FARM TO MARKET
A SOYBEAN'S JOURNEY
FROM FIELD TO CONSUMER

Prepared for:

UNITED SOYBEAN BOARD
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Acronyms

ADM (Archer Daniels Midland)
ALL (American Latina Logistica)
APROSOJA (Association of the Producers of Soy)
BEA (Business Economic Analysis)
CBOT (Chicago Board of Trade)
CIF (Cost, Insurance, Freight)
CIH (Comision Intergubernamental de la Hidrovia)
CNT (National Confederation of Transportation)
CONAB (Companhia Nacional de Abastecimento)
DDGS (Distillers Dried Grains)
FOB (Freight on Board)
GDP (Gross Domestic Product)
GO (Goiás)
H1N1 (Swine Flu)
IBGE (Instituto Brasileiro de Geografia e Estatística)
ICMS (Merchandise Circulation Tax)
IDB (Inter-American Development Bank)
IMEA (Mato Grosso Institute of Agricultural Economics)
MGY (Million Gallons per Year)
MT (Metric Ton)
MMT (Million Metric Tons)
PAC (Program to Accelerate the Economy)
PAC 2 (Program to Accelerate the Economy 2)
PNW (Pacific Northwest)
PPPs (Public-Private Partnerships)
PR (Paraná)
PUWB (Public Use Waybill)
RS (Rio Grande do Sul)
TEU (Twenty-Foot Equivalent)
USDA (United States Department of Agriculture)
USITC (United States International Trade Commission)

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Unit Conversions

Bushel of Corn = 56 pounds
Bushel of Soybeans = 60 pounds
Bushel of Wheat = 60 pounds
Metric Ton of Soybeans = 36.74 bushels
Metric Ton of Corn = 39.37 bushels
Short Ton of Soybeans = 33.33 bushels
Short Ton of Corn = 35.17 bushels
One Pound = 2.2046 kilograms
Metric Ton = 2,204.6 pounds
Short Ton = 2,000 pounds
Long Ton = 2,240 pounds
Cargo Ton = 40 cubic feet
Metric Ton = 1.2204 short tons
Acre = 0.4046 hectares
Hectare = 2.471 acres
Meters = 3.28 feet
Kilometer = 0.6214 mile
Mile = 1.6093 kilometer

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I. Executive Summary

The U.S. transportation infrastructure system is rapidly deteriorating. The interstate highway system is more than a half century old, the lock and dam system more than seven decades, the rail network dating to the late 1800s, while ports and terminals form the bedrock of the trade infrastructure. This infrastructure fostered the economic vitality of the United States but its functional design has been eclipsed, desperately needing rebuilding and modernizing. Decaying roads, bridges, railroads and transit systems cost the United States economy $129 billion annually. Attention has been focused on the impact to the U.S. economy, but little on how the infrastructure system impacts agriculture.

The movement of agricultural commodities and products flow through a number of logistics options from farm to market. The logistics options often require the use of multiple modes across various geographies. The transportation of soybeans and soybean products and other grains and products were analyzed in this report. The material, information and conclusions in this report define and quantify the impact of the infrastructure on U.S. agriculture production, and moving that production from farm to final market position. The goal of this project was to develop a more precise understanding of:

- How U.S. soybeans and other leading agricultural products are transported to its customers.
- The obstacles to efficiency and profitability that transportation challenges may present. An ultimate vision is an evaluation of the counter factual "what if" scenarios, projecting and estimating what the implications might be if insufficient support for U.S. infrastructure were to occur.
- A forecast on the impacts of:
    - lack of investment,
    - sustaining the status quo supporting transport infrastructure, and
    - adequate, robust levels of qualified and strategically directed investment.

In order to achieve these answers, the following tasks were performed:

- Baseline crop and livestock production outlook
- State level crop surplus and deficit outlook
- U.S. transportation system accommodating agricultural products
- Impact on U.S. agriculture for insufficient transportation improvements
    - Inclusion of international flows and seasonal detail
    - International trade flow calibration
    - Economic dependency by mode
- Infrastructure enhancements among international competitors

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This report was prepared by Informa Economics, Inc. and Economic Development Research Group. Summary information characterizing each of these two organizations is available in the appendix.

Report Highlights

- Crop Outlook
  - Production increasing on higher yields, stable cropping area; soybean area expanding, corn shrinking, but overall total production rising.
  - Corn ethanol will reach its Renewable Fuel Standard mandate cap of 15 billion gallons in 2015
    - During the ethanol build out phase surplus corn supplies diminished across the Corn Belt, especially along the geographic reaches of the upper Mississippi and Illinois Rivers.
    - Surplus corn supplies will increase once the ethanol mandate for corn based production is achieved
  - The Environmental Protection Agency will likely increase the biodiesel mandate from 1.0 billion gallons in 2012 to 1.28 billion gallons or about 486 billion liters in 2013, which equates to an additional 2.1 billion pounds or nearly 1 million metric tons of vegetable oil and fats demand, which in turn supports the domestic oilseed crushing industry.
  - China will continue to import larger volumes of soybeans from 52 million metric tons in 2009/10 to 106 million in 2020/21, more than doubling, and will import corn on price opportunities.
  - Cropping of soybeans and corn has been and will continue to expand into the north and to the west, and into the Delta at the expense of wheat, cotton, and other feed crops, such as sorghum and oats.

- Livestock Outlook
  - The livestock outlook is mixed with growth driven by export demand and not domestic consumption.
  - Free Trade Agreement rules are being finalized for implementation between the U.S and South Korea, Panama and Colombia, to the benefit of U.S. meat exports.
  - Poultry production will shrink through 2012/13, and then expand 7.5 billion pounds to 53.9 billion or 24.4 million metric tons in 2020/21.
  - Hogs are projected to increase about 6 million head from the 2010/11 low point to 71 million in 2015/16 and remain steady from there.
    - Hog production will expand more rapidly within the Corn Belt while essentially shrinking in other areas.
    - Even though head count will flatten out, hog productivity gains will expand total pork production.
  - Cattle head counts are forecast to decline up to 2015/16 before nominally expanding through 2020/21, with no significant shift in geographic distribution.

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        - South Korea experienced a severe outbreak of foot-and-mouth disease, which has reduced the size of its herd, and increases the prospect of increased imports from the U.S., especially with the newly established Free Trade Agreement.
    - Dairy cattle head count will remain relatively stable, but annual productivity gains of 1.6% annually will increase total milk production.
        - The size of the U.S. dairy herd is dependent on exports of milk and associated products, especially to Asia and more specifically to China.
        - There will be no significant geographic redistribution.

- Transportation of Soybeans and Products
    - Long haul transport of soybeans and soybean products, grains and grain products move from areas of surplus into deficit areas of the United States for domestic feeding and processing purposes, and to export position.
    - Rail movement has increased in the western Corn Belt moving soybeans and grains to export position in the Pacific Northwest
    - Unit or shuttle train elevators exceed 500 efficient, rapid operational locations across the Corn Belt. These facilities allow fast loading of unit or shuttle trains of 90 to 110 cars per train in less than 12 hours.
    - The relative movement of soybeans and grains by barge has shifted away from the upper Mississippi and Illinois River origins toward the lower Mississippi and lower Ohio Rivers.
    - The fleet of covered barges has transitioned from older equipment with less carrying capacity and shallower draft to equipment that is 15% to 20% larger that has deeper hulls, which requires deeper draft capabilities when fully loaded.
    - Export capacity has increased 30% in the PNW, 10% across the U.S. The PNW capacity accommodates the westerly expansion of crops and increased soybean and grain trade with Asia.
    - Rail carloadings of soybeans to expand 36% to more than 367 thousand in 2020/21 from 2009/10, with the volume moved to increase more than 50% to 41.6 million short tons or 37.7 million metric ton in 2020/21.
    - Barge movements of soybeans to increase 43% to 32.1 million short tons or 29.1 million metric tons in 2020/21 from 2009/10.

- Key Transportation and Infrastructure Issues
    - The locks and dams on the inland navigation system have exceeded the design life of the structures and have not been fully and efficiently maintained, and many are not adequate to accommodate modern tow configurations.

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- Dredging navigation channels to project depths, that is, the specified navigable waterway targeted by the U.S. Army Corps of Engineers at key ports is not being efficiently funded for reliable service to maintain adequate navigational draft. This limits the volume of soybeans and grains that can be loaded on a vessel, leading to higher freight costs.
- Panama Canal is amidst an expansion effort to add a new set of locks to accommodate increased traffic and larger vessels to transit the isthmus between the Atlantic and Pacific Oceans. The expansion will allow vessels to be loaded to a 50 foot draft from the current draft of 39.5 feet, as well as longer and wider vessels to utilize the passage.

- Impact of Infrastructure on U.S. Agriculture
  - The delivery of commodities resulting from grain and soybean farming are of significant importance to the U.S. economy.
  - U.S. industries "fully dependent" on soybeans, grain and related products (down to the second order of consumers in the supply chain) account for nearly:
    - 1.5 million jobs,
    - More than $352 billion in U.S. output,
    - Over $41 billion in labor earnings, and
    - Greater than $74 billion in value added on the U.S. economy.
  - Impacts of grain, soybeans and products on U.S. earnings, employment, output and value-added by key Bureau of Economic Analysis regions include:
    - The largest share of the impact on U.S. earnings, employment and value-added occurs in the Plains region (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota and South Dakota), where the farm commodities are produced. The proximity to the farms where these inputs are produced, the Plains region also has a large concentration of food processing, milling and food manufacturing.
    - The greatest impact on industry output is in the Great Lakes region (Illinois, Indiana, Michigan, Ohio and Wisconsin). This is largely attributable to the concentration of food manufacturers, in the Great Lakes region, as well as the fact that the Great Lakes states are second only to the Plains in their level of grain and soybean farming and production activity.
    - The Southeast (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee and West Virginia) is another major region with a significant dependence on grain and soybean commodities and products, accounting for approximately one-fifth of the U.S. output that is dependent on these commodities.

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    - The Southwest, Mideast, Rocky Mountain, Far West, and New England regions account for significantly smaller shares of grain and soybean dependent output, largely because of the lower concentration of farming and related activity in these regions in comparison with the others.
- Infrastructure projects were identified that can significantly reduce costs moving soybeans and grain commodities to market position. It is expected that the majority of these savings will be passed back through the farm gate and on to U.S. firms using soybeans and grain commodities as inputs to production, enabling these firms to be more productive and competitive both domestically and globally. Cost savings are most likely to be derived from:
    - Improved reliability in the delivery time of soybeans and grains,
    - Reduced travel time and transit costs,
    - Improved efficiency at ports for using larger, more efficient ocean going vessels, and
    - Potential re-assignment of rail traffic to barge traffic for freight currently utilizing rail to avoid deficiencies at key lock and dam facilities
- The cost savings to the soybean and grain industries that are expected to result from the investments in transportation infrastructure nearly total $145.9 million on an average annual basis.
- The transportation improvements described in this report, combined with the impacts of the costs savings are expected to result in an average annual impact of:
    - Over 8,113 jobs,
    - More than $409 million in personal income,
    - Greater than $1.2 billion in output, and
    - Over $630 million in value-added in the U.S. economy.
- Most of the impact is expected to result directly from the enhanced attractiveness in water transportation as a mode of transportation (and increased productivity and outlays in the water transport industry), and from the direct outlays in the maintenance and repair of infrastructure.
    - Other impacts stem largely from industries supplying these providers, (such as fuel providers, landlords or insurance carriers).
    - Still other impacts will be "permanent" impacts in the economy related to improved efficiency in grain and soybean supply chains.
- Removing major bottlenecks in the movement of grain, soybeans and products in the United States would involve $467.2 million of construction outlays on an annual average (over a 5 year construction period for locks and over a 10 year period for dredging) in the U.S. economy, and would be expected to increase the output of water transportation by approximately $43.3 million annually (due to some diversion from rail induced by improved reliability, enabling the rail mode to be used more efficiently as well).

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        - The transportation outlay effects of the suggested transportation improvements are expected to result in:
            - Approximately 7,927 jobs,
            - $400.8 million in personal income,
            - Over $1.17 billion in additional output,
            - More than $615.1 million in value-added on the U.S. economy through the course of the construction period.
    - The impact of supply chain efficiencies associated with the modeled reduced cost in transporting soybeans, grains and products generates:
        - Approximately 185 jobs,
        - Over $8.8 million in annual earnings,
        - More than $40 million in output, and
        - Greater than $15.5 million in value-added on the national economy.
    - Overall, more than 58% of the output enabled by savings in the transport of soybeans and grain will be realized in the Southeast region, with more than 55% of the employment, 53% of the earnings and 53% of the value-added from these savings accruing in the Southeast region. This impact on the Southeast region is very dispersed among industries, with the ten most affected industries accounting for less than half of the overall impact.
    - Soybeans and grain spread far into the U.S. supply chains, such that the inter-regional impacts account for a significant share of earnings (43%), output (38%), employment (41%) and value-added (43%). This indicates that the economic impact of savings on the movement of soybeans, grain and products spreads broadly throughout the economy in many inter-state and inter-regional transactions and is likely to have impacts far beyond those locations that directly consume or use the commodities to which the cost savings apply.
    - A summary of the transportation investment implications as evaluated through economic input-output modeling are then presented in the following table:

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Annual Summary of Transportation Investment Outlays and Returns for the Soybeans, Grain and Products Industries

Description	Impact Type	Dollar Value	Economic Impact			
			Earnings	Output	Employment	Value-Added
Infrastructure Outlays	Construction	$467,200,000	$400,816,086	$1,176,474,978	7,927	$615,177,949
Supply Chain Impacts	Cost Savings	$145,900,019	$8,898,453	$40,314,188	185	$15,535,030

- South America Infrastructure Influence
  - Soybean production in South America to increase more than 25% through 2020/21, with Brazil's production to exceed 90 million metric tons and Argentina's 70 million metric tons.
    - Exports of soybeans will expand commensurately with Brazil's exports to exceed 48 million metric tons and Argentina's nearly 20 million metric tons, while Argentina's soybean meal exports will total about 37 million metric tons. Argentina applies an export tax to unfinished or unprocessed commodities, thus incenting value added services that leads to more soybean meal exports.
  - Transportation is key in future to remain competitive
    - Heavily oriented toward truck movement over long-haul distances, however efforts are underway to shift increasingly to rail and waterway modes to mitigate costs.
    - Since 2005, Brazil's modal shares have been realigning with the more efficient modes of rail and barge gaining notable shares.
  - Inland transportation expensive
    - The transportation cost to export position is expensive in South America, especially in Brazil where truck costs run upwards of U.S. $127 per metric ton (or U.S. $3.50 per bushel) during harvest on some routes. The movement of soybeans in Brazil is over long distances while in the United States the truck move is much shorter, to the next logistics option. In the United States, truck costs moving soybeans to the next market position are considerably lower, between $10 and $15 per metric ton.
    - On select routes in Brazil, an all truck move of 950 miles from Mato Grosso to export position at Santarem costs about U.S. $122 per metric ton while a multi-modal move in the United States moving more than 1,500 miles by truck to barge to export position at the Center Gulf costs about U.S. $47 per metric ton.
  - Proposed soybean corridors

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- Several infrastructure projects have been proposed to accommodate the reliable and efficient movement of soybeans in Brazil. Many have yet to be realized or lack resources to be fully completed.
- Based on information in Brazil, improvements to the infrastructure, including the addition of multi-modal options (e.g., truck-rail or truck-barge to export position), have been estimated by Informa Economics to reduce freight costs $40 per metric ton or between 20% and 30% depending on the origin. Based on information compiled and taking into account wait times between transportation events and eventual vessel loading for export movement, the more optimistic USDA estimated cost savings could exceed 50% or U.S. $55 per metric ton to more than U.S. $60 per metric ton.
- Such potential improvements will bring Brazil nearly on par with the United States in terms of inland transport costs, which effectively bolsters its farm industry.

- For South America, and especially Brazil, projects have been discussed for many years with little fulfillment. Some portions of some proposed projects have been started, but due to poor construction and or the lack of on-going maintenance resources, the infrastructure quickly crumbles.

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II. Introduction

The material, information and conclusions in this report define and quantify the impact of the infrastructure on U.S. agriculture production, and moving that production from farm to final market position. The goal of this project was to develop a more precise understanding of:

- How U.S. soybeans and other leading agricultural products are transported to customers.
- The obstacles to efficiency and profitability that transportation challenges may present. The ultimate vision is an evaluation of the counter factual "what if" scenarios, projecting and estimating what the implications might be if insufficient support for U.S. infrastructure were to occur.
- This work was developed in order to forecast the impacts of three scenarios:
    - lack of investment,
    - sustaining the status quo support for transport infrastructure, and
    - adequate, robust levels of qualified and strategically directed investment.

In order to achieve these answers, the following tasks were performed:

- Baseline crop and livestock production outlook
- State level crop surplus and deficit outlook
- U.S. transportation system accommodating agricultural products
- Assessment of the impact on U.S. agriculture of insufficient transportation improvements
    - Inclusion of international flows and seasonal detail
    - International trade flow calibration
    - Economic dependency by mode
- Evaluation of the impact of infrastructure enhancements among international competitors

This report was prepared by Informa Economics, Inc. and Economic Development Research Group. More information about these two organizations is available in the appendix.

The U.S. transportation infrastructure system is rapidly deteriorating. The interstate highway system is more than a half century old, the lock and dam system more than seven decades, and the rail network dates to the late 1800s. Ports and terminals form the bedrock of the trade infrastructure. This infrastructure fostered the economic vitality of the United States but its functional design has been eclipsed, desperately needing rebuilding and modernizing. Decaying roads,

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bridges, railroads and transit systems cost the United States economy $129 billion annually.[1] Attention has been focused on the impact to the U.S. economy, but little on how the infrastructure system impacts agriculture.

The movement of agricultural commodities and products flow through a number of logistics options from farm to market. The logistics options often require the use of multiple modes across various geographies. The U.S. soybean farm to market value chain and logistics flow is presented visually and is accompanied by a brief description of each component of the marketing chain. The value chain will provide a framework to analyze the journey of a soybean from its initial production region to end consumer as shown in Figure 1. The following information is based on a "typical" journey and does include every possible outcome. The goal is to provide a foundation of for how the vast majority of soybeans are transported from farm to market. The report provides a deeper dive on every area discussed in the logistics flow.

- The U.S. annually produces approximately 3.3 billion bushels or 89.8 million metric tons of soybeans. Soybean production occurs primarily in the Midwest, Northern Great Plains, and along the Mississippi River.

- The first move is from farm to market pipelines. During harvest the farmer has as many as six primary options, depending upon where they are located, transporting soybeans:
    - On-farm storage,
    - Country elevator,
    - Container yard or transloader,
    - Barge terminal,
    - Shuttle elevator, and
    - Crushing plant.

[1] "Failure to Act, The Economic Impact of the Current Investment Trends in Surface Transportation Infrastructure," American Society of Civil Engineers, data and economic analysis prepared by EDR Group, August 2011

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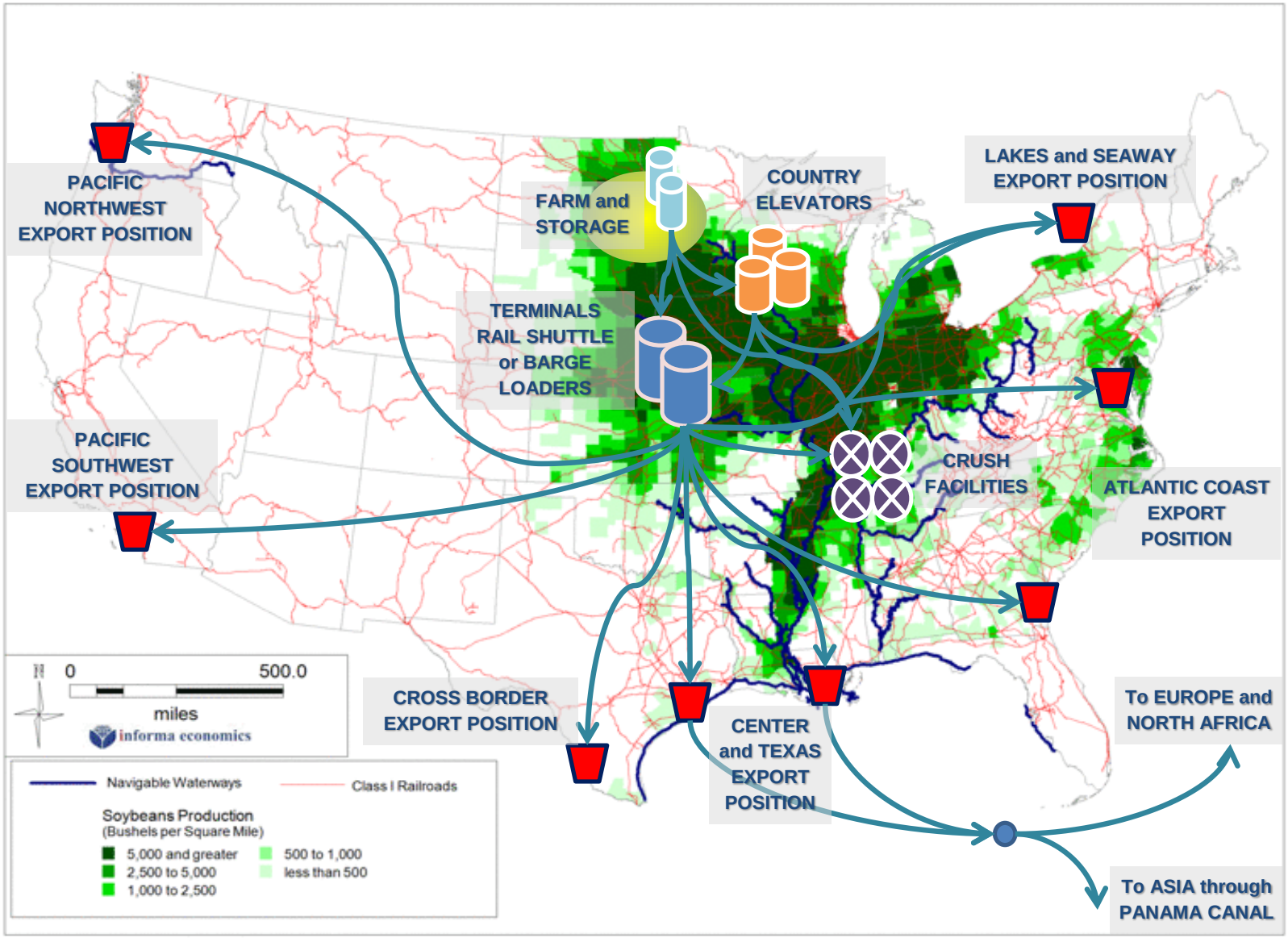
Figure 1: Soybean Logistics Flow



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- Approximately three out of four bushels of the soybeans harvested either remains on-farm initially or is delivered to a country elevator.
    - On-farm storage is an important asset in terms of managing harvest pressure and making marketing decisions.
        - The combination of higher yields and larger harvesting equipment results in large quantities of soybeans needing to be handled in a short period of time. The farmers response to increased harvest pressure has been to add more trucks delivering soybeans to the next step in the value chain, increasing the size of the trucks, and building more on-farm storage.
        - Approximately one-fifth of the soybean production remains on-farm and is then delivered to market position from April through September.
    - Harvest pressure makes the nearby availability of storage valuable. For farmers that are not located within 50 miles of a container yard, barge terminal, shuttle elevator, and/or crush facility, the country elevator is essential during harvest.
        - Country elevator interviews indicated that the main draw area is 20 miles to 50 miles. Farmers west of the Mississippi River typically drive farther distances than farms east of the Mississippi River.
        - Farm to country elevators account for an estimated 55% of first moves.

- Approximately 25% of the soybean harvest is shipped directly from the farm to export position or crusher.
    - To consistently utilize containers requires a farmer to be located within close proximity of a transloader or container yard. Currently, container movements represent less than 1% of soybean production, but shows promise of expanding.
    - It is assumed that during the two months of harvest the farmer delivers directly to the barge terminal, shuttle elevator, and crushing plant.
        - Farm to barge terminal represents an estimated 10% of soybean production.
        - Farm to shuttle elevator is approximately 5% of soybean production.
        - Approximately 10% of soybean production moves directly from farm to crushing plant. According to crush plant managers located in the Corn Belt the average reach of their facilities is 40 miles and nearly all soybeans arrive by truck.

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Table 1: U.S. Soybean Farm to Market Pipeline Distribution at Harvest

	Thousand Bushels	Average Distance (Miles)	Total Ton-Miles (Thousands)	Truck Ton-Miles (Thousands)	Rail Ton-Miles (Thousands)	Barge Ton-Miles (Thousands)
Crop Size	3,300,000	27	2,673,371	2,673,371	-	-
On-Farm Storage	660,000	-	-	-	-	-
Country Elevator	1,815,000	35	1,905,750	1,905,750	-	-
Container	495	50	743	743	-	-
Barge Terminal	330,000	25	247,500	247,500	-	-
Shuttle Elevator	164,505	25	123,379	123,379	-	-
Crushing Plant	330,000	40	396,000	396,000	-	-

Source: USDA, USACOE, USITC, Informa

- On-farm stored soybeans are not transported during harvest, which increases the time available to market directly to an export position or crusher. The availability of time allows the farmer to ship the soybeans a greater distance than during harvest.
  - The on-farm move to export position or crusher is typically 20 miles to 150 miles and 100% is delivered by truck.
  - Farmers in the western U.S. tend to drive farther distances than farmers in the eastern U.S.
  - Of the estimated 660 million bushels remaining on-farm after March, approximately 50% are shipped to a crushing plant, 25% to a shuttle elevator, 15% to a barge terminal, and 10% to a country elevator as shown in Table 2.
  - The on-farm storage shipments are considered to be moved by truck.

Table 2: On-Farm Storage Distribution

	Thousand Bushels	Average Distance (Miles)	Total Ton-Miles (Thousands)	Truck Ton-Miles (Thousands)	Rail Ton-Miles (Thousands)	Barge Ton-Miles (Thousands)
On-Farm Storage	660,000	64	1,257,300	1,257,300	-	-
Country Elevator	66,000	35	69,300	69,300	-	-
Barge Terminal	99,000	50	148,500	148,500	-	-
Shuttle Elevator	165,000	50	247,500	247,500	-	-
Crushing Plant	330,000	80	792,000	792,000	-	-

Source: USDA, USACOE, USITC, Informa

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- The country elevator provides marketing options for the farmer, nearby crushers, feeding operations, barge terminals and shuttle elevators.
  - Elevator operators indicate that approximately 85% of country elevator shipments are shipped out by truck with the remaining 15% by rail as shown in Table 3.
  - Country elevators are in essence feeder elevators to barge terminals and shuttle elevators.
  - Crushers typically either own country elevators and/or have marketing agreements with country elevators.

Table 3: Country Elevator Distribution

	Thousand Bushels	Average Distance (Miles)	Total Ton-Miles (Thousands)	Truck Ton-Miles (Thousands)	Rail Ton-Miles (Thousands)	Barge Ton-Miles (Thousands)
Country Elevator	1,881,000	61	3,447,873	2,930,692	517,181	-
Barge Terminal	470,250	50	705,375	599,569	105,806	-
Shuttle Elevator	714,780	50	1,072,170	911,345	160,826	-
Crushing Plant	658,350	80	1,580,040	1,343,034	237,006	-
Export	37,620	80	90,288	76,745	13,543	-

Source: USDA, USACOE, USITC, Informa

- The shuttle elevator primary utilizes railroads to transport soybeans. The accumulation of soybeans in a single location has increased railroad efficiency and offers incentives to shippers.
  - The expansion of soybean production west of the Mississippi River combined with strong Asian demand has increased exports to the Pacific Northwest (PNW).
  - Increasingly, shuttle trains are delivering soybeans to East St. Louis to be transloaded onto barge. As the dependability of the locks continues to erode and as deeper hull barges become a greater percentage of the fleet, more soybeans will be shipped past the locks to the deeper water terminals in and downriver from St. Louis.
  - Export elevators located at Texas and Louisiana ports do receive shuttle trains of soybeans for loading onto ocean going vessels.
  - Crushers typically have the ability to receive shuttle trains especially those located outside the Corn Belt and ship products out by unit train.

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Table 4: Shuttle Elevator Distribution

	Thousand Bushels	Average Distance (Miles)	Total Ton-Miles (Thousands)	Truck Ton-Miles (Thousands)	Rail Ton-Miles (Thousands)	Barge Ton-Miles (Thousands)
Shuttle Elevator	1,044,285	1,123	35,189,167	-	35,189,167	-
Barge Terminal	73,100	400	877,199	-	877,199	-
Crushing Plant	323,728	600	5,827,110	-	5,827,110	-
Export	647,457	1,467	28,484,858	-	28,484,858	-
PNW	343,152	1,700	17,500,755	-	17,500,755	-
Mexico	161,864	1,600	7,769,480	-	7,769,480	-
Canada	19,424	400	233,084	-	233,084	-
Texas / Louisiana	77,695	900	2,097,760	-	2,097,760	-
East Coast	45,322	650	883,778	-	883,778	-

Source: USDA, USACOE, USITC, Informa

- Soybean barge movements to crushing plants and for export through the Center Gulf are shown in Table 5. An estimated 95% of the soybean barge movements are to export position in the Center Gulf.

Table 5: Barge Terminal Distribution

	Thousand Bushels	Average Distance (Miles)	Total Ton-Miles (Thousands)	Truck Ton-Miles (Thousands)	Rail Ton-Miles (Thousands)	Barge Ton-Miles (Thousands)
Barge Terminal	972,038	972	28,347,547	-	-	28,347,547
Crushing Plant	58,322	535	936,073	-	-	936,073
Export	913,716	1,000	27,411,474	-	-	27,411,474

Source: USDA, USACOE, USITC, Informa

- The journey from farm to crushing plant or export position requires the soybeans to be handled 2.4 times, travel an average distance of 716 miles which amounts to 71 billion ton-miles, for the crop as shown in Table 6.

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Table 6: Farm to Crushing Plant or Export Position Summary

	Thousand Bushels	Average Distance (Miles)	Total Ton-Miles (Thousands)	Truck Ton-Miles (Thousands)	Rail Ton-Miles (Thousands)	Barge Ton-Miles (Thousands)
Total	3,300,000	716	70,925,096	6,862,106	35,706,348	28,356,642
Harvest	3,300,000	27	2,673,371	2,673,371	-	-
On-Farm Storage	660,000	64	1,257,300	1,257,300	-	-
Country Elevator	1,881,000	61	3,447,873	2,930,692	517,181	-
Container	495	50	743	743	-	-
Barge Terminal	972,350	972	28,356,642	-	-	28,356,642
Shuttle Elevator	1,044,285	1,123	35,189,167	-	35,189,167	-

Source: USDA, USACOE, USITC, Informa

- The soybeans for export are primarily loaded into an ocean going vessel at the Center Gulf and PNW.
  - Soybeans exported off the West Coast are destined for Asia.
  - Center Gulf soybean exports are primarily shipped to Europe and Asia.
    - Sixty-four percent of Center Gulf soybean exports transit the Panama Canal.
  - East Coast and Great Lakes exports are to Canada and Europe.

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III. Baseline Crop and Livestock Outlook

This section includes Informa's baseline assumptions, upon which is built the company's long term grain and soybean supply and demand outlook through 2020. The next ten years will feature relatively higher commodity prices, increasing biodiesel mandate, a capping of the ethanol mandate, steady animal markets and China corn imports.

- Commodity prices are expected to remain at historically high levels for the next ten years. Total planted acreage has declined to about 316 million acres in 2011 from just over 366 million acres in 1982. Informa does not expect higher commodity prices to increase total land acreage, but will shift acres between competing crops.

- The biodiesel mandate of one billion gallons is scheduled to increase by 280 million gallons in 2013, which increases demand for vegetable oils and animal fats by 2.1 billion pounds or an increase of 8%. The seven major oils consumed in the U.S totaled 26 billion pounds in 2011.

- U.S. mandated corn based ethanol production is not expected to expand beyond 2015. Ethanol capacity for corn based production is expected to crest at approximately 15 billion gallons per year. As corn yields increase and corn production expands, and less corn will be used for ethanol, more corn will be available for the feeding and export markets. This situation will create an opportunity for China to import more corn without severely impacting the market.

- The higher cost of feed ingredients has reduced the size of herds and flocks. However, Informa expects animal numbers to increase with a growing world population and exports.

- China's increased use of soybeans, and subsequent higher levels of imports have been a major feature of U.S. agriculture the last five years. Crop year 2011, China corn imports are forecast to expand to four million metric tons (MT) and to 7.2 million MT in 2012/13. Informa expects China to remain a modest net importer of corn over the next decade, while other forecasters expect rapidly expanding imports. This difference in opinion plays a major role in the relative crop price forecasts and ultimately what crops are planted, which impacts production.

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A. Macro-Economic Outlook

1. U.S.

- The economy expanded at an annual rate of 3.0% in the fourth quarter of 2011, which is much higher than the 0.9% for the first half of 2011, but slightly below projections.

- The U.S. economy is expected to continue to grow slowly while Europe enters into a recession.

- Retail spending accounts for 70% of U.S. gross domestic production (GDP). Retail spending that is created by new workers entering the workforce is essential to economic growth.

- The economy and job market are unusually weak two years after the recession officially ended. Unemployment has been above 8% for 37 months, the longest streak since the 1930s.

- Two years after the recession officially ended, companies are tentatively adding workers despite record cash stockpiles and healthy profit margins.
    - Improvements in technology are improving productivity, which increases profits by reducing the need for employees and other inputs.
    - The larger profit margins have enabled the economy to add 1.7 million new jobs from December 2010 through December 2011 despite employment reductions in the government sectors.
    - The 133 million non-farm payroll is well below the prerecession 139 million as shown in Figure 2.

- Interest rates are forecast to remain at record low levels through 2013.

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Table 7: U.S. Macroeconomic Outlook

	2010:4	2011:1	2011:2	2011:3	2011:4	2012:1	2012:2	2012:3	2012:4	2013:1	2013:2	2013:3	2013:4
Economy													
Gross Domestic Product (GDP)													
Bils. Chain 2000 $'s	13,216.10	13,227.90	13,271.80	13,331.60	13,429.90	13,478.40	13,569.50	13,651.00	13,742.40	13,825.80	13,913.80	13,992.70	14,058.30
Ann. % Chg	2.30	0.40	1.30	1.80	3.00	1.50	2.70	2.40	2.70	2.40	2.60	2.30	1.90
% Chg. Yr. Over Yr.	3.10	2.20	1.60	1.50	1.60	1.90	2.20	2.40	2.30	2.60	2.50	2.50	2.30
Consumption	9,328.40	9,376.70	9,392.70	9,433.50	9,483.70	9,510.60	9,569.50	9,631.10	9,697.80	9,760.20	9,813.50	9,864.60	9,913.60
Ann. % Chg	3.60	2.10	0.70	1.70	2.10	1.10	2.50	2.60	2.80	2.60	2.20	2.10	2.00
Bus. Fixed Invest	1,371.90	1,378.90	1,413.20	1,465.60	1,475.70	1,497.40	1,521.80	1,547.80	1,572.30	1,592.40	1,615.80	1,641.40	1,653.60
Ann. % Chg.	8.70	2.10	10.30	15.70	2.80	6.00	6.70	7.00	6.50	5.20	6.00	6.50	3.00
Res. Const	323.10	321.10	324.40	325.40	334.40	337.60	344.60	348.00	353.10	356.70	361.40	365.10	366.10
Inven. Invest.	38.30	49.10	39.10	(2.00)	54.30	45.50	37.50	27.20	22.10	19.50	22.40	19.50	16.00
Net Exports	(414.20)	(424.40)	(416.40)	(402.80)	(404.40)	(408.60)	(404.70)	(410.70)	(412.90)	(412.00)	(410.80)	(407.60)	(403.90)
Fed. Govt.	1,079.60	1,053.30	1,058.30	1,063.70	1,044.70	1,048.00	1,051.20	1,054.40	1,053.50	1,050.30	1,049.30	1,044.20	1,043.50
Ann % Chg.	(3.00)	(9.40)	1.90	2.10	(7.00)	1.30	1.20	1.20	(0.40)	(1.20)	(0.40)	(1.90)	(0.30)
State and Local govt.	1,478.90	1,466.40	1,456.10	1,450.40	1,441.00	1,437.70	1,439.50	1,443.10	1,446.40	1,448.50	1,452.10	1,455.40	1,459.40
Ann % Chg.	(2.70)	(3.30)	(2.80)	(1.60)	(2.60)	(0.90)	0.50	1.00	0.90	0.60	1.00	0.90	1.10
Fed. Bdgt. Surpl.													
Unified (Qtry. Rate, NSA, FY)	(370.80)	(460.80)	(141.20)	(326.40)	(321.70)	(310.60)	(301.80)	(297.00)	(245.30)	(243.40)	(235.10)	(201.10)	(145.10)
Trade Bal., Gds, & Servs. - Bils. $/s	(475.00)	(559.90)	(584.80)	(542.30)	(507.80)	(507.30)	(515.80)	(528.10)	(536.50)	(535.50)	(534.50)	(533.50)	(532.50)
Vehicles, Housing, Production													
Vehicle Sales (Mils. Units)	12.30	13.00	12.10	12.40	13.50	14.60	14.20	14.00	14.10	14.70	15.20	15.50	15.40
Autos - Total (Mils. Units)	5.90	6.50	6.00	5.80	6.50	7.70	6.40	6.30	6.40	6.50	6.60	6.60	6.70
Light Trucks (Mils. Units)	6.30	6.40	6.10	6.70	7.00	6.90	7.80	7.70	7.70	8.20	8.60	8.90	8.70
Hous. Starts (Mils. Units)	0.54	0.58	0.57	0.62	0.66	0.70	0.70	0.70	0.74	0.80	0.84	0.88	0.91
Indus. Prod. (1997 =1.000)	0.92	0.93	0.93	0.94	0.95	0.96	0.97	0.99	1.00	1.01	1.01	1.02	1.02
Ann. % Chg.	3.10	4.80	0.70	6.10	3.30	4.40	4.90	5.70	5.20	4.70	1.10	1.10	1.10
Inflation and Wages													
GDP Price Defl. (% Chg.)	1.90	2.50	2.50	2.60	0.90	2.40	2.10	1.70	2.10	2.40	2.40	2.40	2.40
PCE Price Defl. (% Chg.)	1.90	3.90	3.30	2.30	1.20	2.30	2.10	1.80	2.20	2.60	2.50	2.50	2.70
PCE Core Price Defl. (% Chg.)	0.70	1.60	2.30	2.10	1.30	2.10	2.00	1.80	2.00	2.30	2.20	2.10	2.10
CPI-All Urban (% Chg.)	2.60	5.20	4.10	3.20	-	1.80	2.60	2.20	2.60	2.70	2.50	2.60	2.50
PPI-Fin Goods (%Chg.)	6.50	12.40	7.10	1.80	1.70	2.90	2.40	2.60	2.50	2.70	2.50	2.40	2.40
Hrly. Comp. (% Chg.)	0.10	2.50	4.30	2.80	2.90	1.20	4.80	2.80	3.00	3.10	3.20	3.20	3.20
Unemployment Rate (%)	9.60	8.30	9.10	9.10	8.70	8.30	8.00	7.90	7.80	7.60	7.40	7.30	7.20
Unit Labor Costs (% Chg.)	(1.60)	6.20	(0.10)	(2.50)	1.60	5.30	4.90	0.70	1.70	1.80	1.40	1.20	1.60
Productivity Growth (% Chg.)	2.20	(0.60)	(0.10)	2.30	0.30	3.10	(0.10)	2.10	1.30	1.20	1.80	2.00	1.60
Interest Rates (%)													
Fed. Funds	0.19	0.16	0.10	0.11	0.07	0.09	0.11	0.16	0.15	0.17	0.25	0.50	0.75
3-Mos Treas.	0.13	0.12	0.04	0.02	0.01	0.23	0.05	0.15	0.12	0.14	0.38	0.60	0.85
2-Year Treas	0.48	0.68	0.55	0.28	0.26	0.24	0.27	0.40	0.33	0.37	0.80	1.00	1.20
Prime	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.50	3.75
10-Yr. Treas	2.86	3.44	3.19	2.40	2.03	1.98	2.14	2.32	2.44	2.47	2.52	2.75	2.84
30-Yr. Treas	4.16	4.57	4.34	3.70	3.04	3.11	3.32	3.95	3.61	3.68	3.80	4.05	4.20

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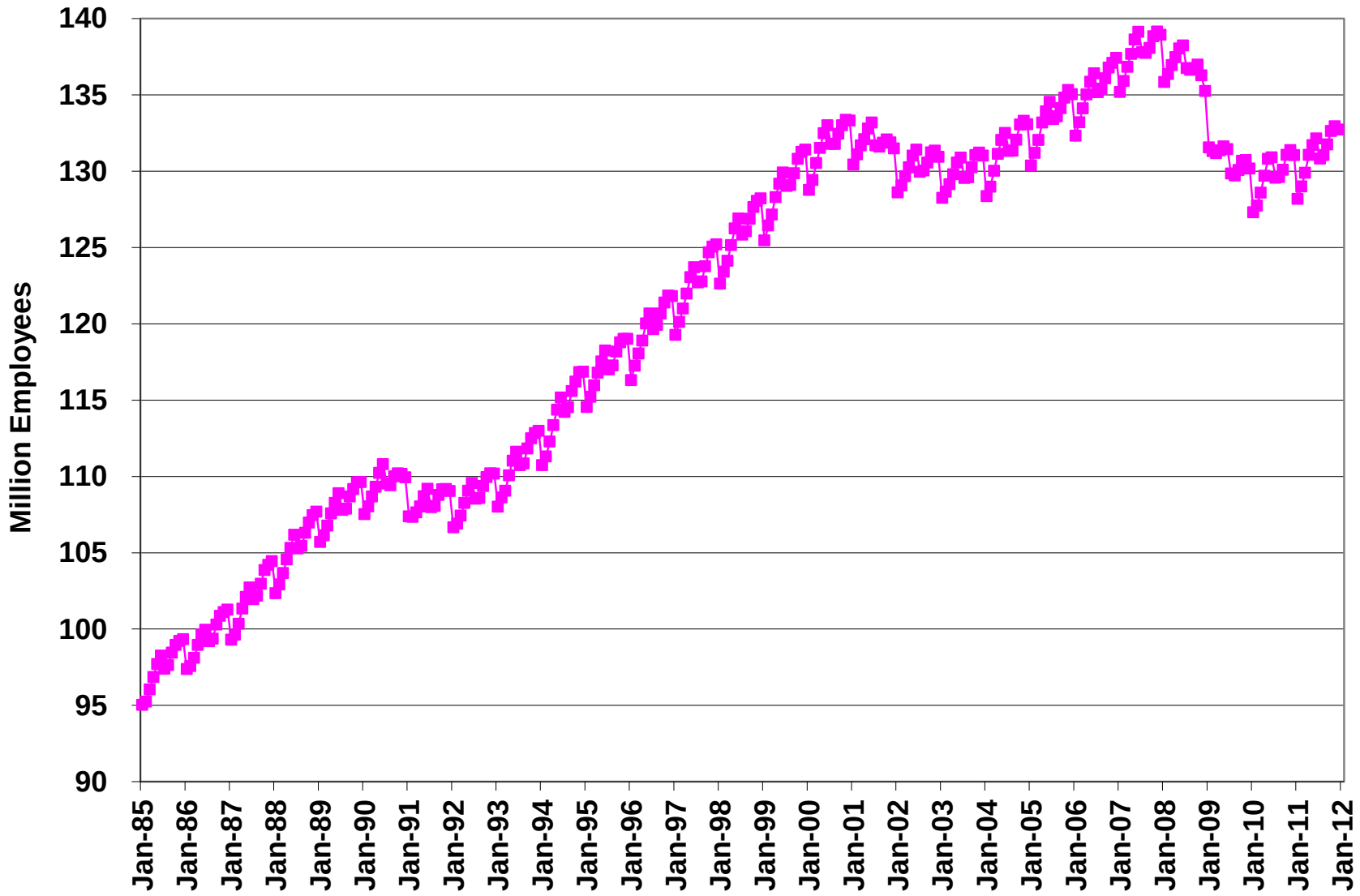
Figure 2: U.S. Non-Farm Payroll



Source: BLS

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- Federal government spending did not break the U.S. out of the slow growth pattern, but did expand the federal budget deficit and delay local governments from cutting staff.
    - Government spending cuts have decreased total government employment by 261 thousand since December 2010 and 1,071 thousand since May 2010.

- In an effort to balance its own budget, the federal government is reducing aid to state governments, and state governments are then reducing aid to local governments.
    - The 2009 federal economic stimulus (American Recovery and Reinvestment Act of 2009) that helped reduce state funding shortfalls, ended in 2011.
    - Meanwhile lower property values led to lower property tax revenues that have contributed to large local budget deficits. As shown in Figure 3, housing starts have not rebounded as expected. The end result is local governments are shedding jobs in unprecedented numbers, and heavy payroll losses are expected to persist into 2012.

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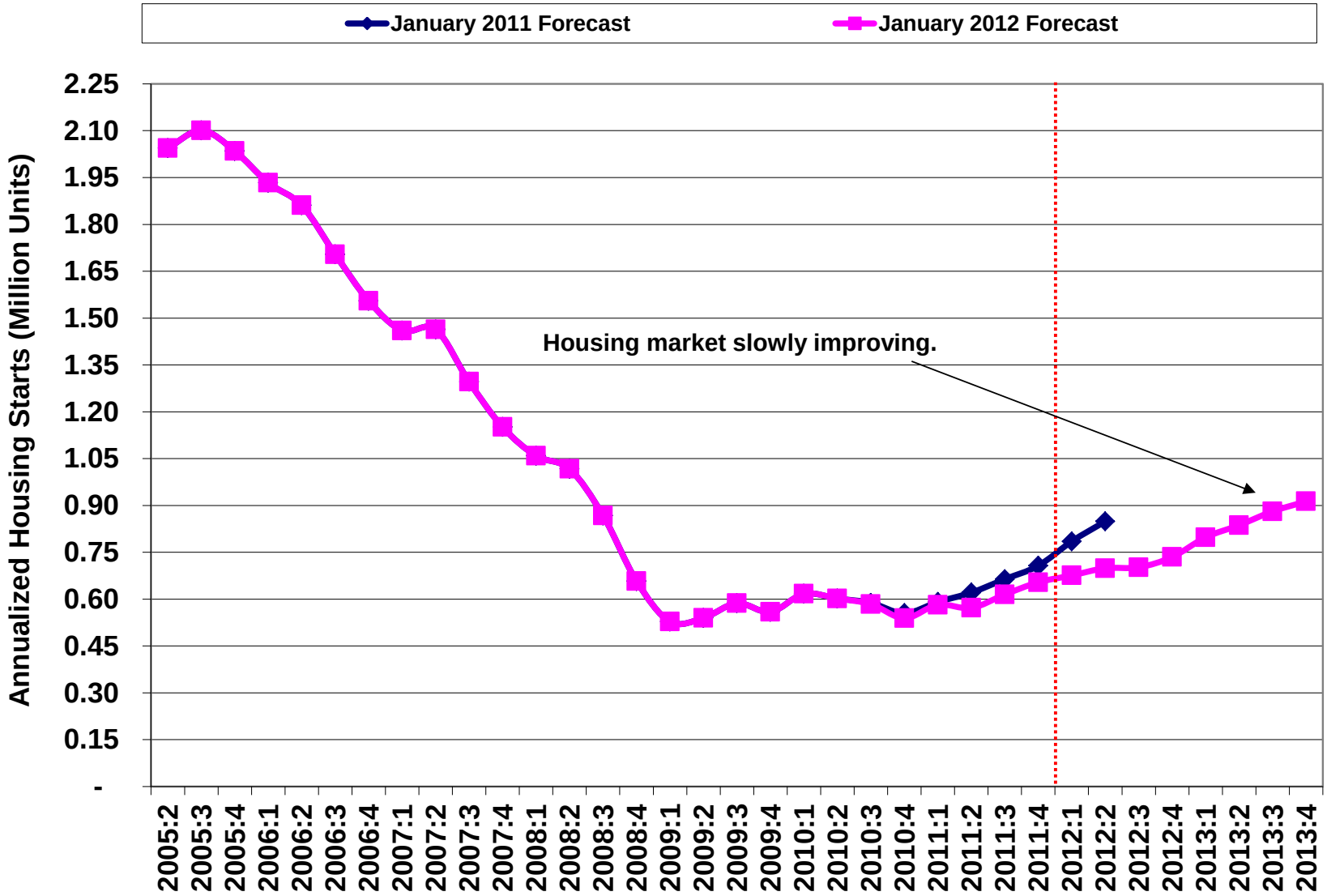
Figure 3: Quarterly U.S. Housing Starts Forecasts



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- The recession taught people to spend their money less freely, which reduces retail sales and increases savings. There are signs the purse strings are loosening, but spending is unlikely to return to prerecession levels in the foreseeable future.
    - Restaurant sales are increasing as people slowly spend more.

- For last six months, credit card balances have increased as shown in Figure 4. This indicates consumers are more comfortable with their personal situation and are willing to spend.
    - Non-revolving debt has increased continuously the last 16 months. The consumer spending reports mirrors the trend towards buying larger more practical purchases, such as a vehicle.
    - For 2012, the savings from the relatively warm winter combined with relatively less expensive natural gas and electricity will increase disposable income.

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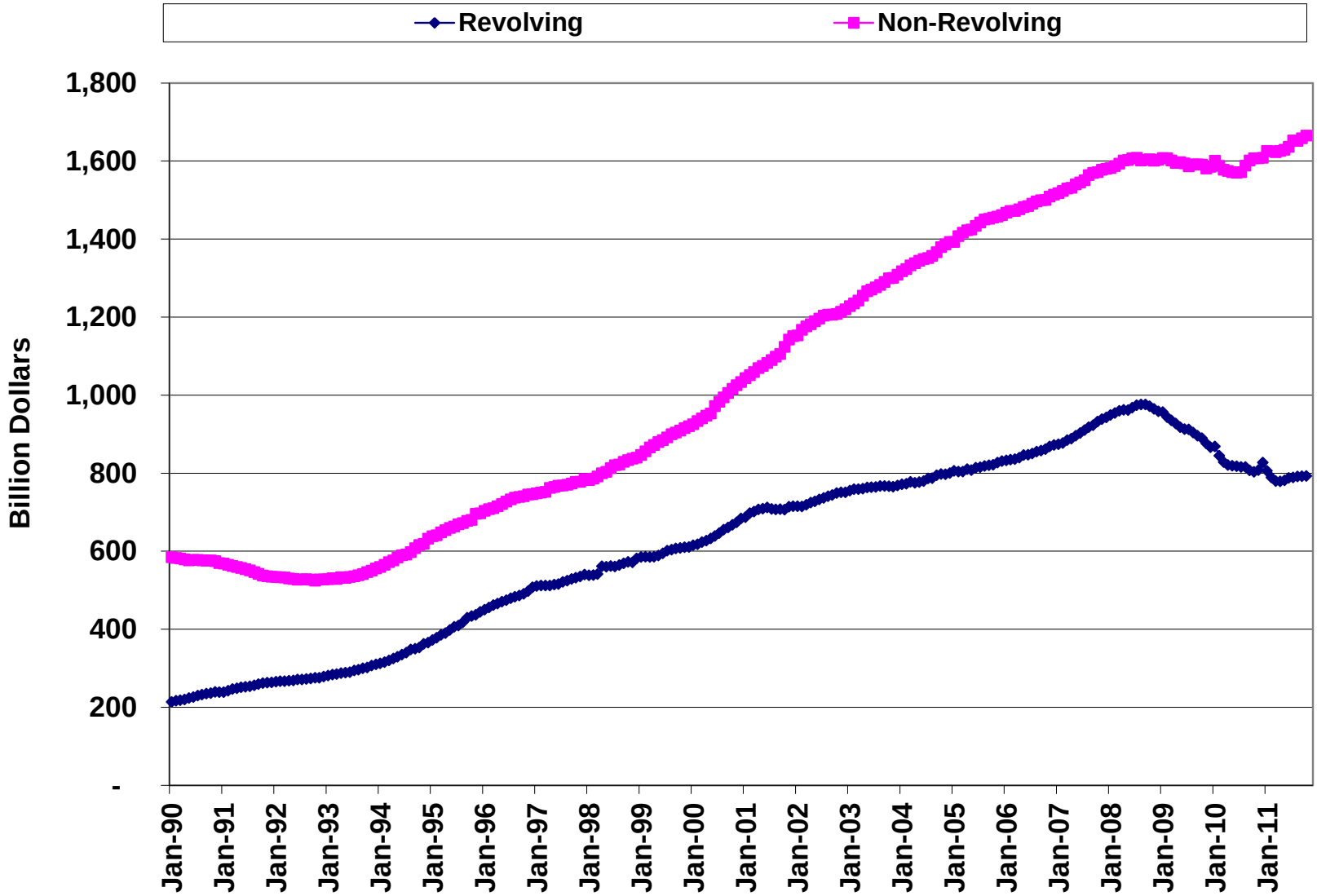
Figure 4: Revolving and Non-Revolving Debt



Source: Federal Reserve

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- Longer-term, individuals and companies have increased available money supplies that could sustain an extremely long period of economic prosperity.
    - For the economy to experience GDP growth above the 3% required to create enough jobs to account for a growing population, individuals and businesses that have capital need to have confidence in the future.

2. World

- The economic recovery remains unbalanced, with emerging countries experiencing strong economic growth and developed countries experiencing weak growth.
    - In developed economies, GDP is below potential with high unemployment and low GDP growth, which implies low growth into the future.
        - In many countries, especially the U.S., the housing market is depressed.
    - The macro economic situation for the world is similar to the U.S. for developed countries as shown in Table 8.

- The positive news is for industries involved with commodities in emerging countries, such as Brazil, Argentina, Russia, India, Indonesia and China, which are experiencing GDP growth above 3.5%. China is experiencing GDP growth of 7.4% to 10.4%, which has slowed to the lower end of this range.
    - As the wealth of individuals expands, demand for basic commodities increases and has in turn triggered price increases. Over the last ten years, demand for iron ore, coal, petroleum, meat, clothing, oilseeds, oilseed products, grains, fruit and vegetables has greatly increased. For this reason, commodity industries are focused on developments in Asian markets, with particular emphasis in China.

- Commodity price increases are reflecting a combination of strong demand growth and supply interruptions.
    - For emerging economies, where the consumption of food and fuel is a large share of GDP, commodity price increases are a major source of concern.
        - Despite inflation concerns, governments of some important developing countries are reluctant to import large quantities of grains and meats.
        - The preferred course of action is to remain self-sufficient until inflation concerns force governments to allow their respective currency to appreciate or open up to imports.

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Table 8: World Economic Projections

	Real Growth (1) (Percent Change)					Inflation - Consumer Prices (2) (Percent Change)				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
United States	(3.5)	3.0	1.7	2.2	2.5	(0.3)	1.6	3.2	2.3	2.5
Canada	(2.8)	3.2	2.5	2.5	2.6	0.3	1.8	2.5	2.2	2.0
United Kingdom	(4.9)	2.1	0.8	0.2	1.3	2.2	3.3	4.5	2.6	1.1
Europe	(4.0)	1.7	1.5	(0.5)	0.9	0.2	1.5	2.4	1.8	1.6
Asia - Pacific	(4.1)	3.7	-	1.0	1.7	(0.7)	-	0.2	0.4	0.7
Newly Industrialized Countries	(0.7)	8.4	4.6	3.4	3.7	1.3	2.4	3.8	2.6	2.5
Latin America	(2.1)	6.1	4.3	3.6	3.8	7.2	7.4	7.2	7.1	6.4
World	(1.9)	4.4	2.9	2.5	2.9	1.3	2.7	3.5	2.8	2.7
OECD	(3.8)	2.9	1.6	1.5	2.0	0.3	1.7	2.6	2.0	2.0
EU	(4.1)	1.9	1.4	0.4	1.1	0.7	1.8	2.8	2.0	1.6
Eurozone	(4.0)	1.6	1.6	(0.6)	1.1	0.3	1.6	2.7	1.7	1.7
Asia-NICs, Emerging	6.5	9.3	7.6	6.6	6.4	1.7	4.5	5.0	3.5	3.3
Russia	(7.8)	4.0	4.3	4.5	4.2	11.8	6.9	9.4	9.9	8.5
Emerging Asia	7.9	9.6	8.2	7.3	7.0	1.8	4.9	5.3	3.7	3.4
China	9.2	10.4	9.3	8.0	7.4	(0.7)	3.3	4.4	2.6	2.4
India	9.1	8.8	7.6	7.5	7.3	10.9	12.0	8.6	6.7	6.5
Indonesia	4.6	6.1	6.0	5.1	5.5	4.4	5.1	6.8	7.0	6.2
Malaysia	(1.6)	7.2	4.2	3.8	4.5	0.6	1.7	3.5	2.7	2.5
Philippines	1.1	7.6	4.4	4.1	4.3	3.2	3.8	5.6	4.6	4.2
Thailand	(2.3)	7.8	3.5	3.2	3.8	(0.8)	3.3	3.7	2.3	2.5
Middle East	2.5	5.0	4.9	4.3	3.7	7.1	6.8	3.8	4.3	4.3
South Africa	(1.7)	2.9	4.3	4.7	4.4	7.1	4.3	4.4	7.5	7.6

(1) Real GDP

(2) Annual averages

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B. Baseline Crop Assumptions

This section includes Informa's assumptions developing the long term crop supply and demand outlook.

- Open trade policies continue that allow countries to import and export.
- For 2011 through 2013, the crude oil price averages $87 per barrel. For 2014 through 2020, the crude oil price averages $82 per barrel. This assumption anticipates a steady dollar in terms of a reasonable degree of stability in exchange rates with other major convertible currencies.
- No major changes in the U.S. renewable fuels policy.
- World meat demand will continue to increase as large populations within developing countries become wealthier.
- U.S. available acreage is already in production as shown in Figure 5.
- Southern Africa has social issues that will prevent the expansion of corn production within the next five years.
- Argentina and Brazil have available crop acreage that is not in production.
- Argentina and Brazilian farmers export crops out of the country quickly because:
    - Lack of adequate storage;
    - Lower hedging opportunities; and
    - Political risk involving policy.

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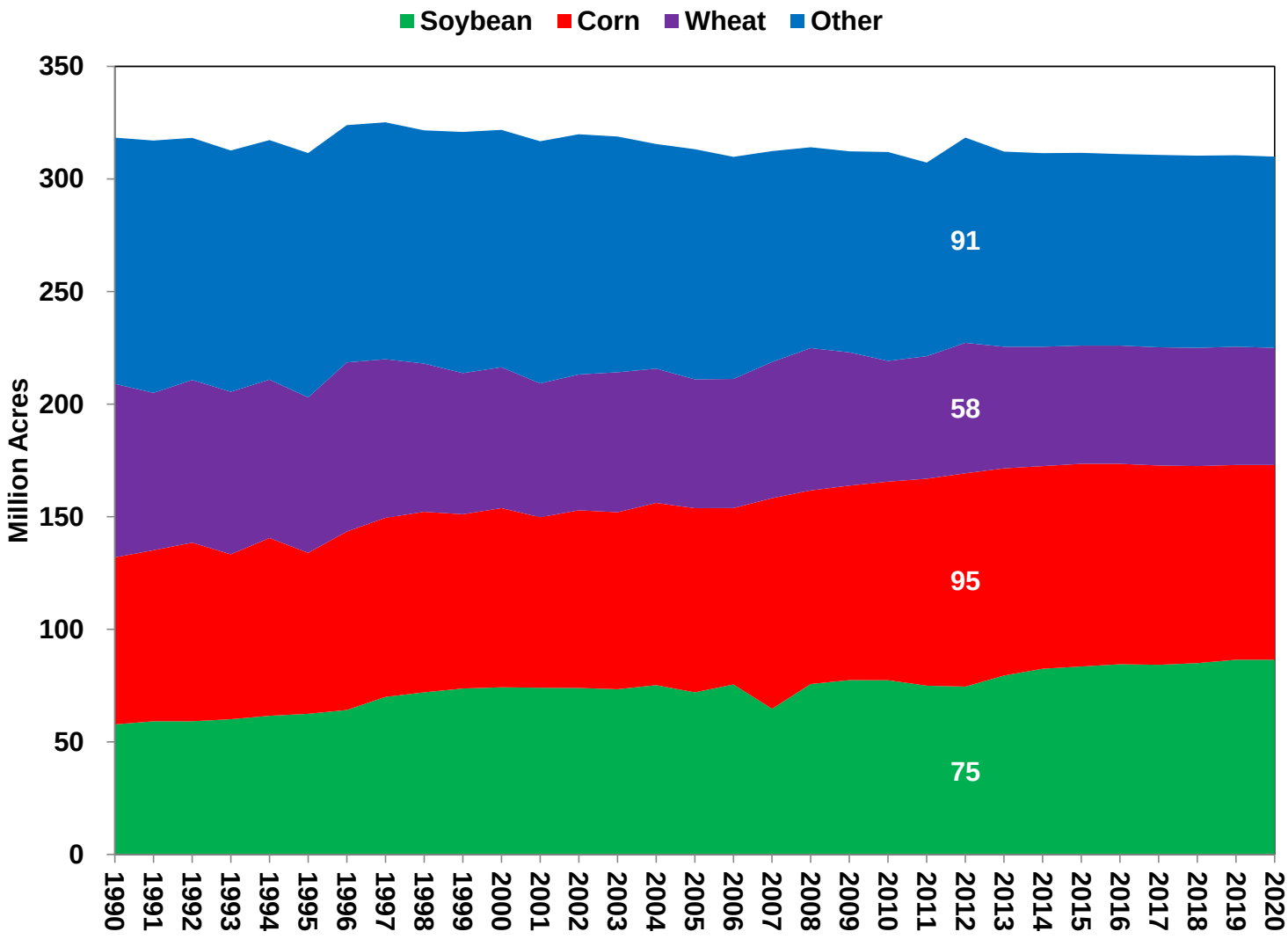
Figure 5: U.S. Planted Acreage



Source: USDA (History) and Informa (Forecast)

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1. Informa Crop Balance Sheets

- Informa's crop balance sheets were derived from a data set that includes detailed supply and demand situation and outlook for each individual grain and oilseed crop by country, and relative net returns to the farmer as shown in Figure 6.
    - Trade is based on production surplus or deficit for a particular crop. For example, if the relative crop prices encourage the farmer to plant more corn in Argentina, then Argentina will have more corn to export or build ending stocks.
    - Prices will reach a level to either increase consumption/decrease production or decrease consumption/increase production.
    - The advantage of this methodology is that it provides constraints to the forecasts and establishes a methodology that continuously adjusts the market projections toward a state of equilibrium.

- Throughout the forecast farmers in the U.S. will be rewarded to plant corn and soybeans over planting wheat.

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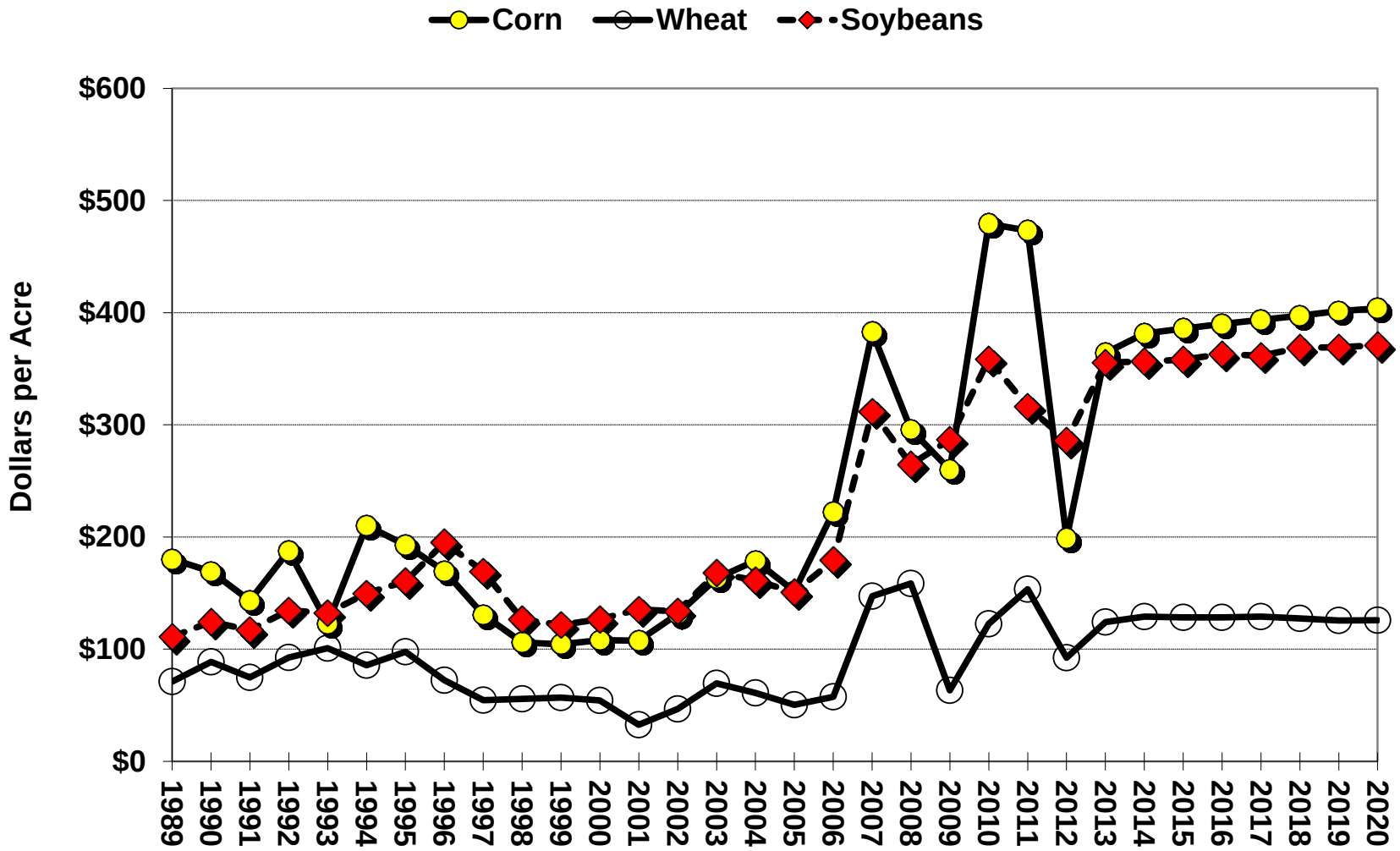
Figure 6: U.S. Major Crop Aggregate Net Revenue



Source: USDA (History) and Informa (Forecast)

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a) CORN

- U.S. planted corn acreage is expected to decline to 86.5 million acres in 2020 as shown in Figure 7.
- By the 2020 crop year, U.S. corn yields are expected to reach 186 bushels per acre, up 21% from 147 in 2011.
- U.S. corn production is expected to average 14.1 billion bushels over the forecast period.
- Feed use is expected to increase by 1,090 million bushels over the forecast period to 6,830 billion in 2020 while ethanol consumption increases 250 million bushels, capping at 5.35 billion in 2015.
- Over the next ten years, U.S. corn exports are expected to increase 490 million bushels to 2,140 billion in 2020.

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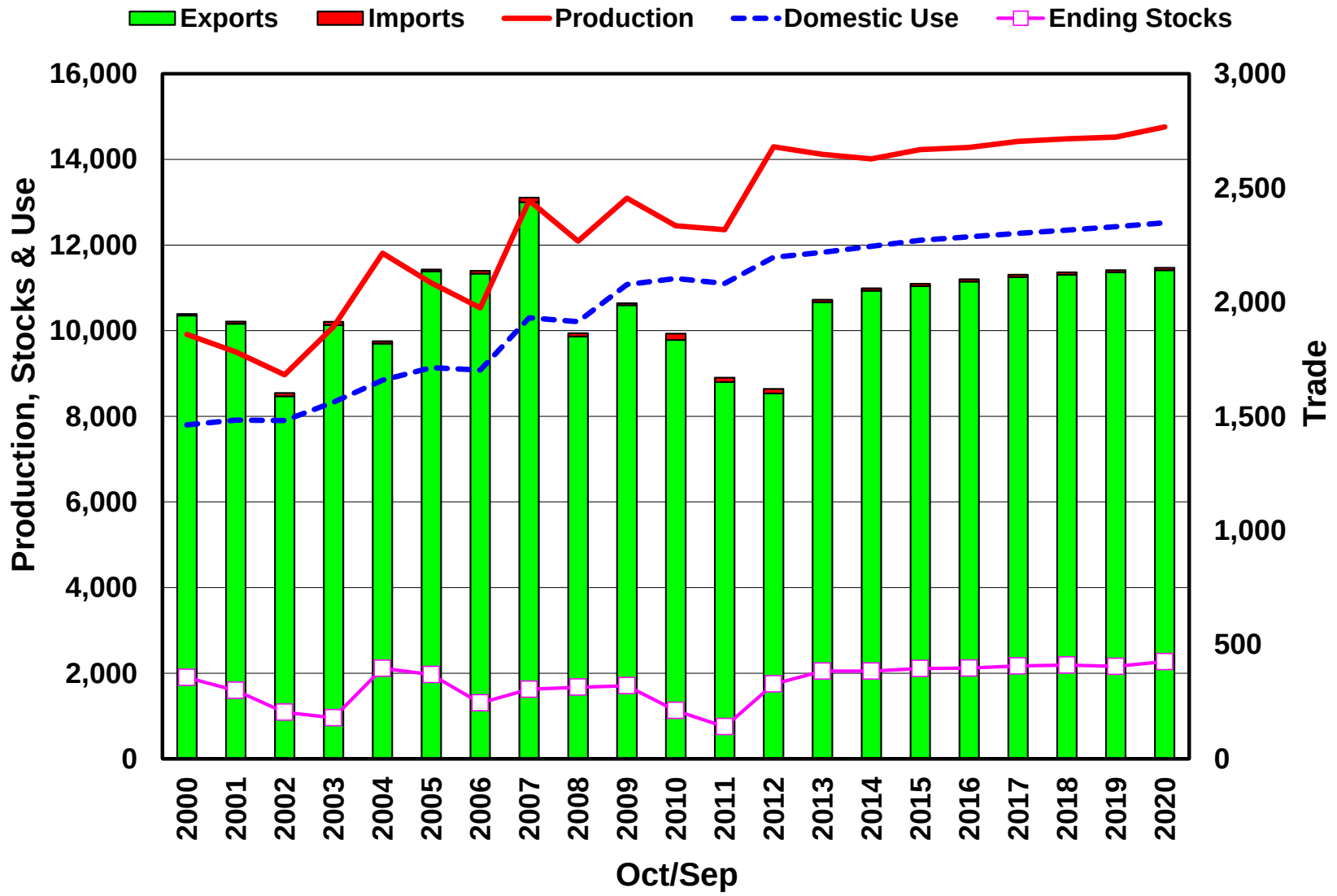
Figure 7: U.S. Corn Supply and Demand (million bushels)



Source: USDA and Informa

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(1) ETHANOL

- U.S. ethanol mandate for corn based ethanol peaks at a level of 15 billion gallons in 2015 (or the equivalent of 5.4 billion bushels of corn).
- The vast majority of ethanol imports are produced from sugarcane in Brazil.
- However, recent ethanol export volumes portray future potential for discretionary volumes in excess of the corn-based ethanol allocation.

(2) DISTILLERS DRIED GRAINS WITH SOLUBLES (DDGS)

- DDGS is a co-product the ethanol manufacturing process. It is a highly valued component of livestock feed rations.
- U.S. DDGS production is expected to reach 46.5 million tons in 2015.
- While Chinese corn imports are limited by internal policy, U.S. DDGS exports to China have been increasing.
- After 2015, DDGS production is expected to remain steady, consistent with corn consumed for ethanol production being capped.

b) WHEAT

- U.S. wheat acreage is expected to remain in a tight range, with little incentive to expand. Any increase is in response to shortages throughout the world.
- U.S. wheat yields are not increasing as much as other crops. Wheat is grown continuously on marginal land.
    - As a result, U.S. wheat production is likely to decrease over the forecast period.
- Over the next ten years, U.S. wheat exports are expected to be on the order of 1 billion bushels annually.

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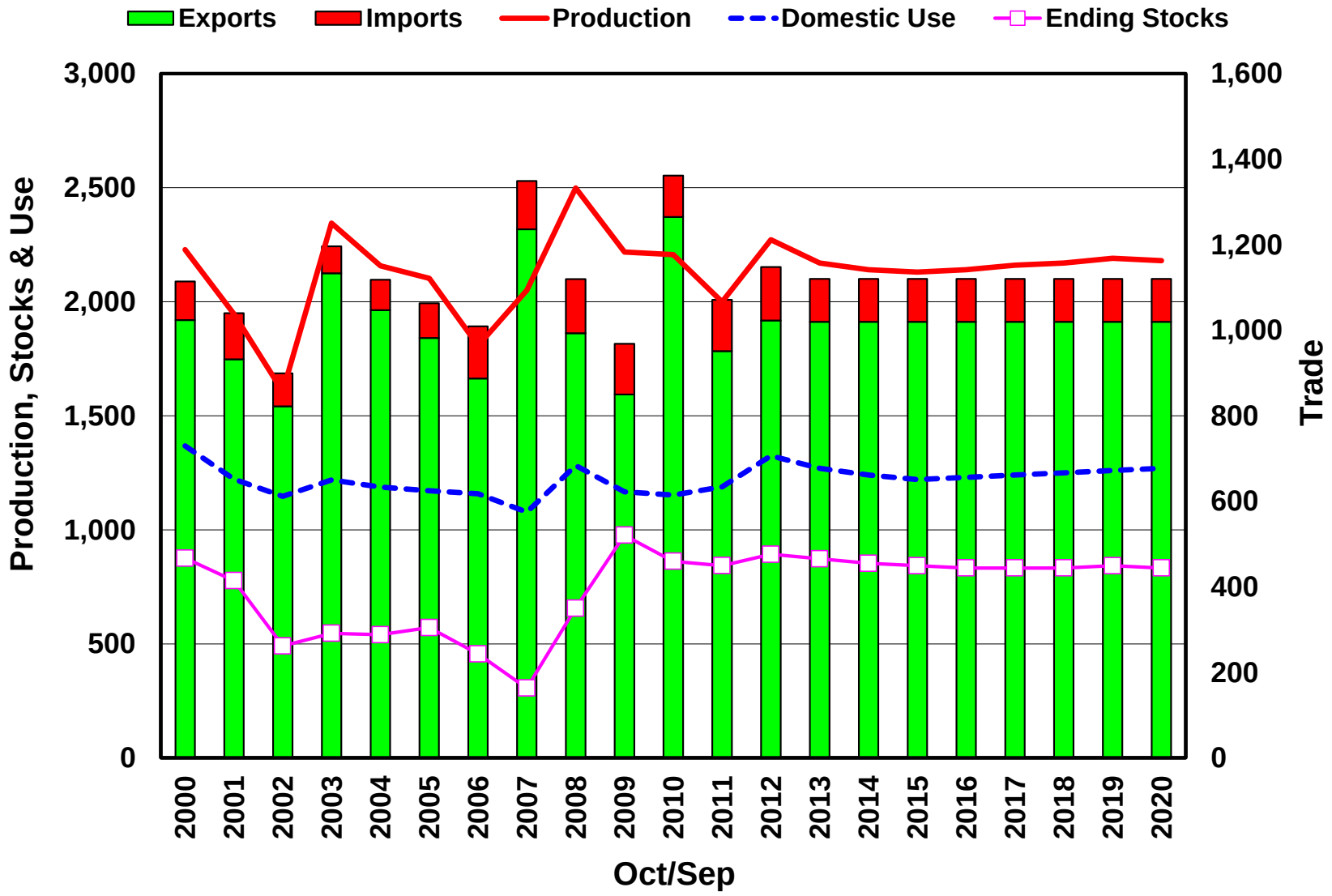
Figure 8: U.S. Wheat Supply and Demand (million bushels)



Source: USDA and Informa

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c) BARLEY

- U.S. barley planted acreage is expected to remain under 3 million acres, and yields are expected to remain below 76 bushels per acre throughout the forecast period.

- Barley that can be grown to malting quality returns profit that is competitive with corn and soybeans. Feed quality barley is losing acreage to corn and soybeans.

- Barley required for brewing and other food processes is limited.

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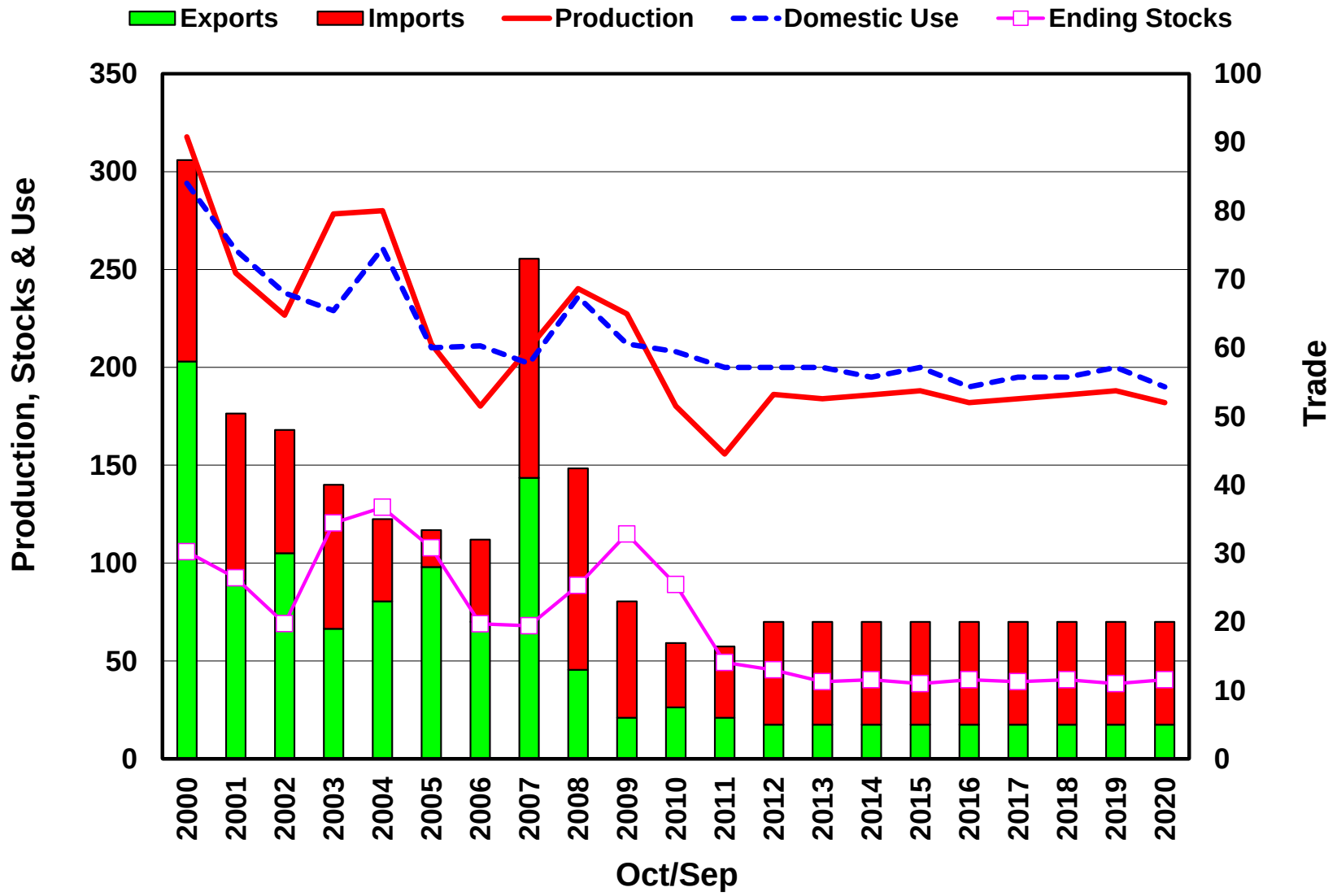
Figure 9: U.S. Barley Supply and Demand (million bushels)



Source: USDA and Informa

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d) OATS

- U.S. oats planted acreage is expected to decline over the forecast period.
    - Oats yields have not increased as quickly as corn and soybeans.
        - Oats have become a niche market.

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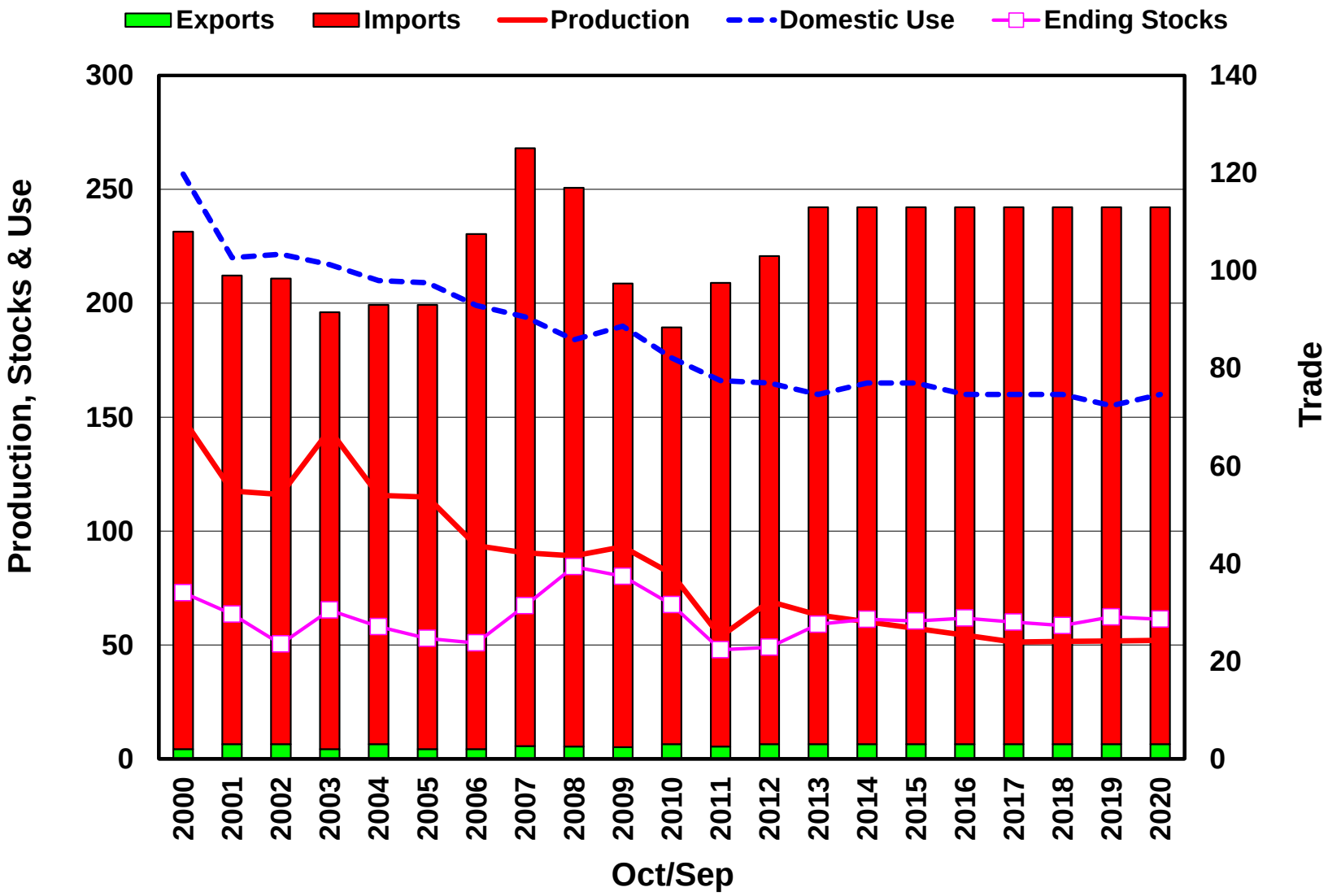
Figure 10: U.S. Oats Supply and Demand (million bushels)



Source: USDA and Informa

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e) SOYBEANS

- U.S. soybean planted acreage is expected to increase 11.5 million acres over the forecast period.
- U.S. soybean yields are expected to increase 7 bushels per acre or an increase of 17%.
- Expected soybean production increases are forecast to exceed 1.1 billion bushels over the forecast period.
- Soybean crush and exports are expected to increase 200 million bushels and 925 million, respectively, from the baseline year of 2011 through to 2020. That translates into increases of 12% over the period for the volume crushed and 76% in exports. Soybean exports will be used to fulfill China's appetite to crush soybeans domestically.
- Listed below are events that have influenced soybean crush margins as shown in Figure 11.
  - In early 1990s, Russia stopped importing grains.
  - A recession occurred in 1991.
  - A world decline in coarse grain production in 1995. China stopped exporting corn in 1994 and 1995.
  - Normal crop yields from 1998 through 2001 coupled with lower world demand.
  - A continual increase in palm oil production led to a glut of oil and lower prices.
  - A consolidation of the world oilseed crushers during the 1990s and early 2000s resulted in a more disciplined industry.
  - In 2005, the trans-fat issue started shifting oil demand away from soybean oil.
  - World biofuel policies combined with U.S. ethanol policies started to significantly increase corn and oil demand yearly from 2005 to present.
  - From 2006 through 2007, the world experienced wheat crop failure in several nations.
  - Record energy prices result in higher biofuel demand for corn and oilseeds in 2008.
  - Worldwide recession starting in 2007 and financial crisis in 2008, combined with record commodity prices, lowered world commodity consumption.
  - Barring a collapse in crude oil prices back to $30 per barrel, soybean crush margins will remain in the 35 cent to 90 cent per pound trading range.

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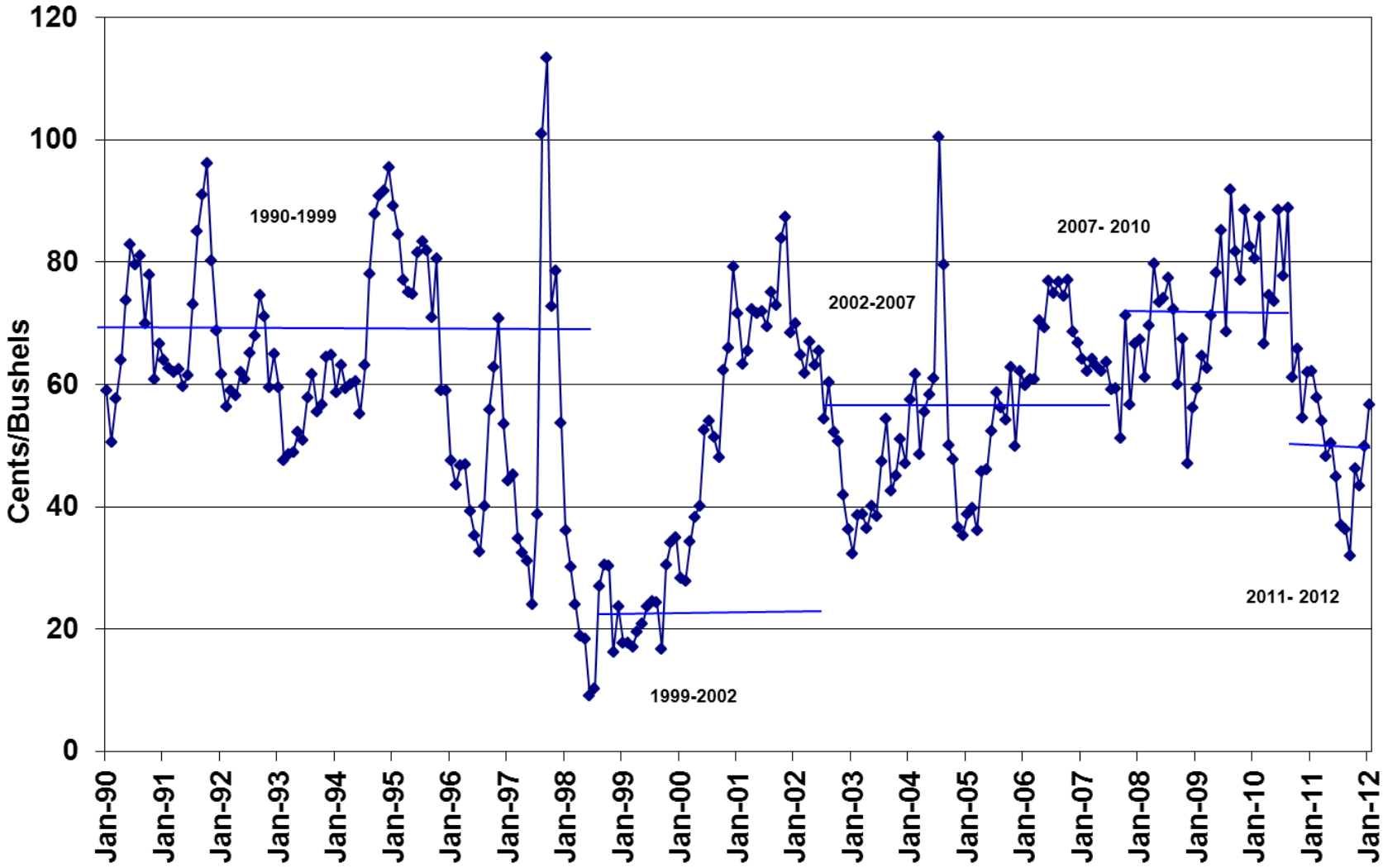
Figure 11: Historical CBOT Nearby Futures Soybean Crush Margins



Source: CBOT

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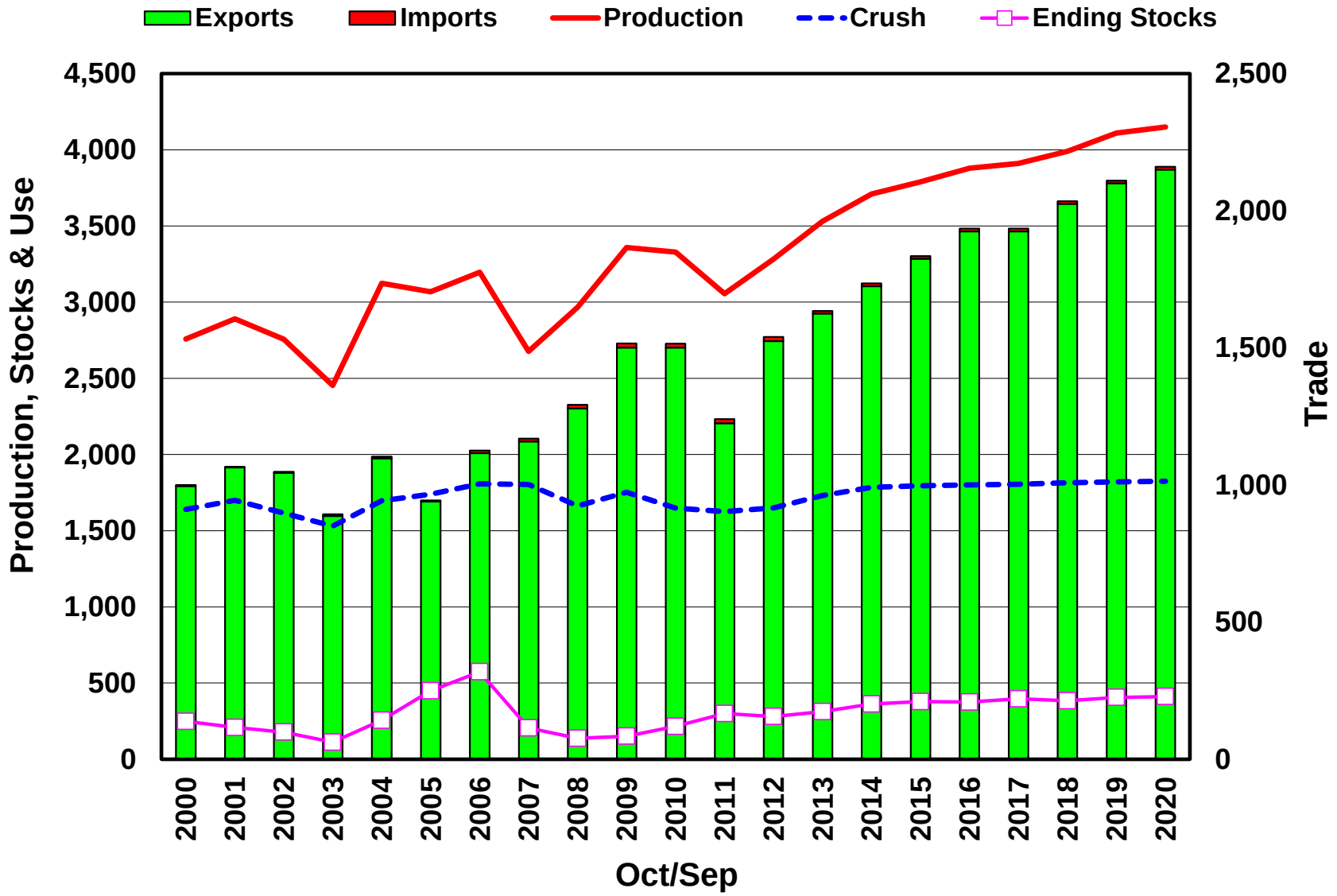
Figure 12: U.S. Soybean Supply and Demand (million bushels)



Source: USDA and Informa

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(1) SOYBEAN PRODUCTS

- U.S. biodiesel mandate is driving the increase in oilseed crush.
  - The mandate is increasing to 1.28 billion gallons in 2013. The 280 million gallon increase represents a vegetable oil and animal fat demand increase of 2.1 billion pounds.
  - Biodiesel production consumes 4.8 billion pounds of vegetable oil, of which 3.7 billion pounds soybean oil, equivalent to 21% of total soybean oil consumption.

- World demand for vegetable oil is increasing as the world population becomes wealthier. In 1974 world GDP per capita in constant U.S. dollars based on the year 2000 was $3,620 and in 2007 had risen to $6,029,[2] while vegetable oil consumption rose from 6.3 kg/capita/year to 11.4 kg/capita/year as food from 1974 to 2007[3] or not quite doubling.
  - The increase in crush to meet vegetable oil demand is expanding the amount of soybean meal available for domestic feeding and exports.

- Oilseeds that are higher in oil content, such as canola, are benefiting from the high oil price versus meal price.

- Soybean oil usage in food products has declined from 16.3 billion pounds in 2000 to 14.2 billion in 2010 while biodiesel usage increased from 63 million in 2000 to 2.6 billion in 2010.
  - The trans-fat issue that lowered soybean oil consumption is no longer a major issue. This will allow soybean consumption to increase.

- Throughout the forecast period, soybean oil production will increase as domestic use and exports do the same. Ending stocks will remain stable as the U.S. exports excess production.

[2] World Bank, World Development Indicators, Global Development Finance, http://databank.worldbank.org/databank/download/WDIandGDF_csv.zip
[3] FAO, FAOSTAT http://faostat.fao.org/site/368/DesktopDefault.aspx?PageID=368#ancor

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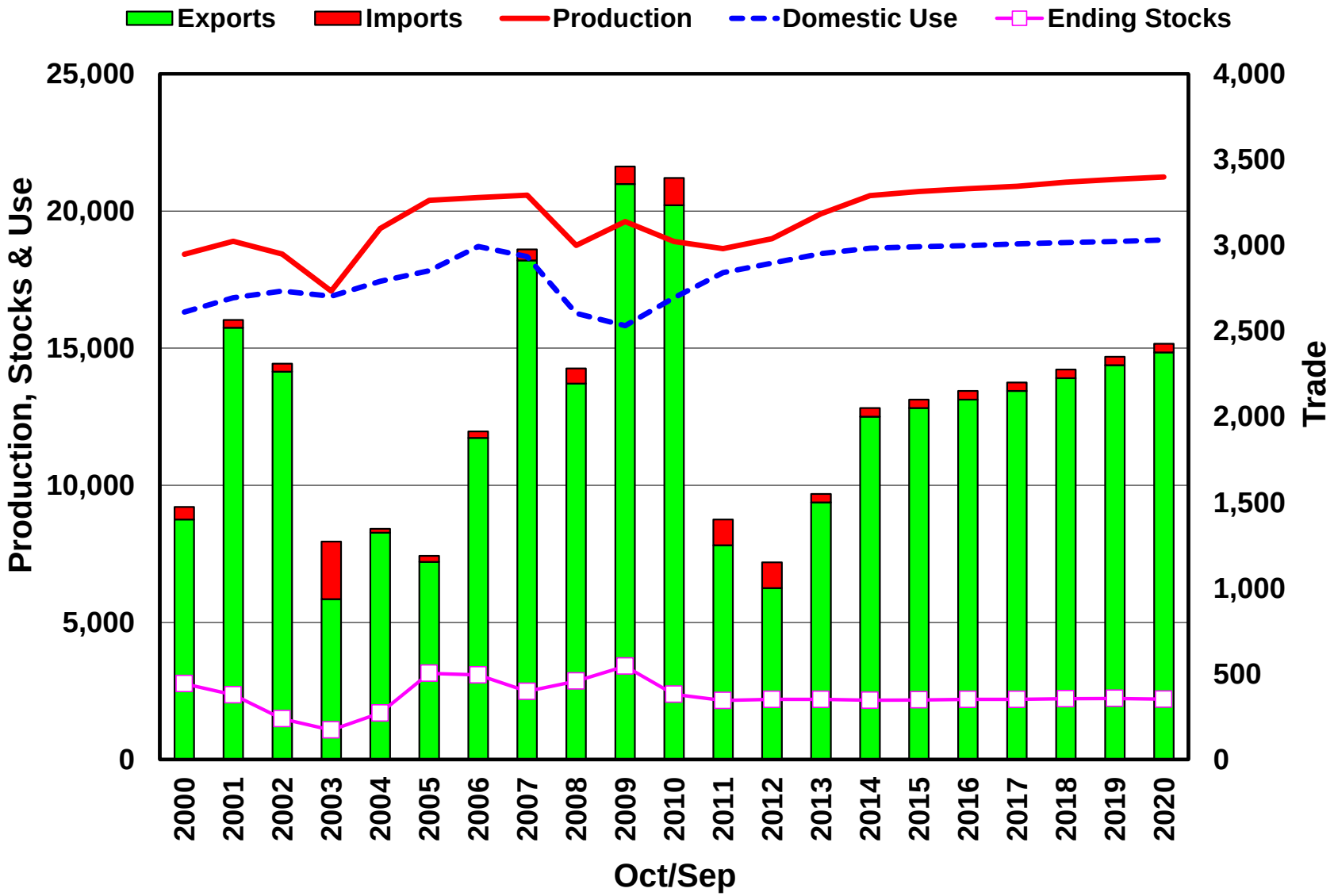
Figure 13: U.S. Soybean Oil Supply and Demand (million pounds)



Source: USDA and Informa

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- The U.S. will continue to be a large soybean meal exporter.
    - Exports are forecast to increase by 2.4 million short tons, reaching 11 million by 2014 before declining to 8.5 in 2020. Exports will decline as domestic use increases as animal numbers rebound.

- Domestic soybean meal usage is expected to increase approximately 5 million tons from 31 million in 2011 to 36 million in 2020. Over the next 10 years, the U.S. soybean meal demand is expected to increase by 15%.
-
    - Increases in canola meal and DDGS production are replacing corn and soybean meal in feed rations.

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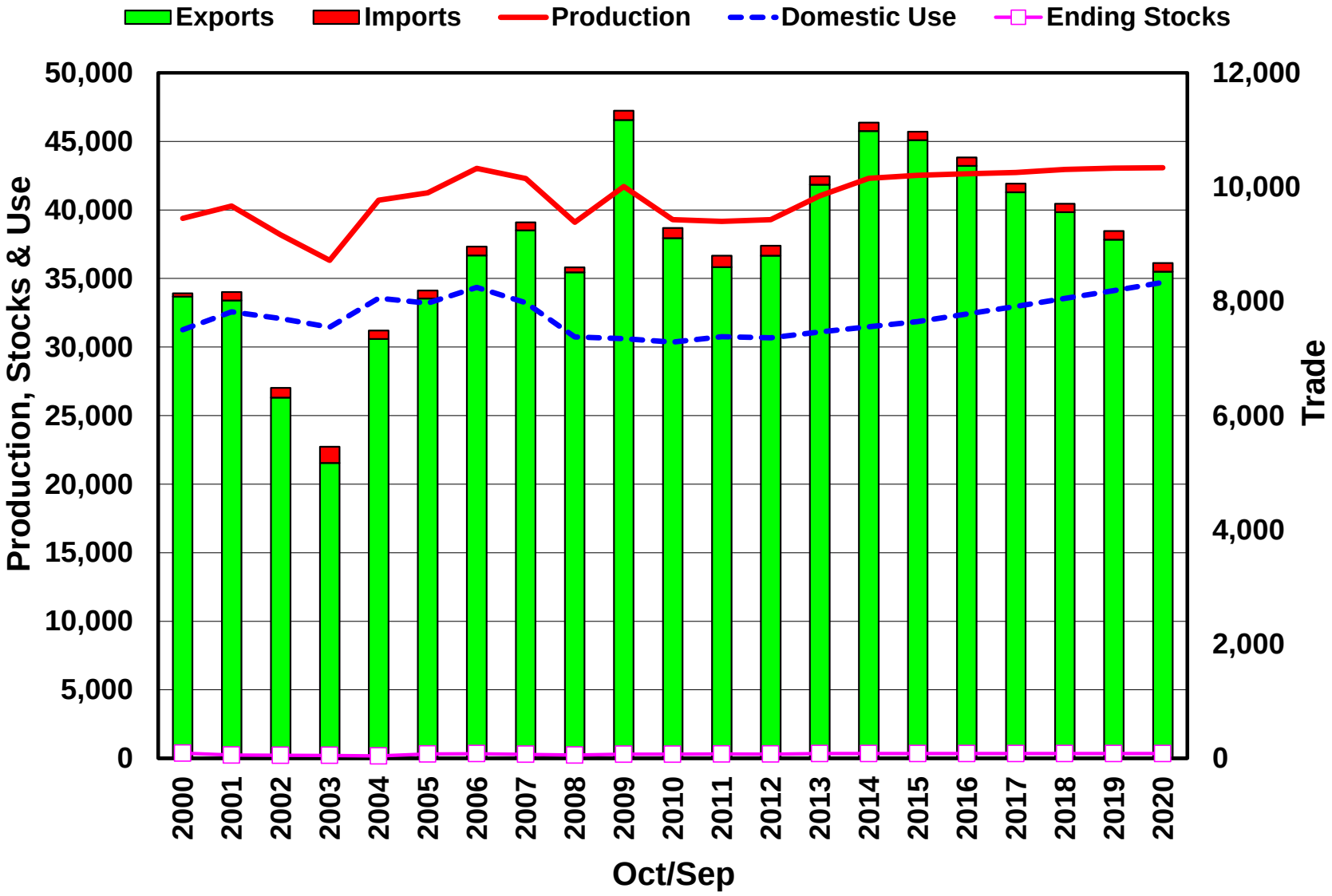
Figure 14: U.S. Soybean Meal Supply and Demand (thousand tons)



Source: USDA and Informa

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2. Major Importing Countries

- U.S. barley exports to any one country are less than 500 thousand MT.

- U.S. oat imports primarily come from the Netherlands and Canada.

- U.S. corn exports are largely shipped to Asia and Mexico.
  - The two largest importers are Japan and Mexico.
    - Japan is a developed country with a declining population.
      - Corn import levels are declining.
  - In crop year 2011, China has imported a significantly higher level of corn than in the last ten years.
    - Increasing corn imports are offsetting export declines in Japan and South Korea.
    - Corn traders are closely monitoring whether China buying corn is a one year aberration, an acceptance that a minimum level of imports are necessary, or a mirror of soybean import patterns.
    - Once China's policy allowed soybean imports, China's soybean imports exploded and changed world trading patterns.
    - Informa believes China will accept a minimum level of corn imports as a necessity, but still attempt to remain nearly grain self-sufficient.
      - China does not want U.S. corn to become a trade negotiation tool. China still remembers the U.S. grain embargo of the former U.S.S.R. in the late 1970s.
  - The South Korean, Colombian and Panamanian trade agreements will improve agricultural exports. South Korea will be able to import more pork products from the U.S.

- U.S. soybean trade is dominated by China as shown in Figure 19.
  - In crop year 2010, China accounted for 60% of U.S. soybean exports.
  - China is also buying South American soybeans, which creates an export surge between the U.S. and South American harvest periods.

- China's buying of soybeans is creating optimism for other agricultural products, such as corn and pork.

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Figure 15: World Soybean Production and Net Trade, 2010

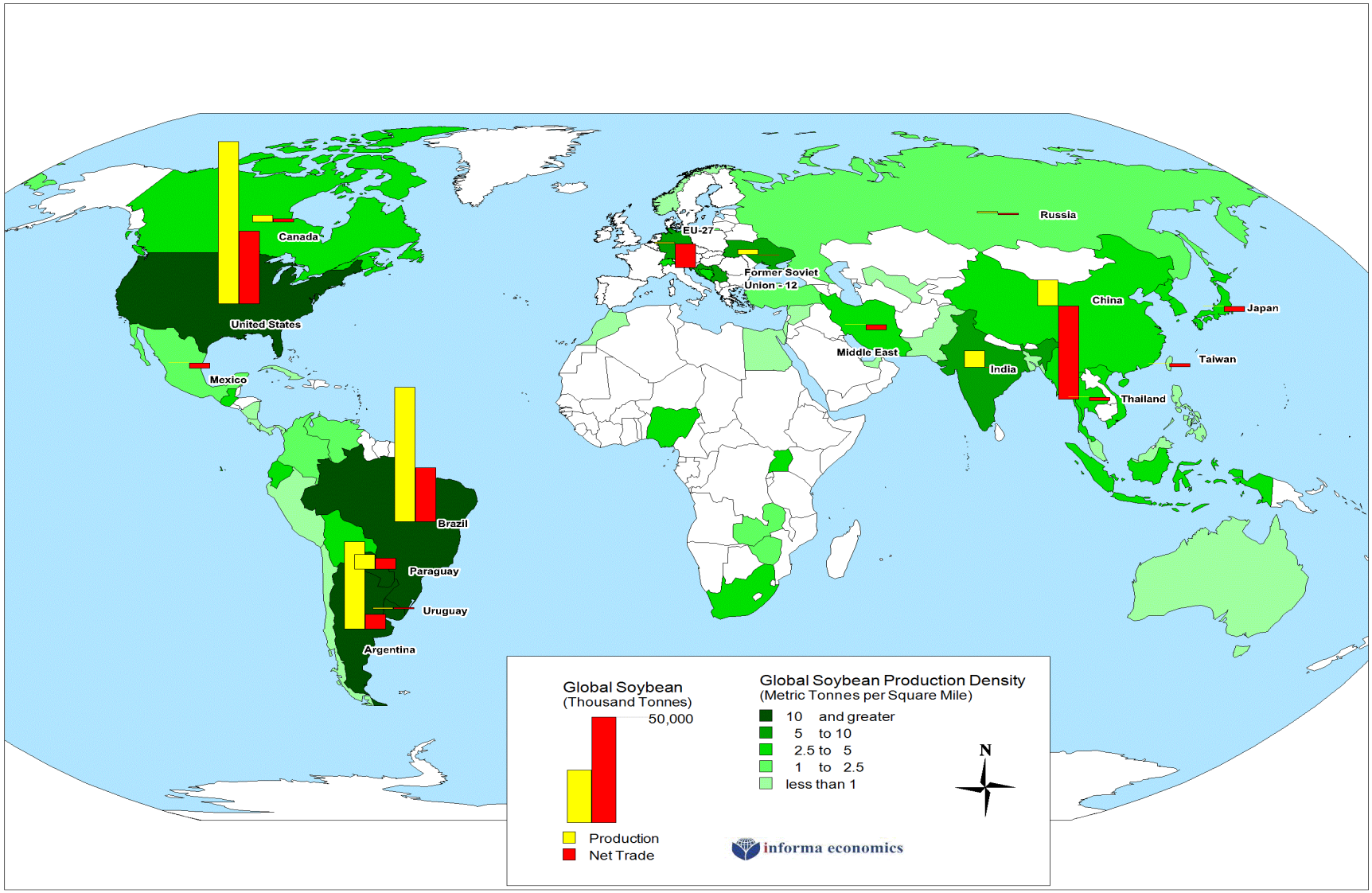

Figure 16: World Soybean Meal Production and Net Trade, 2010

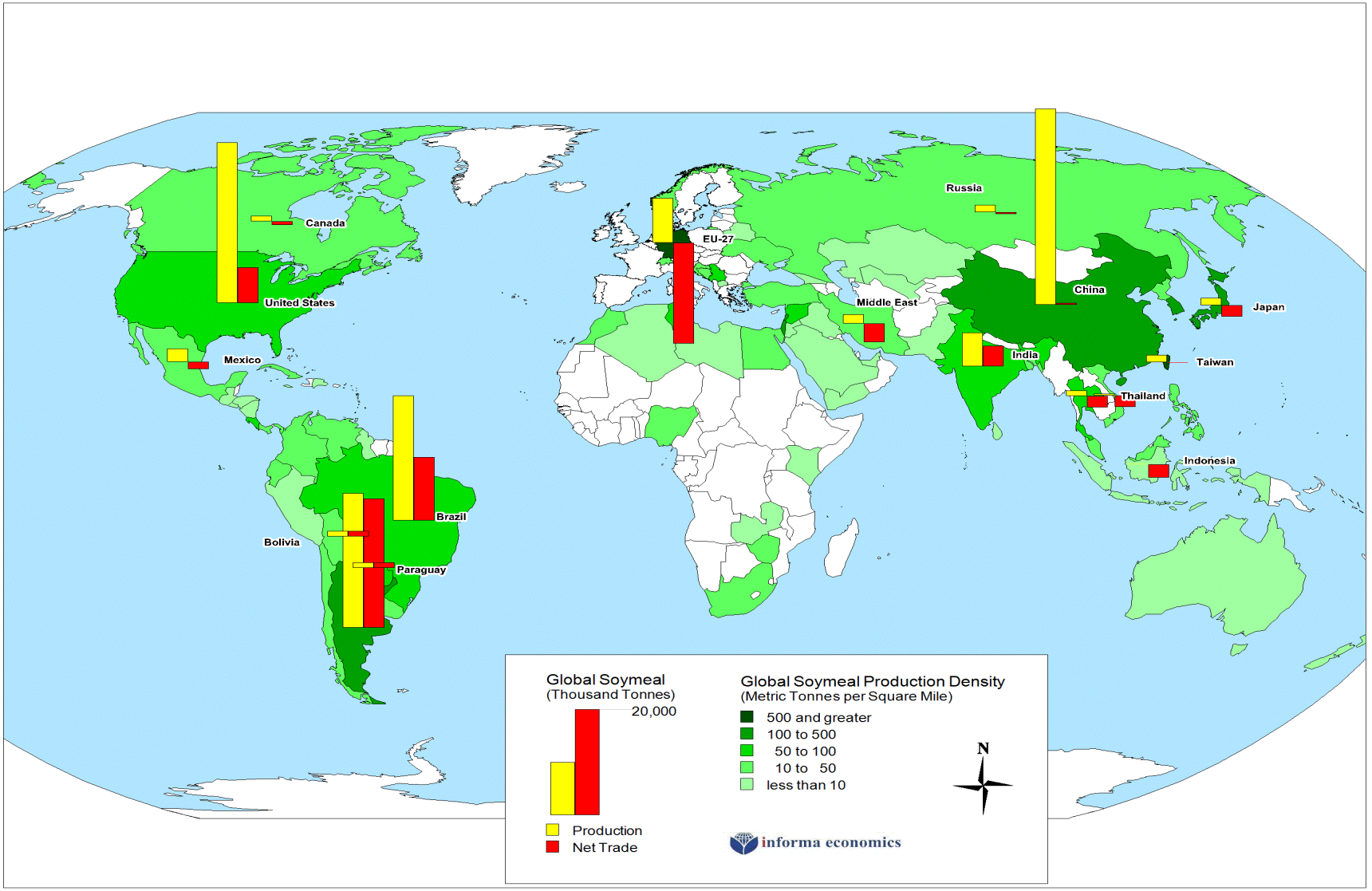

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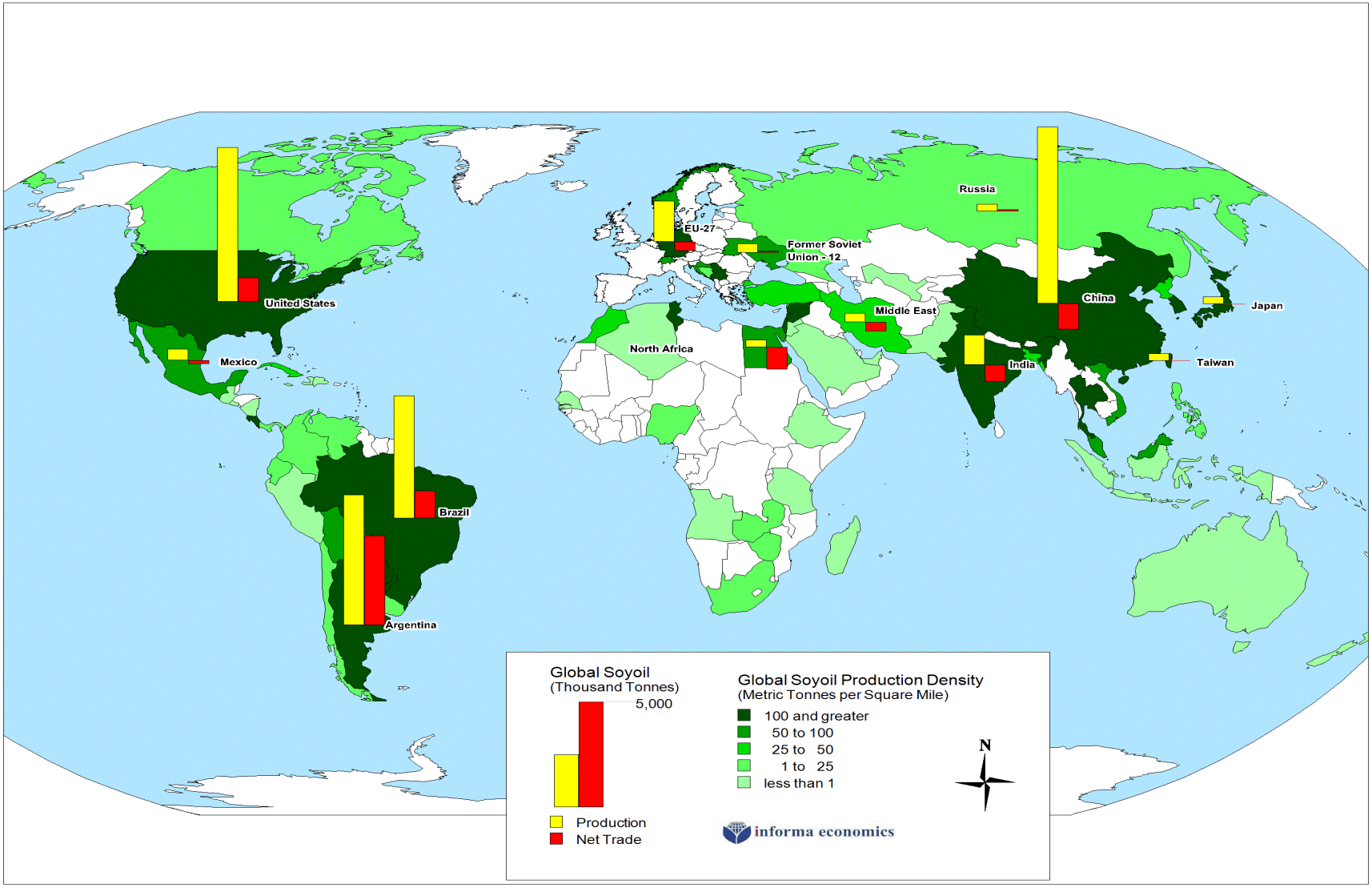
Figure 17: World Soybean Oil Production and Net Trade, 2010



- U.S. soybean meal exports are largely shipped to Canada and Mexico.

- The U.S. biodiesel mandate is reducing the amount of oil available for export.
    - Crop year 2011 soybean oil exports are expected to decrease 884 thousand MT or 61%.

- China corn acreage is expected to increase slightly at the expense of other crops in an attempt to remain grain self-sufficient.

- China domestic consumption of corn is continuing to increase as the population becomes wealthier and in turn, consumes more meat and processed products.
    - The government is attempting to curtail the rate of economic growth to prevent inflation.
        - Increasing commodity imports will shrink inflation.
        - Pork is the main dish in China and the increasing price of pork is a major area of concern for the Chinese government.
            - China could meet domestic pork demand by increasing pork imports and in turn, reduce domestic corn consumption.
            - China could grow the domestic pork industry, which would increase demand for corn.
                - Historically, China's policy was to develop markets to create jobs. For example, China imports soybeans and crushes them domestically instead of importing soybean products.

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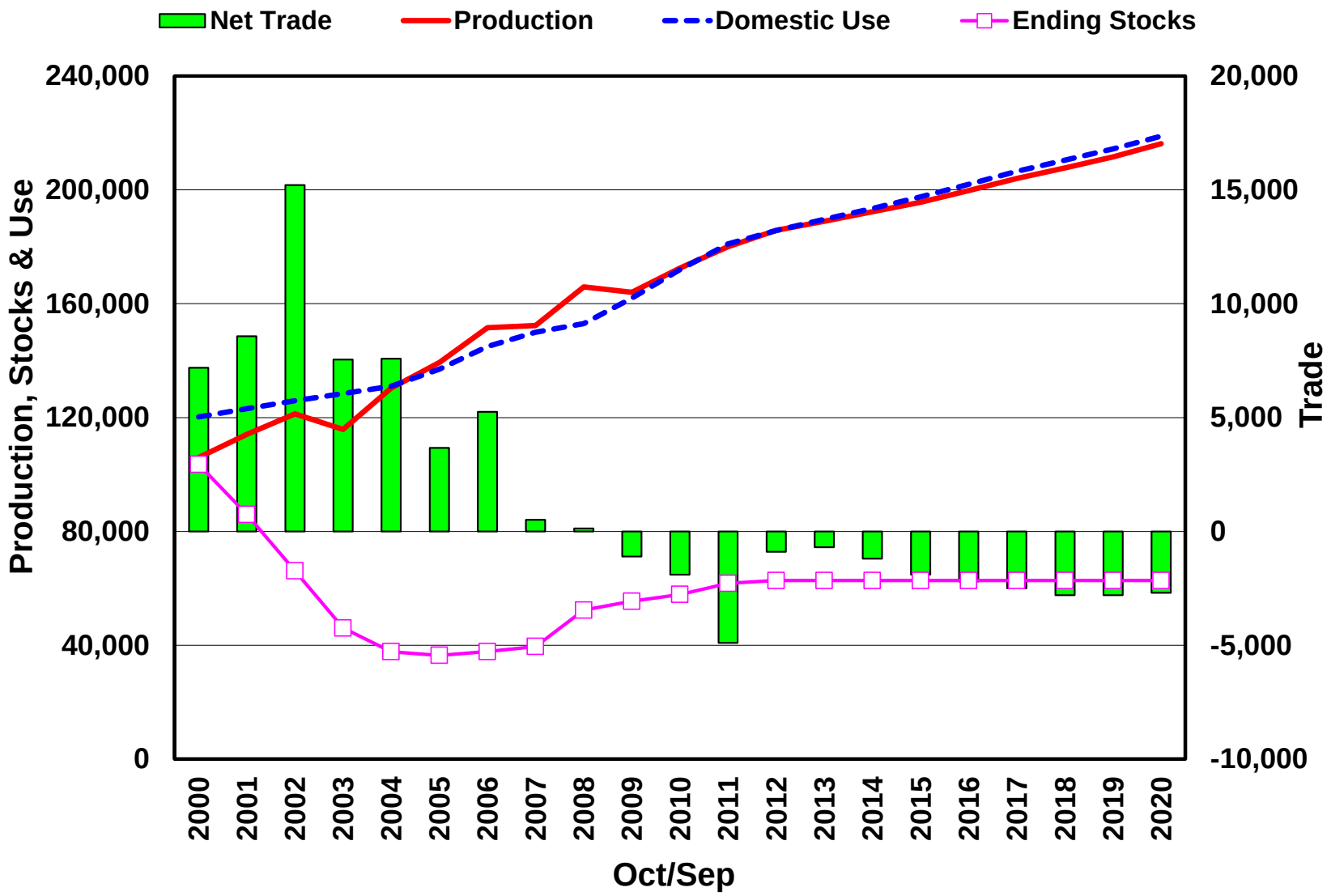
Figure 18: China Corn Supply and Demand (thousand metric tons)



Source: USDA and Informa

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- China's soybean acreage is expected to remain steady.

- Due to China's large population, selling cooking oil locally has not been a problem. So, the level of crush is determined by soybean meal demand.

- As China's domestic consumption of meat increases and animal production switches from "back yard" to modern commercial animal operations, the demand for soybean meal has increased.

- The government has enacted policies that made importing the soybeans and crushing more attractive than importing soybean products.

- China soybean annual net imports have increased by 24 million MT from 2006 through 2010. From 2010 through 2020, soybean annual net imports are expected to increase an additional 54 million MT to 106 million MT in 2020.

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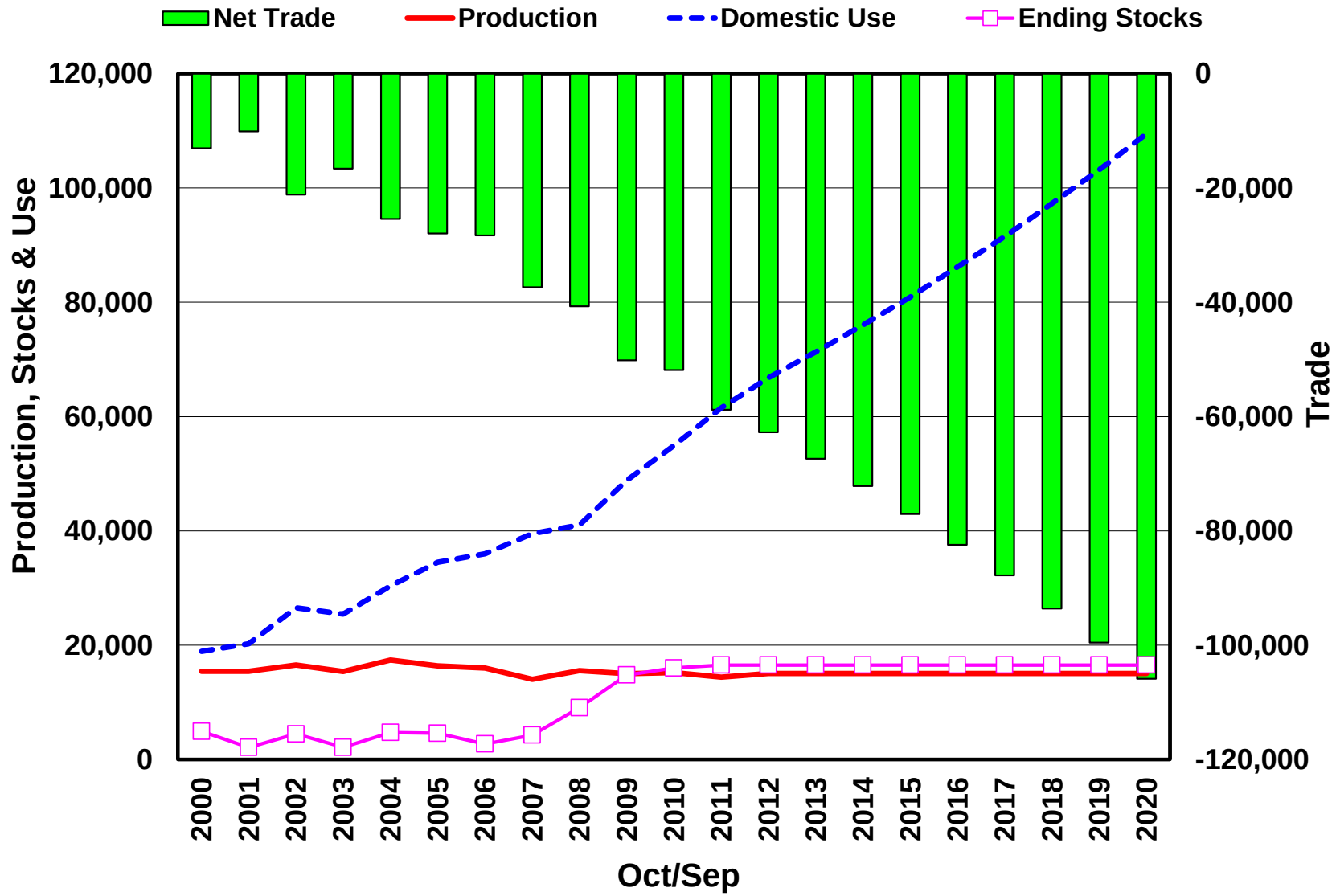
Figure 19: China Soybean Supply and Demand (thousand metric tons)



Source: USDA and Informa

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C. U.S. Animal Outlook

U.S meat production is expected to increase on the strength of foreign demand (see Figure 20). For example, Chinese beef consumption is expected to grow by 1.5 million metric tons over the next decade, with Chinese imports fostering growth. The increase in beef consumption is a result of China's strengthening economy, increasing incomes, and continued urbanization.[4]

- The locations of the different species are shown in Figure 21.

- Livestock outlook is projected to be mixed with growth driven by export demand and not domestic consumption.
    - Free Trade Agreement rules are being finalized for implementation between the U.S and South Korea, Panama and Colombia, to the benefit of U.S. meat exports.
    - Poultry production will shrink through 2012/13, and then expand 7.5 billion pounds to 53.9 billion or 24.4 million metric tons in 2020/21.
    - Hogs are projected to increase about 6 million head from the 2010/11 low point to 71 million in 2015/16 and remain steady from there.
        - Hog production will expand more rapidly within the Corn Belt while essentially shrinking in other areas.
        - Even though head count will flatten out, hog productivity gains will expand total pork production.
    - Cattle head counts are forecast to decline up to 2015/16 before nominally expanding through 2020/21, with no significant shift in geographic distribution.
        - South Korea experienced a severe outbreak of foot-and-mouth disease, which has reduced the size of its herd, and increases the prospect of increased imports from the U.S., especially with the newly established Free Trade Agreement.
    - Dairy cattle head count will remain relatively stable, but annual productivity gains of 1.6% annually will increase total milk production.
        - The size of the U.S. dairy herd is dependent on exports of milk and associated products, especially to Asia and more specifically to China.
        - There will be no significant geographic redistribution.

[4] Hong Kong Business. (2010). "China Meat Demand to Soar in Coming Decade." Retrieved from http://www.chinadaily.com.cn/hkedition/2010-05/07/content_9819611.htm.

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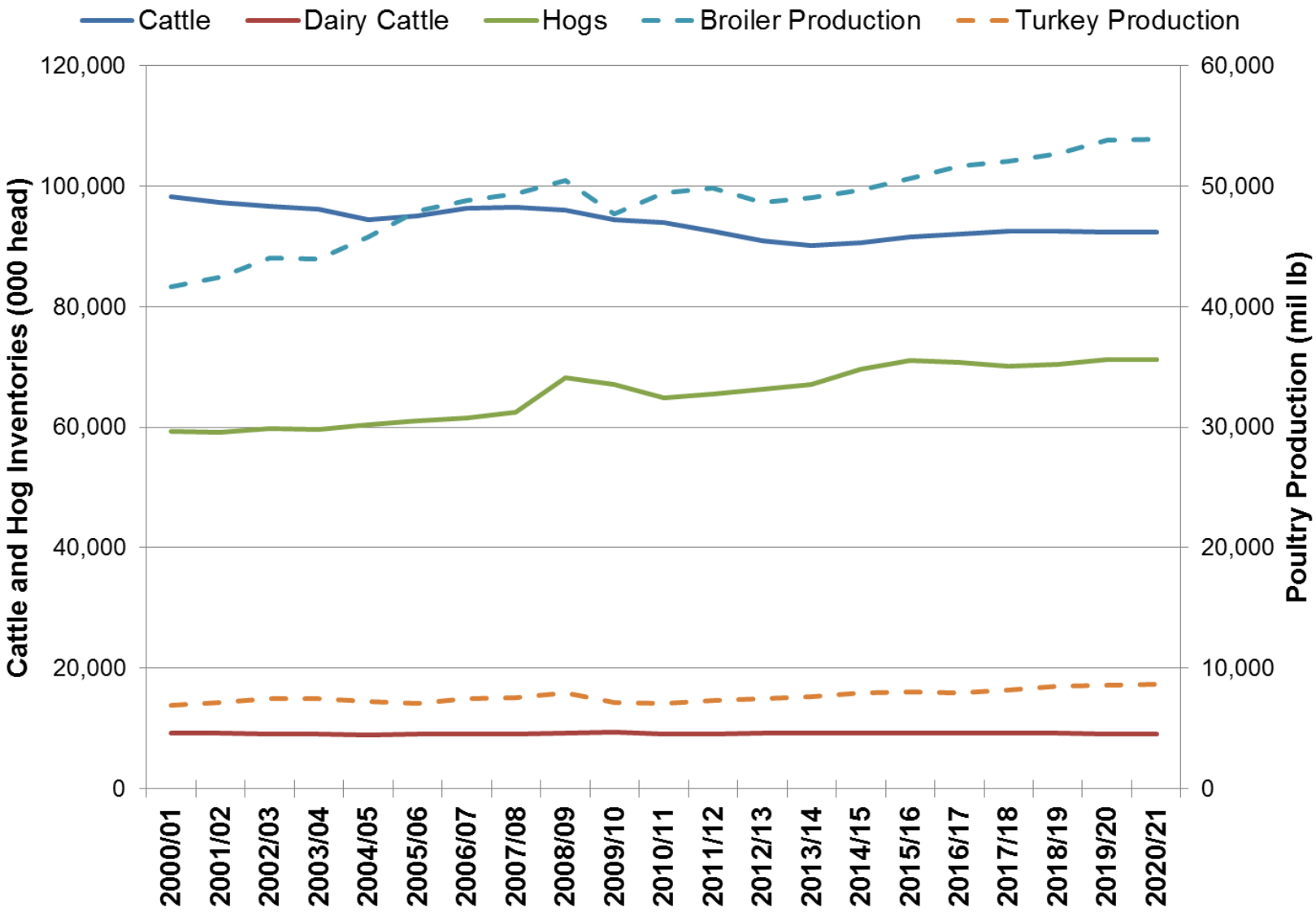
Figure 20: U.S. Livestock Inventories and Poultry Production



Source: Informa (Forecast), USDA (History)

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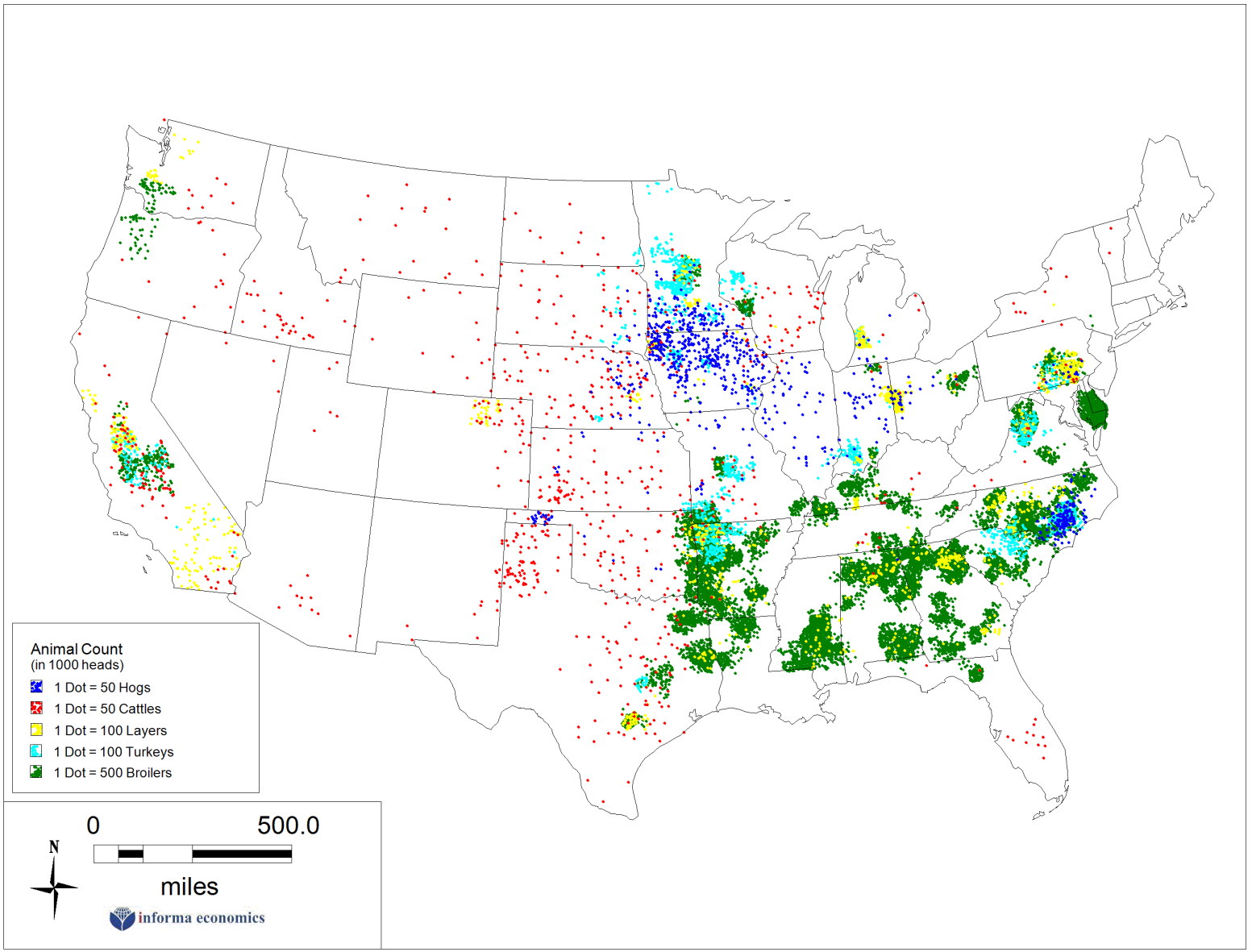
Figure 21: Livestock and Poultry Inventory Map by Species



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1. Beef and Dairy Cattle

- The 2009/10 U.S. cattle herd size was 94.5 million head.
  - With the biological lags inherent in the cattle industry, and the time it takes to rebuild herd stock, beef production is expected to decline during 2012 and 2013.
  - U.S. beef production may not start expanding again before 2015.
  - After 2015, the U.S. beef cattle herd size is anticipated to increase moderately.

- Record global dairy demand is resulting in record supply.
  - Import growth by China slowed in 2011 after surging since 2008.
  - Slower economic growth, rebounding domestic supply, and high prices slowed demand in China.
  - The earthquake in Japan, continued economic growth in developing countries, and foot-and-mouth disease in South Korea all contributed to an 8.3% increase in global imports in 2011.
  - Global demand is expected to continue growing, but it is sensitive to changes in economic conditions.

- Cattle are the least geographically concentrated of the species.
  - Cattle are primarily located in the Southern and Northern Plains States.

- The size of the US dairy herd depends on the export market.
  - Domestic demand has generally been growing by 1.0% per year since 2002.
  - Production per cow has been growing by 1.6%. So without export growth, the herd will decline by an average of 0.6% per year.

- Dairy operations tend to have areas of concentration.
  - The three largest areas for dairy are California, Minnesota/Wisconsin, and west Texas/New Mexico.

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Figure 22: Cattle Inventory Map

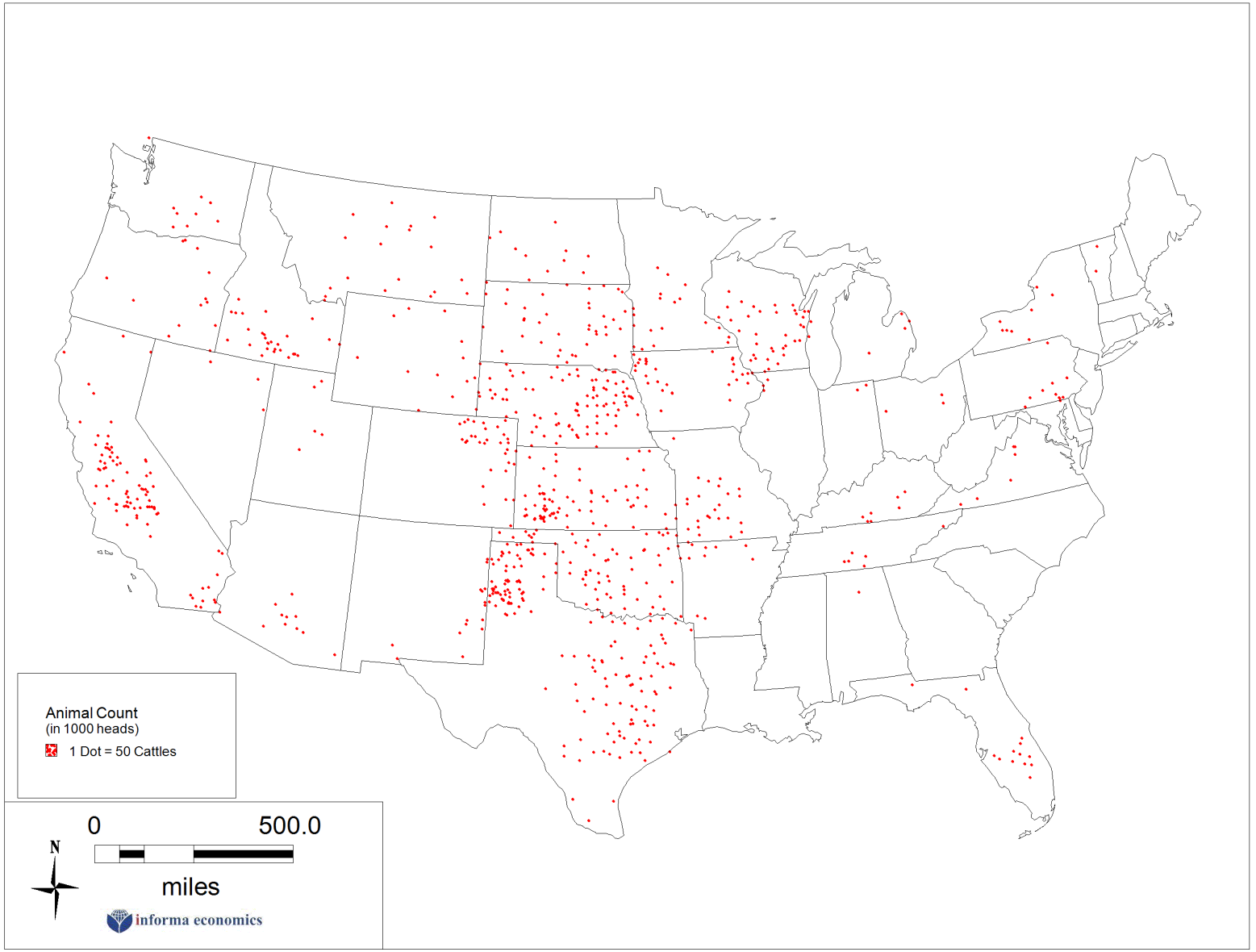

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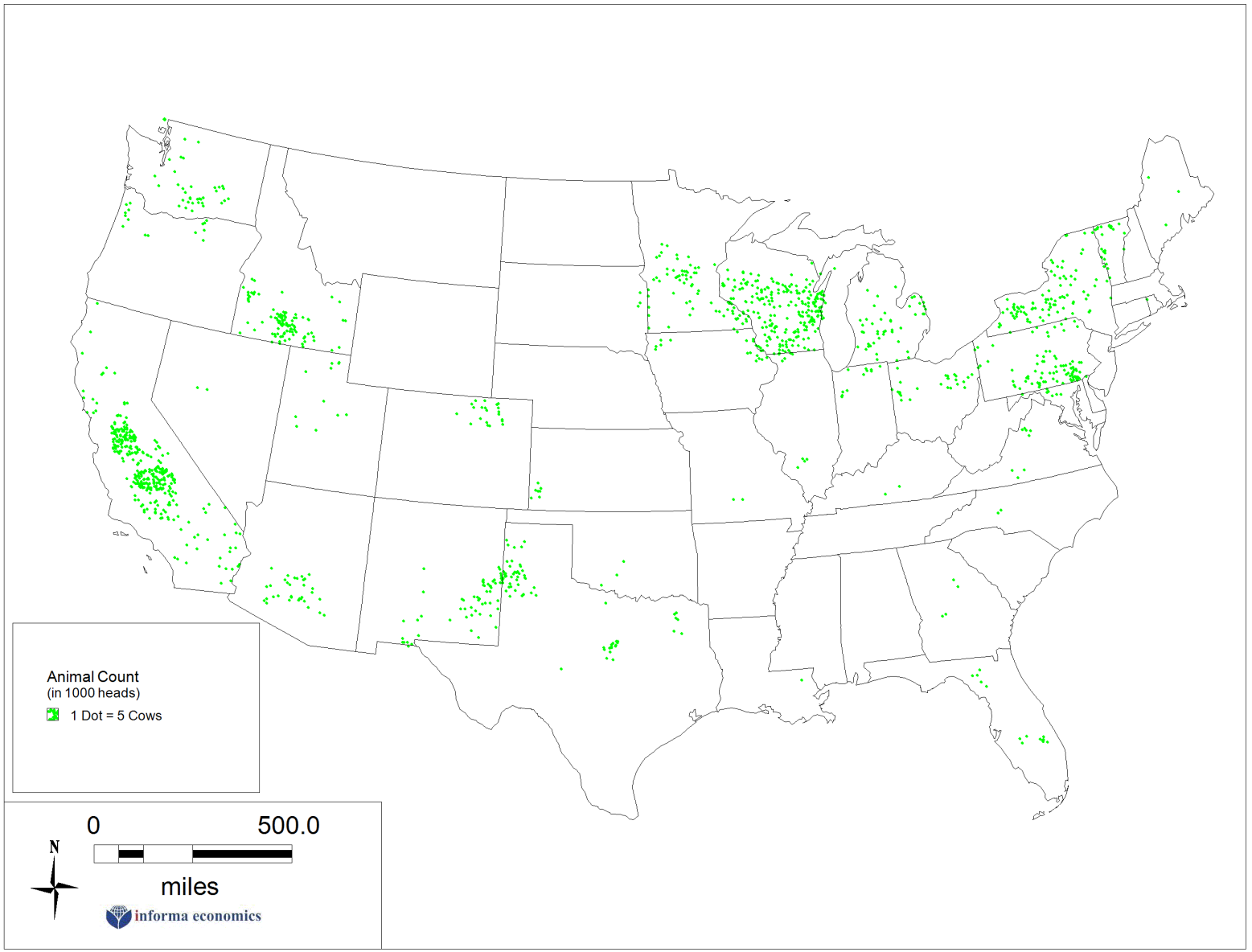
Figure 23: Dairy Inventory Map



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2. Hogs

- The U.S. hog herd size in 2009/10 was 67 million head.
  - U.S. hog inventory levels are projected to show modest expansion over the next decade.
  - H1N1, "swine flu," led to a decline in consumer demand in 2009 and further reductions in inventory levels were the result.

- The breeding herd should expand only slightly during the next few years.
  - Productivity gains account for most of the expansion in pork production.
  - Producers are expected to remain cautious in terms of expanding the breeding herd due to the dependence on export markets.

- Hog production is highly concentrated across the Corn Belt and North Carolina as shown in Figure 24.

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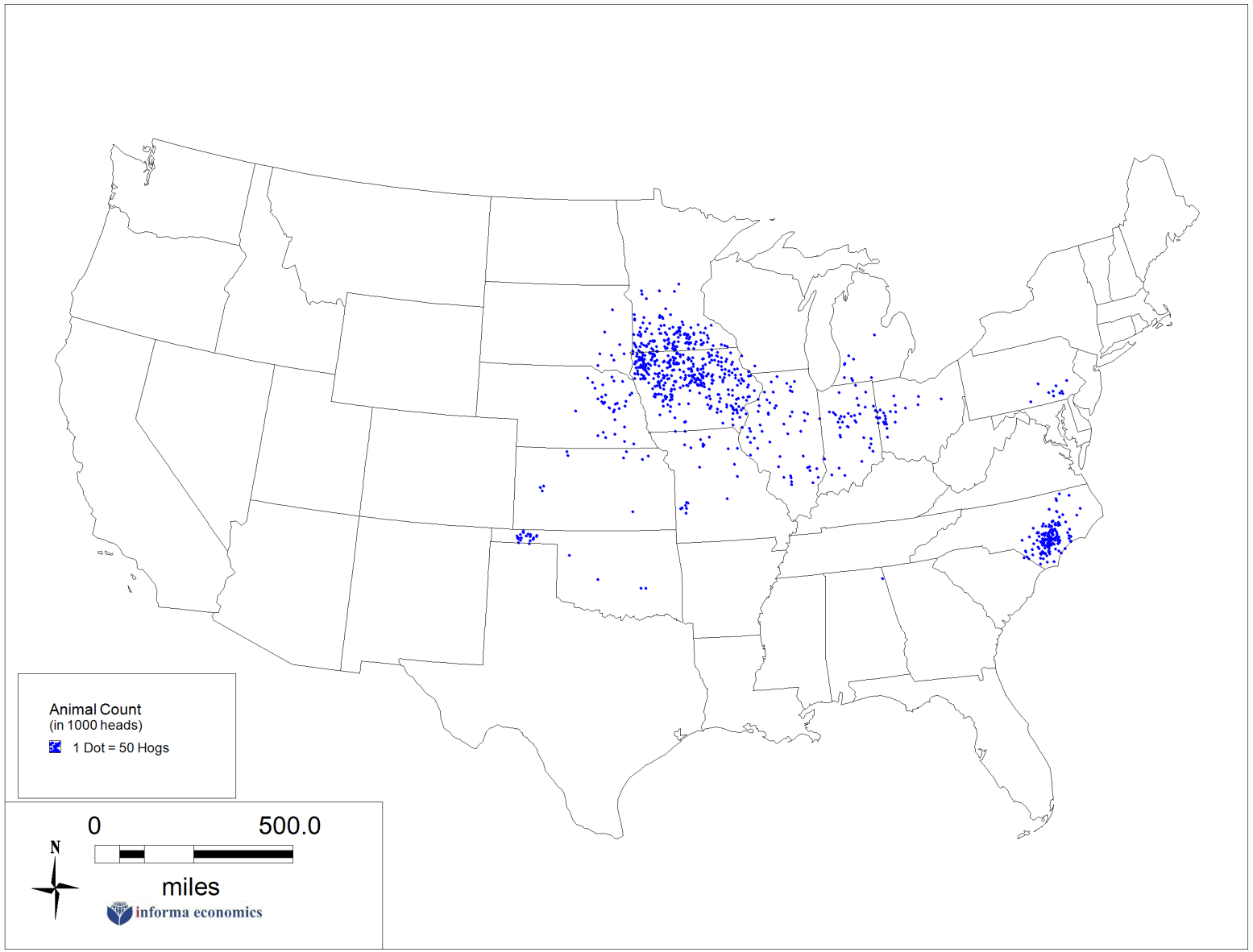
Figure 24: Hog Inventory Map



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3. Broilers

- The baseline U.S. broiler production in 2009/10 was 47.7 billion pounds.
    - A sharp increase in feed input costs in 2011, as well as lackluster demand for broiler white meat, has caused the industry to shrink the past few months, and domestic broiler production should decline in 2012.

- Throughout the forecast period, U.S. broiler production is anticipated to expand modestly from 50.4 billion pounds in 2009/10 to 53.8 billion pounds in 2020/21.

- Broiler production is predominantly located in the Southeast, which requires feed to be shipped into the area from the Corn Belt.

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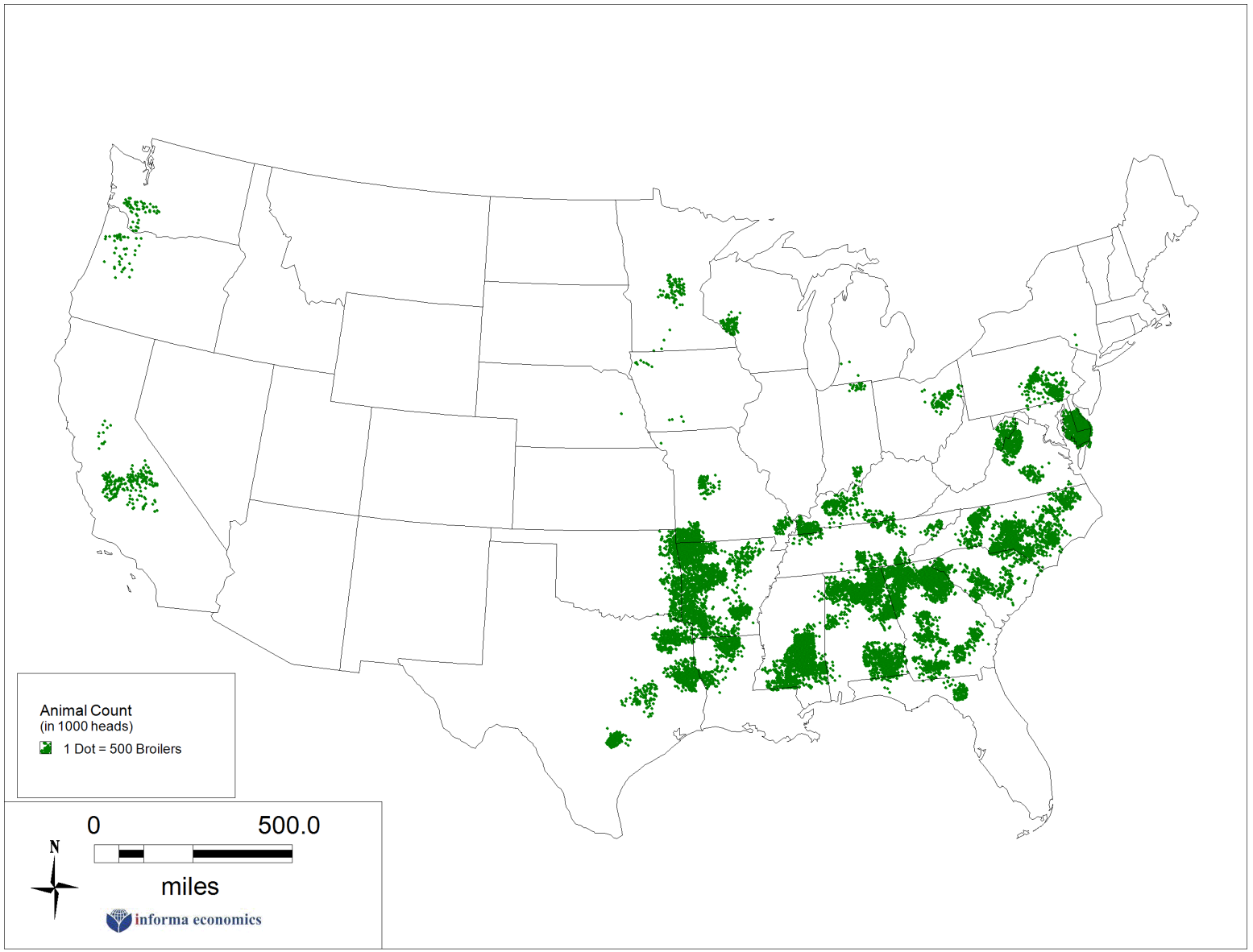
Figure 25: Broiler Inventory Map



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4. Layers

- Over the forecast period, the layer flock is expected to remain stagnant due to pending legislation.
  - The United Egg Producers and U.S. Humane Society have agreed to legislation that changes animal husbandry laws.
  - The uncertainty in production costs and corresponding consumer reaction to higher prices is limiting expansion plans.

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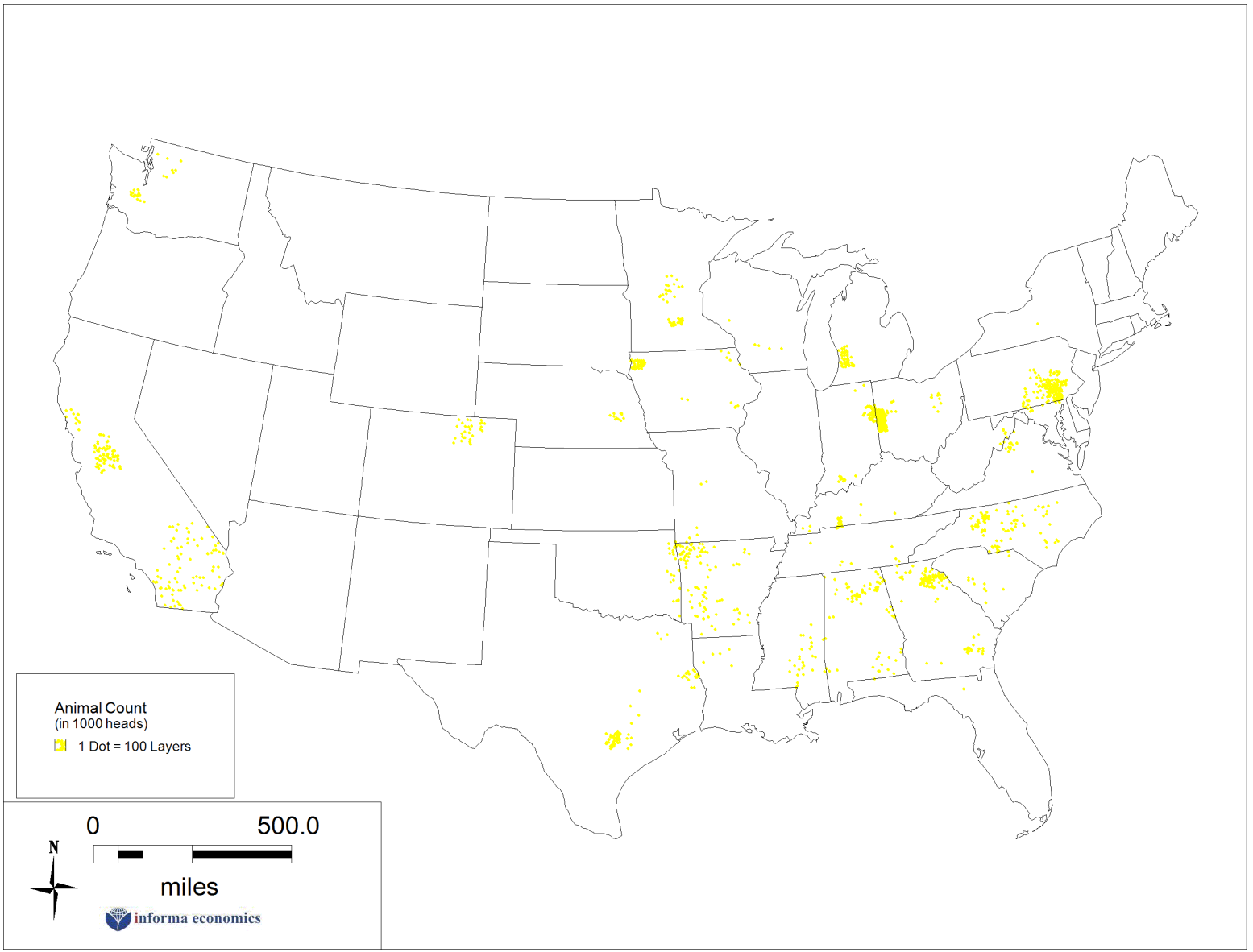
Figure 26: Layers Inventory Map



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5. Turkey

- U.S. baseline turkey production in 2009/10 was 7 billion pounds.
  - Domestic turkey production declined in consecutive years in 2009 and 2010, falling nearly 10% from its 2008 peak of more than 6.2 billion pounds (ready-to-cook basis).

- U.S. turkey production was up in 2011 but still totaled only 7.3 billion pounds.
  - Throughout the forecast period, domestic turkey production is expected to expand by nearly 21% from baseline levels, as export demand continues to grow.

- Despite strong profitability across the industry, turkey producers have been very cautious with regard to expanding their operations because of volatile feed input prices and economic uncertainty.
  - These concerns are expected to play a part in producer expansion decisions throughout the remainder of the forecast period.

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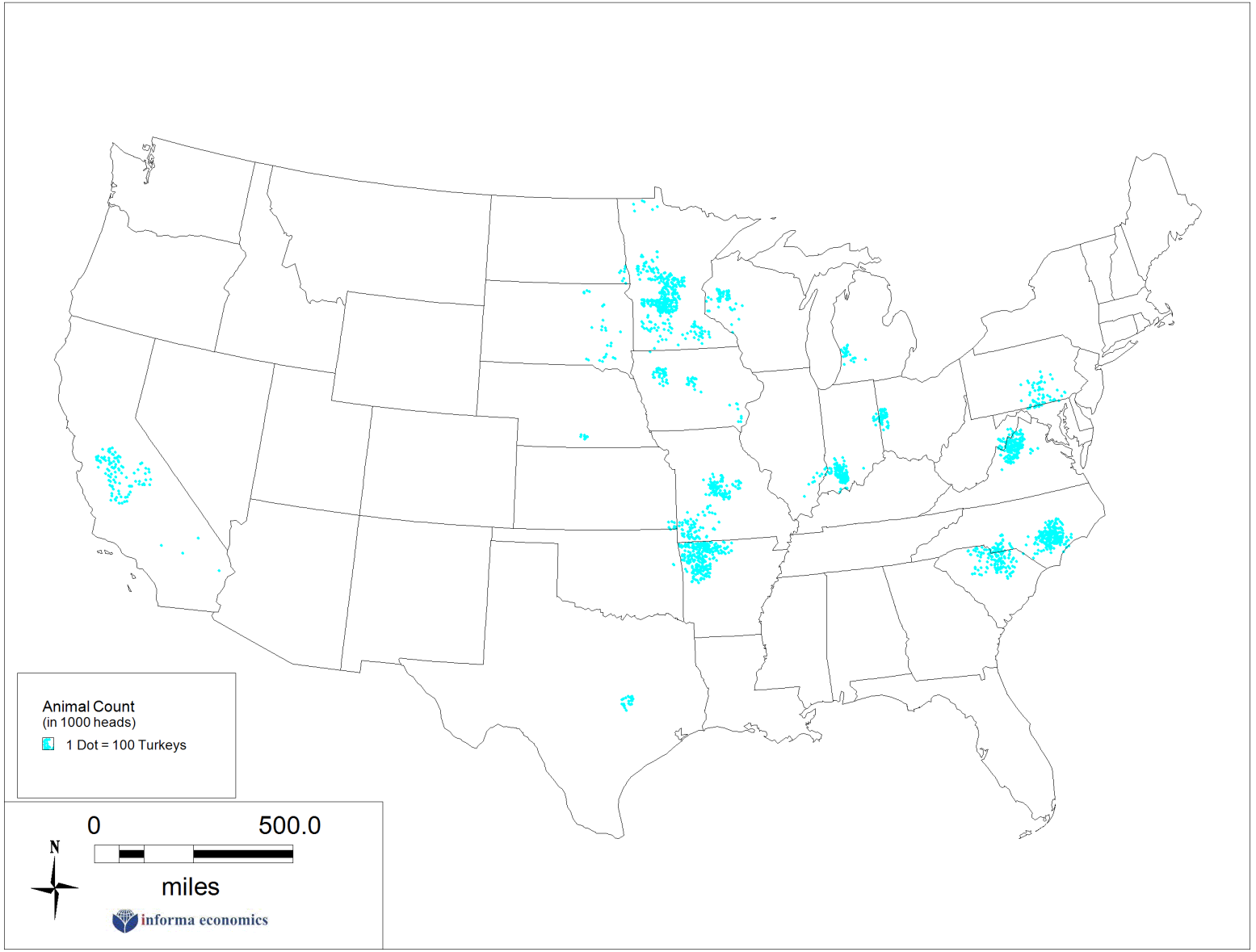
Figure 27: Turkey Inventory Map



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D. State Animal Outlook

1. ARKANSAS

- Arkansas is a large producer of poultry, and is expected to increase production through 2020/21. In 2009/10 Arkansas poultry production accounted for 12% of U.S. production levels.

- Broiler production in Arkansas is anticipated to grow by 10% over 2009/10 levels in 2020/21, from 5.8 billion pounds to 6.4 billion.

- In 2009/10, turkey production in the state reached 568 million pounds. Production is expected to expand by 16.6% to 663 million pounds in 2020/21.

- Arkansas' cattle herds will increase by 10%, while dairy cattle herds will decrease by 36% from 14 thousand head in 2009/10 to 9 thousand in 2020/21.

- Arkansas' hog inventory will decrease by 36%, from 2009/10 levels of 195 thousand head to 124 thousand in 2020/21.

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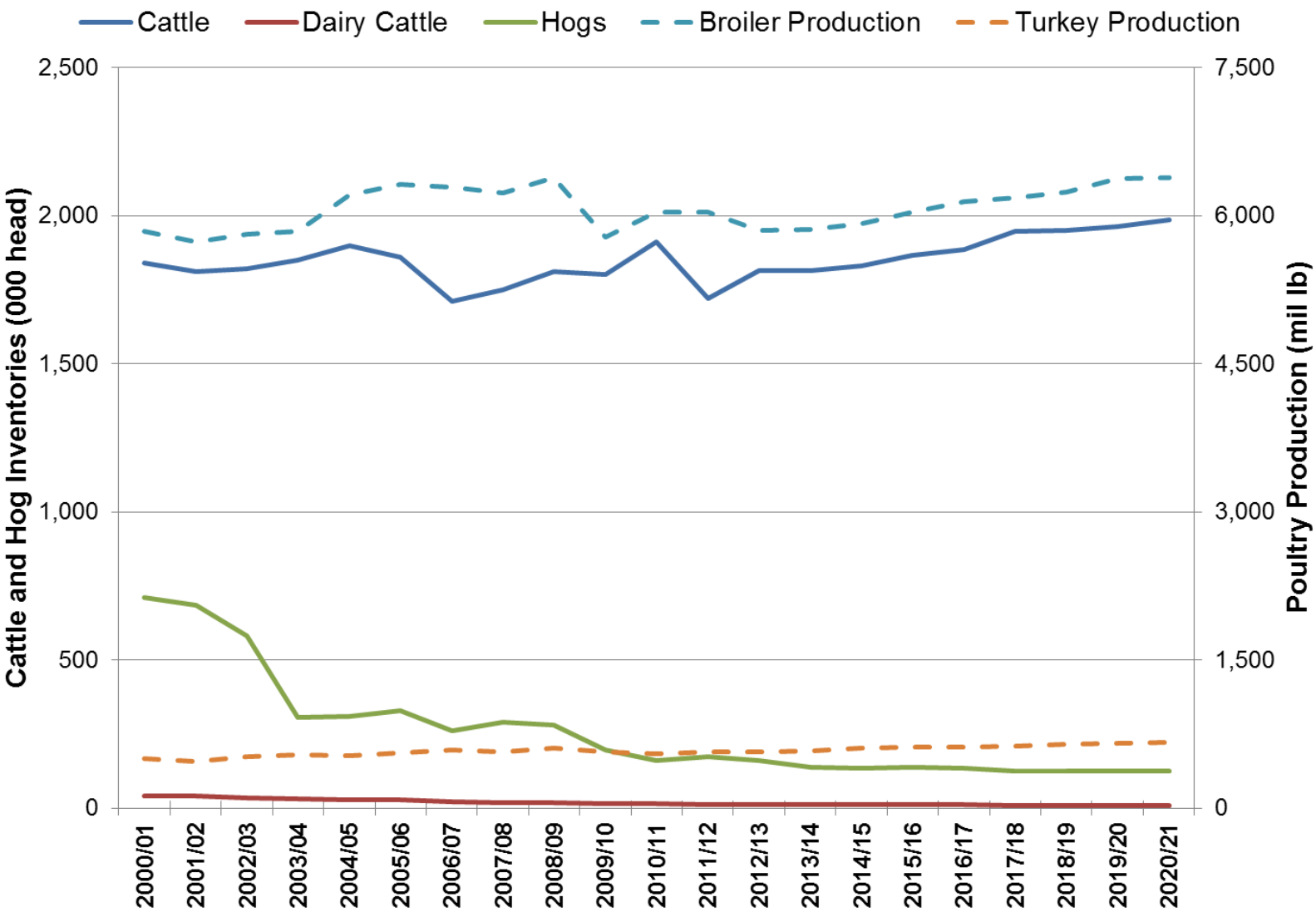
Figure 28: Arkansas Livestock Inventories and Poultry Production



Source: Informa (Forecast), USDA (History)

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2. ILLINOIS

- Illinois' hog herds are the highest of its livestock inventories. These inventories are anticipated to increase by 7%, from 4.3 million head in 2009/10 to 4.5 million in 2020/21. This state accounts for 6% of U.S. hog inventories.

- Cattle inventories in Illinois are anticipated to contract by 1% from 1.2 million head in 2009/10 to 1.19 million head in 2020/21. The dairy cattle herd will also contract, by 5%, from 102 thousand head in the baseline to 97 thousand head in 2020/21.

- Illinois poultry production primarily consists of turkey production. Production levels for turkey totaled 84 million pounds in 2009/10, and these levels are expected to increase by 16.8% to 98 million in 2020/21.

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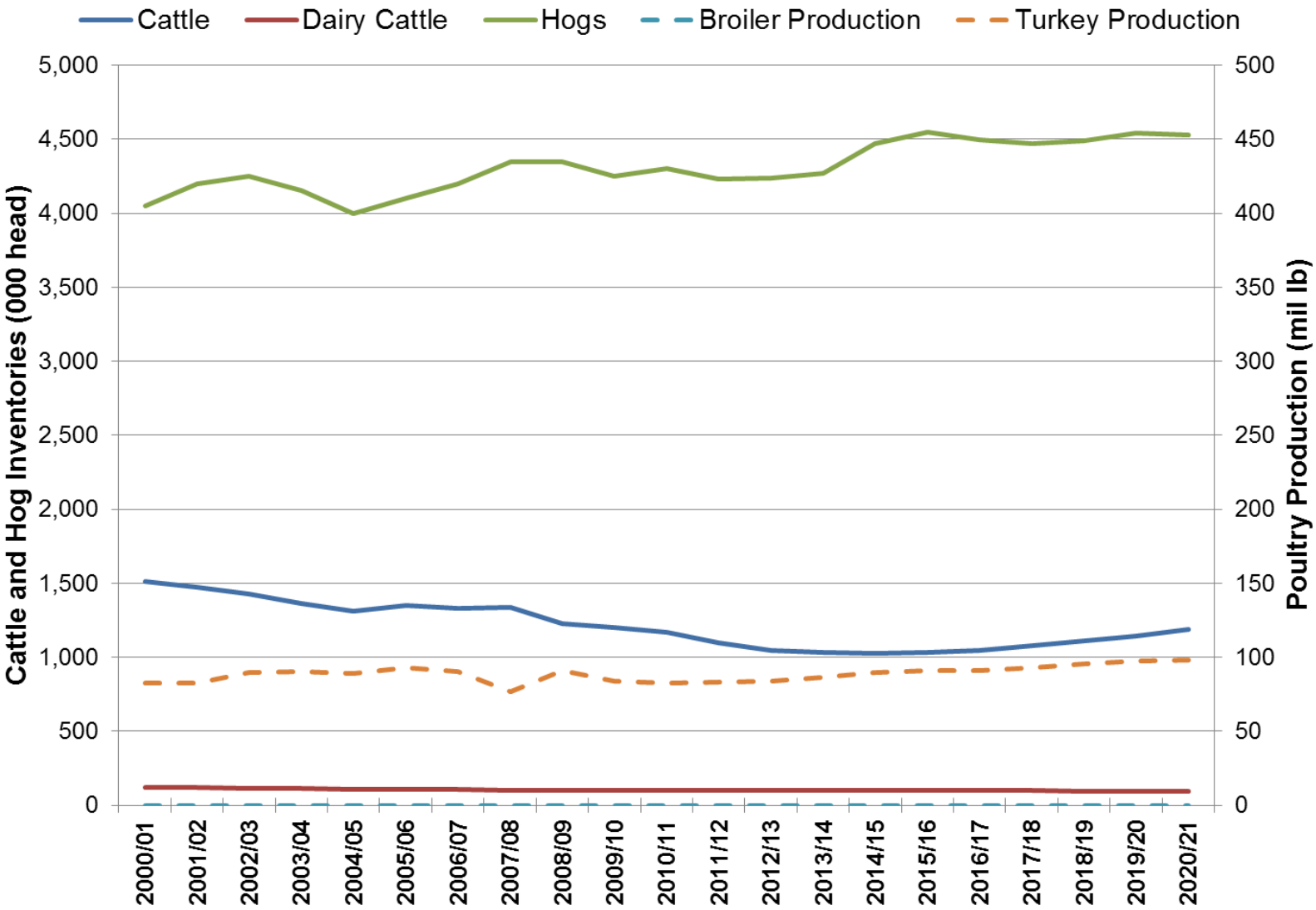
Figure 29: Illinois Livestock Inventories and Poultry Production



Source: Informa (Forecast), USDA (History)

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3. INDIANA

- Indiana hog inventories reached 3.6 million head in 2009/10, and are anticipated to increase by 9%, to 3.9 million in 2020/21. Indiana hog inventories account for approximately 6% of U.S. total inventories.

- Indiana turkey production reached 543 million pounds in 2009/10 and is expected to increase to 637 million (17.3%) in 2020/21.

- Broiler production in Indiana is moderate at 186 million pounds, but will grow by approximately 12% to 208 million in 2020/21.

- Cattle inventories in Indiana will decline by 4% from 860 thousand head in 2009/10 to 825 thousand in 2020/21. However, dairy cattle inventories are anticipated to increase by 4% to 174 thousand head in 2020/21.

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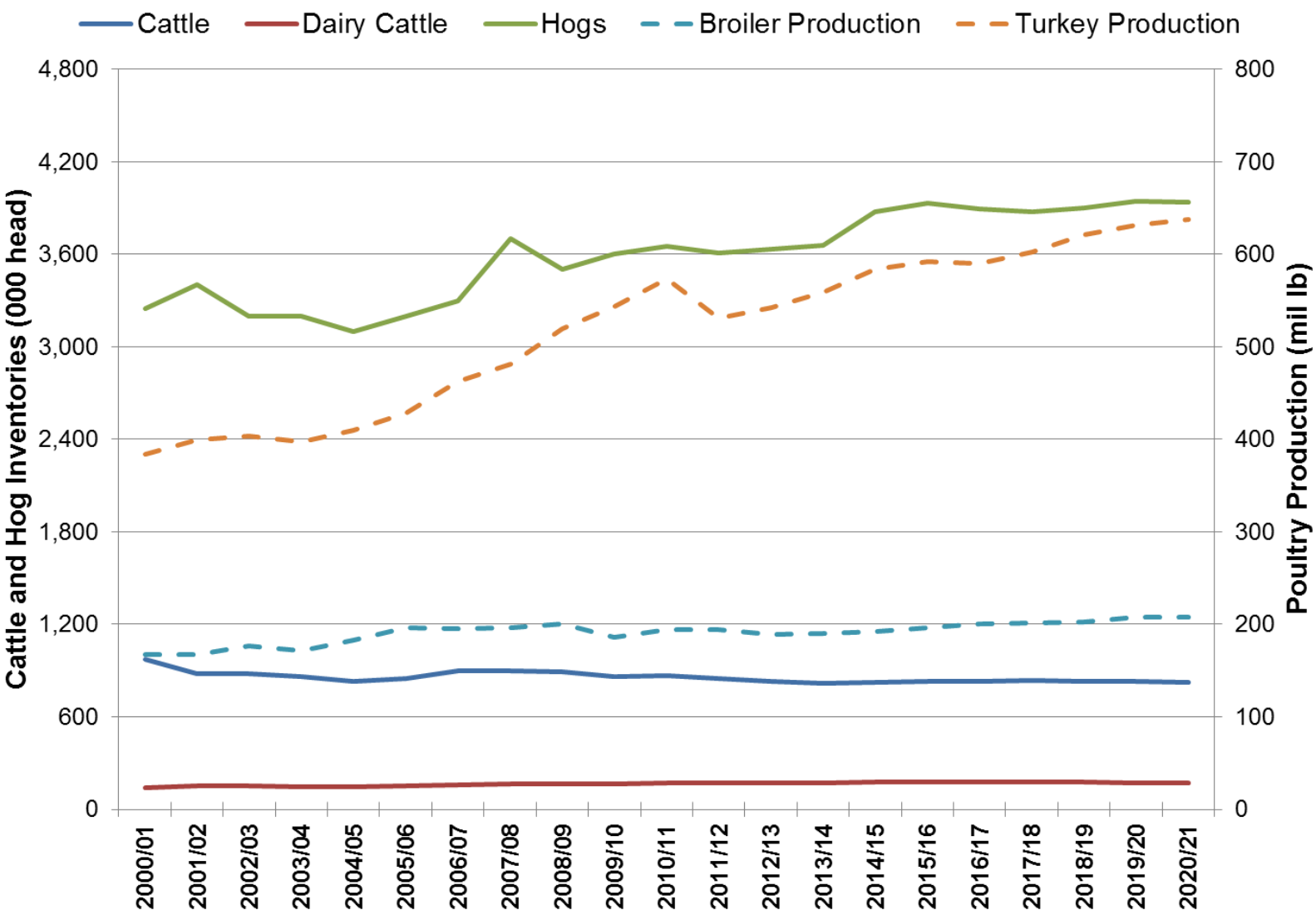
Figure 30: Indiana Livestock Inventories and Poultry Production



Source: Informa (Forecast), USDA (History)

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4. IOWA

- Iowa is the largest producer of hogs within the selected states, with inventories totaling 19 million head in 2009/10, 28% of total U.S. inventories. Iowa hog inventories are expected to increase by 9% to 20.7 million head in 2020/21.

- Iowa turkey production reached 314 million pounds in 2009/10 and is expected to increase by 19% to 374 million pounds in 2020/21.

- Cattle inventories in Iowa are expected to increase 7% from 3.95 million head in 2009/10 to 4.2 million in 2020/21. However, dairy cattle inventories, 215 thousand head in 2009/10, are anticipated to remain stagnant through 2020/21.

- Broiler production in Iowa is expected to increase by 12% from 86 million pounds in 2009/10 to 96 million in 2020/21.

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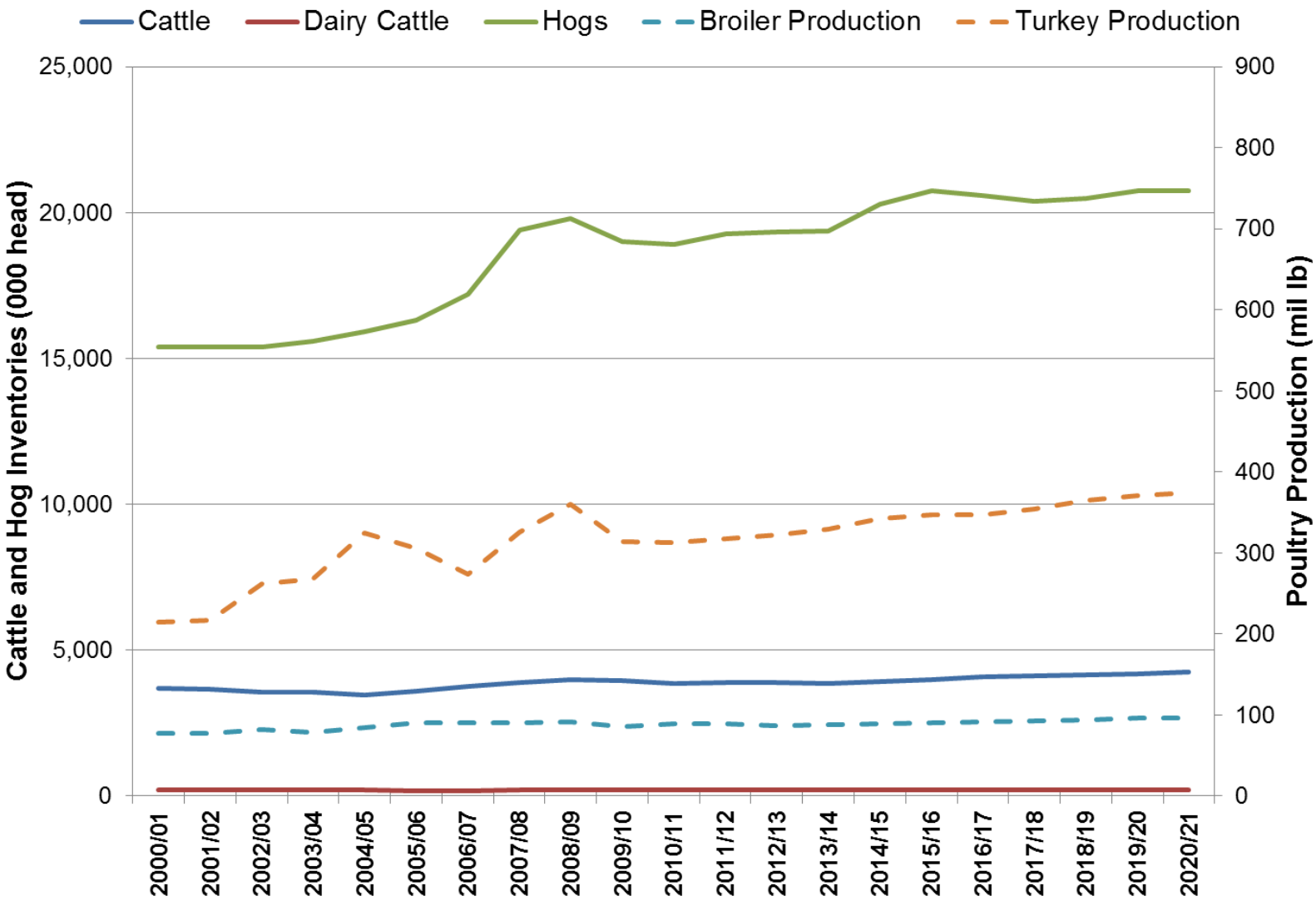
Figure 31: Iowa Livestock Inventories and Poultry Production



Source: Informa (Forecast), USDA (History)

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5. KANSAS

- Kansas is a large producer of beef, with cattle inventories reaching 6.3 million head in 2009/10, approximately 7% of U.S. total cattle inventories. Throughout the upcoming years, until 2020/21 cattle inventories in the state are expected to decrease by 7% to 5.8 million head in 2020/21. The dairy cattle herd in Kansas is expected to remain stagnant at 125 thousand head throughout 2020/21.

- Hog inventories in Kansas for 2009/10 were 1.8 million head, 3% of U.S. total hog herds. Through 2020/21, these inventories are expected to increase by 4% to 1.9 million head.

- Turkey production in Kansas totaled 50 million pounds for 2009/10. Production is expected to expand by 18% to 59 million pounds in 2020/21.

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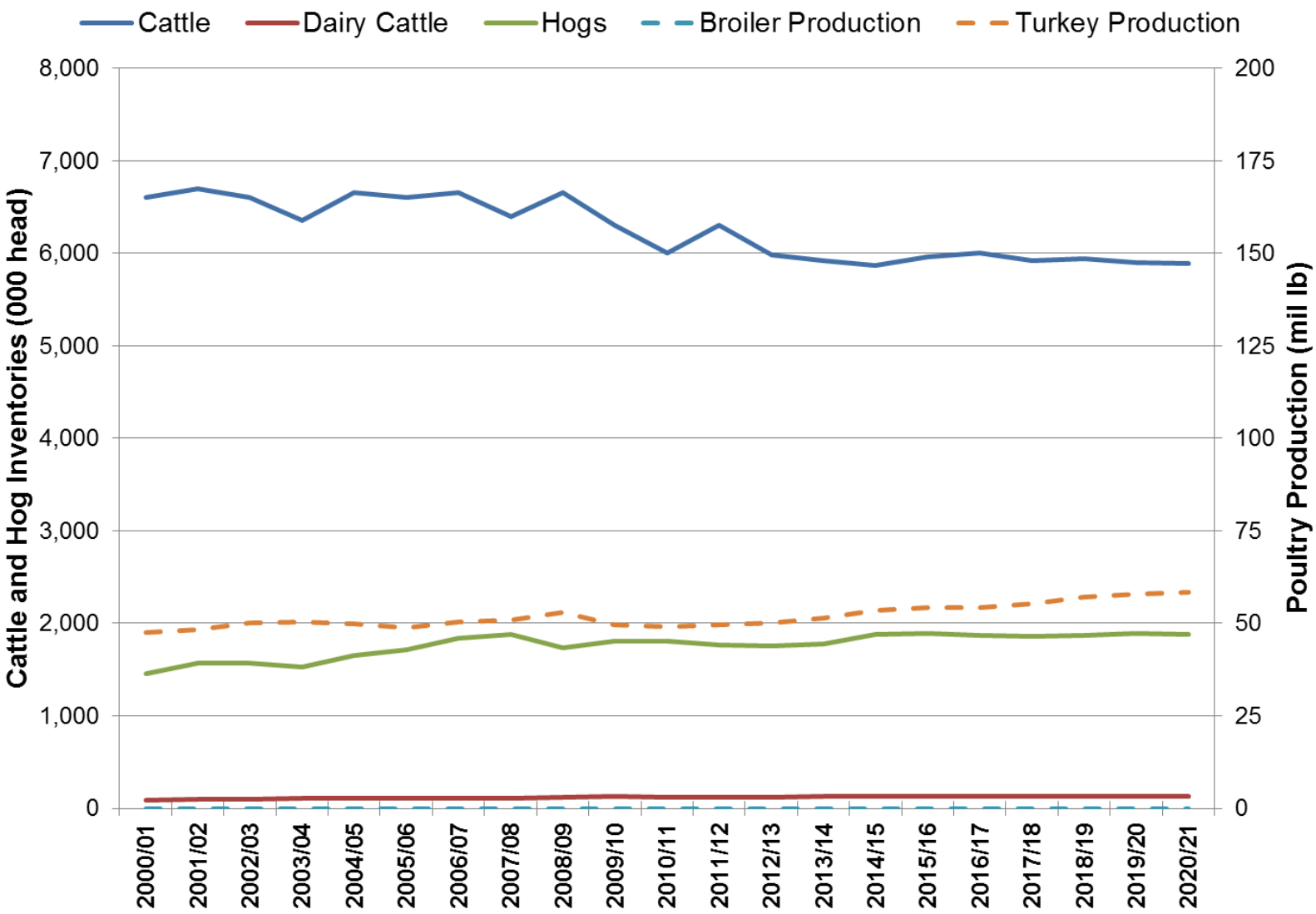
Figure 32: Kansas Livestock Inventories and Poultry Production



Source: Informa (Forecast), USDA (History)

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6. KENTUCKY

- Broiler production in Kentucky totaled 1.7 billion pounds in 2009/10, approximately 3% of U.S. broiler production levels. Kentucky broiler production is expected to expand by 11%, to 1.8 billion pounds in 2020/21.

- Kentucky cattle inventories reached 2.3 million head in 2009/10, close to 2% of total U.S. cattle inventories. By 2020/21, cattle inventories are expected to contract by 17% to 1.9 million head. Dairy cattle inventories are anticipated to decrease by 20% from 86 thousand head in 2009/10 to 69 thousand in 2020/21.

- Hog inventories in Kentucky are expected to remain flat at 345 thousand head from 2009/10 to 2020/21. These inventory levels represent only a small portion (less than 1%) of total U.S. inventories.

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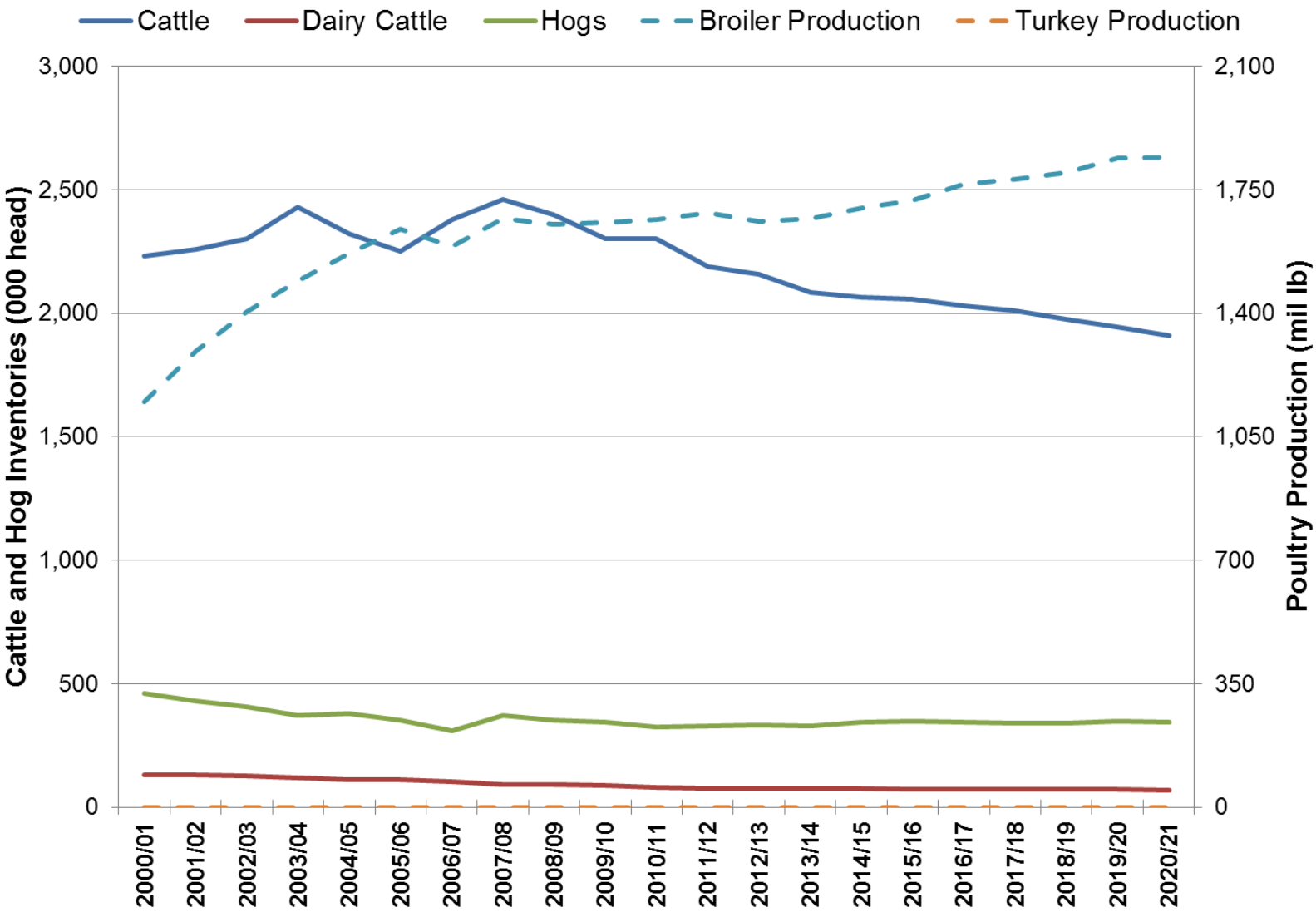
Figure 33: Kentucky Livestock Inventories and Poultry Production



Source: Informa (Forecast), USDA (History)

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7. MICHIGAN

- Michigan cattle inventories reached 1 million head in 2009/10, and are expected to increase by 21% to 1.3 million by 2020/21. Dairy cattle inventories are expected to increase by 6% from 353 thousand head in 2009/10 to 374 thousand in 2020/21. This inventory level represents 4% of total U.S. dairy cattle inventories.

- Hog inventories in Michigan are expected to increase by 5% from 1 million head in 2009/10 to 1.1 million in 2020/21. Michigan hog inventories represent approximately 2% of total U.S. hog inventories.

- Turkey production in Michigan reached 180 million pounds in 2009/10 and is anticipated to increase 18.3% by 2020/21, reaching 212 million. These production levels represent 2% of total U.S. turkey production.

- Broiler production in Michigan is expected to remain flat from 2009/10 through 2020/21, at approximately 4 million pounds.

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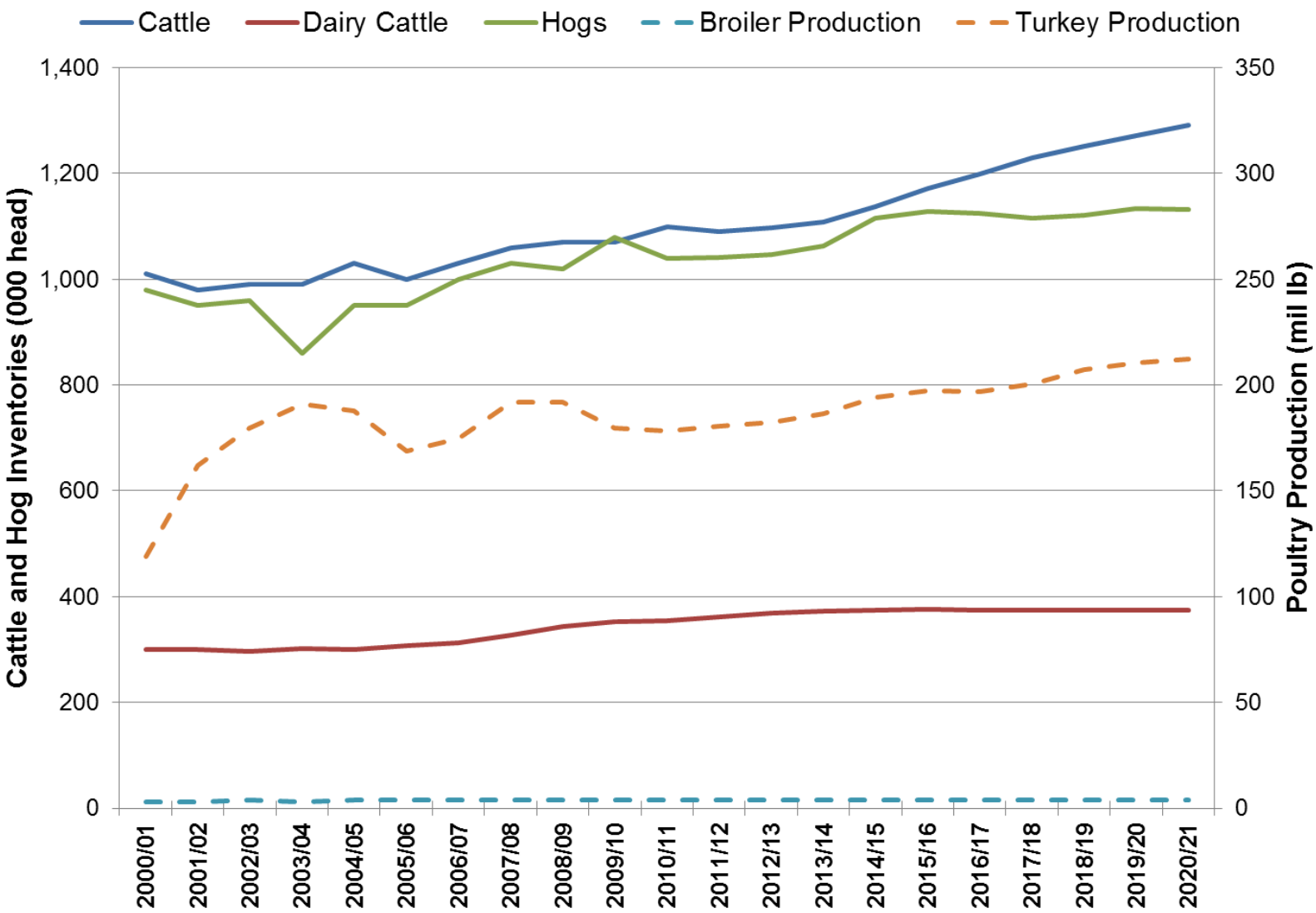
Figure 34: Michigan Livestock Inventories and Poultry Production



Source: Informa (Forecast), USDA (History)

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8. MINNESOTA

- Turkey production in Minnesota totaled 1.2 billion pounds in 2009/10, representing approximately 16% of total U.S. turkey production. Through 2020/21, production is anticipated to increase by 22%, reaching nearly 1.4 billion pounds.

- Minnesota hog inventories currently represent 11% of total U.S. inventories, with state herd size at 7.2 million head in 2009/10. Herd size is expected to increase by 14% through 2020/21, reaching 8.2 million head in 2020/21.

- Cattle inventories in Minnesota reached 2.4 million head in 2009/10, and are expected to increase by 6%, to 2.5 million head in 2020/21. Dairy cattle herd size is also expected to increase by nearly 5%, from 468 thousand head in 2009/10 to 489 thousand head in 2020/21.

- Broiler production is expected to increase by 11%, from 241 million pounds in 2009/10 to 268 million pounds in 2020/21. This number represents only a small percentage (less than 1%) of total U.S. broiler production.

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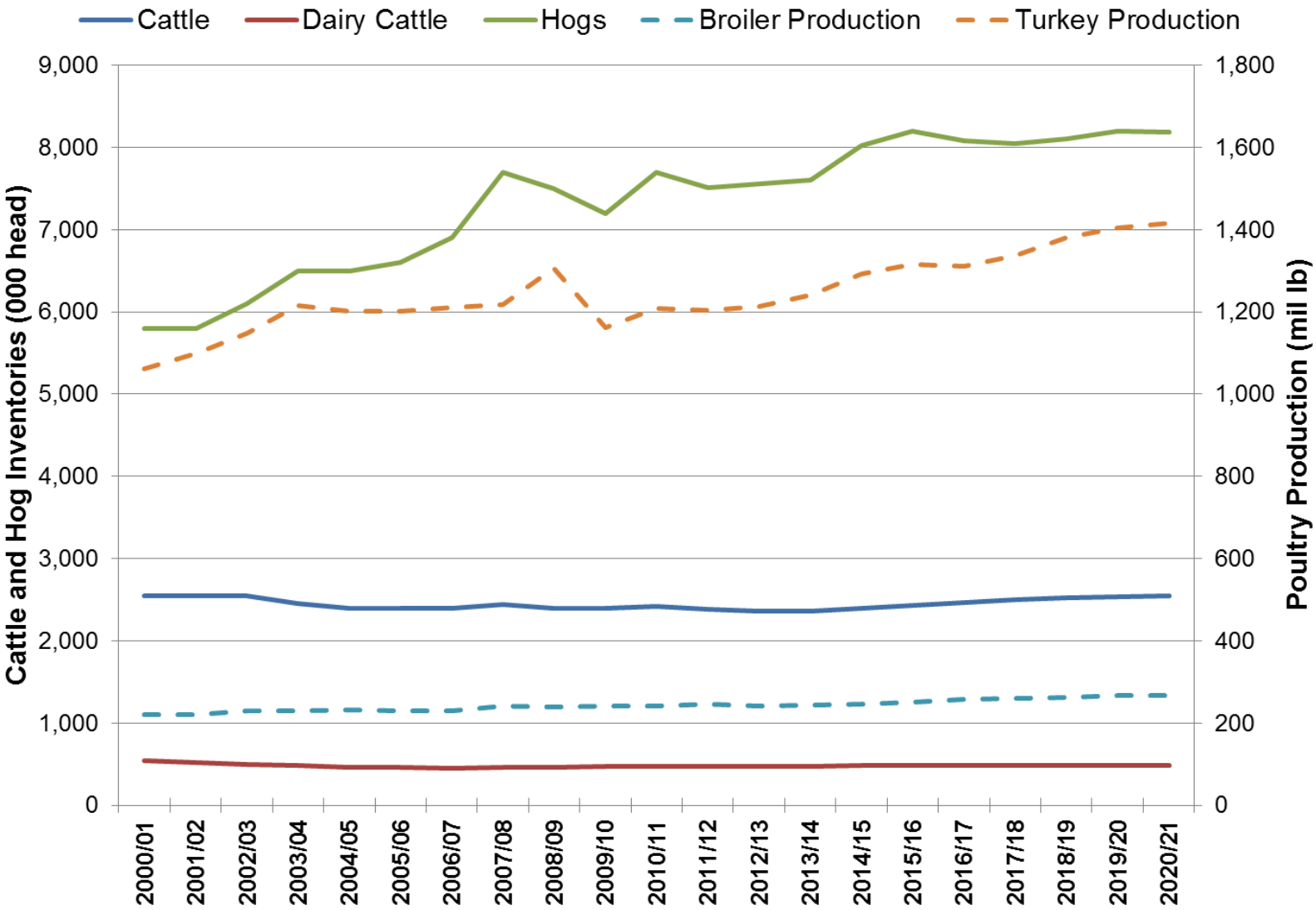
Figure 35: Minnesota Livestock Inventories and Poultry Production



Source: Informa (Forecast), USDA (History)

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9. MISSISSIPPI

- Broiler production in Mississippi represents 10% of total U.S. broiler production. The state's production levels are expected to increase 12% from 4.6 billion pounds in 2009/10 to 5.2 billion pounds in 2020/21.

- Cattle inventories in Mississippi reached 960 thousand head in 2009/10, and expected to expand slightly, by 1%, through 2020/21 to 971 thousand head. Dairy cattle inventories in the state are expected to decrease by 37% from 19 thousand head in 2009/10 to 12 thousand in 2020/21.

- Mississippi hog inventories are anticipated to increase by 16% through 2020/21, from 365 thousand head in 2009/20 to 422 thousand head. These levels represent 1% of total U.S. hog inventories.

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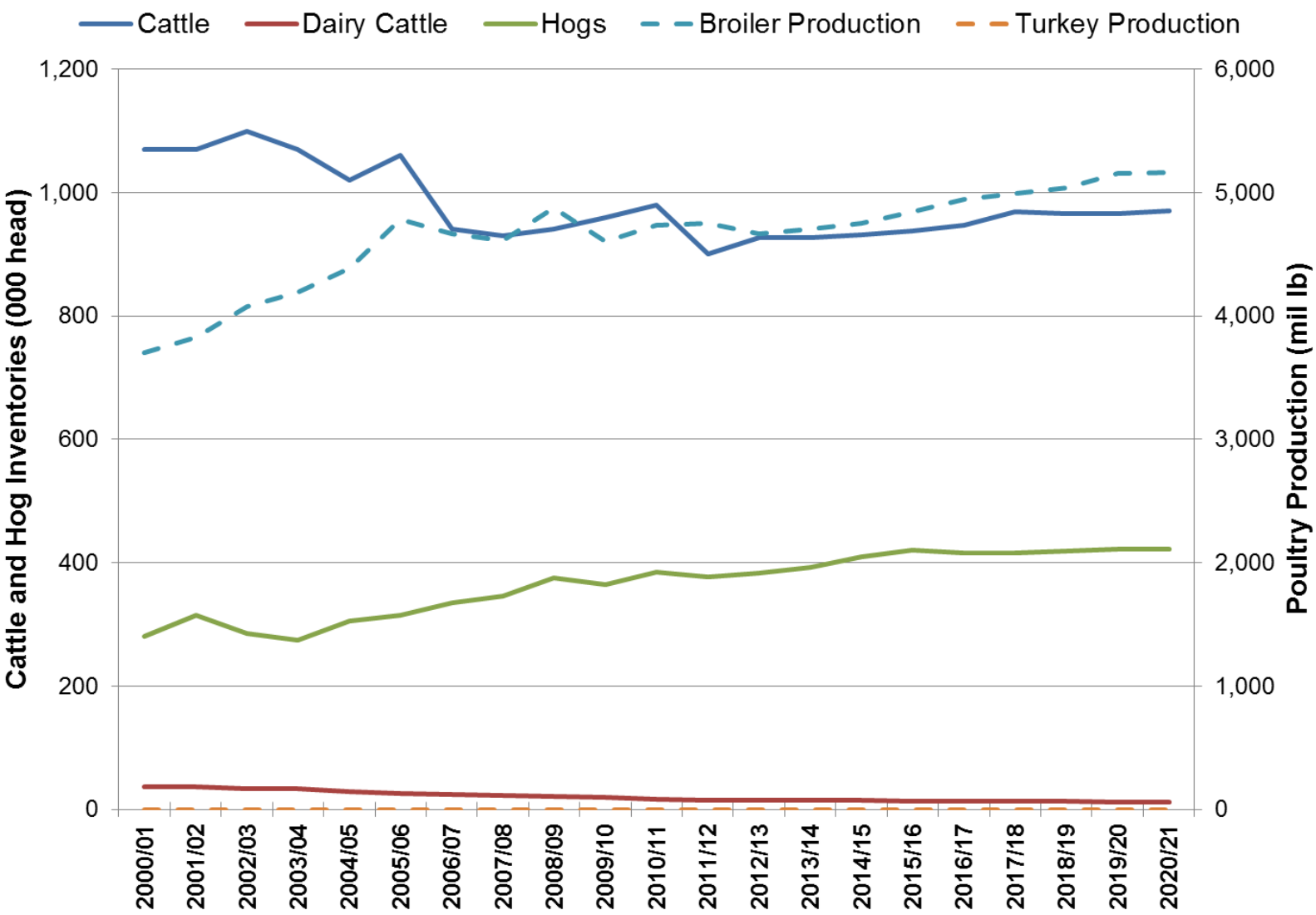
Figure 36: Mississippi Livestock Inventories and Poultry Production



Source: Informa (Forecast), USDA (History)

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10. MISSOURI

- Missouri turkey production represents 9% of total U.S. turkey production. In 2009/10 production reached 611 million pounds. By 2020/21, production is anticipated to increase 17%, to 714 million pounds.

- Hog inventories in Missouri are anticipated to increase 2% from 3.1 million head in 2009/10 to 3.2 million head in 2020/21. Missouri hog inventories represent 4% to 5% of total U.S. hog inventories.

- Cattle inventories in Missouri totaled 4.3 million head in 2009/10, and are expected to contract 20% to 3.4 million head in 2020/21. Missouri total cattle inventories represent approximately 4% of total U.S. cattle inventories. Dairy cattle inventories in the state are anticipated to decrease by 17%, from 108 thousand head in 2009/10 to 90 thousand head in 2020/21.

- Missouri broiler production reached 1.2 billion pounds in 2009/10, and is expected to increase 12% to 1.4 billion in 2020/21. Broiler production in Missouri represents 3% of total U.S. broiler production.

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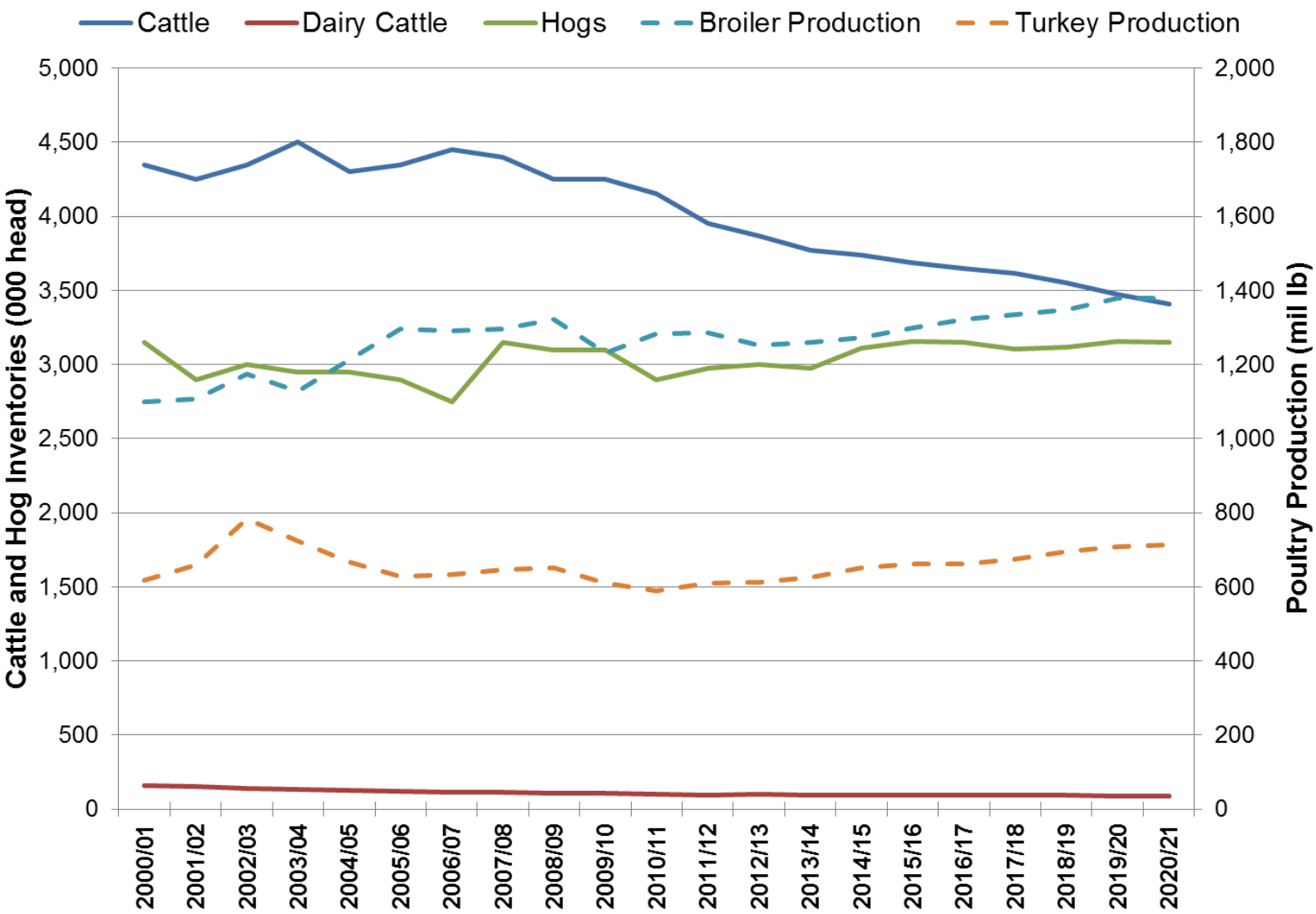
Figure 37: Missouri Livestock Inventories and Poultry Production



Source: Informa (Forecast), USDA (History)

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11. NEBRASKA

- Nebraska cattle inventories represent approximately 7% of total U.S. cattle inventories. In 2009/10, the Nebraska herd totaled 6.4 million head. The herd size is expected to contract 6% to nearly 6 million head in 2020/21. Dairy cattle inventories are also expected to contract, nearly 2% from 59 thousand head in 2009/10 to 58 thousand in 2020/21.

- Hog inventories in Nebraska are anticipated to increase by 7% from 3.1 million head in 2009/10 to 3.3 million by 2020/21. Nebraska hog inventories represent 5% of total U.S. hog herd size.

- Nebraska turkey production is anticipated to grow by 18% from 49 million pounds in 2009/10 to 58 million pounds in 2020/21. Production of turkey in Nebraska represents 1% of U.S. turkey production.

- Broiler production in Nebraska was 27 million pounds in 2009/10 and is anticipated to increase 15% to 31 million pounds in 2020/21. Nebraskan broiler production represents less than 1% of total U.S. broiler production.

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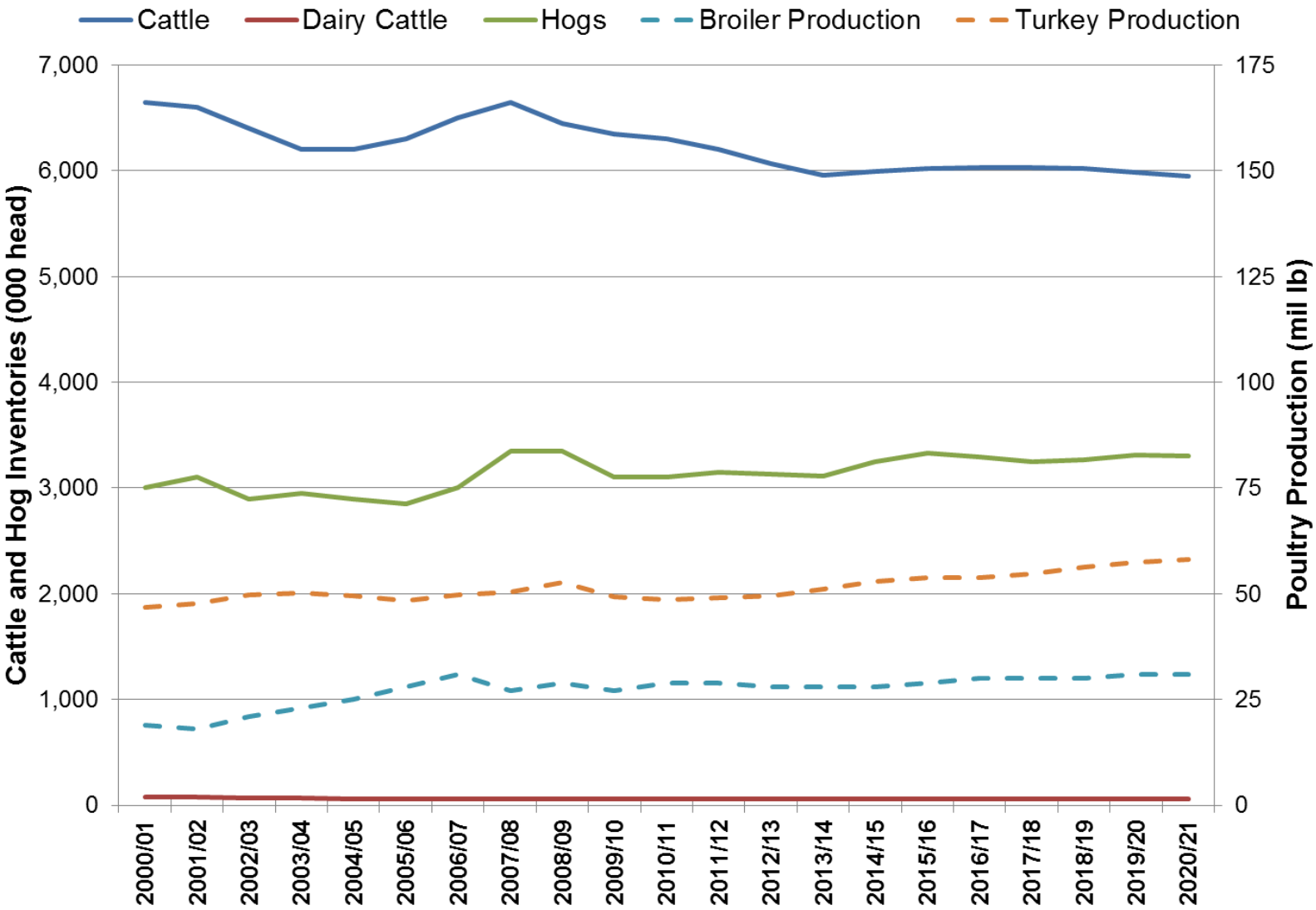
Figure 38: Nebraska Livestock Inventories and Poultry Production



Source: Informa (Forecast), USDA (History)

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12. NORTH CAROLINA

- North Carolina hog inventories represent approximately 13% of total U.S. hog inventories. Inventories are expected to decline by 5% from 9.6 million head in 2009/10 to 9.1 million in 2020/21.

- Turkey production in North Carolina is expected to experience growth throughout the forecast period, going from 1.1 billion pounds in 2009/10 to 1.2 billion in 2020/21. North Carolina turkey production represents 15% of total U.S. turkey production.

- Broiler production is expected to experience growth, increasing 17% from 5.3 billion pounds in 2009/10 to 6.2 billion in 2020/21. North Carolina broiler production represents 11% of total U.S. broiler production.

- Cattle inventories in North Carolina are expected to contract 16%, from 850 thousand head in 2009/10 to 715 thousand in 2020/21. Dairy cattle inventories are expected to contract 11%, from 46 thousand head in 2009/10 to 41 thousand in 2020/21. Cattle inventories in North Carolina represent only a minor share (approximately 1%) of total U.S. inventories.

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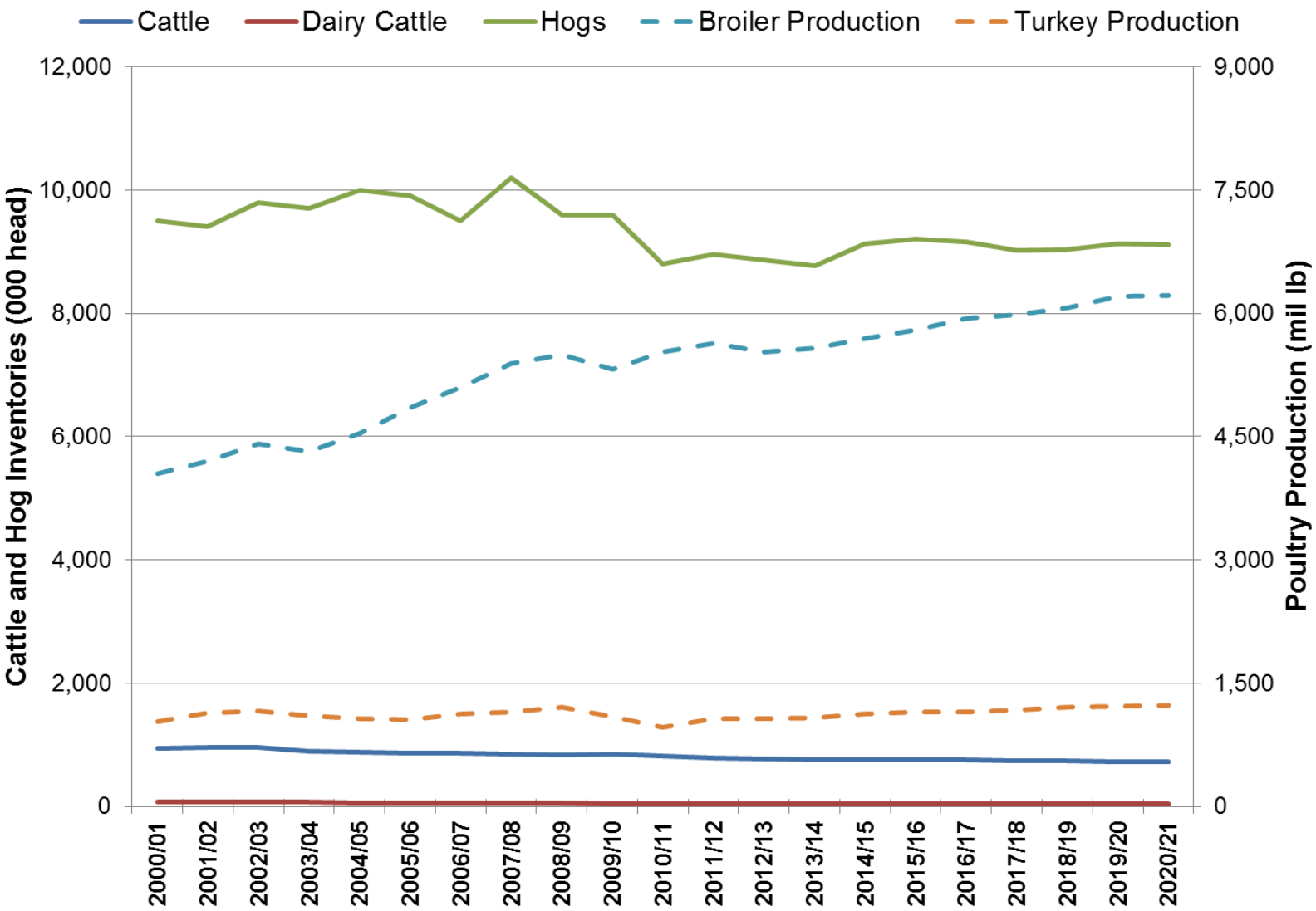
Figure 39: North Carolina Livestock Inventories and Poultry Production



Source: Informa (Forecast), USDA (History)

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13. NORTH DAKOTA

- Cattle inventories in North Dakota are expected to contract 8%, from 1.8 million head in 2009/10 to 1.6 million in 2020/21. Dairy cattle inventories are expected to decrease 36%, from 25 thousand head in 2009/10 to 16 thousand in 2020/21. Inventories in North Dakota represent approximately 2% of total U.S. inventories.

- Turkey production is expected to experience growth within the state, increasing 21%, from 42 million pounds in 2009/10 to 51 million pounds in 2020/21. North Dakota turkey production amounts to merely 1% of total U.S. turkey production.

- North Dakota hog inventories are anticipated to decrease in upcoming years by 10% from 155 thousand head in 2009/10 to 140 thousand in 2020/21. This number accounts for less than 1% of total U.S. hog inventories.

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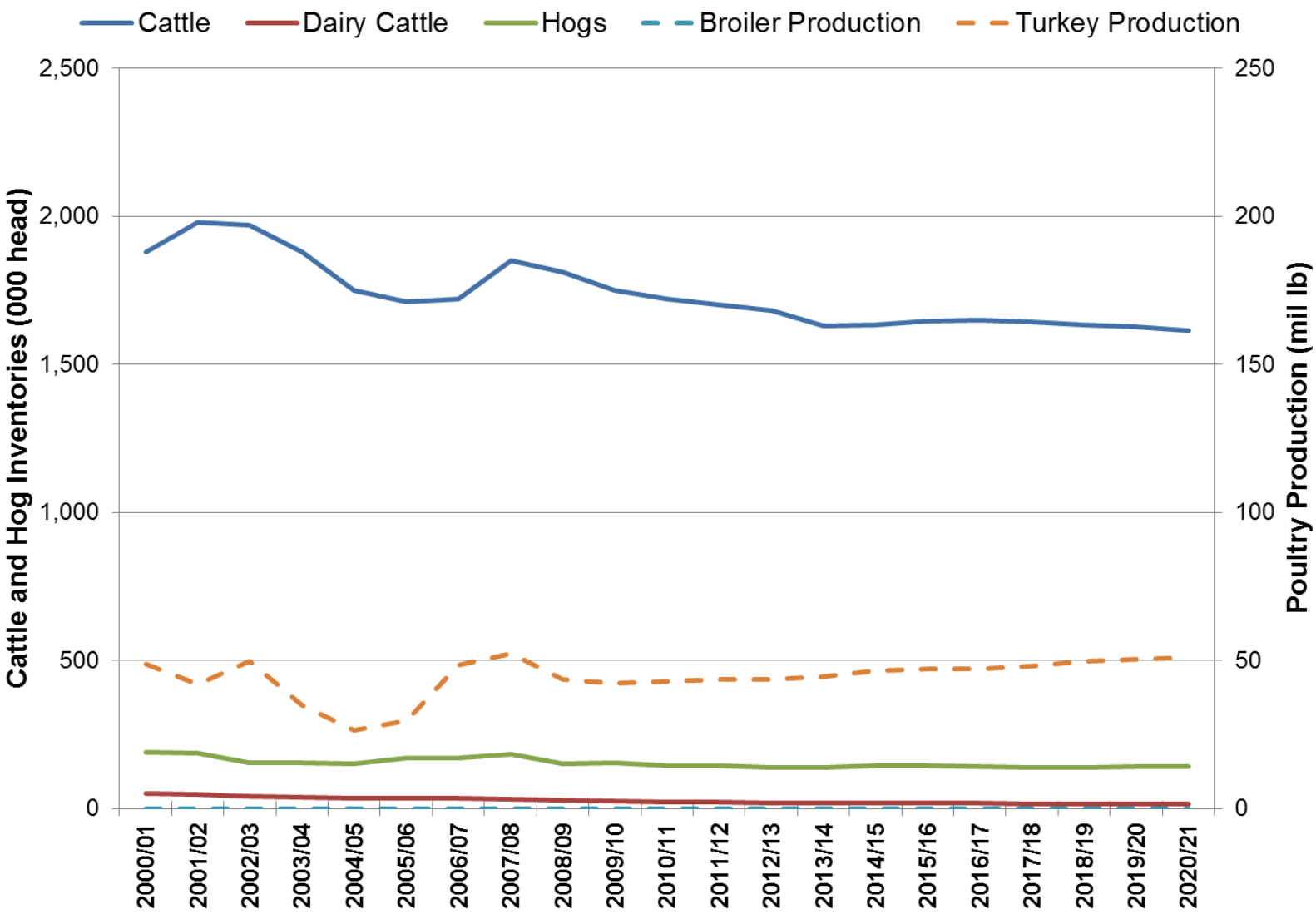
Figure 40: North Dakota Livestock Inventories and Poultry Production



Source: Informa (Forecast), USDA (History)

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14. OHIO

- Cattle inventories in Ohio are expected to expand 4% in upcoming years, from 1.28 million head in 2009/10 to 1.34 million by 2020/21. Dairy cattle inventories, on the other hand, are expected to contract 3%, from 276 thousand head in 2009/10 to 269 thousand in 2020/21. The Ohio dairy cattle herd represents approximately 3% of total U.S. inventories, while the cattle inventory represents 1% of total U.S. cattle inventories.

- Turkey production in Ohio in 2009/10 totaled 203 million pounds. Production is expected to grow 13% to 230 million pounds in 2020/21. This accounts for 2% of U.S. turkey production.

- Broiler production is expected to contract 6% from 338 million pounds in 2009/10 to 319 million in 2020/21. Ohio broiler production makes up 1% of total U.S. broiler production.

- Hog inventories are expected to increase 16% from 2 million head in 2009/10 to 2.3 million head in 2020/21. Currently, the Ohio hog herd represents 3% of total U.S. hog inventories.

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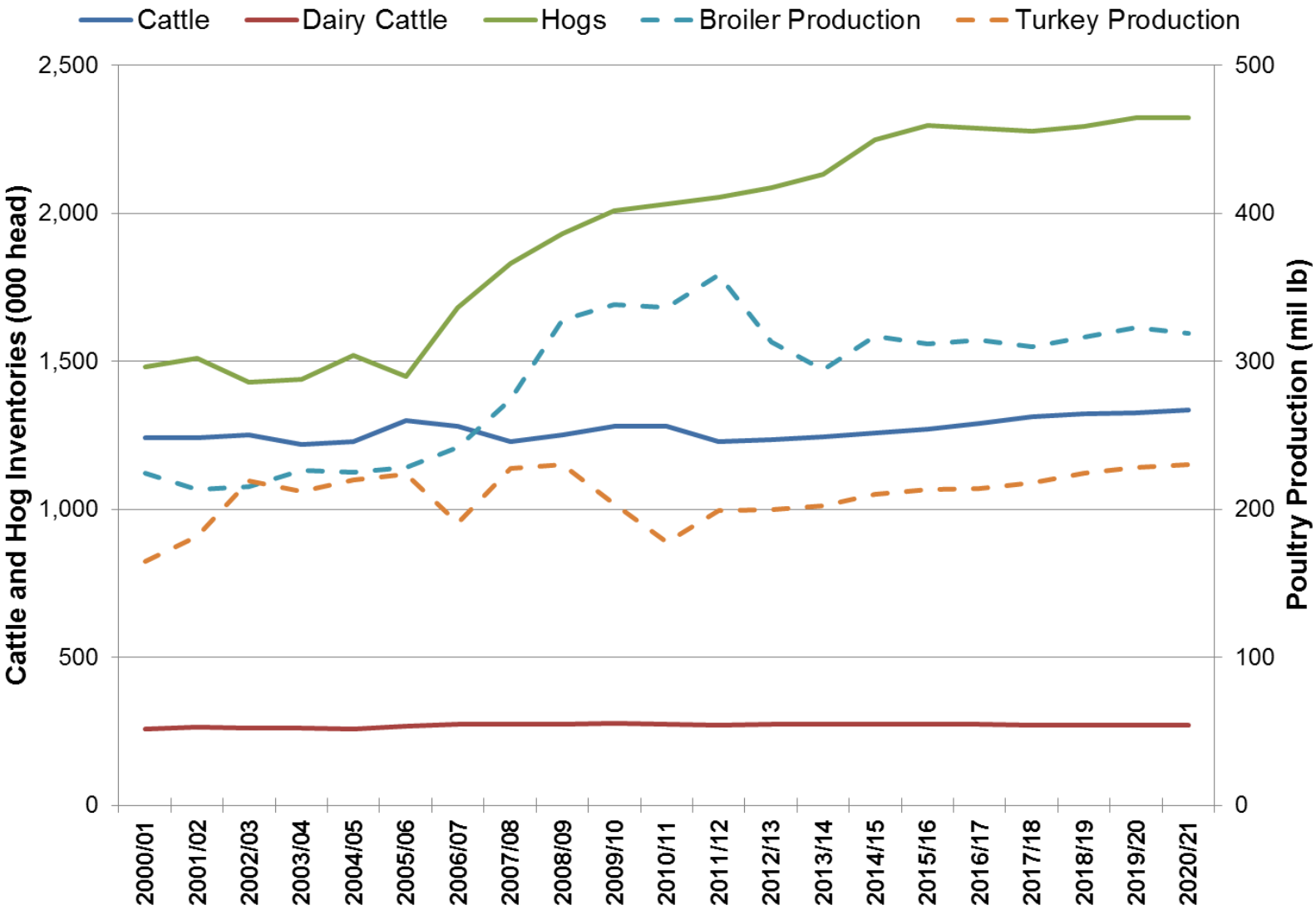
Figure 41: Ohio Livestock Inventories and Poultry Production



Source: Informa (Forecast), USDA (History)

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15. SOUTH DAKOTA

- South Dakota cattle inventories are expected to increase by approximately 11%, from 3.7 million head in 2009/10 to 4.1 million in 2020/21. The South Dakota herd represents 4% of total U.S. cattle inventories. Dairy cattle inventories are also expected to increase by 1% from 94 thousand head in 2009/10 to 95 thousand in 2020/21.

- Hog inventories are anticipated to expand 6%, increasing from 1.19 million head in 2009/10 to 1.26 million in 2020/21. South Dakota inventory levels account for 2% of total U.S. hog inventories.

- Turkey production in South Dakota was 187 million pounds in 2009/10 and is expected to increase 18% to 220 million pounds in 2020/21.

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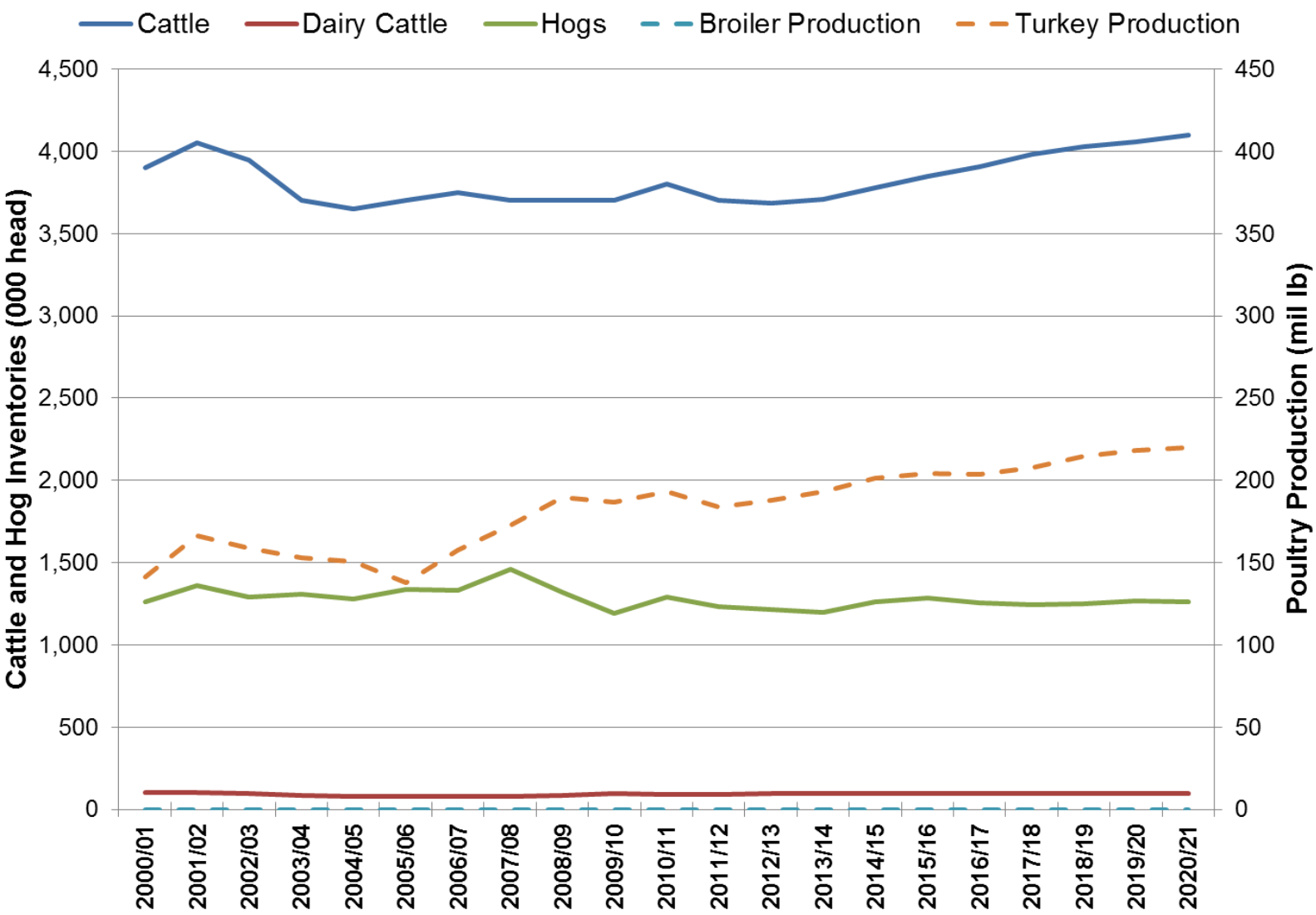
Figure 42: South Dakota Livestock Inventories and Poultry Production



Source: Informa (Forecast), USDA (History)

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16. TENNESSEE

- Cattle inventories in Tennessee are anticipated to contract 13%, from nearly 2 million head in 2009/10 to 1.7 million in 2020/21. The Tennessee herd size represents 2% of total U.S. cattle inventories. The dairy cattle herd is also expected to contract 27% dropping from 59 thousand head in 2009/10 to 43 thousand in 2020/21. However, the dairy cattle herd in Tennessee represents less than 1% of total U.S. dairy inventories.

- Broiler production is expected to increase 9% from 968 million pounds in 2009/10 to just over 1.0 billion in 2020/21. Tennessee broiler production represents 2% of U.S. production.

- The hog herd in Tennessee is expected to decline 6%, from 185 thousand head in 2009/10 to 173 thousand head in 2020/21. However, the hog herd in Tennessee represents only a minor portion (less than 1%) of U.S. production.

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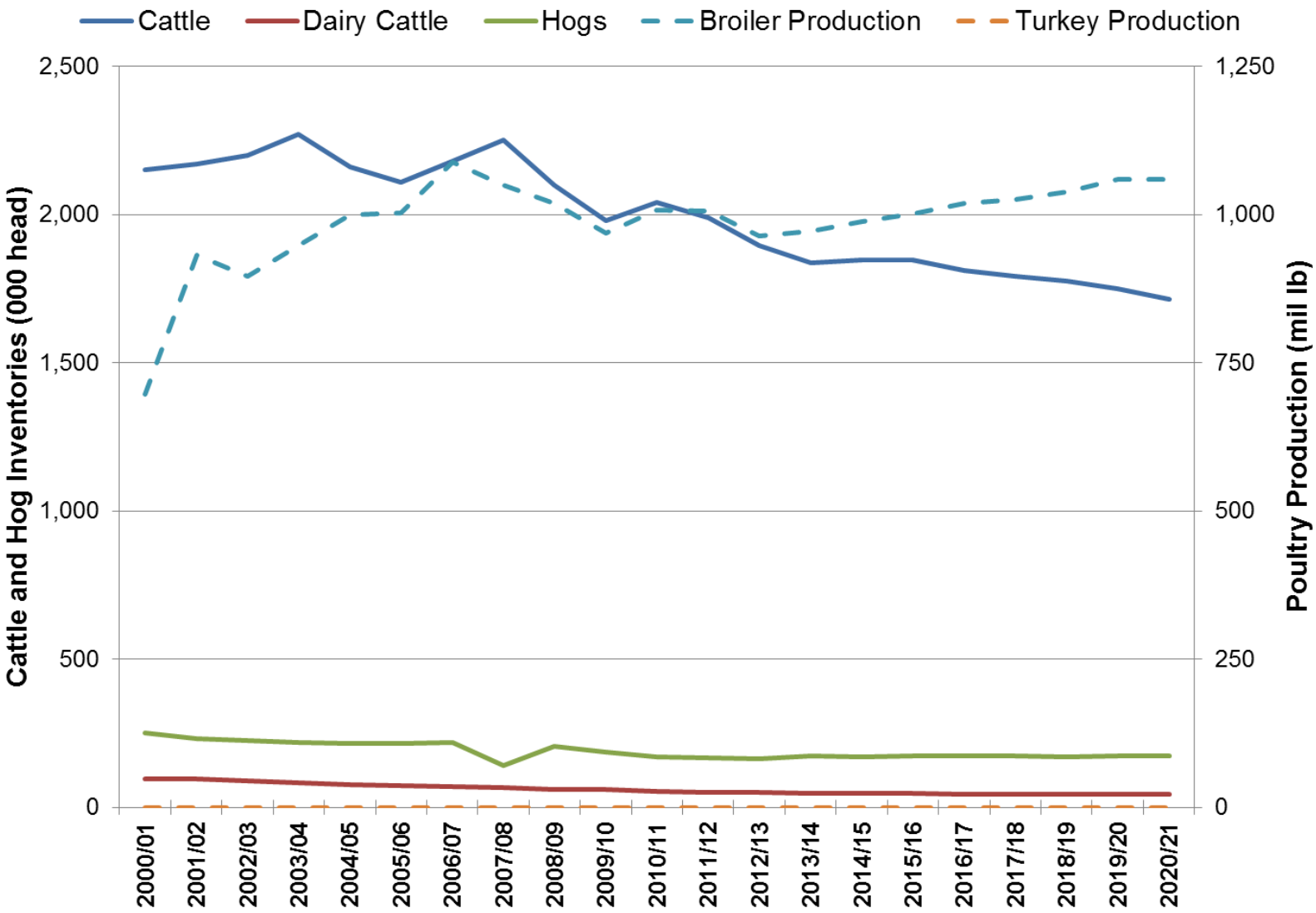
Figure 43: Tennessee Livestock Inventories and Poultry Production



Source: Informa (Forecast), USDA (History)

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17. WISCONSIN

- Wisconsin cattle inventories are expected to expand 18%, from 3.4 million head in 2009/10 to nearly 4 million in 2020/21. The Wisconsin inventory represents approximately 4% of total U.S. cattle inventories. Dairy cattle inventories are also anticipated to increase, but at a smaller rate, 1%. Herd size will increase from 1.26 million head in 2009/10 to 1.27 million in 2020/21. Wisconsin's dairy cattle inventory represents approximately 14% of total U.S. dairy inventories.

- Broiler production is anticipated to increase 27%, from 192 million pounds in 2009/10 to 244 million in 2020/21. However, Wisconsin broiler production represents less than 1% of total U.S. broiler production.

- Hog inventories in Wisconsin are anticipated to contract 12%, from 350 thousand head in 2009/10, to 308 thousand in 2020/21. This brings Wisconsin's total share of U.S. hog production to less than 1%.

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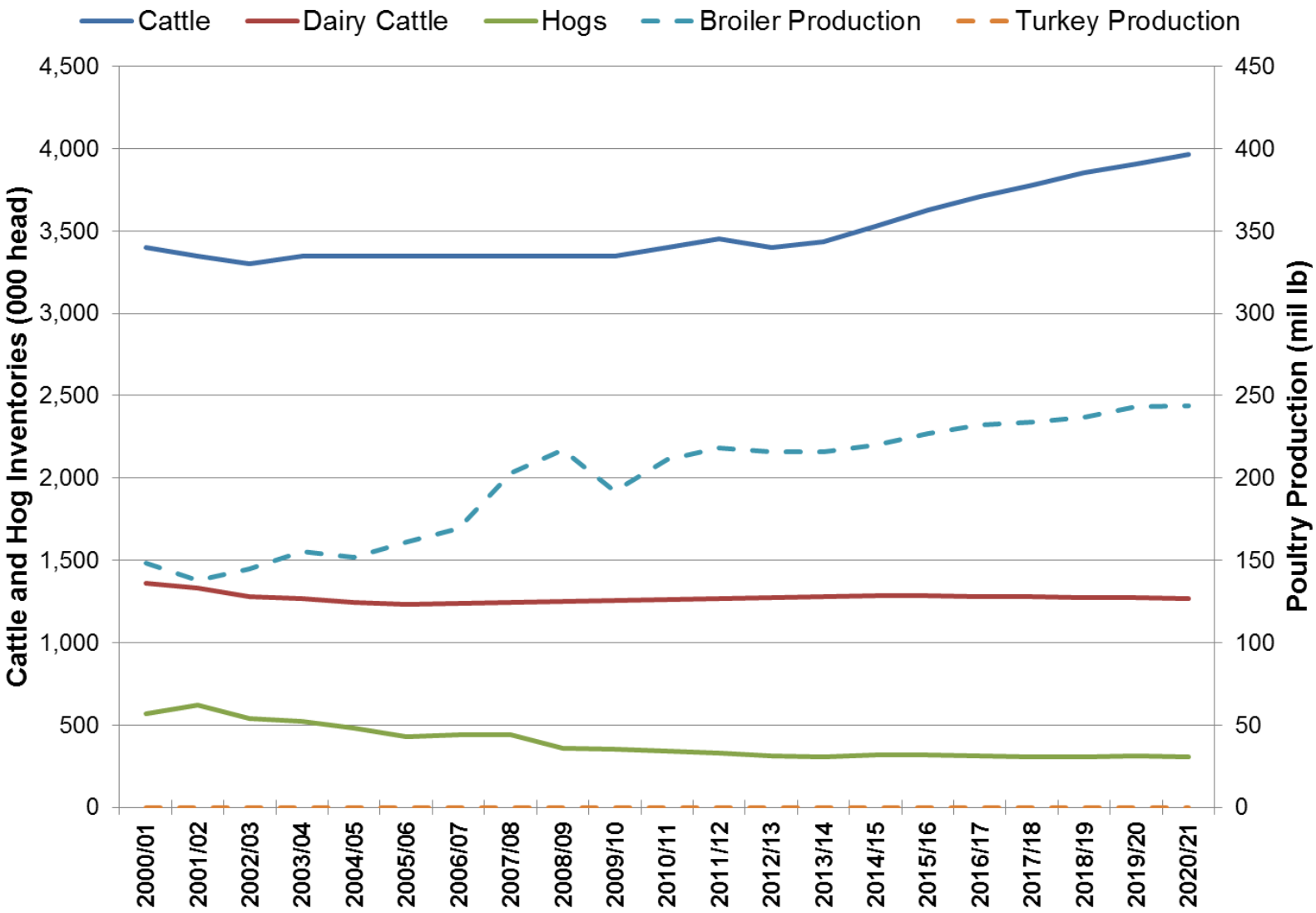
Figure 44: Wisconsin Livestock Inventories and Poultry Production



Source: Informa (Forecast), USDA (History)

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IV. State Level Surplus and Deficit Outlook

This section of the report analyzes the soybean surplus and deficit outlook for the 17 focus states. Macro level discussion of drivers impacting grain flows and the specific factors of soybeans for the states are presented. Each state's soybean net shipment is shown to indicate grain leaving the state as long haul moves by barge, rail or container. Truck movements are short haul in nature, occurring within a state, and from state to state and are considered in this analysis as an offset among nearby states. The net shipment level is the amount of surplus (how many soybeans are shipped out of the state) or deficit (how many soybeans are shipped into a state) grain and soybeans by state, depending if a state has more than enough grain and soybeans to fulfill state demand and inventories and processing capacity. A surplus state has more than enough grain and soybeans that are outshipments while a deficit state does not have enough grain and soybeans requiring inshipments.

A. Methodology for Calculating Net Shipments and Volume by Mode

For each agricultural producing state the movement of grains, oilseeds and meal were calculated from origin to destination. Net shipments, indicating a surplus or deficit for a state, were quantified by subtracting total use and carryout from total supply for each state. After calculating net shipments, the amount flowing by mode was estimated.

For rail moves, Informa utilized the Public Use Waybill (PUWB) of the Surface Transportation Board of the Department of Transportation. The PUWB is a compilation of waybills reported by the railroads. The railroads report many parameters for each carloading such as car type, tons, commodity, origin and termination market, revenue, etc. For this study, Informa prepared key analysis using the 2010 PUWB through crop year 2009/10 for agricultural commodities to establish base line values.

PUWB reports waybills by Bureau Economic Areas (BEA). In most cases, BEAs overlap state boundaries but the counties in each BEA are known. In order to accurately calculate rail volume from origin states, Informa took the crop production of each county and assigned a percentage from each state to a particular BEA. This was done for corn, soybeans, sorghum, wheat, barley and oats. In order to calculate byproduct origin states, Informa used its database of soybean crushers and ethanol facilities to pinpoint soybean meal, soybean oil and DDGS origination. Since PUWB reports waybills for destinations the same way they report originations, Informa used its knowledge of export, processing and feeding locations to determine the exact state of destination.

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Barge volume on the Mississippi River system from state to state was estimated by using the Army Corps of Engineers Lock Performance Monitoring System and the Waterborne Commerce of the United States data. Pool level volume was calculated for downbound commodity movements. This was prepared by subtracting the volume of a lock with the lock directly upriver in order to establish the volume entering the river between the two locks. To establish which state originated the specific grains, because in most cases two states share the same river, the static grain elevator capacity of each state within the specific pools was used to form the share of grain from each state. Most barge volume moving on the river system is destined for export position in Louisiana. There are some state to state movements as domestic shipments.

Barge level forecast was based on Informa's long term export forecast out of the Center Gulf. This forecast takes into account the expansion of the Panama Canal, which will be completed in October 2014.

Base year container volume was obtained using data available through PIERS. The volume of grain and byproducts exported in containers was estimated for each state and export position. This allowed Informa to establish the origin state and destination state for container movements.

The forecast for container volume was based on the projected long term crop outlook and Informa's understanding of potential growth in domestic and international container demand.

B. Key Drivers Impacting Grain Transportation Flows

- Dairy feed costs hit a new record high in 2011, peaking higher and ending with a higher average than in 2008. There was anticipation that the high feed costs would shift some competitive advantage from Western and Southwestern states back toward the upper Midwest and Corn Belt. But at least during 2011, the Western and Southwestern states saw significant herd expansion while the herd was relatively unchanged in the upper Midwest and Corn Belt. As a result, the demand for longer haul shuttle train moves to feed dairy cows in the Southwest and Western states will continue.

- For poultry production, a sharp increase in feed input costs in 2011, as well as lackluster demand for broiler white meat, has caused the industry to shrink over the past few months, and domestic broiler production should decline in 2012. In terms of transportation, not much impact would be expected as poultry production will remain in the Southeast and the supply of feed inputs will continue to be transported from the eastern Corn Belt.

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- For pork production, the sector cycles back into an expanding production base; a key question is "where" this growth will occur. Recall that a good portion of expanded pork production over the next five years will come from increased sow herd productivity and larger hog carcasses. The moratorium on sow expansion in North Carolina will likely persist, and high feed costs will restrain production expansion in feed deficit areas. It is probable that whatever growth in numbers, these will tend to occur close to the source of feed and that would suggest that the western and eastern Corn Belt states will post modest growth.

- Drought has a big impact on beef cattle production as cattle are forced into feed lots at earlier stages of maturity than normal. Drought stricken areas are forced to bring in more feed grains as a result of poor production in the areas. This was seen this past year in Texas and Oklahoma as more grain is brought into the area from farther distances.

- China is a major driver for U.S. grain transportation. Increased demand for soybeans has caused U.S. soybeans to be transported to export positions at a higher rate over the last five years. Recently China has started to demand corn in order to feed their burgeoning animal production. Informa estimates that China will double their imports of soybeans from over 50 million metric tons to nearly 106 million metric tons in 2020/21 while corn import demand in 2020 will be about 2.7 million metric tons compared to 1.9 million in 2010/11.

C. Soybean and Soybean By-Product Destinations

1. Soybeans

- Downbound soybeans moving by barge are destined for export positions in Louisiana.

- Soybeans moving by rail are destined for export position and to a certain extent domestic crushing.
    - In 2009/10, 68% of soybeans traveled to the PNW, followed by the Center Gulf (Louisiana) with 14%.

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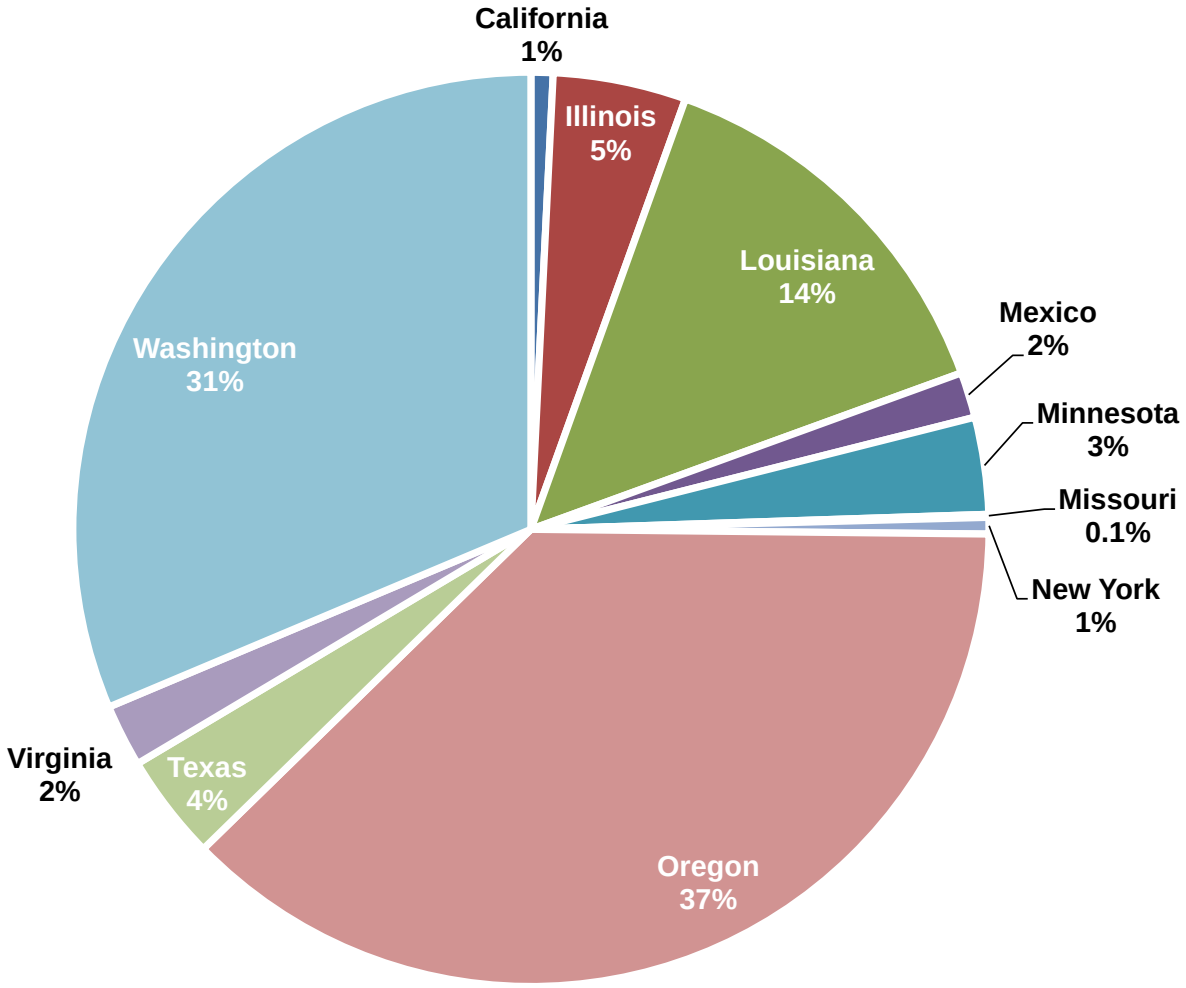
Figure 45: Rail Soybean Destinations 2009/10 (percent by state)



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2. Soybean Meal and Oil

- Due to multiple states for soybean meal destinations, grain flow regions were used instead.
- Low volumes of soybean meal and oil move by barge.
- In 2009/10, the leading destination for soybean meal being transported by rail was to the PNW with 18%, followed by the Southeast feed market with 17%.
- 2009/10 was a record year for soybean meal moving by rail with more than 20.7 million tons transported. This exceeded 2007/08 when 20.6 million tons of soybean meal was transported by rail.
- Soybean meal volume to Washington State has increased over 400% from 2003/04 (422,000 tons) to 2009/10 (2,156,000 tons).
- Shipments of soybean meal to Mississippi and Arkansas have declined 29% since 2007/08 when over 3 million tons of soybean meal was shipped to these states.
- In 2009/10, Illinois was the leading destination for soybean meal with slightly over 3 million tons followed by Texas with nearly 2.4 million tons.
- In 2009/10, more than 7 million tons of soybean oil moved by rail; this was an 11% increase from 2008/09.
- In 2009/10, Illinois was the leading destination for soybean oil with over 2 million tons followed by California with nearly 1 million tons.

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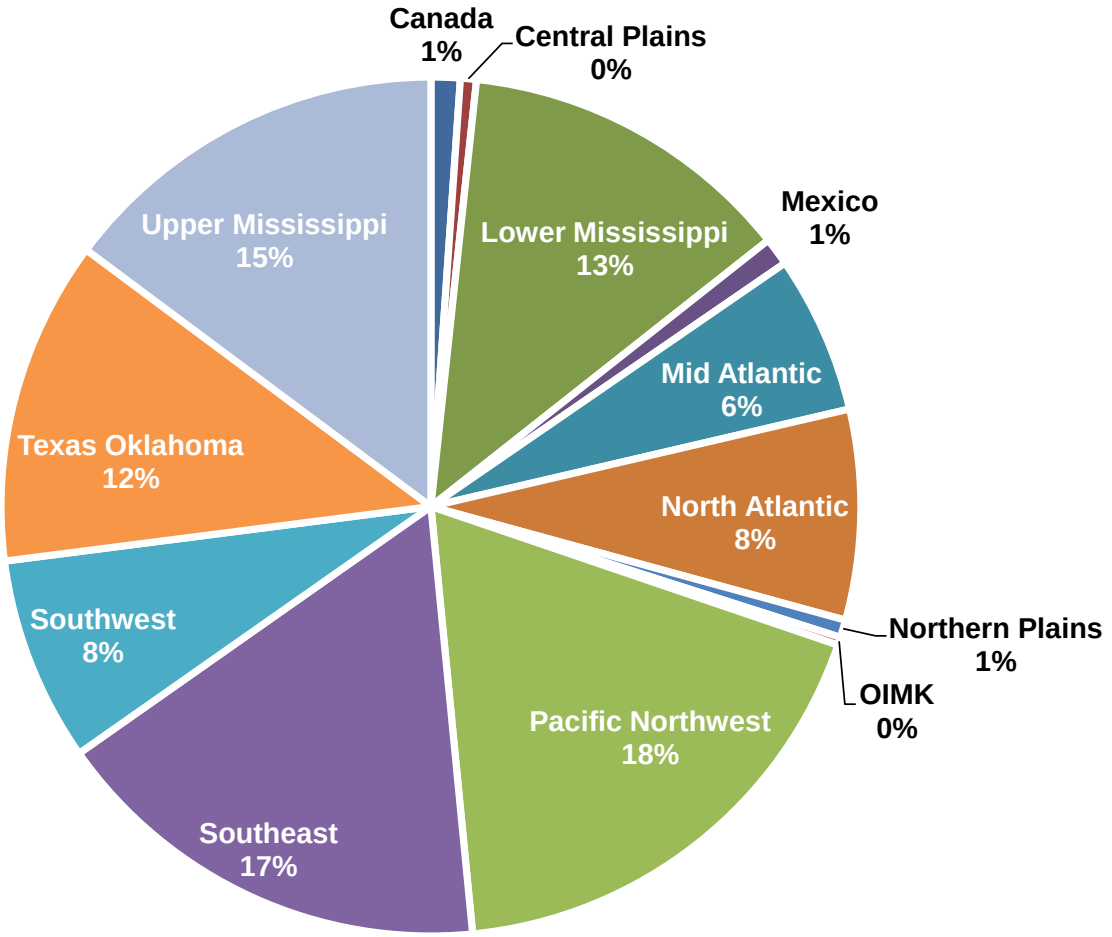
Figure 46: Rail Soybean Meal Destinations 2009/10 (percent by state)



Notes: OIMK equals Ohio, Indiana, Michigan, Kentucky

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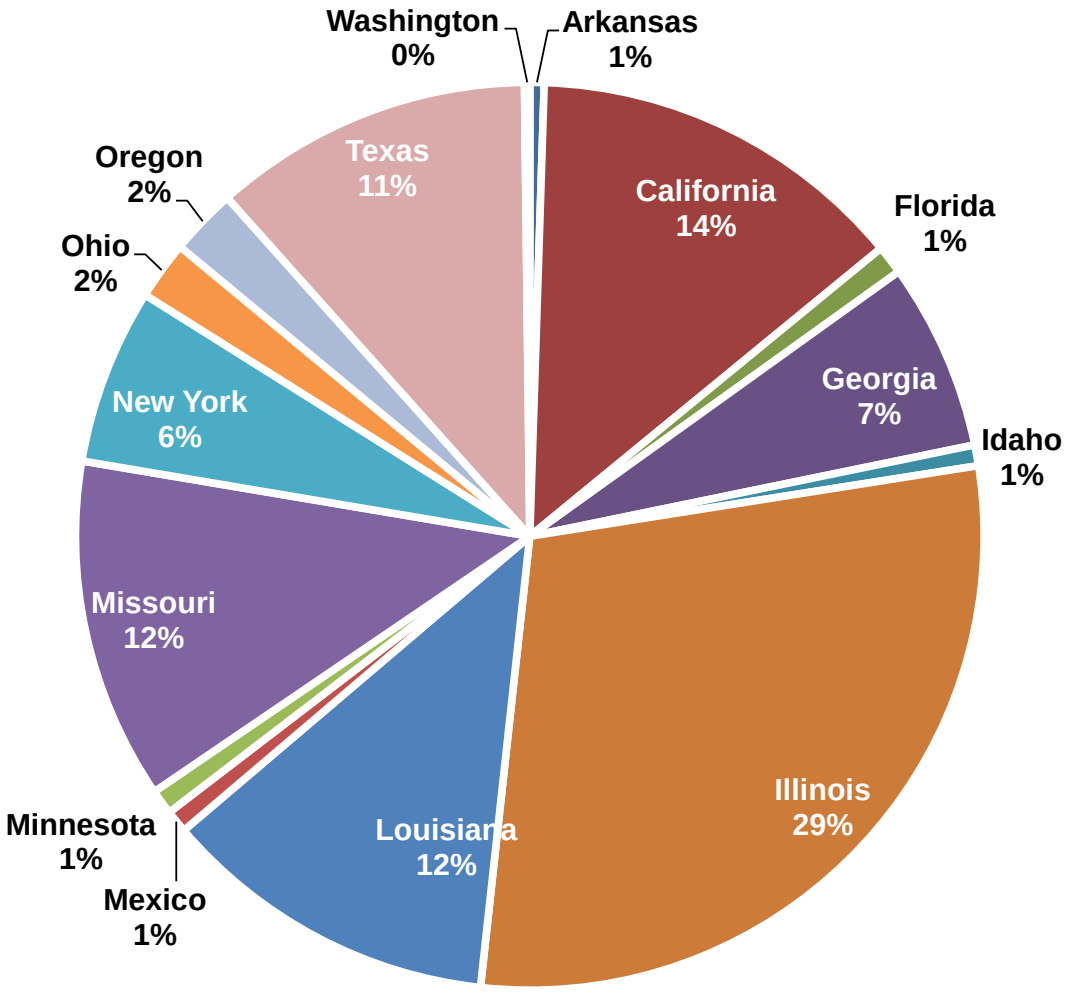
Figure 47: Rail Soybean Oil Destinations 2009/10 (percent by state)



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D. State Summaries

This section includes summarized long haul modal information for each of the 17 target states. The information includes a state map depicting soybean production density, agricultural facilities and key transportation infrastructure, followed by a summary of each state's surplus and deficit outlook, modal distribution for soybean movements and summarized information of its agricultural infrastructure.

The modal demand of each state's soybean volume indicates that rail carloadings will increase 36% to over 367 thousand and barge loadings will increase 55% to 19 thousand as shown in Table 9. The 17 states currently represent 93% of the soybean carloadings in the U.S. while in 2020/21, it is expected they will represent 92%. Compared with barge movements, the 17 states represent 100% of the soybeans moving on the navigable waterways of the Mississippi River System[5].

The forecast for soybean rail carloadings is based on the trends in the historical percentage of soybean carloadings compared with total carloadings; in addition, the tons per carload were calculated using the same methodology. The tons per soybean carload are expected to increase from average of 101 tons in 2009/10 to more than 110 tons in 2020/21. The barge forecast is based on Informa's long term export forecast.

[5] Louisiana is not one of the seventeen states analyzed in this study; however, barges do move soybeans to export position from this state.

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Table 9: Current and Future Demand for Carloadings and Barge Loadings of Soybeans in 17 Focus States

State	Rail Carloadings		Barge Loadings	
	2009/10	2020/21	2009/10	2020/21
Arkansas	1,544	2,342	1,261	2,061
Illinois	17,000	21,080	3,710	3,991
Indiana	15,872	17,152	624	856
Iowa	18,959	33,041	1,093	2,187
Kansas	17,419	24,510	-	-
Kentucky	502	797	245	669
Michigan	6,361	8,018	-	-
Minnesota	35,583	38,859	878	1,613
Mississippi	602	474	1,255	954
Missouri	10,582	18,466	1,520	2,491
Nebraska	30,618	42,438	-	-
North Carolina	-	-	-	-
North Dakota	41,205	52,331	-	-
Ohio	22,350	38,557	503	877
South Dakota	30,012	35,436	-	-
Tennessee	2,805	2,008	817	1,335
Wisconsin	969	2,152	499	1,208
Sub Total	252,385	337,661	12,406	18,241
Others	18,359	29,392	-	-
U.S. Total	270,744	367,053	12,406	18,241

Source: Informa Economics

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Table 10: Current and Future Soybean Volume (tons) by Mode in 17 Focus States

State	Production		Net Shipments		Rail Volume		Barge Volume	
	2009/10	2020/21	2009/10	2020/21	2009/10	2020/21	2009/10	2020/21
Arkansas	3,678,750	3,991,885	2,948,737	3,280,175	145,175	220,141	2,143,562	3,503,600
Illinois	12,903,000	15,047,864	4,806,037	6,682,626	1,683,044	2,086,932	5,765,149	6,201,163
Indiana	7,996,800	9,252,627	540,563	1,632,105	1,587,196	1,715,194	974,127	1,336,507
Iowa	14,580,900	17,110,787	2,908,076	5,705,803	1,895,893	3,304,140	1,698,441	3,397,956
Kansas	4,818,000	4,899,597	2,850,820	2,933,156	1,759,367	2,475,545	-	-
Kentucky	2,044,800	2,255,629	378,262	1,810,418	48,167	76,500	416,616	1,136,922
Michigan	2,388,000	2,982,500	2,081,761	2,637,362	636,093	801,846	-	-
Minnesota	8,544,000	11,746,520	3,459,297	6,634,831	3,771,786	4,119,005	1,363,696	2,506,455
Mississippi	2,314,200	2,166,003	2,250,200	2,092,432	56,590	44,512	2,134,255	1,621,167
Missouri	6,916,500	7,789,598	2,327,882	3,234,796	1,068,777	1,865,051	2,362,163	3,869,833
Nebraska	7,782,600	9,269,520	4,588,180	5,966,680	3,276,149	4,540,871	-	-
North Carolina	1,785,000	1,566,299	250,446	(84,844)	-	-	-	-
North Dakota	3,483,000	4,689,092	3,356,553	4,514,127	4,408,899	5,599,384	-	-
Ohio	6,659,100	7,954,495	3,104,558	4,414,075	2,190,321	3,778,593	785,333	1,369,109
South Dakota	5,279,400	5,851,244	4,612,216	5,090,043	3,241,325	3,827,088	-	-
Tennessee	2,065,500	1,742,966	1,979,998	1,656,259	263,696	188,721	1,388,572	2,269,587
Wisconsin	1,944,000	2,687,392	1,804,252	2,475,365	98,872	219,541	775,543	1,876,531
Sub Total	95,183,550	111,004,017	44,247,839	60,675,409	26,131,351	34,863,065	19,807,459	29,088,830
Others	5,586,780	14,695,983	N/A	N/A	1,319,201	6,725,361	N/A	N/A
U.S. Total	100,770,330	125,700,000	N/A	N/A	27,450,552	41,588,426	19,807,459	29,088,830

Source: Informa Economics

Notes: Louisiana does move some soybeans by barge.

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Soybean barge movement is predominantly destined for the Center Gulf to be exported to foreign countries. A minority of the barge movements are used for domestic placement of soybeans. Soybean rail movements for the focus states are mixed between the Center Gulf and PNW followed by the Texas Gulf and isolated volumes to the Atlantic positions as shown in Table 11.

Table 11: Percentage of Soybeans Moved to Export Positions by Focus States

Soybeans	Barge		Rail				
	Export Position Barge		Export Positon Rail				
Focus State	Center Gulf	Domestic Barge Moves	Center Gulf	PNW	Texas Gulf	Atlantic	Domestic Rail Move
Arkansas	98%	2%	60%	0%	0%	0%	40%
Illinois	93%	7%	53%	14%	4%	0%	29%
Indiana	93%	7%	36%	5%	0%	0%	59%
Iowa	91%	9%	10%	80%	2%	0%	8%
Kansas			29%	0%	51%	0%	20%
Kentucky	93%	7%	60%	0%	0%	0%	40%
Michigan			88%	0%	0%	0%	12%
Minnesota	91%	9%	2%	91%	0%	0%	7%
Mississippi	97%	3%	60%	0%	0%	0%	40%
Missouri	96%	4%	24%	46%	12%	0%	17%
Nebraska			11%	81%	4%	0%	4%
North Carolina							
North Dakota			2%	92%	0%	0%	5%
Ohio	94%	6%	48%	0%	0%	48%	4%
South Dakota			5%	90%	0%	0%	6%
Tennessee	95%	5%	60%	0%	0%	0%	40%
Wisconsin	96%	4%	4%	76%	0%	0%	20%

Source: Public Use Waybill, Army Corps of Engineers and Informa Economics

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Soybean meal travels from and throughout the 17 focus states by rail and truck. The states that crush soybeans will use trucks and to a certain extent rail to transport soybean meal within the state. States like Illinois, Kansas and Nebraska send most of their soybean meal via rail to help meet other states' demand. The percentage of soybean meal that remains in and leaves each of the focus states is shown in Table 12. The percentage of soybean oil is shown in Table 13.

Table 12: Percentage of Soybean Meal Remaining in the Focus States and Departing the States

State	Stays In State			Leaves State
	Truck	Rail	Total	Rail
Arkansas				
Illinois	5%	19%	25%	75%
Indiana	48%	0%	48%	52%
Iowa	45%	0%	45%	55%
Kansas	28%	0%	28%	72%
Kentucky				
Michigan				
Minnesota	46%	1%	47%	53%
Mississippi				
Missouri	57%	0%	57%	43%
Nebraska	32%	0%	32%	68%
North Carolina				
North Dakota				
Ohio	64%	0%	64%	36%
South Dakota	61%	0%	61%	39%
Tennessee				
Wisconsin	64%	0%	64%	36%

Source: Public Use Waybill and Informa Economics

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Table 13: Percentage of Soybean Oil Remaining in the Focus States and Departing the States

State	Stays In State	Leaves State
	Rail	Rail
Arkansas		
Illinois		
Indiana	0%	100%
Iowa		
Kansas	0%	100%
Kentucky		
Michigan		
Minnesota	4%	96%
Mississippi		
Missouri	19%	81%
Nebraska	0%	100%
North Carolina		
North Dakota		
Ohio		
South Dakota	0%	100%
Tennessee		
Wisconsin	0%	100%

Source: Public Use Waybill and Informa Economics

Notes: Modal share data for soybean oil is only available for rail.

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The value of each focus state's production of soybeans indicates that Iowa and Illinois had the highest total value while North Carolina and Tennessee had the lowest total. The value was calculated by multiplying each state's soybean production by the average farm price in each year. For the 17 states, the average value has ranged from $867 million in 2002/03 to $2.1 billion in 2010/11 as shown in Table 14.

Table 14: Value of Soybean Production in Focus States ($ millions)

State	2002/2003	2003/2004	2004/2005	2005/2006	2006/2007	2007/2008	2008/2009	2009/2010	2010/2011	2011/2012
Arkansas	$ 545	$ 791	$ 722	$ 604	$ 689	$ 916	$ 1,191	$ 1,185	$ 1,202	$ 1,491
Illinois	$ 2,568	$ 2,851	$ 2,891	$ 2,531	$ 3,222	$ 3,746	$ 4,372	$ 4,215	$ 5,500	$ 4,955
Indiana	$ 1,329	$ 1,565	$ 1,609	$ 1,524	$ 1,855	$ 2,247	$ 2,492	$ 2,612	$ 2,973	$ 2,761
Iowa	$ 2,766	$ 2,640	$ 2,865	$ 2,909	$ 3,356	$ 4,712	$ 4,586	$ 4,627	$ 5,558	$ 5,500
Kansas	$ 321	$ 438	$ 599	$ 575	$ 628	$ 870	$ 1,129	$ 1,506	$ 1,588	$ 1,154
Kentucky	$ 244	$ 399	$ 336	$ 312	$ 403	$ 306	$ 476	$ 675	$ 539	$ 693
Michigan	$ 441	$ 399	$ 430	$ 439	$ 574	$ 694	$ 687	$ 759	$ 985	$ 990
Minnesota	$ 1,674	$ 1,731	$ 1,373	$ 1,711	$ 2,020	$ 2,727	$ 2,675	$ 2,674	$ 3,586	$ 3,108
Mississippi	$ 242	$ 369	$ 381	$ 344	$ 267	$ 488	$ 728	$ 713	$ 793	$ 835
Missouri	$ 942	$ 1,098	$ 1,254	$ 1,030	$ 1,256	$ 1,769	$ 1,862	$ 2,216	$ 2,462	$ 2,259
Nebraska	$ 957	$ 1,279	$ 1,210	$ 1,306	$ 1,516	$ 1,948	$ 2,212	$ 2,459	$ 2,945	$ 2,972
North Carolina	$ 174	$ 306	$ 284	$ 222	$ 276	$ 307	$ 514	$ 571	$ 484	$ 469
North Dakota	$ 462	$ 586	$ 472	$ 568	$ 729	$ 1,046	$ 1,022	$ 1,075	$ 1,508	$ 1,283
Ohio	$ 844	$ 1,186	$ 1,192	$ 1,157	$ 1,403	$ 1,979	$ 1,661	$ 2,171	$ 2,534	$ 2,566
South Dakota	$ 676	$ 804	$ 782	$ 726	$ 789	$ 1,306	$ 1,332	$ 1,615	$ 1,715	$ 1,717
Tennessee	$ 198	$ 332	$ 270	$ 240	$ 278	$ 198	$ 469	$ 671	$ 485	$ 480
Wisconsin	$ 358	$ 332	$ 305	$ 392	$ 436	$ 549	$ 545	$ 623	$ 889	$ 861
Average	$ 867	$ 1,006	$ 999	$ 976	$ 1,159	$ 1,518	$ 1,644	$ 1,786	$ 2,103	$ 2,006

Source: Informa Economics

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Soybeans travel a very long distance from the field to their eventual destination within the U.S. The average distance on barge is 1,053 miles and rail is 1,006 miles. Interviews with grain elevator managers indicated that a majority of grain originated at elevators comes from within a 25-mile radius. Minnesota soybeans travel the farthest as most of the soybeans leaving the state are sent to export position at the PNW or sent by barge to the Center Gulf as shown in Table 15.

Table 15: Average Length of Haul (Miles) for Soybeans by Mode

State	Truck	Rail	Barge	Truck	Rail	Barge
Arkansas	25	610	533	2%	52%	46%
Illinois	25	1,081	1,205	1%	47%	52%
Indiana	25	1,254	1,014	1%	55%	44%
Iowa	25	1,293	1,296	1%	49%	50%
Kansas	25	863		3%	97%	0%
Kentucky	25	596	1,003	2%	37%	62%
Michigan	25	881		3%	97%	0%
Minnesota	25	1,397	1,617	1%	46%	53%
Mississippi	25	610	416	2%	58%	40%
Missouri	25	957	1,010	1%	48%	51%
Nebraska	25	1,487		2%	98%	0%
North Carolina	25			100%	0%	0%
North Dakota	25	1,446		2%	98%	0%
Ohio	25	638	1,332	1%	32%	67%
South Dakota	25	1,432		2%	98%	0%
Tennessee	25	610	690	2%	46%	52%
Wisconsin	25	938	1,462	1%	39%	60%

Source: Public Use Waybill and Informa Economics

Notes: Since North Carolina moves essentially all of its soybeans and soybean products by truck, the average truck mile for that state is probably further than 25 miles.

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Compared to corn, soybeans are consistently a smaller percentage of net shipments from the focus states. However, the percentage of soybean net shipments compared with corn and wheat has grown from 14% in 2007/08 to 22% in 2010/11 as shown in Figure 48. Arkansas consistently has the highest percentage of soybean net shipments relative to corn and wheat net shipments among the focus states as shown in Table 16.

Table 16: Percentage of Soybean Net Shipments by Focus States

State	2002/2003	2003/2004	2004/2005	2005/2006	2006/2007	2007/2008	2008/2009	2009/2010	2010/2011	2011/2012
Arkansas	53.1%	50.9%	62.7%	59.5%	53.0%	32.1%	54.8%	50.5%	58.9%	38.3%
Illinois	16.3%	12.5%	15.5%	11.7%	11.9%	8.8%	11.8%	11.0%	13.6%	9.6%
Indiana	6.8%	2.8%	8.5%	6.4%	7.7%	4.5%	5.5%	3.5%	4.9%	-1.5%
Iowa	7.8%	0.8%	6.0%	6.1%	7.0%	11.4%	10.4%	10.8%	18.7%	11.6%
Kansas	-2.2%	-1.8%	4.6%	2.6%	3.3%	4.5%	9.7%	11.9%	9.8%	5.8%
Kentucky	-12.0%	-0.9%	-3.5%	-6.1%	-4.1%	-17.7%	-0.2%	6.3%	2.0%	2.7%
Michigan	20.6%	15.4%	18.8%	17.4%	22.5%	22.3%	20.9%	21.4%	23.5%	20.5%
Minnesota	18.7%	9.2%	3.4%	7.5%	12.2%	12.5%	12.0%	11.2%	16.0%	15.6%
Mississippi	36.8%	39.6%	47.9%	52.1%	37.0%	23.5%	43.5%	50.7%	43.8%	34.6%
Missouri	26.1%	19.7%	26.0%	24.5%	28.1%	12.2%	15.7%	21.4%	19.2%	16.8%
Nebraska	9.8%	9.8%	11.9%	10.7%	12.4%	13.6%	15.8%	16.8%	17.2%	17.1%
North Carolina	-436.8%	-37.3%	-27.7%	-38.1%	-43.7%	-35.4%	-0.1%	12.4%	-23.9%	-13.8%
North Dakota	20.8%	20.1%	18.2%	19.9%	22.4%	22.4%	23.1%	23.7%	28.8%	25.2%
Ohio	6.5%	9.1%	13.7%	12.0%	13.5%	17.0%	14.5%	22.1%	23.0%	25.8%
South Dakota	24.7%	18.5%	18.6%	19.0%	25.3%	23.7%	21.8%	25.3%	26.6%	26.0%
Tennessee	-63.5%	-141.6%	-185.9%	-89.9%	-80.3%	-65.6%	-100.2%	-199.9%	-61.7%	-278.0%
Wisconsin	16.1%	14.1%	18.2%	18.4%	19.2%	18.9%	20.9%	23.1%	18.3%	19.0%
Average	16.7%	14.7%	18.0%	17.4%	18.1%	14.0%	18.7%	20.6%	21.6%	17.8%

Source: Informa Economics

Notes: Negative number indicates the state took in shipments of soybeans. The average does not include North Carolina and Tennessee since they are consistently soybean deficit states. Percentages were calculated by dividing soybean net shipments for each state by the sum of soybean, corn and wheat net shipments.

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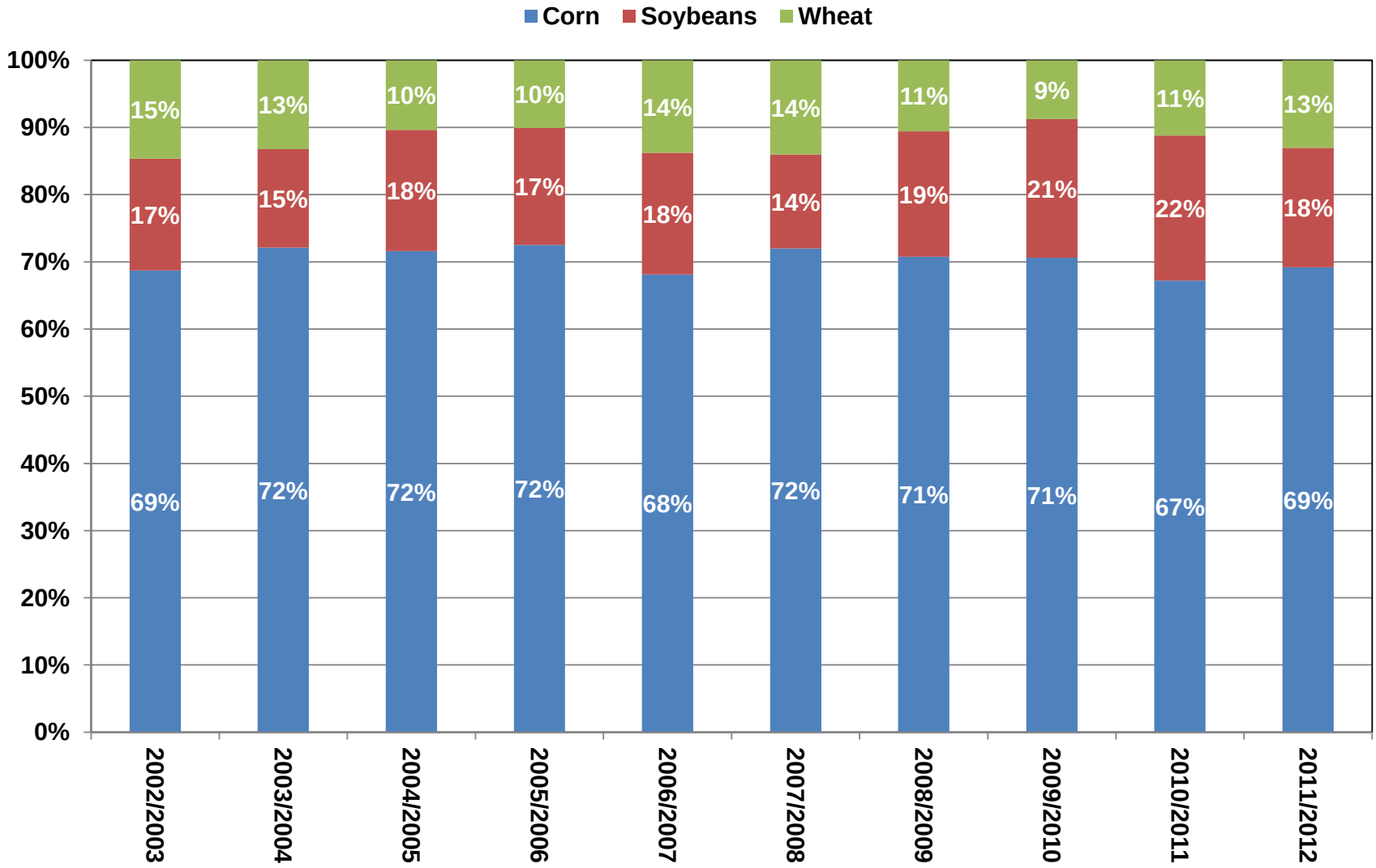
Figure 48: Percentage of Total Net Shipments Accounted for by Corn, Soybeans and Wheat for Focus States



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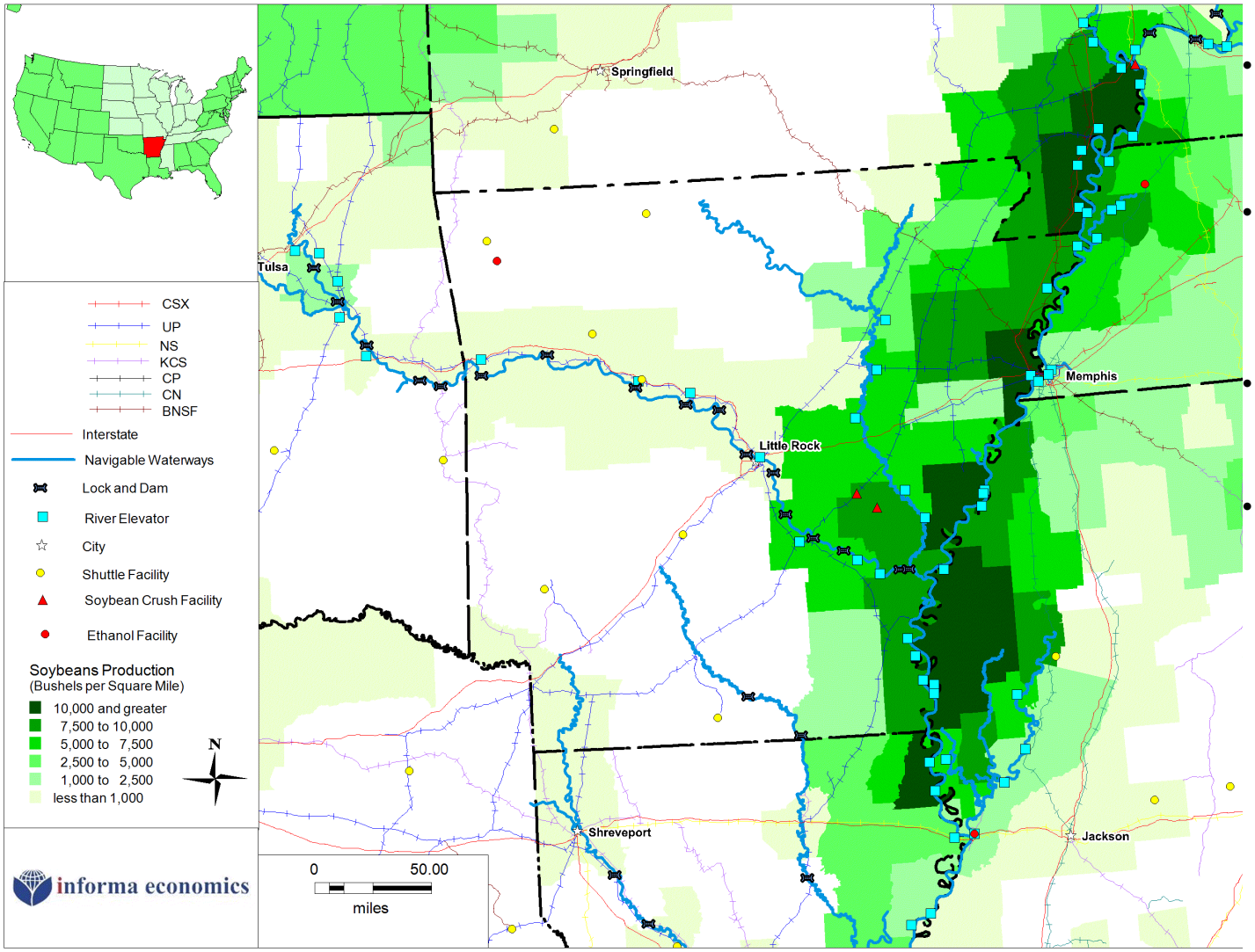
ARKANSAS



Production

- Soybean production occurs mostly along the eastern border of the state near the Mississippi River Delta region.
- Arkansas is a significant producer of poultry, primarily broilers and turkeys.

Infrastructure

- Arkansas has 2,780 miles of rail lines, 658 miles of interstate, and 100,100 total road miles.
- The state also has seven shuttle facilities; two soybean crush facilities; one ethanol facility; 140 grain elevators and 26 river elevators.

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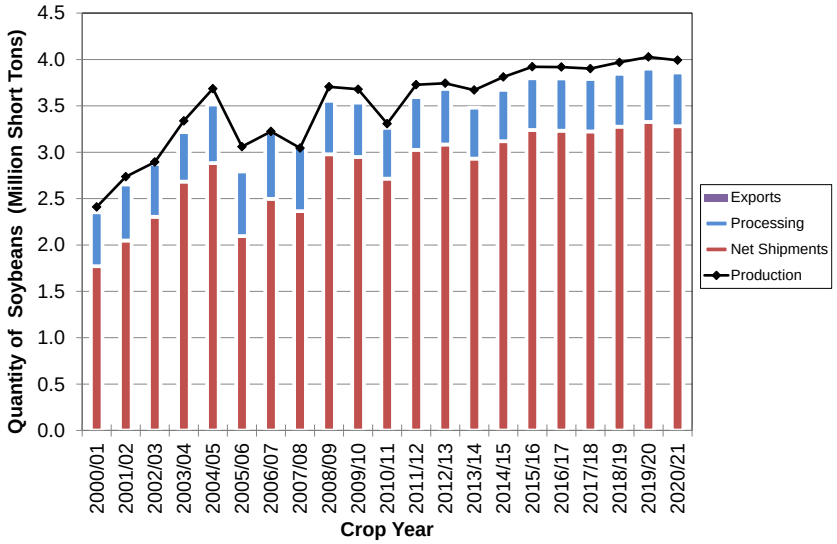
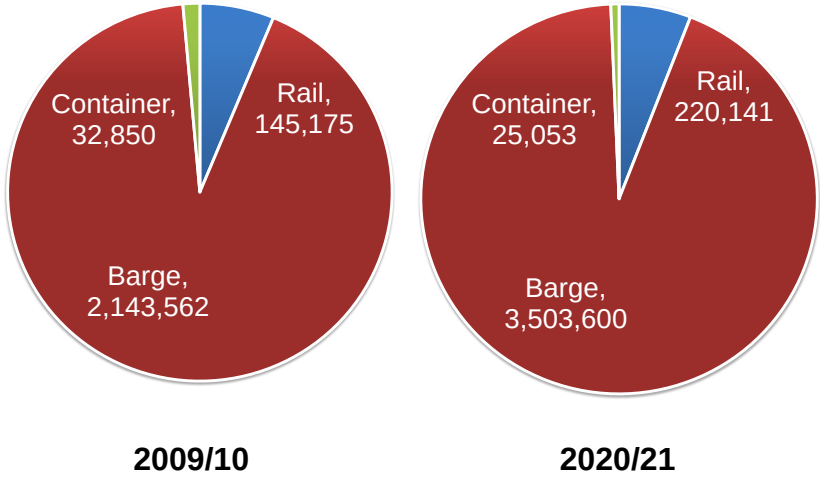
ARKANSAS

Soybean Surplus and Deficit Outlook



Soybean Movements by Mode (Short Tons)



Agricultural Infrastructure: Crush, Ethanol Facilities, Livestock Processing, and Grain Storage

Facility Type	# of Facilities	Capacity/Size	
Soybean Crushers	2	1,976	MT/Day
Ethanol Facility* (operating)	1	0.04	MGY
Federally Inspected Livestock Slaughter/Processing Facilities	73	n/a	
State Inspected Livestock Slaughter/Processing Facilities	0	n/a	
Grain Elevators	140	277,641	Thous. Bu. Storage
Shuttle Elevators	7	8,105	Thous. Bu. Storage
River Elevators**	26	51,645	Thous. Bu. Storage

** Cellulosic ethanol facilities are included in ethanol facility database.*

*** Missing river elevator capacity at 1 AR location*

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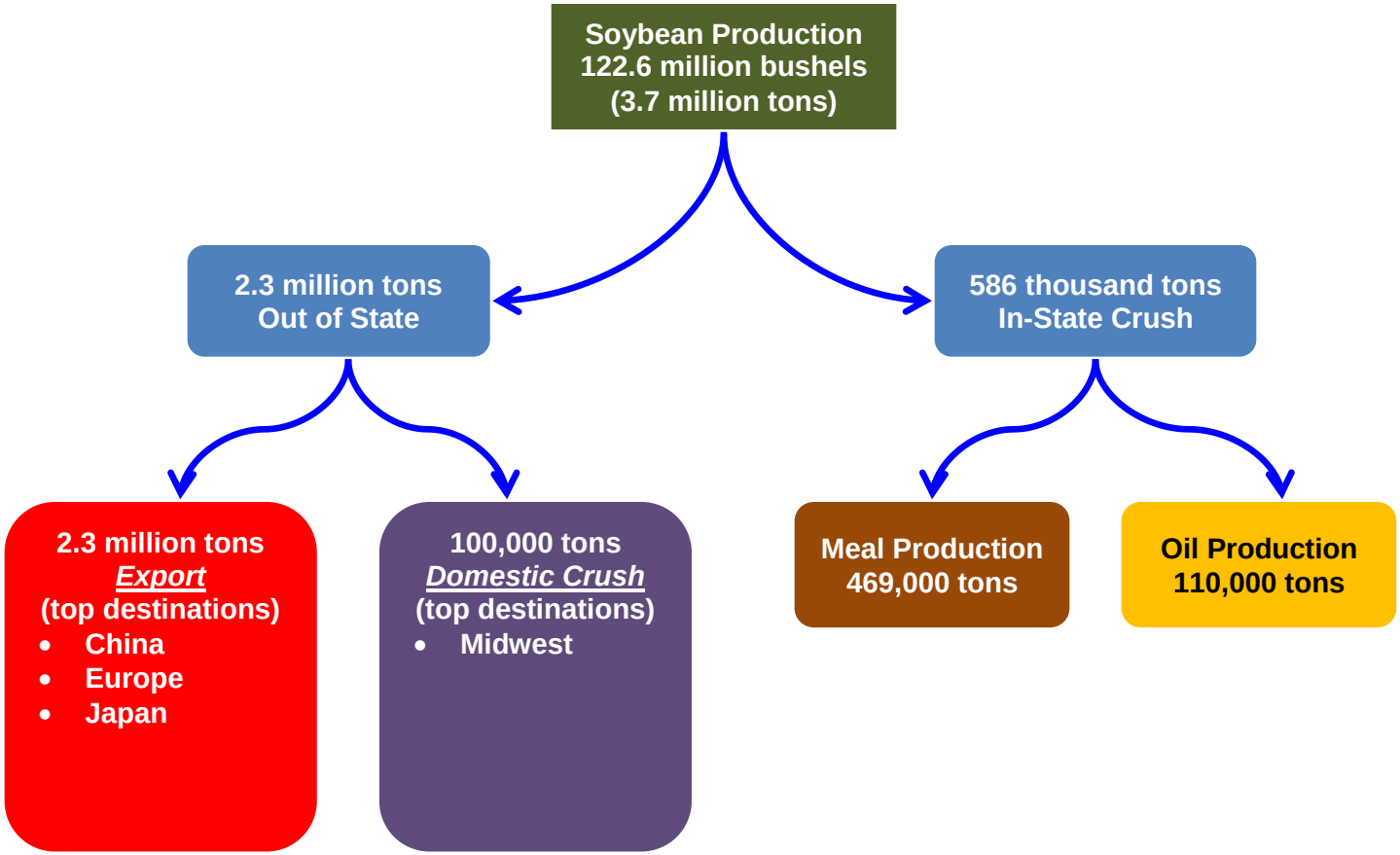
ARKANSAS FLOWCHART OF SOYBEAN MOVEMENTS (2009/10)



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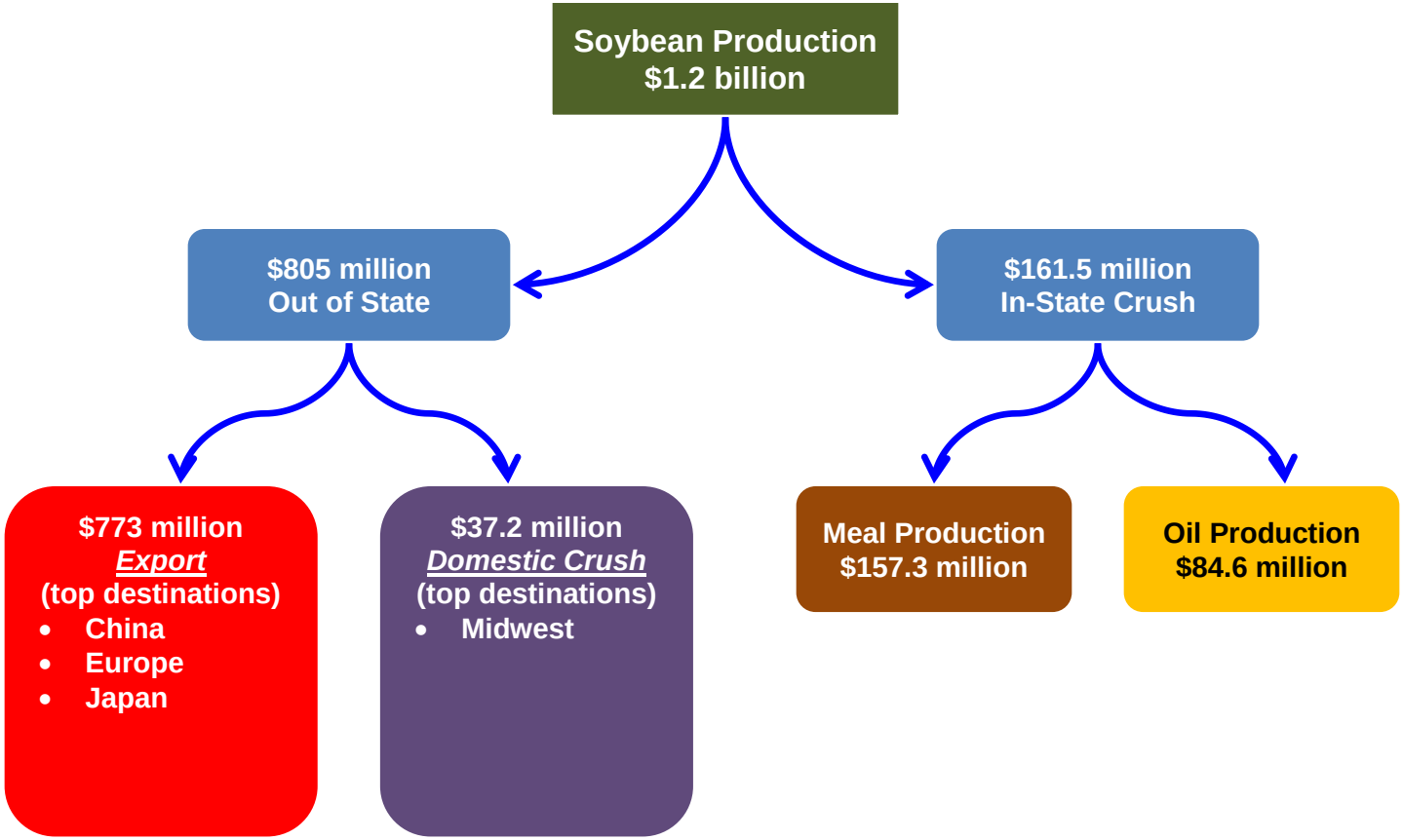
ARKANSAS FLOWCHART OF SOYBEAN VALUE (2009/10)



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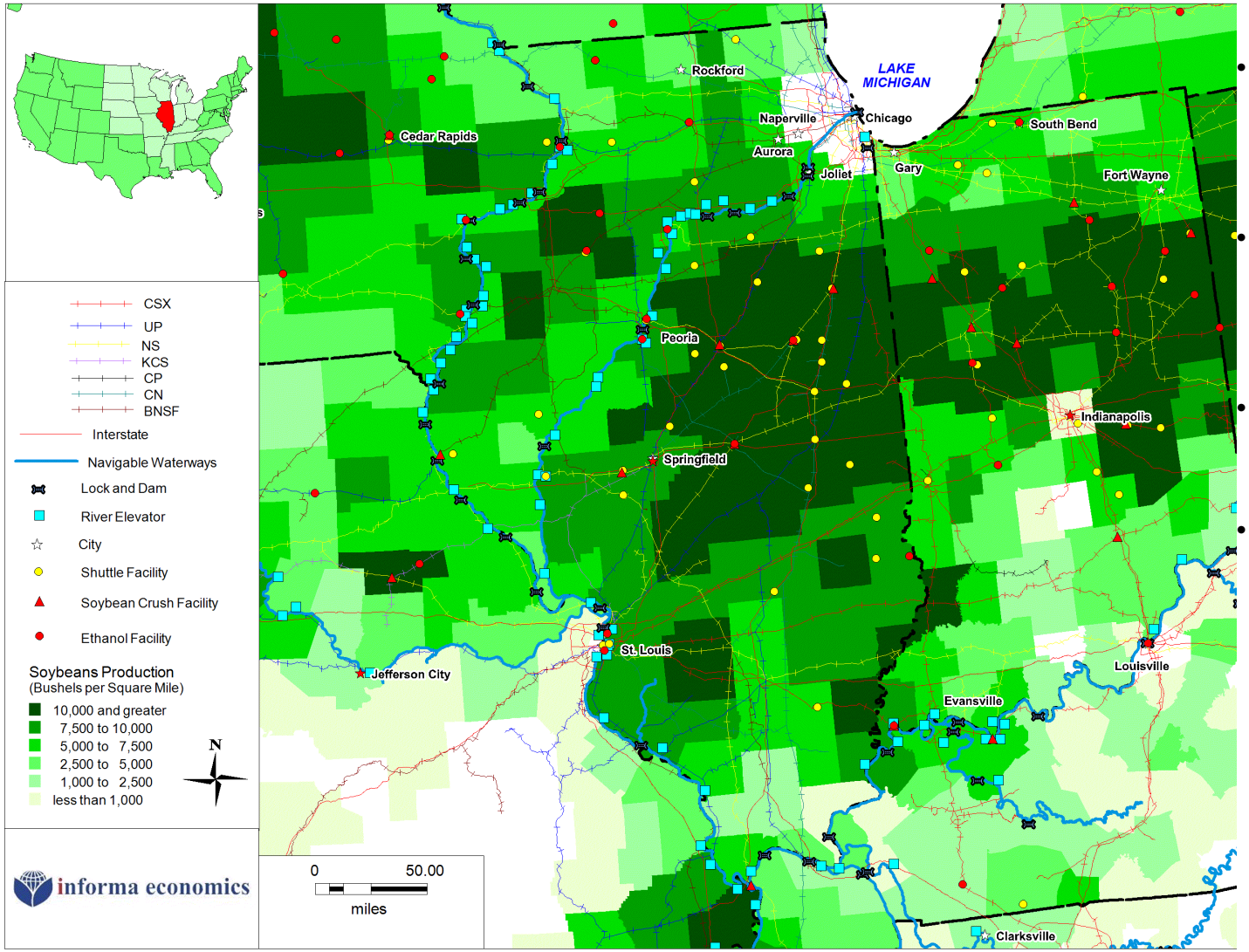
ILLINOIS



Production

- Soybean production occurs throughout the state of Illinois with the heaviest production densities in the central eastern portion of the state.
- In terms of livestock, Illinois is a significant contributor to U.S. hog production.

Infrastructure

- Illinois has 7,313 miles of rail lines; 2,236 miles of interstate, and 139,577 miles of roadways.
- Illinois has 40 shuttle facilities; six soybean crush facilities; 14 ethanol facilities; 667 grain elevators and 65 river elevators.

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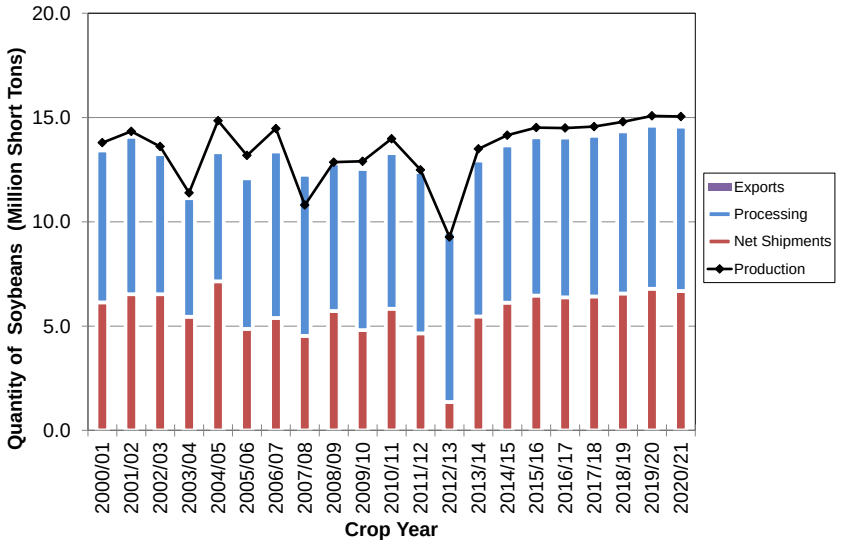
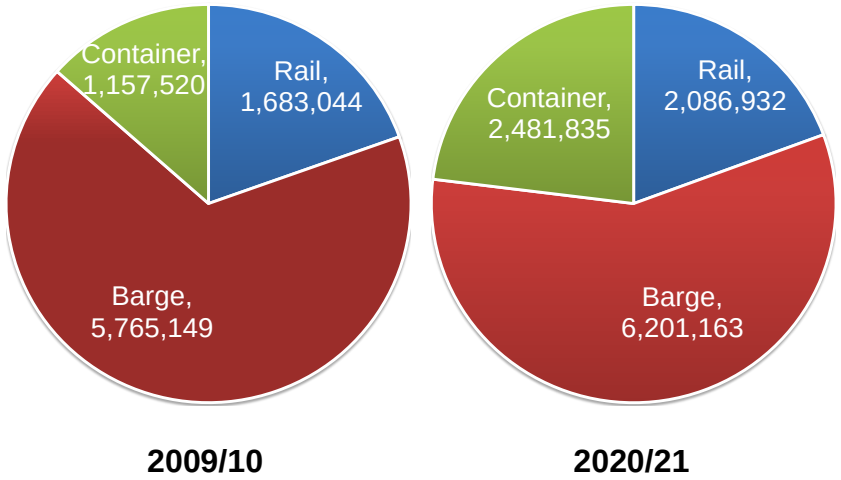
ILLINOIS

Soybean Surplus and Deficit Outlook



Soybean Movements by Mode (Short Tons)



Agricultural Infrastructure: Crush, Ethanol Facilities, Livestock Processing, and Grain Storage

Facility Type	# of Facilities	Capacity	
Soybean Crushers	6	22,456	MT/Day
Ethanol Facility* (operating)	14	1,346	MGY
Federally Inspected Livestock Slaughter/Processing Facilities	253	n/a	
State Inspected Livestock Slaughter/Processing Facilities	161	n/a	
Grain Elevators	667	969,956	Thous. Bu. Storage
Shuttle Elevators	40	177,051	Thous. Bu. Storage
River Elevators**	65	95,455	Thous. Bu. Storage

** Cellulosic ethanol facilities are included in ethanol facility database.*

*** Missing river elevator capacity at 1 IL location*

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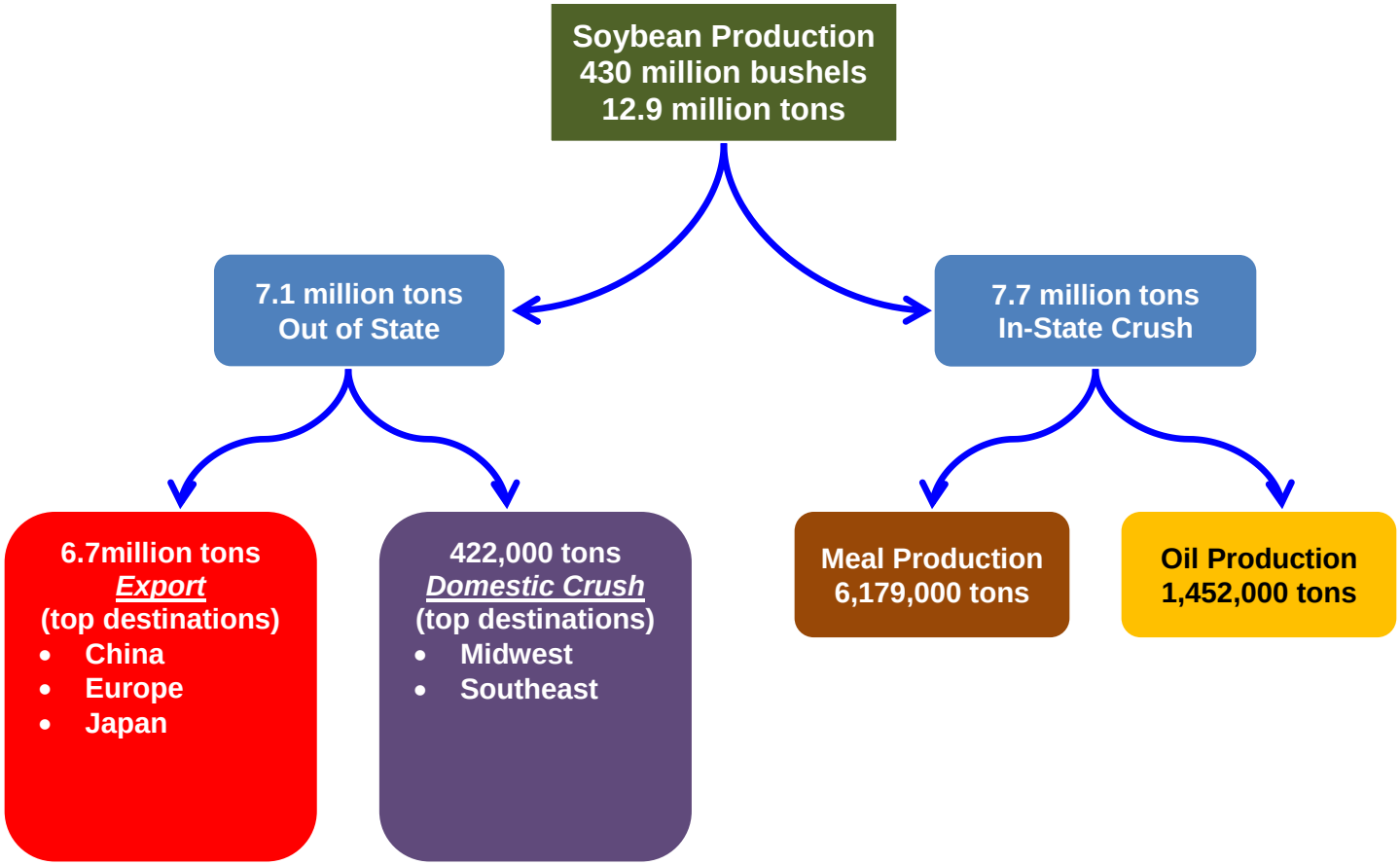
ILLINOIS FLOWCHART OF SOYBEAN MOVEMENTS (2009/10)



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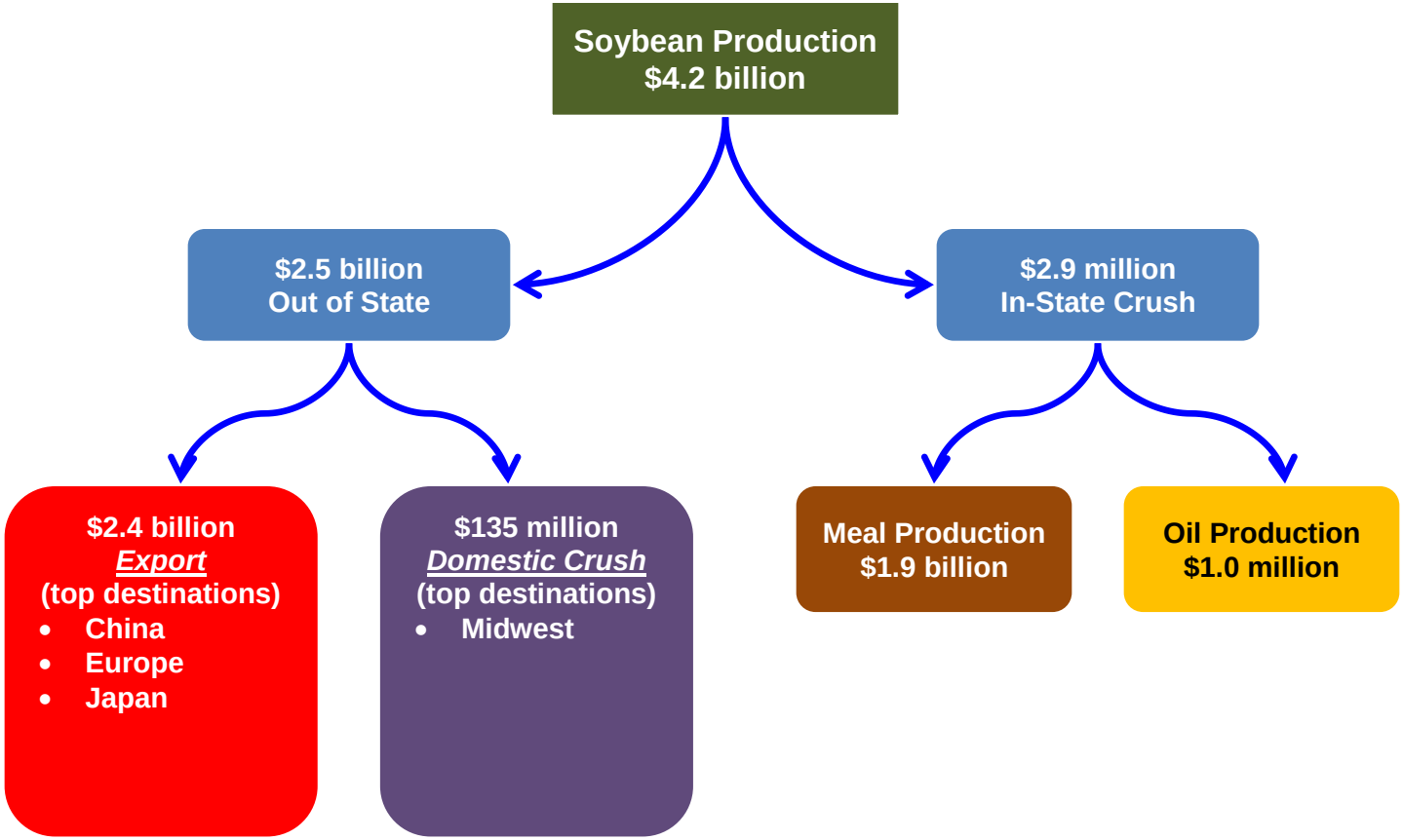
ILLINOIS FLOWCHART OF SOYBEAN VALUE (2009/10)



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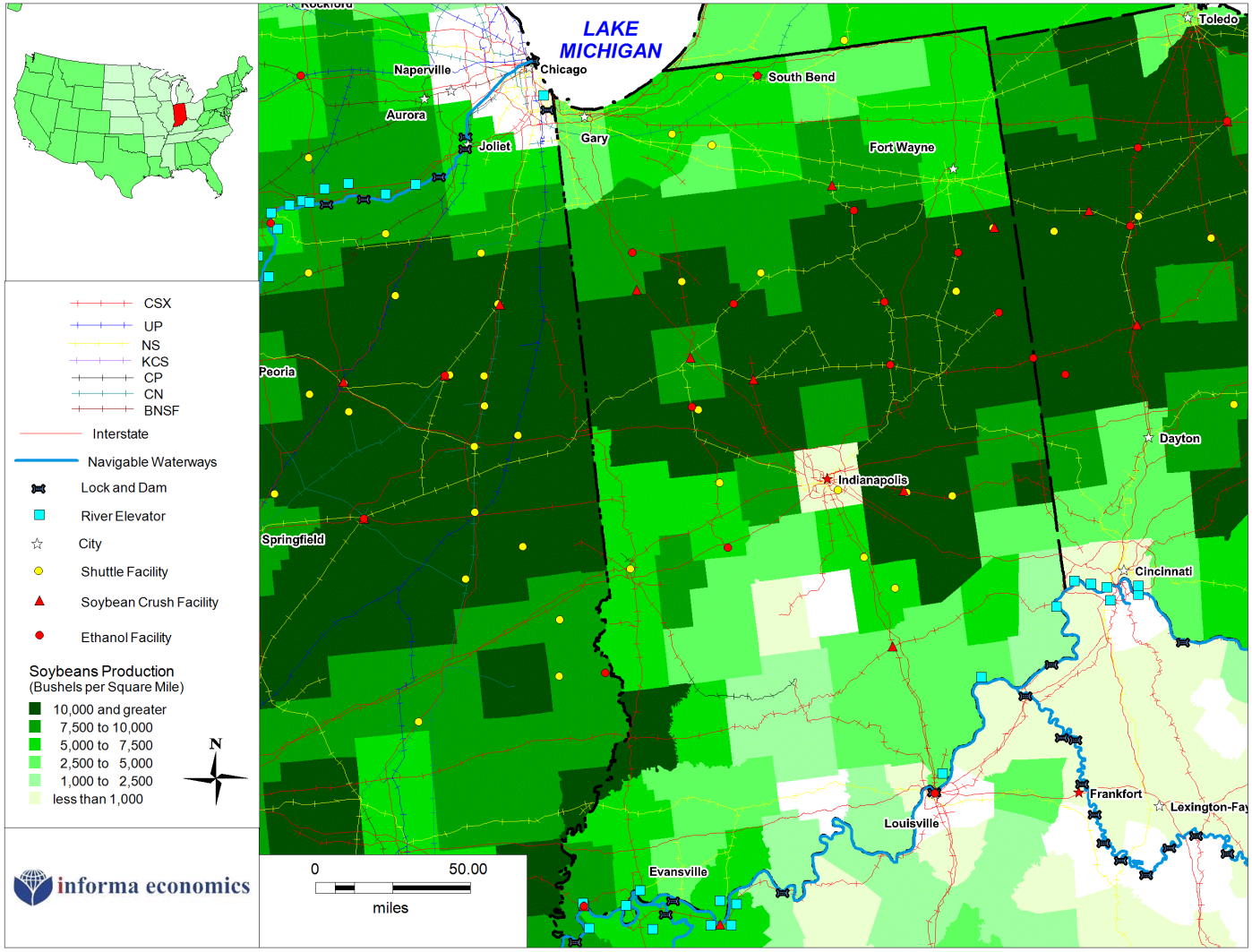
INDIANA



Production

- Soybean production occurs throughout the state of Indiana with the heaviest production densities in the center of the state.
- Indiana is a primary contributor of hog production in the U.S.

Infrastructure

- Indiana has 4,475 miles of rail lines; 1,343 miles of interstate, and 95,679 miles of roadways.
- Indiana has 17 shuttle facilities; eight soybean crush facilities; 13 ethanol facilities; 310 grain elevators and 11 river elevators.

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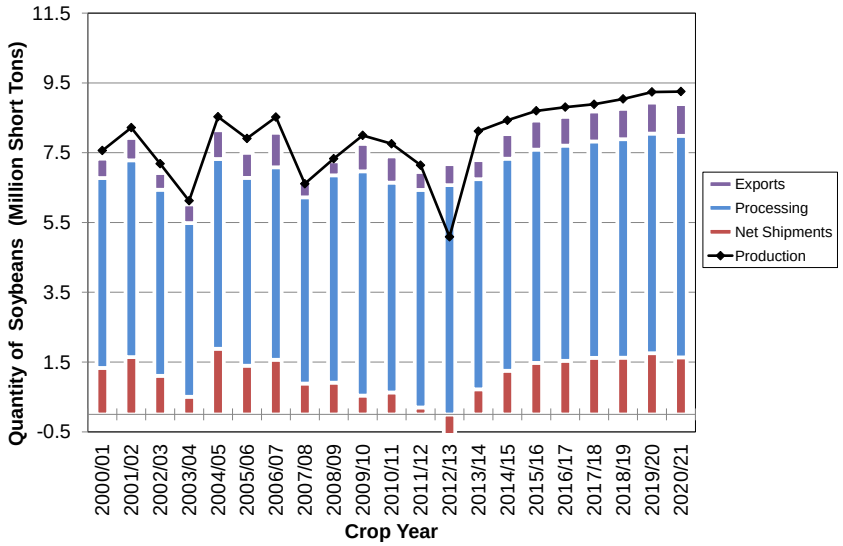
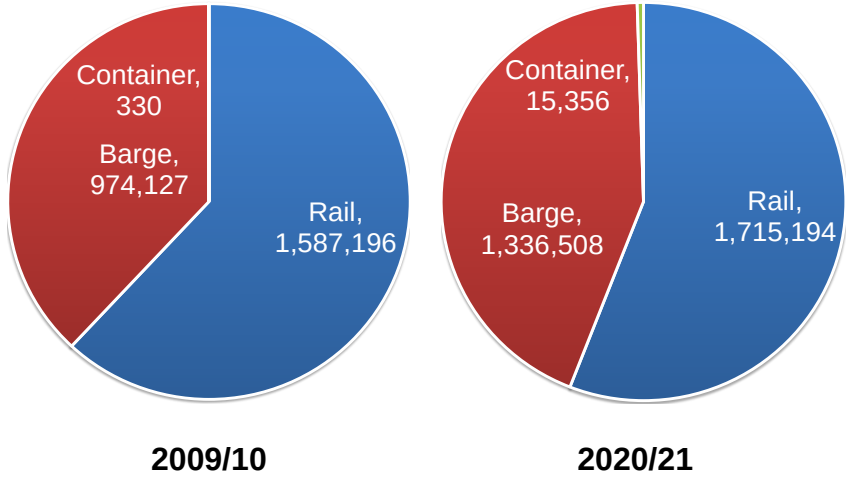
INDIANA

Soybean Surplus and Deficit Outlook



Soybean Movements by Mode (Short Tons)



Agricultural Infrastructure: Crush, Ethanol Facilities, Livestock Processing, and Grain Storage

Facility Type	# of Facilities	Capacity	
Soybean Crushers	8	21,669	MT/Day
Ethanol Facility* (operating)	13	1,126	MGY
Federally Inspected Livestock Slaughter/Processing Facilities	58	n/a	
State Inspected Livestock Slaughter/Processing Facilities	107	n/a	
Grain Elevators	310	418,388	Thous. Bu. Storage
Shuttle Elevators	17	89,881	Thous. Bu. Storage
River Elevators**	11	16,436	Thous. Bu. Storage

** Cellulosic ethanol facilities are included in ethanol facility database.*

*** Missing river elevator capacity at 1 IN location*

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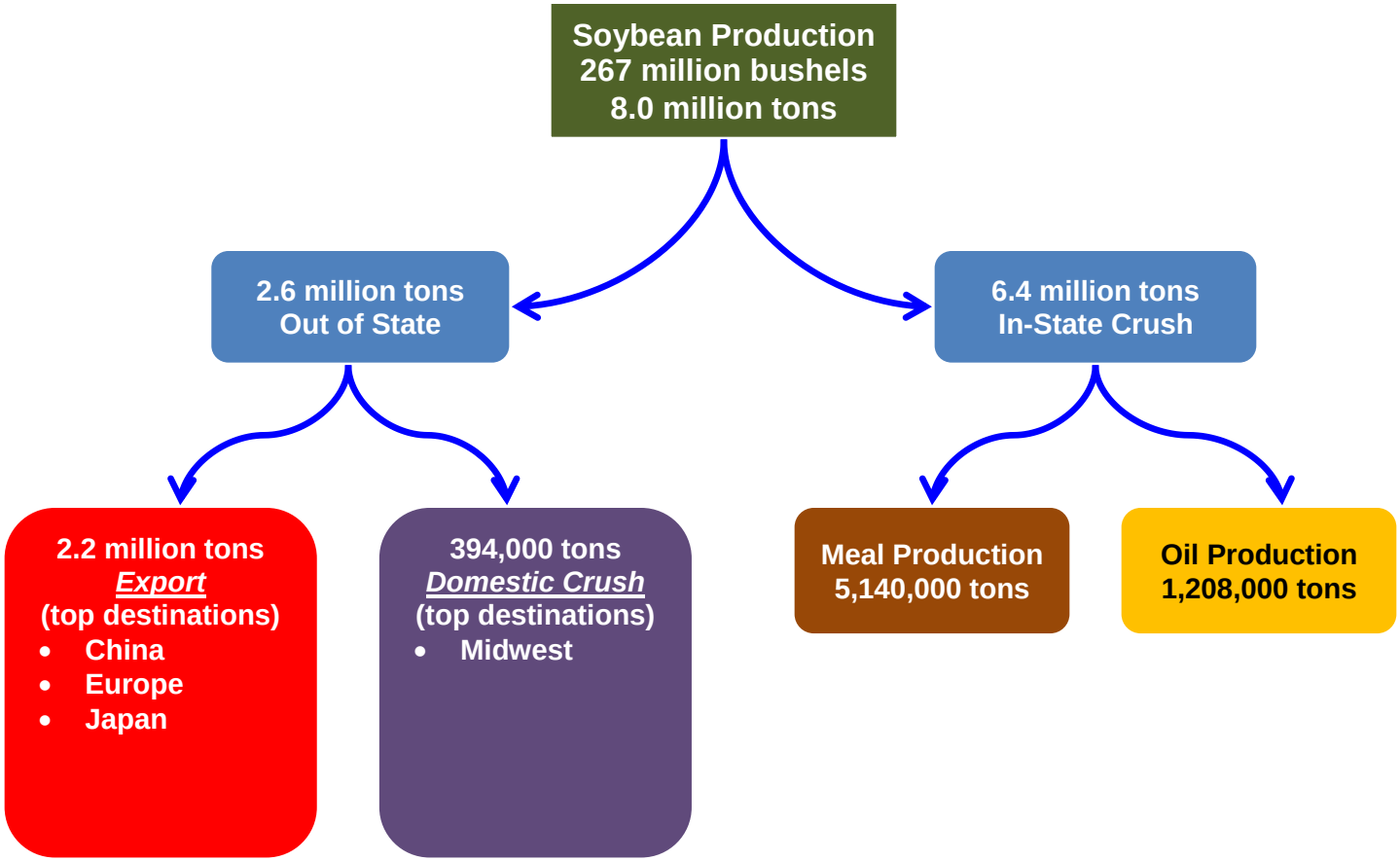
INDIANA FLOWCHART OF SOYBEAN MOVEMENTS (2009/10)



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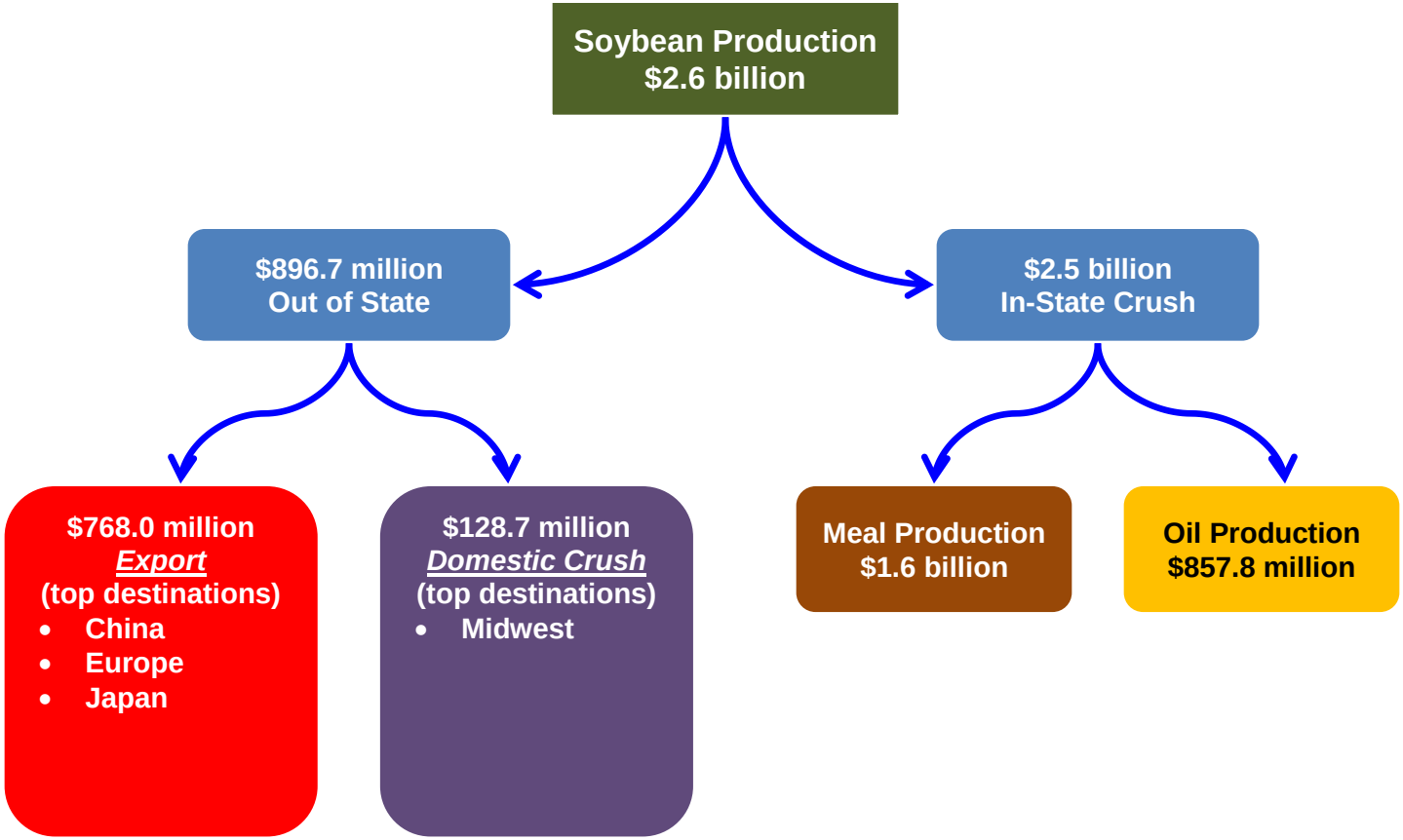
INDIANA FLOWCHART OF SOYBEAN VALUE (2009/10)



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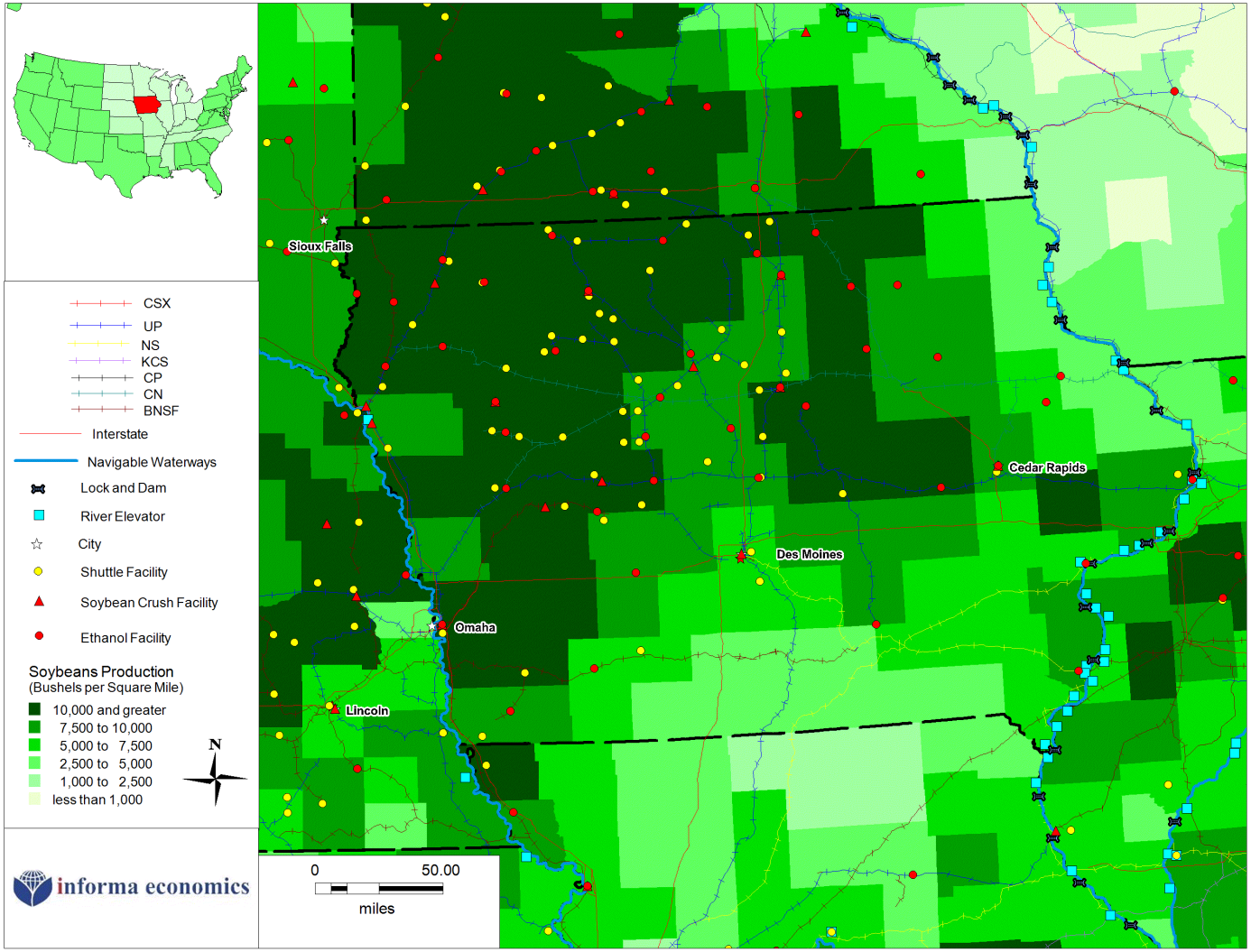
IOWA



Production

- Soybean production occurs throughout the state of Iowa with the heaviest production densities in the western portion of the state, particularly in the northwest.
- Iowa is the largest producer of pork in the U.S. and also a significant producer of cattle.

Infrastructure

- Iowa has 3,925 miles of rail lines; 808 miles of interstate, and 114,347 miles of roadways.
- Iowa has 52 shuttle facilities; 14 soybean crush facilities; 42 ethanol facilities; 750 grain elevators and 16 river elevators.

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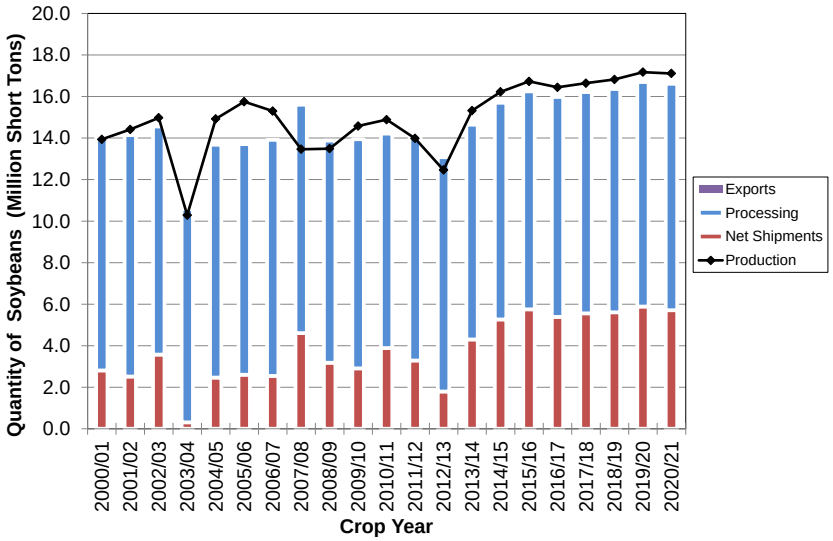
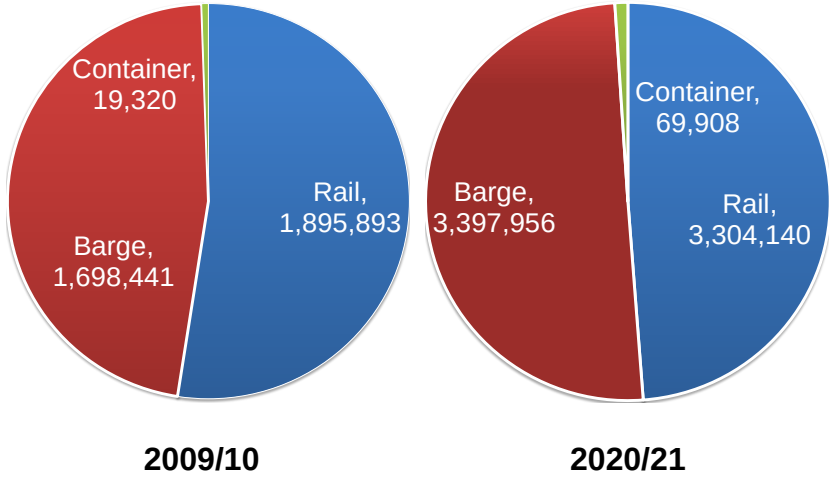
IOWA

Soybean Surplus and Deficit Outlook



Soybean Movements by Mode (Short Tons)



Agricultural Infrastructure: Crush, Ethanol Facilities, Livestock Processing, and Grain Storage

Facility Type	# of Facilities	Capacity	
Soybean Crushers	14	35,169	MT/Day
Ethanol Facility* (operating)	42	3,796	MGY
Federally Inspected Livestock Slaughter/Processing Facilities	111	n/a	
State Inspected Livestock Slaughter/Processing Facilities	76	n/a	
Grain Elevators	750	1,119,065	Thous. Bu. Storage
Shuttle Elevators	52	191,043	Thous. Bu. Storage
River Elevators	16	25,928	Thous. Bu. Storage

** Cellulosic ethanol facilities are included in ethanol facility database.*

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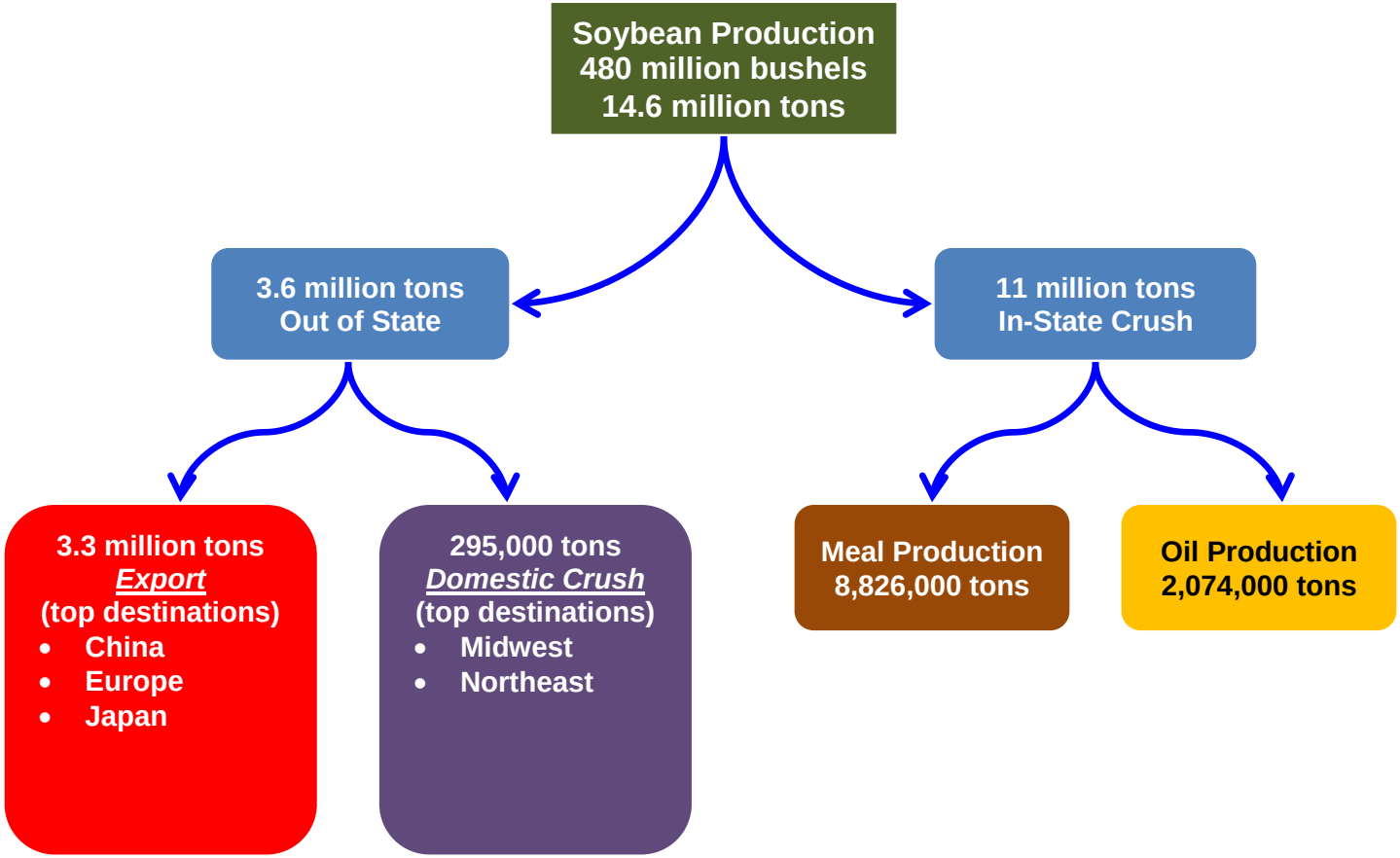
IOWA FLOWCHART OF SOYBEAN MOVEMENTS (2009/10)



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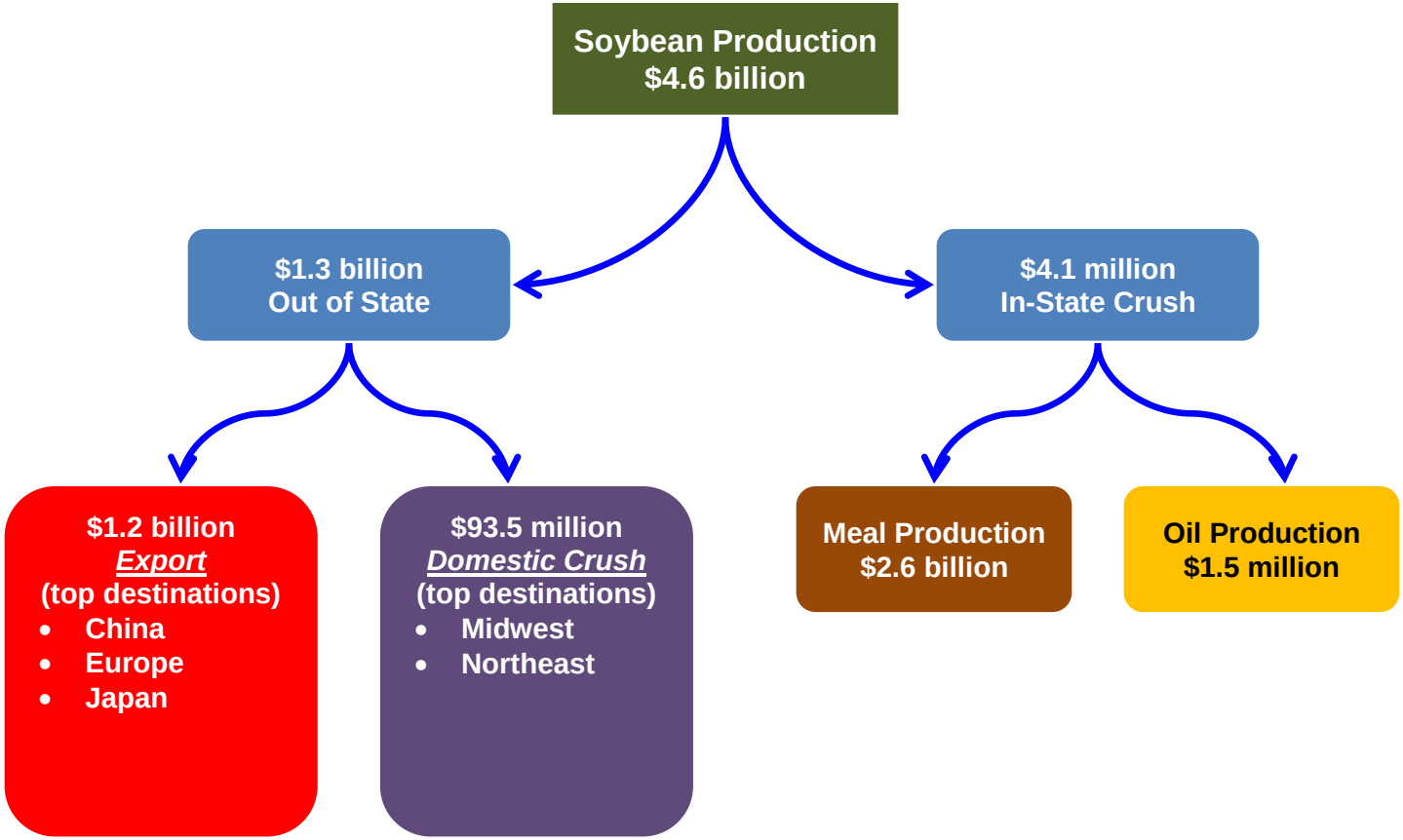
IOWA FLOWCHART OF SOYBEAN VALUE (2009/10)



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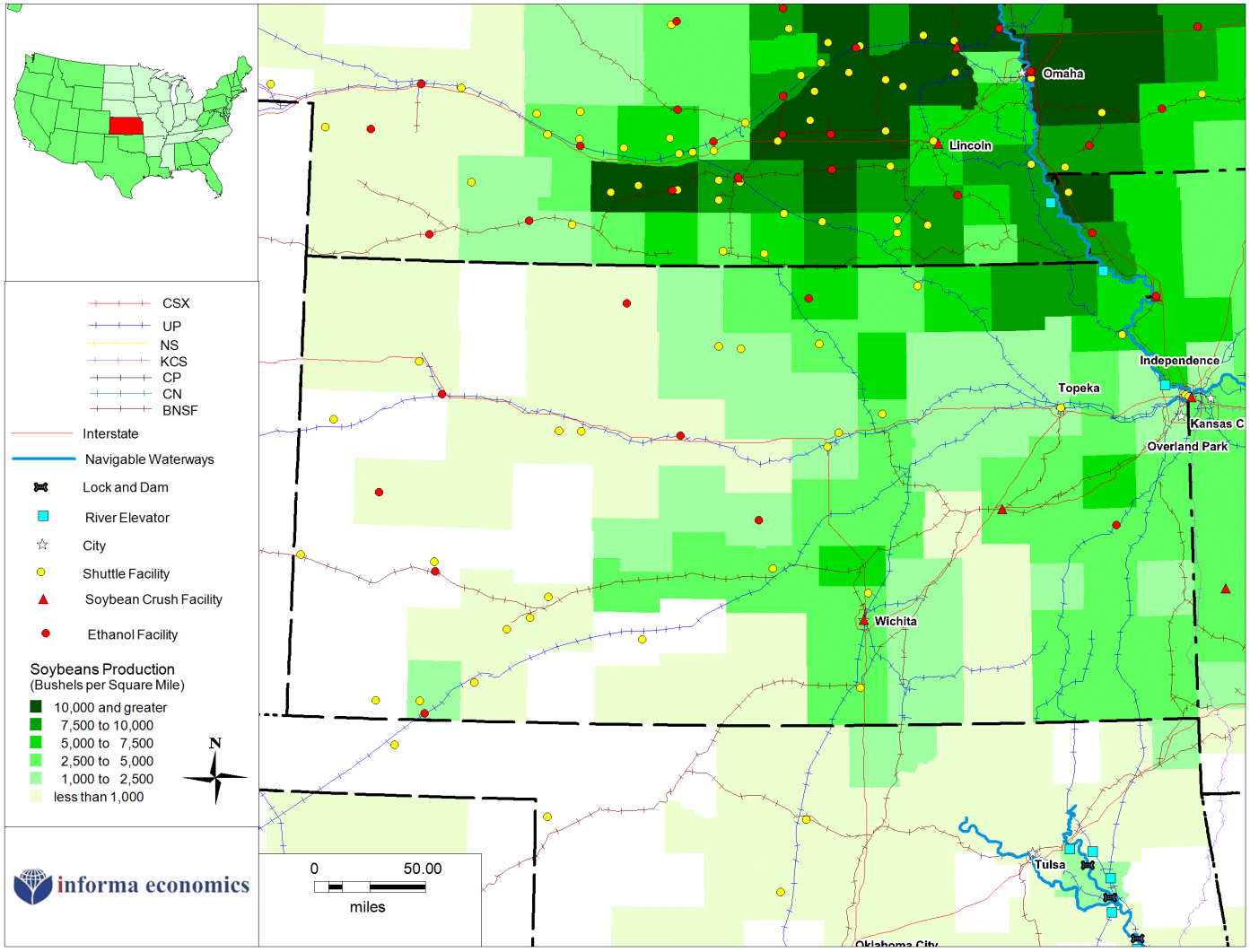
KANSAS



Production

- Soybean production in Kansas occurs mostly in the eastern portion of the state, with production densities highest northeast portion of the state.
- Kansas livestock inventories consist largely of cattle, contributing 7% of U.S. production.

Infrastructure

- Kansas has 4,890 miles of rail lines; 874 miles of interstate, and 140,753 miles of roadways.
- Kansas has 31 shuttle facilities; two soybean crush facilities; 11 ethanol facilities; 556 grain elevators and 2 river elevators.

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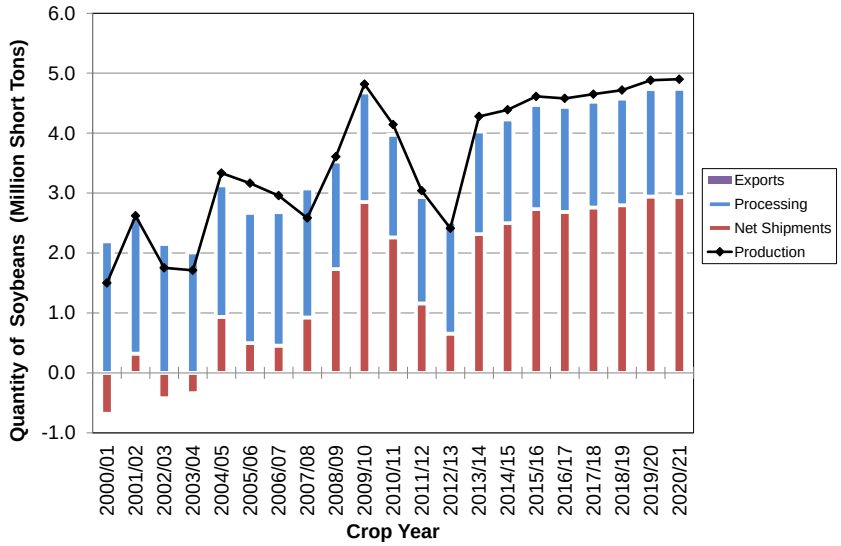
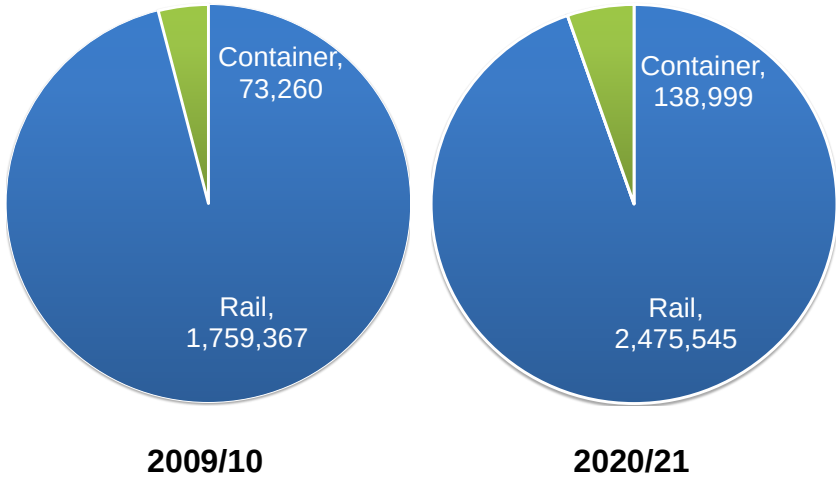
KANSAS

Soybean Surplus and Deficit Outlook



Soybean Movements by Mode (Short Tons)



Agricultural Infrastructure: Crush, Ethanol Facilities, Livestock Processing, and Grain Storage

Facility Type	# of Facilities	Capacity	
Soybean Crushers	2	6,158	MT/Day
Ethanol Facility* (operating)	11	437	MGY
Federally Inspected Livestock Slaughter/Processing Facilities	58	n/a	
State Inspected Livestock Slaughter/Processing Facilities	63	n/a	
Grain Elevators	556	906,654	Thous. Bu. Storage
Shuttle Elevators	31	164,609	Thous. Bu. Storage
River Elevators	2	3,693	Thous. Bu. Storage

** Cellulosic ethanol facilities are included in ethanol facility database.*

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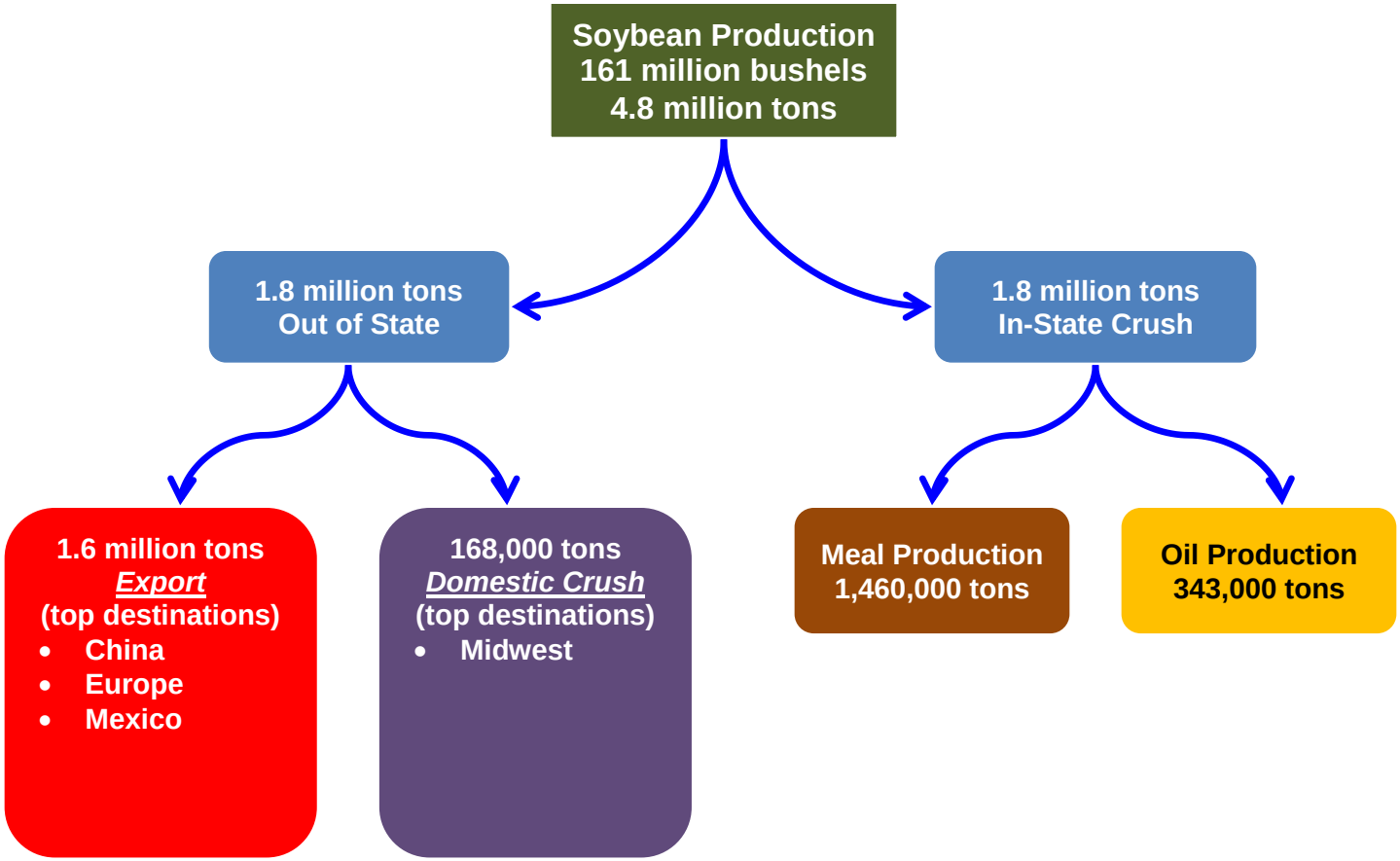
KANSAS FLOWCHART OF SOYBEAN MOVEMENTS (2009/10)



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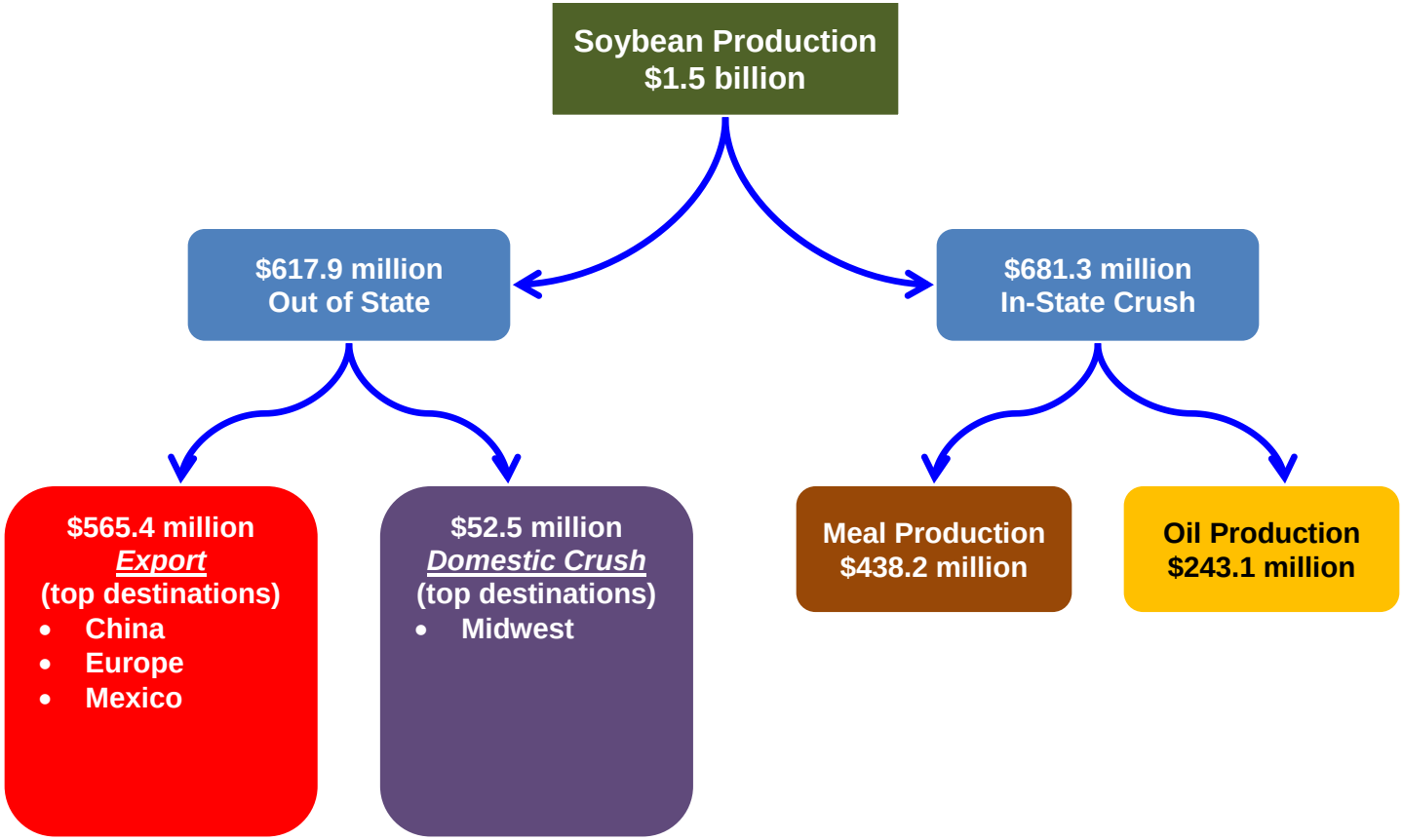
KANSAS FLOWCHART OF SOYBEAN VALUE (2009/10)



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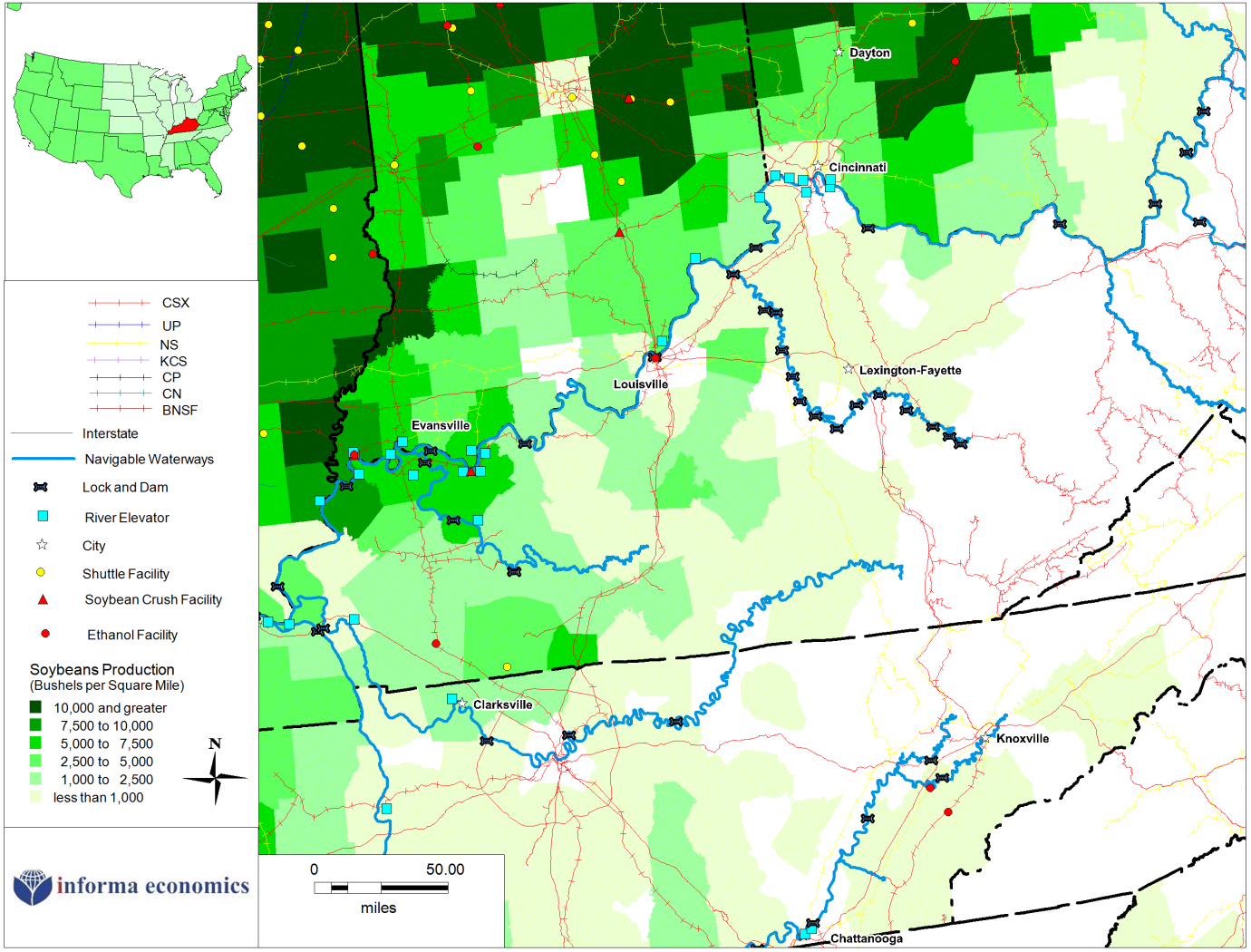
KENTUCKY



Production

- Soybean production in Kentucky occurs mostly in the western portion of the state, with production densities highest in the far west of the state.
- Significant Kentucky livestock inventories consist of broilers and cattle.

Infrastructure

- Kentucky has 2,558 miles of rail lines; 782 miles of interstate, and 78,963 miles of roadways.
- Kentucky has one shuttle facility; one soybean crush facility; two ethanol facilities; 62 grain elevators and 14 river elevators.

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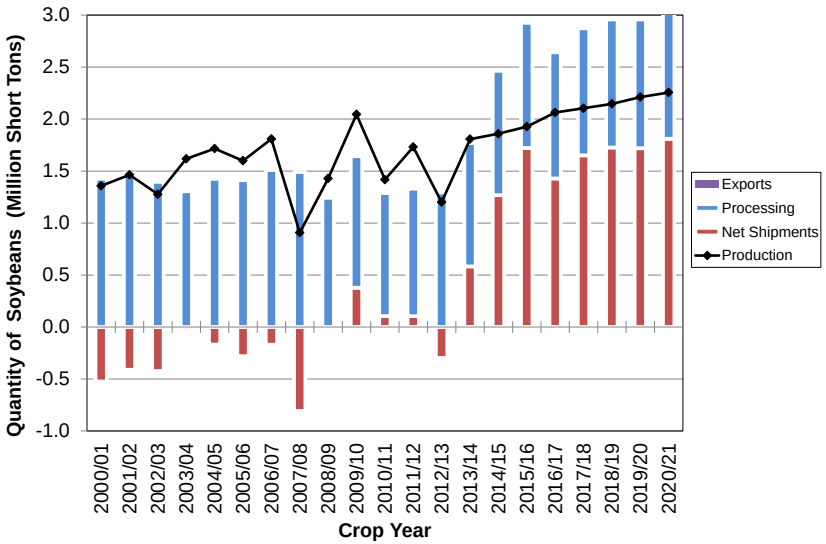
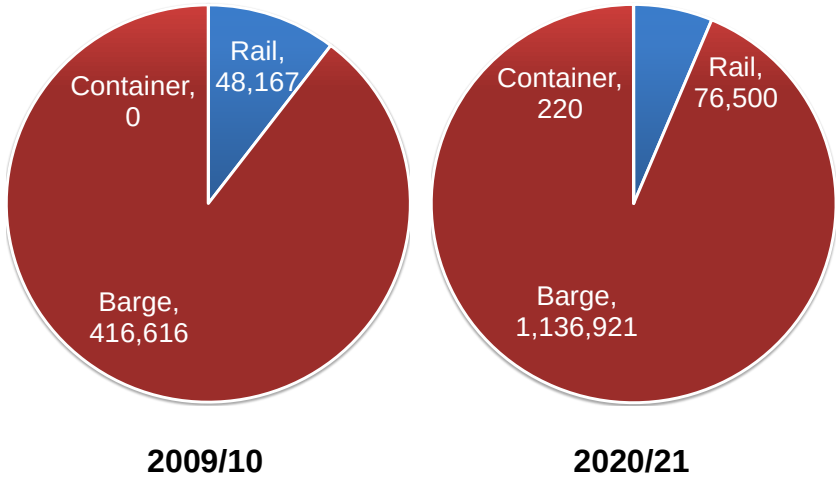
KENTUCKY

Soybean Surplus and Deficit Outlook



Soybean Movements by Mode (Short Tons)



Agricultural Infrastructure: Crush, Ethanol Facilities, Livestock Processing, and Grain Storage

Facility Type	# of Facilities	Capacity	
Soybean Crushers	1	4,265	MT/Day
Ethanol Facility* (operating)	2	36	MGY
Federally Inspected Livestock Slaughter/Processing Facilities	102	n/a	
State Inspected Livestock Slaughter/Processing Facilities	0	n/a	
Grain Elevators	62	57,493	Thous. Bu. Storage
Shuttle Elevators	1	2,170	Thous. Bu. Storage
River Elevators	14	20,138	Thous. Bu. Storage

** Cellulosic ethanol facilities are included in ethanol facility database.*

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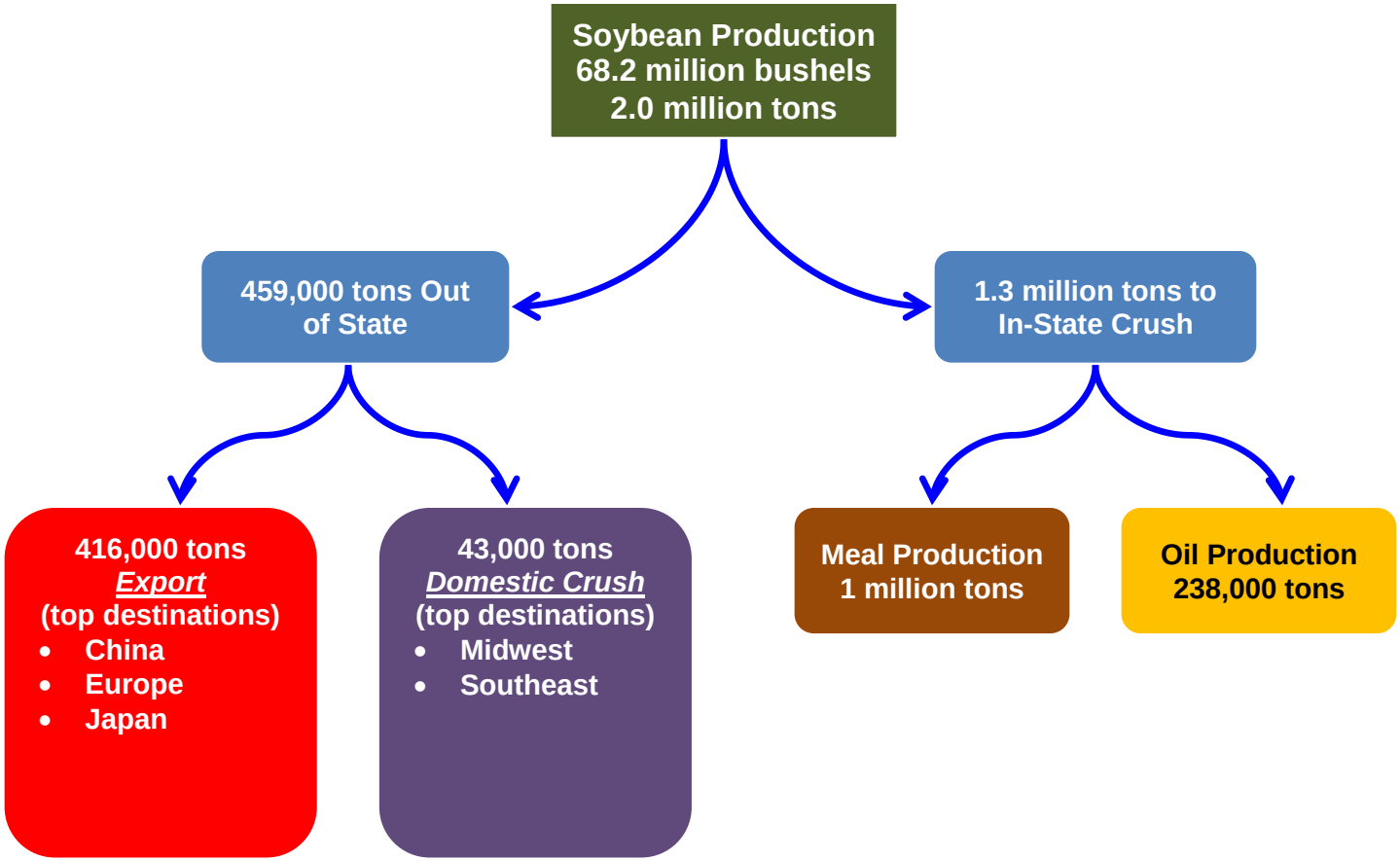
KENTUCKY FLOWCHART OF SOYBEAN MOVEMENTS (2009/10)



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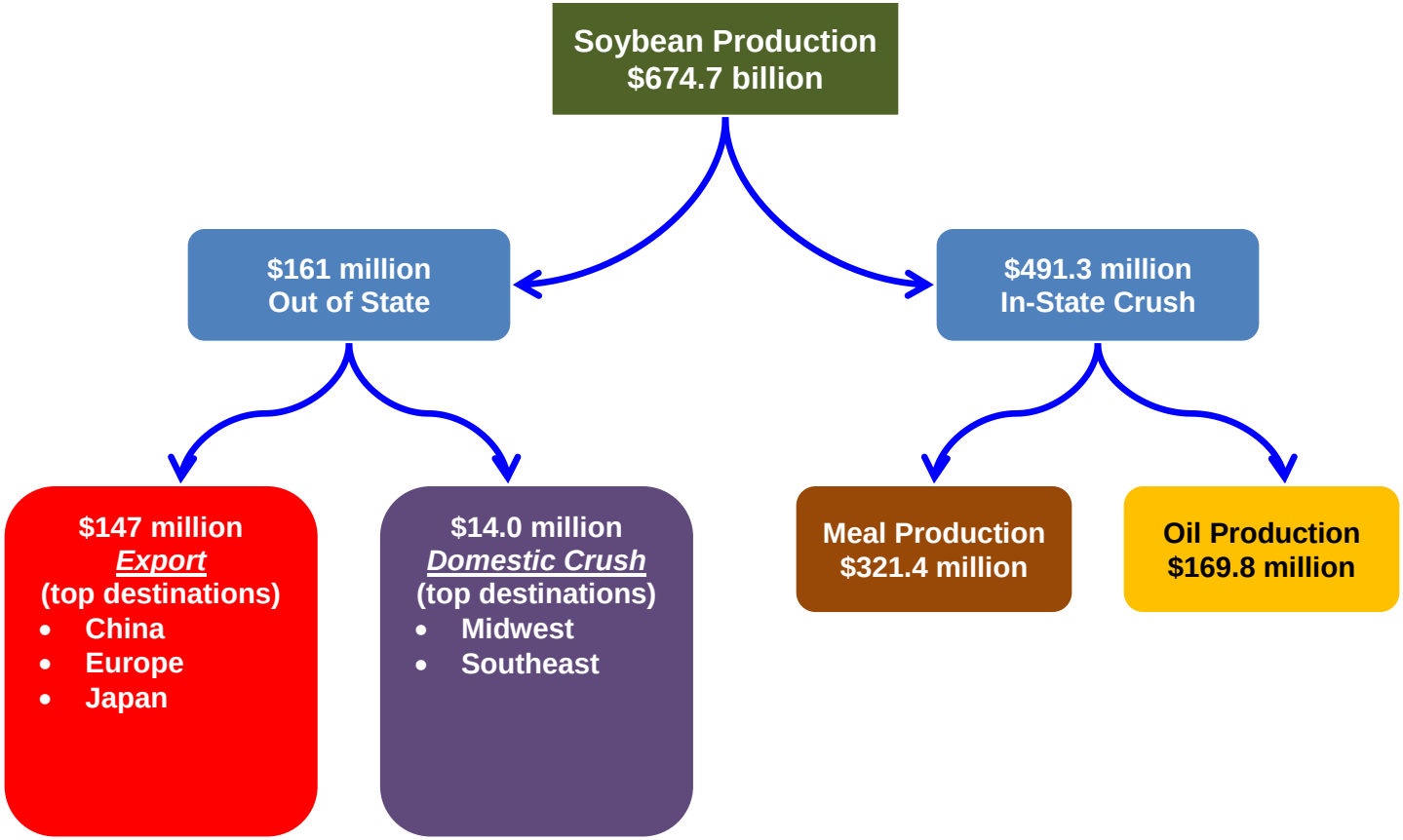
KENTUCKY FLOWCHART OF SOYBEAN VALUE (2009/10)



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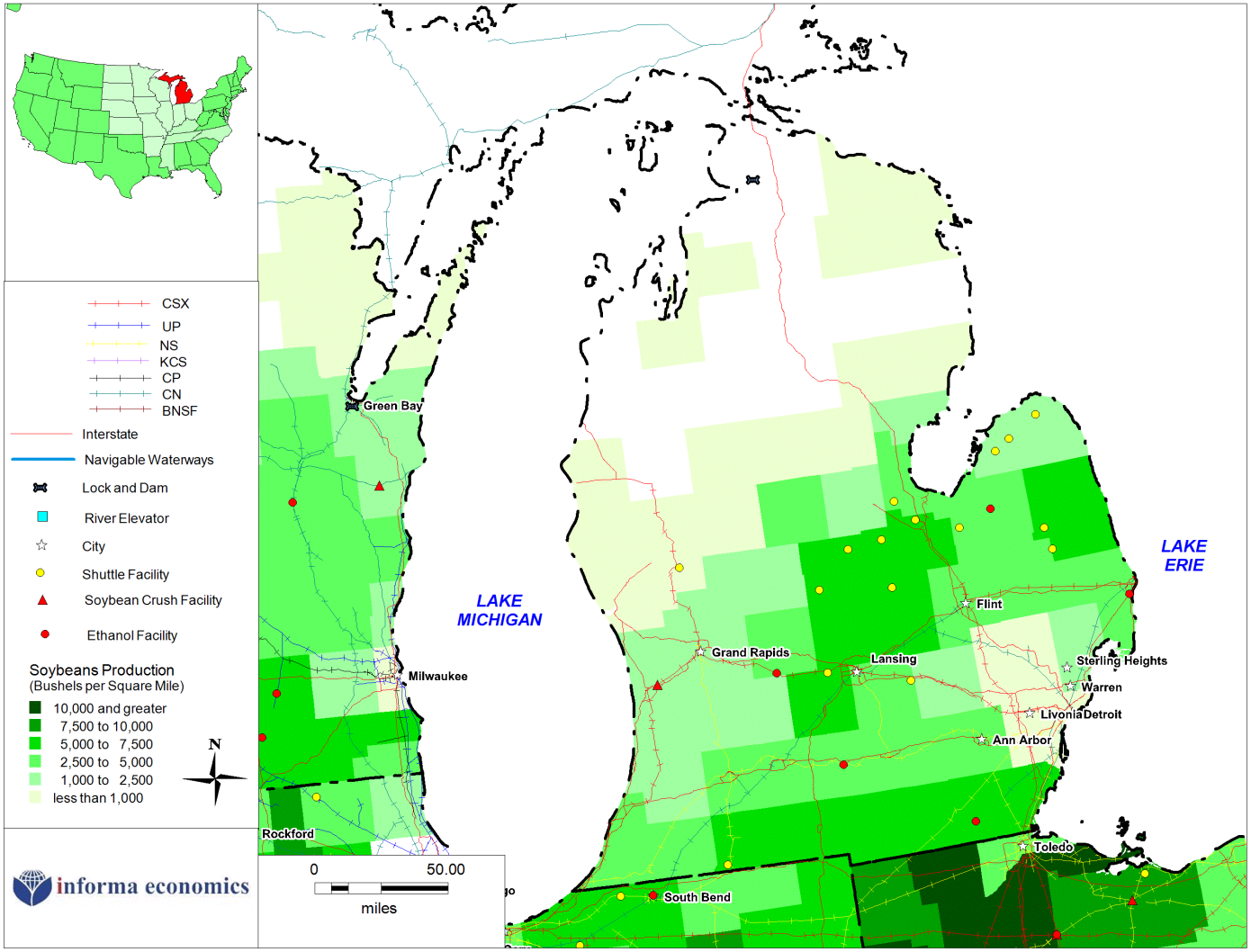
MICHIGAN



Production

- Soybean production in Michigan occurs mostly in the southern portion of the state.
- In terms of livestock, Michigan is a key producer of dairy cattle.

Infrastructure

- Michigan has 3,689 miles of rail lines; 1,246 miles of interstate, and 121,651 miles of roadways.
- Michigan has 17 shuttle facilities; one soybean crush facility; five ethanol facilities; and 177 grain elevators.

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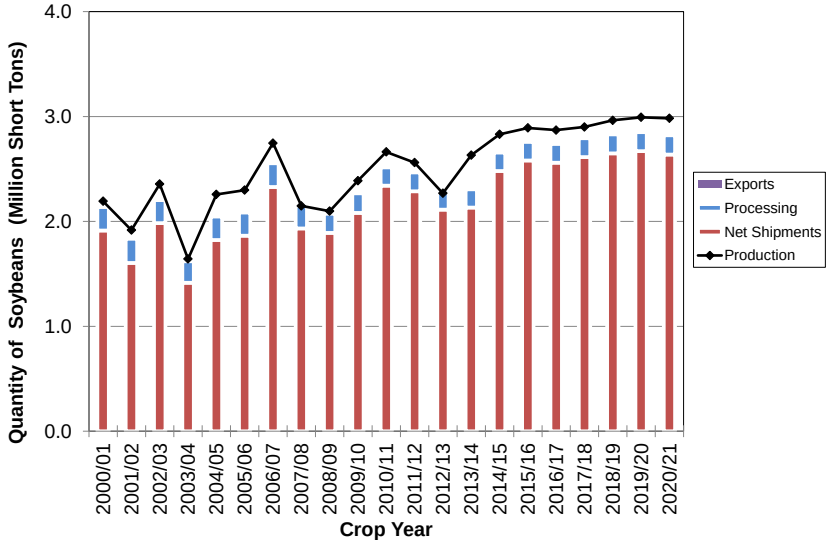
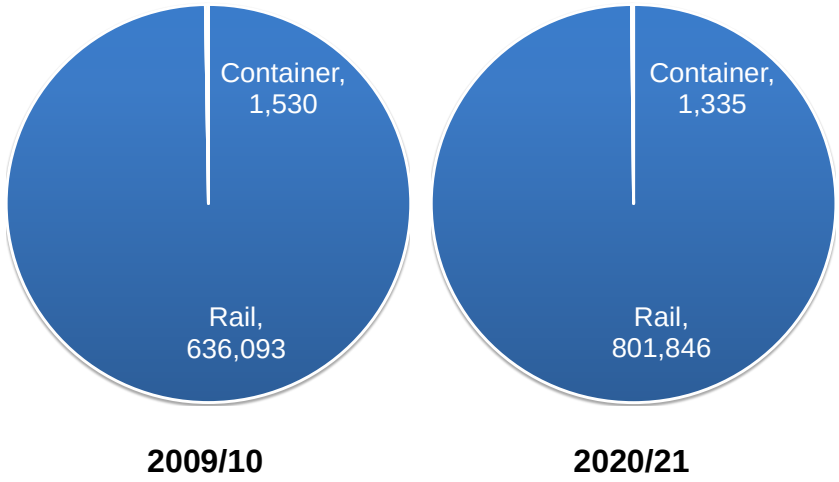
MICHIGAN

Soybean Surplus and Deficit Outlook



Soybean Movements by Mode (Short Tons)



Agricultural Infrastructure: Crush, Ethanol Facilities, Livestock Processing, and Grain Storage

Facility Type	# of Facilities	Capacity	
Soybean Crushers	1	626	MT/Day
Ethanol Facility* (operating)	5	265	MGY
Federally Inspected Livestock Slaughter/Processing Facilities	150	n/a	
State Inspected Livestock Slaughter/Processing Facilities	0	n/a	
Grain Elevators	177	157,446	Thous. Bu. Storage
Shuttle Elevators	17	76,433	Thous. Bu. Storage
River Elevators	0	-	Thous. Bu. Storage

** Cellulosic ethanol facilities are included in ethanol facility database.*

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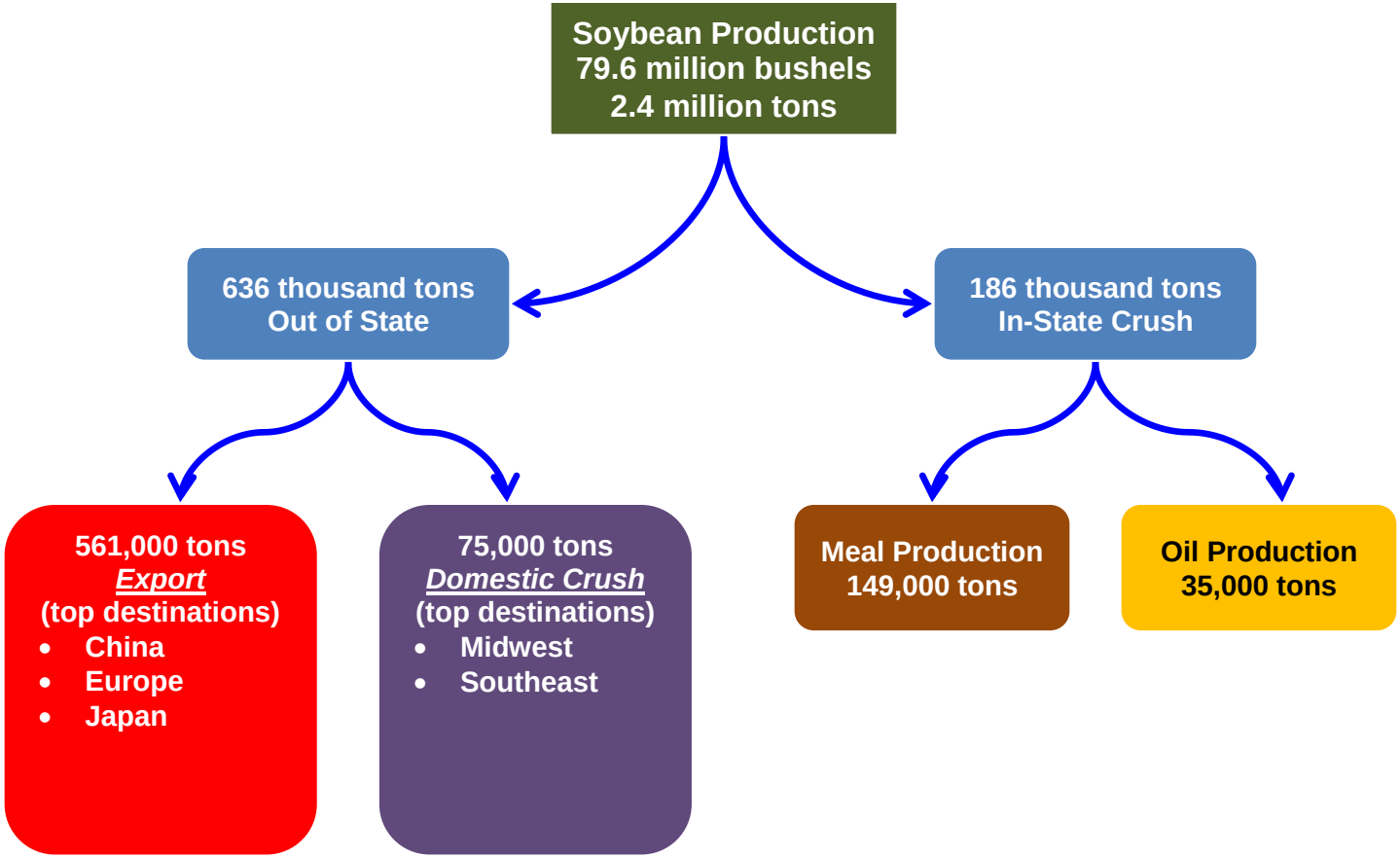
MICHIGAN FLOWCHART OF SOYBEAN MOVEMENTS (2009/10)



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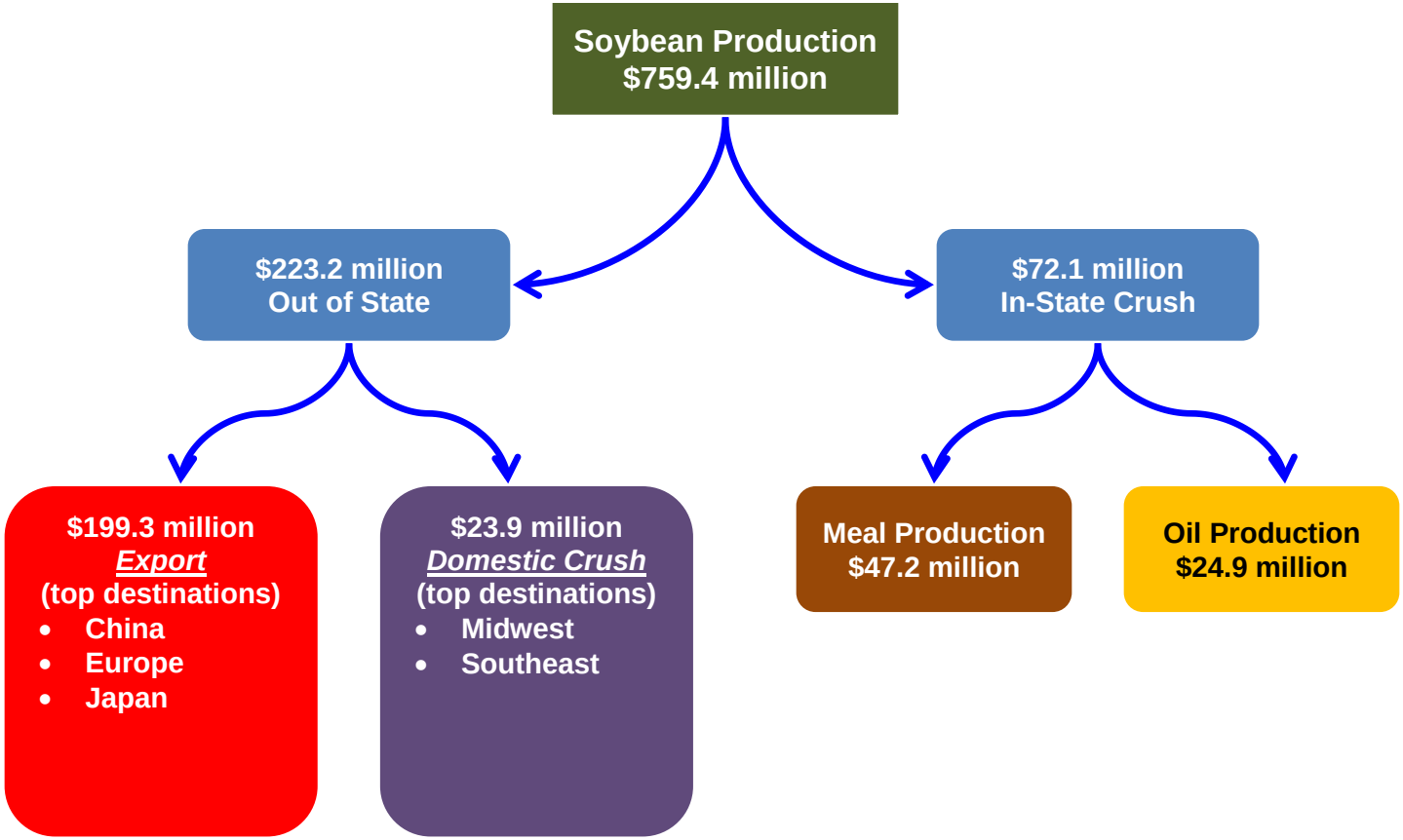
MICHIGAN FLOWCHART OF SOYBEAN VALUE (2009/10)



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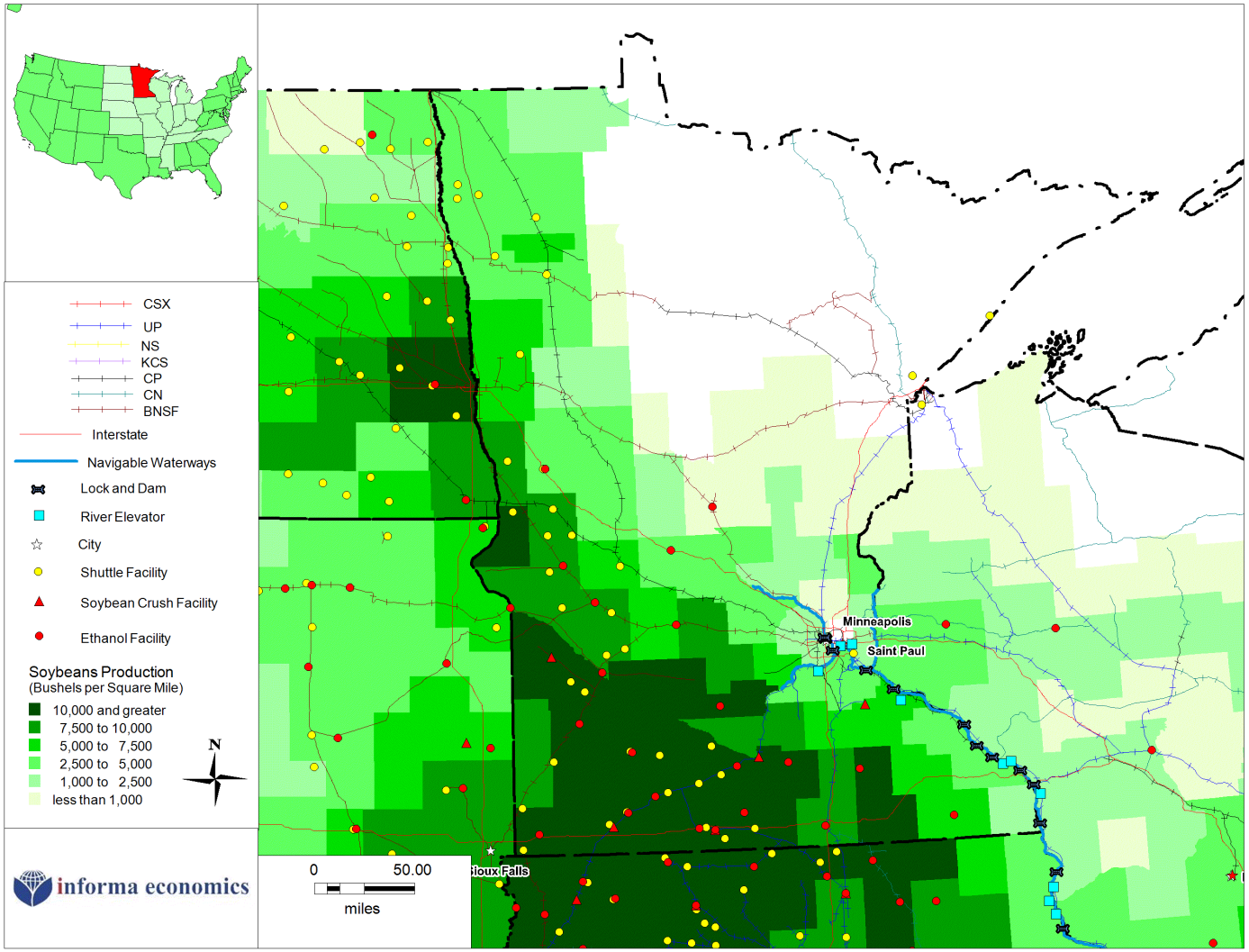
MINNESOTA



Production

- Soybean production in Minnesota occurs mostly in the southern and western portion of the state, with production densities highest in the southwestern portion of the state.
- Minnesota is a key contributor of hog and turkey production to U.S. inventories.

Infrastructure

- Minnesota has 4,528 miles of rail lines; 953 miles of interstate, and 137,932 miles of roadways.
- Minnesota has 40 shuttle facilities; six soybean crush facilities; 21 ethanol facilities; 408 grain elevators and nine river elevators.

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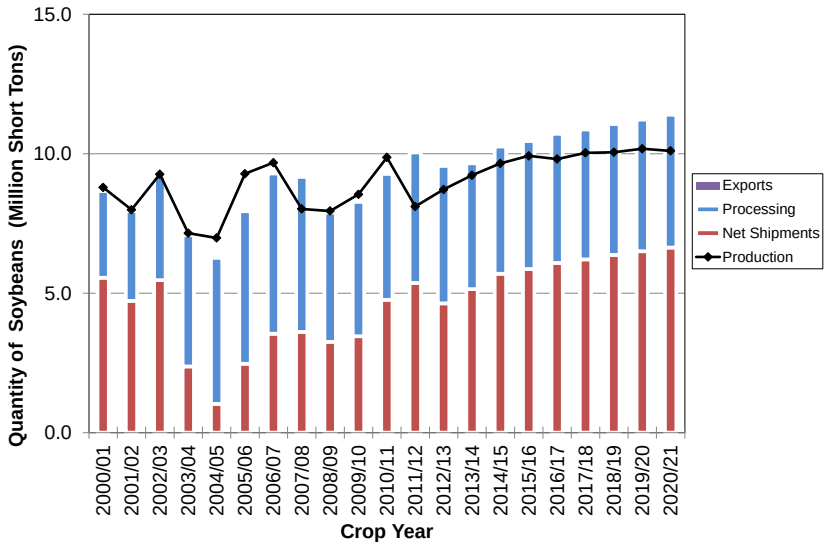
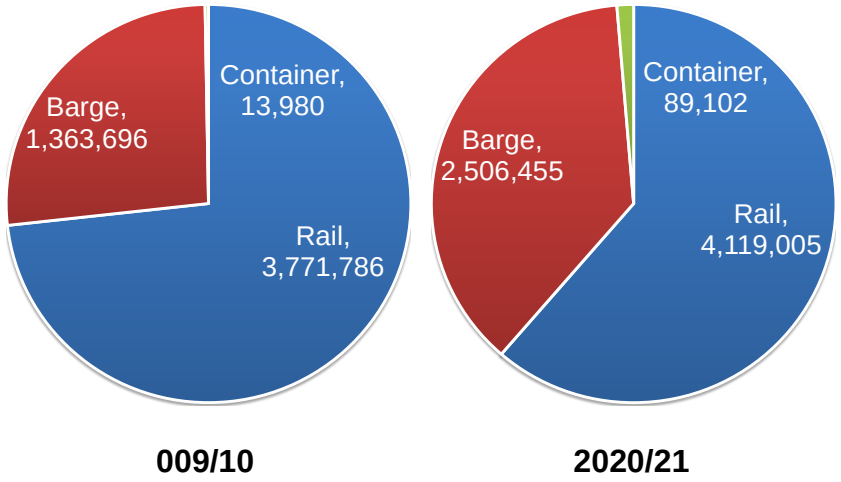
MINNESOTA

Soybean Surplus and Deficit Outlook



Soybean Movements by Mode (Short Tons)



Agricultural Infrastructure: Crush, Ethanol Facilities, Livestock Processing, and Grain Storage

Facility Type	# of Facilities	Capacity	
Soybean Crushers	6	16,903	MT/Day
Ethanol Facility* (operating)	21	1,122	MGY
Federally Inspected Livestock Slaughter/Processing Facilities	133	n/a	
State Inspected Livestock Slaughter/Processing Facilities	7	n/a	
Grain Elevators	408	639,881	Thous. Bu. Storage
Shuttle Elevators	40	133,120	Thous. Bu. Storage
River Elevators	9	31,995	Thous. Bu. Storage

** Cellulosic ethanol facilities are included in ethanol facility database.*

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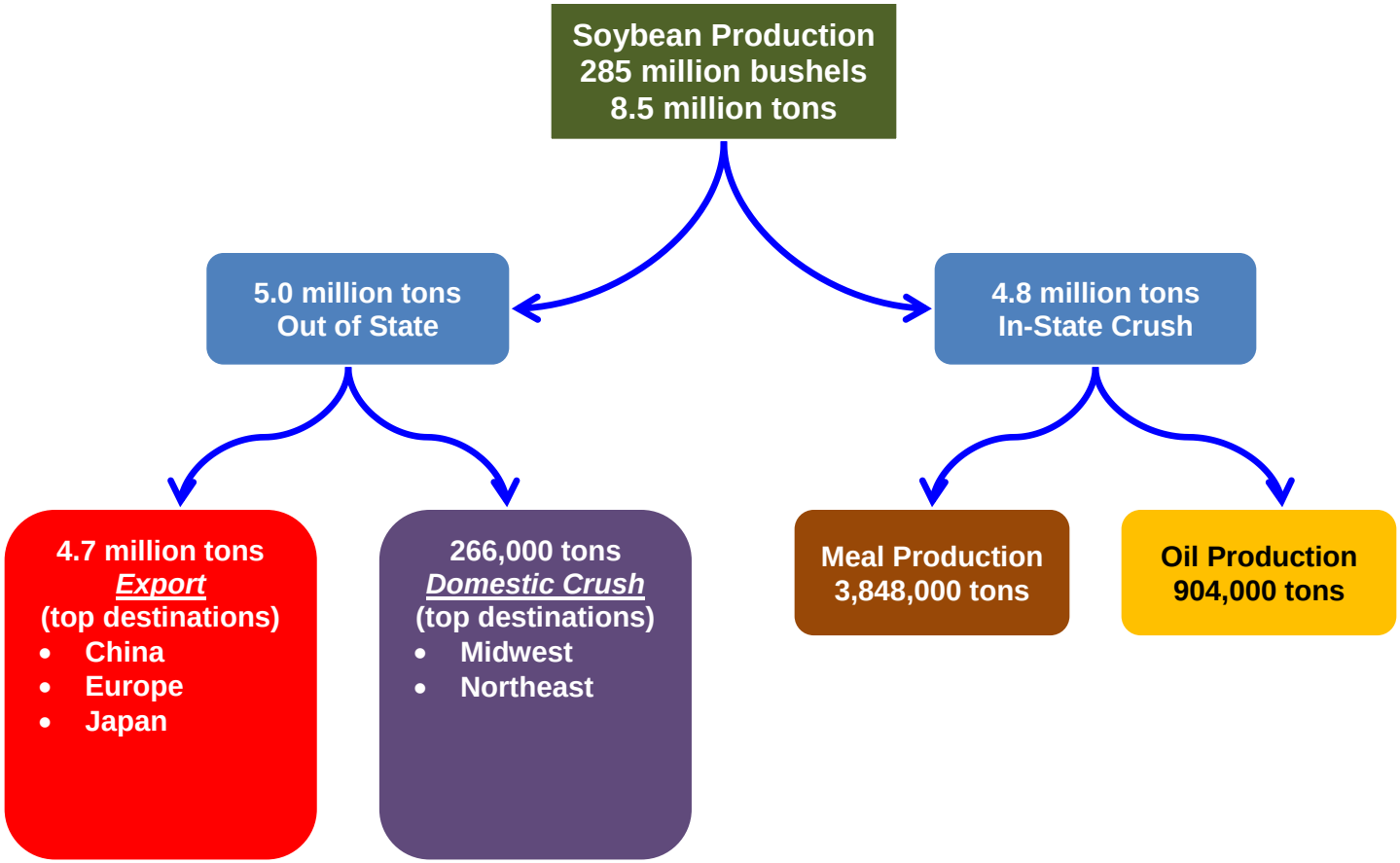
MINNESOTA FLOWCHART OF SOYBEAN MOVEMENTS (2009/10)



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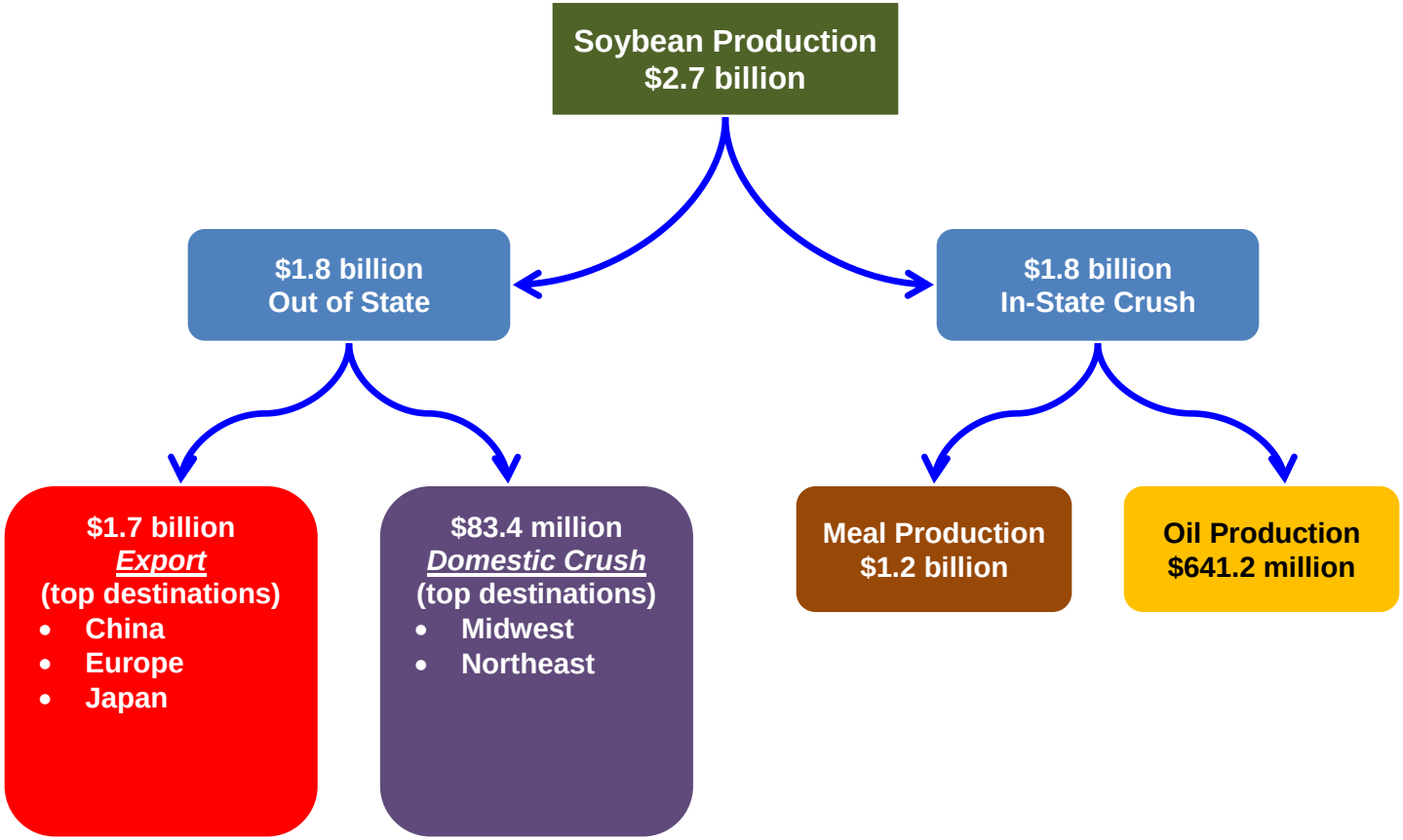
MINNESOTA FLOWCHART OF SOYBEAN VALUE (2009/10)



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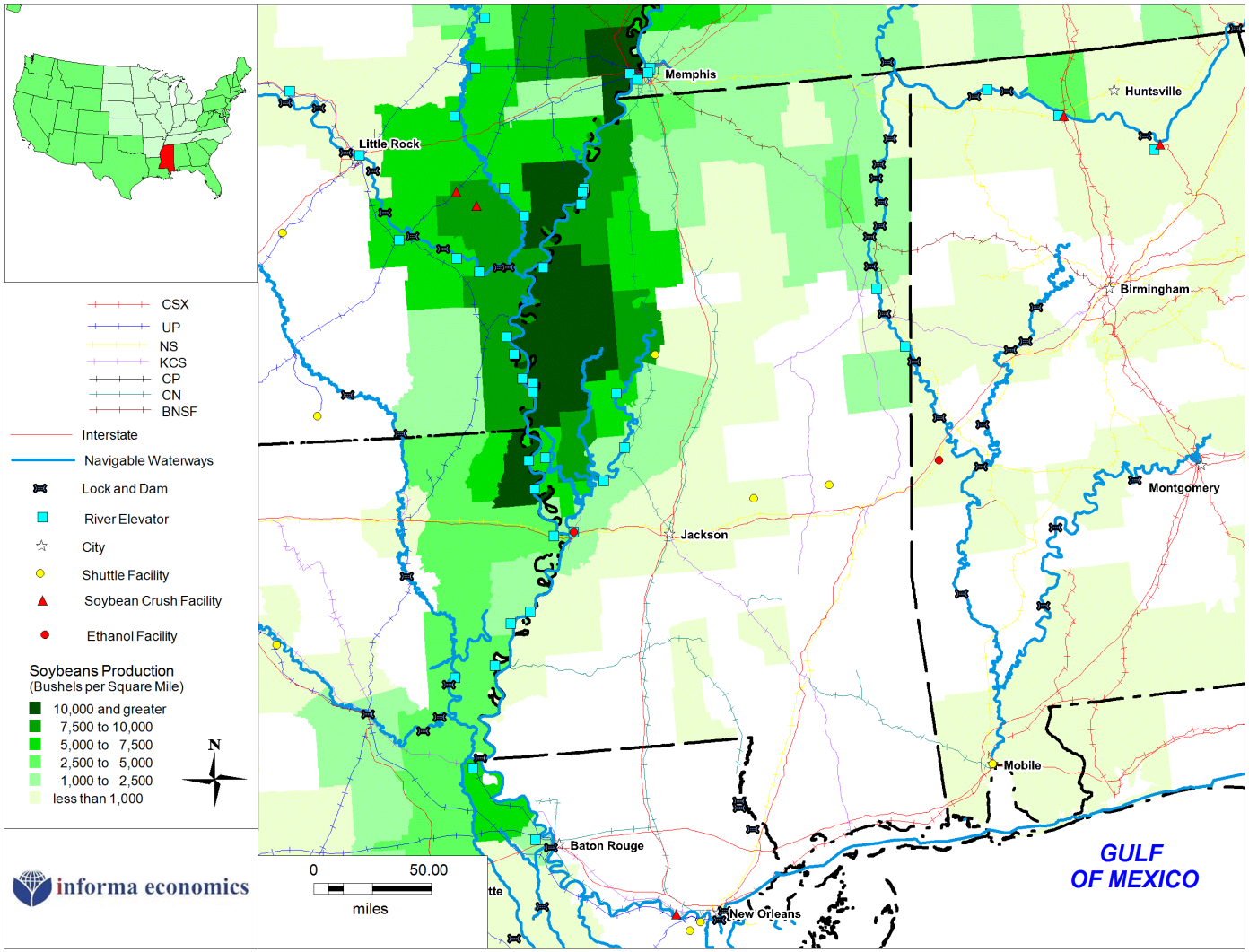
MISSISSIPPI



Production

- Soybean production in Mississippi occurs mostly in the northern portion of the state, with production densities highest in the northwestern portion of the state.
- Mississippi livestock inventories consist primarily of broilers, contributing to 10% of U.S. inventories.

Infrastructure

- Mississippi has 2,683 miles of rail lines; 710 miles of interstate, and 74,985 miles of roadways.
- Mississippi has three shuttle facilities; one ethanol facility; 45 grain elevators and 14 river elevators.

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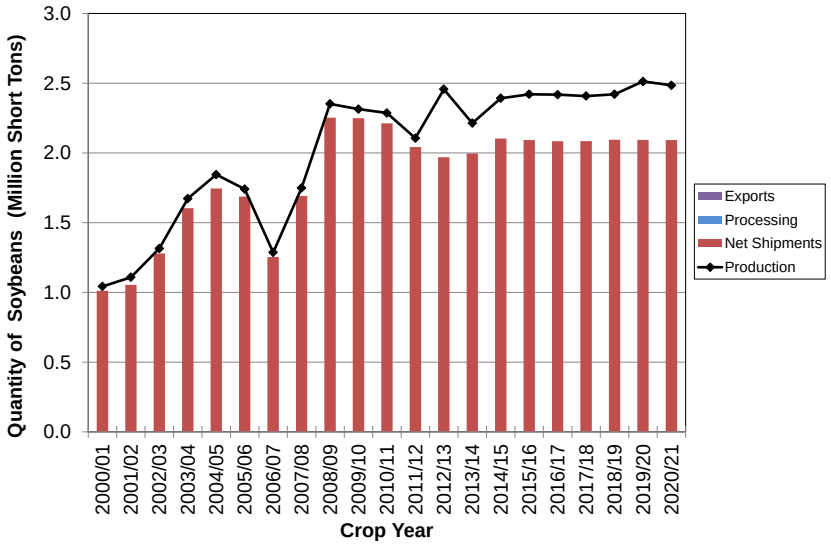
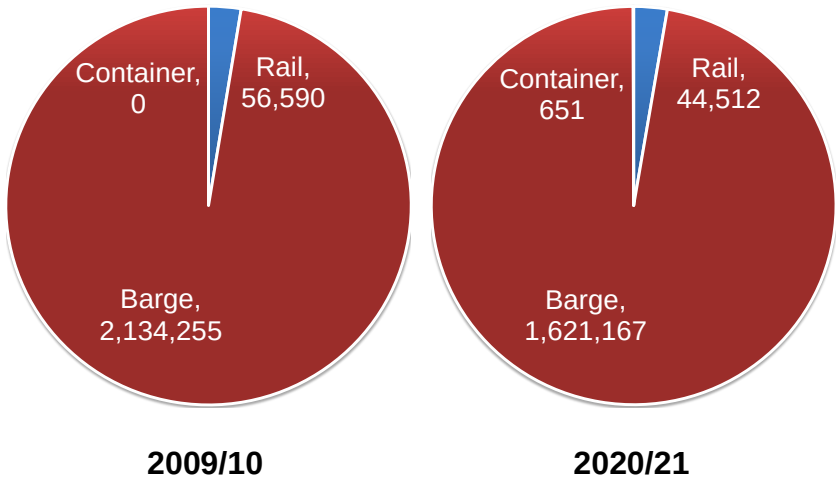
MISSISSIPPI

Soybean Surplus and Deficit Outlook



Soybean Movements by Mode (Short Tons)



Agricultural Infrastructure: Crush, Ethanol Facilities, Livestock Processing, and Grain Storage

Facility Type	# of Facilities	Capacity	
Soybean Crushers	0	-	MT/Day
Ethanol Facility* (operating)	1	60	MGY
Federally Inspected Livestock Slaughter/Processing Facilities	28	n/a	
State Inspected Livestock Slaughter/Processing Facilities	23	n/a	
Grain Elevators	45	70,608	Thous. Bu. Storage
Shuttle Elevators	3	2,700	Thous. Bu. Storage
River Elevators	14	27,050	Thous. Bu. Storage

** Cellulosic ethanol facilities are included in ethanol facility database.*

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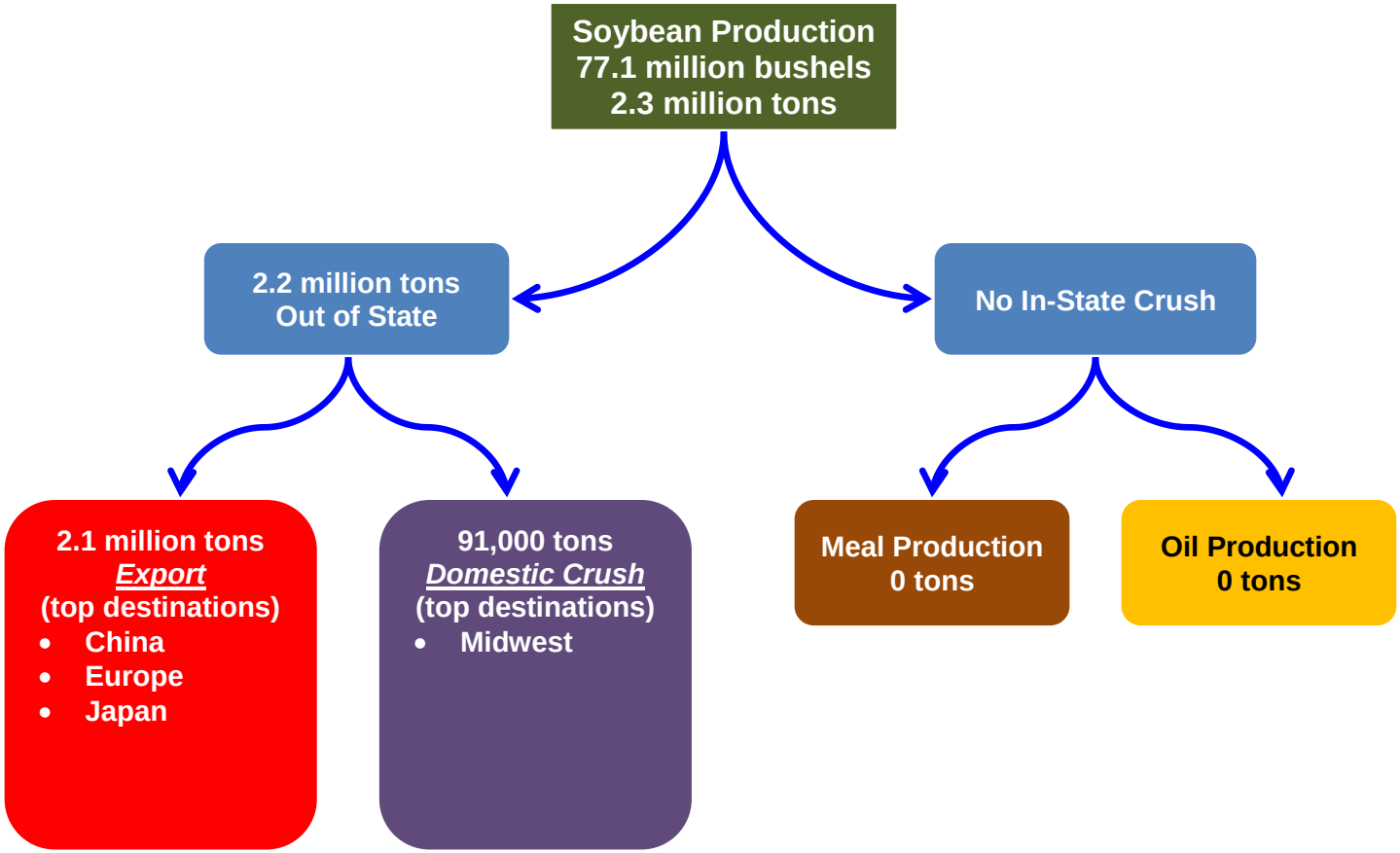
MISSISSIPPI FLOWCHART OF SOYBEAN MOVEMENTS (2009/10)



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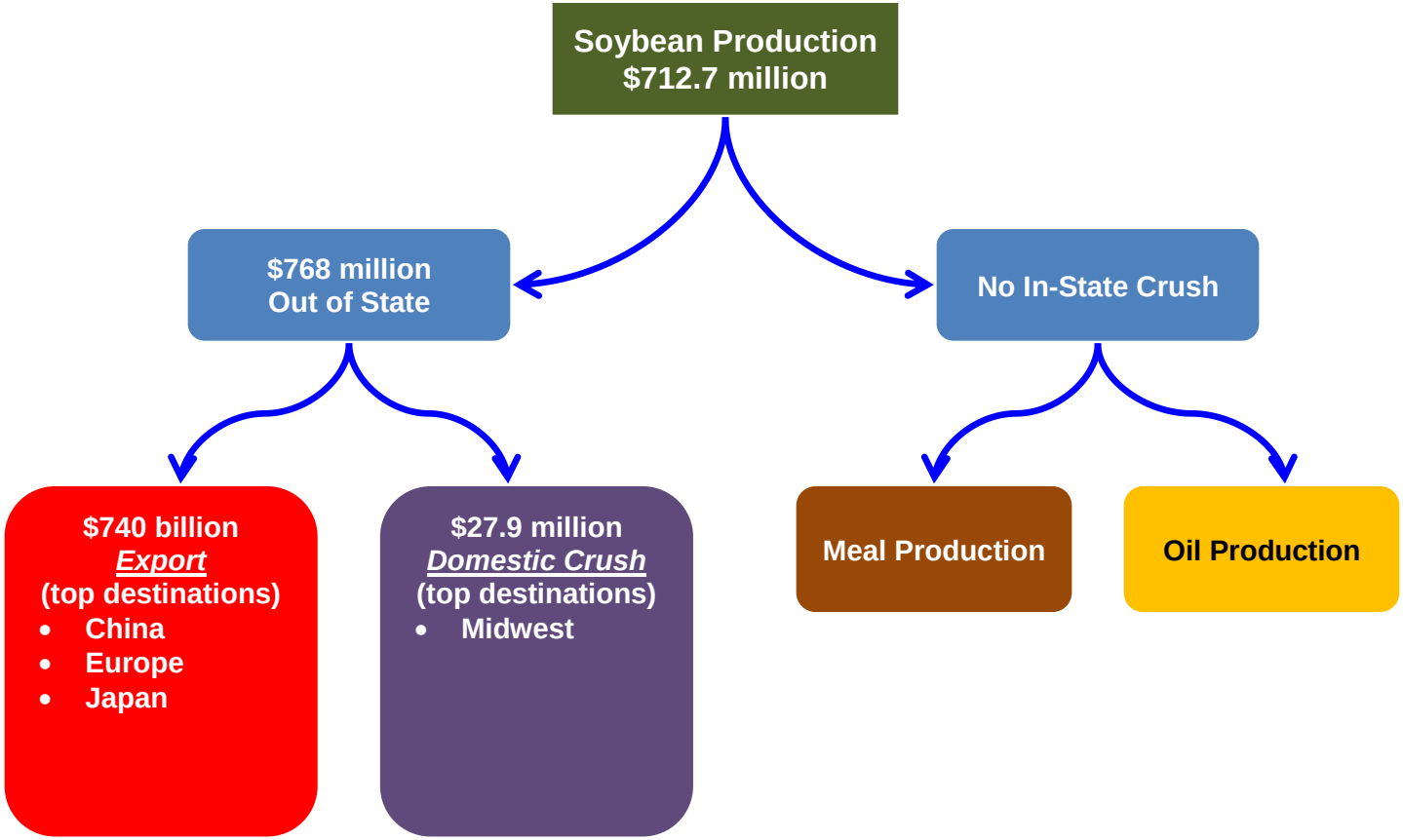
MISSISSIPPI FLOWCHART OF SOYBEAN VALUE (2009/10)



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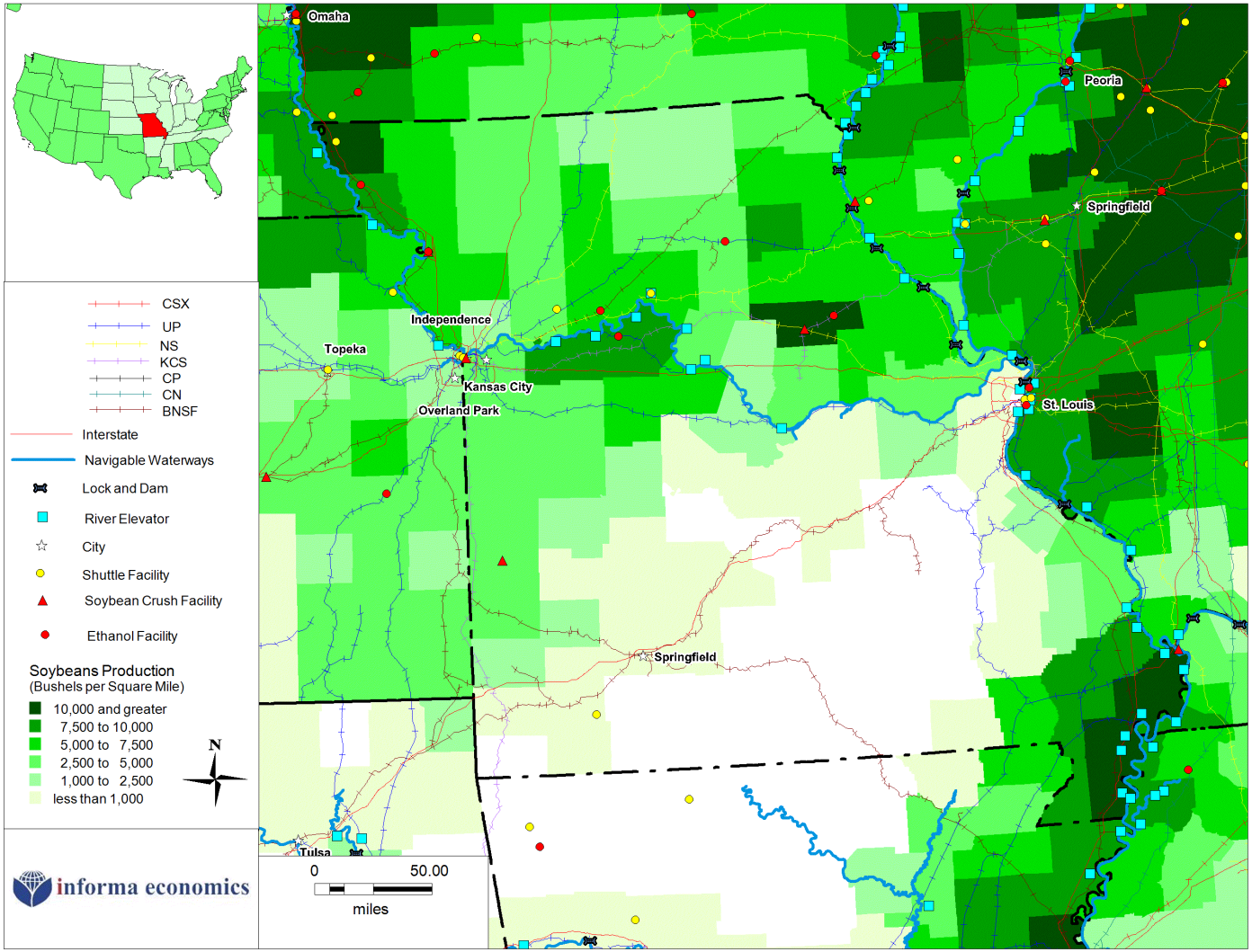
MISSOURI



Production

- Soybean production in Missouri occurs mostly in the northern portion of the state, with production densities highest throughout the northern portion of the state.
- Missouri is a key contributor of cattle, hogs and turkey to U.S. production levels.

Infrastructure

- Missouri has 4,050 miles of rail lines; 1,188 miles of interstate, and 130,359 miles of roadways.
- Missouri has eight shuttle facilities; four soybean crush facilities; six ethanol facilities; 287 grain elevators and 22 river elevators.

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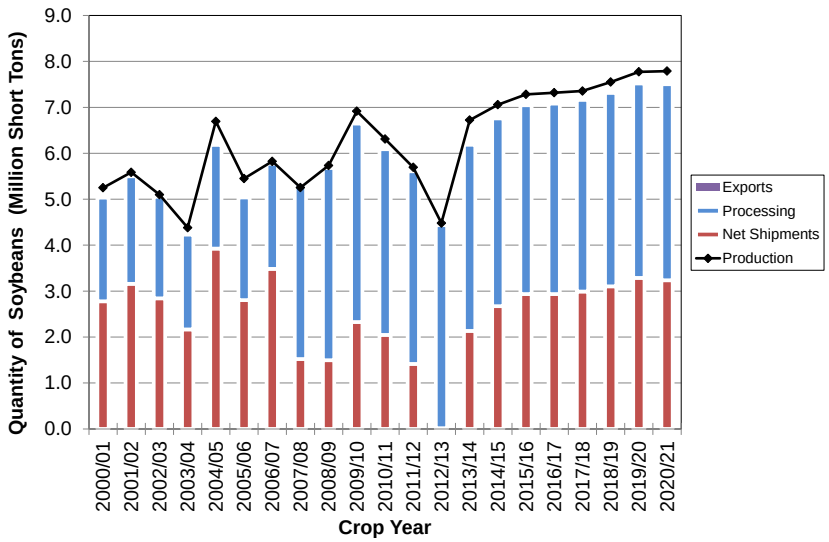
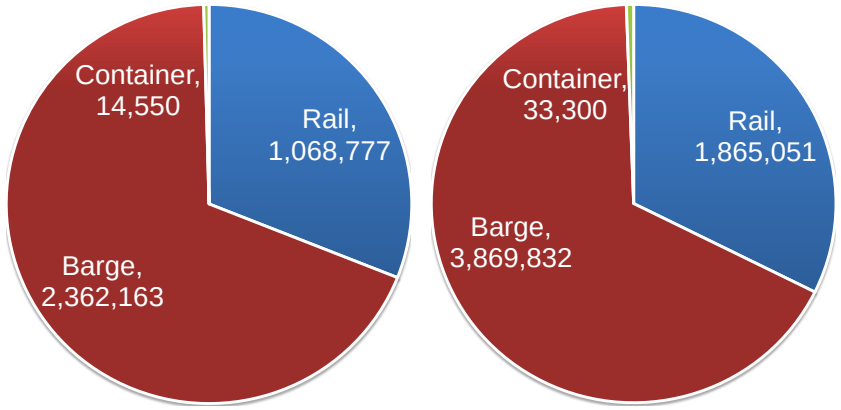
MISSOURI

Soybean Surplus and Deficit Outlook



Soybean Movements by Mode (Short Tons)



Agricultural Infrastructure: Crush, Ethanol Facilities, Livestock Processing, and Grain Storage

Facility Type	# of Facilities	Capacity	
Soybean Crushers	4	11,882	MT/Day
Ethanol Facility* (operating)	6	261	MGY
Federally Inspected Livestock Slaughter/Processing Facilities	139	n/a	
State Inspected Livestock Slaughter/Processing Facilities	31	n/a	
Grain Elevators	287	253,520	Thous. Bu. Storage
Shuttle Elevators	8	18,291	Thous. Bu. Storage
River Elevators	22	43,226	Thous. Bu. Storage

** Cellulosic ethanol facilities are included in ethanol facility database.*

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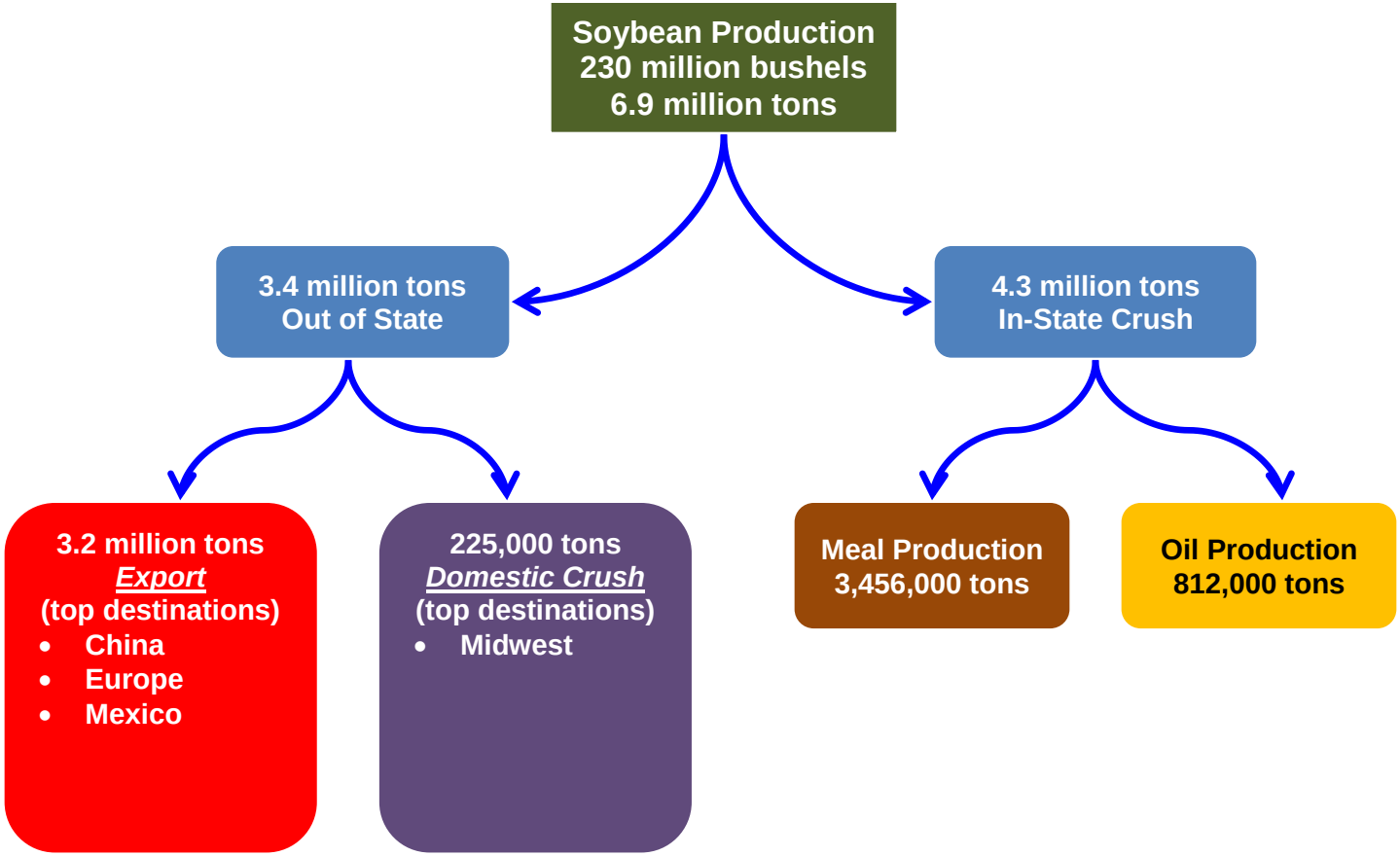
MISSOURI FLOWCHART OF SOYBEAN MOVEMENTS (2009/10)



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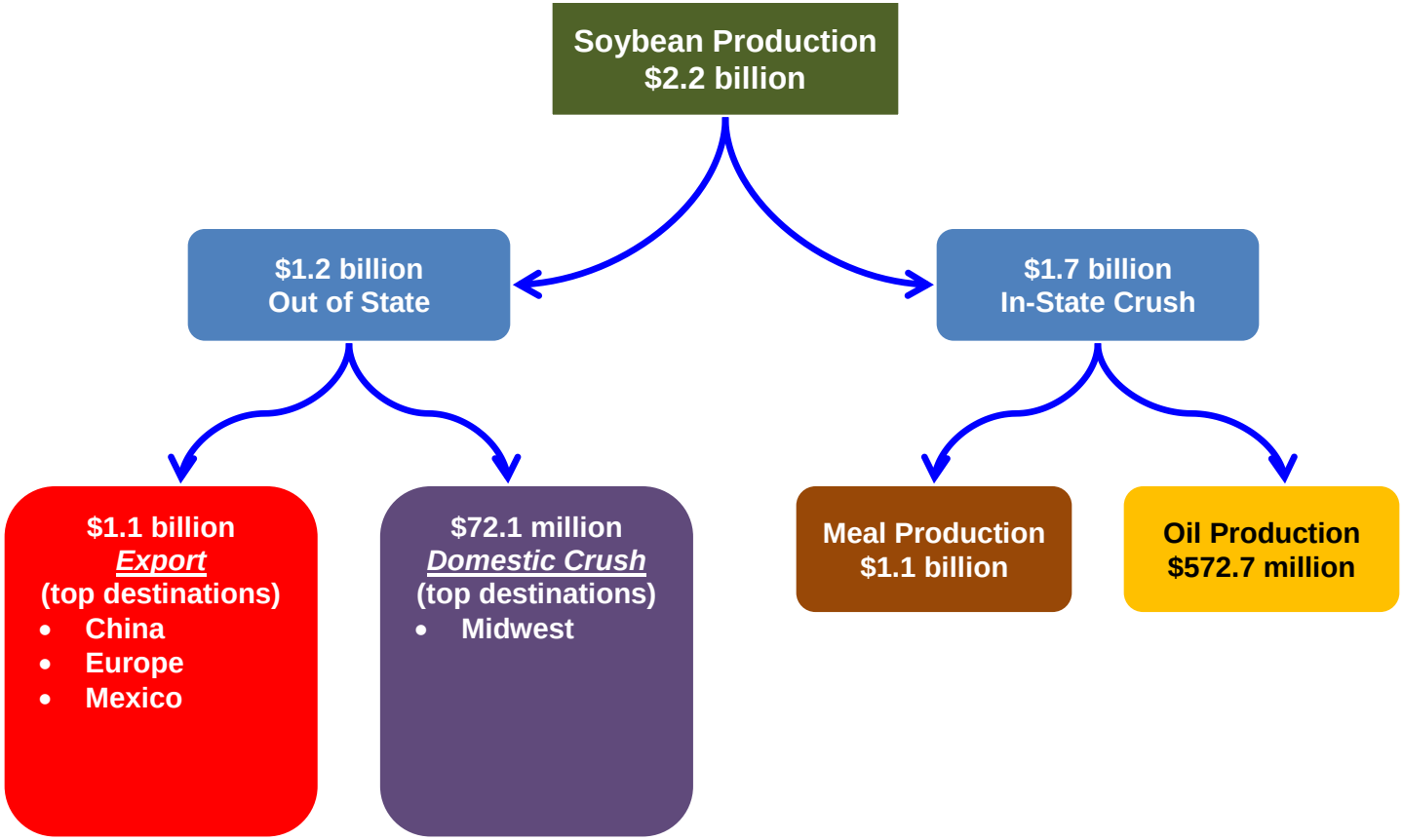
MISSOURI FLOWCHART OF SOYBEAN VALUE (2009/10)



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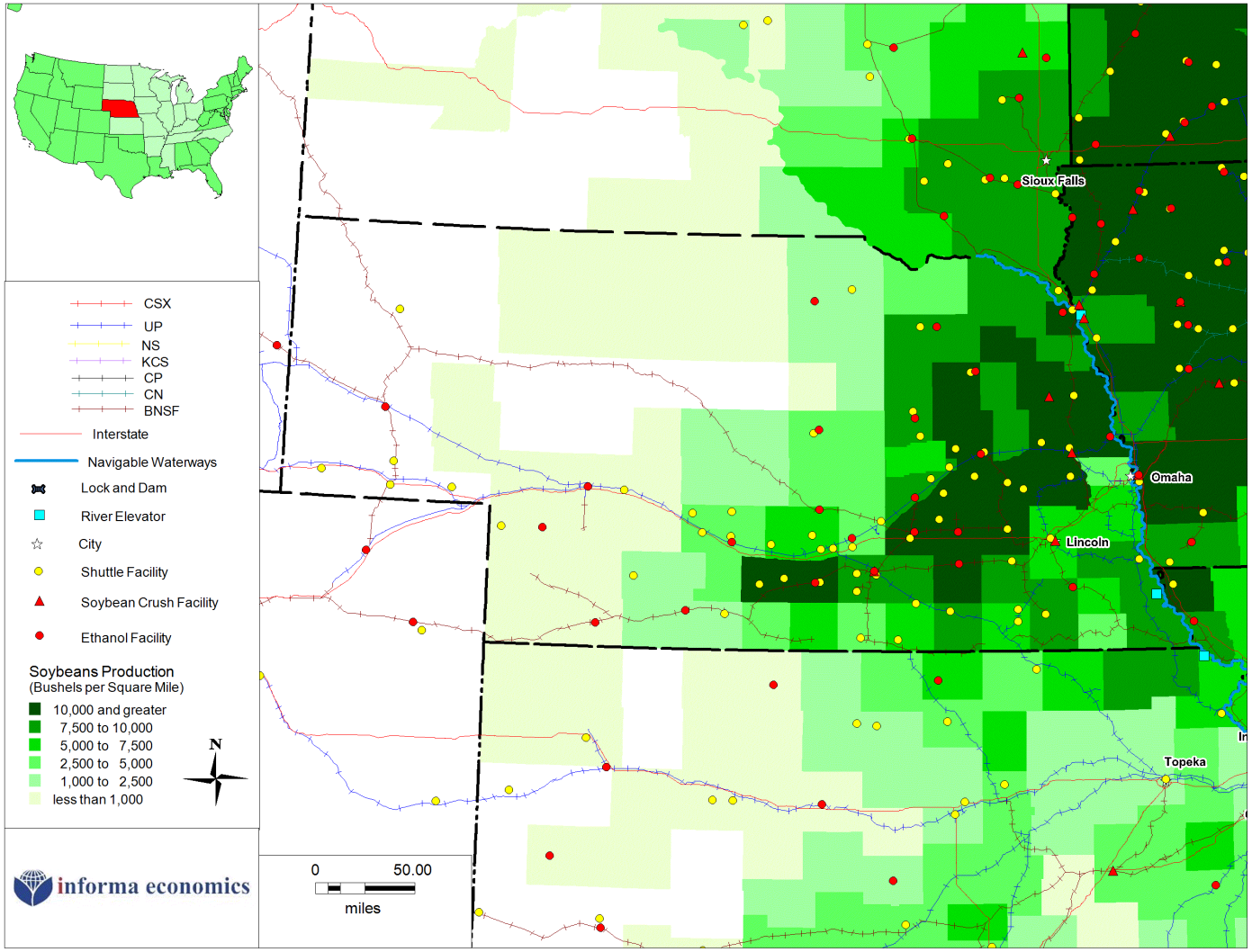
NEBRASKA



Production

- Soybean production in Nebraska occurs mostly in the eastern portion of the state, with production densities highest throughout the central eastern portion of the state.
- Nebraska is a primary contributor to U.S. cattle inventory levels, with nearly 7% of U.S. production.

Infrastructure

- Nebraska has 3,215 miles of rail lines; 482 miles of interstate, and 93,631 miles of roadways.
- Nebraska has 64 shuttle facilities; four soybean crush facilities; 27 ethanol facilities; 414 grain elevators and 2 river elevators.

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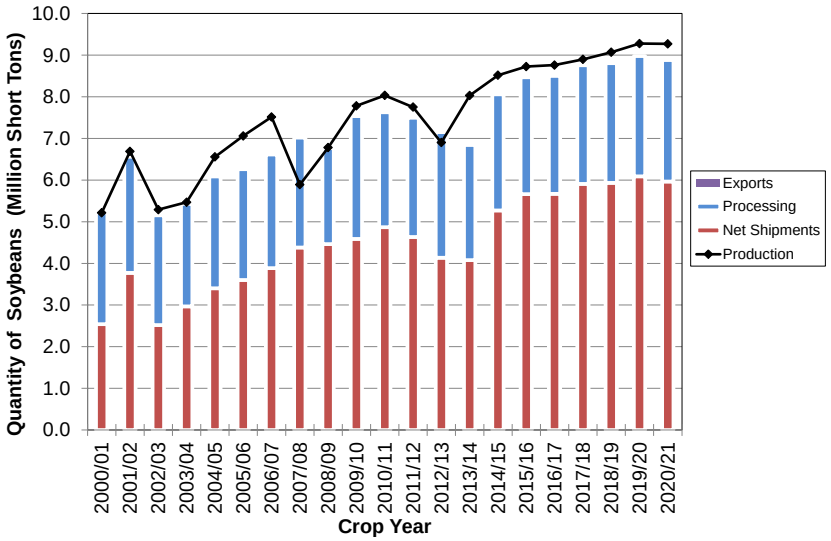
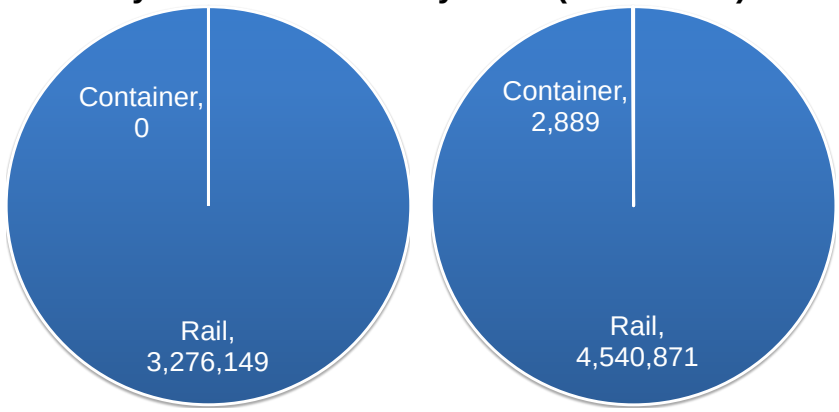
NEBRASKA

Soybean Surplus and Deficit Outlook



Soybean Movements by Mode (Short Tons)



Agricultural Infrastructure: Crush, Ethanol Facilities, Livestock Processing, and Grain Storage

Facility Type	# of Facilities	Capacity	
Soybean Crushers	4	9,943	MT/Day
Ethanol Facility* (operating)	27	1,935	MGY
Federally Inspected Livestock Slaughter/Processing Facilities	88	n/a	
State Inspected Livestock Slaughter/Processing Facilities	0	n/a	
Grain Elevators	414	662,115	Thous. Bu. Storage
Shuttle Elevators	64	200,839	Thous. Bu. Storage
River Elevators	2	1,164	Thous. Bu. Storage

** Cellulosic ethanol facilities are included in ethanol facility database.*

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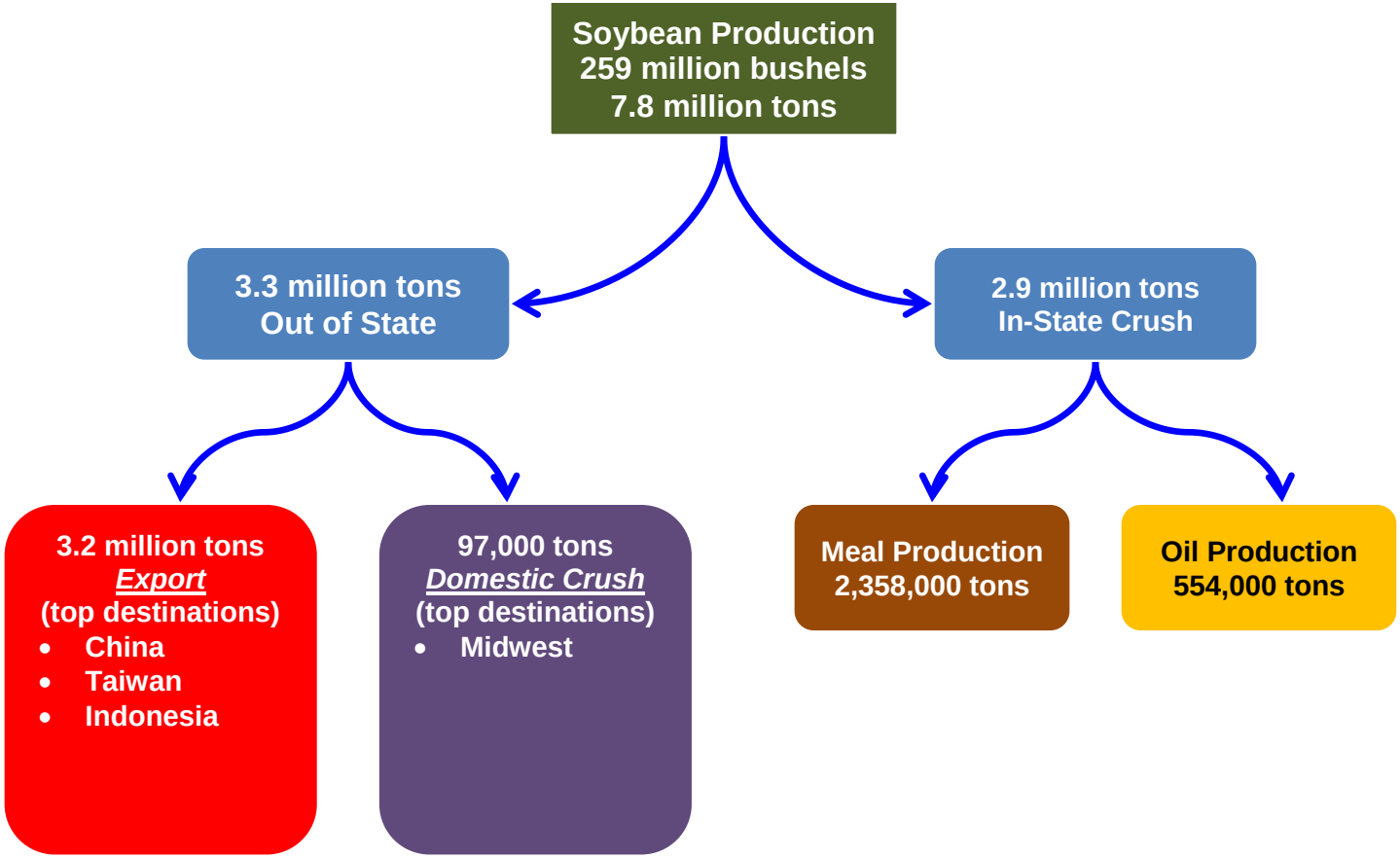
NEBRASKA FLOWCHART OF SOYBEAN MOVEMENTS (2009/10)



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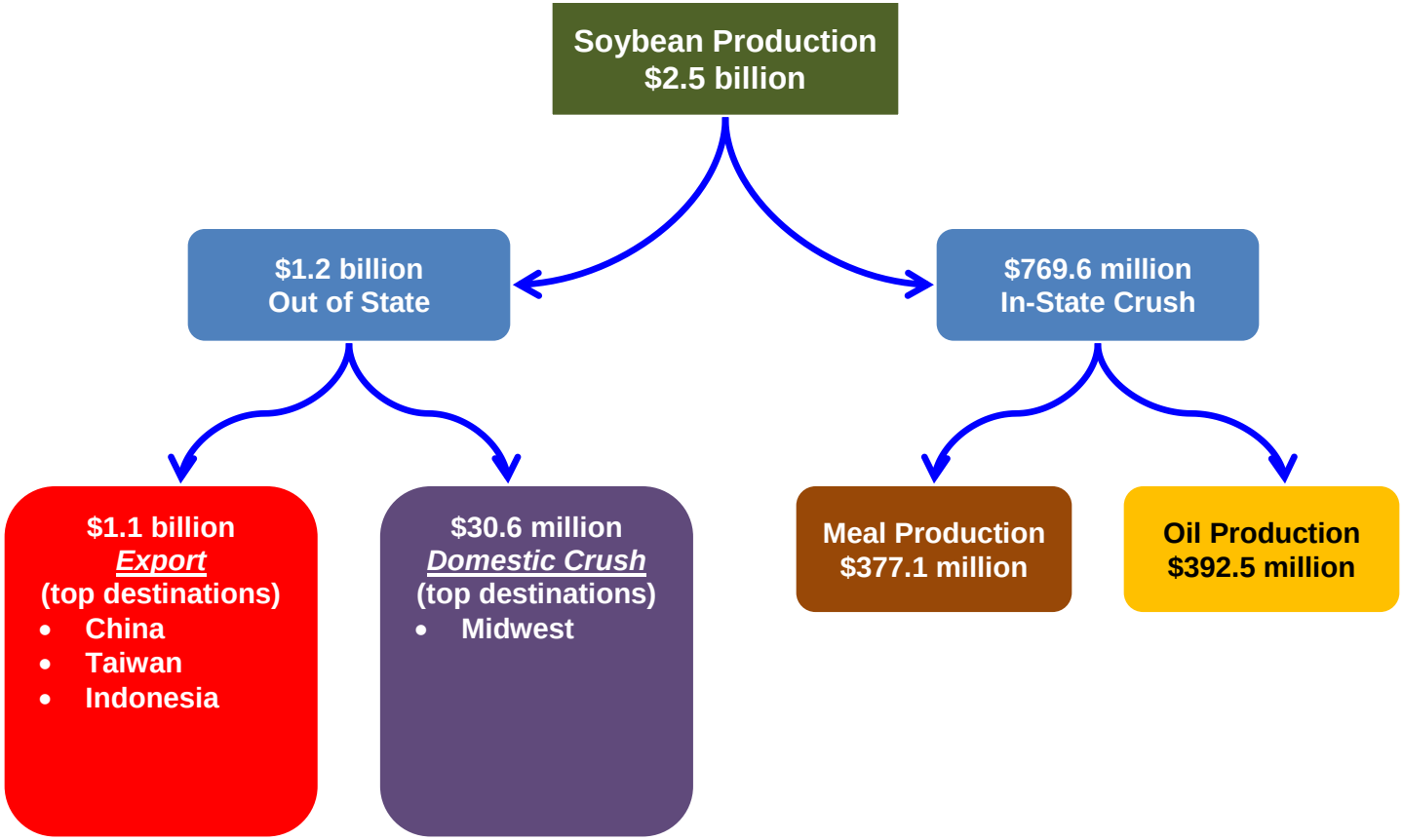
NEBRASKA FLOWCHART OF SOYBEAN VALUE (2009/10)



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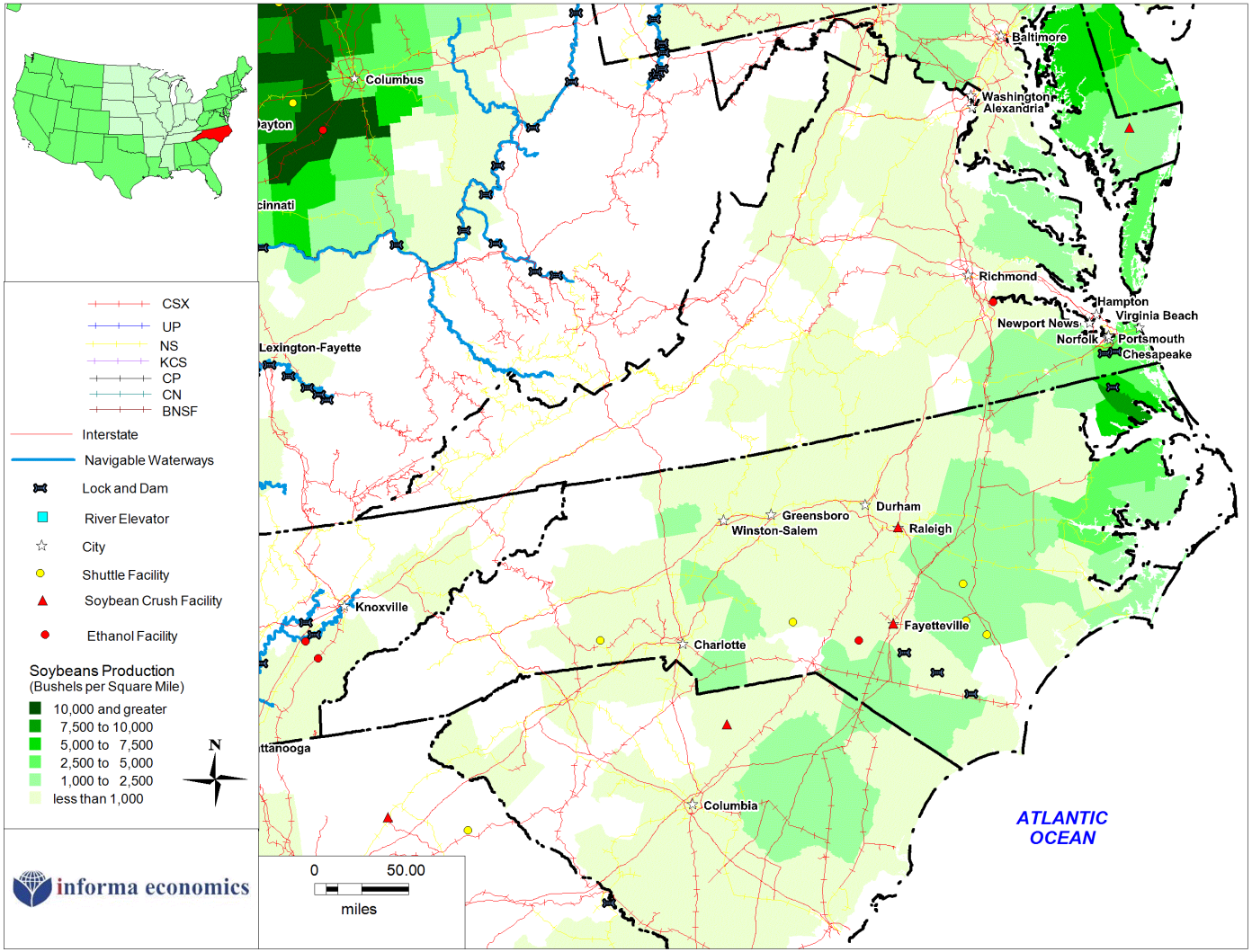
NORTH CAROLINA



Production

- Soybean production in North Carolina occurs mostly in the eastern portion of the state, with production densities highest throughout the far eastern portion of the state.
- North Carolina is a key producer of hogs, broilers, and turkeys.

Infrastructure

- North Carolina has 3,230 miles of rail lines; 1,053 miles of interstate, and 105,317 miles of roadways.
- North Carolina has nine shuttle facilities; two soybean crush facilities; one ethanol facility; and 152 grain elevators.

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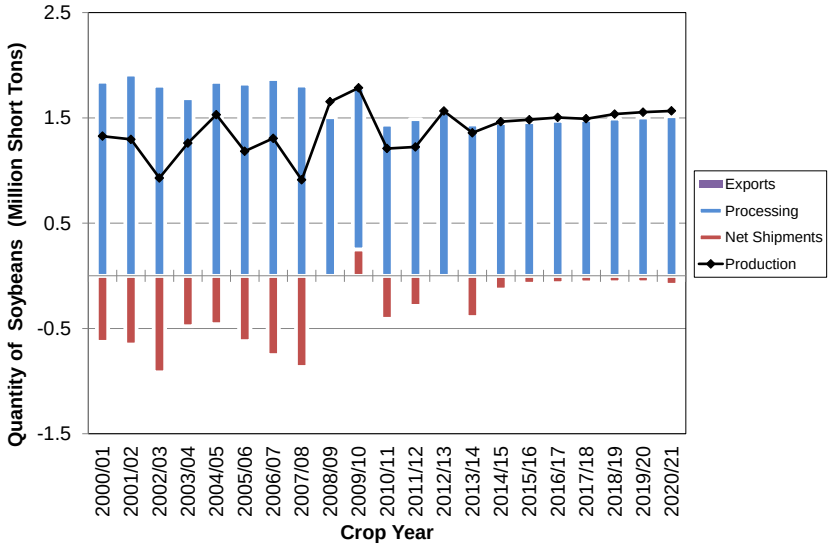
NORTH CAROLINA

Soybean Surplus and Deficit Outlook



Soybean Movements by Mode (Short Tons)

North Carolina has no reported outshipments of soybeans by barge, container or rail.

Agricultural Infrastructure: Crush, Ethanol Facilities, Livestock Processing, and Grain Storage

Facility Type	# of Facilities	Capacity	
Soybean Crushers	2	5,171	MT/Day
Ethanol Facility* (operating)	1	60	MGY
Federally Inspected Livestock Slaughter/Processing Facilities	77	n/a	
State Inspected Livestock Slaughter/Processing Facilities	68	n/a	
Grain Elevators	152	130,773	Thous. Bu. Storage
Shuttle Elevators	9	17,710	Thous. Bu. Storage
River Elevators	0	-	Thous. Bu. Storage

** Cellulosic ethanol facilities are included in ethanol facility database.*

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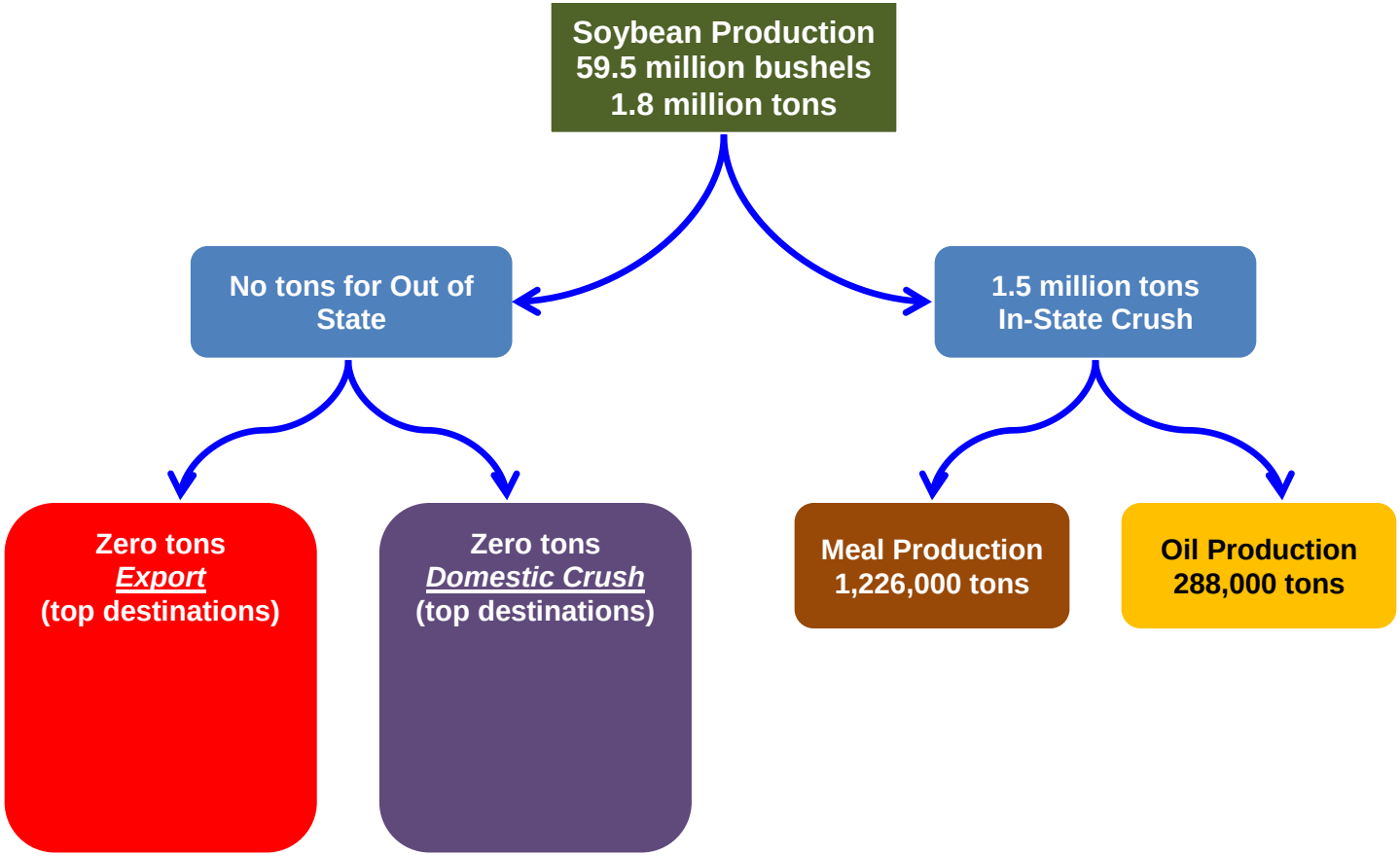
NORTH CAROLINA FLOWCHART OF SOYBEAN MOVEMENTS (2009/10)



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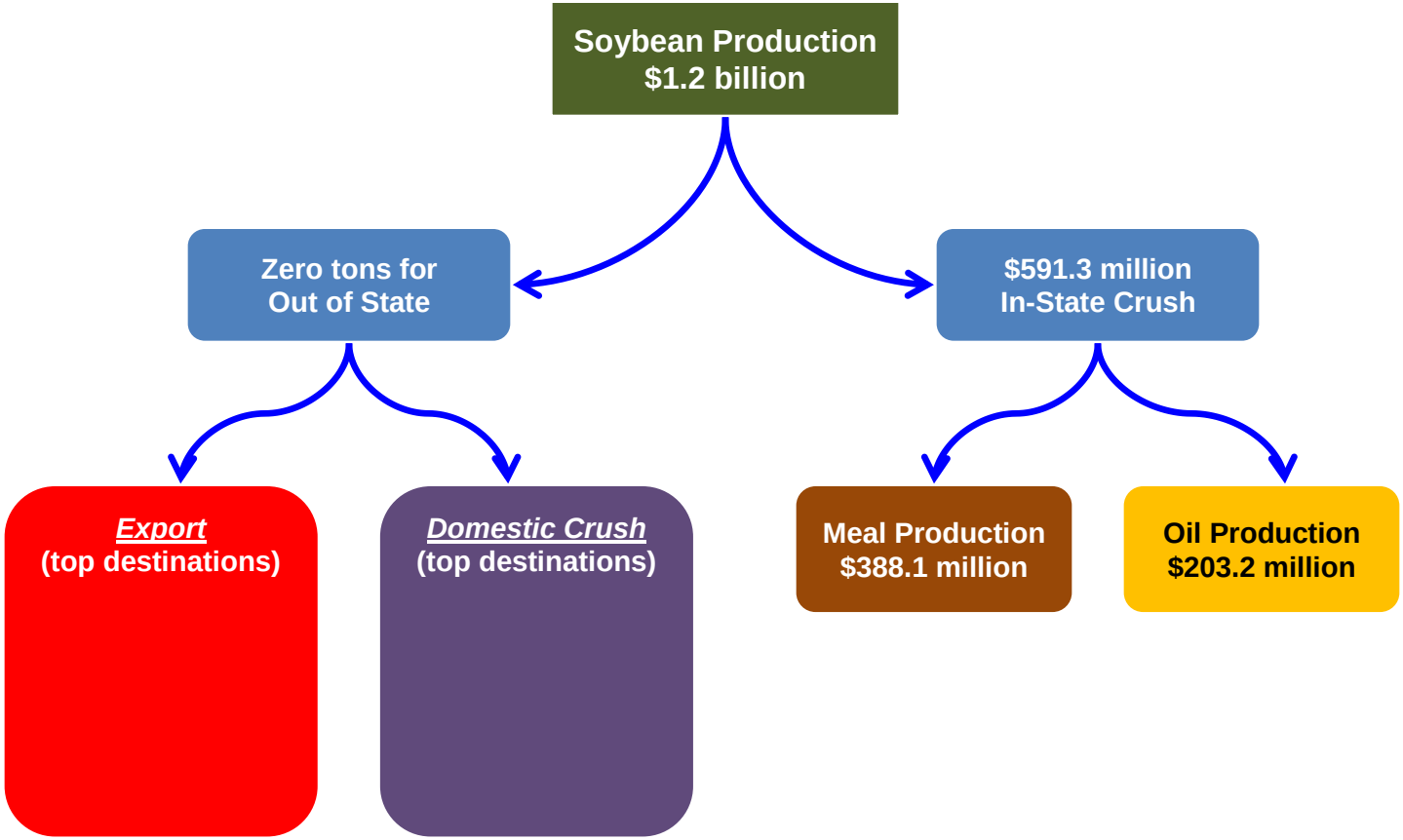
NORTH CAROLINA FLOWCHART OF SOYBEAN VALUE (2009/10)



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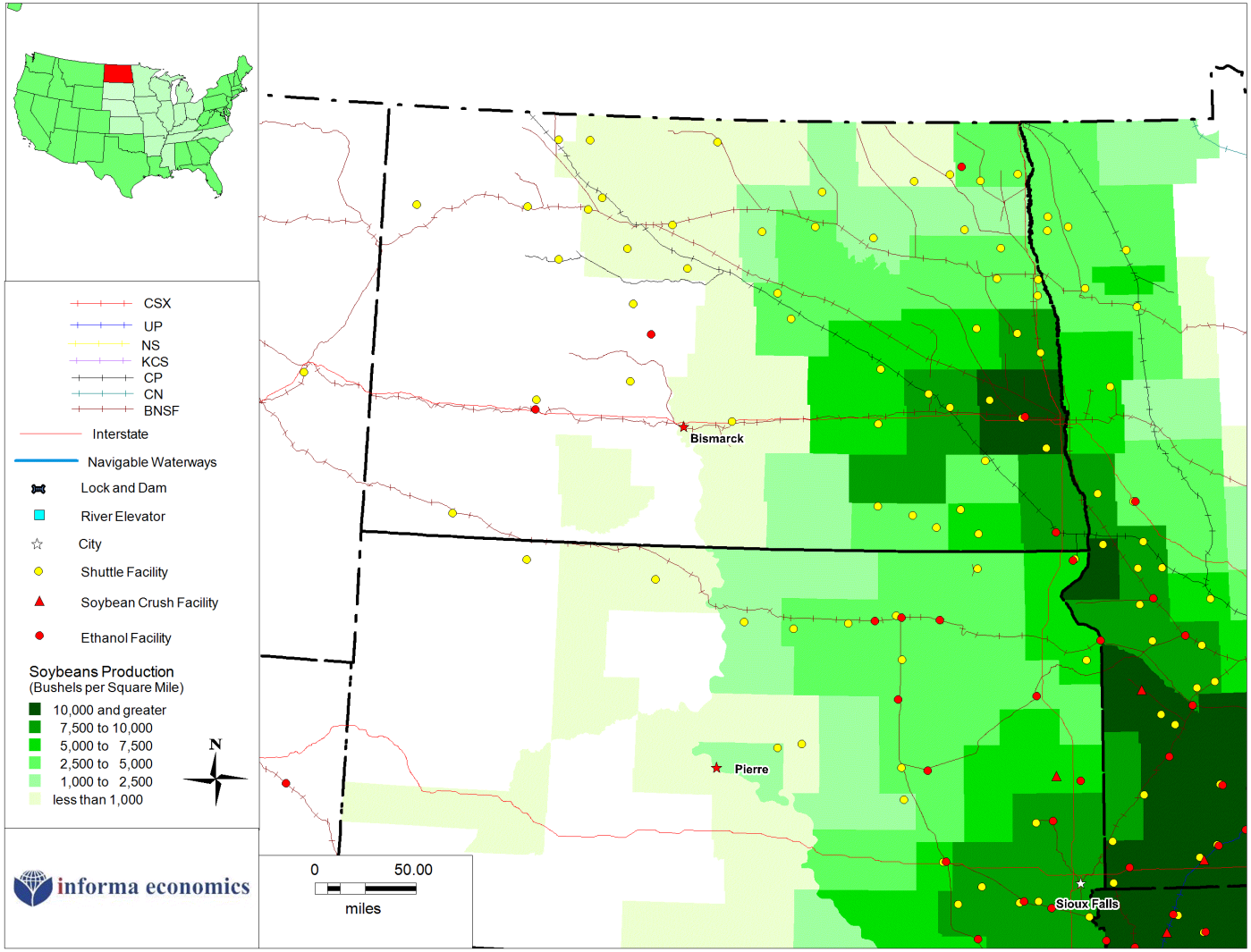
NORTH DAKOTA



Production

- Soybean production in North Dakota occurs mostly in the eastern portion of the state, with production densities highest throughout the southeastern portion of the state.
- North Dakota's primary livestock inventory consists of cattle.

Infrastructure

- North Dakota has 3,413 miles of rail lines; 571 miles of interstate, and 86,843 miles of roadways.
- North Dakota has 49 shuttle facilities; five ethanol facilities; and 367 grain elevators.

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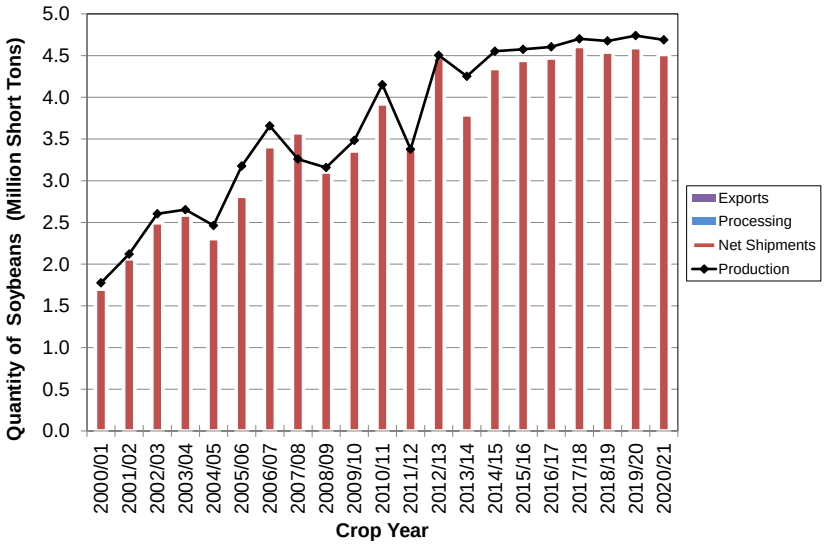
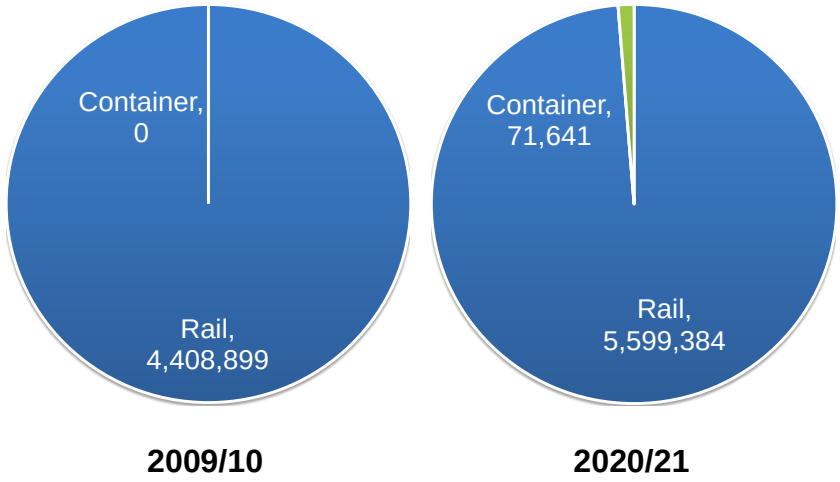
NORTH DAKOTA

Soybean Surplus and Deficit Outlook



Soybean Movements by Mode (Short Tons)



Agricultural Infrastructure: Crush, Ethanol Facilities, Livestock Processing, and Grain Storage

Facility Type	# of Facilities	Capacity	
Soybean Crushers	0	-	MT/Day
Ethanol Facility* (operating)	5	378	MGY
Federally Inspected Livestock Slaughter/Processing Facilities	23	n/a	
State Inspected Livestock Slaughter/Processing Facilities	18	n/a	
Grain Elevators	367	318,115	Thous. Bu. Storage
Shuttle Elevators	49	90,954	Thous. Bu. Storage
River Elevators	0	-	Thous. Bu. Storage

** Cellulosic ethanol facilities are included in ethanol facility database.*

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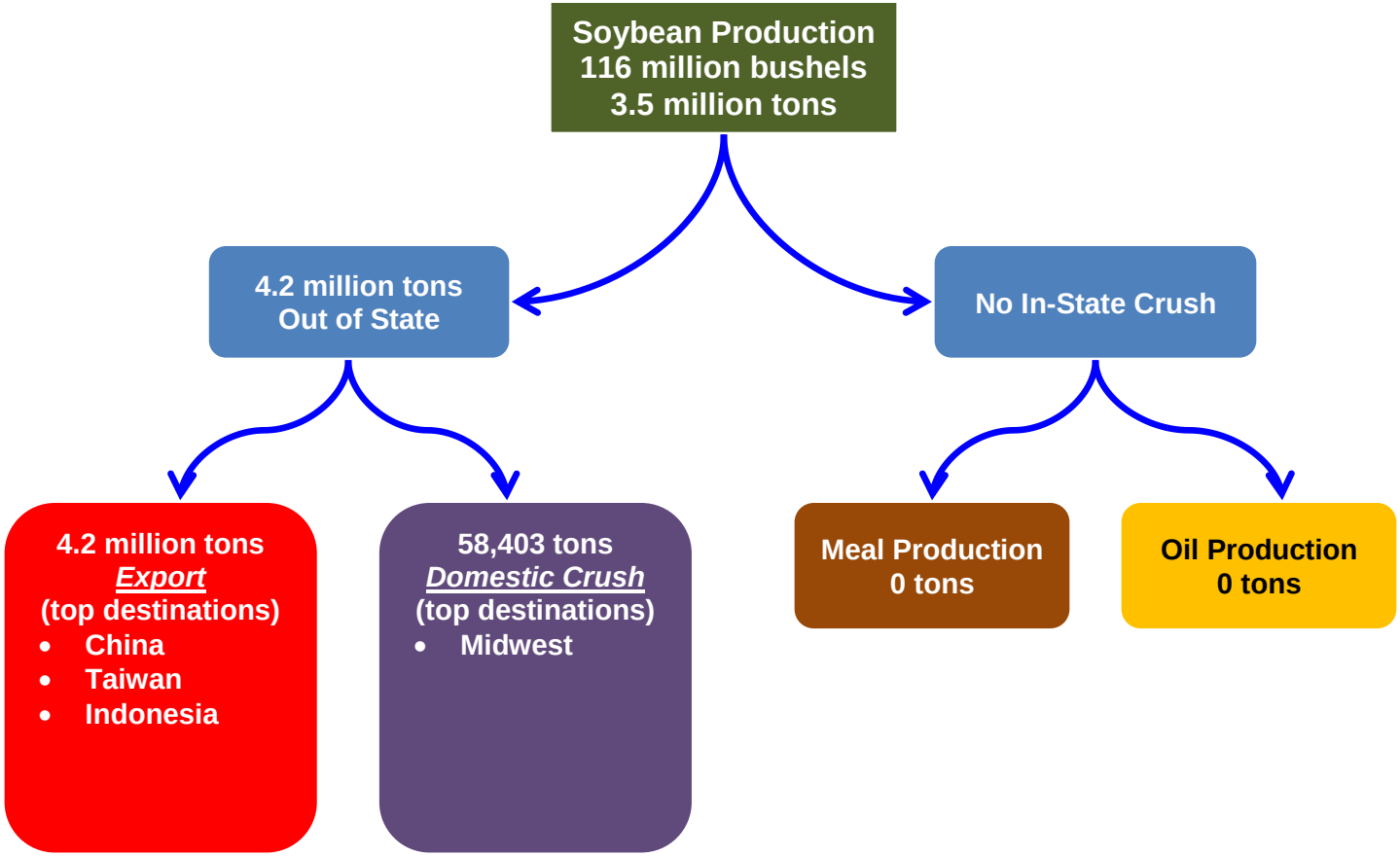
NORTH DAKOTA FLOWCHART OF SOYBEAN MOVEMENTS (2009/10)



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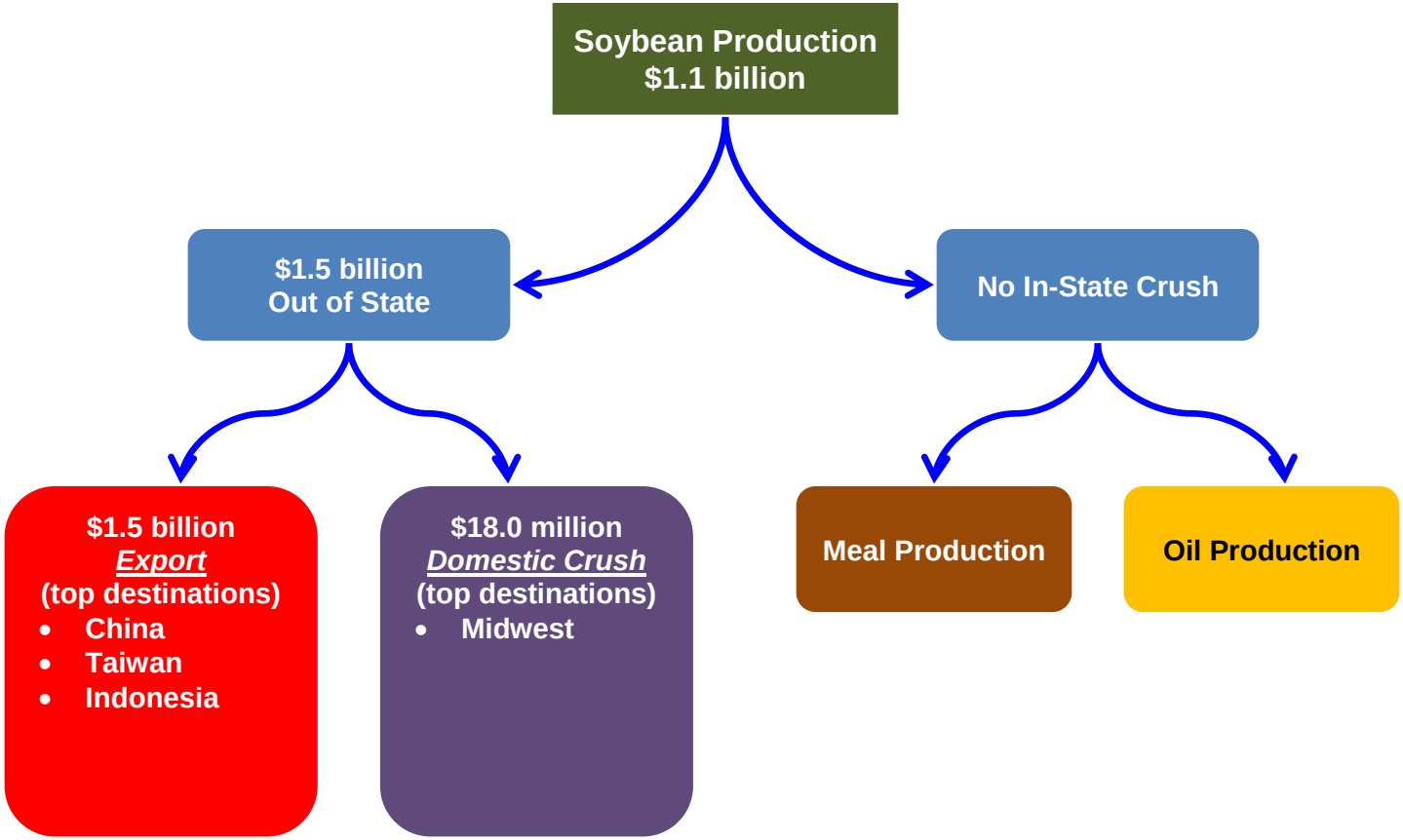
NORTH DAKOTA FLOWCHART OF SOYBEAN VALUE (2009/10)



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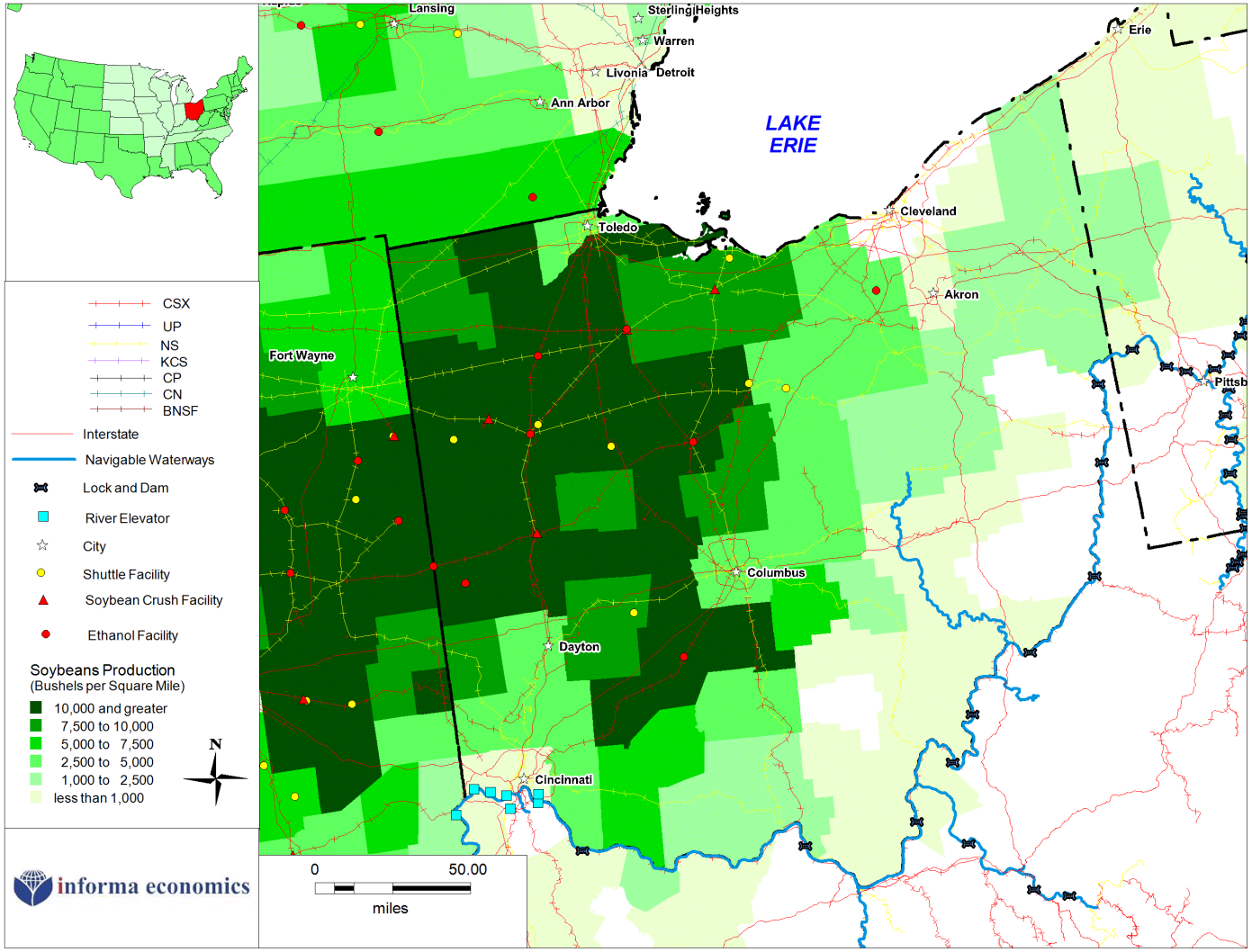
OHIO



Production

- Soybean production in Ohio occurs mostly in the north western portion of the state, with production densities highest in this region of the state.
- Ohio is a contributor of dairy cattle, hogs, and turkey inventories to U.S. production.

Infrastructure

- Ohio has 5,286 miles of rail lines; 1,726 miles of interstate, and 123,024 miles of roadways.
- Ohio has nine shuttle facilities; four soybean crush facilities; seven ethanol facilities; 354 grain elevators and 4 river elevators.

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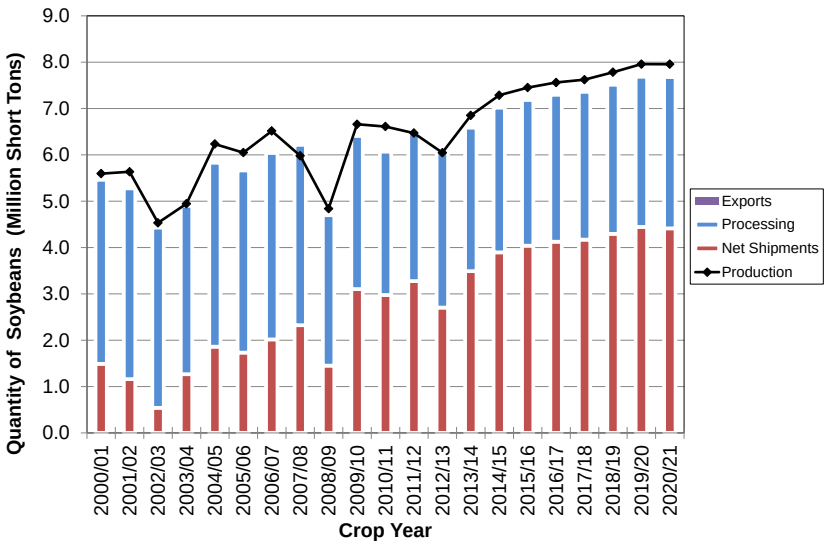
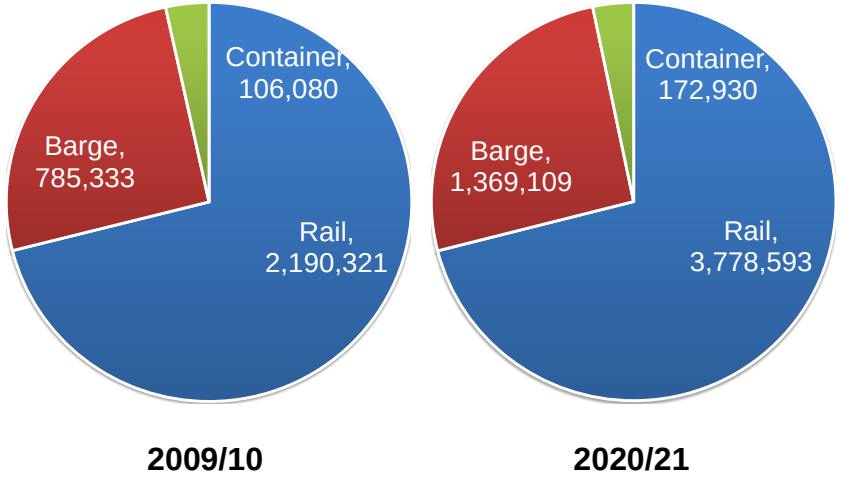
OHIO

Soybean Surplus and Deficit Outlook



Soybean Movements by Mode (Short Tons)



2009/10 **2020/21**

Agricultural Infrastructure: Crush, Ethanol Facilities, Livestock Processing, and Grain Storage

Facility Type	# of Facilities	Capacity	
Soybean Crushers	4	10,138	MT/Day
Ethanol Facility* (operating)	7	475	MGY
Federally Inspected Livestock Slaughter/Processing Facilities	158	n/a	
State Inspected Livestock Slaughter/Processing Facilities	216	n/a	
Grain Elevators	354	373,118	Thous. Bu. Storage
Shuttle Elevators	9	22,210	Thous. Bu. Storage
River Elevators	4	2,914	Thous. Bu. Storage

** Cellulosic ethanol facilities are included in ethanol facility database.*

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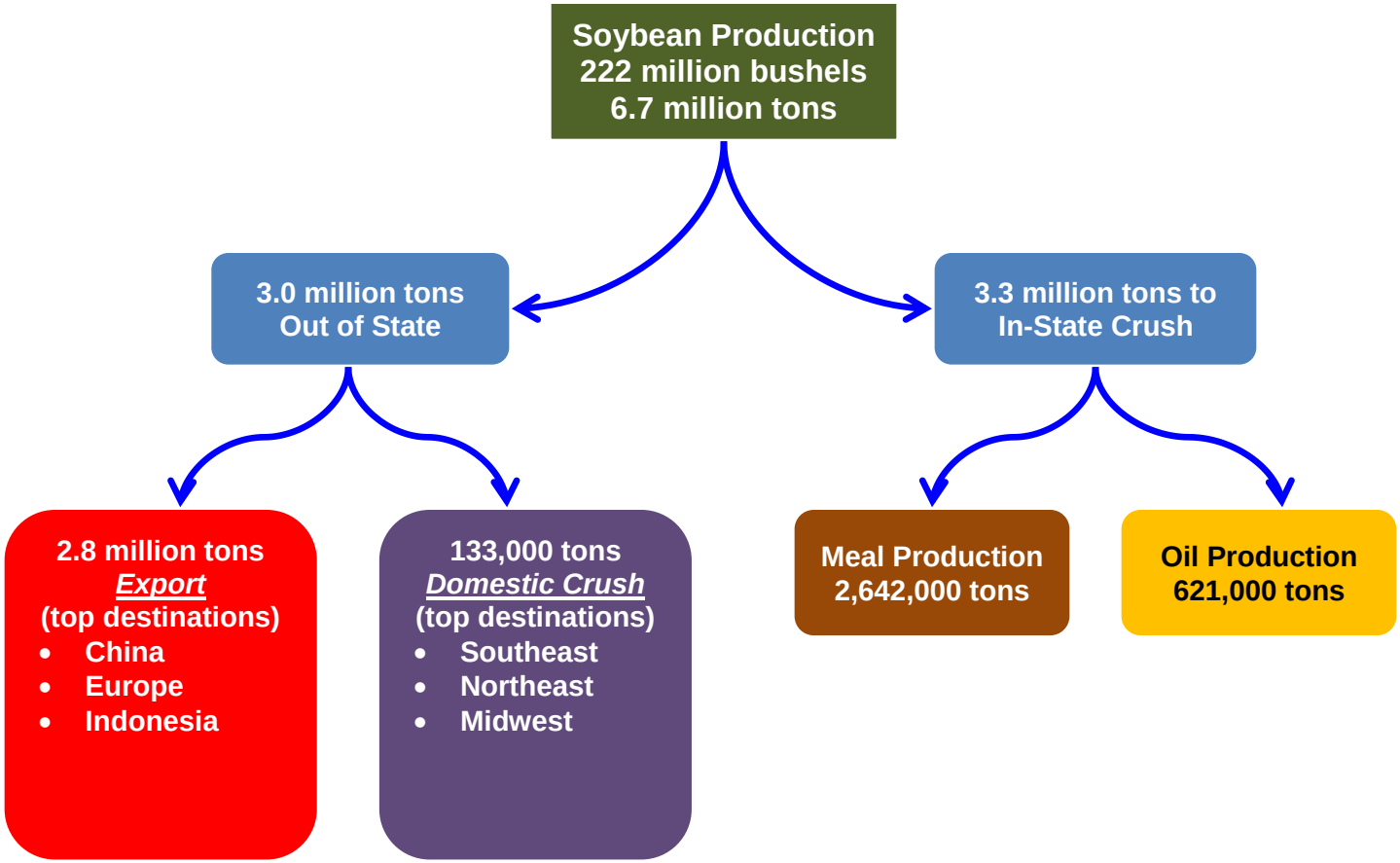
OHIO FLOWCHART OF SOYBEAN MOVEMENTS (2009/10)



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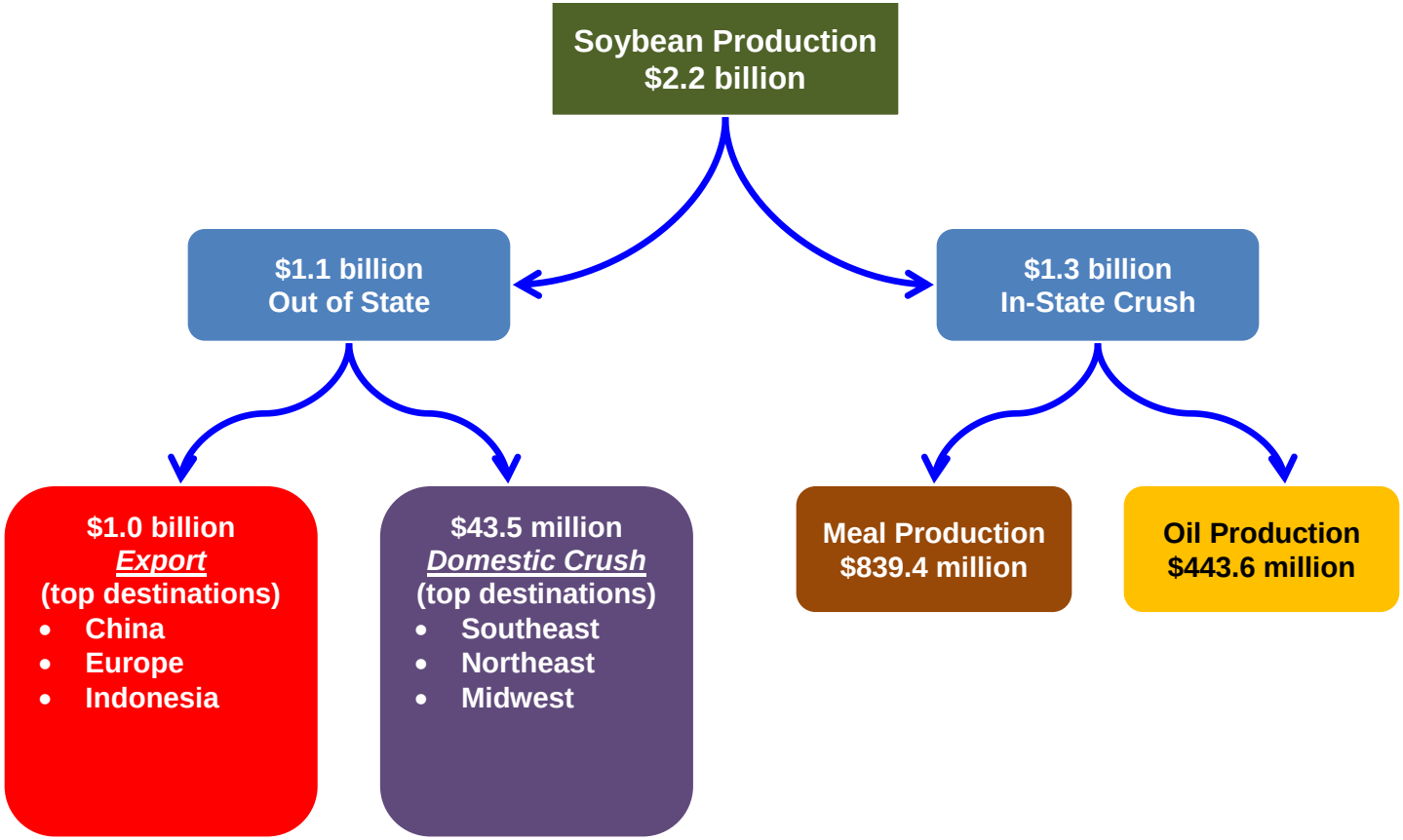
OHIO FLOWCHART OF SOYBEAN VALUE (2009/10)



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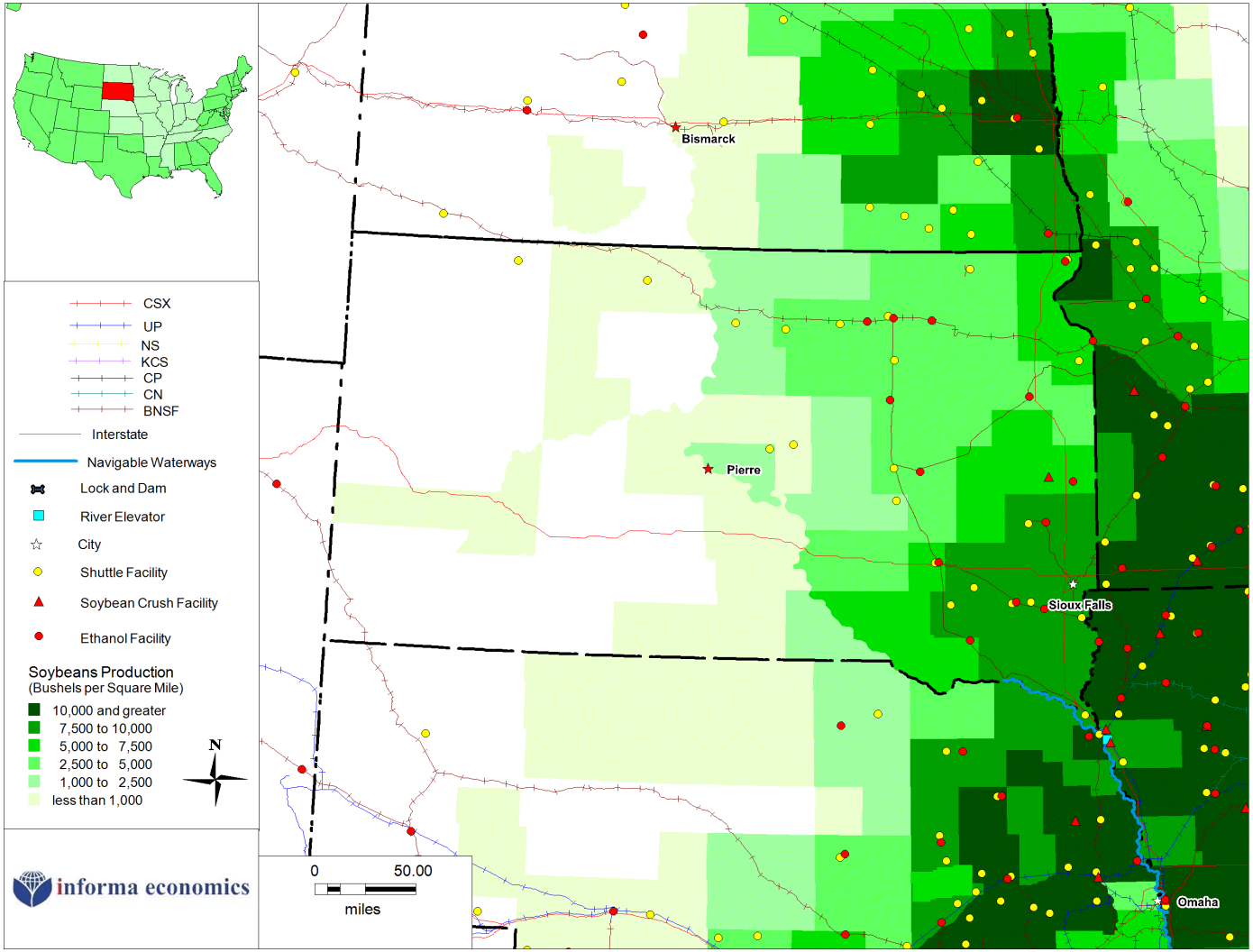
SOUTH DAKOTA



Production

- Soybean production in South Dakota occurs mostly in the eastern portion of the state, with production densities highest in the southeastern region of the state.
- South Dakota's primary livestock inventories consist of cattle.

Infrastructure

- South Dakota has 1,741 miles of rail lines; 678 miles of interstate, and 82,354 miles of roadways.
- South Dakota has 22 shuttle facilities; one soybean crush facility; 16 ethanol facilities; and 210 grain elevators.

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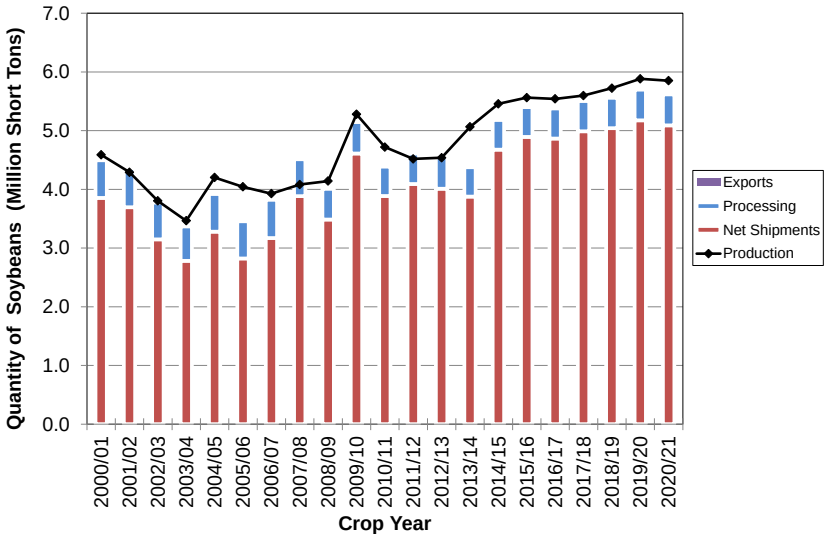
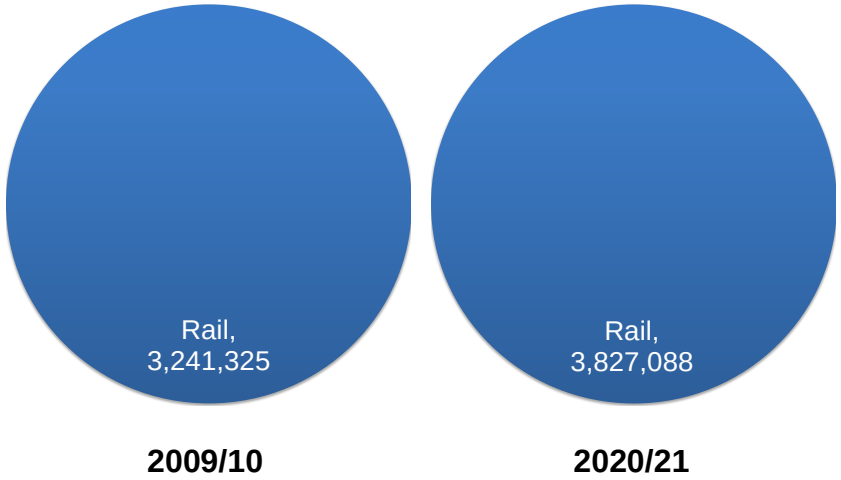
SOUTH DAKOTA

Soybean Surplus and Deficit Outlook



Soybean Movements by Mode (Short Tons)



Agricultural Infrastructure: Crush, Ethanol Facilities, Livestock Processing, and Grain Storage

Facility Type	# of Facilities	Capacity	
Soybean Crushers	1	1,796	MT/Day
Ethanol Facility* (operating)	16	1,009	MGY
Federally Inspected Livestock Slaughter/Processing Facilities	21	n/a	
State Inspected Livestock Slaughter/Processing Facilities	53	n/a	
Grain Elevators	210	249,592	Thous. Bu. Storage
Shuttle Elevators	22	65,188	Thous. Bu. Storage
River Elevators	0	-	Thous. Bu. Storage

** Cellulosic ethanol facilities are included in ethanol facility database.*

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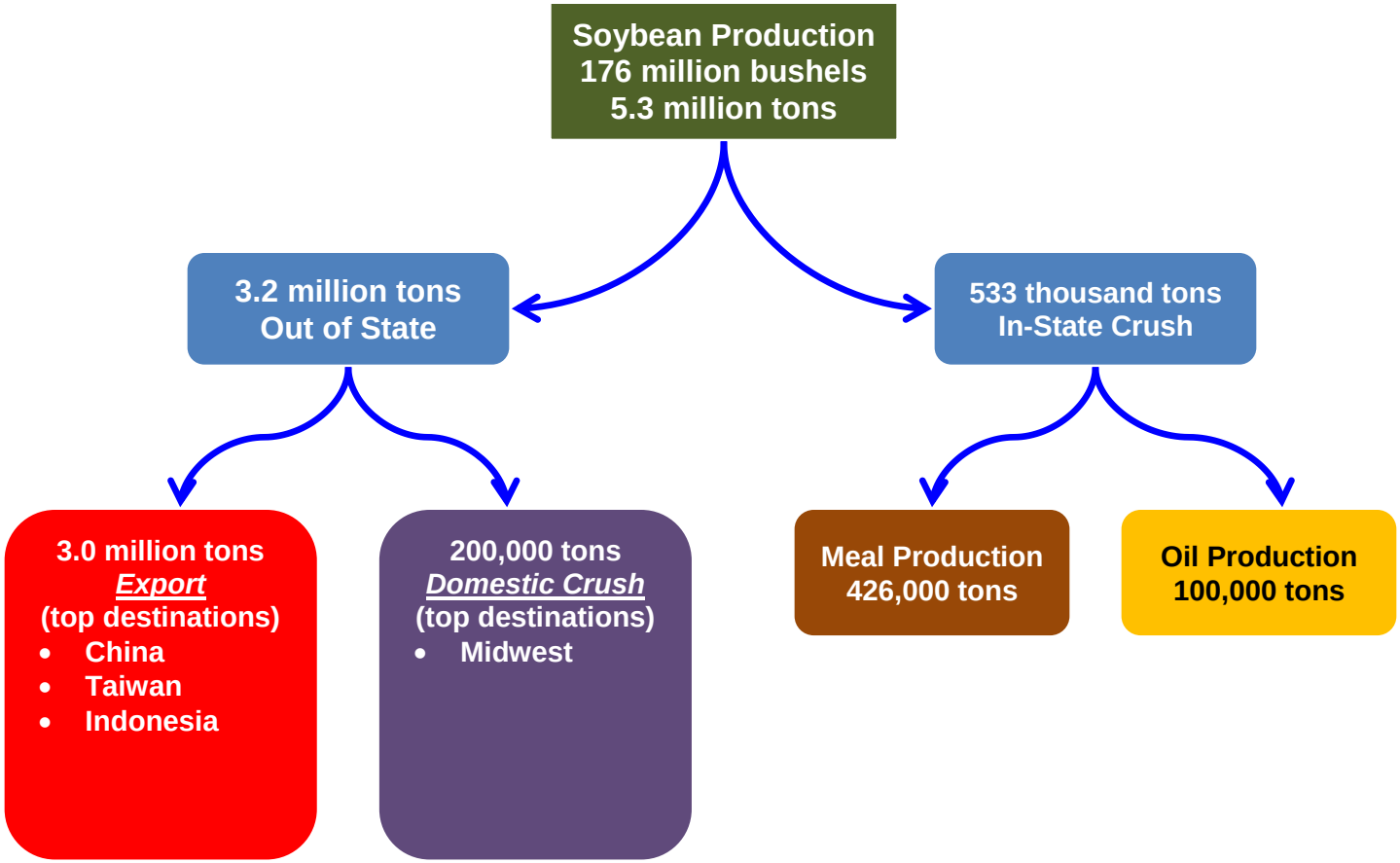
SOUTH DAKOTA FLOWCHART OF SOYBEAN MOVEMENTS (2009/10)



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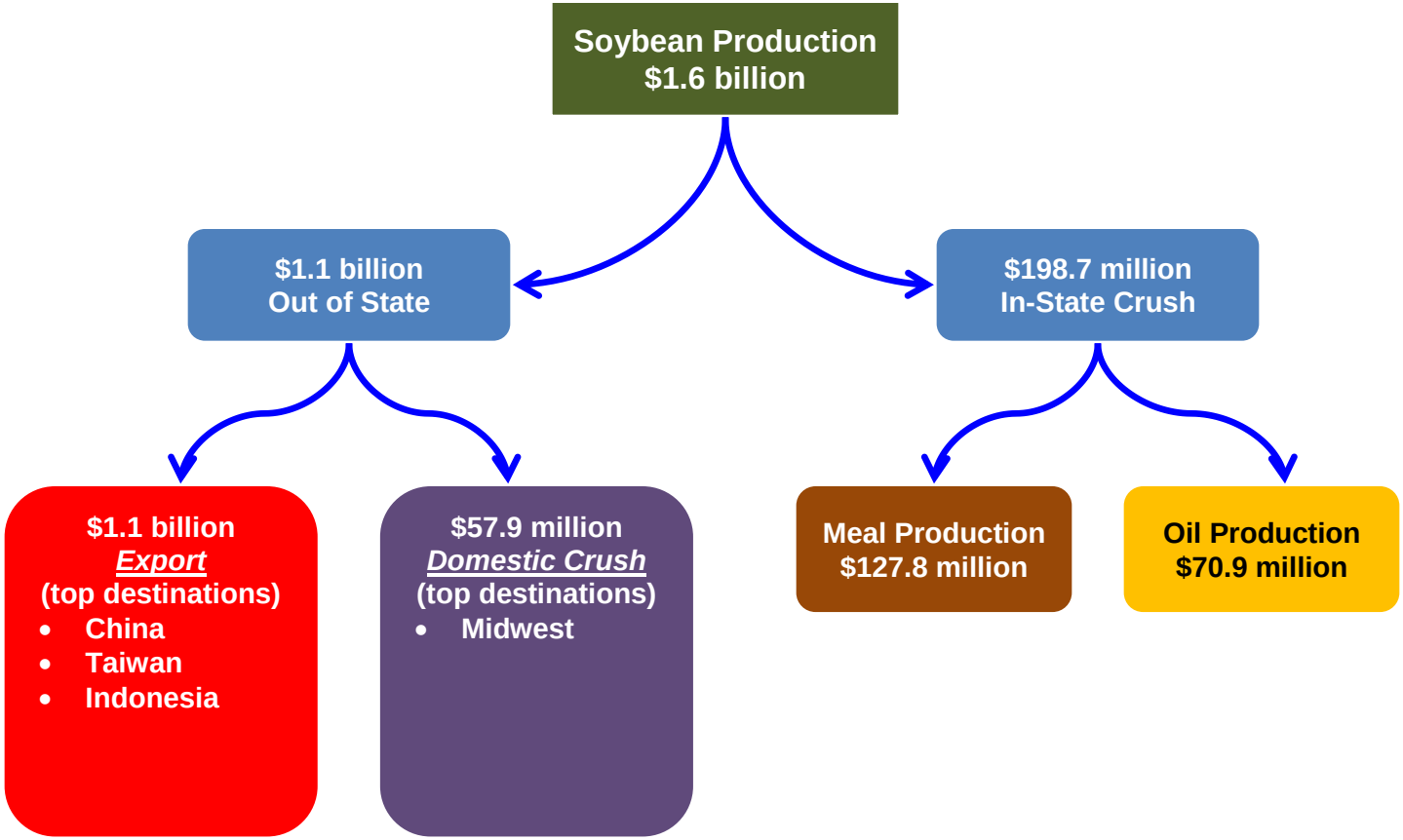
SOUTH DAKOTA FLOWCHART OF SOYBEAN VALUE (2009/10)



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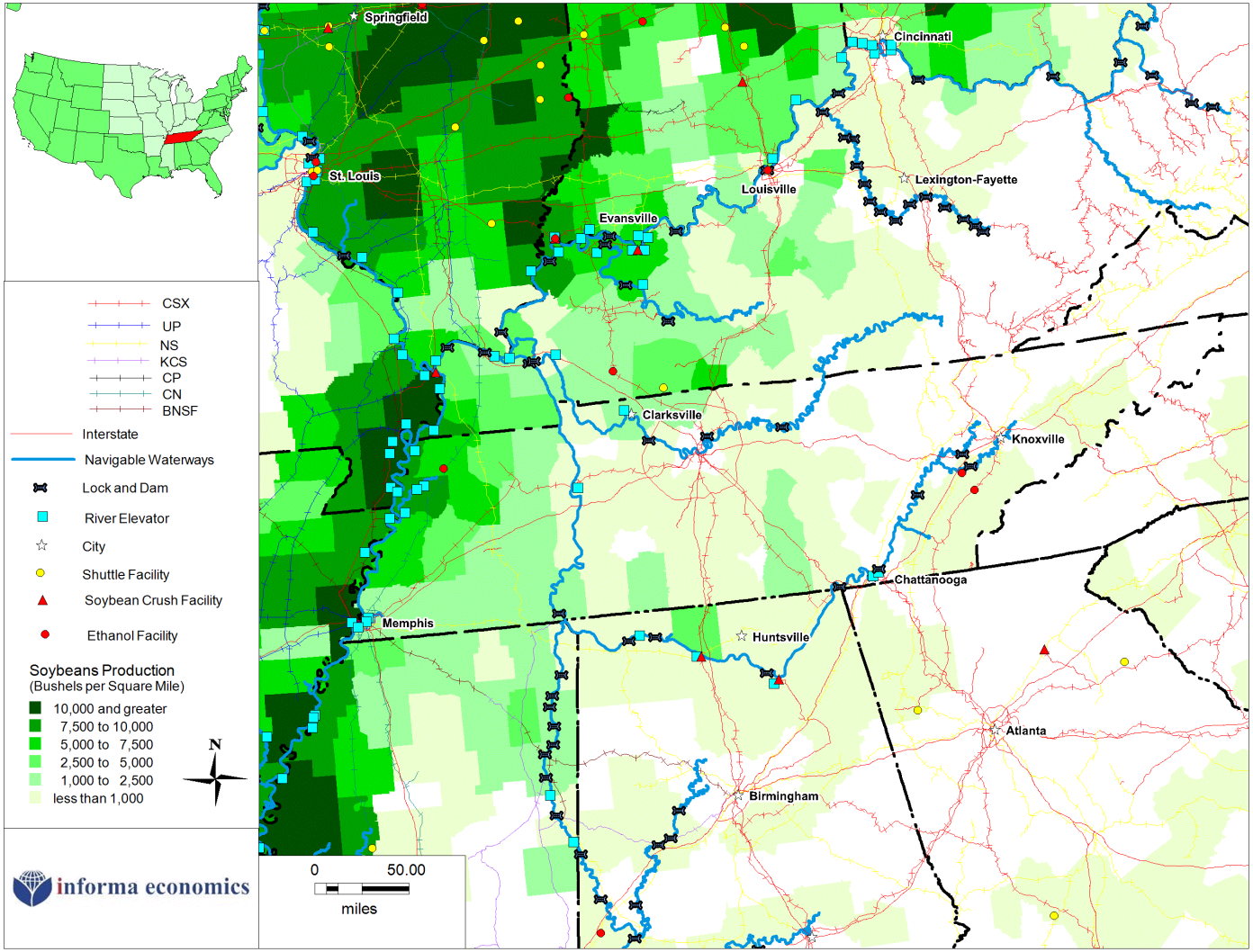
TENNESSEE



Production

- Soybean production in Tennessee occurs most heavily in the western portion of the state, with production densities highest in this region of the state.
- Tennessee, while contributing small amounts, is a source of both cattle and broiler production in the U.S.

Infrastructure

- Tennessee has 2,635 miles of rail lines; 1,097 miles of interstate, and 93,252 miles of roadways.
- Tennessee has one shuttle facility; three ethanol facilities; 44 grain elevators; and 12 river elevators.

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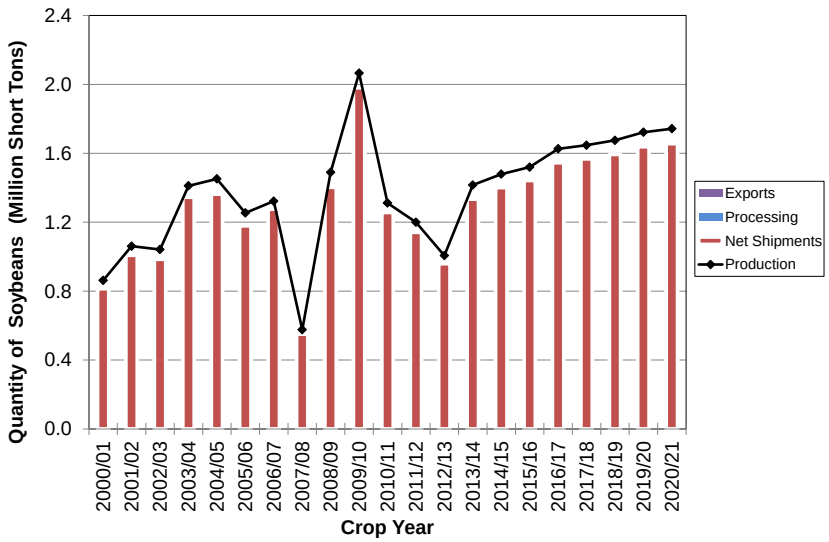
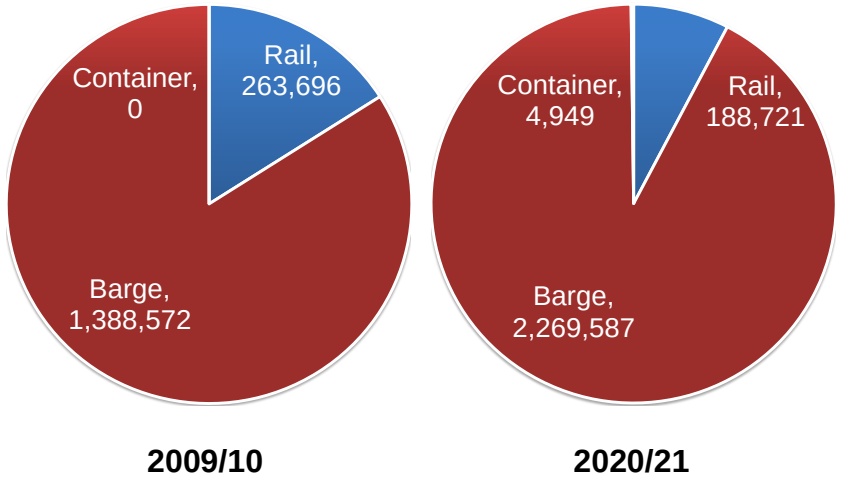
TENNESSEE

Soybean Surplus and Deficit Outlook



Soybean Movements by Mode (Short Tons)



Agricultural Infrastructure: Crush, Ethanol Facilities, Livestock Processing, and Grain Storage

Facility Type	# of Facilities	Capacity	
Soybean Crushers	0	-	MT/Day
Ethanol Facility* (operating)	3	167	MGY
Federally Inspected Livestock Slaughter/Processing Facilities	105	n/a	
State Inspected Livestock Slaughter/Processing Facilities	0	n/a	
Grain Elevators	44	60,971	Thous. Bu. Storage
Shuttle Elevators	1	2,170	Thous. Bu. Storage
River Elevators**	12	20,423	Thous. Bu. Storage

** Cellulosic ethanol facilities are included in ethanol facility database.*

*** Missing river elevator capacity at 1 TN location*

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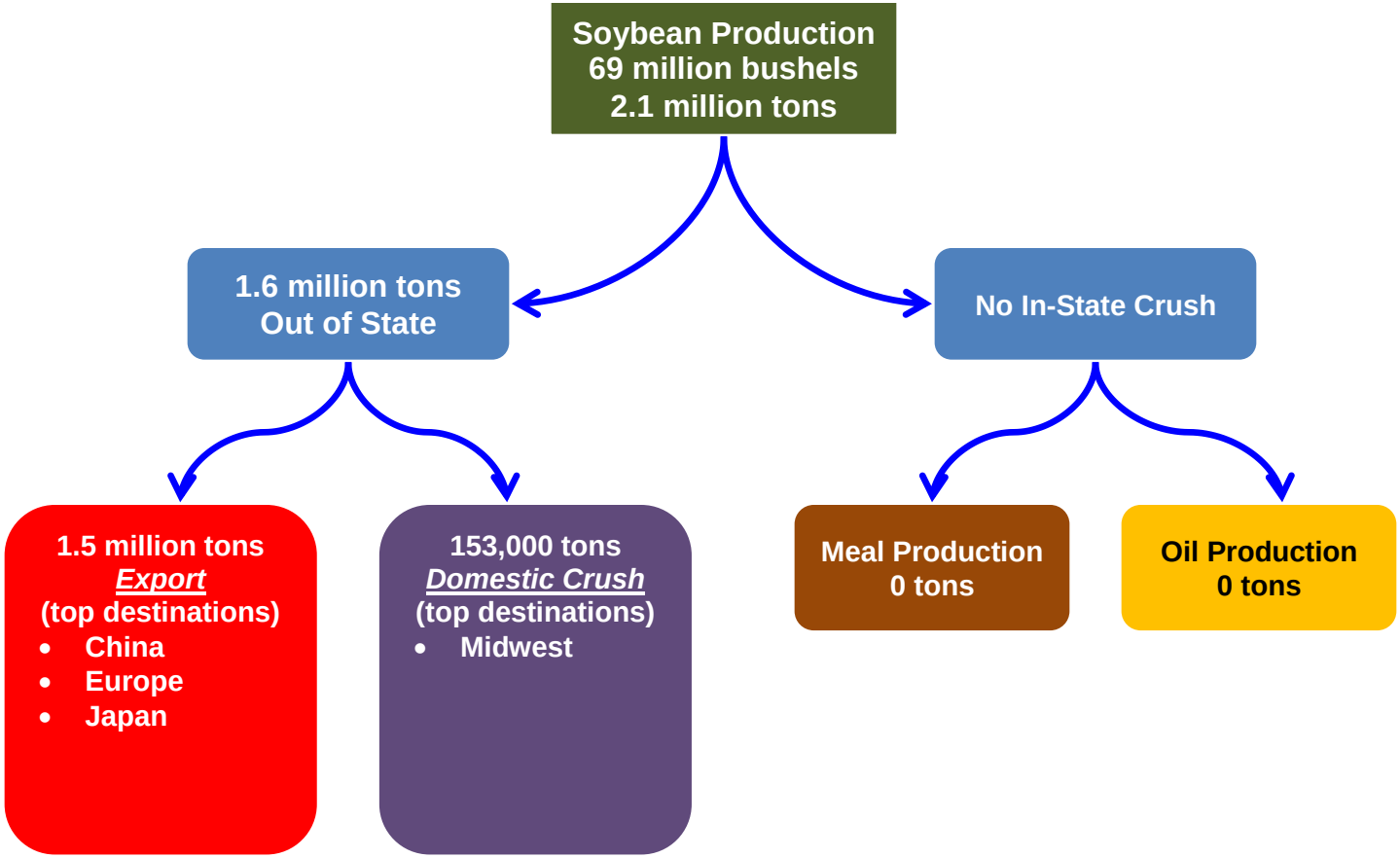
TENNESSEE FLOWCHART OF SOYBEAN MOVEMENTS (2009/10)



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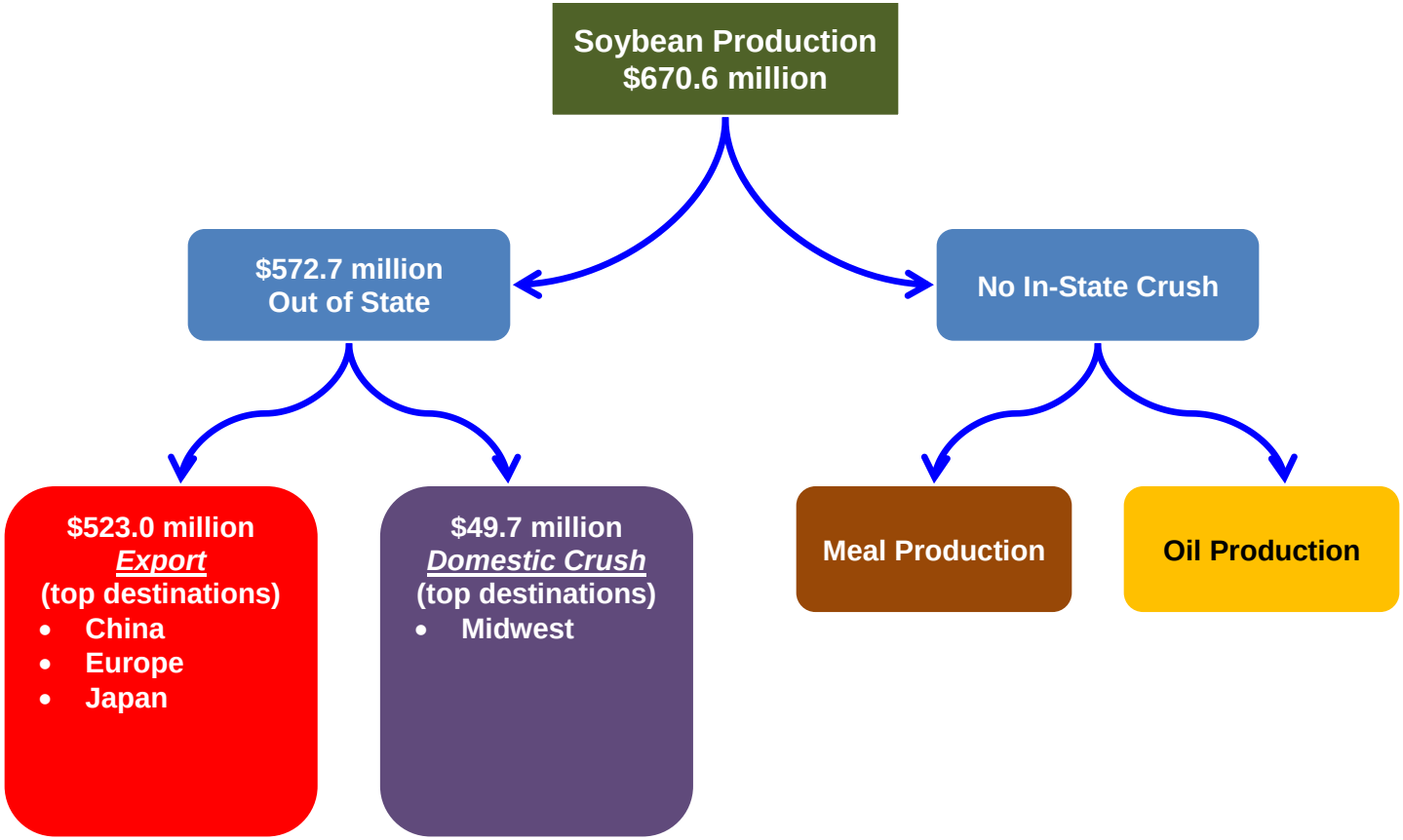
TENNESSEE FLOWCHART OF SOYBEAN VALUE (2009/10)



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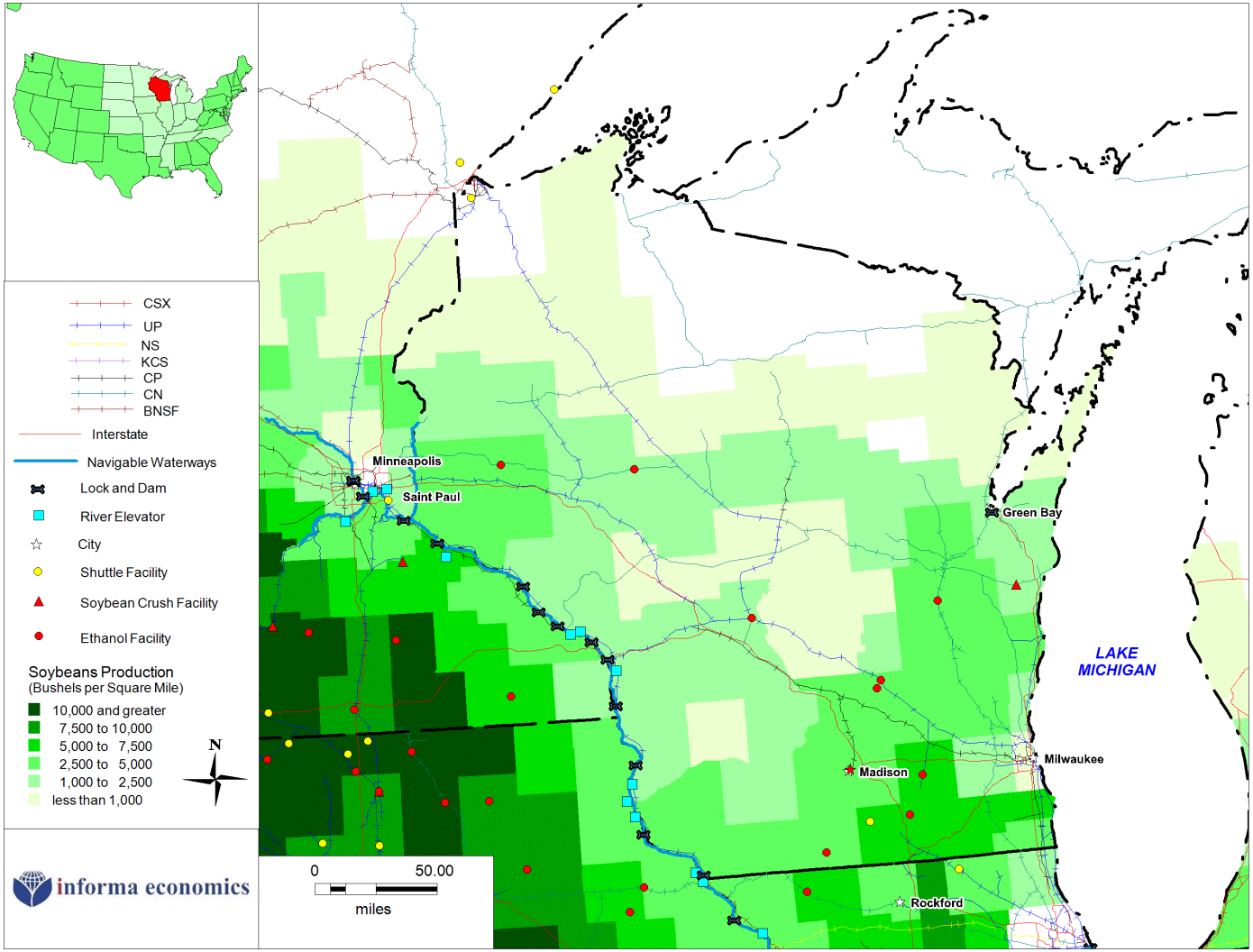
WISCONSIN



Production

- Soybean production in Wisconsin occurs mostly in the southern portion of the state, with production densities highest in the southeastern region of the state.
- Wisconsin is the primary contributor of U.S. dairy cattle production.

Infrastructure

- Wisconsin has 3,510 miles of rail lines; 834 miles of interstate, and 114,910 miles of roadways.
- Wisconsin has two shuttle facilities; one soybean crush facility; nine ethanol facilities; 237 grain elevators and 2 river elevators.

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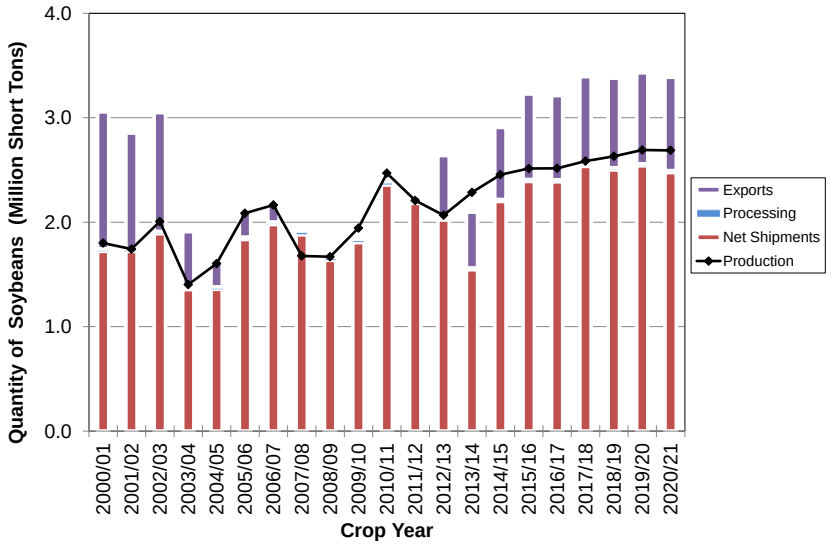
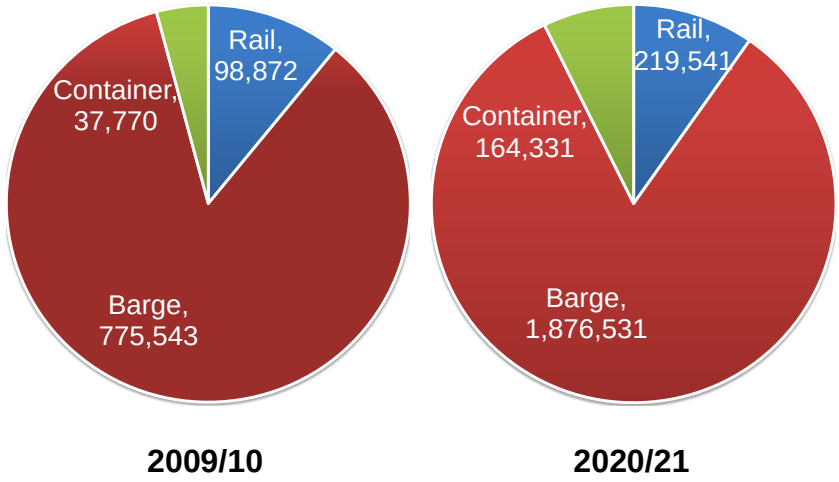
WISCONSIN

Soybean Surplus and Deficit Outlook



Soybean Movements by Mode (Short Tons)



Agricultural Infrastructure: Crush, Ethanol Facilities, Livestock Processing, and Grain Storage

Facility Type	# of Facilities	Capacity	
Soybean Crushers	1	64	MT/Day
Ethanol Facility* (operating)	9	488	MGY
Federally Inspected Livestock Slaughter/Processing Facilities	140	n/a	
State Inspected Livestock Slaughter/Processing Facilities	285	n/a	
Grain Elevators	237	288,514	Thous. Bu. Storage
Shuttle Elevators	4	41,400	Thous. Bu. Storage
River Elevators	2	217	Thous. Bu. Storage

** Cellulosic ethanol facilities are included in ethanol facility database.*

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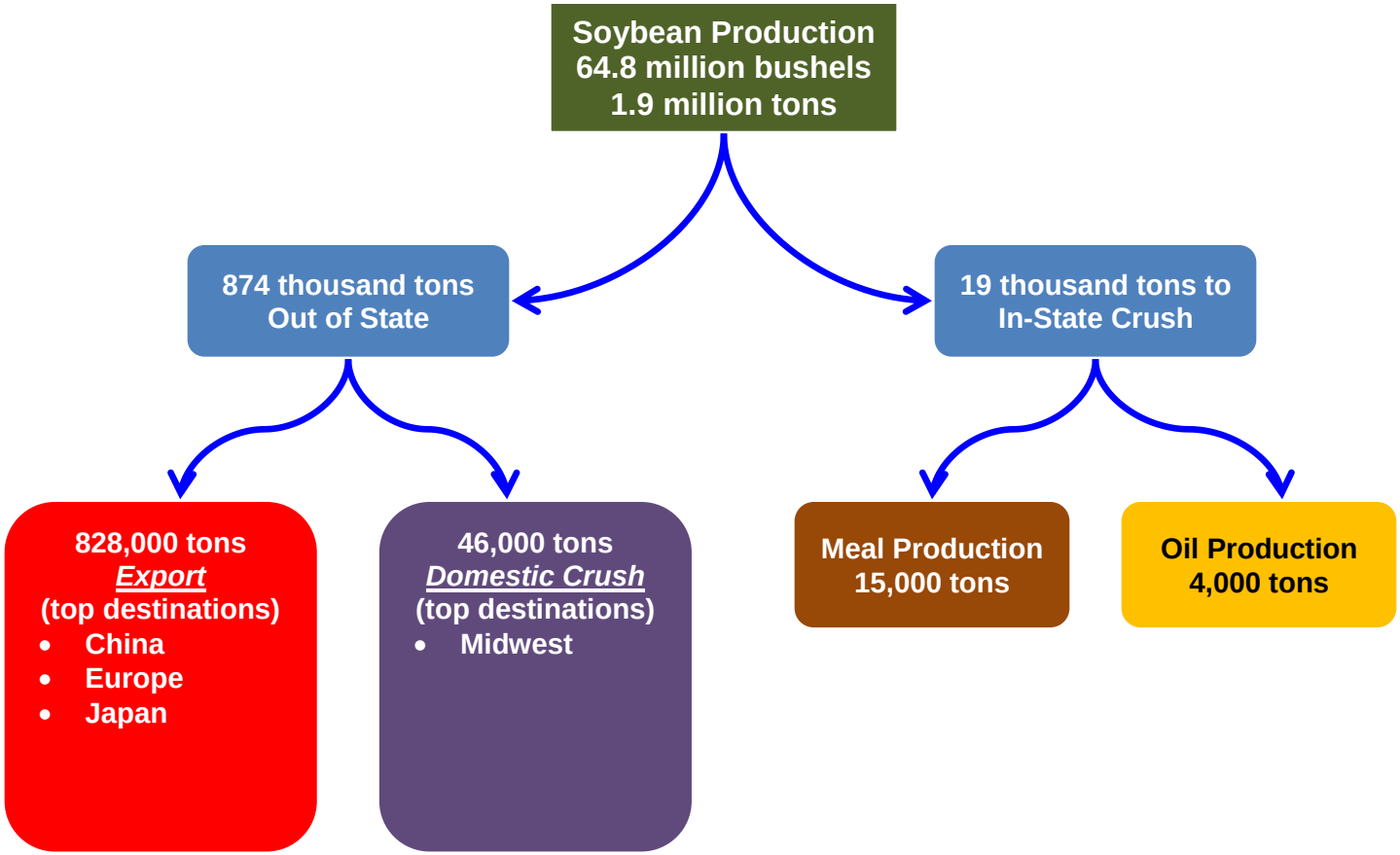
WISCONSIN FLOWCHART OF SOYBEAN MOVEMENTS (2009/10)



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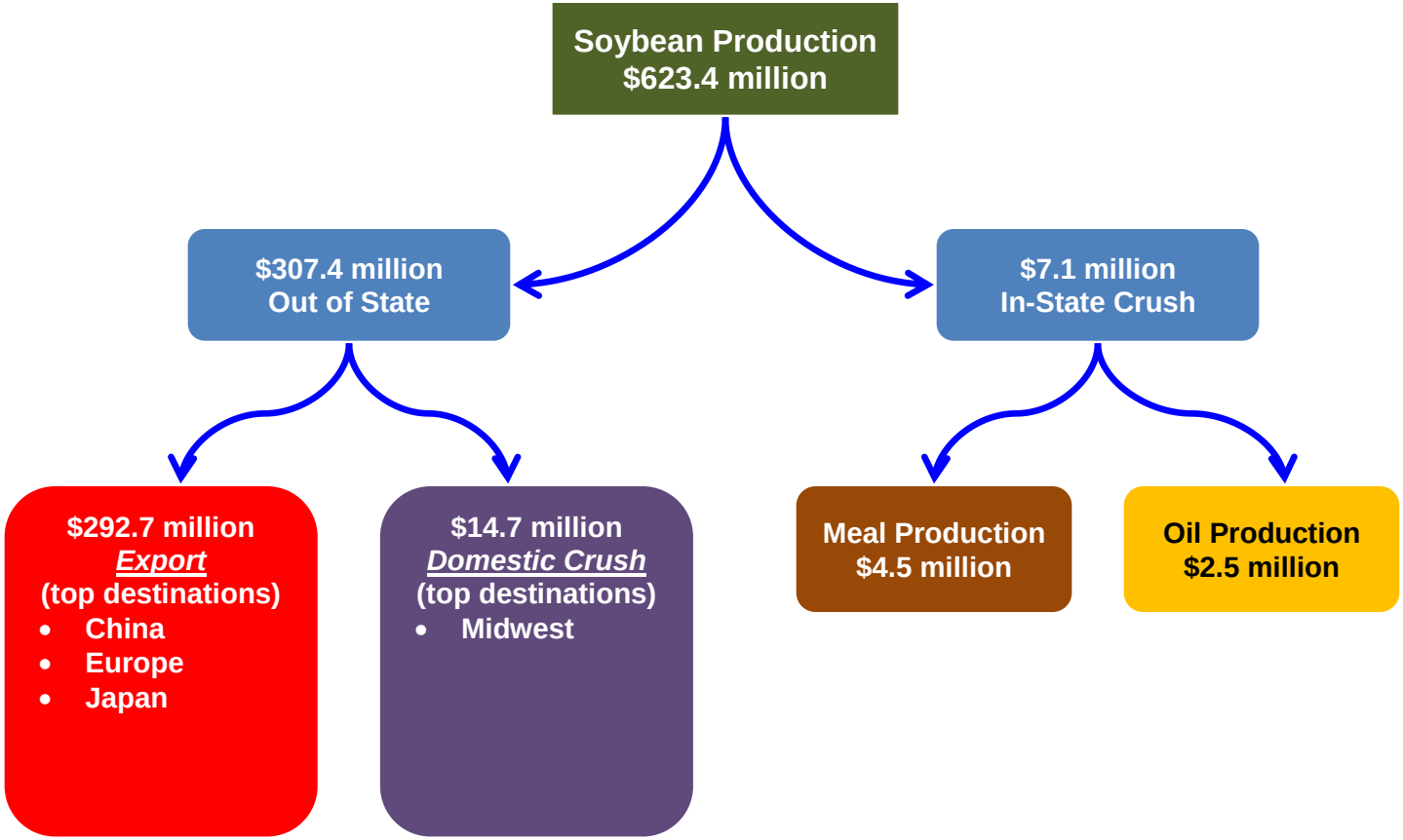
WISCONSIN FLOWCHART OF SOYBEAN VALUE (2009/10)



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V. U.S. Transportation System Accommodating Agricultural Products

With soybean production expected to expand over the next decade, it is very important that the transportation infrastructure system be able to accommodate the movement of soybeans and products. The geographic depiction of the U.S. navigable waterways and Class I railroads overlaid on the density of soybean production is shown Figure 49. This section evaluates the movement of soybeans and product by mode, elaborating on modal developments, and the outlook for movements by mode. Earlier in the report, each of the 17 states' storage capacity was shown for different agricultural facilities. This section includes more in-depth analysis of the expected production of corn, soybeans, wheat and sorghum compared with the grain storage capacity of each state as well as the river system, shuttle and export elevator network in the U.S.

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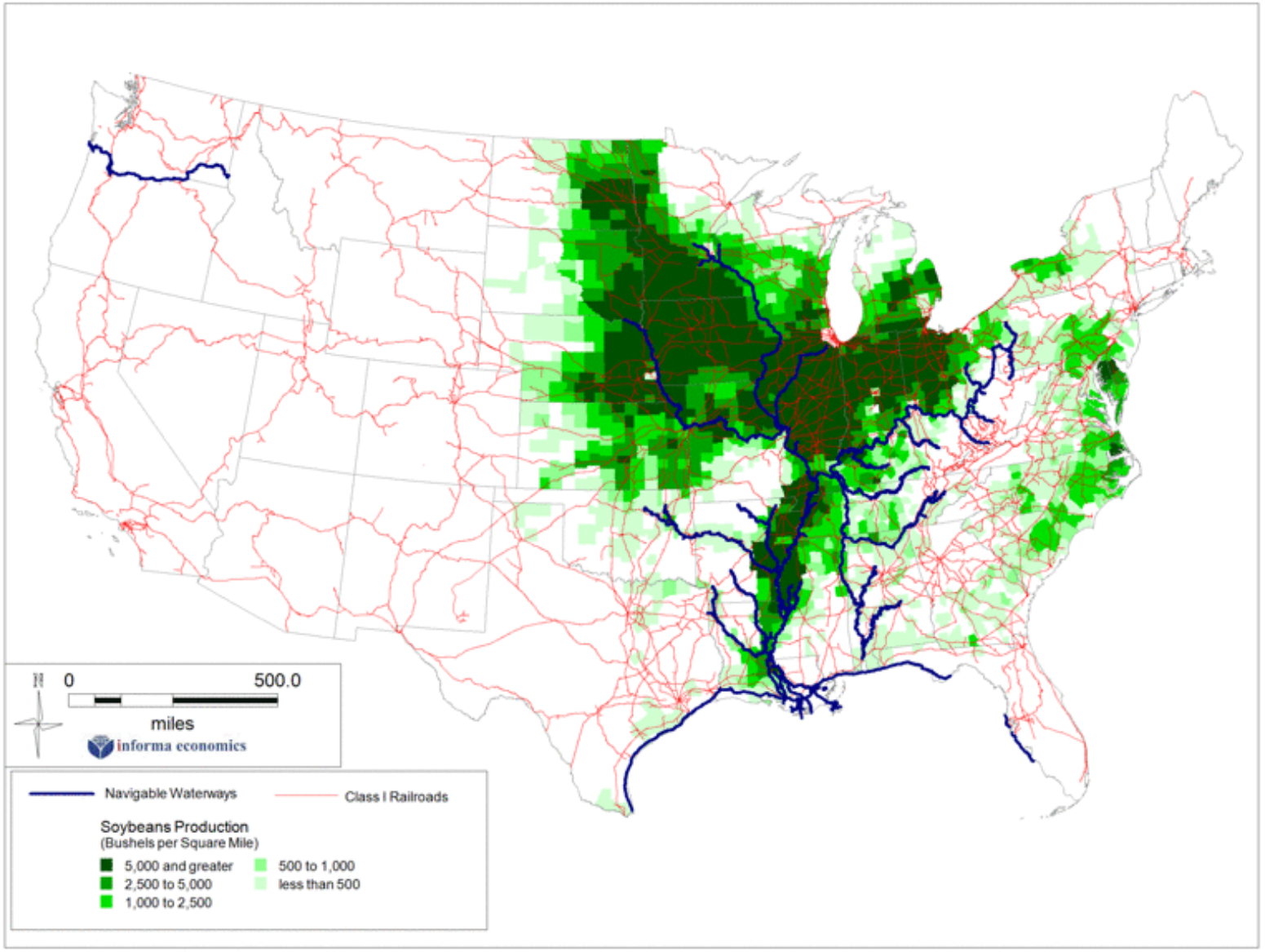
Figure 49: U.S. Navigable Waterways and Class I Railroad Network and Soybean Production Density



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The modal share of soybean movements has shifted as exports have increased. The combined modal shares for rail and barge have increased from 40% in 2005 to 52% in 2010 while truck has declined overall. The modal shares to export position have increased 10 percentage points between 2005 and 2010 for rail to 44% with a corresponding drop in the share for truck to 8%. The modal share for barge remained unchanged at 47%. Rail has gained share as soybean production has expanded further west and north, and as the PNW has become more competitive with the Center Gulf while western railroads and grain shippers have expanded their respective rail loading capabilities with highly efficient shuttle loaders. The modal share of soybean movement by rail, barge and truck, to export and domestic positions, and overall the past fifteen years are shown in Figure 50 based on USDA modal share analysis through 2010.

Meanwhile, the volume of soybeans transported by long haul moves to export position has increased from more than 21.5 million tons in 2001/02 to 35.4 million in 2009/10, increasing 7% annually during that time. Soybean meal and oil has increased as well to export positions especially for soybean meal during 2009/10 as shown in Table 17. The major growth for soybeans has been in rail to export positions as shown in Figure 51. Going forward, it is expected that the growth in Asian demand for soybeans continue to increase rail movements to the PNW.

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Figure 50: U.S. Soybean Modal Shares by Market Position

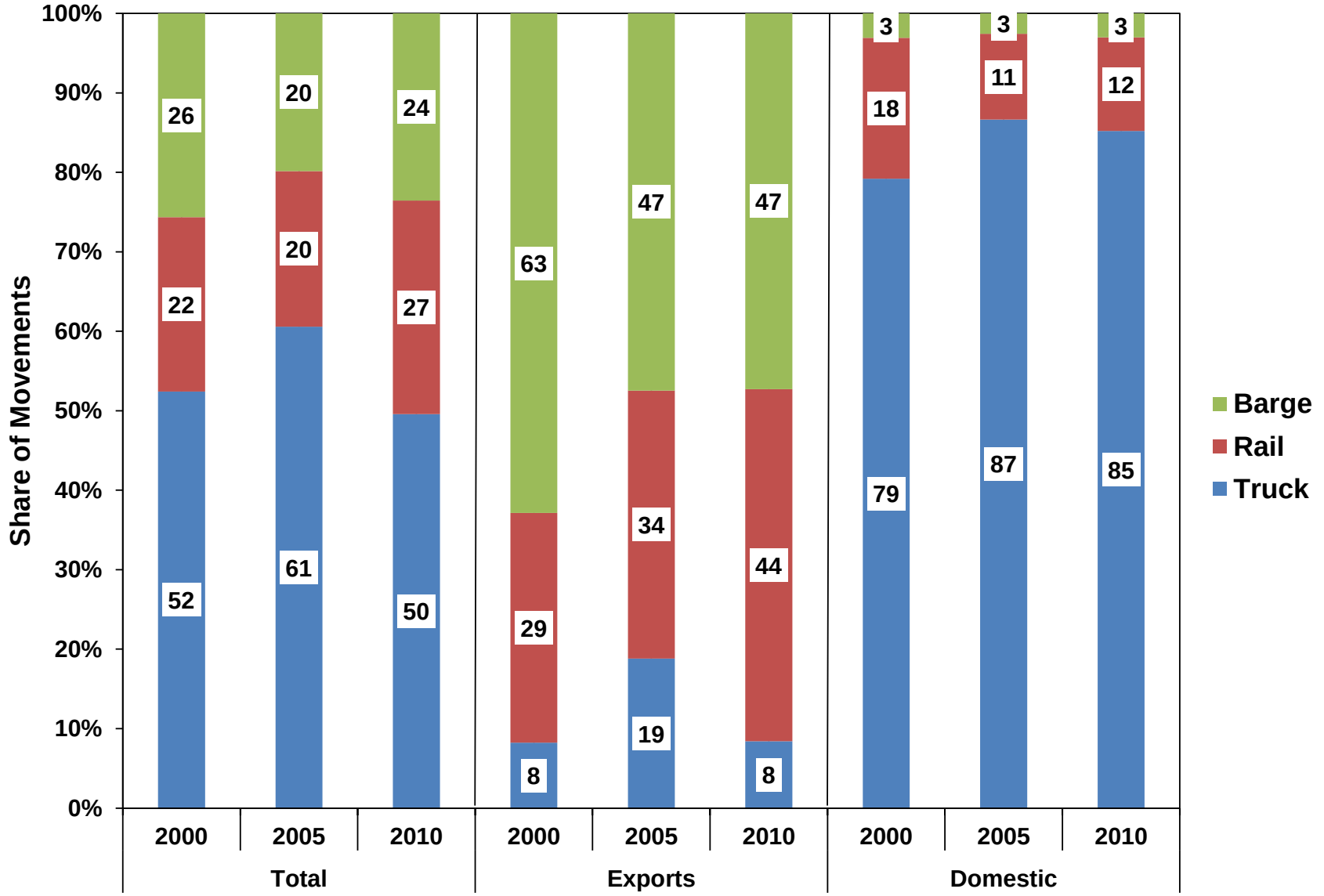

Table 17: Movement of Soybeans and Soybean Products to Domestic and Export Positions

Short Tons		2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10
Soybean	Domestic	13,122,763	7,076,666	6,440,282	4,832,983	3,071,812	2,362,039	4,581,611	3,074,981	2,932,561
	Export	21,534,216	21,783,019	17,787,460	22,334,710	24,857,019	27,636,985	25,628,161	28,125,602	35,433,249
	Total	34,656,979	28,859,685	24,227,742	27,167,693	27,928,831	29,999,024	30,209,772	31,200,583	38,365,810
Soybean Meal	Domestic	16,748,416	14,841,181	14,353,286	16,144,774	16,552,779	17,062,055	16,914,256	15,214,673	14,853,086
	Export	3,755,333	2,477,533	2,900,098	3,289,408	3,748,190	3,273,261	3,717,218	3,445,528	5,851,700
	Total	20,503,749	17,318,714	17,253,384	19,434,182	20,300,969	20,335,316	20,631,474	18,660,201	20,704,786
Soybean Oil	Domestic	5,664,527	5,809,398	5,449,814	5,529,461	6,086,234	5,927,097	5,595,294	5,209,964	5,058,920
	Export	1,962,669	1,618,890	1,356,702	1,910,179	1,781,926	1,816,083	2,154,170	1,342,744	2,047,480
	Total	7,627,196	7,428,288	6,806,516	7,439,640	7,868,160	7,743,180	7,749,464	6,552,708	7,106,400

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Figure 51: Volume of Soybeans Transported to Long Haul Market Position by Barge and Rail

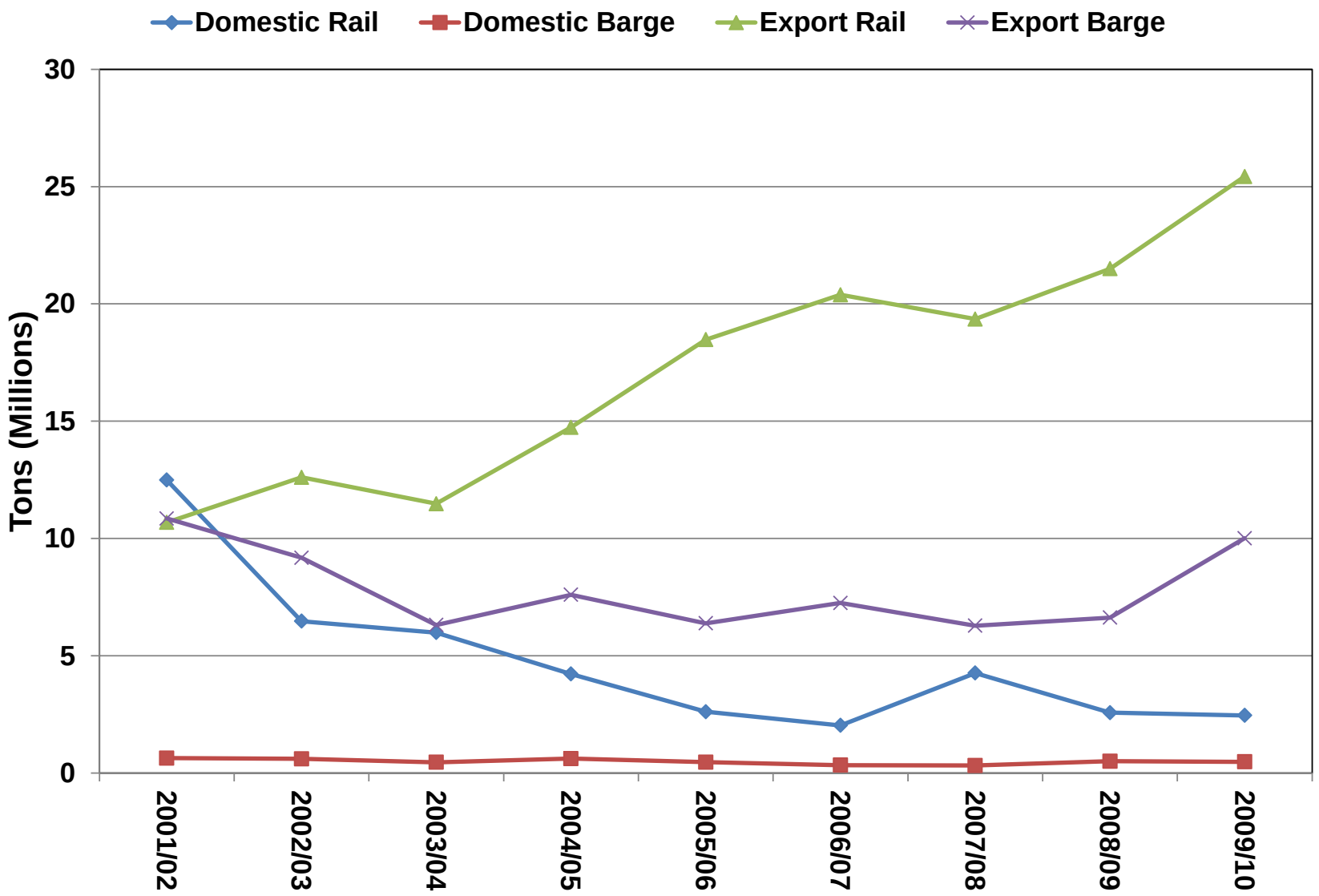

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Table 18: Volume of Soybeans Transported to Market Position by Barge and Rail

Soybean Tons		2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10
Total	Production	86,730,000	82,680,000	73,620,000	93,720,000	92,040,000	95,910,000	80,310,000	89,010,000	100,770,330
	Rail	23,168,741	19,078,409	17,461,778	18,957,938	21,088,640	22,414,633	23,613,940	24,072,728	27,882,308
	Barge	11,488,238	9,781,276	6,765,964	8,209,755	6,840,191	7,584,391	6,595,832	7,127,855	10,483,502
Domestic	Rail	12,486,315	6,472,619	5,984,708	4,219,676	2,612,388	2,027,117	4,263,242	2,572,979	2,456,012
	Barge	636,448	604,047	455,573	613,306	459,424	334,923	318,369	502,002	476,549
Export	Rail	10,682,426	12,605,790	11,477,070	14,738,262	18,476,252	20,387,516	19,350,698	21,499,749	25,426,296
	Barge	10,851,790	9,177,229	6,310,391	7,596,449	6,380,767	7,249,468	6,277,463	6,625,853	10,006,953

Table 19: Volume of Soybean Meal Transported to Market Position by Barge and Rail

Soybean Meal Tons		2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10
Total	Production	40,292,000	38,194,000	36,325,000	40,715,000	41,244,000	43,032,000	42,284,000	39,102,000	41,700,400
	Rail	20,503,749	17,318,714	17,253,384	19,434,182	20,300,969	20,335,316	20,631,474	18,660,201	20,704,786
	Barge	-	-	-	-	-	-	-	-	-
Domestic	Rail	16,748,416	14,841,181	14,353,286	16,144,774	16,552,779	17,062,055	16,914,256	15,214,673	14,853,086
	Barge	-	-	-	-	-	-	-	-	-
Export	Rail	3,755,333	2,477,533	2,900,098	3,289,408	3,748,190	3,273,261	3,717,218	3,445,528	5,851,700
	Barge	-	-	-	-	-	-	-	-	-

Table 20: Volume of Soybean Oil Transported to Market Position by Barge and Rail

Soybean Oil Tons		2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10
Total	Production	9,449,000	9,215,000	8,540,500	9,680,000	10,193,500	10,244,500	10,290,000	9,372,500	9,807,500
	Rail	7,627,196	7,428,288	6,806,516	7,439,640	7,868,160	7,743,180	7,749,464	6,552,708	7,106,400
	Barge	-	-	-	-	-	-	-	-	-
Domestic	Rail	5,664,527	5,809,398	5,449,814	5,529,461	6,086,234	5,927,097	5,595,294	5,209,964	5,058,920
	Barge	-	-	-	-	-	-	-	-	-
Export	Rail	1,962,669	1,618,890	1,356,702	1,910,179	1,781,926	1,816,083	2,154,170	1,342,744	2,047,480
	Barge	-	-	-	-	-	-	-	-	-

Using the Lock Performance Monitoring System data from the Army Corps of Engineers and information on river elevators compiled from multiple sources and Informa's own monitoring system, Informa was able to derive the turns per river segment. The term "turns" refers to the number of times an elevator empties its static storage capacity. This was measured on an annual basis. The three-year average pool level grain volume of each river segment was divided by the total static storage capacity of each river segment (the stretch of the river from one lock to another). The average river elevator on the inland navigation system turns its capacity 17 times annually. Some segments of the inland navigation

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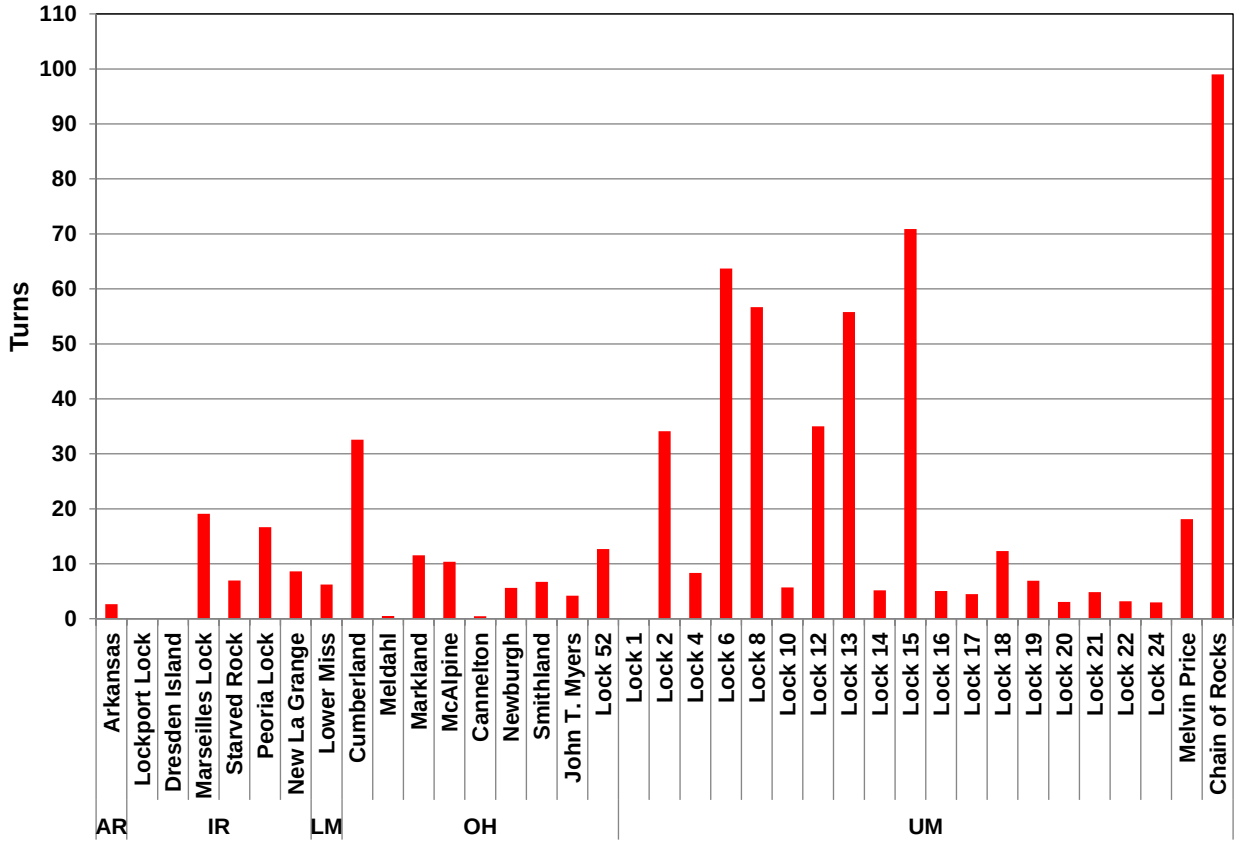
system have small storage capacity but high grain volume coming off the river; as a result, the turns on these segments are very high as shown in Figure 52.

Figure 52: Average River Elevator Turns by River and River Segment



Using the average turns per river elevator and multiplying by the total storage capacity of the river terminals, the total throughput of grain volume exceeds 2.1 billion bushels. The average turns for shuttle elevators were developed through industry surveys. Information on facility throughput at grain export elevators was prepared using industry storage information and export volume by port range. Export elevators have high throughput capabilities, turning the facilities an

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average of 15 times. The average throughput by elevator type is summarized in Table 21. For an export elevator classified as a shuttle receiving facility, the average annual turn rate is approximately 35. Export elevators in the PNW have higher throughput than those on the Great Lakes as these facilities are used more for storage.

Table 21: Average Grain Throughput by Elevator Type (million bushels)

Type of Facility	Static Capacity	Annual Throughput	Average Turns
River Elevator	404,364	6,874,189	17
Shuttle (Eastern)	498,825	2,992,950	6
Shuttle (Western)	1,137,802	11,378,016	10
Shuttle (Export)	81,665	2,858,275	35
Total Export Capacity	284,930	4,202,858	15

Using the crop production forecast for corn, soybeans, wheat and sorghum, and the current commercial and on-farm storage of each of the 17 focus states, Tennessee has the least amount of grain storage relative to its overall future production followed by Kentucky as shown by the storage to future production ratio in Table 22. Since commercial elevators will turn their capacity up to 10 times, depending on the type of elevator and the geography of the facility, a ratio over 100% is not a major factor in deciding if a state will be able to meet the demands of grain storage requirements. What is critical is that grain elevator managers and farmers need to strategically move the grain in ways that allow for the production to be stored and then transported efficiently in sort of a game of musical chairs for grain flows.

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Table 22: Forecast Crop Production and Current Grain Storage Situation by Focus State (1,000 bushels)

State	Production 2020/21					Base Year Storage 2009/10			Current Storage to Forecast Production Ratio
	Corn	Soybeans	Wheat	Sorghum	Total Production	Off-Farm Storage	On-Farm Storage	Total Storage	
Arkansas	67,589	131,087	15,072	3,042	216,791	278,000	266,000	544,000	40%
Illinois	2,301,805	507,270	28,270	2,501	2,839,847	1,360,000	1,450,000	2,810,000	101%
Indiana	905,221	318,495	15,072	-	1,238,789	442,800	770,000	1,212,800	102%
Iowa	2,379,051	659,619	632	-	3,039,301	1,375,000	2,000,000	3,375,000	90%
Kansas	724,081	207,768	386,817	175,147	1,493,813	920,000	380,000	1,300,000	115%
Kentucky	211,282	75,741	14,334	655	302,013	68,000	190,000	258,000	117%
Michigan	322,695	102,657	34,400	-	459,751	170,000	280,000	450,000	102%
Minnesota	1,202,797	392,688	90,859	-	1,686,344	640,000	1,450,000	2,090,000	81%
Mississippi	92,590	72,241	8,974	1,261	175,065	71,000	100,000	171,000	102%
Missouri	515,607	285,652	27,504	2,665	831,427	253,600	490,000	743,600	112%
Nebraska	1,670,264	336,519	67,894	5,279	2,079,955	806,190	1,110,000	1,916,190	109%
North Carolina	92,579	59,223	18,720	456	170,978	131,000	95,000	226,000	76%
North Dakota	193,184	159,715	331,893	-	684,792	335,000	790,000	1,125,000	61%
Ohio	527,815	277,338	44,125	-	849,278	373,200	480,000	853,200	100%
South Dakota	681,899	207,167	140,597	5,158	1,034,821	261,000	670,000	931,000	111%
Tennessee	100,557	59,266	8,799	1,236	169,859	61,000	70,000	131,000	130%
Wisconsin	455,583	90,171	14,771	-	560,525	299,690	355,000	654,690	86%
Subtotal	12,444,599	3,942,620	1,248,733	197,399	17,833,351	7,845,480	10,946,000	18,791,480	95%
Total U.S.	14,760,000	4,150,000	2,190,000	335,000	21,435,000	9,740,655	12,535,000	22,275,655	96%

Grain and soybean storage requirements have led to a renaissance in storage capacity expansion both at on- and off-farm locations. Total grain storage capacity has expanded 17% since 2000 to nearly 22.9 billion bushels during 2011. Over the same time frame on farm storage increased 14% to nearly 12.8 billion bushels while off farm capacity grew 21% to more than 10.1 billion bushels as shown in Figure 53. The expansion in storage capacity has been led by increased crop production associated with the changing cropping patterns, higher yields and opportunities holding crops in storage.

The requirements for storage capacity can be compared to December 1 grain and soybean inventories as shown in Figure 54 and Figure 55. The expansion of storage capacity has increased in a commensurate pace with the volume of grain and soybean inventories on December 1, with exception of the most recent two years that were notably lower due to crop production woes. The comparisons were then made by holding storage fixed at 2011 (22.9 billion bushels) levels and compare it to projected grain and soybean inventories on December 1 to see how soybeans could be impacted. Soybeans share of December 1 crop inventories is expected to remain steady at slightly less than 17% of the crops in storage through 2020, which was soybeans average share since 2000, while the share of corn will increase to 73% over

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the outlook, up from 68% since 2000. The share of wheat under storage on December 1 is projected to average less than 8%, down from more than 11% since 2000. Comparisons of December 1 crop storage and inventories by state are shown in the Section I.IX. Appendices B. State December 1 Crop Storage Capacity and Inventories.

What emerges is an environment that has to take into account the changes in and the pace of soybean exports. Since 2000/2001 when soybean exports totaled about 1 billion bushels, exports represented slightly more than one-third of soybean production. Exports as a share of soybean production has increased further to more than 45% the past two years (with record exports of 1.5 billion bushels in 2010/11) and are expected to increase to nearly 55% in 2020/21 when exports are forecast to nearly total 2.3 billion bushels.

There is less storage pressure on soybeans than other crops since more soybeans need to be moved through the system to export position faster and earlier than in the past. The exports are being moved out of the U.S. ahead of when South America starts its soybean harvest and sending that harvest to the export market. For example, the changing shipping patterns of when corn, soybeans and wheat are exported are show in Figure 56 through Figure 59. Over the past decade 73% of the soybean exports were reported during the first half of the marketing year. In 2010/11, more than 80% of the soybeans were exported during the first half of the marketing year. This phenomenon has affected the timing of exports of other crops where corn and sorghum are not as robust during the first half of the marketing year as they use to be given the surge in soybean exports.

Because soybeans are the higher value crop (nearly double the average farm price of corn during 2011/12), and there are more international competitive pressures with respect to available supplies within the soybean industry as compared to corn and wheat, the logistics system that accommodates grain and oilseeds will prioritize soybeans ahead of other crops. If production growth occurs among the leading commodities, the other commodities will generally make way for soybeans.

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Figure 53: U.S. December 1 Crop Elevator Storage Capacity by Location

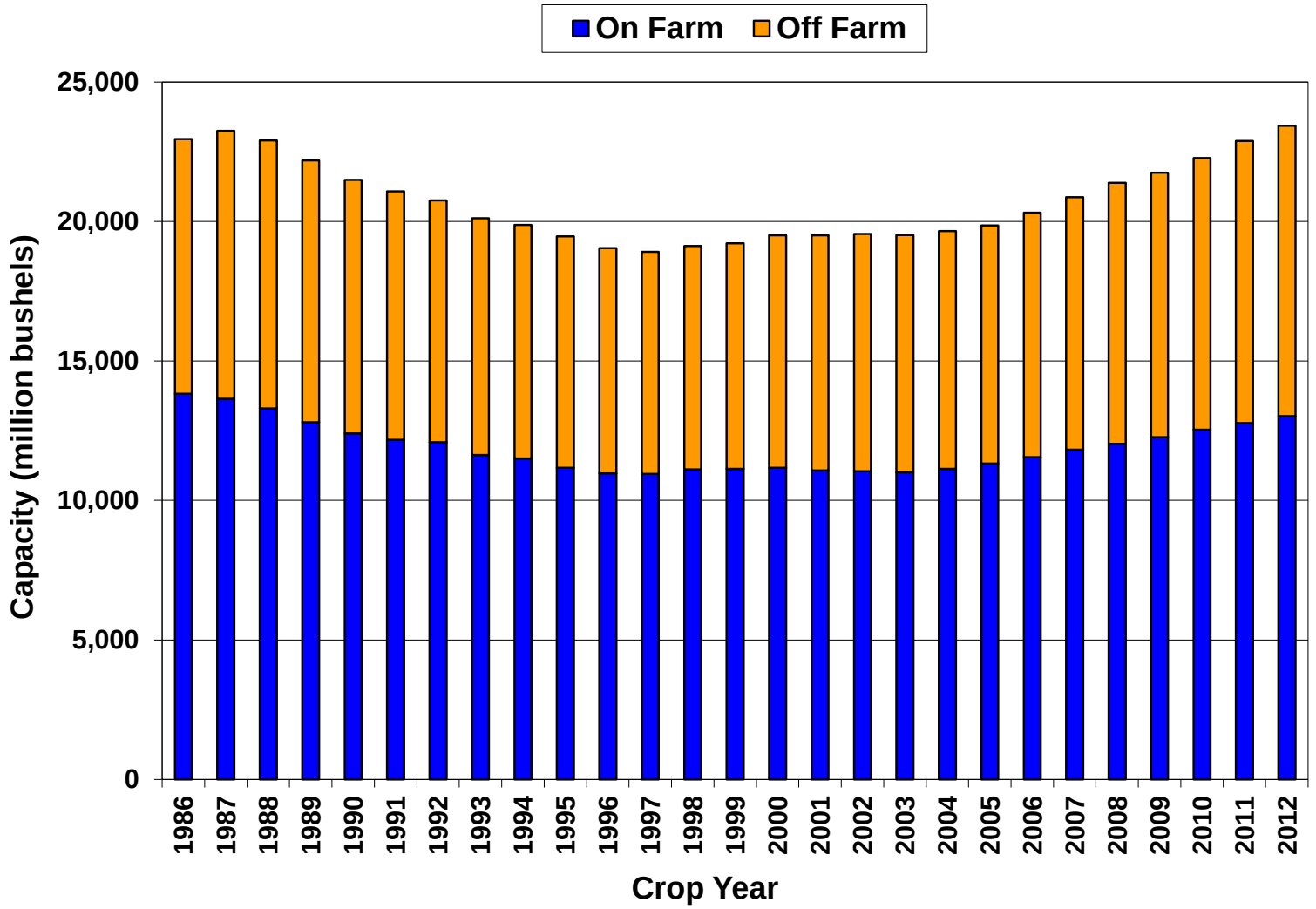

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Figure 54: December 1 U.S. Crop Storage Capacity and Inventories

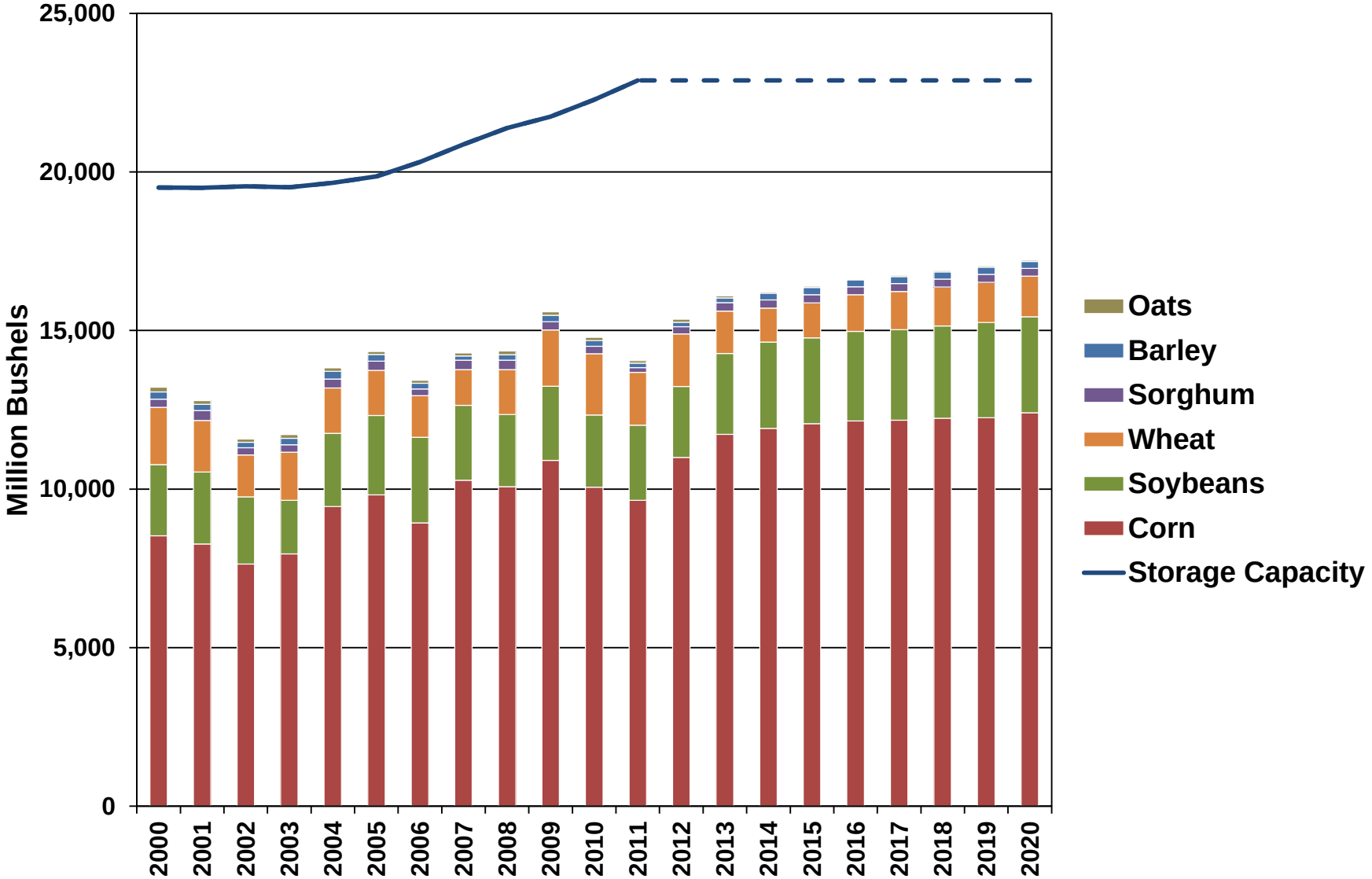

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Figure 55: December 1 U.S. Crop Inventories

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Figure 56: Quarterly Share of Export Inspections of Soybeans

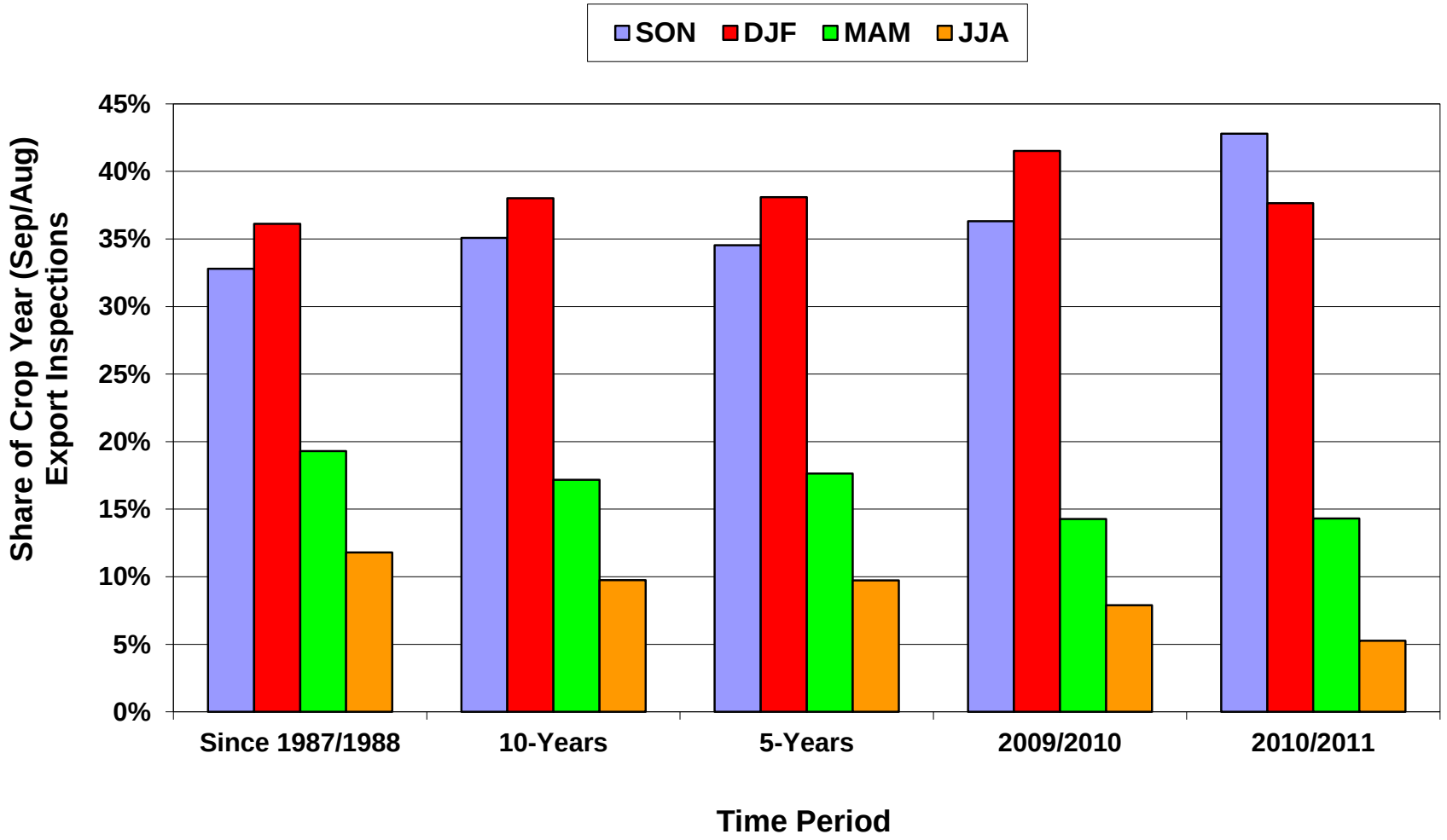

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Figure 57: Quarterly Share of Export Inspections of Corn

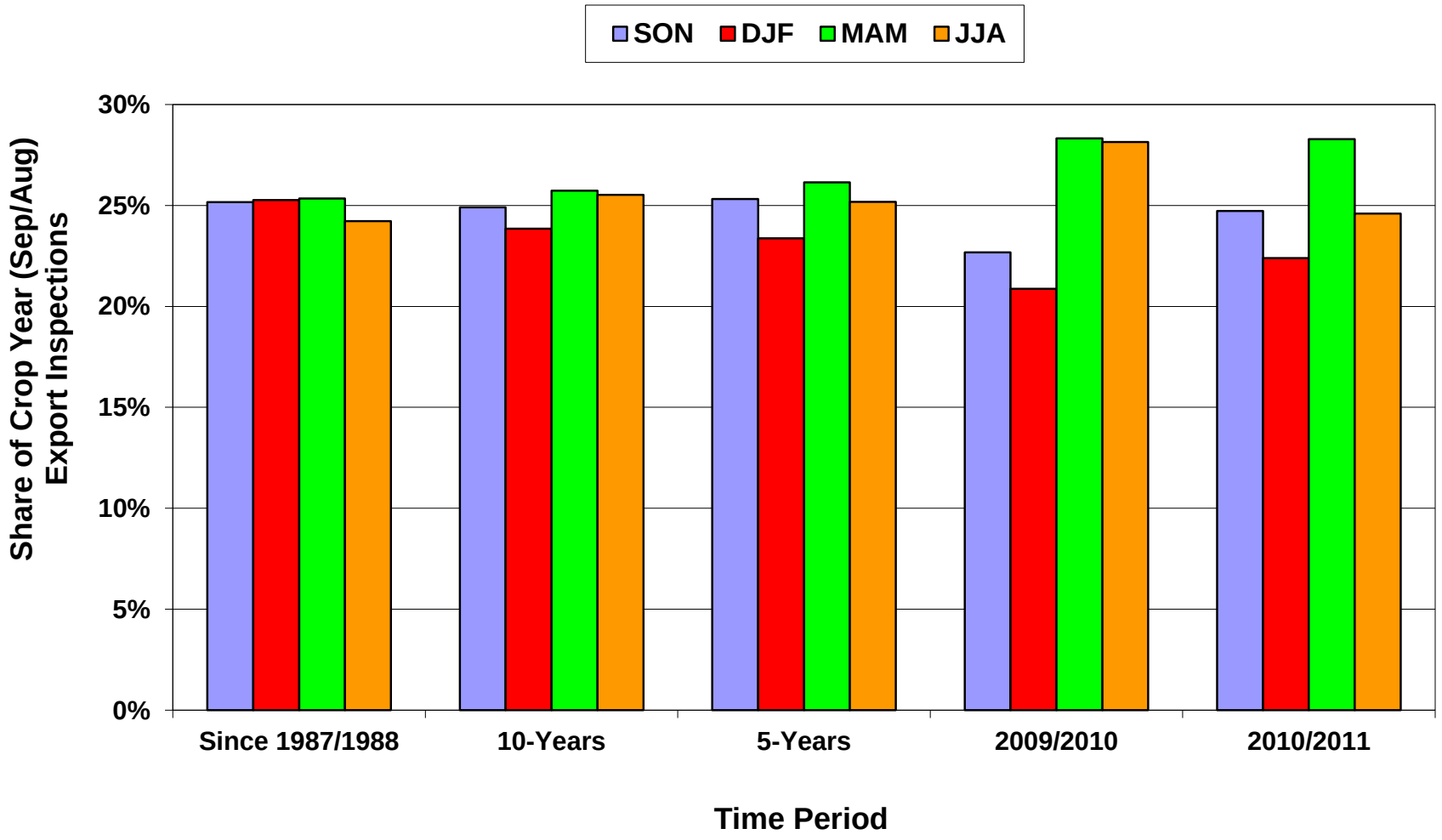

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Figure 58: Quarterly Share of Export Inspections of Wheat

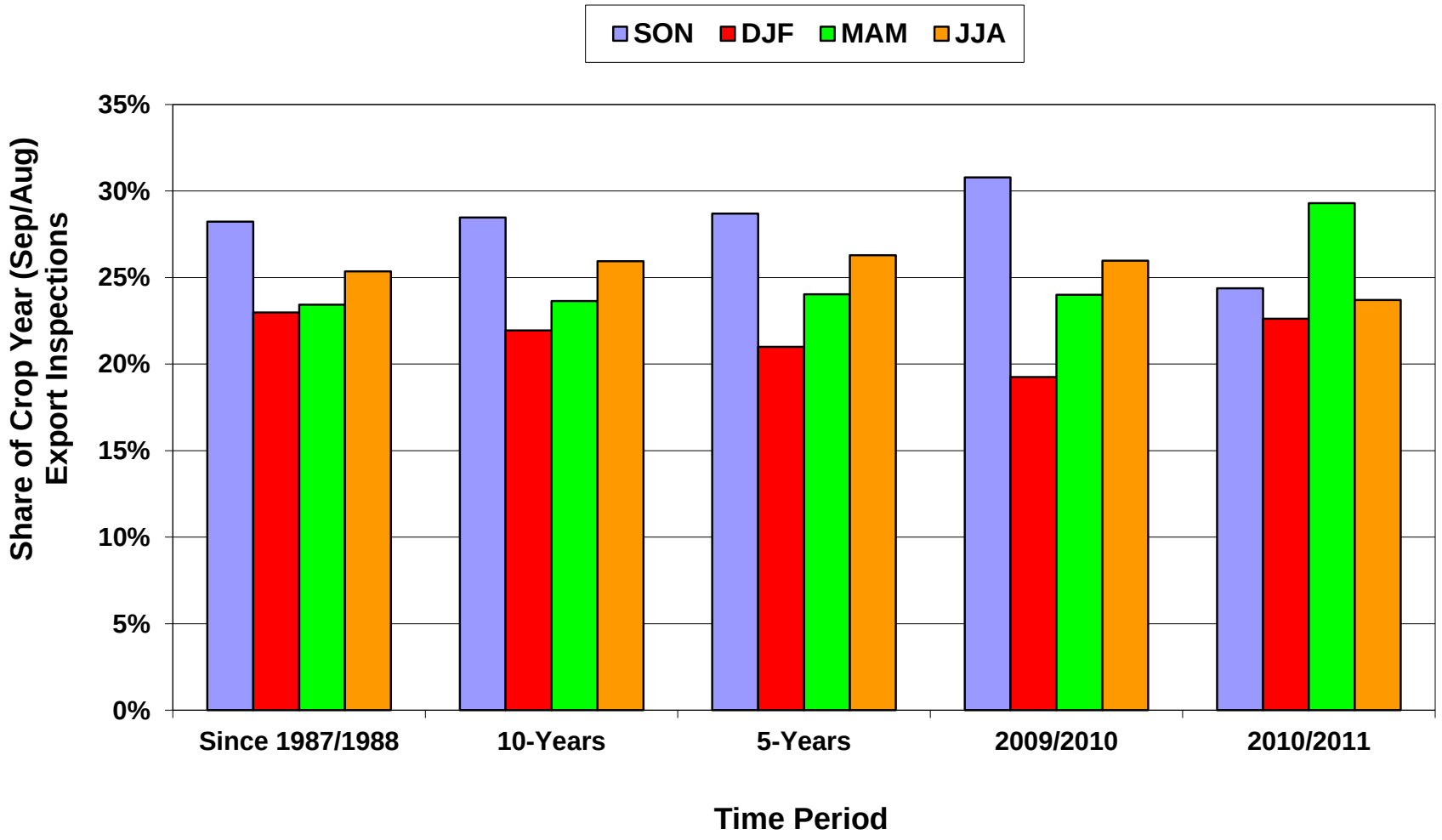

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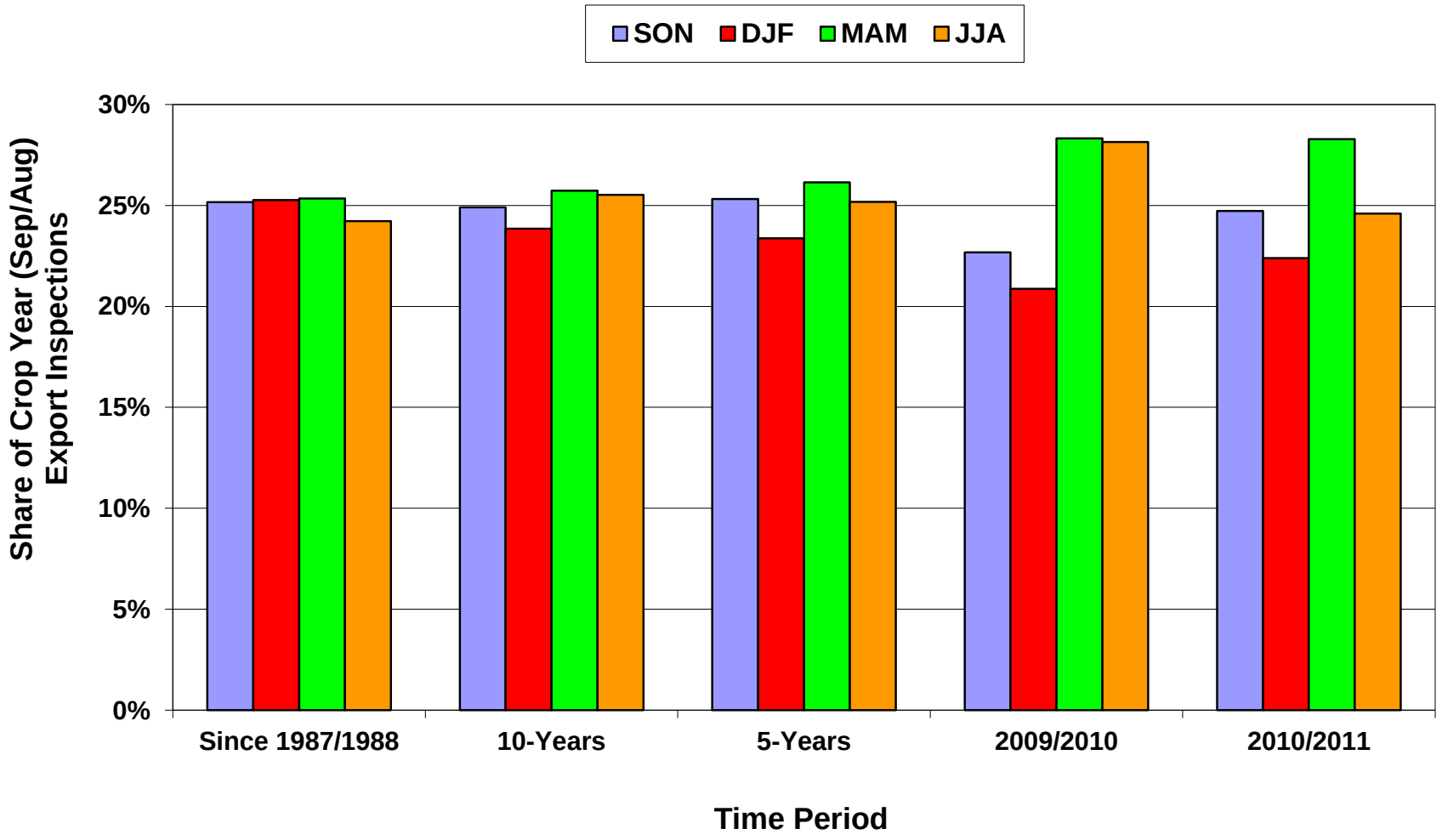
Figure 59: Quarterly Share of Export Inspections of Sorghum



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A. Rail Carloading Situation for Grains and Soybeans

The most current data on rail is available through calendar year 2010. Informa converted the data to a crop marketing year (September/August) through 2009/10. This section includes highlights of key rail factors that have emerged.

- The industry has been transitioning from smaller trains that hauled relatively shorter distances using smaller cars to an industry with more cars per train on longer hauls using bigger cars through shuttle train programs.

- The transition has developed as crop production has expanded north and westward into the western Corn Belt, where corn and soybeans are supplanting wheat area.

- Meanwhile ethanol production has kept increased corn production less surplus in key states like Iowa. As ethanol production reaches its ceiling in the next few years, shuttle trains should continue to increase the average rail distances of corn as the surplus corn is transported to export and feeding positions.

- Grain carloadings peaked at 1.7 million in 2005/06, and fell below 1.5 million in 2008/09 and slightly increased in 2009/10 (see Figure 60).

- One-third of the trains have more than 100 cars, up from less than 15% in 2003; one-third had less than 25 cars per train, down from 45% in 1996 (see Figure 61).

- Carloadings expanded in the western Corn Belt from 765,000 in 2004/05 to nearly 900,000 in 2009/10; from eastern Corn Belt carloadings have remained steady since 1998/99 at 463,000 (see Figure 62).

- Carloading destinations increased to export position in the PNW with nearly 340,000, while Texas & Oklahoma were close to 167,000; the Southwest and Southeast hover near 100,000 carloads each (see Figure 63).

- The average distance increased from less than 800 miles in 2002/03 to more than 900 miles starting in 2007/08 and reached 935 in 2008/09 on increased moves to export position but fell slightly below 900 in 2009/2010 (see Figure 64).

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- The size of railcars is expanding with larger cubic capacity cars (those exceeding 5,000 cubic feet) being used most prominently. These larger car moves have increased from less than 200,000 carloads in 1995/96 to nearly one million starting in 2007/08 (see Figure 65).

- The larger cars can haul more volume, increasing from 96.2 tons per car in 1995/96 to more than 100 tons in 2005/06, and in 2009/10 were nearly 101 tons (see Figure 66).

- With increased miles and heavier loaded cars, total ton-miles have expanded from 107.8 billion in 1997/98 to 171.6 billion in 2007/08 and in 2009/10 had fallen to 151.5 billion ton-miles (see Figure 67).

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Figure 60: Total Grain and Soybean Rail Carloadings

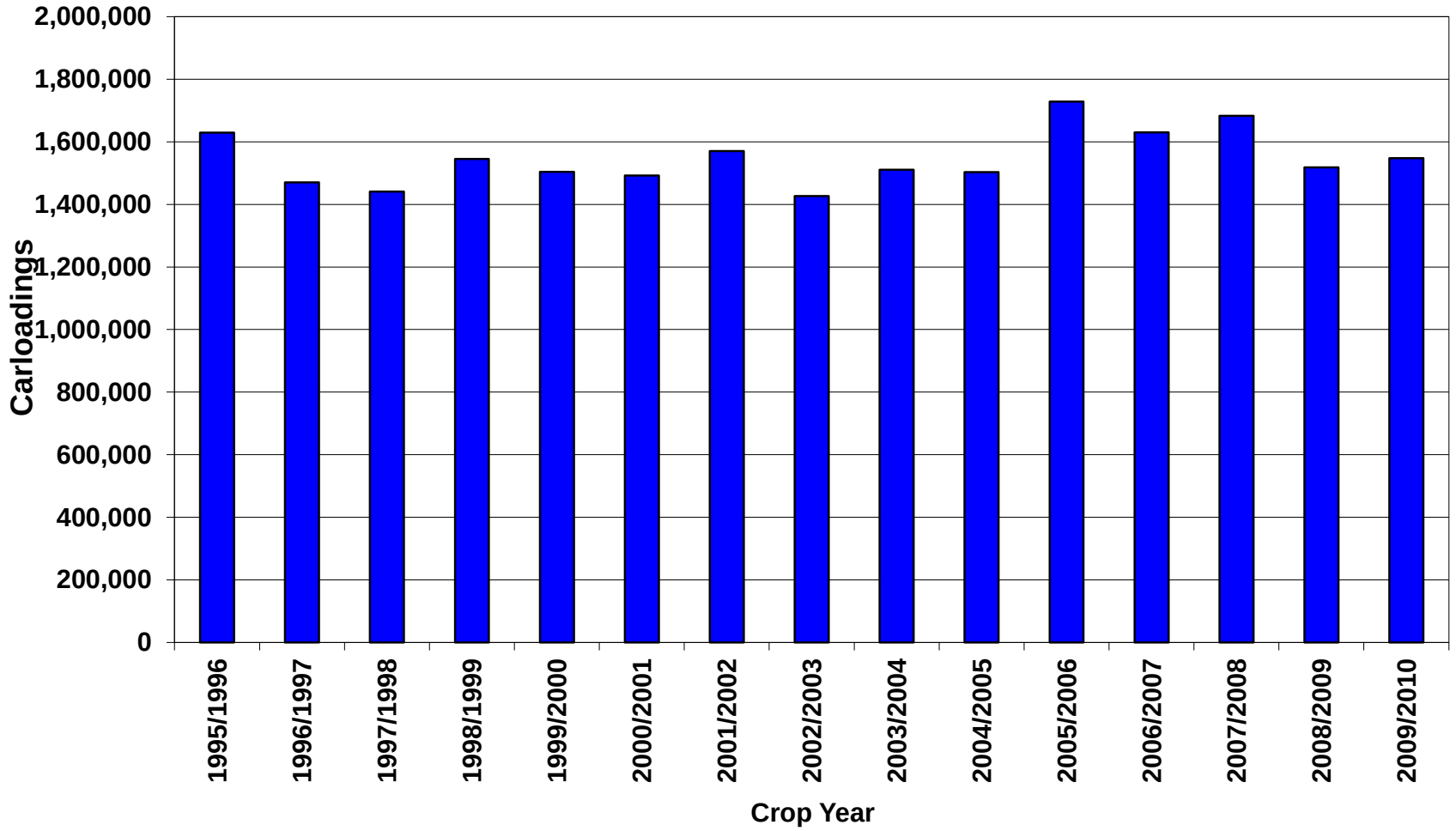

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Figure 61: Grain and Soybean Tonnage Moved by Train Size

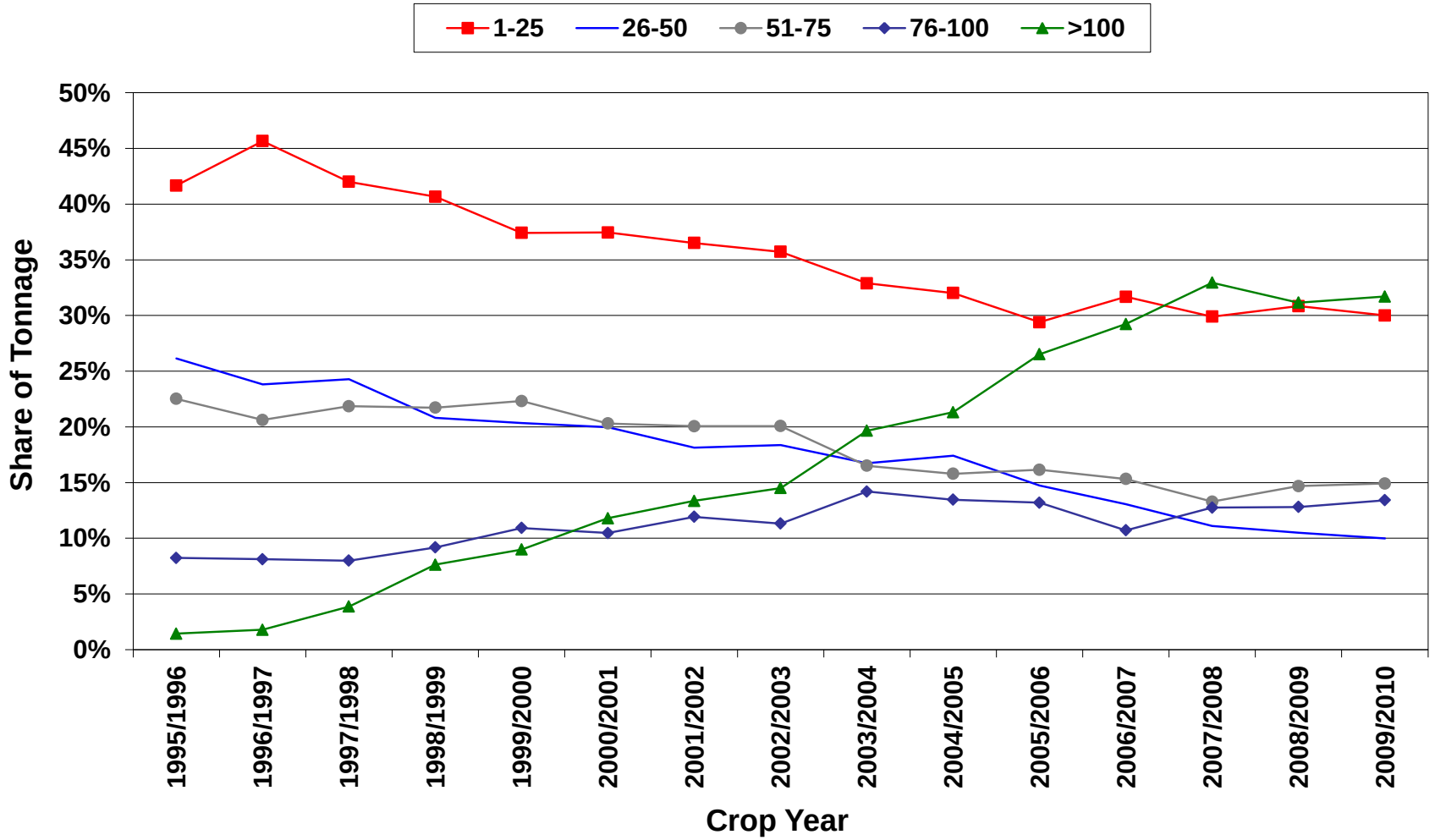

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Figure 62: Grain and Soybean Rail Carloading Origins

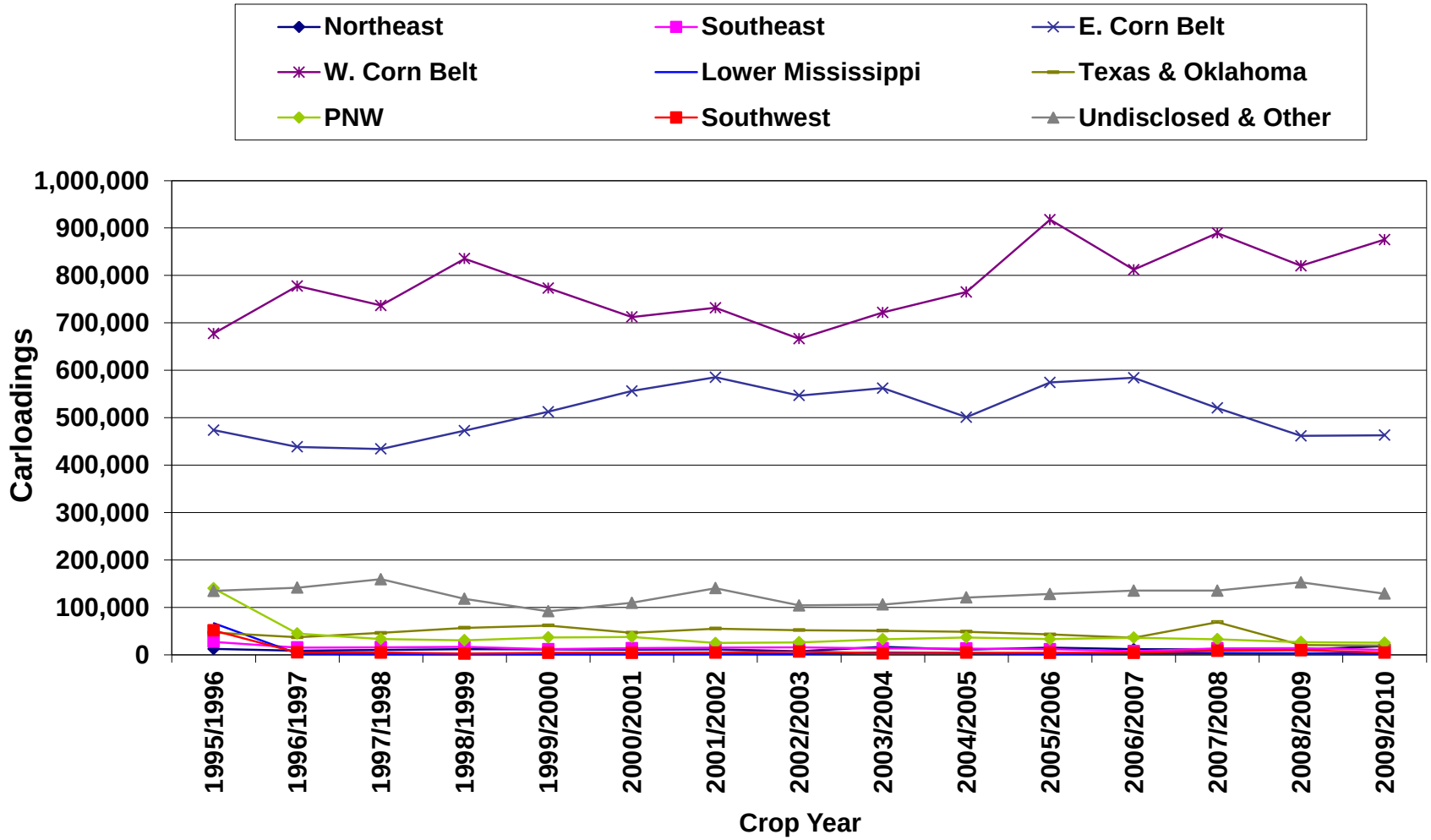

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Figure 63: Grain and Soybean Rail Carloading Destinations

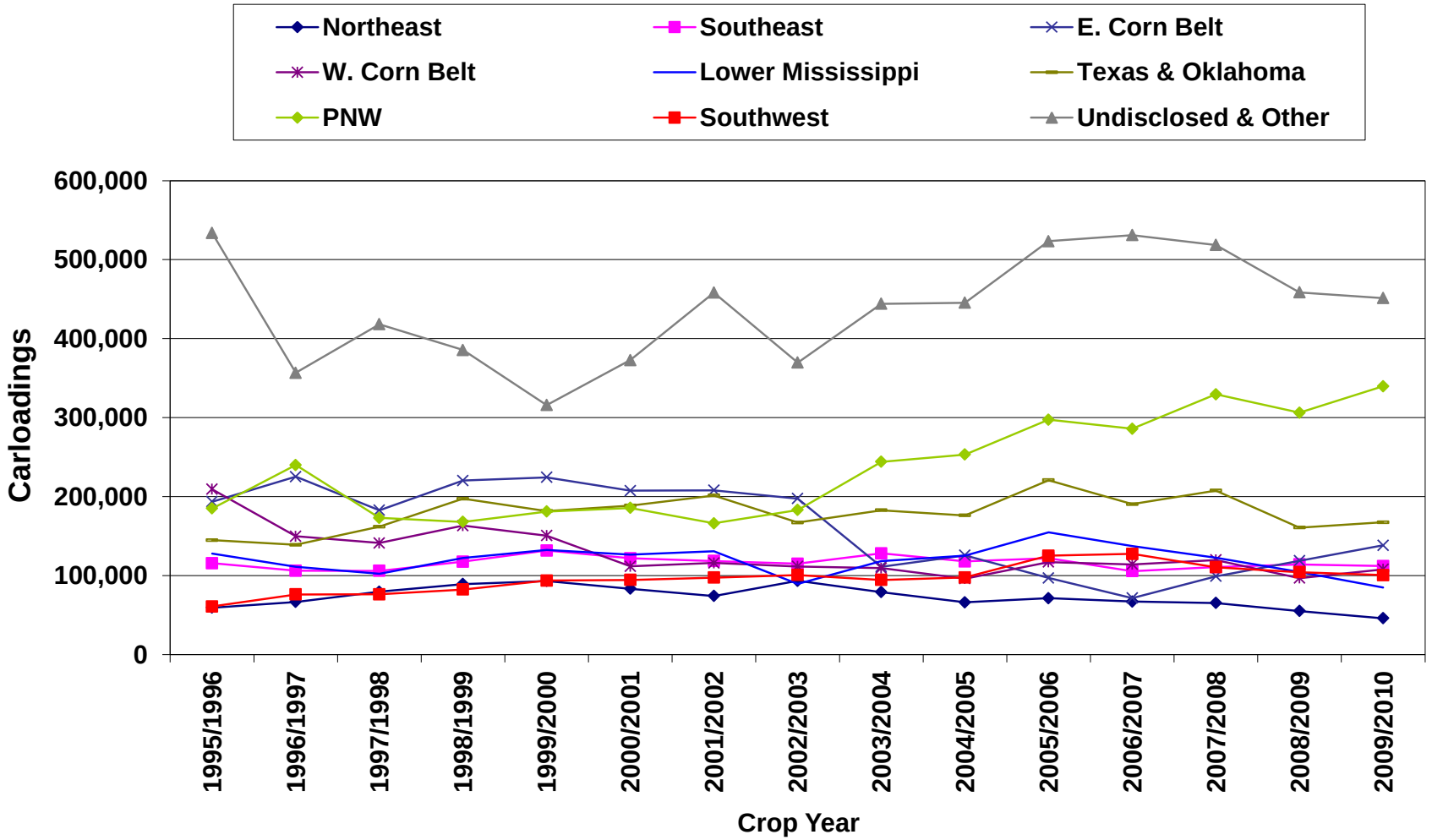

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Figure 64: Grain and Soybeans Average Rail Miles

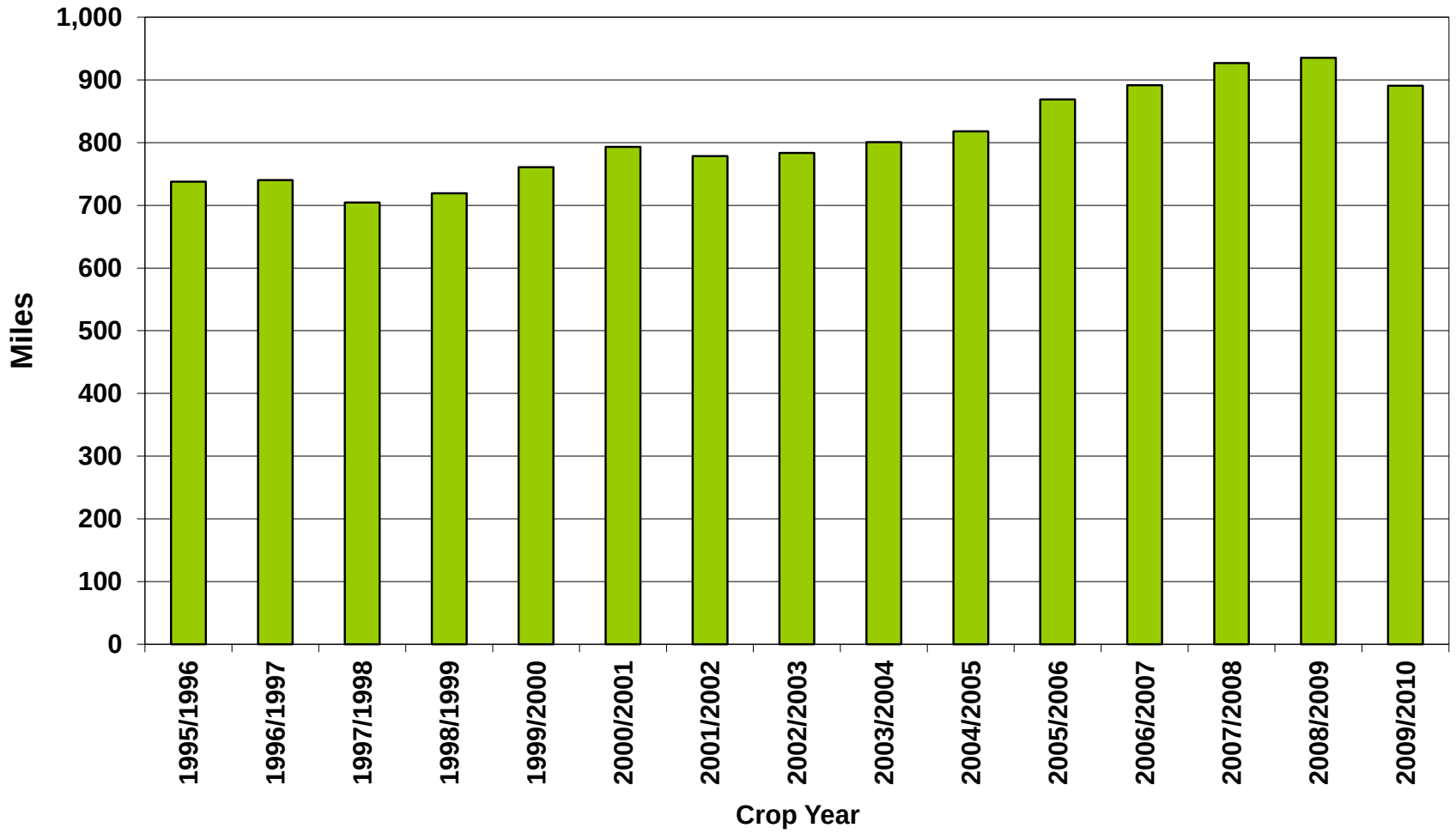

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Figure 65: Grain and Soybean Rail Carloadings by Railcar Cubic Capacity

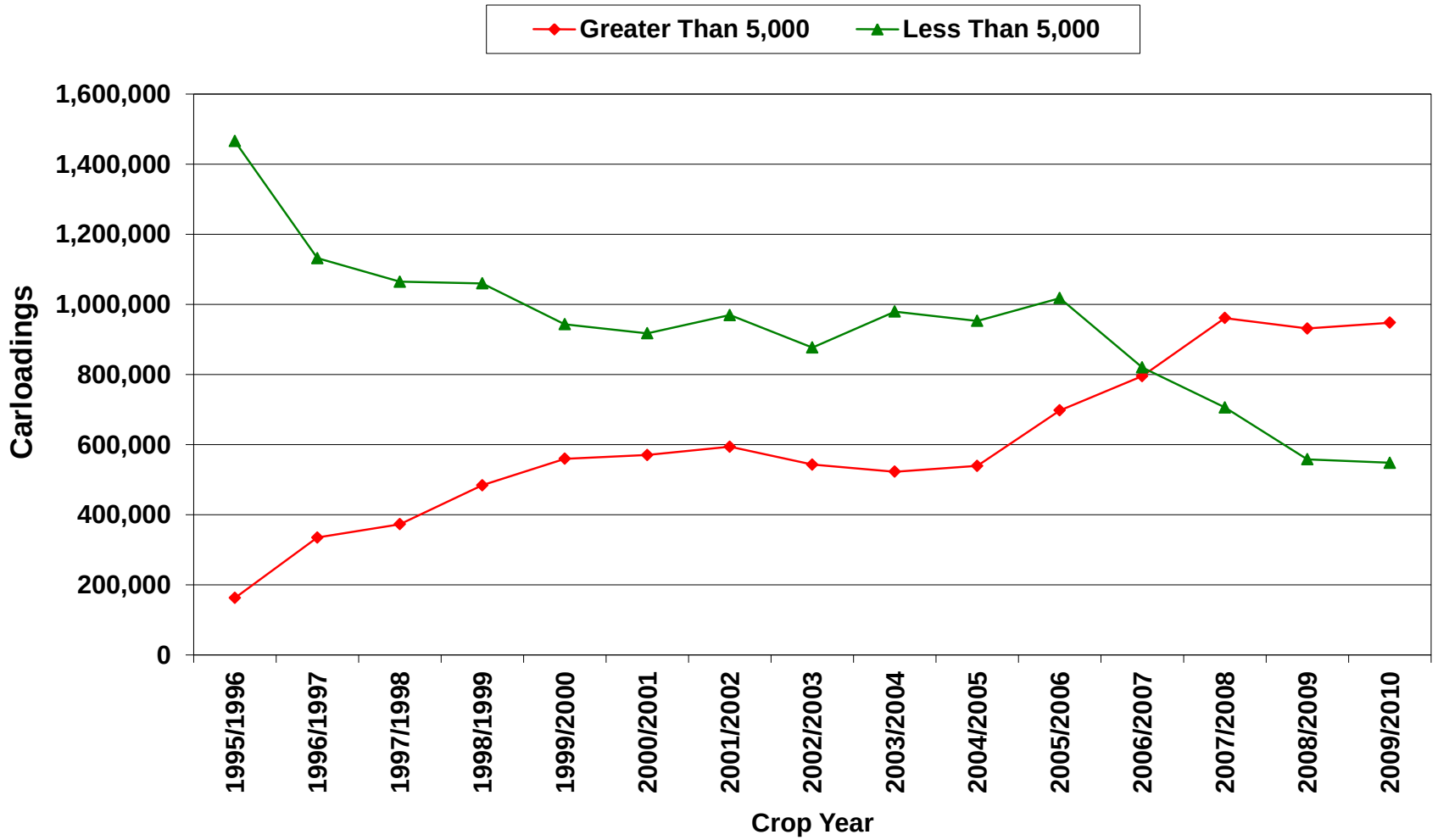

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Figure 66: Average Grain and Soybean Tons per Railcar

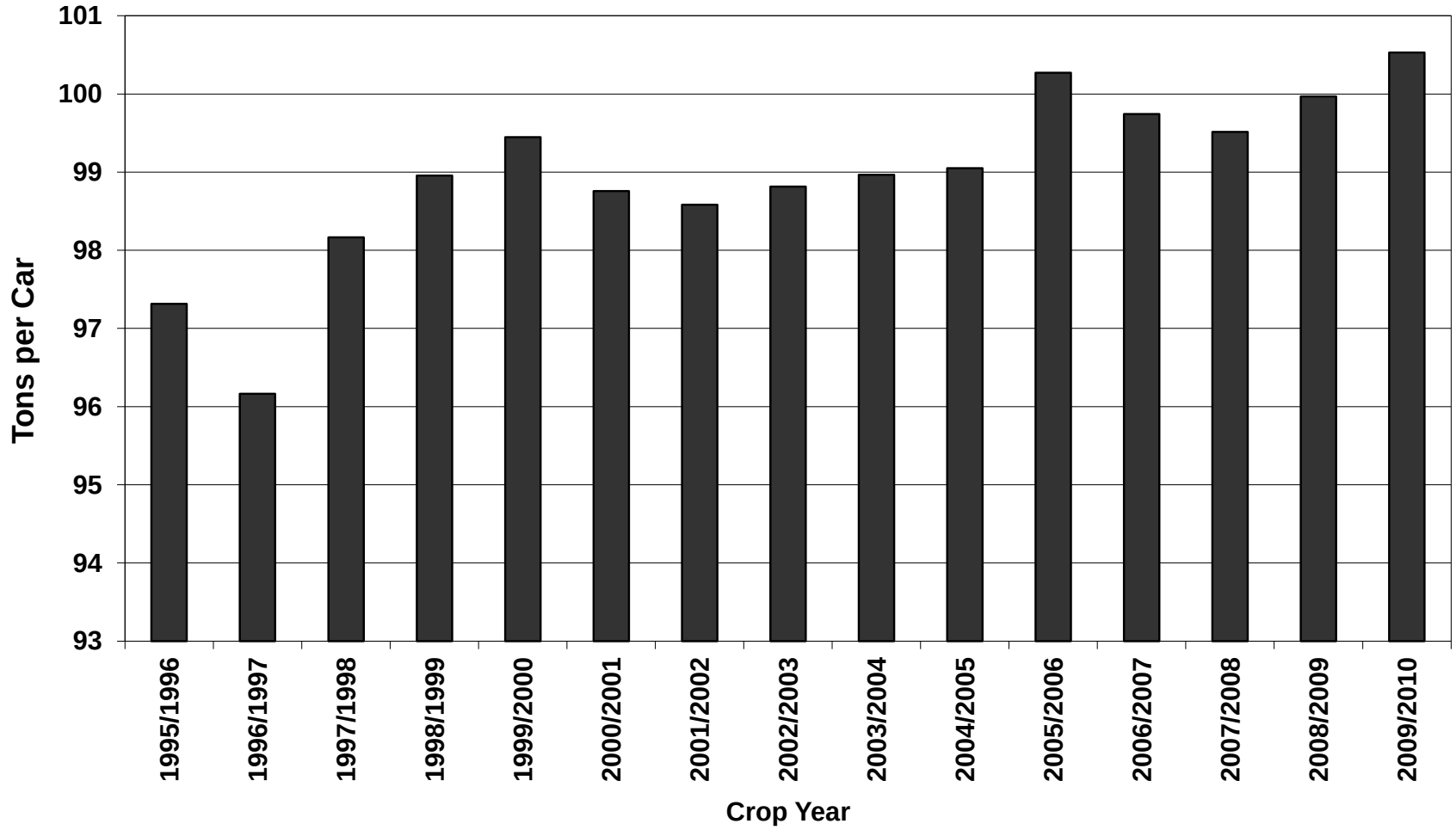

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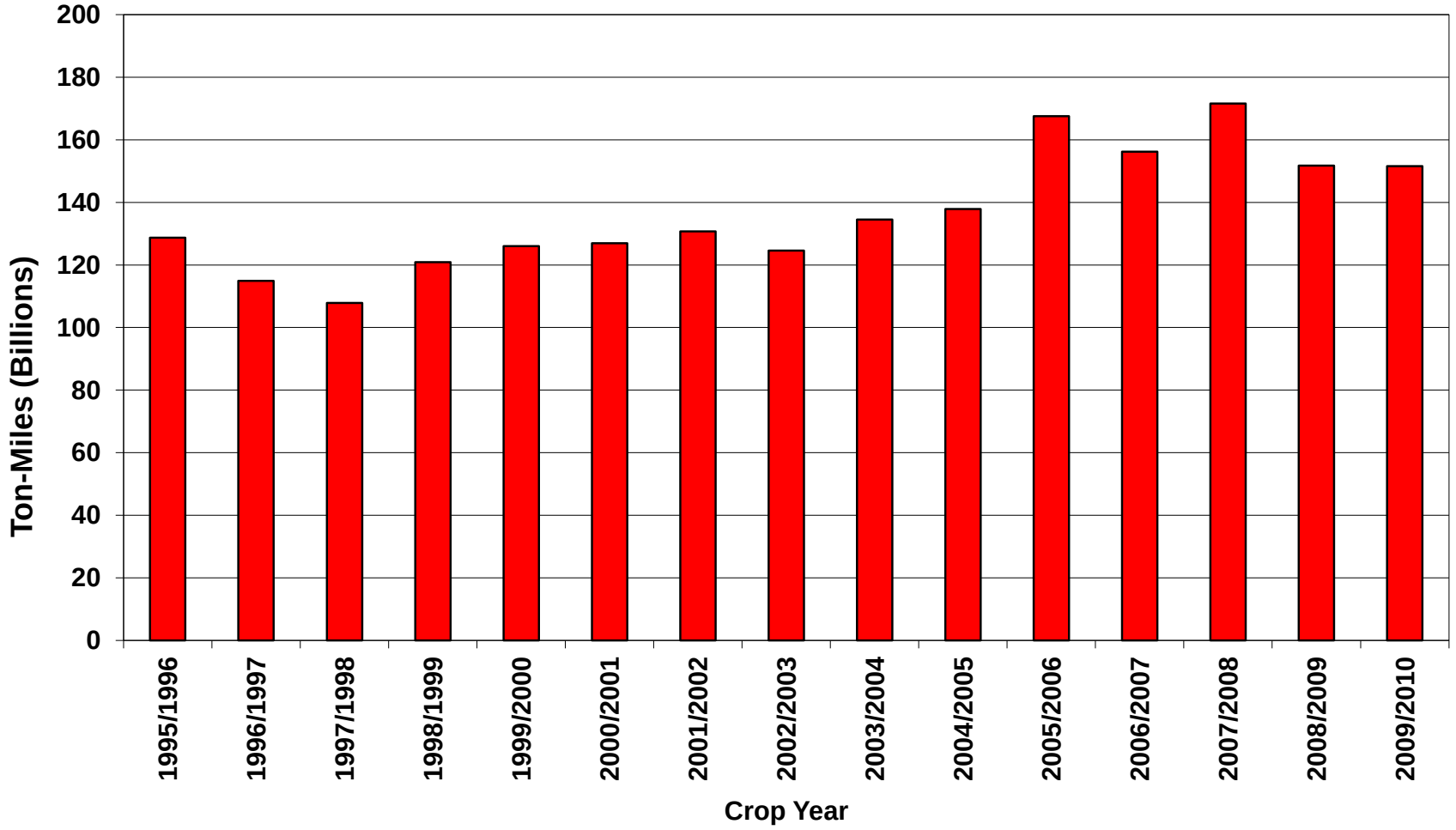
Figure 67: Grain and Soybeans Rail Ton-Miles



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B. Barge Situation for Grains and Oilseeds

This section looks at key barge factors that are impacting movements of grains and oilseeds. The information in this section is based on information from the Army Corps of Engineers Lock Performance Monitoring System, Waterborne Commerce of the United States and Vessel Operator Characteristics, and Informa's annual Barge Fleet Profile report. A map of the Inland Waterway System is shown in Figure 68.

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Figure 68: U.S. Inland River System

Grain barge loadings demonstrate a shift in loadings by waterway. The trend of relatively less grain loading on the upper Mississippi and Illinois Rivers has emerged since the early 2000s. About 60% of annual grain barge loadings originated on the upper Mississippi and Illinois Rivers, and has trended lower to about 40% in 2010 as shown in Figure 69. This trend is particularly evident for soybean loadings with increased loadings on the lower Ohio and lower Mississippi Rivers as shown in Figure 70.

This shift in loadings has occurred during the time of the ethanol build out across the Corn Belt and within proximity of the navigable river system, especially in Iowa where corn became deficit. Once the corn ethanol mandate is achieved corn surpluses are expected to return along the upper Mississippi River. But with issues of crumbling lock infrastructure, increased crop production lower along the Mississippi River, deeper draft barge equipment being used, and a widening barge freight spread, will the upper Mississippi River gain a competitive edge with the lower Mississippi River, during a time when the Panama Canal expansion effort will be completed and will likely expand the draw area for river navigation.

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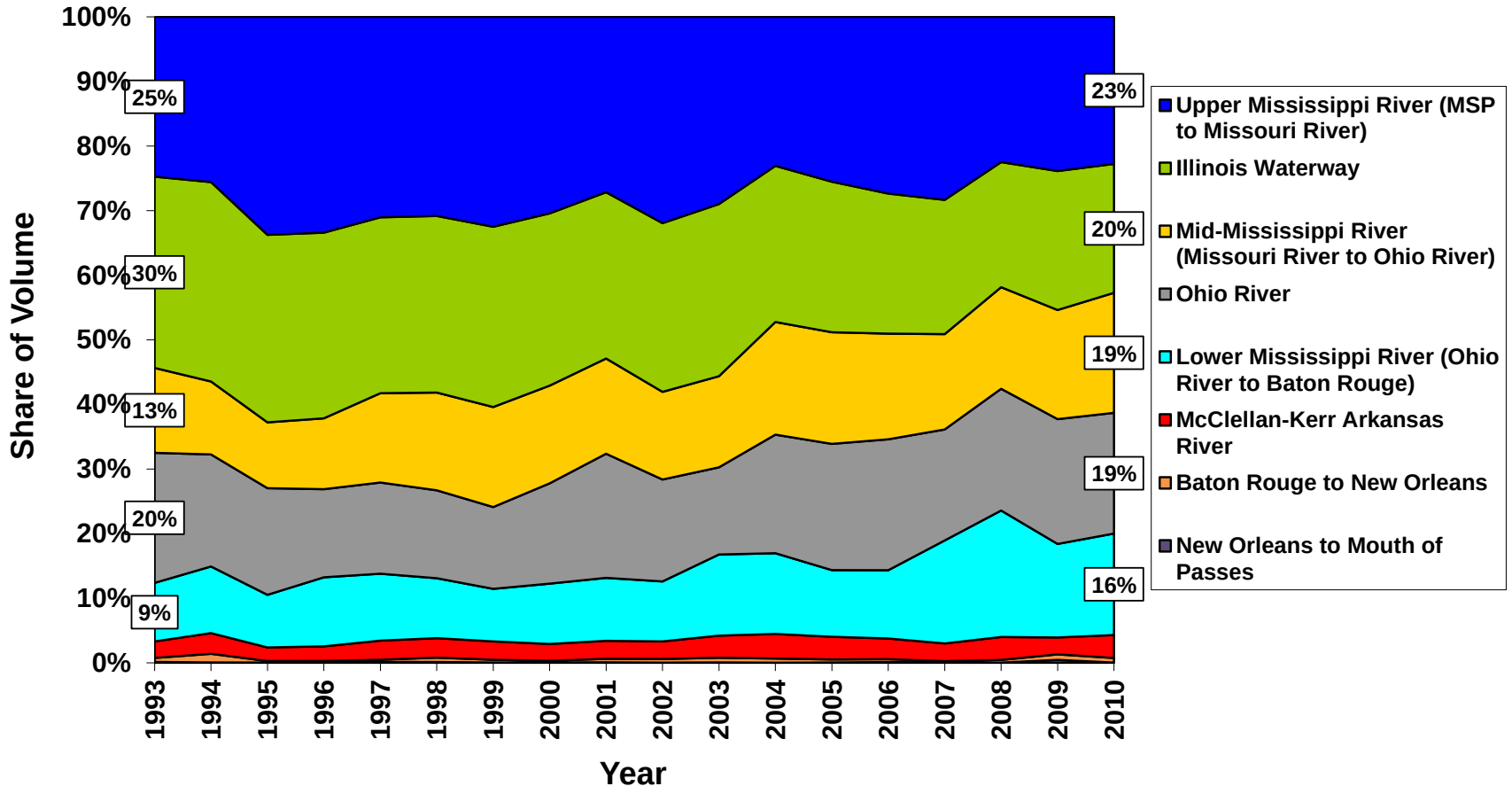
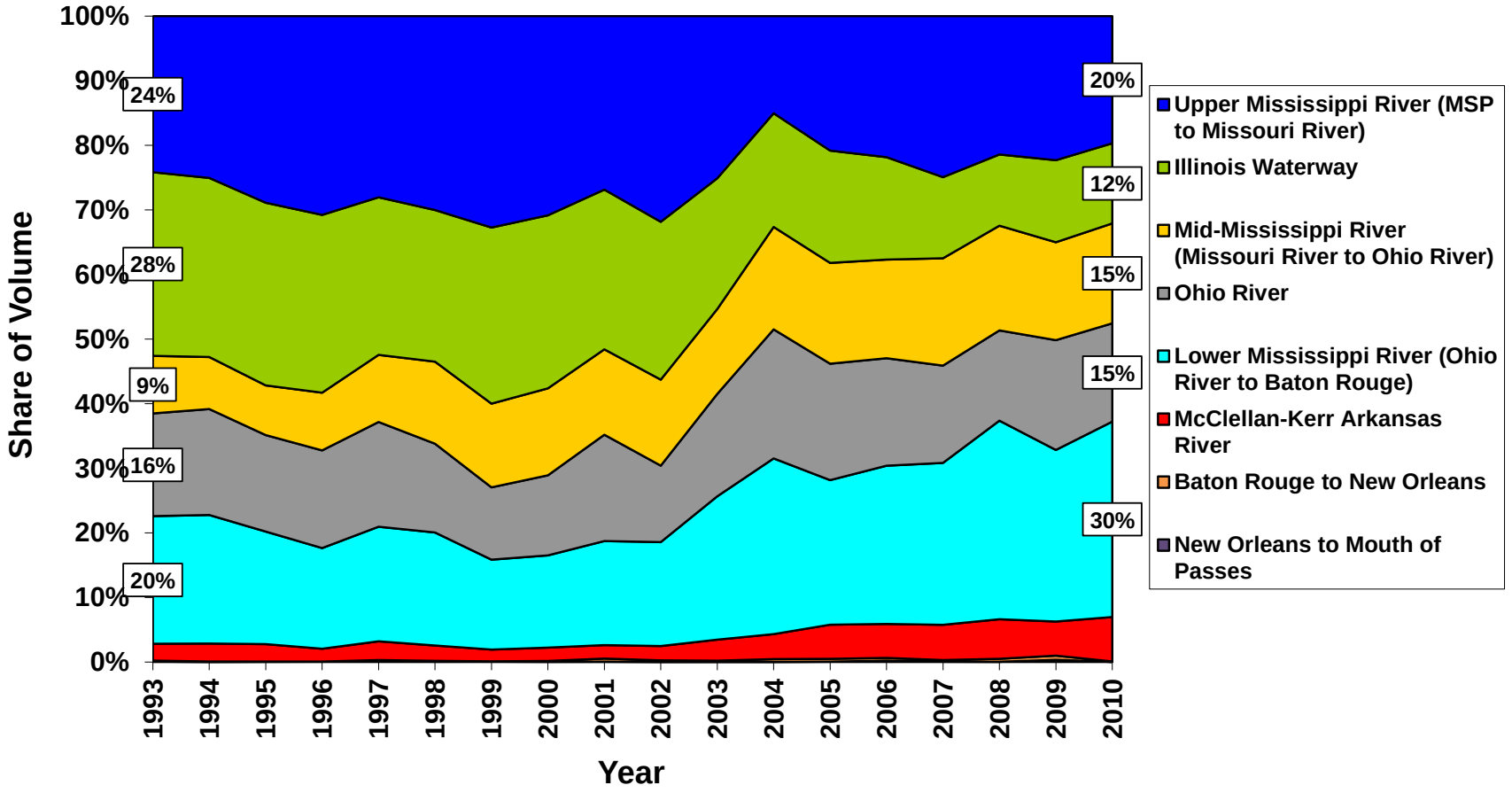
Figure 69: Share of Grain and Soybean Loadings by River Segment



Source: Army Corps of Engineers and Informa

Figure 70: Share of Soybean Barge Loadings by River Segment



Source: Army Corps of Engineers and Informa

- Since 2001, the average tons loaded per barge for grains and soybeans by river segment:
  - Upper Mississippi River 1,554 tons;
  - Lower Mississippi River approximately 1,700 tons;
  - Illinois Waterway 1,552 tons;

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  - Ohio River 1,561 tons; and
  - Arkansas River 1,406 tons (average since 2003).

- Since 2011, the average tons loaded per barge for grains and oilseeds by river segment:
  - Upper Mississippi River 1,538 tons;
  - Lower Mississippi River approximately 1,700 tons;
  - Illinois Waterway 1,544 tons;
  - Ohio River 1,699 tons; and
  - Arkansas River 1,397 tons.

- The number of total grain and oilseed barge loadings has decreased since the 2001/02 highs on the Upper Mississippi and Illinois Waterway while on the Ohio River 2009/10 was the high with just under 5,000 total barge loadings as shown in Figure 76. Around 85% of the covered hopper barge fleet is able to handle loads that draft 12 feet to 14 feet compared with 15% that is limited to 9 feet to 10 feet as shown in Figure 71. As a result, in most cases a covered hopper barge will be able to take advantage of deeper drafts if the river allows.

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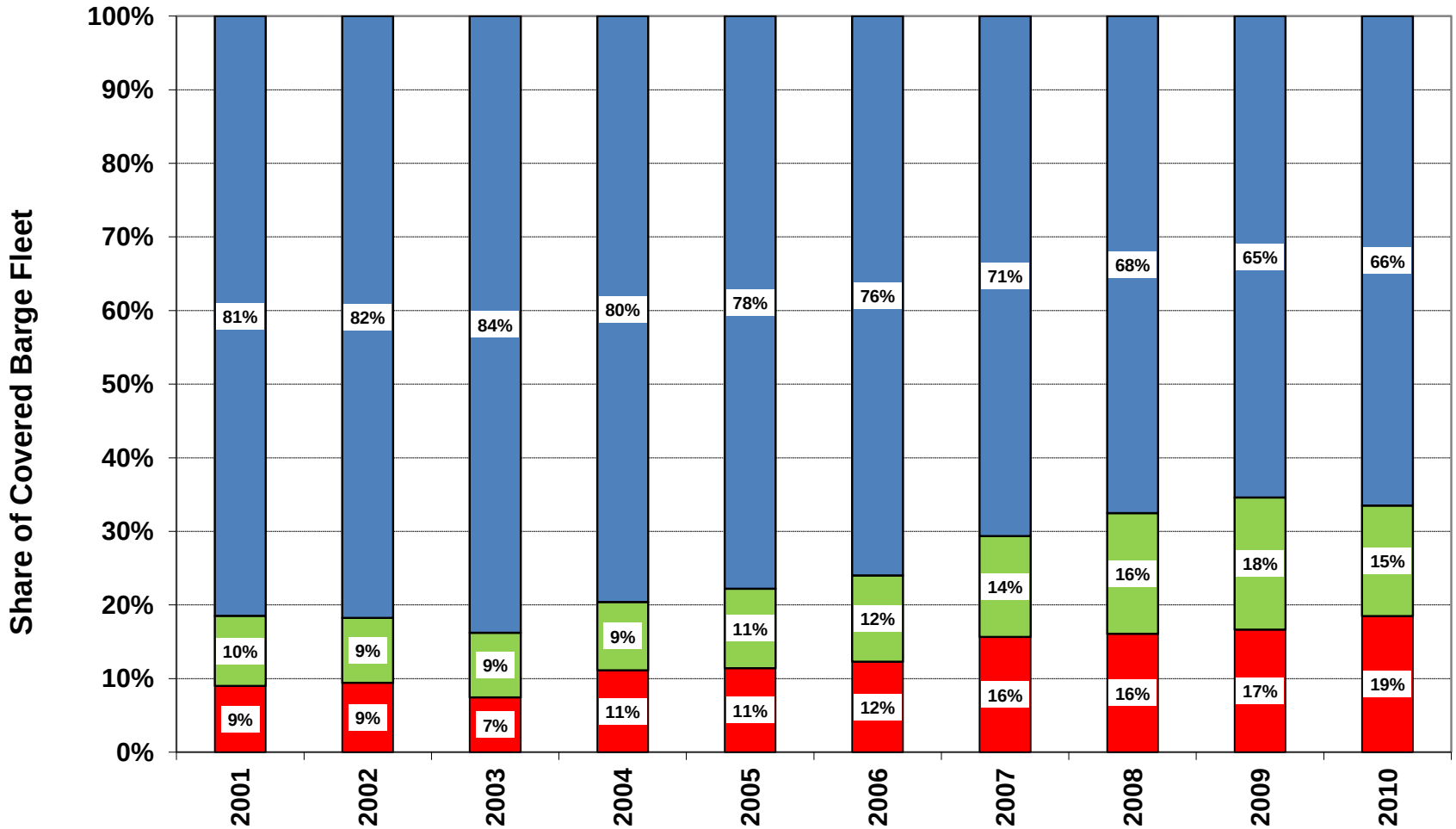
Figure 71: Covered Barge Fleet by Draft Characteristics



Source: Informa Economics, Inc. (www.bargefleet.com)

The barge freight rate differentials between key river locations and Peoria, IL on the Illinois River have been widening. The spreads at locations downriver from Peoria have widened from a range of -10 cents to -15 cents per soybean bushel

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from the mid-1990s to the mid-2000s from Memphis for example. Since 2004 the barge freight spread between Memphis with Peoria has widened further to more than -30 cents per soybean bushel and has maintained a greater than 25% freight advantage since 2009 as shown in Figure 72.

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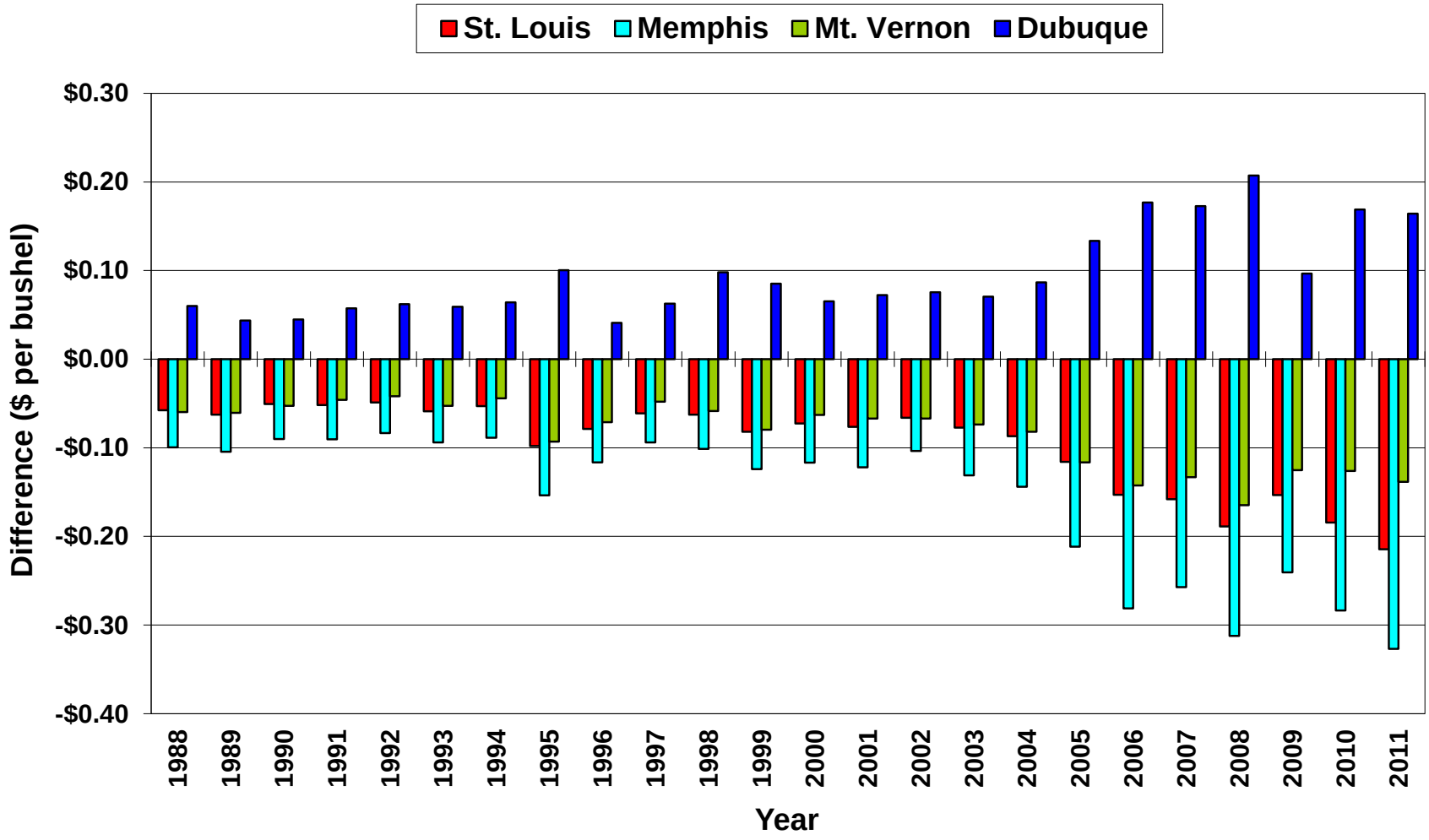
Figure 72: Barge Freight Rate Differential with Peoria, IL for Soybean Movements to New Orleans, LA by Select River Segments



Source: USDA and Informa

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Commodities Moved

Tons

- On the demand side, commodity volumes moved on the inland waterways during 2010 totaled 555.4 million tons, an increase of 9% from 2009. The economic recession led to a dramatic drop in commodity flows during 2009, but movements during 2010 showed a decent rebound.

- Only farm products displayed a positive annual increase in movements, led by higher corn and soybean moves. Farm products were up 7.5 million tons or 11% to 74.7 million tons. The increase follows the poor navigation conditions of 2008 that directly impacted corn moves. Movements of soybeans were record high in 2009 at 21.8 million tons.

- For 2009, Informa estimates waterborne commerce to have expanded 15% to 587 million tons. The estimates were developed through specific commodity and trend analysis.

Average Distance

- The average distance commodities were hauled during 2009 increased to 481 miles, up from 456 miles in 2008, which is about 30 miles above the 5-year average.

- Food and farm products were hauled the greatest distance in 2009, with an average of 972 miles, which was the highest distance for this group since 2006 as shown in Figure 73.

- Chemical movements averaged 604 miles, nearly unchanged from the 602 miles in 2008, but about average for the past five years.

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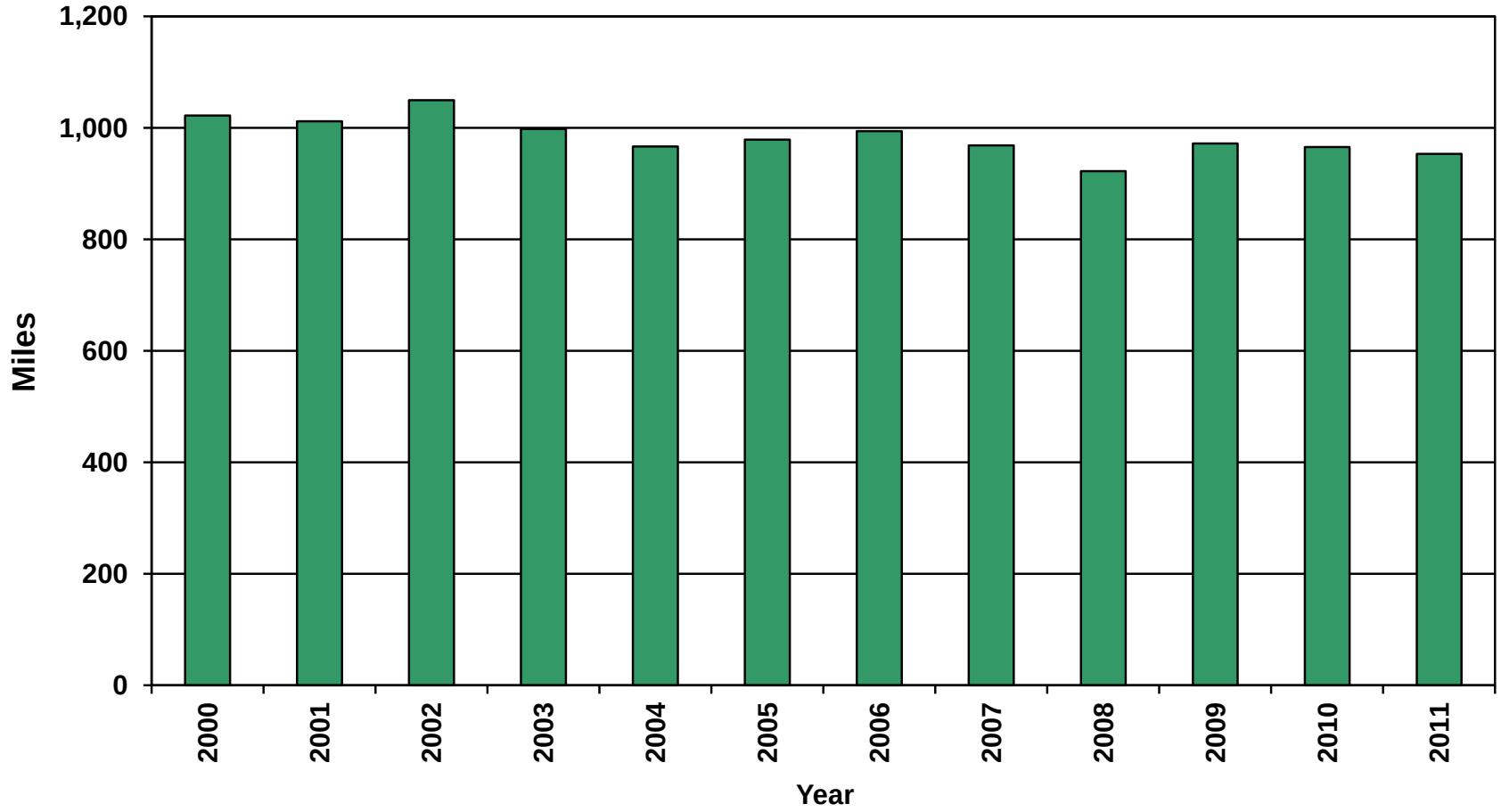
Figure 73: Average Distance Food and Farm Product Moved by Barge (miles)



Ton-Miles

- Commodity ton-miles for all internal movements during 2009 totaled 245 billon ton-miles, down 6% from 2008.
- Food and farm products totaled 72.6 billion ton-miles during 2009, an increase of 17% on higher volumes and longer distances moved.

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Figure 74: Total Grain and Oilseed Barge Loadings on the Upper Mississippi River

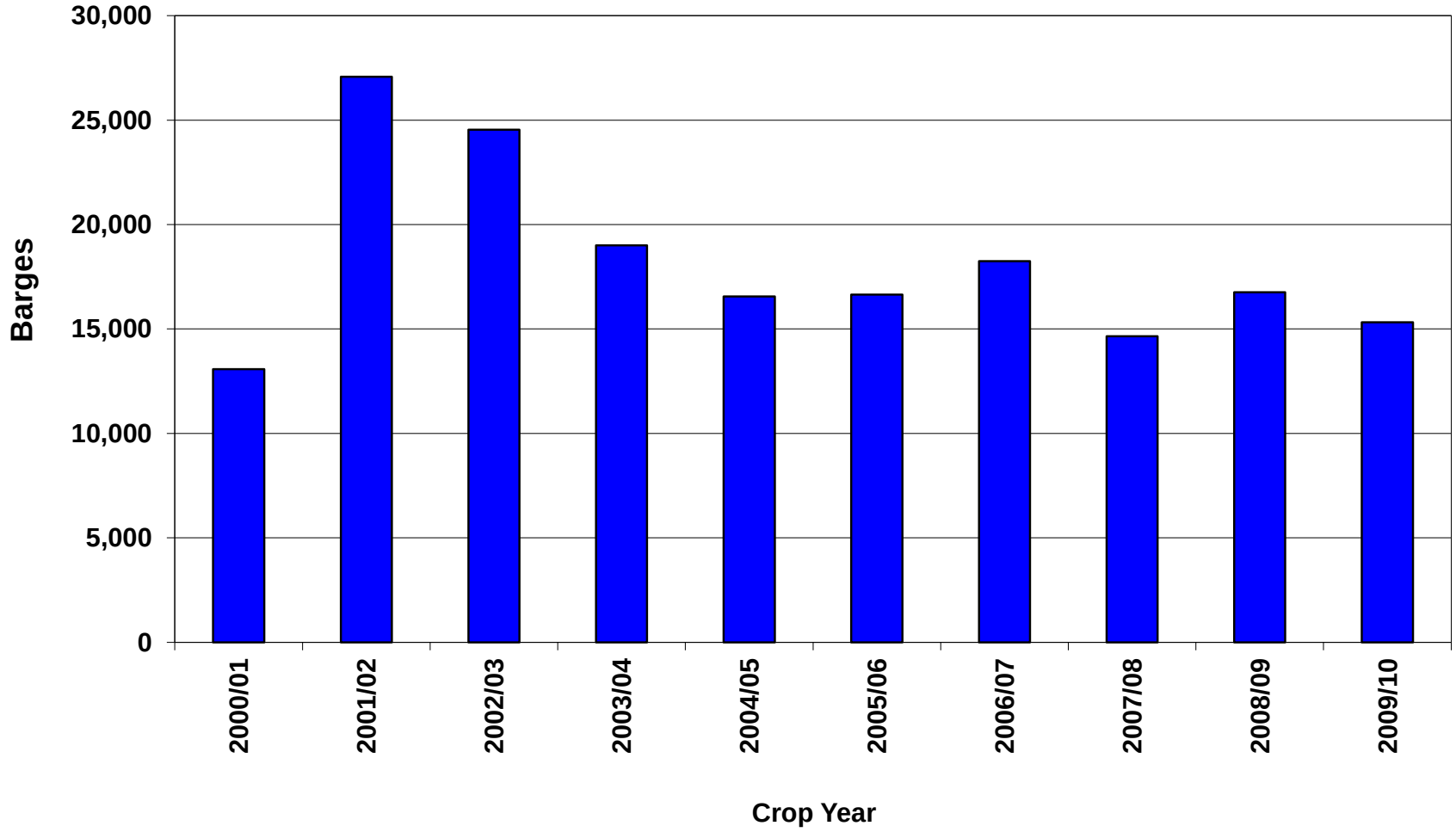

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Figure 75: Total Grain and Oilseed Barge Loadings on the Illinois Waterway

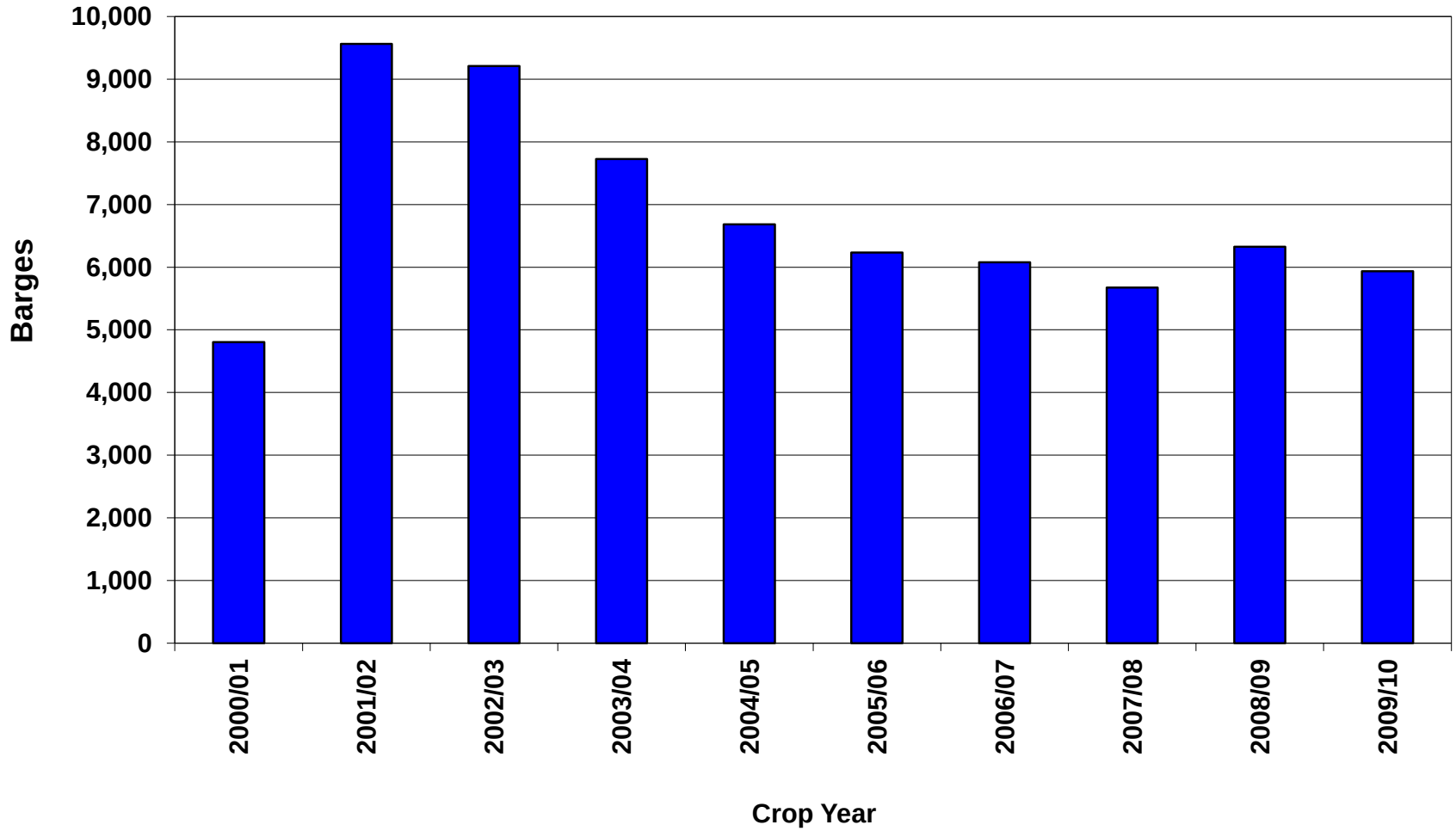

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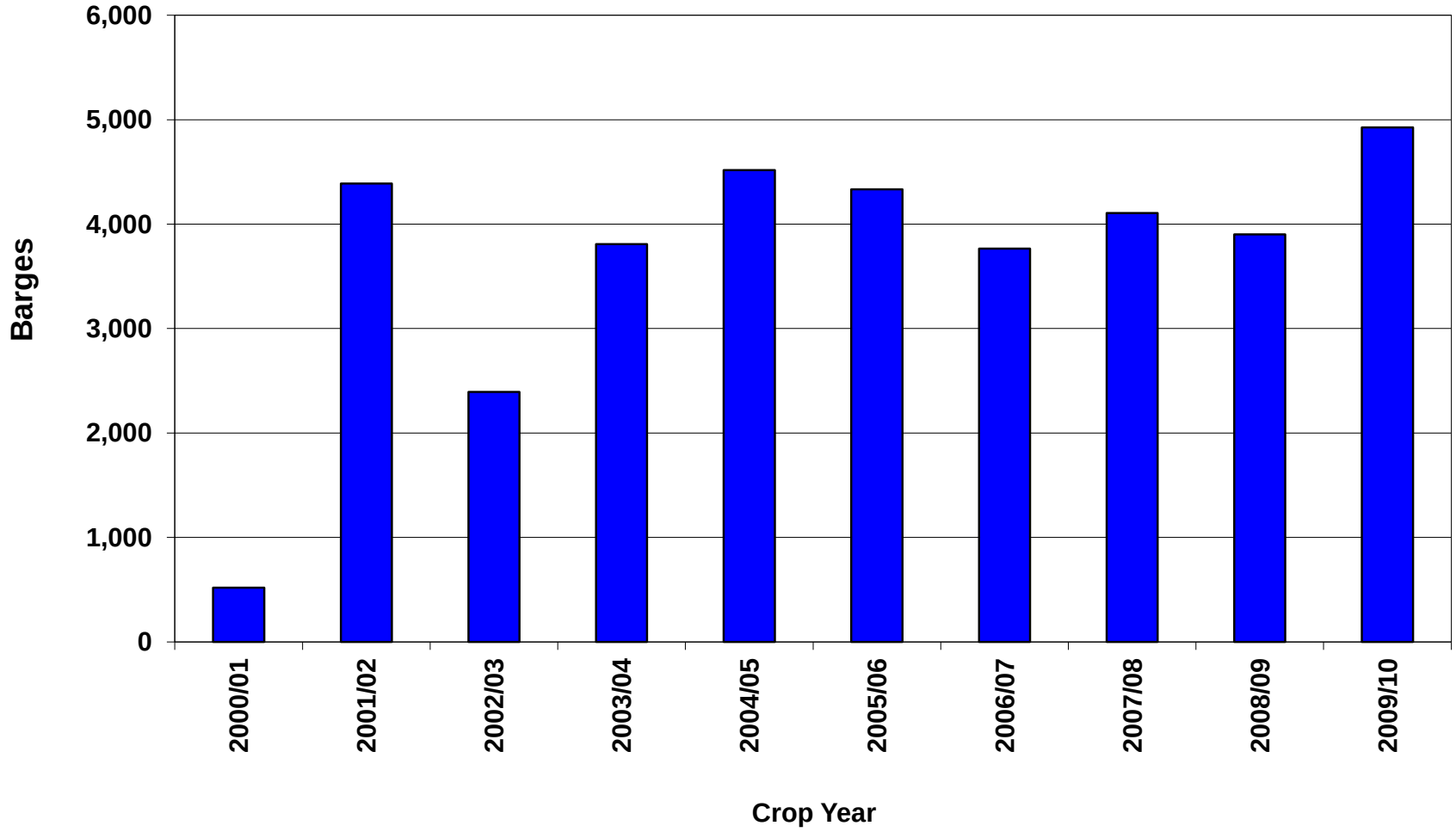
Figure 76: Total Grain and Oilseed Barge Loadings on the Ohio River



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VI. Impact on U.S. Agriculture for Insufficient Transportation Improvements

This section analyzed how investment options and subsequent transportation performance implications affect economic performance. A baseline level of grain, soybean and corresponding product flows were used from the 2009/10 marketing year (September/August). Modal data and information on transportation is most complete through the 2009/10 marketing year making this an appropriate baseline level to compare future implications to. Policy-sensitive differences in cost were translated into changes in earnings, output and employment for each investment option relative to the "business as usual" baseline.

For this task the study team considered several policy implications. These include impacts to inland navigation and channel access to ports.

A. Investment Alternatives

The investment alternatives were developed through known and anticipated funding pathways, industry and stakeholder interviews, the study team's working knowledge of the current and potential pathways for transportation and infrastructure, and in coordination with the United Soybean Board, United States Soybean Export Council and the Soy Transportation Coalition. The effort was prepared in the form of a "needs analysis" for various aspects of the infrastructure including locks and port channel dredging. For the locks the team utilized the soybean checkoff-funded report, "America's Locks & Dams: A Ticking Time Bomb for Agriculture," to develop scenarios for locks. For port channel dredging the team utilized a report, "Lower Mississippi River Dredging" released by the Big River Coalition and dredging information from the U.S. Army Corps of Engineers.

Cost saving estimates from an expanded Panama Canal was incorporated into the dredging analysis. The cost estimates were utilized from the soybean checkoff-funded report, "Panama Canal Expansion: Impact on U.S. Agriculture." For example, on the lower Mississippi River from Baton Rouge past New Orleans through the Southwest Pass to the Gulf of Mexico, the project channel depth is 45 feet while maintained to 47 feet. The two feet of slack provides additional time between necessary dredging events. These depths allow Panamax vessels to be loaded to maximum capacity. The Corps has responsibility to maintain the project depth of 45 feet on the lower Mississippi River but funding issues are limiting dredging efforts, and as such, limiting vessel draft, which then limits loading capacity. During early March 2012 for example, river pilots, vessel captains and ship owners were restricting vessels to a 42-foot draft due to a lack of dredging to maintain an adequate navigable channel. If over the longer run the shipping channel draft was limited to 42 feet due to funding limitations, then the potential benefit of an expanded Panama Canal will not be realized for the soybean industry.

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A vessel transiting the current Panama Canal dimensions is limited to a 39.5 foot draft, which is equivalent to a Panamax vessel being loaded with 56,700 metric tons of soybeans.

The Panama Canal expansion cost savings to the soybean growers is dependent on a project depth of 45 feet on the lower Mississippi River. Once the Panama Canal expansion is complete, vessels can be loaded with an additional 7,000 metric tons on a Panamax or 13,300 metric tons on a small Capesize vessel. ADM has ordered three ships that can maximize the benefit of the Panama Canal expansion by holding 80,000 metric tons.

A Post-Panamax ship has an $18 per MT ($0.48 per bushel) advantage over the current Panamax vessel as shown in Table 23. For soybean farmers within the Mississippi River draw area, the price received for their soybeans could theoretically increase by $0.48 per bushel. The efficiency gain will enable the river terminals to expand their draw area, which will give farmers more marketing options and limit the ability of railroads to increase rates. For example, despite Kansas City being 293 rail miles closer to Portland, the cost per ton is the same as St. Louis as shown in Table 24 and the cost per ton-mile is 12% lower. Being able to fully maximize the use (e.g., fully loading vessels to the project draft depth of 45 feet) of small Capesize vessels is equivalent to $13 per MT ($0.35 per bushel) to the U.S. soybean farmer and fully loading existing Panamax ships is equivalent to $6 per MT ($0.16 per bushel). The willingness to invest in facilities, equipment and vessels to load to the maximum project draft depth to maximize the benefit of the Panama Canal expansion is dependent on investors believing the lower Mississippi River project draft depth will remain at 45 feet.

Table 23: Post-Panama Expansion Transportation Costs to Japan ($ per metric ton)

	Center Gulf (New Orleans)				PNW	PNW
	56,700 MT	63,700 MT	70,000 MT	80,000 MT	65,000 MT	80,000 MT
Inland Rate	$15	$15	$15	$15	$54	$54
Ocean Rate	$62	$56	$49	$45	$29	$23
Landed Cost	$78	$72	$65	$60	$84	$78

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Table 24: Rail Rate Comparison

Origin	Destination	Tariff	Fuel Surcharge	Mileage	Total Fuel Surcharge	Total Cost	Tons	$/Ton	$/Mile
Kansas City, KS	Portland, OR	$6,190	$0.35	2,072	$725	$6,915	110	$63	$3.34
East St. Louis, IL	Portland, OR	$6,090	$0.35	2,365	$828	$6,918	110	$63	$2.93

Source: BNSF

For the lock infrastructure scenario, six locks were analyzed including, Lock 20 on the upper Mississippi River at Canton, MO; Lock 25 on the upper Mississippi River at Winfield, MO; Lock 52 and Lock 53 on the Ohio River at Brookport, IL and Grand Chain, IL respectively; Markland Lock on the Ohio River at Warsaw, KY; and LaGrange Lock on the Illinois River at Versailles, IL. The objective was to determine the impact of a lock's impact to navigation and to calculate the additional rail ton miles that would be created if a diversion of grain was needed due to lock failures.

To derive the rail ton miles, the highest weekly car volume at the Center Gulf over the past decade was used to estimate an assumed quarterly sustained volume. Then the sustained quarterly volume was multiplied by three to assume a sustained year, 75% was used instead of the full year to create a real-world situation with railcar logistics coordination, competitive pressure from Western railroads and seasonality causing other volume limitations on the track. Using the estimated annual maximum rail grain volume to the Center Gulf, and subtracting the average annual rail volume to the Center Gulf, equals the extra grain volume the rail system to the Center Gulf could sustain. The total amount of grain volume being diverted due to the lock failure minus the maximum available rail volume to the Center Gulf equals the amount of grain that would have to be sent to the PNW for export. The total rail ton-miles is based on the rail distances from the failed lock and dam to the Center Gulf or PNW and multiplied by the grain tonnages. Of the six locks analyzed, Lock 25 would have the most grain volume diverted with over 12.2 million tons of grains and oilseeds moved equaling over 18.6 billion rail ton-miles.

The transportation investment scenario details and cumulative project investment outlays through 2020 are summarized in Table 25.

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Table 25: Transportation Investment Alternatives

Infrastructure	Project Description	Cumulative Outlays ($ millions)
Inland Navigation Lock and Dams	Mississippi River Lock 20 1,200 foot Lock Addition + Lock & Dam Rehabilitation	$311.1
	Mississippi River Lock 25 1,200 foot Lock Addition + Scour Repairs & Rehabilitation	$429.9
	Ohio River Olmsted Lock & Dam Construction and Lock 52 and Lock 53 Removal	$2,044.0
	Ohio River Markland Lock Major Rehabilitation	$35.8
	Illinois River LaGrange Lock Addition	$320.9
	Illinois River LaGrange Lock Rehabilitation	$78.8
Channel Dredging by Army Corps of Engineers District	Galveston	$1,230.8
	Mobile	$677.8
	New Orleans	$2,322.5
	Portland	$288.0

B. Impact Analysis

The delivery of commodities resulting from grain and soybean farming are of significant importance to the U.S. economy. This impact can be understood first in terms of the overall jobs, output, personal income and value added on the U.S. economy that depends either directly or indirectly on the long haul movement of these commodities, and second in terms of the potential positive impact of investing in transportation infrastructure that facilitates the more efficient movement of these commodities.

For the purposes of the impact analysis, products of the grain and soybean farming industries (and the magnitude of their flow by transportation mode according to the U.S. Surface Transportation Board Public Use Waybill) are allocated to the general groups of "Soybean Farming" and "Grain Farming" which represent these commodities in national input-output tables. Effectively:

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- **The "Soybean Farming" industry includes:**
  - Soybean
  - Soybean Oil

- **The "Grain Farming" industry includes:**
  - Corn
  - Sorghum
  - Wheat
  - Barley
  - Oats
  - Soybean Meal
  - DDGS

1. Economic Dependence on Soybeans, Grain and Products

As has been described throughout this report, the above listed products have a significant impact on value chains throughout the United States. There are a number of "downstream" industries (industries using these commodities) that are so dependent on the delivery of grain and soybean commodities and their products as inputs of production that the industry itself could not operate without them. These industries (in addition to grain and soybean farming industries themselves) comprise the top ten industries with the largest share of output dependent on grain and soybean commodities and products. They are shown in the first 12 rows of Table 26. In addition to these industries, other industries, such as breweries, frozen food manufacturing, poultry processing, and snack food manufacturing while not fully dependent on grain, soybeans and products for all of their production, are heavily dependent on these commodities for the majority of their output and associated impact. The annual national total for impact in these sectors is summarized for "all other industries" in line 13 of Table 26.

Overall, U.S. industries dependent on grain, soybeans and products account for nearly 1.5 million jobs, exceeding $352 billion in U.S. output, over $41 billion in labor earnings and more than $74 billion in value added on the U.S. economy. A summary of the employment, output, labor income and value added in the U.S. economy from those industries that can be characterized as dependent on grain, soybeans and products (down to the second order of consumers in the supply chain) is shown in Table 26.

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Table 26: Annual Downstream Impact of Soybean, Grain and Products on U.S. Industries in 2009

U.S. Industry	Earnings ($ millions)	Output ($ millions)	Employment	Value-Added ($ millions)
Grain farming	$14,615	$58,833	725,445	$24,607
Oilseed farming	$9,128	$31,077	258,253	$14,149
Dairy cattle and milk production	$1,473	$24,342	175,888	$5,270
Poultry and egg production	$4,588	$32,463	78,980	$5,533
Cookie, cracker, and pasta manufacturing	$2,972	$22,730	53,429	$5,411
Other animal food manufacturing	$1,867	$36,402	32,268	$3,918
Flour milling and malt manufacturing	$1,185	$21,736	18,168	$2,339
Tortilla manufacturing	$681	$3,559	17,887	$980
Breakfast cereal manufacturing	$1,175	$12,326	14,320	$4,177
Soybean and other oilseed processing	$1,058	$64,091	13,802	$2,526
Wet corn milling	$801	$16,877	8,295	$1,666
Fats and oils refining and blending	$402	$14,114	6,180	$1,310
All Other Industries	*$1,761*	*$13,900*	*52,502*	*$2,901*
Total Economic Dependence	**$41,706**	**$352,451**	**1,455,416**	**$74,786**

To understand the impact on grain, soybeans and products on different regions of the United States, the regional definitions established by the U.S. Bureau of Economic Analysis (BEA) serve as a basis for assessing regional impacts. The U.S. BEA Regions are illustrated in Figure 77.

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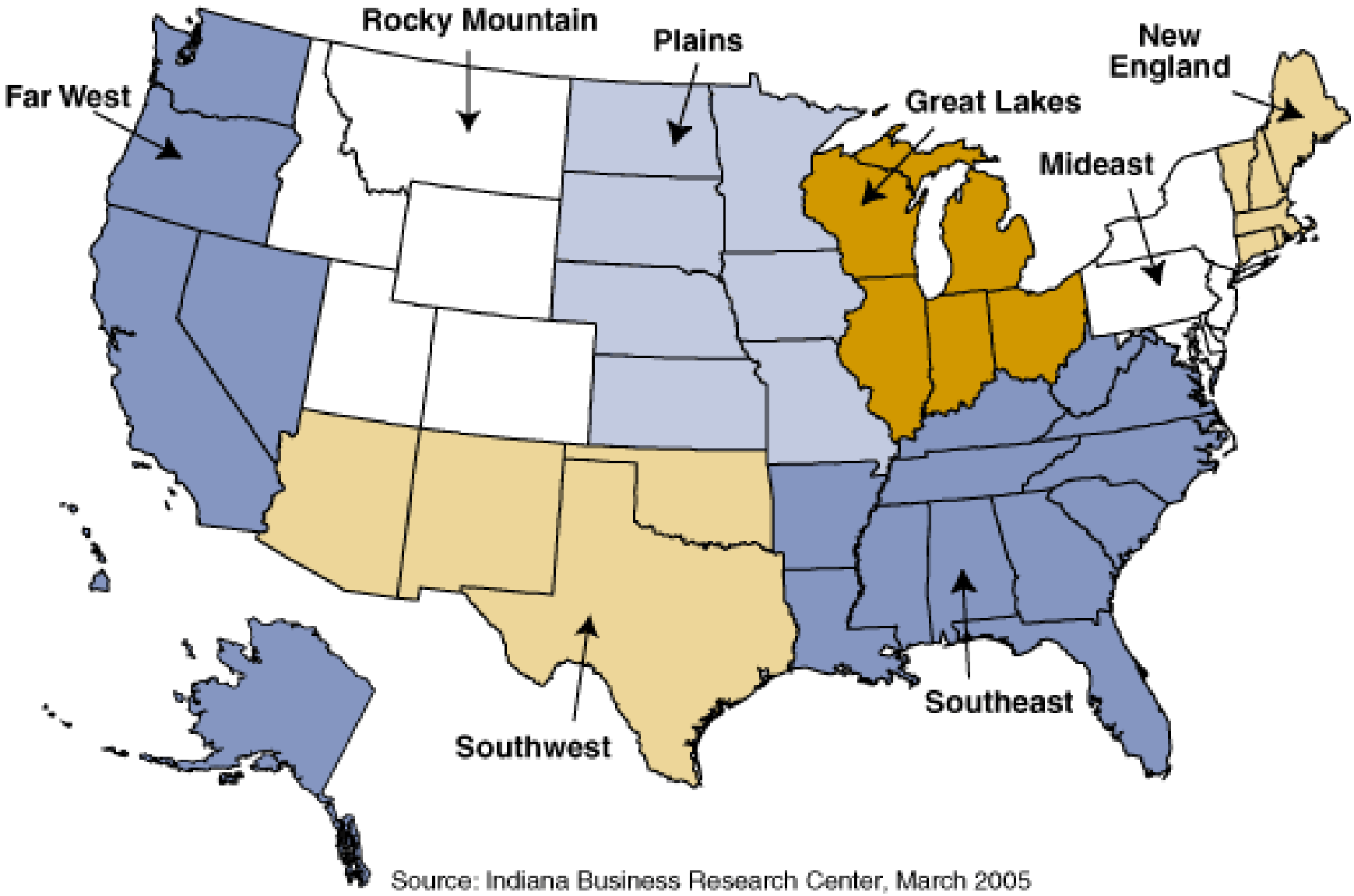
Figure 77: U.S. Bureau of Economic Analysis Regions



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The states within each defined BEA Region are shown below.

New England Region
- Connecticut
- Maine
- Massachusetts
- New Hampshire
- Rhode Island
- Vermont

Mideast Region
- Delaware
- District of Columbia
- Maryland
- New Jersey
- New York
- Pennsylvania

Great Lakes Region
- Illinois
- Indiana
- Michigan
- Ohio
- Wisconsin

Plains Region
- Iowa
- Kansas
- Minnesota
- Missouri
- Nebraska
- North Dakota
- South Dakota

Southeast Region
- Alabama
- Arkansas
- Florida
- Georgia
- Kentucky
- Louisiana
- Mississippi
- North Carolina
- South Carolina
- Tennessee
- West Virginia

Southwest Region
- Arizona
- New Mexico
- Oklahoma
- Texas

Rocky Mountain Region
- Colorado
- Idaho
- Montana
- Utah
- Wyoming

Far West Region
- Alaska
- California
- Hawaii
- Nevada
- Oregon
- Washington

Overall, the largest share of the impact of grain, soybeans and products on U.S. earnings, employment and value-added occurs in the Plains region, where the farm commodities are produced. The proximity to the farms where these inputs are produced, the Plains region also has a large concentration of food processing, milling and food manufacturing. However, the greatest impact on industry output is in the Great Lakes region. This is largely attributable to the concentration of food manufacturers, in the Great Lakes region, as well as the fact that the Great Lakes states are second only to the Plains in their level of grain and soybean farming and production activity. The Southeast is another major region with a significant

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dependence on grain and soybean commodities and products, accounting for approximately one-fifth of the U.S. output that is dependent on these commodities.

The Southwest, Mideast, Rocky Mountain and New England regions account for significantly smaller shares of grain and soybean dependent output, largely because of the lower concentration of farming and related activity in these regions in comparison with the others.

The overall impact of grain and soybeans related output on earnings, output and employment by U.S. BEA region is shown Table 27. The top 10 industries, by BEA region that are dependent on grain and soybean supply chains are shown in Table 28 through Table 35.

Table 27: Annual Economic Dependence on Soybean, Grain and Products by Bureau of Economic Analysis Region

U.S. Bureau of Economic Analysis Region	Earnings ($ millions)	Output ($ millions)	Employment	Value-Added ($ millions)
Great Lakes	$10,121	$98,837	350,449	$19,581
Plains	$16,624	$93,435	362,388	$25,977
Southeast	$7,715	$71,464	319,629	$12,857
Far West	$2,280	$30,280	104,796	$5,471
Southwest	$1,719	$23,785	141,958	$3,914
Mideast	$1,925	$20,413	100,963	$3,941
Rocky Mountains	$1,060	$11,030	63,307	$2,486
New England	$263	$3,207	11,927	$560
Total Economic Dependence	**$41,706**	**$352,451**	**1,455,416**	**$74,786**

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Table 28: Mideast Bureau of Economic Analysis Region Dependence on Soybean and Grain Supply Chains

Top 10 Industries Dependent on Soybeans, Grains and Related Products in 2009				
U.S. Industry	**Earnings ($ millions)**	**Output ($ millions)**	**Employment**	**Value-Added ($ millions)**
Other animal food manufacturing	$181	$3,557	3,156	$380
Dairy cattle and milk production	$264	$3,372	36,314	$731
Cookie, cracker, and pasta manufacturing	$404	$3,272	7,847	$735
Poultry and egg production	$346	$2,456	5,769	$427
Fats and oils refining and blending	$51	$1,722	750	$167
Flour milling and malt manufacturing	$111	$1,679	1,365	$219
Grain farming	$203	$1,169	31,106	$459
Breakfast cereal manufacturing	$64	$626	688	$226
Soybean and other oilseed processing	$6	$553	121	$15
Oilseed farming	$93	$539	8,834	$254
All Other Industries	*$201*	*$1,467*	*5,014*	*$327*
Total Economic Dependence	**$1,925**	**$20,413**	**100,963**	**$3,941**

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Table 29: Southeast Bureau of Economic Analysis Region Dependence on Soybean and Grain Supply Chains

Top 10 Industries Dependent on Soybeans, Grains and Related Products in 2009				
U.S. Industry	**Earnings ($ millions)**	**Output ($millions)**	**Employment**	**Value-Added ($ millions)**
Poultry and egg production	$2,825	$19,733	52,988	$3,320
Soybean and other oilseed processing	$179	$10,528	2,264	$427
Other animal food manufacturing	$388	$8,104	7,245	$814
Cookie, cracker, and pasta manufacturing	$827	$5,987	13,785	$1,505
Flour milling and malt manufacturing	$257	$5,358	4,547	$508
Grain farming	$1,205	$5,169	123,810	$2,131
Oilseed farming	$1,107	$4,506	77,020	$2,073
Fats and oils refining and blending	$114	$4,104	1,802	$372
Dairy cattle and milk production	$64	$1,450	15,896	$310
Poultry processing	$219	$1,437	6,568	$242
All Other Industries	*$528*	*$5,089*	*13,704*	*$1,155*
Total Economic Dependence	**$7,715**	**$71,464**	**319,629**	**$12,857**

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Table 30: Plains Bureau of Economic Analysis Region Dependence on Soybean and Grain Supply Chains

Top 10 Industries Dependent on Soybeans, Grains and Related Products in 2009				
U.S. Industry	**Earnings ($ millions)**	**Output ($ millions)**	**Employment**	**Value-Added ($ millions)**
Grain farming	$8,408	$28,971	223,653	$12,534
Oilseed farming	$5,370	$15,876	90,169	$7,144
Soybean and other oilseed processing	$183	$12,048	2,604	$436
Wet corn milling	$333	$7,830	3,896	$691
Other animal food manufacturing	$437	$7,644	6,675	$917
Breakfast cereal manufacturing	$380	$3,937	4,518	$1,354
Flour milling and malt manufacturing	$208	$3,462	2,856	$410
Poultry and egg production	$529	$3,360	4,126	$553
Fats and oils refining and blending	$77	$2,807	1,233	$252
Dairy cattle and milk production	$124	$2,784	8,932	$602
All Other Industries	*$575*	*$4,715*	*13,725*	*$1,084*
Total Economic Dependence	**$16,624**	**$93,435**	**362,388**	**$25,977**

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Table 31: Far West Bureau of Economic Analysis Region Dependence on Soybean and Grain Supply Chains

Top 10 Industries Dependent on Soybeans, Grains and Related Products in 2009				
U.S. Industry	**Earnings ($ millions)**	**Output ($ millions)**	**Employment**	**Value-Added ($ millions)**
Dairy cattle and milk production	$296	$5,598	30,913	$1,214
Other animal food manufacturing	$240	$4,497	3,963	$505
Soybean and other oilseed processing	$52	$3,616	783	$125
Flour milling and malt manufacturing	$156	$2,939	2,464	$308
Cookie, cracker, and pasta manufacturing	$374	$2,860	6,720	$682
Grain farming	$253	$2,276	42,167	$846
Fats and oils refining and blending	$54	$1,820	792	$177
Poultry and egg production	$177	$1,571	2,485	$288
Tortilla manufacturing	$301	$1,427	6,852	$433
Breakfast cereal manufacturing	$125	$1,334	1,570	$445
All Other Industries	*$251*	*$2,343*	*6,085*	*$446*
Total Economic Dependence	**$2,280**	**$30,280**	**104,796**	**$5,471**

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Table 32: Great Lakes Bureau of Economic Analysis Region Dependence on Soybean and Grain Supply Chains

Top 10 Industries Dependent on Soybeans, Grains and Related Products in 2009				
U.S. Industry	**Earnings ($ millions)**	**Output ($ millions)**	**Employment**	**Value-Added ($ millions)**
Soybean and other oilseed processing	$585	$33,319	7,156	$1,395
Grain farming	$3,692	$15,426	177,909	$6,400
Oilseed farming	$2,514	$9,860	77,423	$4,538
Wet corn milling	$363	$6,574	3,170	$756
Other animal food manufacturing	$338	$6,420	5,671	$710
Cookie, cracker, and pasta manufacturing	$807	$6,149	14,441	$1,467
Dairy cattle and milk production	$427	$5,763	42,686	$1,248
Breakfast cereal manufacturing	$426	$4,512	5,291	$1,512
Flour milling and malt manufacturing	$207	$3,698	3,081	$408
Fats and oils refining and blending	$70	$2,483	1,088	$229
All Other Industries	*$692*	*$4,633*	*12,534*	*$918*
Total Economic Dependence	**$10,121**	**$98,837**	**350,449**	**$19,581**

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Table 33: New England Bureau of Economic Analysis Region Dependence on Soybean and Grain Supply Chains

Top 10 Industries Dependent on Soybeans, Grains and Related Products in 2009				
U.S. Industry	**Earnings ($ millions)**	**Output ($ millions)**	**Employment**	**Value-Added ($ millions)**
Other animal food manufacturing	$30	$629	562	$64
Dairy cattle and milk production	$44	$554	7,257	$120
Cookie, cracker, and pasta manufacturing	$58	$438	1,028	$105
Breakfast cereal manufacturing	$26	$306	383	$94
Fats and oils refining and blending	$6	$255	114	$20
Flour milling and malt manufacturing	$14	$183	146	$27
Soybean and other oilseed processing	$2	$171	37	$5
Wet corn milling	$6	$160	81	$12
Poultry and egg production	$20	$152	546	$27
Bread and bakery product manufacturing	$27	$109	707	$32
All Other Industries	*$30*	*$250*	*1,066*	*$55*
Total Economic Dependence	**$263**	**$3,207**	**11,927**	**$560**

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Table 34: Southwest Bureau of Economic Analysis Region Dependence on Soybean and Grain Supply Chains

Top 10 Industries Dependent on Soybeans, Grains and Related Products in 2009				
U.S. Industry	**Earnings ($millions)**	**Output ($millions)**	**Employment**	**Value-Added ($millions)**
Other animal food manufacturing	$168	$3,860	3,488	$353
Soybean and other oilseed processing	$45	$3,483	757	$108
Flour milling and malt manufacturing	$174	$3,412	2,875	$344
Dairy cattle and milk production	$136	$2,763	23,778	$598
Grain farming	$353	$2,760	83,172	$1,044
Poultry and egg production	$323	$2,760	9,028	$499
Cookie, cracker, and pasta manufacturing	$145	$1,177	2,826	$264
Fats and oils refining and blending	$27	$868	375	$90
Tortilla manufacturing	$136	$868	4,704	$196
Animal (except poultry) slaughtering, rendering, and processing	$28	$298	663	$32
All Other Industries	*$185*	*$1,536*	*10,293*	*$386*
Total Economic Dependence	**$1,719**	**$23,785**	**141,958**	**$3,914**

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Table 35: Rocky Mountain Bureau of Economic Analysis Region Dependence on Soybean and Grain Supply Chains

Top 10 Industries Dependent on Soybeans, Grains and Related Products in 2009				
U.S. Industry	**Earnings ($millions)**	**Output ($millions)**	**Employment**	**Value-Added ($millions)**
Grain farming	$500	$3,056	43,438	$1,192
Dairy cattle and milk production	$118	$2,058	10,112	$446
Other animal food manufacturing	$83	$1,693	1,509	$174
Flour milling and malt manufacturing	$58	$1,005	834	$115
Cookie, cracker, and pasta manufacturing	$96	$875	2,180	$174
Animal (except poultry) slaughtering, rendering, and processing	$60	$690	1,547	$68
Soybean and other oilseed processing	$6	$373	81	$13
Breakfast cereal manufacturing	$19	$241	319	$68
Poultry and egg production	$21	$194	349	$35
Tortilla manufacturing	$27	$139	702	$38
All Other Industries	*$72*	*$707*	*2,238*	*$163*
Total Economic Dependence	**$1,060**	**$11,030**	**63,307**	**$2,486**

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2. Economic Impact of Investing in Improved Transportation

As described in Table 25, infrastructure projects have been identified that can significantly reduce the costs of delivering soybean and grain commodities to U.S. industries or market position. It is expected that a significant share of the transportation cost savings will be passed along to U.S. firms using soybeans and grain commodities as inputs to production. In essence, the transportation cost savings will enable industry manufactures and farmers that use these inputs to be more productive and competitive both domestically and globally. Improved competitiveness will allow the world market to support additional U.S. output in the form of exports. Cost savings to soybean and grain users are most likely to be derived from:

(1) Improved reliability in the delivery time of soybeans and grains
(2) Reduced travel time and transit costs
(3) Improved efficiency at ports for using larger, more efficient ocean going vessels
(4) Potential re-assignment of rail traffic to barge traffic for freight currently utilizing rail to avoid deficiencies at key lock and dam facilities

The value of these direct savings by U.S. industries is estimated based on assumed shipping rates by different modes of transportation, and the value of reliability. The commodity mix of any given improvement is determined based on Corps data about the commodity mix at the facility to be improved, with the geographic distribution of savings assumed to reflect the locations where the commodities using the project are consumed. It is also assumed that for exports, some of the savings created by U.S. infrastructure investment will have positive impacts on buyers as well. The outlays in transportation infrastructure construction or new transportation services, by U.S. BEA region, enabled by the investments described in Table 25 are shown in Table 36. These outlays reflect annual investments (over a 5 year time period for locks and annually for dredging requirements) in the transportation system that is not currently funded (according to discussions with representatives of the Corps and stakeholders) and hence the impacts shown in this analysis explore the potential impact if all the projects in Table 25 were fully funded, beginning with the stimulus of the added transportation outlays, followed by discussion of the supply chain impacts. With the improved performance and reliability of locks and navigation channels at ports (and because water is an important mode of transport for grain and soybeans), Table 36 also shows the likely stimulus in annual water transportation output associated with tonnage currently diverting to rail to avoid deficiencies being attracted back to water as a mode. The cost savings to shipping industries in each U.S. BEA region that are expected to result from the improved transportation performance that would result from making the outlays shown in Table 37.

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Table 36: Annual Increased Outlays on Transportation Infrastructure or Services Associated with Enhanced Transportation of Soybean, Grain and Products

Bureau of Economic Analysis Region	Annual Construction Outlays ($ millions)		$ of Additional Annual Output from Water Transportation Sector
	Lock and Dam	Dredging	
Far West	N/A	N/A	N/A
Great Lakes	$178.05	N/A	N/A
Plains	$145.31	N/A	N/A
Mideast	N/A	N/A	N/A
Southeast	N/A	$105.03	$15,386,822
Southwest	N/A	$38.85	$27,926,203
Total	**$323.37**	**$143.87**	**$43,313,025**

Table 37: Annual Cost Savings by Bureau of Economic Analysis Region Associated with Enhanced Transportation of Soybean, Grain and Products

Bureau of Economic Analysis Region	Cost Savings
Far West	N/A
Great Lakes	$1,400,322
Mideast	$66,617
New England	N/A
Plains	$229,109
Rocky Mountains	N/A
Southeast	$135,040,056
Southwest	$9,163,914
Total Cost Savings	**$145,900,019**

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These savings (in addition to the direct, indirect, and induced impact of the construction itself and the increase in barge transportation) form the basis of the economic impact on each industry and in each region of the U.S. in the more comprehensive economic impact analysis. When all of these factors are considered, the transportation improvements described in Table 25 combined with the impacts of the costs savings (Table 37) are expected to result in an average annual impact of over 8,113 jobs, over $409 million in personal income, over $1.2 billion in output and over $630 million in value-added in the U.S. economy. Most of this impact is expected to result directly from the enhanced attractiveness in water transportation as a mode of transportation (and increased productivity and outlays in the water transport industry), and from the direct outlays in the maintenance and repair of infrastructure. Other impacts stem largely from industries supplying these providers, (such as fuel providers, landlords or insurance carriers). Still other impacts will be "permanent" impacts in the economy related to improved efficiency in grain and soybean supply chains. Because the supply chain impacts are unlikely to accrue until the construction outlays (and associated shifts in output from transportation services) have begun, it is helpful to report the overall impacts in terms of:

- Impacts due to construction or increased productivity of transportation sectors (Transportation Outlay Effects)
- Impacts due to savings in grain and soybean commodities passed down the supply chain (Supply Chain Effects).

f) Transportation Outlay Effects

As shown in Table 36, removing major bottlenecks in the movement of grain, soybeans and products in the United States would involve $467.2 million of construction outlays on an annual average (over a 5 year construction period for locks and over a 10 year period for dredging) in the U.S. economy, and would be expected to increase the output of water transportation by approximately $43.3 million annually (due to some diversion from rail induced by improved reliability, enabling the rail mode to be used more efficiently as well). Overall, both the stimulus in output from the water transport industry and the stimulus in construction output will have a positive impact on output, earnings, employment and value-added on all of the regions where the projects are implemented (or where the relevant water carriers are based).

The transportation outlay effects of the suggested transportation improvements are expected to result in approximately 7,927 jobs and $400.8 million in personal income, as well as over $1.17 billion in additional output and over $615.1 million in value-added on the U.S. economy through the course of the construction period. (Of these, the impacts associated with increased output from the water transportation industry itself will continue to occur after the construction period is over.) The annual transportation outlay effects (by industry) associated with increased investment in infrastructure and enhanced markets for water transportation resulting from the outlays are shown in Table 38.

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Table 38: Annual National Impact of Outlays Made to Improve Transport of Soybeans, Grain and Products

Top 10 U.S. Industries Affected by Cost Savings in the Movement of Soybeans, Grain and Related Products				
U.S. Industry	**Earnings**	**Output**	**Employment**	**Value-Added**
Maintenance and repair construction of nonresidential structures	$124,273,688	$284,325,146	2,554	$146,392,661
Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$43,303,079	$114,324,647	714	$63,757,336
Wholesale trade businesses	$13,592,470	$33,114,544	178	$23,384,574
Imputed rental activity for owner-occupied dwellings	$0	$32,559,237	-	$23,787,335
Real estate establishments	$3,177,090	$32,378,533	226	$23,750,527
Transport by water	$5,834,903	$31,122,335	58	$11,187,383
Petroleum refineries	$832,173	$25,993,335	3	$4,743,339
Architectural, engineering, and related services	$13,691,928	$24,607,766	189	$14,463,324
Support activities for other mining	$2,522,934	$18,907,215	34	$4,973,977
Monetary authorities and depository credit intermediation activities	$3,962,906	$15,806,171	58	$8,266,017
All Other Industries	$189,624,915	$563,336,049	3,913	$290,471,476
TOTAL IMPACT OF TRANSPORTATION OUTLAYS	**$400,816,086**	**$1,176,474,978**	**7,927**	**$615,177,949**

The transportation outlay effects will naturally be concentrated in the regions where the construction outlays, operation and maintenance outlays and outlays in transportation services are realized as revenue by firms providing these services. When assessing the regional impacts of a national schedule of improvements, the majority of impacts can be readily assigned to a BEA region based on where the outlays occur. However in some cases, in addition to the regional impacts, there is some inter-regional, impact. The inter-regional impact is attributable to "leakage" occurring between regions, where an outlay is made in one region, and the inputs needed to facilitate that outlay are acquired from somewhere in the United States, but the region where the inputs originate is not within the resolution of the current model. For example, if a lock and dam is built in Missouri, clearly the direct outlays for that lock and dam will occur in Missouri; however some materials and other inputs of production are likely to be procured from other states, causing an inter-regional impact in addition to the impact on the plains region where the outlay occurs. Consequently the regional analysis covers the impact of outlays on each BEA region, and also accounts for inter-regional impacts within the United States as well.

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The largest share (40%) of new economic output associated with transportation outlays is expected in the Great Lakes Region where most of the lock and dam projects are located.

The South East and Plains regions will also have significant shares of the transportation output related impact each with 25% of output accruing in each of those regions, respectively. It is also notable that a quarter (25%) of the output is expected to be inter-regional in nature, indicating that the output associated with building infrastructure for improved grain and soybean movements are likely to spread throughout the U.S., with effects beyond the regions where the initial outlays occur. The New England, Rocky Mountain and Far West BEA regions are far enough away from the improvements that they are not likely to experience significant impacts from the increases in transportation outlays aside from the inter-regional impacts. The overall impact on U.S. earnings, output and employment by U.S. region stemming from the infrastructure outlays and stimulated water transportation services as described in Table 25 are shown in Table 39.

Table 39: Annual Regional Impact of Outlays Made to Improve Transport of Soybeans, Grain and Products

Bureau of Economic Analysis Region	Earnings	Output	Employment	Value-Added
Mideast Region	$0	$0	-	$0
Southeast Region	$72,720,616	$221,635,165	1,321	$118,218,824
Plains Region	$85,792,202	$221,771,610	1,899	$118,839,969
Far West	$0	$0	-	$0
Great Lakes Region	$134,572,042	$351,579,918	2,787	$190,832,503
New England Region	$0	$0	-	$0
Southwest Region	$27,815,101	$90,520,114	527	$46,675,165
Rocky Mountains Region	$0	$0	-	$0
TOTAL IMPACT OF OUTLAYS	$320,899,961	$885,506,807	6,535	$474,566,461
TOTAL IMPACT INER-REGIONAL	$79,916,125	$290,968,171	1,393	$140,611,488
Total	**$400,816,086**	**$1,176,474,978**	**7,927**	**$615,177,949**

g) Supply Chain Effects

As indicated in Section 1., grain and soybean products are at the top of significant supply chains in the U.S. economy, with many industries fully or partially dependent on these commodities and their products to produce output. While for most of these supply chains, the first entity receiving and using grain or soybeans as an input to production would be

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assumed to bear the cost of transporting the commodities to the location where they are first used are assumed to receive some measure of benefit due to reduced transportation costs. Since farmers of grains and soybeans often use their output production also as inputs, they also benefit from these supply chain efficiencies. Farmers will also benefit from more favorable access to the market, which provides additional support to farm output and will be made possible by the efficiencies acquired through investment in the supply chain. These "first order" consumers or first entity of the commodities may then pass these transport costs or savings down the supply chain in the prices of the products they make with the grain or soybean inputs.

The transportation savings shown in Table 37 are expected to accrue to these first order consumers (including farmers and grain and soybean receivers) due to the transportation investments described and shown in Table 25. These savings are expected to be passed through the economy to second and third order consumers of grain, soybeans and products, making the industries consuming these commodities more productive, and in some cases enabling them to expand their markets because they are now more competitively priced in comparison to substitute alternatives in terms of final demand. The national impact, by industry of the supply chain effects of savings that can be achieved in the soybean and grain supply chains is shown in Table 40 if $467.2 million is invested in the improvement of infrastructure (as described in Table 25 and Table 36), for the movement of these commodities.

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Table 40: Annual National Impact of Supply Chain Savings for Transportation Improvements Relating to Soybeans, Grain and Products

Top 10 U.S. Industries Affected by Cost Savings in 2020				
U.S. Industry	**Earnings**	**Output**	**Employment**	**Value-Added**
Soybean and other oilseed processing	$51,717	$2,684,173	1	$123,440
Wholesale trade businesses	$783,476	$1,910,828	10	$1,349,085
Soft drink and ice manufacturing	$176,700	$1,794,588	3	$227,116
Fats and oils refining and blending	$48,793	$1,465,017	1	$159,019
Other animal food manufacturing	$60,883	$1,089,528	1	$127,691
Bread and bakery product manufacturing	$300,909	$1,068,855	6	$361,171
Tortilla manufacturing	$209,600	$1,050,642	5	$301,239
Management of companies and enterprises	$471,066	$935,028	4	$573,872
Non-chocolate confectionery manufacturing	$131,426	$859,154	2	$206,913
Real estate establishments	$63,392	$646,367	4	$474,122
All Other Industries	$6,600,491	$26,810,008	148	$11,631,362
TOTAL IMPACTS	**$8,898,453**	**$40,314,188**	**185**	**$15,535,030**

The results shown in Table 40 indicate that approximately 185 jobs can be created by the supply chain efficiencies associated with reduced cost in transporting soybeans, grains and products, with over $8.8 million in annual earnings, over $40 million in output and over $15.5 million in value-added on the national economy. From the table it is evident that the first order users and wholesalers of the commodities are expected to experience the greatest enhancement in output due to the transportation savings, however downstream manufacturers of foods such as soft drinks, tortillas, animal food, and bread and bakery product manufacturers can also be significantly more productive and create additional value, jobs and earnings due to the improved transportation of soybeans and grains.

As with the analysis of transportation outlays, the impact of supply chain savings begin in the region where the saving accrues (where the benefiting commodity or its products down the supply chain are consumed). However, as with transportation outlays – supply chain savings have considerable inter-regional impacts as well. For supply chain savings, the inter-regional impact is attributable to "leakage" occurring between regions, where a productivity increase in one region stimulates the demand for inputs from another region somewhere in the United States, but the region where the "inter-regional" impact accrues is not within the resolution of the current model. For example, if a tortilla plant in Texas is

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able to apply transportation savings from more efficient corn delivery to re-tool a plant, clearly the enhanced output from the factory occurs in Texas, but also materials and supplies purchased from outside of Texas for the re-tooling will also accrue somewhere in the U.S. economy, causing an inter-regional impact in addition to the impact in Texas. Consequently the regional analysis covers the impact of outlays on each BEA region, and also accounts for inter-regional impacts within the United States as well.

The Southeast region of the U.S. accrues most of the impact on economic output from cost savings associated with improved movement of grain and soybeans. This is largely due to the role of the Mississippi River System and the export elevators downriver from Baton Rouge, Louisiana (where most of the dredging improvement opportunities shown in Table 25 are located) in directly supplying manufacturers in the Southeast, as well as the commodity mix affected by the current deficiencies. Overall, more than 58% of the output enabled by savings in the transport of soybeans and grain will be realized in the Southeast, with more than 55% of the employment, 53% of the earnings and 53% of the value-added from these savings accruing in the Southeast region. This impact on the Southeast region is very dispersed among industries, with the ten most affected industries accounting for less than half of the overall impact. Some of the most affected industries in the Southeast include soft drink manufacturers, fat and oil refining and blending establishments, soybean and oilseed processing firms and animal food manufacturing establishments.

Because soybeans and grain spread so far into the U.S. supply chains, the inter-regional impacts account for a significant share of earnings (43%), output (38%), employment (41%) and value-added (43%). This indicates that the economic impact of savings on the movement of soybeans, grain and products spreads broadly throughout the economy in many inter-state and inter-regional transactions and is likely to have impacts far beyond those locations that directly consume or use the commodities to which the cost savings apply.

The Southwest is another region in the U.S. accruing potential transportation savings on grain and soybeans. While only 3% to 4% of all of the output, earnings, employment, personal income and value-added attributable to cost savings that could be realized by more efficient movement of grain and soybean commodities occurs in this region, the impact in the Southwest is more concentrated among industries. Eleven percent of the impact on output in the Southwest region's economy will occur in the manufacture of tortillas, and another 11% in bread and bakery products. Other significantly affected industries include wholesale trade, the manufacture of soft drinks and animal processing.

Impacts on the Mideast, Plains and Great Lakes regions are disbursed, with none of those regions experiencing more than 1% of the national impact, and impacts on New England and the Rocky Mountain regions are expected to be too small to quantify. However it should be noted that the significant inter-regional impact described above could occur within

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these regions. This is largely because these regions tend to consume grain and soybeans further down the supply chain, where the cost savings of enhanced transportation of the raw commodities are more disbursed – and also because they are further removed from the locations of the most significant transportation needs (which tend to be concentrated on the Mississippi River System and the Center Gulf ports, and accrue among first order manufacturers who locate near these systems). A summary of the supply-chain savings impacts by BEA region that may be passed down the grain and soybean supply chains if the transportation improvements described in Table 25 are implemented are shown in Table 41.

Table 41: Annual Regional and Inter-Regional Impacts of Supply Chain Savings Resulting from Improved Transportation of Soybeans, Grain and Products

Bureau of Economic Analysis Region	Earnings	Output	Employment	Value-Added
Mideast Region	$1,208	$5,191	0	$2,030
Southeast Region	$4,714,425	$23,391,369	103	$8,263,553
Plains Region	$4,917	$22,376	0	$8,256
Far West	$0	$0	0	$0
Great Lakes Region	$38,789	$170,989	1	$64,732
New England Region	$0	$0	0	$0
Southwest Region	$283,519	$1,273,272	7	$470,224
Rocky Mountains Region	$ 0	$ 0	0	$ 0
TOTAL IMPACT OF OUTLAYS	**$5,042,858**	**$24,863,197**	**110**	**$8,808,795**
TOTAL IMPACT INTER-REGIONAL	**$3,855,595**	**$15,450,991**	**75**	**$6,726,235**
Total	**$8,898,453**	**$40,314,188**	**185**	**$15,535,030**

A summary of the transportation investment implications as evaluated through economic input-output modeling are then presented in Table 42.

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Table 42: Annual Summary of Transportation Investment Outlays and Returns for the Soybeans, Grain and Products Industries

Description	Impact Type	Dollar Value	Economic Impact			
			Earnings	Output	Employment	Value-Added
Infrastructure Outlays	Construction	$467,200,000	$400,816,086	$1,176,474,978	7,927	$615,177,949
Supply Chain Impacts	Cost Savings	$145,900,019	$8,898,453	$40,314,188	185	$15,535,030

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VII. Infrastructure Enhancements among International Competitors

The transportation infrastructure of a country has a great impact on the country's economy, determining production decisions, trade, and who can or cannot operate within the economy.[6] In South America, infrastructure improvements provide the most potential for fostering economic growth and development in the country. However, more effort has been focused on land expansion rather than infrastructure that includes highways and storage capabilities. Both Brazil and Argentina are expected to increase their soybean production by 25% and 27%, respectively, from 2011 levels as shown in Figure 78. Brazil and Argentina will simultaneously increase whole soybean exports throughout the forecast period. In Brazil, soybean meal and soybean oil exports will remain relatively stable given Brazil exports a higher proportion of whole soybeans. Because of Argentina's tax on whole soybeans, it will continue to expand its soybean meal and soybean oil exports while whole soybean exports will grow at a slower pace. Since Brazil and Argentina rely heavily upon roadways for transport of agricultural goods, both domestically and internationally, the challenge for the future will be finding ways through infrastructure enhancements to accommodate growth in both production and exports.

Further, the market conditions for soybean meal and soybean oil are considered factors in the Brazil and Argentina markets. The excess of soybean oil in the market has accumulated from the respective volumes of Brazilian and Argentinian soybean crush. While the current regional market for biodiesel has developed from a B5 formulation, the excess of oil availability leads to expectations that B7 can be expected to be the market standard in the near future, and in the foreseeable future, even B10 is foreseen to become the norm, to utilize the greater volume of the co-product resulting from the soybean crush to generate a demand for the excess supply. Likewise, according to USDA data, in Brazil the soybean meal production has grown significantly. However, the rates of change exhibit a high degree of volatility. The year-on-year soybean meal production, in Brazil particularly, have risen and fallen over the past decade. The rate of change increased by 10.5% in 2002 and 10.0% in 2006 compared to declines of 3.6% in 2005 from the previous year, and a lesser decline of 0.8% in 2008. With such volatility, forecasts for meal production remain unclear, as export markets for soybeans, satisfying international demand appear to be paramount, relative to serving national livestock demand for soybean meal production as locally sourced feed. Moreover, soybean meal exports are expected to decline and be used to fulfill livestock feeding demand within Brazil.

In addition to transportation infrastructure constraints, Brazil and Argentina also face constraints with respect to storage infrastructure. In Brazil, production growth is hindered in Mato Grosso by the lack of storage facilities available to store expanding grain production. Additional storage facilities are slowly being added throughout production regions while

[6] Brazil Country Management Unit. (2008). "Evaluating the Macroeconomic and Distributional Impacts of Lowering Transportation Costs."

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Brazil's government offers low interest loans for the construction of additional storage facilities. The creation of storage in South America provides farmers options by allowing them to store products until after the harvest season, where prices are typically low while transportation costs remain high. However, data and information on storage capacity in South America is limited.

A. Brazil and Argentina Soybean Supply and Demand Outlook

Informa expects Brazil will continue to increase soybean production to meet the growing Chinese usage. The increasing exports are limiting supplies for the domestic market. Brazil's growing poultry market is increasing soybean meal usage and in turn, decreasing net exports as shown in Figure 78.

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Figure 78: Brazil Soybean Production and Net Trade

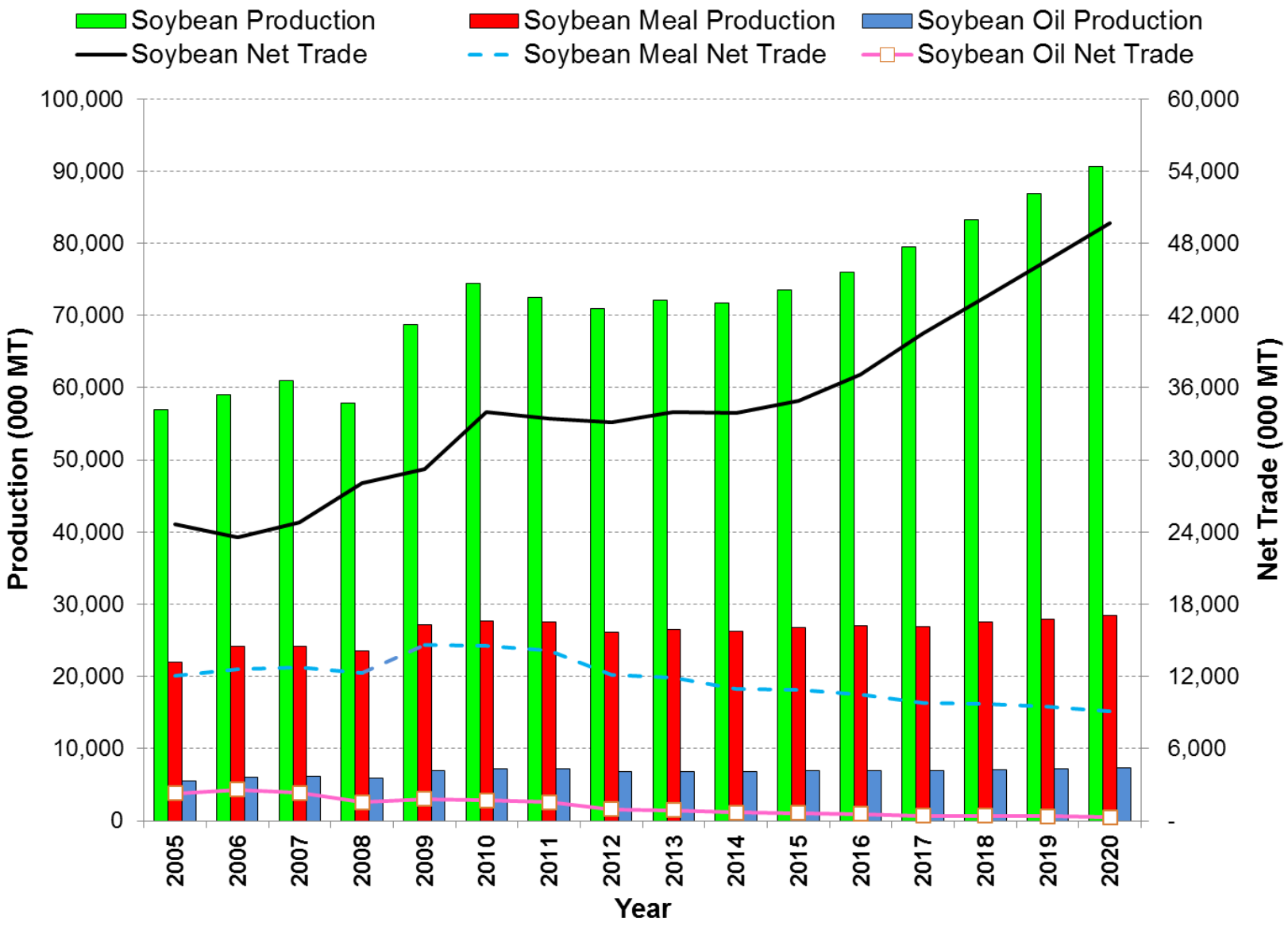

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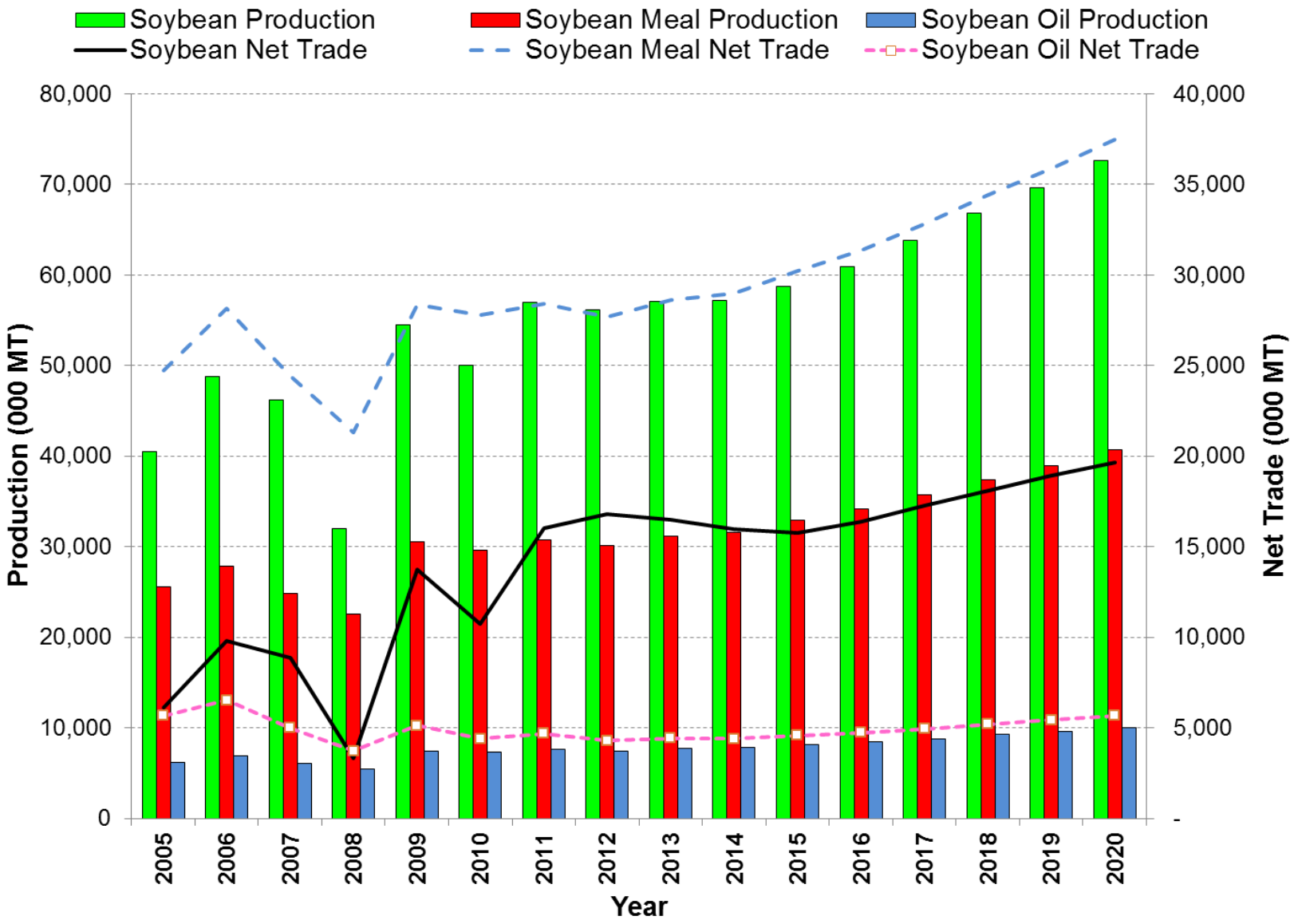
Figure 79: Argentina Soybean Production and Net Trade



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B. Impact of Infrastructure Enhancements

Transporting goods via a port system automatically adds an additional cost component that is not realized when transporting by truck or rail

The initial costs associated with transporting goods within a country, the inland costs, as shown in Figure 80. The cost function also shows the costs incurred in getting the good from its previous transportation mode, to a ship for export (international costs).

The effect of additional costs incurred by adding a port movement to the transportation mix is illustrated in Figure 81. One component that the previous diagram leaves out is inland congestion associated with port traffic. Congestion can result because of 1) improvements in other transportation modes allowing transportation costs to the port to decrease, or 2) improved efficiency at the port which also reduce transportation costs at and from the port, or both. The congestion associated with port traffic is described as a "self-loop" as shown in Figure 81. Actual dollar figures are not available as the graphic characterizes these principles. That which prompts the function of export cost for a domestically produced good was represented by analysis conducted through the World Bank, whose depiction is used here. It was not accompanied by any particular commodity reference, cost data, period or range of destinations. The figures are associated with one another, further defining the inland nodes and international flows in complementary pictorial formats.

In this case, the self-loop represents both the transportation costs associated with transferring goods from one mode of transportation to the other (i.e., truck to ship), as well as actual losses. These losses can occur as a result of the need to store goods, incurring losses, such as spoilage or depreciation.[7] However, while improving the inland road infrastructure to the port can increase truck velocity, the congestion problem is exacerbated at the port where wait times to unload increase if no improvements at the port are made. However, port improvements will allow the agriculture sector to increase their competitiveness globally. In addition, investments in ports will contribute to improving operating efficiency, as well as aiding the regions being serviced by the port.

[7] Brazil Country Management Unit. (2008). "Evaluating the Macroeconomic and Distributional Impacts of Lowering Transportation Costs."

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Figure 80: Cost Function for Export of a Domestically Produced Good

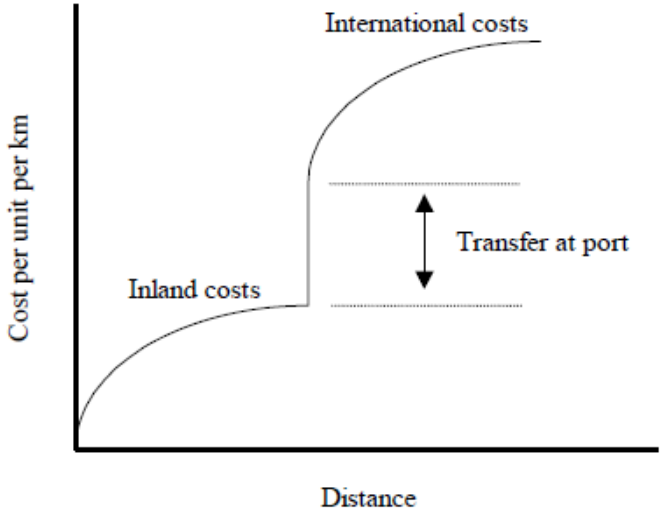
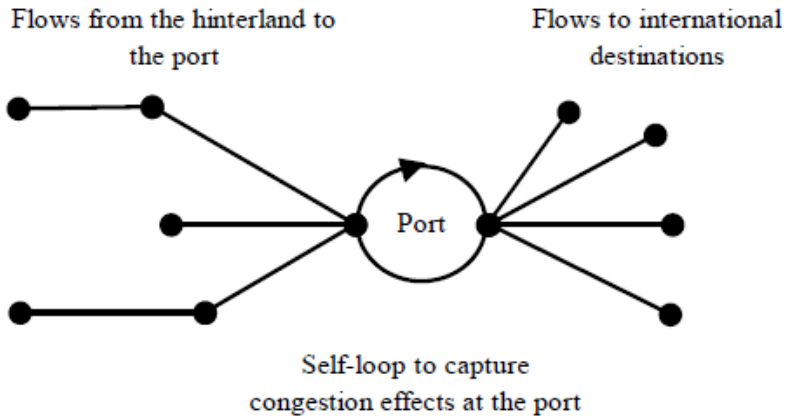


Figure 81: Stylized Representation of Link and Nodal Costs



Source: World Bank, Brazil Country Management Unit, PREM Sector Management Unit, 2008

C. Brazil Transportation and Infrastructure

In 2008, a survey revealed that the primary problem of Brazilian agribusinesses is related to transportation and infrastructure. This infrastructure includes nearly 1.8 million kilometers (km) of roads, of which only 196 thousand km are paved. The country also boasts approximately 43 thousand km of navigable waterways, and 29.5 thousand km of railroads. The country's existing infrastructure results from the importance of commodities, which include sugarcane and coffee.

The country's transport infrastructure has largely been developed by the public sector. By the 1980s it was clear that investments were lagging behind Brazil's economic growth rate, creating bottlenecks, which have grown substantially worse over the course of the recent export boom beginning during the early 2000s. In response to the initial lack of infrastructure, a privatization effort was commenced in the 1990s. As a result, much of the railway network, most ports

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and a significant portion of the highway system are now in private hands. In 2004, the center-left government of President Lula began to study a modified approach, based around the idea of public-private partnerships (PPPs).

Four significant projects, expected to attract some US$1.6 billion worth of investment, were assessed and are in various degrees of coming to fruition, namely: work on a northeast export corridor (to facilitate the export of soybeans and steel from the Port of Itaqui near São Luis in Maranhão state); the modernization of the Port of Santos; building a rail link around the city of São Paulo; and consolidating the Mercosur transport corridor (mainly highways linking Belo Horizonte, São Paulo, Rio de Janeiro and Florianópolis).[8] The key existing and future planned soybean routes to export position are shown in Figure 92.

Lack of adequate investment has prevented Brazil's infrastructure system, particularly waterways and railroads, from growing at a pace that matches both population and economic growth and has in turn created a system that is heavily dependent upon roadways. However, from 2005 to 2010, the modal split moving soybeans to market position has undergone a notable shift. Within the country, the transportation mix for soybeans to both domestic and export positions consists predominantly of highway modal transportation (53%); rail (36%) and water (11%) modal movements make up the remaining mix as reported by the National Association of Grain Exports (ANEC) in 2010. The share of Brazil's soybean movements to market position by highway dropped seven percentage points from 2005 while rail gained three points and barge four points. In the U.S., the modal mix for total soybean transport was nearly one-half by truck, 27% by rail and nearly one-forth by waterway as reported the USDA for 2010, with the truck share dropping eleven percentage points from 2005, rail increasing seven points and barge four points.

Brazil's modal shares moving soybeans are coming in closer alignment with the U.S. Such realignment would be expected to make Brazil's logistics more efficient move soybeans to export position. The comparison of Brazil's and the U.S. modal shares for 2005 and 2010 is shown in Figure 82. Modal share information for soybean movement to export position or domestic position in Brazil is not available. However, there is modal share information to market position for the U.S. as shown earlier in Figure 50. For soybean movement to export position in the U.S. the modal split is 44% by rail, 47% by barge and 8% by truck during 2010.

[8] Brazil Freight Transport Report, Business Monitor International Ltd., Q2/2010, Page 41

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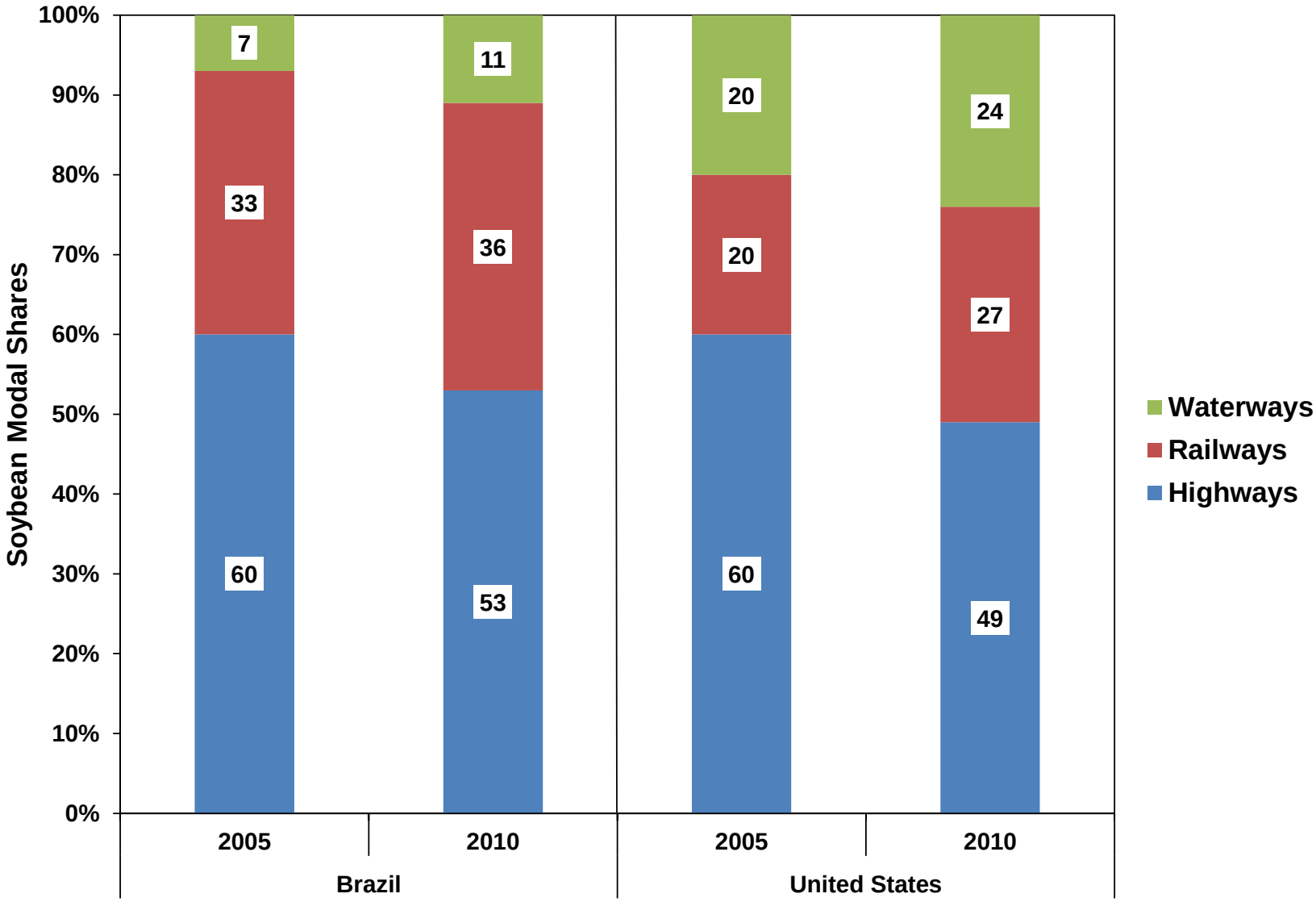
Figure 82: Brazil and United States Soybean Modal Shares to Domestic and Export Positions



Source: ANEC (Brazil) and USDA (United States)

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Brazil's crop storage capacity had been flat at close to 90 million metric tons from the mid-1990s to the early 2000s. As soybean production expanded in Brazil, storage requirements increased in a similar manner. In the most recent years corn production has increased putting further pressure on storage requirements. Since 2003 grain and soybean storage in Brazil has increased from 90 million metric tons to more than 140 million in 2012 as shown by region in Figure 83.

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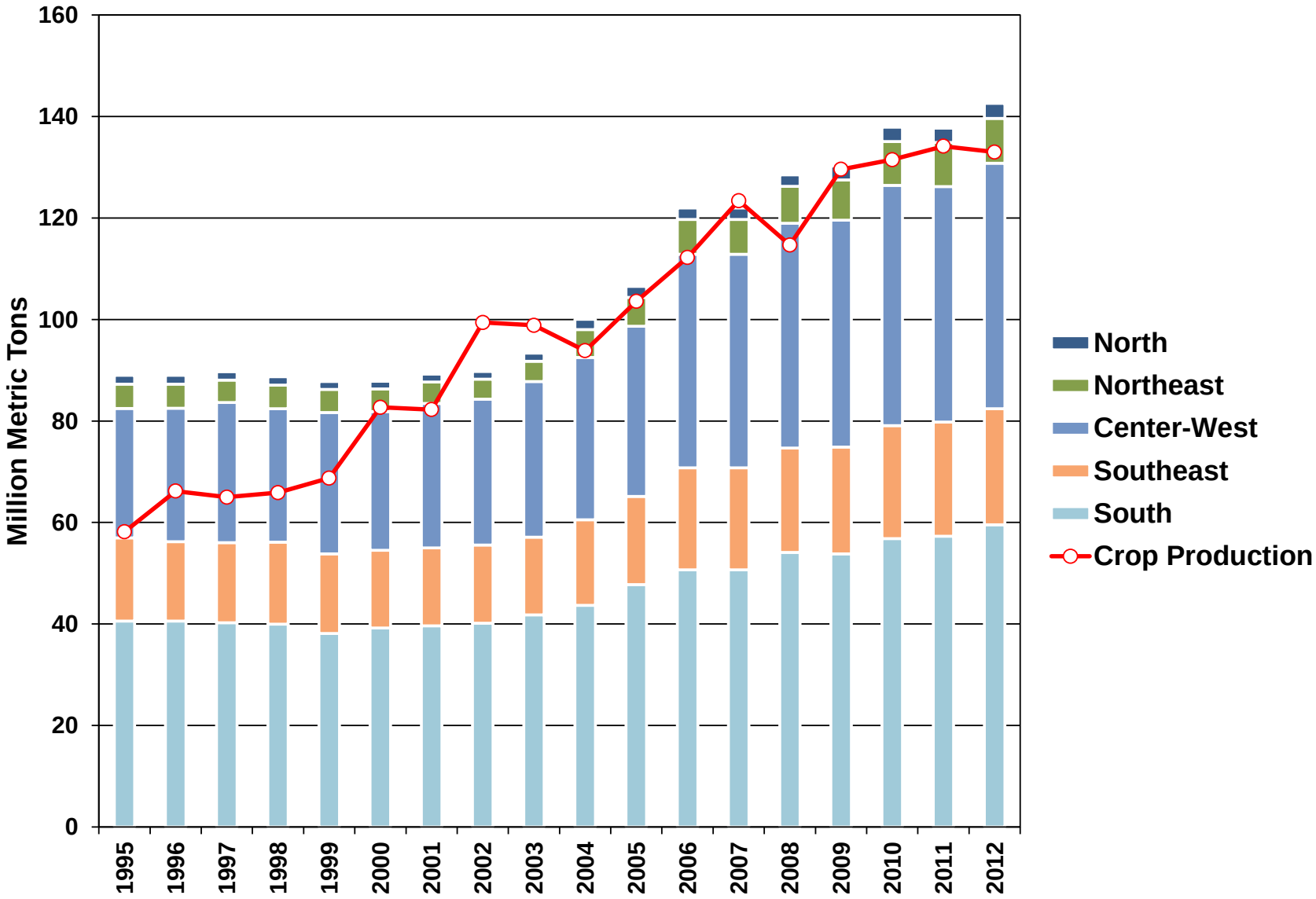
Figure 83: Brazil Grain Storage Capacity by Region



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Chinese Industrial Investments in Brazil

Investments into Brazil from China have skyrocketed. Merely at $400 million in 2009, going to US$17.4 billion in 2010[9], the level of cumulative foreign direct investment (FDI) from China to Brazil declined somewhat to an estimated US$12.67 billion for the annual period of 2011, according to Banco Bradesco SA, one of Brazil's biggest banks. In prior periods agriculture and mining as resource and commodity oriented sectors received around 20 per cent investment. It had been at Brazil's urging that Chinese companies recognized the needs and opportunities to invest in non-raw material sectors, in part as an effort to aid in balancing the Brazilian economy. Brazil has banned farming businesses established solely through foreign investment, instead seeking to encourage FDI, particularly from Chinese companies where there is cooperation with local commercial partners. Producing agricultural products such as soybean oil is truly a focus area for investment, taking Brazil on a path toward managing its own destiny. Historically, the minerals and mining extraction sectors attracted 53 percent of FDI between 2003 and the end of the third quarter of 2011. Another one quarter of the Chinese FDI was channeled especially into the energy sector. Agricultural production and processing, especially the soybean complex attracted 6% of China's flow of funds, while the automotive sector attracted another 4%. The two countries are both recognized among the few, relatively fast growing major economies across the globe. These two of the fast growing economies known as BRIC countries, rounded out by Russia and India, have recognized each other as key partners in their respective global growth strategies. Trade between Brazil and China, meanwhile increased significantly over the past decade. Chinese investment in 2011 was comprised of essentially four major investments, two of which have been reported in the USDA 2011 annual Brazil report. The others are reported to have been focused upon ports and infrastructure investment in the south. The China based State Development and Investment Corp. (SDIC) is planning a 2012 business development trip to Brazil, and one important industry sector they are going to be looking at has been declared to be centered on the production of biofuels.

Furthermore, last year, Chinese foreign direct investment projects in Brazil's soybean sector specifically was reportedly in amounts that totaled over $6 billion. These projects involved a soybean crushing plant, a fertilizer plant and a dry port in western Bahia state along with investments in technology, machinery, and infrastructure. The aim to double production in the state of Goias within seven years, served as the driver for much of the committed investments. Trade between the two surged by a multiple of 16 between 2001 and 2010.[10]

In recent years, funding towards roadways has received the most federal funds totaling US$4.83 billion in 2010 (see Table 43). However, while roadways receive the most funds only minor improvements are made towards roadways. These

[9] Brazil Ministry of Development, Industry & Trade as reported in http://tilt.ft.com/#!posts/2011-09/30246/brazils-official-tally-of-chinese-investment
[10] http://articles.economictimes.indiatimes.com/2011-07-05/news/29738779_1_brazil-accounts-chinese-investment-brazil-s-ministry

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improvements are not keeping pace with growth in the area resulting from increased production of crops. According to the National Confederation of Transport (CNT), 25% of Brazilian highways are labeled as bad or very bad, while the majority, 45%, is considered to be only acceptable.[11]

Table 43: Federal Investments in Brazilian Transportation Infrastructure, 2010

Mode	Investments (Billion USD)
Roads	4.83
Ship Industry	1.53
Railroads	1.15
Airports	0.43
Ports	0.39
Waterways	0.10
Total	**8.45**

Source: Brazilian Federal Government, 2010

Brazil Infrastructure Investments

As Brazil's economy has grown, the government has placed additional emphasis on improving infrastructure. One source of public funding towards infrastructure in Brazil has been the Program to Accelerate the Economy (PAC). The first phase of the Program, from 2007-2011, invested US $349 billion into a number of initiatives, including transportation.[12] In terms of transportation, PAC invested a total of US $33.8 billion, going towards highways, merchant navy, railways, airports, ports, and public waterways (see Table 44).

The second phase, PAC 2, was launched in 2011, and will carry on until 2014. After 2014, investments totaling US $346.4 billion will be devoted primarily to transportation and energy. For transportation, funding is divided among highways, railroads, airports, ports, public waterways, and rural road equipment (see Table 45).

[11] APROSOJA. (2010). "Outlook for Internal and Port Infrastructure Growth in Brazil."
[12] http://blogs.worldbank.org/growth/node/8715

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Table 44: Program to Accelerate the Economy (PAC) Transportation Investments (US$ billions)

PAC TRANSPORTATION INVESTMENTS in billion USD	
PAC TRANSPORTATION INITIATIVES	**TOTAL**
Highways	19.34
Merchant navy	6.14
Railways	4.57
Airports	1.74
Ports	1.56
Public waterways	0.41
Total	**33.8**

Source: Business News America

Table 45: Program to Accelerate the Economy (PAC) 2 Transportation Investments (US$ billions)

PAC 2 TRANSPORTATION INVESTMENTS in billion USD	
PAC 2 TRANSPORTATION INITIATIVES	**TOTAL**
Highways	28.03
Railways	25.42
Airports	1.74
Ports	2.78
Public waterways	1.51
Rural road equipment	1.04
Total	**60.8**

Source: World Bank

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1. Waterways

Brazil has 43,000 km of navigable waterways within the country, as well as a vast number of ports along its eastern coast. Currently, approximately 14,000 km of total waterways are being used to transport goods, mostly along the Madeira, Amazon and Paraguay/Paraná Rivers. In most countries, rivers provide the opportunity to move goods long distances at a low cost, but within Brazil, both political and environmental issues prevent waterways from being used optimally. The length of time associated with starting a waterways project is 10 years, due to bidding and concerns regarding Indian rights. These reasons, along with lacking federal and private investments prevent waterways from being a key component of transportation in Brazil. The Association of the Producers of Soy in the State of Mato Grosso (APROSOJA) estimates that Brazil currently uses less than 25% of its waterway potential. However, two river systems are allowing transportation both within Brazil and outside of Brazil, the "Parana-Paraguay" and the "Tiete-Parana" waterways. An overview of Brazil's waterways is shown in Figure 84.

Amazon River

The Amazon River is the largest watershed area in the world, and the Amazon Basin covers nearly 30% of South America. Brazil's Amazon River Basin has approximately 19,024 kilometers (km) of rivers with 18,300 km considered navigable and 724 km with the potential to be made navigable through dredging efforts. The basin includes 28 rivers (Madeira, Amazon, Solimoes, Teles Pires, Tapajos, Tocantins, Acara, Acre, Branco, Capim, Guama, Envira, Guapore, Ica, Japura, Jari, Javari, Jurua, Mamore, Moju, Negro, Purus, Tarauaca, Tefe, Trombetas, Uatuma, Urucu and Xingo) covering 6 states (Amazonas, Para, Acre, Rondonia, Roraima and Amapa). The major navigable rivers of the Amazon River Basin and significant cities and ports are shown in Figure 84.

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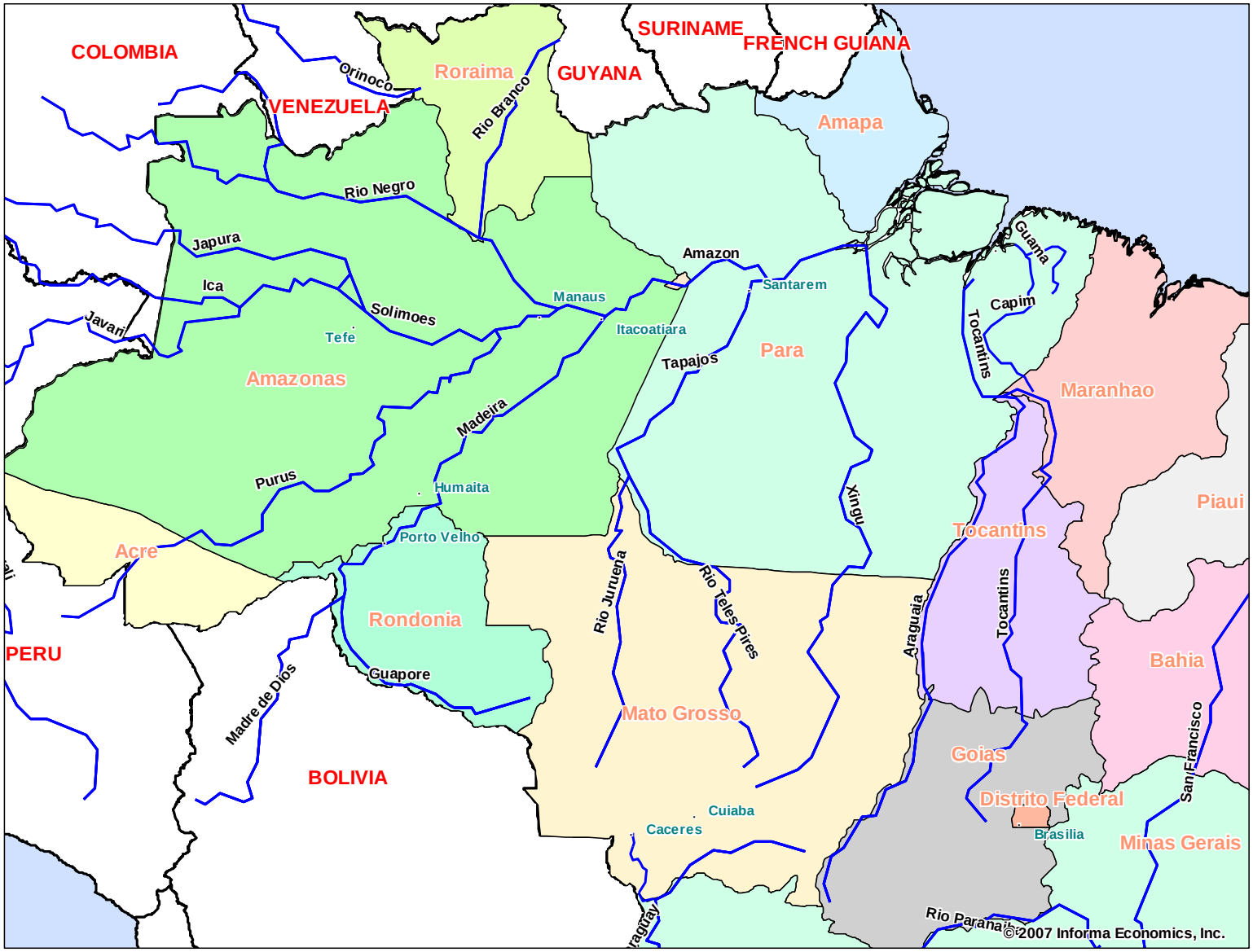
Figure 84: Major Navigable Rivers of the Amazon River Basin



The Amazon River benefits Brazilian agriculture from both production and transportation standpoints. The Amazon region has been a source of soybean production since the 1990s, a result of improved soybean varieties that can be produced within the tropical climate.[13] Production in the region benefits from the advantage of shipping production via the Amazon River. Ocean going vessels are able to navigate nearly two-thirds of the Amazon's length, without regard to vessel tonnage. Many vessels regularly travel up to Manaus, while smaller vessels can make it as far as the Port of Itacoatiara.[14] Despite the Amazon's shipping advantage, it is one of Brazil's most underutilized corridors.

Tiete-Parana River Basin

The Tiete-Parana River Basin includes 2,400 km of navigable riverways that flow through five states: Goiás, Minas Gerais, Mato Grosso do Sul, São Paulo and Paraná. The Tiete-Parana River Basin includes the Paranaíba, Grande, São José dos Dourados, Tietê, Paranapanema, Pardo, Ivinheima, Ivaí, Piquiri e Iguaçu and Paraná Rivers. Various commodities are moved on the Tiete-Parana River Basin such as sugar cane, soybeans, soybean meal, construction sand, corn and fertilizer. The most important rivers are the Parana and Tiete and are shown in Figure 85.

[13] FAS. (2004). "The Amazon: Brazil's Final Soybean Frontier." Retrieved from http://www.fas.usda.gov/pecad/highlights/2004/01/amazon/amazon_soybeans.htm.

[14] Microsoft Corporation Encarta. (2009). Retrieved from http://www.webcitation.org/5kwDrOAQJ.

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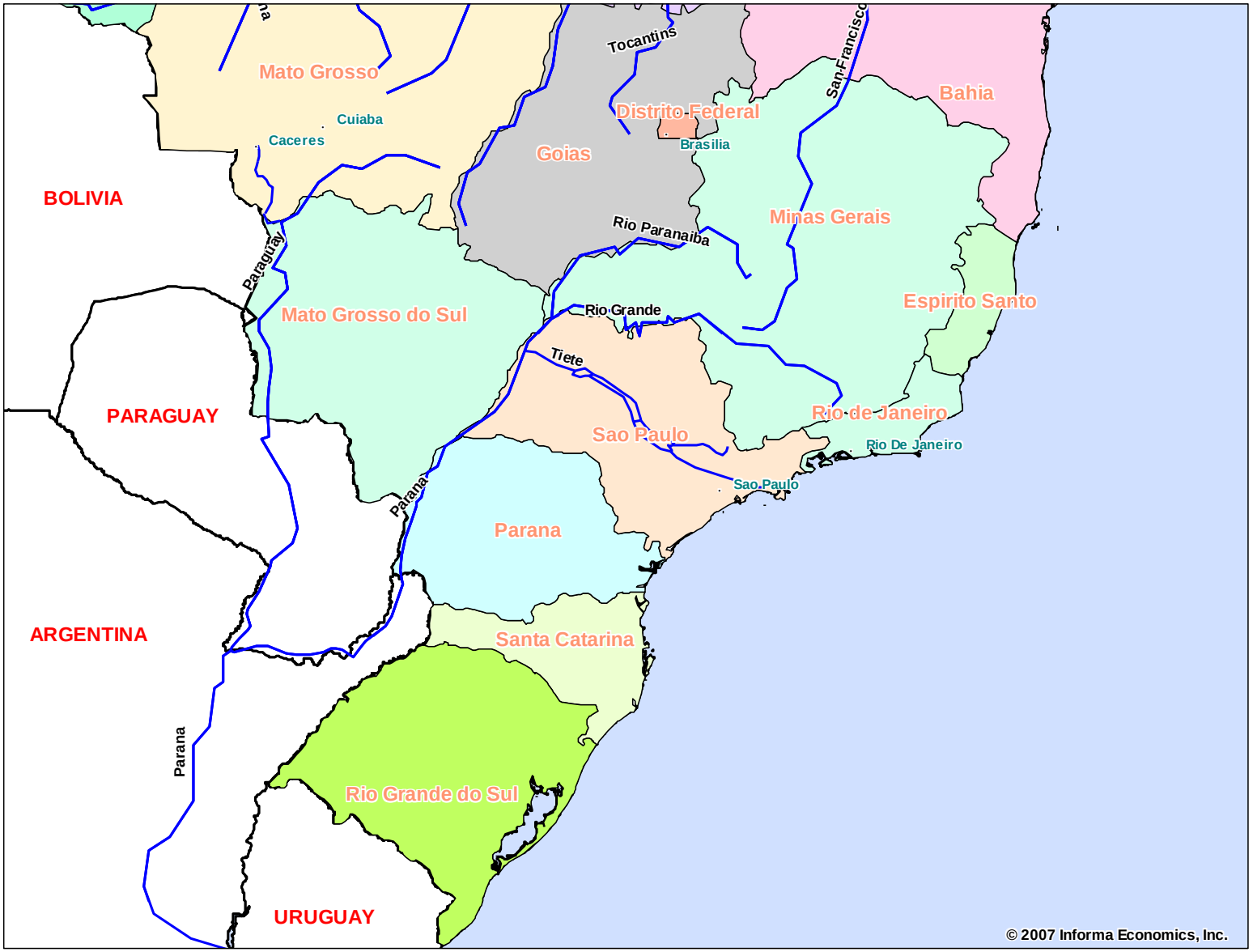
Figure 85: Major Navigable Rivers of the Tiete-Parana River Basin



Rio Madeira River

The Rio Madeira located in Brazil is the largest tributary of the Amazon, and offers the most opportunity for future grain movements in the country. This waterway has the potential to move a total of 2-3 million tons annually. The cost of transporting soybeans along the Rio Madeira is higher than transportation along U.S. rivers. Moving soybeans via truck and barge from Mato Grosso to Europe costs an estimated US$1.51 per bushel or nearly $55 per metric ton, while moving soybeans from Iowa to Europe costs an estimated US$0.85 per bushel or slightly more than $32 per metric ton.[15]

Paraguay-Parana River Basin

The Paraguay-Parana River System is among the longest, and most important inland waterways in South America. It runs from Port Caceres in Mato Graso, Brazil to Port La Plata in Argentina and Nuevo Palmira, Uruguay covering a distance of 3,442 km as shown in Figure 86. Ocean going vessels navigate up the Paraguay-Parana River to Rosario loading to a maximum 38,000 metric tons with commodities. This requires the use of smaller vessels such as Handymax or light loading a Panamax vessel. Once the Panamax vessel is loaded it is shifted or is moved to another deep water port along the Atlantic Coast of Brazil or to a mid-stream operation to be topped off to maximize its payload of about 60,000 metric tons. Handymax and Panamax vessels are commonly used for the movement of grains, fertilizers, steel, and some coal and iron ore. The most efficient vessels for iron ore and coal shipments is a Capesize vessel that loads upwards of 200,000 metric tons of low value bulk commodities. A Panamax vessel is the largest vessel that can transit through the Panama Canal lock system. Capesize vessels sail around the Cape of Good Hope or Cape Horn or through the Suez Canal but they are too big for the Panama Canal.

This inland waterway serves five countries including Brazil, Bolivia, Paraguay, Argentina, and Uruguay. Unlike the Amazon or Madeira Rivers, this system is an international river system with a unifying body, the Comision Intergubernamental de la Hidrovia Paraguay-Parana (CIH), that oversees its operations and functions. The system is maintained (dredging, buoy and light mainteance) by a private contractor arrangement from Rosario Argentina to the mouth of the river at the Atlantic Ocean. The rest of the system northward to Port Caceres is overseen by the governing body wtih representatives from each country.

[15] McVey, M. (2000). "Brazilian soybeans – Transportation problems." Retrieved from http://www.extension.iastate.edu/agdm/articles/others/McVeyNov00.html.

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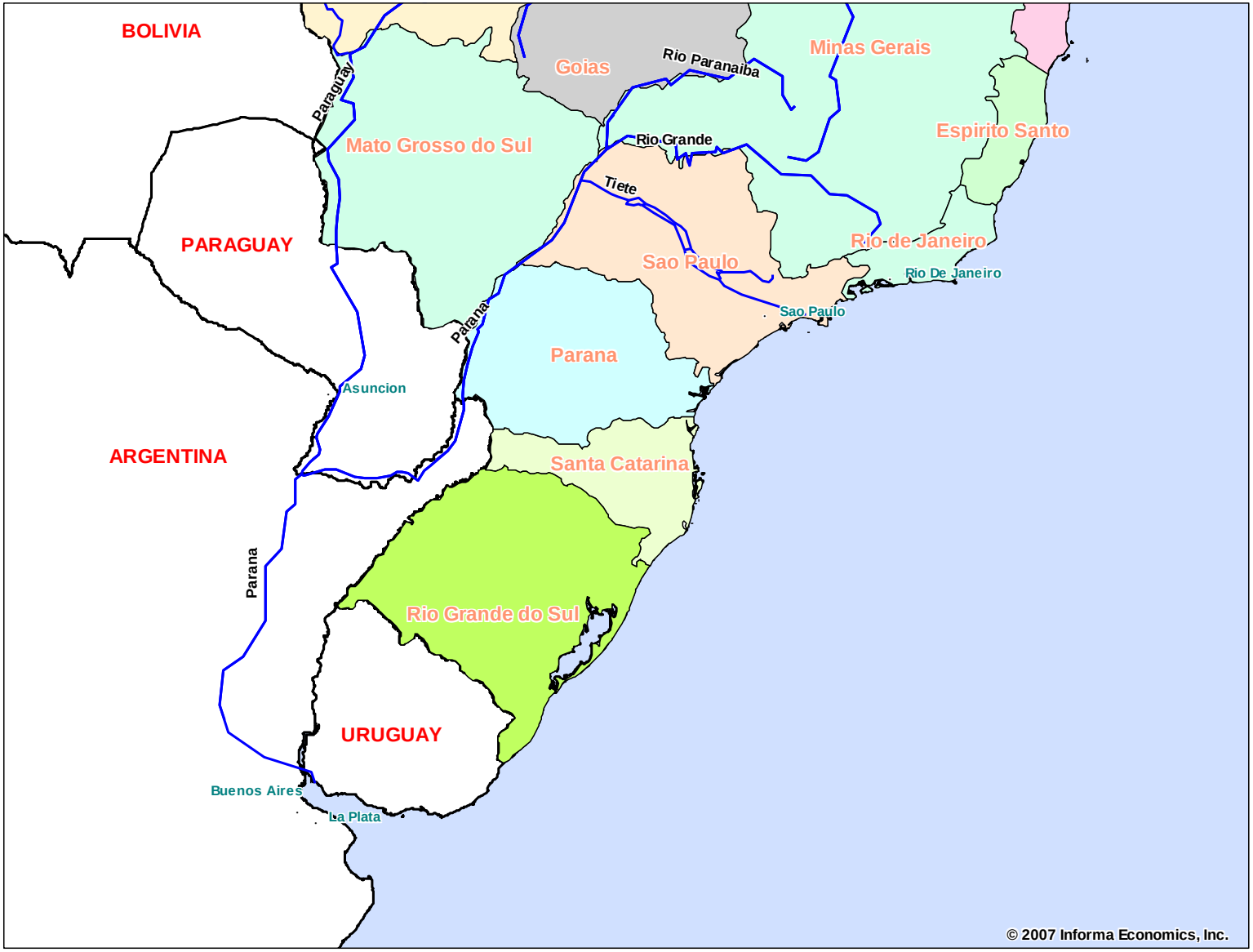
Figure 86: Major Navigable Rivers of the Paraguay-Parana River Basin



Hidrovia Paraguay - Parana

The Hidrovia waterway is a natural river system that flows through five countries in South America: Argentina, Bolivia, Brazil, Paraguay and Uruguay. This river system is equivalent to the Mississippi River's importance in the U.S., and aims to be a nearly 4,000 km shipping canal. The Paraguay and Parana Rivers in Brazil form the beginning point of the Hidrovia.

In order for this river system to be completed, dredging and extensions will be needed, a process that could take several years. Total costs for engineering the canal will cost over US $1 billion, and maintenance for just over two decades would cost US $2 billion.[16] Costs are a hindrance to the project, but alone is not the only constraint keeping the project from moving forward. Several organizations have shown their disapproval for the project arguing that there are environmental factors, such as increased flooding and loss of ecosystems at risk.

a) Ports

As in any country, Brazil's port system is vital to international trade efforts, and determines whether Brazil can compete on a global level with other nations. While the country has an array of ports (see Figure 88), they are constrained by inefficiencies, which include: 1) inadequate investments; 2) poor administration; 3) delays caused by inland traffic; and 4) outdated equipment and technologies.[17]

The country has five major ports, Santos, Vitoria, Paranaguá, Rio Grande, and Rio de Janeiro, all located in the southern portion of Brazil. Santos is Brazil's most vital port, and handles approximately 38% of trade activity among the country's ports.

Figure 87: Hidrovia River System

Source: OFID

[16] http://www.chasque.net/rmartine/hidrovia/Envxtrad.html
[17] Brazil Country Management Unit. (2008). "Evaluating the Macroeconomic and Distributional Impacts of Lowering Transportation Costs."

Figure 88: Brazil Port Map

Source: ANTAQ

Brazil's port system is supported by approximately 330 port terminal concessions, of which 77 will expire by 2013. It is estimated that leveraging Brazil's port sector could earn the government nearly $100 billion.[18] To achieve this potential, and also accommodate rapid economic growth in the country, Brazil's road and rail infrastructure must be improved to accommodate increased traffic to the ports, while the ports capacity and infrastructure must also be improved to handle increases in flows of goods.

While Brazil has many ports, these ports are already hampered in their ability to accommodate both increasing agricultural outputs, as well as industrialized products. The country itself faces three main problems with ports: 1) sufficient port depth; 2) over reliance on hand labor; and 3) red tape impacting port turnover and increasing costs. Vessel loading at ports such as Paranaguá typically requires 36 hours; however, since the port lacks covers for ships, the ships must be closed if a chance of rain exists. This can increase loading times from 36 hours to 5 days, and decreases volumes loaded from 100,000 tons per day to 22,000 tons per day.

According to IBGE and Conab, Brazil will need to increase its port capacity by 30% before 2015 to allow for increasing agricultural exports. In order to meet growing export demand, Brazil's port system needs

[18] Hailey, R. (2012). "Brazil set for retendering spree on concessions for 77 terminals."

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adequate investment, in both technology and administration. The greatest advances in port capacity must be achieved by the Northern and Northeast regions, specifically in the following ports: Manaus; Santarem; Itaqui; Santos; Aratu; Ilheus; and Vitoria.

In 2011, Brazil's top 3 soybean ports (Santos, Paranaguá, and Rio Grande) exported nearly 22 MMT, as shown in Table 46. The volumes exported by port show that southern ports handle most of Brazil's soybean exports year after year, while northern ports lag behind, a result of infrastructure impediments (i.e. lack of paved roadways and rail lines joining soybean production areas with exporting ports).

Table 46: Brazil Soybean Exports by Port (metric tons)

Port	2008	2009	2010	2011
Santos	7,157,919	8,668,273	8,226,982	9,230,508
Porto de Paranagua	4,188,792	4,813,028	5,333,970	6,924,388
Porto de Rio Grande	3,351,312	4,655,506	4,564,075	5,755,691
Sao Francisco do Sul	2,275,989	2,121,637	3,044,282	2,609,398
Sao Luis	1,758,654	1,750,853	2,063,214	2,514,376
Vitoria	2,414,038	2,806,046	2,379,156	2,452,879
Salvador	703,683	1,116,657	1,232,150	1,525,901
Manaus	1,440,976	1,508,069	1,283,034	1,086,216
Santarem	1,088,611	933,449	809,619	789,584
Ilheus	52,972	149,692	130,865	89,029
Foz do Iguacu	305	8,236	3,371	5,789
Mundo Novo	-	-	1,538	1,747
Jaguarao	-	-	-	28
Rio de Janeiro	139	21	4	4
Other Ports[1]	66,099	31,220	891	0.1

1 Other Ports include: Sao Paulo, Guaira, Belem, Caceres, Chui, Corumba, Itajai, Pacaraima, Ponta Pora, Porto Murtinho, Santa Helena, Santana do Livramento and Uruguaiana.

Source: GTIS

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Port Investments

Funding for port investments has largely been attributed to the private sector since 1993 when the Port Modernization Law was enacted. This law encouraged additional competition and allowed for private entities to control major terminals, as well as create local Port Authorities and councils. The private sector has allowed the terminals to lower their operating costs. However, public funding is still needed to contribute towards larger improvements, such as dredging.[19] Brazil's largest ports, Santos and Rio de Janeiro, are federally funded.

Currently, approximately $500 million worth of public investments are spent annually on ports. These investments allow ports to increase their efficiency by improving upon and adding to existing infrastructure. For example, if improvements are made to northern ports, primarily Itacoatiara, Santarem, Vila do Conde, and Sao Luis, it could decrease shipping days to major world destinations by 1-4 days.[20] Additionally, increasing capacity in Brazil's major ports, would allow the country to service more Capesize vessels, which reduce freight costs. The Port of Santos cannot handle Capesize vessels, and only 7 other ports within the country have the ability to handle vessels this large.

Port of Santos

- APM Terminals and Mediterranean Shipping Co. are working together and have invested R$1.8 billion to create a terminal with 1.2 million TEU (twenty-foot equivalent) and 1.4 million MT of grains when finished in 2013.

- Triunfo Participacoes is investing R$1.5 billion to build a privately owned mixed-use terminal with 870,000 TEU, 4.5 million MT of ethanol and 2 million MT of grains.

- Santos Brazil added a fourth berth with six Super Post-Panamax gantry cranes with an investment of R$250 million.

- In 2011, Tecondi, an existing operator at the Port of Santos, finished expansion efforts bringing the terminal's handling capacity to 500,000 TEU annually.

- Embraport, along with DP World and Odebrecht have invested US $1.34 billion to build a greenfield facility along the port of Santos' access channel. This project will handle 2 million TEU and 2 billion liters of ethanol annually.

[19] World Bank, Brazil Country Management Unit. (2008). "Evaluating the Macroeconomic and Distributional Impacts of Lowering Transportation Costs."

[20] APROSOJA. (2010). "Outlook for Internal and Port Infrastructure Growth in Brazil."

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Port of Sao Luis

- In the initial PAC, the Port of Itaqui (Sao Louis) received federal funding to expand grain exporting capacity and storage under a four-phase program, with the first phase to be completed in March 2012. The first phase would expand grain capacity to 7.5 MMT per year, compared to 1.75 MMT in 2009, and later add 125,000 MT of storage capacity. Three phases will follow adding 125,000 MT of storage capacity, totaling 500,000 MT. Support for this investment will total R$339 million, with most funding coming from private sources.

Port of Paranaguá

- GRUP TCB's Terminals de Conteineres de Paranaguá invested in infrastructure at the Port of Paranaguá, providing funding for two Post-Panamax gantry cranes, increasing capacity to 1.2 million TEU beginning in March. An additional berth will be added, improving capacity further, to 1.5 million TEU.

- Additionally at Paranaguá, CMA CGM, a French container line, is looking to invest to build a terminal outside the port.

- Dredging operations have been scheduled for berths at the port, adjoining areas of the pay, and shipping lane from the Atlantic Ocean to the port. This will deepen the shipping lane to a depth of 16 meters, while the berths are dredged to a depth of 14 meters. The project will cost an estimated R$ 90 million with the debt shared by both the federal government and the port authority. The process is estimated to take nine months to complete, and should be finished in late 2012.

Port of Ponta de Madeira

- Improvements are underway at the Port of Ponta de Madeira, where Vale is expected to spend $3 billion to improve its transportation infrastructure (facilities and rail network pertaining to iron ore facilities) in an effort to allow Valemax vessels to load with ease and efficiency. The company is investing in port infrastructure to ensure that the economies of scale for the new vessels are not decreased by delays. Also included in this work is the upgrade of the company's existing three piers, adding a fourth pier, and updating storage facilities[21].

[21] Lloyds List Intelligence.

Port of Santarem

- In 2010, Bom Futuro Group announced that it would be building a new grain terminal at the Port of Santarem beginning in 2011. This required an investment of R $50 million to construct 5 silos, with total storage of 150,000 tons of grain.

Port of Suape

- At Suape, an additional box terminal is being proposed by the Brazilian government, which will likely be funded through a bidder, likely Santos Brasil, APM terminals, or SAAM.

Port of Imbituba

- At Imbituba, Santos Brasil is investing $144 million to build a terminal with 470,000 TEU capacity. The company has also invested in two ZPMC gantry cranes, allowing handling capacity to reach 65,000 TEU in the first year.

Port of Vila do Conde

- Another component of PAC is a waterway project underway to allow for soybean exports of grain to travel northward along the Araguia and Toncantins River System to the Port of Vila do Conde in Para. In addition to the waterway project, a river navigation system project around Tucurui, Para is under development.

Port of Outeiro

- Brazil port authorities recently announced the creation of a new grain port, Outeiro, to be constructed in the Amazon region. This port will surpass the 16.8 million MT capacity at Brazil's largest port, Santos, and will allow the Cerrado, Northeast, and Amazon regions to move their grain to markets. This northern port will allow for exports to markets in the Middle East and Europe, as well as being geographically situated within proximity to the Panama Canal for grain exports to China. The first phase of the project will be auctioned in late 2012, with the possibility of operations beginning in 2014.

Port of Itapoa

- Investments will be made in Itapoa eventually increasing from 300,000 TEU capacity, to 500,000 TEU capacity in the first phase of development.

Port of Itajai

- Investments have been made by Teconvi, which added a new berth and 3 gantry cranes, as well as repairing berths destroyed by floods in 2009.

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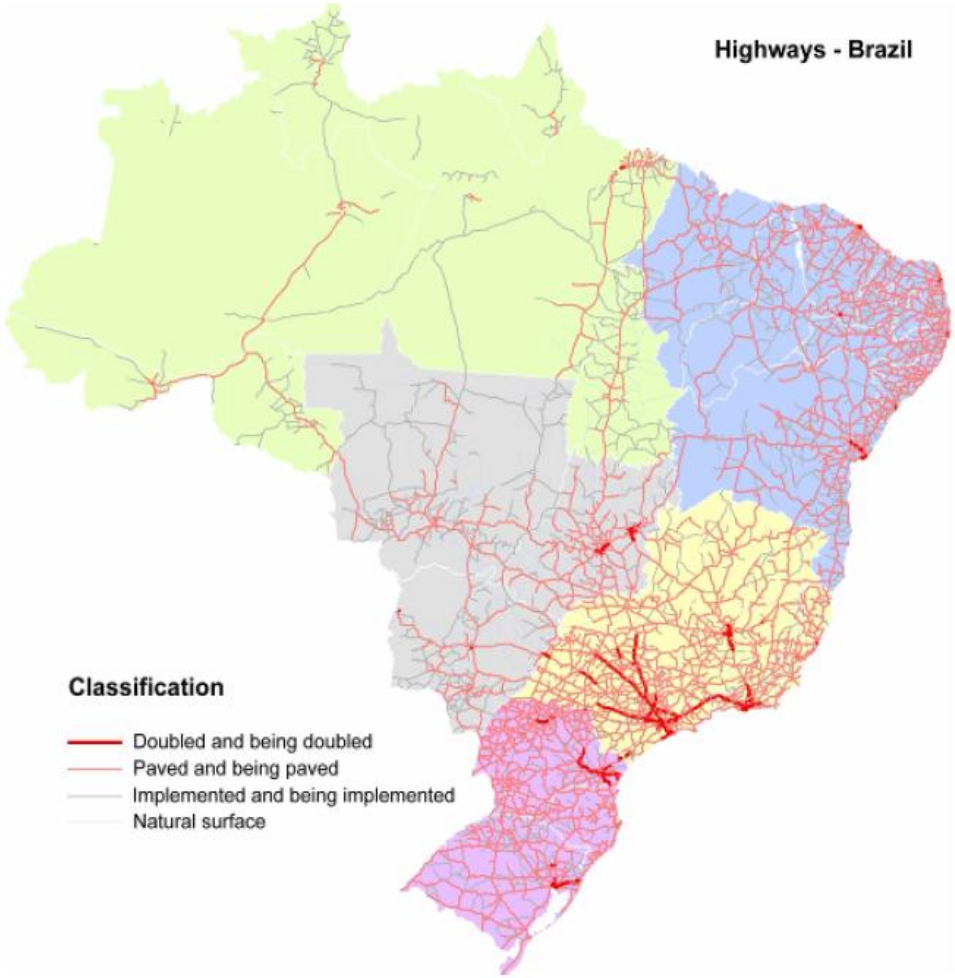
2. Roadways

Brazil's highway system totals 1.8 million km of roads, of which 196 thousand are paved. Most of these highways are federal and state highways. Brazil's road network is better maintained in the populated areas of the south and southeast than within the remainder of the country. In the agricultural regions of Brazil, the roads are used heavily and experience bottlenecks during the soybean harvest season. It is exceptionally difficult to ascertain how many of Brazil's 1.8 million trucks are used to haul grain, but it is notable that the average age of the national heavy truck fleet overall was estimated to be 18 years old in 2010. This aged class of transportation assets is a further impediment to efficient transportation operations.

The country faces increasing problems with truck transportation as the average age of the vehicle fleet increases, and transportation costs continue to be among the highest in the world. Cargo transport costs are compounded by a number of factors which include: 1) poor quality and lack of roads; 2) maintenance costs due to poor roads; 3) extra time required in port moves (i.e. moving product from one transportation mode to another); 4) high diesel prices; 5) insurance costs; and 6) product lost in transit.

Figure 89: Brazil Road System



Source: Caliper of Brazil

BR 163 is an interstate highway that is the primary mode for transporting agricultural goods from production regions to southern coasts for export. Currently, approximately 10,000 trucks per day move down this main Brazilian highway on a road that was anticipated to handle half as much traffic. Brazil aims to pave the

northeast reaches of the highway from the border of Mato Grosso to the Port of Santarem. Paving this stretch will allow producing regions greater access to closer ports and reduce traffic at Brazil's major ports, Paranaguá and Santos. Completion of BR 163 is expected to allow additional land along the highway to be brought into agricultural cultivation. Resignations within the Brazil Ministry of Transportation have delayed completion of the highway until early 2013.

BR 135 is a highway that connects the Maranhao, Tocantins, Piaui, and Bahia region to the southern region of the country. The highway allows these regions to access the Port of Itaqui.

BR 158 is a route that stretches from the border of Uruguay to areas of Rio Grande do Sul State and Para. This road has paved portions running from Mato Grosso to Rendencao. The sections running through Ribeirao Cascalheira to the Para border are unpaved and still under construction.

BR 242 is a highway, still under construction, that connects Sinop and Sorriso to the Port of Itaqui. This highway was first established in 1973, and since then has only had a number of sections paved. Once this highway is functional it is expected to benefit the agricultural regions of Sorriso and Sinop.

Roadway Investments

Funding for roadway investments has been completed through a number of public and private investments. The initial Program to Accelerate the Economy (PAC) devoted a total of R$8.35 billion annually between 2007 and 2010. PAC2 devotes a total of R $48.4 billion towards roadway improvements, which include consolidating, expanding and integrating the logistics networks. Currently, the focus of roadway investment in Brazil is towards improving BR 163 from Mato Grosso to northern ports like Santarem.

BR 163

Investments in BR 163 aim to connect center-west Brazil to the Port of Santarem, and is expected to be finished in early 2013. Completing this road is estimated to redirect 10 million tons of soybeans from the southern ports, such as the Port of Paranaguá and Port of Santos, to the Port of Santarem. However, additional expansion at northern ports, like Santarem, must occur before soybean movements can be redirected to ports closer to production areas. Currently, the Port of Santarem does not have enough existing capacity to handle current grain flows through the port, with maximum capacity at two million tons per year, with only half of the capacity being utilized. This underutilization is a result of vessels' inability to enter the port, as well as transit infrastructure.

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- If utilized in the future, the Port of Santarem will save an estimated $30-$40 per ton through lower truck costs.

Other Interstate Investments

- The Brazilian government is now making efforts to pave and enhance the length of highway BR 135.

- BR 242 is slowly being constructed and paved, aimed at giving agricultural regions better access to the Port of Itaqui.

3. Railroads

Brazil's rail network is limited and inefficient, with only 29.5 thousand kilometers of multiple gauge track. These tracks lie mostly in the south and eastern portions of the country, and were developed around mineral extraction. Brazilian railroads are privately held, and total 12 freight lines. Privatization has left the railroad system underdeveloped and underinvested by the federal government, making expansion efforts a slow process.

The Ferronorte

The railroad system in Brazil is hampered by infrastructure limitations. Characteristics of the Brazilian railroad network include:

- Lack of standardized rail tracks or gauge widths.
- Average cargo train velocity of 24 kilometers per hour.
- Rail lines passing through smaller urban areas, increasing accidents and decreasing efficiency of the rail network.

Figure 90: Brazil Railroads

Source: National Association of Rail Transporters (ANTF)

Expansion efforts in the Brazilian railroad system focus primarily on routes, accessing ports at Belem/Sao Luis, Santos and Salvador, and expansion of the railroad to the center-west of the country to allow goods to be transported to Santos, Salvador and Belem/Sao Luis.

Railroad Investments

Funding for railroad investments has been completed through a number of public and private investments. Current rail networks totals approximately 29,500 km, but nearly 52,000 kilometers are needed to meet current demand.[22] The initial PAC devoted a total of US$4.73 billion annually between 2007 and 2010. PAC's second phase aims to invest US$27.5 billion in the rail network through 2014. Ultimately, investments made in rail lines will not offer farmers much of a financial benefit, as lack of competing railroads results in grain shipping rates of only 3% cheaper than moving grain by truck to ports in the south.

Total Investments

- PAC's first phase intended to fund the addition of 2,518 km of rail network at a cost of US$4.73 billion; however, actual investments totaled in US$2.04 billion and added only 909 km of track to the rail network, approximately
- $2.2 million per km.
- PAC's second phase aims to fund an additional 4,696 km of rail network at a cost of US$27.5 billion.

The Ferronorte

- American Latina Logistica (ALL) invested R$ 2.4 million (approximately US$1.2million in 2012 dollars) to expand unloading capacity at two terminals (Alto Taquari and Alto Araguaia). The two terminals had a previous unloading capacity of 700-800 trucks per day, and will be expanded to 900 trucks per day.
- ALL will inaugurate another terminal at Itiquira in March, with operations beginning subsequently. This terminal will have the capacity to move 2.5 million tons of grain annually, as well as other products including soybean oil and ethanol. Rail lines were expanded to this terminal in September 2011, but the terminal still needs a paved access road, MT-299, linking the terminal and main highway (BR 163).
- The Ferronorte Railroad will also be expanded to the city of Rondonopolis by the end of 2012 where a grain terminal will be built. The expansion of this rail line will allow soybeans to move from key production areas of Mato Grosso to the Port of Santos.

East-West Railroad

[22] Oliveira, N. (2011). "Railroads poised to reduce logistical bottlenecks in Brazil."

- The East-West railroad project of 1,638 km was scheduled to begin construction in 2011, linking the states of Goiás, to the Port of Ilheus. This project aims to handle 20 million MT annually, but has been put on hold after the resignation of three key officials, the transportation minister, director of railroad projects, and director of the National Department of Infrastructure and Transportation.

Central-Western Railroad

- The Central-Western railroad intends to build a line from Goiás State to Lucas do Rio Verde. However, this railroad is not expected to be completed or operational within the next five years.

North-South Railroad

- In 2010, an additional leg of the North-South Goiás running from the Ouro Verde, Goiás was proposed. The track would add 667 km and would require an investment of R $2.3 billion. This will benefit the southwest region stretching to the waterways of Paranaiba-Tiete-Parana.

Other Investments

- The rail line connecting the Port of Ilheus to production areas in western Bahia is scheduled to be finished in 2013.

4. Commercial Environment

Overall, transport inefficiencies contribute a significant part of the extra *Custo Brasil* (translated as the "Brazilian Cost"), which are defined as the additional expenses faced by any business operating in the country, including those associated with red tape or cumbersome bureaucracy.

Brazilian freight transport markets have traditionally been, at best, competitive, only to a degree. This is due to commercial enterprises often having relatively few choices transporting commodities and goods. They are faced with simply using the port in the same state as where the production occurs. This is partly for tax reasons: in Brazil, the merchandise circulation tax (ICMS) must be paid each time an export or import good passes a state frontier. Efforts within the federal government have been taken to reduce these taxes, but they remain a vital source of income for state governments. In the case of road haulage, there exists hundreds of competing freight and logistics companies, but there is very often little or no choice between various transport modes such as road, rail, or waterways. To the extent that investment in transport networks catches up, these multimodal alternatives will allow greater efficiency in transport systems. While this is already starting to happen with rail container freight stations such as the one at Cacapava in São Paulo state, one that consolidates cargo from Belo Horizonte, São Paulo and Rio de Janeiro, then offering shippers of the

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goods the choice between utilizing Santos, Sepetiba or Rio de Janeiro as ports. It is notable that in the future one of the greatest opportunities to make Brazilian exports more competitive in the next decade, across global markets, will be to reduce transportation, distribution and logistics costs, particularly the *Custo Brasil*.

5. Economic Impact of Brazilian Infrastructure Investments

Over the years, high transportation costs resulting from inadequate infrastructure have decreased farmer returns. This decline is a combined result of higher transportation costs, vehicle depreciation, and increased production costs. The primary causes of increased transportation costs have been: 1) lack of competition among modes of transportation; 2) inadequate access for agricultural producers to rail and waterway transportation; and 3) the ability of freight transporters to increase costs, due to the country's heavy reliance on transportation by truck[23]. Improvements toward infrastructure have been slow, and planned improvements have been unable to keep pace with production growth.

For example, because truck is used predominantly to move soybeans to market position, its costs can be more than double the cost of ocean freight rates, such as moving soybeans from North Mato Grasso to the Port of Santos, as shown in Table 47. The Mato Grosso Institute of Agricultural Economics (IMEA) estimates that it costs US $17.00 per metric ton to move soybeans by barge, US $55.00 metric ton by rail, and US $65.00 per metric ton by truck in Brazil. For shipments to China, total transport costs represented one-fifth to more than one-third of total landed costs during 2010, depending on the origin production area and port used.

[23] Brazil Country Management Unit. (2008). "Evaluating the Macroeconomic and Distributional Impacts of Lowering Transportation Costs."

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Table 47: Costs of Transporting Brazilian Soybeans to Shanghai, China and Hamburg, Germany (US$ per metric ton), by Production Region and Port, 2010

Destination	North MT[1] Santos[2]	North MT Paranagua	Southeast MT Santos	North Center PR Paranagua	South GO Santos	Northwest RS Rio Grande
Shanghai, China						
Truck	$116.78	$110.94	$93.41	$34.51	$64.71	$28.18
Ocean	$55.84	$58.92	$55.84	$58.92	$55.84	$58.21
Total transportation	$172.62	$169.86	$149.26	$93.43	$120.56	$86.39
Farm Price [3]	$318.15	$318.15	$318.15	$350.44	$324.27	$344.90
Landed cost	$490.77	$488.01	$467.41	$443.87	$444.82	$431.29
Transport % of landed cost	38.6%	35.3%	32.4%	21.2%	27.4%	20.1%
Hamburg, Germany						
Truck	$116.78	$110.94	$93.41	$34.51	$64.71	$28.18
Ocean	$33.63	$35.08	$33.63	$35.08	$33.63	$36.03
Total transportation	$150.40	$146.03	$127.04	$69.59	$98.34	$64.21
Farm Price [3]	$318.15	$318.15	$318.15	$350.44	$324.27	$344.90
Landed cost	$468.55	$464.18	$445.19	$420.03	$422.61	$409.11
Transport % of landed cost	32.6%	31.9%	29.0%	16.8%	23.6%	15.8%

[1]Producing regions: RS = Rio Grande Do Sul, MT= Mato Grosso, GO = Goiás, PR = Paraná

[2]Export ports

[3]Source: Companhia Nacional de Abastecimento (CONAB) www.conab.gov.br

Source: ESALQ/ USP (University of São Paulo, Brazil) and USDA/AMS

Currently, transportation costs from the production area to the nearest port are the major cost of production in Brazil. The costs associated with transportation from Brazil to both China and Germany is illustrated in Figure 91. Within Brazil, states in the Center North face higher inland freight costs, than states in the southern portion of the country. As a result, farm gate prices for countries in the Center North are considerably lower than those with port access, calculated by taking CBOT prices and subtracting both sea and inland freight costs. The gap in farm gate prices between the production areas in Mato Grasso and Paraná is 34%, where prices in Mato Grosso are 34% less than Paraná, as shown in Figure 91.

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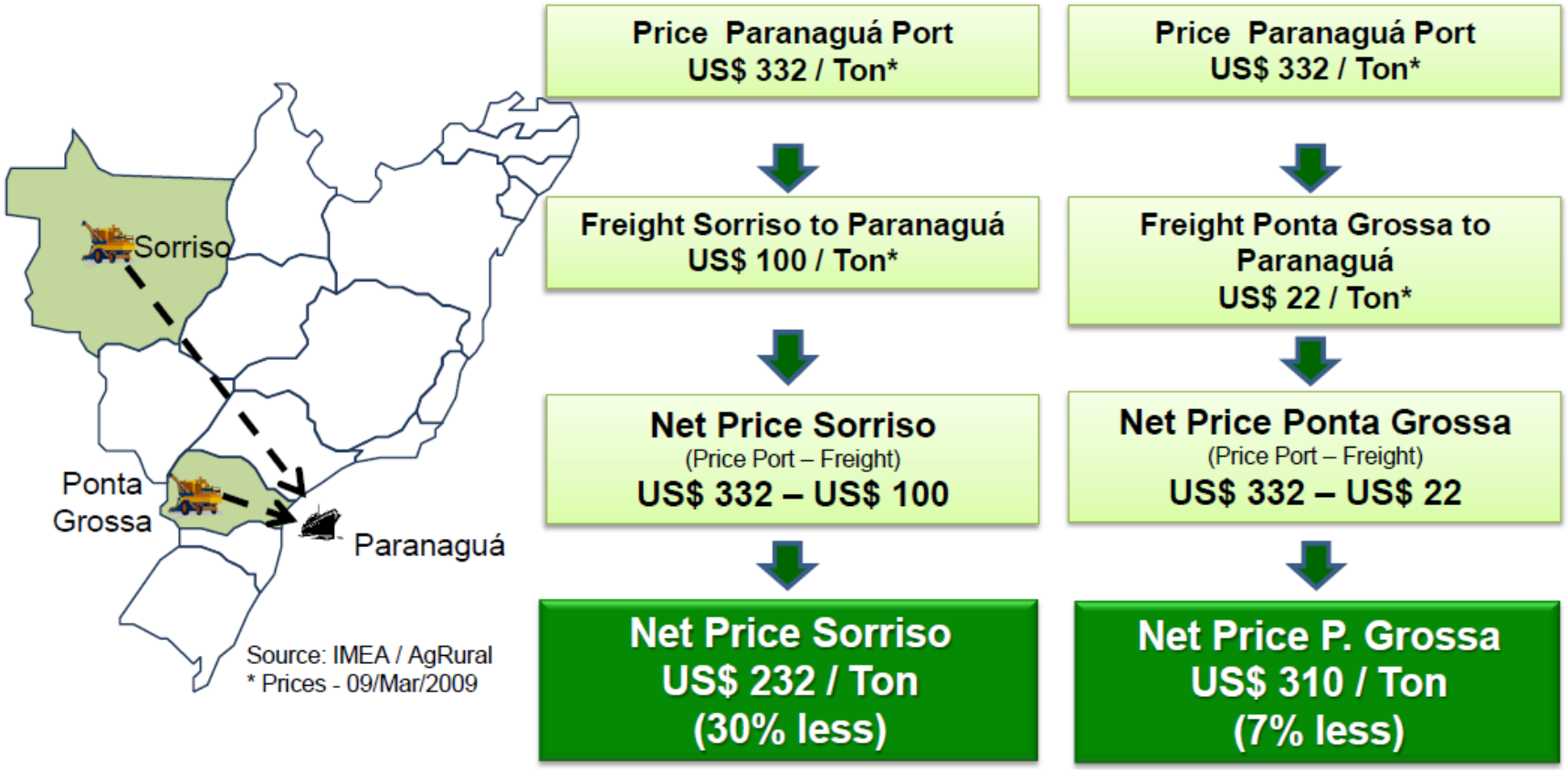
Figure 91: Farm Gate Prices in Sorriso, Mato Grosso and Ponta Grossa, Paraná, 2009



Source: APROSOJA

Brazilian soy transport costs have been rising in recent years with freight rates increasing, on average, by 5% to 10% each year. According to USDA's quarterly Brazil Soybean Transportation report, export truck costs have increased three consecutive years through 2011. During 2010 the truck cost increased nearly 23 percent, to US $11.71 per metric ton during 2011, in an overall increase of 34 percent since 2009.

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Soybeans are predominantly exported through grain export terminals at the Ports of Paranaguá and Santos, where congestion to and at the ports has increased. Efforts are being planned to add export grain capacity at northern ports to relieve the southern ports. One example is shifting soybeans sourced in Sorriso and Querencia that presently ship soybeans to the Ports of Santos to ship them to the Port of Santarem as illustrated in Table 48. If realized, the impact on inland transport cost will be a reduction between 25% and 40%. However, little progress is being made on finishing proposed transportation projects. Another problem that will arise, when and if infrastructure improvements occur, is the lack of added capacity available at ports needed to match inland transportation expansion. Currently, ports are operating at or near capacity and must be expanded if additional production is to be exported. The key existing and future planned soybean routes to export position are shown in Figure 92.

Table 48: Example of Existing and Future Brazilian Soybean Routes

Route	Production Region	Destination Port	Mode	Distance Traveled by all Modes (km)	Transportation Cost ($/ton)[1]
Existing	Sorriso	Santos	Truck, Rail	1.94	$140
	Querencia	Santos	Truck, Barge, Rail	1.96	$198
Future	Sorriso	Santarem	Truck, Rail	1.34	$100
	Querencia	Santarem	Truck, Rail	1.44	$158

Source: APROSOJA, IMEA, Soybean and Corn Advisor

[1] Transportation costs are calculated by assuming costs of US $3.80/bushel to move soybeans from northern Mato Grosso to southern ports, and US $5.40/bushel from east-central Mato Grosso to southern ports. Transportation cost reductions of $40/ton are associated with exporting soybeans through Santarem instead of Brazil's southern ports.

Transportation costs in Brazil are the highest of major soybean producing countries, and may become even worse as the federal government devotes funds towards improving infrastructure within cities. These improvements by the government are in preparation of the 2014 World Cup and the 2016 Olympic Games which will occur in Rio de Janeiro. However, these infrastructure improvements will do little to help the agricultural community, and could further worsen funding towards agricultural infrastructure investments. Pressing infrastructure demand within cities combined with problems involving corruption in the government's transportation department have resulted in continued suspensions in both funds and work on projects benefitting the agricultural community.

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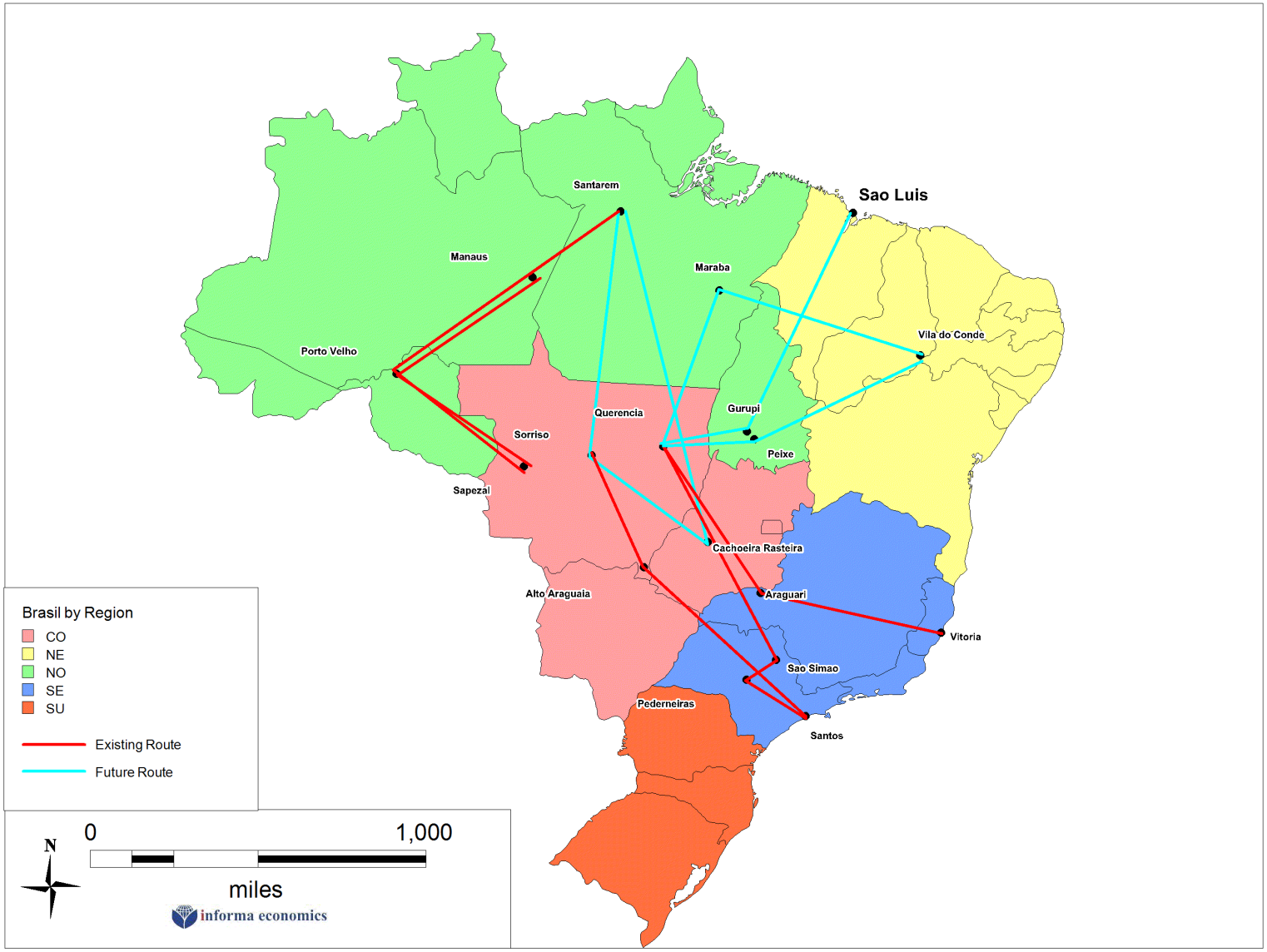
Figure 92: Brazilian Soybean Routes



D. Argentina Transportation and Infrastructure

Much like the infrastructure of Brazil, Argentina's transportation infrastructure is largely concentrated around areas of economic and population activity. The majority of Argentina's transportation modes is located within the Center East portion of the country and are built around the Rosario and Buenos Aires port regions. Argentina's infrastructure consists of 235 thousand km of roads. The rail network consists of 34,572 kilometers of track, while there are 11,000 km of navigable waterways.

Argentina is heavily reliant on truck transportation for moving agricultural commodities off farm and to destination markets. It is estimated that about 83% of grains and oilseeds are moved by truck, 15% by rail, and 2% by barge.[24] While trucks are the most costly form of transportation, this method remains feasible as most production occurs near ports.

1. Highways

Argentina's highway infrastructure contains 235 thousand km of roads, 32% of which are paved, while the remainder is gravel or dirt roads. Highways serve as the primary mode of transportation for moving grain from the farm to destinations within the country, with nearly 80% of freight movements occurring via roadways.[25] The discrepancy between primary and secondary roadways, shown in Figure 93 and Figure 94, indicates that much of the country's primary roads are positioned near population centers in the northern part of the country.

Road transportation has increased over time as the quality and efficiency of railroads continues to diminish. Of paved roads, only 33% were considered to be in good condition, 35% in regular or acceptable condition, and 32% in bad condition. In Argentina, roadways have become more privatized, and as a result the amount of paved roads has been increasing. Much like the U.S., areas surrounding ports have become crowded, decreasing efficiency. However, as roadways improve and demand increases for freight carriers, efficiencies will increase in Argentina's agricultural transportation network.[26]

[24] Regunaga, M. (2009). "The Soybean Chain in Argentina."
[25] Granato, M. and Moncarz, P. (2010). "Internal Transport Infrastructure in Argentina and its Impact on Provincial Exports."
[26] CARD. "A Comparative Analysis of Agricultural Transportation and Logistics Systems in the United States and Argentina."

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Over the past two decades, utilization of the trucking industry in Argentina has increased to compensate for diminishing rail quality and access. The trucking industry is utilized across sectors of the economy, and transport occurs mostly through the center of the country.

Highway Investments

Norte Grand Infrastructure

In 2012, the Inter-American Development Bank (IDB) granted Argentina's Norte Grande area, a US $300 million loan to finance the development and enhancement of roadways. In addition to the loan by IDB, local financing will add nearly US $34 million to the enhancement efforts. A benefit of expansion in this area will be increasing Argentina's exports, reducing accidents, and decreasing both transport times and vehicle maintenance costs.[27] This loan is a continuation of the Norte Grand Road Infrastructure Program, totaling US $1.2 billion in 2007.

Rosario Highway

- In February 2012, the Argentine government announced it will invest US $236 million to improve the beltway in Rosario.

Mendoza Highway Project

- Dycasa, an Argentine construction company, agreed to invest US $129 million to improve a portion of the national highway along Route 40.

[27] http://www.iadb.org/en/news/news-releases/2012-02-01/transport-infrastructure-in-norte-grande-region,9829.html

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Figure 93: Argentina Primary Roadways

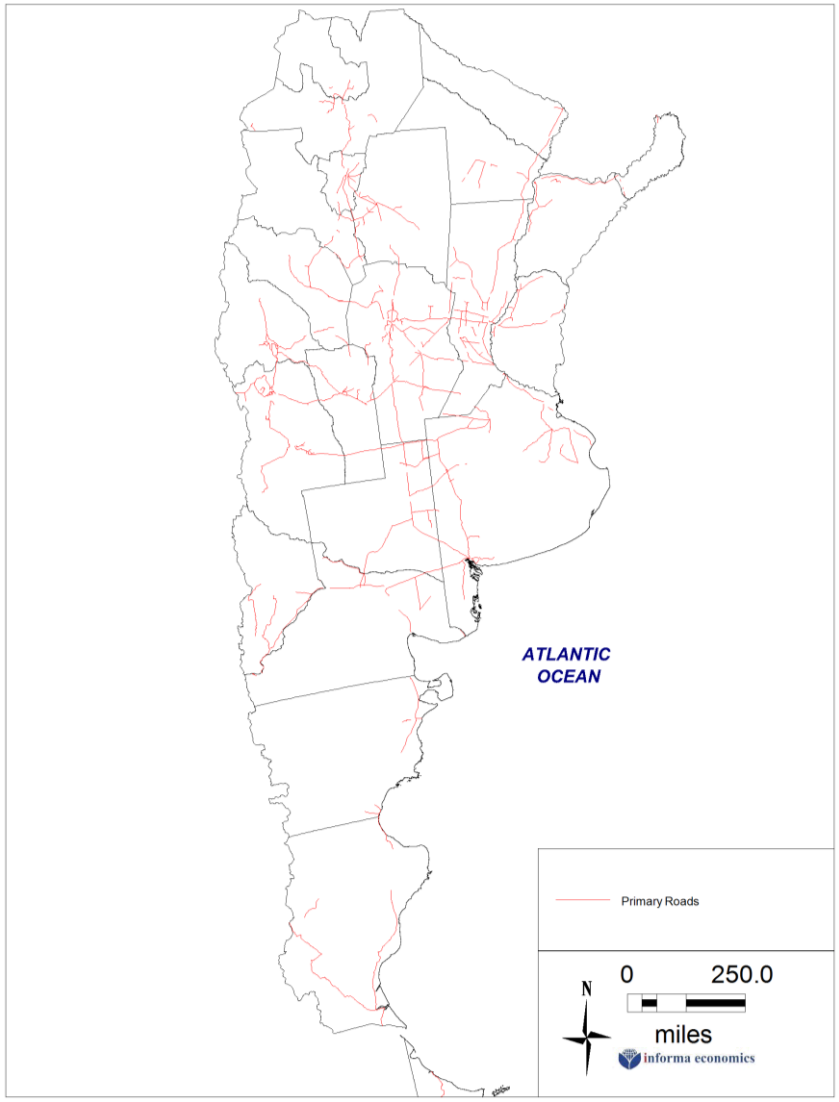
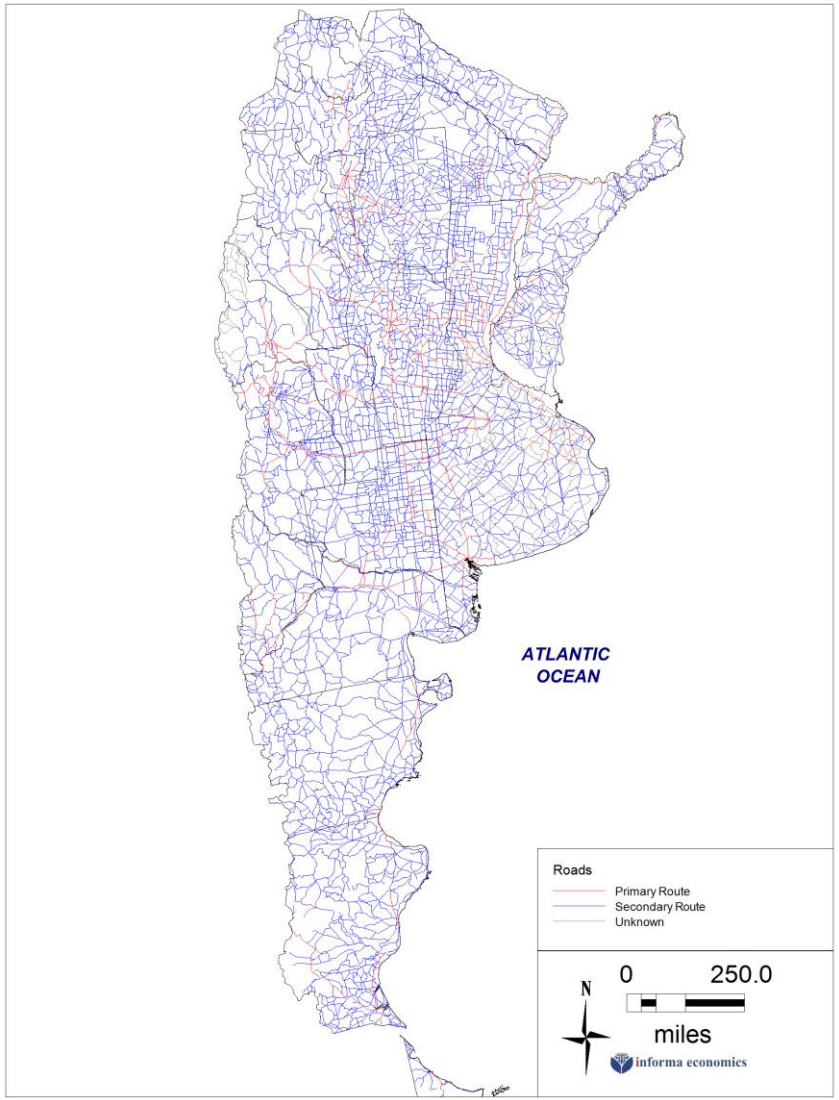


Figure 94: Argentina Primary and Secondary Roadways



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2. Railroads

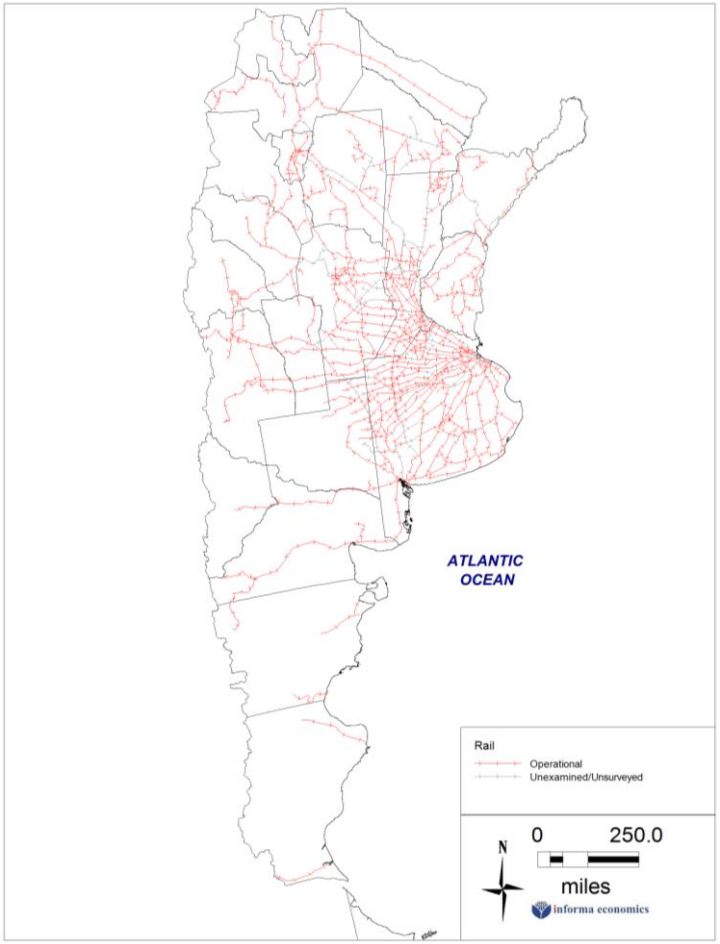
Argentina's rail system totals nearly 35,000 km of railroad track, the largest rail system in South America. The country's rail network is centered on the Rosario-Buenos Aires port cluster, with approximately 20% of grain moving by rail. While rail lines run throughout the country, 50% of the track is located within Buenos Aires, Santa Fe, and Cordoba. These three provinces also account for the destination point of nearly two-thirds of freight moved.[28] Despite existing infrastructure, railroads are only minimally used for world trade, and have a small role in the transport of goods domestically.

Currently, five rail services operate in Argentina: Nuevo Central Argentino, Ferroexpreso Pampeano, Ferrosur Roca, America Latina Logistica, and Belgrano Cargas.

Railroad use is limited by a number of factors, including: 1) lack of tracks; 2) poor quality of roads; 3) inadequate access to ports and storage facilities; and 4) lack of transfer centers between rail and truck.[29] Another limitation to Argentina's rail network is the lack of standardization of rail gauges, making it difficult to move products across various rail lines. The lack of consistency across gauges results in rail traffic within the country passing through Buenos Aires.

In 1991, the Argentine rail transportation network was privatized to allow for additional investment by private donors. As a result, the country has seen some improvements to railroad infrastructure, which have resulted in increased freight moving by rail. While additional rail movements will be utilized in the future, this particular mode still lacks competitiveness against truck transportation.

Figure 95: Argentina Railroad Infrastructure



[28] Encyclopedia of the Nations. (2012). Retrieved from http://www.nationsencyclopedia.com/Americas/Argentina-TRANSPORTATION.html.
[29] Bloch, R. (2009). "El transporte olvidado."

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Railroad Investments
Adding further lines to the rail network is estimated to cost approximately US $200,000 per kilometer, while restoration would cost US $100,000.[30] For this reason, the rail network became privatized and has captured additional shares of the transportation movements. Railroad investments in Brazil have allowed the country to experience increases in freight movement and employment availability, and decreases in railway accidents.

Chinese Investment
China has been a key player in Argentine infrastructure development. In 2011, China announced it would invest US $10 billion into the Argentine transport system, allowing goods to move to ports for trade.[31] In 2010, China agreed to provide US $4.35 billion to restore three freight railroad lines. This includes the Belgrado Line, which is an important railroad for agricultural producers.[32]

3. Waterways

Argentina boasts nearly 11 thousand km of navigable waterways, which are a component of Argentine foreign trade of bulk goods. Domestically, barges are moving efficiently within waterways; however, little freight, aside from dry bulk, is transported via inland waterways. A contributing factor in efficiencies of navigable waterways has been the presence of foreign investments in Argentina's existing waterways. Most shipping occurs within the ports located in the Buenos Aires province. Exports occur mostly through the ports of Rosario, Buenos Aires, Dock Sud, and Puerto Nuevo.

a) Rivers

Rio de la Plata
The Rio de la Plata is Argentina's primary river system and consists of the Alto Parana, Paraguay, Paraná, and Uruguay rivers. Freight can move through Argentina, as well as to Brazil, Paraguay and Uruguay. The Parana can be navigated by ocean vessels to the Port of Rosario, beyond this point only smaller ships sail upriver.

[30] CARD. "A Comparative Analysis of Agricultural Transportation and Logistics Systems in the United States and Argentina."
[31] http://finance.yahoo.com/news/research-markets-argentina-transport-logistics-140500126.html
[32] http://www.thetransportpolitic.com/2010/07/15/china-agrees-to-major-investments-in-argentinas-rail-and-metro-lines/

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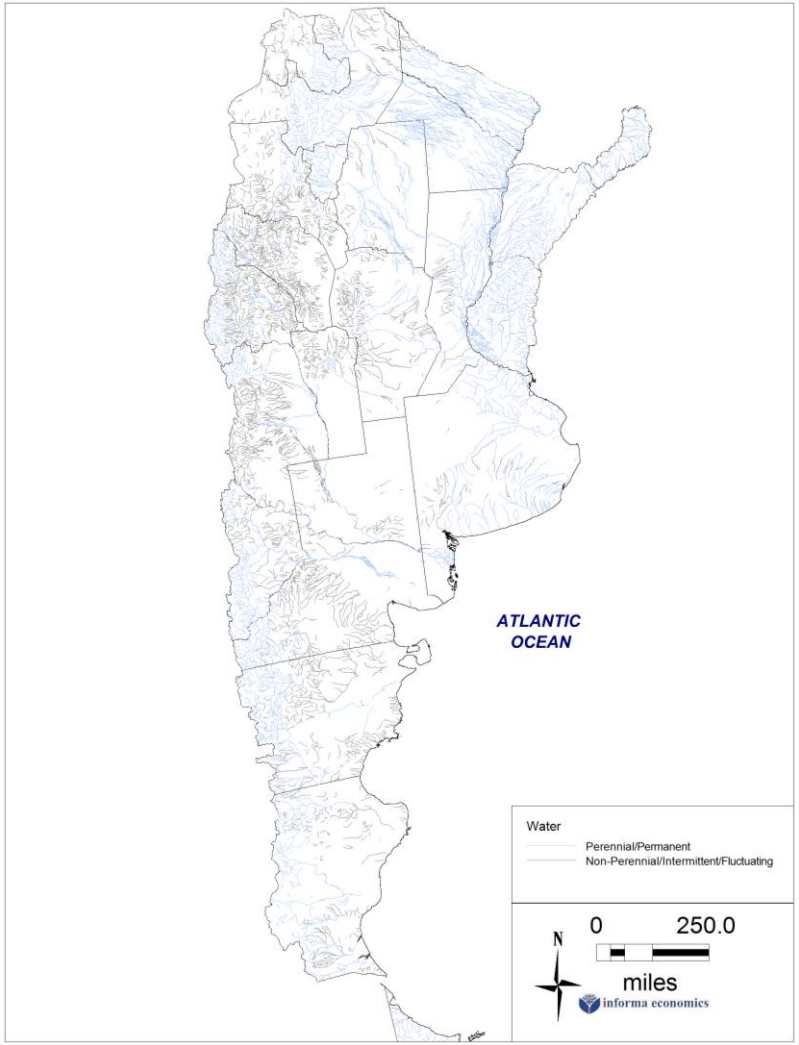
Figure 96: Argentina Waterways



b) Ports

Argentina has more than 50 ports located along the country's rivers and also along the Atlantic coast. Like Brazil, Argentina's ports are constrained by inefficiencies, which include: 1) inadequate investments, 2) poor administration; 3) delays caused by inland traffic; and 4) outdated equipment and technologies.

Major ports of inbound and outbound flows include: San Lorenzo; Rosario; Bahia Blanca; Ramallo; Neocochea; San Nicolas; Lima; Buenos Aires; Diamante; San Pedro and Villa Constucion. The La Plata Ports, Buenos Aires and La Plata, handle the most inflows and outflows of cargo.

The Port of Buenos Aires is the focal point around which economic activity, and thus transportation, is centered in Argentina. This port is responsible for the majority of Argentine trade, and is the source of traffic along the inland waterways. Much like the surrounding infrastructure, the Port of Buenos Aires' facilities are inefficient. Inefficiencies at the port result from the narrow approach channel, which backs up ships within the port and ultimately, trucks waiting to load cargo at the port.

Investments

Investments in Argentine ports are a mixture of both public and private funds. The country has seen a number or private investors contributing funds to ports in an effort to expand and enhance port facilities.

It is estimated that the Buenos Aires port will receive a total of $1.3 billion in investments during 2012.

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Port of Bahia Blanca

- An investment of US $40 million to launch a jetty for tower operations and handling in Bahia Blanca.

Port of Rosario

- In 2010, the addition of a state of the art crane, as well as two Italian port container machinery items, putting the total items at two cranes and five containers.

Port of Buenos Aires

- In 2011, the United Arab Emirates announced their decision to invest US $300 million to enlarge the Port of Buenos Aires.[33]

- In 2011, Maersk Argentina announced that it would invest US $20 million in the terminal at Buenos Aires.

Port of San Antonio

- In 2011, a Chinese farming company announced that it plans to invest US $1.5 billion to expand the Port in San Antonio, as well as to develop farms, primarily soybeans. These investments will span from 2011 to 2021.

Port of Mar del Plata

- Infrastructure improvements made to the Mar del Plata Port, which will broaden terminal 3 and construct two additional docks at the port. Improvements will also add 3-D technology and a cruise terminal in the northern jetty.

Port of Santa Fe

- In 2010, the Argentine government announced that it would invest $14.9 million to improve infrastructure and access roads leading to new Santa Fe port. The efforts will involve relocating the port, modernizing equipment and facilities and larger facilities.[34]

Port of Timbeus

- In 2009, Noble Argentina, and the Timbeus port agreed to a loan of US $18 million (followed by a previous loan of US $40 million in 2005) which would construct a port and a crushing plant in Santa Fe.

[33] http://en.mercopress.com/2011/03/15/cfk-announces-arabs-will-enlarge-the-port-of-buenos-aires
[34] http://www.bnamericas.com/news/infrastructure/Govt_announces_US*14,9mn_for_new_Santa_Fe_port_infrastructure

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Port of San Lorenzo

- In 2005, Vicentin S.A.I.C. provided a loan of US $35 million in an effort to expand port capacity and origination facilities at San Lorenzo.

E. Routing Comparisons – Distance, Time and Costs

1. Analysis of Routings from Sample U.S. Origin Locations to Shanghai and Rotterdam

The case study to demonstrate differences between origins for freight transportation competitive advantages were characterized through identification of several sample locations indicative of major production areas, without immediate proximity to the major long haul corridors.

Truck mileage was developed and estimated using proprietary Informa Economics industry elevator location data analysis to determine average distances for draw areas for different levels of rail operational capacity, considering country elevator, short line and Class I shuttles, as well as unit train load facilities. It was recognized that the location where the major Mato Grosso highway corridor for soybeans and other products, BR 163, leaves the state, there are approximately 10,000 trucks per day moving down the road. It was designed to handle only half as much volume of traffic. It is estimated that one third of the trucks have seven or more axles and each axle supports ten tons of grain. The highway was designed to handle no more than six tons per axle. The result is that these heavy trucks have already burdened the highway and left it in an unsatisfactory condition across numerous locations. This continues to exacerbate the ruining of the infrastructure, resulting in a considerable slowing of the transits over the routes.[35]

Rail mileage was developed using rail distance calculators provided by railroads and utilizing contacts within the railroad companies for verified route miles on their system. Due to the lack of competing railroads within the state, farmers will not see much of a financial benefit from shipping by rail. Currently, shipping rates on the rail line are only about 3% cheaper than shipping the grain by truck to the ports in southern Brazil.[36]

Wage rate data was for the truck drivers in the U.S. was obtained from U.S. Department of Labor, Bureau of Labor Statistics, state occupational wage data for 2010. Wages for truck drivers in Brazil were obtained from

[35] http://www.soybeansandcorn.com/Brazilian-Infrastructure

[36] http://www.soybeansandcorn.com/news/Jan26_12-Three-Grain-Terminals-Now-on-Ferronarte-Railroad-in-Mato-Grosso

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wageindicator.com. Origin locations selected serve as examples of soybean storage and load locations in each U.S. and Brazilian state.

Distances were converted to miles from kilometers for distances in Brazil. The time between pick-up, drive time and delivery does not fully account for time the product is waiting, staged for the following transport or on-carriage. The delivery is not always direct to transfer for the next mode. A truck may take product to a facility for discharge, and while there is storage time for the soy, the next mode may not have assets in position for immediate loading. The arrival of transport equipment for the next mode may require some discharge of another inbound commodity, preparation of equipment, or other operational formalities that delay outflows. Truck to rail, truck to barge, or rail to vessel may await the arrival of the next operating departure. Significant effort goes into planning the coordination between modes. However, the cascade of delays can arise and put strains on terminals as cargo arrives ready to be loaded, but where the train, barge or ship to depart with the cargo has faced delay in its most recent freight.

In constructing the simplified model for comparison purposes, this examination has considered how one metric ton of soybeans are moved, given a set of points in rural Iowa, rural Illinois, and remote points in the Brazilian states of Mato Grasso and Goiás. Transport at peak harvest time can mean arrival of the cargo at a terminal that just missed the on-carriage mode's departure. Frequency and consistency of transportation results in, either effective planning and management of the freight for its intended end use, or when the movements are not timely and routine, the logistics stream, the supply chain reflects the poor connectivity. An analogy would be electricity delivery where if the flow is sporadic, then blackouts occur. Time for the next train, barge, or vessel prompt the need to stage the cargo, anticipate, booking or ordering of equipment for the onward movement and collaboration with the carriers, whether in the northern or southern hemispheres. The model was constructed to define the competitiveness of transits to vastly different market destinations, Rotterdam, Netherlands and Shanghai, China.

From inland locations like Iowa and Illinois the flow to the Center Gulf or to the West Coast were dependent on the destinations. A path of least resistance approach was utilized to direct the cargo in the most logical logistical routing. It was not practical to consider an easterly routing to go to Asia, nor for a westerly routing to get to Europe from the U.S. Midwest. In the case of the Brazilian routings, likewise, if soybean shipments were to move from the inland state hinterlands, at a point beyond the roughly geographic midpoint it does not generally make sense to route cargo in an opposing direction. For origins from within Goiás, it was recognized that the cargo would not logically get routed to the Northern ports under development, unless severe congestion or other extenuating circumstances were to be avoided in the transportation network at the Brazilian East Coast. Therefore, a short move to the rail terminal in Rondonópolis from Goiás was included to consider avoidance of the truck routes to the Port of Santos.

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The Brazilian government have identified a number of projects that were expected to help lower transportation costs overall. Among them, barging operations on the Teles Pires/Tapajos Rivers would be expected to transport soybeans from Mato Grosso's northern regions to the Amazon Port of Santarem. The planning studies for the project were put on hold in 2011. The project faces serious risk of not being included in the National Barging Program due to spending cuts that were a result of policy shifts toward the national Accelerated Growth Program.

Furthermore, the 2011 suspension of work on a Tocantins barge development project and development efforts at the Port of Maraba in the city of Santarem resulted in a setback to expectations of Mato Grosso farmers. These projects, both of which are located in the Para, were put on hold as a result of the federal Transportation Department's widespread corruption. The Brazilian President, Dilma Rousseff, ordered suspension of the work, to enable a complete review of on-going departmental projects.

These two suspended projects were identified as critical to producers in Mato Grosso's northern and north eastern regions. The producer's preference is to export soybeans via the Amazon River instead of the ports in far southern Brazil, were. Without viable alternatives, farmers in the state must continue to rely on the Port of Paranaguá in the state of Parana and the Port of Santos in the state of Sao Paulo. The distance from central Mato Grosso to the Port of Paranaguá is the equivalent of the distance from Minneapolis/St. Paul to Miami, Florida. Slightly more than 60% of the soybeans that are exported from Mato Grosso are transported to the ports via truck down two-lane congested highways. At the peak of the harvest, it can cost as much as US $3.50 per bushel or nearly $127 per metric ton to transport soybeans from central Mato Grosso to the Port of Paranaguá.

In summary, infrastructure improvements are the basis for prospective change, namely, improvement in the competitiveness of landed cost comparisons. The improved returns to farmers, producers, and processors are predicated upon the most cost effective means of movement to the market, from the farm. The ability to fluidly move, transfer, that is unload and load, without undue waiting times, with predictability, not variability in the logistics flow, are criteria that enable delivery to customers and intermediaries in the supply chains.

Looking at the time, distance and estimated costs of the transits in the following tables, the model evaluates the competitive markets in those three particular respects.

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Table 49: Transit Distance Comparisons of U.S. and Brazilian Soybean Routings

Distance (in Statute Miles)	United States				Brazil			
Farm	**Iowa**		**Illinois**		**Mato Grasso**		**Goias**	
Truck	22.5	22.5	15	15	950	350	549	305
Wait								
Country Elevator								
Truck	40	40	40	40				
Wait								
Long Haul						Rondonópolis		Rondonópolis
Barge Loader		1,444		1,235				
Rail Shuttle	1,655		1,820			787		787
Wait								
Export Elevator								
Wait								
Load Vessel								
Sail	**PNW**	**Gulf**	**PNW**	**Gulf**	**Santarem**	**Santos**	**Santos**	**Santos**
Rotterdam		4,854		4,854	5,192	6,310	6,310	6,310
Shanghai	5,708	10,013	5,708	10,013	12,922	12,493	12,493	12,493
TOTAL DISTANCE								
TOTAL to ROTTERDAM		6,361		6,144	6,142	6,660	6,859	6,615
TOTAL to SHANGHAI	7,426	11,520	7,583	11,303	13,872	13,630	13,042	13,585

The distances from the United States are highly competitive. The northern Brazilian Port of Santarem is very comparable to the U.S. easterly transit distances from the Center Gulf. Far and away the Center Gulf location is closer to China. The very long haul initial move in Brazil is by truck. Sixty to seventy percent of the soy freight movement in Brazil is attributed to truck movement. Given the different standards, considering the international movements were originally compiled using standard nautical miles, the default measure for sea distances for moves from port to port. The PNW moves were calculated through Puget Sound, Center Gulf locations focused upon the Port of New Orleans, and from the respective Brazilian East Coast and Amazonian Ports of Santos and Santarem.

Local truck moves in the United States are being considered as from the farm to the first country elevator, as well as from the local elevator to the shuttle train or river elevator.

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Table 50: Transit Time Comparisons of U.S. and Brazilian Soybean Routings

Time (in Hours)	United States				Brazil			
Farm	**Iowa**		**Illinois**		**Mato Grasso**		**Goias**	
Truck	0.6	0.6	0.4	0.4	21.1	7.8	12.2	6.8
Wait for Loading at Harvest	1.5	1.5	1.5	1.5	24.0	24.0	24.0	24.0
Country Elevator								
Truck	1.1	1.1	1.1	1.1				
Wait for Loading	1.5	1.5	1.5	1.5				
Long Haul Terminal						Rondopolis		Rondopolis
Barge Loader		262.5		224.5				
Rail Shuttle	82.8		91.0			52.47		52.47
Wait for Loading	20.0	48.0	20.0	48.0		72.0		72.0
Export Elevator								
Wait	84.0	84.0	84.0	84.0	120.0	420.0	420.0	420.0
Load Vessel	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0
Sail	**PNW**	**Gulf**	**PNW**	**Gulf**	**Santarem**	**Santos**	**Santos**	**Santos**
Rotterdam		345.6		345.6	321.6	391.2	391.2	391.2
Shanghai	423.6	715.2	423.6	715.2	859.2	957.6	957.6	957.6
TOTAL TIME (Hours)								
TOTAL to ROTTERDAM		816.9		778.7	558.7	915.0	919.4	914.0
TOTAL to SHANGHAI	687.1	1,186.5	604.2	1,148.3	1,096.3	1,481.4	1,485.8	1,480.4
TOTAL TIME (Days)								
TOTAL to ROTTERDAM		34.0		32.4	23.3	38.1	38.3	38.1
TOTAL to SHANGHAI	28.6	49.4	25.2	47.8	45.7	61.7	61.9	61.7

The differences in speed and modal split make for the greatest differences in the time in transit. The U.S. barge movement, as can be recognized in the cost comparison, is exceptionally cost effective, is significantly slower. Comparisons for trucking from farm to elevator assume more restrictive load factors in the U.S. than in Brazil, where it is reported that tonnage of loads is routinely 25 metric tons where the vehicles are often 40 metric tons or more, however truck in the U.S. applied a 22 metric ton average load since the national gross vehicle weight ratings for commercial vehicles are 80,000 pounds or just under 36.3 metric tons. The speed of the vehicles in the respective markets were evaluated at 35 miles per hour from the U.S. farm, and 45 from the Brazilian farm, given the average differences in distances, and other operating local road and transportation conditions. The rail cars can carry nominally, 110 tons, with as many as 110 cars being assembled and moved together as a unit train. The cost effectiveness of loading unit trains in as few as 15 hours can help movement of that much cargo over inland distances to achieve even greater savings as published railroad tariffs provide material cost incentives for achievement of such efficiencies. Barges commonly have

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capacities in the U.S. inland river system of around 1,500 to 1,700 tons per barge. The scale of the vessels most commonly plying the trades under this review, known as Panamax vessels, is nominally loading 60,000 tons per voyage. The vessels operate at an average speed of 14 knots, or nautical miles per hour.

For vessels that can carry 60,000 tons of grain, the normal loading time at a Brazilian port is around 36 hours. In 2011, it was reported that as long as 5 days to load a vessel was the resulting nominal time to complete operations due to rain and showers. The average loading rate at the port is 100,000 metric tons per day, but on can drop to as little as 22,000 tons due to wetness arising from inclement weather. In 2012, with a failure in port infrastructure and a back-up of vessels in the harbor, the delays for loading ran up to as many as 20 days.

Table 51: Transport Cost Comparisons of U.S. and Brazilian Soybean Routings

Cost (in US$/MT)	United States				Brazil			
Farm	Iowa		Illinois		Mato Grasso		Goias	
Truck	11.72	11.72	10.17	10.17	110.75	30.58	103.37	31.50
Wait for Loading	1.13	1.13	1.32	1.32	4.2	4.2	4.2	4.2
Country Elevator								
Truck	11.72	11.72	10.17	10.17				
Wait for Loading	1.13	1.13	1.13	1.13				
Long Haul						Rondopolis		Rondopolis
Barge Loader		20.97		17.40				
Rail Shuttle	29.74		21.99			17.60		17.60
Wait for Loading								
Export Elevator								
Wait for Loading								
Load Vessel	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Sail	**PNW**	**Gulf**	**PNW**	**Gulf**	**Santarem**	**Santos**	**Santos**	**Santos**
Rotterdam		31.55		31.55	34.9	34.9	34.9	34.9
Shanghai	27.80	61.36	27.80	61.36	71.9	71.9	71.9	71.9
TOTAL COST								
TOTAL to ROTTERDAM		**85.22**		**78.74**	**149.8**	**69.6**	**142.4**	**70.5**
TOTAL to SHANGHAI	**90.24**	**115.03**	**79.58**	**108.55**	**186.8**	**124.3**	**179.5**	**125.2**

Total landed costs have not taken account of factors outside of the transportation stream, such as differential interest rates, operational assets and the associated capital costs, assuming that these are covered through transportation pricing

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mechanisms. In personal correspondence with USDA Brazilian Post staff, it was noted that from Mato Grosso to the Port of Santos direct by truck (3 days) that time and that volume accounts for one-fifth of soybean deliveries at port. The alternate routing, from Mato Grosso to the Port of Santos via multi-modal – truck to rail – (5-7 days) includes 1-2 days of bin storage with rail carrier, Americana Latina Logistica (ALL), during transfer from truck to rail. Rail actually accounts for 80% of soybean deliveries at port. So the rail option is slower, but more volume moves in the corridor. Routing to the Port of Paranaguá takes three days by truck from Mato Grosso. Recent slowdowns and waiting lines at Paranaguá have been due to a lease expiring at one of the receiving terminals (the port has 9 different terminals/entities that receive grain). As for routing to the Port of Santarem, a majority of the soybeans routed through there are delivered by barge via Porto Velho (7-8 days from farm to Port of Santarem depending on distance of farm to Porto Velho). There are also some significant volumes of soy production occurring right around Santarem that are drawn to the port directly.

Under a scenario where the investments are made in Brazilian infrastructure, and improved efficiencies are achieved through supply chain improvements, there are a number of improvements in competitiveness that can be expected. As can be seen in Table 51, for a metric ton, the reduction in truck miles by improving rail service reduced by more than half, the cost from select locations in Mato Grosso or Goias, going to either Rotterdam in service to the European market as well as to Shanghai, to serve Asian markets. Rather than trucking product all the way from origin to port, using multimodal bulk transportation service, for example utilizing the rail terminal at Rondopolis, can take costs out of the system, as more turns can be achieved for the trucks, greater volumes can be moved utilizing the capital and infrastructure that have been designed to serve as the means to achieve exactly those ends.

To be able to leverage improved logistics service, utilizing rail instead of trucking the commodity all the way to the port, economies of scale are able to be achieved. While there are currently still waiting times and inefficiencies that can be improved upon in the Brazilian logistics stream for soybeans, as well as for other grain movements, the forecast, for when the logistics infrastructure is improved, will be expected to achieve further cost and time savings relative to the existing operations. Furthermore, these improvements can be anticipated to bring added cost reductions to support Brazilian cost competitiveness on world markets. To the extent that the bulk modal services can be operated with consistency, reliably without disruptions or delays at either end of the transport mode interconnections to the next mode, the cost improvements will continue to improve Brazilian production competitiveness. Observing the investments and improvements supporting future exchanges of soybean movements from truck to rail, or truck to barge, and then from the barges or railroads to the deep water export vessels, will help define the Brazilian competitive position in the market.

The cost of wait time at the export elevator, in the model, was defined as the difference between market costs for shipments moving on a Cost, Insurance and Freight (CIF) basis relative to the level of a shipment that moves under terms

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that are Free on Board (FOB). This difference while a reasonable approximation across the marketplace can have greater or lesser differences from season to season, for different sizes of vessels, or with regard to other factors related to vessel loading cost, including port labor rates, the harbor itself and local competitive factors, and crop quality differentials.

The point of the comparisons is that truck, barge, rail and deep water vessel transport create complexities when examining similarities and differences among and between the respective modes. Furthermore, the differences in physical geography, regulatory regimes, labor, capital assets tangential to soybean and product distribution operations, not to mention the climatic distinctions, as well as the degree of maturity of agricultural production result in vastly different local market conditions.

In a separate comparison, it was found that moving a ton of soybeans from the interior of Mato Grosso to Shanghai, China, the cost was around US$ 174 per metric ton, an expense 43% higher than what it would have been to move soybeans a similar distance from the U.S., which would be roughly into Shanghai from Minnesota. Improvements in the transportation systems in Brazil have been very slow to develop. Additional rail lines are planned and some are in various stages of being built to support the country's interior. Some highways are being asphalted, but that only contributes to limited incremental improvements. Those enhancements are expectedly temporary. A huge number of very heavy trucks traverse the roadway, so in just a few seasons, without full maintenance there is speculation that the roads will deteriorate to an unsatisfactory condition. As a result, in the present, Mato Grosso continues to be one of the most expensive regions in the world to grow soybeans, particularly a result of high transportation costs.

The important difference is the nature of how the soybeans have been moved. In the United States, over the past decade there has been a decline in the ratio of soybeans moved by barge. For the most recent year available, 2010, the division between barge, rail and truck taking soybeans to export position was, respectively, 47%, 44%, and 8%. In the U.S., as recently as 2002 about 64% of the soybean moves to export market position were by barge, 31% by rail, and 5% by trucks.[37] It is completely the opposite in Brazil where nationally 60% moves by truck, 33% moves by rail, and 7% moves by barge (modal share information by market position is not readily available for 201, but on average Brazil transports two-fifths of its soybeans to export position). Increasing infrastructure investments are needed in Brazil, as the country spends around 2% of GDP on such inland infrastructure, according to the USDA, yet, there is a forecast need for at least double that level. With the resignation of eight departmental cabinet ministers in the government, since Brazilian President Dilma Rousseff took office on Jan. 1, 2011, the ministers of cities, defense, transportation, agriculture, tourism, sports and labor have stepped down, as well as the president's chief-of-staff, also a Cabinet member, resigned amid

[37] http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5097327

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allegations of improprieties using his office for personal gain. It is these multiple disruptions of governance that are being used as explanations and root causes for delay in completing the building of infrastructure in the country.

Congestion at the load centers and especially at the ports is a notable concern in Brazil. Trucks have lined up to deliver their loads of cargo to the Port of Paranaguá, for example, where 78% of the soybeans are delivered by truck and 73% of the soybean meal, likewise is moved over the road. When the weather is good, at the peak of harvest, reservations are required for the drivers, at most of the main ports. Managers at the farm origin of the freight have commonly sent trucks on their way to the ports, without first having made a reservation. When the trucks arrive and the pre-registration for deliveries were still not made, the domino effect, or reaction in the port area bring about consequent delays for others due to the administrative obstacles. These have led to trucks backed-up as much as 30 kilometers or more. While such a long line can be cleared in about a day or two, for the management of the vessels, and the delivery of soybean product, the logistics stream is adversely impacted by the inefficiencies in the system. The structure of the delivery registration, and reservation systems are getting better. In 2010, around 20% of loads were arriving without reservations and now the indication is that there is one tenth that amount at Paranaguá.

2. Analysis of Routings from Sample US Origin locations to Shanghai and Rotterdam

The case study to demonstrate differences between origins for freight transportation competitive advantages were characterized through identification of several sample locations indicative of major production areas, without immediate proximity, but with reasonable connectivity to the major long haul corridors to get the soybeans to export market positions at ports. Selected locations included select points in the states of Illinois and Iowa, as well as in Mato Grosso and Goiás, states in Brazil. The competitiveness of the origin locations relies on the smooth, consistent ability to move the product to from farm to market, even at peak volume, or harvest times.

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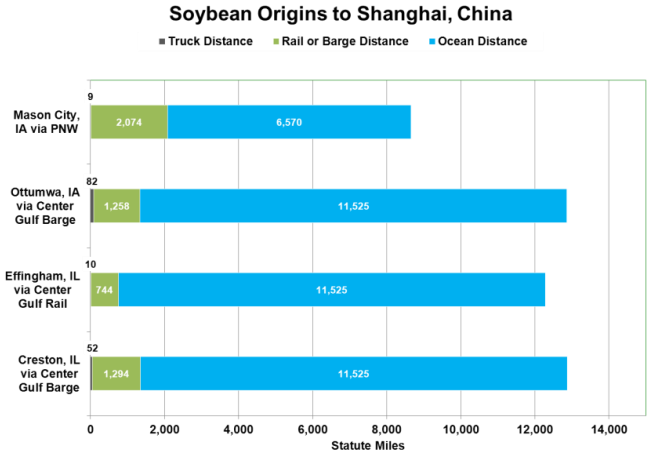
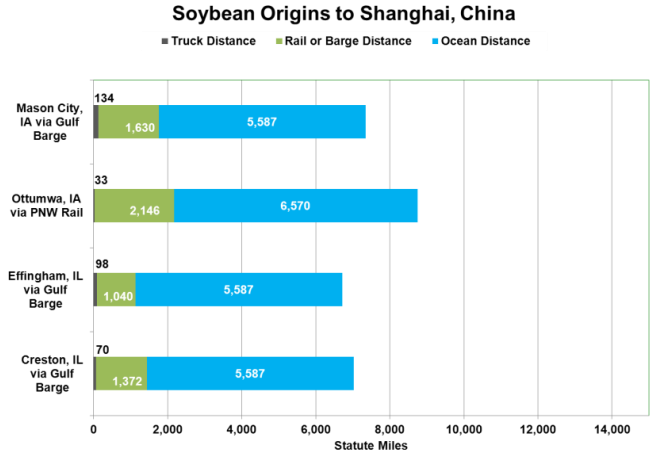
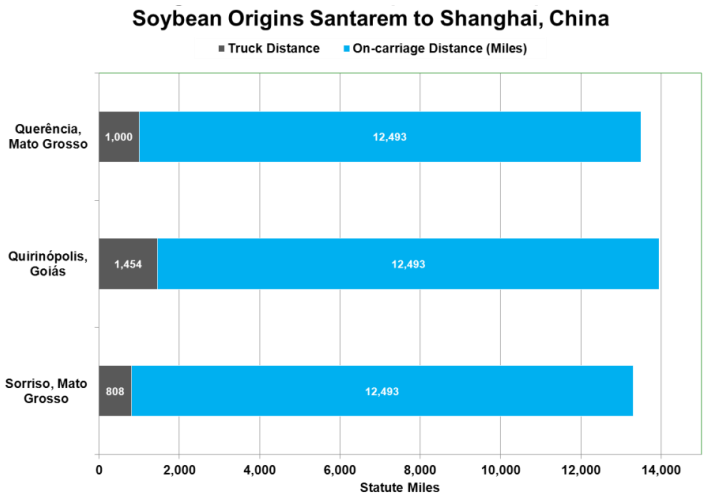
Figure 97: Representative Distances of Soybean Origins and Routings to Shanghai, China

UNITED STATES





BRAZIL



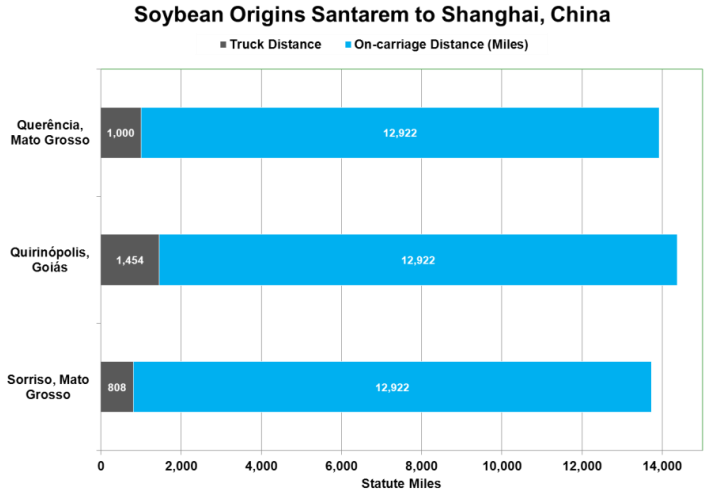


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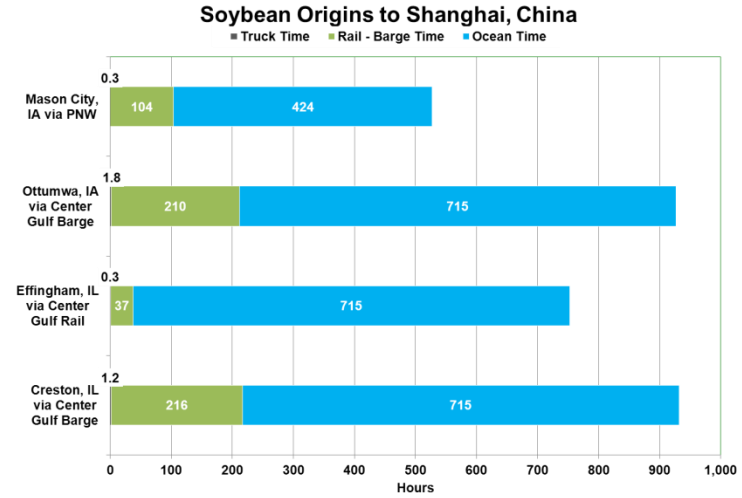
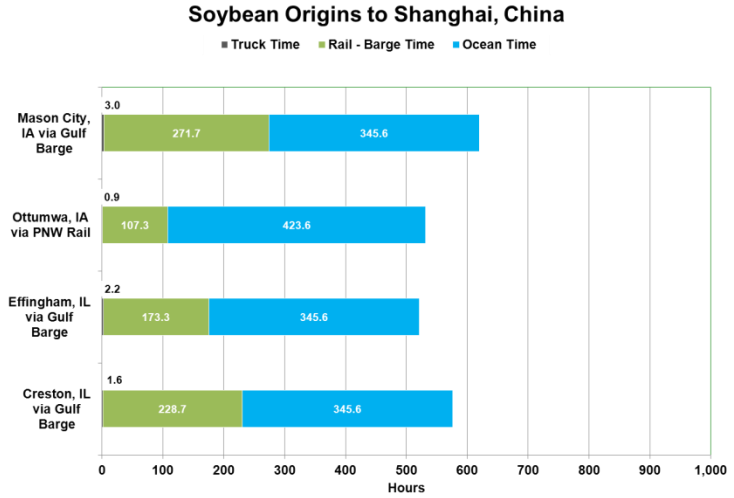
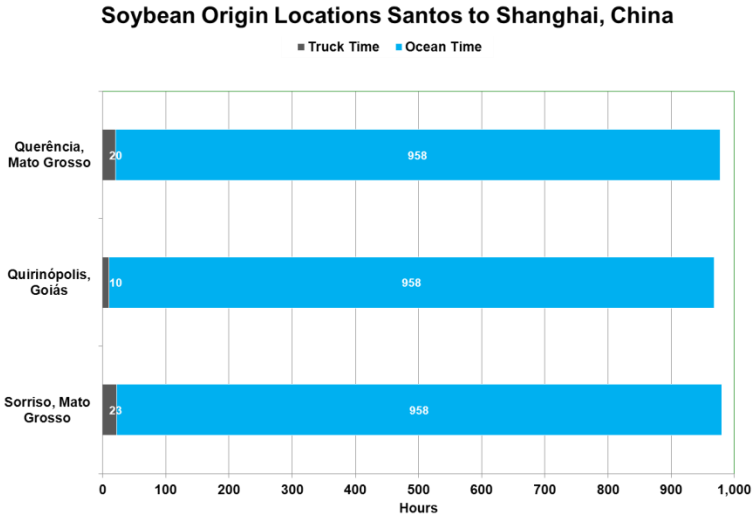
Figure 98: Representative Time (hours) of Soybean Origins and Routings to Shanghai, China

UNITED STATES





BRAZIL



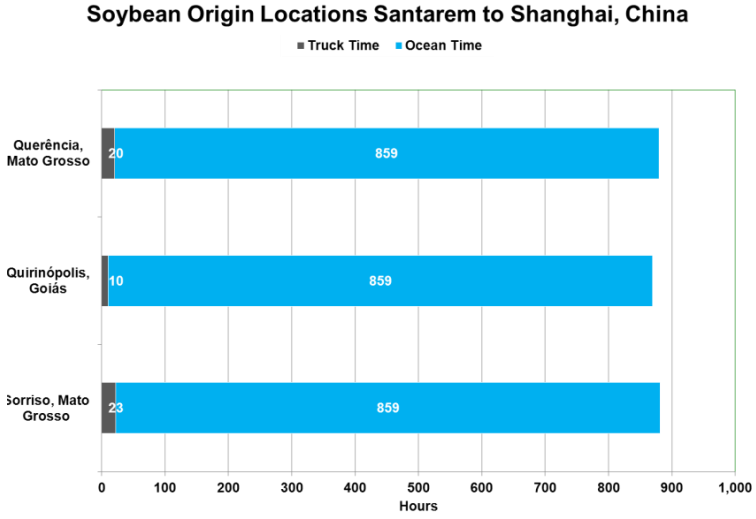


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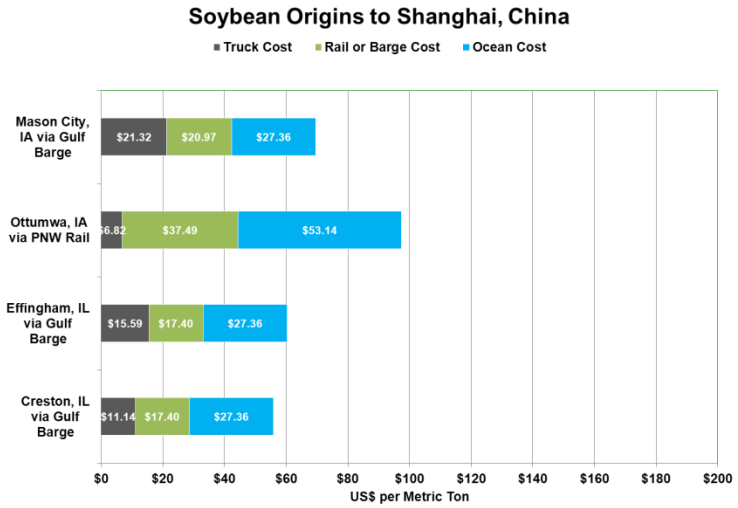
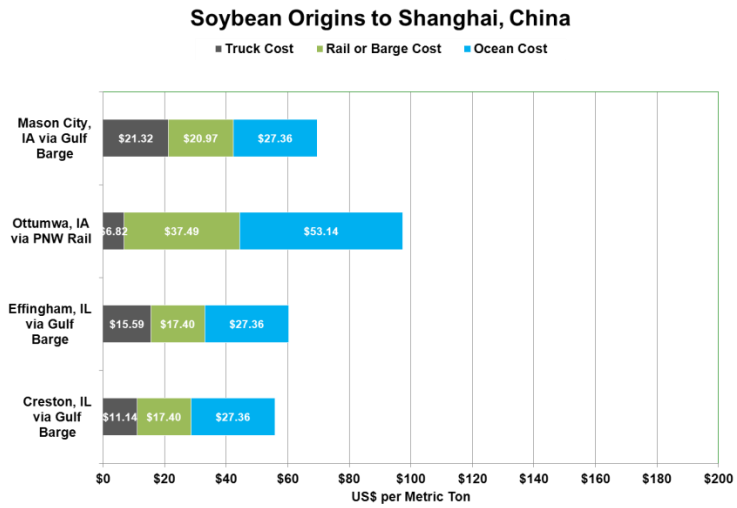
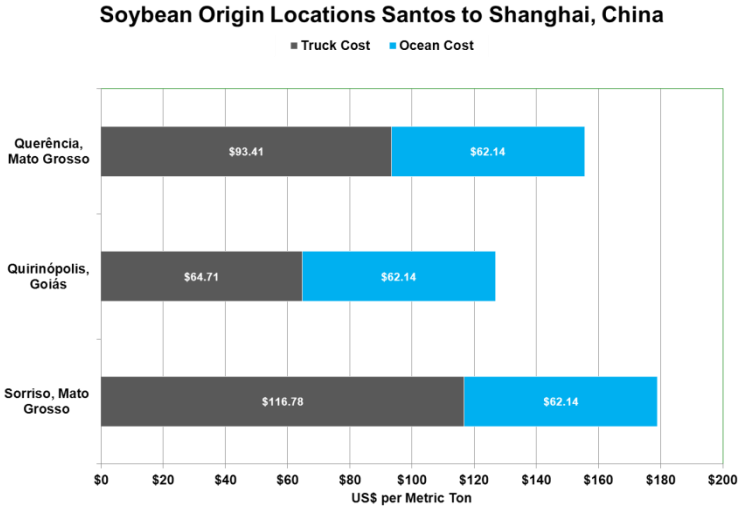
Figure 99: Cost Components of Representative Soybean Origins to Shanghai, China

UNITED STATES





BRAZIL



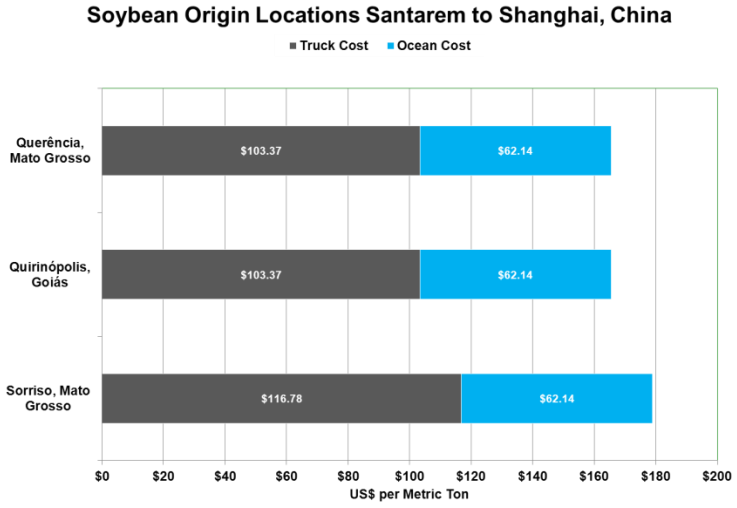


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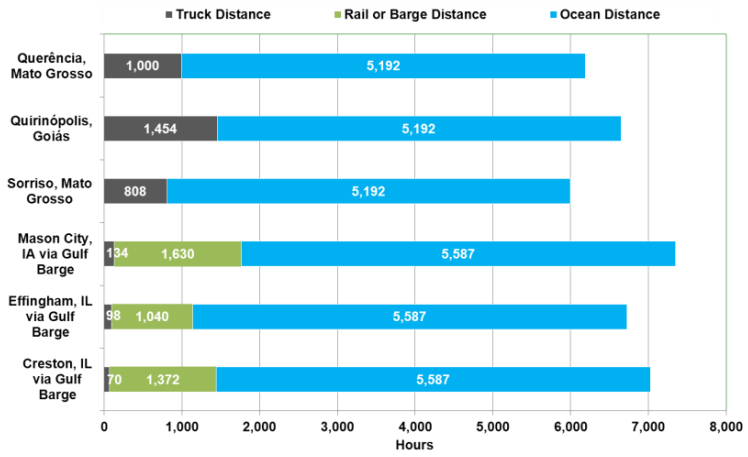
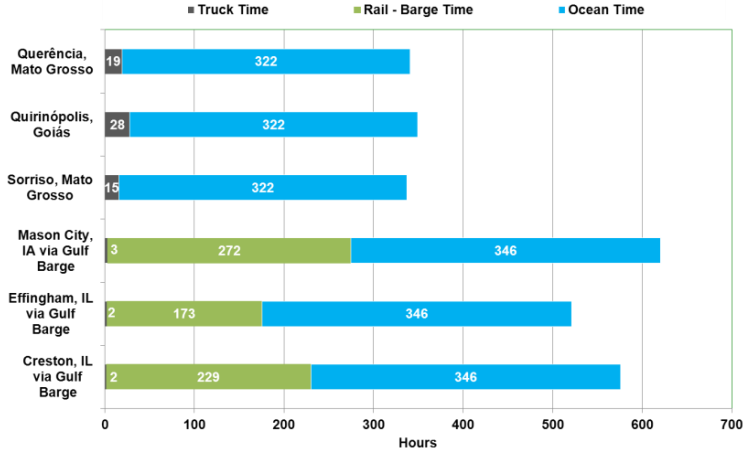
Figure 100: Distance, Time and Cost Components of Representative Soybean Origins to Rotterdam, Netherlands

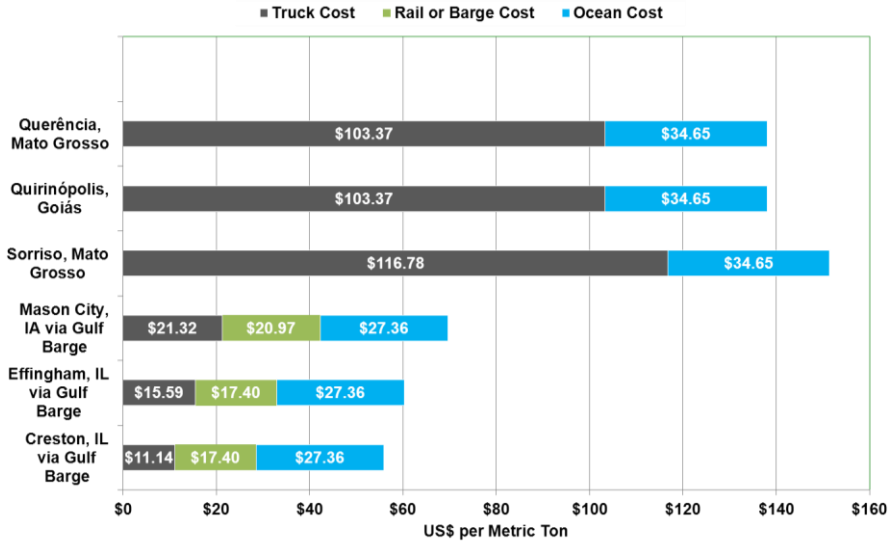
DISTANCES



TIME



COSTS



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There are clearly differences, moving to Rotterdam, as cited above in the figures, where, though the distances from Brazil's hinterland production areas to the East Coast is relatively comparable to the routing from the U.S. Midwest via the Center Gulf Coast. The time in transit is longer from the U.S. due especially to the barge transfers and transits, with the additional handling, and the potential elevations between modes impacting the transit.

F. South America Infrastructure Impacts

While funding and project initiations have been set aside for infrastructure development in South America, the reality of the situation is that these projects are often not completed within the scheduled timeframe. For example, the completion date for finishing BR 163 has been delayed a number of times with infrastructure funds spent elsewhere. If infrastructure developments were to be completed efficiently and in a timely manner, this would benefit producers by reducing transportation costs. Decreases would also allow farmers to increase acreage and transport additional production to ports. However, for South America to prosper, increases in roadway and railway infrastructure must be paired with expansion and infrastructure improvements at the ports. Without both expansion components, producers will experience bottlenecks at the port, where producers may lose profit associated with the time sensitive nature of agricultural products.

The strength of Brazil's road haulage industry is its sheer dominance relative to other transport modes. Well over half of all Brazilian freight is carried by road. That means that particular segment of the transport industry has developed to quite sophisticated levels. In turn it and can count on an experienced workforce and efficient local production of large trucks. However, the extremely poor state of Brazil's roads and the lack of integration across modes cause delays, congestion and high transportation costs. According to a Brazilian private sector lobby group, the National Transport Confederation, three-quarters of Brazil's highways are in bad condition. The trucking business does have a meaningful opportunity in the face of slow global economic recovery, as freight demand is expected to grow in the region at a rate roughly double the growth in the economy as a whole. Brazil is set to experience a strong export boom.

Improvements in rail freight infrastructure meanwhile represent a threat to the road haulage industry. Generally neglected in the past, now that the privatized rail system is beginning to invest and expand capacity, it could win market share, particularly in the agricultural sector as well as for other bulk goods. In moving commodities such as iron ore and soybeans over long distances, rail can deliver lower costs per ton-kilometer or ton-mile.[38]

[38] Brazil Freight Transport Report, Business Monitor International Ltd., Q2/2010, P. 8

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In South America, both Brazil and Argentina provide examples of steps in the right direction towards improving transportation efficiencies. Brazil has taken steps towards improving both highway and port infrastructures. In addition, Argentina has taken a step in the right direction by privatizing its rail network to allow for additional sources of funding. However, at the current rate of expansion both countries still lag behind in achieving greater efficiency to be competitive with developed countries.

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VIII. Summary and Conclusion

- Impact of Infrastructure on U.S. Agriculture
  - The delivery of commodities resulting from grain and soybean farming are of significant importance to the U.S. economy.
  - U.S. industries "fully dependent" on soybeans, grain and related products (down to the second order of consumers in the supply chain) account for nearly:
    - 1.5 million jobs,
    - More than $352 billion in U.S. output,
    - Over $41 billion in labor earnings, and
    - Greater than $74 billion in value added on the U.S. economy.
  - Impacts of grain, soybeans and products on U.S. earnings, employment, output and value-added by key Bureau of Economic Analysis regions include:
    - The largest share of the impact on U.S. earnings, employment and value-added occurs in the Plains region (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota and South Dakota), where the farm commodities are produced. The proximity to the farms where these inputs are produced, the Plains region also has a large concentration of food processing, milling and food manufacturing.
    - The greatest impact on industry output is in the Great Lakes region (Illinois, Indiana, Michigan, Ohio and Wisconsin). This is largely attributable to the concentration of food manufacturers, in the Great Lakes region, as well as the fact that the Great Lakes states are second only to the Plains in their level of grain and soybean farming and production activity.
    - The Southeast (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee and West Virginia) is another major region with a significant dependence on grain and soybean commodities and products, accounting for approximately one-fifth of the U.S. output that is dependent on these commodities.
    - The Southwest, Mideast, Rocky Mountain, Far West, and New England regions account for significantly smaller shares of grain and soybean dependent output, largely because of the lower concentration of farming and related activity in these regions in comparison with the others.
  - Infrastructure projects were identified that can significantly reduce costs moving soybeans and grain commodities to market position. It is expected that the majority of these savings will be passed back through the farm gate and on to U.S. firms using soybeans and grain commodities as inputs to production, enabling these firms to be more productive and competitive both domestically and globally. Cost savings are most likely to be derived from:

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- Improved reliability in the delivery time of soybeans and grains,
- Reduced travel time and transit costs,
- Improved efficiency at ports for using larger, more efficient ocean going vessels, and
- Potential re-assignment of rail traffic to barge traffic for freight currently utilizing rail to avoid deficiencies at key lock and dam facilities

- The cost savings to the soybean and grain industries that are expected to result from the investments in transportation infrastructure nearly total $145.9 million on an average annual basis.
- The transportation improvements described in this report, combined with the impacts of the costs savings are expected to result in an average annual impact of:
  - Over 8,113 jobs,
  - More than $409 million in personal income,
  - Greater than $1.2 billion in output, and
  - Over $630 million in value-added in the U.S. economy.
  - Most of the impact is expected to result directly from the enhanced attractiveness in water transportation as a mode of transportation (and increased productivity and outlays in the water transport industry), and from the direct outlays in the maintenance and repair of infrastructure.
  - Other impacts stem largely from industries supplying these providers, (such as fuel providers, landlords or insurance carriers).
  - Still other impacts will be "permanent" impacts in the economy related to improved efficiency in grain and soybean supply chains.
- Removing major bottlenecks in the movement of grain, soybeans and products in the United States would involve $467.2 million of construction outlays on an annual average (over a 5 year construction period for locks and over a 10 year period for dredging) in the U.S. economy, and would be expected to increase the output of water transportation by approximately $43.3 million annually (due to some diversion from rail induced by improved reliability, enabling the rail mode to be used more efficiently as well).
  - The transportation outlay effects of the suggested transportation improvements are expected to result in:
    - Approximately 7,927 jobs,
    - $400.8 million in personal income,
    - Over $1.17 billion in additional output,
    - More than $615.1 million in value-added on the U.S. economy through the course of the construction period.

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- The impact of supply chain efficiencies associated with reduced cost in transporting soybeans, grains and products generates:
  - Approximately 185 jobs,
  - Over $8.8 million in annual earnings,
  - More than $40 million in output, and
  - Greater than $15.5 million in value-added on the national economy.
- Overall, more than 58% of the output enabled by savings in the transport of soybeans and grain will be realized in the Southeast region, with more than 55% of the employment, 53% of the earnings and 53% of the value-added from these savings accruing in the Southeast region. This impact on the Southeast region is very dispersed among industries, with the ten most affected industries accounting for less than half of the overall impact.
- Soybeans and grain spread far into the U.S. supply chains, such that the inter-regional impacts account for a significant share of earnings (43%), output (38%), employment (41%) and value-added (43%). This indicates that the economic impact of savings on the movement of soybeans, grain and products spreads broadly throughout the economy in many inter-state and inter-regional transactions and is likely to have impacts far beyond those locations that directly consume or use the commodities to which the cost savings apply.

A summary of the transportation investment implications as evaluated through economic input-output modeling are then presented in Table 42 reiterated here.

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Table 42: Annual Summary of Transportation Investment Outlays and Returns for the Soybeans, Grain and Products Industries

Description	Impact Type	Dollar Value	Economic Impact			
			Earnings	Output	Employment	Value-Added
Infrastructure Outlays	Construction	$467,200,000	$400,816,086	$1,176,474,978	7,927	$615,177,949
Supply Chain Impacts	Cost Savings	$145,900,019	$8,898,453	$40,314,188	185	$15,535,030

- Key Transportation and Infrastructure Issues
  - The locks and dams on the inland navigation system have exceeded the design life of the structures and have not been fully and efficiently maintained, and many are not adequate to accommodate modern tow configurations.
  - Dredging navigation channels to project depths, that is, the specified navigable waterway targeted by the U.S. Army Corps of Engineers at key ports is not being efficiently funded for reliable service to maintain adequate navigational draft. This limits the volume of soybeans and grains that can be loaded on a vessel, leading to higher freight costs.
  - Panama Canal is amidst an expansion effort to add a new set of locks to accommodate increased traffic and larger vessels to transit the isthmus between the Atlantic and Pacific Oceans. The expansion will allow vessels to be loaded to a 50 foot draft from the current draft of 39.5 feet, as well as longer and wider vessels to utilize the passage.

- Transportation of Soybeans and Products
  - Long haul transport of soybeans and soybean products, grains and grain products move from areas of surplus into deficit areas of the United States for domestic feeding and processing purposes, and to export position.
  - Rail movement has increased in the western Corn Belt moving soybeans and grains to export position in the Pacific Northwest
  - Unit or shuttle train elevators exceed 500 efficient, rapid operational locations across the Corn Belt. These facilities allow fast loading of unit or shuttle trains of 90 to 110 cars per train in less than 12 hours.
  - The relative movement of soybeans and grains by barge has shifted away from the upper Mississippi and Illinois River origins toward the lower Mississippi and lower Ohio Rivers.

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- The fleet of covered barges has transitioned from older equipment with less carrying capacity and shallower draft to equipment that is 15% to 20% larger that has deeper hulls, which requires deeper draft capabilities when fully loaded.
- Export capacity has increased 30% in the PNW, 10% across the U.S. The PNW capacity accommodates the westerly expansion of crops and increased soybean and grain trade with Asia.
- Rail carloadings of soybeans to expand 36% to more than 367 thousand in 2020/21 from 2009/10, with the volume moved to increase more than 50% to 41.6 million short tons or 37.7 million metric ton in 2020/21.
- Barge movements of soybeans to increase 43% to 32.1 million short tons or 29.1 million metric tons in 2020/21 from 2009/10.

- Crop Outlook
  - Production increasing on higher yields, stable cropping area; soybean area expanding, corn shrinking, but overall total production rising.
  - Corn ethanol will reach its Renewable Fuel Standard mandate cap of 15 billion gallons in 2015
    - During the ethanol build out phase surplus corn supplies diminished across the Corn Belt, especially along the geographic reaches of the upper Mississippi and Illinois Rivers.
    - Surplus corn supplies will increase once the ethanol mandate for corn based production is achieved
  - The Environmental Protection Agency will likely increase the biodiesel mandate from 1.0 billion gallons in 2012 to 1.28 billion gallons or about 486 billion liters in 2013, which equates to an additional 2.1 billion pounds or nearly 1 million metric tons of vegetable oil and fats demand, which in turn supports the domestic oilseed crushing industry.
  - China will continue to import larger volumes of soybeans from 52 million metric tons in 2009/10 to 106 million in 2020/21, more than doubling, and will import corn on price opportunities.
  - Cropping of soybeans and corn has been and will continue to expand into the north and to the west, and into the Delta at the expense of wheat, cotton, and other feed crops, such as sorghum and oats.

- Livestock Outlook
  - The livestock outlook is mixed with growth driven by export demand and not domestic consumption.
  - Free Trade Agreement rules are being finalized for implementation between the U.S and South Korea, Panama and Colombia, to the benefit of U.S. meat exports.
  - Poultry production will shrink through 2012/13, and then expand 7.5 billion pounds to 53.9 billion or 24.4 million metric tons in 2020/21.

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- Hogs are projected to increase about 6 million head from the 2010/11 low point to 71 million in 2015/16 and remain steady from there.
  - Hog production will expand more rapidly within the Corn Belt while essentially shrinking in other areas.
  - Even though head count will flatten out, hog productivity gains will expand total pork production.
- Cattle head counts are forecast to decline up to 2015/16 before nominally expanding through 2020/21, with no significant shift in geographic distribution.
  - South Korea experienced a severe outbreak of foot-and-mouth disease, which has reduced the size of its herd, and increases the prospect of increased imports from the U.S., especially with the newly established Free Trade Agreement.
- Dairy cattle head count will remain relatively stable, but annual productivity gains of 1.6% annually will increase total milk production.
  - The size of the U.S. dairy herd is dependent on exports of milk and associated products, especially to Asia and more specifically to China.
  - There will be no significant geographic redistribution.

- South America Infrastructure Influence
  - Soybean production in South America to increase more than 25% through 2020/21, with Brazil's production to exceed 90 million metric tons and Argentina's 70 million metric tons.
    - Exports of soybeans will expand commensurately with Brazil's exports to exceed 48 million metric tons and Argentina's nearly 20 million metric tons, while Argentina's soybean meal exports will total about 37 million metric tons. Argentina applies an export tax to unfinished or unprocessed commodities, thus incenting value added services that leads to more soybean meal exports.
  - Transportation is key in future to remain competitive
    - Heavily oriented toward truck movement over long-haul distances, however efforts underway to shift to rail and waterway modes to mitigate costs.
  - Inland transportation expensive
    - The transportation cost to export position is expensive in South America, especially in Brazil where truck costs run upwards of U.S. $127 per metric ton (or U.S. $3.50 per bushel) during harvest on some routes. The movement of soybeans in Brazil is over long distances while in the United States the truck move is much shorter, to the next logistics option. In the United States, truck costs moving soybeans to the next market position are considerably lower, between $10 and $15 per metric ton.

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        - On select routes in Brazil, an all truck move of 950 miles from Mato Grosso to export position at Santarem costs about U.S. $122 per metric ton while a multi-modal move in the United States moving more than 1,500 miles by truck to barge to export position at the Center Gulf costs about U.S. $47 per metric ton.
    - Proposed soybean corridors
        - Several infrastructure projects have been proposed to accommodate the reliable and efficient movement of soybeans in Brazil. Many have yet to be realized or lack resources to be fully completed.
        - Based on information in Brazil, improvements to the infrastructure, including the addition of multi-modal options (e.g., truck-rail or truck-barge to export position), have been estimated to reduce freight costs $40 per metric ton or between 20% and 30% depending on the origin. Based on information compiled and taking into account wait times between transportation events and eventual vessel loading for export movement, the estimated cost savings could exceed 50% or U.S. $55 per metric ton to more than U.S. $60 per metric ton.
        - Such potential improvements will bring Brazil nearly on par with the United States in terms of inland transport costs, which effectively bolsters its farm industry.
    - For South America, and especially Brazil, projects have been discussed for many years with little fulfillment. Some portions of some proposed projects have been started, but due to poor construction and or the lack of on-going maintenance resources, the infrastructure quickly crumbles.

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IX. Appendices

A. Flowcharts of the Soybean, Grain and Livestock

The value chains for soybeans, corn, wheat, broiler, dairy, beef and pork are presented in this section. These value chains depict the key features of planting and harvesting crops or raising slaughtering livestock and the flows involved to move them through their respective value chain to consumer.

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Figure 101: Soybean Value Chain

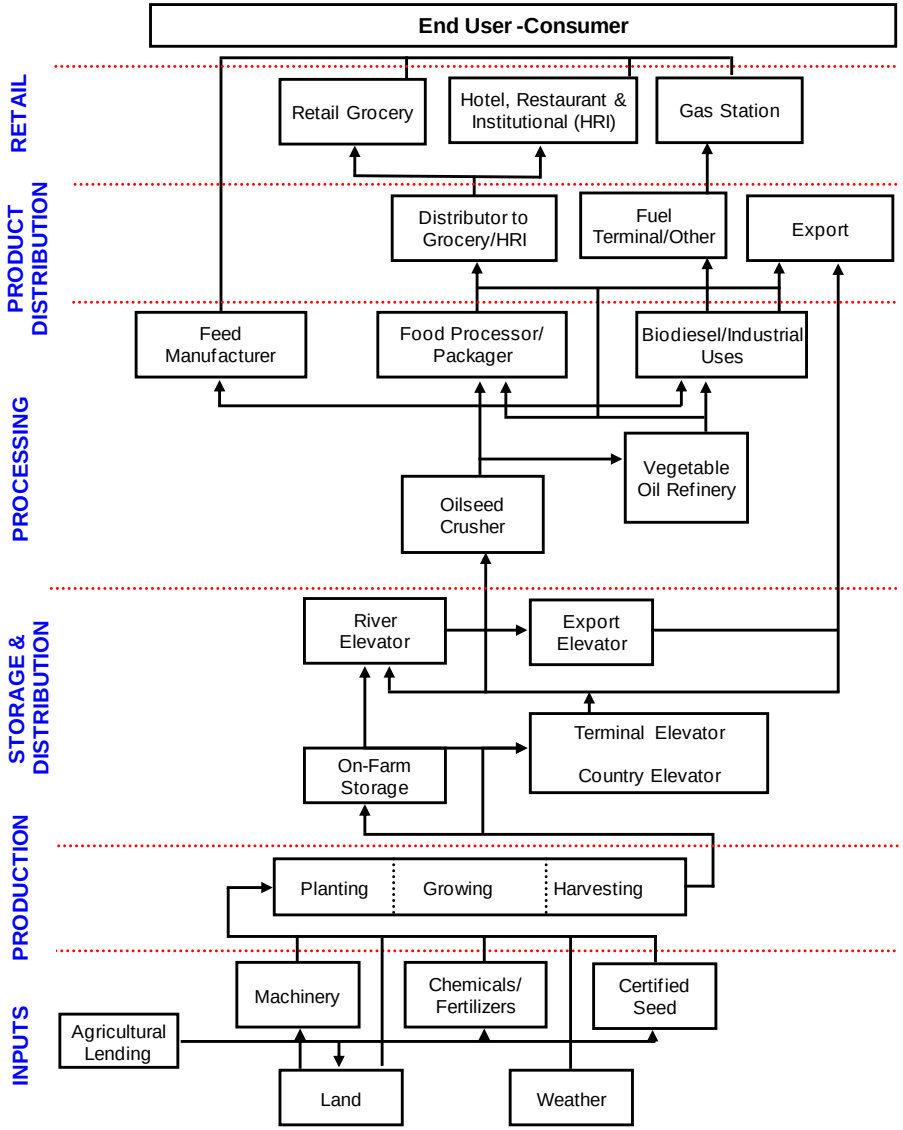

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Figure 102: Soybean Logistics Flow

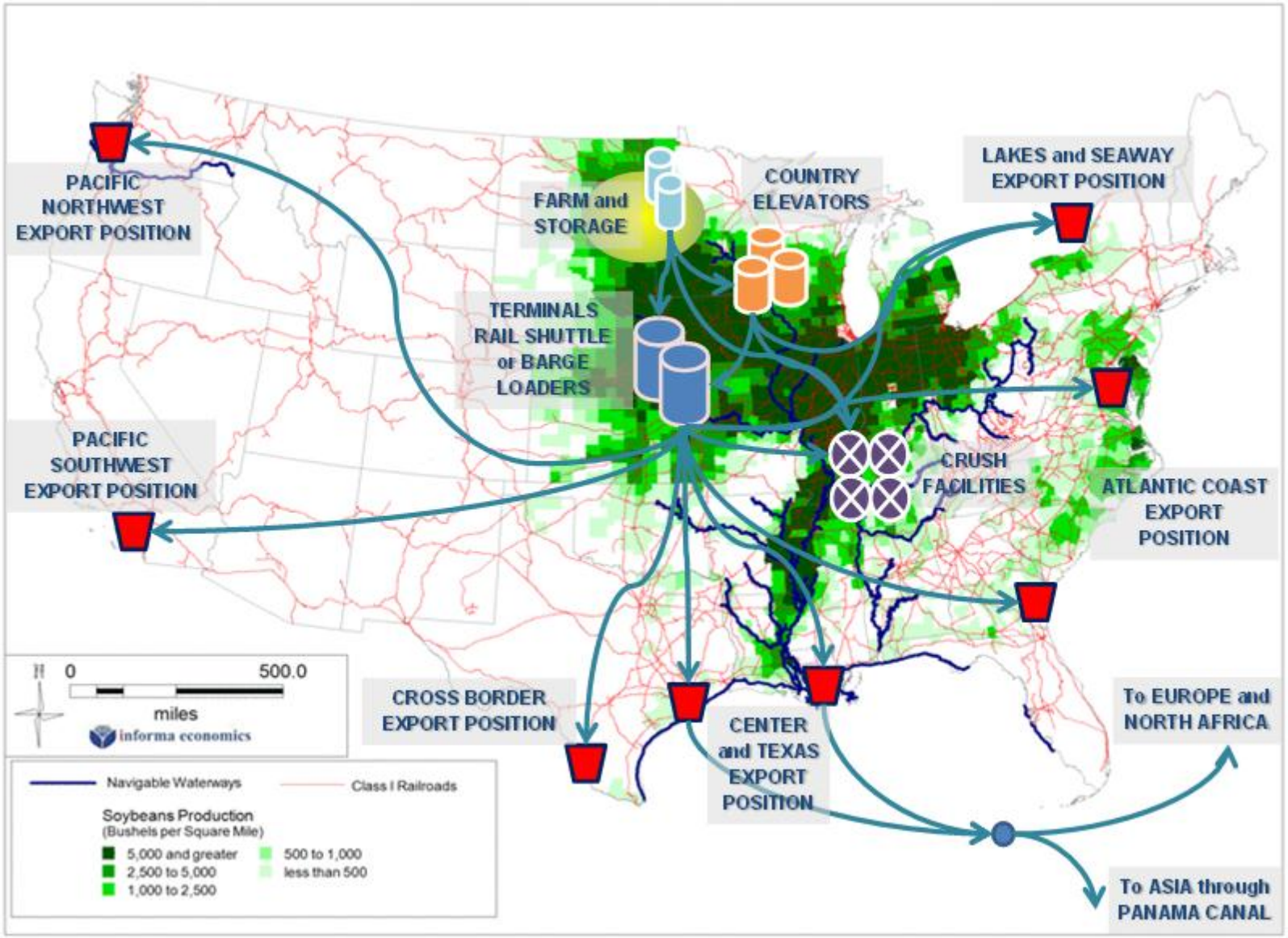

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Figure 103: Corn Value Chain

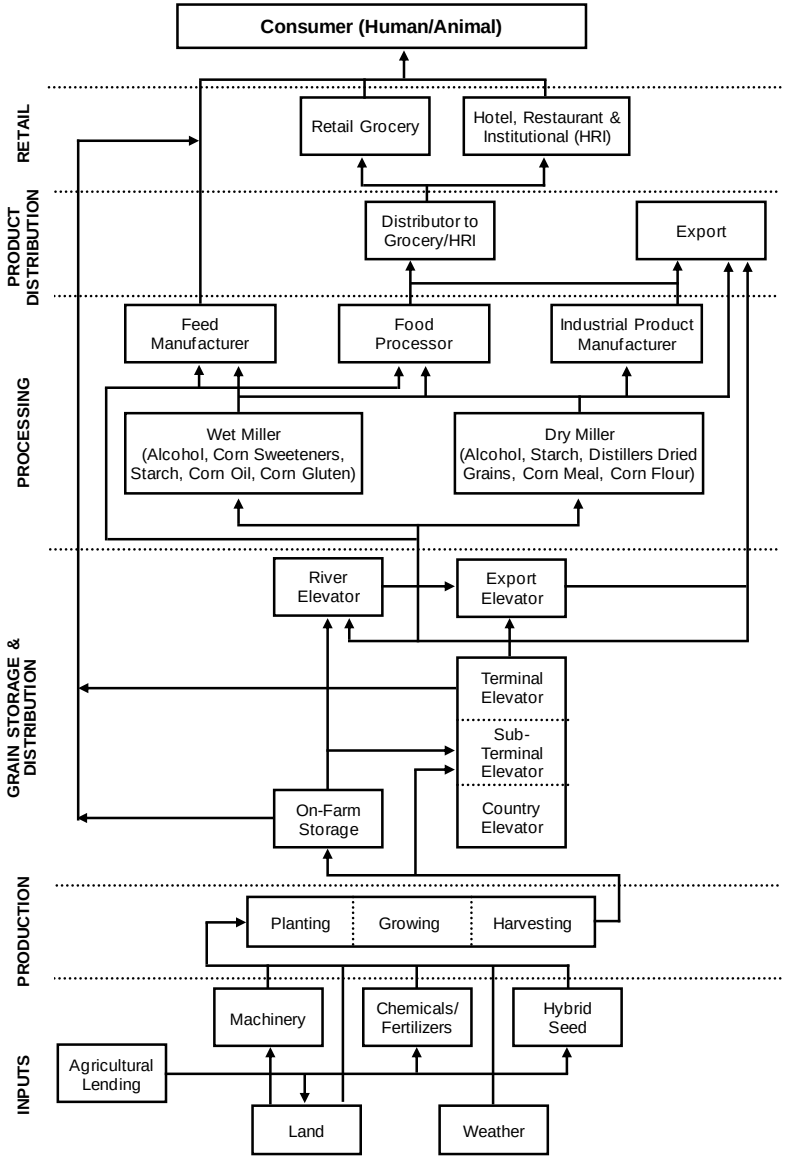

Figure 104: Wheat Value Chain

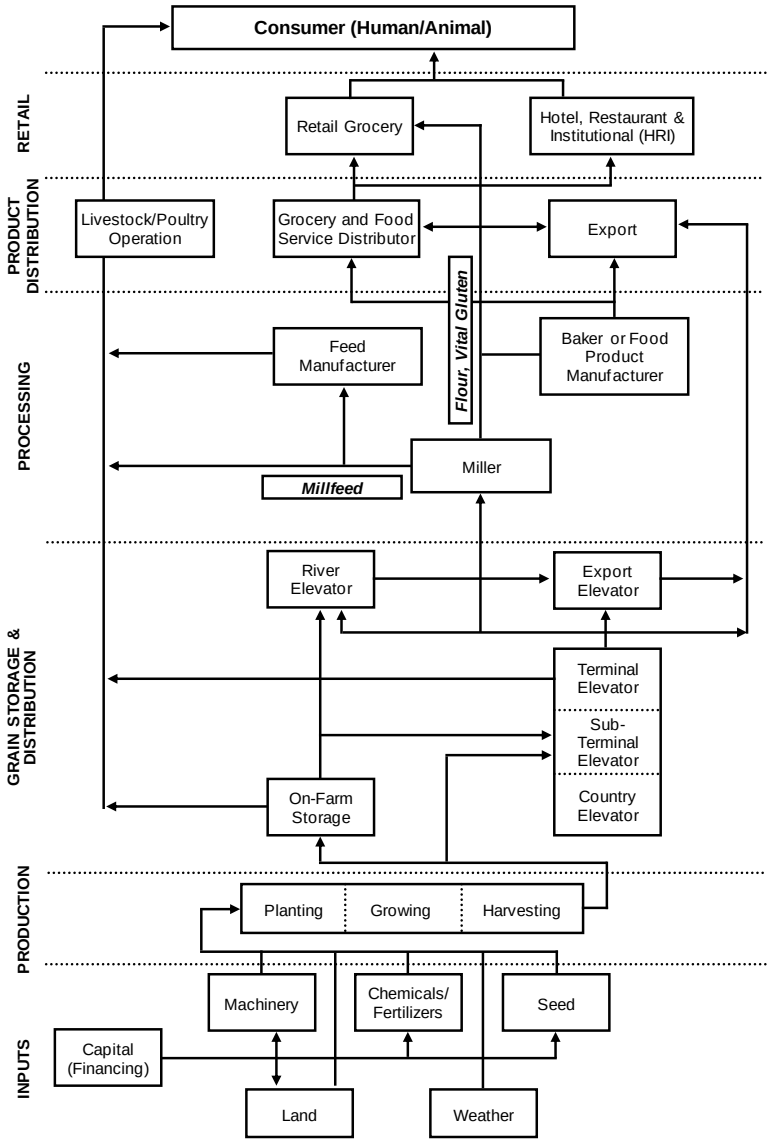

Figure 105: Broiler Value Chain

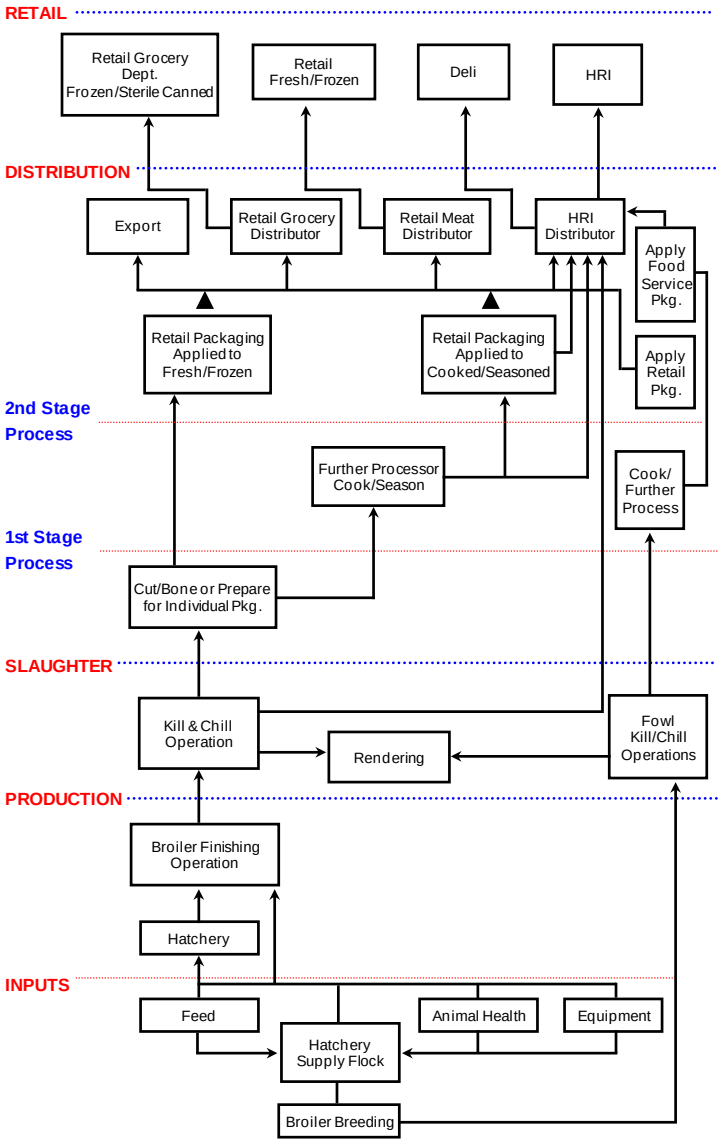

Figure 106: Dairy Value Chain

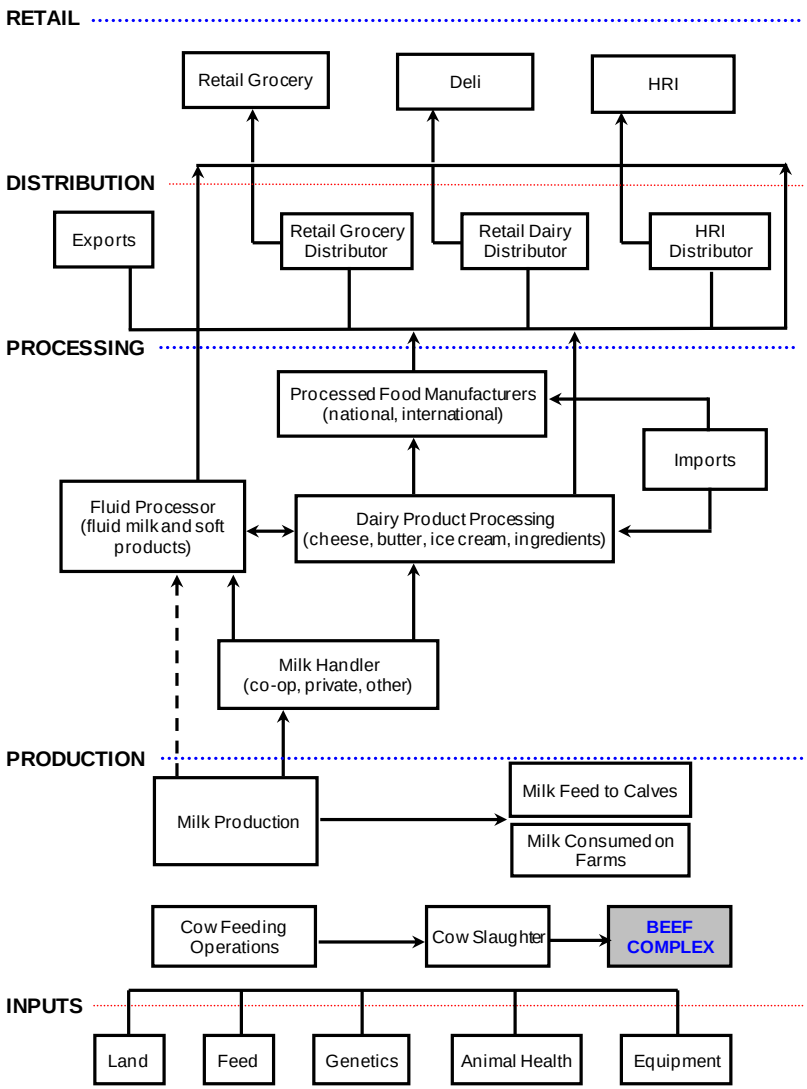

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Figure 107: Beef Value Chain

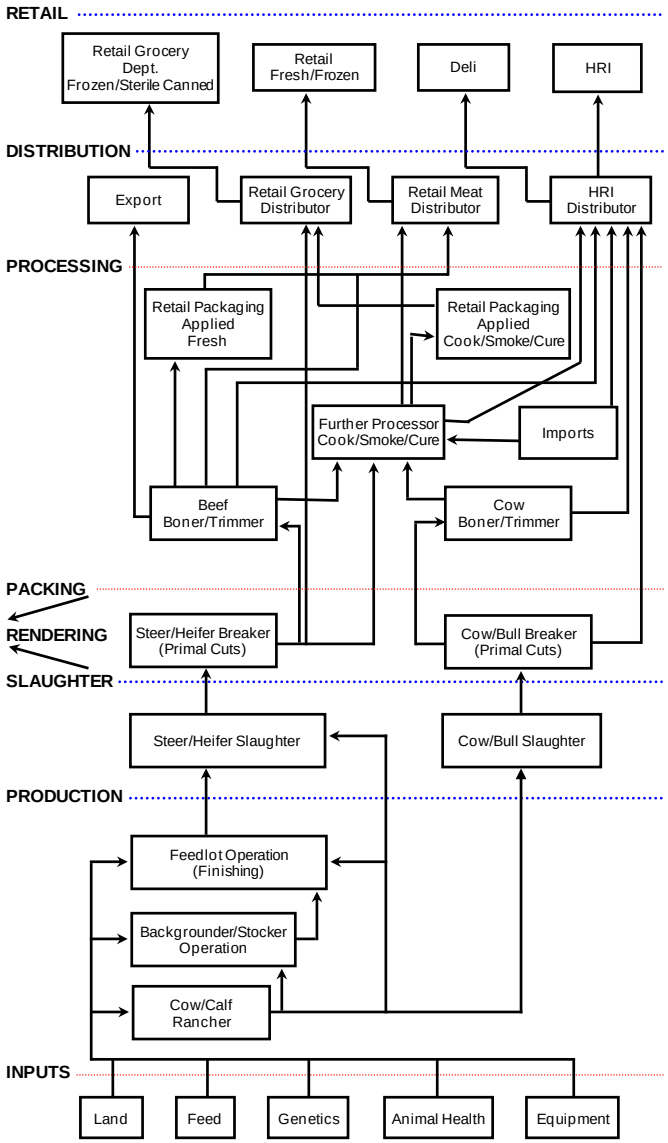
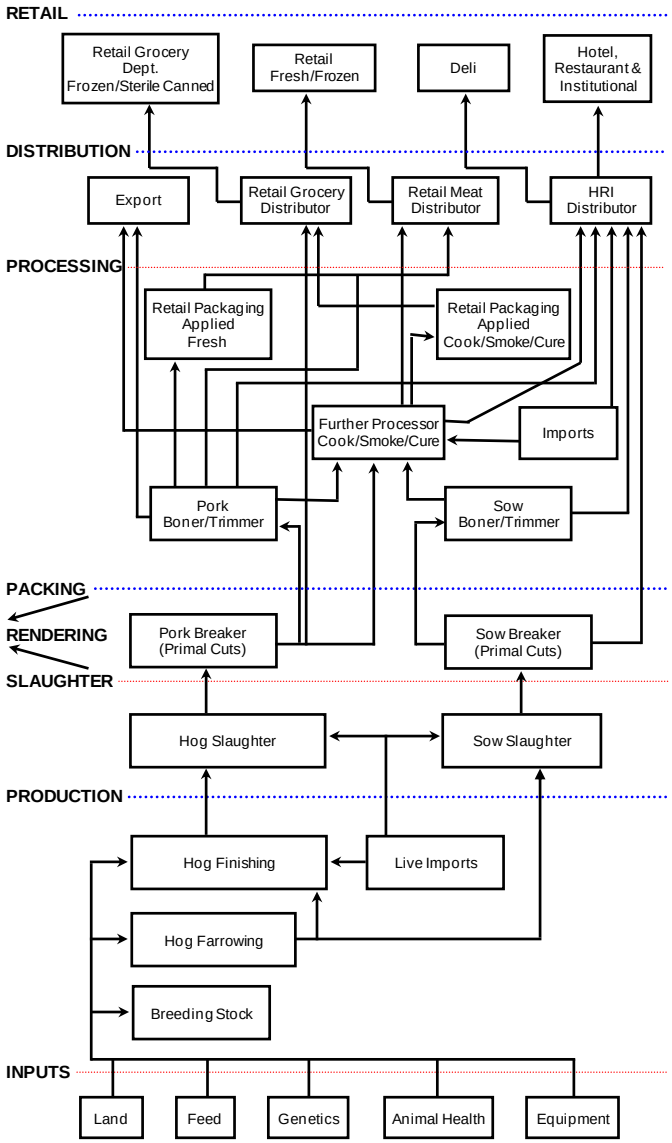


Figure 108: Pork Value Chain



B. State December 1 Crop Storage Capacity and Inventories

December 1 crop storage capacity and inventories among the key states are shown in this Appendix section.

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Figure 109: Arkansas December 1 Crop Storage Capacity and Inventories

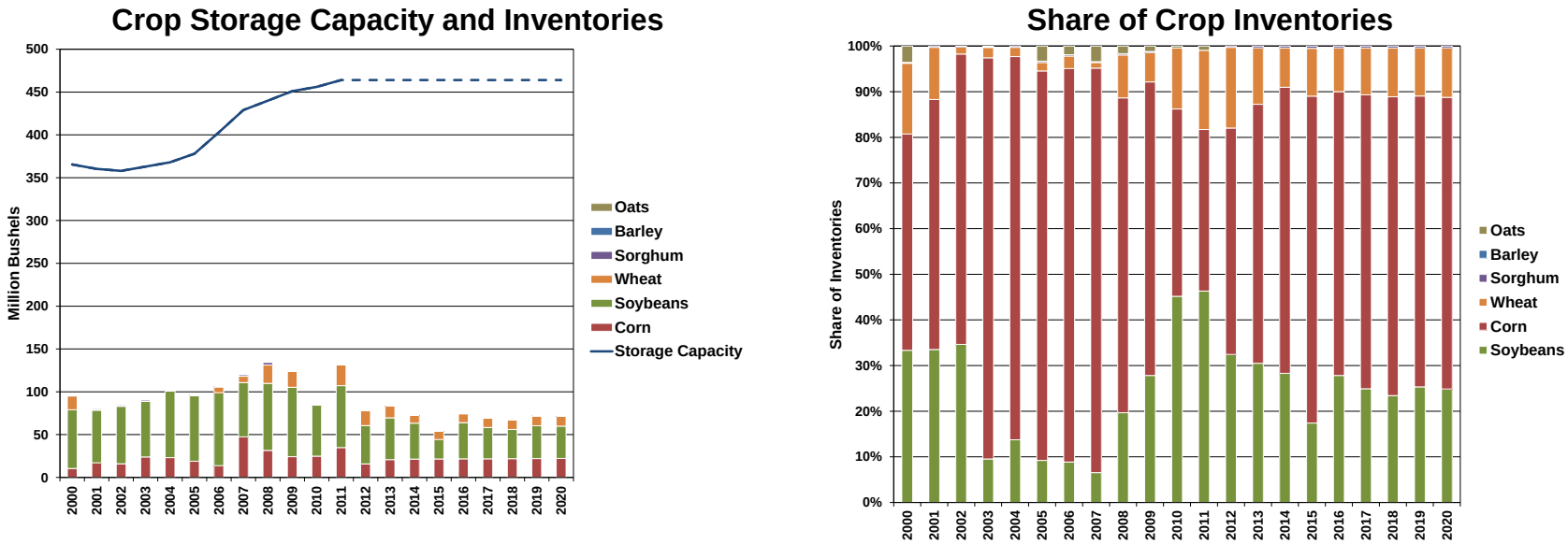

Figure 110: Illinois December 1 Crop Storage Capacity and Inventories

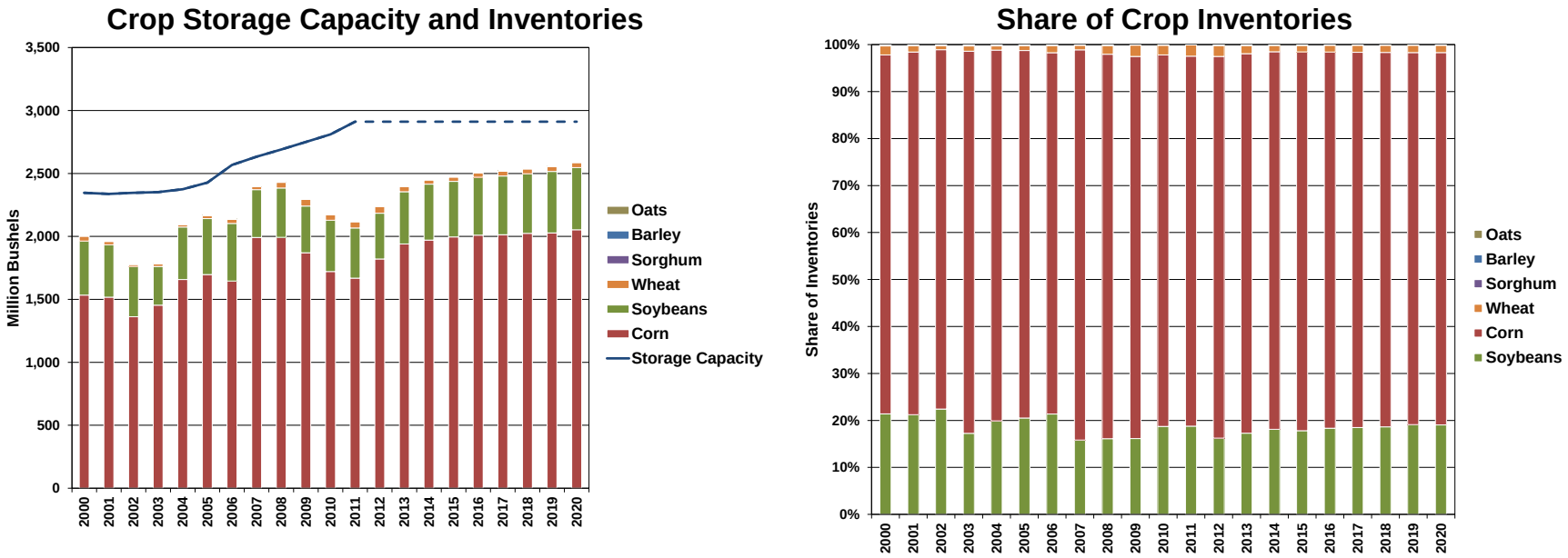

Figure 111: Indiana December 1 Crop Storage Capacity and Inventories

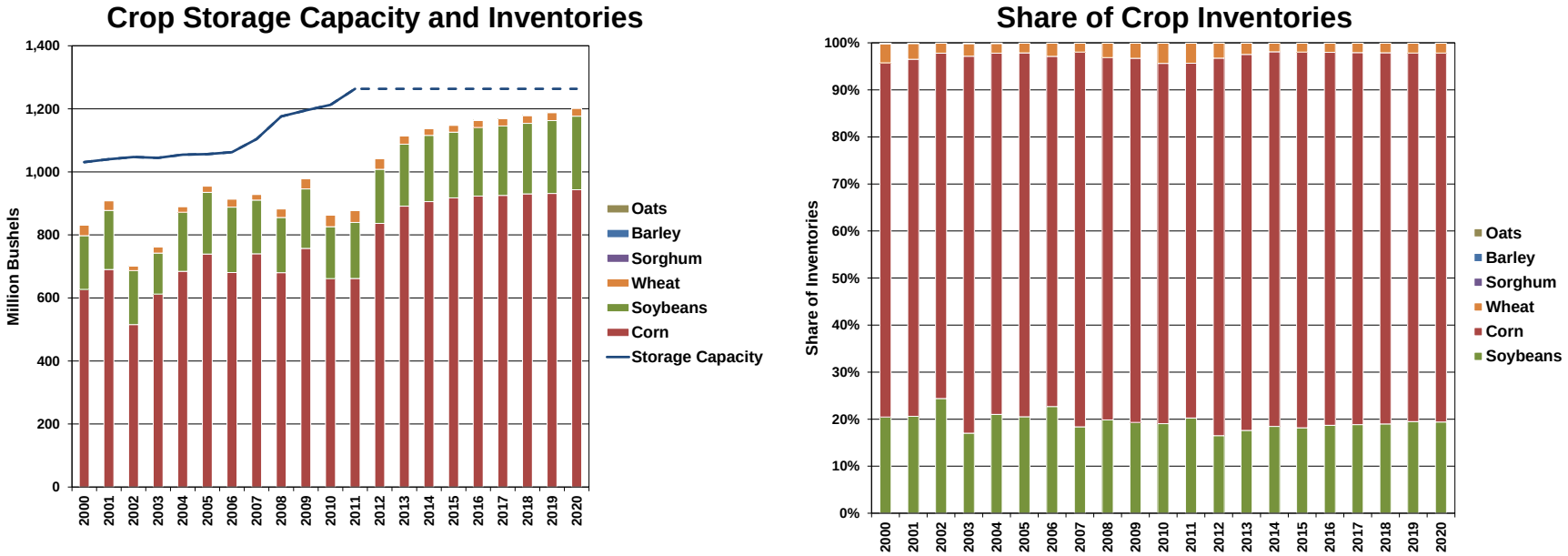

Figure 112: Iowa December 1 Crop Storage Capacity and Inventories

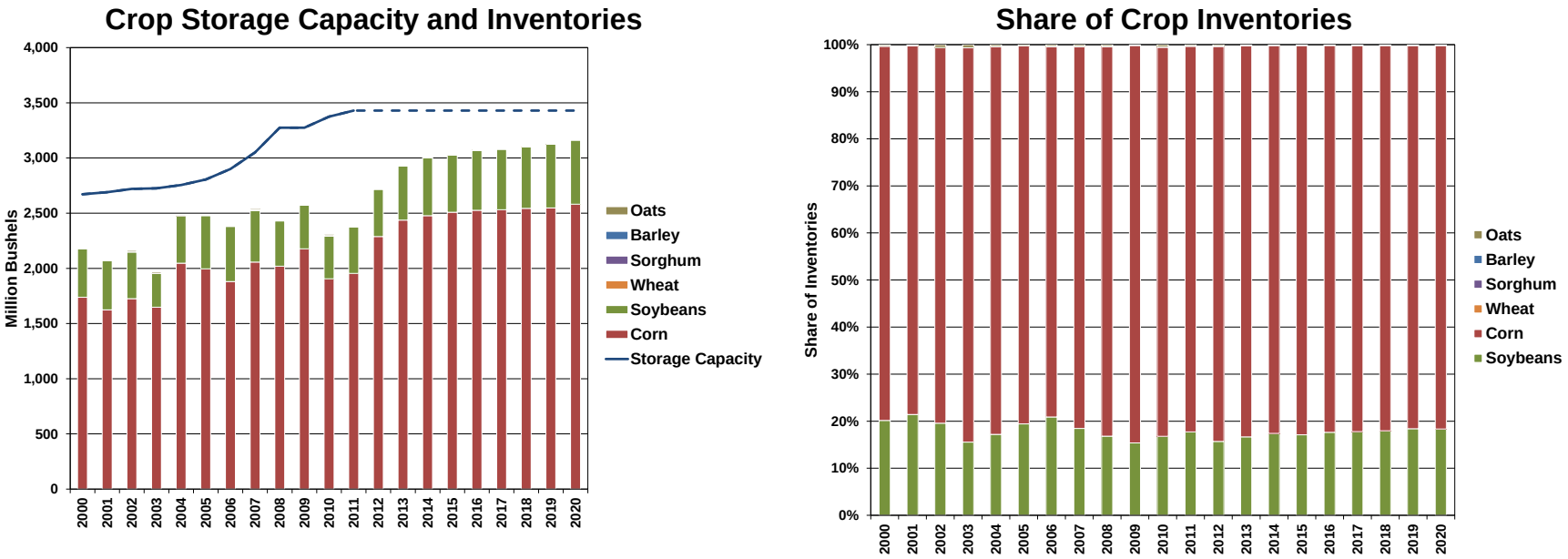

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Figure 113: Kansas December 1 Crop Storage Capacity and Inventories

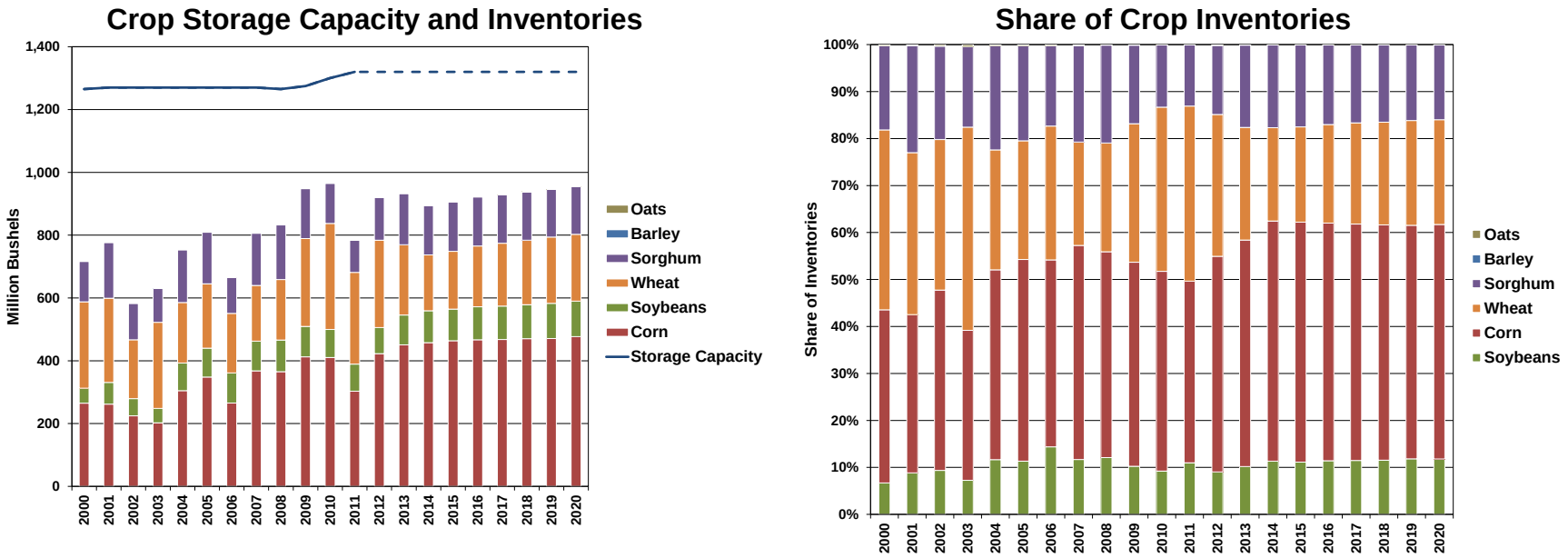


Figure 114: Kentucky December 1 Crop Storage Capacity and Inventories

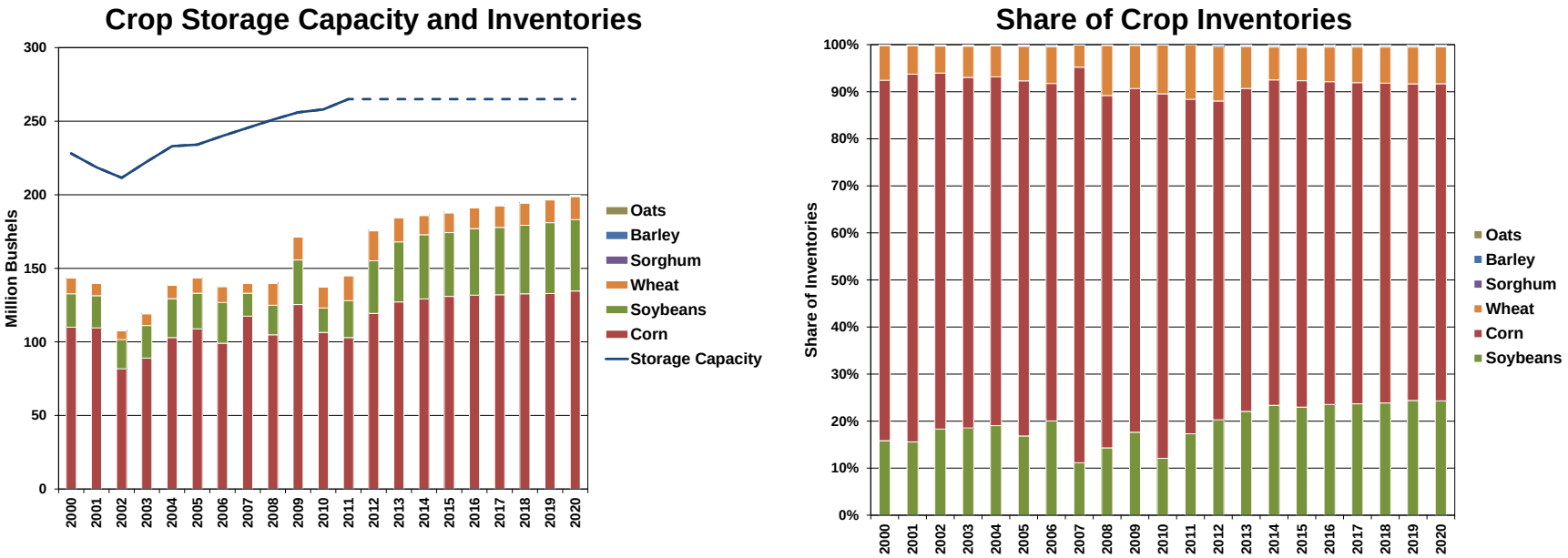


Figure 115: Michigan December 1 Crop Storage Capacity and Inventories

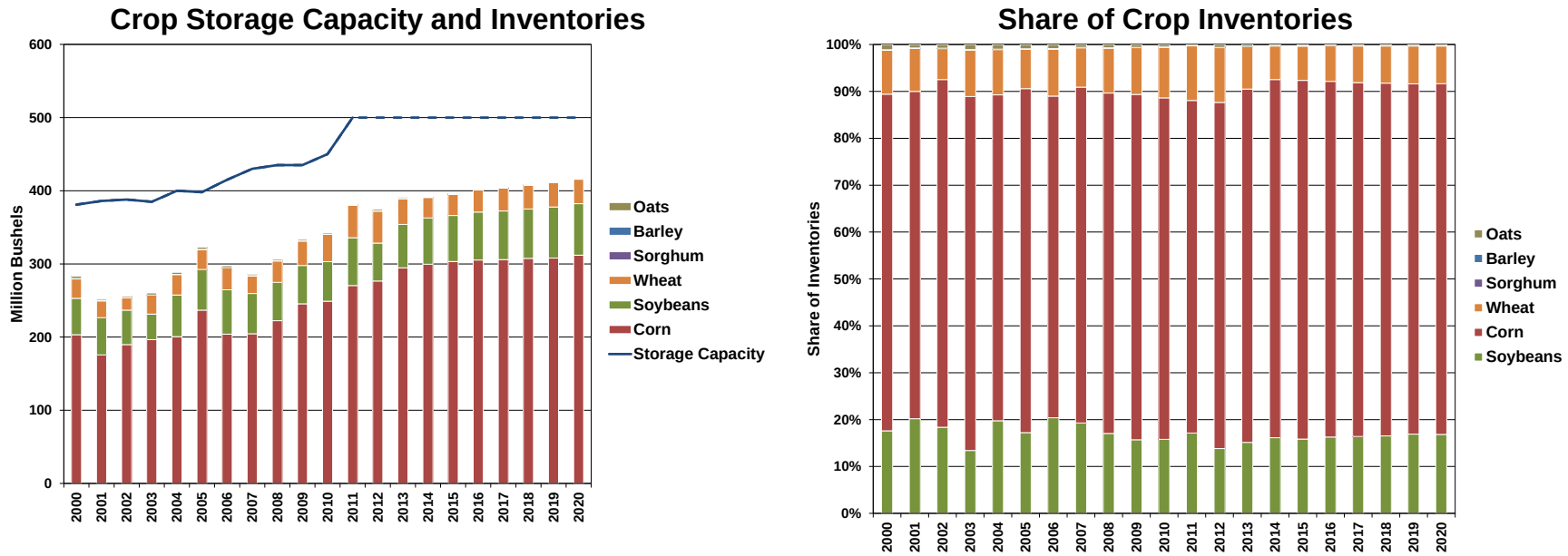


Figure 116: Minnesota December 1 Crop Storage Capacity and Inventories

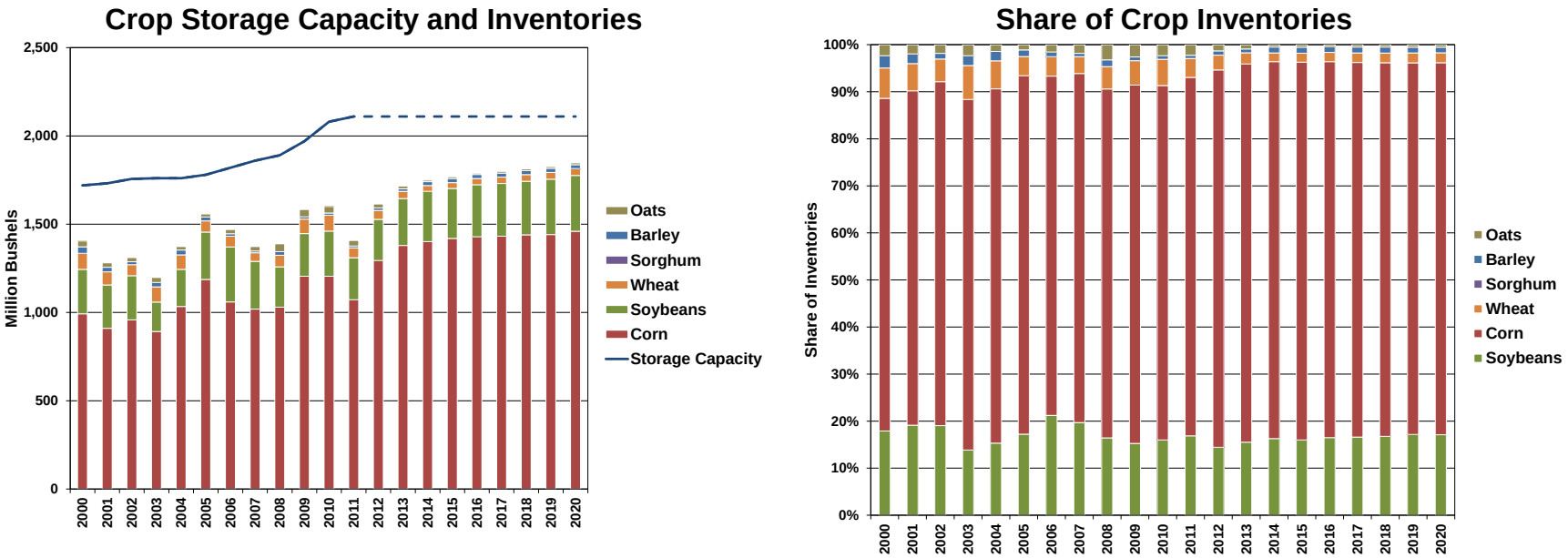


Figure 117: Mississippi December 1 Crop Storage Capacity and Inventories

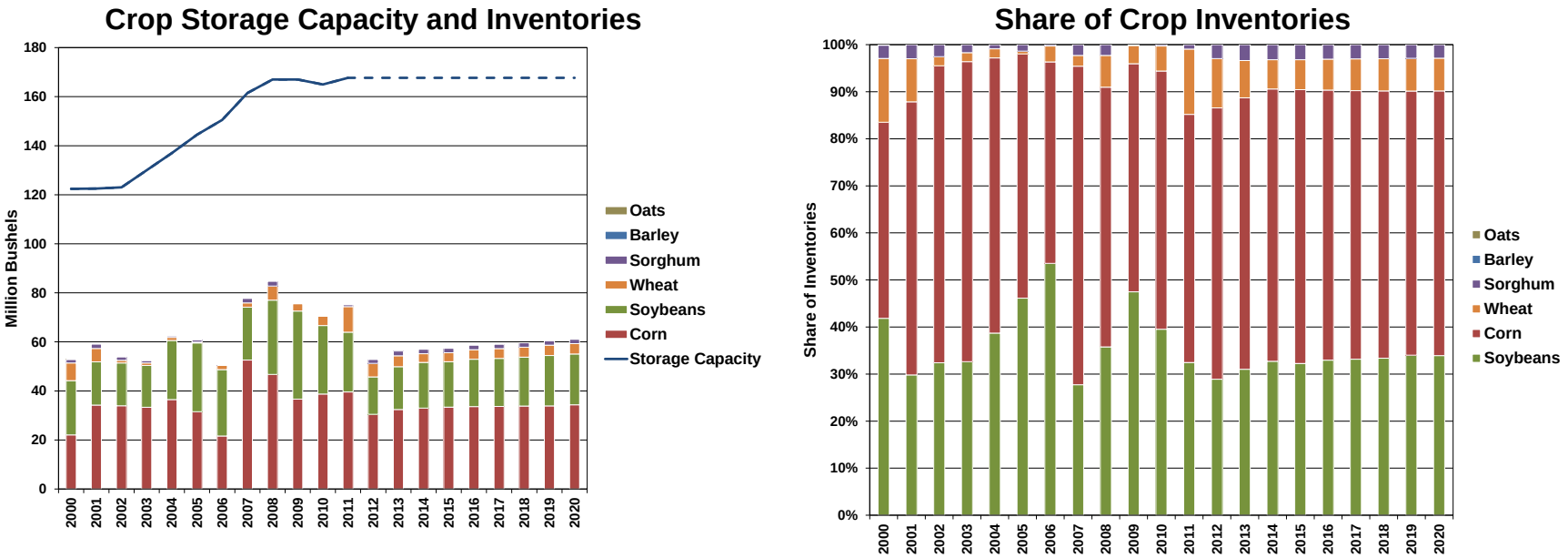
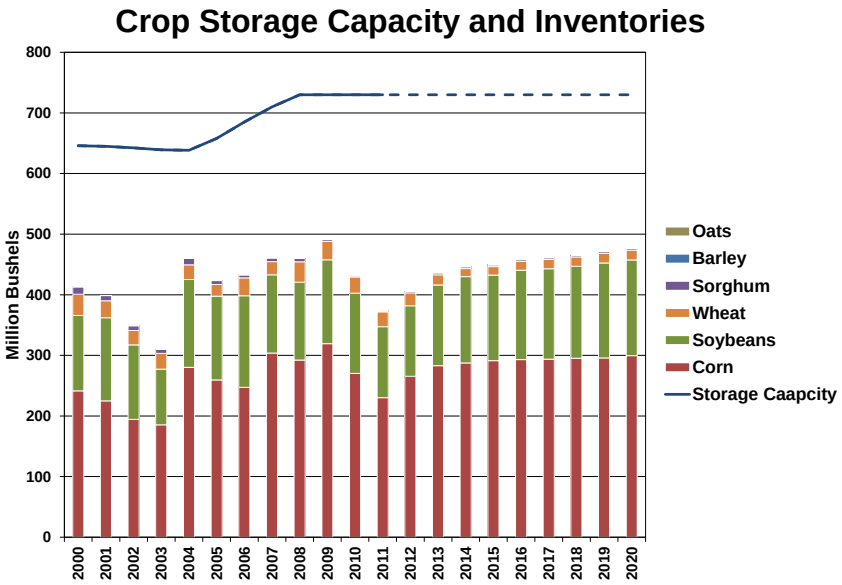


Figure 118: Missouri December 1 Crop Storage Capacity and Inventories



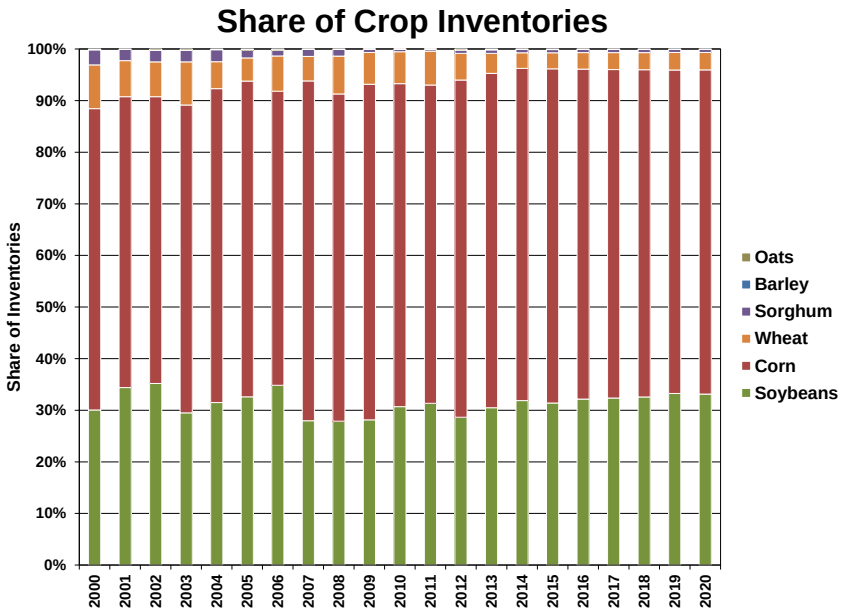


Figure 119: Nebraska December 1 Crop Storage Capacity and Inventories

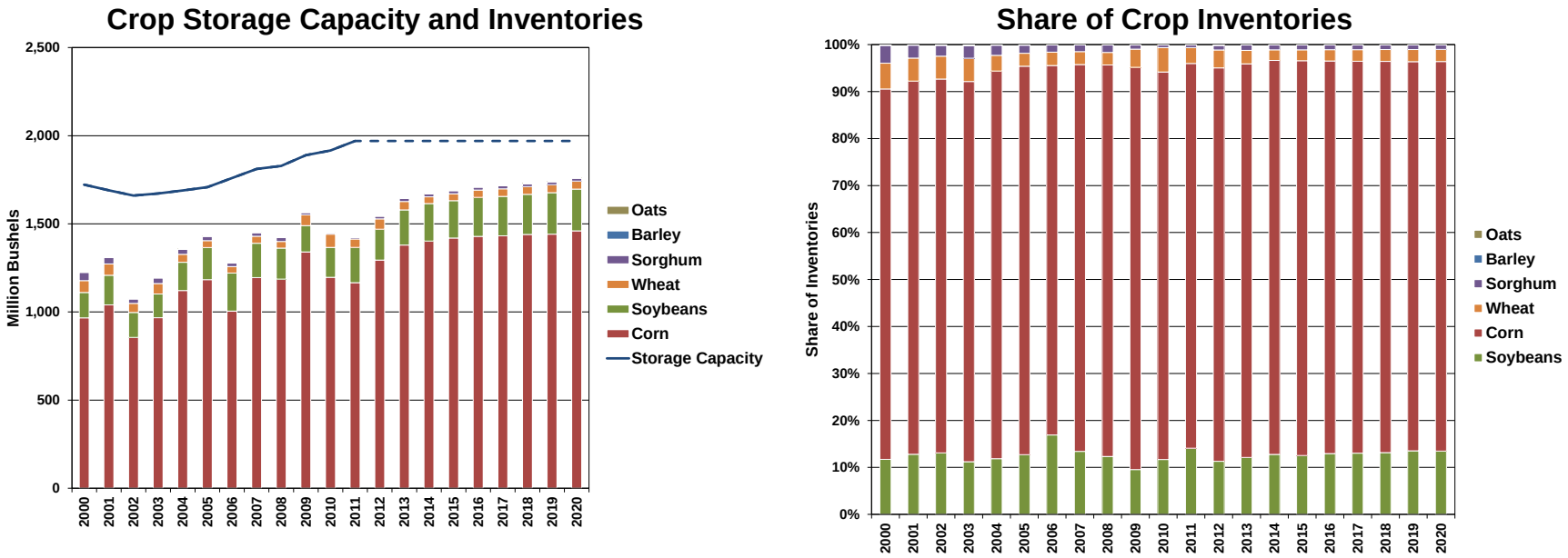


Figure 120: North Carolina December 1 Crop Storage Capacity and Inventories

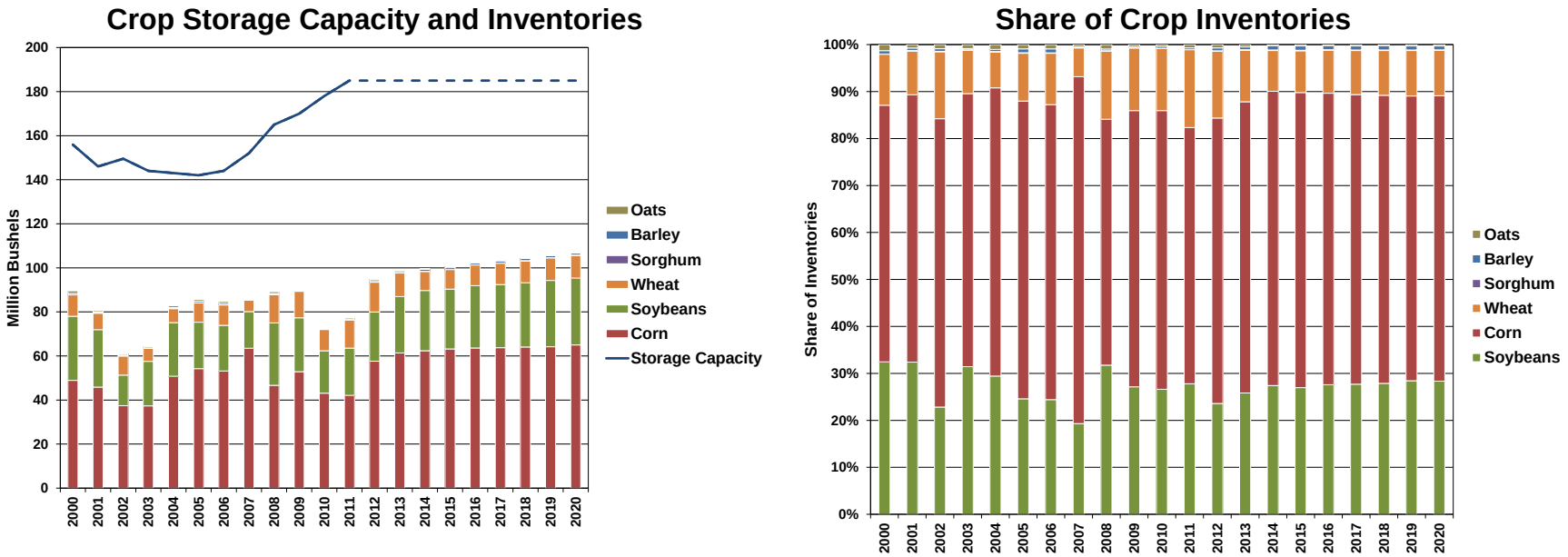


Figure 121: North Dakota December 1 Crop Storage Capacity and Inventories

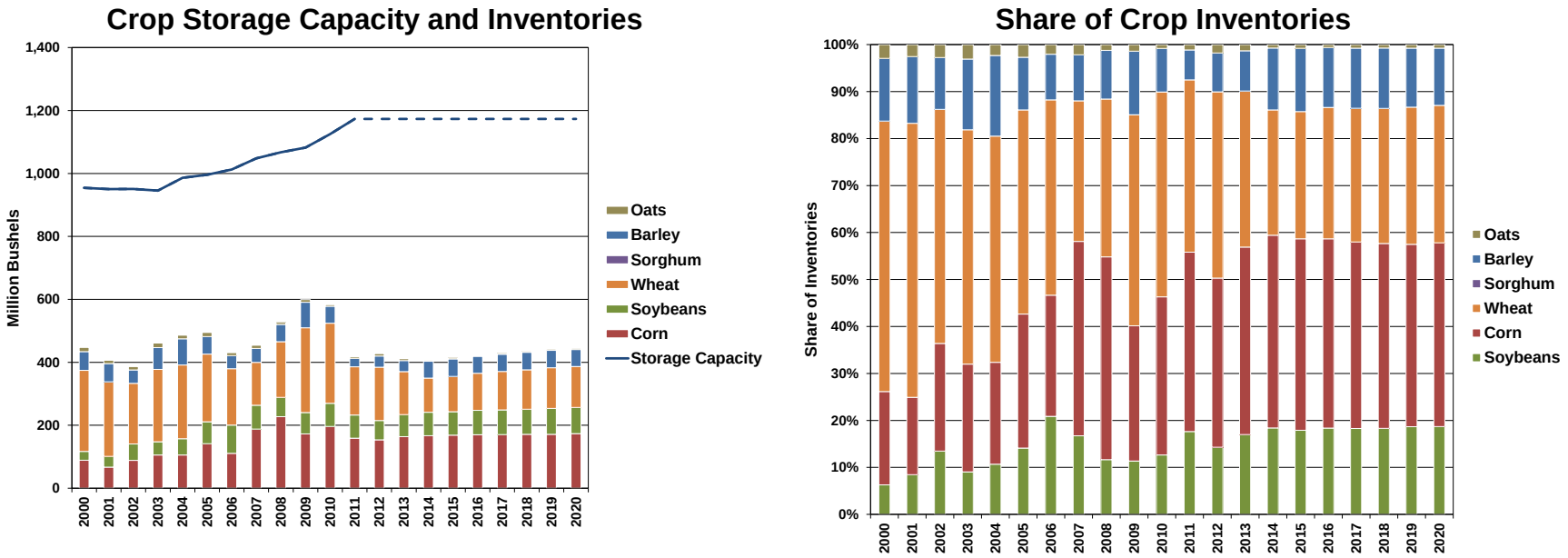


Figure 122: Ohio December 1 Crop Storage Capacity and Inventories

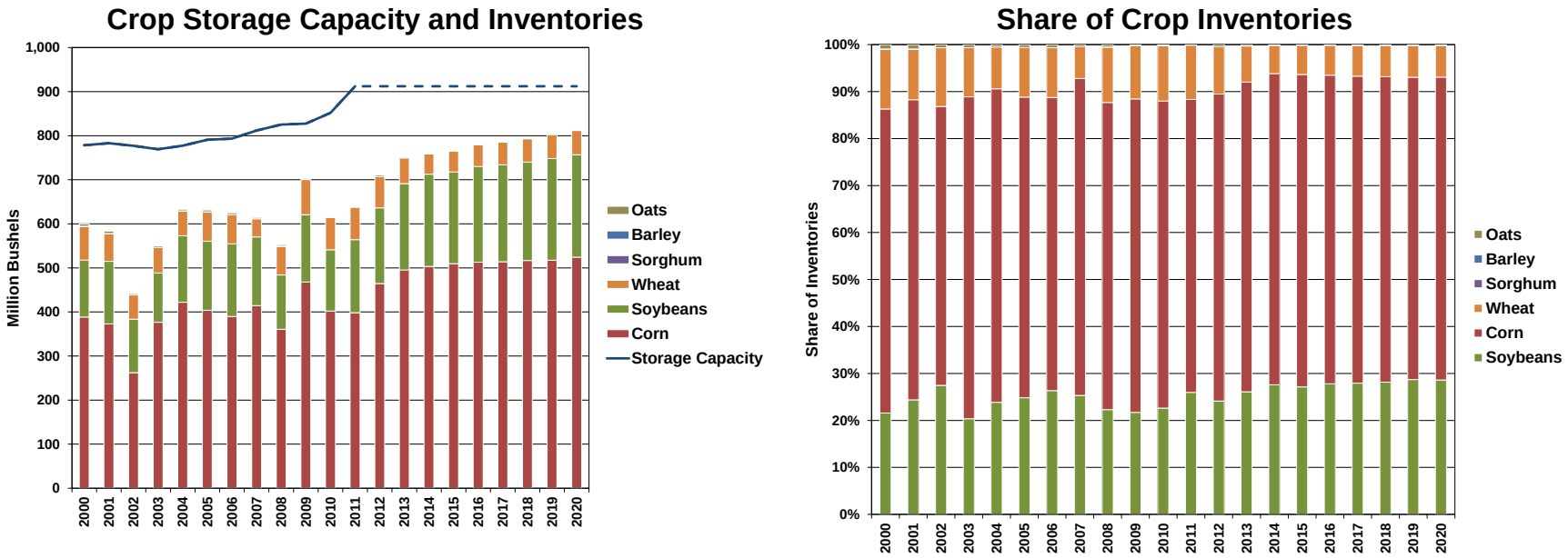


Figure 123: South Dakota December 1 Crop Storage Capacity and Inventories

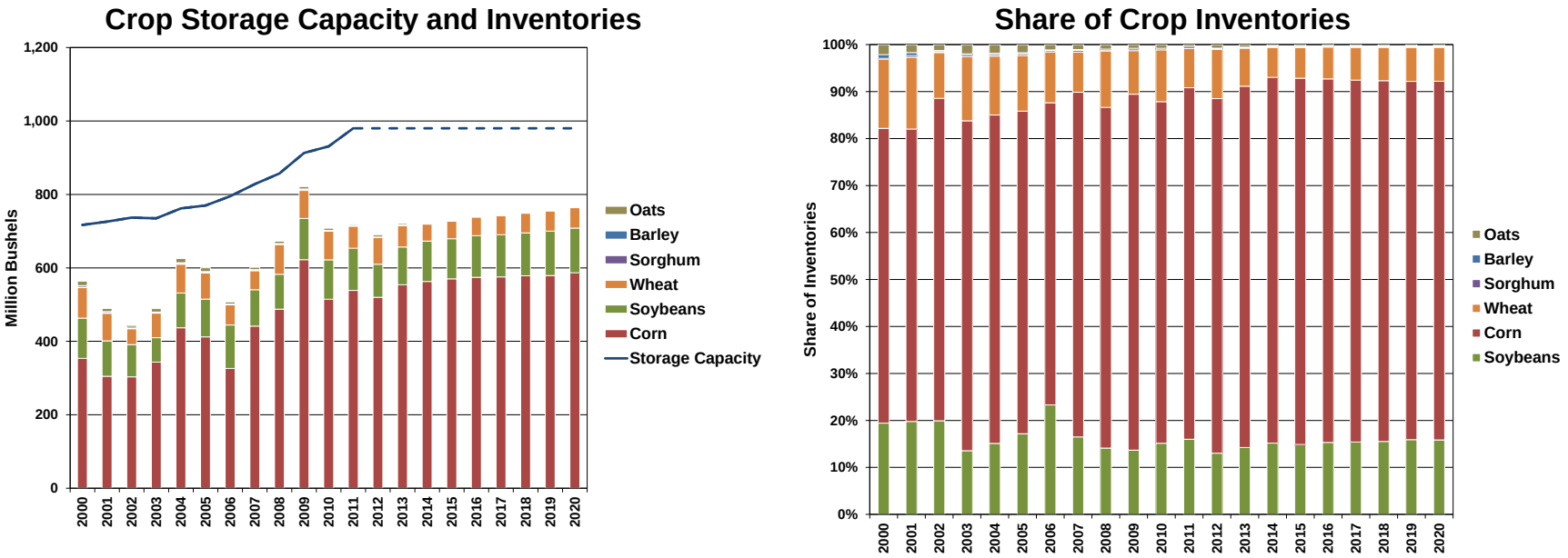


Figure 124: Tennessee December 1 Crop Storage Capacity and Inventories

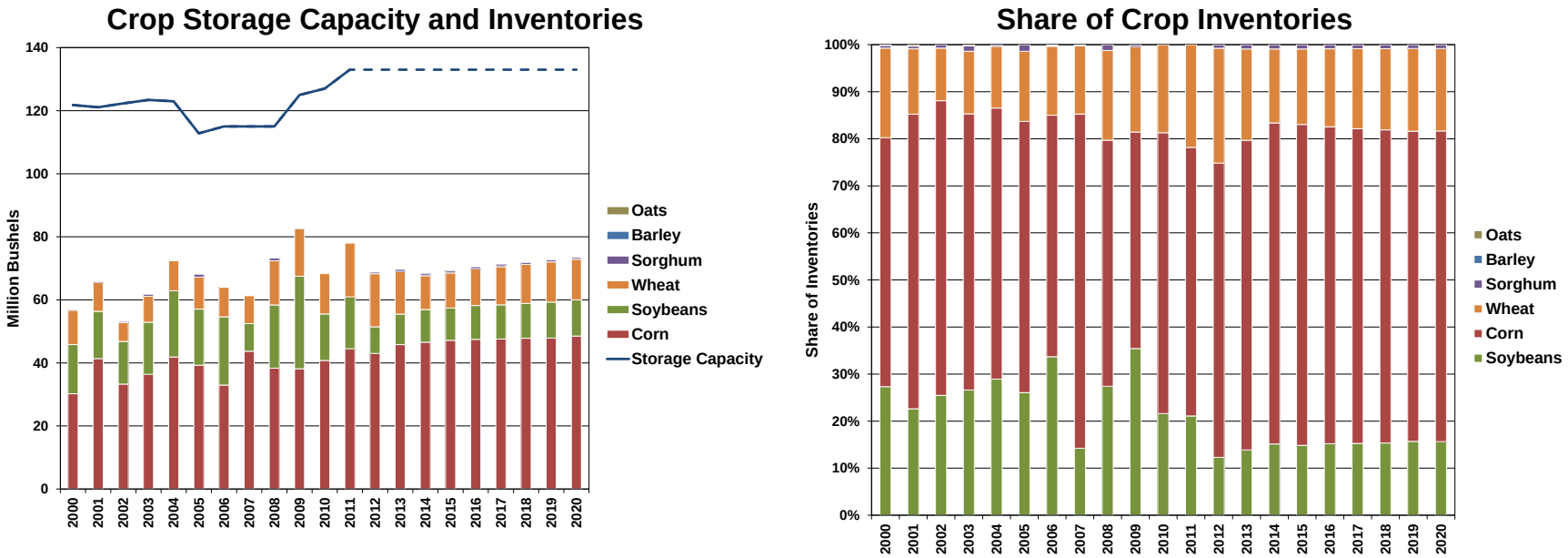
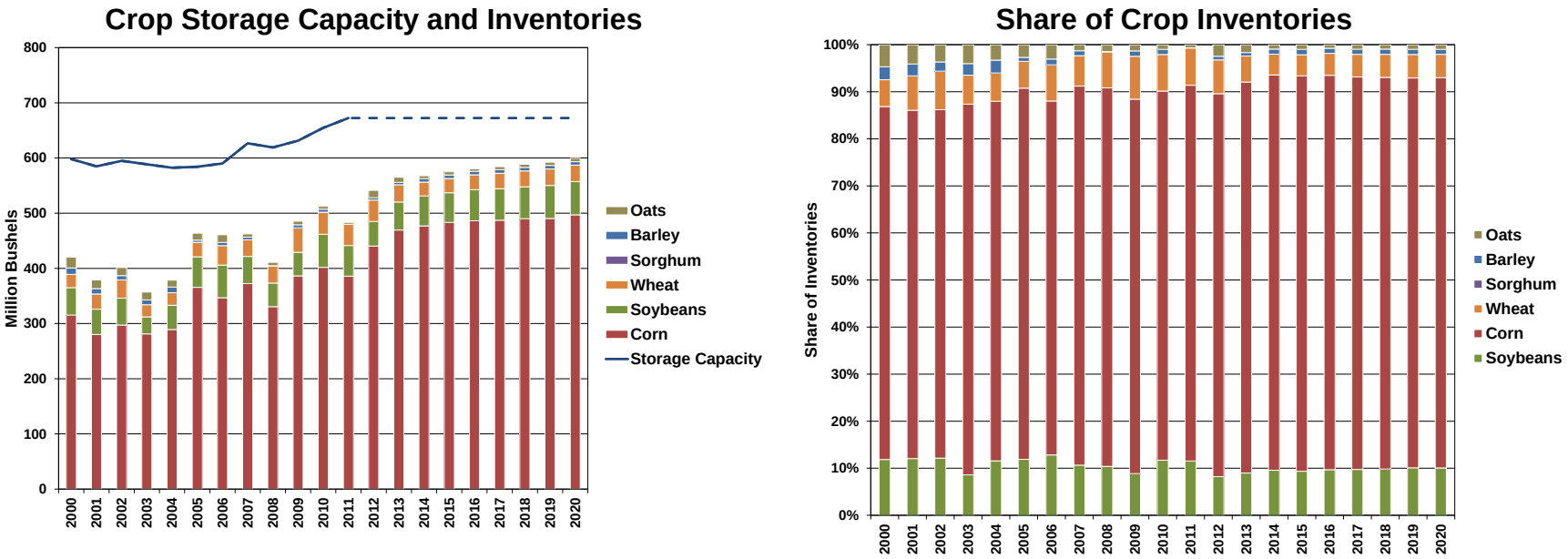


Figure 125: Wisconsin December 1 Crop Storage Capacity and Inventories



C. Background and Information about Informa Economics, Inc. and Economic Development Research Group, Inc.

Informa Economics, Inc.

Informa Economics, Inc. (formerly known as Sparks Companies, Inc.) is a world leader in broad-based domestic and international agricultural and commodity/product market research, analysis, evaluation and consulting. The company was founded in 1977 and, in 2003, was acquired by Informa plc ("Informa").

Informa Economics, Inc. serves hundreds of firms, institutions and trade organizations worldwide from our headquarters in Memphis, Tennessee. We also have integral business partnerships with Informa Economics FNP South America, CEAS in London and Brussels and WPA in Washington DC.

Informa Economics broad categories of services include:

- Management Consulting for Agribusiness;
- Agricultural Commodity Market Analysis and Evaluation;
- Risk Management Strategies;
- Education and Training;
- Newsletters and Other Publications; and,
- Transportation, Industrials and Energy Market Analysis.

The company's professional depth and experience allow us to provide a wide range of services related to the economic and management concerns of clients, as well as to focus on broader issues concerning markets, facilities, resources and many others. In addition, Informa Economics is a world leader in the collection, analysis, and dissemination of agriculture and food information.

> The Informa Economics team has also has extensive experience in agricultural policy analysis, especially since many employees formerly held senior policy, analysis or advisory positions in government; worked for major trade associations; held positions in land grant universities; or held senior management positions in leading agribusiness companies; most hold advanced degrees in agricultural economics or related fields. (For more information on Informa Economics, its staff and the services it provides see www.informaecon.com)

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Informa Economics FNP South America

Informa Economics FNP South America operates in consulting and agribusiness information. It represents the Brazilian division of Informa Economics, based in the United States. Informa Economics is now the global leader in information for agribusiness.

Informa Economics FNP offers consulting services to various clients through a multidisciplinary team that involves renowned professionals in the sector.

The consulting projects take in technical and economic analysis of investments, analysis of sectors, asset evaluations, strategies for new investors, technical due diligences, mergers and acquisitions, market research, competitive intelligence studies, macro-market and sector studies.

One of Informa Economics FNP's strengthens on the market is having one of the most complete databanks on varied areas of agribusiness, built up since the foundation of FNP Consultancy, in 1989 - later to be Informa Economics FNP with its incorporation by the English group in 2005.

In the informant area, Informa Economics FNP publishes the traditional ANUALPEC and AGRIANUAL yearbooks of statistics for the cattle farming and agriculture sectors, used for years by professionals and companies in the agribusiness sector, in academia, in research and by students and public bodies in Brazil and in other countries.

Other specialized publications produced by Informa Economics FNP are also references in the agribusiness sector. In partnership there are market newsletters and the Long Term Strategic Consultancy (CELP). Produced in English for Brazilian and international clients, the weekly Brazilian Meat Monitor and the special reports (Brazilian Livestock and Meat Industry and Brazilian Poultry Meat Study) offer a complete approach to the sector.

In agriculture the company publishes market newsletters on soy and corn, the Agricultural Market Consultancy (COMAG) involving the main commodities in the sector, and special reports and Biofuels Brazil, in English.

The company is also the only one to publish the results of a detailed survey on the land market in Brazil, in the two-monthly Land Report and the six-monthly Yield Report, publications which are also available in English.

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Economic Development Research Group

Economic Development Research Group, Inc. (EDR Group) is a consulting firm focusing specifically on applying state-of-the-art tools and techniques for evaluating economic development performance, impacts and opportunities. The firm was started in 1996 by a core group of economists and planners who are specialists in evaluating impacts of transportation infrastructure, services, and technology on economic development opportunities.

EDR Group provides both consulting advisory services and full-scale research projects for public and private agencies throughout North America as well as in Europe, Asia and Africa. EDR Group's work focuses on three issues:

- Economic Impact Analysis – How can my project/program affect economic growth & attraction? How can I best target my efforts?
- Market / Strategy Analysis – How will I be affected by changes in the economy? What should I do to respond to them?
- Benefit / Cost Analysis – What will be the economic benefits & costs of my project / program? What should I do to maximize net value?

The transportation work of EDR Group includes studies of the economic impacts of road, air, sea and railroad modes of travel, including economic benefits, development impacts and benefit/cost relationships. The firm's work is organized into three areas: (1) General research on investment benefit and productivity implications, (2) Planning studies including impact, opportunities, and benefit/ cost assessment, and (3) Evaluation including cost-effectiveness implications.

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