UC Small Farm Program Research Brief

Growers' Compliance Costs for the Leafy Greens Marketing Agreement and Other Food Safety Programs

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September 2009

Summary

Many of the compliance requirements of the Leafy Greens Marketing Agreement (LGMA) and other food safety programs fall upon growers to implement. We surveyed leafy greens growers in California during 2008 and 2009 to measure these compliance costs. Our key findings are listed below.

- Growers' costs for modifications made specifically for LGMA compliance averaged $21,490, or $13.60 per acre.
- Growers reported their seasonal food safety costs more than doubled after the implementation of the LGMA, increasing from a mean of $24.04 per acre in 2006 to $54.63 per acre in 2007.
- The sum of the average modification costs and 2007 seasonal food safety costs—$68.23—represents almost 1 percent (0.93%) of growers' average lettuce revenues. Since it appears that growers may have excluded costs when reporting their seasonal food safety costs, a combined per acre cost of approximately $100 could be a more accurate average per acre cost.
- Growers with revenues in 2007 between $1 million and $10 million had the highest modification costs per acre ($18.05), followed by growers with revenues under $1 million ($14.82) and, lastly, growers with revenues over $10 million ($8.29).

Farm workers spray disinfectant on the cut end after harvesting head lettuce, a practice not required by LGMA. Photo by Shermain Hardesty.

- Seasonal food safety costs per acre followed the same pattern, with the costs for medium-size growers being 159 percent higher than the average for the largest growers.
- Previous research findings indicate a high degree of consolidation in the U.S. grocery sector; thus it is unlikely that growers have been able to obtain higher prices for their leafy greens in order to cover their increased food safety compliance costs.
- Since growers with revenues over $10 million benefit from significant economies of size in complying with the LGMA and other food safety provisions, they have the greatest capacity to absorb these costs.
- Furthermore, growers with revenues over $10 million tend to hire food safety specialists to manage their compliance programs, while the owners/managers of operations with revenues under $1 million need to manage these complex programs themselves.
- It is essential that the proliferation of public and private food safety standards in the leafy greens industry be addressed, while at the same time recognizing that a one-size-fits-all approach does not take into account the fact that leafy greens growers are a highly diverse group.

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Introduction

In spring of 2007, a group of California handlers of leafy greens established the Leafy Greens Products Handler Marketing Agreement (LGMA) in response to the September 2006 E. coli outbreak that was attributed to spinach grown in the Salinas Valley. Two years after the enactment of this industry initiative, the LGMA website (www.caleafygreens.ca.gov) reports that "nearly 120 handlers, representing approximately 99 [percent]" of the leafy greens grown in California, have joined the LGMA. This broad-based adoption differentiates the LGMA from other food safety programs, as described further in the next section.

A voluntary program, the LGMA has been widely accepted by the produce industry, grocers and foodservice firms. Arizona has also adopted an LGMA, and Florida is considering doing the same. In June 2009, a proposal for a national leafy greens marketing agreement was submitted to USDA's Agricultural Marketing Service (USDA AMS). Although the LGMA is an agreement between handlers, many of its compliance requirements fall upon growers to implement, as it requires signatory members to source their leafy greens solely from growers found to be in compliance with a set of food safety provisions called "best practices."

California is the nation's leading producer of leafy greens; in 2007, the value of production of the major leafy greens crops (head lettuce, leaf lettuce, romaine lettuce and spinach) totaled $2.4 billion (California Department of Food and Agriculture, 2008). The economic impacts of the LGMA and other food safety programs on growers, particularly their compliance costs, are the focus of the study. After describing the LGMA's provisions and reviewing the few recent studies regarding the impacts on growers of food safety requirements, we will present the findings from our survey of a sample of leafy greens growers that we conducted during 2008 and 2009.

Description of the LGMA and Other Food Safety Programs

Summary of the LGMA

LGMA is funded by an assessment on growers; the initial assessment rate of 2 cents per 24-pound carton was recently lowered to 1.5 cents. The California Department of Food and Agriculture conducts audits using a 273-item checklist. Each signatory member is required to have a compliance plan that addresses guidelines for best practices covering five main risk categories: growing environment, water, soil amendments, worker practices and field sanitation.

These guidelines are summarized in the text box on p. 3; the complete set of requirements is available at the LGMA web site (http://www.caleafygreens.ca.gov/members/documents/LGMAAcceptedGAPs07.10.09.pdf). These guidelines specifically state that members are responsible for complying with all relevant government rules and regulations and that the guidelines are "intended only to convey the best practices associated with the industry ... and that [various industry organizations] ... make no claims or warranties about any specific actions contained herein" (LGMA, 2009, p.11). The 14 leafy greens products covered by the LGMA (LGMA, 2009) are:

Arugula	Endive	Red Leaf Lettuce
Baby Leaf Lettuce	Escarole	Romaine Lettuce
Butter Lettuce	Green Leaf Lettuce	Spinach
Cabbage	Iceberg Lettuce	Spring Mix
Chard	Kale	

For each of the guidelines described at right, growers must incorporate these best practices into written standard operating procedures; in other words, they must compile their own compliance manual. They must document that compliance is verified for all procedures on a regular basis. All records must be kept for at least two years. Additionally, the California Department of Food and Agriculture must verify compliance through periodic field- and paperwork audits.

The five broad risk categories in the LGMA provisions have been addressed since the mid-1990s, either in federal guidance documents, international standards or third-party audits. Nonetheless, LGMA best practices have changed the way that food safety is implemented for many growers. Three aspects of the LGMA account for its large impact on California growers of lettuce and leafy greens: its wide scope, its enforceability, and its extensive industry coverage.

The LGMA's Scope

The LGMA has widened the scope of what falls under the rubric of food safety for many growers. Historically, food safety provisions centered on pesticide residues and worker hygiene. In recent years and especially after the E. coli outbreak of 2006, food safety has come to include the mitigation of potential risks from flooding, soil amendments and animal intrusion. While recent good agricultural practices (GAPs) have addressed these risk areas, the LGMA has been a driving force in operationalizing such provisions at an industry-wide level.

Enforceability of Food Safety Programs

The LGMA added metrics to existing industry standards, and enforces them through audits. Since the mid-1990s, the Food and Drug Administration and USDA have directed multiple food safety initiatives at the fresh produce industry and the lettuce industry in particular. These include the USDA AMS Qualified through Verification program (1996), the FDA Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables (1998), the FDA Produce Safety Action Plan (2004), and the FDA Draft Guide to Minimize Microbial Food Safety Hazards of Leafy Greens (July 2009). The 1998 FDA Guide has been considered one of the most comprehensive general food safety documents, and the GAPs and good management practices (GMPs) outlined therein have become industry standards. These

LGMA Provisions

Environment

Risk factors from the growing environment include past flooding, the use of land adjacent to growing fields, and intrusion by animals. Growers are expected to document past flooding on growing fields and to avoid planting crops immediately following flooding events. Buffers must be maintained between growing fields and areas used for compost production and/or storage, animal grazing, animal feeding, septic leach fields, and certain other uses. All evidence of intrusion by animals of significant risk,[1] such as feces and downed fences, must be documented and may necessitate the designation of non-harvest areas and the destruction of crops.

Water

LGMA established maximum allowable levels for generic E. coli in irrigation water based on both a rolling geometric mean and a single sample; the metrics vary by type of water source. Growers must monitor and document levels of generic E. coli through regular sampling and microbial testing at all sources and points of use. They must also prepare a description of their water system.

Soil Amendments

Growers must show that all non-synthetic soil amendments or crop treatments do not contain animal manure, or if they do, that the manure has been physically heat-treated or composted. All non-synthetic soil amendments and crop treatments must be tested for Salmonella, E. coli O157: H7 and fecal coliforms, or otherwise must be accompanied by certificates of process validity that ensure the length and lethality of the heating and/or composting processes.

Worker Practices

Growers must provide field sanitation units (toilets and hand-washing stations) accessible from all work sites. These facilities must be regularly cleaned, serviced and stocked with sufficient supplies. The number, condition, and placement of field sanitation units must comply with all applicable state and federal regulations. Ongoing training sessions and signage must indicate employee work rules regarding hand washing, eating, drinking, clothing, and the storage of personal items in or adjacent to fields.

Field Sanitation

Potential cross-contamination between leafy greens growing fields and other fields must be avoided through the segregation and/or cleaning of equipment. Growers must identify potential sources of cross-contamination and maintain records of equipment cleaning. Any potential contamination from risk sources must be dealt with in accordance to standard operating procedures. A food safety harvest assessment must document, for each growing block, cleaning and sanitation procedures, equipment storage procedures and any evidence of animal intrusion during the growing season.

[1] Animals deemed by the Centers for Disease Control and Prevention as having a higher risk of carrying E. coli O157:H7 are cattle, sheep, goats, pigs (domestic and wild) and deer (LGMA, 2009).

GAPs and GMPs, however, were not typically accompanied by compliance rules or metrics. The LGMA best practices attached specific metrics and compliance rules to these recommendations.

Many aspects of food safety have long been legislated and enforced for all growers. The Occupational Safety and Health Administration, for example, already requires and enforces the number, condition, and placement of field sanitation units as stipulated in the LGMA. The Environmental Protection Agency already stipulates practices for handling pesticides. The language applying to the production and application of compost in the LGMA derives heavily from the federal National Organic Program and is already familiar to certified organic growers. Other aspects, however, such as those pertaining to water quality and potential environmental risk sources, had not been enforced in any standard way.

Industry Coverage By Food Safety Programs

As previously indicated, a very high proportion of the leafy greens grown in California passes through handlers who are LGMA signatories.[3] Because a signatory handler may not source from growers found in non-compliance with the LGMA best practices, and because the vast majority of California's packers and shippers of leafy greens are members of the LGMA, most growers fall under the rubric of the LGMA. Some of these growers, at the behest of purchasers, have been subject to comprehensive, metric-based food safety audits prior to the implementation of the LGMA.[4] Even among those growers who had adopted formal food safety systems, standards varied widely, and the uptake of on-farm food safety practices throughout the entire industry is likely to have been spotty. In a 2001 survey, fruit and vegetable farmers in the six New England states were asked about their adoption of food safety practices, including those related to water quality, manure and bio-solids, worker health and hygiene, field sanitation, and recordkeeping. The majority of farmers reported that they always used good agricultural practices over all surveyed categories and practices, and most used good agricultural practices most of the time. However, approximately 10 percent of growers responded as never having implemented certain food safety practices (Cohen et al., 2005).

Growers in the California leafy greens industry have changed their practices as a result of the LGMA. Understanding the

[3] The remaining 1 percent are primarily directly marketed by growers to grocery stores and restaurants, or to consumers through community supported agriculture programs (CSAs) and farmers markets.

[4] Most exporting producers were already certified as meeting certain food safety standards under certification programs such as Safe Quality Food and GlobalGAP. Many food service organizations required that their producers undergo periodic third-party audits and certification for food safety.

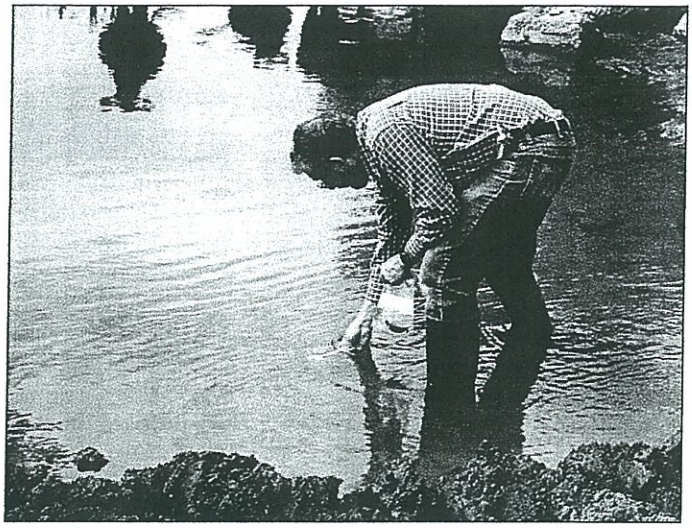
industry response and quantifying the costs is crucial at this juncture, as handlers in other states, the federal government, and other industry entities contemplate implementing similar agreements. Soon after California growers created the LGMA, Arizona growers of leafy greens adopted a similar agreement. This is not surprising, since many California handlers source leafy greens grown in Arizona during the winter. Also in 2007, Florida officials began exploring the possibility of implementing a program using food safety standards similar to those in the California LGMA. In spring of 2007, the Food Safety Leadership Council (FSLC), a consortium of large produce buyers including Disney, Walmart, McDonald's, Darden (as the world's largest company-owned and operated restaurant company, its operations include Olive Garden, Red Lobster, Longhorn Steakhouse—Darden, 2009) and Publix, launched its Food Safety Initiative and began designing its own set of on-farm produce safety standards. These standards, which were finalized in September 2007, are more stringent than the LGMA best practices,[5] leading industry observers to speculate about a potential "arms race" developing between different purchasing entities. Many in the produce industry refer to the FSLC standards, as well as those imposed by various large foodservice and grocery chains, as "supermetrics."

Many produce shippers support the adoption of a single set of food safety standards to simplify their compliance practices and recordkeeping. In October 2007, USDA AMS issued a notice in the Federal Register requesting comments regarding a national marketing agreement for leafy greens. Proponents submitted a proposal for a national leafy greens marketing agreement to the agency in June 2009. Similar to the LGMA, handlers could voluntarily sign the agreement; however, compliance with the regulations would then be mandatory for these signatories.

Previous Studies of the Impacts of Food Safety Programs

We know of three other studies that assess the impacts of the LGMA and other food safety programs. The Monterey County Resource Conservation District study (Beretti and Stuart, published internally in August 2007 and in the peer-reviewed journal *California Agriculture* in 2008) assessed the effects of the LGMA on soil and water conservation efforts; respondents included 181 row crop growers on the Central Coast, of whom 92 grew leafy greens. Nearly one-third of the surveyed leafy greens growers had been told by auditors to remove non-crop vegetation and all had done so. Similarly, nearly half had been told to remove wildlife, and 85 percent of them had done so.

Paggi (2008) included the LGMA in his assessment for food safety policies and programs. He noted the proliferation of food safety programs with conflicting standards and provided detailed comparisons of the standards related to selected leafy greens cultural practices for four programs—GlobalGap, USDA-FDA, LGMA and FSLC. From an international trade perspective, he concluded that harmonization of the standards was necessary. The LGMA itself conducted an internal study regarding the food safety costs incurred by signatory handlers (Tootelian, 2008). Responses from 49 member handlers indicated that they had expanded their traceability systems, doubled the number of food safety staff, tripled annual food safety expenditures, and quintupled the number of water tests conducted monthly compared to before September of 2006. Most respondents also reported having lost acreage due to buffer zone requirements[6] and animal activity concerns. While this study addressed many of the same issues as ours, it was conducted among signatory handlers. As such, it may capture grower costs only to the extent that most handlers are also growers, or insofar as handlers can estimate the costs of measures taken by growers. To the best of our knowledge, ours is the first study to assess the food safety costs incurred by growers as a result of the LGMA and other food safety programs.



A geneticist collects a sediment sample to test for E. coli 0157:H7, the pathogen found near fields implicated in the 2006 outbreak. USDA Photo.

Methodology for Survey of Costs to Growers to Comply with the LGMA and Other Food Safety Programs

Data for this study were collected using a questionnaire (included as Appendix A) that was sent to leafy greens growers in Monterey and Fresno counties. Monterey County leads the nation in the production of head, leaf and romaine lettuce, and spinach; the value of production of all types of lettuce and spinach totaled $1.1 billion in 2007 (Monterey County Agricultural Commissioner, 2008). We included Fresno County to capture information from Central Valley growers who often supply LGMA signatories with leafy greens during the fall and spring seasons when the primary supply region is shifting between Monterey and Yuma counties. The list of 192 producers (42 growers in Fresno County and 154 growers in Monterey County)[7] was compiled using data from the respective Agricultural Commissioners' records.

[5] For example, FSLC standards apply to produce from any place of origin (not just California) and require a minimum of ¼ mile between growing areas and animal grazing areas and 1 mile from feedlots, whereas the LGMA standards call for 30 feet from animal grazing areas and 400 feet from feedlots.

[6] Buffer zone requirements indicate specific distances that must be kept between certain environmental uses and harvested leafy greens acreage. Vegetation removal is not necessary within the buffer zone.

[7] Considering information from the 2007 Agricultural Census and the Monterey County Agricultural Commissioner's 2007 Crop Report leads us to believe that 154 is an upper bound on the number of operations likely to sell to LGMA signatories.

The questionnaire was first mailed in June 2008 and mailed again in August as a follow-up. Additional phone interviews were conducted between September 2008 and April 2009 to increase the response rate. Though the responses arrived over a 10-month period, we do not believe that the timing of the responses affects the data; the questions pertain specifically to the 2006 and 2007 seasons, and nearly all growers had either already undergone audit, or had no intention of doing so at the time of their response.

The first two sections of the questionnaire asked growers about their general farming operations and specifics regarding the scale and scope of their leafy greens operations, as well as certifications and marketing channels utilized; we surmised that some of these characteristics could impact growers' food safety costs. In the third section, growers who had already undergone audit or were planning to undergo audit reported their costs of complying with the LGMA best practices. One-time modification costs and investments to comply with the LGMA were reported separately from annual expenses and losses related to the LGMA and other food safety programs. These costs and losses related to buffer zone requirements, water quality, compost production, monitoring, and the documentation of operating procedures. While the scope of the LGMA extends beyond these areas, we narrowed our focus based on input from growers and food safety specialists. As mentioned in the previous section, many parts of the LGMA best practices were previously stipulated and enforced by the EPA, OSHA, and the National Organic Program. We identified the areas above as those in which growers are most likely to incur new costs.

The survey was designed to answer the following questions:

- What are the characteristics of leafy greens growers who supply LGMA signatories?
- What one-time modifications costs did growers incur in order to be LGMA-compliant?
- What annual costs and losses do growers incur in order to comply with the LGMA and other food safety programs?
- How did food safety costs change for LGMA-compliant growers?
- Are there grower characteristics, such as size, that explain differences in these costs?

We acknowledge that our task was made difficult by the existence of many different types of leafy greens operations in California, and the varying degrees to which they were already in compliance with the LGMA best practices. We also recognize that some of the costs reported by the respondents as LGMA modification costs could relate to expenses incurred to comply with other food safety programs, such as those of private third-party food safety auditors and the FSLC.

Survey Findings

Through the mailings and phone calls, we were able to contact 67 growers, or one-third of the total 192 operations in Monterey and Fresno counties producing leafy greens. Of these, 10 refused to participate, and another eight indicated that they did not grow any leafy greens. This study is based on the remaining 49 growers, of whom 42 indicated that Monterey County was their primary growing region, five as Fresno County, two as Santa Cruz County, and one as Ventura County. The overall response rate was 25 percent. The response rate is uneven over the two target counties that our grower list came from; Monterey County had a 27 percent response rate and Fresno County's was 12 percent. We found no data from either county or federal sources to determine how representative these respondents were. It is difficult for the county to compile such data at the grower level since many growers farm numerous parcels that are tracked separately by the county. LGMA data are tracked according to handlers, not growers. Data from the USDA Census of Agriculture are aggregated into broad crop groupings to protect confidentiality.

Table 1. Respondents by 2007 Gross Revenue Category

Gross revenue in 2007	N	Percent
$100,000 to $250,000	1	2.3
$250,000 to $500,000	4	9.3
$500,000 to $1 million	4	9.3
$1 million to $10 million	19	44.2
Greater than $10 million	15	34.9

Leafy Greens Grower Characteristics

The survey included questions on grower characteristics. We included these questions to see if LGMA growers are systematically different from non-LGMA growers, and which characteristics, if any, could explain differences in food safety compliance costs. Unfortunately, too few of the respondents reported not planning on undergoing LGMA to allow such a comparison. Of the 49 respondents to our survey, 42 indicated that they had undergone an LGMA audit, one stated that they would likely undergo audit within two years, five stated that they would not be undergoing LGMA certification within two years and one did not indicate their LGMA status.[8] We summarize here the characteristics of the 44 growers who report having already undergone LGMA audit or have otherwise initiated the process.

Operation Size and the Relative Importance of Leafy Greens

We used total acreage, number of full-time year-round workers, and 2007 sales as indicators of size. Total acreage planted in 2007 ranged from 116 to 23,000 acres, with 3,866 acres as the average. Twenty-eight percent grew less than 1,000 acres. Given the large variation in acreage, the number of full-time year-round employees also varied widely; it ranged from one to 450 full-time year-round employees, with an average of 49. Gross revenue in 2007 is a concise descriptor of size, and also highly correlated with total acreage and number of staff. For these reasons we rely on it as our primary indicator of size. Table 1 shows the distribution of gross revenue categories.[9] Because evaluating the effects of scale on compliance costs was one of our primary objectives in conducting this survey, we strove to get a balanced distribution of respondents in terms of reported 2007 total farm gross revenue categories.

[8] We surmised that this grower had undergone LGMA audit because he/she reported information on the various types of compliance costs; therefore, data reported by this respondent are included in our subsequent analysis.

[9] Because one respondent did not disclose gross revenue category, only 43 observations appear in Table 1. Observation sizes indicated throughout the rest of this report will also vary due to such occurrences of missing data.

Table 2. Leafy Greens Marketing Channels
Average Percentage of 2007 Leafy Greens Revenues By Marketing Channel

Marketing channel	< $1 million	$1 million-$10 million	> $10 million
Commodity shippers	75	67	51
Fresh-cut processors	8	22	30
Wholesalers/distributors	9	3	5
Grocers	3	4	6
Foodservice operators	6	4	7
Farmers markets/CSAs	0	0	0

Table 3. Land Use Types Adjoining Growing Fields

Land use type	Percent of respondents in proximity
Riparian areas	72.7
Reservoirs	56.8
Tree lines	45.5
Drainage canals	43.2
Residential areas	40.9
Grazing lands	36.3
Wild areas/woods	27.2
Septic leach fields	20.4
Irrigation canals	16.3

Despite our efforts to identify smaller growers who supply LGMA signatories, the number of total respondents with sales under $250,000 (the USDA definition of a "small farm") is conspicuously low, and none appear among the LGMA-participating growers. We attribute this to the fact that growers in California who sell their leafy greens directly to consumers, grocers and/or restaurants are not required to be in compliance with the LGMA.

Throughout this study we use total farm size as an indicator of the scale of the leafy greens operations. We do this because LGMA growers appear to be fairly specialized in leafy greens: Growers' 2007 acreage of leafy greens ranged from 77 to 19,000 acres, with an average of 2,330 acres and a median of 1,100 acres. Leafy greens are clearly the dominant crop, averaging 61 percent of total farm acreage; 77 percent of respondents dedicated at least half of their total acreage to leafy greens. And three respondents grew solely leafy greens. In terms of revenue as well, our sample shows a high reliance on leafy greens. Growers' estimates of the leafy greens' share of total sales averaged 60 percent and ranged from 10 percent to 100 percent; leafy greens revenues comprised at least half of total crop sales for 76 percent of the respondents.[10] For ease of analysis, we collapsed the six revenue categories into three, classifying growers with less than $1 million in sales as "small," those with sales between $1 million and $10 million as "medium," and those with sales greater than $10 million as "large."

Marketing and Certification of Leafy Greens

Beretti and Stuart's results suggest that growers selling to shippers/packers tended to have dismantled more water and wildlife conservation practices than those marketing through other channels.[11] Therefore, we asked about marketing channels and activities beyond growing, such as packing and distributing. One-third of the respondents engaged in field packing their production, 18 percent had leafy greens packing operations and 12 percent were leafy greens distributors. Regardless of size category, most of the leafy greens were marketed through commodity shippers; the second most important marketing channel overall was fresh-cut processors.

Size of the farming operation appears be linked to marketing channel utilization (Table 2). The smallest growers generate the highest proportion of their sales through the most popular channel—commodity shippers; they are also most likely to sell to wholesalers/distributors. The proportion of sales to fresh-cut processors clearly increases with farm size.

As previously noted, the LGMA incorporated provisions from the National Organic Program and other food safety certification programs. We hypothesized that growers who were already certified through other programs would incur lower costs to comply with the LGMA. Twenty percent grew leafy greens that were certified as organic, and 57 percent reported undergoing other third-party audits, through Primus Labs, NSF-Davis Fresh or similar organizations.

Proximity to Land Uses With Potential To Increase Food Safety Risk

The survey presented growers with a list of land use types that could potentially increase food safety risks if located adjacent to growing fields. Growers indicated which of the land use types their fields bordered (Table 3). Two-thirds bordered riparian areas. Other prevalent adjacent land uses included reservoirs, drainage canals, tree lines, residential areas and grazing lands. The LGMA metric applied in a specific situation depends on the surrounding topographic conditions and/or other factors.

Costs to comply with the LGMA and other food safety requirements

The remainder of the questionnaire related to the costs, losses and activities related to complying with the LGMA and other food safety requirements. The discussion below is based on the responses from the 44 growers who had already undergone LGMA audit or planned on doing so.

LGMA Compliance Costs

We categorized LGMA and other food safety costs into two types: modification costs made specifically for LGMA compliance and seasonal food safety costs that would be incurred each year to comply with the LGMA and other food safety programs.

LGMA-Related Modification Costs

We first asked growers what modifications and related costs they had incurred to date, ***in order to be in compliance with***

[10] In addition to leafy greens, respondents typically grew broccoli to complete the production year after growing leafy greens, and almost half of the producers also grew celery.

[11] Beretti and Stuart found that 88 percent of growers who removed conservation practices for water quality or wildlife sold to packer/shippers.

Table 4. LGMA-Related Investments/Modifications ($ Per Operation)

Respondents who have ...	Percent making modification	Cost ($ mean)	Standard Deviation	Minimum	Maximum
Installed additional fencing	57	28,354	36,977	1,200	148,000
Increased/modified bathroom/hand-washing facilities	57	6,964	19,627	0	100,000
Lined wells/irrigation canals, made other changes to water system	23	3,167	4,008	0	10,000
Modified compost storage area	11	2,625	4,922	0	10,000
Modified packing area	2	10,000	--	10,000	10,000
Made other modifications/investments, any examples?	16	2,416	3,878	0	10,000
Total cost (41 cases)		21,490	36,331	0	150,500
Cost per acre of leafy greens		13.60	20.40	0	106.00

the LGMA (bold italics included in the questionnaire). The modifications most commonly made for LGMA compliance were installing additional fencing and modifying bathroom/hand-washing facilities (Table 4). Growers have used fencing to minimize the possibility of animal intrusion; evidence of intrusion by animals of significant risk (cattle, sheep, goats, pigs and deer) within a week of harvest could require that the crop be destroyed. While we asked only the one-time costs of these investments, we surmise that maintenance costs will also be associated with such modifications.

The total cost of the investments/modifications for LGMA compliance averaged $21,490, and ranged from $0 to $150,500. There are several cases of zero values for the minimum; they reflect cases where respondents indicated that they had made a modification at no cost. In such cases we surmise that respondents did not consider labor costs. The total, per acre cost of modifications per acre of leafy greens averaged $13.60; this cost varied widely depending on the modifications that the grower made. The highest cost item was additional fencing at an average per acre cost of $17.20. Per acre costs for other modifications ranged from $0.80 (modification of the compost storage area) to $5.40 (other modifications); these "other" modifications included purchasing air cannons to scare away wildlife, posting "no trespassing" signs, and consulting fees.

Additionally, one-third of the respondents reported removing acreage to meet buffer zone requirements. Those who removed acreage lost an average of 21 acres (representing a 1.5 percent loss in average acreage of leafy greens), with this value ranging from from 1 to 150 acres. The opportunity cost of the lost acreage (as estimated by the growers themselves) averaged $21,800 and ranged from $2,000 to $60,000; it appears that most of the respondents estimated the value of the lost acreage based on a year's worth of net income foregone. The percentage of total leafy greens acreage lost was 1.8 percent and 1.9 percent of the small and medium farms, respectively, but only 0.6 percent for the large farms. Thus, the buffer zone requirements have a greater impact on the small- and medium-size farms.

In the questionnaire, we erroneously included increased bait traps for rodents and the removal of vegetation near leafy greens fields among the list of possible LGMA-related modifications. Even though we had included these in error, we made sure that the LGMA compliance cost analysis excluded these two categories. It is curious, however, that approximately half of the respondents reported incurring costs in these categories; either they were not knowledgeable about specific LGMA provisions and/or they had made these modifications to reduce their risk of not being in compliance with the LGMA. Thus, it is possible that some costs not related to LGMA compliance could have been included in the values that our respondents reported.

Over half (55%) of the respondents had removed vegetation near growing areas for an average cost of $7,668 or $10.80 per acre of leafy greens. Adding bait traps was almost as common of a practice (48%) but substantially less costly—an average cost of $3,676 or $6.00 per acre. This is substantially lower than the example described by Paggi (2008) of a leafy greens grower/shipper who sold to a processor that required a rodent trapping station every 50 feet; the grower had to invest $480,000, or $64 per acre, for the $30 traps for his 7,500 acre operation. Additionally, the grower was required to monitor each station twice a week, and keep a log of rodent activity.

Seasonal Food Safety Program Compliance Costs

We also asked growers to report various types of seasonal impacts—costs, losses, and activities—associated with the LGMA and other food safety programs for both 2006 and 2007 (Table 5). Since 57 percent of growers reported participation in other food safety programs that may require similar types of compliance activities, we did not ask growers to disaggregate any of these costs between the LGMA and other food safety programs. With the exception of cartons lost due to flooding (flooding was not a concern in the Monterey area during 2007) and compost, the average post-LGMA impact is higher than the pre-LGMA value for each loss category; the t-test results indicate that each of these differences is statistically significant at the .05 level—except for training, which is statistically significant at the .10 level.

We also asked respondents to estimate their own per acre seasonal food safety costs for both 2006 and 2007. The reported values ranged from $0 to $100 per acre in 2006, and $1 to $200 per acre in 2007. Their reported estimates increased by an average of $30.59 an acre, from $24.04 in 2006 to $54.63

in 2007. The t-test results indicate that this difference is statistically significant at the .01 level.

The difficulty with these values is that we do not know what factors each grower took into account in their estimation. For this reason, we take each of the impacts (with the exception of compost and flooding losses) and translate them into cost estimates. In doing so, we make the following assumptions:

- A field grows leafy greens eight months out of the year, or two crops per year.
- We valued cartons lost to animal activity based on the average net price paid to growers in California for Romaine lettuce ($9.07 in 2006 and $8.30 in 2007—USDA-NASS, 2009).
- Field monitoring is carried out by general laborers, who are paid $11.39 per hour, including a 35 percent payroll overhead (Smith, Klonsky and DeMoura, 2009).
- Food safety-related documentation and personnel training are carried out by salaried staff, whose time is valued at $25.00 an hour, including benefits.

Table 6 displays our calculated cost estimates for the various seasonal food safety losses and activities. Summary statistics are reported only for those respondents reporting losses or activities.

We based the total cost estimates on animal activity losses, microbial water tests, time spent monitoring fields, time documenting standard operating procedures, and time training personnel. We excluded the cost of hiring food safety specialists from this value to avoid "double counting" the costs of time spent monitoring fields, documenting operating procedures, and training personnel.

It is not surprising that all of the respondents reported activity related to documenting food safety standard operation procedures, water testing and personnel training since these are mandated by the LGMA, as is field monitoring (97% incidence—one respondent may not have reported incurring costs in this category if he or she did not consider the value of his or her time). However, the proportions of respondents who engaged in each of these activities were also relatively high in 2006. Almost three-fourths (73%) reported product losses in 2007 due to animal activity, which stood out as the highest cost seasonal food safety expense, followed by food safety specialists

Our estimated per acre seasonal costs for food safety programs for 2006 and 2007 averaged $36.46 and $84.36, respectively; they are each approximately 50 percent higher than the mean food safety values reported by growers ($24.04 and $54.63). More importantly, the increase in the mean values between 2006 and 2007 was approximately 130 percent for both sets of seasonal costs. Thus, we can safely conclude that leafy growers' per acre seasonal costs for food safety programs more than doubled after the implementation of the LGMA.

Table 5. Growers' Seasonal Compliance Impacts Per Operation, 2006 and 2007

Food safety impact	Unit		Respondents reporting impacts: Percent	Mean	Median
Animal activity**	Cartons	2006	38	3,247	2,000
		2007	73	6,387	3,000
Flooding concerns	Cartons	2006	7	28,583	5,000
		2007	5	1,000	1,000
Field monitoring***	Hours/ week	2006	89	16.07	5
		2007	97	24.18	10
Procedures documentation***	Hours/ week	2006	83	10.86	3.5
		2007	100	17.54	6
Water testing***	Tests/ month	2006	87	12.27	3
		2007	100	19.36	9
Personnel training*	Hours/ season	2006	97	99.25	10
		2007	100	130.69	18
Compost Expenses	$	2006	31	240,250	65,000
		2007	27	264,959	50,000
Food safety specialists***	FTE	2006	36	1.31	1
		2007	53	1.45	1
Average food safety costs $/acre		2006		24.04	15
		2007		54.63	40

*Difference between 2006 and 2007 is statistically significant at .10 level.
**Difference between 2006 and 2007 is statistically significant at .05 level.
***Difference between 2006 and 2007 is statistically significant at .01 level.

Table 6. Estimated Cost of Per Acre Seasonal Food Safety Losses and Activities

Costs per acre from		Respondents reporting impacts: Percent	Mean costs ($/acre)	Median costs ($/acre)
Cartons lost due to animal activity	2006	38	60.08	26.16
	2007	73	66.14	16.20
Field monitoring	2006	89	4.12	2.14
	2007	97	7.48	3.60
Procedures documentation	2006	83	6.26	3.01
	2007	100	10.43	5.20
Water testing	2006	87	3.14	1.88
	2007	100	7.14	4.00
Personnel training	2006	97	2.47	0.71
	2007	100	3.38	1.00
Food safety specialists	2006	36	42.93	37.37
	2007	53	50.89	37.37
Total costs (excludes specialists)	2006		36.46	17.40
	2007		84.36	31.67

Effects of scale and other characteristics on growers' LGMA and other food safety compliance costs

Scale effects have been expressed as a major concern regarding growers' food safety compliance costs. During congressional consideration earlier this year to food safety legislation, small-scale farmers fought one-size-fits-all proposals, stating that large farms are better positioned to comply with food safety mandates because they tend to grow fewer crops and have more resources—financial and staffing—to support their compliance; they consider the recordkeeping requirements to be particularly onerous. Furthermore, small-scale farmers have claimed that, unlike large farmers, they have been more accountable to their customers because they rely extensively on direct marketing (Luntz, 2009). Ferd Hoefner, policy director for the National Sustainable Agriculture Coalition, based in Washington, D.C., recently reiterated this perspective, noting that food safety legislation needs to consider "the incredible diversity of systems for different types of agriculture ... we need different tiers and rules for different sectors of food and agriculture." (Natural Foods Merchandiser, 2009). Similarly, the California-based nonprofit, Community Alliance With Family Farmers (CAFF), is developing a set of basic food safety practices that all farmers can implement. CAFF is seeking "to avoid mandatory 'one size fits all' rules that could easily destroy the fresh local food system that so many have worked so hard to create. We want farmers to be able to continue to implement biological practices that in fact control pathogens" (Community Alliance With Family Farmers, 2009).

Recall that we classified farms with 2007 sales under $1 million as "small," those with sales between $1 million and $10 million as "medium," and those with sales in excess of $10 million as "large." Our efforts to evaluate the effects of size on growers' food safety compliance costs were hampered by the small number of responses to our survey from small farms; only one of the 42 respondents who reported being LGMA audited (or soon-to-be-audited) reported sales between $100,000 and $250,000 in 2007, four farms had sales between $250,000 and $500,000 and another four farms had sales between $500,000 and $1,000,000. We attributed this to the fact that many small-scale growers of leafy greens do not need to comply with LGMA because they are primarily engaged in direct marketing to consumers, grocers and/or foodservice operations. Furthermore, the problem was compounded by having only seven responses from the "small" farms for the key variable—seasonal food safety costs per acre in 2006 and 2007.

To examine the scale effects of food safety program compliance costs, we report the compliance costs in this section on a per acre basis. We reviewed per acre modification costs by size category (Table 7) using only the observations for respondents who had made a specific modification; packing area modifications are excluded because only one farm made this change. The medium farms have the highest average cost per acre for all modifications combined and for the individual modifications, except for sanitary facilities (second highest), compost storage (lowest), and other modifications (lowest). The small farms have the second highest averages for total modifications and individual modifications, except for sanitary facilities and other modifications (both highest). The large farms have the lowest averages for total costs, fencing and sanitary facilities; they only have the highest average for compost storage. Their lower modification costs are likely attributable to economies of size, as well as previously having already made many of these modifications at the behest of purchasers, prior to the LGMA's implementation.

Table 7. Mean Per Acre Modification Costs By Farm Size ($)

Modification	<$1 million	$1 million–$10 million	> $10 million
Installed additional fencing	13.38	24.02	9.84
Increased/modified sanitary facilities	7.42	2.62	2.49
Lined wells/modified water system*	1.00	4.61	1.04
Modified compost storage area	0.56	0.00	1.93
Made other modifications	10.42	1.68	3.57
Total per-acre modification costs	14.82	18.05	8.29

* Differences in distributions across size categories are statistically significant at .10 level.

We tested the statistical significance of each of these differences in the LGMA modification costs among the size groups using the Kruskal-Wallis test (a nonparametric test); specifically, it tests whether these observations come from the same distribution (i.e. the size groups have the same population median). Although some of differences look substantial, only the differences in costs to modify the water system were statistically significant at the .10 level.

Next, we examined the differences in seasonal food safety costs per acre reported by growers across the different size groups using the Kruskal-Wallis test. Although the mean value for the medium farms looks noticeably higher than those for either the small or large farms for both years (Table 8), the difference in the rankings is statistically significant at the .10 level only in 2007.

Average 2007 per acre costs are highest for the smallest farm size for every seasonal impact category, except for cartons rejected for animal activity and microbial water tests (second highest) and full-time food safety specialists (lowest). Again, we tested each of the seasonal average impacts by size category individually for both 2006 and 2007 to determine if the size groups could come from the same distribution. The difference in the rankings is statistically significant for documentation time in 2007 (at the .10 level) and food safety specialists (at the .05 level) in both 2006 and 2007. It is highly likely that total documentation effort does not vary much by acreage; thus, the difference reflects the effect of economies of size.

It is more meaningful to look at the number of food safety specialists per operation, rather than per acre. The mean number of specialists for the small farms was 0.11; only one of the nine reporting "small" farms had a food safety specialist. The means for the medium and large operations were, respectively, 0.63 and 1.33; thus, specialist staffing was more than twice as high for the large operations than for the medium operations. Further review of the data indicated that only two of the 15 large farms did not have any food safety specialists. Having such specialized staff frees operators of large farms to focus on other critical business management issues; the small farms may not be able to afford such staff.

We did not collect data pertaining to the value of management's time to review, strategize and implement compliance with food

Table 8. Mean Per Acre Seasonal Food Safety Costs in 2006 and 2007 By Farm Size

Food safety impact	Unit		<$1 million		$1 million–$10 million		> $10 million	
			N	Mean	N	Mean	N	Mean
Total seasonal food safety costs	$	2006	7	13.71	6	47.50	9	16.44
		2007*	7	38.57	9	85.89	9	33.22
Cartons rejected due to animal activity	Cartons	2006	9	6.09	15	2.16	14	0.87
		2007	9	5.78	17	8.50	13	2.66
Cartons rejected due to flooding concerns	Cartons	2006	9	1.23	15	0.00	15	0.30
		2007	9	0.25	17	0.00	15	0.03
Field monitoring	Hours/week	2006	8	0.02	15	0.01	13	0.01
		2007	8	0.02	17	0.02	13	0.02
Procedures documentation	Hours/week	2006	9	0.01	17	0.01	14	0.01
		2007*	9	0.02	18	0.01	14	0.01
Microbial water tests	Tests/month	2006	9	0.01	16	0.06	13	0.00
		2007	9	0.01	18	0.02	13	0.01
Personnel training	Hours/season	2006	9	0.10	14	0.04	12	0.02
		2007	9	0.10	15	0.08	12	0.04
Compost purchase/ production cost	$	2006	9	41.55	16	17.71	13	16.11
		2007	9	27.78	17	8.65	13	20.98
Full-time food safety specialists	FTE	2006**	9	0.00000	17	0.00023	15	0.00035
		2007**	9	0.00014	18	0.00033	15	0.00060

*Difference in distributions across size categories are statistically significant at the .10 level.
**Difference in distributions across size categories are statistically significant at the .05 level.

safety requirements; since this effort is a fixed cost, the cost per acre declines as the size of the operation increases. We investigated this issue indirectly by examining the number of full-time year-round employees by farm size; the mean values were 6.8, 18.9 and 117.0, respectively, for the small, medium and large farms, with the Kruskal-Wallis test results for the differences in the rankings being significant at the .0001 level. With an average of less than 7 year-round employees, it is safe to conclude that the small farm operators/owners did not have the benefit of either a management team or food safety specialist; they had to add food safety requirements to their already long list of managerial responsibilities.

Previous studies have suggested that cost impacts could vary by the size and other characteristics of operations. Tootelian (2008) cautiously notes that medium volume shippers (100,000 to 1 million cartons) appear to lose a higher percentage of acreage due to buffer zones and animal activity, and that they also incur higher water testing costs. Beretti and Stuart (2008) suggest that growers who sell to packer/shippers, operate on more than 500 acres, and grow conventionally make disproportionately more changes with respect to conservation practices. We therefore used ordinary least squares regression to estimate the joint effect of various factors, in addition to size, on food safety costs. Explanatory variables included indicators reflecting the presence of various environmental risk sources near fields, percentage of leafy greens sold to salad processors and the percentage of acreage in leafy greens. The two food safety cost variables that we analyzed (as dependent variables) were total modification costs per acre and total 2007 seasonal food safety costs per acre.

Despite considering a multitude of combinations of explanatory variables, we rarely had a single estimated coefficient that was statistically significant at the .10 level. None of our specifications for total modification costs explained more than 8 percent of the variation. Of the specifications for the 2007 seasonal food safety costs per acre, the only variables that were statistically significant at the .10 level were the indicator variables for size; consistent with our previous findings, the estimated coefficients indicated that the per acre seasonal food safety costs of small and large size operations were lower than those of the medium-size operations.

Conclusions

Our survey results indicate that the costs for modifications made specifically for LGMA compliance averaged $21,490, or $13.60 per acre. The modifications most commonly made were installing additional fencing and modifying bathroom/hand-washing facilities. Overall, leafy greens growers reported that their seasonal food safety costs rose by an average of 127 percent, from $24.04 per acre in 2006 to $54.63 per acre in 2007 after implementation of the LGMA. This difference was statistically significant. Since we were uncertain about the specific expenses growers included in their reported seasonal food safety costs, we estimated seasonal costs by assigning values to the specific food safety-related impacts reported by the growers. Our results indicate that $84 per acre could be a reliable average seasonal food safety cost, excluding the costs of hired food safety specialists. Thus, it is likely the average $54.63 per acre cost reported by growers is too low because growers may have not considered some costs that were not out-of-pocket expenses, such as the value of lost production due to animal intrusion and labor required to monitor fields and document food safety procedures.

We determined that growers with revenues between $1 million and $10 million had the highest per acre modification costs ($18.05), followed by growers with revenues under $1 milllion ($14.82), and lastly the growers with revenues over $10 million ($8.29). Similarly, the medium-size growers reported the highest per acre seasonal food safety costs ($85.89), followed by the small-size growers ($38.57), and the large-size growers ($33.22). It is unknown how our findings would have changed if we had obtained responses from a broader spectrum of leafy green growers with sales under $1 million—particularly under $500,000. Nevertheless, it is clear that the large operations have the lowest seasonal food safety costs per acre.

To obtain an estimate of the total food safety program cost incurred per acre by growers in 2007, we added together the mean modification costs ($13.60) and the reported mean cost per acre of the seasonal food safety costs in 2007 ($54.63). We presume that it is unlikely that the respondents included the profit lost for acreage used to meet buffer requirements, which averaged $21,490, into their seasonal cost estimates, nor the cost of time spent on food safety-related documentation, monitoring and training among operations without any food safety specialist. Thus, we can infer that the sum of the two costs—$68.23—may be at the low end of the average per acre food safety compliance costs incurred by growers in 2007, when they had to implement modifications to comply with the LGMA as well as meeting other food safety program requirements. If we use the seasonal costs estimates that we derived instead, then $100 per acre is a more reliable estimate of the total food safety costs incurred by growers per acre in 2007.

Paggi (2008) reported anecdotal evidence from a large Monterey County leafy greens grower/shipper claiming LGMA compliance costs of $210 to $260 per acre, making our average cost of $68 or even $100 appear to be quite low. According to the 2008 Monterey County Agricultural Commissioner's Crop Report, 2007 lettuce revenues averaged $7,309 per acre; thus, the average $68.23 food safety compliance cost (excluding lost acreage costs) represents almost 1 percent (0.93%) of growers' average lettuce revenues, while the $100 estimate reflects 1.3 percent of lettuce revenues. Although neither percentage sounds very high, recall that they are based on average costs and that these costs vary by size of operation.

It seems unlikely that growers have been able to obtain higher prices in order to cover part or all of their increased food safety compliance costs; Sexton, Zhang and Chalfant (2005) found that the highly consolidated grocery sector often pays below perfectly competitive prices for lettuce, which is a highly perishable product (as are all leafy greens). Our results indicate that growers with revenues over $10 million benefit from significant economies of size in complying with the LGMA and other food safety provisions; therefore they have the greatest capacity to absorb these costs. Operations with sales between $1 million and $10 million appear to be the most vulnerable, but operations with sales under $1 million could also incur high compliance costs. Furthermore, the owners/managers of these small operations do not have the personnel—neither the food safety specialists nor the management teams—to whom they can delegate the effort of reviewing food safety regulations and completing administrative activities.

After the tragic events that occurred in September 2006, California's leafy greens industry moved quickly to organize itself to restore consumer confidence in its products. Due to the differences in LGMA, FDA and private food safety requirements, leafy greens growers now face a costly and conflicting array of food safety standards that could potentially force some of them out of business. It is essential that the proliferation of public and private food safety standards be addressed, while at the same time recognizing that the one-size-fits-all approach is not appropriate. Regulators, researchers, retailers and foodservice operators, growers and other produce industry leaders must communicate and collaborate to develop standards based on sound science and spread the compliance costs equitably to maintain a diverse leafy greens production system that is sustainable for the long term.

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Appendix A
Questionnaire : University of California Leafy Greens Marketing Agreement Survey

Please return to the Small Farm Center by June 30th, 2008.

Name of Operation:
(optional) ☐

Name of person answering questions:
(optional) ☐

Title:
(Check all that apply.)
- ☐ owner
- ☐ operator
- ☐ manager

INSTRUCTIONS

If your operation did ***not*** grow any lettuce or leafy greens in 2007, answer only questions 1 through 4.

If your operation grew lettuce or leafy greens in 2007, but is ***not*** marketing through LGMA signatories, please answer questions 1 through 12 only.

Otherwise, fill out all questions (1 through 16).

Please return the completed survey to us in the enclosed envelope by June 30th, 2008.

GENERAL QUESTIONS

1. County: ☐ Fresno ☐ Monterey ☐ Santa Cruz

2. What crops did your operation produce in 2007?
(Check all that apply.)

☐ lettuce/leafy greens	☐ herbs	☐ other vegetables
☐ broccoli	☐ tomatoes	☐ fruits
☐ celery	☐ bell peppers	☐ nuts
☐ green onions	☐ root crops	☐ livestock

3. How many total acres were planted in 2007?
(Please account for any double- and triple cropping.) ☐ acres

4. Of your total cropped acreage, how many acres of **lettuce/leafy greens** (iceberg, romaine, green leaf, red leaf, butter, baby leaf, escarole, endive, spring mix, spinach, cabbage, kale, arugula and chard) did you plant in 2007?

☐ acres

(If no acres were planted in lettuce and/or leafy greens, indicate '0 acres,' STOP, and return the survey as is.)

5. How many full-time year-round workers worked on your operation in 2007?

☐ workers

6. What was your operation's total revenue in 2007? (Check one.)

- ☐ less than $10,000
- ☐ $10,000 to $50,000
- ☐ $50,000 to $100,000
- ☐ $100,000 to $250,000
- ☐ $250,000 to $500,000
- ☐ $500,000 to $1 million
- ☐ $1 million to $10 million
- ☐ $10 million and over

7. Of this total revenue, what percent came from the lettuce/leafy greens (iceberg, romaine, green leaf, red leaf, butter, baby leaf, escarole, endive, spring mix, spinach, cabbage, kale, arugula and chard) portion of your operation?

[ ] %

LETTUCE/LEAFY GREENS QUESTIONS

The following questions refer strictly to the lettuce/leafy greens portion of your operation:

8. Which of the following activities does the lettuce/leafy greens portion of your operation do? (Check all that apply.)

☐ grow ☐ pack ☐ field pack ☐ distribute

9. Are any of your lettuce/leafy greens products certified as any of the following? (Check all that apply.)

- ☐ Organic
- ☐ LGMA GAPs
- ☐ other GAPs
- ☐ other: _____

10. What percentage of your revenue from *lettuce/leafy greens* comes from sales to each of the following marketing channels?

Commodity shippers	[ ] %
Fresh-cut processors	[ ] %
Wholesalers / distributors	[ ] %
Grocers	[ ] %
Foodservice operations	[ ] %
Farmers markets / CSAs	[ ] %
Other: _____	[ ] %
	100 %

11. Are any of your lettuce/leafy greens growing fields bordered by the following types of areas? (Check all that apply.)

- ☐ riparian areas
- ☐ irrigation canals
- ☐ residential areas
- ☐ reservoirs
- ☐ septic leach fields
- ☐ drainage canals
- ☐ wild areas / woods
- ☐ grazing lands
- ☐ tree lines

12. Which of the following best describes your operation? (Check one.)

☐ This operation is *not* likely to undergo LGMA audit within the next two years.
→ **STOP: Please return the survey as is.**

☐ This operation is likely to have its first audit in the next two years.
→ **CONTINUE to fill out the survey.**

☐ This operation has already been audited by the LGMA but has not yet passed.
→ **CONTINUE to fill out the survey.**

☐ This operation has already been audited by the LGMA, and was found to be in compliance.
→ **CONTINUE to fill out the survey.**

LGMA GAPS QUESTIONS

13. When did your operation have its *first* LGMA audit?

month: ☐ year: ☐

Check box if not yet audited. ==>☐

14. Have you made the following modifications to your operation ***in order to be in compliance with the LGMA***? If yes, what was the total cost of the modification?

	NO	YES	
a) Increased the number of bait traps	☐	☐	Cost: $
b) Installed additional fencing	☐	☐	Cost: $
c) Removed vegetation near growing areas	☐	☐	Cost: $
d) Increased or modified bathroom/ hand-washing facilities	☐	☐	Cost: $
e) Lined wells/irrigation canals, or otherwise modified water sources or distribution system	☐	☐	Cost: $
f) Made modifications to compost storage areas	☐	☐	Cost: $
g) Taken acreage out of production to meet buffer zone requirements	☐	☐	Cost: $ Acres lost:
h) Enclosed and/or modified packing area	☐	☐	Cost: $
i) Other modifications/investments:	☐	☐	Cost: $

Specify: _____

15. For the following questions please give a response for both the **2006 growing season** (two years ago) and the **2007 growing season**.

	2006	2007	
a) How many cartons were lost or rejected due to animal activity concerns?			cartons
b) How many cartons were lost or rejected due to floodwater concerns?			cartons
c) How many hours per week were spent monitoring fields?			hours/week
d) How many hours per week were spent documenting operating procedures?			hours/week
e) How many microbial water tests were conducted each month?			tests/month
f) How many hours of personnel training were conducted over the entire season?			hours/season
g) How much did your operation spend to produce and/or purchase compost?			dollars
h) How many full-time food safety specialists did you employ?			employees
i) How many cartons of lettuce/leafy greens were harvested?			cartons
j) What was your average food safety cost per acre of: (circle one) commodity Romaine lettuce commodity Iceberg lettuce			$/acre

16. Please share any additional comments below:

Thank you very much for taking the time to complete this survey.
Your responses are highly valued and will be kept strictly confidential.