

North Dakota Corn Industry

Economic Contribution Analysis

Summary Report

Dean Bangsund and Nancy Hodur, PhD

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Preface

This report is one in a series of summary documents examining the role of agriculture in North Dakota. These summary reports cover only the highlights from an ongoing study of the industry in the state.



Industry Highlights

The following figures combine all segments of the North Dakota corn industry. Crop production is a three-year average from 2018 through 2020, ethanol is based on 2021 data, other industry segments represent a three-year average from 2015 through 2017, and economic metrics include direct and secondary economic effects.

Annual average corn production from 2018 through 2020.

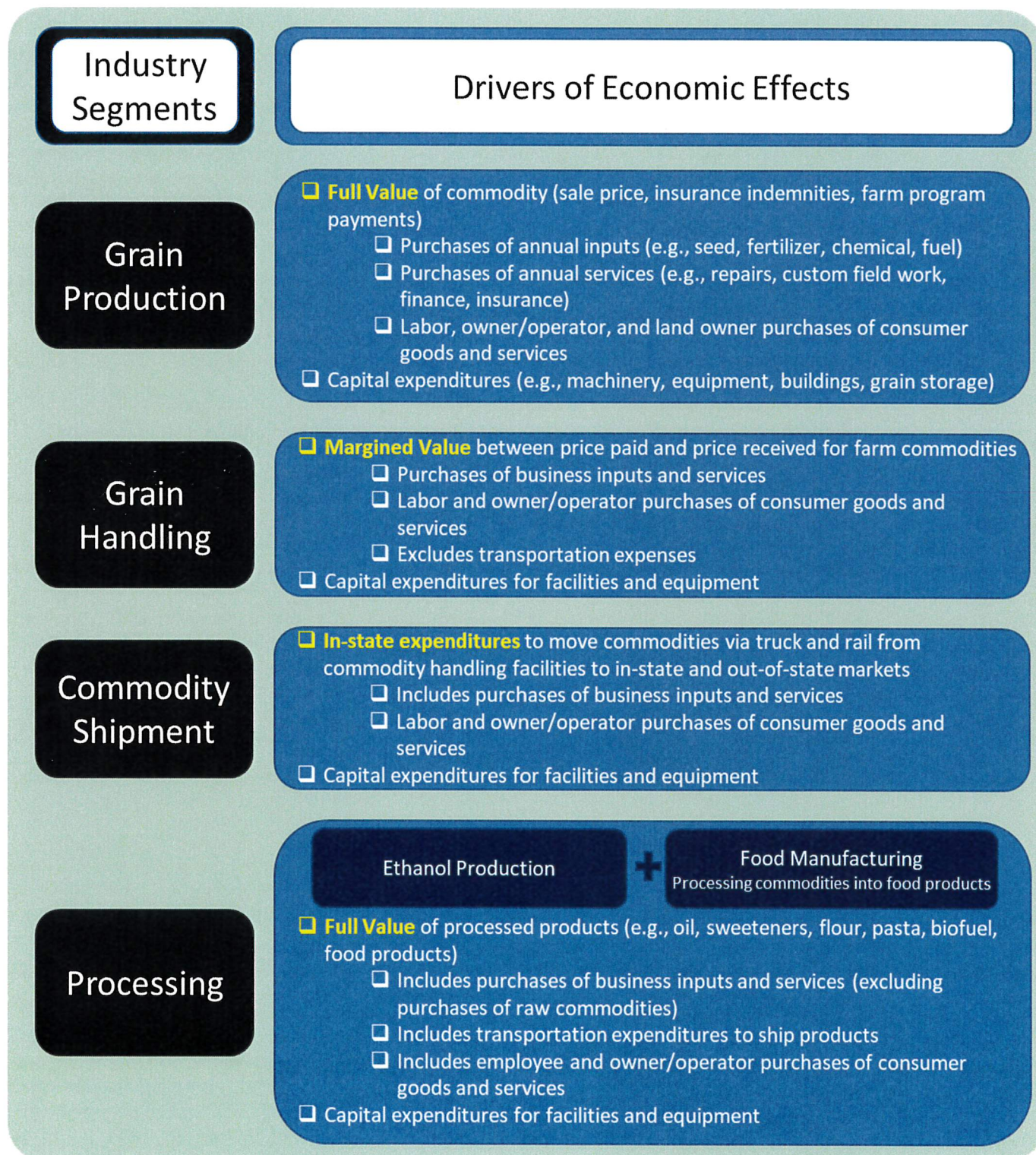
- ❖ 2,702,900 planted acres
- ❖ 388,210,000 bushels produced
- ❖ \$1,348,200,000 farm gate value
- ❖ \$1,753,900,000 combined value of farm gate, insurance indemnities, and farm program payments

Economic metrics for the North Dakota corn industry.

- ❖ \$6.1 billion gross business volume
 - \$3.1 billion from corn production
 - \$3.0 billion from grain handling, transportation, ethanol, and other processing
- ❖ 16,800 jobs
 - 10,220 jobs supported by production
 - 6,580 jobs supported by grain handling, transportation, ethanol, and other processing
- ❖ \$1.2 billion in labor income
- ❖ \$2.4 billion in value-added
- ❖ \$130 million in local and state government revenues

Industry Composition

The corn industry in North Dakota includes farm production, grain handling, transportation, processing, and ethanol. For each component, production expenditures, outlays for capital acquisitions, employment compensation, and owner/operator income are measured for their economic contribution to the state economy. Therefore, each segment is measured for direct effects and secondary effects relating to business-to-business transactions (indirect) and households to business expenditures (induced).



Understanding the Numbers

Economic contribution assessments measure the gross size of an industry or economic sector.

Size is estimated by combining **direct** or first-round effects (i.e., sales, spending, and/or employment) with economic modeling to estimate secondary effects of business-to-business transactions (**indirect**) and household spending for goods and services (**induced**).

Economic measures frequently used in economic contribution assessments:

- ❖ **Labor Income** – earnings of workers and sole proprietors
- ❖ **Employment** – wage and salary jobs and sole proprietor/self-employed jobs
- ❖ **Gross Business Volume** – sum of all business-to-business and household-to-business transactions
- ❖ **Value-added** – represents share of gross state product

An overview and additional information on study methods, data sources, and economic definitions are appended to the end of this report.

Recent Production History

The study period for the economic contribution of corn production was 2018 through 2020, and included all corn-grain production in ND. Corn grown for silage was not included in the corn sector economic contribution. The next three figures show how key economic information for corn production in North Dakota compares from 2012 through 2020.

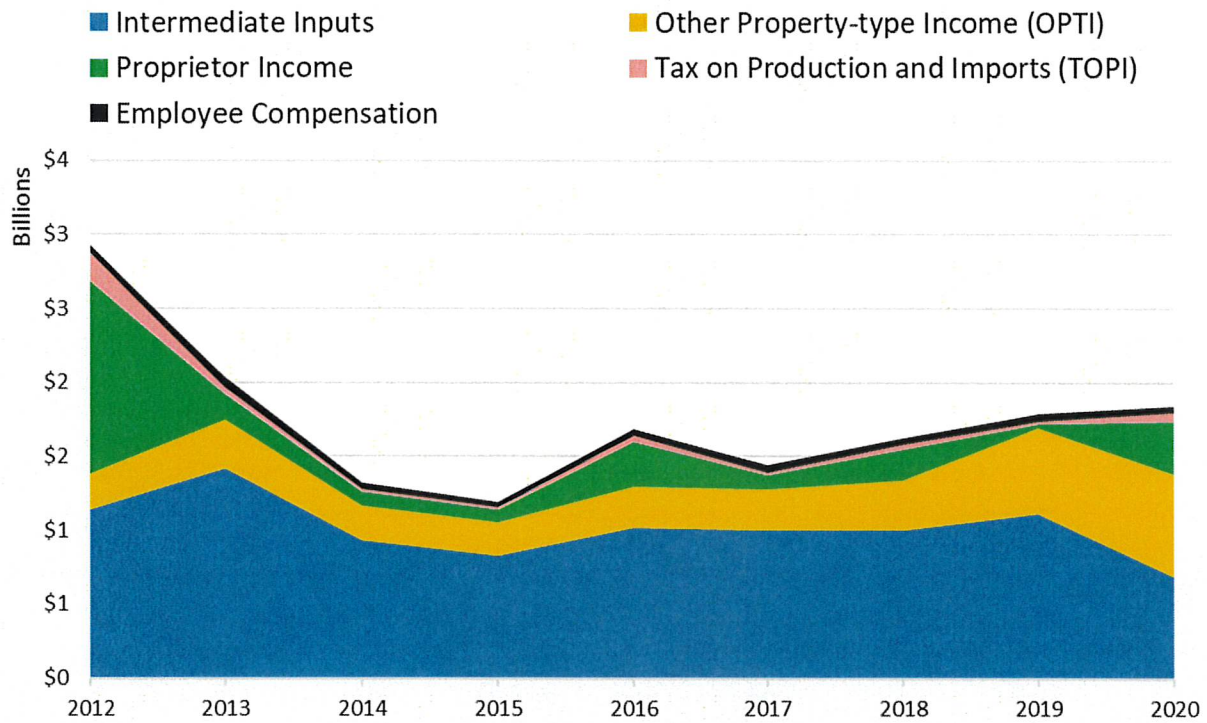
Economic sector profiles, part of the economic modeling requirements, show the relative financial values for proprietor income, paid labor, taxes, other property type income (cash rent, capital outlays), and intermediate inputs (term for inputs consumed during one production year such as seed, fertilizer, fuel, among others). As would be expected in farm production, production revenues varied considerably over the period.

Gross revenues for corn production were comprised of farm gate value (price/bu x bushels), farm program payments, insurance indemnities, and other revenues. During the 2012 to 2020 period, farm gate values were the dominant source of revenues for corn production.

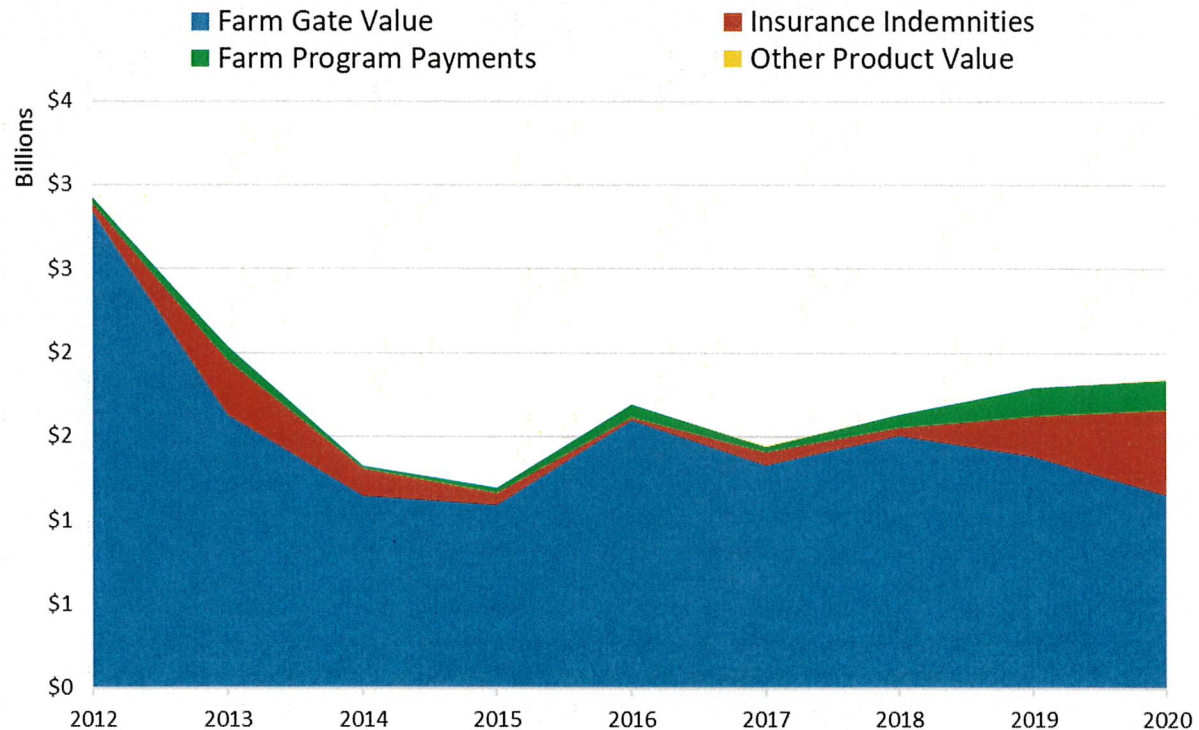
Corn production revenues in North Dakota averaged \$1.75 billion from 2018 to 2020. The average from 2018 through 2020 was compared to the annual revenues for 2012 through 2017, and was considered representative of average revenues for corn production over that period.

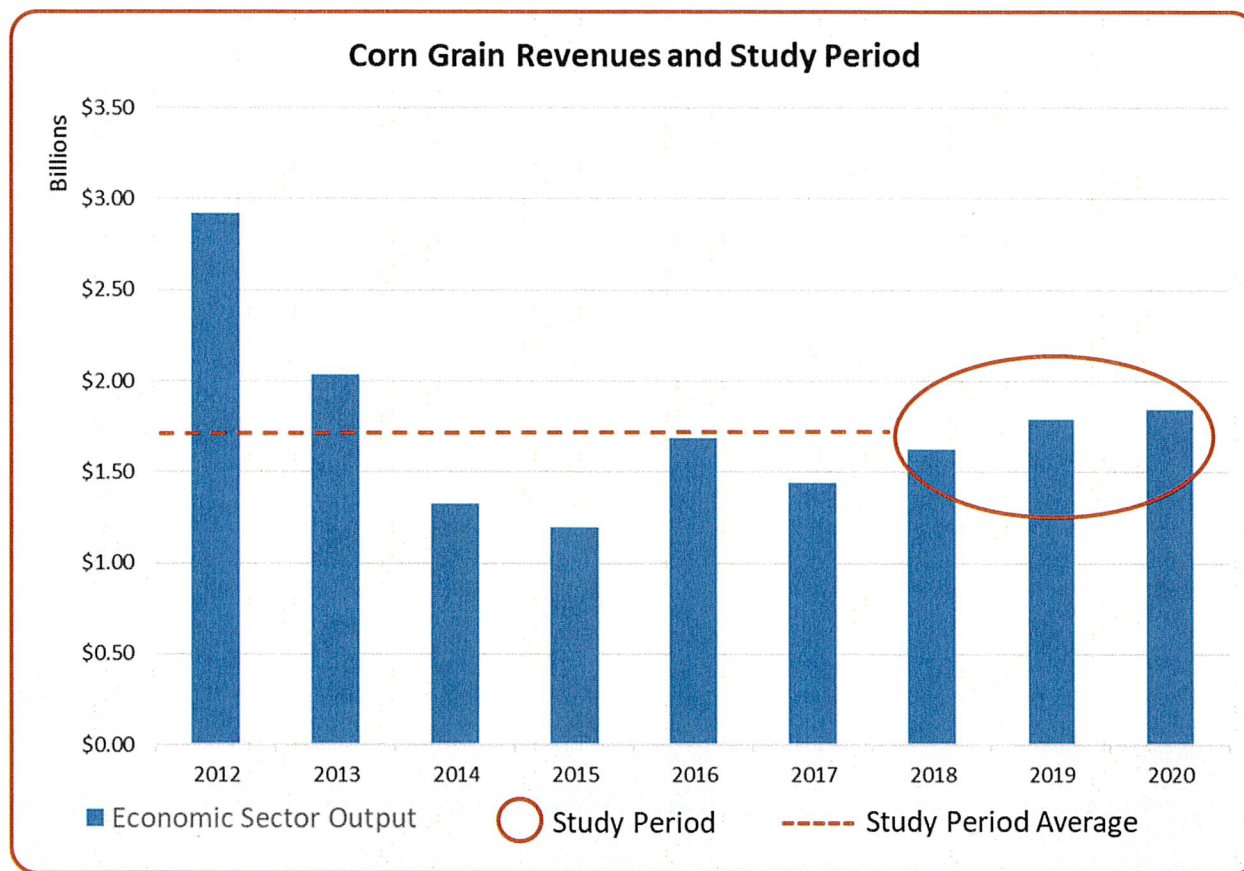
Corn production averaged about \$935 million in production inputs, nearly \$200 million in proprietor income, and \$48 million in paid labor expenses annually from 2018 through 2020.

Corn Grain, Economic Sector Profile



North Dakota Corn Grain Production Revenues





Corn Production Statistics and Economic Profile, North Dakota, 2016 through 2020

| | 2016 | 2017 | 2018 | 2019 | 2020 | Average 2018- 2020 |
|--------------------------------------|-------------------------|---------|---------|---------|---------|--------------------------|
| Production Statistics | | | | | | |
| Acreage (000s) | 3,181.6 | 3,137.6 | 2,870.5 | 3,319.8 | 1,918.5 | 2,702.9 |
| Yield (bu/ac) | 166.8 | 139.7 | 157.9 | 136.1 | 135.4 | 143.6 |
| Price (per bushel) | \$3.01 | \$3.04 | \$3.32 | \$3.07 | \$4.44 | \$3.47 |
| Farm Gate Value (millions \$) | 1,597.5 | 1,332.9 | 1,504.6 | 1,386.6 | 1,153.4 | 1,348.2 |
| Other Product Value (millions \$) | 0.7 | 3.6 | 0.0 | 0.0 | 6.3 | 2.1 |
| Insurance Indemnities (millions \$) | 14.4 | 76.7 | 45.2 | 232.9 | 504.6 | 260.9 |
| Farm Program Payments (millions \$) | 76.0 | 29.0 | 77.4 | 169.8 | 180.6 | 142.6 |
| Economic Profile | | | | | | |
| | ----- millions \$ ----- | | | | | |
| Output | 1,702.9 | 1,518.9 | 1,627.2 | 1,789.4 | 1,845.0 | 1,753.9 |
| Employee Compensation | 41.8 | 46.9 | 42.2 | 54.0 | 49.2 | 48.5 |
| Proprietor Income | 301.6 | 89.4 | 207.6 | 27.6 | 356.7 | 197.3 |
| Other Property-type Income (OPTI) | 291.7 | 357.1 | 342.8 | 578.9 | 688.0 | 536.6 |
| Tax on Production and Imports (TOPI) | 50.1 | 24.5 | 36.0 | 13.2 | 59.4 | 36.2 |
| Intermediate Inputs | 1,017.7 | 1,001.0 | 998.5 | 1,115.7 | 691.5 | 935.3 |

Business Volume

Gross business volume for corn production was estimated at \$3.1 billion, with \$1.75 billion in direct effects and \$1.35 billion in secondary economic effects. The corn industry, which included grain handling, commodity shipment, corn processing, and ethanol production was estimated to have direct output of \$4 billion, and when combined with secondary economic effects, had an average annual total gross business volume of \$6.1 billion.

Corn production represented about half of the corn industry's gross business volume in North Dakota. Ethanol represented 27 percent of the industry. Economic output from commodity shipment was 10 percent, with grain handling and other processing comprising the remaining 13 percent of the industry.

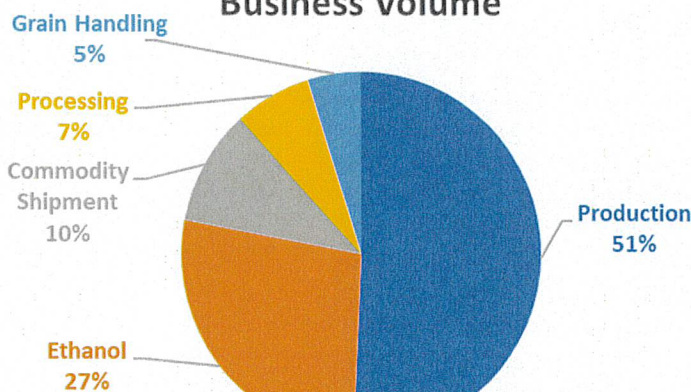
Ethanol production had a gross business volume of nearly \$1.7 billion in 2021. A separate section, presented later in this summer, highlights the findings of a recent industry-wide survey of ethanol production in the state. To prevent disclosure of the state's only non-corn-based plant, all ethanol production is presented in this summary. Output from the lone non-corn plant is sufficiently small as to not distort the findings for the corn industry in North Dakota.

Business Volume

Business volume, sometimes called output or economic output, is the value of goods or services produced by an economic sector, and is largely synonymous with sales or gross receipts.

Gross business volume (GBV) is the sum of direct output/sales and output/sales from indirect and induced economic activity in all economic sectors.

Corn Industry, Share of Gross Business Volume



Business Volume, Corn Industry, North Dakota, Average Annual 2018 through 2020

| Economic Activity | Crop Production | Grain Handling | Commodity Shipments | Commodity Processing | Ethanol | Industry Totals |
|-------------------------|-----------------|----------------|---------------------|----------------------|---------|-----------------|
| ----- millions \$ ----- | | | | | | |
| Direct Sales | 1,753.9 | 190.1 | 370.5 | 290.5 | 1,420.9 | 4,025.9 |
| Indirect Activity | 964.0 | 53.5 | 130.7 | 101.6 | 174.7 | 1,424.5 |
| Induced Activity | 394.0 | 47.6 | 133.5 | 32.2 | 75.9 | 683.2 |
| Gross Business Volume | 3,111.9 | 291.2 | 634.7 | 424.3 | 1,671.9 | 6,134.0 |

Notes: Crop production represents an annual average from 2018 through 2020. Grain handling, commodity shipments, and commodity processing represent an annual average from 2015 through 2017. Ethanol represents annual operations in 2021 and capital expenditures averaged from 2019 through 2021.

Employment

Assigning direct farm employment to specific farm enterprises (i.e., individual crops or livestock operations) is difficult, if not inaccurate, as wage/salary labor and self-employment are assigned based on only one NAICS code. Farms and ranches are represented based on which enterprise provides one-half or more of the establishment's total production. Therefore, if a farm produces multiple crops, it is likely that wage/salary employment will be placed in only one NAICS code for a specific crop. In reality, some of the direct farm labor in some commodity assignments also contributes to the production of other commodities, but current labor tracking systems prevent the estimation of crop-shares for those employment values.

Direct employment for corn production, using the limitations of NAICS assignments identified above, was estimated at 2,600 jobs (wage/salary and sole proprietors). All direct employment, across the industry's several

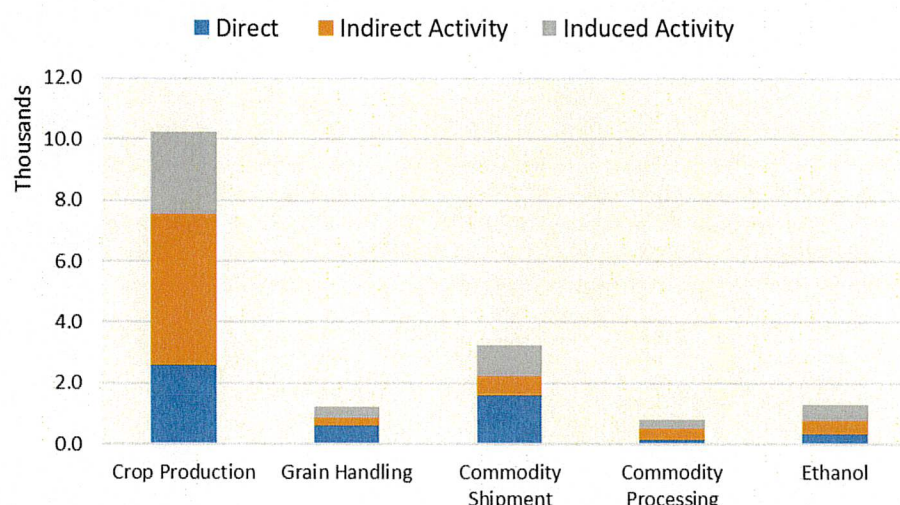
segments, was estimated at 5,300 jobs. Over 1,600 jobs were in commodity shipment, with the majority of those jobs in the trucking transportation sector (data not shown).

Secondary employment for corn production, across all economic sectors, was estimated at 7,600 jobs. All secondary employment for the industry's other segments was estimated at 3,800 jobs. The corn industry, including production, grain handling, commodity shipment, and all forms of commodity processing was estimated to support 16,800 jobs.

Employment

Employment represents jobs with paid compensation. Estimates of employment include both wage and salary positions and sole proprietors/ self-employed.

Employment, by Type, by Industry Segment



Employment, Corn Industry, North Dakota, Average Annual 2018 through 2020

| Economic Activity | Crop Production | Grain Handling | Commodity Shipments | Commodity Processing | Ethanol | Industry Totals |
|-------------------|-----------------|----------------|---------------------|----------------------|---------|-----------------|
| ----- jobs ----- | | | | | | |
| Direct | 2,598 | 630 | 1,628 | 144 | 342 | 5,342 |
| Indirect Activity | 4,967 | 266 | 650 | 416 | 468 | 6,767 |
| Induced Activity | 2,659 | 344 | 968 | 233 | 500 | 4,704 |
| All Jobs | 10,216 | 1,239 | 3,243 | 793 | 1,310 | 16,801 |

Notes: Crop production represents an annual average from 2018 through 2020. Grain handling, commodity shipments, and commodity processing represent an annual average from 2015 through 2017. Ethanol represents annual operations in 2021 and capital expenditures averaged from 2019 through 2021.

Labor Income

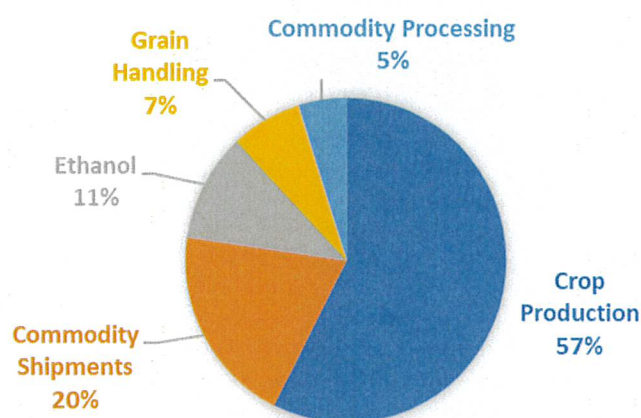
The corn industry directly paid \$532 million for wage/salary and self-employed jobs across all industry segments. Labor income supported by indirect economic activity was estimated at \$467 million, and labor income for induced economic activity was estimated at \$221 million. The corn industry supported a total of \$1.2 billion in labor income across direct, indirect, and induced economic effects.

Corn production comprised the largest share of labor income estimated at \$700 million or 57 percent of the industry's total labor income. Consistent with employment among the industry's segments, commodity shipment was responsible for \$242 million in labor income, followed by ethanol, with \$132 million in labor income.

Labor Income

Labor income represents financial compensation paid to workers, and includes wages, salaries, benefits and income of sole proprietors/ self-employed.

Labor Income, by Industry Segment



Labor Income, Corn Industry, North Dakota, Annual Average 2018 through 2020

| Economic Activity | Crop Production | Grain Handling | Commodity Shipment | Commodity Processing | Ethanol | Industry Totals |
|-------------------------|-----------------|----------------|--------------------|----------------------|---------|-----------------|
| ----- millions \$ ----- | | | | | | |
| Direct | 237.0 | 53.8 | 155.8 | 15.3 | 69.9 | 531.8 |
| Indirect Activity | 335.7 | 16.8 | 42.4 | 32.5 | 39.7 | 467.1 |
| Induced Activity | 127.2 | 15.6 | 43.9 | 10.6 | 23.7 | 221.0 |
| All Labor Income | 699.9 | 86.2 | 242.1 | 58.4 | 132.4 | 1,219.0 |

Notes: Crop production represents annual average from 2018 through 2020. Grain handling, commodity shipments, and commodity processing represent an annual average from 2015 through 2017. Ethanol represents annual operations in 2021 and capital expenditures averaged from 2019 through 2021.

Value-added

The corn industry had an average annual value-added of \$2.35 billion. Corn production comprised 54 percent of the industry's total value added.

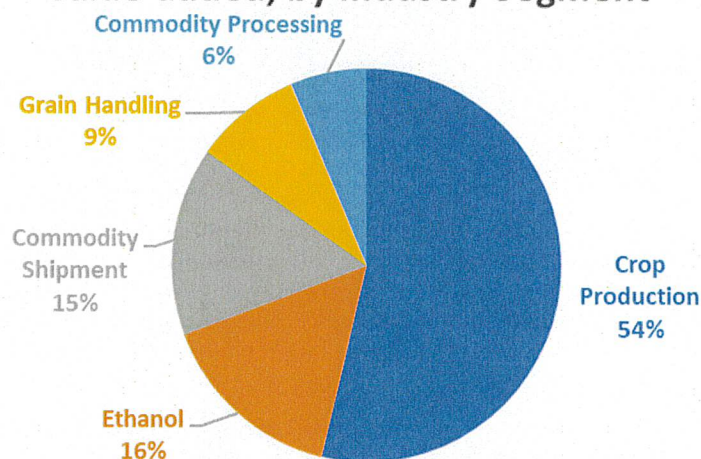
Of the \$2.35 billion in value added, direct output in the industry produced about \$1.2 billion, while secondary economic output generated about \$1.1 billion.

Contribution to gross state product was nearly equal for commodity shipment and ethanol production, each estimated at \$365 million.

Value-added

Value-added is the contribution made to gross state product. Gross state product includes labor income, other property type income, and taxes on production and imports. It does not include the purchases of inputs and services (intermediate inputs) but does include capital consumption.

Value-added, by Industry Segment



Value-added, Corn Industry, North Dakota, Average Annual 2018 through 2020

| Economic Activity | Crop Production | Grain Handling | Commodity Shipments | Commodity Processing | Ethanol | Industry Totals |
|-------------------------|-----------------|----------------|---------------------|----------------------|---------|-----------------|
| ----- millions \$ ----- | | | | | | |
| Direct | 538.1 | 151.7 | 217.5 | 78.7 | 254.8 | 1,240.8 |
| Indirect Activity | 516.0 | 29.3 | 71.8 | 52.9 | 70.5 | 740.5 |
| Induced Activity | 212.7 | 27.1 | 76.0 | 18.4 | 40.1 | 374.3 |
| Total Value-added | 1,266.7 | 208.1 | 365.3 | 150.0 | 365.4 | 2,355.5 |

Notes: Crop production represents annual average from 2018 through 2020. Grain handling, commodity shipments, and commodity processing represent an annual average from 2015 through 2017. Ethanol represents annual operations in 2021 and capital expenditures averaged from 2019 through 2021.

Government Revenues

Corn production generated over \$45 million in state and local government revenues. Property taxes were estimated at \$34.9 million of production's total direct payments.

Secondary business activity associated with production was estimated to generate \$50.9 million in state and local government tax revenues. Corn production, through direct and secondary business volume, was estimated to generate \$96.4 million in state and local government revenues.

Government Revenues

Government revenues represent industry payments for taxes, licenses, permits, fees, penalties, and fines.

Government Revenues, Corn Grain Production, North Dakota, Average Annual 2018 through 2020

| Government Jurisdiction and Type of Revenue | Government Revenues --- 000s \$ --- |
|---|--|
| Paid Directly by Corn Grain Production¹ | |
| Federal Government | 40,124.5 |
| State and Local Governments | 45,509.0 |
| Total | 85,633.5 |
| Paid Directly by Corn Grain Production to State and Local Government¹ | |
| Social Insurance Taxes | 559.5 |
| Sales and Use Tax | 3,556.0 |
| Property Tax | 34,859.2 |
| Corporate Income Tax | 1,371.7 |
| Personal Income Tax | 2,098.4 |
| Misc. Taxes and Revenues | 3,064.2 |
| Total | 45,509.0 |
| Paid by Secondary Business Activity to State and Local Government² | |
| Social Insurance Taxes | 2,389.6 |
| Sales and Use Tax | 16,291.9 |
| Property Tax | 23,308.2 |
| Corporate Income Tax | 1,112.6 |
| Personal Income Tax | 2,793.0 |
| Misc. Taxes and Revenues | 5,024.5 |
| Total | 50,919.8 |
| Total State and Local Revenues | |
| Paid by Corn Grain Production | 45,509.0 |
| Paid from Secondary Business Activity | 50,919.8 |
| Total | 96,428.8 |

¹ Payments made by producers, farm workers, and owners of farm land.

² Payments associated with indirect (business spending) and induced (household spending) activity generated by corn grain production, land rent, Federal Crop Insurance Administrative and Operational outlays, and producers' capital expenditures.

Sources: IMPLAN LLC (2022), FINBIN (multiple years), ND Office of State Tax Commissioner (multiple years).

Overall, the corn industry made direct payments of \$57 million to state and local governments. Across all industry segments, the industry contributed an additional \$73 million in government revenues. Direct and secondary business activity resulted in state and local government revenues of \$130 million.

North Dakota Corn Industry , State and Local Government Revenues, Annual Average 2018 through 2020

| Economic Activity | Crop Production | Grain Handling | Commodity Shipments | Commodity Processing | Ethanol | Industry Totals |
|---------------------|-----------------|----------------|---------------------|----------------------|---------|-----------------|
| ----- 000s \$ ----- | | | | | | |
| Direct | 45,509.0 | 3,611.7 | 4,201.9 | 899.6 | 2,902.1 | 57,124.3 |
| Indirect | 50,919.8 | 1,769.8 | 4,735.1 | 2,700.7 | 3,630.8 | 73,010.9 |
| Induced | | 1,631.0 | 4,588.5 | 1,105.1 | 1,930.1 | |
| Total Payments | 96,428.8 | 7,012.5 | 13,525.5 | 4,705.4 | 8,463.0 | 130,135.2 |

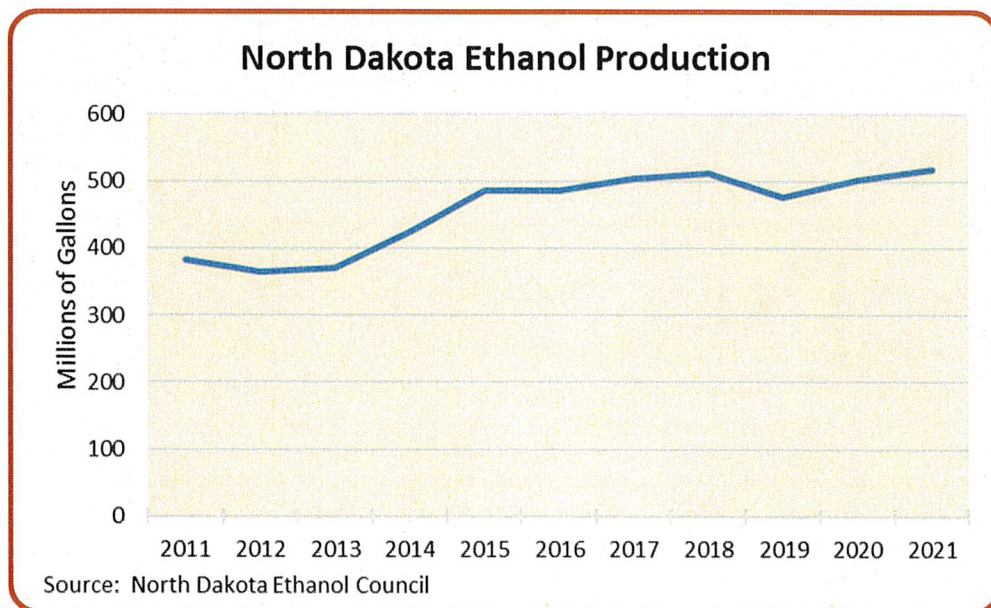
Notes: Crop production represents annual average from 2018 through 2020. Grain handling, commodity shipments, and commodity processing represent an annual average from 2015 through 2017. Ethanol represents annual operations in 2021 and capital expenditures averaged from 2019 through 2021.

Ethanol Industry Summary

The ND Ethanol Council sponsored an industry-wide survey of ethanol producers in ND during the summer of 2022. The information collected represented updated processing volumes, due to recent industry expansions, and capital expenditures collected in North Dakota relating to those expansions.

As with other surveys of industries, the information is aggregated at an economic sector level, and provides key information for modeling the direct, indirect, and induced economic contributions. The ethanol industry was estimated to purchase \$1.2 billion in operating inputs in 2021, of which, \$1 billion was for corn. Corn purchases are excluded from ethanol production expenses, since corn in the economic contribution study is valued prior to reaching the ethanol facilities.

The following tables present the economic data gathered for ethanol production in ND, and include the economic profile used in the larger agriculture industry contribution assessment. Also presented are the estimated economic contribution from ethanol plant operations and ethanol industry capital expenditures.



Purchases of Inputs and Services, Ethanol Industry, North Dakota, 2021

| NAICS Code | Economic Sector | Operating Inputs | |
|---------------|--|---------------------|----------------------|
| | | Total | Sourced in- state |
| | | ----- 000s \$ ----- | |
| 11 | Agriculture, Forestry, Fishing and Hunting | 1,008,025 | 895,190 |
| 21 | Mining, Quarrying, and Oil and Gas Extraction | 0 | 0 |
| 22 | Utilities | 91,139 | 91,139 |
| 23 | Construction | 9,918 | 5,512 |
| 31 | Manufacturing | 3,596 | 0 |
| 32 | Manufacturing | 66,185 | 2,826 |
| 33 | Manufacturing | 4,861 | 3,420 |
| 42 | Wholesale Trade | 230 | 172 |
| 44 | Retail Trade | 235 | 176 |
| 45 | Retail Trade | 2,196 | 1,173 |
| 48 | Transportation and Warehousing | 6,215 | 22 |
| 49 | Transportation and Warehousing | 0 | 0 |
| 51 | Information | 224 | 191 |
| 52 | Finance and Insurance | 12,756 | 4,776 |
| 53 | Real Estate and Rental and Leasing | 12,411 | 638 |
| 54 | Professional, Scientific, and Technical Services | 1,774 | 854 |
| 55 | Management of Companies and Enterprises | 0 | 0 |
| 56 | Administrative and Support and Waste Management and Remediation Services | 1,200 | 656 |
| 61 | Educational Services | 212 | 153 |
| 62 | Health Care and Social Assistance | 0 | 0 |
| 71 | Arts, Entertainment, and Recreation | 0 | 0 |
| 72 | Accommodation and Food Services | 133 | 40 |
| 81 | Other Services (except Public Administration) | 1,309 | 690 |
| 92 | Public Administration | 0 | 0 |
| Totals | | 1,222,620 | 1,007,628 |

Source: Ethanol industry survey (2022).

Economic Sector Profile, Ethanol Production, North Dakota, 2021

| Economic Metric | Value |
|---------------------------------|-------------------|
| | -- millions \$ -- |
| Output (all product sales) | 1,489.8 |
| Employee Compensation | 38.4 |
| Proprietor Income | 33.9 |
| Other Property-type Income | 192.8 |
| Taxes on Production and Imports | 2.1 |
| Operating Inputs | 1,222.6 |
| | -- jobs -- |
| Wage and Salary Employment | 284 |
| Proprietor Jobs | 58 |

Sources: Ethanol industry survey (2022); IMPLAN (2022).

Capital Expenditures, Ethanol Industry, North Dakota, 2019 through 2021

| Year and Type of Capital Expenditure | Capital Outlays | |
|--------------------------------------|---------------------|------------------|
| | Total | Sourced In-state |
| 2019 | ----- 000s \$ ----- | |
| Expansion | 9,641 | 2,656 |
| Replacement | 6,866 | 3,026 |
| Other | 50 | 0 |
| 2020 | | |
| Expansion | 20,091 | 7,301 |
| Replacement | 5,807 | 2,970 |
| Other | 0 | 0 |
| 2021 | | |
| Expansion | 42,868 | 16,911 |
| Replacement | 8,599 | 3,963 |
| Other | 33 | 33 |

Source: Ethanol industry survey (2022).

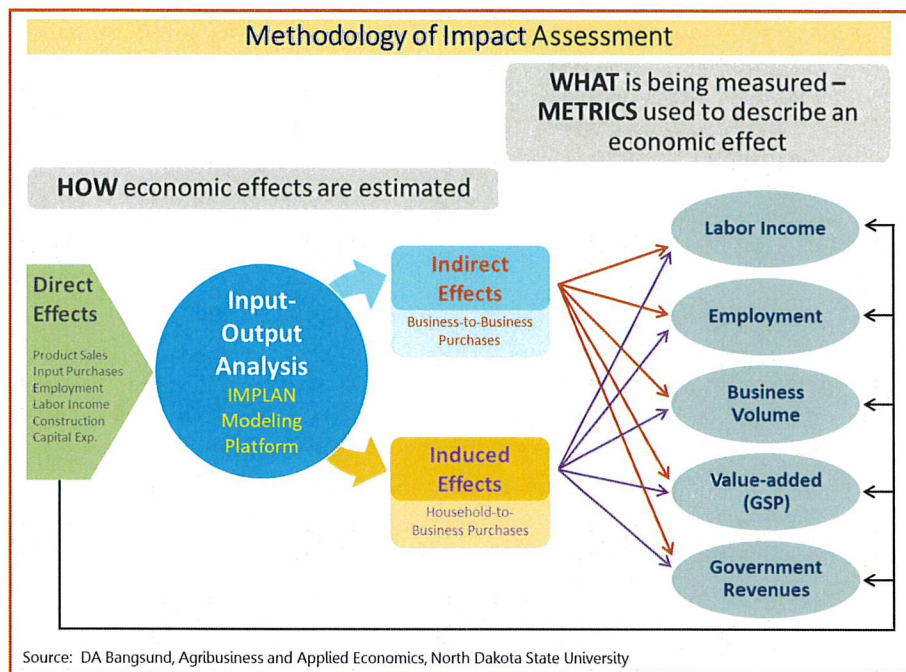
Economic Contribution, Ethanol Production and Capital Outlays, North Dakota, 2021

| Industry Segment and Type of Economic Activity | Employment | Labor Income | Value- added | Gross Business Volume |
|---|------------------|-------------------------|-----------------|-----------------------------|
| | ----- jobs ----- | ----- millions \$ ----- | | |
| Operations (2021) | | | | |
| Direct | 342 | 69.0 | 254.8 | 1,420.9 |
| Indirect | 371 | 33.3 | 63.0 | 161.2 |
| Induced | 473 | 22.4 | 37.9 | 71.7 |
| Total | 1,185 | 124.7 | 355.8 | 1,653.9 |
| Capital Expenditures (annual average 2019 through 2021) | | | | |
| Direct | 85 | 5.6 | 6.0 | 10.6 |
| Indirect | 13 | 0.9 | 1.4 | 2.9 |
| Induced | 28 | 1.3 | 2.2 | 4.2 |
| Total | 125 | 7.8 | 9.7 | 17.6 |

Supplemental Materials

Economic Contribution Analysis

An economic contribution assessment measures the gross size of some aspect or component of an economy, and is usually measured in conjunction with the overall size of a given economy over a specified period. Size is estimated by combining direct or first-round effects (e.g., industry expenditures, business sales, new employment) with economic modeling to estimate how those first round effects generate business-to-business transactions and household spending on consumer goods and services. Both of those conduits for economic output can be framed using labor income, employment, value-added, gross business volume and government revenues.



Key Terms and Concepts

Direct Effects: Represent the first-round of payments for services, labor, and materials and/or sales of an industry's products.

Indirect Effects: Economic activity created through purchases of goods and services by businesses.

Induced Effects: Economic activity created through purchases of goods and services by households.

Industry Output and Gross Business Volume: Industry output is the value of all goods and services produced and supported by an industry. In most industries, output is largely synonymous with sales; however, for some sectors output also includes changes in product inventory. For production agriculture, direct output includes both sales and inventory adjustments.

When output from business-to-business transactions (*indirect*) and households-to-businesses (*induced*) are measured, they also are described as the *sum of gross receipts* as annual adjustments to inventories are largely unquantified and not distinguished from sales. *Gross business volume* (GBV) therefore includes direct output/sales and includes secondary sales from indirect and induced economic activity.

Value-added: Value-added is synonymous with measures of gross domestic product (GDP) and gross state product (GSP), are some of the most commonly used economic measures to indicate the economic size and change in economic output. However, official government estimates of GDP and GSP do not include secondary economic effects generated by any industry. For agriculture, official government estimates are primarily limited to crop, livestock, and forestry sectors. Economic contribution assessments include secondary economic effects, and include GSP from those effects, thereby providing a more realistic and representative portrait of an industry.

Key components of value-added include labor income, consumption of fixed capital, profits, business current transfer payments (net), income derived from dividends, royalties, and interest. In nontechnical terms, value-added is equal to product value minus production inputs. For example, value-added from growing wheat would be the value of wheat produced less the value of the inputs consumed in raising that crop, such as fertilizer, chemical, repairs, fuel, etc. Depreciation charged to durable assets (e.g., tractors) are not included in value-added measures.

Employment Compensation: Wages, salaries, and benefits earned by an employee.

Proprietor Income: Payments received by self-employed individuals and unincorporated business owner/operators.

Labor Income: Combination of wages, salaries, and benefits for employees and compensation for self-employed individuals.

Input-output Analysis (I-O): Mathematical application of the interdependence among producing and consuming sectors in an economy.

I-O Matrix: Depiction of an economy using a grid of rows and columns that represents consumption and production for each economic sector in an economy.

Intermediate Inputs: Goods and services consumed in one year to produce another good or service. Intermediate inputs do not include expenditures for capital inputs used for multiple production seasons (e.g., machinery, buildings).

Capital Inputs: Represent the use of inputs to produce another good or service that are not consumed in one production season and are subject to depreciation. *Capital expenditures* represent the purchase of those depreciable assets.

Industry Balance Sheet: Dividing an industry or economic sector into various components for use in estimating the economic effects using input-output analysis. Components of the balance sheet include measures of output, wage and salary employment, self-employment, payroll and proprietor income, other property type income, taxes on production and imports, and intermediate inputs.

Institutions: Represent governments and other non-private entities consuming goods and services in an economy.

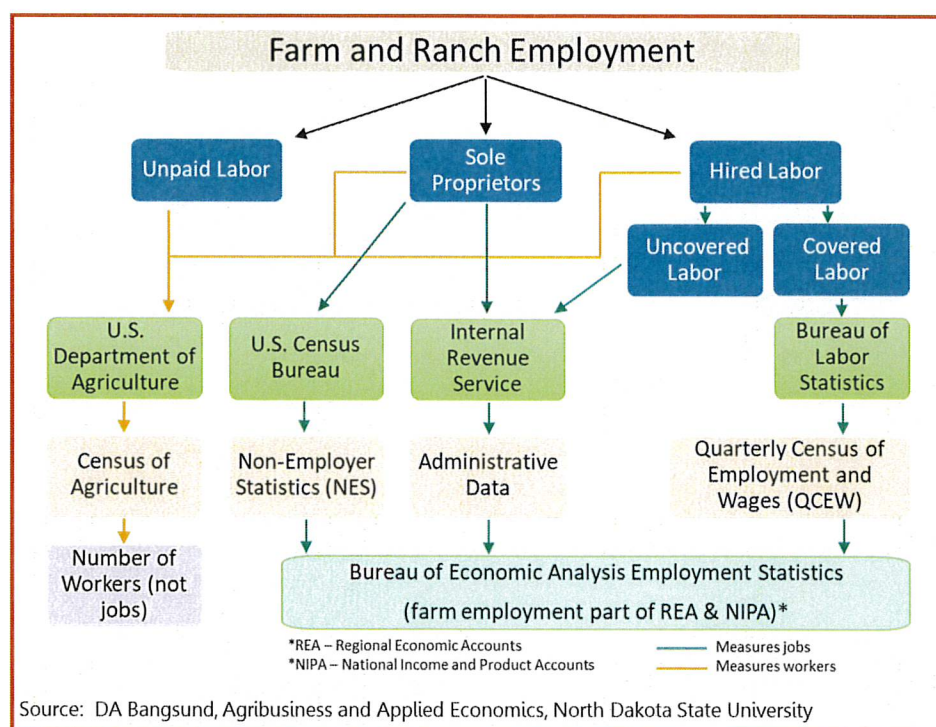
Households: Represent one or more individuals in a specific living arrangement for which income from all sources is used to purchase goods and services.

North American Industry Classification System (NAICS): Government classification system for all goods and services produced in the economy.

Employment Sources and Measures

Employment is broadly measured in two distinct categories: covered and uncovered. Covered workers are those that are employed by a business, institution, or government agency, receive a wage or salary, and are subject to unemployment insurance (UI). Jobs that fall under an UI program are called 'covered' employment. Quarterly Census of Employment and Wages (QCEW) employment reported by Job Service ND is 'covered' employment. QCEW data are collected for each state and reported by the US Bureau of Labor Statistics (BLS). Therefore, employment statistics for self-employed farmers and ranchers cannot be derived from QCEW data.

By contrast, 'uncovered' employment largely includes self-employed and sole-proprietors not enrolled in a state's UI program (enrollment is voluntary for self-employed individuals). The majority of on-farm employment is self-employed with only a small portion of on-farm employment qualifying as covered employment. The U.S. Bureau of Economic Analysis (BEA) reports uncovered employment in conjunction with QCEW employment from BLS. The only source of on-farm employment that includes covered and uncovered hired labor, self-employed, and sole proprietors is the BEA's Regional Economic Accounts. The U.S. Department of Agriculture's Census of Agriculture collects information on individuals, not jobs, and cannot be directly substituted for BEA employment statistics.



For most 'industries', sole proprietors are not the predominate form of employment, and QCEW is often used to measure employment in those industries. In some economic 'sectors', sole proprietors represent a meaningful level of employment, such as independent truckers, construction and repair, retail shops, personal service providers, among others, but do not represent a meaningful share of employment at a broader 'industry' level. Crop and livestock production are largely unique among industries in that the majority of employment is represented by sole proprietors.

Assigning direct farm employment to specific farm enterprises (i.e., individual crops or livestock operations) is difficult, if not inaccurate, as wage/salary labor and self-employment are assigned based on only one NAICS code. Farms and ranches are represented based on which enterprise provides one-half or more of the establishment's total production. Therefore, if a farm produces multiple crops, it is likely that wage/salary employment will be placed in only one NAICS code for a specific crop. In reality, some of the direct farm labor in some commodity assignments also contributes to the production of other commodities, but current labor tracking systems prevent the estimation of crop-shares for those employment values.

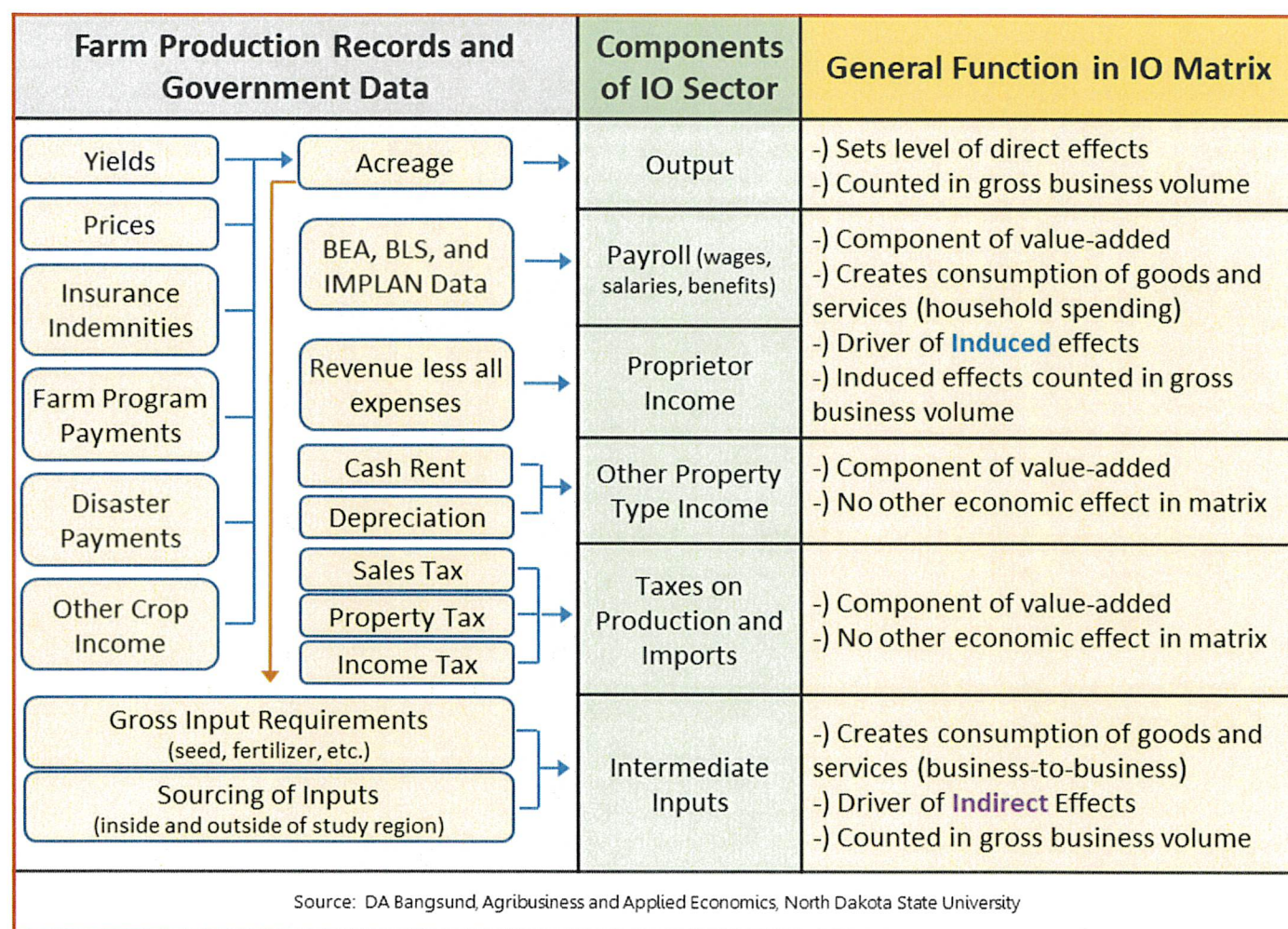
Developing Economic Sector Profiles

An industry balance sheet or economic profile is one of the most important elements in economic contribution studies. Nearly all key economic metrics have their origin within an industry's economic profile/sector. Information and data to create economic sector profiles were collected from surveys of industry firms, government agencies, and farm production records and statistics.

While the IMPLAN modeling platform provides baseline economic profiles generated from proprietary estimation techniques applied to government data, this study relied on state-sourced data and industry

input to create a customized IO matrix. The process of developing study-specific economic profiles and then modifying an IO matrix is time consuming and requires considerable empirical analysis, but the results from those efforts produce a credible and transparent evaluation of an industry's role in an economy.

To the extent possible, other economic sectors (e.g., manufacturing) were customized using financial information from an industry-wide survey conducted in 2017-2018. Survey data also was used to estimate capital expenditures for various manufacturing and processing sectors. Ethanol producers were surveyed in 2022, and information from that survey provided a custom economic profile for ethanol production and produced a three-year average of capital expenditures.



What Economic Activities are Included in Crop and Livestock Production?

The following activities were included for crop and livestock sectors:

- ❖ Production
- ❖ Capital Expenditures
- ❖ Cash Rent
- ❖ Insurance Industry A&O

Crop and livestock production generate economic effects from spending of labor income and purchase of production inputs to produce a crop or raise livestock, and first-round effects are driven by the custom economic profiles.

By definition, **capital expenditures** would arise from use of Other Property Type Income (OPTI); however, OPTI does not generate any indirect or induced effects. Capital expenditures were modeled independently from the custom crop and livestock sectors to estimate the economic effects from purchases of new buildings and structures, tractors, combines, machinery, equipment, and other durable goods not consumed in one production cycle.

Cash rent can be included as proprietor income within an ag production sector, assigned to a real estate sector as an intermediate input, or placed in OPTI. Cash rent was placed in OPTI, and a share of cash rent paid by producers, net of property tax, was modeled as a revenue stream to in-state landowners.

The revenue stream to landowners was modeled as a labor income event within the custom IO matrix. Federal crop insurance generates additional revenue to the state from **Administrative and Operating (A&O) subsidies**. A&O subsidies were modeled as separate industry spending events since those revenue streams affect financial sectors and are not internally linked in the IO matrix to crop and livestock production sectors.

Study Parameters

-) Crop and livestock production was based on 2018 through 2020 data.
-) All other segments of the industry were based on 2015 to 2017 data, except ethanol production, which was based on 2021 production.
-) Expenses associated with summer fallow and prevent plant were included in crop production.
-) Sale barns/livestock exchanges were estimated separately in the study, but are presented in this summary as part of commodity handling.
-) Default IMPLAN data was used for all forestry activities in the state.
-) Data for the study came from surveys of industry firms, state and federal government agencies, NDSU Extension, and other secondary sources. Survey and secondary data were used to develop industry balance sheets (i.e., profiles) for the Agriculture's numerous economic sectors.

Treatment of Traditional Ag Sectors Supporting Production Agriculture

This summary omits specific details of how the secondary economic effects are distributed among the state's numerous sectors and sub-sectors. Several economic sectors support production agriculture by providing inputs and services to crop and livestock producers. Examples include implement sales, custom field work and applications, seed companies, and supply stores. Under some definitions, those activities and sectors are presented as "direct" segments of the Agriculture Industry, much like crop production and grain handling are considered stand-alone components of the industry. However, from the perspective of how this study's input-output analysis was structured, those sectors represent "indirect" economic output of the industry, meaning those sectors are supported and sustained from purchases relating to crop and livestock production.

Sectors traditionally considered core components of Agriculture, but defined as indirect components of the industry in this assessment, are identified in the following table and with corresponding NAICS codes for those activities.

Key Economic Sectors Representing Components of Production Agriculture Whose Output and Employment are Contained (grouped) within Indirect Economic Effects

| Industry Segment | Economic Sector Description | NAICS ¹ |
|--|--|--------------------|
| Agricultural Production | | |
| | Support activities for agriculture and forestry | 1151 |
| | Construction of new commercial structures, including farm structures | 2362 |
| | Support activities for transportation | 4882 |
| | Warehousing and storage | 4931 |
| | Securities and commodity contracts intermediation and brokerage | 5231 |
| | Insurance agencies, brokerages, and related activities | 5242 |
| | Commercial and industrial machinery and equipment rental and leasing | 5234 |
| | Veterinary services | 5419 |
| | Commercial and industrial machinery and equipment repair and maintenance | 8113 |
| Wholesale Trade | | |
| | Agricultural chemicals merchant wholesalers | 424910 |
| | Agricultural machinery and implement merchant wholesalers | 423820 |
| | Animal feeds (except pet food) merchant wholesalers | 424910 |
| | Auction markets, tobacco, horses, mules | 424590 |
| | Beans, dry, merchant wholesalers | 424510 |
| | Berries, fresh, merchant wholesalers | 424480 |
| | Cattle, hog, sheep merchant wholesalers | 424520 |
| | Doughs, frozen, merchant wholesalers | 424420 |
| | Dried foods (e.g., fruits, milk, vegetables) merchant wholesalers | 424490 |
| | Dry beans merchant wholesalers | 424510 |
| | Eggs merchant wholesalers | 424440 |
| | Elevators merchant wholesalers | 423830 |
| | Farm supplies merchant wholesalers | 424910 |
| | Feed additives merchant wholesalers | 424910 |
| | Fertilizer and fertilizer materials merchant wholesalers | 424910 |
| | Flour merchant wholesalers | 424490 |
| | Grain elevators, merchant wholesalers grain | 424510 |
| | Honey merchant wholesalers | 424490 |
| | Irrigation equipment merchant wholesalers | 423820 |
| | Land preparation machinery, construction, merchant wholesalers | 423810 |
| | Livestock equipment, merchant wholesalers | 424470 |
| | Storage bins merchant wholesalers | 423820 |
| | Veterinarians' equipment and supplies merchant wholesalers | 423390 |
| | Veterinarians' medicines merchant wholesalers | 423490 |
| | Wool, raw, merchant wholesalers | 424210 |
| ¹ North American Industrial Classification System | | |

Economic Sectors for Processing, Manufacturing, and Transportation included in the Agriculture Industry, Defined by North American Industry Classification System

| Industry Segment | Sector Description | NAICS ¹ |
|--|---|--------------------|
| Crop and Livestock Commodity Processing | | |
| | All other food manufacturing | 3119 |
| | Animal, except poultry, slaughtering | 3116 |
| | Beet sugar manufacturing | 3113 |
| | Bottled and canned soft drinks & water | 3121 |
| | Bread and bakery product, except frozen, manufacturing | 3118 |
| | Breweries | 3121 |
| | Canned fruits and vegetables manufacturing | 3114 |
| | Confectionery manufacturing from purchased chocolate | 3113 |
| | Creamery butter manufacturing | 3115 |
| | Dehydrated food products manufacturing | 3114 |
| | Distilleries | 3121 |
| | Dry pasta, mixes, and dough manufacturing | 3118 |
| | Fats and oils refining and blending | 3112 |
| | Flour milling | 3112 |
| | Fluid milk manufacturing | 3115 |
| | Frozen cakes and other pastries manufacturing | 3118 |
| | Frozen fruits, juices and vegetables manufacturing | 3114 |
| | Frozen specialties manufacturing | 3114 |
| | Malt manufacturing | 3112 |
| | Meat processed from carcasses | 3116 |
| | Nonchocolate confectionery manufacturing | 3113 |
| | Other animal food manufacturing | 3111 |
| | Other basic organic chemical manufacturing (ethanol) | 3251 |
| | Rendering and meat byproduct processing | 3116 |
| | Roasted nuts and peanut butter manufacturing | 3119 |
| | Soybean and other oilseed processing | 3112 |
| | Spice and extract manufacturing | 3119 |
| | Tobacco product manufacturing | 3122 |
| | Wet corn milling | 3112 |
| | Wineries | 3121 |
| Agricultural Manufacturing | | |
| | Pesticide and other agricultural chemical manufacturing | 3253 |
| | Farm machinery and equipment manufacturing | 3331 |
| Transportation | | |
| | Truck transportation | 4841 |
| | Railroad transportation | 4821 |
| ¹ North American Industrial Classification System | | |

Acknowledgments

Several organizations and individuals were instrumental in providing leadership throughout the study. The authors express their appreciation and thanks to the following individuals and organizations:

Nancy Johnson, North Dakota Soybean Growers Association
 Stephanie Sinner, Executive Director, North Dakota Soybean Council
 Deana Wiese, Executive Director, North Dakota Ethanol Council
 Brenda Elmer, Executive Director, North Dakota Corn Growers Association
 Matt Perdue, Government Relations Director, North Dakota Farmers Union
 Mitch Coulter, Executive Director, Northharvest Bean Growers Association

The authors sincerely appreciate the financial support provided by the following organizations.

American Crystal Sugar Company
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 North Dakota Dry Bean Council
 North Dakota Ethanol Council
 North Dakota Farmers Union
 North Dakota Soybean Council
 North Dakota Stockmen's Association
 Northern Canola Growers Association
 Northern Pulse Growers Association
 Red River Valley Sugarbeet Growers Association

The authors also wish to thank all the individuals, companies, organizations, and associations that participated in numerous capacities to make this study comprehensive and representative of the industry.

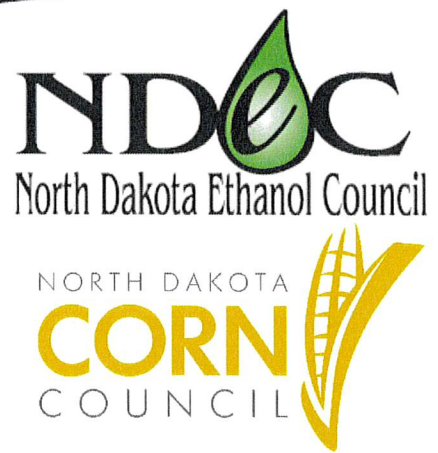
We wish to thank Edie Nelson, Department of Agribusiness and Applied Economics, for document preparation.

The authors assume responsibility for any errors of omission, logic, or otherwise. Any opinions, findings, and conclusions expressed in this publication are those of the authors and do not necessarily reflect the view of the NDSU Department of Agribusiness and Applied Economics or the NDSU Center for Social Research.

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FOR IMMEDIATE RELEASE
Nov. 29, 2022

Contact: Deana Wiese
NDEC Executive Director
701-355-4458
office@ndethanol.org

Pink at the Pump® Campaign Supports Breast Cancer Awareness

BISMARCK, N.D. – By choosing Unleaded88, a higher-octane fuel containing 15 percent ethanol and 85 percent gasoline, drivers across North Dakota helped raise \$2,350 for breast cancer awareness as part of the fifth annual Pink at the Pump® campaign, co-sponsored by the North Dakota Ethanol Council and North Dakota Corn Utilization Council.

Eighteen North Dakota retail stations offering Unleaded88 participated in this promotion by donating three cents of every gallon of Unleaded88 sold from Oct. 1 through Oct. 31 to North Dakota Women's Way.

"We are grateful to be the recipient of Pink at the Pump® promotion. The funds will be used to extend our reach to women across North Dakota," says Susan Mormann, North Dakota Women's Way director. North Dakota Women's Way provides a way to pay for most breast and cervical cancer screening services for eligible North Dakota women and promotes early detection of breast and cervical cancer through provision of screening services to eligible women.

"Petro Serve USA stations across the state welcomed the opportunity to be part of this campaign for North Dakota," says Kent Satrang, Petro Serve USA CEO. "We are honored to contribute to Women's Way knowing the great work it is doing on early detection of breast cancer."

"The North Dakota Corn Utilization Council is proud to be a partner in this effort," says Tysen Rosenau, North Dakota Corn Utilization Council chairman. "Ethanol is the world's cleanest source of fuel octane. By choosing Unleaded88 during October, consumers fought breast cancer at the pump while directly supporting North Dakota's corn farmers."

Unleaded88 is a fuel blend containing 15 percent ethanol, just five percent more ethanol than E10, the most commonly used fuel in the U.S. Over the past year nationwide, Unleaded88 saved consumers an average of 16 cents per gallon. It is approved by the Environmental Protection Agency for use in all 2001 and newer vehicles, which make up more than 96 percent of the vehicles on the road today.

###

**NORTH DAKOTA ETHANOL INDUSTRY
RESEARCH PRIORITIES
August 2022**

OBJECTIVE: Initiate research focused on enhanced productivity and profitability of North Dakota's ethanol plants

1. Alternative production options

Identify and evaluate value-added alternative production options for ethanol plants, such as renewable chemicals and sustainable aviation fuels.

2. Value-added opportunities for co-products, including CO₂

Explore the feasibility of enhanced processing options (new technologies) for co-products, including CO₂, from the current ethanol production process.

3. Alternative uses for ethanol (biochemicals)

Identify alternative uses for ethanol, such as using it as a carbon feedstock to make nano fibers or other feedstocks to petrochemical processing to displace petroleum-based products, such as ethylene.

4. Reduce carbon intensity of feedstocks

Identify ways to measure carbon sequestration through farming methods with the goal of reducing the carbon intensity of the feedstock, primarily corn.

5. Usability of corn

Identify methods to better characterize corn as it relates to starch and oil to benefit the ethanol producer and farmer.

6. Market opportunities for ethanol with low carbon intensity (CI) scores

Identify potential marketplaces and develop strategies for facilities to participate in these markets.

7. Feasible options for transporting ethanol to market

Identify logistical efficiencies to move ethanol to market (pipeline, rail, truck, etc.). Consideration must be given to proposed pipelines, such as the one in South Dakota, and the ability for North Dakota to benefit from this or other transport methods.

8. Operating technologies to improve production efficiency of dry mill facilities

Research and develop enhanced technologies and methods to improve efficiencies in yield, energy and water use, etc. with priority given to improving field instrumentation to eliminate the laborious process of taking samples and running analysis in the lab on high-performance liquid chromatograph (HPLC) and gas chromatography (GC).

9. Advanced biofuel feedstock options

Explore options for the most viable advanced feedstocks.

10. Feasible options for local blending

Identify economically feasible options for expanding blending facilities in North Dakota, which will enable competitive pricing of blended fuels in the state.

ETHANOL

North Dakota's homegrown, carbon-conscious, cost-effective fuel

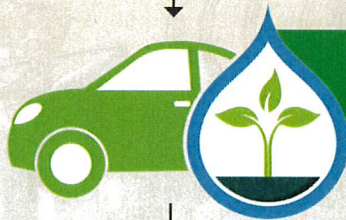
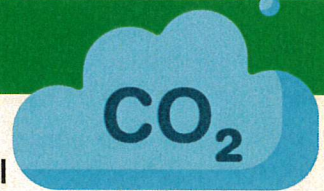


Homegrown

- Uses 40-60% of North Dakota's corn annually
- Purchases 80% of its corn from North Dakota farmers

Carbon-conscious

- National leader in carbon capture and storage
- Ability to capture up to 2.4 million tonnes of annual CO₂ emissions for potential sequestration to assist in meeting North Dakota's carbon-reduction goals
- This carbon reduction is equivalent to removing more than 520,000 vehicles from the road



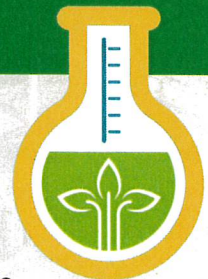
Cost-effective fuel

- Unleaded88 (E15) saved consumers an average of \$0.16 per gallon summer 2022

Opportunities

North Dakota's ethanol industry is well positioned to take advantage of several future opportunities, including:

- Sustainable aviation fuel (SAF)
- Biochemicals
- High-protein feed for livestock, pet food and aquaculture



Brought to you by the
North Dakota Ethanol Council,
and its member plants.





October 12, 2021

Dear ND Farmer's Union Co-op Board Member:

One of the priorities of the North Dakota Ethanol Council (NDEC) and North Dakota Corn Utilization Council (NDCUC) is increasing offerings of E15 (marketed as Unleaded88) in the state. As a board member of a farmer owned co-op, we'd ask for your assistance by encouraging your local Cenex stations to offer E15. Your connection to the producer growing the corn and to the station offering fuel in rural communities, provides you with a unique role to assist us in the expansion of E15.

To make E15 more accessible, CHS has removed barriers for its Cenex brand retail locations by establishing an EPA-approved misfuelling mitigation plan and establishing E15 as a qualifying grade of fuel. In addition, it has expanded access to higher ethanol blend fuels by offering E15 through 19 additional fuel terminals, including the Nustar terminal in Jamestown.

We understand there may be questions regarding equipment compatibility, so we have developed the enclosed document outlining E15 equipment compatibility guidelines, as well as other resources for available funding and marketing assistance.

With a production capacity of more than 520 million gallons annually, North Dakota's ethanol industry is well positioned to meet this increased demand. The state's ethanol industry is strong and ready to partner with North Dakota Cenex retailers for the long-term.

We look forward to working with you to increase the offerings of E15 in North Dakota. This creates a win-win not only for retailers and ethanol producers, but also for the state's farmers, consumers and economy. If you would like to visit further, feel free to contact NDEC Executive Director Deana Wiese at office@ndethanol.org or 701-355-4458 or NDCUC Executive Director Jean Henning at jean@ndcorn.org or 701-566-9322.

Sincerely,

Jeff Zueger
NDEC Chairman

Deana Wiese
NDEC Executive Director

Jason Rayner
NDCUC Chairman

Jean Henning
NDCUC Executive Director



E15 (Unleaded88) Compatibility Guidelines and Resources

E15 Compatibility GUIDELINES

(marketed as Unleaded88)

The Environment Protection Agency (EPA) accepts EITHER of the following to show E15 equipment compatibility¹:

UL Listing

OR

Manufacturer's Warranty

- Wayne dispensers are all E15 compatible, with the newer dispensers (2014) approved up to E25.
- Gilbarco dispensers, since 2008, are all E15 compatible.
- Since around 1980, petroleum equipment manufacturers have offered standard equipment for sale that is compatible with blends above 10% ethanol including: storage tanks, piping, valves, hanging hardware, dispensers, hoses, and nozzles.
- For manufacturer letters about compatibility for ethanol blends above 10%, visit the [Petroleum Equipment Library](#).
- Nearly all underground storage tanks (UST) made in the last 30 years are approved up to 100% ethanol. Learn more at the [Fiberglass Tank & Pipe Institute](#).
- The majority of current installed tanks can store blends above E10. For many decades, UST manufacturers approved their tanks for blends up to E100. For example, all steel tanks and double-walled fiberglass tanks have had this approval since 1990. Manufacturers of pipe thread sealants (pipe dope) used in UST systems have stated their products have been compatible with ethanol blends up to E20 for many years. [Learn more here](#).
- The Steel Tank Institute confirms steel tanks are also compatible with 100% ethanol. To learn more, visit the [Steel Tank Institute website](#).
- See the appendix checklist for the majority of UST compatible equipment. Consult with your equipment supplier on equipment compatibility.

For more information, please contact Growth Energy:

- Mike O'Brien at MO'Brien@GrowthEnergy.org
- David Durling at DDurling@GrowthEnergy.org
- Will Beck at WBeck@GrowthEnergy.org

Additional E15 Compatibility Information²

- Retailer Resources - www.flexfuelforward.com
- Equipment Compatibility Searchable Database - <https://flexfuelforward.com/flexcheck/>



E15 (Unleaded88) Compatibility Guidelines and Resources

E15 RESOURCES

(marketed as Unleaded88)

Unleaded88 Expansion Program Funder

Jean Henning, Executive Director
ND Corn Utilization Council
Fargo, ND
701-566-9322
jean@ndcorn.org

Unleaded88 Marketing Assistance

Mike O'Brien, VP of Market Development
Growth Energy
202-545-4000
mobrien@growthenergy.org
growthenergy.org/resources/retailer-hub

North Dakota Fuel Labeling Specifications

Robin Schiermeister, Environmental Scientist II
ND Department of Environmental Quality
701-328-5172
raschiermeister@nd.gov
➤ legis.nd.gov/cencode/t23-1c13.pdf
➤ legis.nd.gov/information/acdata/pdf/33.1-34-01.pdf

North Dakota Ethanol Producers

Tracey Olson, Plant Manager
Hankinson Renewable Energy
Hankinson, ND
701-242-9420
tracey.olson@guardianNRG.com

Jeff Zueger, CEO
Midwest AgEnergy Group
Blue Flint and Dakota Spirit
Underwood and Spiritwood, ND
701-442-7501
jzueger@midwestagenergy.com

Gerald Bachmeier, CEO
Red Trail Energy, LLC
Richardton, ND
701-974-3308
gerald@redtrailenergy.com

Ryan Thorpe, COO
Tharaldson Ethanol Plant
Casselton, ND
701-347-4000
rthorpe@tharaldsonco.com

Keshav Rajpal, Managing Member
Red River Biorefinery
Grand Forks, ND
608-334-7240
keshav.rajpal@biomasssolution.com

Federal E15 Specifications

- www.epa.gov/sites/production/files/2016-06/documents/rfa-e15-retailer-handbook.pdf
- www.epa.gov/ust/underground-storage-tank-ust-technical-compendium-about-2015-ust-regulation#compatibility

EXPLORE the STATE with

LOOK FOR
Unleaded88/E15
Labeled Pumps

UNLEADED88!! *Your safe, economical, cleaner-fuel option!!*

What is Unleaded88?

- Unleaded88 (E15) is a higher-octane fuel containing 85 percent gasoline, 15 percent ethanol.

What vehicles can use Unleaded88?

- Unleaded88 is government approved for all 2001 and newer cars and light-duty vehicles, as well as flex-fuel vehicles.
 - These vehicles make up more than 90 percent of the light-duty vehicles on the road today.
- ### Why choose Unleaded88?
- Good for North Dakota – Supports North Dakota's farmers and enhances the state's economy.
 - Better value – Provides unrivaled value to North Dakota agencies and its citizens by saving up to 10 cents per gallon.
 - Better for your engine – Higher-octane level helps increase horsepower, efficiency and engine life.
 - Burns cleaner – Reduces toxins with 46 percent lower greenhouse gas emissions than gasoline making it more environmentally friendly.

Where is Unleaded88 available?

- Unleaded88 is available in Bismarck, Casselton, Drayton, Fargo, Grand Forks, LaMoure, Mandan, Valley City, West Fargo, Watford City, Williston, and Wyndmere.
- Unleaded88 is available at nearly 2,500 stations in more than 30 states, including 25 stations in North Dakota.

LEARN MORE AND FIND UNLEADED88 LOCATIONS NATIONWIDE AT UNL88.COM

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