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## 3 Industries and commodities

- 3.1 Freight-dependent industries
- 3.2 Commodity movement
- 3.3 Primary supply chains

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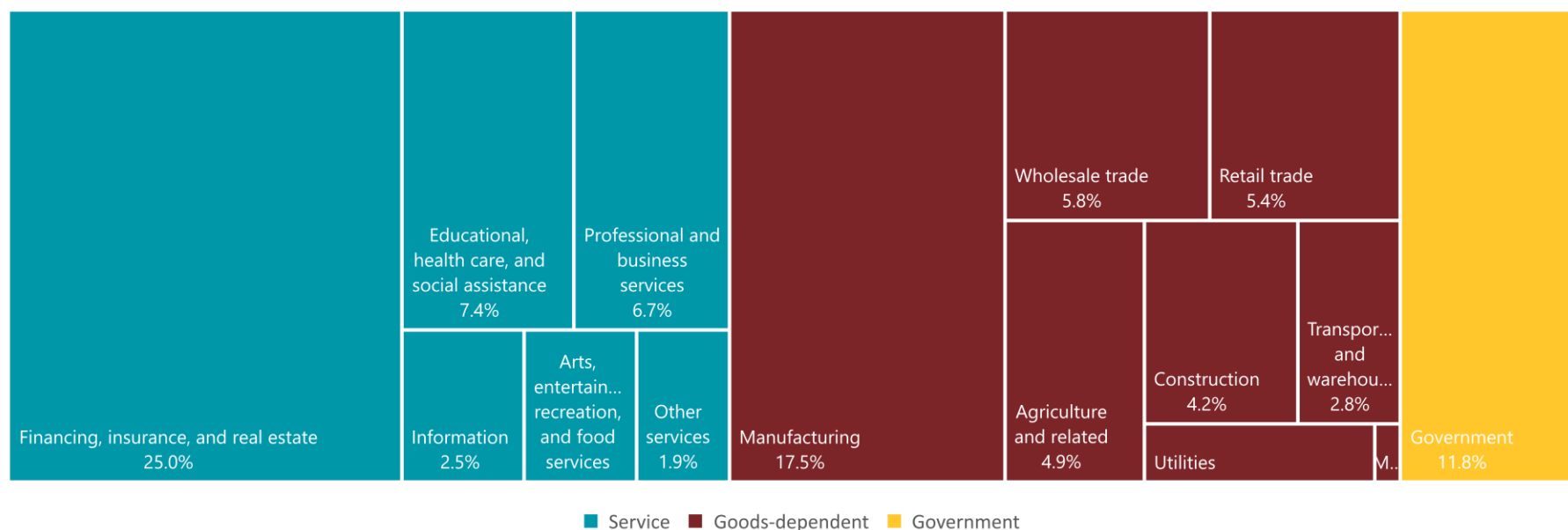
### 3.1 Freight-dependent industries

Goods-dependent (or freight-dependent) industries are those that rely on transportation to receive raw supplies or manufactured goods and to send their refined or finished products to market. Service industries are not as dependent on the movement of raw or manufactured materials, but do rely on smaller shipments of materials, office products, or other supplies.

Iowa's economy and transportation system are heavily influenced by goods-dependent industries, mostly related to grain production and the associated food and agricultural products and byproducts. The state continues to have a robust agricultural industry with the now added transportation demands of a greatly expanded value-added agricultural products sector, as well as a geographically dispersed industrial base that includes large industrial sectors of manufacturing, trade, construction, transportation, and warehousing that will continue to have significant transportation infrastructure needs.

Gross domestic product (GDP) is the total market value of all goods and services produced in the economy. In 2000, Iowa's GDP was \$93 billion; by 2020, Iowa's current-dollar GDP had grown by 107% to \$193 billion. Figure 3.1 details the proportion of GDP by each industry.

Figure 3.1: Iowa gross domestic product by industry, 2020



Source: U.S. Bureau of Economic Analysis

## 3.2 Commodity movement

According to the Federal Highway Administration's Freight Analysis Framework (FAF) tool, freight tonnage moving in the U.S. will double in the next 20 years, which would prove to be a sizable challenge for the overall freight transportation system. This growth will be reflected in Iowa and likely won't be uniform across all modes.

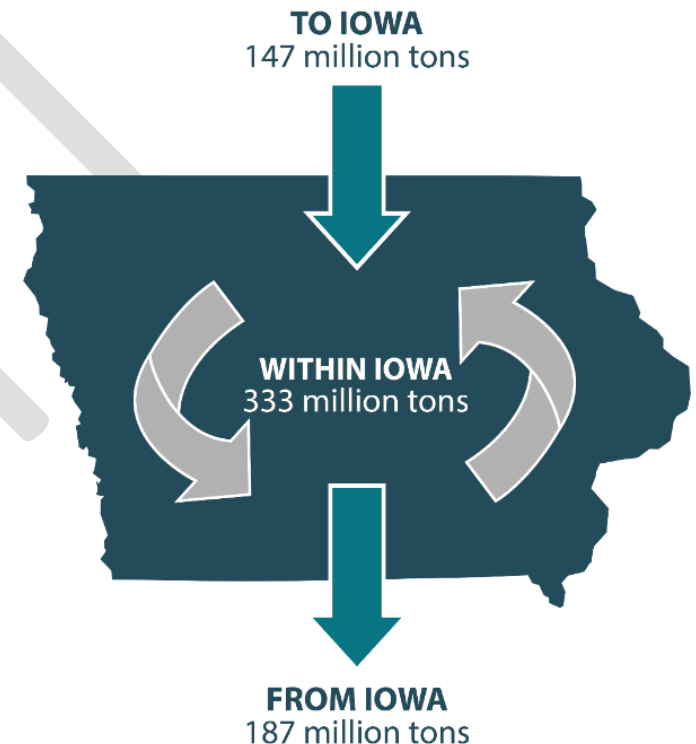
FAF integrates data from a variety of sources (including the Commodity Flow Survey) to create a comprehensive picture of freight movement among states and major metropolitan areas. The tool estimates tonnage, value, and domestic ton-miles by region of origin and destination, commodity type, and mode for current and forecasted years. Understanding the flow of freight by weight provides insights into the infrastructure needs in Iowa, while understanding the flow of freight by value provides insights into the economic impact it has on the area.

Iowa's transportation system facilitated the movement of over 666 million tons of freight with an estimated value of \$383 billion in 2017 (Figures 3.2). The total weight of goods imported into and exported out of the state is expected to grow (Figure 3.3).

Since the turn of the century, Iowa has remained an exporting state, meaning the state produces and exports more goods than it imports. This is true both in terms of tonnage and value. The gap between Iowa's imports and exports is projected to grow wider, from 40 million tons in 2017 to 115 million tons in 2050.

Figure 3.4 shows Iowa's freight tonnage and value by mode in 2017, and the projections for 2050. Truck, rail, and pipeline are the three top modes and transport collectively 93 percent of the tonnage to, from, and within Iowa. These three modes are expected to maintain their prominence through 2050. In addition, the share of each mode's tonnage is expected to remain consistent with small changes of less than one percent, as shown in Table 3.1. The continued prominence of trucks coupled with the projected 52 percent increase in tonnage will have a large impact on the state's highway system. It will result in increased congestion and more rapid deterioration of pavement and structures along the roadways.

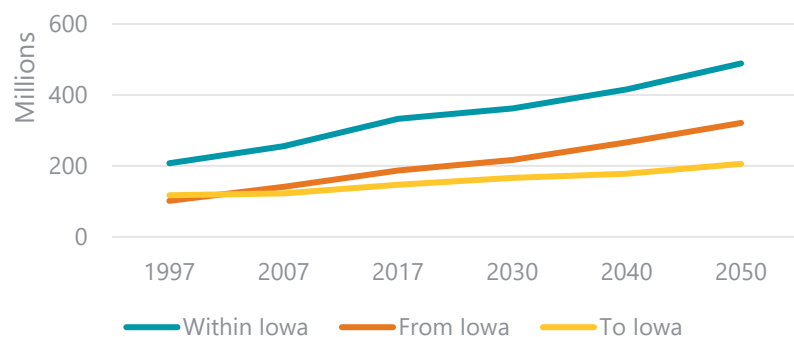
Figure 3.2: Iowa freight movement, 2017



Source: Freight Analysis Framework

### 3. INDUSTRIES AND COMMODITIES

Figure 3.3: Projected Iowa freight movement by ton, 1997-2050



Source: Freight Analysis Framework

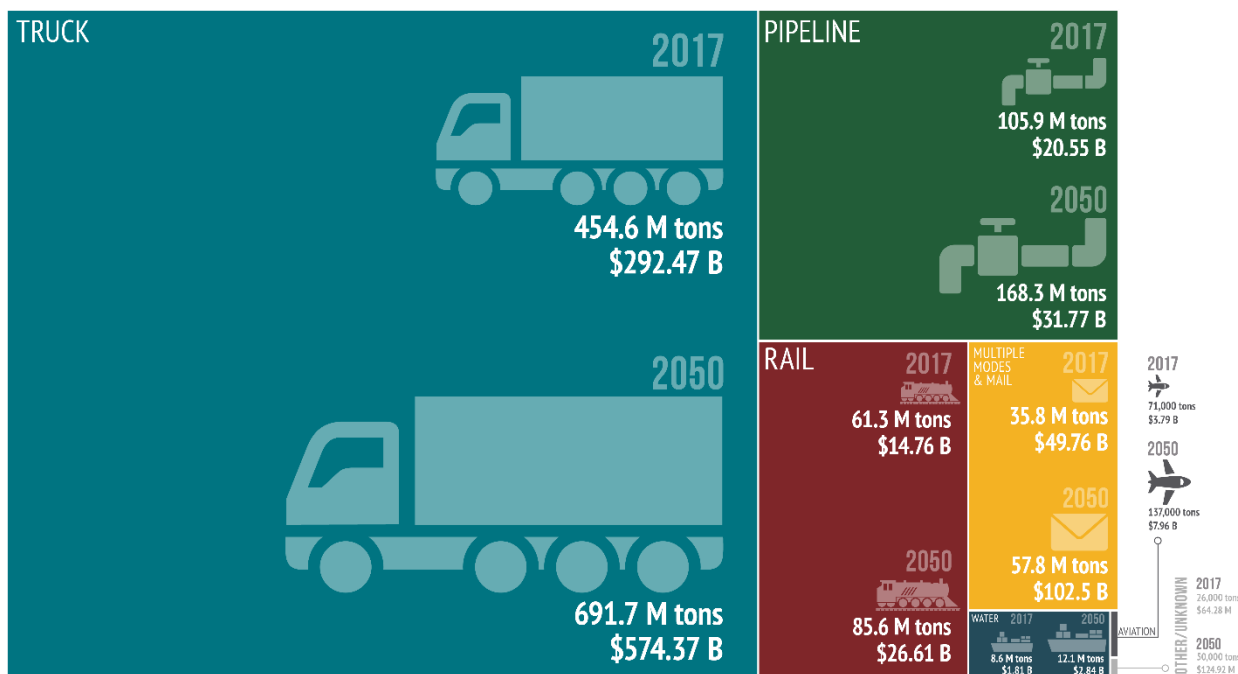
Table 3.1: Projected growth in share of tonnage of Iowa freight by mode, 2017-2050

Mode	Percent of total tonnage (2017)	Percent of total tonnage (2050)
Truck	68.23%	68.11%
Pipeline	15.89%	16.57%
Rail	9.21%	8.43%
Multiple modes & mail	5.37%	5.69%
Water	1.29%	1.19%

*Aviation and Other Modes were excluded as they account for less than 1% of total tonnage.*

Source: Freight Analysis Framework

Figure 3.4: Projected growth in tonnage and value of Iowa freight by mode, 2017-2050



Source: Freight Analysis Framework

## Commodity flow by tonnage

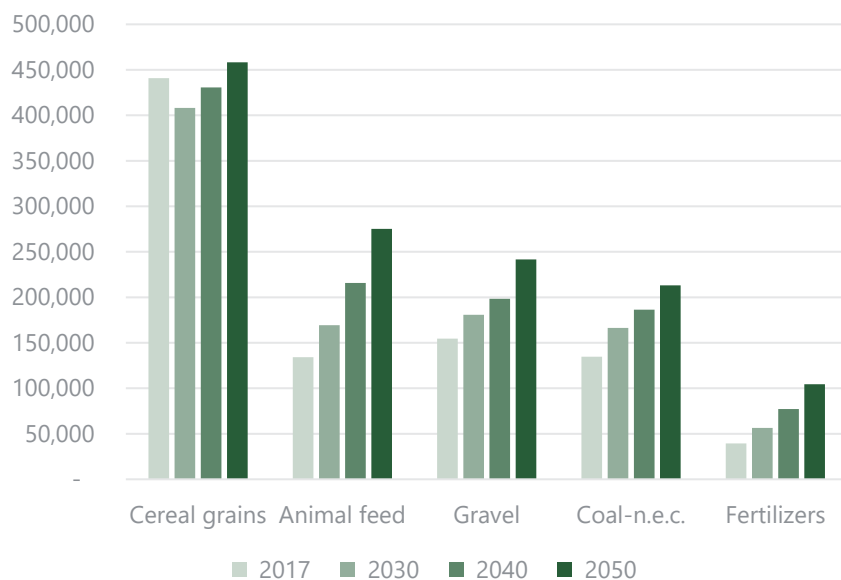
According to FAF, the total weight of Iowa freight (including freight moved within, exported from, and imported to the state) is expected to grow from roughly 666 million tons in 2017 to just over a billion tons in 2050.

In 2050, agricultural products will continue to be the top freight commodities, both as imports and exports. Figure 3.5 shows that cereal grains (such as corn) and animal products and feed (includes eggs) will be the top two commodities imported to and exported from Iowa by weight. These commodities are typically high-weight but low-value bulk shipments.

In terms of weight, cereal grains were the top commodity to move to, from, and within Iowa in 2017. Cereal grains are projected to continue to remain the top commodity through 2050.

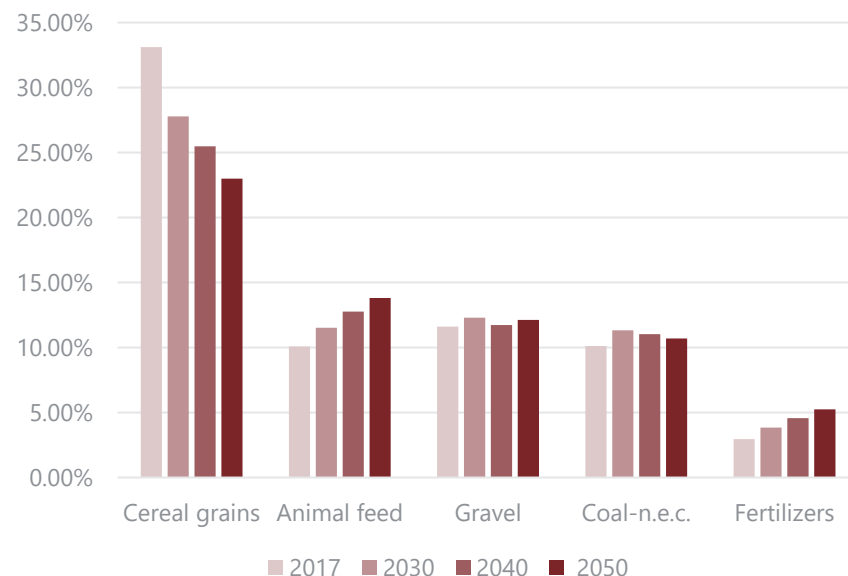
However, as shown in Figure 3.6, cereal grains are projected to become less prominent in part due to growth in other commodities such as animal feed, gravel, and fertilizers.

Figure 3.5: Forecast of Iowa domestic freight by tonnage, 2017-2050



Source: Freight Analysis Framework

Figure 3.6: Forecast of Iowa domestic freight tonnage by market share, 2017-2050



Source: Freight Analysis Framework

## Commodity flow by value

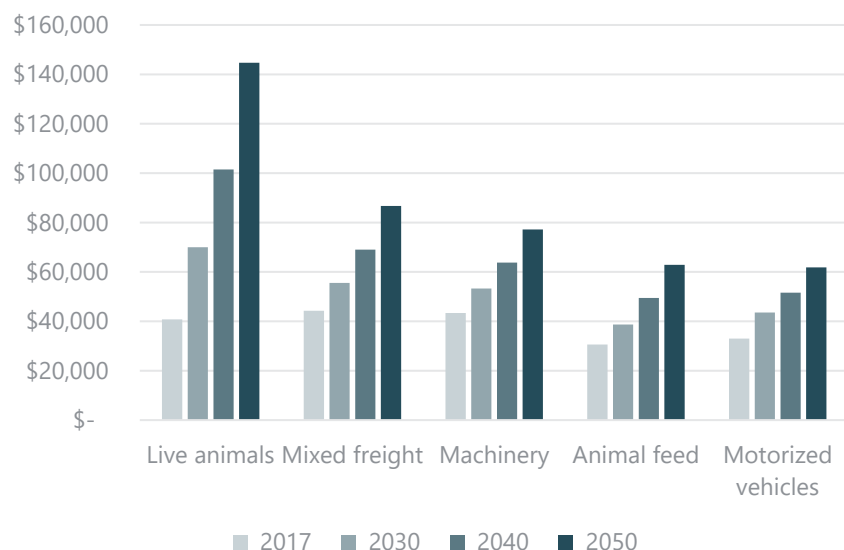
The total value of Iowa freight (including freight moved within, exported from, and imported to the state) is expected to grow from \$383.2 billion in 2017 to \$746.3 billion in 2050.

In 2050, live animals (such as pork) mixed freight (including items for grocery stores, restaurants, and hardware stores), and machinery (including turbines, boilers, internal combustion engines, and other non-electric motors and engines) will be the top commodities by value, as shown in Figure 3.7. According to FAF, the total value of live animals/fish freight is expected to increase by 255 percent by 2050.

It is interesting to note that while cereal grains (not shown) was the top commodity by value in 2017, it will drop to the 11<sup>th</sup> most valuable by 2050, according to FAF. This change is not due to a lack of growth. The value of cereal grain freight is expected to grow by 4 percent, but live animals is expected to grow even more.

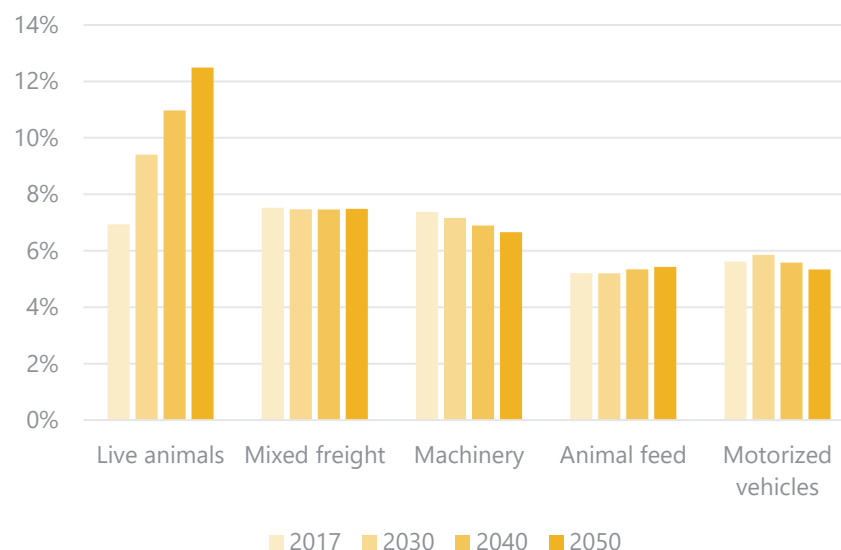
Live animals will continue to become a larger and larger portion of the state's freight by value, as shown in Figure 3.8. However, machinery and motorized vehicles will decline by 0.72 percent and 0.28 percent respectively.

Figure 3.7: Forecast of Iowa domestic freight by value (millions of dollars), 2017-2050.



Source: Freight Analysis Framework

Figure 3.8: Forecast of Iowa domestic freight value (millions of dollars) by market share, 2017-2050.



Source: Freight Analysis Framework

## Trading partners

In 2017, Iowa's top domestic trading partner by value was Illinois, as shown in Table 3.2. By tonnage, Minnesota was Iowa's top domestic trading partner in 2017, with 88 million tons imported from Minnesota or exported to Minnesota.

Table 3.2: Iowa's top five domestic trading partners by value, 2017.

State	Imported from Iowa (\$)	Exported to Iowa (\$)	Total (\$)
<b>Illinois</b>	\$22,644.86	\$18,987.94	\$41,632.80
<b>Minnesota</b>	\$16,851.56	\$16,447.80	\$33,299.36
<b>Nebraska</b>	\$10,082.55	\$11,119.62	\$21,202.16
<b>Texas</b>	\$11,310.54	\$5,076.50	\$16,387.04
<b>Missouri</b>	\$7,613.68	\$7,712.34	\$15,326.02

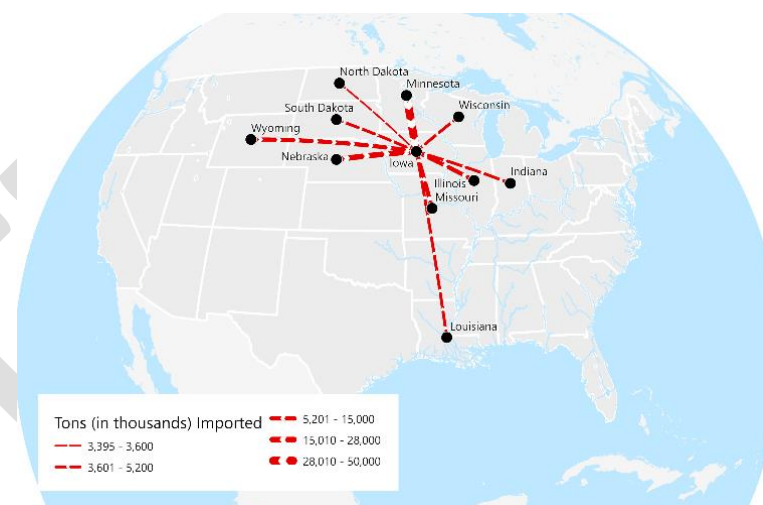
Source: Freight Analysis Framework

Iowa receives most domestic imports from the Great Plains and Midwest regions, as shown in Figure 3.9, with some exports from Louisiana, most likely shipments along the Mississippi and Missouri Rivers.

Iowa exports goods throughout the Midwest, but also to non-Midwest states like Texas (16.9 million tons), Louisiana (9.6 million tons), and California (3.9 million tons). These trading partners are shown in Figure 3.10.

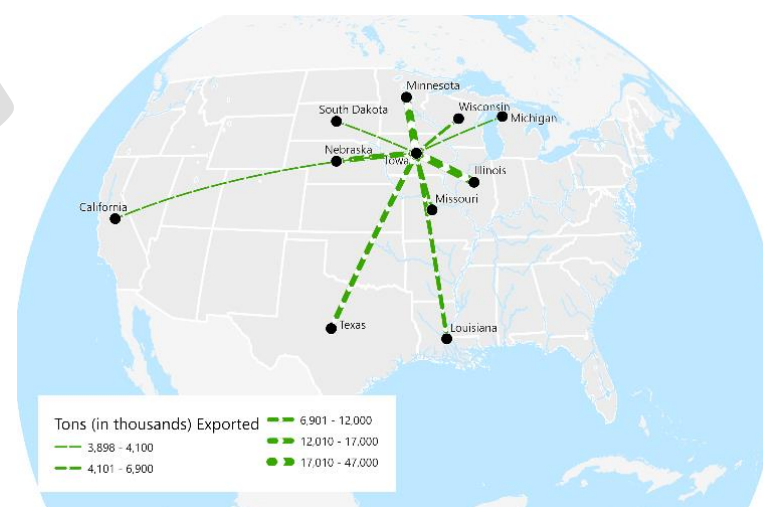
The Iowa DOT believes that with a large majority of Iowa's inbound and outbound freight involving states in the immediate vicinity, the coordination of network identification, regulation, infrastructure projects, and freight-related initiatives is crucial to economic growth and prosperity in the region.

Figure 3.9: Top 10 domestic exporters to Iowa by tonnage, 2017.



Source: Freight Analysis Framework

Figure 3.10: Top 10 domestic importers from Iowa by tonnage, 2017.

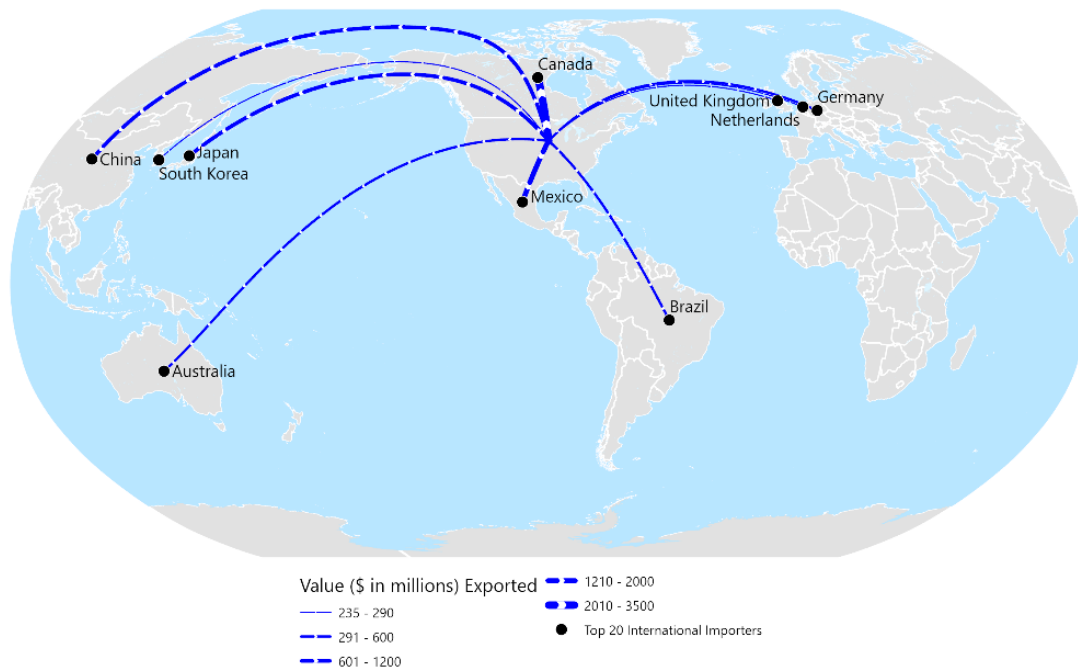


Source: Freight Analysis Framework

### 3. INDUSTRIES AND COMMODITIES

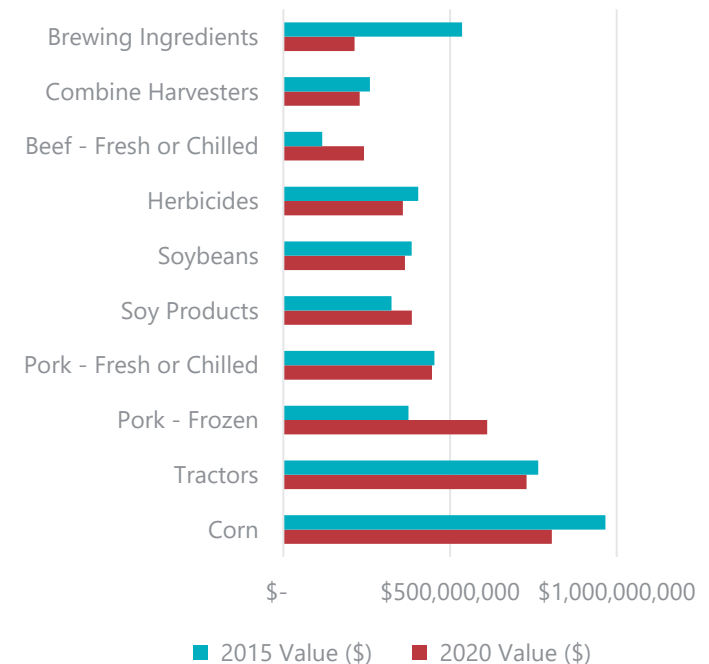
In 2020, Iowa's top trading partner was Canada at \$3.5 billion of goods, followed by Mexico at almost \$2 billion, and China at \$1.2 billion. Figure 3.11 shows the locations of Iowa's top ten international trading partners, and the value of goods exported. The state of Iowa exported roughly \$12.6 billion in goods in 2020. The top commodity in 2020 was corn, followed by tractors, and then pork. Figure 3.12 shows the top ten commodities exported internationally. Because international trade is an important factor affecting freight transportation in Iowa, the Iowa DOT pays special attention to international trading lanes (such as the Panama Canal) and trading regulations.

Figure 3.11: Iowa's top 10 international trading partners (exports only) by value, 2020.



Source: U.S. Census Bureau and U.S. Trade Online

Figure 3.12: Iowa's top 10 exported commodities by value, 2020.



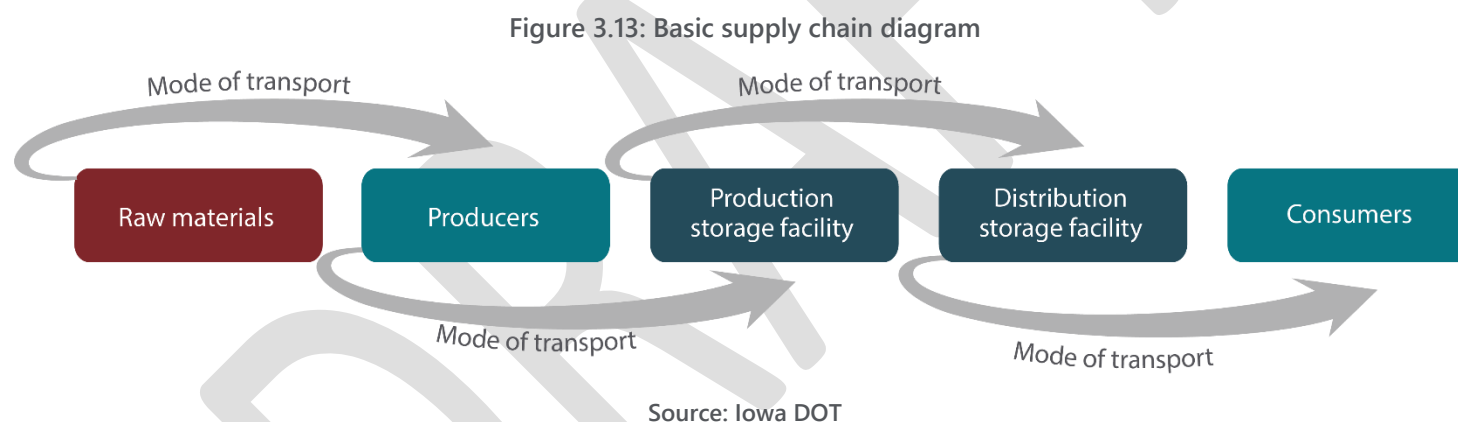
Source: U.S. Census Bureau and U.S. Trade Online



### 3.3 Primary supply chains

Although Iowa has a diverse economy made up of many service and goods-dependent industries, agriculture-related products dominate the state's imports and exports. Whether it is corn, products made from corn, farm machinery, meat, animal health products, or agricultural chemicals, many products moving on the freight transportation system are closely tied to the agricultural industry.

The movement of these commodities from origin to destination is reliant on efficient and profitable supply chains. Supply chains encompass the myriad of transportation legs and logistics functions associated with the complete process of bringing commodities from production to market. They incorporate a network of individuals, processes, and physical entities involved in producing, handling, and/or distributing a specific commodity, all of which are linked together by information and transportation infrastructure. Figure 3.13 shows a basic example of a supply chain that goes from the production of a commodity through various stops and using multiple modes of transportation before reaching the market and, ultimately, consumers.



Iowa is fortunate to have transportation infrastructure that has long provided Iowa producers and businesses with a strong comparative advantage, fostering the ability to efficiently and competitively serve domestic and global markets. As a producer-state, it is extremely valuable to have transportation flexibility that includes an advanced highway network, well-developed rail system, two navigable rivers, extensive pipeline grid, and several commercial airports that open the door to multiple options for producers and businesses to optimize their supply chains.

This section will provide an overview for a few of the major supply chains in Iowa. These commodities are not an exhaustive list of important commodities in the state but are major imports and exports by weight and value (see Section 3.2, Commodity movement) and have a large impact on the freight transportation system.

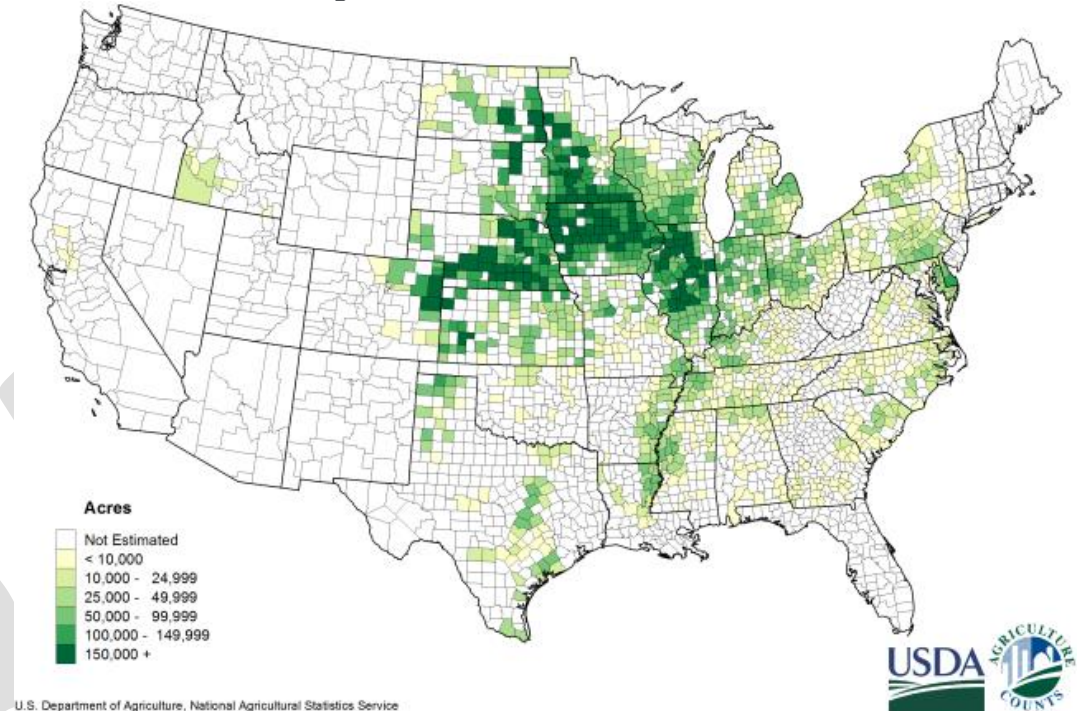


## Corn

According to the U.S. Department of Agriculture (USDA), Iowa corn farmers produced 2.3 billion bushels of corn on 12.9 million acres of land in 2020, accounting for over 16 percent of total U.S. corn production. This is a consistent trend as the state has produced the largest corn crop of any state each year for two decades. Figure 3.14 shows the number of acres of corn harvested in each U.S. county in 2019 with the darkest green, representing the most acres, being concentrated in and around Iowa.

With the help of constant innovation, Iowa corn and corn byproducts are used to produce countless products in the state and around the world, such as food, fuel, pharmaceuticals, oils, sweeteners, starches, and plastics, with the majority being dedicated to food and fuel. Iowa is a national leader in the production of ethanol, dried distillers grains (DDGs), and other livestock feed. One-third of the corn that goes into producing ethanol comes out as DDGs – a byproduct of the process that is a high-value feed grain for livestock. Millions of bushels of corn (or corn byproducts) are consumed by Iowa livestock annually, mainly hogs, cattle, and poultry. The readily available livestock feed has helped Iowa consistently be a national leader in the production of eggs, pork, and beef, all of which are major Iowa and U.S. exports to top markets such as Japan, Mexico, and China. Another byproduct of corn production is corn stover, the above-ground part of the corn plant remaining after the grain is harvested, which can be used for ethanol production, cattle feed, livestock bedding, and building materials.

Figure 3.14: Corn acres harvested, 2019



Source: U.S. Department of Agriculture

### ONE BUSHEL OF CORN IS EQUIVALENT TO:

2.9 gallons of ETHANOL

16 pounds of DDGs

8 pounds of BEEF

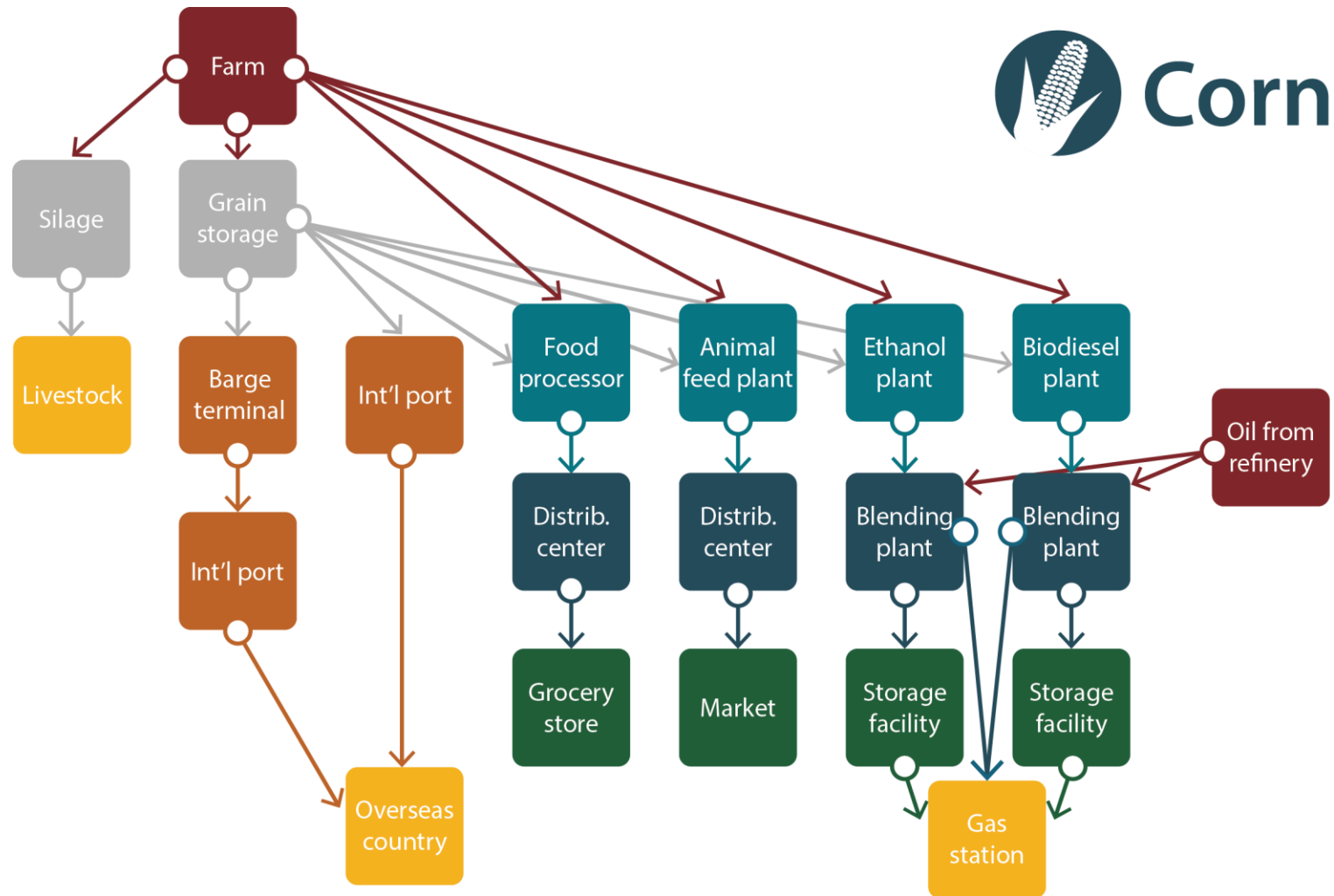
15.6 pounds of PORK

21.6 pounds of CHICKEN

30 pounds of TURKEY

Source: Iowa Corn Growers Association

Figure 3.15: Corn supply chain



Source: Iowa DOT

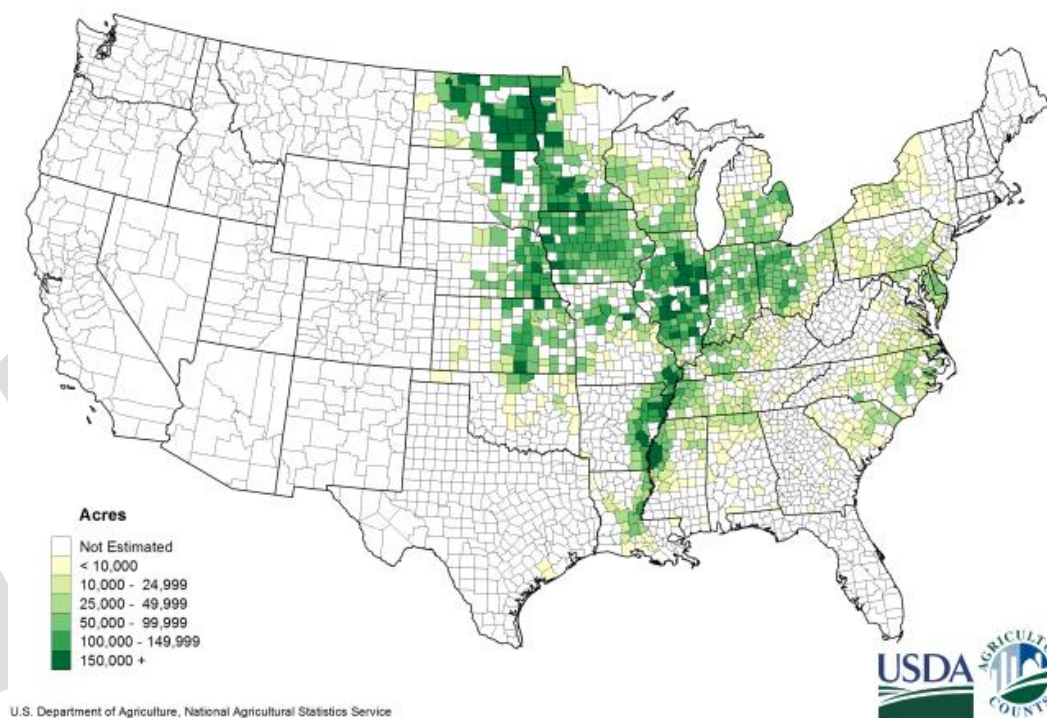
## Soybeans

Iowa is also a leader in the production of soybeans, consistently ranking in the top three states in the nation each year. Iowa farmers produced 506 million bushels on 9.3 million acres in 2020. This translates to 12 percent of the nation's soybean production. Figure 3.16 shows the number of acres of soybeans harvested in each U.S. county in 2019 with the darkest green, representing the most acres, being concentrated in and around Iowa.

Soybeans are processed into numerous forms such as soy meal and soybean oil used to make valuable products consumed domestically and internationally. Soy meal is a major ingredient in animal feed for pork and poultry and makes up a majority of soybean production. Soybean oil, the second most consumed oil in the world, is used to produce food products such as margarine, salad dressings, and cooking oils, as well as industrial products like plastics and biodiesel fuel.

Like corn, soybeans are a major Iowa and U.S. export to countries around the world. Top buyers of soybeans include China, Mexico, and Japan; top markets of soy meal are Mexico, Philippines, and Canada; and the top destinations for soybean oil are China, Mexico, and India.

Figure 3.16: Soybean acres harvested, 2019



Source: U.S. Department of Agriculture

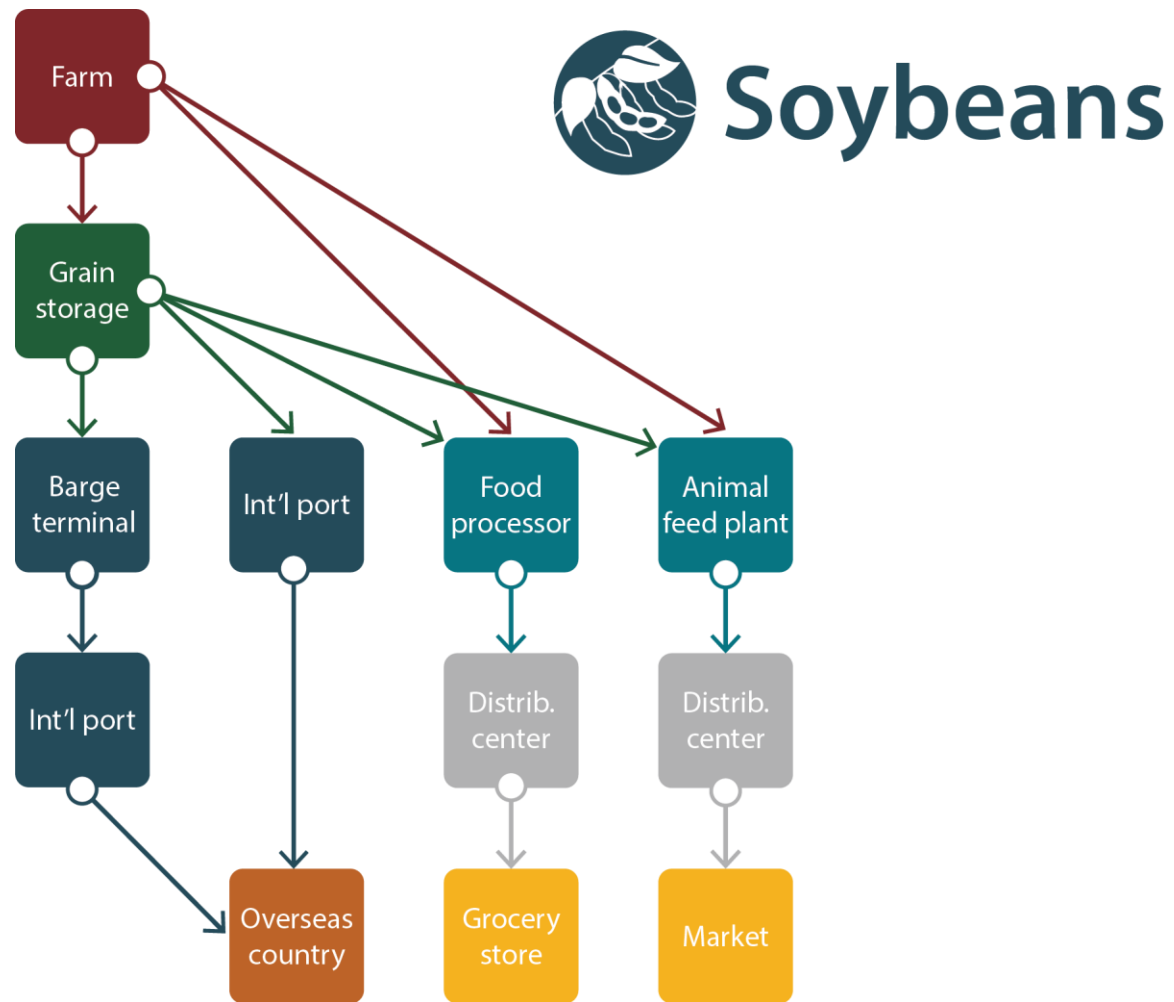
### ONE BUSHEL OF SOYBEANS IS EQUIVALENT TO:

48 pounds of SOY MEAL

11 pounds of SOYBEAN OIL

Source: Iowa Soybean Association

Figure 3.17: Soybean supply chain



Source: Iowa DOT



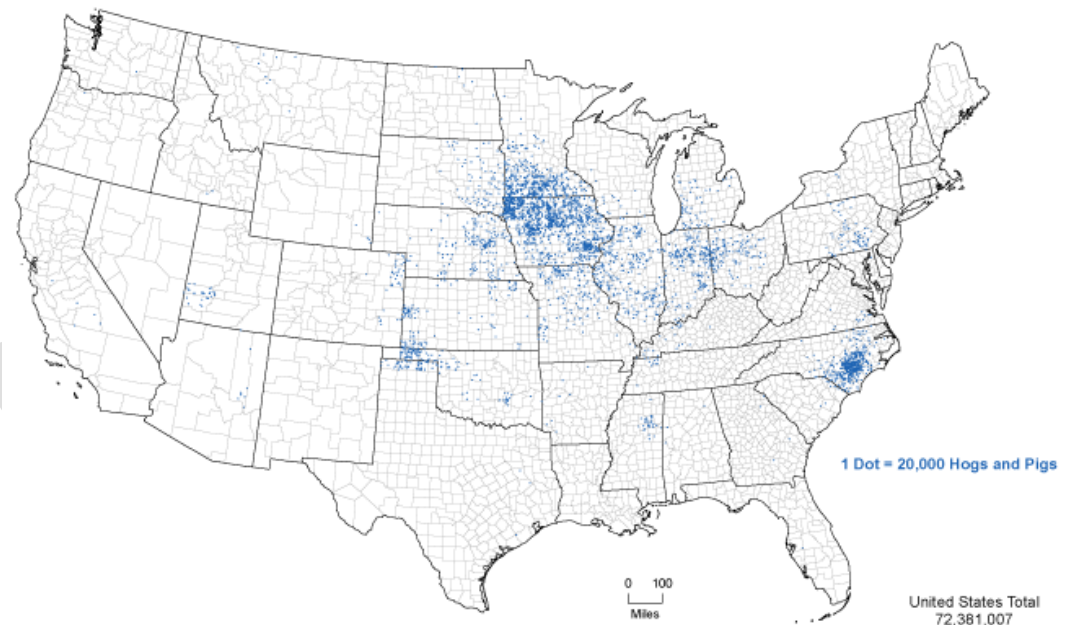
## Pork

Iowa is the nation's leading pork producing state in numerous USDA categories, including all hogs and pigs inventory, all hogs and pigs value, pig crop, and pork export value. The state raises nearly one-third of the nation's hogs with over 5,400 operations and a total inventory of 24 million animals. Figure 3.18 shows the total inventory of hogs and pigs by U.S. county in 2017.

With a concentration of corn, soybeans, and packing plant capacity, Iowa is an ideal location for pork production. The abundance of materials and capacity within the state lowers the cost of transportation and feed for Iowa farmers.

Many hog byproducts are used in drugs and medical products such as insulin hormones and heart valves for transplants, as well as chemicals used in manufacturing to make glue, upholstery, pet food, lubricants, and cement. Additionally, a major byproduct from hogs is a necessity for Iowa's corn and soybean farmers: manure to be used as fertilizer for cropland. According to the Iowa Pork Producers Association, ten pigs from weaning to market provide the nutrient needs of an acre of cropland on a semiannual basis. This helps to enrich the soil for strong corn and soybean yields.

Figure 3.18: Inventory of hogs and pigs, 2017



Source: U.S. Department of Agriculture

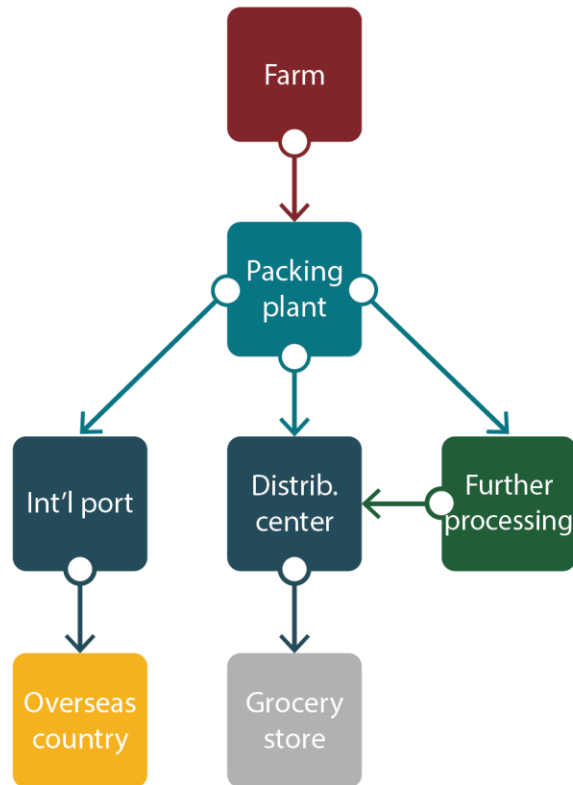
### FROM WEAN TO MARKET WEIGHT OF 270 POUNDS, ONE PIG EATS:

12 bushels of CORN

2.5 bushels of SOYBEANS

Source: Iowa Pork Producers Association

Figure 3.19: Pork supply chain



Source: Iowa DOT

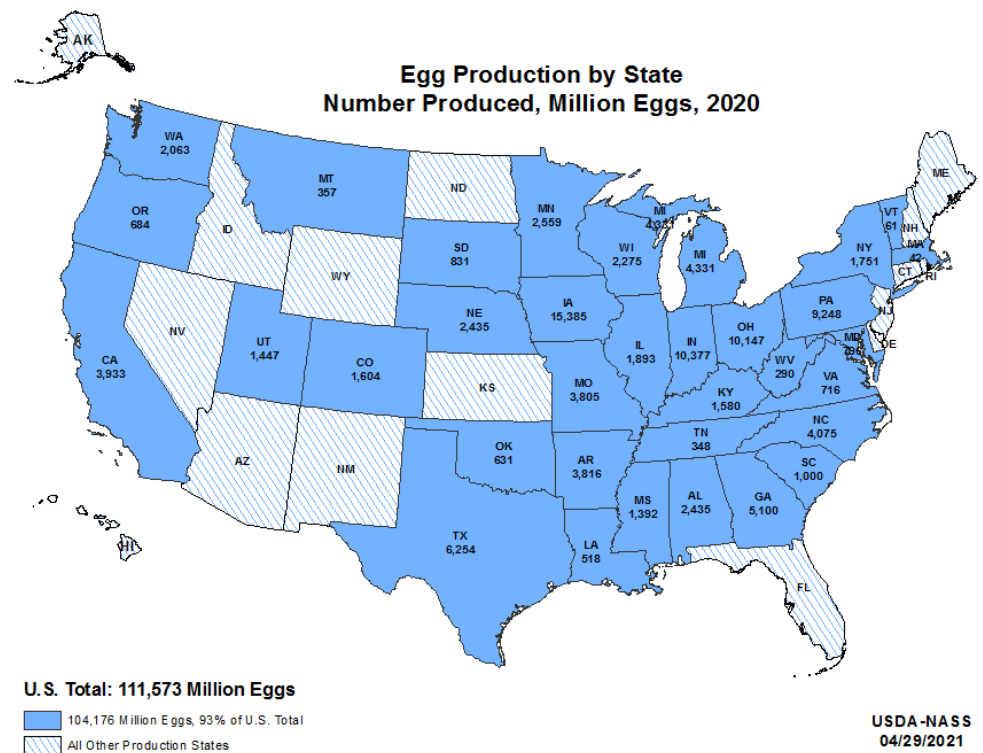


## Eggs

Iowa led the nation in egg production in 2020, continuing a trend that has lasted over a decade. The state increased egg output significantly between 1997 and 2006, taking advantage of a growing population and rising egg product consumption in the country. Production in Iowa has steadied since then, resulting in nearly 16 billion eggs being produced each year. Figure 3.20 shows U.S. egg production by state.

A significant reason for Iowa leading the nation in egg production is the competitive advantage the state has with affordable and abundant feed, which makes up a substantial percent of egg production costs. Laying hens alone consume more than 50 million bushels of corn and more than 450,000 tons of soybean meal each year. Iowa egg producers do not have the large additional cost of transporting feed like many other states. Iowa also has a feed price advantage due to its extensive feed-grain production and will likely maintain that advantage for the foreseeable future.

Figure 3.20: Egg production by state, 2020

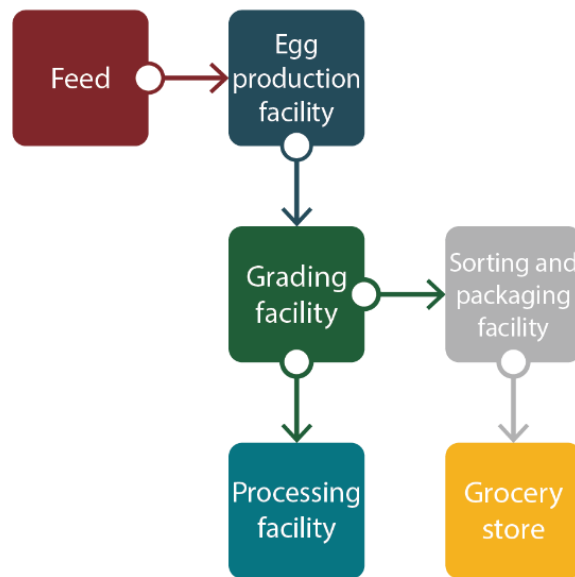


Source: U.S. Department of Agriculture

**Iowa farmers are responsible for about one in five eggs consumed in the United States each year.**

Source: Iowa Egg Council

Figure 3.21: Egg supply chain



Source: Iowa DOT

## Tractors and machinery

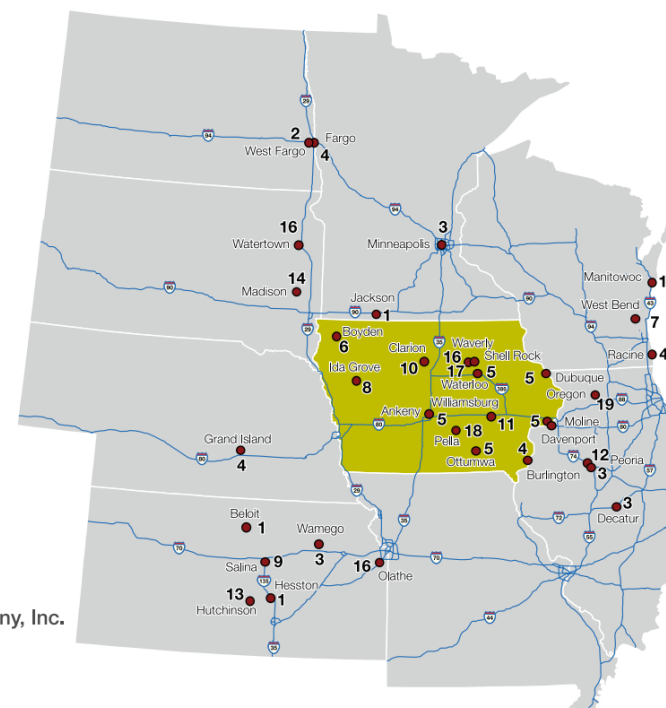
To produce record numbers of corn and soybeans, Iowa farmers need the appropriate equipment. The manufacturing of tractors and agricultural/construction machinery is a natural fit for a major agricultural production area like Iowa.

The state is a major manufacturing center for agricultural machinery giants John Deere, Caterpillar Inc., Kinze Manufacturing, Vermeer, Danfoss, CNH Industrial (CASE, New Holland), Bridgestone/Firestone Agricultural Tire, and Hagie Manufacturing. There are approximately 6,000 manufacturers with over 22,000 employees in Iowa with sales of over \$91 billion per year. Figure 3.22 shows regional tractor and machinery manufacturing locations.

Agricultural and construction equipment manufacturing has continually developed over the years. These products are now the state's leading manufactured commodities in terms of value with tractors being Iowa's top manufactured export.

Figure 3.22: Regional agricultural and construction equipment manufacturers

- 1 AGCO Corporation
- 2 Bobcat Company
- 3 Caterpillar, Inc.
- 4 CNH Industrial
- 5 Deere & Company
- 6 DEMCO
- 7 Gehl Company
- 8 GOMACO Corporation
- 9 Great Plains Manufacturing, Inc.
- 10 Hagie Manufacturing Company
- 11 Kinze Manufacturing, Inc.
- 12 Komatsu America Corporation
- 13 Krause Corporation
- 14 Manitou Americas, Inc.
- 15 Manitowoc Company, Inc.
- 16 Terex Corporation
- 17 Unverferth Manufacturing Company, Inc.
- 18 Vermeer Manufacturing Company
- 19 Woods Equipment Company

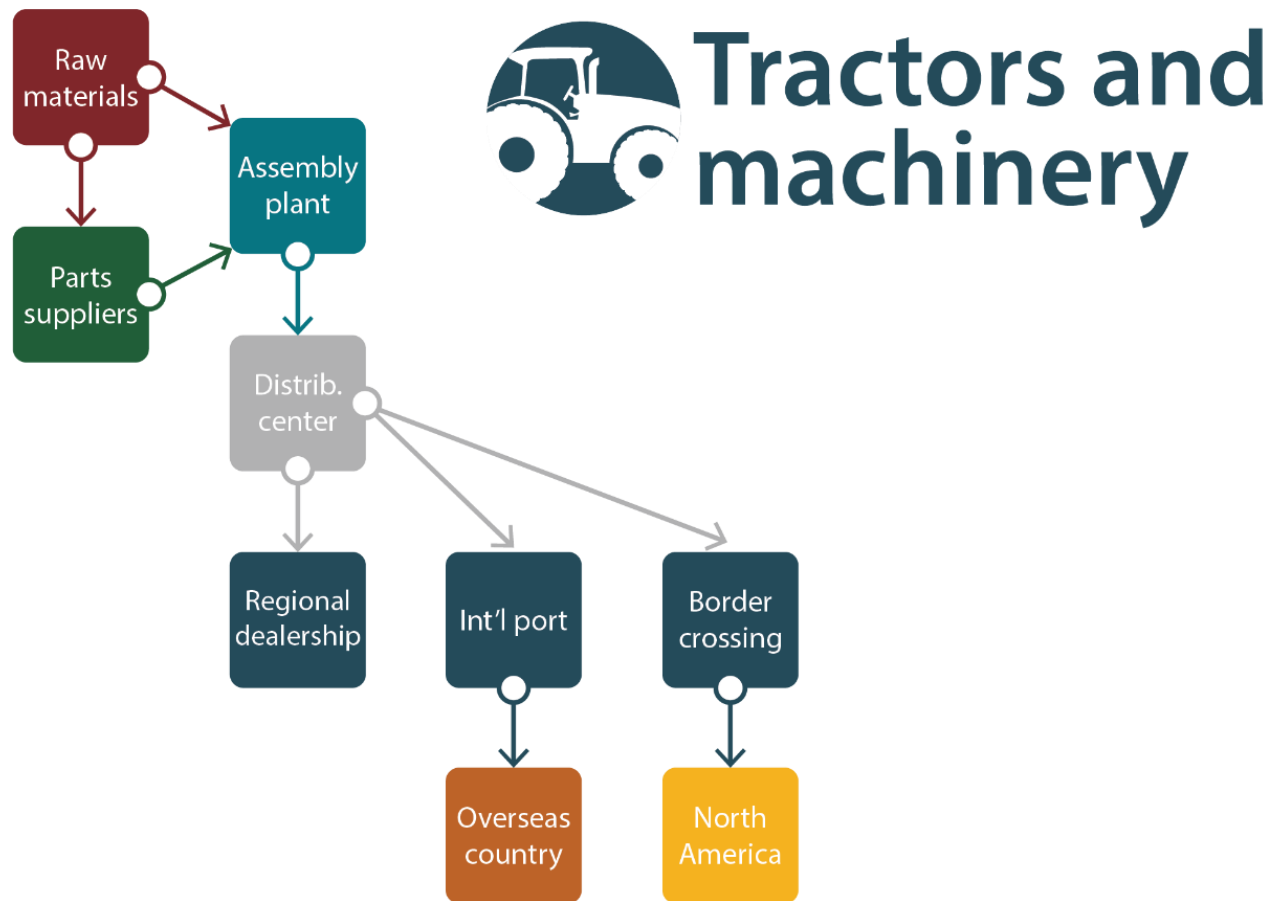


Source: Iowa Economic Development Authority

**Iowa has nine times the concentration of agricultural and construction equipment manufacturing compared to the rest of the nation.**

Source: Iowa Economic Development Authority

Figure 3.23: Tractors and machinery supply chain



Source: Iowa DOT