



# Domestic Grain and Oilseed Transportation to the Southeastern United States (Summary)

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This is a summary of "Domestic Grain and Oilseed Transportation to the Southeastern United States," by Jungkeon Jo and William Secor.<sup>1</sup> This research and analysis received funding from USDA's Agricultural Marketing Service (AMS) through cooperative agreement number 21-TMTSD-GA-0009. The opinions and conclusions expressed are the authors' and do not necessarily reflect the views of USDA or AMS. The full paper—and a workbook of the data generated in the research—is available at: <https://ageconsearch.umn.edu/record/349221>.

## WHAT IS THE ISSUE?

The grain, livestock, and poultry industries are among the largest in U.S. agriculture. According to the [2022 Census of Agriculture](#), U.S. farmers sold \$168.7 billion worth of grain and oilseeds and \$262.5 billion worth of livestock, poultry, and their products in 2022—up 43 percent (combined) from 2017. These grain and livestock-based industries rely on each other, because animals consume grain as feed, and feed represents an important end market for grain. For example, over the past 10 years, feed for poultry and livestock has been about 38 percent of the Nation's total annual corn use.<sup>2</sup> Another major feed ingredient is soybean meal, produced from crushing whole soybeans.

More than 20 percent of U.S. feedgrains are destined to the Southeast—a major poultry- and livestock-producing region.<sup>3</sup> In 2024, the Southeast accounted for 71 percent of the Nation's broiler production, and among all U.S. States, North Carolina ranked third for hog production. However, because the Southeast's limited grain production does not cover its feed needs, the region has a perennial grain deficit. In marketing year (MY) 2021/22, the researchers estimated the Southeast's corn needs exceeded local production by 9 million metric tons (mmt)—more than the eighth-largest importing country that year.

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<sup>2</sup> USDA Economic Research Service, [Feed Grains Database](#).

<sup>3</sup> In this research, the Southeast region comprises Alabama, Arkansas, Delaware, Florida, Georgia, Maryland, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia.

Because of the Southeast's grain deficit, the region must import millions of tons of corn, soybeans, soybean meal, and other feed ingredients from the Midwest (primarily, States in the "Eastern Cornbelt") to keep animals fed. Thus, a reliable, well-planned transportation network [is essential](#) to the Southeast, to prevent feed shortages and keep food supply chains running smoothly.

This research sheds light on grain transportation in the region through three contributions: (1) estimates of the amount of feed consumed in each State (2006-22); (2) estimates (shares) of the modes used for each State (2009-20); and (3) examination of the factors behind the use of rail for moving grain into the Southeast.<sup>4</sup> Overall, the report's analyses inform strategies to improve feed logistics, guide investment decisions, and help ensure competitive transportation options.

## **WHAT DID THE STUDY FIND?**

### ***Southeast's Consumption of Corn and Soybean Meal for Feed Fell From 2006 to 2022***

The researchers estimated the Southeast's annual feed needs for livestock and poultry during the 2006-22 study period, as well as the "imports" of corn and soybean meal required to meet those needs. The region's top three States for corn and soybean meal consumption have long been North Carolina, Georgia, and Arkansas (in descending order). Together, these States accounted for about 60 percent of Southeastern feed consumption in 2022. From 2006 to 2013, the Southeast's annual corn consumption for feed fell from an estimated 40 mmt to 26 mmt, before rising to 32 mmt in 2022. Soybean meal consumption for feed also decreased from 12 mmt in 2006 to a study-period low of 10 mmt in 2013—but then reached a study-period peak of 13 mmt in 2022.<sup>5</sup> Over the 17-year study period, the region's grain production more than doubled for corn and rose over 70 percent for soybeans.

Taken together, Southeast corn and soybean meal consumption for feed exceeded the region's grain production by 35 mmt in 2006. That "deficit" decreased to 8 mmt by 2014 and then roughly stabilized around 14 mmt per year from 2015 to 2022. As the Southeast's feed needs have lessened relative to its poultry and livestock production, so too has the region's reliance on grain imports from outside States.<sup>6</sup>

### ***Truck and Rail Modal Shares Dominate; Truck Shares Increases From 2009 to 2020***

The researchers estimated the modal shares for grain and oilseeds transported to the Southeast (during the 2009-20 study period), focusing on rail, barge, and truck. Modal shares varied substantially by State, commodity, and year. For most Southeastern States, truck and rail had the highest shares. From 2016 to 2020, truck shares were roughly 35-75 percent in each State for corn and 10-40 percent for soybean meal.<sup>7</sup> Top truck States for corn included Arkansas, Delaware, Maryland, and Virginia—which each sustained more than a 60-percent share from 2016 to 2020. Top truck States for soybean meal included Maryland, North Carolina, South Carolina, and Virginia, which had more than a 35-percent share over the same period.

Rail had a 20-50 percent modal share for corn in most States, while rail shares for soybean meal were 20-65 percent. Florida and Georgia were the top rail States, with at least a 68-percent share for corn and 80-percent share for soybean meal. Across the period—parallel to national trends over time—rail modal shares slid in all but one State for corn and in four States for soybean meal, while truck shares increased. Barge modal shares were low for the Southeast overall—roughly, 10 percent for corn and 30 percent for soybean meal.

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<sup>4</sup> The analysis was done on a marketing year basis, where, for example, "2020" refers to the "2019/20" marketing year.

<sup>5</sup> Corn and soybean meal consumption derive from an "animal unit" measure multiplied by a measure of "amount fed per animal unit." Southeast animal units generally fell from 2006 to 2014 and increased through 2022. The amount of corn fed per animal unit decreased from 2006 to 2013, increased in 2014, and remained stable through 2022. The amount of soybean meal fed per animal unit also decreased through 2013—but differing from corn—rose each year to a period high in 2022.

<sup>6</sup> For instance, based on USDA/AMS analysis of the Surface Transportation Board's public waybill (available on AgTransport), 19.9 million tons of corn was delivered to Southeastern States in (calendar year) 2006—the highest annual volume between 2005 and 2022. Corn rail terminations in the Southeast fell to 11.4 million tons in 2013, then remained somewhat stable through 2022, at an average 13.1 million tons per year. Based on the same data, soybean meal terminations in the Southeast were stable, averaging about 5.1 million tons per year from 2005 to 2022.

<sup>7</sup> The modal share statistics cited roughly capture the range from the third-lowest State to the third-highest State. Note, too, that, more technically, soybean meal shares were computed on a "soybean-meal-equivalent" basis—that is, whole soybean shipments converted to soybean meal (using a factor of 0.792) plus soybean meal shipments.

### ***Southeast Demand for Railed Grain Responded Only Moderately to Price Changes From 2009 to 2020***

The third part of the study estimated the degree to which different factors influenced the demand for rail transportation of corn and soybean meal into the Southeast. Using data from 2009-20, the researchers found a 1-percent increase in rail rates was associated with a 0.90-percent reduction in corn and soybean meal rail demand in the Southeast. The less-than-one value suggests that rail demand in the Southeast was moderately robust in response to price changes, underscoring the region's reliance on rail transportation.

The researchers also found that, for a 1-percent increase in animals' consumption of grain (as measured by "poultry-grain-consuming animal units"), the demand for rail transportation increased 0.51 percent. However, neither barge rates nor the amount of grain production in the rail-terminating State had a statistically significant effect on grain rail demand. These results underscore the limited responsiveness of rail demand to changes in rail rates and the importance of feed demand in driving railed grain shipments into the region.

### **HOW WAS THE STUDY CONDUCTED?**

To examine corn and soybean meal transportation to the Southeastern United States, this study employed economic modeling and statistical analysis of agricultural production, consumption, and transportation data. To estimate a State's feed needs, the researchers gathered counts of various livestock populations (e.g., the number of cattle, hogs, and poultry) at the State level and then converted those animal populations to a common unit (e.g., "grain consuming animal units" (GCAUs) for corn and "high-protein animal units" for soybean meal).<sup>8</sup> Then, to obtain estimates of feed consumption (in tons), the authors summed a State's various animal units and multiplied those units by the national average feed per animal unit. Lastly, comparing a State's production to its feed needs provided an estimate of the "extra" grain available or needed by the State for feed.<sup>9</sup>

Part II of the study estimated State-level modal shares (rail, barge, and truck) for corn and soybean meal (inclusive of shipments into, out of, and within each State). The basic formula for calculating modal share was the tons shipped by a mode divided by the total tons shipped. Rail data were obtained from the Surface Transportation Board's confidential Carload Waybill Sample, and barge data were obtained from the U.S. Army Corps of Engineers' Waterborne Commerce Statistics. However, State-level data on truck and (therefore, also) total shipments were not readily available. To estimate truck modal shares, the researchers implemented a "residual" approach: truck shipments (in or out of a State) were the net of grain supplies (production, rail in, barge in) and use (feed, ethanol, exports, rail out, and barge out).<sup>10</sup> Because of imperfect data (partly, due to ambiguity of estimating truck movements as a residual), the estimated truck shares may have been underestimated. Nevertheless, the calculated modal shares reflect a State's overall reliance on each mode.

Finally, to uncover the relationship between different factors and the demand for rail transportation of corn and soybean meal into the Southeast, the study employed a fixed effects-instrumental variable (FE-IV) regression. The dependent variable was the tons of corn and soybean meal shipped by rail into each Southeastern State. Explanatory variables included rail rates, barge rates, corn and soybean production levels (both within and outside the rail terminating State), and proxies for feed demand. Monthly diesel fuel prices and the average hourly wage of Class I railroads were used as instrumental variables to deal with the issue of simultaneity between rail rates and shipping quantity. Because these variables affect rail operating costs (rail supply), but not demand for grain rail transportation to the Southeast, the instruments isolate the effect of rail rates on rail demand. Fixed effects were incorporated to account for constant, unobserved differences across States.<sup>11</sup>

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<sup>8</sup> For example, one dairy cow (in grain consuming animal units) is equivalent to (consumes the same amount as) about 500 broilers.

<sup>9</sup> Note, analogous to footnote 7, soybean meal production data were not directly available by State, so the authors converted (whole) soybean meal production to "soybean-meal-equivalent" production using a factor of 0.792. As one limitation in this part, the estimates—based on national average feed ratios per animal unit—may not perfectly reflect State-specific feeding practices.

<sup>10</sup> "Truck within" shipments were also calculated using this "residual" accounting framework. In the truck-within case, the identity where "needs" (such as feed and exports) involve (equal) transportation in plus within. An equivalent way to look at it is "production" turns into (equals) transportation out plus within.

<sup>11</sup> One limitation in this part is the barge rates used in the model were average spot Illinois River rates to the Gulf. These rates might better reflect export demand than Southeastern feed demand, but should still capture barge supply issues (e.g., navigation conditions).

## **PREFERRED CITATION**

Caffarelli, Peter, Jesse Gastelle, Austin Hunt, and Richard Henderson. June 2025. *Domestic Grain and Oilseed Transportation to the Southeastern United States* (Summary). U.S. Department of Agriculture, Agricultural Marketing Service. Web. <<http://dx.doi.org/10.9752/TS470.06-2025>>

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