United States Department of Agriculture

# Wheat Transportation Profile

Agricultural Marketing Service Transportation and Marketing Programs

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## Executive Summary

America's farmers depend on transportation as the critical link between the fields of growers and the tables of consumers, both here and abroad. Transportation demand is a derived demand because the production and consumption of an agricultural commodity create the demand for transportation services. As such, it is an essential part of marketing; any change in supply or demand of the underlying commodity or commodities that compete for transportation services can affect the transport system's efficiency by bringing about either shortages or surpluses in transportation capacity. Freight transportation is a critical element of U.S. agricultural competitiveness in the world grain markets. This report examines transportation implications of the recent trends and outlook for U.S. wheat.

Key highlights:

- Since the mid-1990's, U.S. wheat production has remained almost unchanged. The number of acres planted with wheat, however, decreased by almost 20 percent. An increase of over 20 percent in yield has offset the drop in acreage.

- Despite unchanged production levels, the United States continues to be a major wheat exporter. Between 2009 and 2013, the United States claimed an average 20 percent annually of the world wheat trade.

- All three major port regions (the Pacific Northwest (PNW), the Mississippi Gulf, and the Texas Gulf) are used to export wheat. In 2013, 36 percent of wheat was exported through the PNW, 27 percent through the Texas Gulf, and 29 percent through the Mississippi Gulf.

- The domestic wheat market is not as dynamic as the export market. Unexpected changes in export demand due to changes in world prices and global annual production levels can pose logistical challenges for U.S. grain shippers and carriers.

- According to the February 2014 USDA long-term projections that assume normal growing conditions, U.S. wheat exports are projected to increase slightly, by 1 percent over 10 years, and remain above 1 billion bushels per year. Domestic demand, however, is projected to decrease by 3.5 percent over the next 10 years.

- Based on these long-term projections, U.S. wheat exporters will continue to rely on rail service to ship the U.S. wheat to the ports for export, according to the USDA modal share analysis. Domestic demand by the livestock and poultry sectors is serviced by truck and rail.

## Introduction

U.S. farmers depend on freight transportation as the critical link along the supply chain between their fields and consumers, located domestically and abroad. Because transportation is a derived demand, any change in supply or demand of the underlying commodity can affect the transport system's efficiency by bringing about either shortages or surpluses in transportation capacity. Short-term agricultural transportation demand can be influenced by weather disruptions, variation in annual crop size, changes in the timing of the agricultural cycle, global trade patterns, quality concerns, competition in production by other countries, and resulting commodity price fluctuations. These and other factors can translate into unexpected shifts in transportation patterns and costs, adding to the ever-present commodity price risk to be managed by agricultural producers, processors, and shippers.

The United States is a major producer of wheat, trailing only the European Union, China, the Former Soviet Union (FSU), and India.[1] It is also a major exporter of wheat, with a 20-percent share of world wheat trade. Other major wheat suppliers include Canada, Australia, the European Union, and FSU-12.[2] Wheat is the third most-grown crop in the United States by acreage, after corn and soybeans. However, due to policy changes and smaller economic returns than other crops, the amount of land devoted to wheat has decreased by 30 million acres since its peak in 1981.[3]

## Supply and Demand

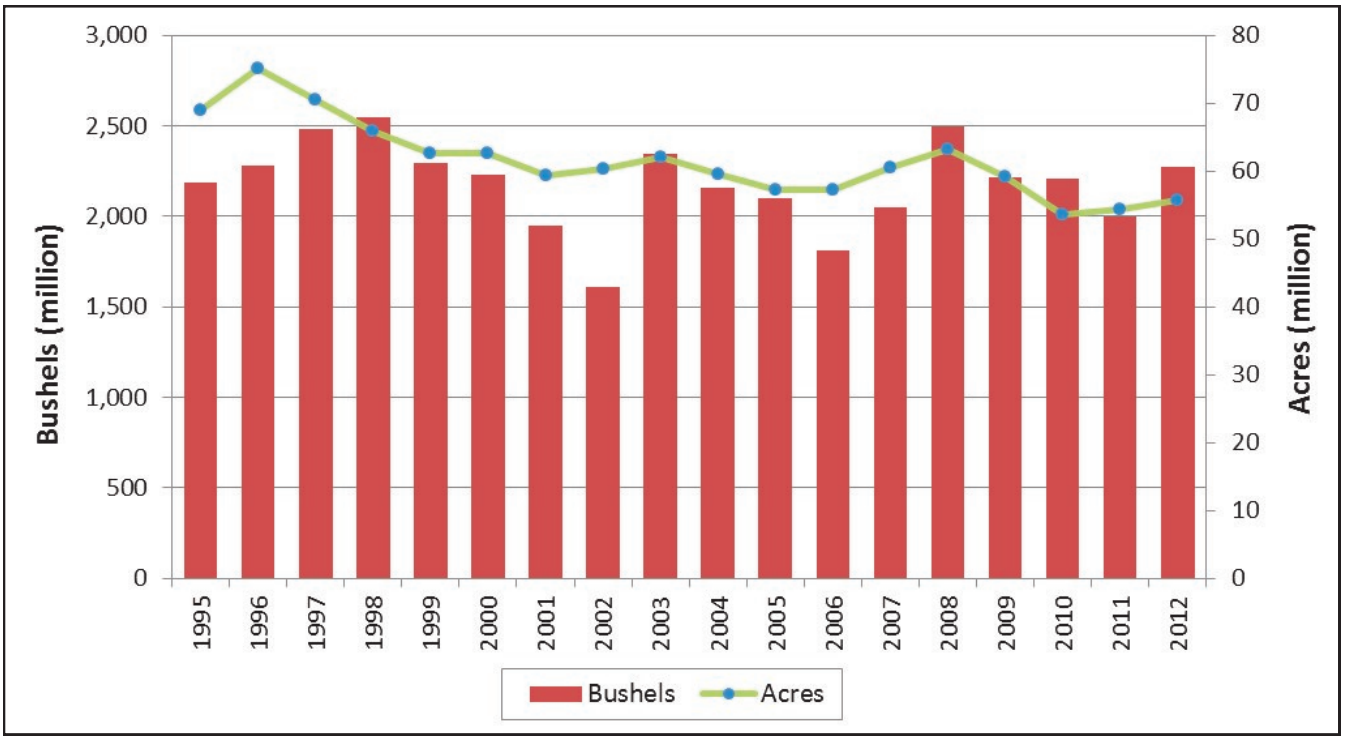
In the United States, the wheat marketing year begins on June 1. However, there are two wheat harvests: one in the spring and one in the fall. Winter wheat is planted in the fall and harvested in the spring, while spring wheat is planted in the spring and harvested in the fall. The winter wheat crop is substantially larger; 72 percent of wheat grown in 2013 was winter wheat.[4] Harvest timing is an important factor in agricultural transportation. Typically, demand for transportation is highest at harvest times, and most of the newly harvested wheat is shipped by truck to grain elevators for storage and by rail or barge to ports for export.

Total planted acreage has steadily declined since the mid-1990s, but wheat production has remained relatively stable or dropped just slightly because yields have increased (see figure 1).[5] During the 5 years between 2008 and 2012, U.S. growers planted an average of 57 million acres of wheat per year, almost 20 percent fewer than in the mid-1990s, while yields increased to 45 bushels per acre, slightly over 20 percent over the same period.

1 USDA/Foreign Agricultural Service Production, Supply and Distribution Online.
2 Ibid.
3 USDA/Economic Research Service (ERS), Wheat Briefing Room and Wheat Yearbook Tables, 2014.
4 USDA/National Agricultural Statistics Service Quickstats, Winter Wheat Production by State, 2013.
5 USDA/Agricultural Marketing Service (AMS) Analysis of USDA/Economic Research Service Wheat Yearbook Data, All years for Table 1.

Declines in acreage can be attributed to several factors. Wheat has a lower return than other commercial crops. Increased international competition from lower cost of production regions, in particular, has lowered the profit margin for U.S. wheat farmers, encouraging shifts to corn and soybeans. Furthermore, flexibility programs built into farm subsidy legislation have encouraged wheat farmers to diversify their crops. In 1996, new laws removed base acreage requirements for subsidized crops, allowing wheat farmers to devote more of their land to other crops in response to market conditions.[6]

**Figure 1: U.S. Wheat Production and Planted Acreage, 1995/96 to 2012/13***




**2012/13 is the marketing year for wheat; it begins June 1 and ends May 31.*
*Source: USDA/National Agricultural Statistics Service Crop Production, 2013 Summary, January 2014. Production in million bushels is indicated by the bars and read from the left axis, while harvested acres in million acres is shown by the line and read from the right axis.*

Domestic demand for wheat is driven primarily by the food industry. From 2005/06 to 2013/14, 78 percent of wheat consumed domestically was used for food. The remainder was used for animal feed, seed, and residual (see table 1).[7] Demand for wheat for food has remained remarkably consistent from 2001/02 to 2011/12 with a low of 910 million bushels (mbu) in 2004/05 and a high of 948 mbu in 2007/08. Demand for exports has been more volatile, with a high of 1,291 mbu in 2010/11 and a low of 850 mbu in 2002/03 (see figure 2).

Many factors contribute to the volatility of demand for U.S. wheat in global markets. Demand fluctuates with the gross domestic product and population growth of major importing countries. In addition, changes in the value of the dollar affect the price of wheat from the United States as compared to other exporters. Meanwhile, droughts, bumper crops, and political decisions (the 2010 Russian wheat export embargo, for example) alter global wheat supplies and prices.

6 USDA/ERS Wheat Yearbook Tables, 2013.

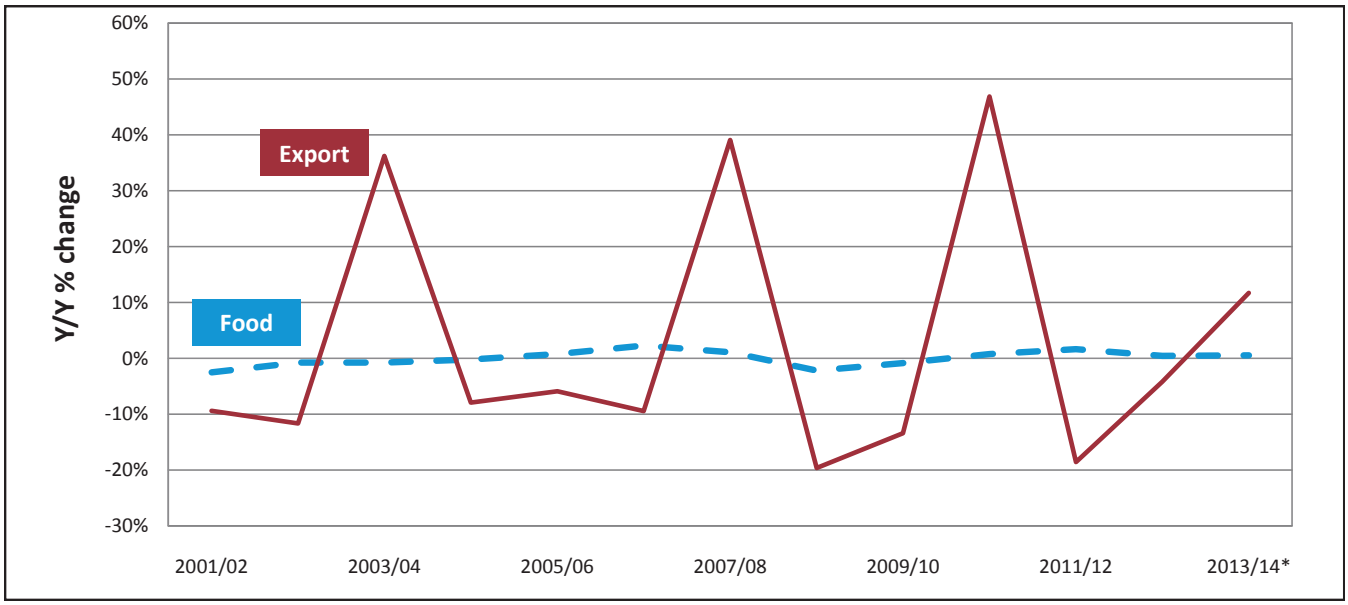
7 USDA/ERS Wheat Yearbook Tables, 2013; Feed and Residual Use category is calculated to ensure that ending stocks are consistent with total supply and known uses of wheat for export, seed, and food. The estimate includes both feed use and a residual that accounts for errors made in estimating the other variables. For more information, see: http://www.ers.usda.gov/topics/crops/wheat/estimating-wheat-supply-and-use.aspx.

**Table 1: U.S. Wheat Supply, Demand, 1995/96 to 2013/14***

| | Supply | | | | Use | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | Beginning Stocks | Production | Imports | Total | Food | Feed, Seed, Residual | Exports | Total | Stocks/Use Ratio |
| — Million Bushels — | | | | | | | | | |
| 1995/96 | 507 | 2,183 | 68 | 2,757 | 883 | 257 | 1,241 | 2,381 | 16% |
| 1996/97 | 376 | 2,277 | 92 | 2,746 | 891 | 410 | 1,002 | 2,302 | 19% |
| 1997/98 | 444 | 2,481 | 95 | 3,020 | 914 | 343 | 1,040 | 2,298 | 31% |
| 1998/99 | 722 | 2,547 | 103 | 3,373 | 910 | 471 | 1,046 | 2,427 | 39% |
| 1999/00 | 946 | 2,296 | 95 | 3,336 | 929 | 371 | 1,086 | 2,386 | 40% |
| 2000/01 | 950 | 2,228 | 90 | 3,268 | 950 | 379 | 1,062 | 2,392 | 37% |
| 2001/02 | 876 | 1,947 | 108 | 2,931 | 926 | 265 | 962 | 2,154 | 36% |
| 2002/03 | 777 | 1,606 | 77 | 2,460 | 919 | 200 | 850 | 1,969 | 25% |
| 2003/04 | 491 | 2,344 | 63 | 2,899 | 912 | 283 | 1,158 | 2,352 | 23% |
| 2004/05 | 546 | 2,157 | 71 | 2,774 | 910 | 259 | 1,066 | 2,234 | 24% |
| 2005/06 | 540 | 2,103 | 81 | 2,725 | 917 | 234 | 1,003 | 2,154 | 27% |
| 2006/07 | 571 | 1,808 | 122 | 2,501 | 938 | 199 | 908 | 2,045 | 22% |
| 2007/08 | 456 | 2,051 | 113 | 2,620 | 948 | 104 | 1,263 | 2,314 | 13% |
| 2008/09 | 306 | 2,499 | 127 | 2,932 | 927 | 333 | 1,015 | 2,275 | 29% |
| 2009/10 | 657 | 2,218 | 119 | 2,993 | 919 | 219 | 879 | 2,018 | 48% |
| 2010/11 | 976 | 2,207 | 97 | 3,279 | 926 | 200 | 1,291 | 2,417 | 36% |
| 2011/12 | 862 | 1,999 | 112 | 2,974 | 941 | 238 | 1,051 | 2,231 | 33% |
| 2012/13* | 743 | 2,266 | 123 | 3,131 | 945 | 461 | 1,007 | 2,414 | 30% |
| 2013/14* | 718 | 2,130 | 160 | 3,008 | 950 | 324 | 1,125 | 2,399 | 25% |

**USDA Forecast, July 2013 World Agricultural Supply and Demand Estimates, http://www.usda.gov/oce/commodity/wasde/index.htm.*
*Source: USDA/Economic Research Service Wheat Yearbook Tables, 2013*

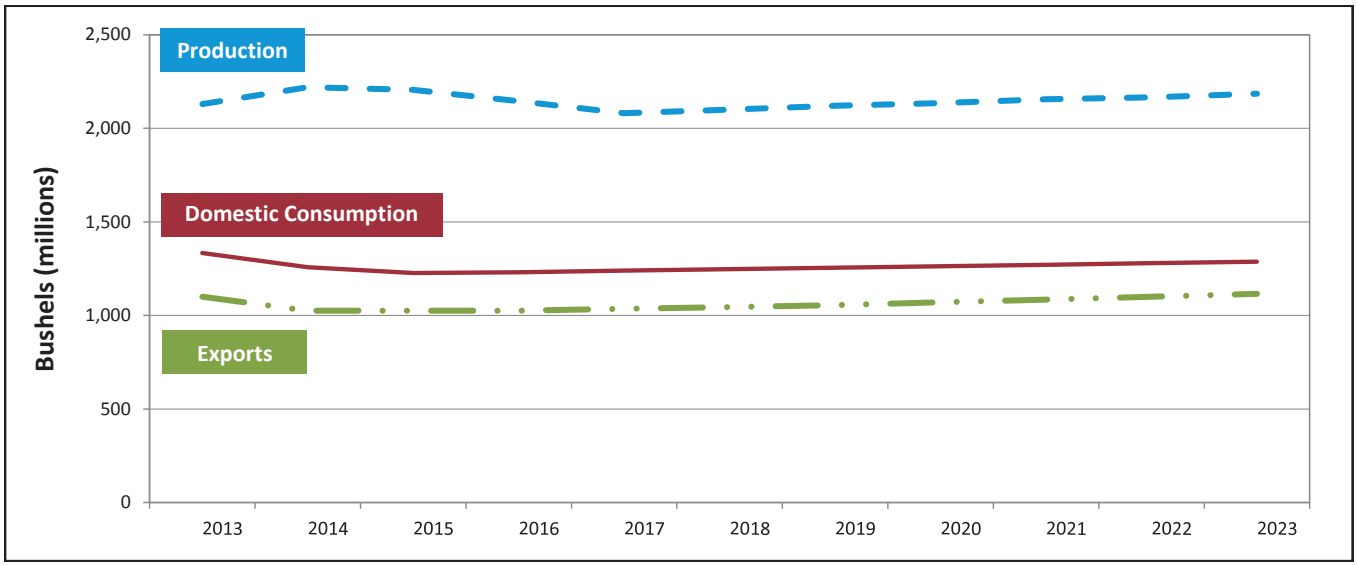
**Figure 2: Yearly percent changes in wheat demand, for food and exports, 2001/02 to 2012/13**




**The 2013/14 marketing season is projected.*
*Source: USDA/Economic Research Service Wheat Yearbook Tables, 2014*

USDA long-term projections show total production averaging about 2.2 bbu by 2023/24, up almost 3 percent from 2013/14 (see figure 3). Over this timeframe, domestic consumption is expected to decrease to 1.3 bbu, 3.5 percent lower than in 2013/14. Exports, however, are expected to increase to 1.3 bbu, 1.4 percent higher than in 2013/14.[8] The long-term projections by their nature cannot forecast year-to-year fluctuations. However, if the stable lower export demand persists, the demand for rail service to ship wheat to port will also remain low, because rail is the primary mode of transportation for moving wheat to port (see Wheat Modal Shares section of the report).

**Figure 3: USDA long-term projections for wheat, 2013/14 to 2023/24* (as of February 2014)**




**2023 is marketing year 2023/24.*
*Source: USDA Economic Research Service/Office of the Chief Economist Agricultural Long-Term projections to 2023, February 2014*

8 USDA ERS/OCE Agricultural Long-Term projections to 2022/2023, February 2013.

## Transportation Implications

Transportation demand for wheat used domestically does not change greatly year to year. Wheat exports, however, fluctuate based on foreign demand and competition from other exporters (see figure 2). Export demand, therefore, is one of the principal variables affecting wheat export logistics, which primarily rely on shipping by rail to port (see table 2).

**Table 2: Soybean modal shares, 2002 to 2011**

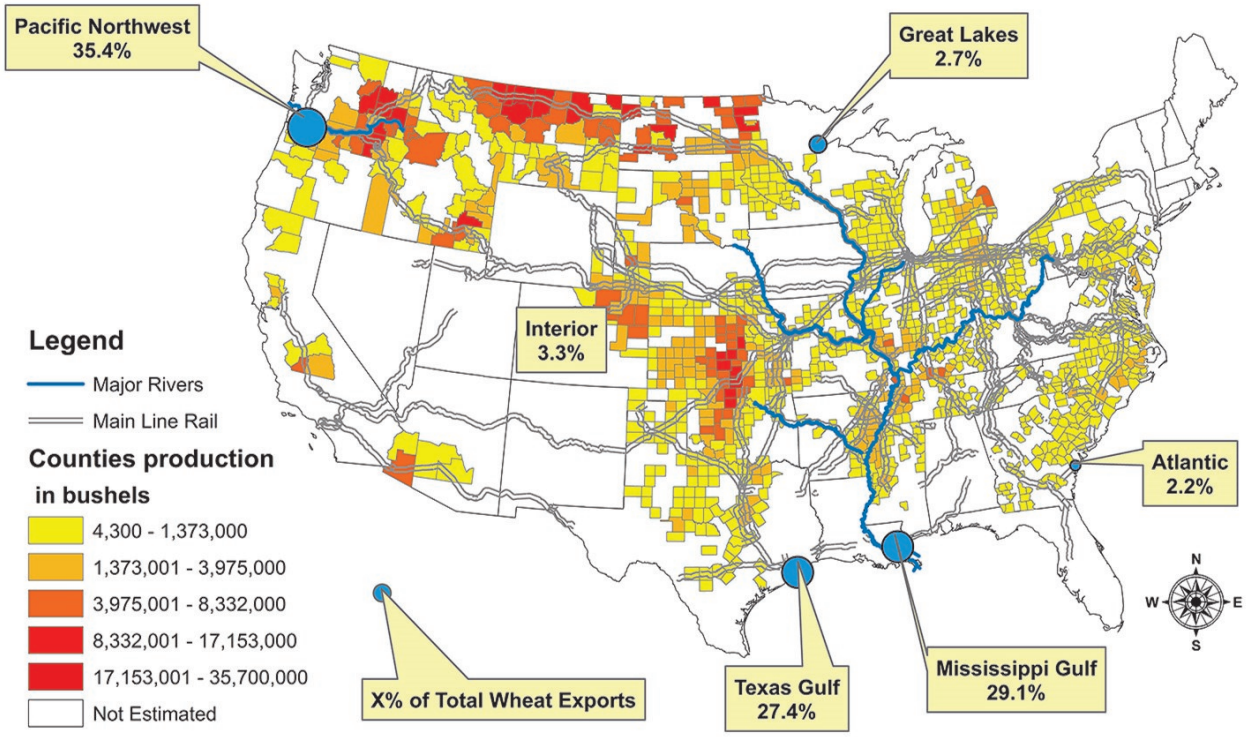
| Year & Type of Movement | Rail | | Barge | | Truck | |
|---|---|---|---|---|---|---|
| | 1,000 Tons | Percent | 1,000 Tons | Percent | 1,000 Tons | Percent |
| **Total** | | | | | | |
| 2002 | 34,523 | 59% | 9,876 | 17% | 14,270 | 24% |
| 2003 | 36,900 | 57% | 10,180 | 16% | 17,710 | 27% |
| 2004 | 40,924 | 61% | 11,937 | 18% | 13,973 | 21% |
| 2005 | 44,180 | 71% | 8,668 | 14% | 9,441 | 15% |
| 2006 | 44,735 | 77% | 8,767 | 15% | 4,324 | 7% |
| 2007 | 47,777 | 71% | 10,515 | 16% | 9,132 | 14% |
| 2008 | 45,670 | 69% | 8,872 | 13% | 11,959 | 18% |
| 2009 | 41,094 | 72% | 8,462 | 15% | 7,582 | 13% |
| 2010 | 44,017 | 70% | 8,471 | 14% | 10,202 | 16% |
| 2011 | 43,417 | 63% | 9,844 | 14% | 15,580 | 23% |
| ***Average*** | 42,324 | 67% | 9,559 | 15% | 11,417 | 18% |
| **Export** | | | | | | |
| 2002 | 16,966 | 62% | 9,367 | 34% | 1,247 | 5% |
| 2003 | 18,348 | 62% | 9,726 | 33% | 1,316 | 4% |
| 2004 | 21,439 | 61% | 11,370 | 32% | 2,400 | 7% |
| 2005 | 23,613 | 74% | 8,294 | 26% | 0 | 0% |
| 2006 | 20,804 | 71% | 8,566 | 29% | 0 | 0% |
| 2007 | 24,806 | 67% | 10,229 | 28% | 2,004 | 5% |
| 2008 | 24,519 | 72% | 8,428 | 25% | 883 | 3% |
| 2009 | 17,117 | 68% | 7,970 | 32% | 63 | 0% |
| 2010 | 22,369 | 72% | 8,013 | 26% | 838 | 3% |
| 2011 | 22,845 | 63% | 9,333 | 26% | 4,232 | 12% |
| ***Average*** | 21,283 | 67% | 9,130 | 29% | 1,298 | 4% |
| **Domestic** | | | | | | |
| 2002 | 17,556 | 56% | 509 | 2% | 13,023 | 42% |
| 2003 | 18,552 | 52% | 454 | 1% | 16,394 | 46% |
| 2004 | 19,485 | 62% | 566 | 2% | 11,573 | 37% |
| 2005 | 20,567 | 68% | 375 | 1% | 9,441 | 31% |
| 2006 | 23,931 | 84% | 200 | 1% | 4,324 | 15% |
| 2007 | 22,971 | 76% | 286 | 1% | 7,127 | 23% |
| 2008 | 21,151 | 65% | 444 | 1% | 11,076 | 34% |
| 2009 | 23,977 | 75% | 493 | 2% | 7,519 | 24% |
| 2010 | 21,647 | 69% | 458 | 1% | 9,364 | 30% |
| 2011 | 20,572 | 63% | 511 | 2% | 11,348 | 35% |
| ***Average*** | 21,041 | 67% | 430 | 1% | 10,119 | 32% |

*Source: Transportation of U.S. Grains: A Modal Share Analysis 1977-2011. USDA/Agricultural Marketing Service. May 2013*

Most wheat is produced in the Midwest and is shipped to flour mills, ports, and—in smaller quantities—to feedlots and feed mills. In 2013/14, over 100 million bushels of wheat, 54 percent of total U.S. production, were produced in six States: Kansas, North Dakota, Montana, Washington, Oklahoma, and Idaho. Although the top wheat-producing States have varied over the last decade, growing is generally concentrated in the Plains States of the central and western parts of the country.[9]

Wheat is transported to major population centers around the United States for food use, and a significant portion is moved to ports in the Gulf of Mexico and the Pacific Northwest for export. The map in figure 4 displays wheat production by county and shows the largest wheat export ports and the location of main rail lines and waterways.

**Figure 4: 2013 wheat production map by county with wheat export ports and transportation system**




Source: USDA Agricultural Marketing Service analysis of data from USDA National Agricultural Statistics Service State and county level statistics 2013, and Federal Grain Inspection Service port inspection data, 2013.

9 USDA/NASS Quick Stats, Wheat Production by State, 2001-2013.

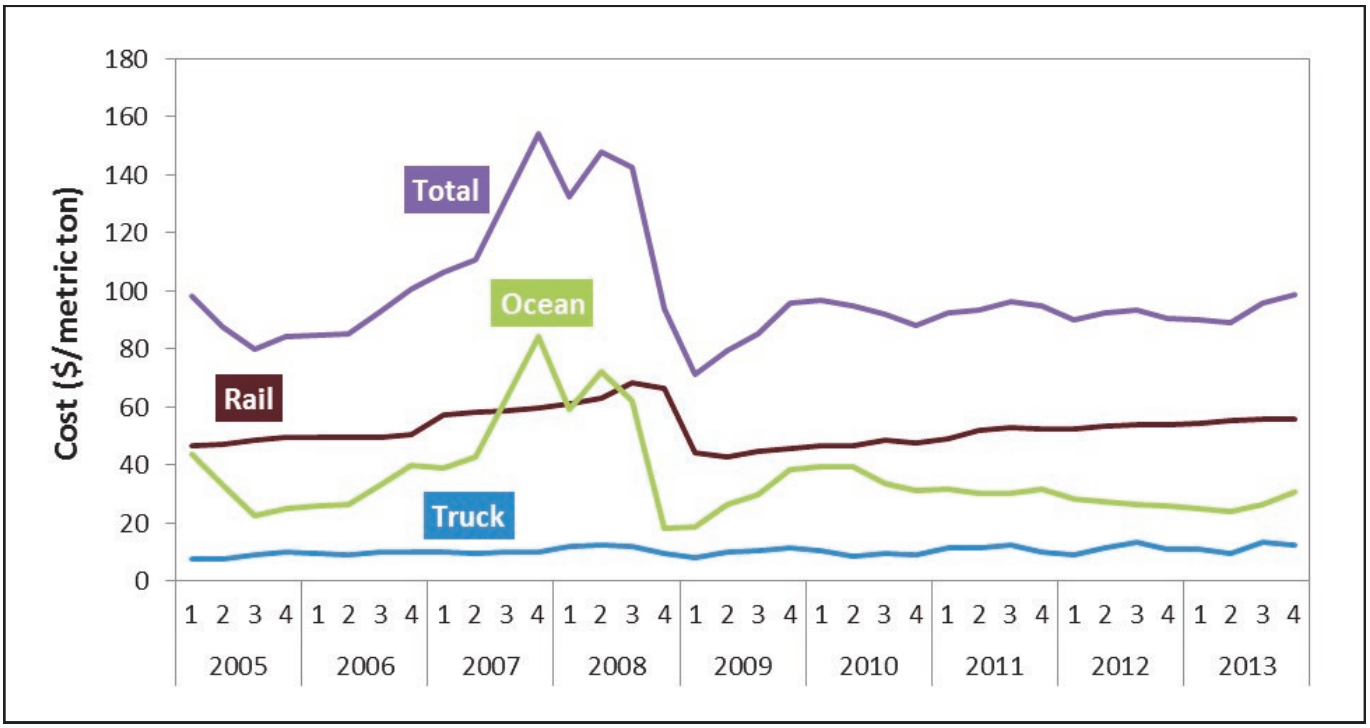
## Wheat Modal Shares

From 2002 to 2011, wheat accounted for 14.2 percent of all grain movement. Wheat for both domestic use and export is transported primarily by rail (see table 2). Rail is the dominant mode of transportation for wheat grown in the Great Plains States,[10] where barge transportation is not accessible. Because wheat is often transported over long distances to ports and milling locations in bulk, shipping by rail is cheaper than shipping by truck.[11]

U.S. grain shippers rely on three and sometimes all four modes of transportation to deliver the grain to a primary destination, such as Japan. Shipping wheat to a primary destination can be accomplished via truck, rail, and ocean vessels through the Pacific Northwest ports or through the U.S. gulf via barges moving down the Mississippi River in addition to the other modes of transportation.

Figure 5 shows the relative costs (in dollars per metric ton) by mode of transportation (truck, rail, and ocean) of shipping wheat from Kansas to Japan via the Pacific Northwest from the 1st quarter of 2005 to the 1st quarter of 2012. Total transportation costs spiked from the 4th quarter of 2006 to the 3rd quarter of 2008, fueled by higher diesel prices and strong demand for U.S. grain exports. In the years since the 2009 global financial crisis and the ensuing economic slowdown, total transportation costs have fallen substantially and have returned to the pre-financial crisis levels.

**Figure 5: Modal transportation costs for shipping wheat from Kansas to Japan through the Pacific Northwest by quarter, 2005 to 2013**




*Source: USDA/Agricultural Marketing Service, Transportation costs for major grains, 2014.*

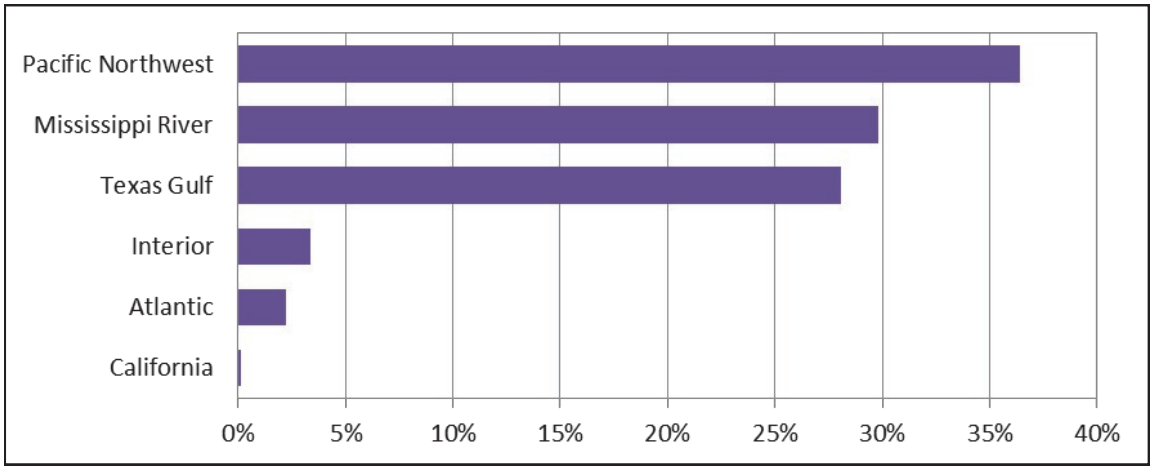
10 Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, and Wyoming.

11 Transportation of U.S. Grains: A Modal Share Analysis 1977-2011. USDA/AMS. May 2013

## Wheat Exports by Port Region

In 2013, 36 percent of wheat was exported through the Pacific Northwest (PNW), 27 percent through the Texas Gulf, and 29 percent through the Mississippi Gulf (see figure 6).[12] The major destinations for 2013 U.S. wheat included China and other Asian destinations, Brazil, Mexico, Japan, and Nigeria.[13] Because U.S. wheat is shipped to all regions of the world, the top 10 importers accounted for only 75 percent of total U.S. exports in 2013.

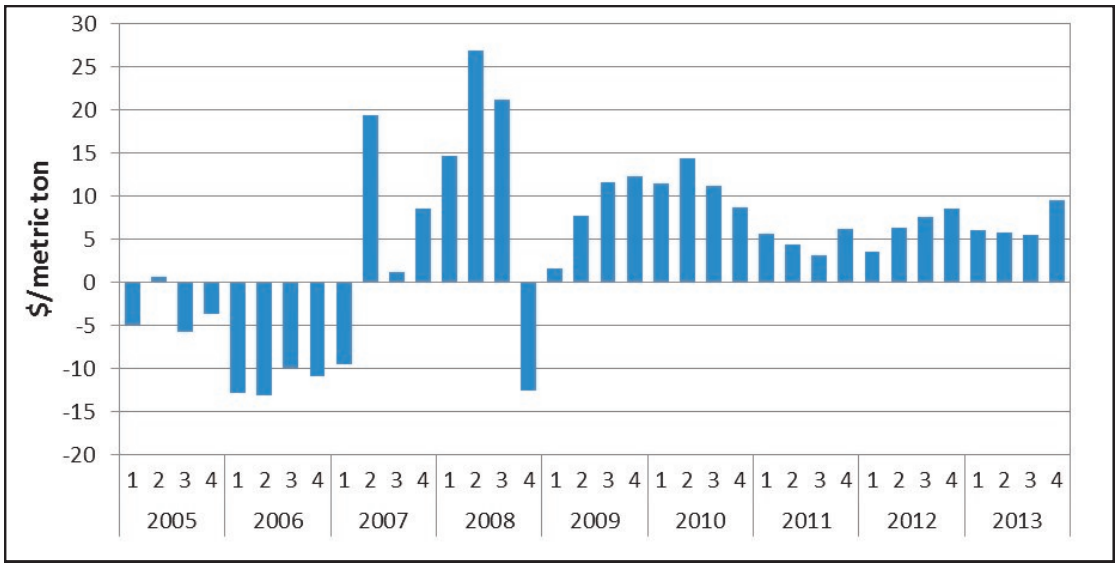
**Figure 6: Wheat Exports by Port Region, 2013**




*Source: USDA/Federal Grain Inspection Service Grain Inspections, 2014.*

The ocean freight spread between the U.S. Gulf and the Pacific Northwest can influence the decision grain shippers make when choosing the export port for the grain. Figure 7 shows the spread (difference) in total transportation costs between shipping from Kansas through the U.S. Gulf and the Pacific Northwest. From the 1st quarter of 2005 to the 4th quarter of 2013, shipping through the Gulf was, on average, $4.46/mt more expensive.[14]

**Figure 7: Spread of total wheat transportation costs between Gulf to Japan and Pacific Northwest (PNW) to Japan (Gulf total costs minus PNW total costs), Q1 2005 to Q4 2013**




*Source: USDA/Agricultural Marketing Service, Transportation costs for major grains, 2012.*

12 USDA/Federal Grain Inspection Service Grain Inspections, 2013.

13 USDA/Foreign Agricultural Service Marketing Year Final Reports.

14 USDA/AMS, Transportation costs for major grains, data collected by AMS Transportation Services Division, 2012.

## Conclusion

Wheat is used widely in domestic food production and is needed around the world in differing quantities year to year. Most of the U.S. population lives far from the wheat-producing areas, requiring wheat shippers to rely on long-distance freight transportation options. The changing overseas destinations for U.S. wheat often require producers to be flexible in shipping their product long distances to the three major ports regions. Wheat exports rely mostly on rail transportation to reach the ports. An efficient and flexible U.S. transportation network, particularly the rail system, is important for keeping U.S. wheat competitive in the world wheat market.

## References


1. Yearbook Tables: http://www.ers.usda.gov/data-products/wheat-data.aspx#25170
2. Economic Research Service briefing room: http://www.ers.usda.gov/topics/crops/wheat.aspx
3. NASS Quickstats: http://quickstats.nass.usda.gov
4. *Modal Share Analysis*: http://www.ams.usda.gov/ATModalShareReport



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