The Importance of Freight Transportation to Agriculture

Chapter 2

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The global economy experienced a period of unprecedented growth and relatively low inflation from the 1990's through 2007. At the same time, U.S. agriculture also experienced strong growth. In 2007, the market value of agricultural products sold was more than $297 billion—83 percent higher than in 1992.[13] U.S. agriculture is increasingly dependent on transportation to deliver agricultural and food products to urban centers and coastal export facilities, most of which are distant from the producing regions.[*] Raw agricultural products also need to be moved to agricultural processing facilities such as grain mills, fruit and vegetable processors, and meat processors. The agricultural sector is the largest user of freight transportation in the United States.

Adequate and efficient transportation is especially critical to successful marketing of U.S. agricultural products, which depends on transportation to deliver goods. This chapter reviews how agriculture uses transportation in the context of all freight transportation moving along major transportation corridors. It also examines the characteristics of agricultural supply and demand that make transportation critical to successful marketing and analyzes the supply and demand characteristics of several agricultural commodities for transportation implications.

Figure 2-1: Peas being harvested directly into a field truck. Trucks are often the first and last steps in the transportation chain.

Source: USDA

[*] According to the 2000 Census, over 36 percent of the U.S. population resides in the East Coast States, 20 percent in the West Coast States, and almost 12 percent in the Gulf Coast States.

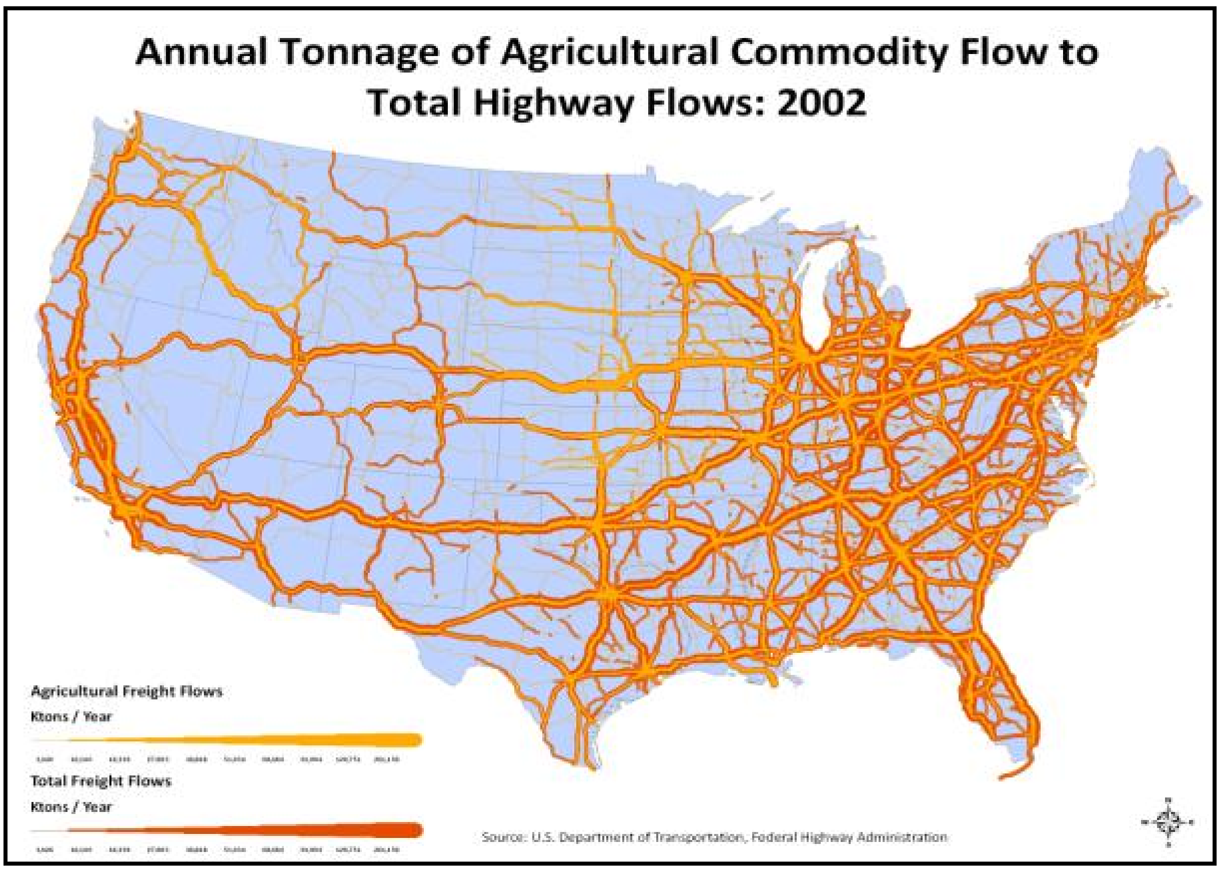
How Agriculture Uses Transportation

Agricultural freight moves by truck, rail, and barge along the nation's vast network of highways, rail lines, and navigable waterways, competing with other freight for capacity. Maps in Figures 2-1, 2-2, and 2-3 show the magnitude of agricultural shipments relative to other freight traffic moving along the critical transportation corridors. Colors on the maps indicate the type of shipment and the width indicates its volume. Orange represents all commodity movements and yellow indicates food and farm products as a component of all commodity movements—areas where food and farm products predominate are mostly yellow.

Highways

Trucks moving food and agricultural products compete for capacity along the major interstate highways crossing the United States (Figure 2-2). Agriculture and food movements comprise most of the commodities on highways crossing several States. For example, the lines are mostly yellow in parts of North and South Dakota, Nebraska, Kansas, Idaho, and Washington, indicating that agricultural commodities make up most of the shipments on those highways.

Figure 2-2: Agricultural and total freight moving on U.S. interstate system, 2002



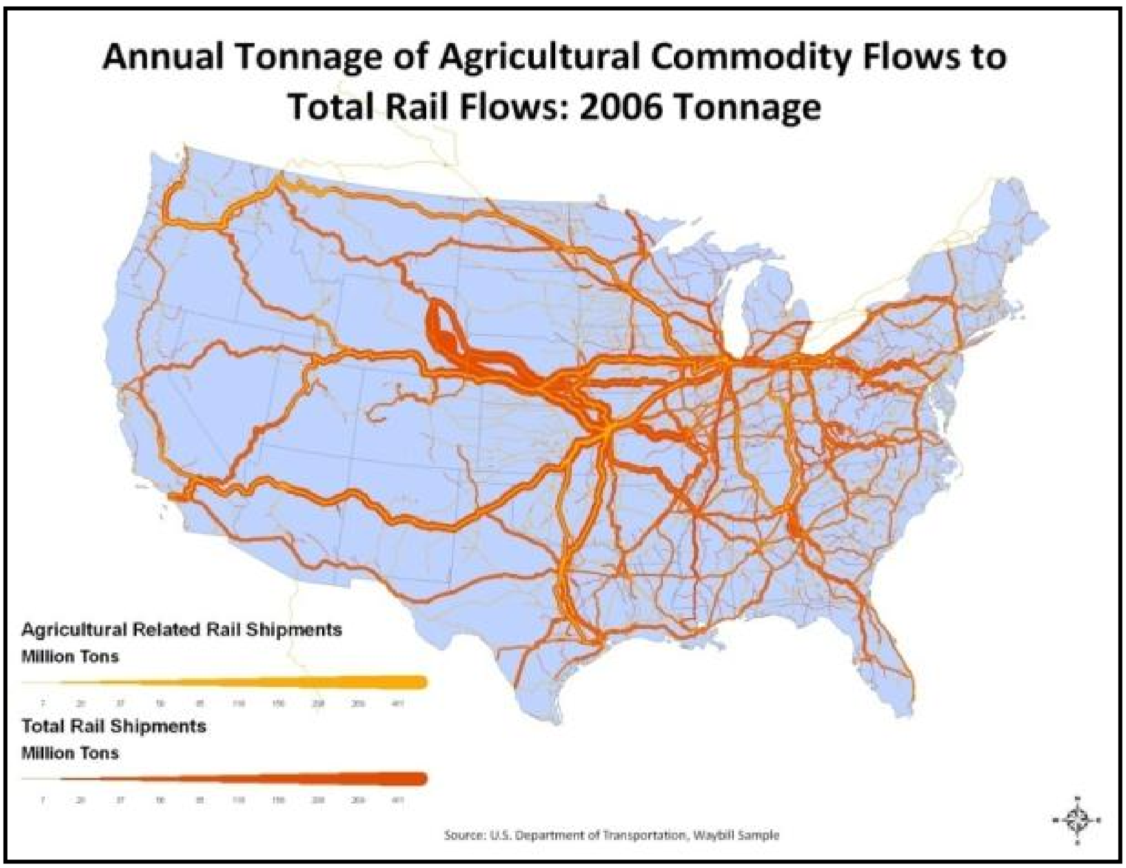
Railroads

Agricultural traffic competes with other freight along key rail corridors. It plays an important role in several major corridors; agricultural movements are significant along many east-west corridors, as well as along the West Coast and parts of the Midwest (Figure 2-3).

Seven Class I railroads are in operation in the United States today, and each is important to agricultural movements:[*,14]

- BNSF Railway (BNSF) operates in the Western corridors.
- CSX Transportation (CSX) operates in the Eastern corridors.
- Kansas City Southern Railway (KCS) operates in the South-Central region.
- Norfolk Southern Combined Railroad Subsidiaries (NS) operates in the East.
- Union Pacific Railroad (UP) operates in the West.
- Canadian National (CN, through its U.S. subsidiary, Grand Trunk Corporation) operates mainly in the central North-South corridors.
- Canadian Pacific (CP, through its U.S. subsidiary, Soo Line Railroad) operates in the corridors between the Northern Upper Great Plains to the Northern Midwest and Northeast.

Figure 2-3: Agricultural and total freight moving on U.S. rail lines, 2006

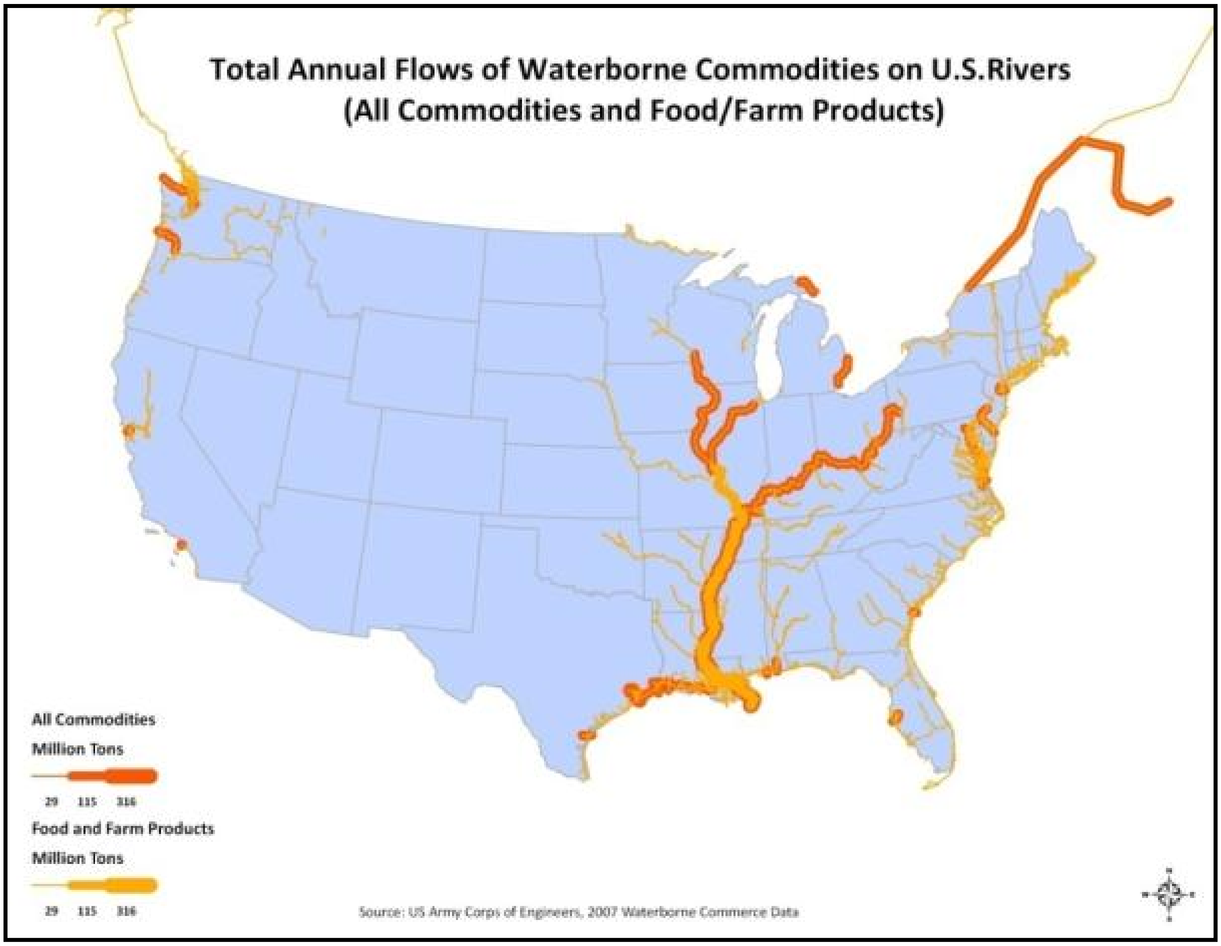


* Class I Railroads are line haul freight railroads with 2007 operating revenue in excess of $359.6 million each.

Waterways

The Mississippi River system is the primary waterway for moving agricultural products by barge. It is especially important for transporting bulk grains and oilseeds from the Midwest to export ports in the New Orleans region. Other important rivers include the Columbia River in the Pacific Northwest, which also moves some bulk grains and oilseeds, and coastal waterways that supply poultry and hog operations in the mid-Atlantic region.

Figure 2-4: Agricultural and total freight moving on U.S. waterways



Relative Modal Importance

Every 5 years, the U.S. Census Bureau conducts the Commodity Flow Survey (CFS), which collects information about the value, tons, and ton-miles moved by the U.S. transportation system, as well as modal share information.* Modal shares are modal characteristics that

* When the analysis for this study was conducted, only the 2002 CFS detailed data (5-digit commodity code level) data and the 2007 preliminary general commodity data (2-digit) were available. The 2007 CFS complete report, with the updated detailed 5-digit data, was released in December 2009, but is not included in this report.

represent those portions of total tonnages or ton-miles that move by a specific mode of transport—truck, rail, barge, multimodal, or other.

In 2007, agriculture represented 22 percent of all tons and 31 percent of all ton-miles moved by the transportation system in the United States—almost the same as it was in 2002.[*] The movement of coal, in comparison, accounted for 9 percent of all tons and 21 percent of all ton-miles. Agriculture is the largest user of the U.S. transportation system.

According to the preliminary 2007 CFS data tables, the value of all commodities transported grew by 41 percent, the tons by 12 percent, and the ton-miles by 11 percent in 5 years. The value, tons, and ton-miles of agricultural commodities moved grew by 34, 5, and 5 percent, respectively, from 2002 to 2007[†] (Table 2-1).

Modal shares vary by commodity based on the quality of service and other factors, such as rates, availability, and customer needs. Commodities high in value or susceptible to deterioration or spoilage are more sensitive to handling procedures and to speed of delivery than less perishable commodities. For example, fresh fruits and vegetables require speed and careful handling above all. Trucks dominate movements of fresh fruit and vegetables, livestock, meats and poultry, dairy products, and bakery and confectionary products. Rail and barges lend themselves to bulk and lower-value products such as wheat and soybeans. Many commodities depend heavily on railroads, particularly grain and oilseed, alcohols, and fertilizers. The higher ratio of ton-miles for rail and barge indicates their efficiency at moving commodities longer distances, such as moving grains and oilseed to ports for export and to distant feedlot locations (Tables 2-2 and 2-3).

CFS data show that in 2002 trucks were the primary mover of agricultural products, claiming 70 percent of all agricultural tonnages and 46 percent of all agricultural ton-miles (Table 2-2). Railroads followed with 18 percent of tonnages and 36 percent of ton-miles (although railroads' share is much higher in the heavier bulk commodities such as grains and oilseeds, milled grain products and animal feed, alcohols, fertilizers, and lumber). Barges have a 9 percent share of agricultural tonnages and a 12 percent share of agricultural ton-miles—most of which is accounted for by movements of grain, animal feed, and fertilizers on the Mississippi River and its tributaries.

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[*] Includes movements of raw agricultural commodities (grains, livestock, timber, fruit, and vegetables), processed products (feedstuffs, dairy, canned foods, lumber, pulp, and paper), and agricultural inputs (fertilizer and pesticides).

[†] The CFS data are estimated with coefficients of variance, which makes this comparison inexact.

Table 2-1: Transportation characteristics of agricultural commodities, 2002 and 2007

	2002				2007				% Change from 2002		
Commodity description (2-digit)	**Value (billion $)**	**Tons (Million)**	**Ton-Miles (Billion)**	**Average Miles per Shipment**	**Value (billion $)**	**Tons (Million)**	**Ton-Miles (Billion)**	**Average Miles per Shipment**	**Value**	**Tons**	**Ton-Miles**
All Commodities	**8,397**	**11,668**	**3,138**	**546**	**11,832**	**13,017**	**3,491**	**580**	41	12	11
Agricultural Products:											
Live animals and live fish	7	6	2	530	15	9	4	725	98	43	146
Cereal grains	54	561	264	138	110	673	280	153	104	20	6
Other agricultural products	129	259	109	481	158	271	122	374	22	5	11
Animal feed and products	52	228	51	167	82	231	71	383	58	2	38
Meat, fish, seafood	201	85	41	162	259	90	44	243	28	7	7
Grain, alcohol, and tobacco products	113	109	49	189	137	115	50	262	21	5	3
Other prepared food; fats and oils	356	449	162	179	490	462	160	230	38	3	(1)
Alcohol and alcoholic beverages	109	89	26	55	157	117	33	87	44	31	29
Tobacco products	70	4	1	334	81	3	1	414	16	(23)	(34)
Fertilizers	34	264	88	157	42	137	52	162	23	(48)	(41)
Logs and Wood products	164	346	128	242	225	414	145	290	37	20	13
Paper Pulp	102	137	78	206	129	145	80	250	26	6	3
Paper or paperboard articles	104	69	23	282	118	82	30	392	14	18	27
Agricultural Products Sub-Total	**1,497**	**2,607**	**1,022**		**2,002**	**2,749**	**1,072**		**34**	**5**	**5**
% of All Commodities	**18%**	**22%**	**33%**		**17**	**21**	**31**				
Coal	23	1,240	686	120	33	1,235	722	115	46	(0.4)	5
% of All Commodities	**0.3%**	**11%**	**22%**		**0.3%**	**9%**	**21%**				

Source: DOT, Bureau of Transportation Statistics, U.S. Census Bureau, CFS, 2002
<http://www.bts.gov/publications/commodity_flow_survey/>

Table 2-2: Modal transportation characteristics of agricultural commodities by volume, 2002

Commodity Groups	Truck	(%) All Modes	Rail	(%) All Modes	Water	(%) All Modes	Multi-Modal	(%) All Modes	Other*	(%) All Modes	All Modes	Total
			-- Million Tons --									
Ag. and Food Products												
Grains (Incl. Seeds) & Soybeans	286.3	**40**	197.1	**27**	208.5	**29**	15.3	**2**	11.4	**2**	719	**100**
Other Oilseeds	5.7	**75**	1.3	**17**					0.5	**7**	8	**100**
Fruit & Veg (incl. potatoes)	73.0	**94**	1.0	**1**			0.5	**1**	3.4	**4**	78	**100**
Livestock and live fish	7.0	**95**	-						0.4	**5**	7	**100**
Meat and poultry, fresh or frozen	75.8	**98**	0.4	**1**			0.1	**0.1**	1.4	**2**	78	**100**
Dairy products	95.1	**98**	0.2	**0.2**			0.1	**0.1**	1.7	**2**	97	**100**
Processed veg., fruit, or nuts	54.6	**90**	2.6	**4**			1.5	**2**	2.0	**3**	61	**100**
Milled grain products; animal feed	94.8	**76**	23.5	**19**	1.2	**1**	0.7	**1**	4.1	**3**	124	**100**
Bakery products and preparations	58.0	**97**	0.3	**0.5**			0.6	**1**	1.0	**2**	60	**100**
Animal or vegetable fats and oils	31.6	**57**	17.4	**31**	3.1	**6**			3.5	**6**	56	**100**
Sugar (beet or cane); corn syrup	15.9	**42**	20.0	**53**			0.8	**2**	1.0	**3**	38	**100**
Confectionery, incl. cocoa	5.6	**91**	0.4	**7**			0.1	**2**	0.0	**0**	6	**100**
Beverages	218.3	**97**	2.4	**1**			0.5	**0**	4.2	**2**	225	**100**
Misc. food products	46.5	**92**	1.9	**4**			0.8	**2**	1.1	**2**	50	**100**
Alcohols (bev. and industrial)	7.9	**64**	3.6	**29**			0.2	**2**	0.7	**5**	12	**100**
Fertilizers	151.2	**57**	95.9	**36**	10.6	**4**			6.7	**3**	264	**100**
Lumber & wood products	284.6	**82**	48.5	**14**	0.4	**0.1**	2.6	**1**	9.9	**3**	346	**100**
Paper, pulp, paperboard articles	160.8	**78**	38.5	**19**			3.0	**1**	3.9	**2**	206	**100**
Farm machinery and equipment**	9.5	**89**							1.2	**11**	11	
Other ag. products	151.4	**88**	16.3	**9**	4.2	**2**	--		--		**172.5**	**100**
											-	
Ag. And Food Products Total	**1,824.1**	**70**	**471.2**	**18**	**228.0**	**9**	**32.7**	**1**	**51.4**	**2**	**2,607.4**	**100**
% of All Commodities, by mode	**23%**		**25%**		**33%**		**15%**		**5%**		**22%**	
Coal	149.8	**12**	839.5	**68**	39.7	**3**	58.3	**5**	152.5	**12**	**1,239.9**	**100**
% of All Commodities, by mode	**2%**		**45%**		**6%**		**27%**		**14%**		**11%**	
All Commodities	**7,842.8**	**67**	**1,873.9**	**16**	**681.2**	**6**	**216.7**	**2**	**1,053.3**	**9**	**11,667.9**	**100**

*Includes suppressed modal data, other single modes (air, parcel post, or pipepines), and other and unknown modes. For additional information about the CFS, please see, www.census.gov/cfs.

**Unpublished estimates. May contain high levels of sampling and nonsampling error. Not included in Ag and Food Products Subtotal.

Source: DOT, Bureau of Transportation Statistics, U.S. Census Bureau, CFS, 2002

Table 2-3: Modal transportation characteristics of agricultural commodities, by ton-miles, 2002

Commodity Groups	Truck	(%) All Modes	Rail	(%) All Modes	Water	(%) All Modes	Multi-Modal	(%) All Modes	Other*	(%) All Modes	All Modes	Total
			-- Billion Ton-Miles --									
Ag. and Food Products												
Grains (Incl. Seeds) & Soybeans	28.0	**9**	158.3	**50**	113.8	**36**	16.3	**5**	2.4	**1**	318.9	**100**
Other Oilseeds	2.9	**63**	1.1	**24**					0.6	**13**	4.5	**100**
Fruit & Veg (incl. potatoes)	33.1	**81**	2.1	**5**			1.2	**3**	4.4	**11**	40.7	**100**
Livestock and live fish	5.8	**95**							0.3	**5**	6.1	**100**
Meat and poultry, fresh or frozen	36.4	**97**	0.6	**2**			0.1	**0.4**	0.3	**1**	37.4	**100**
Dairy products	20.1	**98**	0.3	**1**			0.1	**0.4**	0.2	**1**	20.6	**100**
Processed veg., fruit, or nuts	31.5	**78**	5.2	**13**			3.1	**8**	0.6	**2**	40.4	**100**
Milled grain products; animal feed	19.2	**39**	22.4	**46**	0.7	**1**	0.6	**1**	5.9	**12**	48.7	**100**
Bakery products and preparations	23.8	**90**	0.4	**2**			1.0	**4**	1.2	**5**	26.5	**100**
Animal or vegetable fats and oils	9.7	**39**	12.4	**49**	2.4	**10**			0.5	**2**	25.0	**100**
Sugar (beet or cane); corn syrup	4.8	**19**	18.6	**75**			1.1	**4**	0.4	**1**	24.9	**100**
Confectionery, incl. cocoa	3.2	**83**					0.2	**5**	0.5	**12**	3.9	**100**
Beverages	34.3	**83**	2.1	**5**			0.8	**2**	4.2	**10**	41.4	**100**
Misc. food products	23.4	**83**	2.5	**9**			0.1	**0**	2.3	**8**	28.2	**100**
Alcohols	1.3	**25**	3.2	**61**			0.2	**5**	0.4	**9**	5.1	**100**
Fertilizers	45.0	**50**	35.2	**39**	6.5	**7**			3.2	**4**	89.9	**100**
Lumber & wood products	70.3	**55**	51.3	**40**			4.1	**3**	2.3	**2**	127.9	**100**
Paper, pulp, paperboard articles	64.1	**63**	32.4	**32**			3.5	**3**	1.5	**2**	101.5	**100**
Farm machinery and equipment**	4.2	**91**							0.4	**9**	4.6	**100**
Other ag. products	21.8	**62**	4.7	**13**					8.9	**25**	35.4	**100**
Ag. And Food Products Subtotal	**468.3**	**46**	**360.2**	**36**	**126.7**	**12**	**38.9**	**4**	20.1	**2**	1,014.3	**100**
% of All Commodities, by mode	**37%**		**29%**		**45%**		**17%**		**18%**		***32%***	
Coal	**11.7**	**2**	**590.4**	**86**	**11.8**	**2**			72.4	**11**	686.3	**100**
% of All Commodities, by mode	**1%**		**47%**		**4%**				**65%**		**22%**	
All Commodities Total	**1,255.9**	**40**	**1,261.6**	**40**	**282.7**	**9**	**225.7**	**7**	112.0	**4**	3,137.9	**100**

*Includes suppressed modal data, other single modes (air, parcel post, or pipepines), and other and unknown modes. For additional information about the CFS, please see, www.census.gov/cfs.

**Unpublished estimates. May contain high levels of sampling and nonsampling error. Not included in Ag and Food Products Subtotal.

Source: DOT, Bureau of Transportation Statistics, U.S. Census Bureau, CFS, 2002

Moving Agricultural Commodities to Market

Transportation demand is frequently referred to as a derived demand, suggesting that it is required to deliver products from producers to consumers. As such, it is an essential part of marketing; any change in supply or demand can affect the transport system's efficiency by bringing about either shortages or surpluses in transportation capacity. Additional factors that impact agricultural transportation demand include weather, the seasonality of the agricultural cycle and the resulting commodity price fluctuations that can translate into unexpected shifts in transportation patterns. America's agricultural producers depend on transportation as the critical link between the fields of growers and the tables of consumers, both here and abroad.

This section presents select transportation "profiles" to show overarching transportation characteristics and relationships. These profiles portray the supply and demand characteristics of the commodities and reveal some significant transportation implications. The groups of profiles are:

- Grains and Oilseeds
    - Corn
    - Soybean
    - Wheat
    - Rice
- Livestock and Livestock Products
    - Cattle and Beef
    - Hogs and Pork
    - Poultry
    - Dairy
- Fruits and Vegetables
    - Apple
    - Lettuce
    - Potatoes
- Fertilizers

The list above includes commodity groups for which transportation profiles were developed. The transportation profiles provide details of industry trends and transportation implications for each commodity. Where possible, the location of processing facilities is included in the profile.

Grains and Oilseeds Profile

The largest users of freight transportation in agriculture are the grains and oilseeds. In 2002, grains and oilseeds comprised 28 percent of all agricultural tons and 31 percent of ton-miles moved by all modes of transportation (Tables 2-2 and 2-3).

Industry Trends

Global agricultural supply and demand has changed rapidly since 1990. Table 2-4 shows changes in the eight major U.S. agricultural commodities between 1990/91 and 2007/08. Corn and soybeans have increased the most in production and demand since 1990. It is not surprising that they have also dominated the growth in transportation demand and account for most of the grain modal share. Between 2000 and 2006, corn accounted for 60 percent and soybeans 20 percent of all U.S. grain movements.

U.S. rice production, domestic use, and exports have also grown over the last 17 years. Production and domestic demand of wheat and the other feedgrains (sorghum, barley, and oats) have declined since 1990. Wheat production has declined because of the slow growth in global demand, causing farmers to switch to more profitable crops such as soybeans and corn. Sorghum production has declined because many farmers have shifted to growing more profitable corn and soybeans. Cotton domestic use has declined as a result of the movement of the U.S. textile sector to Asia and because of increased cotton production in China and India.

Exports of corn and soybeans grew strongly during this time, increasing by 44 and 69 percent, respectively. Rice, cotton, and sorghum exports also rose. Transportation demand was the strongest for the three major commodities; corn, soybean, and wheat exports accounted for 89 percent of exports of the 8 major crops.

Transportation is impacted most by changes in crop production and export demand; domestic demand for the major crops tends to be relatively stable. A look at the previous 17 years and USDA's long-term projections—until the 2018/19 marketing year—shows that production and exports for the three major grains return to a more stable growth, contrasted with the dramatic changes of the past 17 years (Table 2-4).[15]

Production Outlook for Grains and Oilseeds

Corn production is expected to grow, but at a slower pace, increasing 12 percent by 2018/19, compared with the 58 percent growth over the previous 17 years. The expected growth reflects high levels of domestic corn-based ethanol production and gains in exports that keep corn demand strong and grower returns high.

Soybean production is expected to grow rapidly, increasing 22 percent by 2018/19 compared with the 28 percent growth over the previous 17 years.

Declines in the livestock sector initially reduce demand for soybean meal for livestock feed, lowering the domestic soybean crush in the near term. However, once meat production gains resume, the soybean crush will follow; long-term growth in the domestic soybean crush is mostly driven by domestic soybean meal demand.

Despite an expected decrease in wheat acreage, wheat production is expected to increase by 13 percent over the projected period.

Export Outlook for Grains and Oilseed

Following a year of record U.S. corn exports in 2007/08, exports are expected to drop in 2008/09 but rise in the long term in response to a strengthening global demand for feed grains to support growth in meat production. The U.S. share of the global corn trade is expected to hold at around 55–60 percent.

U.S. wheat exports also reached recent record high levels in 2007/08 but are projected to drop in 2008/09 and then increase slowly as competition from the European Union (EU), Canada, Argentina, Australia, and the Black Sea region limits further gains.

U.S. soybean exports will hold fairly flat, increasing by 3 percent over the projection period. Competition from South America limits growth in U.S. exports. Consequently, the U.S. market share of global soybean trade is forecast to decline from 40 percent in 2009/10 to about 30 percent at the end of the projections.

Table 2-4: Key supply and demand indicators: U.S. major eight field crops, (million metric tons)

	----------5-year averages------------						USDA Long-term Projections	% Change 1990-94 to 2007/08	% Change 2007/08 to 2018/19
	1990-94	1995-99	2000-04	2005/06	2006/07	2007/08	2018/19		
Production									
Corn	209.7	228.8	255.4	282.3	267.5	331.2	370.3	58	12
Wheat	64.7	64.1	56.0	57.2	49.2	55.8	62.9	(14)	13
Soybeans	57.1	68.8	76.1	83.4	87.0	72.9	88.7	28	22
Sorghum	16.3	15.3	11.2	10.0	7.0	12.6	10.3	(23)	(19)
Barley	9.2	7.6	5.9	4.6	3.9	4.6	5.4	(50)	19
Oats	3.9	2.3	1.9	1.7	1.4	1.3	1.5	(66)	11
Rice	7.7	8.3	9.5	10.1	8.8	9.0	10.8	17	20
Cotton	3.7	3.8	4.2	5.2	4.7	4.2	4.0	13	(4)
Domestic Use									
Corn	165.8	180.3	207.2	232.0	230.7	261.7	312.3	58	19
Wheat	33.5	34.7	32.7	31.3	30.9	28.6	36.8	(15)	29
Soybeans	34.8	41.2	44.5	47.3	49.2	49.0	51.6	41	5
Sorghum	10.9	9.9	6.0	4.8	4.0	5.1	5.0	(53)	(2)
Barley	8.5	7.3	5.6	4.6	4.6	4.4	5.4	(49)	23
Oats	5.1	3.7	3.3	3.0	2.9	2.8	2.9	(45)	2
Rice	4.3	5.0	5.4	5.5	5.8	5.6	6.6	30	18
Cotton	2.2	2.3	1.6	1.3	1.1	0.9	0.8	(58)	(8)
Exports									
Corn	43.1	48.0	46.5	54.2	54.0	61.9	56.5	44	(9)
Wheat	33.3	29.5	29.0	27.3	24.7	34.4	29.3	3	(15)
Soybeans	18.7	23.9	27.7	25.6	30.4	31.6	32.7	69	3
Sorghum	6.2	5.4	5.3	4.9	3.9	7.1	5.3	13	(24)
Barley	1.69	0.98	0.68	0.61	0.44	0.90	0.5	(47)	(40)
Oats	0.04	0.03	0.04	0.03	0.04	0.04	0.0	16	3
Rice	3.61	3.85	4.67	5.21	4.12	4.89	5.9	36	20
Cotton	1.56	1.44	2.52	3.82	2.83	2.61	3.1	67	20

Sources: Economic Research Service, Commodity Yearbooks; USDA World Agricultural Supply and Demand Estimates; USDA Long-term Projections to 2018

Mode of Transportation of U.S. Grains, 1978-2006*

The term "modal share" means the portion of the total tonnages of grain moved by each mode of transport—rail, barge, or truck. Almost all grain moves off the farm by truck to its first destination. However, this analysis looks only at the final mode used. Grain is frequently shipped by more than one mode. For example, corn may travel to St. Louis by rail and then be loaded on a barge to be shipped to New Orleans for export.

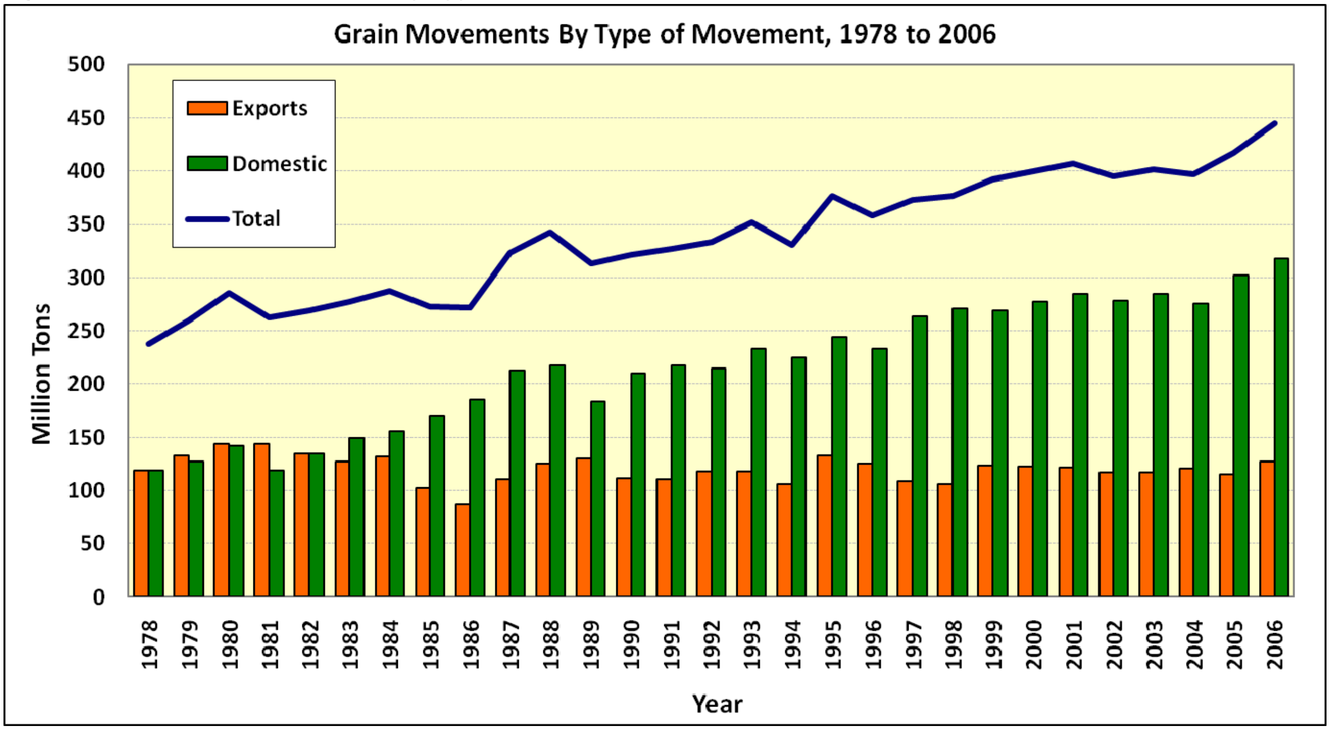
Barges, railroads, and trucks compete to transport grain. Despite this competition, the modes also complement each other. This balance between competition and integration provides farmers with an efficient and low-cost transportation system.

The most remarkable trend in grain transportation is the nearly constant annual increases in the amount of grain transported each year. Total grain movements increased 84 percent from 1978 to 2006. During those 28 years, there were only 8 years in which annual grain movements decreased. The decreases in 1989 and 1994 are notable. The 1989 decline reflected production losses due to the widespread 1988 drought. The 1994 decrease was caused by production losses due to massive flooding in 1993.

Grain movements have two distinct patterns, depending upon whether the final destination is domestic or foreign. From 1978 to 2006, all growth in grain transportation was a result of increases in the domestic market. During this time, the export market peaked in 1980 and 1981, with record levels for corn in 1980 and wheat in 1981 (Figure 2-5). The trucking sector experienced the largest growth in grain movements from 1978 to 2006, when tonnage increased from 74 million to 227 million tons—growing at a compound annual growth rate (CAGR) of 4.1 percent. During this period, rail movements increased from 117 million to 158 million tons (1.1 percent CAGR), and barge movements from 51 million to 60 million tons (0.6 percent CAGR) (Figure 2-6).

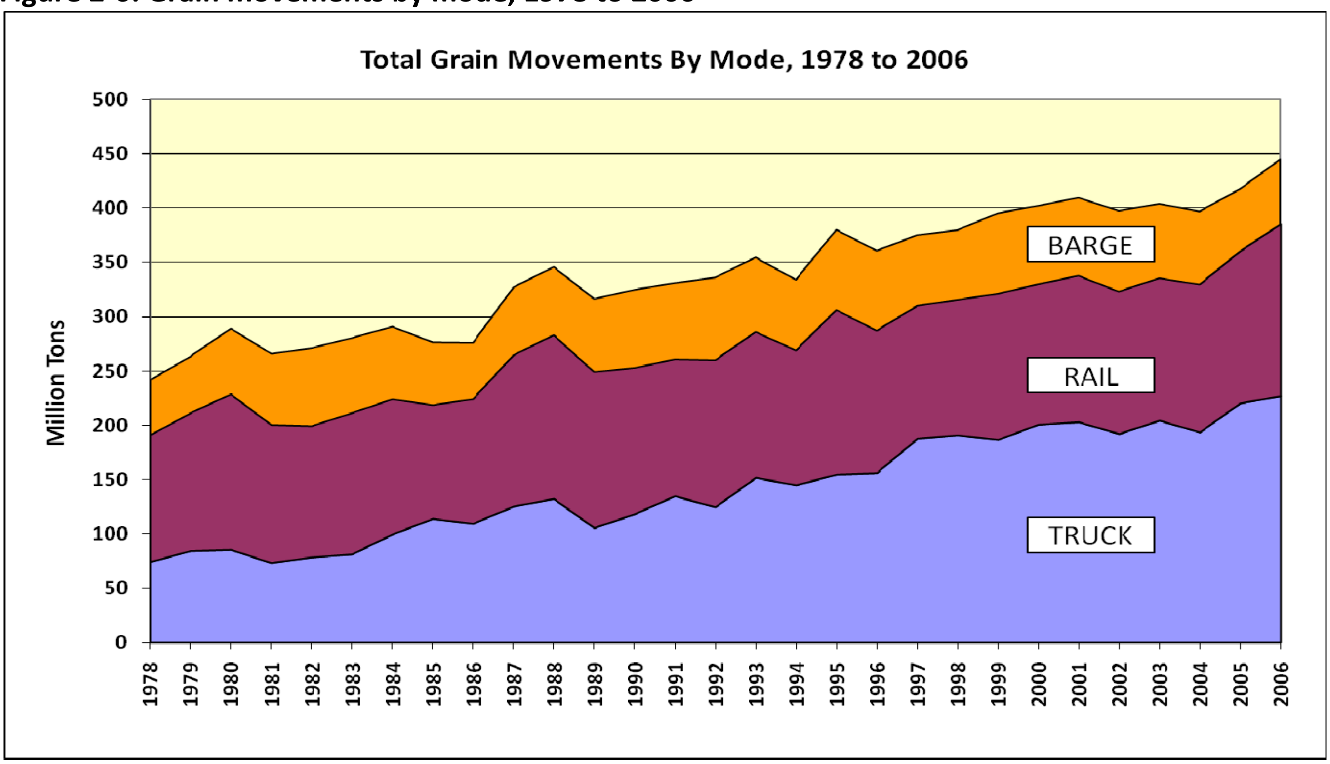
* Information for this section was developed through a preliminary update of the October 2006 report, *Transportation of U.S. Grains: A Modal Share Analysis, 1978-2004* to include the years 2005 and 2006. This report is periodically updated by AMS.

Figure 2-5: Grain movements by type of movement, 1978 to 2006



Source: AMS, *Transportation of U.S. Grains: A Modal Share Analysis, 1978-2006* (not yet published as of printing)

Figure 2-6: Grain movements by mode, 1978 to 2006



Source: AMS, *Transportation of U.S. Grains: A Modal Share Analysis, 1978-2006* (not yet published as of printing)

Location of Elevators

The location of agricultural storage facilities—mainly grain elevators and warehouses—has played a key role in the development of the United States. As Eastern cities expanded and Midwest farms increased their capacity, an efficient system of transportation and storage was introduced to prevent spoilage and reduce transportation costs. In 1842, a retail merchant named Joseph Dart constructed what is believed to be the first grain elevator on Buffalo Creek, near Buffalo, NY. Since then, storage facilities have evolved to highly mechanized modern operations that include the grain-barge and ocean-vessel loading facilities of today.

Two key factors play a role in the location of elevators and warehouses. The first is the need to store grain, oilseeds, and other agricultural products immediately after harvest to prevent spoilage and infestation. The second factor is the need to efficiently gather and load the quantities required to fill a tow of barges or an ocean-going vessel. As can be seen in Figure 2-7, the highest concentrations are in the Midwest and West Coast—near major grain and oilseed producing and/or consuming areas—and the port regions of the Gulf and Pacific Northwest. Storage capacity is also located near the poultry and swine operations of the Mid-Atlantic and the dairy farms of the Northeast, West, and Southwest.

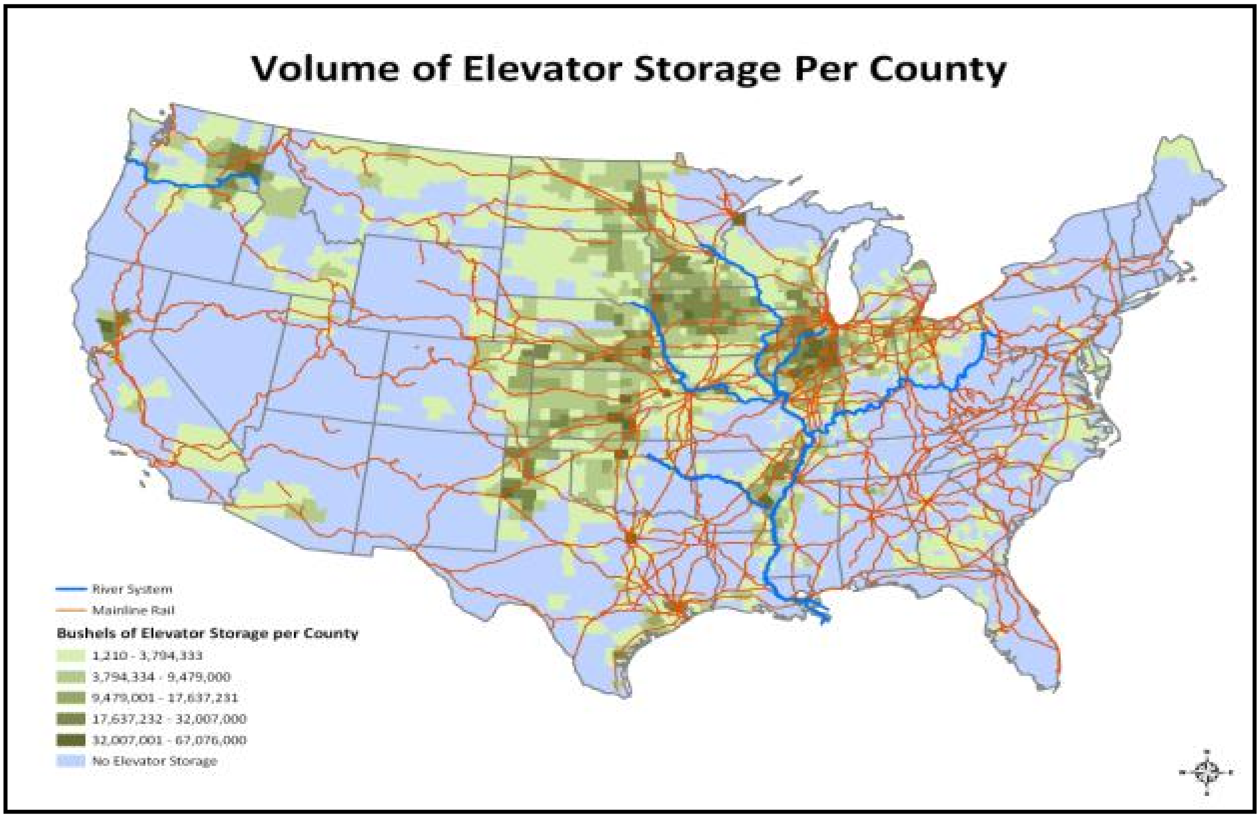
Elevator and warehousing operations in the United States fall into two categories**:** those with a Federal license issued under the United States Warehouse Act (USWA) and those licensed by States. Many of these facilities also have storage agreements with USDA's Commodity Credit Corporation (CCC). Either State or Federal licensing is required by many States and under some of the CCC storage agreements.

The USWA authorizes the Secretary of Agriculture to license warehouse operators who store agricultural products. Warehouse operators must meet USDA standards established by Congress within the USWA and its regulations. Application is voluntary and applicants who agree to be licensed under the USWA observe the rules for licensing and pay associated user fees. The CCC enters into storage agreements with private individuals and companies to allow warehouse operators to store commodities owned by CCC or pledged as security to CCC for marketing assistance loans. Typically, these agreements are in the form of the Uniform Grain and Rice Storage Agreement (UGRSA). Warehouse operators that enter into these agreements must meet standards established by USDA, agree to comply with the terms and conditions of the agreement, and pay any associated user fees. In some agreements, the warehouse operators are required to be licensed either by the USWA or by a State authority.

Transportation Implications

Agricultural processing facilities are usually located in close proximity to the raw agricultural products they use, in part due to the economic advantages that include lower transportation costs. This is also the case with the grain and oilseed milling facilities. As the map in Figure 2-8 shows, the processing facilities that use wheat, corn, rice, and soybeans to manufacture flour, vegetable oil, and other products are concentrated in the same areas as the storage facilities.

Figure 2-7: Location of elevator storage capacity, with rail and barge systems*



Source: Farm Service Agency USWA/UGRSA database (as of January 2009)

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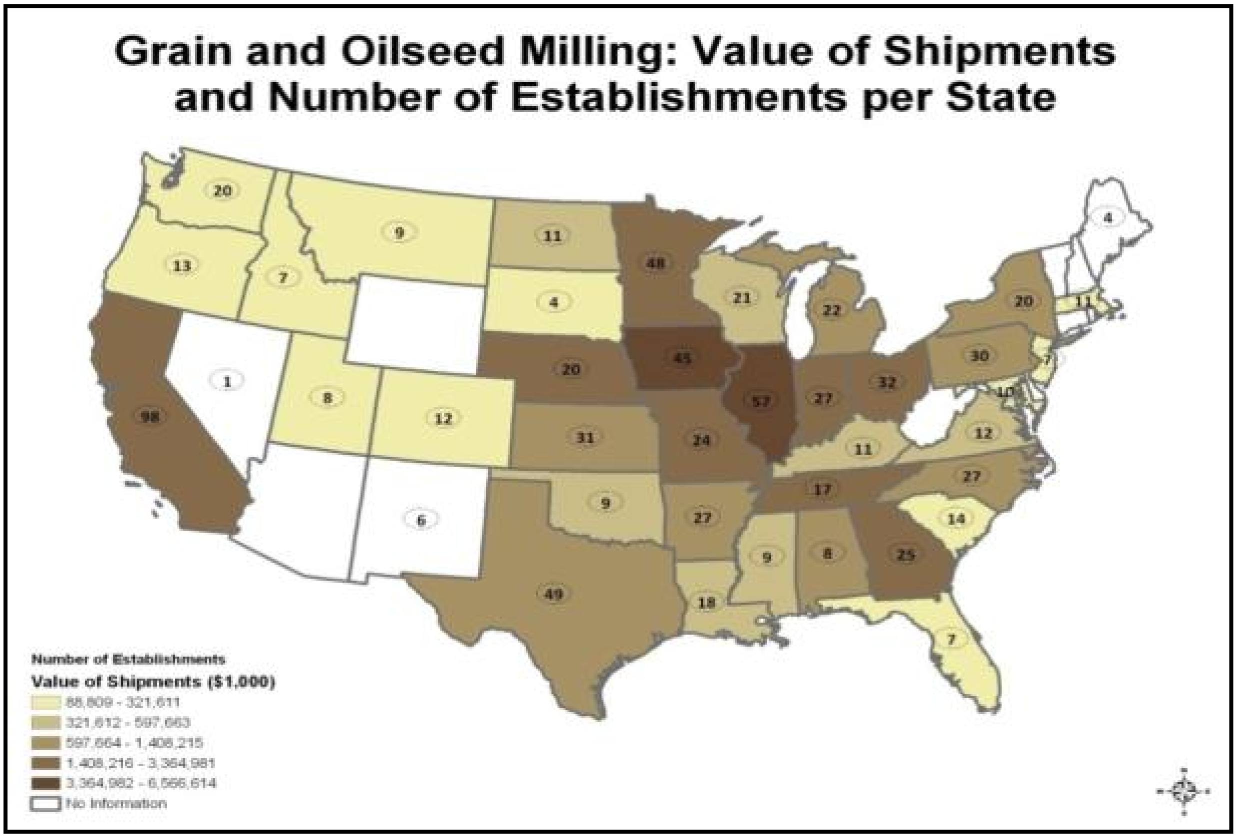
* This map includes storage operations that warehouse several commodity groups. Each warehouse may hold different commodities at different times of the year or, in multi-silo elevators, different commodities at the same time. However, the vast majority of the elevators on this map primarily handle grains. This map is estimated to represent more than 80 percent of total storage capacity.

Figure 2-8: Grain and oilseed milling facilities, 2000



Source: Econ 02 Report Series, 2002, Economic Census, U.S. Census Bureau

Corn Profile

Corn produced in the United States is used mainly as animal feed, with smaller portions exported and used for ethanol, human food, and seed.

Supply and Demand

Supply and demand patterns in the U.S. corn market have shifted dramatically since 1990. Domestic and export shares have decreased and the share used by industry has grown substantially. Feed use has decreased from 59 percent in the 1990/91 growing season to 47 percent in 2007/08; exports decreased from 22 to 19 percent. During the same period, industrial use increased from 18 percent to 34 percent (Table 2-5). Most of the change occurred after the rapid expansion of the ethanol sector.

Table 2-5: Corn usage by sector, percentage

	Feed	Exports	Industrial
1990/91	59	22	18
2007/08	47	19	34

Domestic demand for feed corn has grown by only 29 percent between 1990/91 and 2007/08 marketing years (Table 2-6). But demand for corn for food, seed, and industrial products, including ethanol, has surged by 206 percent. About a third of the corn used to make ethanol ends up as distiller grains, which are used as animal feed. Corn exports peaked in 2007/08 at a record 2.4 billion bushels—41 percent higher than in 1990/91. Corn exports are expected to decrease to 1.75 billion bushels in 2008/09 due to reduced global demand for corn feeding as a result of the current economic downturn. USDA projects that by 2018/19, corn exports will recover to 2.25 billion bushels.

Table 2-6. U.S. corn supply and use for various marketing years, million bushels

	Supply				Use			
Marketing Year[a]	Beginning Stocks	Production	Imports	Total	Food, seed, and alcohol	Feed	Exports	Total
1990/91	1,344	7,934	3	9,282	1,425	4,609	1,727	7,761
2000/01	1,718	9,915	7	11,639	1,957	5,842	1,941	9,740
2001/02	1,899	9,503	10	11,412	2,046	5,864	1,905	9,815
2002/03	1,596	8,967	14	10,578	2,340	5,563	1,588	9,491
2003/04	1,087	10,087	14	11,188	2,537	5,793	1,900	10,230
2004/05	958	11,806	11	12,775	2,687	6,155	1,818	10,661
2005/06	2,114	11,112	9	13,235	2,982	6,152	2,134	11,268
2006/07	1,967	10,531	12	12,510	3,490	5,591	2,125	11,207
2007/08	1,304	13,038	20	14,362	4,363	5,938	2,436	12,737
2008/09[b]	1,624	12,101	15	13,740	4,900	5,300	1,750	11,950
2009/10[c]	1,790	12,365	15	14,170	5,400	5,200	1,850	12,450

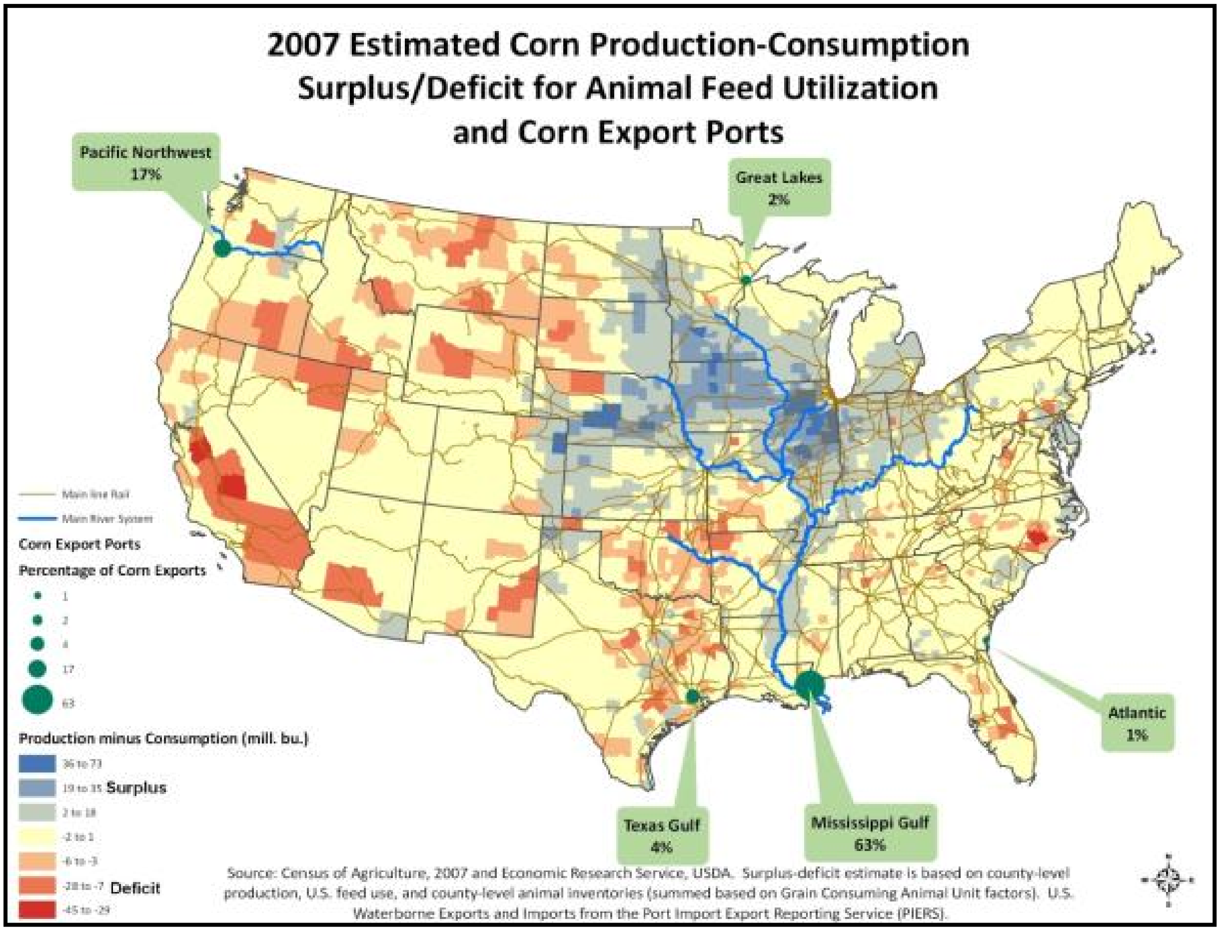
[a] Marketing Year: September 1-August 31
[b] Projected, WASDE, February 10, 2009
[c] Preliminary, February 27, 2009

Source: USDA/ERS, Feedgrains database. <http://www.ers.usda.gov/data/feedgrains>

Corn Transportation Characteristics

In 2007, more than 60 percent of U.S. corn was harvested in five states**:** Iowa, Illinois, Nebraska, Minnesota, and Indiana. Demand for corn, however, was more diverse, creating areas of deficit throughout the West, Texas, the Southeast, and Northeast. Corn is also shipped to export port regions in the Gulf, the Pacific Northwest, the Atlantic Coast, and the Great Lakes. Figure 2-9 demonstrates that this imbalance of surplus and deficit creates the need for long distance transportation.

Figure 2-9: Corn surplus/deficit map with the transportation system



Because of the projected trend in supply and demand, long-term transportation demand for corn exports can be expected to grow at a stable rate. Domestic corn transportation patterns will continue to be dominated by the dynamics of corn used for ethanol and distillers grain because the growth of the ethanol industry in the Corn Belt introduced additional transportation needs. More than 90 percent of ethanol production capacity is located within a 50-mile radius of the corn producing areas, so trucks have been the primary mode of transportation for inbound corn. However, the newer and larger bio-refineries are able to receive corn shipments by rail. Chapter 4 provides more information on transportation of biofuels.

Corn Modal Shares

During 2000 to 2006, corn accounted for 60 percent of all grain movements. It dominates the bulk transportation market because of its large production volumes; it usually has the largest harvested acreage of any crop, although soybean acreage has risen in the last several years and sometimes surpasses the number of corn acres. However, the high yield-per-acre of corn makes it a driver in the transportation market. Corn yields can be more than three times those of soybeans or wheat.

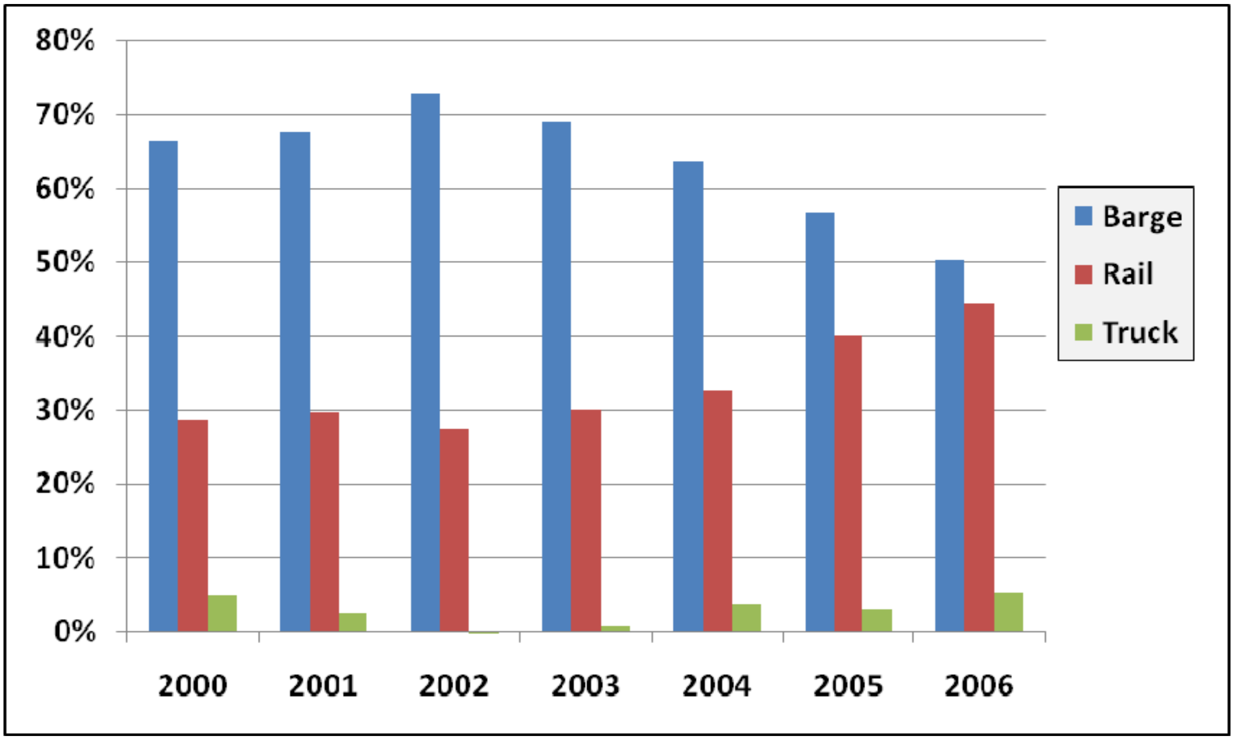
Corn is transported to distant markets in two patterns—one for domestic use and the other for export. Trucks supply most of the transportation for the domestic market, and barges supply the export market. From 2000 to 2006, trucks transported, on average, about 68 percent of the corn used by the domestic market (Table 2-7). During the same period, barges transported 64 percent of the corn exports. Rail handled about 33 percent of the export market and 30 percent of the domestic market. Barges continue to be the main mode of transportation for corn moving to port regions for export. But the modal share trend for exported corn has seen an increase in the rail share and a decrease in barges. By 2006, rail's share of export corn increased to 44 percent—15 points higher than in 2000. At the same time, barge's share had decreased to 50 percent after peaking at 73 percent in 2002 (Table 2-7 and Figure 2-10).

Table 2-7: Corn modal shares

CORN						
Year & Type of Movement	**Rail**		**Barge**		**Truck**	
	1,000 Tons	**Percent**	**1,000 Tons**	**Percent**	**1,000 Tons**	**Percent**
TOTAL						
2000	68,984	30%	37,831	16%	122,531	53%
2001	73,633	31%	38,864	16%	125,340	53%
2002	72,615	31%	41,598	18%	119,713	51%
2003	71,443	30%	36,488	15%	127,916	54%
2004	77,377	32%	37,302	15%	126,588	52%
2005	77,908	30%	31,739	12%	150,519	58%
2006	91,552	32%	34,587	12%	159,086	56%
Average	76,216	31%	36,916	15%	133,099	54%
EXPORT						
2000	15,213	29%	35,150	66%	2,594	5%
2001	15,822	30%	35,904	68%	1,306	2%
2002	14,327	27%	38,125	73%	Not available *	
2003	14,371	30%	32,872	69%	364	1%
2004	17,422	33%	33,974	64%	1,978	4%
2005	20,251	40%	28,778	57%	1,600	3%
2006	28,145	44%	31,941	50%	3,342	5%
Average	17,936	33%	33,821	64%	1,598	3%
DOMESTIC						
2000	53,771	30%	2,681	2%	119,936	68%
2001	57,811	31%	2,960	2%	124,034	67%
2002	58,288	32%	3,473	2%	119,835	66%
2003	57,072	30%	3,616	2%	127,552	68%
2004	59,955	32%	3,328	2%	124,611	66%
2005	57,657	28%	2,961	1%	148,918	71%
2006	63,407	29%	2,646	1%	155,744	70%
Average	58,280	30%	3,095	2%	131,519	68%

Source: AMS, *Transportation of U.S. Grains: A Modal Share Analysis, 1978-2006* (not yet published as of printing)

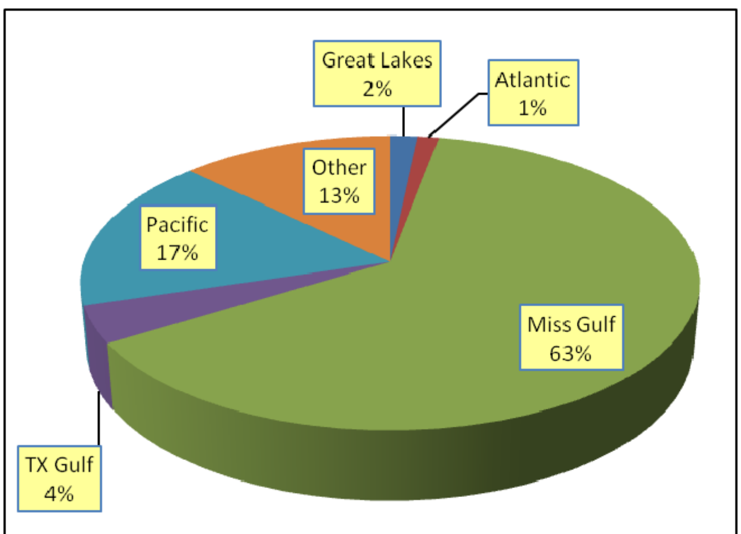
Figure 2-10: Modal shares of corn exports, 2000-2006



Source: AMS, *Transportation of U.S. Grains: A Modal Share Analysis, 1978-2006* (not yet published as of printing)

Corn Exports by Port Region

Figure 2-11: Corn export inspections by port region, 2007



Source: FGIS, 2007

- Most corn exports are shipped through the Mississippi Gulf region—63 percent of all corn volumes exported in 2007 (Figure 2-11).
- The Pacific Northwest accounted for 17 percent of all corn exports in 2007.
- The top five destinations—Japan, Mexico, Korea, Taiwan, and Egypt accounted for 64 percent of all U.S. exports in 2007/08.
- The port share of corn exports depends on the ocean rate spread (the difference between the cost of shipping from the Gulf to Japan and the cost of shipping from the Pacific Northwest).

Soybean Profile

Soybeans are used to produce soybean meal used as animal feed, soybean oil, and other soybean products used in food manufacturing.

Supply and Demand

The 65 percent growth in the global economy since 1990 has contributed to the rise in world demand for meat, milk, and eggs,[16] which has translated into demand for U.S. soybeans and soymeal used as a high-protein livestock feed. Between 1990 and 2008, domestic demand for soybeans grew by 52 percent and soybean exports increased by 108 percent. USDA's preliminary projections indicate that U.S. soybean exports could reach a record level in 2009/10, but then continue a more stable long-term growth. A continuing demand for soybean exports will require efficient and reliable rail and barge transportation.

Table 2-8: U.S. soybean supply and use for various marketing years (in million bushels)

	Supply			Use			
Marketing Year[a]	Beginning Stocks	Production	Total	Crush	Exports	Seed, Feed, Residual	Total
1990/91	239	1,926	2,165	1,187	557	96	1,840
2000/01	290	2,758	3,048	1,640	996	168	2,804
2001/02	248	2,891	3,138	1,700	1,064	169	2,933
2002/03	208	2,756	2,964	1,615	1,044	131	2,791
2003/04	178	2,454	2,632	1,530	887	109	2,525
2004/05	112	3,124	3,236	1,696	1,097	193	2,986
2005/06	256	3,063	3,319	1,739	940	194	2,873
2006/07	449	3,197	3,646	1,808	1,116	157	3,081
2007/08	574	2,677	3,251	1,801	1,161	93	3,055
2008/09[b]	205	2,959	3,164	1,650	1,150	163	2,963
2009/10[c]	210	3,240	3,450	1,675	1,225	172	3,072

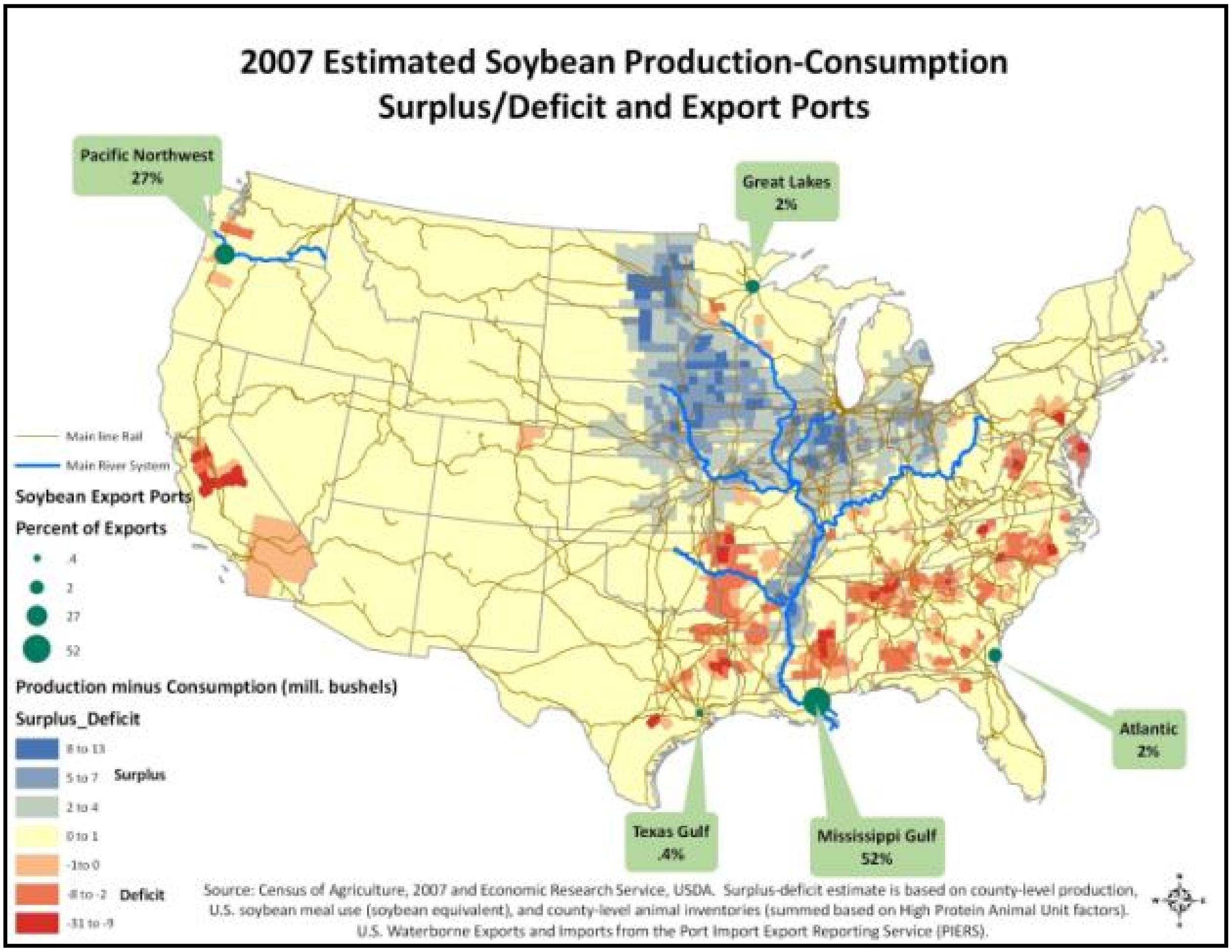
[a] Marketing Year: September 1-August 31
[b] Projected, WASDE, February 10, 2009
[c] Preliminary, February 27, 2009

Source: USDA/ERS, Soybean and Oil Crops Recommended Data <http://www.ers.usda.gov/Briefing/SoybeansOilcrops/data.htm>

Soybean Transportation Characteristics

As with corn, the top soybean producing states are Iowa, Illinois, Minnesota, Indiana, Ohio, and Nebraska. However, demand for soybean products in feed rations is distributed around the U.S. markets and port regions for export (Figure 2-12).

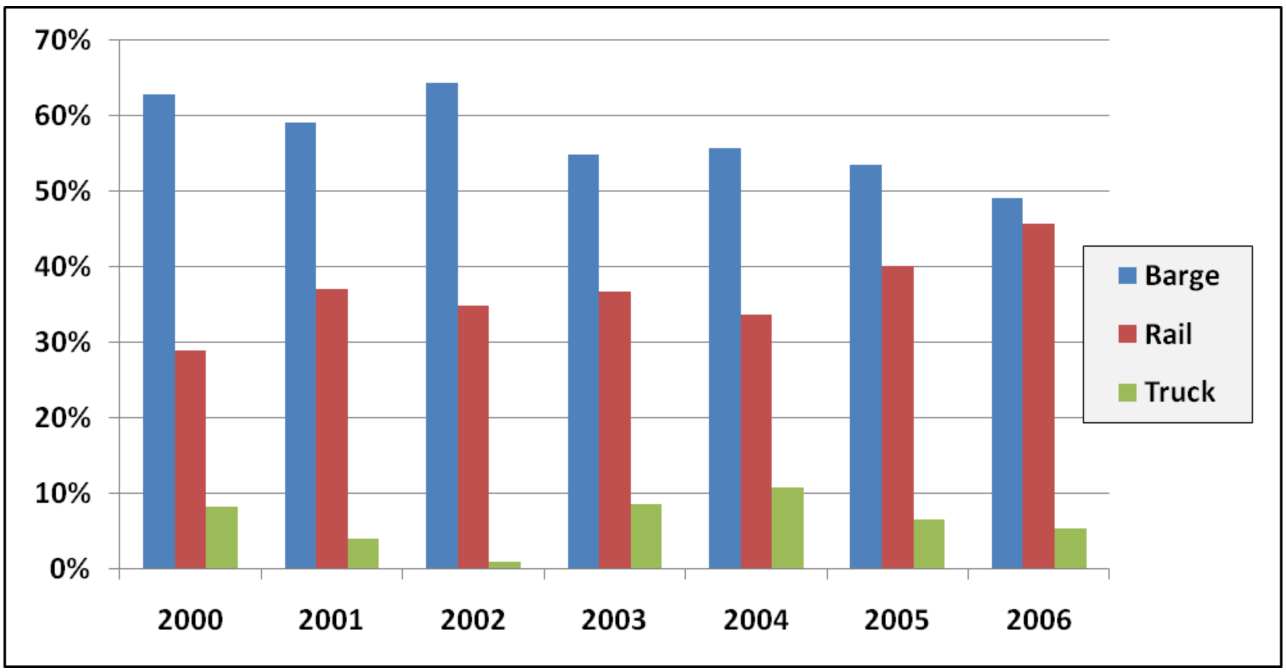
Figure 2-12: Soybean surplus/deficit map with transportation system



Soybean Modal Share

From 2000 to 2006, soybeans accounted for 20 percent of all grain movements. Their transportation pattern resembles that of corn; barges provide most of the transportation for export, and trucks serve most of the domestic markets. With a domestic modal share for truck of more than 80 percent, the domestic soybean market uses more trucks than corn, the latter having a modal truck share of under 70 percent (Tables 2-7 and 2-9). Soybeans used in the domestic market are more likely to be trucked to a crushing facility, so more trucked soybeans appear in the domestic market. Since 2004, the share of soybeans moved for export by rail has been rising, while the share of soybean export movements by barge has slowly decreased. In fact, by 2006, the share of export soybean movements by barge was only 3 percent above that moved by rail (Figure 2-13 and Table 2-9).

Figure 2-13: Modal shares of soybean exports, 2000-2006



Source: AMS, *Transportation of U.S. Grains: A Modal Share Analysis, 1978-2006* (not yet published as of printing)

Table 2-9: Soybean modal shares, 2000-2006

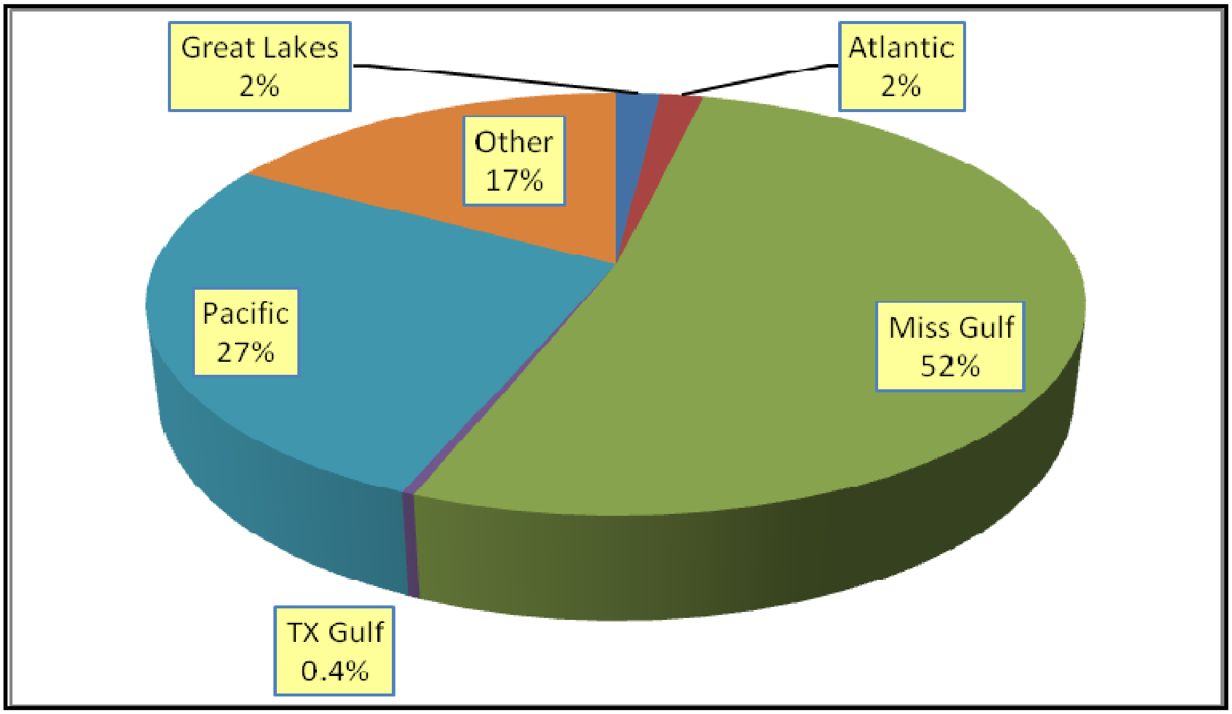
SOYBEANS						
Year & Type of Movement	**Rail**		**Barge**		**Truck**	
	1,000 Tons	**Percent**	**1,000 Tons**	**Percent**	**1,000 Tons**	**Percent**
TOTAL						
2000	17,257	22%	20,174	26%	41,225	52%
2001	20,662	24%	19,872	23%	44,813	53%
2002	19,120	22%	21,399	25%	44,848	53%
2003	20,216	24%	20,167	24%	44,409	52%
2004	16,346	22%	17,053	23%	39,337	54%
2005	17,655	22%	16,332	21%	45,501	57%
2006	21,858	25%	16,221	19%	49,557	57%
Average	19,016	23%	18,745	23%	44,242	54%
EXPORT						
2000	8,591	29%	18,665	63%	2,442	8%
2001	11,711	37%	18,689	59%	1,262	4%
2002	10,602	35%	19,642	64%	263	1%
2003	12,479	37%	18,632	55%	2,878	8%
2004	9,322	34%	15,412	56%	2,977	11%
2005	11,273	40%	15,030	53%	1,815	6%
2006	14,169	46%	15,240	49%	1,654	5%
Average	11,164	37%	17,330	57%	1,899	6%
DOMESTIC						
2000	8,666	18%	1,510	3%	38,783	79%
2001	8,950	17%	1,183	2%	43,552	81%
2002	8,518	16%	1,758	3%	44,586	81%
2003	7,737	15%	1,535	3%	41,531	82%
2004	7,024	16%	1,641	4%	36,361	81%
2005	6,382	12%	1,302	3%	43,686	85%
2006	7,688	14%	982	2%	47,903	85%
Average	7,852	15%	1,416	3%	42,343	82%

Source: AMS, *Transportation of U.S. Grains: A Modal Share Analysis, 1978-2006* (not yet published as of printing)

Soybean Exports by Port Region

- Most soybean exports are shipped through the Mississippi Gulf region—52 percent in 2007 (Figure 2-14).
- The Pacific Northwest accounted for 27 percent of all soybean exports in 2007.
- The top 5 destinations—China, Mexico, Japan, EU, and Taiwan—accounted for 80 percent of all U.S. soybean exports in 2007.

Figure 2-14: Soybean exports by port region



Source: FGIS grain inspections, 2007 annual

Wheat Profile

Wheat is the most important food grain produced in the United States. Annual production exceeded 2 billion bushels in 4 out of the last 5 years (Table 2-10).

Supply and Demand

Wheat production in the United States has declined since 1990/91 because of slow growth in global demand, and also because farmers have found it more profitable to grow soybeans and corn. U.S. wheat exports surged in 2007/08 due to a weather-related shortfall in production by other major exporters. This reduced available world wheat supplies and resulted in importing countries buying more U.S. wheat than they have done in the recent past.

Various types of wheat are grown in highly concentrated production areas of the United States and the grain must be dispersed for use throughout the United States. Seasonality of the types of wheat can affect its transportation. The harvest seasons of the two major types of wheat—winter and spring—grown in the United States take place in May–June and August–September, respectively. As in the case of corn and soybeans, export demand necessitates shipping both winter and spring wheat to the major export regions.

Table 2-10: U.S. wheat supply and use, (million bushels)

	Supply				Use			
Marketing Year[a]	Beginning Stocks	Production	Imports	Total	Food	Feed, Seed, Residual	Exports	Total
1990/91	536	2,730	36	3,302	790	575	1,069	2,434
2000/01	950	2,228	90	3,268	950	379	1,062	2,391
2001/02	876	1,947	26	2,849	926	265	962	2,153
2002/03	777	1,606	77	2,460	919	200	850	1,969
2003/04	491	2,344	63	2,899	912	283	1,158	2,353
2004/05	546	2,157	71	2,774	910	259	1,066	2,235
2005/06	540	2,103	81	2,725	917	234	1,003	2,154
2006/07	571	1,808	122	2,501	938	199	908	2,045
2007/08	456	2,051	113	2,620	947	103	1,264	2,314
2008/09[b]	306	2,500	110	2,916	950	310	1,000	2,260
2009/10[c]	655	2,120	105	2,880	950	316	950	2,216

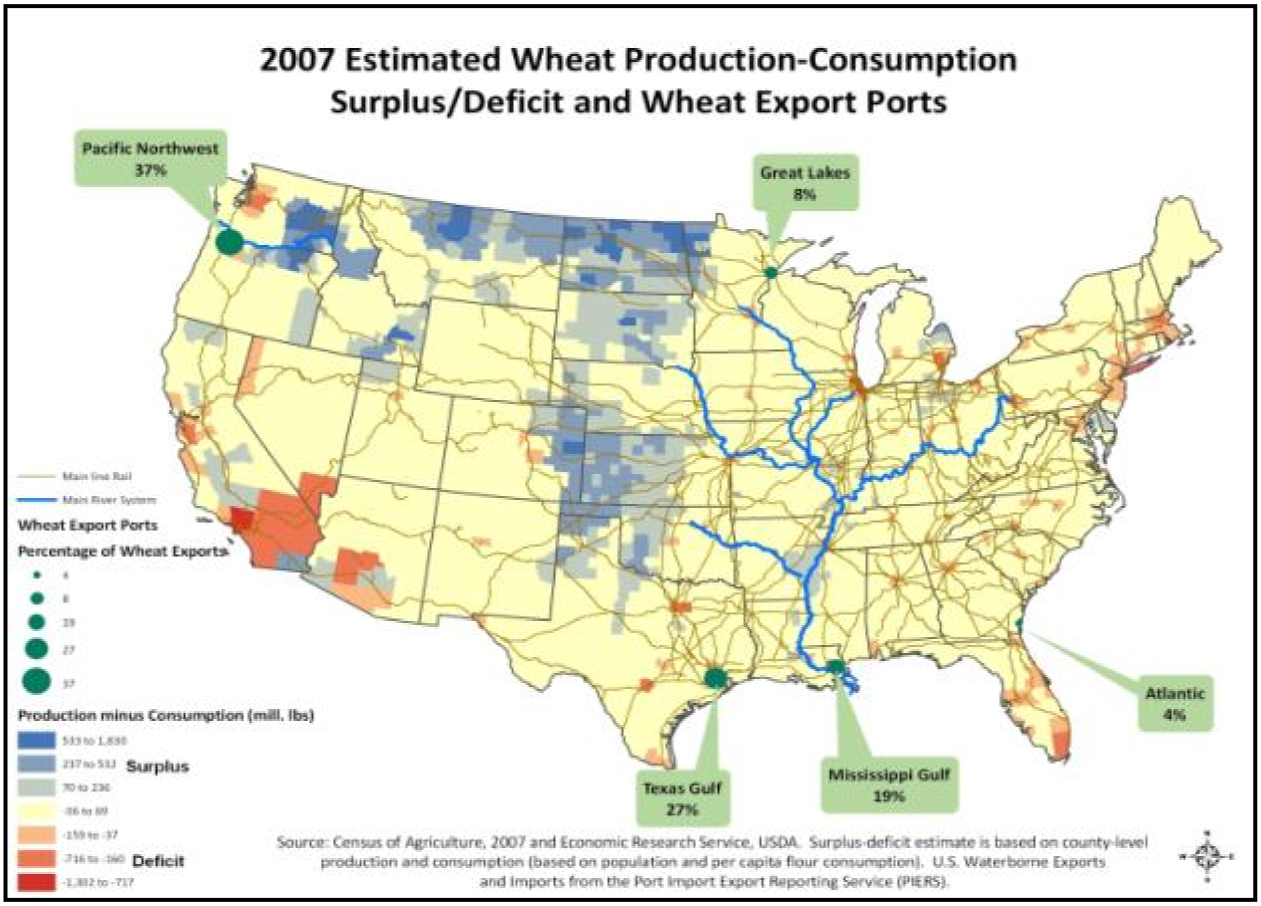
[a] Marketing Year: June 1 - May 31
[b] Projected, WASDE, February 10, 2009
[c] Preliminary, February 27, 2009

Source: USDA/Economic Research Service, Wheat Yearbook Tables. <http://www.ers.usda.gov/Data/Wheat>

Wheat Transportation Characteristics

In 2007, almost 83 percent of U.S. wheat was grown in 10 states: North Dakota, Kansas, Montana, South Dakota, Texas, Washington, Oklahoma, Colorado, Nebraska, and Idaho.[17] However, the demand for wheat is dispersed throughout the population centers of the United States. In addition, almost 45 percent of the U.S. wheat crop is exported through the major U.S. port regions to overseas destinations (Figure 2-15).

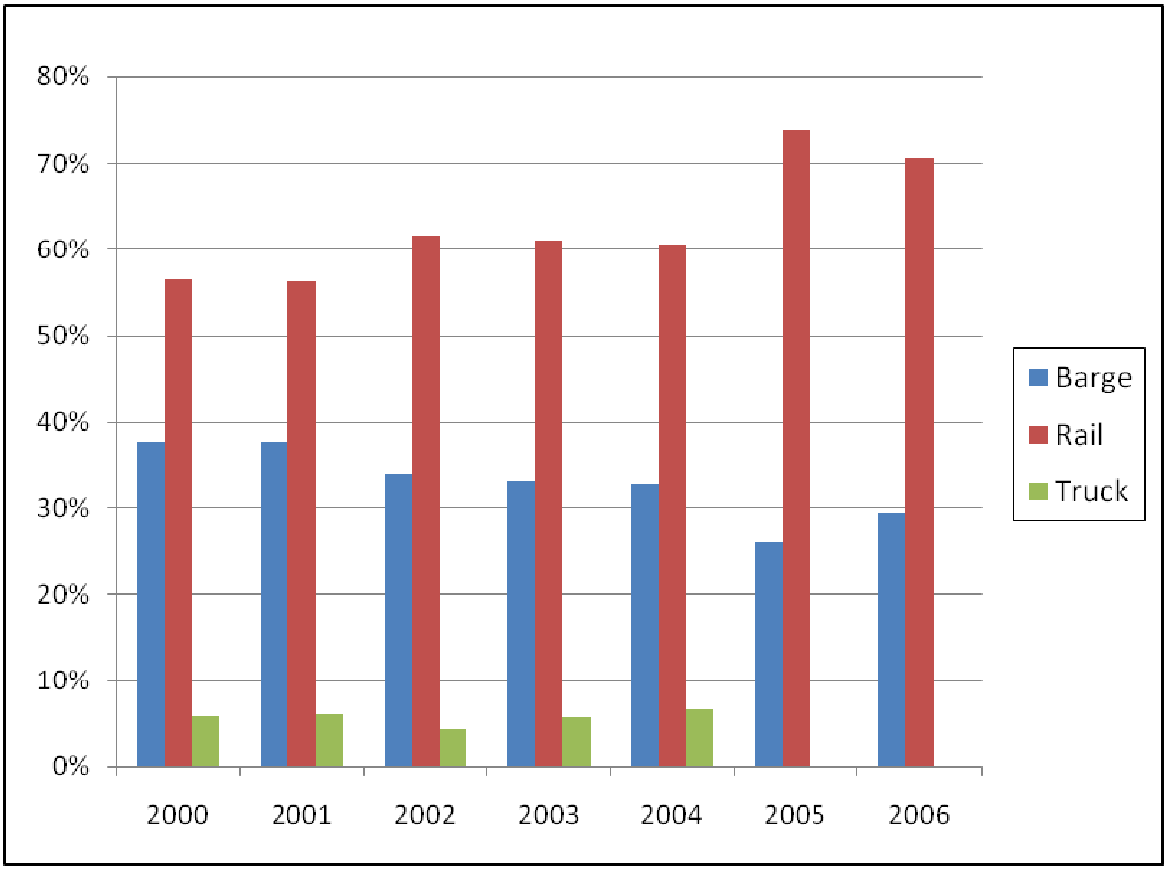
Figure 2-15: Wheat surplus/deficit map with a transportation system overlay



Wheat Modal Shares

From 2000 to 2006, wheat accounted for 15 percent of all grain movements. The major wheat production region is in the Plains States, where rail is the dominant mode of transportation. Most classes of wheat are produced in areas where barge transportation is not accessible, so rail is the leading provider of transportation for both the domestic and export market (Figure 2-16 and Table 2-11).

Figure 2-16: Modal shares of wheat exports, 2000-2006



Source: AMS, *Transportation of U.S. Grains: A Modal Share Analysis, 1978-2006* (not yet published as of printing)

Table 2-11: Wheat modal shares, 2000-2006

WHEAT						
Year & Type of Movement	**Rail**		**Barge**		**Truck**	
	1,000 Tons	**Percent**	**1,000 Tons**	**Percent**	**1,000 Tons**	**Percent**
TOTAL						
2001	33,269	52%	11,534	18%	19,668	31%
2002	32,702	56%	9,876	17%	16,081	27%
2003	34,181	53%	10,180	16%	20,428	32%
2004	37,302	56%	11,937	18%	17,625	26%
2005	39,287	63%	8,312	13%	14,759	24%
2006	38,596	67%	8,068	14%	11,302	19%
Average	35,889	58%	9,984	16%	16,644	26%
EXPORT						
2000	17,934	56%	11,975	38%	1,871	6%
2001	16,549	56%	11,099	38%	1,762	6%
2002	16,988	62%	9,367	34%	1,225	4%
2003	17,983	61%	9,726	33%	1,681	6%
2004	21,045	61%	11,370	33%	2,294	7%
2005	22,452	74%	7,938	26%	Not available*	
2006	18,922	71%	7,868	29%	Not available	
Average	18,839	63%	9,906	33%	1,262	4%
DOMESTIC						
2000	17,446	46%	416	1%	20,267	53%
2001	16,720	48%	435	1%	17,906	51%
2002	15,714	51%	509	2%	14,856	48%
2003	16,198	46%	454	1%	18,747	53%
2004	16,256	51%	566	2%	15,330	48%
2005	16,835	53%	375	1%	14,759	46%
2006	19,674	63%	200	1%	11,302	36%
Average	16,978	51%	422	1%	16,167	48%

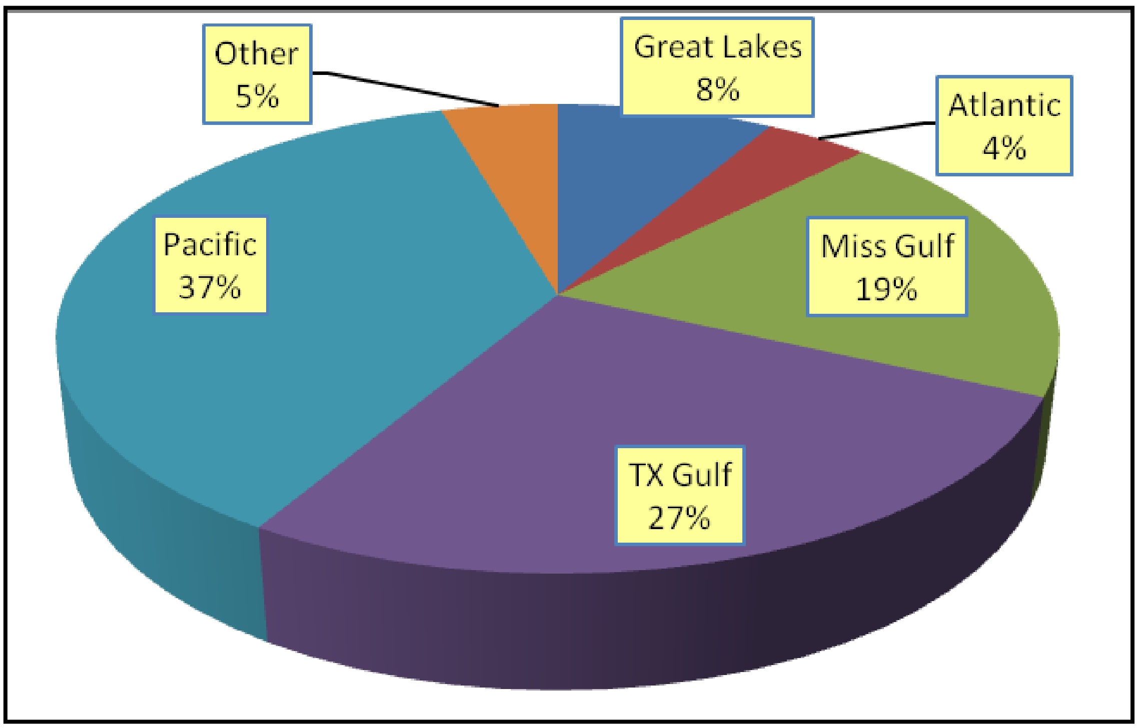
* The methodology used in this analysis calculates the truck portion as a residual value after barge and rail values are derived. In the case of 2005 and 2006, wheat exports where truck values are not available as total exports were apportioned to only barge and rail. Values are assumed to be zero for calculating modal shares and averages. There were obviously some minor quantities of wheat trucked directly to export facilities but that cannot be calculated using current methodology. There may be a case of overcounting of railed wheat due to traffic disruptions that began in 2005 and continued into 2006. During that time, Hurricanes Katrina and Rita rattled the Gulf Coast and caused some re-routing and diversion of rail shipments, possibly causing double-counting of some railed wheat shipments. Also in 2006, there were high grain car loadings and higher-than-normal grain movements.

Source: AMS, *Transportation of U.S. Grains: A Modal Share Analysis, 1978-2006* (not yet published as of printing)

Wheat Exports by Port Region

- In 2007, most wheat was exported through the Pacific Northwest region—37 percent, followed by the Texas Gulf at 27 percent, and the Mississippi Gulf at 19 percent (Figure 2-17).
- In 2007, the major destinations of wheat exports were Japan, Egypt, and Nigeria. Wheat was also shipped to many other destinations in Asia, South America, Africa, and the Middle East.

Figure 2-17: Wheat exports by port region



Source: FGIS Grain Inspections, 2007 Annual

Rice Profile

U.S. rice farming is a high-cost, large-scale operation that depends on the global market for about half its annual sales. Although domestic use of rice continues to increase, the outlook for rice farm incomes is tempered by rising production costs, only modest increases in farm prices, and strong competition in international markets from lower-cost Asian exporters.

Although the United States produces less than 2 percent of the world's rice, it is a major exporter, accounting for 12–14 percent of the annual volume of global rice trade. The United States is regarded as a consistent, reliable, and timely supplier of high-quality rice in global rice markets. By class, 75–80 percent of U.S. exports are long grain. The United States exports rough rice, parboiled rice, brown rice, and fully milled rice. Milled rice—including brown rice—typically accounts for around two-thirds of U.S. rice exports. Rough rice accounts for the remainder.[18]

Figure 2-18: Rice being harvested into a bankout truck.

Source: Grain Harvesters Association

Supply and Demand

U.S. rice production, domestic use, and exports all have grown over the last 18 years (Table 2-12). Demand in the United States and around the world for rice has contributed to the growth of the rice sector. USDA forecasts the United States will be the fourth largest exporter of rice in 2008/09 after Thailand, Vietnam, and Pakistan. Exports will account for half of U.S. rice production in 2008.

Table 2-12: U.S. rough and milled rice (rough equivalent) supply and use (million hundredweights)

	Supply				Use		
Marketing Year[a]	Beginning Stocks	Production	Imports	Total	Domestic and Residual	Exports	Total
			- Million cwt -				
1990/91	26.3	156.1	4.8	187.2	91.2	71.4	162.6
2000/01	27.5	190.9	10.9	229.2	117.5	83	200.7
2001/02	28.5	215.3	13.2	256.9	123.3	95	218.0
2002/03	39.0	211.0	14.8	264.8	113.4	125	238.0
2003/04	26.8	199.9	15.0	241.7	115.0	103	218.0
2004/05	23.7	232.4	13.2	269.2	122.7	109	231.5
2005/06	37.7	223.2	17.1	278.1	120	115	235.1
2006/07	43.0	194.6	20.6	258.2	128	91	218.9
2007/08	39.3	198.4	23.9	261.6	124	108	232.1
2008/09[b]	29.4	203.7	18.0	251.1	127	98	225.0
2009/10[c]	26.2	206.5	22.0	254.7	128	101	229.0

[a] Marketing Year: August 1 - July 31
[b] Projected, WASDE, February 10, 2009
[c] Preliminary, February 27, 2009

Source: USDA/Economic Research Service: Rice Yearbook Tables, <http://www.ers.usda.gov/Briefing/Rice>

Rice Transportation Characteristics

Virtually the entire U.S. rice crop is produced in four regions:

- The Arkansas Grand Prairie.
- The Mississippi Delta (parts of Arkansas, Mississippi, Missouri, and Louisiana).
- The Gulf Coast (Texas and Southwest Louisiana).
- The Sacramento Valley of California.

The Mississippi Delta is the largest producing region (Figure 2-19). Arkansas contains more than 45 percent of U.S. rice acreage and is the largest producing State. California is the second largest producing State, achieving the highest yields. Louisiana is the third largest producing State, usually planting the second or third largest area. Mississippi is usually the fourth largest rice-producing State. Along with Missouri and Texas, these six States account for more than 99 percent of U.S. rice production. Florida accounts for most of the rice grown outside these six States, but it is not included in USDA's area and production estimates. The domestic rice market consumes more than 50 percent of total use and has more than doubled in the past 25 years.

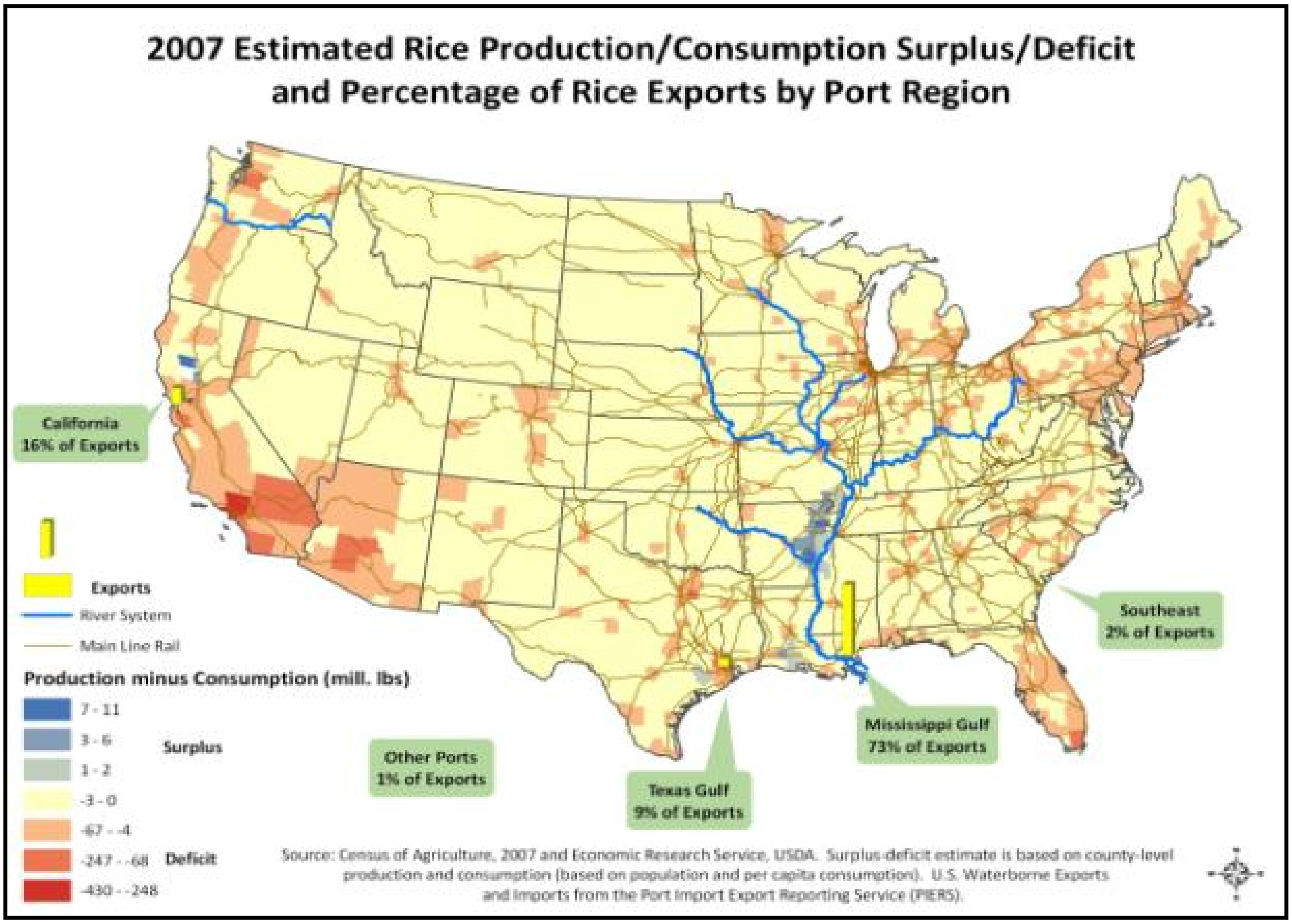
About half of the United States rice crop is exported each year. Mexico, Central America, Northeast Asia, and the Middle East are the largest export markets, based on quantity shipped. The Caribbean, the European Union, and Sub-Saharan Africa make up the next largest tier of U.S. export markets. The highest-valued single-country market is Japan. Mexico is usually the second highest valued. The rough rice share of exports has more than doubled since the mid-1990s. The United States is the only major exporter that ships rough rice. None of the major Asian exporters allow rough rice to be exported, preferring to keep the value added from milling the rice. Rough rice accounts for a very small share of global trade, typically around 4 percent of annual quantity shipped.

Although a major exporter, the United States regularly imports rice. Imports account for almost 15 percent of domestic use, and this share has been rising for 25 years. The bulk of U.S. rice imports are aromatic (fragrant) varieties. Thailand supplies about three-fourths of U.S. rice imports, India and Pakistan most of the rest. Italy ships a small amount of rice to the United States, much of it *Arborio* rice used in risotto.

Rail transportation is important to the rice industry in maintaining its competitive advantage in international trade. In 2006, rail moved 4.1 million short tons of major categories of rice,[19*] about 42 percent of the U.S. rice produced that year. During the same year, barges moved approximately 1.9 million short tons of rice—about 20 percent of the crop.

* Including rough, milled, cleaned, and brewers rice, in 2006 rough equivalent basis.

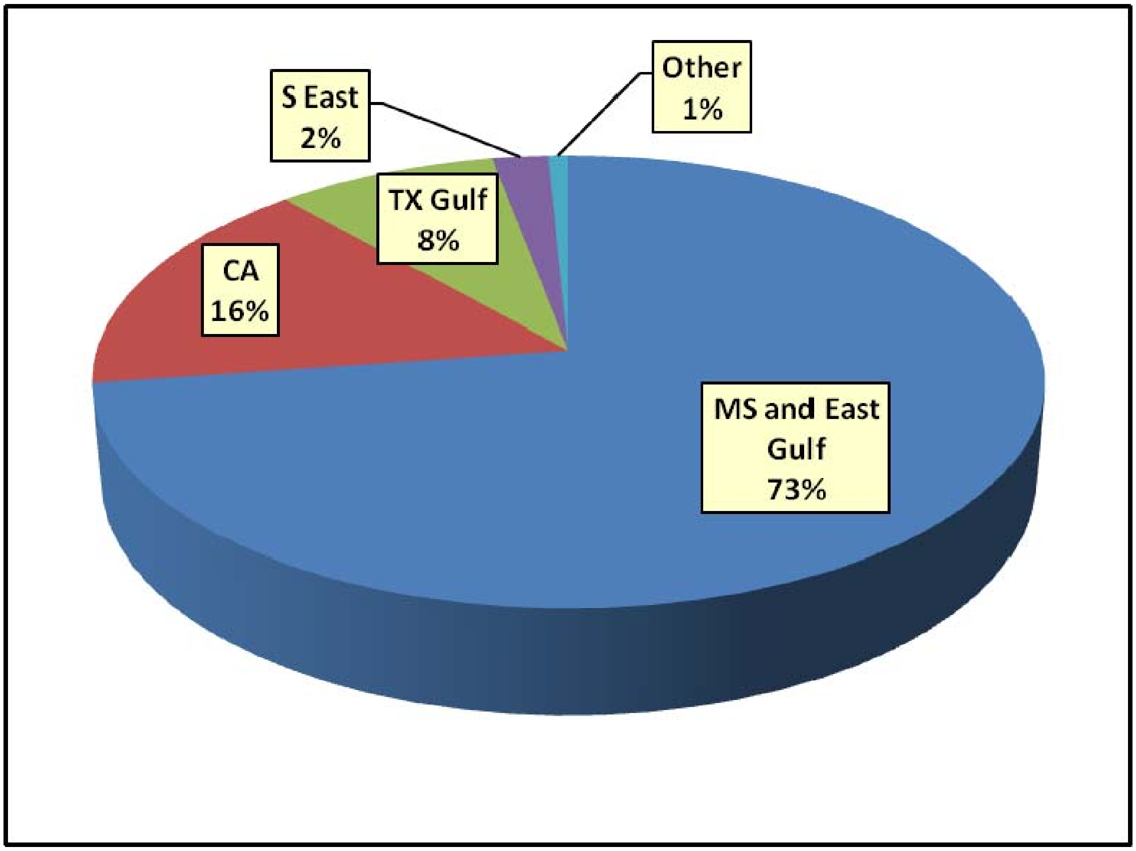
Figure 2-19: Rice surplus/deficit map with transportation system overlay



Rice Exports by Port Region

- In 2007, most waterborne rice exports were shipped through the Mississippi Gulf—73 percent—followed by Northern California at 16 percent and the Texas Gulf at 8 percent (Figure 2-20).
- In 2007, major destinations of rice exports included Mexico, Japan, Haiti, Canada, and Iraq, accounting for about 54 percent of 2007 rice exports. Other major markets include countries of Latin America, East Asia, Middle East, and Sub-Saharan Africa.[20]

Figure 2-20: 2007 waterborne rice exports by port region



Source: Port Import Export Reporting Service (PIERS)

Livestock and Livestock Products Profile

The four major industries of the U.S. livestock agriculture sector include beef cattle, hogs, broilers, and milk. The livestock industry has undergone striking transformations over the last few decades, several of which have changed the transportation picture. The industry trends can be categorized into three areas:

- *Changed Regional Concentration:* Cattle feeding, hog production, and the dairy sectors have experienced geographical changes, concentrating in fewer States than in previous decades due changes in the production systems.

- *Increased Concentration and Industrialization:* Strong financial pressures have driven a shift toward large-scale industrialized production systems, resulting in increased productivity and lower production costs.

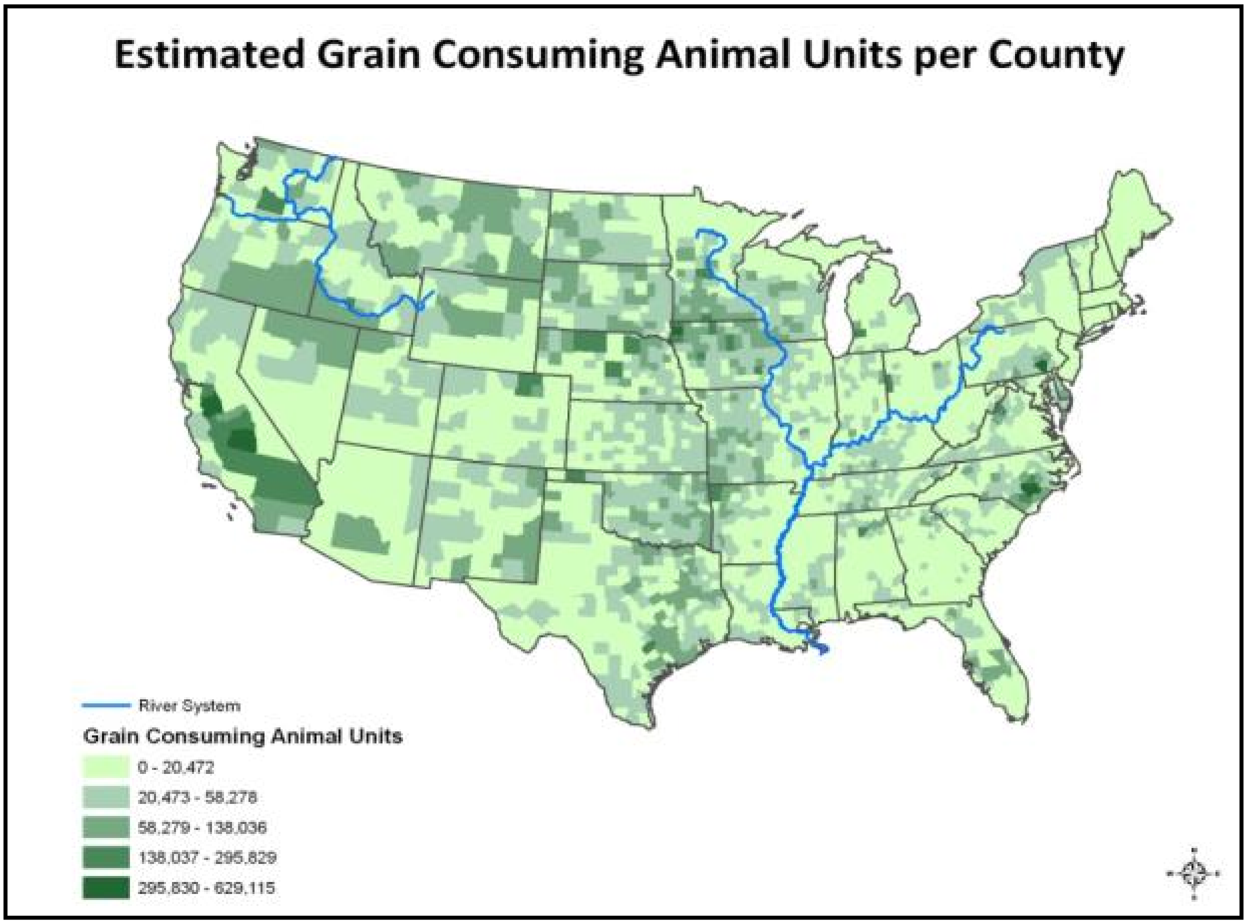
- *Increased International Trade:* Domestic production continues to provide most meat and dairy products in the United States, but international trade—especially exports—has grown rapidly in recent years and is expected to continue.

Most of the domestic changes have occurred during the previous several decades, but the long-term growth in international trade is expected to continue. This creates the critical need for reliable and efficient domestic trucking and international ocean freight transportation.

Recent Trends in the Livestock Industry

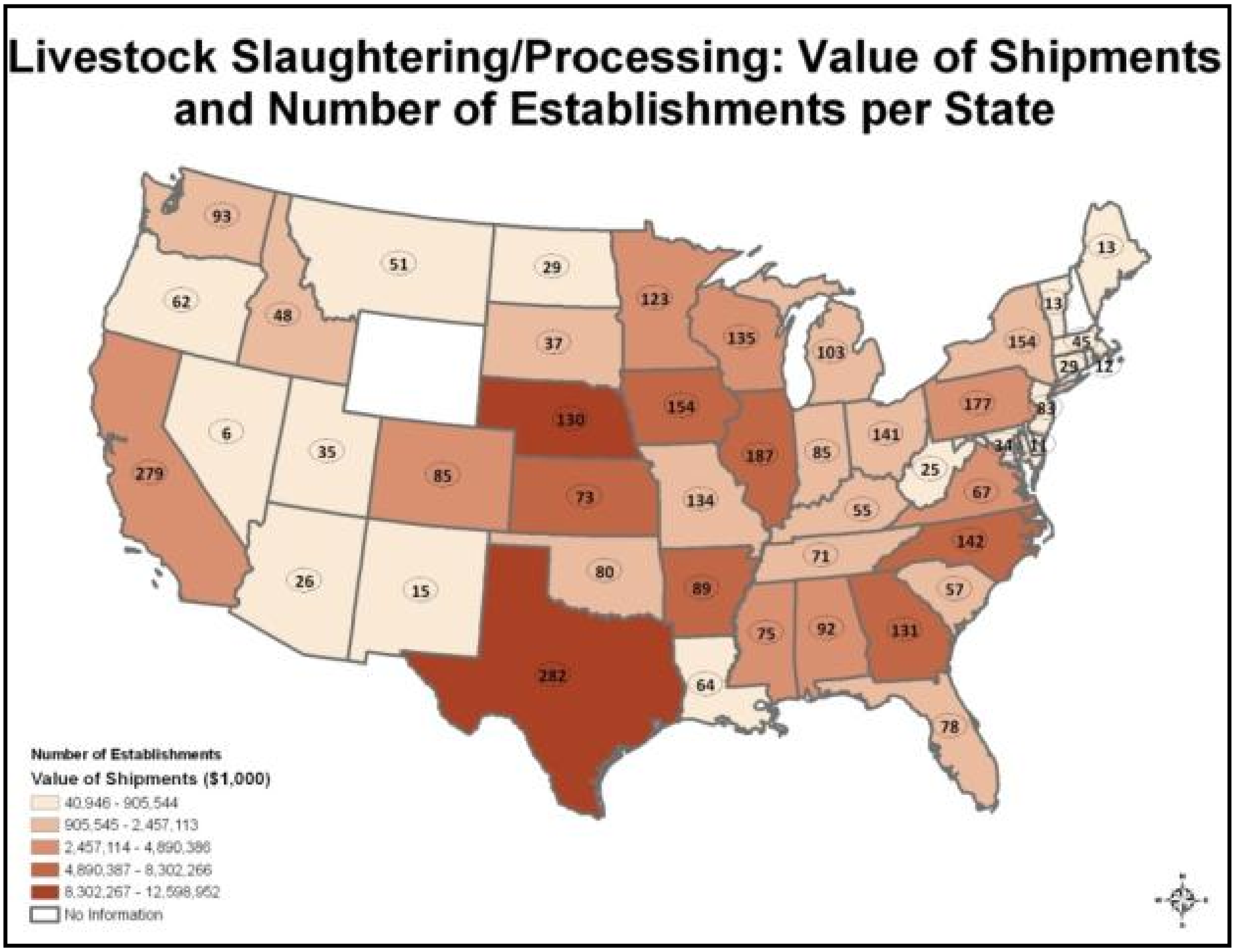
The transportation needs of U.S. livestock operations depend on their location. The map in Figure 2-21 shows that livestock inventories in 2007 were concentrated in the Great Plains, the Corn Belt, parts of California and the Pacific Northwest, and areas of the mid-Atlantic. Not surprisingly, most of the meat slaughtering/processing facilities are located near the animal population. Meat and poultry consumption, however, is concentrated in the states with higher populations of people (Figures 2-22, 2-27, and 2-30). The meat processing locations are usually far removed from population centers, so the industry relies on long-haul truck transportation of finished products to market.

Figure 2-21: Estimated grain-consuming animal units per county



Source: NASS, Census of Agriculture, 2007

Figure 2-22: Livestock processing facilities, 2002



Source: U.S. Census Bureau, *Econ 02 Report Series, 2002*

Transportation Implications

As Tables 2-2 and 2-3 at the beginning of this chapter show, almost all (95–98 percent) of livestock, meat, poultry, and dairy products are shipped by truck to domestic markets from the highly concentrated production areas.

The trucking data in the CFS are divided into two categories**:** private trucks and for-hire trucks.

Private trucks Trucks operated by employees of the establishment or the buyer/receiver of the shipment, including trucks providing dedicated services to the surveyed establishment.

For-hire trucks Shipments made by common or contract carriers under a negotiated rate.

The livestock and livestock products industry relies on independent motor carriers for most of the long-haul movements in the United States. The data in Table 2-13 show that in 2002, for-hire trucks carried most of the ton-miles; this mode was preferred for long-distance hauling. For-hire trucks dominated meat and poultry hauling in both tons and ton-miles, despite the vertical integration trend in the industry over the past decade.

Table 2-13: Share of private vs. for-hire truck activity, 2002

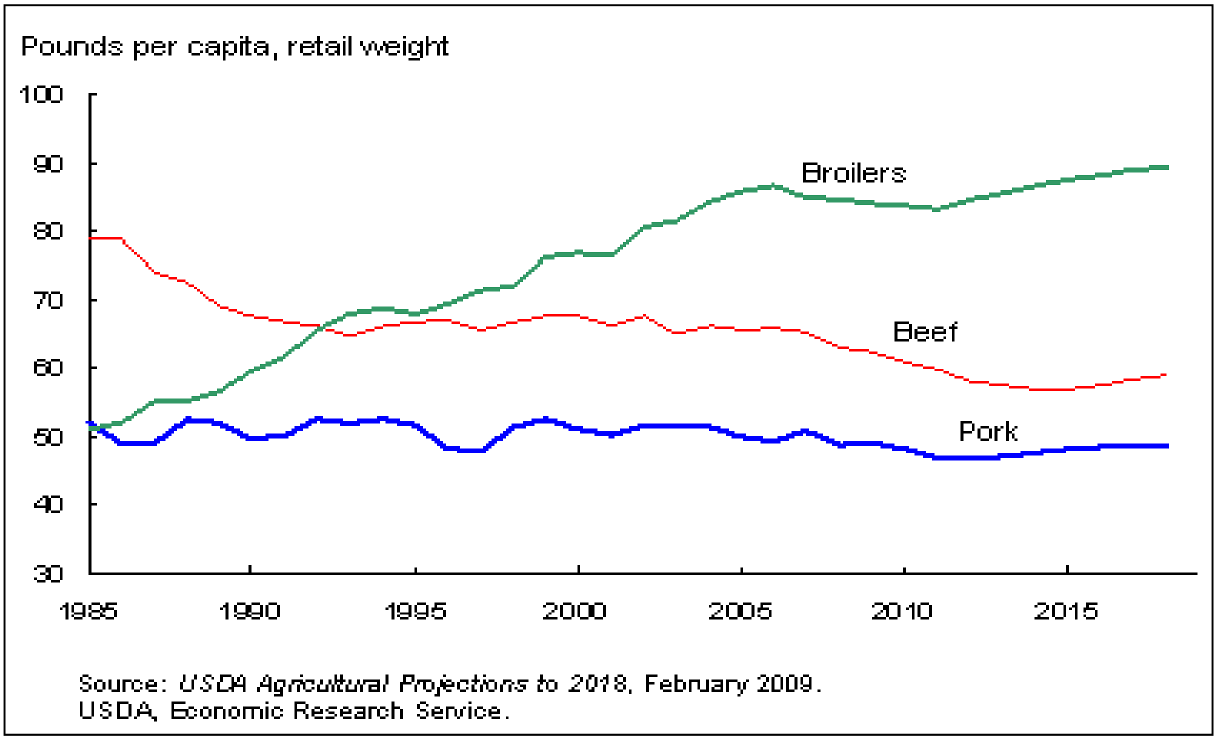
Livestock and Livestock Products			
	Tons	**Ton-Miles**	**Activity**
Live animals and fish			
For-hire truck	32%	52%	Long haul
Private Truck	68%	48%	Short haul
Meat and Poultry			
For-hire truck	59%	82%	Short and Long haul
Private Truck	41%	18%	
Dairy			
For-hire truck	39%	72%	Long haul
Private Truck	60%	27%	Short haul

Source: DOT, Bureau of Transportation Statistics, 2002 CFS, Table 14

Recent Trends in Meat Consumption

U.S. consumer preferences began to shift in the mid-1980's away from red meats and towards poultry. Per capita chicken consumption surpassed that of pork in 1986 and that of beef by the mid 1990's. Chicken consumption is expected to continue to outpace that of red meat over the long term, with just a slight slowdown in consumption due to the recessionary conditions in 2009 (Figure 2-23).

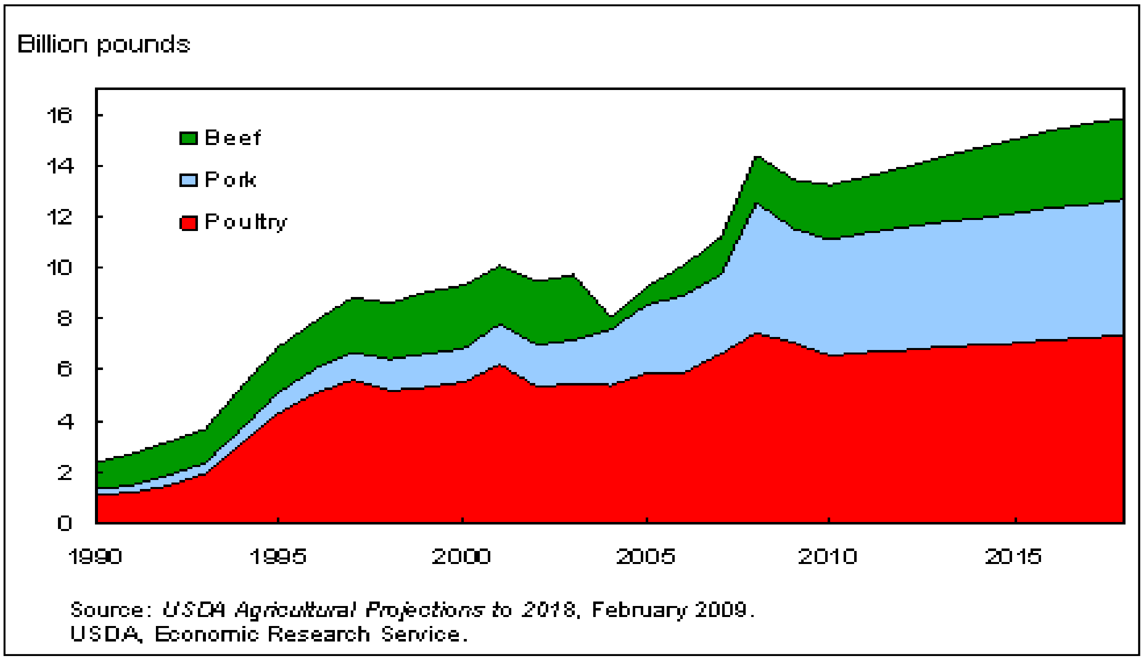
Figure 2-23: U.S. per-capita meat consumption[21]



International Trade

U.S. exports of beef, pork, and poultry have increased dramatically since 1990. Factors driving the international trade growth were not only rising incomes, but also the preference of United States and foreign consumers for a greater variety of red meat cuts, facilitated by the expansion of free trade agreements. Changes in currency values, including the recent depreciation of the dollar against the currencies of trading partners, have also helped expand trade in red meat products. Domestic production continues to provide most beef and pork consumed in the United States, but imports of lamb have increased. Although the meat and poultry markets have been troubled by animal disease problems over the last few years, the recovery and integration of trade is expected to continue.

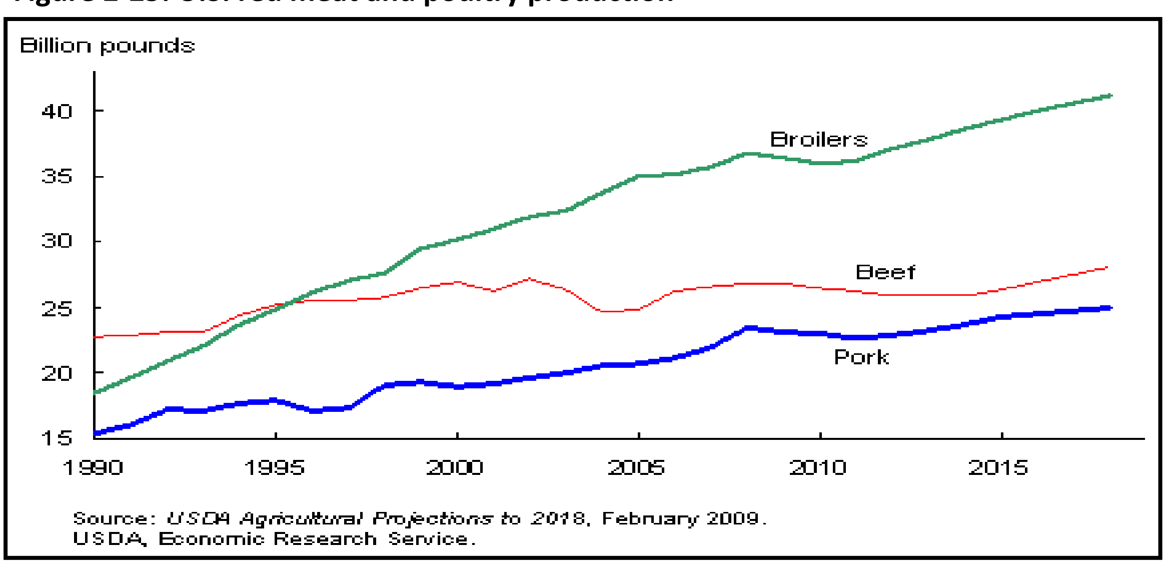
Figure 2-24: U.S. meat exports



Projections for Livestock and Livestock Products

USDA projects that high grain and soybean meal prices in 2007 and 2008 will continue to ripple through the livestock sector for the next several years. Demand is also expected to somewhat weaken due to the domestic recession and global economic slowdown. Total U.S. meat and poultry production is expected to decline through 2011. Production adjustments, combined with strengthening meat exports, are expected to reduce domestic per-capita consumption through 2012. The result is lower production at higher prices, with improving net returns providing economic incentives for moderate expansion in the sector toward the end of the projection period (Figure 2-26).

Figure 2-25: U.S. red meat and poultry production



Meat and Poultry Exports Outlook

Although the domestic market remains the dominant source of total meat demand, exports account for a growing share of U.S. meat production. The economic slowdown and higher meat prices reduce overall meat and poultry exports in 2009 and 2010. Exports rise through the rest of the projection period as global economic growth resumes and the dollar remains relatively weak.

Beef

Exports reflect demand for high-quality fed beef, with most U.S. beef exports going to Mexico, Canada, and markets in Pacific Rim nations. These projections assume a gradual recovery in beef exports to Japan and South Korea—export markets that were lost following the first U.S. case of bovine spongiform encephalopathy (BSE) in December 2003.

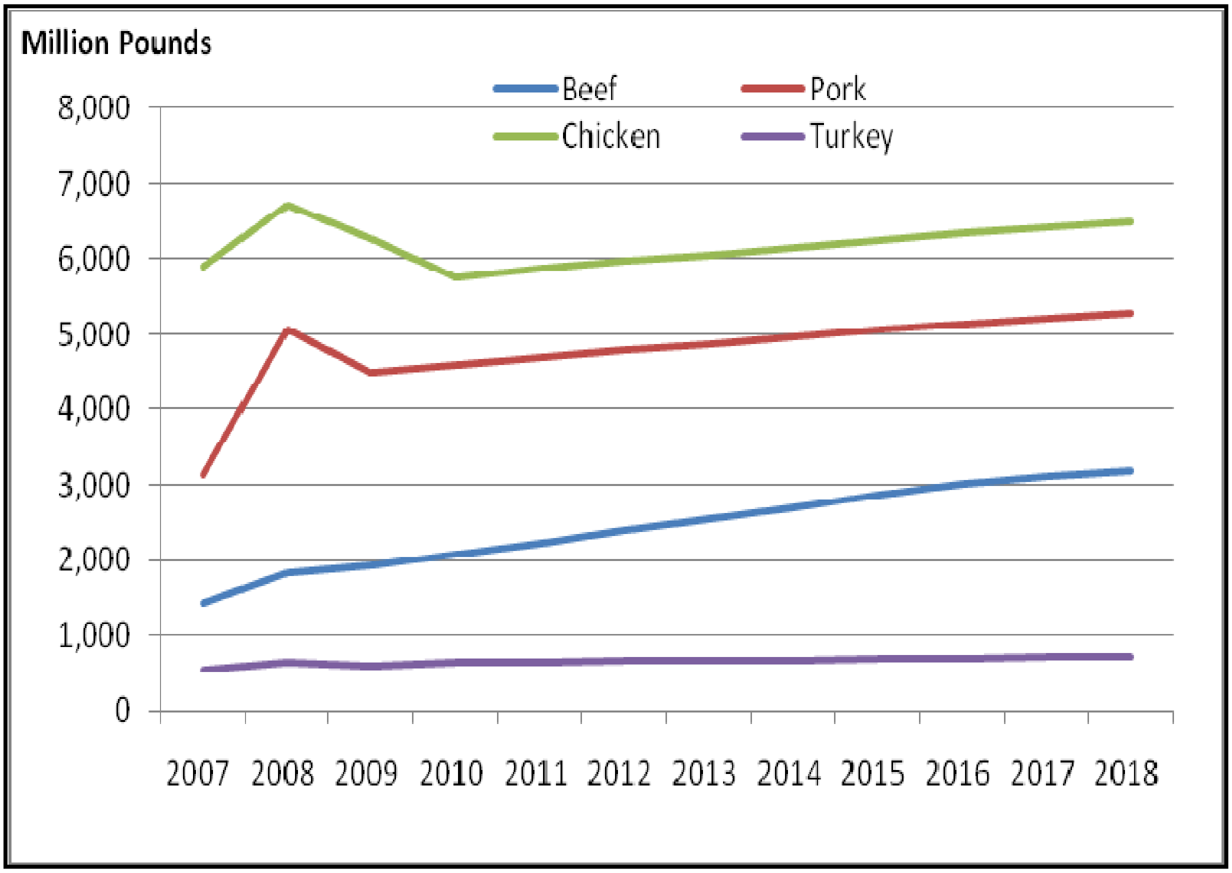
Pork

Despite rising feed costs, increased efficiency is expected to enhance the competitiveness of U.S. pork products. Nonetheless, long-term gains in exports will be determined by costs of production and environmental regulations relative to competitors; production costs are lower in countries that are developing integrated pork industries, such as Brazil. Pacific Rim nations and Mexico are expected to remain key markets for long-term growth.

Poultry

After declining in 2009 and 2010, broiler exports are expected to rise through the rest of the projection period (Figure 2-26). Major export markets include China, Russia, and Mexico. Long-term gains in these markets are dependent on their economic growth and increasing consumer demand. Demand for poultry also remains strong because it costs less than beef and pork. Producers continue to face strong competition from other exporters, particularly Brazil. For most of the projection period, exports from avian influenza-affected countries are expected to be limited to fully cooked products.

Figure 2-26: Long-term projections of U.S. meat and poultry exports



Source: USDA Agricultural Projections to 2018

Table 2-14. U.S. beef, pork, chicken, and turkey supply and use long-term projections

Item	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2007-18 Change
(million lbs.)													
Beef													
Production	26,523	26,801	26,752	26,466	26,209	25,865	25,896	25,930	26,293	26,863	27,497	28,054	6%
Imports	3,052	2,443	2,595	2,663	2,740	2,812	2,884	2,957	3,030	3,103	3,150	3,195	5%
Total supply	30,205	29,874	29,942	29,724	29,544	29,272	29,375	29,482	29,918	30,561	31,242	31,844	5%
Domestic Consumption	26,707	25,597	25,507	24,979	24,487	23,899	23,686	23,473	23,589	23,908	24,425	24,861	-7%
Exports	1,434	1,841	1,920	2,075	2,231	2,389	2,547	2,707	2,867	3,029	3,111	3,194	123%
Total consumption	28,141	27,438	27,427	27,054	26,718	26,288	26,233	26,180	26,456	26,937	27,536	28,055	0%
Pork													
Production	21,962	23,471	23,094	22,970	22,618	22,822	23,203	23,699	24,196	24,459	24,696	24,934	14%
Imports	968	832	850	950	1,000	1,025	1,050	1,075	1,100	1,125	1,150	1,175	21%
Total supply	23,444	24,839	24,584	24,560	24,258	24,487	24,893	25,414	25,936	26,224	26,486	26,749	14%
Domestic Consumption	16,626	14,063	14,944	14,740	14,254	14,297	14,511	14,838	15,160	15,308	15,430	15,553	-6%
Exports	3,141	5,068	4,500	4,590	4,682	4,775	4,871	4,968	5,068	5,138	5,208	5,278	68%
Total consumption	19,767	19,131	19,444	19,330	18,936	19,072	19,382	19,806	20,228	20,446	20,638	20,831	5%
Chicken													
Production	35,739	36,745	36,347	35,980	36,195	37,092	37,822	38,568	39,295	39,962	40,572	41,150	15%
Domestic Consumption	24,008	23,401	23,887	24,526	24,479	25,214	25,752	26,322	26,855	27,322	27,780	28,212	18%
Exports	5,904	6,719	6,275	5,757	5,888	5,969	6,065	6,153	6,250	6,350	6,426	6,499	10%
Consumption	29,912	30,120	30,162	30,283	30,367	31,183	31,817	32,475	33,105	33,672	34,206	34,711	16%
Turkey													
Production	5,880	6,185	6,025	6,015	6,052	6,115	6,188	6,267	6,384	6,479	6,552	6,611	12%
Domestic Consumption	4,753	4,851	4,862	4,748	4,756	4,801	4,852	4,911	5,008	5,079	5,136	5,179	9%
Exports	547	643	605	640	654	663	674	684	694	706	714	722	32%
Consumption	5,300	5,494	5,467	5,388	5,410	5,464	5,526	5,595	5,702	5,785	5,850	5,901	11%

Source: USDA, Agricultural Projections to 2018 (only major supply and use items selected)

Cattle and Beef Profile

The United States has the largest fed-cattle industry in the world, and is the world's largest producer of high-quality, grain-fed beef. With its abundant grasslands and large grain supply, the United States has developed a beef industry that is largely separate from its dairy sector. The industry is divided into two production sectors: cow-calf operations and cattle feeding.[22]

Supply and Demand

Cow-calf operations are located throughout the United States, typically on land not suited for crop production. Beef cows harvest forage from grasslands to maintain themselves and raise calves. Cows are maintained on pasture year-round; the calf remains with its mother until it is weaned, then is sold. The sold calves are transported by truck to cattle feeding operations concentrated in the Great Plains.

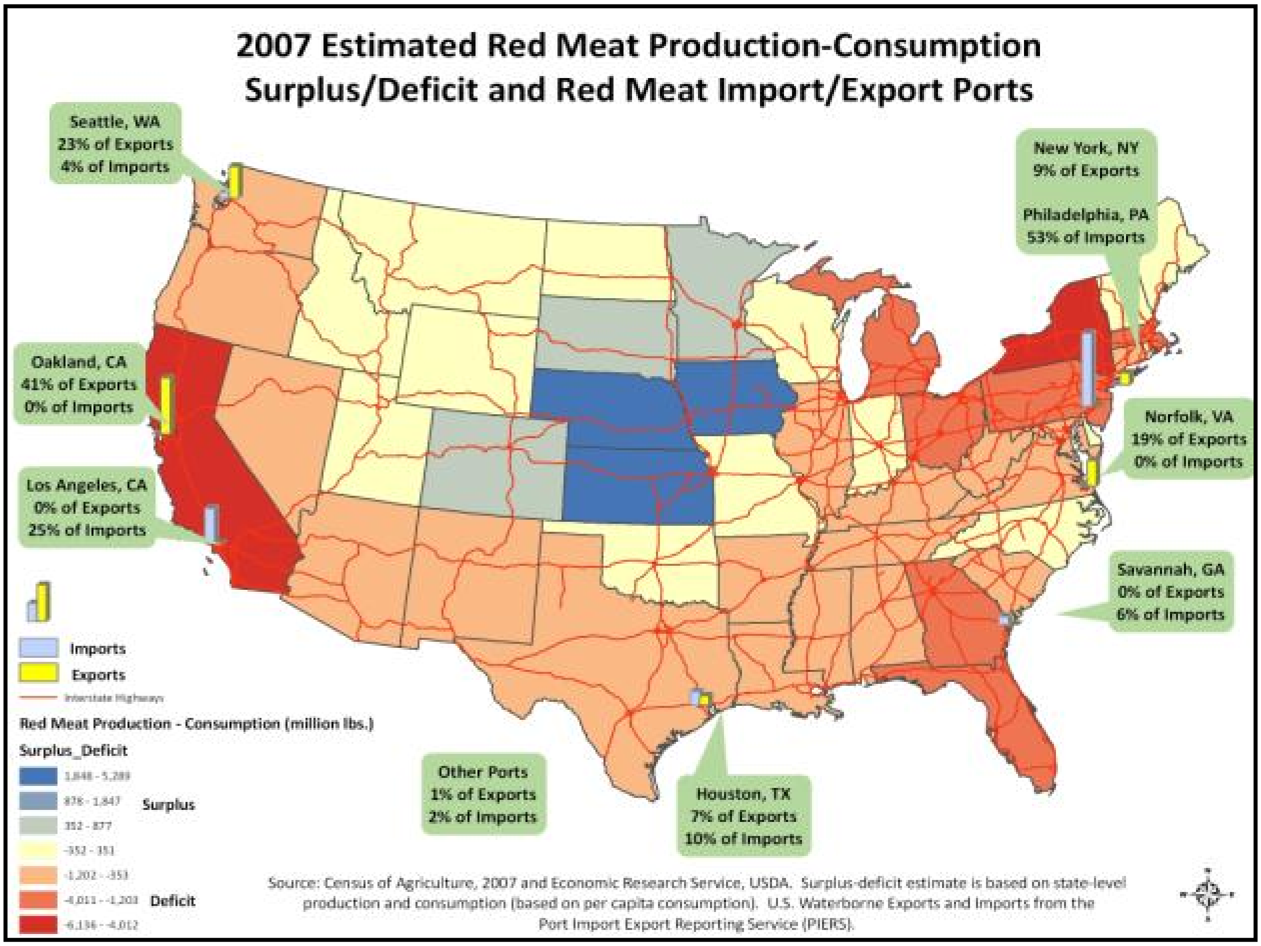
Cattle operations (feeding, slaughtering, and packing) have undergone a structural change since the early 1970's and are currently concentrated in the Great Plains, but are also important in parts of the Corn Belt, Southwest, and Pacific Northwest. In 1990, 80 percent of cattle slaughtering operations were located in ten States, but by 2007 just seven States are home to more than 80 percent of cattle slaughter operations (Table 2-15). Most livestock slaughtering and processing facilities are west of the Mississippi River and usually far removed from population centers, whereas meat consumption takes place in highly populated areas. This situation shows the importance of interstate highways to meat transportation (Figures 2-21 and 2-27).

Table 2-15: Major U.S. cattle slaughter States, 2007

	KS	NE	TX	CO	WI	CA	WA	7-State	U.S.
Slaughter (million head)	7.7	7.1	6.1	2.2	1.7	1.6	1.1	27.5	34.3
Share of U.S. Total	23%	21%	18%	6%	5%	5%	3%	80%	100%

Source: NASS Quick Stats, Slaughter Annual, 2007

Figure 2-27: U.S. red meat surplus-deficit



Recent Trends in Beef

In 2003, the United States had its first case of bovine spongiform encephalopathy (BSE), widely referred to as "mad cow disease.” Subsequently, the markets for U.S. beef slammed shut. In 2004, beef exports dropped from more than 1 million metric tons per year to just over 200,000 metric tons. By 2008, however, they had gradually recovered, surpassing 800,000 metric tons (Table 2-16). The reentry of Japan and Korea as significant markets for U.S. beef was critical to the recovery. Growth in sales to Canada and Mexico has been largely due to market integration as a result of the North American Free Trade Agreement (NAFTA) and, more recently, the lower-value dollar. Beef exports to Canada, for example, are higher than before the BSE episode. Rising incomes, the preference of domestic and foreign consumers for a greater variety of red meat cuts and the expansion of free trade agreements also have helped expand trade in red meat.[23]

U.S. beef imports are usually of lean trimmings and processed beef used in fast food and frozen dinner preparations; they have fluctuated between 1.15 and 1.66 million metric tons annually.

For the first time in more than a decade, the USDA forecast for 2009 predicts a drop in the global meat trade. Deterioration of global economic conditions, increases in restrictive trade policies, and the rise in U.S. dollar value are among the reasons for falling demand in major importing countries such as Russia, Mexico, and South Korea.[24]

Table 2-16: U.S. beef supply and use, 1999-2009

	Production	Imports	Domestic Use	Exports
1999	12,124	1,303	12,325	1,094
2000	12,298	1,375	12,502	1,120
2001	11,983	1,435	12,351	1,029
2002	12,427	1,459	12,737	1,110
2003	12,039	1,363	12,340	1,142
2004	11,261	1,669	12,667	209
2005	11,318	1,632	12,664	316
2006	11,980	1,399	12,833	519
2007	12,096	1,384	12,829	650
2008	12,163	1,151	12,452	856
2009 (f)	12,105	1,256	12,554	826

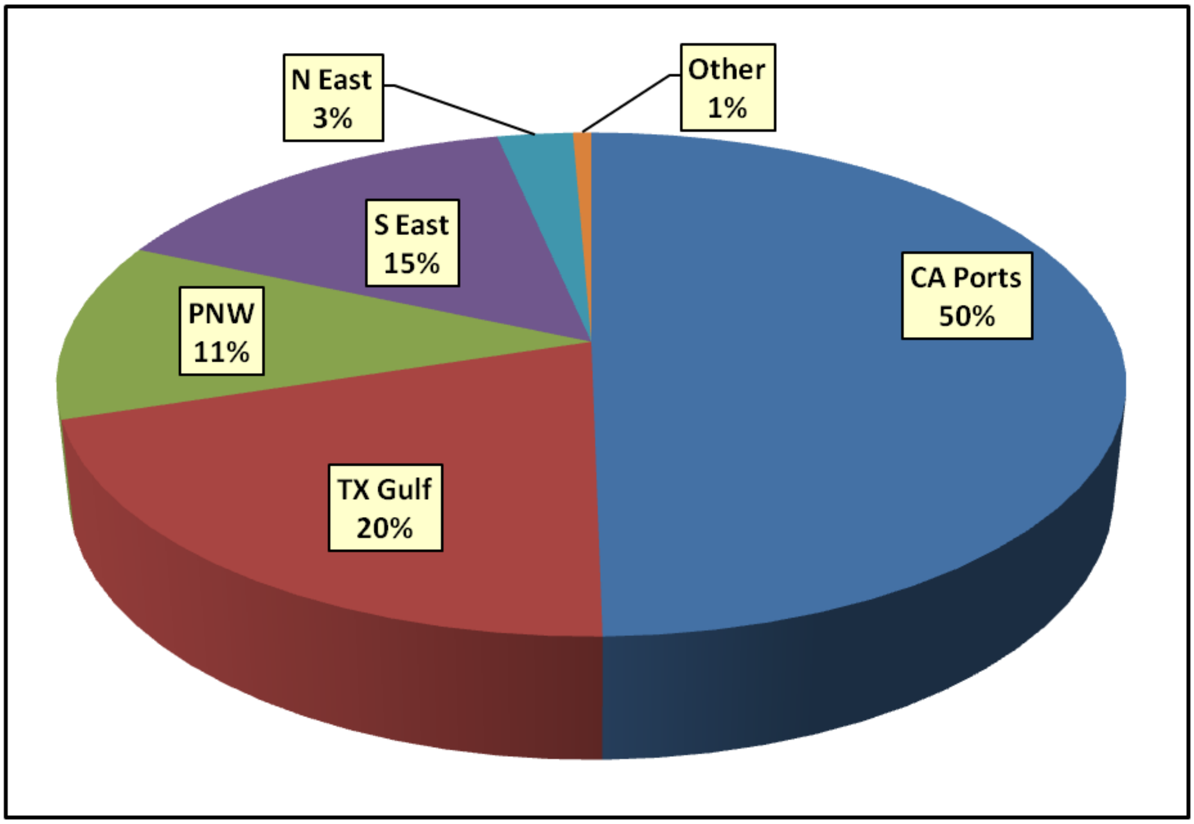
(f) = Forecast, April 2009.

Source: Production, Supply and Distribution Online, Foreign Agricultural Service, USDA <http://www.fas.usda.gov/psdonline/>

Exports and Transportation Needs

U.S. beef exporters rely on refrigerated containers to ship their products overseas and refrigerated trucks for cross-border movements. In 2007, more than 99 percent of waterborne beef exports moved in containers.[25]

Figure 2-28: Port regions moving beef exports, 2007



Source: Port Import Export Reporting Service (PIERS)

Beef Exports by Port Region

- Most waterborne beef exports are shipped through California ports—50 percent in 2007 (Figure 2-28).
- The second-most exports were shipped out of Texas Gulf ports—20 percent in 2007.
- The top five destinations—Canada, Mexico, South Korea, Taiwan, and Japan—accounted for 86 percent of the total export volume in 2007.

Hogs and Pork Profile

The United States is the world's largest exporter of pork and pork products. It is also the third largest producer and consumer and the fifth largest importer. Pork accounts for about a fourth of domestic meat consumption, with imports accounting for more than 4 percent. About 14 percent of domestic production is exported. The U.S. hog herd stands at nearly 64 million animals, with about 68 percent of them in the Corn Belt area, where they have access to that region's abundant supplies of feed grains and soybean meal. Another 20 percent of hogs are produced in the Southeast.[26]

Geographical shifts in hog production have accompanied the structural and organizational changes in the industry.[27] Historically, hog production was concentrated in Corn Belt States, where an abundant supply of corn provided a cheap source of feed. During the 1980s and 1990s, however, hog production grew dramatically in nontraditional areas, driven mainly by the growth of large contract operations. For example, in North Carolina the inventory of hogs and pigs more than doubled between 1987 and 1998, pushing the State's rank in total hog inventory from seventh in 1987 to second by 1998 (Table 2-17). Rapid growth in the North Carolina hog industry ended after a State law enacted in August 1997 placed a moratorium on building or expanding hog operations. Restricted growth in North Carolina may explain some of the particularly rapid recent growth of the industry in Iowa, Minnesota, and Oklahoma.

Table 2-17: Hogs and pigs inventory in major States on December 1, 1987-2007

	1987	1992	1998	2007	1987 Rank	2007 Rank
		Million Head			1=Highest; 8=Lowest	
Iowa	13.9	14.9	15.3	19.4	1	1
North Carolina	2.58	4.5	9.7	10.2	7	2
Minnesota	4.5	4.7	5.7	7.7	4	3
Illinois	5.4	5.9	4.85	4.35	2	4
Indiana	4.5	4.55	4.05	3.7	3	5
Nebraska	4.05	4.6	3.4	3.35	5	6
Missouri	3	2.85	3.3	3.15	6	7
Oklahoma	0.2	0.24	1.92	2.35	8	8
Top 8 States	**38.1**	**42.2**	**48.2**	**54.2**		
Top 8 States as % of U.S. Total	70%	73%	78%	79%		
U.S. Total	**54.4**	**58.2**	**62.2**	**68.2**		

Source: USDA, NASS Quick Stats, Hogs and Pigs Inventory by Class, Dec 1

Supply and Demand

As does the beef industry, the pork industry relies on trucking to move its product to market. The importance of the Nation's highways is highlighted once again because of the concentration of pork production in a handful of States that are long distances from urban population centers.

Recent Trends in Pork

From 2004 to 2008, domestic consumption of pork in the United States grew at a relatively slow rate of 6 percent. The growth in the pork trade surplus, however, has been tremendous—exports grew by 71 percent and imports decreased by 16 percent (Table 2-18). Factors driving this trade growth are the same as those for beef: rising incomes, the preference of United States and foreign consumers for a greater variety of red meat cuts, expansion of free trade agreements, and the recent depreciation of the dollar against the currencies of key trading partners.[28]

Table 2-18: U.S. pork supply and use, 2004-2008

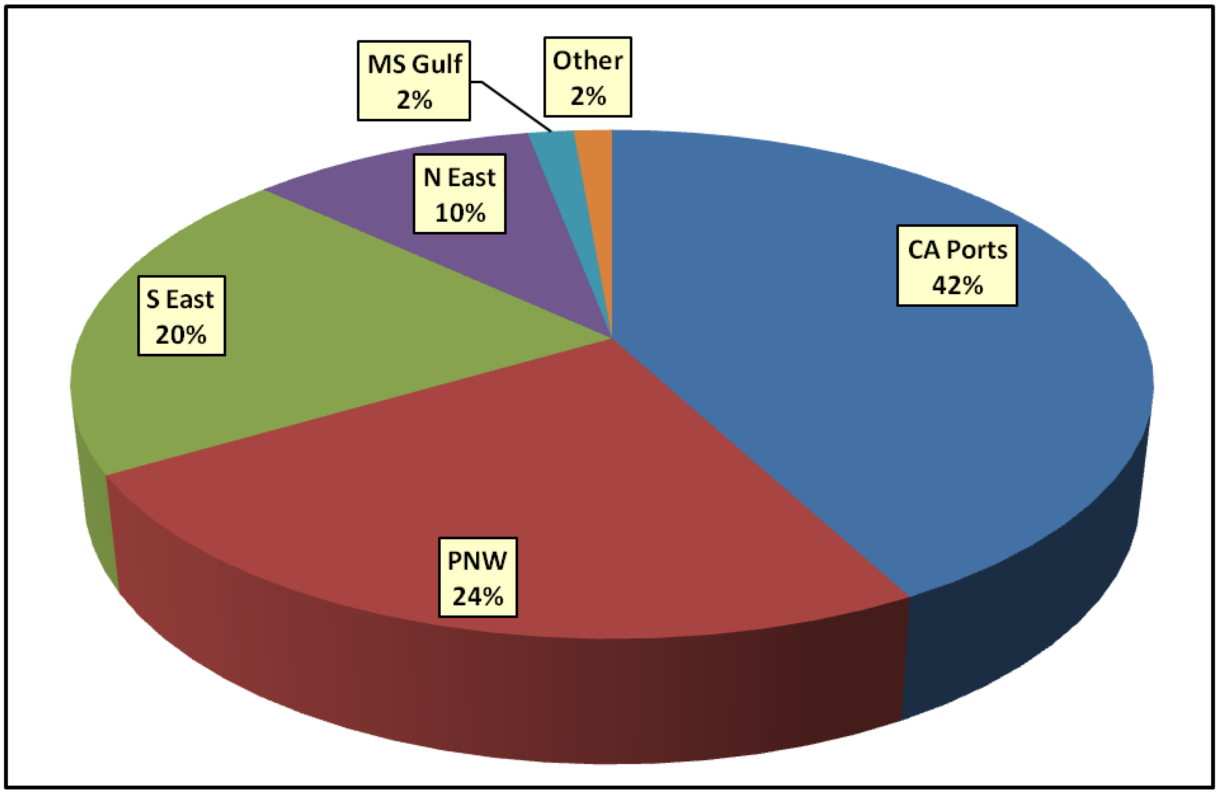
	Production	Imports	Domestic Use	Exports
		(million pounds)		
2004	20,529	1,099	19,437	2,181
2005	20,705	1,024	19,112	2,666
2006	21,074	990	19,048	2,995
2007	21,962	968	19,763	3,138
2008	23,554	925	20,686	3,735
5-year growth	15%	-16%	6%	71%

Source: ERS. Agricultural Outlook, Table 10

Exports and Transportation Needs

U.S. exporters of pork rely on refrigerated containers to ship their products overseas and refrigerated trucks for cross-border movements. In 2007, more than 99 percent of U.S. pork waterborne exports moved in containers.[29]

Figure 2-29: Port regions moving pork exports, 2007



Source: Port Import Export Reporting Service (PIERS)

Pork Exports by Port Region

- Most waterborne pork exports are shipped through California ports—42 percent of pork exports in 2007 (Figure 2-29).
- The other key ports include the Pacific Northwest and the Southeast, accounting for 24 and 20 percent, respectively, of pork exports in 2007.
- The top 5 destinations—Japan, Mexico, Canada, South Korea, and Russia—accounted for 76 percent of total U.S. pork export volume in 2007.

Poultry Profile

The U.S. is the world's largest producer and second-largest exporter of poultry meat, which is mostly chicken (broilers). The United States is the world's second-largest exporter of broilers behind Brazil. Annual broiler exports average between 5 and 6 billion pounds, about 15 percent of U.S. production. Demand for broilers has fluctuated over the last several years due to changing economic conditions and currency exchange rates in major importing countries.

Supply and Demand

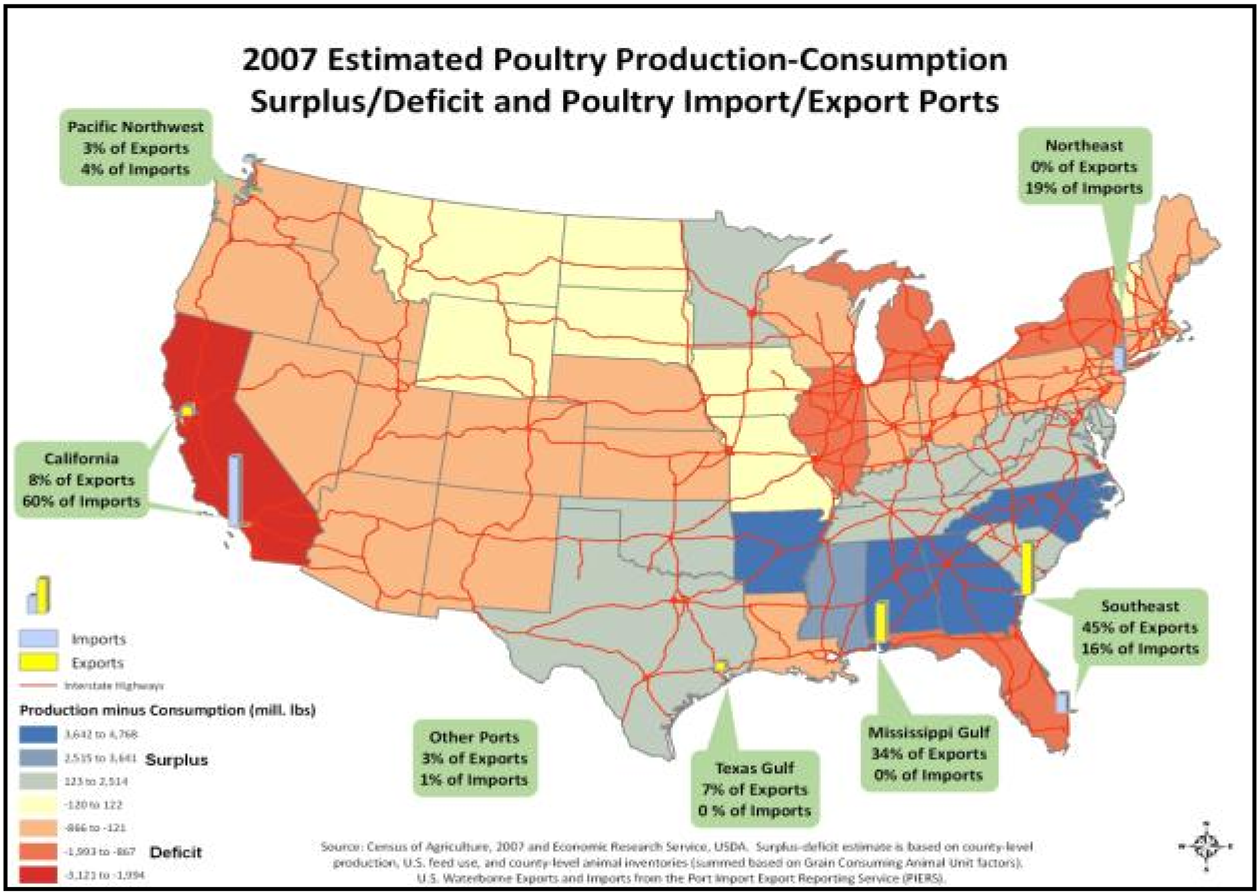
The U.S. poultry industry is concentrated in the Southeast. The top seven States account for 68 percent of the total chicken slaughter but, of these, only Texas (7 percent) and Missouri (5 percent) are outside of the Southeast region (Table 2-19). The rest of the poultry production is distributed among Mid-Atlantic States, Minnesota, and Oklahoma. The surplus-deficit map in Figure 2-30 indicates that most of the West is a deficit region, and demonstrates the importance of the U.S. interstate system to the concentrated poultry production area.

Table 2-19: Major U.S. chicken slaughter States, 2007

	GA	AR	AL	MS	NC	TX	MO	7-State	U.S.
Slaughter (million head)	1,321	1,135	1,059	783	718	648	412	6,076	8,903
States as percent of U.S.	15%	13%	12%	9%	8%	7%	5%	68%	100%

Source: NASS, 2008 Poultry Slaughter Annual, February 2009

Figure 2-30: U.S. poultry meat surplus-deficit



Recent Trends in Poultry

From 2004 to 2008, domestic consumption of chicken and turkey has increased by 6 and 9 percent, respectively. U.S. exports of chicken and turkey, however, increased at a much higher rate—25 percent and 37 percent, respectively. Although turkey exports grew at a faster rate, total turkey export volumes were only 10 percent of total chicken exports in 2008.

Table 2-20: U.S. poultry supply and use, 2007

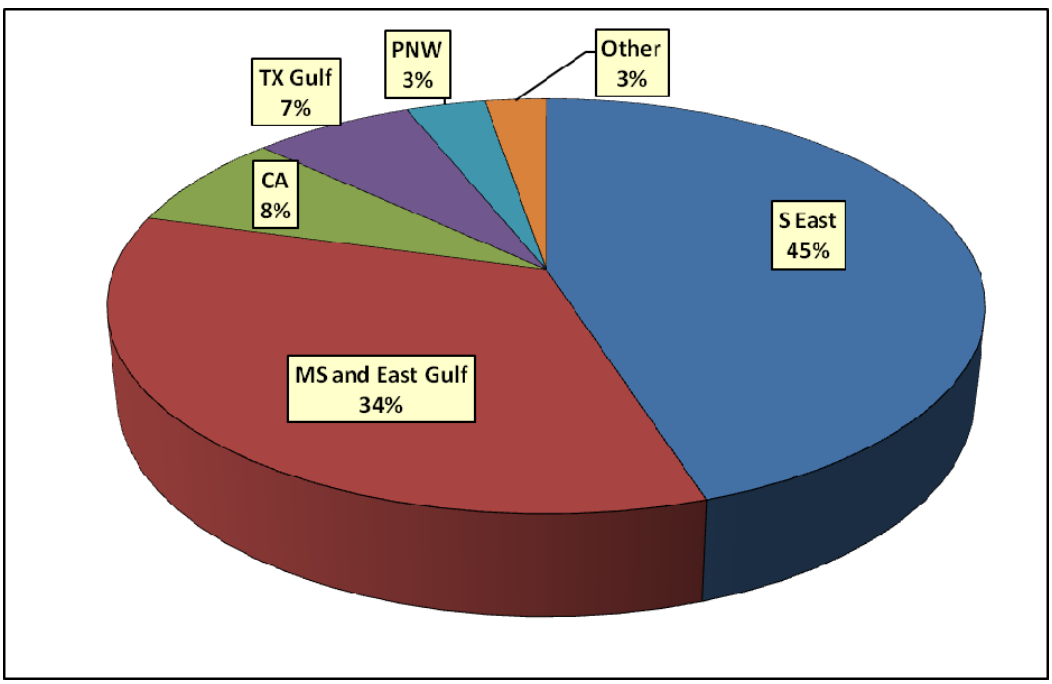
	2004	2005	2006	2007	2008	5-yr growth
Broilers (million pounds)						
Production	33,699	34,986	35,120	35,739	36,505	8%
Domestic Use	28,837	29,607	30,139	30,034	30,629	6%
Exports	4,783	5,203	5,205	5,772	6,000	25%
Turkeys (million pounds)						
Production	5,383	5,432	5,607	5,880	6,084	13%
Domestic Use	5,010	4,952	5,060	5,292	5,477	9%
Exports	442	570	547	554	605	37%

Source: ERS <http://www.ers.usda.gov/briefing/poultry>

Exports and Transportation Needs

U.S. exporters of poultry use refrigerated containers and bulk refrigerated vessels to ship their products overseas, and refrigerated trucks for cross-border movements. In 2007, 58 percent of waterborne exports moved in containers and 42 percent in bulk refrigerated vessels.[30]

Figure 2-31: Top ten ports moving poultry exports, 2007



Source: Port Import Export Reporting Service (PIERS)

Poultry Exports by Port Region

- Most waterborne poultry exports are shipped through Southeastern ports (including Savannah, GA, Jacksonville, FL, and Charleston, SC)—45 percent of poultry exports in 2007 (Figure 2-31).
- The other key ports include Mississippi and East Gulf ports**:** Mobile, AL, New Orleans, and Pascagoula, MS, accounting for 34 percent of poultry exports in 2007.
- The largest importers of U.S. broiler products are Russia, China (including Hong Kong), and Mexico. Together, these markets accounted for more than half the exports, on a quantity basis.

Dairy Profile

Milk has a farm value second only to beef among livestock industries and equal to corn. Dairy products include cheese, fluid milk, yogurt, butter, and ice cream, as well as dry and condensed milk and whey products, which are used mostly as ingredients in processed foods.

Key factors that have dramatically altered the U.S. dairy industry and changed the context for dairy policies and the sector as a whole include**:**

- Shifts in consumer demands.
- Shifts in the location and structure of milk production due to industry concentration.[31]
- Growth in international markets and in trade agreements.

In the future, the U.S. dairy industry is likely to become more fully integrated with international markets. At the same time, dairy products such as fluid milk, butter, and cheese are likely to be increasingly used as ingredients for restaurants and in processed foods, as well as being sold in their traditional forms.

Government policies and programs play an important role in the U.S. dairy sector. Both national and State dairy programs support the industry. U.S. dairy policy rests on two fundamental concepts—price and income support, and orderly marketing. Price and income support is primarily a Federal responsibility. Orderly marketing objectives, as embodied in milk-marketing orders, are pursued at both the Federal and State levels.

Regional Changes in Milk Production

The structure and location of dairy processing and manufactured product firms depend on the products they make. Fluid milk processing is dominated by proprietary firms, and the fluid plants tend to be located near major population (consumer) centers. Production of storable manufactured products occurs near milk production areas, and the cooperatives play a large role. A geographic pattern for perishable manufactured products is more difficult to discern, although most are produced by fluid milk processors. However, some storable manufactured-product plants operate lines for the perishable products and some firms (and plants) specialize solely in these products (Figure 2-33).[32]

During the past few decades, many States and even some regions have reversed long-established trends. In the 1970s, dairies in several western States (particularly California) grew dramatically larger than those in the rest of the country. These dairies had developed business organizations capable of operating large dairies, resulting in low costs.

Figure 2-32: Dairy farms have been getting larger, driven by economies of scale.

Source: North Dakota Department of Agriculture

The price impacts of this growth began to put pressure on higher-cost producers, resulting in a decline in output and a shift away from the higher-cost producing regions. Thus began a westward shift of milk production that still continues. Recently, however, large modern dairy farms similar to those built by western producers have been appearing in the Midwest and Northeast, where they are helping to stem the long-term decline in production.   In 2007, more than 70 percent of U.S. milk production occurred in just 9 states (Table 2-21). California and New Mexico accounted for more than 26 percent of the nation's total milk production.

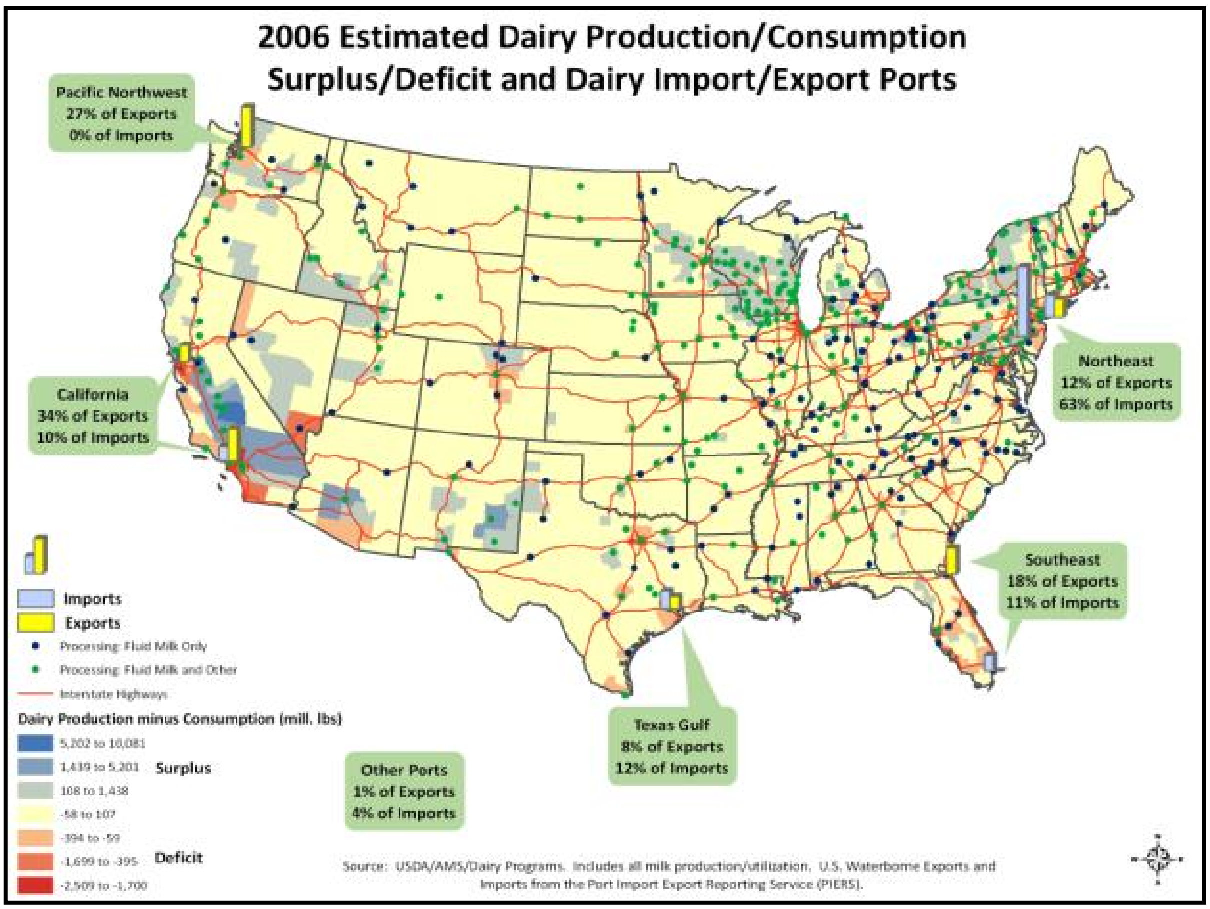
Environmental issues, such as water and air quality, traffic impacts, and odors concern the milk production industry. Environmental regulation, zoning, and animal nuisance laws have become increasingly important, particularly for large dairy farms. Except for a few areas of high animal density, these regulations have not yet had major effects on industry growth. However, the time needed to bring a new dairy farm or expansion into full production has lengthened, and location is increasingly likely to be affected by environmental issues and regulations.

Table 2-21: Major milk producing States, 2007

	Milk Production (Million pounds)	Major States as Percent of Total
California	40,683	22%
Wisconsin	24,080	13%
New York	12,103	7%
Idaho	11,549	6%
Pennsylvania	10,682	6%
Minnesota	8,656	5%
Michigan	7,625	4%
Texas	7,384	4%
New Mexico	7,290	4%
9-States	130,052	70%
U.S.	185,654	100%

Source: NASS, Quick stats, Dairy Annual

Figure 2-33: U.S. dairy surplus-deficit, U.S. highway system



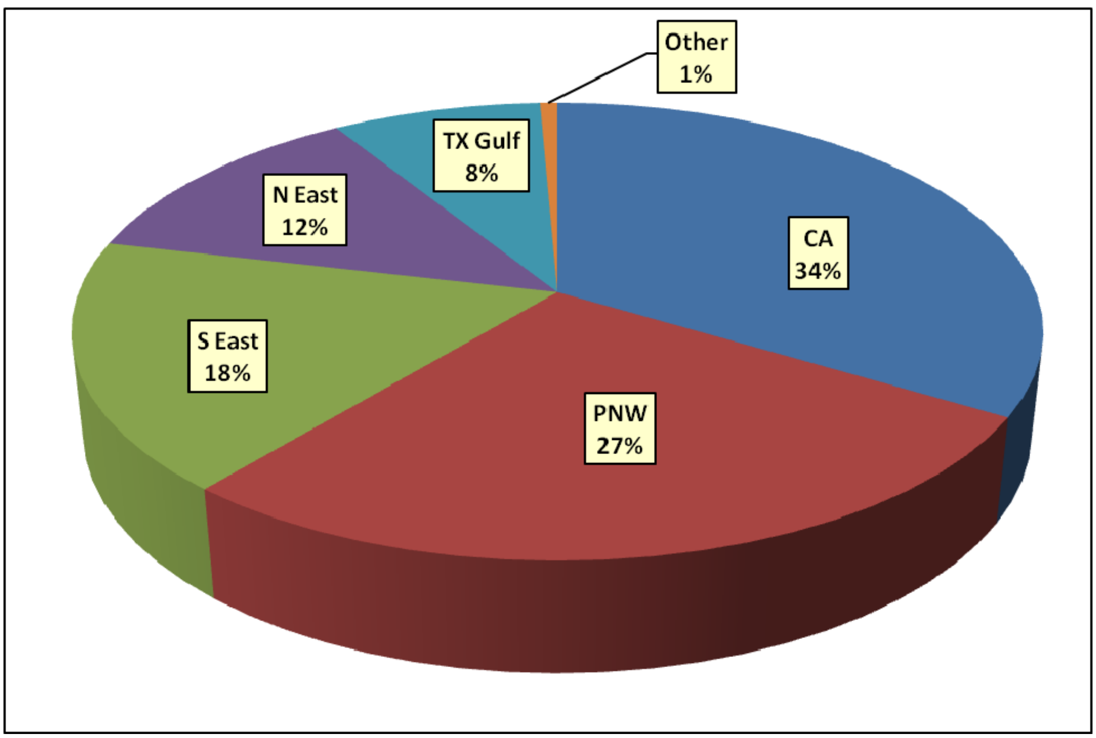
Supply and Demand

The surplus-deficit map in Figure 2-33 demonstrates the importance of the interstate system to the dairy industry. Most fluid milk and other dairy processing plants are located on or near the interstates in the milk-producing areas. The dairy sector depends on trucks for transportation of fluid milk. Food-grade but unrefrigerated tanker trucks transport raw milk to fluid milk plants; the finished products are distributed in refrigerated trucks. Cheese and other dairy products are shipped by refrigerated rail cars to population centers or to ports for export. In addition, geographic concentration of the dairy industry, as discussed above, has contributed to increased demand for trucking services.

Trade and Transportation

The United States exports large amounts of cheese and non-fat dry milk (NFDM). In 2007, the largest importers of U.S. cheese were Japan, Canada, South Korea, United Kingdom, and Dominican Republic. The largest importers of U.S. NFDM were Mexico, Philippines, Indonesia, Vietnam, and Thailand. USDA's Commodity Credit Corporation and the Foreign Agricultural Service administer the Dairy Export Incentive Program, a policy tool that assists international marketing of U.S. dairy products. West Coast ports account for the majority of dairy exports (Figure 2-34). Dairies at a distance from a port rely on highways and railroads to get their products to port.

Figure 2-34: U.S. port regions used to move dairy exports, 2007



Source: Port Import Export Reporting Service (PIERS)

Dairy Production and Export Outlook

Strong farm-level milk prices in 2007 encouraged milk producers to increase cow numbers in 2008, despite increased feed costs. Combined with an upward trend in output per cow, milk production rose relatively strongly into 2008.[33] USDA's long-term agricultural outlook for dairy products indicates that the number of milk cows will resume the more typical yearly declines after 2008 (Table 2-22). However, annual reductions are expected to be lower than in past decades as increasing specialization of dairy farms slows exit rates from milk production. Milk output per cow is projected to increase, although some slowing is expected in 2008-10 in response to higher feed costs.

Domestic commercial use of dairy products is forecast to increase faster than the growth in U.S. population over most of the next decade. Cheese demand should benefit from the greater consumption of prepared foods and increased away from-home eating. However, consumption of fluid milk is expected to continue to decline slowly. Exports of dairy products are projected to decline from the levels reached in 2008, but remain high by historical standards. Global demand for dairy products has grown as incomes in developing countries have risen.

Table 2-22: U.S. dairy supply and use long-term projections

Item	Units	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2007-2018 change
Milk production and marketings:														
Number of cows	Thousand	9,158	9,265	9,245	9,190	9,165	9,125	9,080	9,030	8,985	8,945	8,900	8,845	-3%
Milk per cow	Pounds	20,267	20,480	20,710	20,960	21,315	21,665	21,910	22,220	22,535	22,905	23,160	23,465	16%
Milk production	Bil. lbs.	185.6	189.8	191.5	192.6	195.4	197.7	198.9	200.6	202.5	204.9	206.1	207.5	12%
Farm use	Bil. lbs.	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	-8%
Marketings	Bil. lbs.	184.4	188.6	190.3	191.5	194.3	196.6	197.8	199.5	201.4	203.8	205.0	206.4	12%
Supply and use, milkfat basis:														
Marketings	Bil. lbs.	184.4	188.6	190.3	191.5	194.3	196.6	197.8	199.5	201.4	203.8	205.0	206.4	12%
Imports	Bil. lbs.	4.6	3.4	3.6	3.6	3.7	3.8	3.9	4.0	4.2	4.3	4.4	4.5	-2%
Commercial supply	Bil. lbs.	198.6	202.3	203.4	204.2	206.6	209.0	210.3	212.2	214.4	217.1	218.5	220.1	11%
Domestic commercial use	Bil. lbs.	182.5	184.4	187.7	189.7	192.1	194.9	196.3	198.2	200.4	203.1	204.7	206.4	13%
Commercial exports	Bil. lbs.	5.7	8.4	6.7	5.9	5.8	5.5	5.3	5.2	5.0	4.9	4.6	4.4	-23%
Total utilization	Bil. lbs.	198.6	202.3	203.4	204.2	206.5	209.0	210.3	212.2	214.4	217.1	218.5	220.1	11%
Supply and use, skim solids basis:														
Marketings	Bil. lbs.	184.4	188.6	190.3	191.5	194.3	196.6	197.8	199.5	201.4	203.8	205.0	206.4	12%
Imports	Bil. lbs.	4.4	3.3	3.4	3.7	3.8	4.0	4.1	4.2	4.4	4.5	4.6	4.7	7%
Commercial supply	Bil. lbs.	198.0	201.8	203.9	205.2	208.0	210.6	211.9	213.8	215.9	218.4	219.7	221.3	12%
Domestic commercial use	Bil. lbs.	163.6	164.5	169.9	172.7	176.3	180.2	181.9	184.1	186.0	188.6	190.0	192.0	17%
Commercial exports	Bil. lbs.	24.5	26.3	23.5	22.2	21.3	20.1	19.7	19.5	19.6	19.6	19.4	19.2	-22%
Total utilization	Bil. lbs.	198.0	201.0	203.3	204.8	207.6	210.3	211.7	213.7	215.7	218.3	219.6	221.3	12%

Source: USDA, Agricultural projections to 2018 (only major supply and use items selected)

Fruit and Vegetables Profile

The national debate on diet and health frequently focuses on the nutritional role of fruit and vegetables; this continued emphasis on the benefits of eating produce may provide opportunities to the industry. In the domestic market, Americans are eating more fruit and vegetables than they did 20 years ago, but consumption remains below recommended levels. The United States consumed approximately 174 pounds per capita of vegetable and melons (excluding potatoes) and nearly 270 pounds per capita of fresh and processed fruits in 2007. The top five vegetables were potatoes, tomatoes, lettuce, sweet corn, and onions.[*] The top five fruits are oranges, grapes (including wine grapes), apples, bananas, and pineapples.[34]

Recent Fruit Trends

The industry faces a variety of trade-related issues, including competition with imports. Despite year-to-year fluctuations, fruit production in the United States during the 1990s and early 2000s averaged 10–20 percent higher than the 1980s. This growth was in response to several factors:

- Increased domestic consumption.
- Expanding export markets.
- Technical changes in production, such as the adoption of close-density planting.
- New propagation methods that decrease the time needed for new trees to reach bearing age from 5–6 years to 2–3 years.
- Use of disease- and pest-resistant, high-yielding varieties.
- Greater use of early- and late-season varieties that extend marketing seasons so growers can take advantage of marketing windows.

Production declines in recent years may be attributed to weather and disease problems, mostly affecting citrus production.

Total fruit production in 2007 was 29.5 million tons, down 2 percent from 2006, and the smallest crop since 1991. Citrus production alone was down 11 percent. Florida's citrus industry is still coping with the effects of the hurricanes in 2004 and 2005. In addition, diseases such as citrus canker and citrus greening plague the industry. Production of fruit other than citrus rose 1 percent in 2007 from 2006, with 17 million tons produced. Bigger peach, pear, grape, sweet cherry, apricot, fig, strawberry, avocado, nectarine, and papaya crops contributed to the increase in non-citrus production.

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* Per capita consumption expressed on a fresh-weight basis.

Figure 2-35: Loading oranges in California. Most fresh oranges in the United States are grown in California, Arizona, and Texas. Florida raises most of the juice oranges.

Source: USDA

The value of the 2007 fruit and tree nut crops reached $18.5 billion, 9 percent above 2006 and the sixth consecutive year of record high values. The value of the crop rose for citrus and non-citrus fruit, as well as for tree nuts. In 2007, record high crop values were set**:** $3.1 billion for citrus and $11.4 billion for non-citrus. The value for tree nuts was the second highest on record, at almost $4 billion.[35]

The Nation's largest fruit-producing States are California, Florida, and Washington. California accounts for about half of the harvested fruit acreage, Florida almost one-fourth, and Washington around one-tenth. Michigan, New York, Oregon, and Pennsylvania are also important fruit-producing States; together they account for one-tenth of the Nation's fruit acreage.

Annual per capita fruit and nut consumption averaged 271 pounds in 2007—down 2 percent from 2006, and the lowest level since 1992. The decline was led by reduced consumption of apple and orange products, two of the most popular fruits in the American diet. Contributing to the lower use of these fruits was lower production in 2007, which was not fully compensated for by imports.

Recent Vegetable Trends

U.S. production of all vegetables, potatoes, melons, and pulse crops increased 5 percent in calendar year 2007. Fresh and processed imports for these crops were greater than the previous year, plus inventories of processed vegetables coming into the year were greater. As a result, total vegetable and melon supplies available for domestic use and export were up 5 percent to about 181 billion pounds in 2007.

Larger supplies encouraged the use of all vegetables, potatoes, melons, and pulse crops, which increased 2 percent in 2007 to 444 pounds (on a fresh-weight basis). Potatoes (including potato products) remained the top vegetable crop in the United States, with 28 percent of total use. This was followed by tomatoes at 20 percent, lettuce at 8 percent, sweet corn at 6 percent, and onions at 5 percent.

State Production

Fruit and vegetables are produced throughout the United States, with the largest acreage (excluding potatoes and dry beans) being in California and Florida. The Upper Midwest (Michigan, Minnesota, and Wisconsin) and the Northwest (Washington and Oregon) report the largest vegetable acreage for processing; California, Florida, and Texas harvest the largest share of fresh vegetable and melon acreage.

The eastern seaboard States (from Georgia to New York) also report substantial vegetable acreage. With its strong output of cool-season crops, such as lettuce, broccoli, and celery, California remains the major producer of fresh vegetables during the winter. Florida is the top producer of warm-season crops (such as tomatoes, peppers, and snap beans). Potato production is concentrated in the Northwest (Idaho, Washington, and Oregon), but Colorado, North Dakota, California, Wisconsin, and Maine are also key suppliers.

California, Florida, Washington, Texas, Michigan, New York, and Oregon have the most acreage in fruit orchards. California alone accounts for about half of U.S. fruit and tree nut acreage (including berries). Florida accounts for more than one-tenth and Washington almost one-tenth. California's mild climate gives it an advantage over other fruit-producing States. It is the Nation's largest producer of grapes, strawberries, peaches, nectarines, avocados, fresh-market oranges, and kiwifruit. It also leads in tree nut production, including virtually all almonds, pistachios, and walnuts.

Florida is the primary citrus producer, and Washington is the largest apple producer for both fresh use and processing. California is the leading producer of grapes for wine, juice, and raisin production. Midwestern and Northeastern States are key producers of processed fruit products, such as canned tart cherries and apple sauce, and Florida leads in the production of oranges for juice, and grapefruit and tangerines.

Fruit and Vegetable Processing

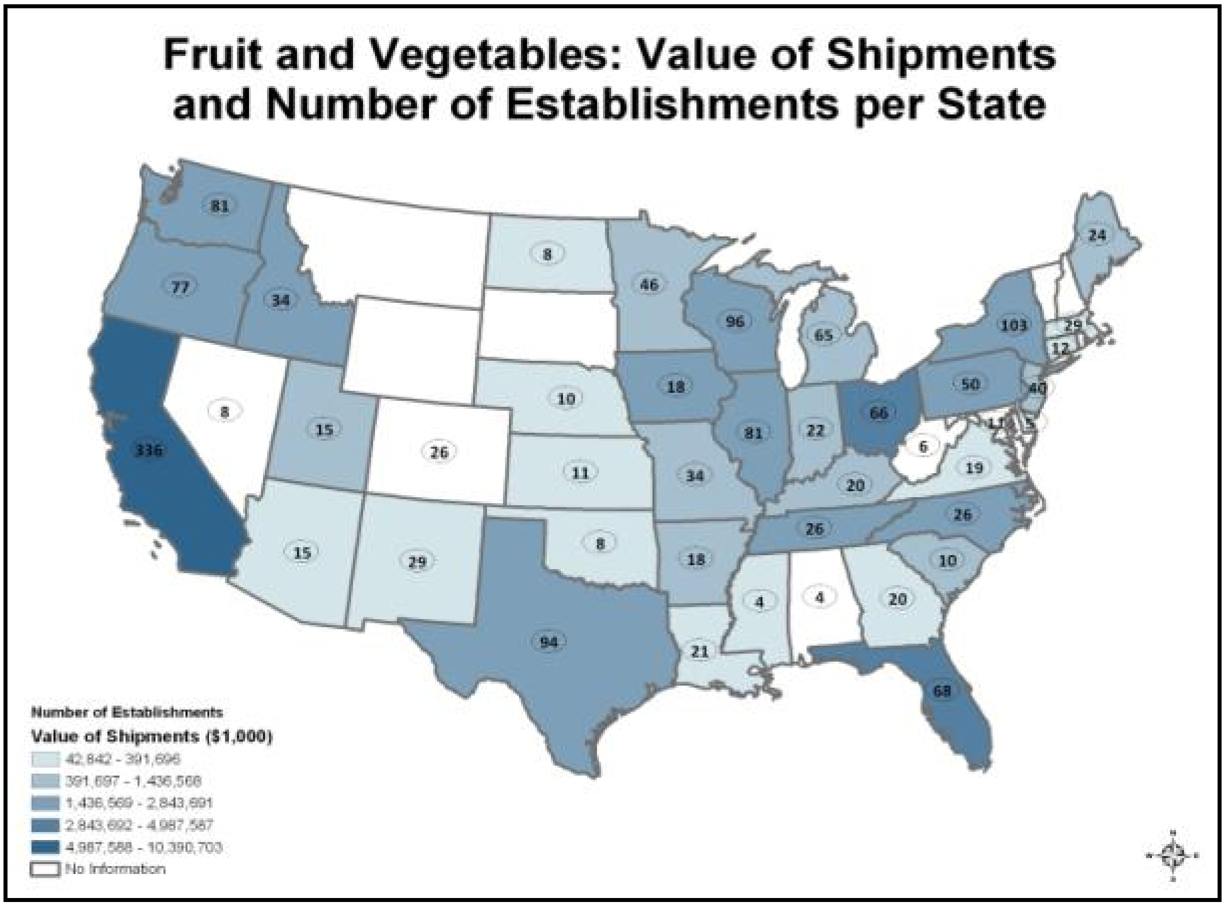
Commodities within the fruit and vegetable industries may be classified according to their end use: fresh market or processing. Processing can be further subdivided into canning, freezing, juicing, and dehydrating. Other than the production of certain commodities with varieties suitable for both uses (apples, grapes, broccoli, cauliflower, and asparagus), growing for processing is distinct from growing for the fresh market. Occasionally, some fruit and vegetables harvested for fresh use do not meet quality standards and are sold for processing but, in general, substitution between the markets is uncommon, even in years when crop output is severely reduced due to bad weather or pests.

Most vegetable varieties grown for processing are better adapted to mechanical harvesting and often lack characteristics desirable for fresh market sale (for example, processing tomatoes are generally smaller and possess different internal attributes than fresh varieties). Most fruit varieties grown for processing are harvested by hand. In spite of that, strong demand for processed fruit products establishes the processing sector as the primary marketing outlet. [36]

More than half of U.S. fruit and vegetable production is processed. Approximately 60 percent of non-citrus fruit production moves into processing channels, and more than 70 percent of citrus production is processed. Tomatoes and potatoes are the top two vegetable crops processed, and oranges and grapes are the top two fruit crops processed. Most citrus fruit—especially oranges—is processed into juice. Grapes are processed into juice, wine, and raisins. The grapes made into wine make up more than one-third of all fruit processed; raisins make up well more than half the dried fruit production.[37]

The map below shows the location of fruit and vegetable processors (Figure 2-36). Most processing facilities are located in production centers to allow the freshest products available for processing. Fruit and vegetable processors are located across the country, with only a handful of States (Montana, Wyoming, South Dakota, New Hampshire and Vermont) having none. The major fruit and vegetable growing States, such as California, Florida, Texas, and the Pacific Northwest States, are also major processing States.

Figure 2-36: Fruit and vegetable processors per State



Source: U.S. Census Bureau, Econ 02 Report Series, 2002

International Trade

In 2007, fruit, vegetables, and tree nuts accounted for 14 percent of the value of U.S. agricultural exports, totaling more than $12.4 billion. However, the country is becoming increasing more reliant on fruit and vegetable imports which, in some cases, provide direct competition for domestically grown products.

The vegetable and melon trade deficit widened in 2007, as the value of imports increased more than the value of exports. Nearly 17 percent of all the vegetables and melons consumed domestically were imported. Thirty-two percent of frozen vegetables were sourced from other nations, up significantly from 18 percent a decade earlier.[38]

Imports of all vegetables, melons, pulse crops, and seed rose 9 percent in 2007 to $7.9 billion. The increase was led by gains in fresh vegetables, melons, and dehydrated vegetables. Mexico remained the top foreign source, with 45 percent of import value (the same as a year earlier). This was followed by Canada at 23 percent, China at 6 percent, Peru at 4 percent, and Spain at 4 percent.

Exports of all vegetables, melons, pulse crops, and seed rose 9 percent in 2007 to $4.6 billion. The increase was led by gains in mushrooms, dry peas and lentils, and frozen vegetables. Canada remained the top foreign market with 47 percent of export value. This was followed by Mexico at 11 percent, Japan at 11 percent, Taiwan at 2 percent, and South Korea at 2 percent. About 9 percent of total U.S. vegetables and melons were exported in 2007—little changed from a decade earlier.[39]

Although growth in U.S. fruit exports has been strong, the country remains a net fruit importer. Not only have imports expanded for commodities already produced domestically, creating competition for U.S. growers, but imports also have increased for nontraditional fruits, especially many tropical fruits.

Imported fruit is increasing in importance in domestic consumption. Relative to the 1990s, import shares of domestic consumption rose for all fruit categories in recent years. Imports' role grew most rapidly for frozen fruit, but fresh and canned fruit were the most dependent on imports to meet domestic demand during the mid- to late-2000s. Currently, nearly half the fresh fruit and two-fifths the canned fruit consumed are from imports.

Fresh fruit imports rose, as a share of domestic consumption, from 35 percent in 1990 to nearly 50 percent during the mid- to late-2000s. Bananas claim more than 50 percent of the volume of fresh fruit imports. Excluding bananas, fresh fruit imports rose from 12 percent of domestic consumption in 1990 to more than 28 percent during the mid- to late-2000s.

Mexico is the largest supplier of fresh and frozen fruit to the United States, accounting for more than 30 percent of both the volume and the value of fresh and frozen fruit imports (excluding bananas). Mexico ships mostly limes, tangerines, mangoes, grapes, pineapples, papayas, avocados, and strawberries. U.S. production of these commodities—except for tangerines, grapes, strawberries, and avocados—is minimal. Geographic proximity and NAFTA provide Mexico with a competitive advantage over other countries, with lower transportation costs and lower or no tariffs.

Chile also is a major supplier of fresh fruit, with more than a 20 percent share of the U.S. import market. Chile enjoys the advantage of having a counter-seasonal production schedule with the United States. Its location in the southern hemisphere means it can provide fresh fruit at times when the United Sates produces little, particularly from November through March. Expanded trade with Chile—beginning in the mid- to late-1980s—extended the availability of certain fruits in the market without direct competition with domestic production and provided U.S. consumers with fruit choices beyond the traditional domestic winter fruits of citrus, apples, and pears. Important fruit imports from Chile are grapes, stone fruit, avocados, and kiwifruit.

U.S. exports of fresh-market fruit account for about 15 percent of available supplies. Fresh-market fruit exports were valued at $3 billion each year during 2005-07, capturing more than half of total fruit exports. The leading fresh fruit exports are apples, grapes, and oranges (including tangerines), with combined sales averaging more than $1 billion annually, or about half the value of fresh fruit exports. Apples and grapes averaged more than $500 million each in annual export sales during 2005-07 and oranges averaged more than $300 million. Export sales of fresh berries, led by strawberries, nearly tripled between 2000 and 2007, for a combined value of more than $400 million. Canada is the leading destination for U.S. fresh fruit, generally accounting for more than one-third of all fresh fruit exports. Other major markets are Japan, Mexico, South Korea, Taiwan, and Hong Kong.

Transportation of Fruit and Vegetable Products

Fresh and processed fruit and vegetables require transportation to move the products between the producer and the packing shed, then to wholesalers, retailers, farmers markets, or the export market.

Domestic fruit and vegetables are transported from growing areas to markets via truck and rail. Import and export shipments are moved by truck and rail to cross-border consumers and by ship and air to overseas markets. Many major shipping areas for U.S. fruit and vegetables are located on the coastal rim of the United States in California, Florida, Texas, and the East Coast; different regions are active at different times of the year.[40]

Trucks account for the vast majority of the domestic movement of fresh and processed produce. Tables 2-2 and 2-3 show that 94 percent of fresh and 90 percent of processed fruits and vegetables are moved by truck. In terms of ton-miles, trucks move around 80 percent and the railroads 5 percent of fresh products and 13 percent of processed products.

Transporting products to market can be difficult and costly. Moving fruit and vegetable products often requires quick and efficient transportation because of their perishable nature, and fresh material needs to be kept at the correct temperature and/or humidity to ensure it arrives in the best condition possible.

Some of the major transportation challenges facing fruit and vegetable shippers are:

- A long-term decline in rail shipments and availability.
- Frequent truck shortages in some growing areas.
- Escalating costs for diesel fuel and labor.[*]

[*] Fruit and Vegetable Backgrounder, ERS

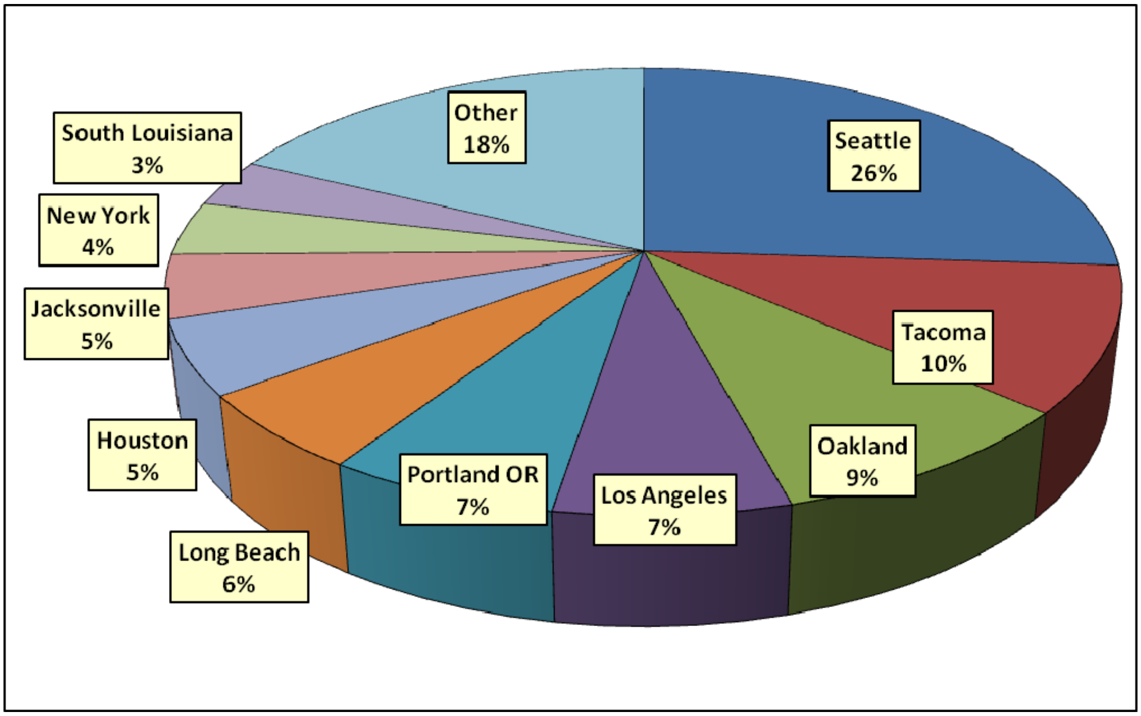
The industry's reliance on truck service leaves it vulnerable to changes in the trucking industry. For example, truck rates experienced a sharp increase in 2008 when faced with record-high oil and diesel fuel prices; the average rates increased 44 percent between the first and third quarter.

Processed fruit and vegetable products (canned, frozen, dried, and juice) may be moved to other processing firms, which add further value by repackaging the products into consumer packs, combining them with meats or other products to be sold as meals, or further refining them into final products. Final products may be exported or stored for later sale by the processor, or they may be transported to warehouses after purchase by buyers, brokers, or buying groups.

Fruit and vegetable trade markets rely heavily on the ocean transportation system to move their commodities. U.S. waterborne exports of fruits and vegetables are moved both in bulk and in shipping containers. In 2007, 99 percent of fruit exports and 85 percent of vegetable exports were moved in containers. Containers conserve quality by controlling temperature or humidity during transit. Commodities such as beans, peas, lentils, and potatoes as well as some citrus fruits and melons, may be shipped in the cargo holds of a bulk vessel. In fact, nearly 33 percent of fruit imports and 15 percent of vegetable exports were moved in refrigerated bulk vessels in 2007. However, the mode of transit preferred by most fruit and vegetable exporters and importers is containerized transportation.

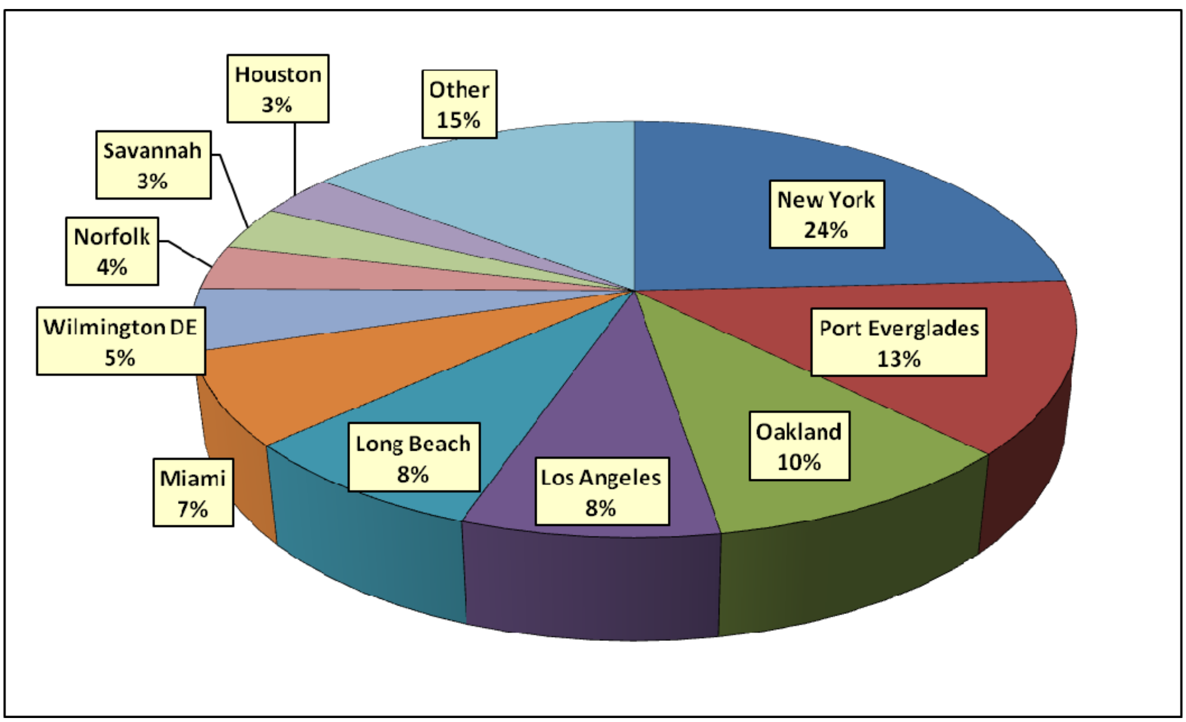
The pie charts below show the use of U.S. ports for waterborne fruit and vegetable imports and exports. Because of heavy reliance on Latin and South American countries to supply our off-season fruits and vegetables, nearly 55 percent of fruit imports and 66 percent of vegetable imports enter through East Coast ports. Conversely, 69 percent of fruit and 66 percent of vegetable exports are shipped from West Coast ports close to the growing areas.

Figure 2-37: U.S. ports used to export vegetables, 2007



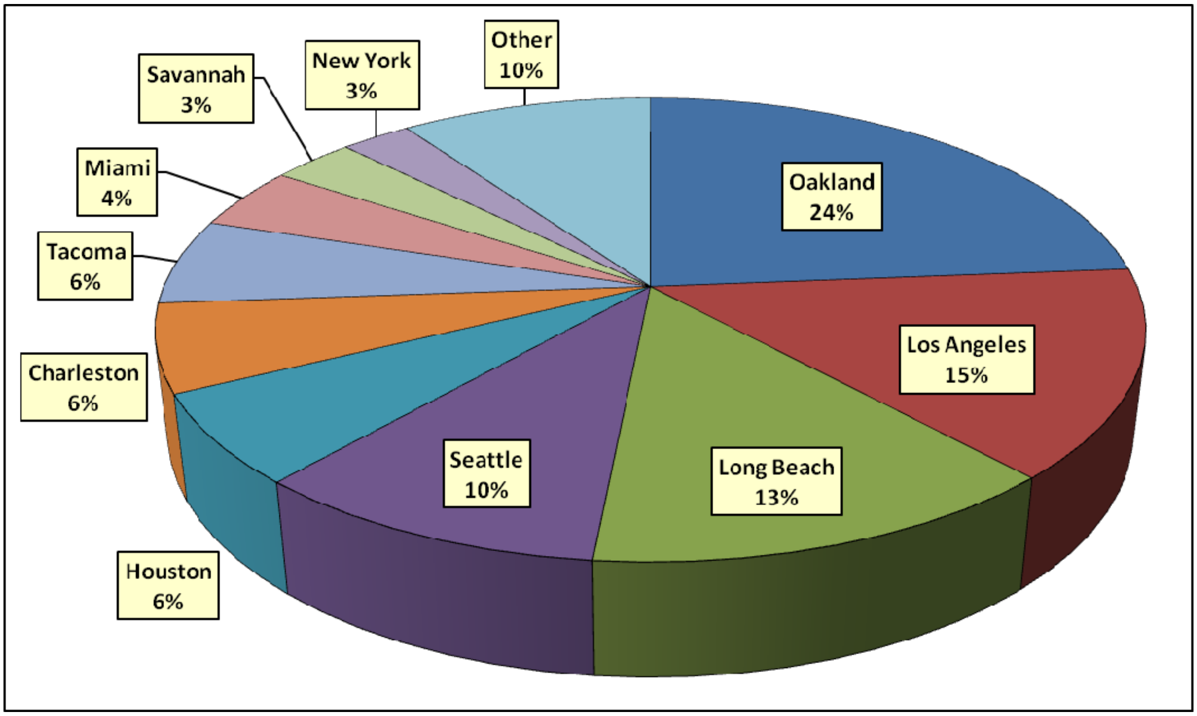
Source: Port Import Export Reporting Service (PIERS)

Figure 2-38: U.S. ports used to import vegetables, 2007



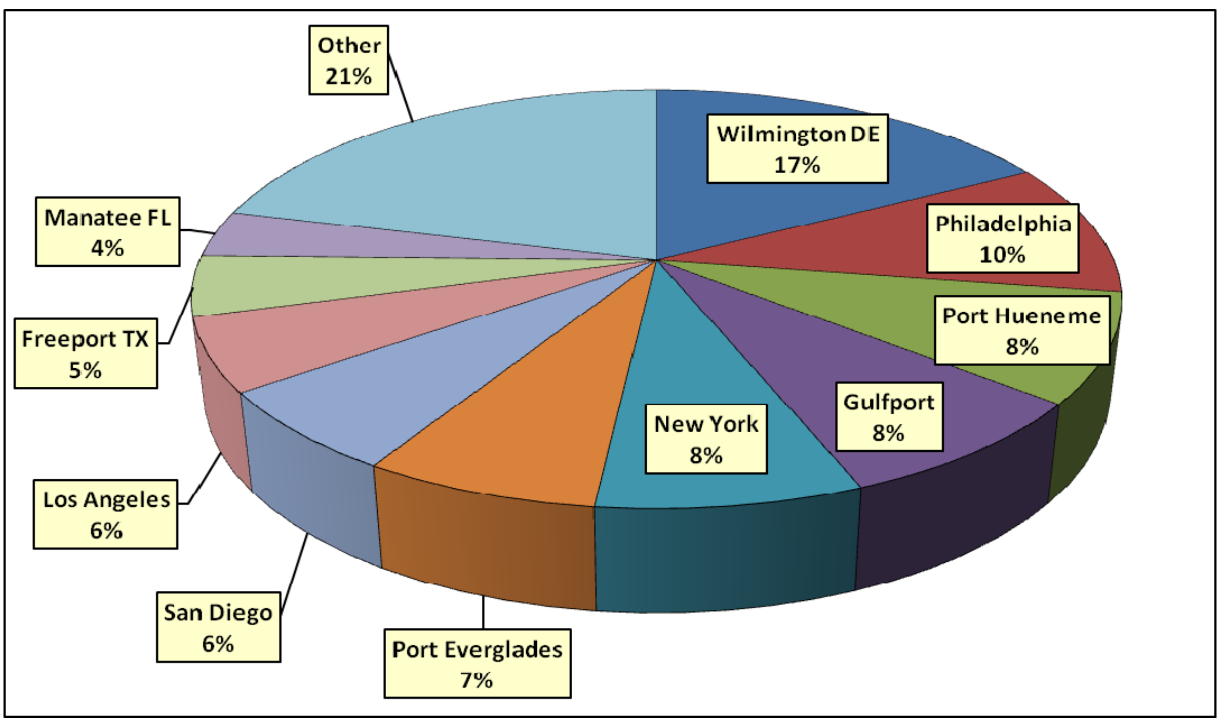
Source: Port Import Export Reporting Service (PIERS)

Figure 2-39: U.S. ports used to export fruit, 2007



Source: Port Import Export Reporting Service (PIERS)

Figure 2-40: U.S. ports used to import fruit, 2007



Source: Port Import Export Reporting Service (PIERS)

Apple, Lettuce, and Potato Profiles

The fruit and vegetable industry comprises a diverse group of agricultural commodities. The Census of Agriculture reports more than 100 separate fruit and vegetable commodities or groups of commodities. For the purposes of this study, the transportation of apples, lettuce, and potatoes are described as examples of the complexities of these markets and the ways transportation serves the industry. They are among the highest-volume fruits and vegetables grown in the United States.

Table 2-23 shows historical production, import, domestic use, and export data for apples, lettuce and potatoes. These commodities have each experienced an increase in trade volumes since the early 1990s, particularly in import traffic. Fresh apple imports have increased 44 percent since the early 1990s; lettuce imports 642 percent, and fresh and processed potatoes 81 and 480 percent, respectively. Apple production decreased 12 percent, lettuce production increased by 34 percent, and potato production increased by 4 percent.

Table 2-23: Supply and demand of apples, lettuce and potatoes

Supply and Demand Indicators for: U.S. Apples, Lettuce, and Potatoes (million pounds)								
		1990-94	1995-99	2000-04	2005	2006	2007	% Change 1990-94-2007
Apples								
	Production	10,325	10,436	9,393	9,603	9,776	9,070	**-12%**
	Imports (fresh)	264	367	374	349	428	381	**44%**
	Domestic Use							
	Fresh	4,918	5,099	4,915	4,978	5,362	4,987	**1%**
	Processed	4,481	4,382	3,554	3,485	3,434	2,979	**-34%**
	Exports (fresh)	1,190	1,322	1,298	1,488	1,407	1,485	**25%**
Lettuce								
	Production	8,424	8,649	9,920	10,157	11,191	11,257	**34%**
	Imports	31	58	108	171	172	230	**642%**
	Domestic Use	7,814	8,052	9,177	9,393	10,537	10,682	**37%**
	Exports	641	655	851	936	824	804	**25%**
Potatoes								
	Production	42,897	47,304	46,465	42,393	44,135	44,681	**4%**
	Imports							
	Fresh	611	884	797	788	817	1,106	**81%**
	Processed	336	791	1,715	1,957	1,988	1,948	**480%**
	Domestic Use*	42,691	47,052	46,963	42,944	44,586	45,196	**6%**
	Exports							
	Fresh	480	623	617	639	631	645	**34%**
	Processed	674	1,305	1,397	1,555	1,724	1,894	**181%**

*Calculated by adding production to imports, then subtracting exports. Stocks are not accounted for.

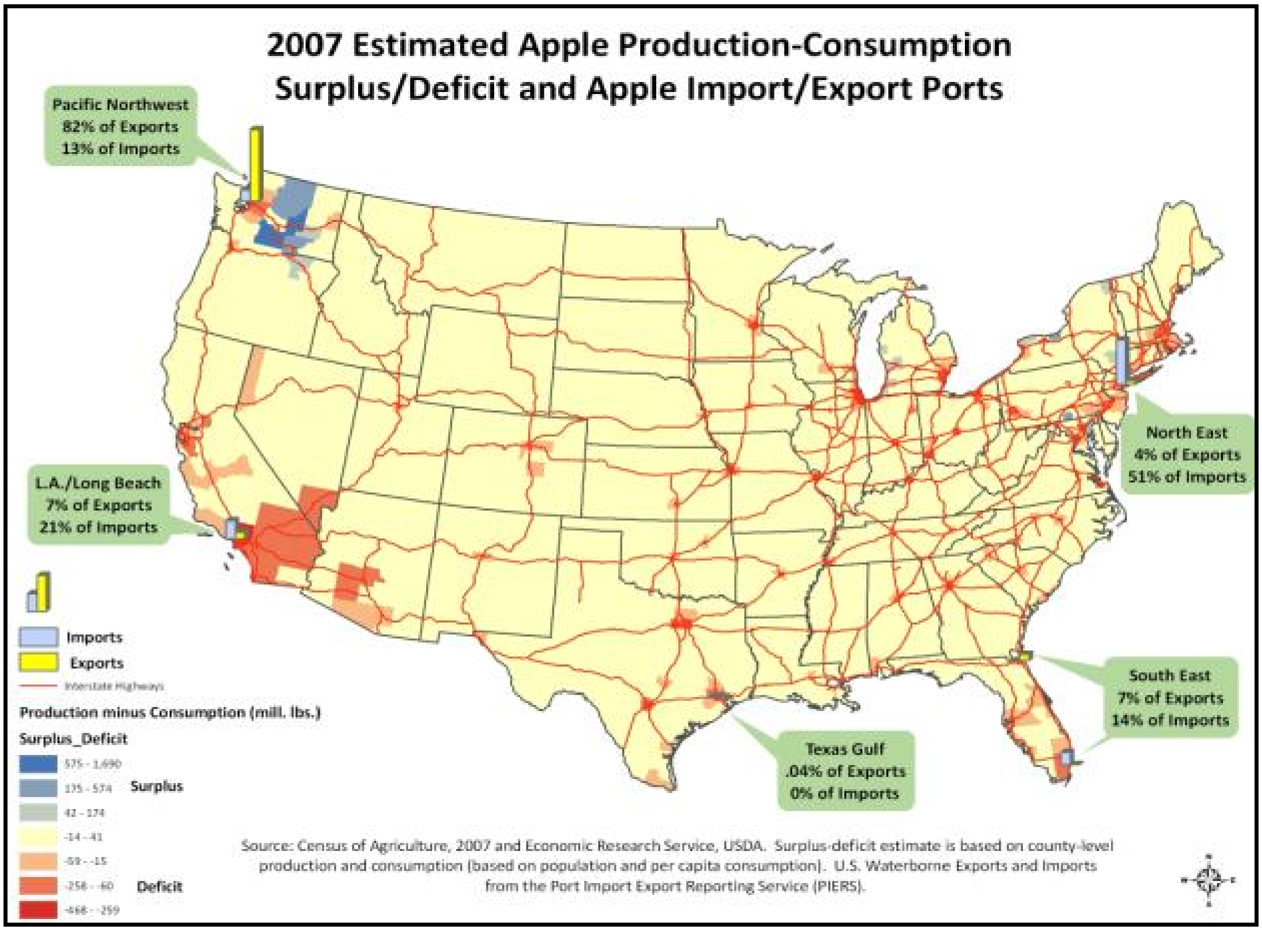
Source: USDA/Economic Research Service, Yearbook 2007

Apple Profile

As the largest apple-producing State, Washington supplies 65 to 75 percent of all the apples sold in the fresh market. New York, Michigan, California, and Pennsylvania are also major apple-producing States, but a larger share of each of these States' production is sold to processors. Together, these four States supply 15 to 20 percent of fresh-market apples and 40 to 50 percent of processing apples. Although three-quarters of Washington's production is for fresh use, it also supplies the largest quantity to processors.

It's no surprise that the map in Figure 2-41 below shows concentrated areas of surplus apples in parts of Washington and Oregon. Counties in New York and Pennsylvania also show surpluses. Most of the Nation experiences a slight deficit, but significant deficits appear in highly populated areas such as southern California, southern Florida, Chicago, and major cities in Texas, such as Dallas and San Antonio.

Figure 2-41: U.S. apple surplus/deficit map with transportation overlay



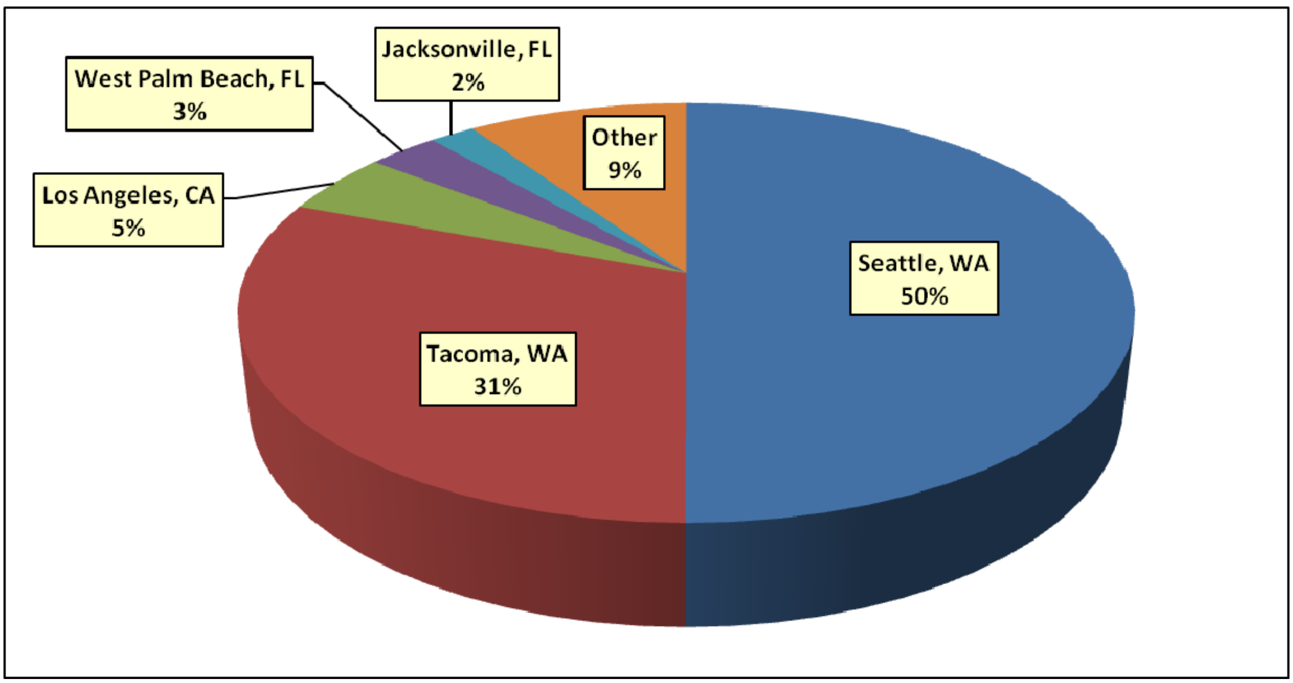
Trade and Transportation Needs

U.S. apples exporters use refrigerated containers almost exclusively to ship their products overseas. In 2007, more than 99 percent of waterborne apple exports were moved in containers.[41] They use refrigerated trucks for cross-border movements.

Apple Export Ports

- Most waterborne apple exports are shipped through Pacific Northwest ports (mostly Seattle and Tacoma, WA)—82 percent of apple exports in 2007 (see Figures 2-42 and 2-43).
- Other key ports include Los Angeles and West Palm Beach, FL, which together account for 8 percent of apple exports in 2007.
- The largest importers of U.S. apples are Mexico, Canada, Taiwan, and the United Kingdom. Together, these markets account for more than half the fresh apple exports.

Figure 2-42: Ports used to export U.S. apples, 2007

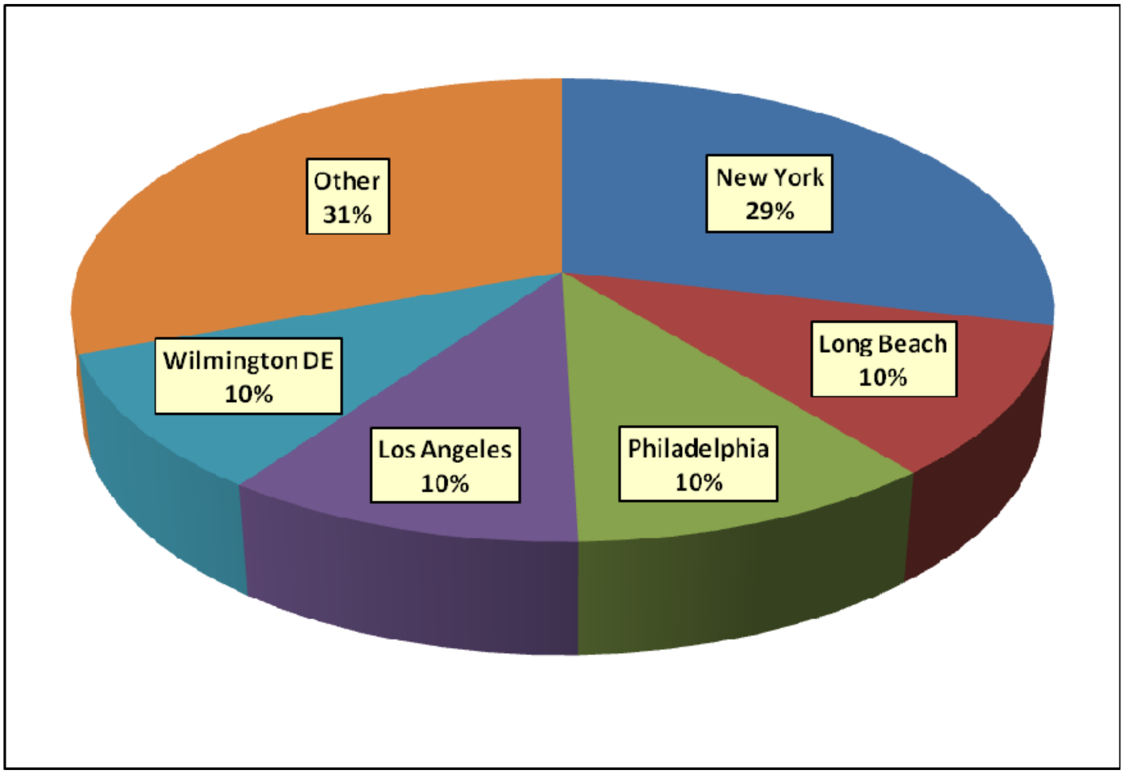


Source: Port Import Export Reporting Service (PIERS)

Apple Import Ports

- Most waterborne apple imports arrive at northeastern ports (including New York, Philadelphia, and Wilmington, DE)—49 percent of apple imports in 2007 (see Figure 2-43).
- Other key ports include Los Angeles and Long Beach, CA, accounting for 20 percent of apple imports in 2007.
- The largest suppliers of U.S. apple imports are Chile, New Zealand, and Canada, which combined account for more than 90 percent of fresh and dried apple imports.

Figure 2-43: Ports used to import U.S. apples, 2007



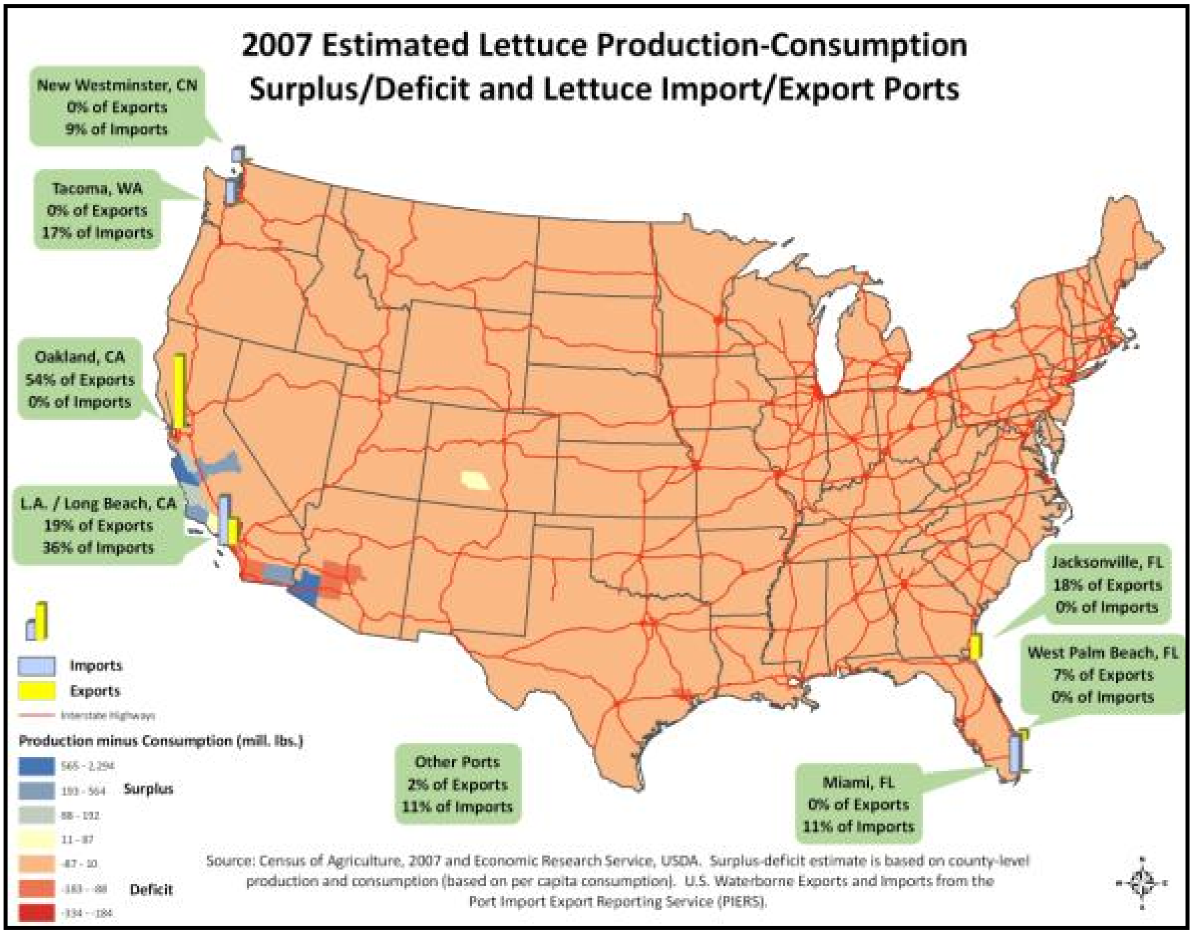
Source: Port Import Export Reporting Service (PIERS)

Lettuce Profile

The top lettuce-producing States in 2006 were Arizona, California, and Colorado. Domestic demand for lettuce is strong. The demand for export is also strong, with more than 7 percent of U.S. production being exported. Both domestic use and imports have increased since the early 1990s—37 and 642 percent, respectively.

Based on U.S. production and consumption rates, strong increases in domestic demand over the past decade have resulted in a deficit of lettuce across most of the country. Surplus supplies are found in California and Arizona, where significant production takes place. Lettuce production has increased 34 percent since the 1990s. Increased domestic production combined with growing but relatively small levels of imports to meet U.S. demand.

Figure 2-44: U.S. lettuce surplus/deficit map with transportation network



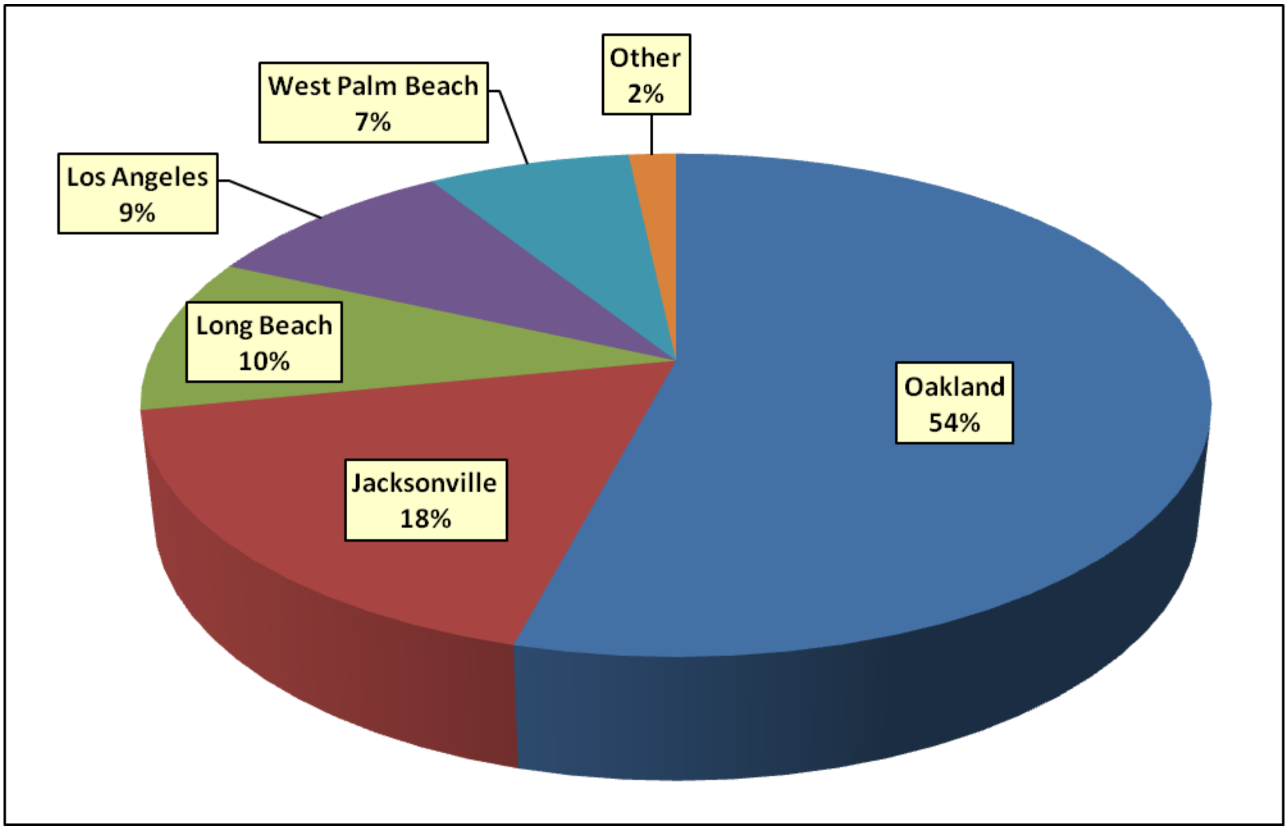
Trade and Transportation Needs

Lettuce movements need both temperature and humidity control to keep the product at its peak quality during transportation. Its highly perishable nature requires quick and efficient truck transportation and the use of containers for overseas markets. More than 99 percent of U.S. waterborne lettuce exports were moved in refrigerated containers.

Lettuce Export Ports

- Most waterborne lettuce exports are shipped through California ports (including Oakland, Los Angeles, and Long Beach)—73 percent of lettuce exports in 2007 (see Figure 2-45).
- Other key ports include Jacksonville and West Palm Beach, FL, accounting for 25 percent of lettuce exports in 2007.
- The largest importers of U.S. lettuce are Mexico, Canada, Taiwan, and the United Kingdom. Together, these markets accounted for more than half of U.S. fresh apple exports, on a quantity basis.

Figure 2-45: Ports used to export U.S. lettuce, 2007

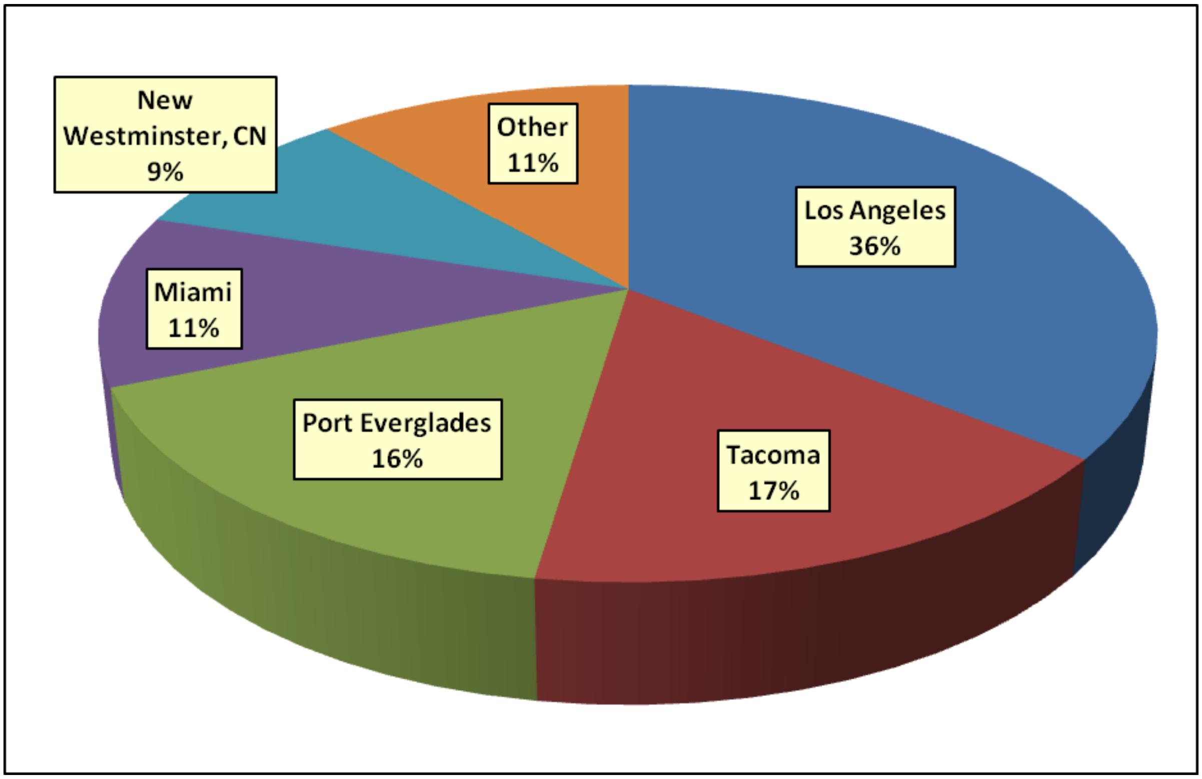


Source: Port Import Export Reporting Service (PIERS)

Lettuce Import Ports

- Most waterborne lettuce is imported through the ports at Los Angeles and Tacoma—53 percent of lettuce imports in 2007 (see Figure 2-46).
- Other key ports include Port Everglades and Miami, FL, which accounted for 27 percent of lettuce imports in 2007.
- Most U.S. lettuce imports are from Mexico, Canada, Israel, and Peru. Together, these markets accounted for more than half of U.S. fresh lettuce imports.

Figure 2-46: Ports used to import U.S. lettuce, 2007



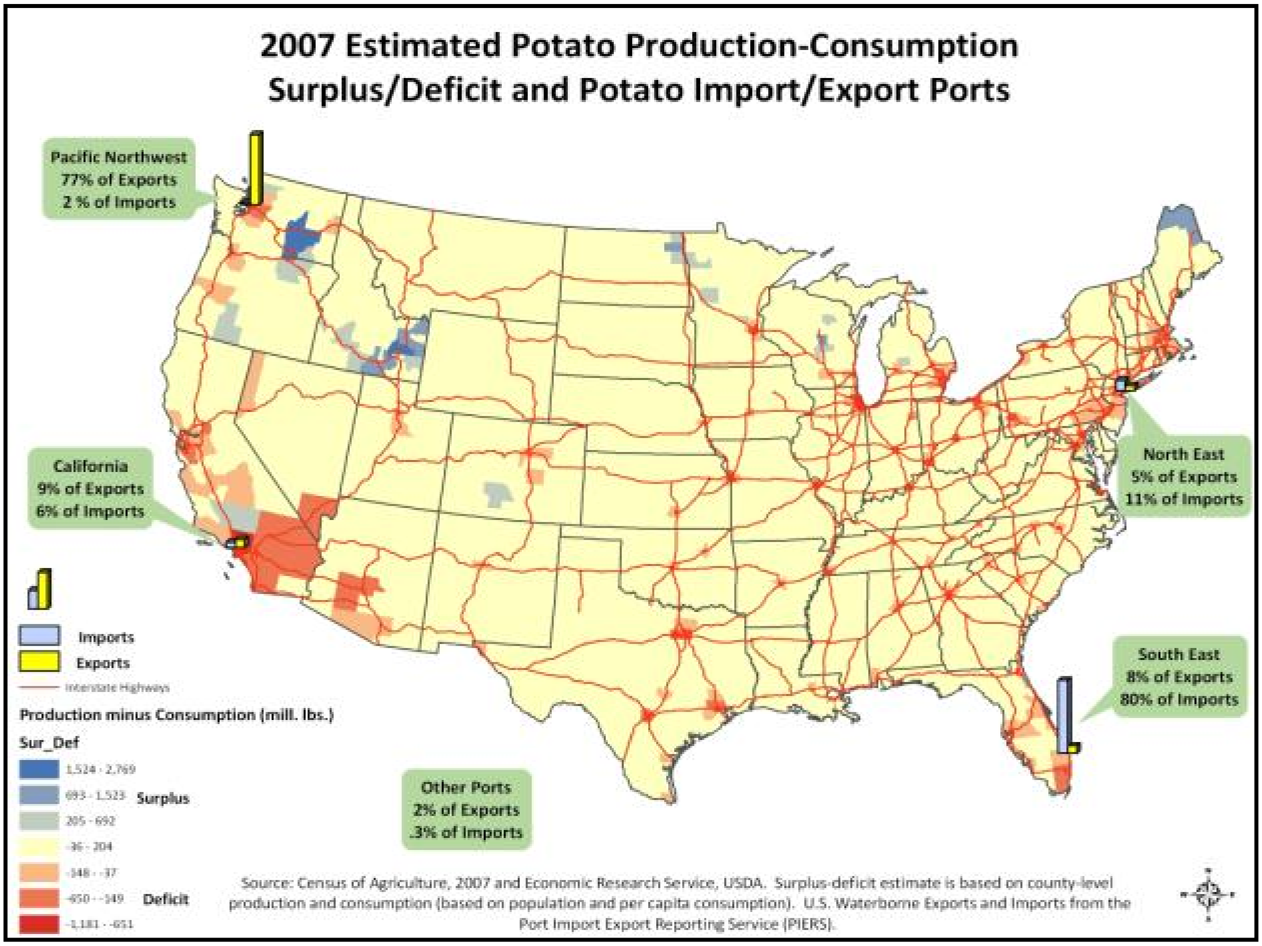
Source: Port Import Export Reporting Service (PIERS)

Potato Profile

The top potato-producing States in 2007 were Idaho, Washington, and Wisconsin. Though U.S. production has increased only minimally (4 percent) since the early 1990s, imports have grown significantly; processed potato imports increased by 480 percent and fresh potato imports by 81 percent. Exports of processed potato products have also increased significantly, by 181 percent. Most processed potato exports are frozen products.

Potatoes are one of the most popular vegetables in the United States. Production is concentrated in the northwest, but pockets of production are also found in Maine, North Dakota, Minnesota, Wisconsin, Michigan, and Colorado. Based on production and consumption rates, most of the nation experiences a slight deficit, with significant deficits seen where the populations are dense in Southern California, Arizona, Southern Florida, the Northeast, and Texas.

Figure 2-47: U.S. potato surplus/deficit map with transportation overlay



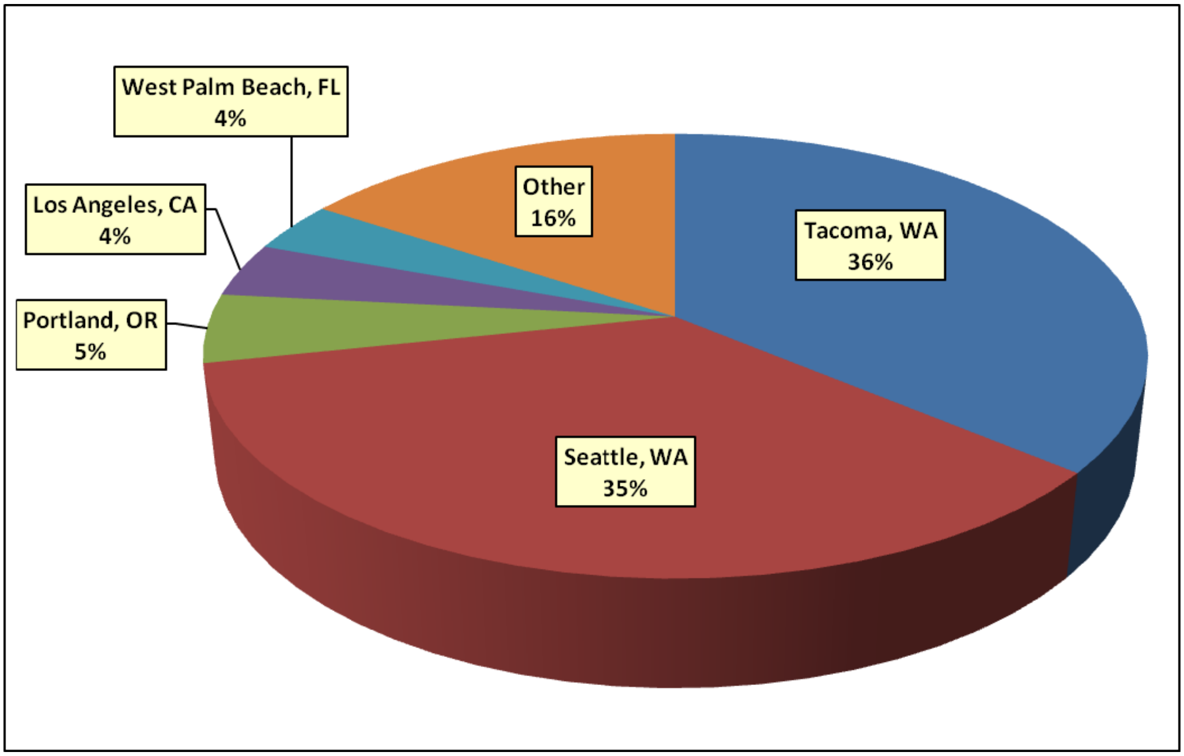
Trade and Transportation

Fresh and frozen potatoes are more versatile in their transportation needs than most other vegetables. The hardy nature of the potato allows the use of truck or rail to move them domestically or across borders. Most potato exporters prefer the use of containers when shipping overseas to keep the potatoes frozen during transit.

Potato Export Ports

- Most waterborne potato exports are shipped through Pacific Northwest ports (including Tacoma, Seattle, and Portland, OR)—77 percent of potato exports in 2007 (see Figure 2-48).
- Other key ports include Los Angeles, CA and West Palm Beach, FL which accounted for 8 percent of potato exports in 2007.
- The largest importers are Japan, Canada, Mexico, and China.

Figure 2-48: U.S. ports used to export potatoes, 2007

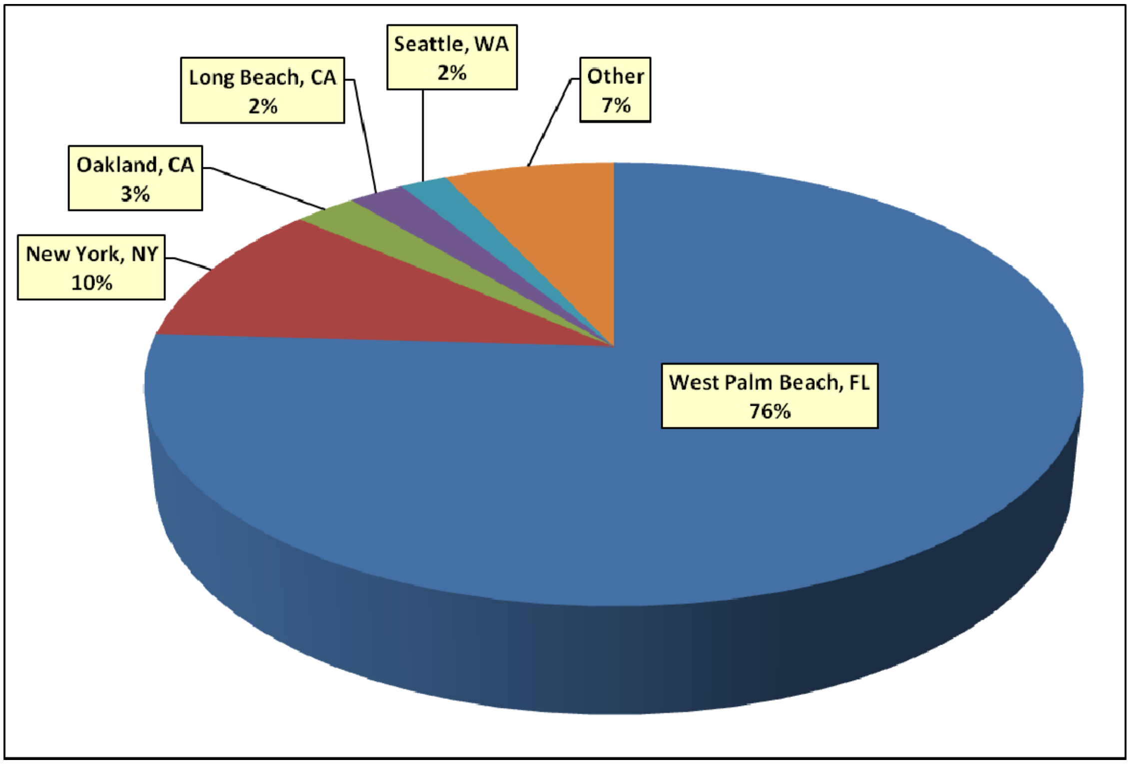


Source: Port Import Export Reporting Service (PIERS)

Potato Import Ports

- Most waterborne potato imports are shipped through East Coast Ports (including West Palm Beach, FL and New York)—86 percent of potato imports in 2007 (see Figure 2-49).
- Other key ports include Oakland, CA, Long Beach, CA, and Seattle, WA, which accounted for 7 percent of potato imports in 2007.
- Most potato imports are from Canada and Mexico. Together, they accounted for more than 99 percent of potato imports in 2007.

Figure 2-49: Ports used to import U.S. potatoes, 2007



Source: Port Import Export Reporting Service (PIERS)

Trends in Fruit and Vegetable Consumption

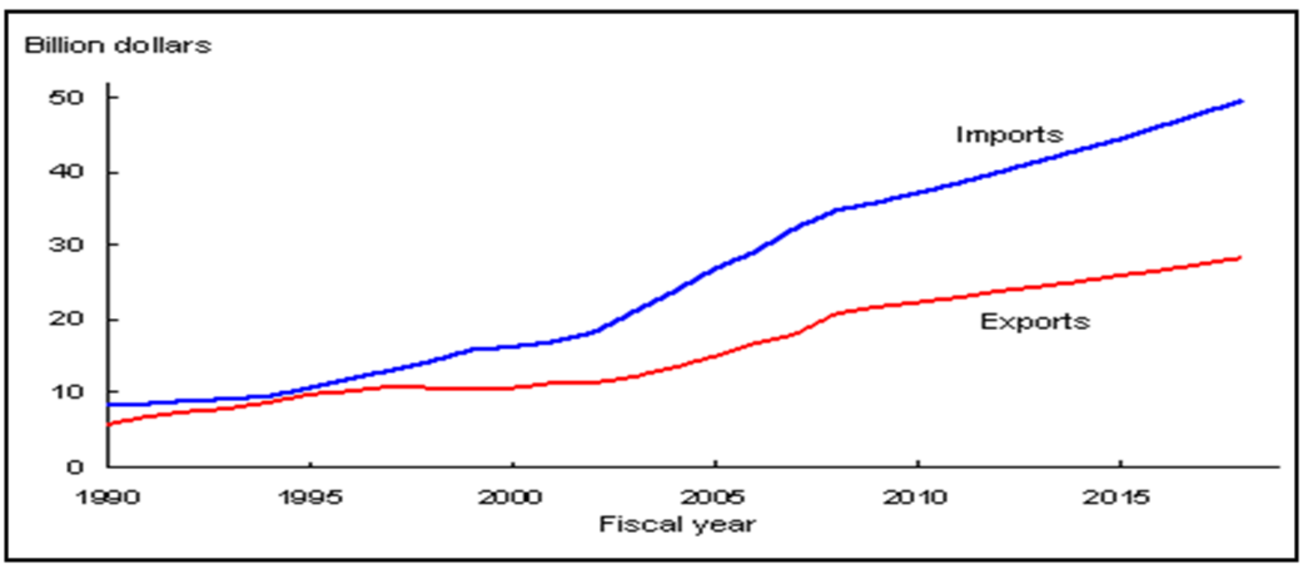
With the increasing national concern about diet and obesity, Americans are realizing the need to increase fruit and vegetable consumption. This realization, combined with industry promotional efforts, Federal dietary emphasis, an aging and health-conscious population, and positive news reports on the benefits of eating fruit and vegetables, indicates that gains in fruit and vegetable consumption may be expected in the future.

The economic slowdown, however, will have an impact on farm income for fruit and vegetables in 2009; the average annual price for fruit and tree nuts is expected to decline by 8.2 percent from 2008. Although the quantities sold were relatively stable from 2008 to 2009 for most fruit and tree nut commodities, fewer fresh oranges and grapefruit were available. Overall, fruit and tree nut receipts are expected to account for 10.4 percent of 2009 crop receipts.

Vegetable and melon receipts are expected to decline more than 4 percent from 2008 as fresh-market vegetable acreage and production decline. Because of the smaller 2008 fall crop (which is marketed through the following summer), potatoes also are expected to decline a bit in sales volume, with higher prices during the first half of the year giving way to lower values later in 2009. Cash receipts from the sale of vegetables for processing may increase in 2009 as processors offer higher contract prices to secure delivery. Dry bean quantities are expected to exceed their 2008 levels by about 1 percent but at reduced prices. In 2009, vegetables and melons are expected to account for 12.8 percent of total crop receipts.[42]

Farm sales of horticultural crops are projected to grow by 2.1 percent annually over the next decade, reaching $71.6 billion in calendar year 2018, up from $58 billion in 2008. U.S. horticultural trade continues to become increasingly important, both in terms of the export share of production and the import share of consumption.

Figure 2-50: Value of horticulture trade



Source: ***USDA Agricultural Projections to 2018*****, February 2009**
USDA, ERS

Fruit and Vegetable Outlook

Here are some highlights for fruit and vegetable products from USDA's Agricultural Projections to 2018:

- Within horticultural products, vegetables and melons continue to rank first in farm sales value over fruits and nuts. Annual growth over the next 10 years is expected to be fastest for fruits and tree nuts, at 2.6 percent, followed by vegetables at 2.0 percent.

- Total vegetable production volume is projected to expand at 0.6 percent annually. Fruit production is forecast to decline by 0.1 percent in the next decade. The gradual increases in vegetable production hold gains in grower prices for vegetables at an annual 1.3 percent through the next decade. Combined with average price increases of 2.7 percent for fruits and nuts, farm produce prices are estimated to increase by 1.9 percent annually during the projection period.

- The average growth of the value of U.S. horticultural imports is forecast at 3.7 percent from fiscal year (FY) 2009 to 2018. The value of exports is forecast to grow at 3 percent, with both fruits and vegetables averaging 2.8 percent in the next 10 years. Import growth and export growth of fresh-market vegetables and fruits exceed that of their processed products. The trade deficit in horticulture crops and products increases from $14 billion in FY 2008 to more than $21 billion in FY 2018. Of the total $28 billion U.S. horticultural products exports in FY 2018, fruits and nuts contribute $12.8 billion and vegetables represent $6.5 billion. Total imports of $50.5 billion in FY 2018 include $16 billion worth of fruits and nuts, and $12 billion of vegetables and vegetable products.

- Imports will increasingly supplement the domestic supply of horticulture crops and products. The share of imports in the U.S. consumption of horticulture crops and products (based on the dollar value) is projected to climb from 48 percent in 2008 to 54 percent by FY 2018. Horticultural exports are projected to increase their share of U.S. production value from 36 percent in FY 2008 to 39 percent in FY 2018. The import and export shares of fruits and nuts are about twice as large as the corresponding import and export shares of vegetables.[43]

Table 2-24: Fruit and vegetable long-term supply and use projections

Fruit and Vegetables Long-Term Supply and Use Projections													
Items	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**% change**
	Million Pounds												**2007-2018**
Supply													
Production, farm weight													
Fruit and nuts	59,047	64,369	64,249	64,142	64,043	63,954	63,875	63,804	63,743	63,691	63,648	63,614	8%
Citrus	20,934	25,994	25,604	25,220	24,842	24,469	24,102	23,741	23,384	23,034	22,688	22,348	7%
Noncitrus	34,129	34,300	34,471	34,643	34,817	34,991	35,166	35,342	35,518	35,696	35,874	36,054	6%
Tree nuts	3,984	4,076	4,174	4,278	4,385	4,495	4,607	4,722	4,840	4,961	5,085	5,212	31%
Vegetables and melons	141,158	135,778	136,562	137,858	138,712	139,576	140,451	141,337	142,233	143,140	144,059	144,988	3%
Fresh market 2/	60,700	59,950	59,659	60,358	61,066	61,784	62,510	63,247	63,992	64,748	65,513	66,288	9%
Processing 3/	35,777	34,774	34,370	34,542	34,473	34,404	34,335	34,267	34,198	34,130	34,062	33,994	-5%
Potatoes	44,681	41,055	42,532	42,958	43,173	43,388	43,605	43,823	44,043	44,263	44,484	44,706	0%
Pulses 4/	4,535	4,550	4,641	4,734	4,828	4,925	5,024	5,124	5,227	5,331	5,438	5,546	22%
Total fruit, nuts, vegetables	200,470	200,412	201,074	202,263	203,018	203,793	204,588	205,403	206,238	207,093	207,968	208,864	4%
Imports													
Fruit, nuts, and vegetables	41,597	42,197	42,719	43,734	45,137	46,586	48,082	49,628	51,225	52,874	54,578	56,337	35%
Fruit and tree nuts	20,928	20,568	20,780	21,204	21,780	22,372	22,980	23,604	24,246	24,905	25,581	26,277	26%
Vegetables & melons	18,456	19,196	19,446	19,932	20,649	21,393	22,163	22,961	23,787	24,644	25,531	26,450	43%
Use													
Exports													
Fruit, nuts, and vegetables	20,019	23,034	23,800	24,197	24,602	25,014	25,435	25,865	26,303	26,749	27,205	27,670	38%
Fruit and tree nuts	7,817	9,238	9,553	9,689	9,827	9,968	10,111	10,257	10,406	10,558	10,713	10,871	39%
Vegetables & melons	10,552	11,927	12,285	12,481	12,681	12,884	13,090	13,299	13,512	13,728	13,948	14,171	34%
Domestic use 5/													
Fruit, nuts, and vegetables	222,048	219,575	219,993	221,800	223,554	225,365	227,235	229,167	231,160	233,217	235,341	237,531	7%
Fruit and tree nuts	72,159	75,699	75,476	75,657	75,997	76,359	76,744	77,151	77,582	78,037	78,516	79,020	10%
Vegetables & melons	149,062	143,048	143,723	145,309	146,681	148,085	149,524	150,998	152,508	154,056	155,642	157,267	6%

2/ Includes melons, sweet potatoes, fresh mushrooms, and California specialty vegetables. 3/ Major processing vegetables and agaricus mushrooms. 4/ Includes edible dry beans and peas, lentils, and other peas. 5/ Calculated by adding farm weight production to imports, then subtracting exports. Stocks are not accounted for.

Source: USDA Long-Term Projection Tables, February 2009

Fertilizer Profile

For centuries, arable land was replenished by simple fertilizers and fallowing. Fallowing is the practice of allowing a field to remain unplanted for one or more seasons to regain nutrients. Until early in the 20th century, fertilizers were limited to animal manure and scrap organic material. These methods had their limits because, as the manure needs increased, the land needed to produce livestock reduced the land available to produce crops.

During the westward expansion of the United States and throughout much of the 19th century, a vast amount of land was available, but there was limited transportation infrastructure; manure and other simple fertilizer methods were not economically viable at the scale needed. When settlers noticed depleted soil fertility, they simply moved on. By the 1930s, this process left large parts of the Plains as depleted "dust bowls."

At the beginning of the 19th century, the relationship of soil nitrogen, potassium, and other organic minerals to plant health and yield was discovered. This discovery, coupled with a developing transportation infrastructure, led to the development of the modern commercial fertilizer industry. Since the very beginning of fertilizer use, its ability to reduce famine by increasing yields led to nearly immediate international acceptance and the global search for fertilizers began. Shortly after the first manufacture of economically viable superphosphate fertilizer in the 1840s, sodium nitrate from Chile entered the market. At the dawn of the 20th century, ammonia synthesizing was developed and nitrogen fertilizers were produced through chemical reactions controlled by humans. Today's crop production in the United States, and the high yields achieved, require large amounts of nutrients and other inputs. These nutrients fuel the American agricultural exports that help feed the world.

The three primary commercial fertilizers in use today are nitrogen based (urea, ammonia, etc.), phosphates, and potash. However, animal manure and other organic materials are still used to replace nutrients. In most areas, fertilizers are applied to replace nutrients withdrawn by crops as they grow. In other areas, fertilizers are used to make the land more arable. Potash, urea, anhydrous ammonia, and other commercial fertilizers are used to replace depleted nutrients. The application of commercial fertilizer is a widespread and accepted practice in the United States and globally because of the economic benefits.

Trends in Fertilizer Markets

As with any industry, the fertilizer industry has had many successes and faces several challenges. The U.S. fertilizer industry has recently implemented changes that allow for more production, more security, and a greater economic viability. Some of the problems facing the industry are:

- Volatility in U.S. fertilizer prices.
- Transportation policies and procedures.
- Long-term increases in fertilizer use.

Fertilizer Price Volatility

The prices of nitrogen, phosphate, and potash, as well as other fertilizers, have been rising since 2002. In 2008, fertilizers reached historic highs at the same time as grain and oilseeds reached their own record-setting highs. Between April 2007 and April 2008, nitrogen prices increased 32 percent, phosphate prices increased by 93 percent, and potash prices increased by 100 percent. The price surge in 2008 was due to strong domestic and global demand for fertilizers, low fertilizer inventories, and the inability of fertilizer production to be ramped up quickly enough to meet demand.[44]

In any business, volatility in prices creates a difficult operating environment; extreme fluctuations make planning and inventory management difficult. Late in 2008, the fertilizer price environment quickly changed again, as prices fell precipitously. The price retreat had several causes, but chief among them was the response to the record high prices of 2007 and 2008, which caused global fertilizer demand to fall as declining crop prices provided less of an incentive for farmers to boost yields. In addition, U.S. producers delayed fertilizer applications because of high prices, and tighter credit markets slowed fertilizer purchases.

Transportation Policies and Procedures

In the aftermath of the 9/11 attack, the transportation of hazardous materials and the security environment of Toxic by Inhalation Hazards (TIH) or Poison by Inhalation Hazards (PIH) materials has become ever more scrutinized. TIH and PIH are toxic gases, such as ammonia, which are harmful if inhaled. In many cases, on their way to a distribution center or a manufacturing facility, fertilizer rail cars containing ammonia or other chemicals pass through or are delivered to high threat urban areas. Because of the dense population of these areas and the potential for high physical and economic loss, insuring TIH or PIH rail shipments through high threat urban areas has become increasingly costly, and some say uneconomical.

Most of the debate over fertilizer transportation policies centers on the rail industry, though fertilizers move by other modes, such as pipeline, truck, barge, and ocean-going vessel. This issue was recently considered by the Surface Transportation Board (STB) in the proceeding *STB Ex Parte 677 (Sub-No. 1) Common Carrier Obligation of Railroads – Transportation of Hazardous Materials.* Several interested parties, including USDA and the U.S. Department of Transportation (DOT), submitted testimony in the hearing.

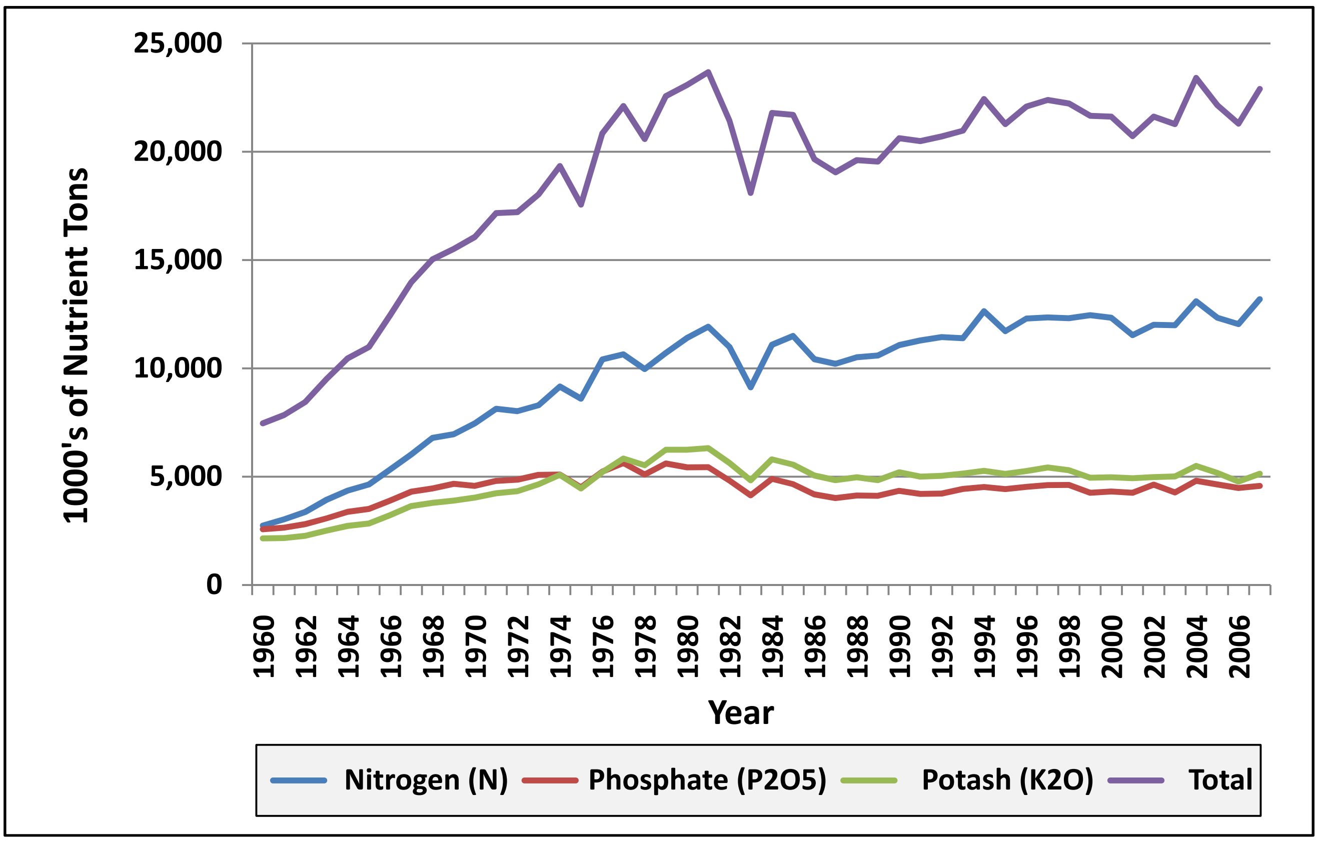
The railroads proposed a solution modeled on the Price-Anderson Nuclear Industries Indemnity Act of 1957, which required Congressional action to implement. The Price-Anderson Act is designed to partially indemnify the nuclear industry in the event of a catastrophic nuclear accident. If an accident occurs, the first $10 billion in liability claims are paid from insurance carried by the nuclear industry. The remainder of the claims are paid by the federal government. The act includes other provisions that alter normal civil court proceedings, and requires nuclear companies to agree they cannot defend actions for damages by claiming it was not their fault. Action has not yet been taken on the railroads' proposal, and the Common Carrier Obligation hearing is still active with the STB.[45]

The fertilizer industry forwarded a proposal to Class I railroads that would require fertilizer producers to pay for an extended insurance pool. The new insurance would increase the coverage for TIH or PIH incidents, and payouts would become available if claims grew beyond the amount of insurance railroads carried. In return for the expanded coverage, the fertilizer industry asked for new rate negotiations. As this report is published, the industry's insurance plan is still under discussion, but there has been no significant movement recently.

Long-Term Increases in Fertilizer Use

As can be seen in Figure 2-51, U.S. fertilizer consumption increased rapidly from 1960 to 1980, by more than 300 percent. Since that time, the rate of increase has slowed, although still increasing more than 1 percent a year. The growth is due to several reasons, such as increases in acreage planted and higher-yielding crop varieties that require more nutrition. These domestic increases, combined with increases in developing countries—which resemble the rapid growth the United States experienced from 1960 to 1980—could put pressure on global fertilizer prices for years to come.

Figure 2-51: Fertilizer use from 1960 to 2007



Source: ERS

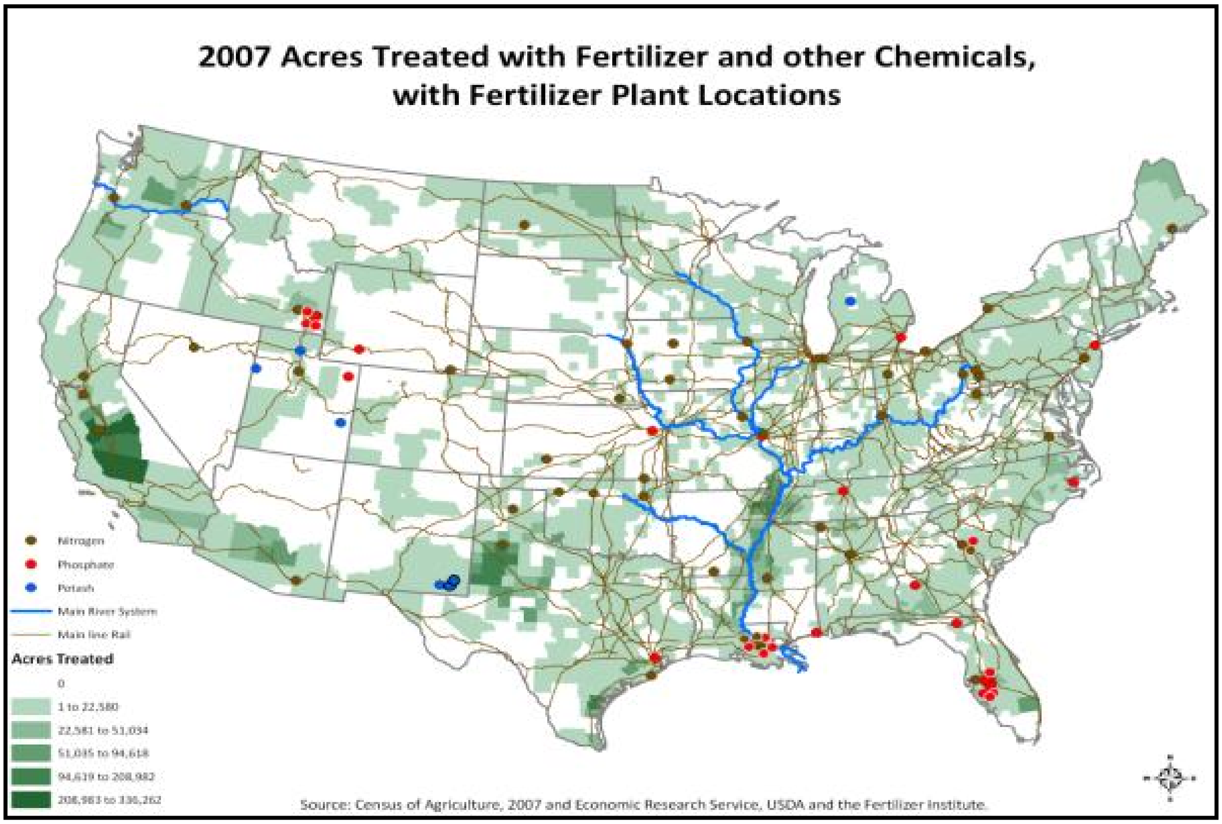
Fertilizer Production

Fertilizer production is, in most cases, based on the resources available. Nitrogen fertilizers can be produced in nearly every country of the globe, and are currently produced in more than 78 countries. The primary raw material for nitrogen production is natural gas, but nitrogen can also be produced from coal, fuel oil, and naphtha. In the United States, 30 companies make nitrogen fertilizer in 29 States.[46] Figure 2-52 identifies States that make nitrogen, potash, and phosphate fertilizers.

Phosphate and potash are mined, so fertilizer is produced where ore is found. The raw materials for phosphate fertilizer are phosphate rock and sulfur. In the United States, these reserves are found in 14 States and are mined by 11 companies. Globally, phosphate rock is found in 32 countries, but only a few countries are able to extract it economically. The top three phosphate-producing countries account for 68 percent of global production. The top 12 countries account for 94 percent. Potash ore reserves are identified in 21 countries worldwide, but extraction occurs in only 12 countries. In the United States, three companies in three States conduct potash ore mining and extraction (Figure 2-52).[47]

Production figures for fertilizers are confidential due to the nature of the business and the few companies that produce fertilizers. For this study, the best estimate for fertilizer production is domestic consumption and exports. Although it is possible to store fertilizers for long periods, storage is costly and demand is high enough that domestically produced fertilizers are either quickly utilized domestically (discussed in the next section) or exported (discussed in a later section).

Figure 2-52: Fertilizer production facilities



Fertilizer Use

As discussed previously, the use of fertilizers increased rapidly during the early 20th century as farmers and producers assimilated new fertilizers and fertilizing techniques. The acceptance grew as evidence mounted of their economic benefits. Since then, the ever-increasing nature of fertilizer utilization—that acts as a proxy for the increased demand placed on the U.S. food supply—requires a high level of complexity in fertilizer creation and transportation. Figure 2-52 shows the wide range of fertilizer use across the country. Every State in the contiguous 48 States except Nevada reported some fertilizer use.[48]

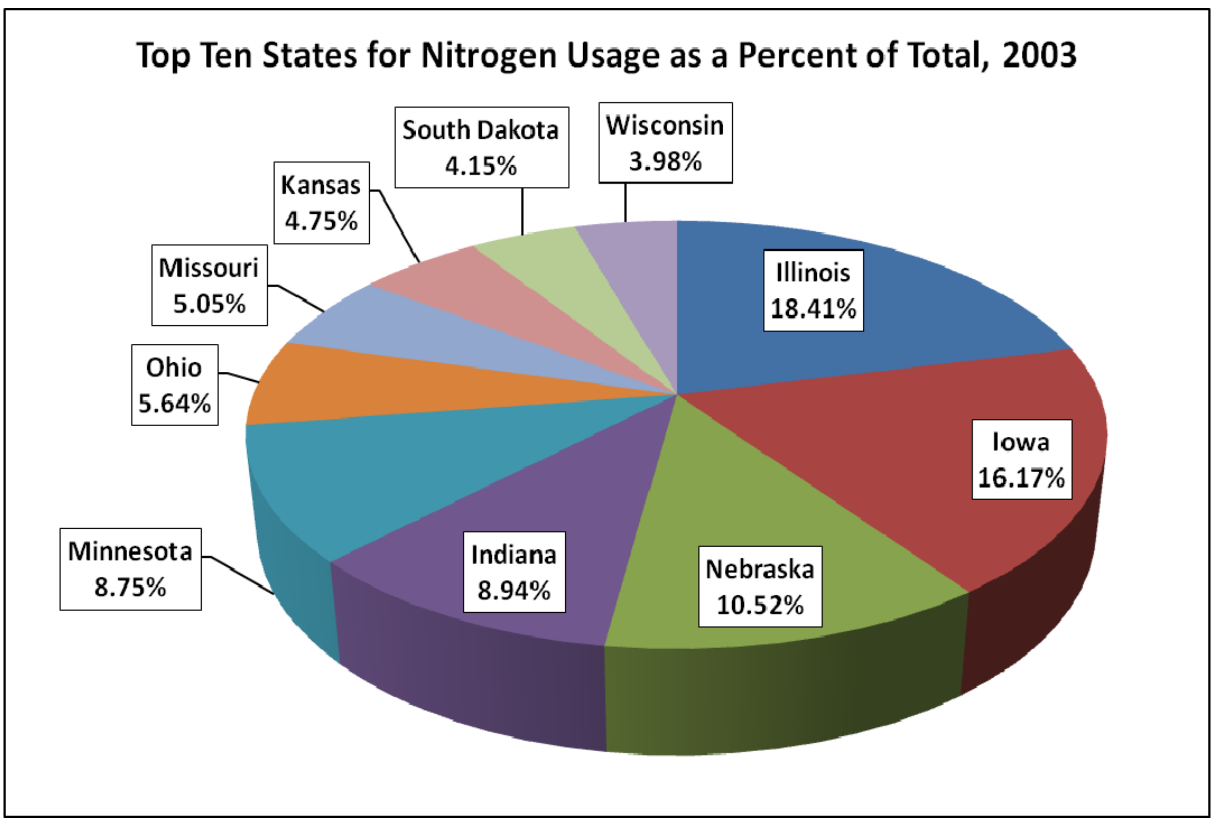
For 2007, the most recent year with available data, the United States consumed more than 13.2 million tons of nitrogen fertilizer, 5.1 million tons of potash, and about 4.6 million tons of phosphate, for a grand total of more than 22.9 million tons of fertilizer. The total amount of fertilizer consumed was 7.5 percent greater than 2006. The increase had two causes**:** higher commodity prices, which gave an incentive for farmers to increase their yields, and an increase in planted acreage. Over the past 10 years—from 1998 to 2007—the use of fertilizers has increased more than 2.3 percent. The small increase over the 10-year period may be due to what is described as "precision agriculture," techniques that allow producers to reduce amounts of fertilizers used by careful placement around the plant.

Over the 5-year span from 2003 to 2007, corn was the largest single user of all three major fertilizers. Corn accounted for 40 percent of nitrogen use and 39 percent each of phosphate and potash use. Several factors determine amounts used for corn, such as the percentage of the crop fertilized, the number of acres fertilized, and the amount applied per crop. Usually, more than 90 percent of corn acreage receives nitrogen, 80 percent receives phosphates, and 60 percent receives potash.

Wheat application rates are close to those of corn, with more than 87 percent of planted acres receiving nitrogen, 63 percent phosphate, and 32 percent potash. However, corn is fertilized at a higher rate, and more acres are fertilized.

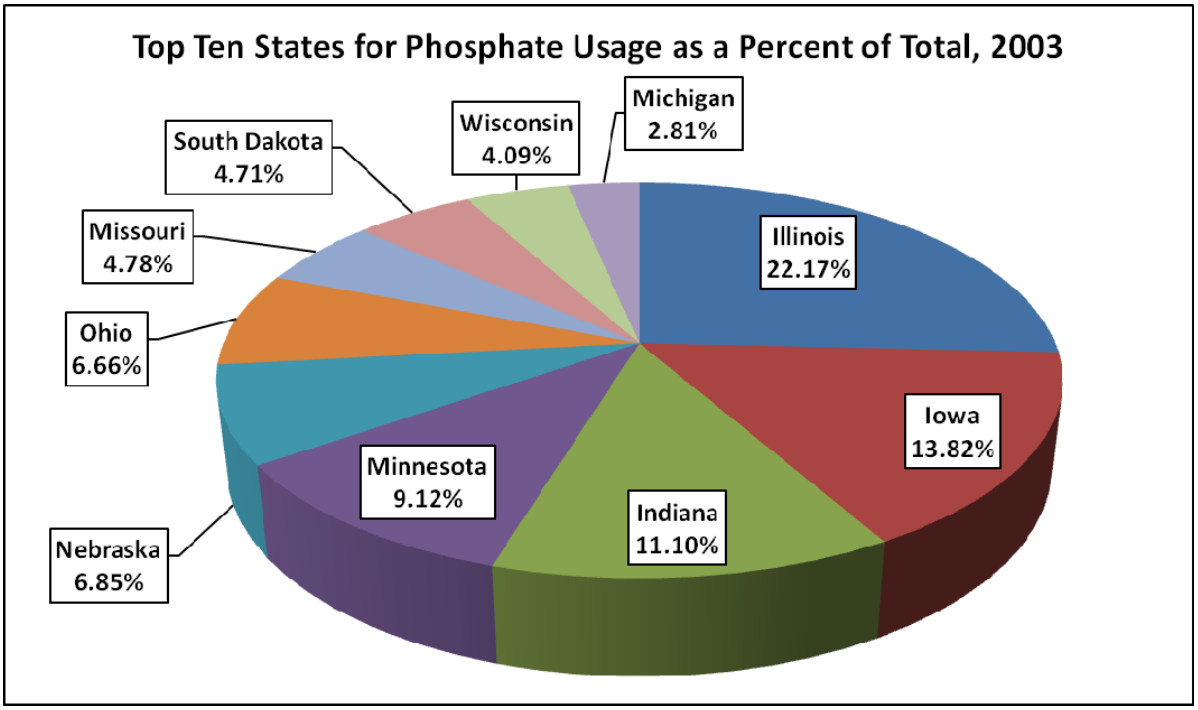
Illinois is the largest user of nitrogen, phosphate, and potash, and Iowa is the second largest user. Five other states—Indiana, Minnesota, Ohio, Missouri, and Wisconsin—are also included in the top ten of all three fertilizer usage categories. Most of these States are in the Corn Belt, and include some of the heaviest-producing corn States in the country (Figures 2-53, 2-54, and 2-55).[49]

Figure 2-53: Nitrogen fertilizer use, top 10 States



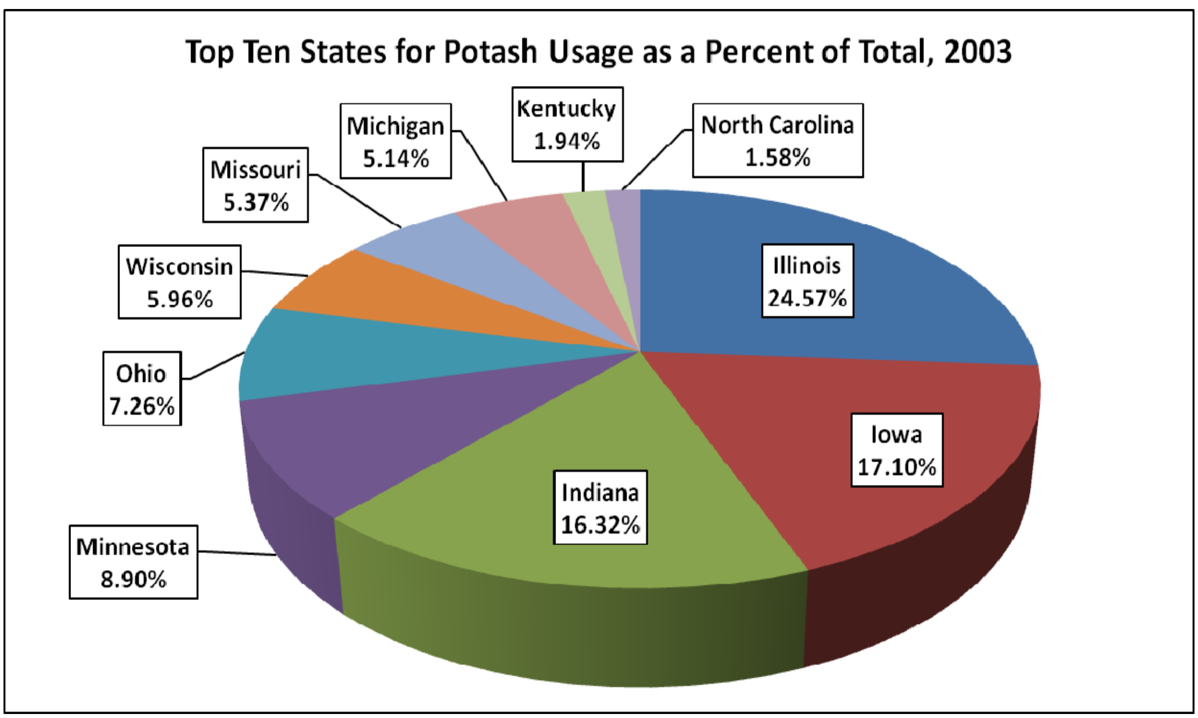
Source: USDA/NASS

Figure 2-54: Phosphate fertilizer use, top 10 States



Source: USDA/NASS

Figure 2-55: Potash fertilizer use, top 10 States

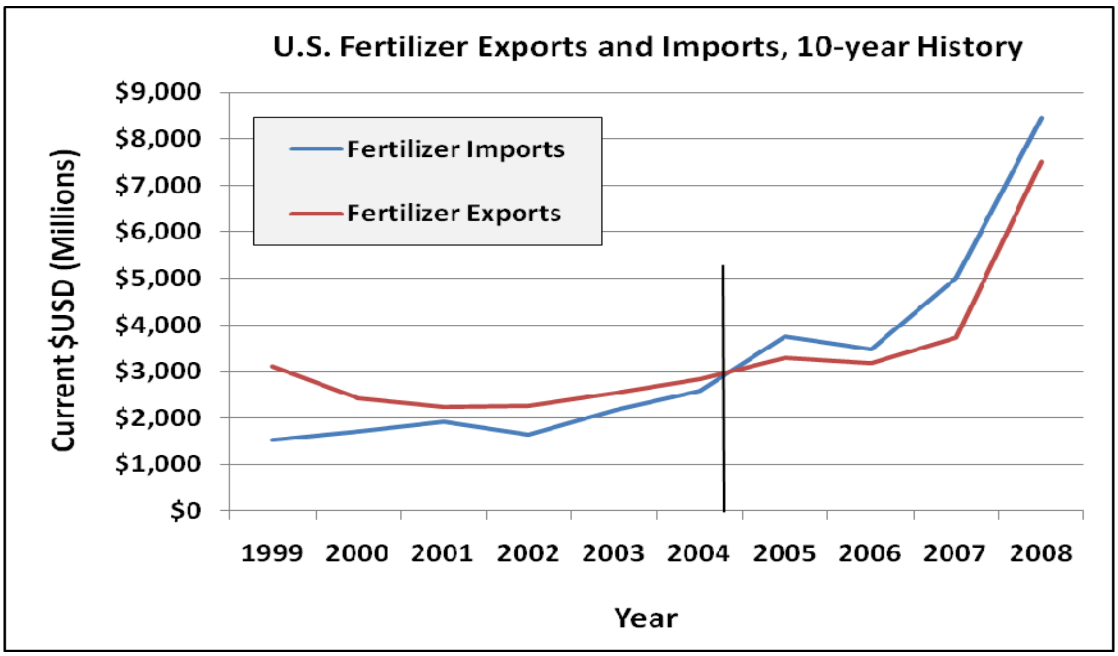


Source: USDA/NASS

International Trade

In 2008, the United States exported more than $7.5 billion worth of fertilizer to the rest of the world, more than twice that exported during 2007 ($3.7 billion).[50] As shown in Figure 2-56 below, fertilizer exports have steadily increased by value every year since 2000, with the only exception being 2006. Despite the increase in exports, the United States has a trade deficit in fertilizers. Over the 16-year period from 1989 to 2004, the United States had a surplus trade in fertilizers with the rest of the world. Between 2004 and 2005 the United States fertilizer trade balance switched to a deficit and has remained so since. For 2008, the deficit was $940 million, the second highest deficit to 2007 at $1.29 billion.

Figure 2-56: U.S. international fertilizer trade – 10-year history

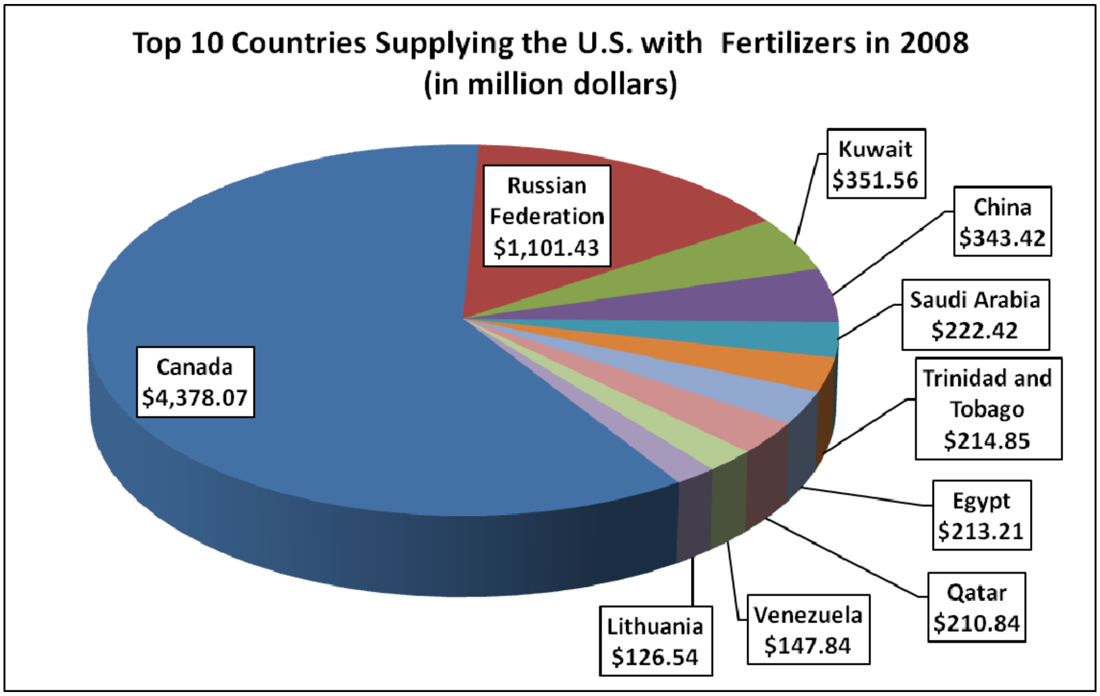


Source: Foreign Trade Division, U.S. Census Bureau

As also can be seen in Figure 2-52, a close relationship exists between U.S. fertilizer imports and exports. This is due to the United States being the largest importer of fertilizer intermediaries, the building blocks of finished commercial fertilizers, which are classified as fertilizers.[51] This phenomenon makes the United States the second largest exporter and the largest importer of fertilizers. China's entry into the World Trade Organization (WTO) had a significant impact on fertilizer trade, especially urea. In one year—between 2006 and 2007—China increased its imports of U.S. fertilizers by more than 330 percent, or $155 million.

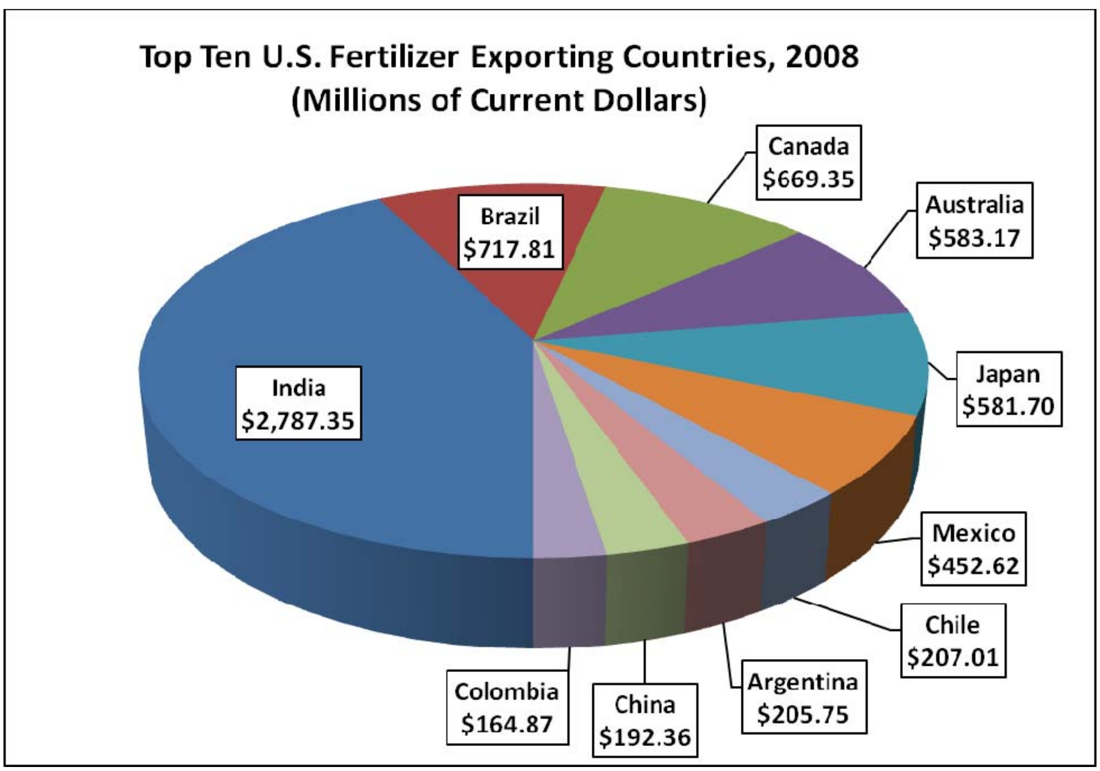
Canada has been the largest single source of fertilizer imports into the U.S. for at least the past 20 years, with some $4.378 billion in 2008 (Figure 2-57). In 2008, the United States exported the largest amount of fertilizer products to India (Figure 2-58), nearly four times as much as to Brazil. India has been the largest U.S. fertilizer export customer for the last five years.

Figure 2-57: U.S. fertilizer imports, top 10 supplying countries, 2008



Source: Foreign Trade Division, U.S. Census Bureau

Figure 2-58: U.S. fertilizer export customers, top 10 countries, 2008

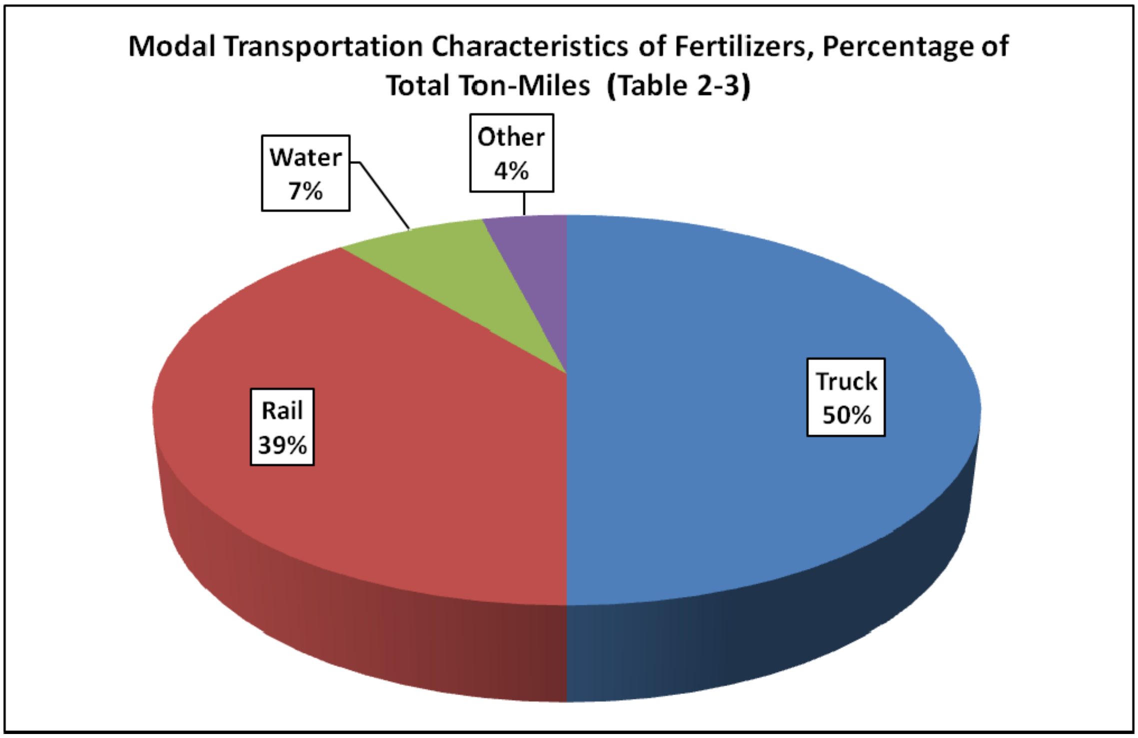


Source: Foreign Trade Division, U.S. Census Bureau

Fertilizer Transportation

Fertilizers are transported by all major transportation modes, including pipeline, barge, rail, truck, and ocean vessels. Most ton-miles in the U.S. are shipped by truck (Figure 2-59). Domestically produced fertilizers are usually railed from the origination plant to larger distribution centers. They may be delivered by truck directly to end users or sent to smaller cooperatives for sale to local farmers. This structure helps to explain why truck transportation has such a large share of ton-miles; several truck shipments originate from each railcar. For example, a typical ammonia railcar carries 80 tons of material, which can fill four trucks.

Figure 2-59: Fertilizer modal share



Source: U.S. DOT, Bureau of Transportation Statistics, U.S. Census Bureau, Commodity Flow Survey 2002

Fertilizers and raw materials imported from Canada and Mexico enter the country by truck or rail. These products from other international sources enter the United States by vessel. The next step depends on whether the product is finished or not. As can be seen in Figure 2-52, several fertilizer manufacturing plants are located in or near the port regions of New Orleans, Galveston, TX, and the Tampa Bay–St. Petersburg area. Two ammonia pipelines in the United States help safely distribute ammonia from production sites to manufacturing plants. One pipeline runs from the Texas production area into Minnesota and the other from the Louisiana production area to Nebraska and Indiana.

Nitrogen fertilizer production areas are not only destinations for imported raw materials but are also points of departure for fertilizer exports. Phosphate and potash are tied to mining operations, so these materials are moved by rail or truck to export destinations. In 2007, more than 23.014 million tons of chemical fertilizer moved by rail, up 2 percent from 2006. Barges carried more than 8.477 million tons, up 13 percent from the previous year. These increases were due to the increase of 1.2 percent in the number of acres planted in the United States during the same period.

Table 2-25: Chemical fertilizer movements for rail and barge

All Chemical Fertilizer Movements (Tons)						
	2003	2004	2005	2006	2007	5-year average
Rail	26,331,106	22,124,653	24,339,134	22,540,141	23,014,227	23,669,852
Barge	9,260,622	8,472,700	8,116,279	7,497,594	8,477,613	8,364,962

Source: Rail: STB, Carload Waybill Sample, Barge: U.S. Army Corps of Engineers, OMNI Reports

Fertilizer Outlook

In 2008, the U.S. economy entered a recessionary period, which slowed output and reduced pressures on fertilizer demand in two significant ways: by lowering incomes and increasing unemployment and by making credit harder to find.

Despite the recent economic recession, the increases in incomes throughout the developing world over the last ten years have triggered diet changes that include more meat, fish, fruits, and vegetables.[52] More meat products in the diet require the developing countries to use larger amounts of animal feed (e.g. corn, soybean meal, etc.) resulting in an increased use of fertilizer to boost yields for animal feed production. If this trend continues for the next ten years—and the signs are that it will—the need for foodstuffs and fertilizers will continue to grow.

Fertilizer Demand

The United States needs to increase agricultural production to meet growing food and biofuel requirements. The newly enacted Renewable Fuel Standard will increase the need for energy-producing crops such as corn and sorghum, which will increase the demand for fertilizer. However, the increase in biofuels production may decelerate until new technologies such as cellulosic ethanol become commercially viable. The new biofuels technologies may not totally negate an increase in fertilizer demand. For example, a new biofuels feedstock crop such as switch grass may require some form of fertilization to meet the needs of biofuels producers. These needs, combined with food diversification in the developing world, will increase the demand for fertilizers. According to the International Fertilizer Association, average global consumption will increase by 3.1 percent annually between 2008 and 2012.

Fertilizer Supply Outlook

In 2007, the U.S. fertilizer industry entered a demand-driven period caused by high consumption and a global supply shortage. Fertilizer companies tried to quickly increase production to capitalize on high prices. However, increases in energy prices, especially natural gas, combined with the fertilizer price increase created a difficult operating environment. This lasted into 2008 when the recession took hold, reducing fertilizer and natural gas demand. Also, in 2008, several fertilizer exporting countries implemented export taxes, which further decreased the already-low supply. These taxes helped U.S. fertilizer producers compete more effectively on the world stage. Many of the new export taxes are expected to remain in place for at least the near future.

Despite the recession, fertilizer demand is expected to grow in the long term throughout the world, and supply is expected to increase with it as producers try to capitalize on new and increasing markets in the U.S. Since transportation demand is derived, the global demand for transportation services for fertilizers is expected to increase in the next several years.

Conclusions

America's transportation system carries the food from our farms to our tables and to a hungry world. That system is based on four principal modes of transportation—trucks, trains, barges, and ocean vessels—that make up a seamless network. They cooperate and compete with one another to make a balanced and flexible system that moves our food and farm products efficiently and economically.

The transportation system is more heavily used by agriculture than any other business sector; in 2007, 31 percent of all ton-miles carried were agricultural products or inputs. Many of these products are bound for export. During the past 5 years, half of the U.S. wheat crop, 36 percent of the soybean crop, and 19 percent of the corn crop moved from farms to ports for export on an unbroken transportation chain.

As the world develops, eating patterns change, with demand rising for high-quality food products and bulk commodities. These changes increase America's needs for transportation. Domestically, during the last decade, the livestock, poultry, and dairy industries have become more concentrated and experienced geographic shifts. The production and consumption areas are geographically dispersed, creating the need for efficient long-distance transportation from the highly concentrated producing areas to the growing domestic and international markets.

Raising concerns for the safety of urban areas are making fertilizer transportation more regulated, even as the need for fertilizers grows, increasing the demand for rail, barge, and trucks to transport it.

The need for agricultural transportation will continue to increase, based on projected growth in demand for U.S. agricultural products domestically and overseas.