportation to your store	<input type="radio"/>				

Please indicate the answer that most closely reflects your perception.

	very unsafe	somewhat unsafe	neutral	somewhat safe	very safe
How safe would you consider the food system in the United States?	<input type="radio"/>				

Please indicate the degree to which you agree with the following statements.

	strongly disagree	somewhat disagree	neutral	somewhat agree	strongly agree
Pesticide residues are a major food safety concern	<input type="radio"/>				
Bio-terrorism is a major food safety concern	<input type="radio"/>				
Bacteria are a major food safety concern	<input type="radio"/>				
Genetic engineering is a major food safety concern	<input type="radio"/>				
Foreign objects are a major food safety concern	<input type="radio"/>				

Have you ever personally experienced an issue with food safety? If yes, please describe:

How safe would you consider fresh produce at your grocery store that was grown on each of the following continents?

	very unsafe	somewhat unsafe	neutral	somewhat safe	very safe
North America	<input type="radio"/>				
South America	<input type="radio"/>				
Europe	<input type="radio"/>				
Africa	<input type="radio"/>				
Asia	<input type="radio"/>				
Australia	<input type="radio"/>				

Is there a particular country (or countries) about which you have food safety concerns?

How safe would you consider the following food supply chains? (Assume that a food supply chain includes the production, processing, and transportation of an agricultural product from farm to consumer.)

	very unsafe	somewhat unsafe	neutral	somewhat safe	very safe
A localized supply chain that occurs entirely within your county and neighboring counties	<input type="radio"/>				
A regional supply chain that occurs entirely within your state and neighboring states	<input type="radio"/>				
A national supply chain that occurs entirely within the United States	<input type="radio"/>				
A global supply chain that occurs in multiple countries	<input type="radio"/>				

How much of the food in your grocery store do you think was grown:

	0-25%	26-50%	51-75%	76-100%
In your county and neighboring counties?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In your state?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the United States?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Outside of the United States?

Impacts of Food Supply on Climate

These questions will help us determine your opinions and perceptions about the ecological effects of our food supply, specifically as they relate to greenhouse gas emissions. Greenhouse gases trap heat energy closer to the earth, which may contribute to climate change. The burning of fossil fuels releases carbon dioxide, one of the major greenhouse gases.

Please rank the following sectors, according to your perceptions, from the lowest annual emissions of greenhouse gases to the highest annual emissions of greenhouse gases.

	1 (lowest emissions)	2	3	4	5 (highest emissions)
Industry	<input type="radio"/>				
Commercial (non-industrial business)	<input type="radio"/>				
Transportation	<input type="radio"/>				
Residential	<input type="radio"/>				
Agriculture	<input type="radio"/>				

Please rank the following modes of transportation, according to your perceptions, from the lowest greenhouse gas emissions to the highest greenhouse gas emissions per pound of agricultural product transported.

	1 (lowest emissions)	2	3	4 (highest emissions)
Ship	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Train	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Truck	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Airplane	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Which link in the domestic food supply chain do you think causes the highest annual emissions of greenhouse gases?

- production
- processing
- packaging
- distribution (includes storage)
- wholesale/retail marketing
- consumer travel to and from the food store
- in-home food preparation

Please rank the following food supply chains, according to your perceptions,

from the lowest greenhouse gas emissions to the highest greenhouse gas emissions per pound of produce trucked to your grocery store.

	1 (lowest emissions)	2	3	4 (highest emissions)
Local produce grown in an open field from a neighboring county	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Local produce grown in a temperature-controlled greenhouse from a neighboring county	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Produce grown in an open field from across the country	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Produce grown in a temperature-controlled greenhouse from across the country	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please rank the following food supply chains, according to your perceptions, from the lowest greenhouse gas emissions to the highest greenhouse gas emissions per pound of produce trucked to your grocery store.

	1 (lowest emissions)	2	3	4 (highest emissions)
Local organic produce from a neighboring county	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Local conventional produce from a neighboring county	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Organic produce from across the country	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Conventional produce from across the country	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Assuming identical quality and appearance, how much would you be willing to pay for a fresh produce item whose supply chain emitted half the greenhouse gases of a typical produce supply chain? Assume other environmental impacts are the same.

- I'd pay 30% more
- I'd pay 20% more
- I'd pay 10% more
- I'd pay the same amount
- I'd pay 10% less
- I'd pay 20% less
- I'd pay 30% less
- Other (please specify another percentage):

Organic Food Supply Chains

These questions will help us determine your opinions and perceptions about organic food supply chains and organic farming.

Assume the following pieces of information regarding origin are labeled on a fresh produce item at your grocery store. How important would each label be in your motivation to buy the item?

	very unimportant	somewhat unimportant	neutral	somewhat important	very important
Conventional produce grown in your county or a neighboring county	<input type="radio"/>				
Organic produce grown in your county or a neighboring county	<input type="radio"/>				
Conventional produce grown in your state of residence	<input type="radio"/>				
Organic produce grown in your state of residence	<input type="radio"/>				
Conventional produce grown in the U.S.	<input type="radio"/>				
Organic produce grown in the U.S.	<input type="radio"/>				
Conventional produce grown outside the U.S.	<input type="radio"/>				
Organic produce grown outside the U.S.	<input type="radio"/>				

Although demand for organic products is growing in the United States, many farmers are not transitioning to organic production practices. How important would you consider the following factors in their decision?

	very unimportant	somewhat unimportant	neutral	somewhat important	very important
Amount of additional work	<input type="radio"/>				
Aversion to risk	<input type="radio"/>				
Access to markets	<input type="radio"/>				
Social pressure	<input type="radio"/>				
Lack of technical information	<input type="radio"/>				
Aversion to change	<input type="radio"/>				

Please list any other important decision factors you think ought to be included:

Please indicate the degree to which you agree with the statements provided.

	strongly disagree	somewhat disagree	neutral	somewhat agree	strongly agree
I think that organic food is better for my health than conventional food.	<input type="radio"/>				
I think that local food is better for my health than food transported from across the country.	<input type="radio"/>				
I think that local food grown conventionally is better for my health than organic food.	<input type="radio"/>				

transported from across the country.

Please choose the degree to which you agree with the statements provided.

	strongly disagree	somewhat disagree	neutral	somewhat agree	strongly agree
Science has proven that organic food is better for my health than conventional food.	<input type="radio"/>				
Science has proven that local food is better for my health than food transported from across the country.	<input type="radio"/>				
Science has proven that local food grown conventionally is better for my health than organic food transported from across the country.	<input type="radio"/>				

Demographics

We would like to know a little more about you. Please answer the questions with which you feel comfortable.

Please choose the answers that best describe yourself.

	Gender?	Age?	Ethnicity?	Level of education attained?
What is your:	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Please choose the answers that best describe your household.

	Number of adults (18 and over)?	Number of children (under 18)?	Annual household taxable income?
My household has:	<input type="text"/>	<input type="text"/>	<input type="text"/>

In what type of area do you live?

- city with population greater than 50,000
- town with population between 5,000 and 50,000
- village with population less than 5,000
- on a farm/in a rural area

Where have you purchased food in the past month? (please mark all that apply)

- | | |
|---|--|
| <input type="checkbox"/> Community-supported agriculture (CSA) subscription | <input type="checkbox"/> Internet/mail-order |
| <input type="checkbox"/> Convenience store | <input type="checkbox"/> Natural/organic grocery store chain |
| <input type="checkbox"/> Conventional grocery store chain | <input type="checkbox"/> Restaurant/cafeteria |
| <input type="checkbox"/> Farm stand/on a farm | <input type="checkbox"/> Superstore/supercenter |
| <input type="checkbox"/> Farmers market | <input type="checkbox"/> Other (please specify) |
| <input type="checkbox"/> Food cooperative | <input type="text"/> |

What is your ZIP code?

ZIP/Postal Code:

The End

Thank you so much for your interest in our survey. Please click the Submit button below to send your response.

Appendix 2. Response Data

Print-formatted summary of responses received to this survey.

Food safety and origins

Please indicate your eligibility to participate in this survey.		
	Response Percent	Response Count
I am at least 18 years of age and consent to participating in this survey.	100.0%	500
I am under 18 and/or do not wish to participate in this survey.	0.0%	0
<i>answered question</i>		500
<i>skipped question</i>		0

How important would you consider the following pieces of information if they appeared on a fresh produce item in your grocery store?							
	very unimportant	somewhat unimportant	neutral	somewhat important	very important	Rating Average	Response Count
Contact information for the farmer (name, address, phone)	15.7% (78)	21.5% (107)	32.5% (162)	18.5% (92)	11.8% (59)	2.89	498
The date on which the produce item was harvested	8.0% (40)	4.6% (23)	10.9% (54)	36.2% (180)	40.2% (200)	3.98	497
Whether or not pesticides were used on the item	8.2% (41)	5.8% (29)	13.8% (69)	29.3% (146)	42.9% (214)	3.93	499
How far the item has traveled from farm to store	9.0% (45)	13.1% (65)	27.5% (137)	33.9% (169)	16.5% (82)	3.38	498
The amount of greenhouse gas emitted during production and transportation to your store	16.2% (81)	17.0% (85)	33.3% (166)	20.4% (102)	13.0% (65)	2.97	499
Whether or not the farm has passed a food safety inspection	8.0% (40)	4.4% (22)	8.6% (43)	23.9% (119)	55.0% (274)	4.13	498
<i>answered question</i>							500
<i>skipped question</i>							0

Please indicate the answer that most closely reflects your perception.							
	very unsafe	somewhat unsafe	neutral	somewhat safe	very safe	Rating Average	Response Count
How safe would you consider the food system in the United States?	2.0% (10)	14.3% (71)	12.9% (64)	57.4% (286)	13.5% (67)	3.68	498
<i>answered question</i>							498
<i>skipped question</i>							2

Please indicate the degree to which you agree with the following statements.							
	strongly disagree	somewhat disagree	neutral	somewhat agree	strongly agree	Rating Average	Response Count
Pesticide residues are a major food safety concern	3.4% (17)	9.0% (45)	13.1% (65)	40.4% (201)	34.1% (170)	3.93	498
Bio-terrorism is a major food safety concern	3.0% (15)	9.5% (47)	15.3% (76)	35.7% (177)	36.5% (181)	3.93	496
Bacteria are a major food safety concern	2.6% (13)	3.6% (18)	9.3% (46)	36.4% (181)	48.1% (239)	4.24	497
Genetic engineering is a major food safety concern	8.7% (43)	13.1% (65)	28.6% (142)	27.8% (138)	21.8% (108)	3.41	496
Foreign objects are a major food safety concern	4.5% (22)	8.6% (42)	23.2% (114)	35.4% (174)	28.3% (139)	3.75	491
Have you ever personally experienced an issue with food safety? If yes, please describe:							241
						<i>answered question</i>	499
						<i>skipped question</i>	1

How safe would you consider fresh produce at your grocery store that was grown on each of the following continents?							
	very unsafe	somewhat unsafe	neutral	somewhat safe	very safe	Rating Average	Response Count
North America	1.0% (5)	3.2% (16)	10.0% (50)	49.8% (248)	35.9% (179)	4.18	498
South America	3.6% (18)	24.2% (120)	37.7% (187)	30.6% (152)	3.8% (19)	3.07	496
Europe	2.8% (13)	10.1% (50)	37.2% (185)	40.0% (199)	10.1% (50)	3.45	497
Africa	17.4% (86)	36.0% (178)	37.0% (183)	8.5% (42)	1.2% (6)	2.40	495
Asia	18.4% (91)	35.4% (175)	32.2% (159)	12.1% (60)	1.8% (9)	2.44	494
Australia	2.9% (14)	8.8% (43)	38.6% (188)	39.0% (190)	10.7% (52)	3.48	487
Is there a particular country (or countries) about which you have food safety concerns?							309
						<i>answered question</i>	498
						<i>skipped question</i>	2

How safe would you consider the following food supply chains? (Assume that a food supply chain includes the production, processing, and transportation of an agricultural product from farm to consumer.)							
	very unsafe	somewhat unsafe	neutral	somewhat safe	very safe	Rating Average	Response Count
A localized supply chain that occurs entirely within your county and neighboring counties	0.4% (2)	2.4% (12)	11.6% (58)	43.6% (217)	42.0% (209)	4.24	498
A regional supply chain that occurs entirely within your state and neighboring states	0.6% (3)	1.6% (8)	9.0% (45)	53.0% (264)	35.7% (178)	4.22	498
A national supply chain that occurs entirely within the United States	0.6% (3)	4.4% (22)	20.3% (101)	57.5% (286)	17.1% (85)	3.88	497
A global supply chain that occurs in multiple countries	10.9% (54)	42.9% (213)	34.3% (170)	10.7% (53)	1.2% (6)	2.48	496
<i>answered question</i>							499
<i>skipped question</i>							1

How much of the food in your grocery store do you think was grown:						
	0-25%	26-50%	51-75%	76-100%	Rating Average	Response Count
In your county and neighboring counties?	44.3% (221)	29.3% (146)	22.0% (110)	4.4% (22)	1.87	499
In your state?	44.4% (220)	38.5% (191)	14.7% (73)	2.4% (12)	1.75	496
In the United States?	8.9% (44)	34.3% (170)	46.4% (230)	10.5% (52)	2.58	496
Outside of the United States?	36.4% (180)	36.2% (179)	20.6% (102)	6.9% (34)	1.98	495
<i>answered question</i>						500
<i>skipped question</i>						0

Impacts of food supply chains on climate change

Please rank the following sectors, according to your perceptions, from the lowest annual emissions of greenhouse gases to the highest annual emissions of greenhouse gases.

	1 (lowest emissions)	2	3	4	5 (highest emissions)	Rating Average	Response Count
Industry	1.6% (7)	4.9% (22)	11.6% (52)	25.2% (113)	56.8% (255)	4.31	449
Transportation	2.0% (9)	4.7% (21)	18.0% (72)	46.4% (209)	30.9% (139)	4.00	450
Commercial (non-industrial business)	11.7% (53)	25.2% (114)	39.6% (179)	15.5% (70)	8.0% (36)	2.83	452
Residential	48.2% (222)	28.4% (131)	18.3% (75)	5.4% (25)	1.7% (8)	1.84	481
Agriculture	27.9% (128)	36.6% (165)	20.4% (92)	10.2% (48)	4.9% (22)	2.27	451
						<i>answered question</i>	497
						<i>skipped question</i>	3

Please rank the following modes of transportation, according to your perceptions, from the lowest greenhouse gas emissions to the highest greenhouse gas emissions per pound of agricultural product transported.

	1 (lowest emissions)	2	3	4 (highest emissions)	Rating Average	Response Count	
Airplane	11.5% (55)	20.3% (97)	34.2% (164)	34.0% (183)	2.91	479	
Train	29.8% (141)	36.4% (172)	28.8% (127)	7.0% (33)	2.11	473	
Ship	42.1% (200)	34.1% (162)	18.5% (88)	5.3% (25)	1.87	475	
Truck	14.0% (68)	10.3% (50)	22.3% (108)	53.3% (258)	3.15	484	
						<i>answered question</i>	497
						<i>skipped question</i>	3

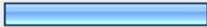
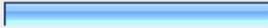
Which link in the domestic food supply chain do you think causes the highest annual emissions of greenhouse gases?			
		Response Percent	Response Count
production		14.3%	71
processing		28.1%	140
packaging		4.8%	23
distribution (includes storage)		34.1%	170
wholesale/retail marketing		1.6%	8
consumer travel to and from the food store		16.7%	83
in-home food preparation		0.8%	3
answered question			498
skipped question			2

Please rank the following food supply chains, according to your perceptions, from the lowest greenhouse gas emissions to the highest greenhouse gas emissions per pound of produce trucked to your grocery store.						
	1 (lowest emissions)	2	3	4 (highest emissions)	Rating Average	Response Count
Local produce grown in an open field from a neighboring county	71.6% (336)	14.3% (67)	8.1% (38)	6.0% (28)	1.48	489
Local produce grown in a temperature-controlled greenhouse from a neighboring county	13.2% (62)	48.4% (228)	32.9% (155)	5.5% (26)	2.31	471
Produce grown in an open field from across the country	7.3% (35)	31.4% (151)	41.6% (200)	19.8% (95)	2.74	481
Produce grown in a temperature-controlled greenhouse from across the country	9.0% (43)	8.4% (40)	16.7% (80)	66.0% (316)	3.40	479
answered question						493
skipped question						7

Please rank the following food supply chains, according to your perceptions, from the lowest greenhouse gas emissions to the highest greenhouse gas emissions per pound of produce trucked to your grocery store.

	1 (lowest emissions)	2	3	4 (highest emissions)	Rating Average	Response Count
Local organic produce from a neighboring county	78.6% (381)	12.6% (61)	4.9% (24)	3.9% (19)	1.34	485
Local conventional produce from a neighboring county	9.0% (43)	55.3% (263)	30.3% (144)	5.5% (26)	2.32	476
Organic produce from across the country	7.8% (37)	28.6% (136)	52.8% (251)	10.7% (51)	2.67	475
Conventional produce from across the country	3.5% (17)	5.2% (25)	12.6% (61)	78.7% (381)	3.67	484
<i>answered question</i>						494
<i>skipped question</i>						6

Assuming identical quality and appearance, how much would you be willing to pay for a fresh produce item whose supply chain emitted half the greenhouse gases of a typical produce supply chain? Assume other environmental impacts are the same.

	Response Percent	Response Count
I'd pay 30% more 	2.8%	14
I'd pay 20% more 	8.8%	44
I'd pay 10% more 	35.5%	177
I'd pay the same amount 	46.6%	232
I'd pay 10% less 	1.8%	9
I'd pay 20% less 	0.8%	4
I'd pay 30% less 	2.6%	13
Other (please specify another percentage): 	1.0%	5
<i>answered question</i>		498
<i>skipped question</i>		2

Organic and local food supply chains and health

Assume the following pieces of information regarding origin are labeled on a fresh produce item at your grocery store. How important would each label be in your motivation to buy the item?							
	very unimportant	somewhat unimportant	neutral	somewhat important	very important	Rating Average	Response Count
Conventional produce grown in your county or a neighboring county	5.8% (28)	6.0% (30)	21.6% (107)	37.1% (184)	29.6% (147)	3.79	496
Organic produce grown in your county or a neighboring county	8.7% (43)	8.5% (42)	23.5% (117)	32.2% (160)	27.2% (135)	3.61	497
Conventional produce grown in your state of residence	4.8% (24)	5.3% (26)	23.8% (117)	41.0% (203)	25.3% (125)	3.77	495
Organic produce grown in your state of residence	6.9% (34)	8.9% (44)	24.7% (122)	32.7% (161)	26.8% (132)	3.63	493
Conventional produce grown in the U.S.	3.4% (17)	5.2% (26)	30.0% (149)	36.1% (179)	25.2% (125)	3.74	496
Organic produce grown in the U.S.	6.2% (30)	7.0% (34)	30.4% (148)	31.6% (154)	24.8% (121)	3.62	487
Conventional produce grown outside the U.S.	6.7% (33)	9.9% (49)	25.3% (125)	21.4% (106)	36.8% (182)	3.72	495
Organic produce grown outside the U.S.	9.5% (47)	10.7% (53)	23.8% (118)	19.6% (97)	36.4% (180)	3.63	495
<i>answered question</i>							497
<i>skipped question</i>							3
Although demand for organic products is growing in the United States, many farmers are not transitioning to organic production practices. How important would you consider the following factors in their decision?							
	very unimportant	somewhat unimportant	neutral	somewhat important	very important	Rating Average	Response Count
Access to markets	3.2% (16)	6.9% (34)	25.4% (125)	36.5% (180)	28.0% (138)	3.79	493
Aversion to change	3.9% (19)	9.3% (46)	29.5% (145)	37.0% (182)	20.3% (100)	3.61	492
Aversion to risk	3.7% (18)	7.1% (35)	28.9% (142)	31.1% (153)	29.3% (144)	3.75	492
Lack of technical information	4.3% (21)	7.7% (38)	26.9% (133)	35.4% (175)	25.7% (127)	3.71	494
Amount of additional work	2.8% (13)	5.5% (27)	19.9% (98)	36.3% (179)	35.7% (178)	3.97	493
Social pressure	7.7% (38)	13.6% (67)	38.7% (191)	24.3% (120)	15.8% (78)	3.27	494
Please list any other important decision factors you think ought to be included:							97
<i>answered question</i>							496
<i>skipped question</i>							4

Please indicate the degree to which you agree with the statements provided.							
	strongly disagree	somewhat disagree	neutral	somewhat agree	strongly agree	Rating Average	Response Count
I think that organic food is better for my health than conventional food.	6.1% (30)	10.7% (53)	25.7% (127)	38.7% (191)	18.8% (93)	3.53	494
I think that local food is better for my health than food transported from across the country.	2.2% (11)	5.7% (28)	22.1% (109)	39.1% (193)	30.8% (152)	3.91	493
I think that local food grown conventionally is better for my health than organic food transported from across the country.	3.9% (19)	10.4% (51)	35.6% (175)	30.8% (151)	19.3% (95)	3.51	491
<i>answered question</i>							494
<i>skipped question</i>							6

Please choose the degree to which you agree with the statements provided.							
	strongly disagree	somewhat disagree	neutral	somewhat agree	strongly agree	Rating Average	Response Count
Science has proven that organic food is better for my health than conventional food.	5.8% (29)	12.3% (61)	37.4% (186)	32.0% (159)	12.5% (62)	3.33	497
Science has proven that local food is better for my health than food transported from across the country.	4.6% (23)	9.7% (48)	45.0% (223)	27.6% (137)	13.1% (65)	3.35	496
Science has proven that local food grown conventionally is better for my health than organic food transported from across the country.	5.7% (28)	11.7% (58)	52.9% (262)	21.2% (105)	8.5% (42)	3.15	495
<i>answered question</i>							497
<i>skipped question</i>							3

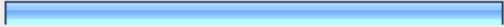
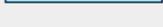
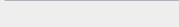
Appendix 3. Demographics

Respondent demographics.

Please choose the answers that best describe yourself.								
Gender?								
	Male		Female			Response Count		
What is your:	47.4% (235)		52.6% (261)			496		
Age?								
	18-27	28-47	48-70	71 and over		Response Count		
What is your:	8.5% (42)	32.5% (161)	49.9% (247)	9.1% (45)		495		
Ethnicity?								
	White, non-Hispanic	Asian or Pacific Islander	Latino or Hispanic	Alaskan Native	Black or African American	Other	Response Count	
What is your:	90.7% (450)	1.4% (7)	1.8% (9)	0.0% (0)	4.4% (22)	1.6% (8)	496	
Level of education attained?								
	high school	some college	bachelor's degree	master's degree	doctorate degree	none of these	Response Count	
What is your:	23.1% (115)	43.1% (214)	21.5% (107)	8.9% (44)	2.4% (12)	1.0% (5)	497	
							<i>answered question</i>	497
							<i>skipped question</i>	3

Please choose the answers that best describe your household.							
Number of adults (18 and over)?							
	1	2	3	4 or more		Response Count	
My household has:	19.1% (94)	58.7% (289)	14.0% (69)	8.1% (40)		492	
Number of children (under 18)?							
	0	1	2	3	4	5 or more	Response Count
My household has:	61.3% (271)	18.1% (80)	14.5% (64)	3.8% (17)	2.0% (9)	0.2% (1)	442
Annual household taxable income?							
	less than \$40,000	\$40,001-70,000	\$70,001-100,000	more than \$100,000		Response Count	
My household has:	33.9% (163)	35.8% (172)	18.7% (90)	11.6% (56)		481	
	<i>answered question</i>					496	
	<i>skipped question</i>					4	
In what type of area do you live?							
					Response Percent	Response Count	
city with population greater than 50,000					37.4%	186	
town with population between 5,000 and 50,000					41.7%	207	
village with population less than 5,000					7.9%	39	
on a farm/in a rural area					13.1%	65	
	<i>answered question</i>					497	
	<i>skipped question</i>					3	

Where have you purchased food in the past month? (please mark all that apply)

	Response Percent	Response Count
Conventional grocery store chain 	87.3%	433
Natural/organic grocery store chain 	16.1%	80
Superstore/supercenter 	57.7%	286
Food cooperative 	3.0%	15
Restaurant/cafeteria 	53.2%	264
Convenience store 	27.8%	138
Farmers market 	30.4%	151
Community-supported agriculture (CSA) subscription 	1.6%	8
Farm stand/on a farm 	27.8%	138
Internet/mail-order 	3.8%	19
Other (please specify) 	3.2%	16
<i>answered question</i>		496
<i>skipped question</i>		4

What is your ZIP code?

	Response Percent	Response Count
ZIP/Postal Code: 	100.0%	486
<i>answered question</i>		486
<i>skipped question</i>		14