THE IMPACTS OF CHANGES IN THE AGRICULTURAL TRANSPORTATION SECTOR ON THE COMPETITIVENESS OF THE CALIFORNIA SPECIALTY CROP INDUSTRY FY 2009

This study addressed the lack of information available to assess how changes in agricultural transportation technology, infrastructure, and cost impact the regional and international competitiveness of California specialty crop industries. The specific approach used in this study included:

- Gathering primary and secondary data on the various modes of transportation, including product market and transportation market information by region and specialty crop sector;

- Identifying transportation modes (truck, rail, air, ports) where California specialty crop growers, shippers, and transportation industry firms are experiencing or may experience changes in their regional and international competitiveness due to logistical and cost issues associated with current and projected changes in transportation technology, infrastructure, and agricultural transportation markets;

- Evaluating the impact that changes in agricultural transport technology, infrastructure, and agricultural transportation markets will have on the future competitiveness of California specialty crop producers in the regional and international marketplace; and

- Providing policy makers and others involved with transportation policy suggestions on maintaining or improving the regional and international competitiveness of California specialty crop industries through changes and improvements in existing transportation mode services.

FINAL REPORT

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An Analysis of California Agricultural Transportation

Origins, Destinations, Modal Competition and Industry Perspectives

Selected Fresh Fruits and Vegetables

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Introduction

Transportation is critical component to the success of the national and international food system. The U.S transportation system moves agricultural commodities and products thorough a vast network of food system handlers, processors and distributors to domestic consumers and coastal ports for export to international markets. An agricultural transportation system that provides reliable, safe, and cost efficient service is critical to the current and future successful marketing of U.S. food products.

The USDA reports that the agricultural sector is the largest user of freight transportation services in this country.[1] By aggregating the movements of raw agricultural commodities with the movements of processed products and agricultural inputs, agriculture accounted for 31% of all ton-miles transported in the U.S. in 2007.

This observation is reinforced by a previous U.S. Department of Transportation (USDOT) study[2] that used input-output methods to determine the extent to which transportation is incorporated into the output of various sectors. Their study shows $0.15 of transport service is required for each $1 increase in final demand for agricultural products which is the highest transport requirement of any sector. It follows that transportation costs embodied in agricultural product prices are comparatively large implying the potential importance of transportation costs and investments on product price, regional and international competitiveness, and agricultural producers and affiliated industries profitability.

Transportation is especially important for California agriculture because of the dynamic link between the major markets for much of California's specialty crop[3] production other than California markets are the other 49 U.S states. Across the nation, U.S. consumers regularly purchase several crops produced solely in California.

Additionally, foreign markets have become relatively more important in the past six years for California exports of specialty crops. California agricultural exports reach nearly 150 countries in any given year. The 2010 export value of California's principal commodities was $39,952 million dollars. Specialty crop exports were $11,454 million or 29% of that $39,952 million dollars.[4] For a number of California specialty crops the export market is the largest market as measured by the ratio of quantity exported to quantity produced. Examples would include almonds (67%), blueberries (50%), dried plums (59%), oranges (43%), and walnuts (56%).

Table 1.1 shows the crops and livestock in which California leads the nation in production. California leads the nation in the production of 77 different crops and livestock, i.e. it is the top producer in terms of dollar value of the commodity. There are 14 commodities in this group

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[1] U.S. Department of Agriculture, Transportation Services Division, Agricultural Marketing Service. *Study of Rural Transportation Issues.* April, 2010.

[2] U.S. Department of Transportation (USDOT).Transportation Satellite Accounts: A New Way of Measuring Transportation Services in America. Bureau of Transportation Statistics, BTS99-R01. Washington. DC. 1999.

[3] Fresh fruit, nuts, and vegetables are three of the crop categories included in the USDA definition of specialty crops. The other categories include dried fruit, nursery and floriculture products.

[4] California Agricultural Exports 2010 report. Agricultural Issues Center University of California. http://www.aic.ucdavis.edu/publications/exportstable2012.pdf. The California specialty crop export figure has been adjusted by removing the wine export value.

where California producers over 99% of the production for the US. Hence, for consumers in the rest of the country to have access to products like almonds, kiwifruit, pistachios, etc., they rely on an efficient transportation network.

Table 1.1. Crops and Livestock Commodities in which California Leads the Nation[5]

Almonds	Escarole/Endive	Limes	Pigeons and Squabs
Apricots	**Figs**	Mandarins & Mandarin Hybrids 2/	**Pistachios**
Artichokes	Flowers, Bulbs	Melons, Cantaloupe	Plums
Asparagus	Flowers, Cut	Melons, Honeydew	**Plums, Dried**
Avocados	Flowers, Potted Plants	Milk	Pluots
Beans, Dry Lima	Garlic	Milk Goats	**Pomegranates**
Bedding/Garden Plants	**Grapes, Raisins**	Nectarines	Raspberries
Broccoli	Grapes, Table	Nursery, Bedding Plants	**Rice, Sweet**
Brussels Sprouts	Grapes, Wine	Nursery Crops	Safflower
Cabbage, Chinese	Greens, Mustard	**Olives**	Seed, Alfalfa
Cabbage, F.M.	Hay, Alfalfa	Onions, Dry	Seed, Bermuda Grass
Carrots	Herbs	Onions, Green	**Seed, Ladino Clover**
Cauliflower	Kale	Parsley	Seed, Vegetable and Flower
Celery	**Kiwifruit**	**Peaches, Clingstone**	Spinach
Chicory	Kumquats	Peaches, Freestone	Strawberries
Cotton, American Pima	Lemons	Pears, Bartlett	Tomatoes, Processing
Daikon	Lettuce, Head	Peppers, Chile	Vegetables, Greenhouse
Dates	Lettuce, Leaf	Peppers, Bell	Vegetables, Oriental
Eggplant	Lettuce, Romaine	Persimmons	**Walnuts**
			Wild Rice

For California specialty crop producers to continue to benefit from increasing overseas demand, exporters must be able to deliver their products to customers thousands of miles away with no substantial loss in freshness and quality. Moreover, the cost of transporting perishable products, in many cases, is substantially more than for bulk commodities: 5 to 10 percent of the free on board (fob) value of grain versus over 30 percent for important horticultural products such as lettuce and citrus. Increasingly major challenges facing California specialty crop producers in the future will be related to issues of maintaining an efficient, timely, and competitive agricultural transportation system.

The movement of these California fruits, vegetables, and nuts to distant domestic and international markets requires movement by a multimodal system of refrigerated trucks, refrigerated rail cars, intermodal refrigerated units, ocean ports and air transport. The service provided, the prices charged, and the competitive/complementary interactions among modes directly affects the competitive success of California shippers in reaching and serving these markets.

Increasingly a major future challenge facing California specialty crop producers, affiliated firms, and California public officials will be related to issues of maintaining an efficient, timely, and competitive California agricultural transportation system.

[5] California Agricultural Statistics, Crop Year 2010 (October 28, 2011). USDA, National Agricultural Statistic Service California Field Office.

Study Problem Statement and Objectives

The basic problem addressed by this study was the lack of information available to assess how changes in the agricultural transportation technology, infrastructure, and cost impact the regional and international competitiveness of California specialty crop industries.

The specific objectives associated with answering the basic problem included:

- Gather primary and secondary data on the various modes of transportation. This data would include product market and transportation market information by region and specialty crop sector.
- Identifying those transportation modes (truck, rail, air, ports) where the California specialty crop grower, shippers, and transportation industry firms are experiencing or may experience changes in their regional and international competitiveness due to logistical and cost issues associated with current and projected changes in transportation technology, infrastructure, and agricultural transportation markets. The importance will be identified by specialty crop category and California region.
- Evaluate the impact that changes in agricultural transport technology, infrastructure, and agricultural transportation markets will have on the future competitiveness of California specialty crop producers in the regional and international marketplace.
- Provide policy makers and others involved with transportation policy suggestions on maintaining or improving the regional and international competitiveness of California specialty crop industries through changes and improvements in existing transportation mode services.

Overview of the Report and Study Limitations

The primary limitation for this study as it progressed was the availability of secondary data. As noted in the overview of demand for transportation services, there is limited information available for total shipments of fresh fruit and vegetables into specific cities/markets and from designated locations. The United States Department of Agricultural, Agricultural Marketing Service last produced an annual report of Fresh Fruit and Vegetable Arrival Totals for 20 Cities in 1998. The report is no longer prepared due to budget limitations. A possible other data limitation is that shipment data is based on information obtained from various terminal markets (shipping points). While having up-to-date data would have strengthened the analysis, the past as well as the current data collection of the USDA does not fully account for the intricacies of the current transportation system in the United States.

The shipment information used in this analysis fails to captures the total shipments to various domestic market destinations (e.g. Chicago). Many California fruits and vegetables have historically been sold through terminal market (cash market) transactions with buyers and sellers developing stable and on-going relationships. There has been an increase in the use of market contracts between produce buyers and seller. These contracts take a myriad of forms from a payment for so much per pound (or box) of production to complex cost and revenues sharing

agreements. Calvin[6] provides a discussion of the recent changes that have occurred in produce marketing. The data that represent the changes do not appear to exist in the public domain. Furthermore, data for air, rail, and boat transportation appears to be limited in a usable form.

The rest of the report is broken into six key sections. The next section provides an overview of the demand for transportation services. It develops an estimate of the quantities of selected California fruits and vegetables that must be moved each year to domestic and international markets. The third section discusses characteristics of refrigerated truck transportation services. This discussion is based on two surveys regarding the issue. The first survey covered examined transportation issues from the standpoint of specialty crop refrigerated truck shipper while the second survey examined transportation issues from the specialty crop refrigerated trucker's perspective. The forth section is an overview of the rail and air transportation services and the fifth discusses ocean port specialty crop transportation issues. The final section provides insights on emerging specialty crop transportation issues and directions for additional research.

II. Demand for Transportation Services

California agricultural production encompasses a wide variety of products; the California Department of Food and Agriculture reports that 400 different commodities are grown within the state.[7] The production of specialty crops abounds, with nearly half of the fruits, nuts and vegetables produced in the United States grown in California. While per capita consumption of specialty crops by California's 37 million plus population is estimated to be above the national average the vast majority of production is exported either to other states in the United States or into the global marketplace.[8]

To better understand the overall magnitude of the demand for transportation services it was necessary to develop an estimate of the quantities of California's fruits and vegetables that must be moved each year. To accomplish this we begin with a review of the annual production tonnages of the major fruit and vegetable crops obtained from the California Department Food and Agriculture statistics. To estimate a "usual" crop, an annual average of the production of the crops for 2008, 2009 and 2010 was used.

This average is used to represent the annual tonnage production of 20 fruit crops and 22 vegetable crops (Tables 2.1 and 2.2). To provide some understanding of the seasonal nature of the demand for transportation services, the usual harvest periods and each crop's production are also provided. To give insight regarding where the overall level of demand may be headed production trends of each crop based on 10-year production data for the indicated crops were calculated. Lastly the importance of export markets for selected California fresh fruits and vegetables expressed as the percent of production being exported, which have implications for international transportation service demand, are presented in Table 2.3.

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[6] Linda Calvin and Roberta Cook (coordinators); Mark Denbaly, Carolyn Dimitri, Lewrene Glaser, Charles Handy, Mark Jekanowski, Phil Kaufman, Barry Krissoff, Gary Thompson, and Suzanne Thornsbury. U.S. Fresh Fruit and Vegetable Marketing: Emerging Trade Practices, Trends, and Issues. Economic Research Service, U.S. Department of Agriculture. Agricultural Economic Report No. 795. May 2001

[7] California Department of Food and Agriculture. "California Agricultural Highlights, 2010", www.cdfa.ca.gov/statistics

[8] Robert Wood Johnson Foundation. " F as in Fat: How Obesity Threatens America's Future, 2010", www.healthyamericans.org , page 21.

TABLE 2.1 – CALIFORNIA FRESH FRUIT PRODUCTION

FRUITS - FRESH MARKET

Commodity	Volumes in 1,000 Short Tons				U.S. Rank 2010	CA Share of U.S. Production (2010)			
	2008	**2009**	**2010**	3 Year Average	Number	Percent	Harvest Season	Leading Counties	Trend
Apples	180.0	132.5	140.0	150.8	5	3	July 15-Oct. 30	San Joaquin, Kern, El Dorado, Fresno, Stanislaus	Decrease
Apricots	77.0	59.5	59.2	65.2	1	91	May 1-July 15	Stanislaus, Fresno, Kings, Kern, San Joaquin	Decrease
Avocados	165.0	88.0	274.8	175.9	1	92	Continuous	San Diego, Santa Barbara, Ventura, Riverside, San Luis Obispo	Increase
Boysenberries	0.3			0.3	-	-	June 1-Oct. 31	Santa Cruz, Ventura, Monterey, Los Angeles, San Bernardino	Decrease
Cherries, Sweet	86.0	78.0	97.0	87.0	2	31	May 20-June 25	San Joaquin, Fresno, Stanislaus, Tulare, Kern	Increase
Grapefruit, All	174.2	160.8	150.8	161.9	2	14	Nov. 1-July 31	Riverside, San Diego, Tulare, Kern, Kings	Decrease
Grapes, Raisin Type	2,520.0	1,927.0	2,079.0	2,175.3	-	-	May 15-Nov. 15	Fresno, Madera, Tulare, Kern, Kings	Decrease
Grapes, Table Type	973.0	874.0	1,008.0	951.7	-	-	May 25-Dec. 15	Kern, Tulare, Fresno, Riverside, Madera	Increase
Grapes, All	6,548.0	6,544.0	6,716.0	6,602.7	1	90		Fresno, Kern, Napa, Sonoma, Tulare	Decrease
Kiwifruit	23.0	26.0	32.7	27.2	1	97	Oct. 1-May 31	Tulare, Butte, Yuba, Fresno, Sutter	Decrease
Lemons	562.4	798.0	798.0	719.5	1	90	Aug. 1-July 31	Ventura, Riverside, Kern, Tulare, San Diego	Increase
Nectarines	295.0	210.0	225.0	243.3	1	96	June 10-Sept. 5	Fresno, Tulare, Kings, Kern, Madera	Increase
Olives	66.8	46.3	195.0	102.7	1	96	Sept. 25-Mar. 15	Glenn, Tehama, San Joaquin, Tulare, Butte	Decrease
Oranges, Navel & Misc.	1,687.5	1,293.8	1,593.8	1,525.0	-	-	Nov. 1-Aug 31	Tulare, Fresno, Kern, Riverside, San Bernardino	Increase
Oranges, Valencia	637.5	450.0	562.5	550.0	-	-	Nov. 1-June 15	Tulare, Kern, Fresno, Ventura, San Diego	Increase
Oranges, All	2,325.0	1,743.8	2,156.3	2,075.0	2	29		Tulare, Fresno, Kern, Ventura, Riverside	Increase
Peaches, Clingstone	426.0	469.0	432.0	442.3	1	100	July 15-Sept. 15	Stanislaus, Sutter, Yuba, Merced, Butte	Decrease
Peaches, Freestone	433.0	350.0	385.0	389.3	1	54	May 10-Sept. 15	Fresno, Tulare, Kings, Stanislaus, Merced	Increase
Pears, All	243.0	255.0	220.0	239.3	2	27	Aug. 5-Oct. 5	Sacramento, Fresno, Lake, Mendocino, Yuba	Decrease
Plums	160.0	112.0	141.3	137.8	1	97	May 25-Aug. 20	Fresno, Tulare, Kings, Madera, Yuba	Decrease
Raspberries	27.2	51.3	40.5	39.7	1	55	June 1-Oct. 31	Ventura, Santa Cruz, Monterey	Increase
Strawberries, Fresh Market	930.2	1,002.0	1,041.1	991.1	1	79	--	Monterey, Ventura, Santa Barbara, San Luis Obispo, Sacramento	Increase
Tangerines, Mandarins, Tangelos & Tangors	251.2	251.2	371.3	291.2	1	67	Nov. 1-May 15	Kern, Tulare, Madera, Riverside, San Diego	Increase

Source: California Agricultural Statistice, various crop years, NASS , California Field Office, USDA

Note: Trend is based on the estimated slope of the commodity for the period of 1990-2010

TABLE 2.2 – CALIFORNIA FRESH VEGETABLE PRODUCTION

VEGETABLES - FRESH MARKET

Commodity	Volumes in 1,000 Short Tons				U.S. Rank 2010	Production (2010)			
	2008	**2009**	**2010**	3 Year Average	Number	Percent	Harvest Season	Leading Counties	Trend
Artichokes	57.2	55.9	45.0	52.7	1	99	Continuous	Monterey, Riverside, Imperial, San Mateo, San Benito	Increase
Asparagus	21.0	20.0	20.2	20.4	1	50	Jan. 1-Nov. 30	San Joaquin, Monterey, Fresno, San Benito, Imperisl	Decrease
Beans, Snap	30.4	34.6	52.5	39.2	2	21	June 1-Dec. 31	Stanislaus, Riverside, Fresno, San Diego, Santa Clara	Increase
Broccoli	928.0	920.0	858.7	902.2	1	94	Continuous	Monterey, Santa Barbara, Imperial, San Lui Obispo, Fresno	Increase
Cabbage	266.5	246.9	234.4	249.3	1	21	Continuous	Monterey, Ventura, San Luis Obispo, Imperial, Santa Barbara	Increase
Carrots	1,068.2	993.8	987.0	1,016.3	1	68	Continuous	Imperial, Monterey, Fresno, Riverside, Los Angeles	Decrease
Cauliflower	290.7	290.4	274.7	285.3	1	87	Jan. 20-Dec. 15	Monterey, Santa Barbara, Imperial, San Luis Obispo, Riverside	Increase
Celery	954.0	931.5	964.2	949.9	1	95	Continuous	Monterey, Ventura, Santa Barbara, San Luis Obispo, Imperial	Increase
Corn, Fresh Market Sweet	199.2	224.1	244.2	222.5	2	17	May 1-Dec. 1	Imperial, Fresno, San Joaquin, Contra Costa, Riverside	Increase
Cucumbers, Fresh Market	27.0	23.2	41.6	30.6	4	10	Apr. 1-Nov. 30	Ventura, San Diego, San Joaquin, Tulare, Fresno	Decrease
Garlic	195.5	187.0	180.7	187.7	1	97	Apr. 1-Sept. 15	Fresno, Kern, Santa Clara, San Benito, Mono	Decrease
Lettuce, Head	2,059.0	2,109.0	1,942.5	2,036.8	1	77	Jan. 1-Nov. 30	Monterey, Imperial, Fresno, Santa Barbara, San Lui Obispo	Decrease
Lettuce, Leaf	531.3	475.9	474.0	493.7	1	85	Continuous	Monterey, Imperial, Fresno, Santa Barbara, San Lui Obispo	Increase
Lettuce, Romaine	884.5	1,023.8	461.0	789.8	1	76	Continuous	Monterey, San Benito, Riverside, Ventura	Increase
Melons, Cantaloupe	585.0	585.6	546.0	572.2	1	58	June 1-Dec. 15	Fresno, Imperial, Merced, Stanislaus, Kern	Decrease
Melons, Honeydew	134.3	134.4	118.2	129.0	1	74	June 1-Dec. 15	Fresno, Sutter, Imperial, Riverside, Stanislaus	Decrease
Melons, Watermelon	327.7	347.2	313.5	329.5	3	15	June 1-Oct. 25	Fresno, Riverside, San Joaquin, Kern, Imperial	Decrease
Mushrooms, Agaricus	59.4	62.0	55.8	59.1	2	14	Continuous	Monterey, Santa Clara, Ventura, San Diego, Fresno	Decrease
Onions	1,507.0	1,010.2	941.3	1,152.8	1	26	May 1-Oct. 31	Fresno, Imperial, Kern, Los Angeles, San Joaquin	Increase
Peppers, Bell	403.1	379.8	387.4	390.1	1	40	Apr. 1-Oct. 31	Riverside, Ventura, Kern, San Joaquin, San Benito	Increase
Spinach, Fresh Market	206.2	220.9	216.8	214.6	1	71	Continuous	Monterey	Increase
Tomatoes, Fresh	582.8	522.0	598.5	567.8	1	41	May 15-Jan. 31	Fresno, San Diego, San Joaquin, Merced, Stanislaus	Increase

Source: California Agricultural Statistice, various crop years, NASS , California Field Office, USDA

Note: Trend is based on the estimated slope of the commodity for the period of 1990-2010

Table 2.1 provides information regarding the production of a select set of fruits produced in California. It shows that approximately half of the commodities have an upward trend, while the rest are trending lower. Grapes and oranges are the two largest produced commodities in terms of short tons in the table. Thirteen of the commodities are ranked first in production in comparison to the rest of the United States. The fruits presented in the table in total represent production that occurs throughout the year.

Information in Table 2.2 shows the amount of short tons of a select group of vegetables that were produced in California in 2008, 2009, and 2010. Head lettuce, carrots, and onions have the largest volume of production occurring in this time period. As with the fruits in Table 2.1, the vegetables in totality are grown across the whole year. In the case of vegetables, there are more commodities that are produced on a continuous basis in comparison to fruits. California ranks first in the production of 17 of the crops presented. A little more than half the crops in the table have production trends that are increasing.

Demand for international transportation services are generated by the large percentage of California fresh fruits and vegetables going to the export market (Table 2.3). For example in 2010 over sixty percent of raspberries and blackberries were exported. Exports markets account for smaller, but important outlets for California fresh vegetables. For example 36 percent of cauliflower production flows to international markets.

TABLE 2.3. Percent of Fresh Fruits and Vegetables Going to Export, California: 2010

FRUITS	EXPORT PERCENT		VEGETABLES	EXPORT PERCENT
Apples	24.7%		Artichokes	6.2%
Apricots	10.1%		Asparagus	1.2%
Avocados	14.2%		Broccoli	16.8%
Cherries, Sweet	35.9%		Cabbage	2.6%
Grapefruit	29.0%		Carrots	11.0%
Grapes All	28.0%		Cauliflower	36.0%
Kiwifruit	27.0%		Celery	11.7%
Lemons	12.9%		Garlic	14.8%
Peaches and Nectarines	10.2%		Lettuce	8.0%
Pears, All	10.0%		Melons	11.4%
Plums	41.0%		Onions	19.5%
Raspberries and blackberries	61.5%		Peppers, Bell and Chili	4.3%
Strawberries	10.7%		Spinach, Fresh Market	9.4%
Tangerines, Mandarins,	4.3%		Tomatoes, Fresh	5.7%

Source: Agricultural Issue Center, University of California, Davis

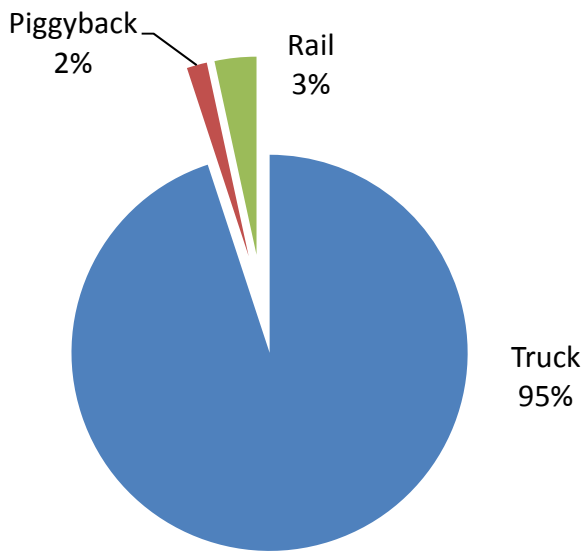
Shipments by Mode: Land-based Services

Information regarding the movement of specialty crops by alternative land-based modes is limited. For many years the USDA, Agricultural Marketing Service (AMS) has provided a

summary of shipments by mode by calendar year.[9] Data provided in these reports is admittedly not representative of the complete movements for any given commodity. However, the information provided allows for a useful approximation of the role of individual carrier modes in the shipment of California fruits and vegetables and the role California plays in the utilization of each mode and total volume usage for product deliveries. The information reported here represents movements both within California and throughout the United States. The distributions of these inter and intrastate movements among various market destinations will be discussed in the following section.

Trucks dominate as a mode of surface transportation for the United States fruits and vegetables. According to the most recent AMS movement report, shipments by truck account for 95 percent of all movements, while rail accounts for the remaining 5 percent split between refrigerated railcar and the multi-modal function of container on flatcar (Piggyback) as illustrated in Figure 2.1.

Figure 2.1. U.S. Fresh Fruit and Vegetable Shipments by Mode 2010



Source: USDA, AMS, FVAS-4, Callendar Year 2010

Shipments of fresh fruit and vegetables from California reflect the U.S. experience with truck transport accounting for 92 percent of surface movements, with rail accounting for the remaining 8 percent evenly split between piggyback and railcar (Figure 2.2).

[9] USDA, AMS. *Fresh Fruit and Vegetable Shipments: By Commodities, States, and Months,* FVAS-4 Calendar Year 2010.

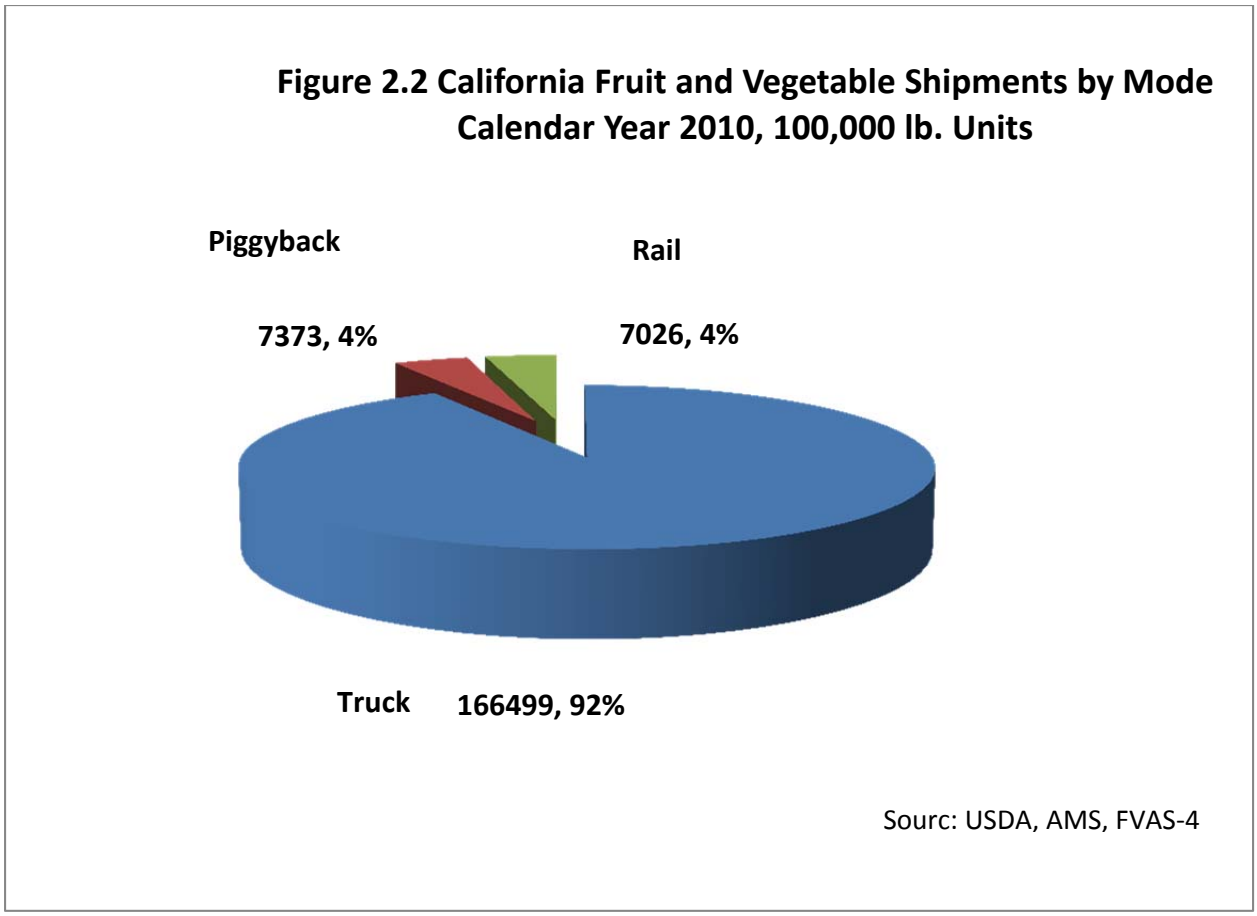
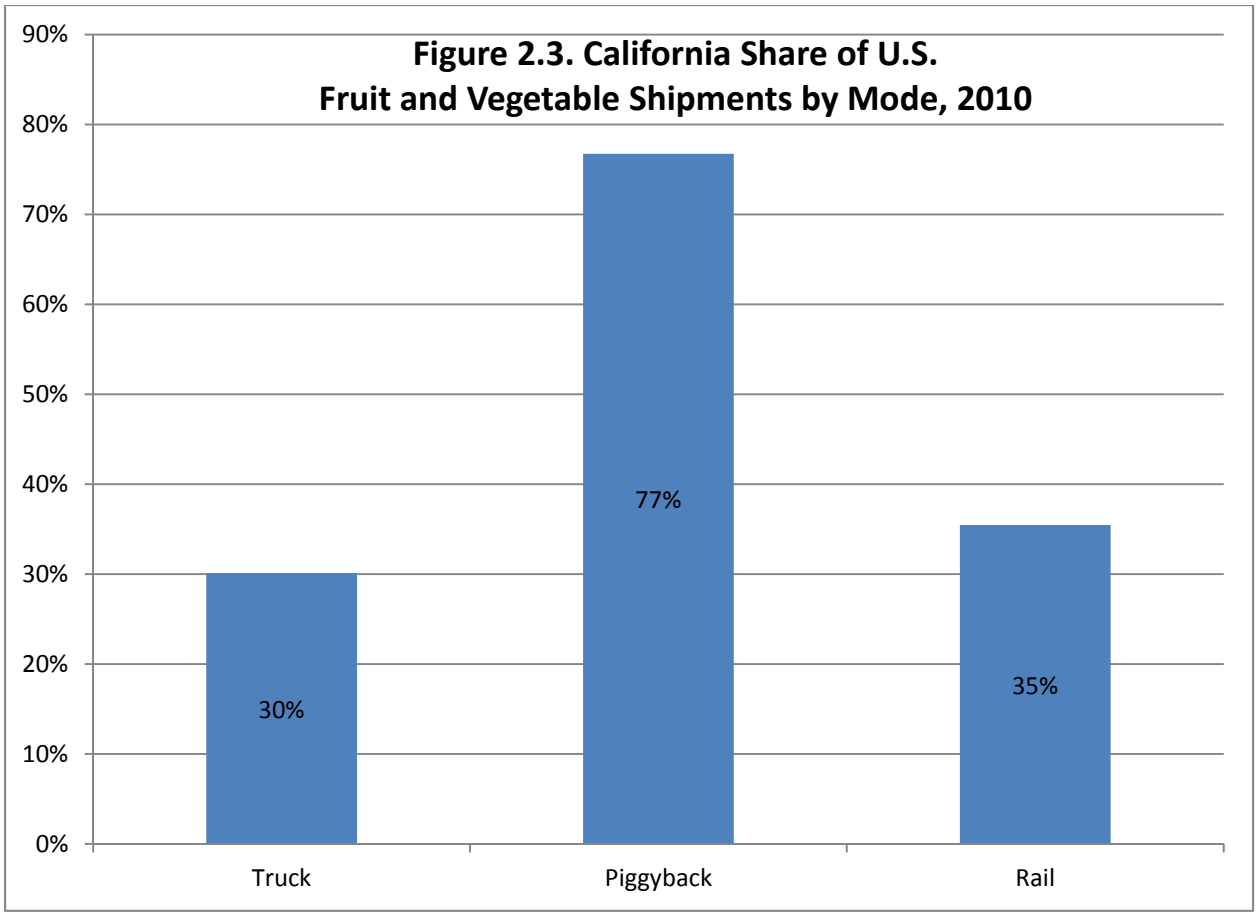


Figure 2.3 provides information on what percentage of the US total shipments of fruits and vegetables are shipped from California producers by mode. While piggyback shipments comprise a small portion of total state shipments of fruits and vegetables, California shipments take up the lion's share of total piggyback rail shipments accounting for seventy-seven percent of all recorded US movements of fruits and vegetables using the piggyback mode of transportation. Out of all the fruits and vegetable shipments across the country by truck transport, California accounted for thirty percent of total recorded truck shipments. Thirty-five percent of all rail deliveries of fresh fruits and vegetables originate from California.

On a commodity specific basis the choice of surface transportation mode appears to be linked with relative perishability. Hence, more perishable crops with higher values would utilize air transport, while less perishable low value crops might be more likely to move by rail. However for all California commodities trucks remain the dominant transportation as described in Appendix Tables 1-2.



Shipments to Selected Markets

Domestic shipments of California specialty crops are directed toward markets throughout the United States. In the existing supply chain, shipments from California travel to major regional distribution centers for subsequent repackaging, storage and additional handling and/or transit to other markets for delivery to their final destination. As mentioned earlier, data on fresh produce shipments are limited and those reported here include movements for export, for California markets along with product destined for markets outside of California in other western and eastern states. To develop a better approximation of actual domestic shipments outside of the state of California a subset of commodities produced in the state was examined in greater detail. In addition to the subset of commodities an effort was made to describe market destinations based on historical information to aid in understanding where the demand for enhanced transportation services may most likely be present.

The commodities selected for this study were chosen to represent a mix of specialty crops that reflect the overall variation in perishability and the broad category of the many commodities produced in California. These include root crops (celery), stone fruit (cherries), vine crops (table grapes), leafy green (head lettuce), stone fruit (peaches), berries (strawberries), common vegetables (sweet corn, fresh tomatoes), and melons (watermelon). The refined shipment volume estimates by mode are presented in Table 2.4.

Limited information is available for total shipments of fresh fruit and vegetables into specific cities/markets and from designated locations. However, the United States Department of Agricultural, Agricultural Marketing Service, has historically produced an annual report of Fresh Fruit and Vegetable Arrival Totals for 20 Cities, but has ceased production of this report due to budget limitations. The last year this report was available is for the calendar year 1998, and it is utilized here to provide general information regarding key markets for California fresh fruit and vegetables.

TABLE 2.4. Shipments by Months: 2010

California Fruits (100,000 LBS)

Commodity	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
TRUCK:													
Cherries, Sweet					476.59	444.62							921.21
Grapes, Table	50.76				100.80	583.07	938.42	1974.75	2372.16	2139.37	1989.25	836.17	10984.77
Peaches, Fresh Market					123.87	663.54	907.82	869.71	585.58	269.40	0.87		3420.79
Strawberries	218.55	402.60	1458.54	2279.84	2737.65	2646.78	2073.94	1698.95	1457.39	889.16	422.15	169.09	16454.64
Sub Total	**269.32**	**402.60**	**1458.54**	**2279.84**	**3438.91**	**4338.00**	**3920.18**	**4543.41**	**4415.14**	**3297.93**	**2412.27**	**1005.26**	**31781.40**
PIGGYBACK:													
Grapes, Table							5.80	13.05	41.34	14.50	10.15	3.63	88.48
Peaches, Fresh Market					2.60	8.66	14.73	14.73	9.53	2.60			52.84
Sub Total					**2.60**	**8.66**	**20.53**	**27.78**	**50.87**	**17.10**	**10.15**	**3.63**	**141.32**
RAIL													
Grapes, Table						11.60	7.25	31.18	118.93	88.48	39.16	18.13	314.74
Peaches, Fresh Market					0.87					2.60			3.46
Sub Total					**0.87**	**11.60**	**7.25**	**31.18**	**118.93**	**91.07**	**39.16**	**18.13**	**318.21**
Grapes, Table total	**50.76**	**0.00**	**0.00**	**0.00**	**100.80**	**594.67**	**951.48**	**2018.99**	**2532.44**	**2242.35**	**2038.57**	**857.92**	**11387.99**
Peaches, Fresh Market total	**0.00**	**0.00**	**0.00**	**0.00**	**127.34**	**672.20**	**922.55**	**884.43**	**595.11**	**274.60**	**0.87**	**0.00**	**3477.09**

Shipments by Months: 2010

California Vegetables (100,000 LBS)

Commodity	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
TRUCK:													
Celery	927.58	889.76	1091.45	1036.83	1166.04	1187.05	872.95	926.53	924.43	1148.18	1797.38	1194.40	13162.57
Corn, Sweet				135.51	356.88	200.72	238.40	209.78	132.25	64.85	72.10	11.96	1422.45
Lettuce, Head	1181.29	1025.52	1376.01	3063.57	3154.44	3141.46	2894.81	2920.78	2907.80	3362.14	2206.81	1077.44	28312.06
Melons, Watermelon					54.31	184.72	271.01	309.61	153.01	30.60	0.00	0.00	1003.26
Tomatoes						86.31	1159.29	1282.91	1562.82	1508.01	459.52	8.16	6067.02
Sub Total	**2108.87**	**1915.28**	**2467.46**	**4235.90**	**4731.67**	**4800.25**	**5436.47**	**5649.61**	**5680.30**	**6113.78**	**4535.81**	**2291.96**	**49967.36**
PIGGYBACK													
Celery	93.49	79.84	97.70	125.01	114.50	104.00	80.89	73.53	73.53	65.13	94.54	99.80	1101.96
Lettuce, Head	0.00	0.00	0.00	155.77	129.81	116.83	90.87	90.87	90.87	103.85	51.92	0.00	830.80
Melons, Watermelon					0.00	2.21	7.17	5.79	5.79	0.83	0.00	0.00	21.78
Tomatoes						4.67	36.15	36.15	38.49	48.98	19.83	0.00	184.27
Sub Total	**93.49**	**79.84**	**97.70**	**280.78**	**244.32**	**227.70**	**215.08**	**206.35**	**208.68**	**218.79**	**166.30**	**99.80**	**2138.81**
RAIL													
Celery	28.36	39.92	30.46	33.62	69.33	66.18	45.17	25.21	22.06	31.51	95.59	79.84	567.26
Tomatoes						4.67	17.49	14.00	15.16	19.83	0.00	0.00	71.14
Sub Total	**28.36**	**39.92**	**30.46**	**33.62**	**69.33**	**70.85**	**62.67**	**39.21**	**37.22**	**51.34**	**95.59**	**79.84**	**638.40**
Celery total	**1049.43**	**1009.52**	**1219.61**	**1195.45**	**1349.87**	**1357.23**	**999.01**	**1025.27**	**1020.02**	**1244.82**	**1987.52**	**1374.03**	**14831.79**
Lettuce, Head total	**1181.29**	**1025.52**	**1376.01**	**3219.35**	**3284.25**	**3258.29**	**2985.68**	**3011.65**	**2998.66**	**3465.99**	**2258.73**	**1077.44**	**29142.86**
Melons, Watermelon total	**0.00**	**0.00**	**0.00**	**0.00**	**54.31**	**186.92**	**278.18**	**315.40**	**158.80**	**31.43**	**0.00**	**0.00**	**1025.04**
Tomatoes total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**95.64**	**1212.94**	**1333.06**	**1616.47**	**1576.82**	**479.34**	**8.16**	**6322.43**

Source: Distribution is taken from: Fresh Fruit and Vegetable Shipments by Commodities, States, and Months, Agricultural Marketing Service, Fruit and Vegetable Programs, USDA, FVAS-4 Calendar Year 2010, Issued February 2011. Production data: NASS, USDA; Consumption: ERS, USDA

The data provided from this report do not capture all shipments from California, since there are likely many cities, not included in this report, that receive smaller volumes individually but comprise a significant portion collectively. More recent studies suggest that while regional groupings may have expanded to include larger service areas, the destinations remain similar in-terms of the major city hub market that defines each region (Figure 2.4).[10]

The amount of shipments (as measured in 100,000 lbs. units) to each of the selected cities for California divided by modal choice is provided in Table 2.5 (truck and rail + piggyback). In this case the volumes presented include all recorded shipments to account for sizeable intra-state movements. The California production origins and the commodity movement volumes and destinations are additionally illustrated geographically in Figures 2.5 a/b - 2.12 a/b. Those products where rail movements are notable are illustrated in Figures 2.13 – 2.16.

Figure 2.4 Regional Distribution/Consumption Centers

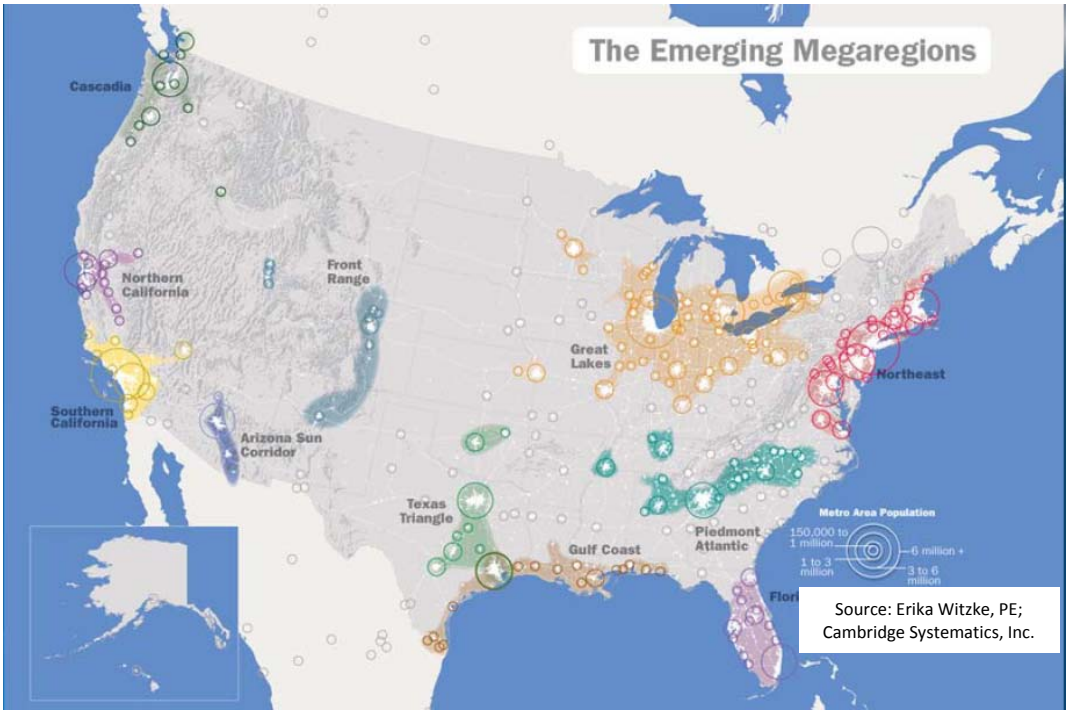


Table 2.5. Selected Commodity Shipments by Destination

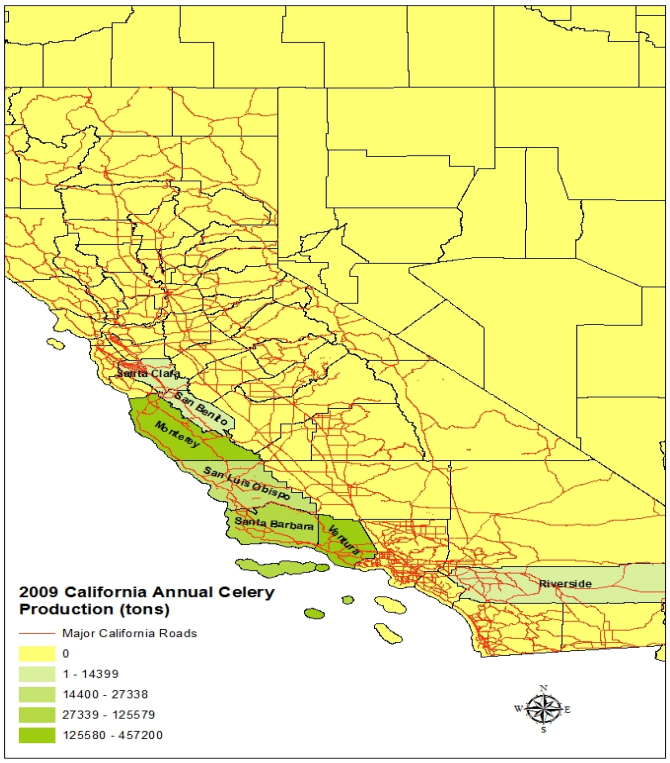
California Commodity Shipments*	Atlanta	Baltimore	Boston	Chicago	Columbia	Dallas	Detroit	Los Angeles	Miami	New York	Philadelphia	Pittsburg	St. Louis	San Francisco	Seattle	Total
CELERY-RAIL		46.67	295.58	471.14						531.15	244.46					1589
CELERY-TRUCK	522.38	889.45	540.03	1782.44	38.83	772.98	1125.94	1867.15	430.61	1284.77	607.09	564.73	490.61	942.40	670.62	12530
CHERRIES-TRUCK		103.25	68.83	206.50			68.83	516.25	34.42					240.92		1239
CORN, SWEET-TRUCK	3.75		7.50	11.25		262.48	3.75	1769.89	3.75				101.24	1327.42	434.97	3926
GRAPES-TABLE-RAIL			88.45	214.82						173.75	78.98					556
GRAPES-TABLE-TRUCK	819.03	1344.83	788.70	1526.83	65.72	854.42	1177.99	2674.49	424.68	1243.71	596.58	455.02	748.25	1612.78	813.97	15147
LETTUCE, ICEBERG- RAIL		28.78	221.70	380.51						418.89	187.59	8.53				1246
LETTUCE, ICEBERG - TRUCK	1684.79	1382.14	1603.82	2403.81	250.60	807.70	1187.45	2779.70	437.58	1339.73	684.32	746.01	709.38	852.03	454.93	17324
PEACHES-RAIL			15.78	15.78						22.72	10.73					65
PEACHES-TRUCK	83.83	180.90	141.19	489.76	0.00	313.27	313.27	864.81	114.72	83.83	75.01	105.89	229.44	847.16	105.89	3949
STRAWBERRIES-TRUCK	747.97	1078.33	1146.89	1514.65	24.93	991.07	1097.03	3085.39	193.23	822.77	436.32	623.31	635.78	1171.83	735.51	14305
TOMATOES-RAIL			45.63	59.31						73.00	41.06					219
TOMATOES-TRUCK	216.75	139.72	78.82	703.99	53.74	841.92	438.87	1393.65	42.99	309.90	50.16	87.77	168.38	512.32	163.01	5202
TOMATOES, CHERRY-TRUCK	1.71	1.71	4.79	10.94	0.68	11.28	7.86	2.74	0.34	1.03	2.05			5.81	2.05	53
WATERMELONS-TRUCK	9.74		5.84	7.79		1.95	29.21	2227.40	1.95		13.63		3.89	1090.34	247.27	3639

* Shipments in 100,000 lb. units

2010 California shipments volume from USDA/AMS/FVAS-4 2010
Allocated based on destinations from Historic shipment patterns from USDA/AMS/FVAS-3, 1998

[10] Witzke, Erika, Cambridge Systematics, Inc.

Figure 2.5 a/b California Celery Production and Distribution



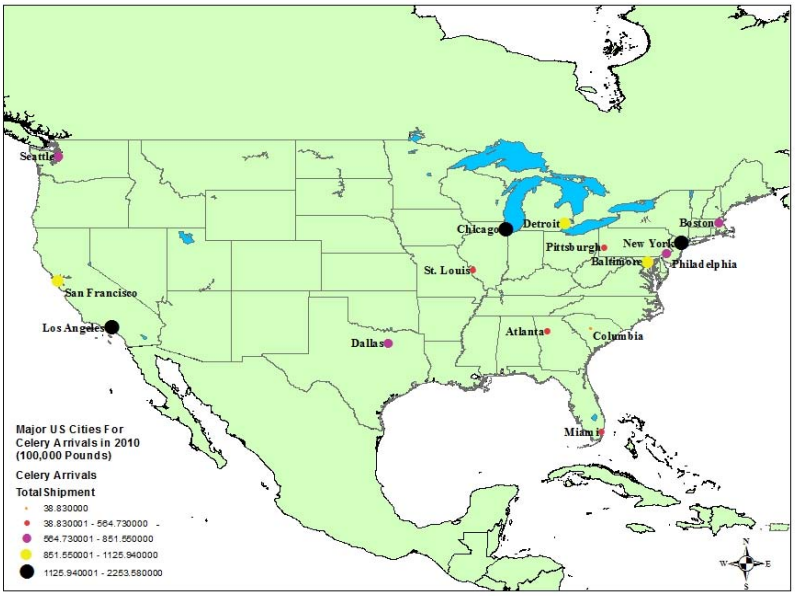
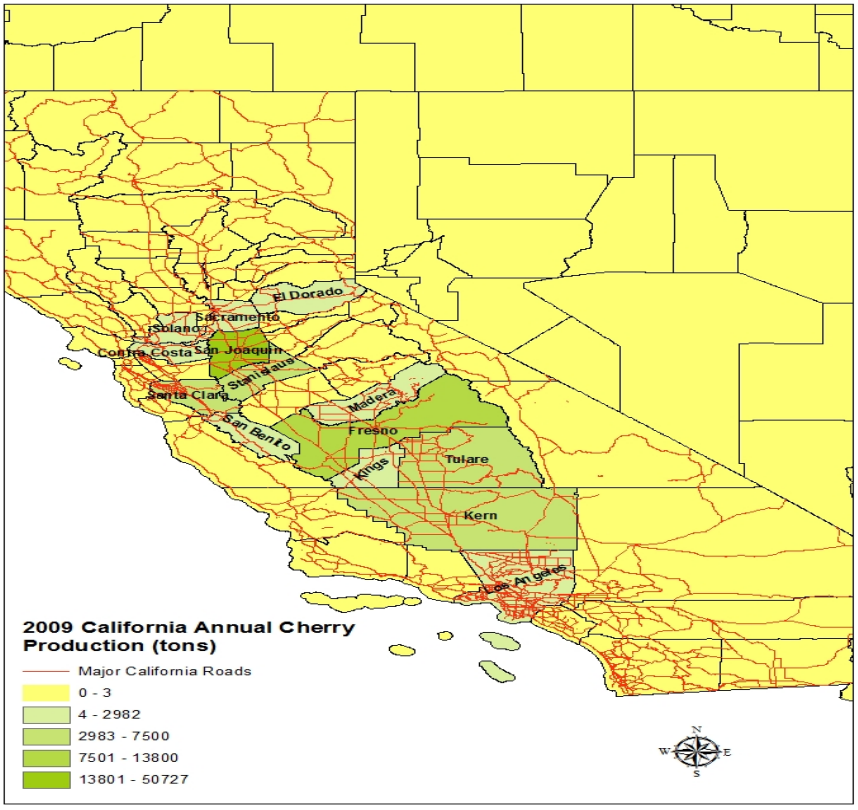


Figure 2.6 a/b California Cherry Production and Distribution



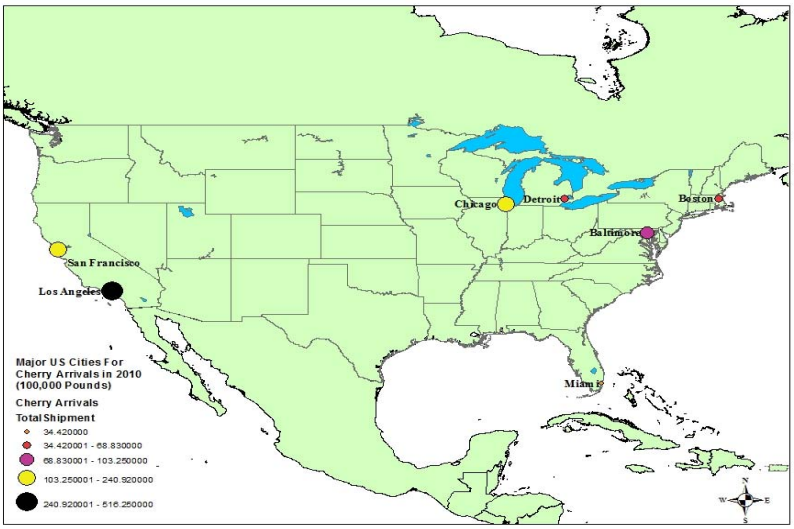
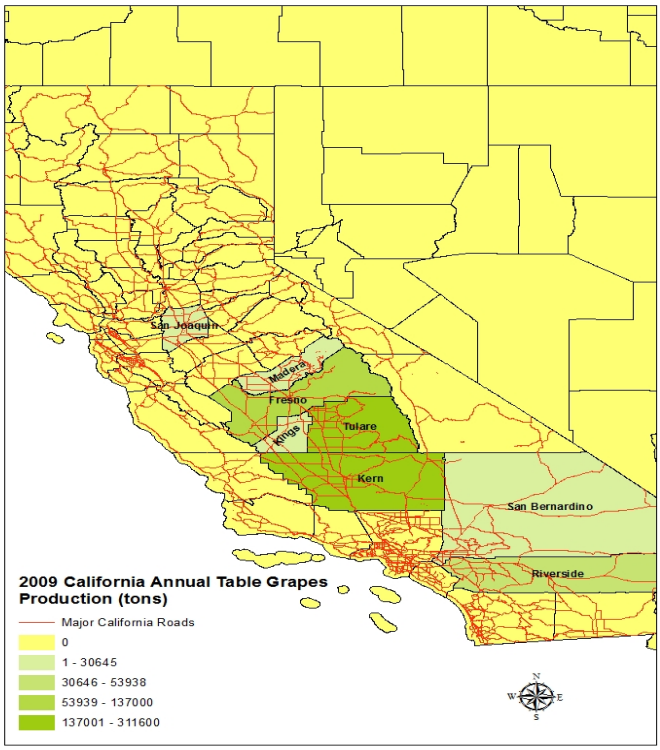


Figure 2.7 a/b California Table Grape Production and Distribution



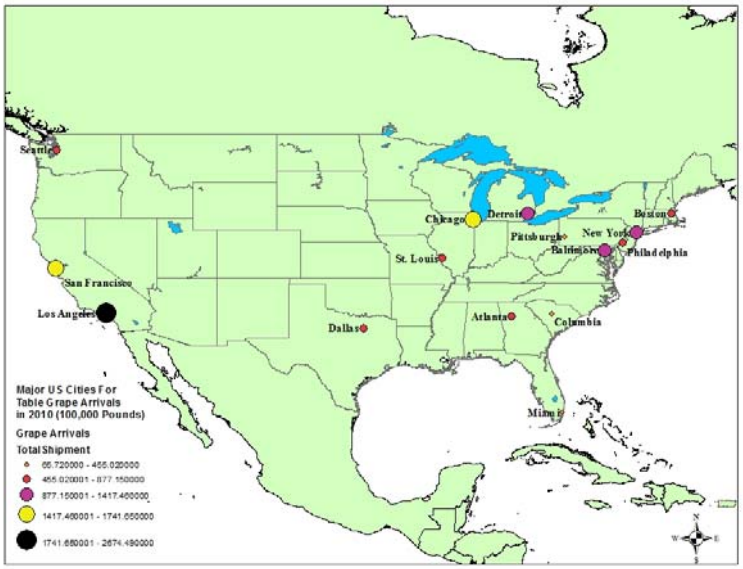
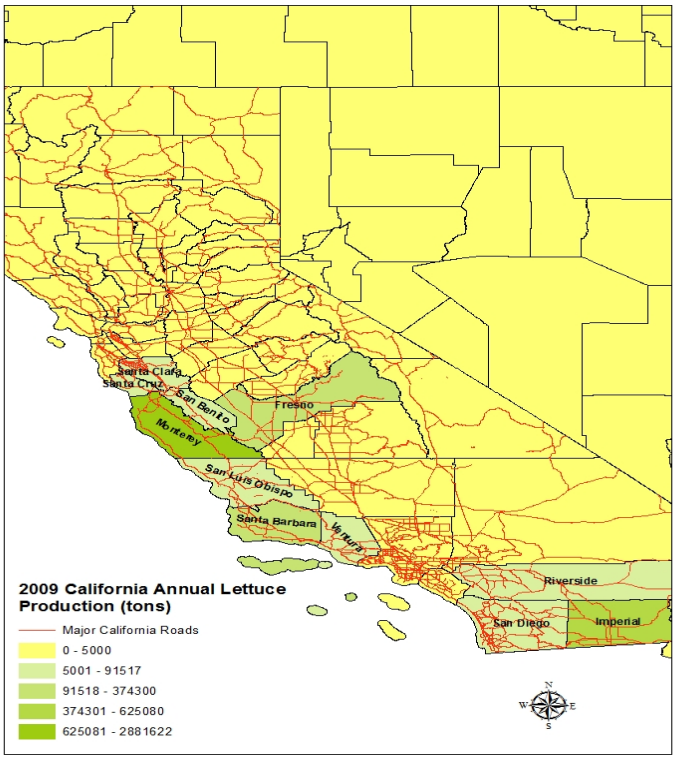


Figure 2.8 a/b California Lettuce Production and Distribution



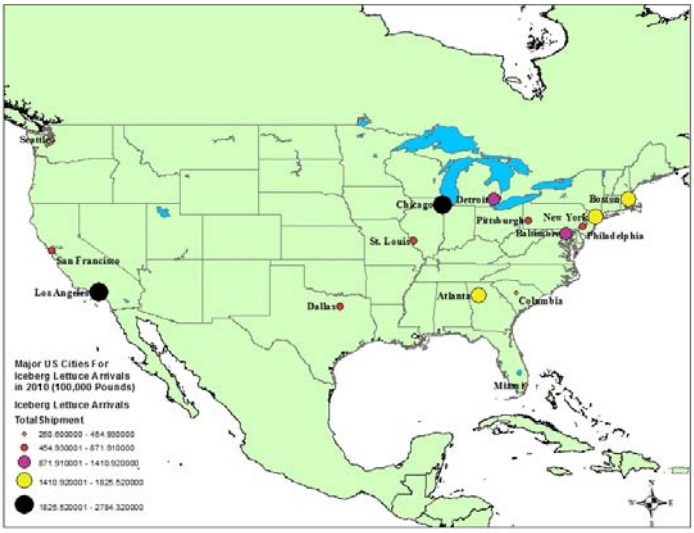
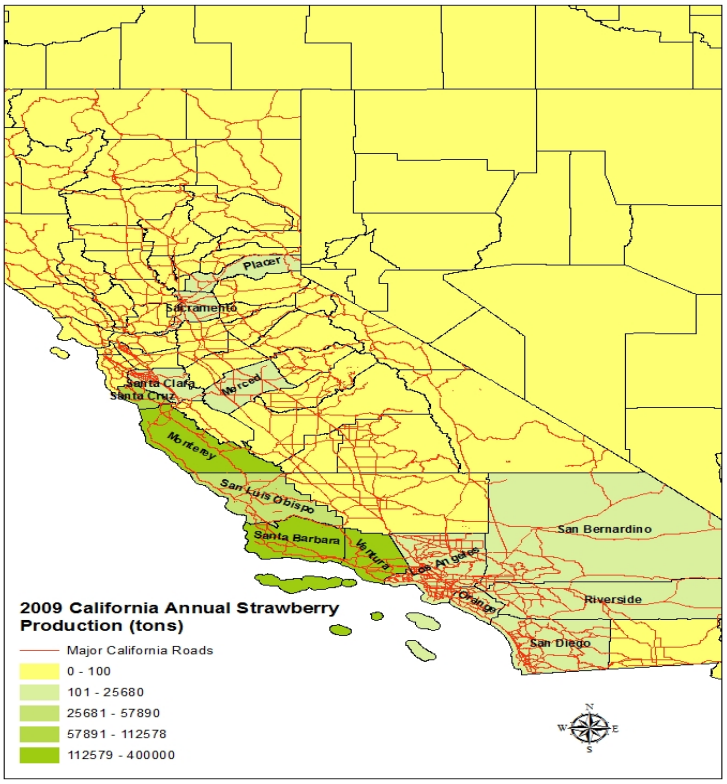


Figure 2.9 a/b California Strawberry Production and Distribution



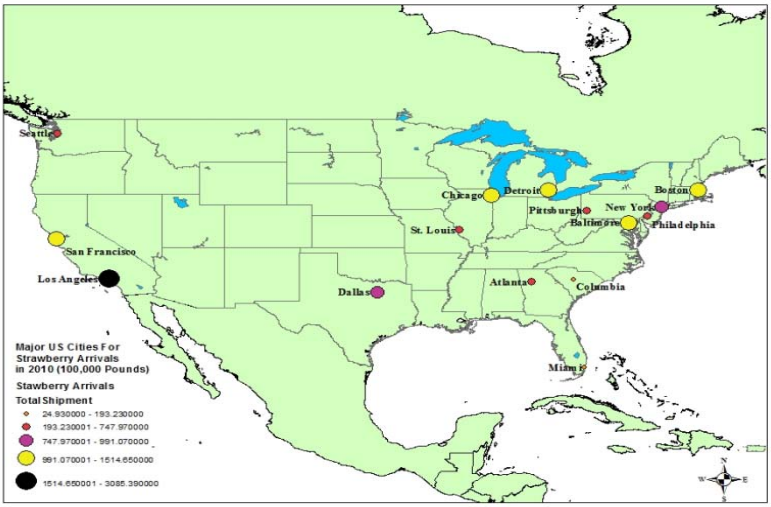
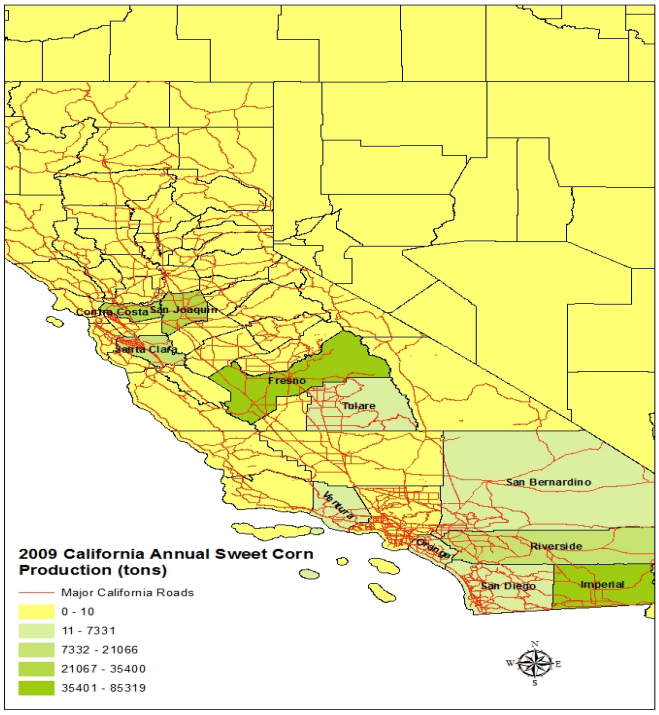


Figure 2.10 a/b California Sweet Corn Production and Distribution



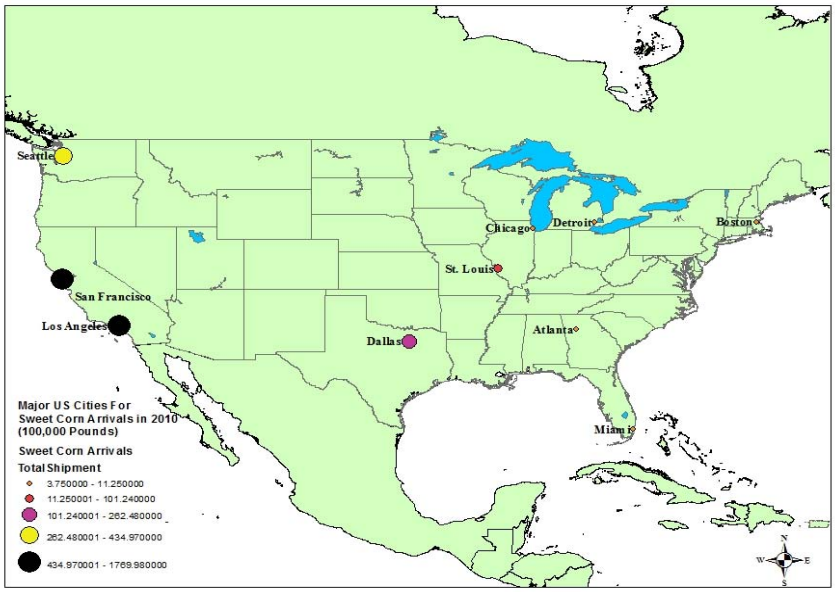
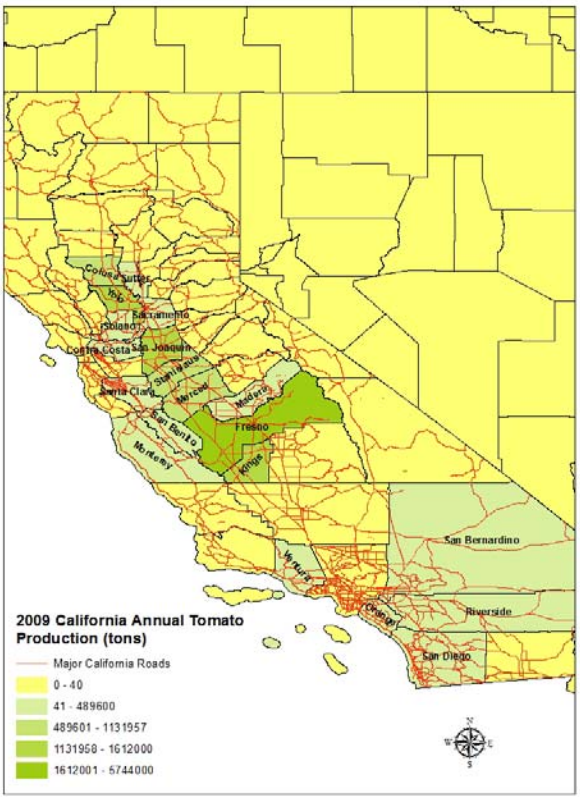


Figure 2.11 a/b California Fresh Tomato Production and Distribution



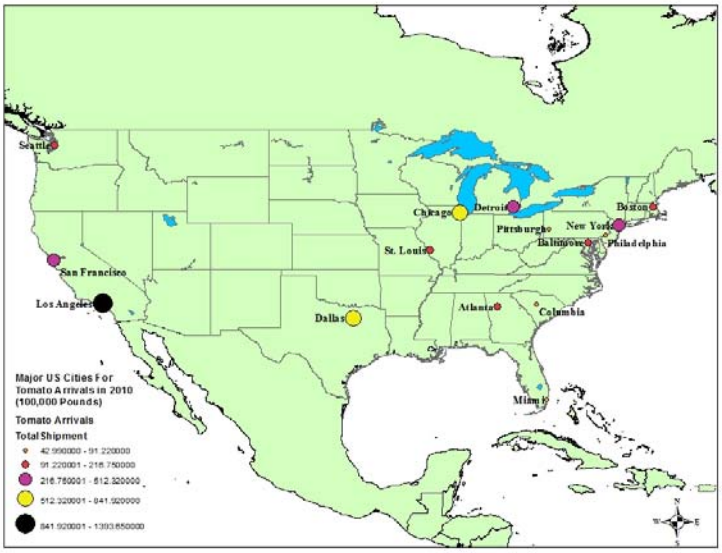
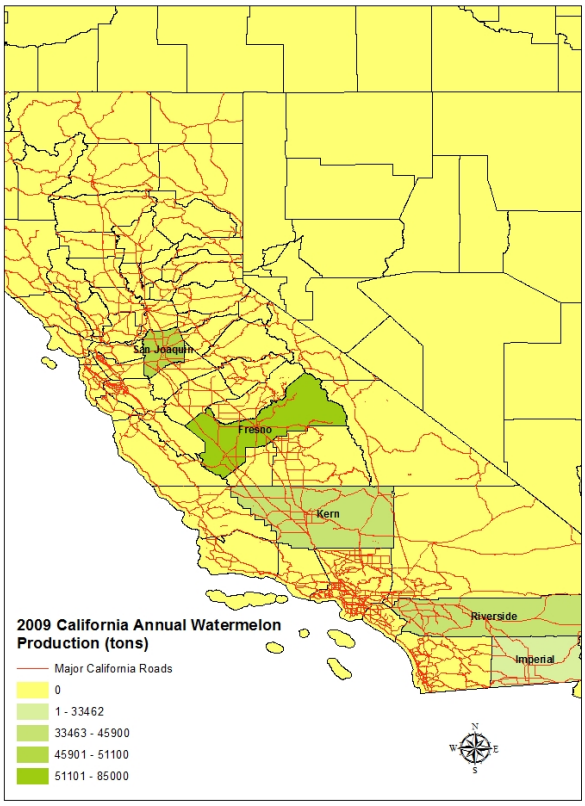


Figure 2.12 a/b California Watermelon Production and Distribution



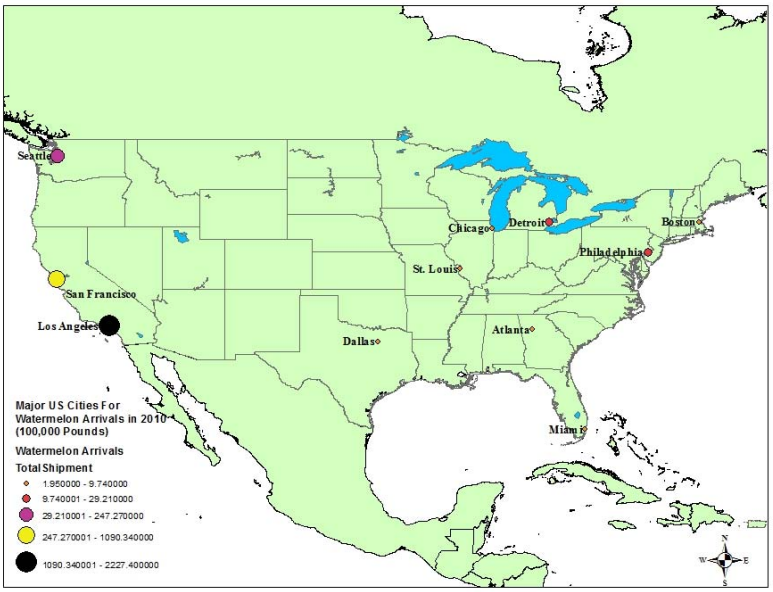


Figure 2.13 Celery Shipments by Mode, 2010

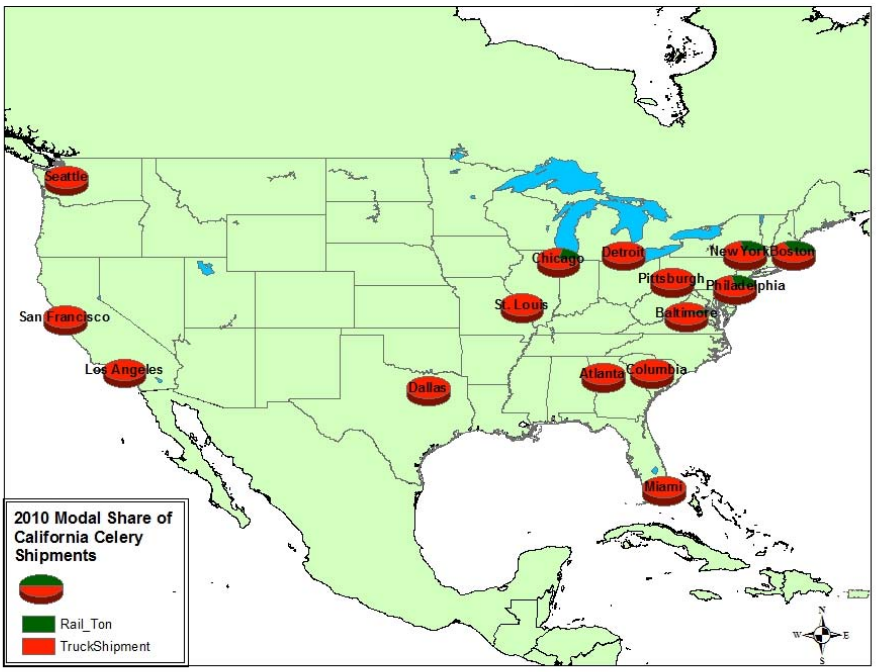


Figure 2.14 Table Grape Shipments by Mode, 2010

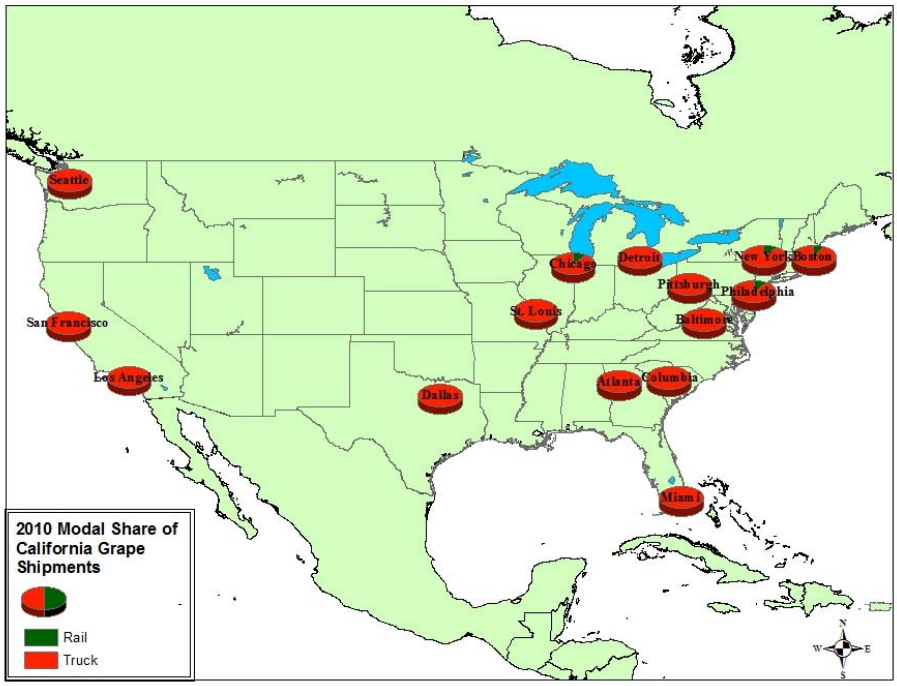


Figure 2.15 Lettuce Shipments by Mode, 2010

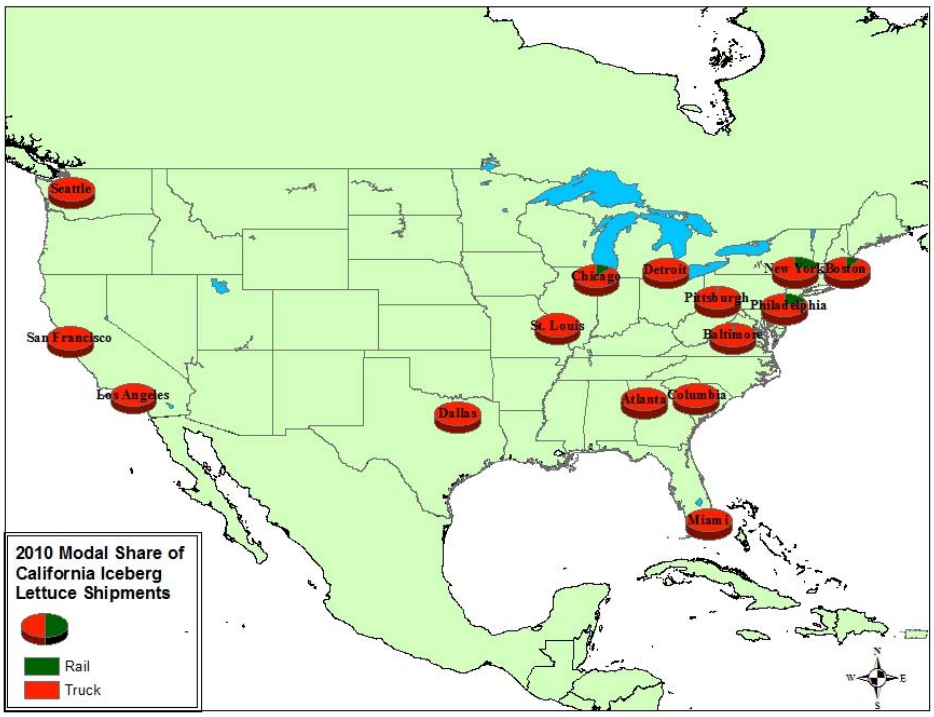
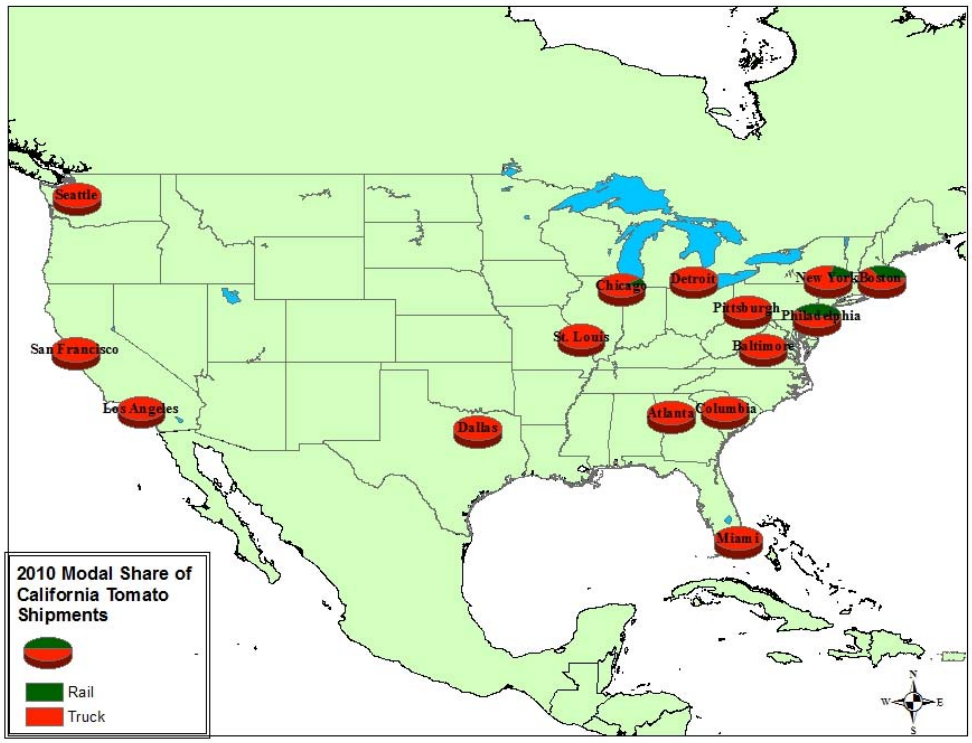


Figure 2.16 Tomato Shipments by Mode, 2010



Upon reviewing Figures 2.5 through 2.16, there are several key points that can be highlighted. Production of each of the crops examined is distributed differently across the state. For example, strawberries and lettuce are primarily produced on the coast, while cherries and table grapes are produced in the inner valleys of California. Different markets across the country have greater or lesser demand for certain products than other parts of the country. As would be expected San Francisco and Los Angeles usually have the highest demand for the crops studied, but there are times when other regions surpass some of the demand in San Francisco. When examining modal distributions, most of the products studied move by truck. It is not until Boston, New York, and Philadelphia are reached that rail starts to account for a noticeable share of the transport of the crops studied. The exception to this observation is Chicago. It is conjectured that since Chicago is along the major rail route to the upper eastern seaboard, that it does receive some rail shipments. Out of the 11 crops that were studied for this project, five of them only utilize trucks and did not ship by rail.[11]

III. Characteristics of Transportation Services: Truck

As indicated by the reported data, the mode of choice for the movement of California fresh fruit and vegetables is truck. Accordingly it is important to better understand the relationship between those who utilize these services and those that provide them. In order to formulate alternatives for improvements in the efficiency of goods movements, an understanding of stakeholder views on the current state of operations and important issues of concern are critical. With a view toward obtaining such insight a detailed survey of carriers and shippers were conducted. The results of these surveys are provided in the following sections. A copy of the survey instruments is provided in the appendix.

Description/Summary of Carrier Survey

Transportation issues can have an effect on both shippers and truckers. In the produce industry, where perishability requires the timely transport of products, transportation is a key factor in California maintaining a competitive edge over its rivals. Unfortunately, there is little information about the issues that are affecting the transportation of California fresh produce. In order to understand these issues, a survey was conducted from September 2010 to October 2010 that elicited responses from truckers/carriers who haul California fresh produce.

There were two main goals of the trucker survey. One of the goals was to develop an understanding of the transportation issues that are having an effect on truckers who transport California produce within and outside of the state. The other goal was to take a snapshot of the characteristics of the trucking industry that ships California produce.

The trucking survey was developed utilizing a previous survey conducted by Hagen, Minami, Mason, and Dunston (1999) entitled *California's Produce Trucking Industry: Characteristics and Important Issues*. While many questions from this survey overlap the study by Hagen et al., this survey incorporated new questions that are related to the current economic and transportation environment. Representatives who transport California fresh produce were

[11] It should be noted that only four out of the 11 crops studied are represented in the modal figures presented. This is because they represent the most noticeable usage of rail transport.

utilized in the design phase of the survey. These individuals provided feedback on important questions that should be asked, as well as, appropriate responses that participants would understand.

To obtain the sample, a branch of the American Truckers Association known as the Agricultural and Food Transporters Conference provided assistance. This group represents carriers/truckers on issues that affect the transportation of agricultural commodities. A letter was sent to a representative of this organization which was forwarded to a set of truckers who ship California produce. In this letter, the truckers were asked to fill out an online survey regarding their thoughts about transporting California produce. A copy of the letter and survey are available at www.csufcab.com.

The survey of truckers and carriers had thirty-eight questions that can be broken up into eight major categories. These eight categories are:

- Fleet Demographics
- Transit Times
- Capital Issues
- Labor Issues
- Issues of Importance and Satisfaction
- Use of Lumpers
- Routes
- Factors that Affect Service Charges

The first category of questions elicited general demographic information about the respondent. This information was requested to develop a snapshot of the California produce trucking industry. Information was collected on fleet size, gross revenue from 2009, and percentage of produce that is shipped from California. This section also inquired about the firm's headquarters and how many employees they have employed inside and outside of California.

The next category of questions inquired about transit times. These questions can be broken up into three main types. The first type of questions asked about time spent loading and unloading produce. This part broke-up loading and unloading time into four areas--waiting time to load, loading time, waiting time to unload, and unloading time. The next type of question related to transit time inquired about the typical length of hauls for produce. These first two types of questions differentiated between full loads, mixed loads, and partial loads. The third type of questions inquired about whether produce takes more or less time to ship in comparison to other products the company handles.

The third category of questions investigated capital issues that these truckers are facing. In regards to capital, one question asked about the average age of their trucks and the average age of their trailers. It should be noted that at the time of the survey the US economy was recovering from the "Great Recession". This recession led to a large capital shortage due to a recent downturn in the economy. Hence, a few questions were asked to gauge how this shortage was affecting the truckers. One of the questions investigated whether the truckers had any difficulty obtaining capital for fleet maintenance or expansion. Another question asked whether lack of capital was a hindrance to their future plans regarding maintenance/expansion of their fleet.

While the third category focused on capital issues, the fourth category of questions emphasized labor issues. One set of questions asked about the average age of the drivers in the fleet and whether the average age has increased over the past five years. Three questions were asked to provide an understanding regarding driver turnover and its effect. One question looked at how

long the typical driver is employed with the company. Another question inquired about whether the company has had difficulty in the last three years obtaining drivers. A third question asked whether a lack of drivers is hindering the maintenance/ expansion of the trucker's fleet.

The fifth category of questions inquired about what issues were important to the truckers and their level of satisfaction regarding particular issues. The questions related to satisfaction were a subset of the issues of importance. These issues can be broken-up into three sets. One set of issues revolved around the shipper. Another set focused on the receiver. A third set of issues focused on transportation issues and characteristics of the truckers produce load (e.g., risk, perishability, and value).

The next category of questions inquired about lumpers, who are professionals hired to assist with loading and unloading the trucks. The first question in this group asked whether the trucker utilized lumpers for unloading some of their produce loads. If the respondent answered yes to this question, he/she was asked a set of follow-up questions. The first follow-up question asked what percentage of loads do the drivers require lumpers. The second follow-up question queried whether lumpers increase or decrease unloading time. The third inquiry asked about the rates that lumpers charge.

The seventh category of questions inquired about the trucker's routes and shipments. One set of questions asked about the characteristics of the routes (e.g., single vs. multiple stops, predictable vs. varied). Another question in this category asked about the destinations of the shipments. These destinations were broken-up into major regions of the United States (e.g., Midwest, Northeast, etc.). Two questions in this group asked about congestion. One of the questions regarding congestion inquired about the percentage of shipments that were affected by congestion on major routes (e.g., Interstate 5, Interstate 80, etc.). Another question on congestion asked about the typical delay time due to when congestion is encountered on a particular route.

The eighth category of questions asked about how the truckers would change the prices of their services if there was a permanent change in the set of selected factors. These factors included regulatory issues, costs of shipping, costs of shipping by other competitors, driver availability, and road congestion. In a competitive setting, it is expected that a 10 percent permanent increase in cost of transportation would lead to a less than 10 percent increase in what the trucker would charge. This is because any single cost factor may make-up only a portion of the total costs.

The last three questions in the survey were open-ended questions. The first question asked about what strategies the truckers employ to minimize delay due to traffic congestion. The second question inquired about negative impacts that have been experienced by the truckers due to unexpected delays. The third question asked the truckers to identify the most important factors that will affect the produce trucking industry in the next five to ten years.

Service Provider Perspectives/Concerns

There were 94 trucker/carriers who responded to the request to take the survey. Of these 94 truckers who responded, it appears that eight clicked through the questions in the survey without providing any responses. Hence these eight have been dropped in the tabulation of results taking the final amount of respondents to 86.

The respondents in the survey represented trucking companies who have headquarters in 32 different states. Figure 3.1 provides the number of respondents in the survey based on where their headquarters are located. Thirteen percent of the respondents have headquarters in California. Texas and South Dakota have approximately 7 percent each of the headquarters. Five respondents are headquartered in Wisconsin, while Missouri and Nebraska have headquarters of four of the respondents each.

Figure 3.1. State Location of Respondent's Headquarters

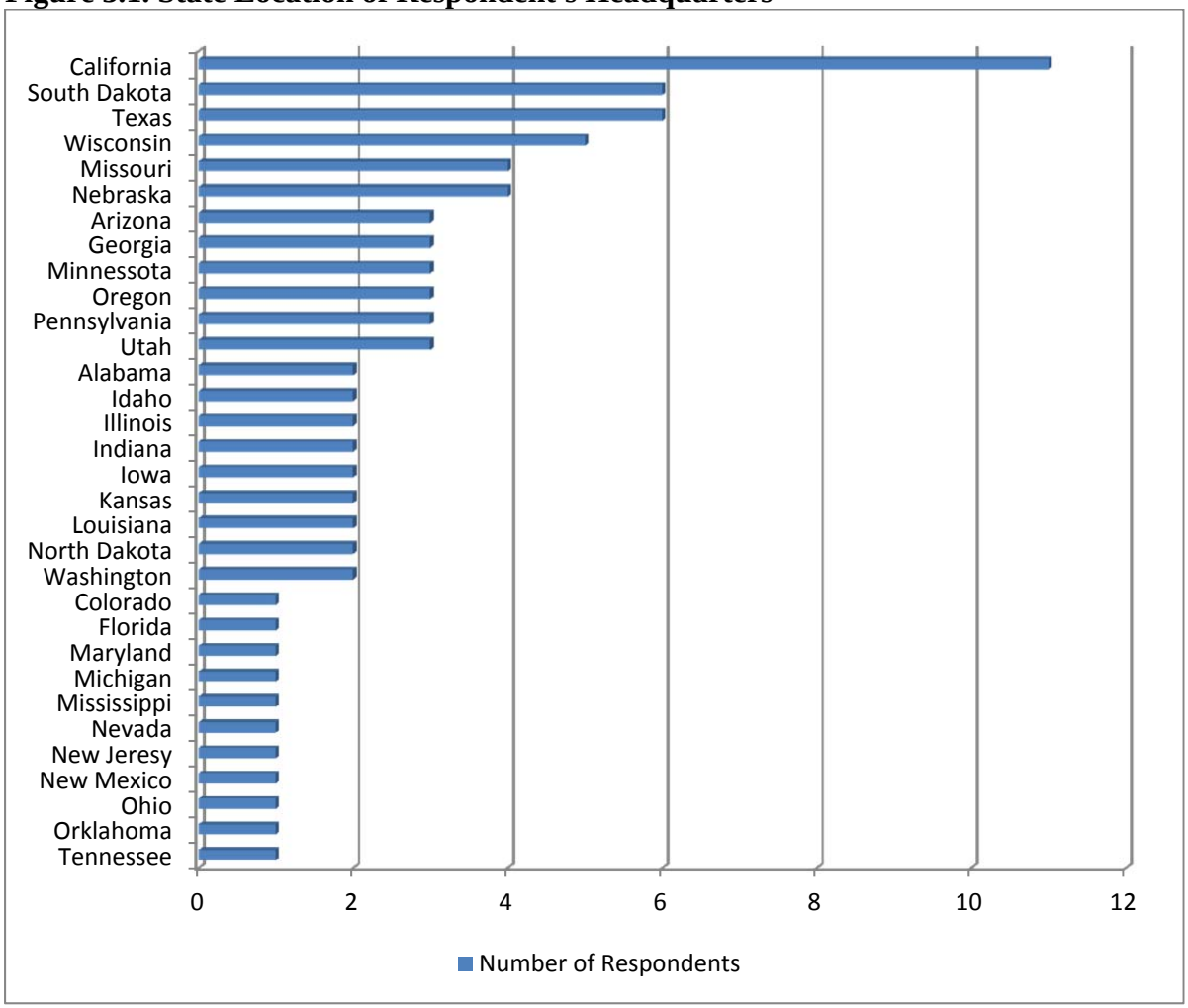


Table 3.1 provides the distribution of respondents across the number of drivers working for them outside and inside California. For those respondents who indicated that they had employees outside of California, 47.50 percent indicated that they employed between 1 to 5 drivers. Another 21.25 percent indicated that they employed between 6 and 25 truckers in their fleet. Only 2.5 percent of the respondents were representing companies that had over 1000 employees outside of California. For those companies that had truckers inside California, 61.54% had between 1 to 5 employees. There were no companies in the survey that had between 101 and 1,000 employees working in California. This information indicates that a vast majority of respondents were from smaller trucking companies. Hence the general results of the survey are weighted towards small trucking firms.

Table 3.1. Distribution of the Number of Drivers Employed by Trucking Firms Who Responded to the Survey

Number of Drivers	Outside CA	Inside CA
1-5	47.50%	61.54%
6-25	21.25%	5.13%
26-50	10.00%	17.95%
51-100	6.25%	10.26%
101-500	7.50%	0.00%
501-1,000	5.00%	0.00%
Above 1,000	2.50%	5.13%

Figure 3.2 shows the distribution of respondents based on the number of trucks in their fleet, while Figure 3.3 provides the distribution of respondents by gross revenue in 2009. Forty-nine percent of the respondents have less than five trucks in their fleet, while two percent have more than 1000 trucks. A majority of the truckers, sixty percent, earned less than $1 million in revenue in 2009, while nearly nineteen percent earned over $10 million in revenue. Since nearly seventy percent of the truckers who responded to this survey have fleet sizes less than twenty-five trucks, as seen in the previous question the responses of this survey are primarily coming from small trucking firms. The truckers in the survey leased on average approximately fifteen percent of their fleet, with a vast majority of the truckers not leasing any part of their fleet. Approximately six percent of the respondents leased one-hundred percent of their fleet.

Figure 3.2. Distribution of Respondents Based on the Number of Trucks in Their Fleet

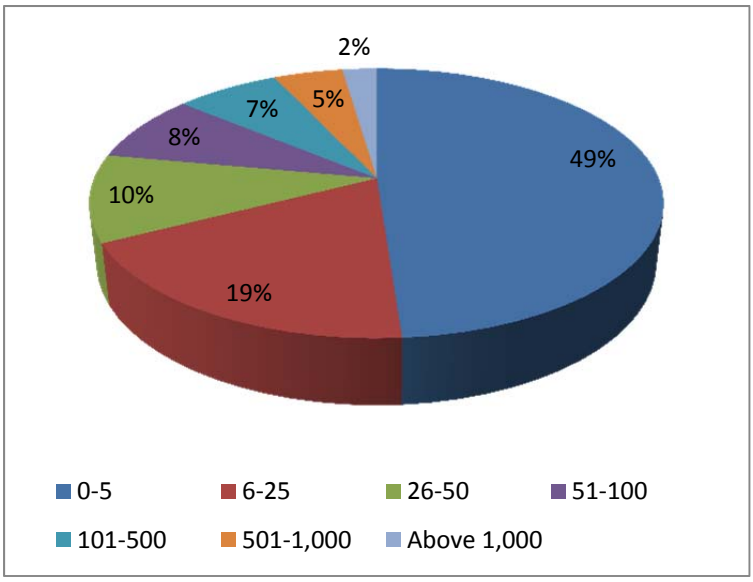
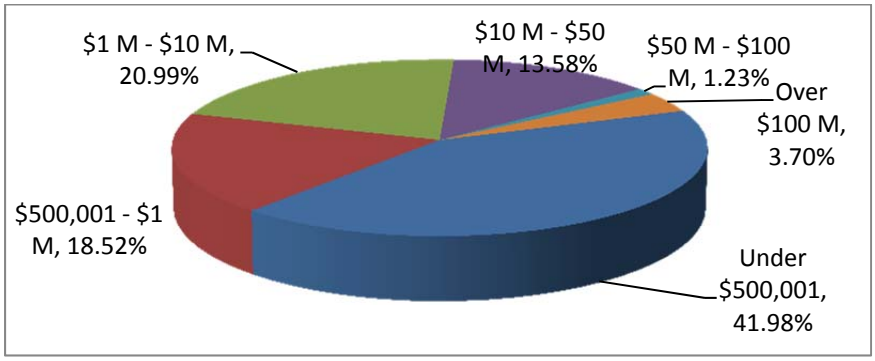


Figure 3.3. Distribution of Respondents by Gross Revenue in 2009



One of the questions on the survey asked the respondents to indicate what percentage of their loads are California produce. There were only two trucking companies in the survey that only shipped California produce. The average percentage of loads containing California produce is forty-two percent. Approximately thirty-seven percent of the respondents indicated that no more than twenty-five percent of their shipments are California produce. An equal percentage indicated that California produce made up between twenty-five and fifty percent of their total shipments. Nearly sixteen percent of the respondents indicated that over seventy-five percent of their total shipments are California produce.

One of the major factors affecting truckers is transit time. The transit time can be broken up into driving time and loading time. In the survey, a set of questions focused on the wait time for loading, load time, wait time for unloading, and time to unload California produce. This was done for full loads, mixed loads, and partial loads. In Table 3.2, it can be seen that the average wait time reported by the truckers in the survey was 6.85 hours for a full load, 9.30 hours for a mixed load, and 5.64 hours for a partial load.

The wait time for loading takes up the highest percentage of total loading and unloading time for all load types. Mixed loads appear to have on average the longest wait times and load times in comparison of the other types of loads. The average wait times and load times for a full load of fresh produce sum to 16.22 hours. Truckers spend approximately forty-percent of the loading and unloading time waiting to load the product. Eighty-nine percent of the truckers indicated that produce takes more time to load than other products that these individuals haul given the same in transit mileage.

To obtain a different perspective, the median hours were also calculated for loading and unloading times. In Table 3.2, it appears that the average data is skewed from the median data on the high side. This would imply that there are a few large responses in the data that are pulling the average above the median. Looking at the data closely shows that this is not a single data point pulling the average up. Over thirteen percent of the respondents reported a waiting time of at least 12 hours. By focusing on the median hours, a typical loading and unloading time for a full load of produce is 9 hours. Forty-four percent of this time is taken up by a truck driver waiting to load. Whether you are examining the average or median wait time before loading, both make up the highest percentage of the loading and unloading time for all types of loads.

Table 3.2. Loading and Unloading Time by Type of Load

Load Type	Segment Of Transit	Average Hours	Percentage of Total Time	Median Hours	Percentage of Total Time
Full Load	Wait Time Before Loading	6.85	42.23%	4.00	44.44%
	Load Time	3.46	21.33%	2.00	22.22%
	Wait Time for Unloading	3.03	18.68%	1.00	11.11%
	Time to Unload	2.88	17.76%	2.00	22.22%
	Total	16.22	100.00%	9.00	100.00%
Mixed Load	Wait Time Before Loading	9.30	40.61%	6.00	44.44%
	Load Time	7.15	31.22%	4.50	33.33%
	Wait Time for Unloading	3.29	14.37%	1.00	7.41%
	Time to Unload	3.16	13.80%	2.00	14.81%
	Total	22.9	100.00%	13.50	100.00%
Partial Load	Wait Time Before Loading	5.64	37.93%	3.00	37.50%
	Load Time	4.45	29.93%	2.00	25.00%
	Wait Time for Unloading	2.64	17.75%	1.00	12.50%
	Time to Unload	2.14	14.39%	2.00	25.00%
	Total	14.87	100.00%	8.00	100.00%

Another question in the survey related to transit was the length of the haul for California fresh produce. The truckers reported that the average length of a full load in miles was 1,961. Partial loads on average have the shortest haul of 1,686 miles. The truckers estimated that a mixed load on average traveled 1,872 miles. This distance would put the average load being delivered somewhere to the Midwest. Table 3.3 shows how the transit miles are distributed for full loads, mixed loads, and partial loads. Eight percent of the respondents indicated that their average transit distance was 500 miles or less for a full load. Another eight percent indicated that they travel greater than 500 miles but less than 1,000 miles for a full load. The highest percentage of respondents, thirty-two percent, travelled between 2,000 and 2,500 miles for a full load shipment of California produce. This travel distance had the highest percentage for all three load types: full, mixed, and partial.

Table 3.3. Distribution of Average Haul Length by Load Type

	Percentage of Respondents		
Average Length of Hauls (Miles)	**Full Load**	**Mixed Load**	**Partial Load**
0 to 500	8.00%	11.11%	17.14%
501 to 1,000	8.00%	8.89%	11.43%
1,001 to 1,500	12.00%	13.33%	11.43%
1,501 to 2,000	20.00%	13.33%	14.29%
2,001 to 2,500	32.00%	33.33%	31.43%
2,501 to 3,000	16.00%	17.78%	14.29%
Above 3,000	4.00%	2.22%	0.00%

The trucking firms in the survey indicated that the average age of their trucks in their fleet is 4.86 years, while the average age of their trailers is 5.59 years. Approximately fifty-five percent of the respondents indicated that they experienced difficulty obtaining capital in the last three years for expanding/maintaining their fleet. Typically, the smaller trucking firms indicated difficulty obtaining capital, while the larger firms responded that they did not have difficulty obtaining capital. Of the group that indicated difficulty obtaining capital, nearly eighty-four percent had less than twenty-five trucks in their fleet. There were no trucking companies with a fleet size over 500 reporting that they had trouble obtaining capital. Of the group of truckers who indicated that they had difficulty accessing capital, ninety-six percent believe that this difficulty has hindered their ability to maintain/expand their fleet.

The trucking industry is heavily reliant on qualified individuals to drive trucks as an occupation. The trucking companies in the survey indicated that the average age of their driver is 44.65 years old. For 59% of the companies in the survey, this average age has increased over the last five years. A typical driver will work for a trucking company for an average of 8.43 years. Forty-three percent of the trucking firms reported having difficulty finding drivers for expanding/maintaining their fleet. Of this group reporting difficulty, almost 96% believe that this difficulty finding drivers has hindered the maintenance/expansion of their fleet.

A select list of issues of importance was developed for the survey. This list can be found in Table 3.4 along with a distribution of responses that range from "Not Important" to "Very Important". The most important issue for the truckers in the survey was waiting time for loading their trailers. Over 92% of the respondents indicated this as a very important issue. Couple this result with the wait times for loading found in Table 3.2, and produce shippers should examine carefully the issue of waiting time for loading. The second highest important issue for truckers is the attitude of the shippers. This issue was closely followed by attitude of dock personnel and perishability of load. The top three issues for truckers are all related to issues with shippers. The issues of relative least importance were roadside regulations and attitude of other drivers.

Table 3.4. Truckers' Issues of Importance*

Issue of Importance	Mean Response	Not Important		Somewhat Important		Very Important
Wait time for loading	4.91	0.00%	0.00%	1.85%	5.56%	92.59%
Attitude of shippers	4.59	1.85%	0.00%	7.41%	18.52%	72.22%
Attitude of dock personnel	4.56	3.70%	0.00%	7.41%	14.81%	74.07%
Perishability of load	4.56	3.70%	0.00%	7.41%	14.81%	74.07%
Ability to load/unload easily	4.48	1.85%	0.00%	14.81%	14.81%	68.52%
Parking	4.48	0.00%	1.85%	16.67%	12.96%	68.52%
Attitude of receiver	4.41	1.85%	3.70%	9.26%	22.22%	62.96%
Wait time for unloading	4.38	3.77%	1.89%	15.09%	11.32%	67.92%
Availability of backload with current trailer	4.36	1.89%	5.66%	11.32%	16.98%	64.15%
Risk of shipment	4.31	1.85%	1.85%	20.37%	14.81%	61.11%
Value of load	4.25	5.66%	1.89%	13.21%	20.75%	58.49%
Attitude of other employees	4.17	1.85%	3.70%	20.37%	24.07%	50.00%
Attitude of dispatcher (carrier)	4.11	5.56%	3.70%	20.37%	14.81%	55.56%
Clear loading/unloading area	4.06	3.70%	3.70%	22.22%	24.07%	46.30%
Roadside regulation monitoring	3.94	7.55%	5.66%	20.75%	16.98%	49.06%
Attitude of other drivers	3.65	9.26%	9.26%	24.07%	22.22%	35.19%

*Not Important was assigned a 1, Somewhat Important was assigned a 3, and Very Important was assigned a 5 when calculating the mean response.

While the previous table presented results regarding the importance of particular issues to truckers, Table 3.5 provides information regarding truckers' satisfaction with certain issues from the previous table. The issue that truckers find the worst performance with is waiting time for loading. Given the wait times found in Table 3.2, it is no wonder that drivers are indicating a poor performance in this area. Over fifty-seven percent of the respondents recorded a poor performance for this issue. Availability of restrooms ranked second in poor performance with over fifty-three percent of respondents signifying a very poor performance record. It appears that the truckers in the survey believe that receivers of California produce are performing better than the shippers. The best performer in terms of mean response was other drivers.

Table 3.5. Truckers' Satisfaction of a Select Set of Issues*

Issue	Mean Response	Very Poor Performance		Moderate Performance		Excellent Performance
Wait time for loading	1.67	57.41%	20.37%	20.37%	1.85%	0.00%
Availability of restroom	1.94	53.70%	9.26%	29.63%	3.70%	3.70%
Attitude of shippers and their employees	1.94	42.59%	29.63%	18.52%	9.26%	0.00%
Parking	2.02	37.74%	32.08%	20.75%	9.43%	0.00%
Wait time for unloading	2.22	37.04%	18.52%	33.33%	7.41%	3.70%
Attitude of receivers and their employees	2.35	33.33%	22.22%	25.93%	12.96%	5.56%
Ability to load/unload easily	2.37	20.37%	31.48%	38.89%	9.26%	0.00%
Clear loading/unloading area	2.44	27.78%	14.81%	44.44%	11.11%	1.85%
Attitude of other drivers	2.69	12.96%	20.37%	53.70%	11.11%	1.85%

*Very Poor Performance was assigned a 1, Moderate Performance was assigned a 3, and Excellent Performance was assigned a 5 when calculating the mean response.

A set of questions was asked regarding truckers use of lumpers. Approximately 83% of the truckers have used lumpers to unload their trucks. Sixty-nine percent of respondents believed that lumpers decreased the unloading time. Over 97% of the truckers who used lumpers indicated that they were charged by the load rather than per hour where the average cost per load was $160. For the trucker that paid the lumper by the hour, he was charged an hourly rate of $45.

Trucking routes are important to the efficiency of truckers delivering their loads. Sixty-eight percent of the respondents indicated that their shipment of produce require only a single stop, while the remaining thirty-two percent are delivered to multiple places. Twenty percent of these truckers have predictable routes, while fifty-four percent have common routes that are not necessarily set. The remaining truckers have routes that vary widely. Table 3.6 provides the distribution of delivery regions for California produce. The highest percentage of loads, just over thirty-three percent, is going to the Midwest region of the country. The Southwest, Northeast, and South/Southeast each get approximately one out of six loads of produce from California based on the truckers in this survey. Around seven percent of the produce loads are staying within the state.

Table 3.6 Distribution of Delivery Regions for California Fresh Produce

Produce Destination By Region	Percentage of Loads
Instate destinations	6.76%
Pacific Northwest (Example: Seattle, Portland)	9.07%
Southwest (Example: Dallas, Houston)	14.29%
Midwest (Example: Chicago, Detroit)	33.98%
Northeast (Example: Baltimore, New York)	16.10%
South and Southeast (Example: Atlanta, Miami)	17.34%
Mountain (Example: Denver, Salt Lake City)	2.46%

One of the biggest issues that can affect a trucker's productivity is traffic congestion. A question on the survey asked the trucker to identify what percentages of their shipments are due to traffic congestion on California's major transportation routes. Another question inquired about what the typical delay was on each route due to congestion. Table 3.7 provides the results of these two questions. Interstate 5 had the highest average percentage of congestion at thirty-five percent. This congestion on average caused a typical delay of 3.21 hours. The route that had the second highest percentage of congestion was Interstate 80. The truckers in the survey found this route congested nearly thirty-two percent of the time. These truckers experience an average delay of 4.36 hours when they run into congestion on this route. This delay was ranked the second longest of the routes studied. The route that had the longest delay time at 4.63 hours was Interstate 15. This route had the fourth highest percentage of time being congested.

Table 3.7 Congestion and Typical Delay Times on Major California Routes

Major Routes	Percentage of Time Congested	Typical Delay in Hours Due to Congestion
I-5	35.03%	3.21
I-80	31.62%	4.36
I-10	27.78%	2.21
I-15	27.32%	4.63
I-40	26.06%	2.17
Port of LA/Long Beach	18.70%	1.82
Port of Oakland	16.14%	1.71
Other	14.05%	1.26
I-8	6.96%	0.76

There are many factors that affect the prices of the service truckers provide. Table 3.8 identifies a subset of factors that affect transportation costs. In the survey each factor was presented as a permanent rather than a transient change. For each factor presented, the survey inquired what percentage change in charges of service would occur if there was a permanent change in the factor. The two factors that garnered the highest percentage increase were regulatory based. The truckers in the survey indicated that if the new California regulations are permanent, then they expect to increase what they charge for shipment by at least twenty-eight percent. The 2010 Carrier Safety Administration legislation would potentially cause a nineteen percent increase in price of services charged.

The next two highest impacting factors are a ten percent permanent increase in fuel prices and a ten percent increase in road congestion. The truckers indicated that if there were a permanent ten percent increase in fuel prices, they would increase the price of services charged by approximately seventeen percent. This is an interesting finding because it may indicate that the truckers have some market power and/or the truckers did not understand the question completely. Since fuel costs make up less than 100% of the total costs to the transport goods, it is expected that a ten percent increase in fuel price should cause the price of service to increase by ten percent multiplied by the percentage of fuel costs in terms of total shipping costs assuming no market power. If you assume that fuel made up 100% of transportation cost, any increase over 10% would indicate that there was market power.

Table 3.8 Expected Change in Transit Prices Due to a Permanent Change in Selected Factors

Factor Affecting Transportation Costs	Percentage Change in Charges for Services
The New California Air Resources Board Regulations	28.92%
The Carrier Safety Administration 2010 Legislation	19.14%
10% Increase in Fuel Price	17.46%
10% Increase in Road Congestion	14.61%
10% Increase in Truck Maintenance Costs	12.44%
10% Increase in Trailer Maintenance Costs	12.38%
10% Decrease in Driver Availability	11.77%
10% Increase in Taxes	11.76%
10% Increase in Produce Shipping Insurance Costs	11.06%
10% Increase in Roadside Equipment Inspections	10.81%
10% Decrease in Rail Transportation Prices	10.14%
10% Decrease in Intermodal Transportation Prices	9.96%
10% Decrease in Airline Transportation Prices	9.22%

There were several open ended questions that were asked on the survey. The first question inquired about the strategies truckers use to handle road congestion. A large majority of the responses indicated that they would schedule pick-ups and deliveries either at night or on off-peak congestion hours. Other strategies suggested by the truckers dealt with using technology to reroute the trucks away from congested roads. Two survey respondents indicated that they would avoid doing California hauls. Two other respondents indicated that they would manipulate their logbooks to get around regulatory constraints on the number of hours that could be driven.

An interesting result that comes out of this survey is that you have many truckers who are attempting to avoid congestion and there are long wait times for loading. These two findings beg two interesting questions. First, is the wait time so long because truckers who are trying to avoid congestion are scheduling when shippers are not prepared to ship? Or since everyone is attempting to avoid congestion, shippers are inundated with trucks that they cannot handle because they do not have the infrastructure to handle the amount of truckers who want to load at night?

Another open ended question asked about the negative consequences for unexpected delays in shipments. While there were a few truckers who indicated there were no negative consequences, there was a large group that indicated that they loss backloads or other shipping opportunities from delays. Many pointed out that time was money for them. A few of the truckers indicated that they were fined for some of their late loads.

The final open ended question asked the truckers to identify the most important factors that truckers will face in the next five to ten years. A preponderance of the respondents indicated the major factor in the future will be regulations. Many of the truckers specifically highlighted the CARB regulations. Another factor that garners support from several truckers was fuel prices. A few of the truckers were concerned about waiting times at the shippers and different costs to doing business. Another couple was concerned about availability of drivers and equipment.

Description/Summary of Shipper Survey

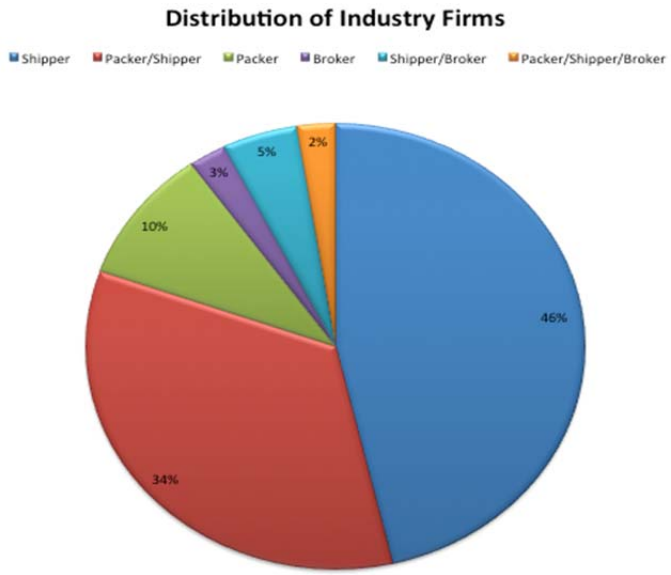
In July of 2010 an online survey was distributed to firms involved in the shipping of fresh fruit and vegetables. These firms were solicited from the members of Western Growers Association. Respondents were asked to answer thirty-four questions regarding the state of the transportation industry today with two primary goals in mind. The foremost goal was to garner a better understanding of the demographic information regarding the state and makeup of the shipping industry in California. The second goal of the survey was to try and identify potential problem areas that exist from the shipper perspective that may be inhibiting the competitiveness of California fresh fruit and vegetables.

The set of questions that were asked in the survey could be allocated to one of three major categories. The first set of questions queried about general demographic information regarding the shippers and their shipments. The second set of questions examined issues with truck availability and reliability. The third set of questions examined the shippers' perspectives and concerns of shipping produce in-state and out of state. The specific questions as well as the letter sent to the participants in our study can be found at: www.csufcab.com.

Respondent Demographics

In all, forty-two individuals responded to the shipper survey, with one of those individuals not completing any questions. This implies that the results of this survey are based on forty-one respondents. Approximately thirty-three percent consider themselves seasonal shippers, while the rest are year-round shippers. Figure 3.4 provides a break-down of the respondents by type. Of the forty-one individuals who responded to the survey, nineteen individuals indicated that they were shippers. Fourteen of the respondents specified that they were both packers and shippers, while four revealed that they were only packers. There was one broker and two shipper brokers who also participated in the survey. One of the respondents did all three, i.e., pack, shipping, and brokering.

Figure 3.4. Distribution of Respondent by Firm Types



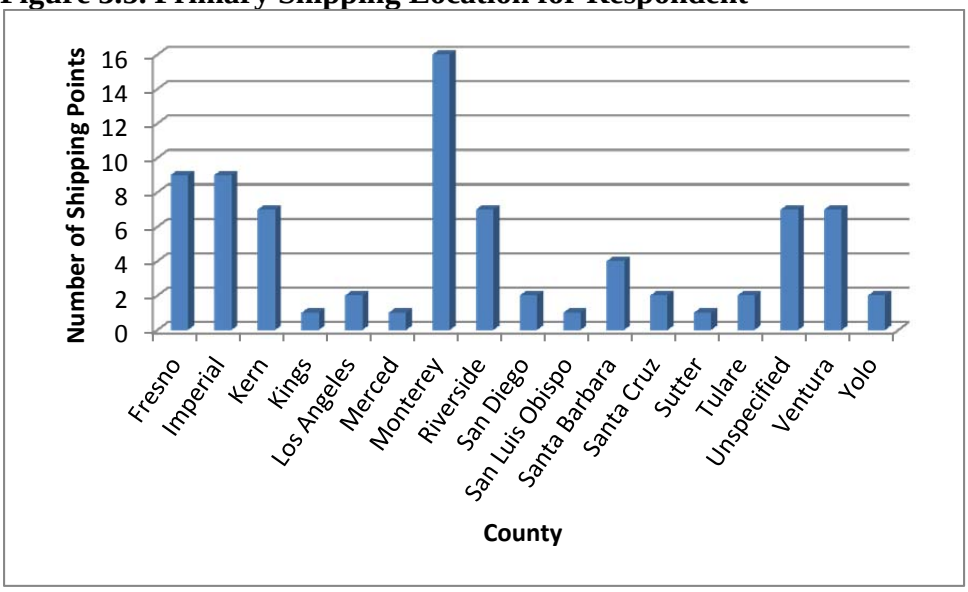
In a calendar year, the participants in the survey ship approximately 290,098 truckloads of fruits and vegetables in the continental US. The average number of truckloads for this group was 7,438. The largest shipper estimated that his company shipped 40,000 truckloads, while the smallest shipper did 100 truckloads. The median number of truckloads for the survey respondents was 3,000. The upper third of the largest producers shipped approximately eighty-two percent of the truckloads, while the lower third shipped less than three percent. The top three shippers in the survey in terms of truckloads identified themselves as only being shippers, rather than also doing brokering and packing.

Most participants in the study, ninety-two percent, ship produce to Canada and Mexico. In a calendar year, this group sent an estimated 56,830 truckloads to Canada and Mexico. This amount represents approximately sixteen percent of all truckloads that were shipped inside the continental US, and to Mexico and Canada. The largest shipper sent 8,580 truckloads of produce, while the smallest positive shipper only sent one truckload. The upper third of the shippers who sent produce to Canada and Mexico shipped 51,080 truckloads, which represents almost ninety percent of the total shipments to Mexico and Canada. In contrast, the lower third of this group accounted for only one percent of the Mexican/Canadian shipments. For those who shipped to Mexico and/or Canada, the average truckload for a respondent in the survey was 1,578 in a calendar year.

The participants in the survey were asked to provide the county and the state where there shipping points were. The respondents in the survey represent a broad group of counties and states where there shipping points are located. This group indicated that they had shipping points in thirteen different states outside of California. These states are located across the United States and represent all regions of the US. Even though they were not asked, a few of the participants indicated that they have shipping points in other parts of the world including Asia, Australia, Canada, Mexico, and the United Kingdom.

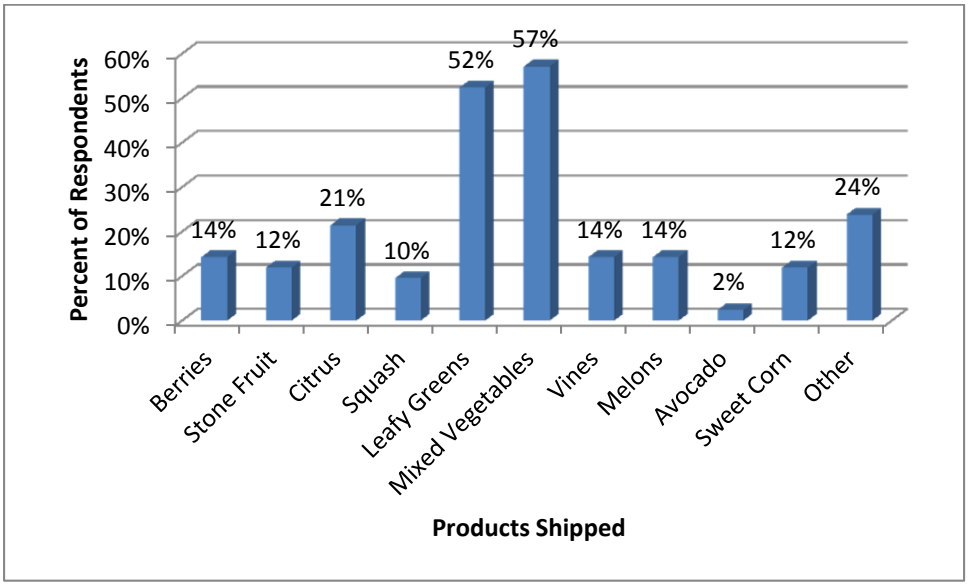
Figure 3.5 provides the number of respondents that indicated that they had a shipping point in a particular county of California. Participants in the survey had the ability to write-in up to five different counties. Examining this figure shows that sixteen out of the fifty-eight counties in California are represented in the survey. Monterey County had the largest number of shipping points represented with a total of sixteen. This is nearly double Fresno and Imperial counties which had the second largest amount of shipping points represented in California. This result suggests one of two things. Either the survey had some bias in the respondents or there are many more shipping points in Monterey County than in Fresno and Imperial counties.

Figure 3.5. Primary Shipping Location for Respondent



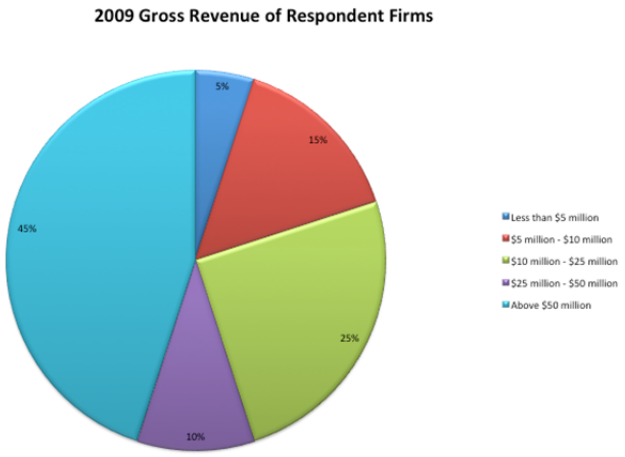
California produces well over three hundred different crops. In order to make the survey easier for the respondents, eleven category types were chosen based on the unique needs of transporting each of the type of crops. The respondents from the survey ship a variety of fruits and vegetables. Figure 3.6 provides a look at the percentage of respondents in the survey shipping particular types of products. While the survey has representation of all the types of product categories, the majority of respondents are shipping either leafy greens or mixed vegetables. This result coincides with the previous result in the survey where Monterey County had the highest number of shipping points. Over two-thirds of the respondents indicated that they shipped in more than one of the categories examined in the survey. Twenty-nine percent of the respondents shipped in only one of the categories. Another thirty-seven percent indicated that they shipped two category areas, while nearly twenty percent shipped three categories of products. There were very few firms that shipped more than three categories of fresh fruit and vegetables.

Figure 3.6. Type of Products Shipped by Respondents



There were five categories that the respondents could use to indicate how much yearly gross revenue their firms received in 2009. Figure 3.7 provides the distribution of respondents based on gross revenue. Forty-five percent of the respondents in the survey reported that they make over fifty million in gross revenue. The next largest group was the shippers that made between ten and twenty-five million dollars in gross revenue, which represents twenty-five percent of the respondents. There were very few respondents in the survey, five percent, who make less than five million dollars in gross revenue.

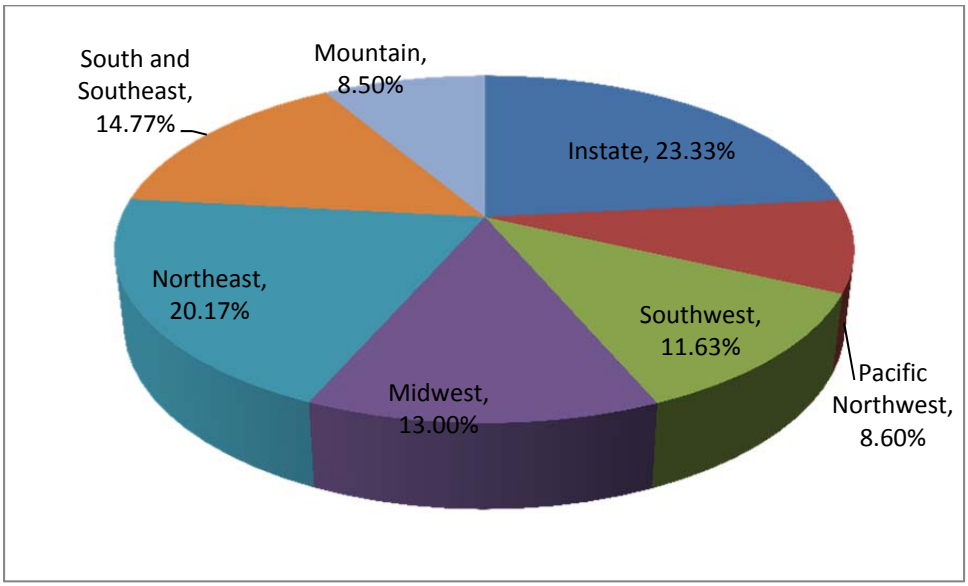
Figure 3.7. Distribution of Respondent's Gross Revenue



Except for one respondent in the survey, each individual indicated that they shipped to multiple locations across the continental US. Figure 3.8 shows the percentage of shipments that the respondents ship to different regions across the country. Nearly one-quarter of the shipments that were shipped by the respondent stayed within the state. Approximately twenty percent of

the shipments went to the Northeast. The Pacific Northwest and the Mountain states received the lowest percentage of shipments coming from California. Based on the population base of each, this is to be expected. When shipping produce across the country, shippers reported that they use temperature recording devices on approximately seventy-seven percent of their shipments.

Figure 3.8. Percentage of Shipments Shipped to Different Regions in the US



There are two primary ways that shippers quote prices to sellers which represent the location where the seller takes control of the product. A shipping point price implies that the seller assumes the transportation costs, whereas a destination price has the seller paying the transportation costs. Respondents to the survey indicated that approximately eighty-eight percent of their current domestic sales are quoted at shipping point prices. The range in responses was a low of zero to a high of one-hundred percent. When shippers look down the road five years, the percentage of prices quoted at shipping point reduces by five percent to eighty-two percent. Hence, in the next five years, the respondents to the survey expect that they will be more responsible for handling the trucking needs of the buyer.

Truck Availability and Reliability

Truck availability is an important issue for shippers of perishable fresh produce. Respondents to the survey indicated that on average, they experience difficulty getting trucks in a timely manner for ten percent of their in-state shipments. Over forty-five percent of the respondents indicated that they have experienced no difficulties in obtaining trucks, while nine percent of the respondents indicated that they experience difficulty in getting trucks in a timely manner for over half their shipments. For out of state destinations, the percentage of shipments that shippers are having difficulty finding a truck in a timely manner increases to fifteen percent. Twenty percent of the shippers from the survey indicated no difficulties getting trucks in a timely manner, while eleven percent had difficulty getting trucks in a timely manner with fifty percent or higher of their shipments. When the trucks arrive, fewer than five percent of them have issues with either the container/trailer or the refrigeration unit that delays loading.

Another important issue for shippers is that their shipments arrive to the buyer on-time. Shippers in this study reported that on average just over six percent of their shipments arrive late to the destination. Over thirteen percent of the respondents indicated no late arrivals of shipments to their destinations. One individual who reported the worst late arrival percentage indicated that one-fourth of his shipments arrive late to their destination. Forty-five percent of the respondents reported that they have lost sales due to trucks arriving late to their destination points in the last year.

Shipper Perspectives/Concerns

The second objective of surveying California shipping firms was to develop an understanding of potential concerns that may be affecting the competitiveness of California agriculture. One of the questions in the survey asked shippers to rate various different domestic services offered by their carriers. These services were related to availability, dependability, timeliness of delivery, overall quality of service, proper refrigeration in transit, minimizing in transit damage, and attitude of the driver. Respondents were given the opportunity to rate these services as "Very Poor", "Average", or "Very Good". Respondents were also given the opportunity to respond between the "Very Poor" and "Average" ratings and the "Average" and "Very Good" ratings.

Table 3.9 provides the distribution of responses for each service rated. For each of the services, at least ninety-two percent of the respondent indicated that the service was average. Very rarely did the respondent indicate that the services were "Very Poor" or "Very Good". When asked to rate the carrier's ability to handle claims for delays, damage goods, etc., none of the respondents indicated the carrier's ability as "Excellent". Most of the respondents to this question, approximately forty-one percent, indicated that the carriers' ability in this area was "Fair", while almost thirty-percent indicated "Poor". Except for proper refrigeration, all other services had at least fifty-four percent indicating that the various services were considered average. The next highest response rate for each of the services was between the "Average Rating" and the "Very Good" rating. Very few shippers indicated that the service was either "Very Poor" or "Very Good".

Table 3.9. Domestic Carrier Services Ratings

	Rating				
Services	**Very Poor**		**Average**		**Very Good**
Availability of Service	0.00%	8.11%	64.86%	24.32%	2.70%
Dependability of Service	0.00%	2.70%	70.27%	24.32%	2.70%
Timeliness of Delivery	0.00%	2.70%	54.05%	40.54%	2.70%
Quality of Service--Overall	0.00%	8.11%	59.46%	29.73%	2.70%
Proper Refrigeration	0.00%	10.81%	40.54%	45.95%	2.70%
Minimizing In-Transit Damage	2.70%	8.11%	56.76%	29.73%	0.00%
Driver Attitude	2.70%	10.81%	62.16%	21.62%	2.70%

When the shippers were asked to rate the carriers' ability to handle claims associated with delays, damage goods, etc., over forty-percent indicated that the carriers did a "Fair" job. Nearly nineteen percent indicated that the carrier's ability to handle claims was "Good". Approximately

thirty percent of the respondents indicated that the carriers are doing a poor job of handling claims, while none indicated that an excellent job was being done. Another eleven percent had no opinion on the question.

Shippers in the survey were asked to rank the top three most common problems encountered with carrier services. Table 3.10 provides the results of this ranking. Of the forty-one shippers in the survey, approximately fifty-six percent chose the availability of service as ranking in their top three most common problems. Of the group who selected availability of service as a top three ranked problem, nearly fifty-seven percent indicated that it was the number one problem. Timeliness of service garnered the next highest response rate at seventeen respondents which equates to over forty-one percent of the total respondents to the survey. The third highest response rate was dependability of service at sixteen respondents. While proper refrigeration in transit had thirteen respondents ranking it in their top three, it had the second highest amount of individuals ranking it as their first choice for common problems. The respondents were given the opportunity to write problems under another category. The only problem that was written in for this response was cleanliness of the trucks.

Table 3.10 Ranking of the Top Three Most Common Problems Encountered with Carrier Services

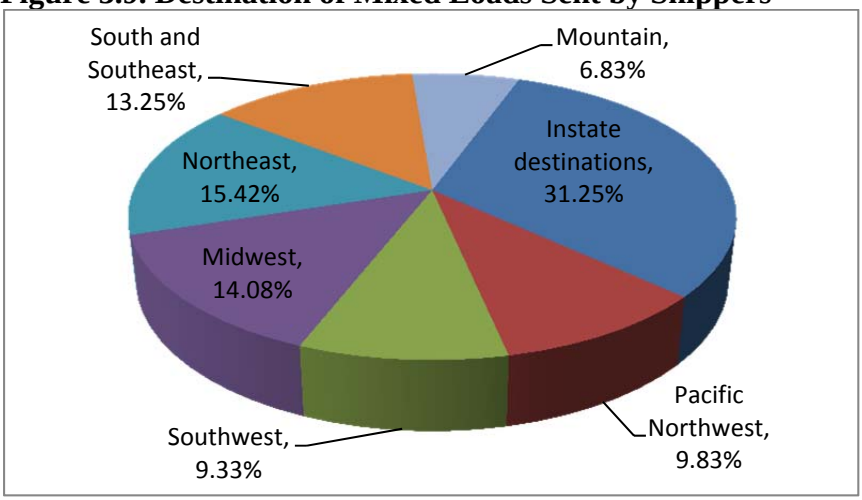
	Number of Respondents			
Issue	**First**	**Second**	**Third**	**Total**
Availability of Service	13	5	5	23
Dependability of Service	5	7	4	16
Timeliness of Service	4	7	6	17
Quality of Service - Overall	3	5	7	15
Proper Refrigeration in Transit	7	3	3	13
In-Transit Damage	2	7	5	14
Driver Attitude	3	3	3	9

Nearly seventy-six percent of the respondents who ranked the common problems in Table 3.10 indicated that the problems in this table were most common when shipping through a broker. Twelve percent of the respondents indicated that these problems are most common when shipping through a large trucking firm. Another nine percent identified independent carriers as the most common source of the problems indicated in the table. When asked about what type of shipments are these problems more common with, a third of the respondents indicated that partial loads were more common with service problems. An equal amount, nearly nineteen percent each, indicated that service problems were more common with full loads and multiple destination loads. The respondents indicated that on average twenty-two percent of their loads go to multiple destinations. Twenty-nine percent of the respondents chose mixed loads as having more problems with service. A vast majority of respondents, nearly, fifty-eight percent, indicated that the summer season was when the service problems are most prevalent. Twenty percent indicated that the winter season was the most prevalent season for service problems, while nearly nine percent indicated the spring season.

When shippers were asked about whether carrier services (e.g., dispatching, hauling, and unloading) were improving, remaining constant, or deteriorating, over twenty-nine percent indicated deteriorating services, while nearly nine percent responded that services have been improving in the past few years. Most of the respondents, nearly sixty-two percent, indicated that the service has been remaining constant over the past few years.

A set of questions inquired specifically about mixed commodity loads. Figure 3.9 provides a distribution of the destinations for the mixed commodity loads. The destination for the largest percentage of mix loads is in-state destinations at thirty-one percent. The respondents indicated that nearly sixty percent of their shipments are mixed commodity loads. Slightly over fifty-five percent indicated that the shippers had problems with mixed loads where commodities were not compatible. Seventy-five percent of respondents identified problems with temperature maintenance with mixed commodity loads.

Figure 3.9. Destination of Mixed Loads Sent by Shippers



The shippers were provided a list of concerns and asked to rate their level of concern for shipping produce for the next five years as a "Serious Problem", "Problematic", or "Not Important". They were also provided the opportunity to rate each concern as being between "Serious Problem" and "Problematic" and between "Problematic" and "Not Important". Table 3.11 provides a distribution of their responses for each concern. The concern that garnered the highest percentage at over fifty-nine percent of respondents indicating a "Serious Problem" was the cost of trucking. CARB regulations, shortage of drivers, and availability of trucks were all concerns that had more than forty percent of the respondents indicating a "Serious Problem". It appears that the shippers least concern was related to the limits on double-triple trailers for hauling commodities. Highway weight limits also seems to be an area that shippers are not overly concerned.

Table 3.11. Shipper Concerns for Shipping Produce over the Next Five to Ten Years

	Rating				
Issue of Concern	**Serious Problem**		**Problematic**		**Not Important**
CARB Regulation	45.95%	10.81%	24.32%	0.00%	2.70%
Shortage of Drivers	43.24%	24.32%	13.51%	8.11%	2.70%
Highway Weight Limits	5.41%	13.51%	29.73%	21.62%	13.51%
Limits on Double-Triple Trailers	2.70%	0.00%	16.22%	29.73%	35.14%
Hours of Service for Drivers	29.73%	13.51%	37.84%	5.41%	0.00%
Truck and Trailer Regulations	21.62%	24.32%	29.73%	10.81%	0.00%
Quality of Trucks, Containers, and Refrigeration Equipment	10.81%	35.14%	18.92%	21.62%	0.00%
Timely Arrivals at Destinations	13.51%	8.11%	35.14%	24.32%	2.70%
Timely Pick-Up at Shipping Points	13.51%	8.11%	27.03%	32.43%	2.70%
Cost of Trucking	59.46%	18.92%	8.11%	2.70%	0.00%
Availability of Trucks	40.54%	21.62%	21.62%	5.41%	0.00%

One of the last questions of the survey asked respondents an open-ended question regarding their opinion of the most pressing problems affecting produce trucking in the next five to ten years. There are four broad categories that a majority of the comments fell under. It appears from the general comment that the cost of trucking is what shippers believe is the most pressing problem in the next five to ten years. These general remarks also showed a great concern for the availability of drivers and the availability of trucks. A fourth broad category by this group expected in the next five to ten years is the regulatory environment in California regarding transportation. When asked what alternative shipping modes to trucking that the shippers might use, almost unanimously respondents are looking toward shipping via rail in the next five to ten years, with a few interested in intermodal transportation options. The perception of rail shipping still seems somewhat mixed and the knowledge of intermodal transportation options seems still in its infancy.

Summary of Key Findings from the Trucker and Shipper Surveys

The truckers in the survey indicated that they spent a large amount of time waiting to load produce at the shipper's facility. The issue of wait-time is highest on the list of issues truckers find are important and it is an issues that truckers believe the shippers have a high level of poor performance. They indicated that this wait time seems to be worse for produce than it is for other goods they haul.

Many truckers in the state face major time delays due to congestion of the road ways. Truckers who use Route I-5 and I-80 encounter congestion at least thirty-percent of the time on these routes. This congestion can lead to major delays in shipments which can cause shipment to be late. The typical delay that occurs on these routes when congestion is encountered is over three hours. In order to deal with congestion issues, a large majority of truckers indicated that they schedule pick-ups and deliveries either at night or on off-peak congestion hours.

With truckers trying to avoid congestion, it appears that they could be creating a new problem for themselves. It seems that they are showing up to the shipping sites before the shippers are ready to load them. This may indicate that there needs to be better coordination between shippers and carriers so that carriers can avoid as much traffic congestion as possible, while minimizing the amount of wait time at the shipping points to load their products.

Access to capital during the time of the survey was challenging for smaller truckers in comparison to large trucking firms. The smaller trucking firms indicated difficulty obtaining capital, while the larger firms responded that they were not having difficulty obtaining capital. This lack of access to funds has hindered some small trucking firms from maintaining and expanding their fleet.

Both the truckers and the shippers are concerned about the regulatory environment in California. If the regulatory environment continues on its current course, shippers should expect that the price of shipping is going to increase over the next five to ten years. This is problematic for shippers because they are already concerned about the current cost of shipping their produce.

Other major concerns that shippers have are a shortage of drivers that are willing to ship their produce and the availability of service. Over forty-three percent of the shippers participating in the survey indicated driver shortages as a serious problem. Availability of service received the highest response rate for being the most common problem encounter by shippers regarding carrier services.

IV. Characteristics of Transportation Usage: Air and Rail

Rail

As indicated in the data reported earlier, rail movements of California fruit and vegetables are limited. Readily accessible public information on rail shipments is not available. In study team meetings with rail service provider proprietary data on shipment volumes by commodity was not forthcoming. Accordingly it is difficult to expand on the current understanding of trends in rail freight movement of California specialty crops. It is clear from the data that shippers utilize higher priced truck movement for goods with the implication that alternative lower priced rail transport has negative attributes that are not offset by potential marginal savings. However, if future truck shortages and increasing rates become more of a problem shippers and receivers may be more willing to explore rail transport opportunities.

One effort underway to establish rail transport alternatives that attract shipments of California fruits and vegetables is the emergence of dedicated unit train movements. Railex LLC, Schenectady, N.Y. began service in Central California at its Delano terminal in 2008. To capture some of the transport market produce shipments, Railex provides trains with guaranteed cross-country service in 5 days to the firm's Rotterdam, N.Y. terminal, comparable with over the road truck transit times. The company contracts for train service through CSX Transportation and Union Pacific Railroad. Trains depart the facility twice a week on Wednesday and Friday afternoon, 55 refrigerated car units. In addition the firm provides support services such as cold storage and less-than-carload freight consolidation. Product departing from the Central Valley can make the cross-country journey by rail, be off loaded into cold storage and distributed by truck to area final markets at buyer's demand. The Delano facility offers an alternative to truck shipments but will likely need a successful and extended history to maintain and grow its customer base.

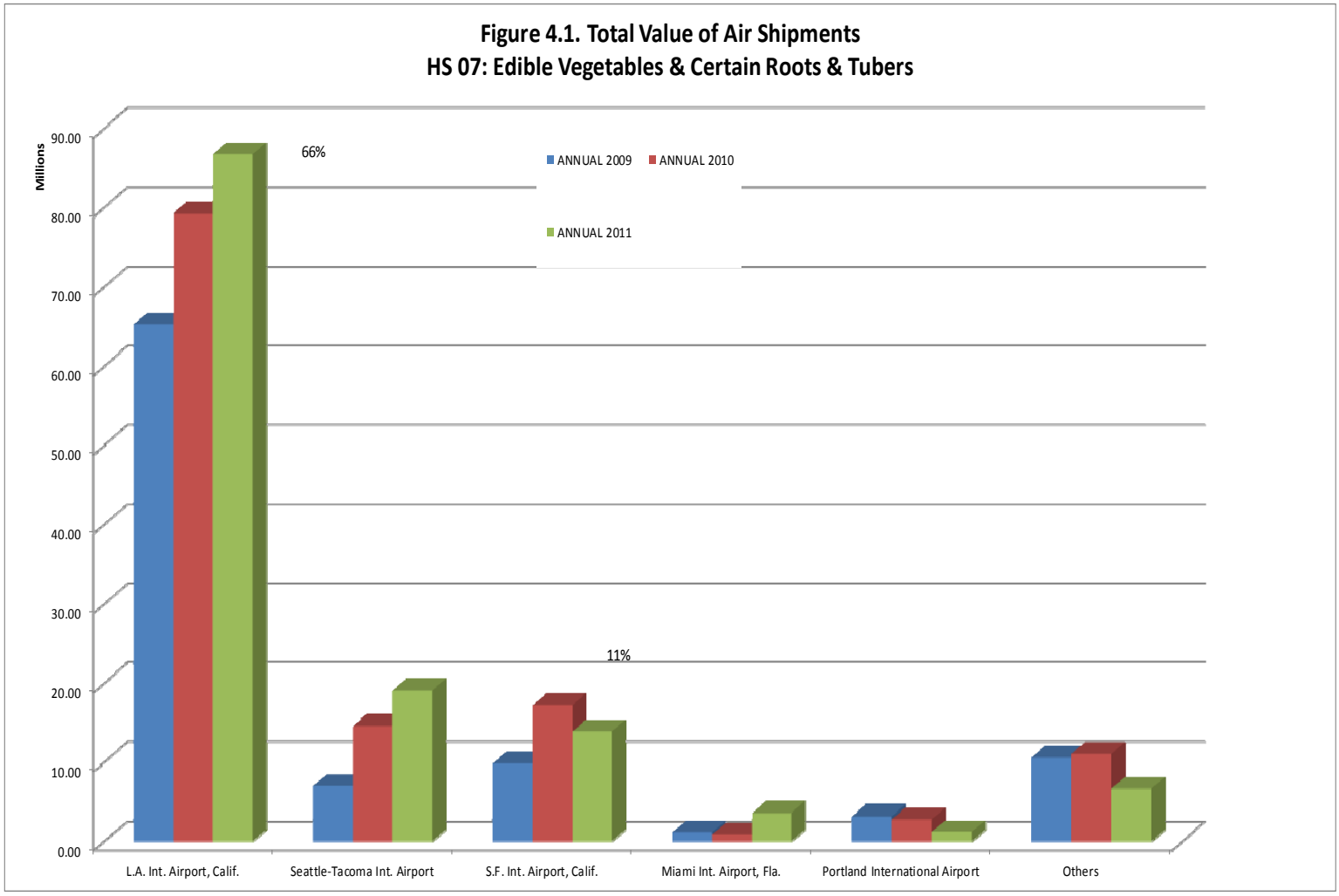
For the foreseeable future it appears rail will remain a small, but important option for some movements, particularly for commodities that are less perishable or have unique attributes that fit well with refrigerated railcar configurations. Railex currently is moving products such as table grapes, stone fruit, citrus and some vegetables such as celery, carrots and broccoli. In addition the service has expanded to include other agriculturally related products such as beer, wine, cheese, dried fruit and candy.

Air

Transport of specialty crops by air is limited in general to higher valued, perishable products for which freshness is an attribute customers are willing to pay a premium for. Nationwide, the average value of air shipments of edible vegetables and certain roots and tubers (HS Classification 07 commodities) is reported to have exceeded $118 million over the past three years.[12] Of that total, 77 percent is transported through California's main air terminals, where 65

[12] Source: http://www.wisertrade.org, data from U.S. Census Bureau, Foreign Trade Division. For a discussion of Wiser Trade data please see: O'Connell, Jock, Bert Mason and John Hagen. "The Role of Air Cargo in California's Agricultural Export Trade", CATI Pub. #050502, California State University, Fresno, Center for Agricultural Business, 2005, page 70.

percent moves through Los Angeles International Airport and 12 percent through San Francisco International Airport (Figure 4.1). A similar pattern is found for air shipments of edible fruits and nuts, citrus fruit or melon peel (HS Classification 08 commodities) with an average air shipment value of over $378 million during the past three years. In this case 76 percent of all movements by air are through California main air terminals. Shipments through Los Angeles International Airport and San Francisco International Airport were about equal averaging 38 percent from each location over the period 2009 to 2011 (Figure 4.2).



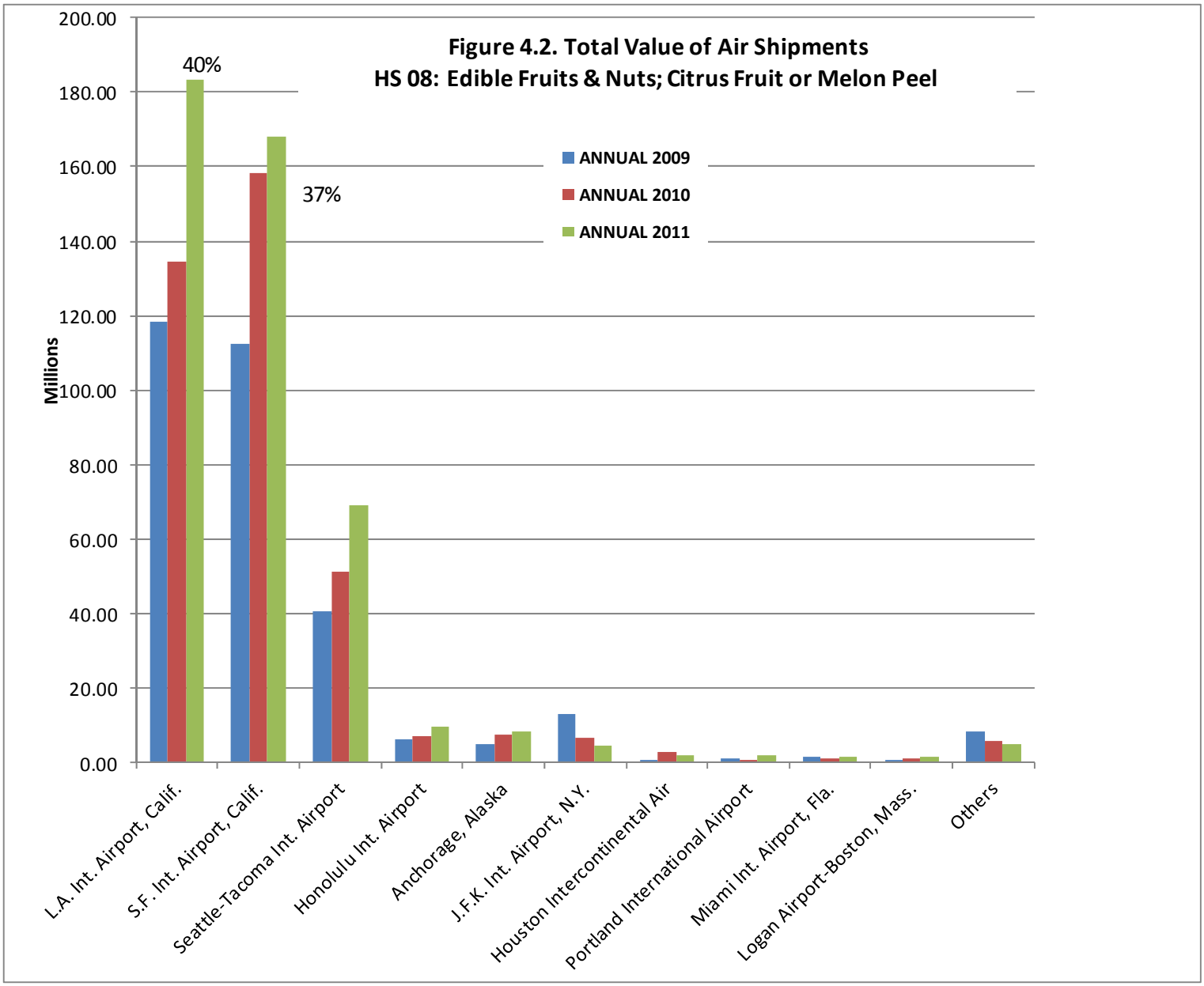
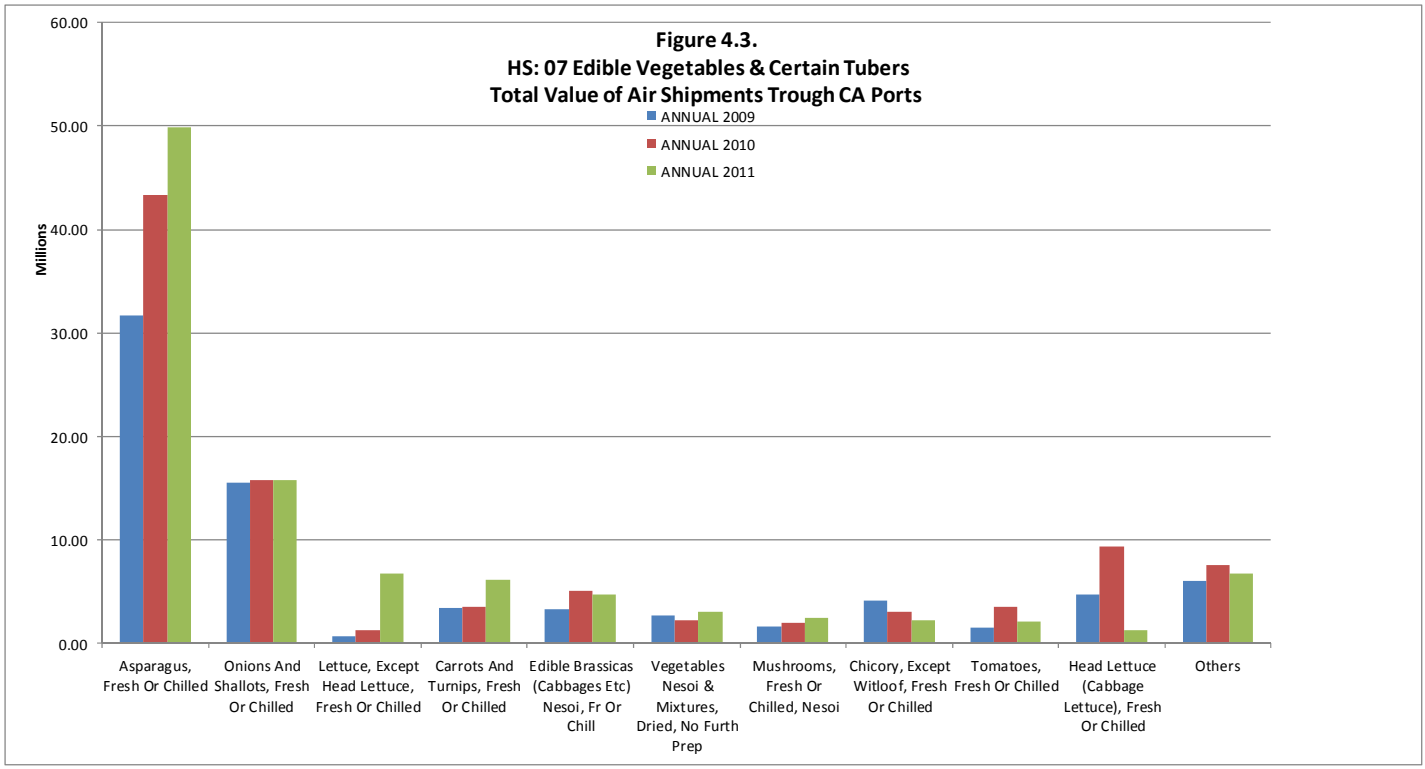
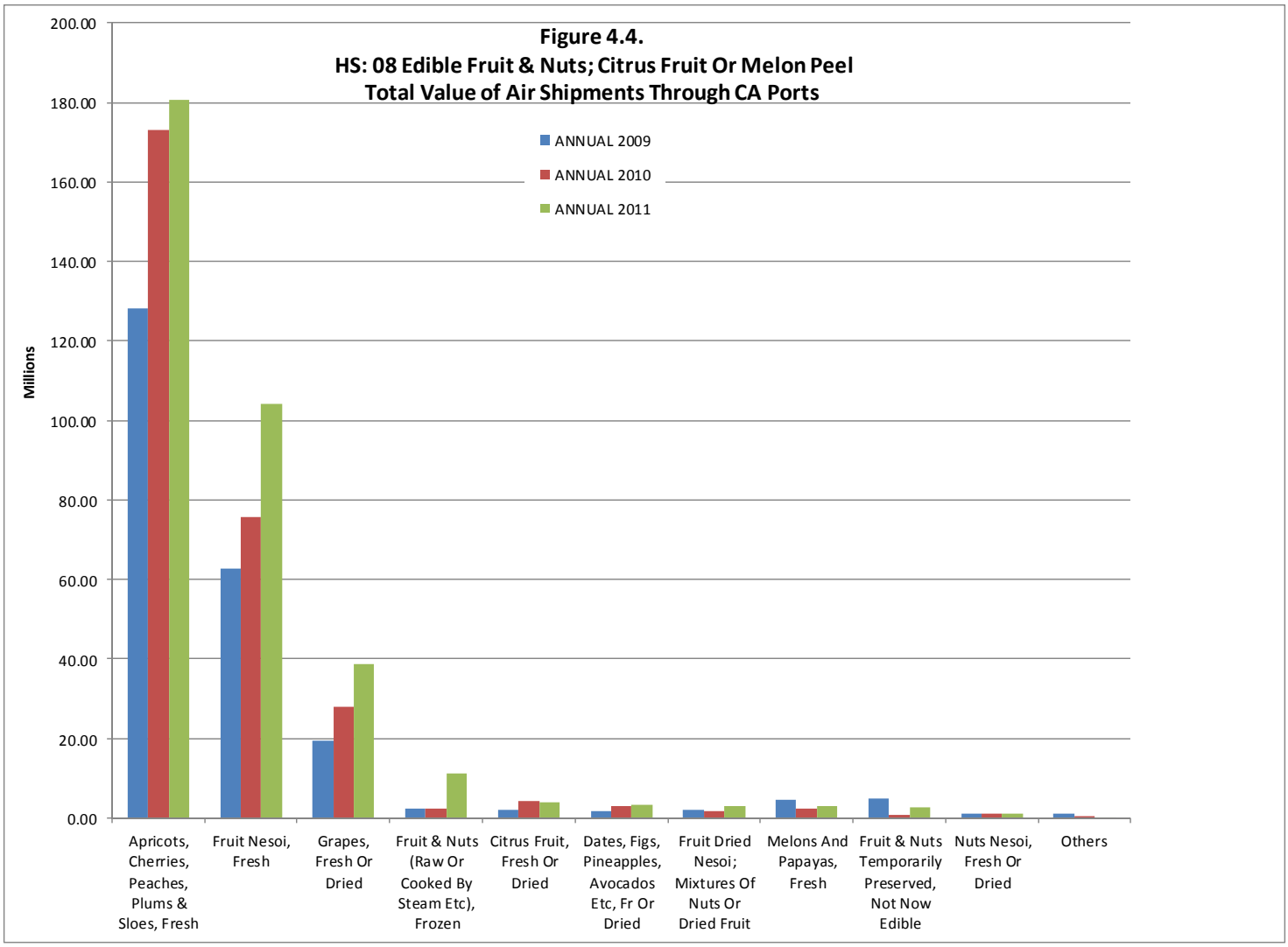


Figure 4.2. Total Value of Air Shipments
HS 08: Edible Fruits & Nuts; Citrus Fruit or Melon Peel
ANNUAL 2009
ANNUAL 2010
ANNUAL 2011
40%
37%
Millions
200.00
180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
L.A. Int. Airport, Calif.
S.F. Int. Airport, Calif.
Seattle-Tacoma Int. Airport
Honolulu Int. Airport
Anchorage, Alaska
J.F.K. Int. Airport, N.Y.
Houston Intercontinental Air
Portland International Airport
Miami Int. Airport, Fla.
Logan Airport-Boston, Mass.
Others



The commodity mix of airfreight specialty crop shipments is concentrated among a few major crops in each HS classification along with lesser amounts of a wide variety of other fruits, vegetables and nuts. For edible vegetables and certain tubers, 65 percent of air shipments are accounted for by fresh or chilled asparagus and fresh or chilled onions and shallots with a combined value of over $47 million (Figure 4.3). For edible fruits and nuts, citrus fruit or melon peel 82 percent of the air shipments are accounted for by fresh fruits comprised primarily of cherries, peaches and strawberries with a combined value of over $352 million (Figures 4.4). A more detailed examination illustrates the important contributions of a few specific fruits and berries (Figure 4.5).

The customers for specialty crop air shipments like the commodities themselves are also concentrated among a number of specific countries. In the case of edible vegetables and certain roots and tubers, 95 countries are reported to have purchased HS 07 commodities delivered by air from the U.S. over the past three years. However, on average, 89 percent of the value of all shipments over the past 3 years has been destined for 10 countries, with the top two, Japan and the United Kingdom, accounting for over 53 percent of all air shipments during the same period (Figure 4.6). Partner countries for air shipments from California's major terminals for HS 07 commodities, as expected, are similar to the national figures (Figure 4.7).



In the case of edible vegetables and certain roots and tubers, 95 countries are reported to have purchased HS 07 commodities delivered by air from the U.S. over the past three years. However, on average, 89 percent of the value of all shipments over the past 3 years has been destined for 10 countries, with the top two, Japan and the United Kingdom, accounting for over 53 percent of all air shipments during the same period (Figure 4.6). Partner countries for air shipments from California airports of HS 07 commodities, as expected, are similar to the national figures (Figure 4.7).

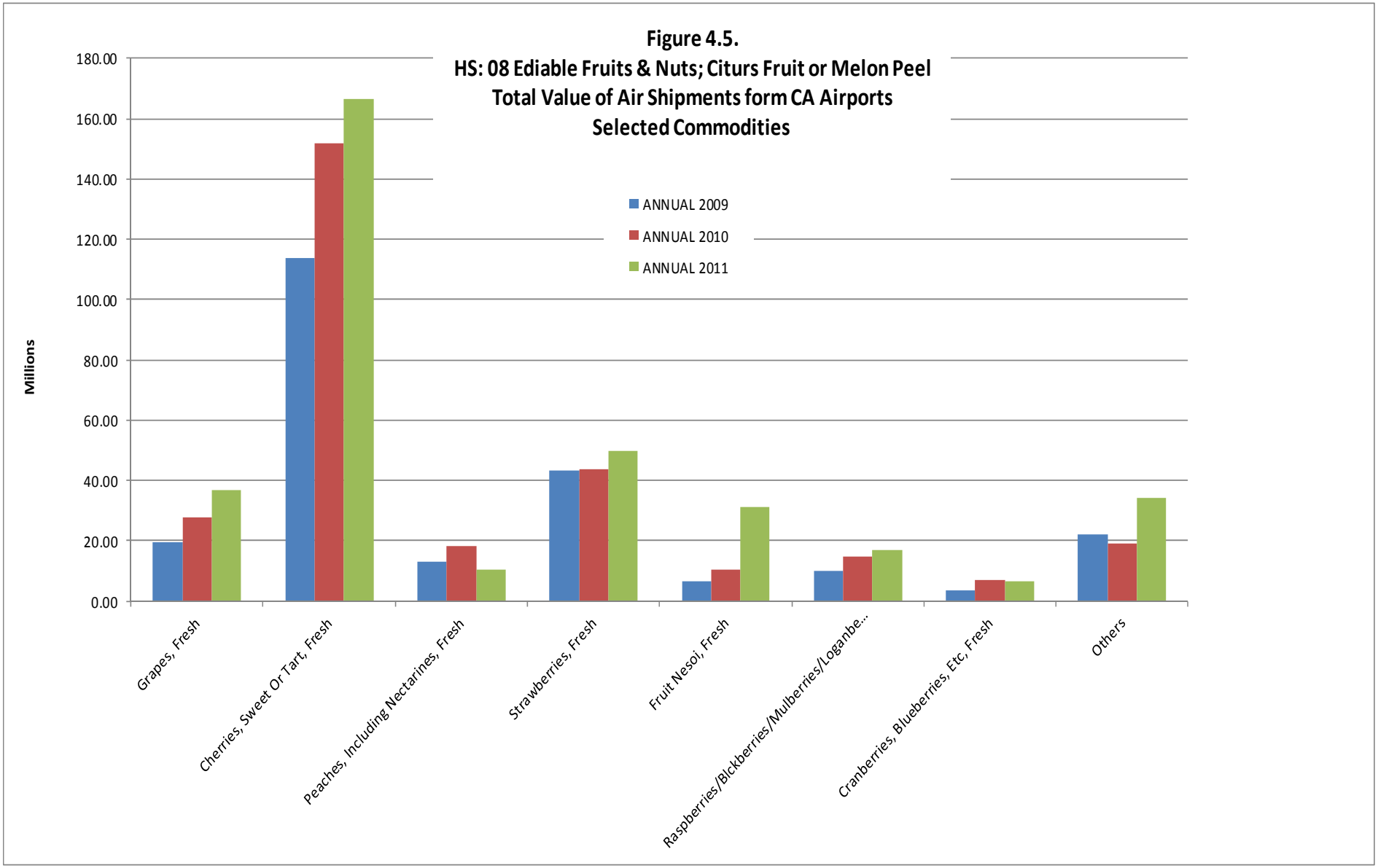


Figure 4.5.
HS: 08 Ediable Fruits & Nuts; Citurs Fruit or Melon Peel
Total Value of Air Shipments form CA Airports
Selected Commodities
ANNUAL 2009
ANNUAL 2010
ANNUAL 2011
Millions
180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Grapes, Fresh
Cherries, Sweet Or Tart, Fresh
Peaches, Including Nectarines, Fresh
Strawberries, Fresh
Fruit Nesoi, Fresh
Raspberries/Blckberries/Mulberries/Loganbe...
Cranberries, Blueberries, Etc, Fresh
Others

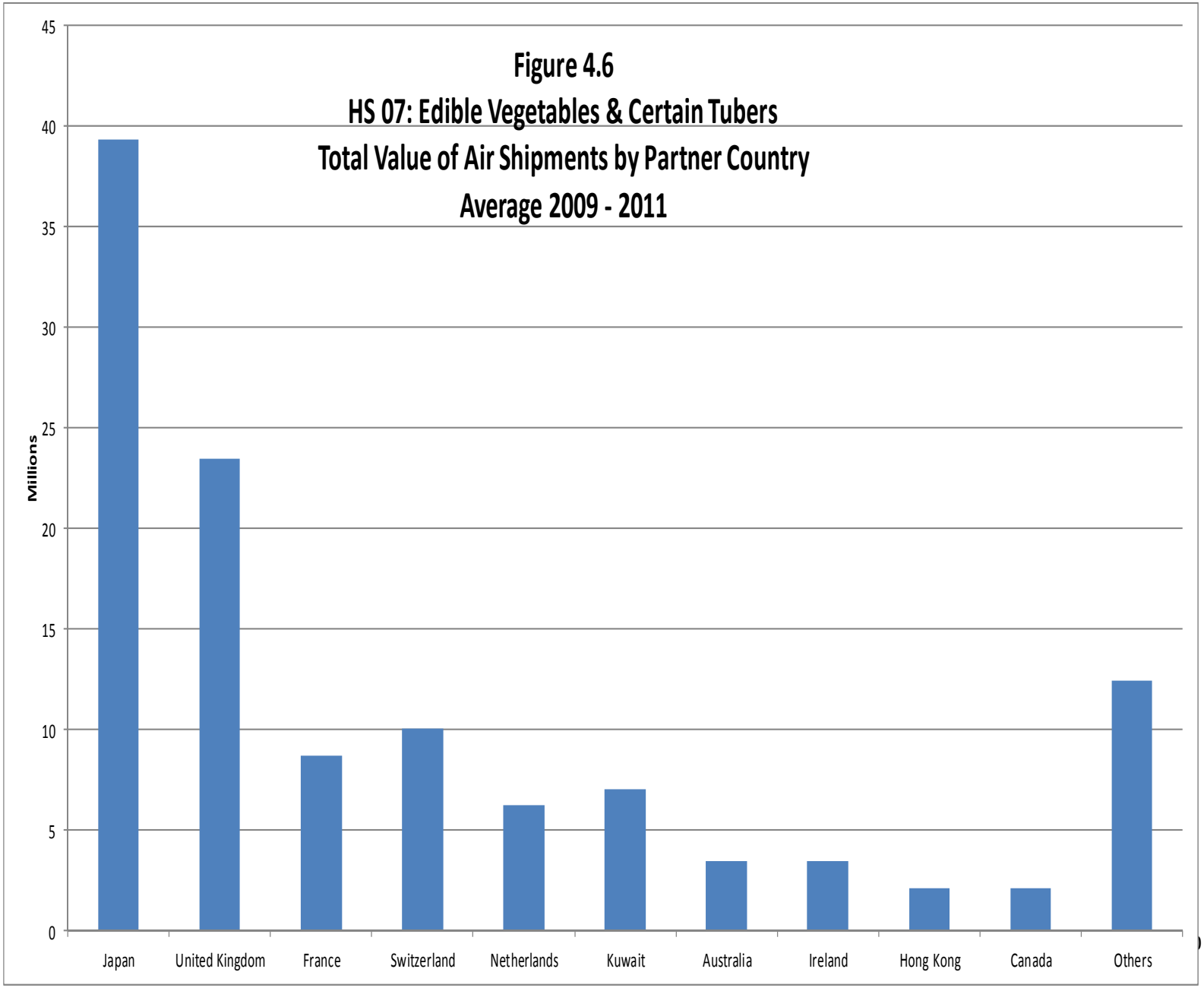
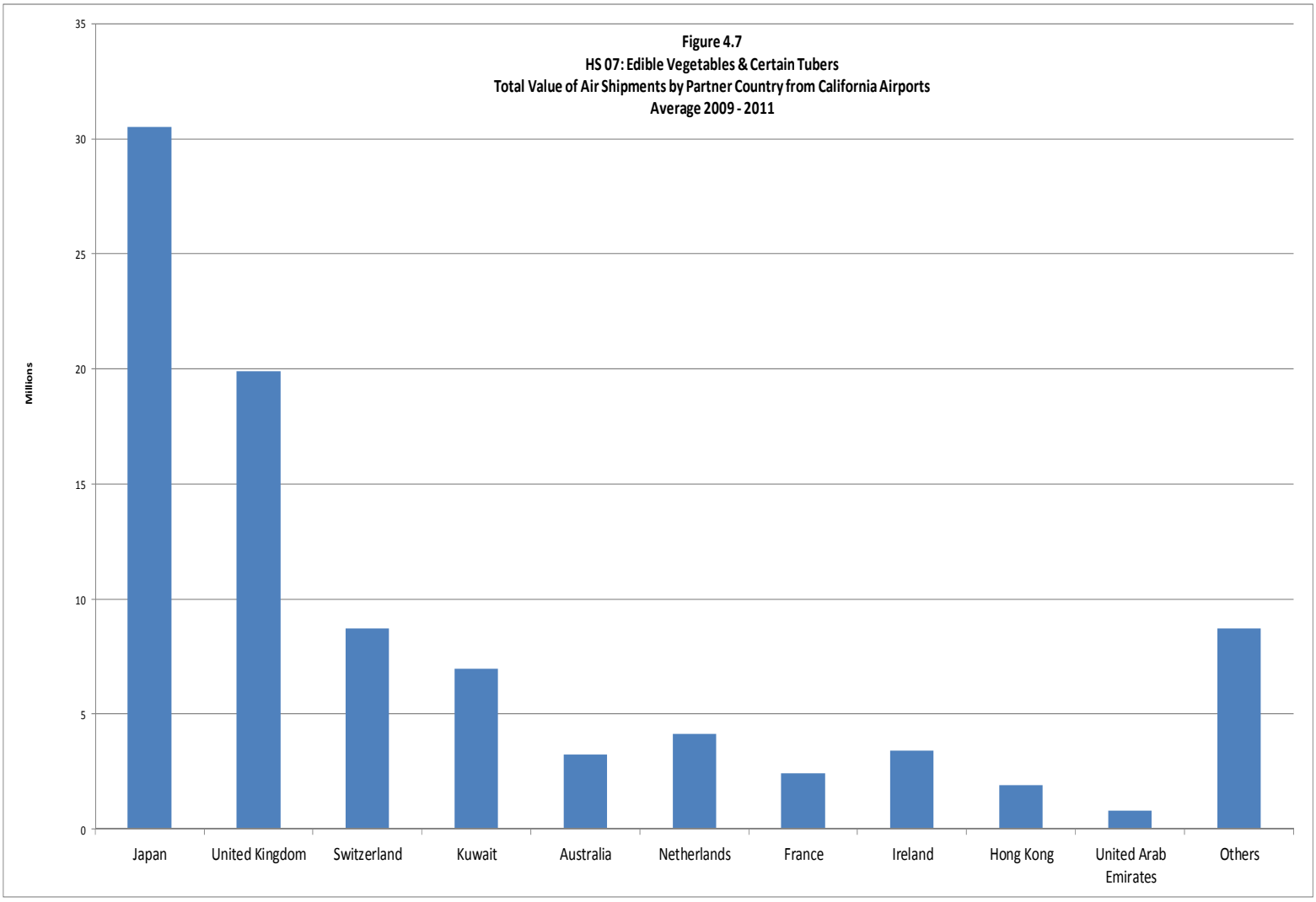


Figure 4.6
HS 07: Edible Vegetables & Certain Tubers
Total Value of Air Shipments by Partner Country
Average 2009 - 2011
Millions
45
40
35
30
25
20
15
10
5
0
Japan
United Kingdom
France
Switzerland
Netherlands
Kuwait
Australia
Ireland
Hong Kong
Canada
Others

In the case of edible fruits, nuts, citrus or melon peel, 88 countries are reported to have purchased HS 08 commodities delivered by air from the U.S. over the past three years. However, on average, 88 percent of the value of all shipments over the past 3 years has been destined for ten countries, with the top two, Japan and the Australia, accounting for over 45 percent of all air shipments during the same period (Figure 4.8). Partner countries for air shipments from California airports of HS 08 commodities, as expected, are similar to the national figures (Figure 4.9).



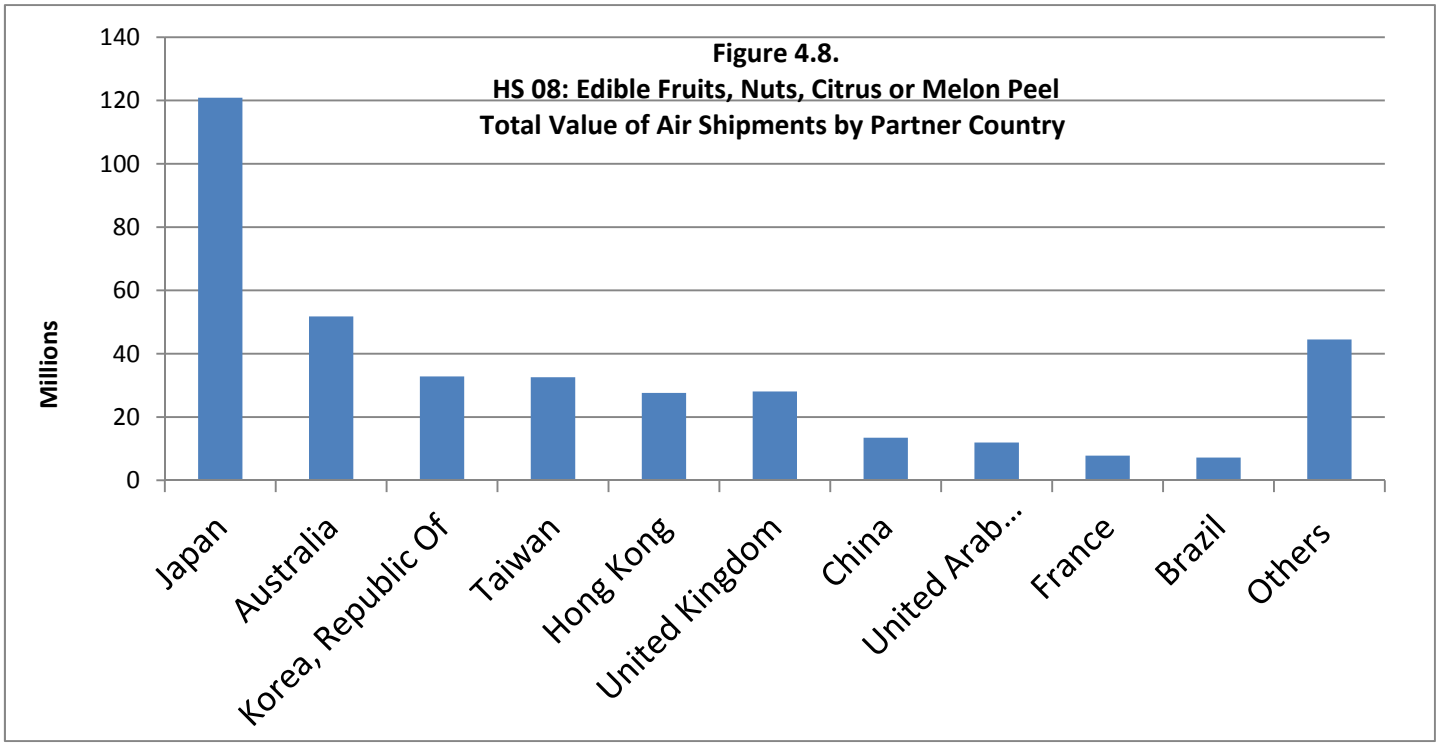


Figure 4.8.
HS 08: Edible Fruits, Nuts, Citrus or Melon Peel
Total Value of Air Shipments by Partner Country
Millions
140
120
100
80
60
40
20
0
Japan
Australia
Korea, Republic Of
Taiwan
Hong Kong
United Kingdom
China
United Arab...
France
Brazil
Others

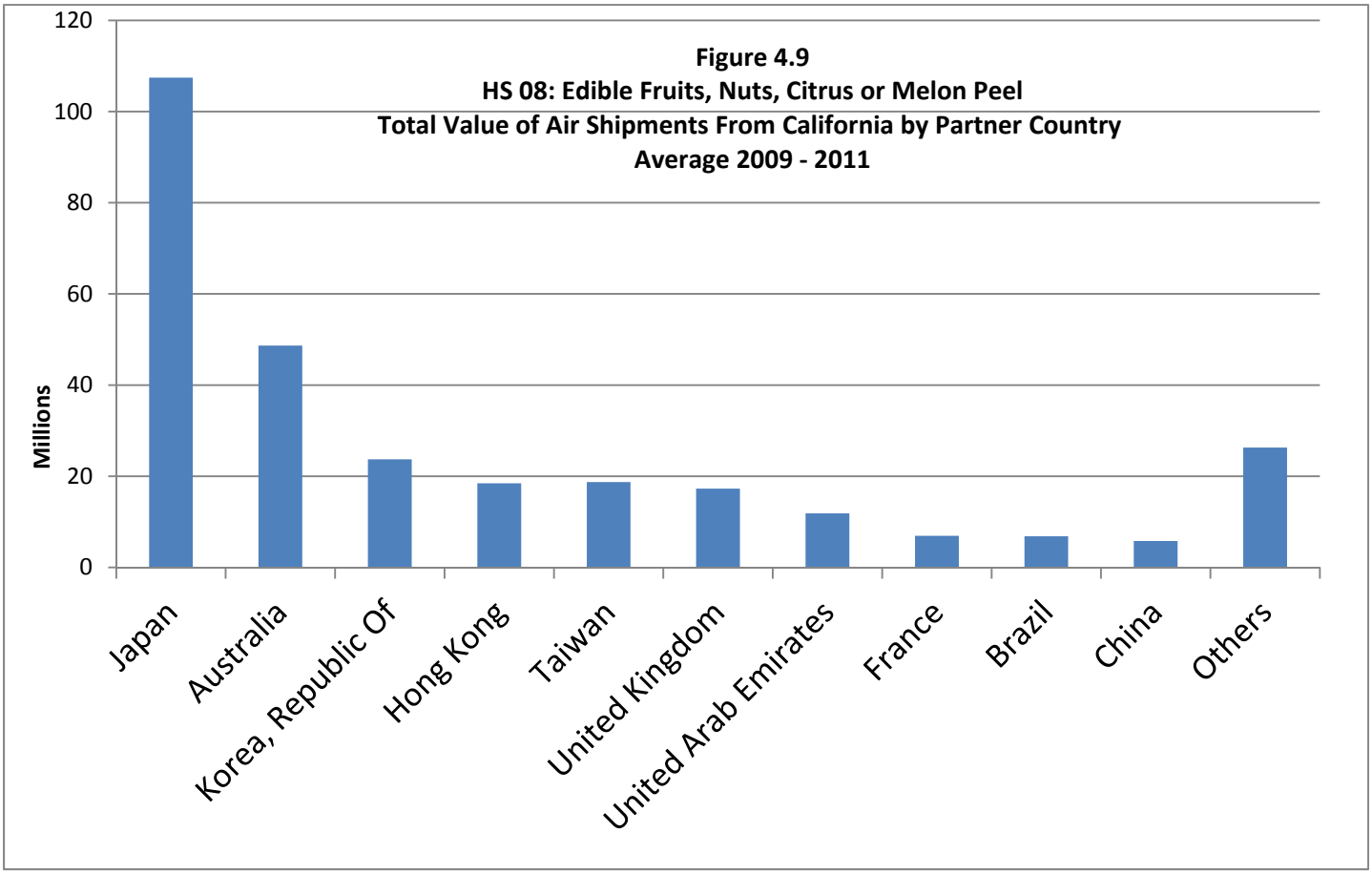


Figure 4.9
HS 08: Edible Fruits, Nuts, Citrus or Melon Peel
Total Value of Air Shipments From California by Partner Country
Average 2009 - 2011
Millions
120
100
80
60
40
20
0
Japan
Australia
Korea, Republic Of
Hong Kong
Taiwan
United Kingdom
United Arab Emirates
France
Brazil
China
Others

Overall air transportation remains a limited, transportation mode for the movement of a small portion of California specialty crops into international markets. Trends suggest that while some large markets dominate airborne traffic at the present time, emerging markets continue to offer opportunities that will call for additional air carrier capacity and/or bidding up the rates on existing capacity to meet future demand.

V. Characteristics of Transportation Services: Ports

The movement of California fruits and vegetables by water is directed to export destinations. Transport to export destinations by ship takes place in dedicated ships and refrigerated containers. Publicly available shipment data by customs region was analyzed to determine the volumes moving by port of departure for the selected study commodities.

California Waterborne Exports

In 2009, California exported approximately $10.223 billion in principal commodities (California Agricultural Resource Directory 2010-2011). This accounts for one-third to one-fourth of all agricultural products produced in the state. In order for these products to be exported, they must leave one of the United States Custom Districts. California has three such districts–San Francisco, Los Angeles, and San Diego. Each district represents a location where agricultural products could leave California as exports. These exit points in California handle all four modal transportation--air, rail, truck, and sea vessel. Table 5.1 provides a listing of the locations that fall within each district.

Table 5.1. California Customs Districts

LOS ANGELES UNITED STATES CUSTOM DISTRICT			
Los Angeles	Port San Luis Harbor	Long Beach	Segundo
Ventura	Port Hueneme	Capitan	Morro Bay
Los Angeles Int. Airport	Ontario Int. Airport	Las Vegas, NV	DHL, Los Angeles
GATEWAY FREIGHT SER. INC	AIR CARGO HANDLING SERV	Virgin Atlantic Cargo	TNT Express, LAX
IBC Pacific	Palm Springs User Fee, LAX	San Bernardino Int. Airport	Meadows Field Airport
Los Angeles	DHL-Hub Riverside	UPS-Ontario	
SAN FRANCISCO UNITED STATES CUSTOM DISTRICT			
San Francisco Int. Airport	Eureka	Fresno	Monterey
San Francisco	Stockton	Oakland	Richmond
Alameda	Crockett	Martinez	Redwood City
Selby	San Joaquin River	San Pablo Bay	Carquinez Strait
Reno, NV	San Jose Int. Airport	Sacramento Int. Airport	DHL Worldwide Express
Aircargo Handling Service	TNT Skypak	IBC Pacific	Federal Express, Oakland
SAN DIEGO UNITED STATES CUSTOM DISTRICT			
San Diego	Andrade	Calexico	San Ysidro
Tecate	Otay Mesa Station	Calexico-East	

All of the specialty crops in this study (celery, cherries, grapes, lettuce, oranges, peaches, strawberries, sweet corn, tomatoes, and watermelon) are exported through the three California custom districts. Table 5.2 provides a look at how much of each crop in terms of dollars is

exiting the country through one of the three districts from 2006 to 2010. Appendix A provides a look at the top countries where these products are being shipped. At the Los Angeles custom district, grapes and oranges exceed the other crops in the study with grapes being the largest exported commodity in dollar terms. Except for 2008, cherries are the largest commodity leaving the San Francisco custom district. Oranges are typically the second largest commodity being exported through this district. In 2006 and 2010, grapes were the largest exported commodity out of the group being studied that leaves from the San Diego custom district. In 2007, lettuce was the largest of the studied commodities leaving the San Diego custom district, while strawberries was the highest export of 2008 and tomatoes was the highest in 2009.

Table 5.2. Total World Exports by Custom District of Select Group of Specialty Crops*

	World Total (Thousands of Dollars)				
U.S. Custom Districts--Los Angeles					
Product (Fresh Market)	**2006**	**2007**	**2008**	**2009**	**2010**
Celery	5,659	4,655	5,157	5,010	4,459
Cherries	14,560	18,619	37,173	30,275	37,010
Grapes	248,121	271,088	328,292	308,825	314,415
Lettuce	7,186	8,196	5,784	5,242	6,642
Oranges	167,631	122,286	193,776	149,382	181,047
Peaches	19,529	22,301	32,488	26,381	31,117
Strawberries	7,036	6,305	10,480	17,699	14,316
Sweet Corn	454	408	6,226	1,508	2,110
Tomatoes	3,142	2,519	481	1,011	2,782
Watermelon	0	19	0	25	85
U.S. Custom Districts--San Francisco					
Product (Fresh Market)	**2006**	**2007**	**2008**	**2009**	**2010**
Celery	5,079	5,111	5,992	6,343	7,562
Cherries	56,628	61,817	63,753	75,679	102,140
Grapes	14,224	17,303	29,052	35,947	74,571
Lettuce	11,049	12,287	15,046	14,154	21,614
Oranges	43,626	33,617	69,299	64,075	45,329
Peaches	15,225	20,287	16,530	15,161	28,295
Strawberries	24,766	26,441	24,704	22,794	24,455
Sweet Corn	7,038	1,222	0	0	14
Tomatoes	918	468	109	12	83
Watermelon	62	49	53	101	446
U.S. Custom Districts--San Diego					
Product (Fresh Market)	**2006**	**2007**	**2008**	**2009**	**2010**
Celery	1,424	1,192	1,709	953	1,380
Cherries	88	34	67	543	865
Grapes	18,902	14,558	23,462	9,201	19,183
Lettuce	16,107	19,527	20,884	7,205	6,546
Oranges	4,434	4,327	4,250	1,240	4,171
Strawberries	15,767	12,786	24,184	9,161	8,344
Sweet Corn	721	1,120	1,371	1,271	1,539
Tomatoes	7,478	12,276	6,132	12,122	5,002
Watermelon	257	222	313	144	107

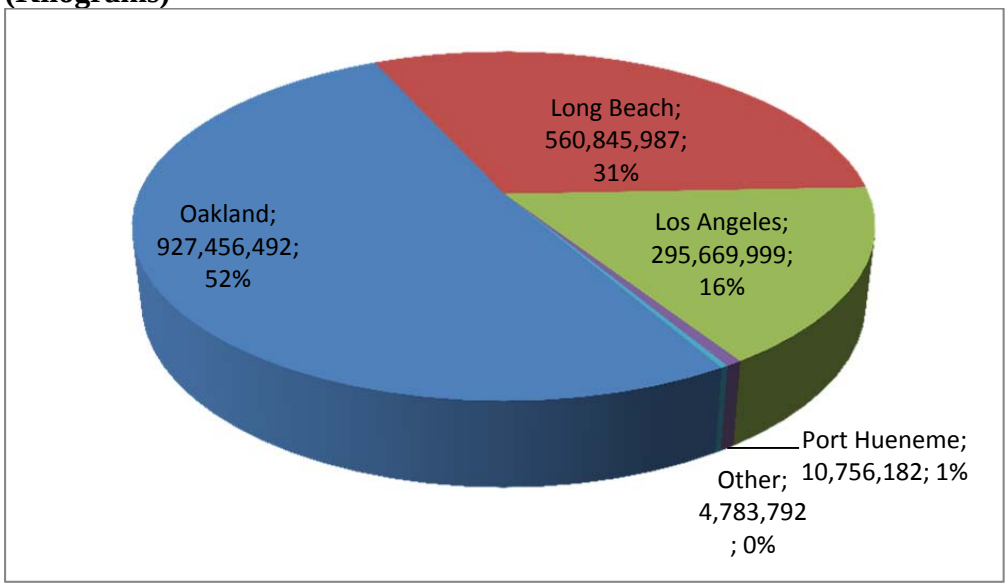
*Data Source: Department of Commerce, U.S. Census Bureau, Foreign Trade Statistics, U.S. Customs District Data

Table 5.2 provides information regarding how much of each of the commodities being studied is leaving the state through the custom districts of California. In some sense, this table is masking where transportation issues are most important because it does not provide information based on the different modes. One of the modes embodied in these custom district data is products leaving ports.

Transportation of Specialty Crops through the California Port System

There are eleven major ports that serve California-- Port of Humboldt Bay, Port of West Sacramento, Port of Stockton, Port of Richmond, Port of San Francisco, Port of Redwood City, Port of Oakland, Port of Hueneme, Port of Los Angeles, Port of Long Beach, and Port of San Diego. The agricultural industry uses many of these ports to export their products. In 2010, nearly 1.8 billion kilograms of fruits and vegetables were shipped from these major ports. The four largest exporting ports during 2010 in terms of containerized vessel weight for shipping fruits and vegetables were Oakland, Long Beach, Los Angeles, and Port Hueneme (see Figure 5.1). The Port of Oakland is the largest exporter of fruits and vegetables by sea vessel out of the state of California. It shipped over 900 million kilograms of fruits and vegetables in 2010 which represents approximately fifty-two percent of all fruits and vegetables leaving California by sea. The next largest port for shipping fruits and vegetables is Long Beach. Around thirty-one percent of all fruits and vegetables leave from this port. Los Angeles is the third largest exporter of fruits and vegetables by containerized vessel weight.

Figure 5.1. 2010 CA Water Ports for Fruit and Vegetables Containerized Vessel Weight (Kilograms)



Out of the 1.8 billion kilograms of fruits and vegetables leaving California water ports, the largest share comes from fruit when measured in terms of weight. Over eighty-six percent of the containerized weight of fruits and vegetables can be attributed to fruits alone. The other fourteen percent is vegetable shipments. Figures 5.2 and 5.3 provide the weight in kilograms for 2010 that are being shipped out of the California ports for vegetables and fruits respectively. For both sets of commodities, the Port of Oakland has a fifty-one percent share of both products. The

ranking for the second and third largest ports remain the same whether the category is vegetables or fruits, Long Beach is ranked second while Los Angeles is third. Long Beach and Los Angeles are closer in percentage terms for vegetables than for fruits. The conglomeration of other ports ranks fourth for vegetables, while the Port of Hueneme ranks fourth for fruits.

Figure 5.2. 2010 CA Water Ports for Vegetables Containerized Vessel Weight (Kilograms)

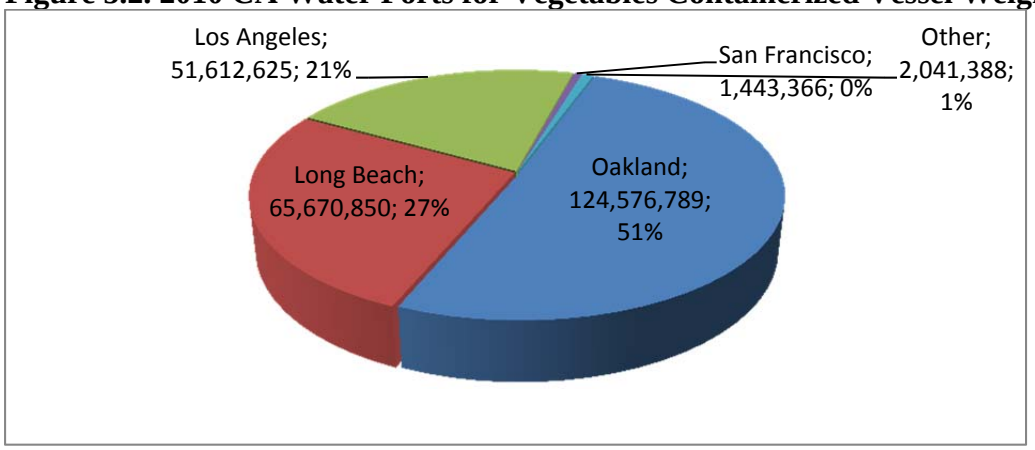


Figure 5.3. 2010 CA Water Ports for Fruits Containerized Vessel Weight (Kilograms)

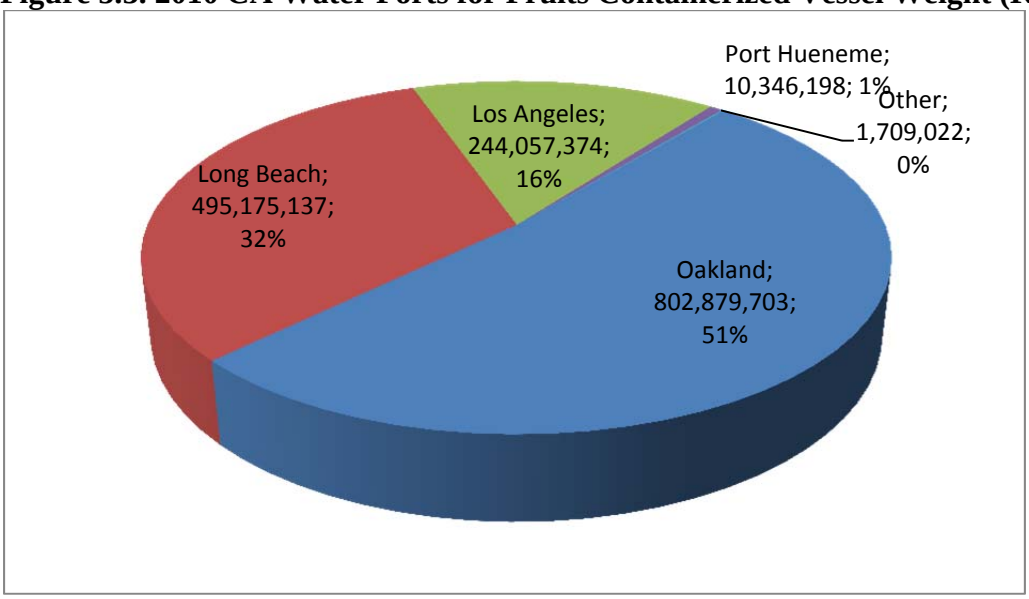


Table 5.3 provides information regarding how much of each of the commodities in this study are being shipped through the ports. It also provides the top three shipping ports for each of these commodities, as well as, the percentage of the total amount shipped for each of these ports. As Table 5.3 shows, the Port of Oakland ranks first in the exporting of celery, cherries, lettuce, peaches, strawberries, and watermelons. For all of these crops, Oakland ships at least fifty percent of the total weight in kilograms. Long Beach is the top sea exporter of tomatoes, oranges, and grapes. The Port of Los Angeles is the largest exporter of sweet corn. The only other port that breaks into the top three for any of these commodities is Port Hueneme. It is the second largest exporter of cherries. In terms of weight, oranges and grapes are the largest of the commodity group in the study shipped by sea, while tomatoes are the lowest.

Table 5.3. The Top Three Ports by Containerized Vessel Weight in 2010 for Shipping a Select Group of Specialty Crops

Commodity	Total Shipped from All Ports in Kilograms	Largest Shipping Port	% of Total	Second Largest Shipping Port	% of Total	Third Largest Shipping Port	% of Total
Celery	14,663,141	Oakland	63%	Long Beach	29%	Los Angeles	8%
Cherries	125,990	Oakland	88%	Port Hueneme	8%	Los Angeles	4%
Tomatoes	53,641	Long Beach	44%	Los Angeles	40%	Oakland	16%
Lettuce	27,677,230	Oakland	81%	Long Beach	11%	Los Angeles	8%
Sweet Corn	1,498,459	Los Angeles	88%	Oakland	8%	Long Beach	4%
Oranges	406,770,339	Long Beach	51%	Oakland	27%	Los Angeles	21%
Peaches	34,299,709	Oakland	50%	Long Beach	32%	Los Angeles	16%
Strawberries	2,073,652	Oakland	99%	Los Angeles	1%		
Grapes	163,721,785	Long Beach	54%	Los Angeles	28%	Oakland	16%
Watermelon	561,130	Oakland	79%	Long Beach	20%	Los Angeles	1%

While Table 5.3 provides the top three ports for shipping the commodities in this study, other ports in California ship some of the products. The port located at San Pablo Bay and the Port of San Diego ship celery. The Ports of West Sacramento and San Francisco have a small export share of lettuce. A relatively small amount of oranges also get shipped from Port Hueneme and the Port of San Diego. Peaches were exported out of Port Hueneme, the Port of San Diego, and Morro Bay. Port Hueneme, the Port of West Sacramento, and the Port of San Diego each had a small share of the grapes that were exported by sea vessel.

Transportation Issues Involving the Ports

For the crops that are a focus of this study, at least 98% of the exported crops are shipped from the ports of Oakland, Long Beach, and Los Angeles. To better understand the transportation issues that are affecting the ports, a visit was made to three different ports in the state to investigate what issues are affecting them the most when transporting specialty crops. The three ports that were selected were Oakland, Los Angeles, and Stockton. The ports of Oakland and Los Angeles were selected because they are ranked in the top three ports for the crops being studied. Since the port of Los Angeles and the port of Long Beach are right across from each other, they should face most if not all of the same transportation issues. Hence, only the port of Los Angeles was visited. The port of Stockton was selected because it represents an inland port that is in the heart of the Central Valley. Also, the port of Stockton is in the process of developing a marine highway that will transport goods from the Central Valley to the ports in the bay area, e.g., Oakland, San Francisco, etc.

On December 9, 2010 a visit was taken to meet with representatives at the Port of Los Angeles followed by a visitation with the Port of Oakland and Port of Stockton on August 22, 2011. A few notable points can be made after visiting the three California ports and discussing potential and current concerns with the various administrative representatives. On a general level, the various concerns that all the ports are faced with tend to be universal to all products exported from California. Congestion, stricter government regulation, and environmental concerns are all issues being dealt with. However, the consensus is that shippers and carriers understand that California has more stringent regulations and for the most part increased costs of these

regulations has been shared by firms, state and federal agencies through grants, and the ports. Shipping firms are reducing costs through methods such as slow steaming, i.e., reducing travel speed to save on fuel costs, and dry-docking.

In addition, California producers do not face the same issues that exporting agriculture producers in the Midwest do. The abundance of import trade has created an excess supply of containers at California ports with some shipping companies actually returning empty containers to Asia. Furthermore, it seems that the demand for California agriculture in Asia has steadily been increasing. The major indicated hindrances to increased agricultural exports are the lack of foreign infrastructure and direct import relations. For example, Mainland China has seen a large increase in agricultural imports due to the increased middle class and current exchange rates. However, the lack of rail and road infrastructure has made it hard for demand to be met. As the factors that affect the cost of transporting California agriculture within the nation rise it appears that the agricultural industry may be pushed to increase Asian exports. While this may not pose a threat to producers it will directly affect consumers.

The different ports have been somewhat progressive in complying with new regulations and have capitalized on their comparative advantages. In addition, the standard shipping line creates a unique opportunity for the different ports. The major route from Asia has the liners stopping first at the Ports of Long Beach and Los Angeles, dropping most of their cargo then cruising up to the Port of Oakland where the remaining space is filled with exports back to Asia. Since the port of Oakland is the second port of call for many exporting ships, it makes sense why Oakland has over fifty percent of the share of fruits and vegetables being exported by sea vessel.

Port of Los Angeles

The Port of Los Angeles specializes in high volume imports of durable goods. Agriculture plays a small role in their export portfolio with specialty crops comprising an even smaller share of the port's total exports. Due to their size and proximity to the major metropolitan area of Los Angeles, the representatives of the Southern California port reported that they have enacted programs to help limit peak-hour congestion due to port business and have been proactive in complying with environmental regulations. The Pier Pass, which established off-peak operating, shifts for 6 p.m. to 3 a.m. and other such programs create incentives to deliver goods at non-peak hours. The port officials had no great concerns that may affect California specialty crops in general. One of the largest general concerns for the port that affects all of their business, including the transportation of specialty crops, is the constrained infrastructure.

Port of Oakland

Unlike the southern ports, the Port of Oakland is a net exporting port and their top exported commodities include agriculture. The Port of Oakland offers roughly two fewer days of travel time due to the standard shipping line as compared to other California ports shipping perishable goods. In order to comply with current environmental regulations, the port, as well as other ports in California, are currently installing infrastructure that allows vessels to plug into the port’s electrical grid and turn off their engines historically needed to maintain refrigerated cargo. Port officials reported that current infrastructure is up-to-date and the port has the capacity to increase export volumes substantially.

Port of Stockton

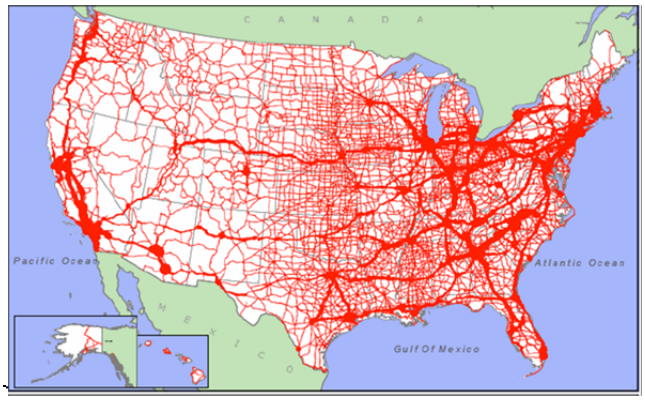
The Port of Stockton is currently working on a barge system that will allow agricultural producers to fill both refrigerated and dry containers at their port and ship them downriver to the Port of Oakland where they will be transferred to container vessels for export. This federally funded program is meant to shift highway traffic to Oakland onto the major California waterways thereby reducing vehicle emissions and increasing the inner port profitability. In addition to this project, the port has recently acquired a substantial amount of former military property increasing their ability to expand operations. Their main commodity mix includes agricultural chemicals, some of which are processed in close proximity to the port. A representative highlighted two major issues with transporting crops in California that were related to the trucking industry. This representative mentioned that it is becoming more difficult for trucking companies to find qualified drivers due to stricter regulations that have been imposed recently. He also mentioned that the highway weight limits are causing some trucks that are moving to the ports to only be partially filled. He believed that both of these issues would make a marine highway invaluable to Central Valley agricultural producers.

VI. Emerging Issues and Areas for Additional Research

The ability of existing resources to meet the current demand for transportation services associated with the distribution of California fresh fruit and vegetables, particularly movements by truck, will be a challenge in the future. For example vehicular traffic volume increases will continue to compete for space along major arteries within the population growth centers and across transcontinental pathways. Estimates predict increased congestion that will likely add to the difficulty associated with the timely delivery of perishable commodities. For example the Federal Highway Administration estimates of increased daily truck traffic are illustrated in Figure 6.1.[13] Assuming no change in existing network capacity the number of highways with recurring congestion and larger truck volumes is expected to increase nearly four-fold by 2040.[14]

Figure 6.1. Estimated Average Daily Truck Traffic 1998, 2020.

1998



2020

[13] Estimated Average Annual Truck Traffic, Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework.

[14] U.S. Department of Transportation, Federal Highway Administration, Office of Highway Policy Performance Monitoring System; and Office of Freight Management and Operations, Freight Analysis Framework, Version 3.1, 2010.

Many issues are associated with the future path of specialty crop transportation. For example the ongoing discussion regarding the sourcing of food and related eco-system impacts has the potential to increase the flow pattern of commodities. If the demand for locally grown products, currently defined in various ways, drives increased production within the service areas of major consumer markets it may decrease the extent of long-haul truck deliveries and impact markets in traditional growing areas like California. The extent of any change will be determined by effects on crop mix, relative prices and other factors.

Environmental Concerns

Major buyers like Wal-Mart are in the process of encouraging suppliers to measure their carbon footprint and report to measuring bodies like the Carbon Disclosure Project. These buyers are being encouraged to identify how they can benefit from a transition to a low carbon economy.[15] To meet such buyer demands, more attention will need to be focused on the total cost associated with transportation of specialty crops from surplus production regions to deficit demand centers. To begin to understand how such changes may impact the environment requires some measure of the current situation with regard to environmental quality.

In the move toward accounting for and managing greenhouse gas emissions the first step is to measure them. A straight forward method to estimate is the greenhouse gas (GHGs) emissions associated with the current movement patterns of California specialty crops is to utilize a mass balance approach. For purposes of illustration in this report our focus is limited to carbon dioxide emissions associated with the movement from California to the terminal market areas defined earlier by the 15 city delivery points. Shipment distance was simple average of the distance from California production areas (Table 6.1). Based on information supplied by industry collaborators the GHGs estimates associated with outbound movement of the study commodities was calculated as:

GHGE = QF * CC * FC

Where GHGE is the measure of metric tons of CO_{2e}; QF the quantity of fuel used; CC the carbon emissions per unit of fuel use; and FC the percentage of carbon dioxide released during use.

The estimates for emissions per truck are based on several key assumptions provided by industry sources. First, the expected average gas mileage used in the model estimate is 5.8 miles per gallon. The second key assumption is that the carbon coefficient is 10.04724. This coefficient is the estimated amount of carbon that is emitted per gallon of combusted. The third key assumption is that 99% of the fuel used is combusted. Given these key assumptions, the estimates of per truck load emissions for each destination based on the mass balance approach described above are presented in Table 6.2. The emissions per truck load for the cities covered in this study range from 0.31 metric tons of CO2 equivalent up to 5.22 metric tons.

[15] Wal-Mart Sustainability Supplier Assessment: *www.**walmart**stores.com/**Sustainability**/*

Table 6.1 Avearge Transport Miles							
			Average Shipment Distance				
	Ship From:					Rancho	
	Fresno CA	Salinas CA	Santa Maria CA	El Centro CA	Oxnard CA	Palos Verdes CA	Average
Ship To:							
Atlanta GA	2301	2397	2305	2032	2230	2202	2245
Baltimore MD	2826	2923	2830	2615	2755	2727	2779
Boston MA	3112	3197	3116	2941	3042	3013	3070
Chicago IL	2144	2229	2148	2045	2074	2045	2114
Columbia SC	2510	2605	2536	2241	2439	2412	2457
Dallas TX	1557	1654	1561	1250	1486	1459	1495
Detroit MI	2409	2494	2413	2275	2338	2310	2373
Los Angeles CA	219	303	170	212	61	31	166
Miami FL	2870	2966	2906	2548	2797	2757	2807
Nashville TN	2132	2228	2136	1913	2061	2033	2084
Philadepphia PA	2845	2972	2849	2634	2774	2746	2803
Pittsburg PA	2561	2674	2564	2350	2490	2462	2517
San Francisco CA	192	106	264	591	388	404	324
Seattle WA	928	895	1053	1347	1144	1160	1088
St. Louis MO	1956	2052	1959	1744	1884	1856	1909
Source: GoogleMaps.com							

Table 6.2 Emissions Per Truck Load							
	Average Mileage from Shipping Points	MPG	Quantity of Fuel (Total Gallons)	Carbon Coefficient	Fraction Combusted	Kg/Load	Emissions per Truck Load (MT CO2)
Atlanta GA	**2206**	**5.8**	**380**	**10.04724**	**99%**	**3783**	**3.78**
Baltimore MD	**2747**	**5.8**	**474**	**10.04724**	**99%**	**4712**	**4.71**
Boston MA	**3043**	**5.8**	**525**	**10.04724**	**99%**	**5219**	**5.22**
Chicago IL	**2096**	**5.8**	**361**	**10.04724**	**99%**	**3594**	**3.59**
Columbia SC	**2457**	**5.8**	**424**	**10.04724**	**99%**	**4217**	**4.22**
Dallas TX	**1451**	**5.8**	**250**	**10.04724**	**99%**	**2489**	**2.49**
Detroit MI	**2351**	**5.8**	**405**	**10.04724**	**99%**	**4031**	**4.03**
Los Angeles CA	**181**	**5.8**	**31**	**10.04724**	**99%**	**310**	**0.31**
Miami FL	**2762**	**5.8**	**476**	**10.04724**	**99%**	**4736**	**4.74**
New York NY	**2833**	**5.8**	**488**	**10.04724**	**99%**	**4858**	**4.86**
Philadelphia PA	**2771**	**5.8**	**478**	**10.04724**	**99%**	**4752**	**4.75**
Pittsburg PA	**2485**	**5.8**	**428**	**10.04724**	**99%**	**4261**	**4.26**
San Francisco CA	**370**	**5.8**	**64**	**10.04724**	**99%**	**635**	**0.64**
Seattle WA	**1133**	**5.8**	**195**	**10.04724**	**99%**	**1943**	**1.94**
St. Louis MO	**1877**	**5.8**	**324**	**10.04724**	**99%**	**3218**	**3.22**
Source: Industry Collaborators; Mass Balance of Emissions							

Combining the estimates presented in Table 6.2 with the allocation of distribution by commodity provides a first approximation of the carbon footprint associated with the movement of any of the study commodities to any of the selected destinations. For example the results for the movement of celery by truck are presented in Table 6.3, where 100,000 lb. units are converted to 40,000 lb. truckloads as used in USDA/AMS daily movement reports.[16]

Table 6.3 Emissions by Destination: Celery by Truck			
CELERY-TRUCK	Number of Truck Arrivals	Emissions Per Truck Load (MT CO_2)	Total Yearly Emissions (MT CO_2)
Atlanta GA	1305.94	3.78	4940
Baltimore MD	2223.63	4.71	10477
Boston MA	1350.06	5.22	7046
Chicago IL	4456.09	3.59	16017
Columbia SC	97.06	4.22	409
Dallas TX	1932.44	2.49	4809
Detroit MI	2814.84	4.03	11348
Los Angeles CA	4667.87	0.31	1447
Miami FL	1076.52	4.74	5099
New York NY	3211.92	4.86	15603
Philadepphia PA	1517.72	4.75	7212
Pittsburg PA	1411.83	4.26	6016
San Francisco CA	1226.53	0.64	779
Seattle WA	2355.99	1.94	4577
St. Louis MO	1676.55	3.22	5396
Total	31325.00		101173.96

In a similar fashion the carbon footprint associated with the movement of the study commodities by rail may be approximated. In the case of rail transportation the emission factors used in the calculation include conversion factor of 3.67 (CCF) to convert the amount of carbon burnt in transit to equivalent amounts of CO2 (every 12 grams of carbon burnt releases 44 grams of CO2). Given the gallons per mile used (GPM) and the mass density (MD) of conventional diesel

[16] For example see: USDA, AMS, Fruit and Vegetable Programs, Market News Branch, Daily Shipment and Crossings Report for Selected Commodities: http://www.marketnews.usda.gov/portal/fv

of equal to 3167 grams/gallon, with carbon content (CC) of 0.86, the amount of carbon burnt (CB) is equivalent to:

$$CB = GPM * MD * CC$$

Combining these values allows for the deamination of CO2 generated in grams per mile by:

$$CO2 = CCF * CB$$

Assuming a class 1 freight locomotive under normal conditions and train tonnage is in the range of 2.5 miles per gallon the equivalent CO2 per mile would be 24.98 kg per mile or about 22.2 lbs. of CO2 per gallon.[17] Because of the difference in cargo capacity truck freight emissions are calculated to be around 13,900 ton miles per ton of CO2 while rail freight emissions are reported to be around 37,200 ton miles per ton of CO2.[18]

The calculation of the carbon footprint associated with the movement of specialty crops becomes more meaningful when viewed in the context of what the value/cost of such a measure implies. For example if the customers value the attribute associated with a company accounting for GHG emissions and the willingness to offset them in some way, what might be the cost? One way to establish such a value is to apply the current price for carbon to the total emissions associated with the movement of an individual commodity. Once established that value may then be expressed on a per-carton or related sales quantity to establish the eco-system cost associated with the purchase of a given commodity for a given origin. In this way consumers could better determine the impact on a measurable environmental effect of the purchase of a product from a distant location compared to one produced "locally". It is important to emphasize that such a measure is only a small part of the total system costs as truck transport from origin to destination represents only around 11 percent of the life-cycle GHG emissions associated with a given product transformation from farm to retail.[19]

The price of carbon varies depending on the market upon which it is based. Surveys of existing market prices in April, 2012 suggest a range of prices per metric ton CO2 with a low of $2.75 to a high of $29.[20] Incorporating these cost with the emissions per truckload provides a simple estimate of the current value the market places on the negative externality in the form of CO2 emissions associated with a given product movement. For example a truckload of produce moving from California to Boston creates 5.22 metric tons of CO2 emissions. Choosing a cost at the higher end of the range $25.35 per metric ton reported for Sustainable Travel International, a firm that facilitates carbon footprint offsets for personnel and business travel, results in a per truckload cost (carbon offset value) of $132.33.

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[17] U.S. Department of Energy, Energy Efficiency and Renewable Energy, Fact #576: June 22,209 Carbon Dioxide from Gasoline and Diesel Fuel. U.S. Environmental Protection Agency, "Emission Facts: Average Carbon Dioxide Emissions Resulting from Gasoline and Diesel Fuel," February 2009. http://www1.eere.energy.gov/vehiclesandfuels/facts/2009_fotw576.html

[18] Texas Transportation Institute. "A modal Comparison of Domestic Freight Transportation Effects on the General Public", March, 2009.

[19] 2008. Weber, Christopher L. and H. Scott Matthews. "Food-Miles and Relative Climate Impacts of Food Choices in the United States", Environmental Science Technology, Vol. 42, pp. 3508-3513, 2008.

[20] http://www.ecobusinesslinks.com/carbon_offset_wind_credits_carbon_reduction.htm

When expressed as a cost per unit the actual value the market places on the externality, and hence recovery cost to offset the negative externality link to produce transportation, is relatively small. The average refrigerated truck rate for produce movements from California to Boston is reported to be $2.37 per mile, or $7,212 per delivery.[21] In this example the addition of a carbon offset duty would amount to an additional 1.8% in the cost of the transit from origin to destination, based on 40,000 lbs. of cargo. This equates to $0.0033 per pound in additional costs to the product. For a commodity such as celery, with a Boston terminal market price of $19 per 55 lb. carton the individual unit price offset cost would be about $0.01 per pound.[22]

Clearly this is a starting point for understanding how transportation of produce impacts the environment. A product life cycle analysis would need to be done for each commodity to more accurately measure the environmental effects. Such an accounting would need to include, but not necessarily be limited to: the net balance between any sequestration value from plant growth, emissions from machinery used in production, emissions from backhaul movement and many other.

Framework for Future Policy Analysis

A number of regulatory issues have the potential to substantially impact the produce transportation system in California and across the U.S. Rules that govern truck weights, hours of service allowed for truckers and alike can be expected to affect time and hence cost of movements of fresh produce and other cargo. One approach to the analysis of such policy changes is to examine the effects on market flows as costs associated with a given policy option change the competitive mix of origins for products to a given location. To examine such policy questions the study team has initiated a threefold approach directed to the analysis of California's specialty crop refrigerated truck transportation competitiveness.

A visual model approach provides a visual representation of California's specialty crop transportation competitive boundaries with other states producing selected specialty crops. The competitive boundaries provide a set of visual diagrams known as service area diagrams. The boundaries of the service areas are based on transportation cost differentials. These boundaries will show how far California specialty crops can travel before running into competition by other states.

An EXCEL spreadsheet model has been constructed that merges shipping point prices, distances from production counties and major destination cities in the US, and per mile truck transportation rates. Mileage rates are estimated using an average of rates provided by AMS, Refrigerated Truck Quarterly, and industry contacts. Shipping point prices are aggregated up to full truck value based upon average container weights and a 43,500 lbs. truck capacity. Distances from production regions and destination cities are based upon the shortest distance from production county seats and destination city centers. Weekending prices are then weighted by 10,000 lbs. movements and aggregated quarterly. End results give shipping point price differentials, total transportation cost differentials, and delivered price differentials for 10 commodities originating from 46 production counties and going to 15 destinations.

[21] http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5097094
[22] USDA, AMS, Fruit and Vegetable Market News, Terminal Market Report, Boston, May 23, 2012.

The third modeling approach is a mathematical programming model of California specialty crop delivered cost competitiveness. The delivered cost California specialty crop competitiveness model (DCCSCC) can be shown mathematically as:

$$1.\ \ Min \sum_{r} \sum_{l} \sum_{q} Del\cos t_{rlq} * Shipments_{rlq}$$

$$S.T.$$

$$2.\ \ \sum_{r} Shipments_{rlq} \geq Demand_{lq}$$

$$3.\ \ \sum_{l} Shipments_{rlq} \leq Supply_{rq}$$

$$Shipments_{rlq} \geq 0$$

The objective function for the DCCSCC model is to minimize the sum of the total delivered cost ($Delcost_{rlq}$ * $Shipments_{rlq}$) of supplying a specific specialty crop from major production regions (r) to major market locations (l) by quarters (q) for a calendar year. The delivered cost ($Delcost_{rlq}$) is the per-unit (e.g. carton, box) shipping point price plus the transportation cost per unit for each major production region to each major market location for each quarter of the year. Delivered cost was selected because it contains the two values that can affect the competitiveness of California specialty crops against other producing regions. The delivered cost provides information on the possible offsetting impacts between shipping point price and transportation cost. The $Shipments_{rlq}$ are the optimal amounts of a specialty crop that would be shipped from each major producing region to each major market location in each quarter given the objective of minimizing the sum of the total delivered cost.

The objective function is constrained by the market demand for each major market and available supply for each major production region for each quarter of the year. The major market demand constraint requires that the sum of major production region shipments of a specific specialty crop to a specific major market equal or exceed major market demand for that specialty crop in a given quarter. The supply constraint requires that the sum of the shipments to the major market locations be less than or equal to the supply available from the major production regions in a given quarter. The supply and demand constraints result in equilibrium between major market demand and major location supplies in each quarter of the year.

The following presents an example of value of using delivered cost as the competitive variable. Suppose for a given specialty crop in a given quarter California has a shipping point price of $12.50/unit and a transportation cost of 2.85/unit to Chicago then the delivered cost to Chicago would be $15.35/unit. Let a competing production region have a shipping point price of $13.00/unit and transportation cost of 2.50/unit to Chicago for a delivered price of $15.50. California has a transportation cost that is $0.35 per-unit greater than the competing producing region however California's shipping point price is $0.50 per-unit lower than the competing production region. The lower shipping point price offsets California's transportation cost disadvantage, ceteris paribus. Thus, California's lower shipping price allows it to maintain a competitive advantage in the given quarter even though California has a higher transportation cost.

VII. Summary and Conclusions

This report summarizes the first part of a concerted effort to study how transportation affects the competitiveness of California specialty crops. This effort was broken-up into two main parts. The first part, which is the topic of this report, is to characterize the transportation system that California specialty crop producers utilize and have to compete within. The second part of the effort attempts to model the transportation sector that California producers face, primary dealing with trucks, for the purposes of understanding how transportation issues affect the competitiveness of California producers.

In order to characterize the transportation sector that California producers utilize, several key areas were investigated. The first area identified the key ways agricultural products are transported to the consumers outside of the states. Four modes of transportation were examined—air, boat, rail, and truck. Given that California produces a vast array of specialty crops, which is estimated to be over 400 commodities, certain representative commodities were chosen as a focus for this study. These commodities include: celery representing root crops, cherries and peaches representing stone fruit, table grapes representing vine crops, head lettuce representing leafy greens, strawberries representing berries, sweet corn and fresh tomatoes representing common vegetables, and watermelons representing melons. Given that most of the nuts in the state are primarily produced within the state, they were left out of the analysis since there are no significant competitors.

The second key area examined where each of the commodities is being shipped from, where they are shipped to, and by what means. Data gathered from a multitude of USDA sources were utilized to provide this examination. It was found that the data employed for this study had several limitations. First, the data only represents shipments that are made to the terminal markets that are collected by the USDA. These include: San Francisco and Los Angeles, CA, Seattle, WA, Dallas, TX, St. Louis, MO, Chicago, IL, Atlanta, GA, Pittsburgh and Philadelphia, PA, New York, NY, Boston, MA, Baltimore, MD, Columbia, SC, and Miami, FL. Hence, many minor metropolitan areas were not analyzed. The second limitation was that the data does not take into account any shipments that are done by large shippers such as Wal-Mart. Even more so, the data that is collected by the USDA currently does not appear to represent the existing environment for shipping specialty crops.

One of the key findings in this study is that the vast majority of specialty crops move by truck transportation. The other three modes of transportation do not come close to moving volume and value of specialty crops that trucks do. Because of this fact, two surveys were conducted. One survey examined transportation issues that are pertinent to the shippers of specialty crop. Another survey was conducted to understand the trucker’s point of view of the issues for shipping.

The truckers in the survey indicated that they spent a large amount of time waiting to load produce at the shipper's facility. The issue of wait-time is highest on the list of issues truckers find are important and it is an issues that truckers believe the shippers have a high level of poor performance. They indicated that this wait time seems to be worse for produce than it is for other goods they haul. There were several major findings from these surveys.

The first major finding is that truckers who ship specialty crops in California must contend with a large amount of congestion. This has led truckers to schedule their pick-ups and deliveries during off-peak congestion hours. This finding speaks for the need of better infrastructure in the state. This is especially true when examining the long-run growth trends of California traffic.

Another major finding of the surveys is that truckers have large wait times for loading and unloading there trucks. This seems to be more of a specialty crop industry issue than governmental policy issue. It is recommended that shippers and receivers of specialty crops investigate how they can decrease these weight times for truckers. Since the typical trucker gets paid by the mile, these wait times cut into the effective wage that the trucker receives.

The effective wages of truckers can be an important issue for shippers of specialty crops. This issue is potentially intertwined with another finding of the survey which is that shippers are concerned about the availability of drivers. The survey found that over forty-three percent of shippers believe that driver shortages are a serious problem. Since the shippers may have the ability to reduce waiting times for trucker loading, they could increase the truckers' relative wages which could alleviate some of the driver shortages issues.

It appears from the surveys that both truckers and shippers concur on the regulatory environment in California. Both are concerned with the level of regulation in California. One of the findings from the trucker survey indicates that the current path of regulations is going to lead to future increases in cost of transporting goods. This can lead to an increase in the cost of specialty crops. This leads to the policy question of do the benefits of regulations on truck transportation exceed the potential cost to society of increasing the cost of specialty crops. Answering this question is beyond the scope of this work, but it is recommended to policymakers that they consider these implications when designing policies regarding truck transportation.

A cursory examination was conducted regarding the greenhouse gas emissions from transporting celery to the various different major markets across the country. It was estimated that a total of approximately 101,174 metric tons of CO2 equivalent greenhouse gas is emitted to ship celery from California to the major metropolitan areas that were a part of this study. Looking at the Boston market and incorporating a market price for carbon, it was found that the per pound cost for celery would increase by around $0.01 to account for a carbon tax offset.

Effort was given to examining all four modes of transportation. It was found that the available access to data was not uniform. It was found that the data regarding air, ship, and rail modes of transportation are much more limited than truck transportation. In order to deal with the limited data, discussions with industry representatives were conducted for rail and ship. In terms of the ports and transporting specialty crops, there does not seem to be many crucial issues affecting the competitiveness of specialty crops. It appears that the biggest limitation for transporting specialty crops overseas by boat is the marketing infrastructure that exists overseas. In terms of rail, it was found that the cost of rail in terms of its services cannot compete well against the trucking industry. It was found that only a select few specialty crops use rail and it usually is to the farthest major cities across the United States.

Out of all the topics that were discussed with representatives of the different modes of transportation, several issues kept rising to the top. The first issue is infrastructure. All of the people we talked to had similar concerns that the transportation infrastructure in California

needed much improvement. Another key issue that was important to the stakeholders we talked to was the regulatory environment in California. Most believed that the regulatory environment in California was causing major issues with transporting specialty crops. Since trucks carry the vast amount of specialty crops, any regulation that affects the trucking industry has a great effect on the competitiveness of the specialty crop industry in California.

Appendix A

Apendix Table 1. Shipments by Months: 2010
California Fruits (100,000 LBS)

Commodity	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
TRUCK:													
Apples	20							190	323	268	80	54	935
Apricots					66	78	39	11	2				196
Avocados	52	93	229	429	736	692	905	774	631	563	251	36	5391
Cherries, Sweet					641	598							1239
Grapes	70				139	804	1294	2723	3271	2950	2743	1153	15147
Kiwifruit	15	4								12	24	23	78
Nectarines					114	618	806	722	566	119			2945
Peaches					143	766	1048	1004	676	311	1		3949
Pears							257	460	348	183	21		1269
Plums					26	354	715	751	590	269	19		2724
Raspberries	27	26	23	27	99	168	115	129	141	112	61	29	957
Strawberries	190	350	1268	1982	2380	2301	1803	1477	1267	773	367	147	14305
PIGGYBACK:													
Apples								4	5	8	11	1	29
Apricots					1								1
Grapefruit						9	6	6	8				29
Grapes							8	18	57	20	14	5	122
Kiwifruit													
Lemons	7	10	18	30	39	49	51	44	25	19	23	29	344
Nectarines					1	7	7	10	5				30
Oranges	148	166	224	174	115	86	65	57	51	41	83	91	1301
Peaches					3	10	17	17	11	3			61
Pears								1	4				5
Plums						4	6	5	4	2			21
RAIL													
Apples								18	41	12	3		74
Apricots						1							1
Avocados						2	10	4	4				20
Grapefruit					2	3	3	11	8				27
Grapes						16	10	43	164	122	54	25	434
Lemons		2	11	8	3	2	8	2		2	9	5	52
Oranges	303	347	419	366	286	259	101	63	69	70	105	247	2635
Peaches					1					3			4
Plums									1	4			5
Tangerines, Mandarins, Tangelos & Tangors	1												1

Source: Fresh Fruit and Vegetable Shipments by Commodities, States, and Months, Agricultural Marketing Service, Fruit and Vegetable Programs, USDA, FVAS-4 Calendar Year 2010, Issued February 2011.

Appendix Table 2. Shipments by Months: 2010
California Vegetables (100,000 LBS)

Commodity	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
TRUCK:													
Artichokes	31	59	30	52	51	46	51	49	65	60	59	41	594
Asparagus		5	110	181	122	7							425
Beans				17	19					10	39		85
Broccoli	307	264	376	526	476	496	498	509	478	476	425	395	5226
Cabbage	115	98	104	91	99	105	114	135	115	95	103	94	1268
Carrots	482	479	564	537	516	613	741	788	747	796	709	690	7662
Cauliflower	167	134	249	277	284	293	269	295	288	297	206	188	2947
Celery	883	847	1039	987	1110	1130	831	882	880	1093	1711	1137	12530
Corn, Sweet				374	985	554	658	579	365	179	199	33	3926
Lettuce, Iceberg	495	442	713	1806	1939	2145	2162	2110	2122	2108	958	324	17324
Lettuce, Other	91	79	106	236	243	242	223	225	224	259	170	83	2181
Lettuce, Romaine	268	269	459	1017	1081	1090	1004	953	1057	1176	811	337	9522
Melons, Cantaloupe					514	922	1497	3021	2213	768			8935
Melons, Honeydew					28	173	558	996	825	126			2706
Melons, Watermelon					197	670	983	1123	555	111			3639
Onions	166	57	38	105	788	889	1224	1142	468	317	163	100	5457
Peppers, Bell	12	1		73	306	512	658	668	613	510	418	59	3830
Spinach	30	31	36	45	55	49	45	46	46	49	41	34	507
Tomatoes						74	994	1100	1340	1293	394	7	5202
PIGGYBACK													
Broccoli	8	9	27	46	42	42	38	32	30	29	24	5	332
Carrots	58	50	56	63	42	44	39	38	36	33	36	35	530
Cauliflower	2		2	14	12	18	16	14	15	10	9	2	114
Celery	89	76	93	119	109	99	77	70	70	62	90	95	1049
Lettuce, Iceberg	36	37	52	158	135	152	133	134	143	112	63	14	1169
Lettuce, Other				12	10	9	7	7	7	8	4		64
Lettuce, Romaine	18	15	34	95	84	88	76	70	82	67	45	13	687
Melons, Cantaloupe					7	17	39	129	90	35			317
Melons, Honeydew						7	13	42	42	8			112
Melons, Watermelon						8	26	21	21	3			79
Onions				1	78	114	157	95	45	6			496
Peppers, Bell				3	18	24	29	32	37	29	20	3	195
Tomatoes						4	31	31	33	42	17		158
RAIL													
Broccoli	17	40	34	92	48	35	18	6		16	10	3	319
Carrots	90	48	73	57	73	98	104	77	68	51	63	55	857
Cauliflower		4	20	8		3						1	36
Celery	27	38	29	32	66	63	43	24	21	30	91	76	540
Lettuce, Iceberg	7		4	3	3	21	28	3	4	4			77
Melons, Cantaloupe					6	119	94	201	122	62			604
Melons, Honeydew					2	29	17	38	44	9			139
Onions	2			5	34	68	101	49	12	2		2	275
Peppers, Bell				1	3	3	7		1				15
Tomatoes						4	15	12	13	17			61
AIR													
Asparagus				1									1

Source: Fresh Fruit and Vegetable Shipments by Commodities, States, and Months, Agricultural Marketing Service, Fruit and Vegetable Programs, USDA, FVAS-4 Calendar Year 2010, Issued February 2011.