



Economic Research Service
U.S. DEPARTMENT OF AGRICULTURE

Technical
Bulletin
Number 1977

July 2026

Documentation for the USDA, Economic Research Service Agricultural Resource Management Survey-Based Forecast Models for Farm-Level and Farm Household Income

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Economic Research Service www.ers.usda.gov

Recommended citation format for this publication:

Litkowski, C., Whitt, C., Borisova, T., Lim, K., Todd, J., & Winter, H. (2026). *Documentation for the USDA, Economic Research Service Agricultural Resource Management Survey-based forecast models for farm-level and farm household income*. (Report No. TB-1977). U.S. Department of Agriculture, Economic Research Service.



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Documentation for the USDA, Economic Research Service Agricultural Resource Management Survey-Based Forecast Models for Farm-Level and Farm Household Income

Carrie Litkowski, Christine Whitt, Tatiana Borisova, Katherine Lim,
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Abstract

This report documents the methods used to produce the USDA, Economic Resource Service's (ERS) forecasts of farm-level average net cash farm income and farm household level median and mean income. These forecasts, released three times per year, provide insights into the financial well-being of farms and the households that operate them. Historical components of the financial indicators are drawn from the annual Agricultural Resource Management Survey (ARMS), a representative cross-section of farms in the 48 contiguous States. Forecasts are generated using models that begin with micro-level data from ARMS and incorporate USDA, ERS sector-level net cash farm income forecasts, along with broader, economy-wide forecasts. These models project changes in two income categories: income from farm operations and off-farm household income. Summary statistics are reported in two USDA, ERS data products: the Farm Income and Wealth Statistics and the Farm Household Income and Characteristics. These forecasts support informed decision-making by farm operators, policymakers, and other agricultural stakeholders by highlighting expected income trends across various farm types, sizes, and specializations, and projected changes in farm household financial well-being.

Keywords: farm income, farm households, Agricultural Resource Management Survey (ARMS), income forecasts, income projections

Acknowledgments

The authors appreciate the review and feedback of the report provided by Krishna Paudel, Jonathan McFadden, and four anonymous reviewers. They also thank Andrew Nash, Grant Wall, and Jeremy Bell for editorial review and design services.

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Introduction

The U.S. farm sector represents 1.9 million farms (USDA, National Agricultural Statistics Service (NASS), 2024). Together, these farms operate nearly 900 million acres of land and support 4.6 million people living in households of principal farm operators, according to the 2023 Agricultural Resource Management Survey (ARMS) (USDA, NASS, 2024; USDA, Economic Research Service (ERS), 2024c). Estimates and forecasts of aggregate net farm income for U.S. agriculture provide important information on the financial well-being of the farm sector. However, changes in the farm sector can have varied impacts on farm operations and farm households, depending on geographical region, specialization, farm size, and other characteristics. Sector-wide measures can mask important differences among farm operations.

USDA, Economic Research Service (ERS) uses ARMS data¹ as the basis for two income forecast models that characterize differences in financial performance among farm operations. The purpose of these models is to inform decision makers about expected income changes for different groupings of farms (such as by farm size and specialization) and about projected changes in farm household well-being (from both on-farm and off-farm income sources).

The first model, the farm-level forecast model, forecasts the net cash farm income of farm operations at the farm level. Among other things, the farm-level forecast model compares average net farm income for farm businesses across geographic regions and commodity specializations. Farm income influences farm-level decisions, such as allocation of labor on and off the farm, savings and borrowing, investment in machinery and land, and the selection of crops to plant and livestock to produce. Some Federal Government policies have sought to shelter producers from income fluctuations or to reduce income risk (Key et al. 2017). Therefore, farm-level income forecasts can inform the decisions of policy-makers and other agricultural stakeholders.

The second model, the farm household forecast model, forecasts total income for the households of principal operators on family farms. Family farms are those in which at least one operator and their relatives own a majority of the operation, and they accounted for about 96 percent of all farms in 2023 (USDA, ERS, 2024e).² The farm household model projects year-to-year changes in average and median farm household income from different sources, highlighting the trends in farm and off-farm income streams (Morehart & Johnson, 2005, 2008; Harris et al., 2009; Morton et al., 2010; Morehart &

¹ ARMS is an annual survey from USDA, Economic Research Service (ERS) and USDA, National Agricultural Statistics Service (NASS) and is the USDA's primary source of information on the production practices, resource use, and economic well-being of America's farms and ranches. See glossary at the end of the document for additional information and definitions of key terms.

² Here, principal operator refers to the operator most responsible for the day-to-day decisions on the farm operation.

Park, 2011). Farm household income can fluctuate more than the income of the typical U.S. household because of variable farm yields and market prices for agricultural products (Jones et al., 2010; Key et al., 2017). The farm household data allows for the comparison of farm household economic well-being with that of the typical U.S. household (Jones et al., 2010). The forecast can expose the response of households' income to specific events (Shane et al., 2009), informing the decisions of farm investors, lenders, and policymakers (Mishra et al., 2002).

The objective of this report is to document the farm-level and farm household forecast models together because both models use ARMS as their primary data source. ARMS is annually administered by USDA, NASS and USDA, ERS. The survey is USDA's primary source of information on the production practices, resource use, and economic well-being of farms and ranches in the United States (see box, Agricultural Resource Management Survey (ARMS) Information). In addition to ARMS, there are other inputs into the two models, including the farm sector-level income forecast, and various economy-wide forecasts. These two models are linked because the output from the farm-level forecast model is used as an input in the farm household model. Farm-level forecasts and farm household forecasts are designated as premier USDA, ERS data products, being influential and central to the agency's mission.³

The scope of this report is restricted to documenting the existing ARMS-based forecast models, and it is not intended to compare it with other strategies to analyze and predict farm income and household well-being. For example, one area of agricultural economics research is the analysis of different factors influencing farm-level income and household well-being, such as sociodemographics, farm-land ownership, or management techniques (El-Osta et al., 2007; Key et al., 2017; Prager et al., 2018; Francois et al., 2024). While these studies can inform future model developments, the farm household and farm-level forecast models discussed in this report only consider the farms' sources of income and differences in income by geographic region and farm class defined by annual gross cash farm income rather than various other farm characteristics. Another research area uses scenario analysis to develop farm policy (e.g., scenarios involving droughts, commodity price changes, or new farm policies; see Nelson et al., 2007; Mittenzwei & Britz, 2018; Hughes et al. 2022) and to guide producers' decision making (e.g., farm-level fertilizer and irrigation scenarios in Bizimana and Richardson (2019) and decision support system review in Ara et al. (2021)). ARMS-based forecast models discussed in this report focus on projecting income and well-being assuming continuation of current policies and economic conditions. The forecasts do not model different scenarios that could result from changes to policies or economic conditions, which would require additional assumptions. The third broad research area is nowcasting, which focuses on methods and data for timely and accurately characterizing current economic conditions (Bock et al., 2018; Stundziene et al., 2024). As discussed in this USDA, ERS publication, characterizing the farm-level and farm household economy using data involves significant delays in forecast release to allow for collecting and analyzing relevant survey-based, administrative, and other information. To assist real-time decisions, nowcasting provides economic prediction for the present or near future in real time, using high-frequency data from traditional sources (such as government reports) as well as alternative sources (e.g., daily financial transactions data). Nowcasts to supplement the analysis produced by the ARMS-based models discussed in this report are an area of future research.

³ Premier USDA, ERS data product status is given to the Farm Income and Wealth Statistics, which includes the farm-level income forecast.

Agricultural Resource Management Survey (ARMS) Information

The Agricultural Resource Management Survey (ARMS) is conducted annually, and it is a collaboration between USDA, Economic Research Service (ERS) and USDA, National Agricultural Statistics Service (NASS). ARMS is USDA's primary source of information on the financial condition, production practices, resource use, and economic well-being of U.S. farms and their principal operators' households (referred to as farm households). The target population for ARMS is the official U.S. farm population. However, ARMS only covers the contiguous 48 States. Farms are defined as all establishments that produced and sold (or normally would have sold) at least \$1,000 of agricultural products during the calendar year.

The characteristics and financial performance of farm operations and farm households are collected during the early spring of the year following the reference year. For example, respondents reported farm and household costs and returns, as well as other characteristics that occurred during calendar year 2022, in the spring of 2023. Over the past decade, the number of usable farm records has ranged from 11,841 in 2020 to 29,733 in 2014. In the 2023 ARMS dataset, there were 14,705 usable observations. On average, 17,092 usable farm records are included in the ARMS sample since the survey was first conducted in 1996. More information is available from USDA, ERS ARMS Farm Financial and Crop Production Practices (see USDA, ERS, 2024e).

Background: Models' Scope and the Schedule of Data Releases

The U.S. agricultural sector is comprised of varied farm operations, and USDA, ERS data products and models are designed to reflect and inform stakeholders about this variation. Specifically, the USDA, ERS farm-level forecast model produces data for all farms, and it provides tabulations by gross cash farm income based on the USDA, ERS farm typology.⁴ The USDA, ERS farm typology is a mutually exclusive grouping of farms of different sales classes, ownership structures, and primary occupations of the principal operator. The intersection of these three variables creates eight different typology categories. The eight groups are combined into three mutually exclusive categories: residence, intermediate, and commercial farms (referred to as the collapsed typology, figure 1).

The farm-level forecast model produces forecasts of average net cash farm income by the farms in different gross cash farm income categories and by collapsed farm typology. It also produces forecasts for family farms as a single grouping. Additionally, for farm businesses, the farm-level forecast model produces forecasts of average net cash farm income by region and production specialty.⁵ In

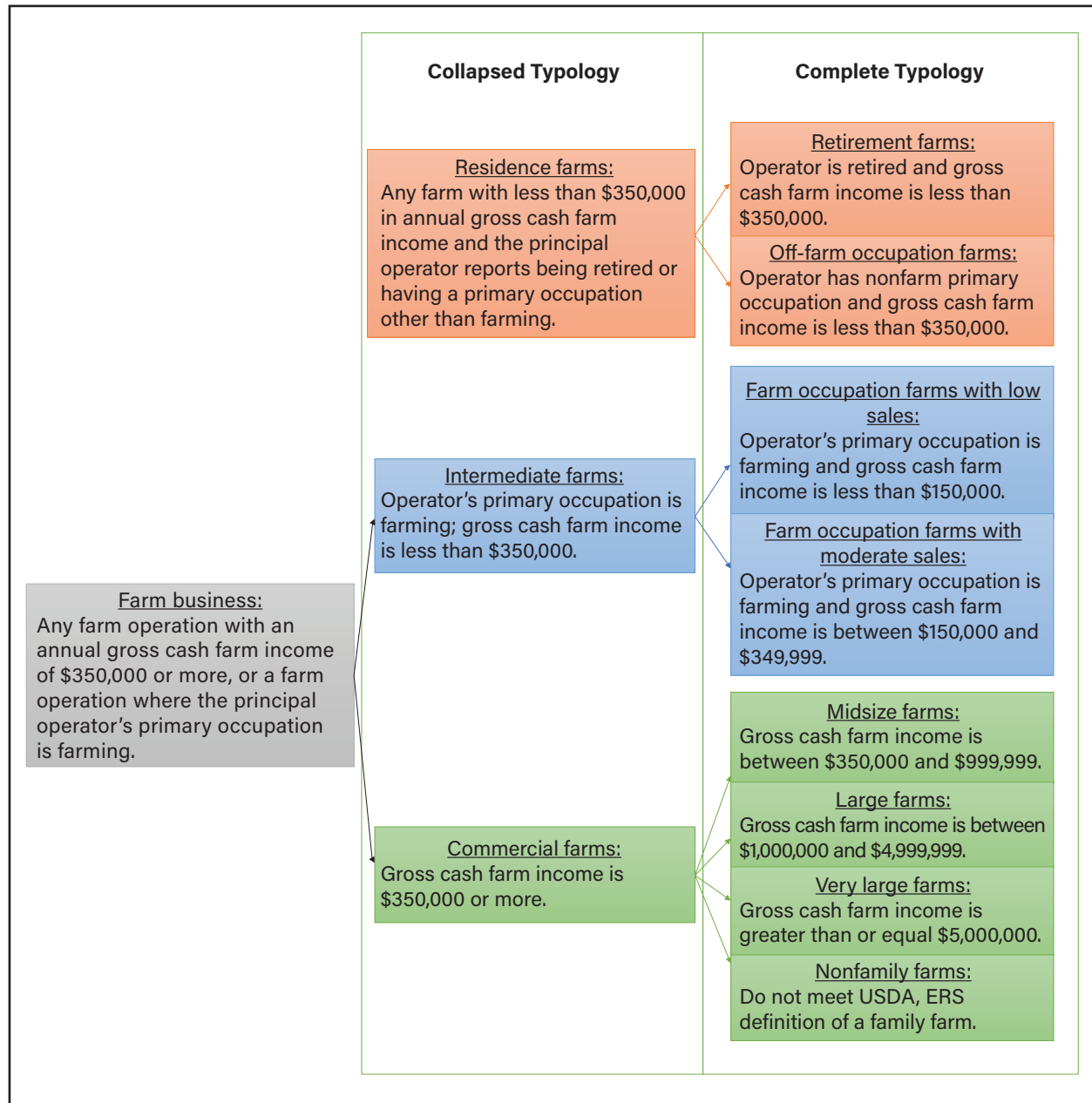
⁴ The population of all farms is comprised of all operations in the 48 contiguous States (excluding Alaska and Hawaii) that meet the official USDA definition of a farm (that is, all establishments that sold or would normally have sold at least \$1,000 of agricultural products during the previous year). These operations include not only traditional agricultural farms such as grain farms and ranching operations, but also specialty farms like orchards, nurseries, and aquaculture. The USDA, ERS farm typology categorizes farms into more homogeneous groupings for reporting and evaluation purposes. Alaska and Hawaii are excluded from the tabulations because they are not covered by the Agricultural Resource Management Survey, a primary source of data for the farm-level forecast model. For the definition of gross cash farm income and other key terms, see the glossary at the end of the document.

⁵ The USDA, ERS Farm Resource Regions include nine regions: Northern Crescent, Eastern Uplands, Southern Seaboard, Mississippi Portal, Prairie Gateway, Fruitful Rim, Basin and Range, Northern Great Plains, and Heartland. These regions were first defined in 2000 based on county-level farm, land, and soil characteristics (Heimlich, 2000). See also the description in Dubman et al. (2021). In turn, farm commodity specializations include cotton, corn, wheat, soybeans, specialty crops, other crops, dairy, hogs, poultry, cattle/calves, and other livestock. A farm's commodity specialization is defined by the commodity that represents more than 50 percent of the farm's value of production. If a farm does not have one commodity or one related group of commodities that makes up 50 percent of the total value of production, then the farm is classified as "other crops" if crops account for the majority of production or "other livestock" operation if livestock account for the majority of production.

2022, farm businesses accounted for 48 percent of all farms and more than 90 percent of the value of U.S. agricultural production (Whitt et al., 2023).

Figure 1

USDA, Economic Research Service's collapsed and complete farm typology



Note: Operator refers to the principal operator, the person most responsible for the decisions on the operation. Gross cash farm income is a measure of the farm's revenue (before deducting expenses) that includes sales of crops and animal/animal products, payments received from Federal agricultural programs, and other farm-related cash income, including fees from production contracts.

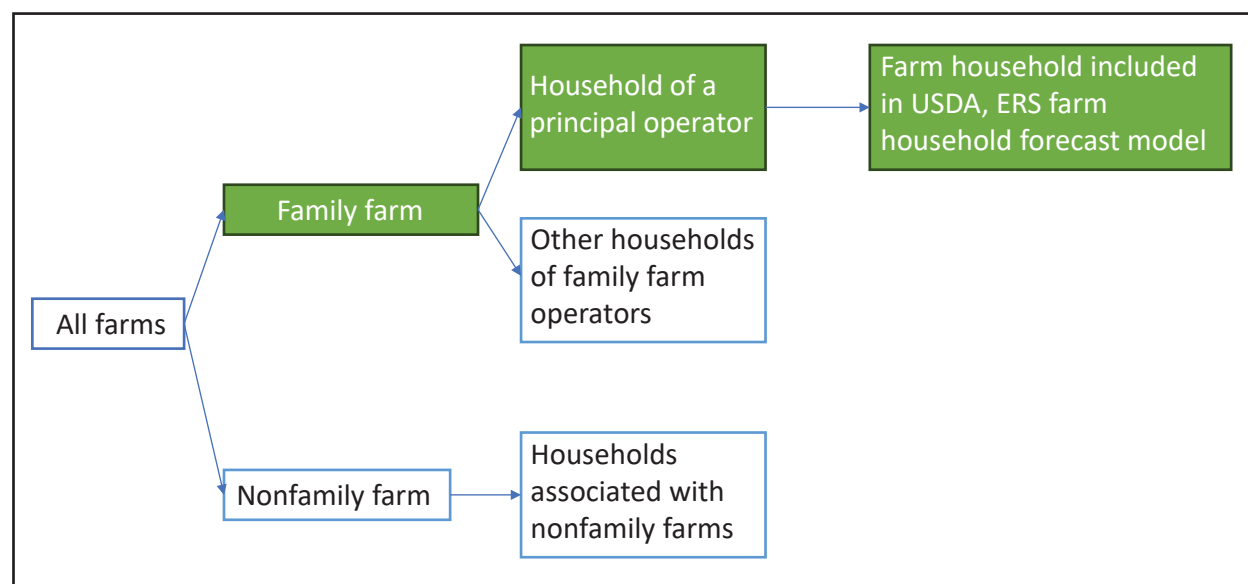
Source: USDA, Economic Research Service (ERS) visualization of typology categories based on definitions by Hoppe and MacDonald (2013), Updating the ERS Farm Typology.

Unlike the farm-level forecast model, the farm household forecast model accounts for both farm and off-farm income streams to study the total household income for principal farm operator households (figure 2). ARMS collects household financial data only for the primary operator's household.

Therefore, other households associated with the family farm operation are not included in the forecast model. Note that nonfamily farms are also excluded from the farm household forecast model. Some examples of nonfamily farms include farm operations owned by two or more unrelated business partners, or an operation run by an operator or operators (such as a hired manager) unrelated to the farm business owners.

Figure 2

Households included in the USDA, Economic Research Service farm household model



Note: The principal operator is the person most responsible for the day-to-day decision making on the farm. Family farm is any farm where the majority of the business is owned by an operator and any individuals related to them by blood, marriage, or adoption, including relatives who do not live in the operator's household.

Source: USDA, Economic Research Service (ERS) visualization of farm households based on the USDA, ERS definition of a farm household.

The ARMS data production cycle is central for the forecast release schedule because ARMS provides essential inputs for USDA, ERS farm-level and farm household forecasts. When financial indicators are projected using our models based on previous years' ARMS data, they are labeled as forecasts. These indicators are labeled as estimates once ARMS data covering that calendar year become available.

The farm-level and farm household forecast data are released three times per year.⁶ The first release of the calendar year is in early February (figure 3). For the February release, the farm-level and farm household forecast models provide the first forecasts for the current calendar year. At that time, the models also provide the fourth forecast for the previous calendar year. For example, in February 2022, farm-level net cash farm income and farm household income for 2021 were forecast for the fourth time and the first forecasts for 2022 were provided. The 2021 results were still labeled as a forecast, since they were partially based on projected data, rather than 2021 ARMS data, which was not available until the summer of 2022.

The second annual release occurs in late August or early September. At that time, preliminary ARMS data for the previous calendar year are available, and therefore, the forecast for that year becomes a preliminary estimate. The forecast models for the current calendar year are also updated using these

⁶ The farm-level and farm household forecast is released together with other data included in the USDA, ERS Farm Income and Wealth Statistics data product.

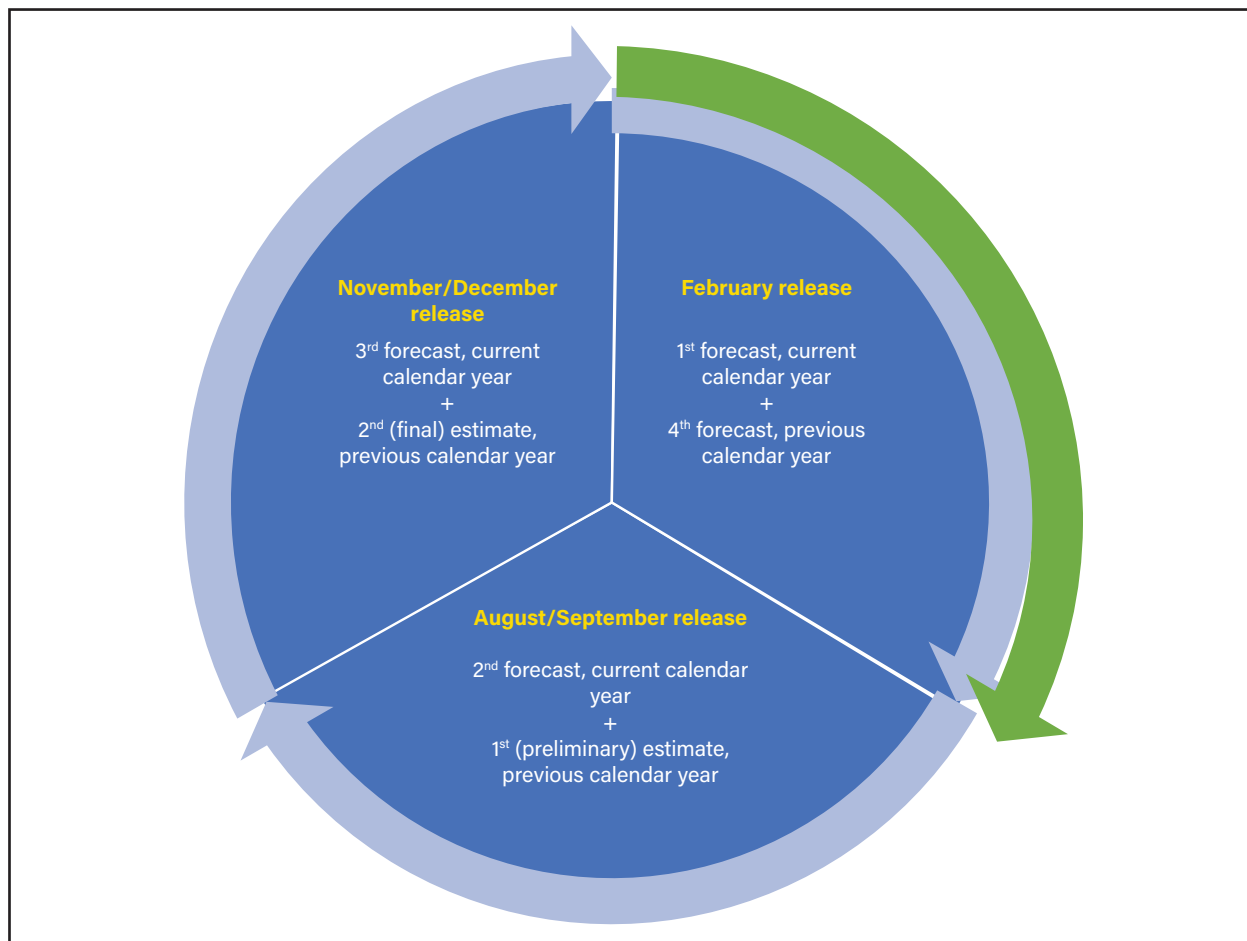
newly available ARMS data (covering the previous calendar year), the concurrently released U.S. farm sector income forecast, and other data. In the example above, the 2021 income values become preliminary estimates in September of 2022 using 2021 preliminary ARMS data, while 2022 income values remain forecasts.

The final release of the year occurs in late November or early December. At that time, the ARMS data for the previous year are finalized and, therefore, the previous calendar year estimate is no longer preliminary. The current calendar year is forecast for the third time, and it is updated to incorporate any revisions to ARMS, the U.S. farm sector income forecast, and other data.⁷

Based on this data release cycle, it is approximately 22 months between the release of the first forecast and the release of the final ARMS-based estimates for farm-level and farm household income. Note that the final estimates can still be periodically revised. For example, following the release of results from the Census of Agriculture, which is conducted every 5 years, ARMS survey weights are updated and can change the farm-level and farm household income estimates for the census year. The final farm-level and farm household income estimates can also be revised if ARMS micro-data are revised.⁸

Figure 3

Release schedule for data from the farm-level and farm household models



Source: USDA, Economic Research Service.

⁷ Note that the U.S. farm sector income estimates can be revised up to 5 years after the publication of the first estimate for the calendar year following revisions to source data. Therefore, the sector-level estimates are not labeled “preliminary” and “final.”

⁸ Micro-data refers to un-tabulated records about individual farm operations and households of the principal operator. This is also referred to as farm-level data.

Data Sources

The first of the two models discussed in this report, the farm-level forecast model, uses two primary sources of data: ARMS and the USDA, ERS sector-level estimates and forecasts included in U.S. Farm Income and Wealth Statistics (FIWS). Specifically, the model takes the forecasted, year-to-year percentage change in the components of farm income from the sector-level farm income forecast and applies it to the most recent year of the ARMS micro-data. This approach allows the model to forecast net income at the farm level for the following year. The sector-level forecast is used to project farm-level income to maintain consistency between the two levels of forecasts. The sector-level forecast is USDA's official farm income forecast, reflecting expectations for the sector as a whole using data from a variety of sources (see box, U.S. Farm Sector Income Estimates and Forecasts: Summary of Data Sources). The most recent year of the ARMS micro-data is referred to as the base year in this report.

U.S. Farm Sector Income Estimates and Forecasts: Summary of Data Sources

The sector-level estimates and forecasts are used to produce farm-level and farm household forecasts, as described in this report. The sector-level estimates and forecasts are compiled using data from a broad range of surveys and administrative sources. Agricultural Resource Management Survey (ARMS) data are the primary source used to estimate two components of the sector-level net cash farm income (NCFI): cash production expenses and some elements of cash farm-related income. ARMS data also contribute to cash receipts estimates; however, the estimates rely primarily on more comprehensive information from USDA, National Agricultural Statistics Service (NASS) surveys. Direct Government payments are estimated using USDA administrative data.

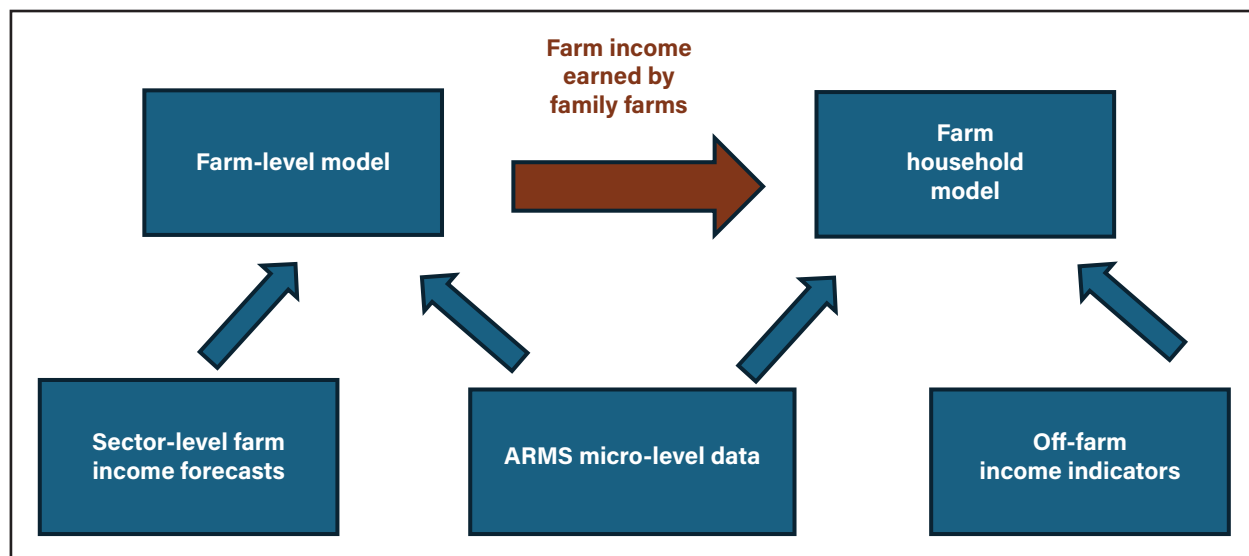
The sector-level forecasts are developed using both USDA and non-USDA data sources. The USDA sources include the *World Agricultural Supply and Demand Estimates (WASDE)* report, the USDA 10-year (Baseline) Agricultural Projections, and monthly commodity and input prices from USDA, NASS. Non-USDA data sources include the U.S. Energy Information Agency's short-term energy outlook and Oxford Economics' government bond rate and consumer price index forecasts.

This report doesn't describe the methods used to derive the sector-level farm income forecasts. Instead, see the USDA, Economic Research Service publication *Forecasting Farm Income: Documenting USDA's Forecast Model* (McGath et al., 2009) and information on the Farm Income and Wealth Statistics (FIWS) data product page on the USDA, ERS website (USDA, ERS, 2024f).

The second model, the farm household forecast model, takes the output from the farm-level model, ARMS micro-data, and forecasted growth factors to forecast total farm household income (figure 4). Total income for the farm household consists of income from farm activities (referred to as farm income), and income from non-farm sources (referred to as off-farm income). The farm household model uses forecasted farm financial data from the farm-level model to forecast the profit or losses transferred from the farm operation to the farm household. Economic indicators from Oxford Economics are used to forecast household income from non-farming activities. Oxford Economics is an independent economic firm with expertise in forecasting global and country-specific macro-economic indicators, such as the Gross Domestic Product (GDP) and the Consumer Price Index (CPI).

Figure 4

Data flows for the farm-level and farm household models



ARMS = Agricultural Resource Management Survey.

Note: See box “U.S. Farm Sector Income Estimates and Forecasts: Summary of Data Sources” for more information on the data sources used to derive the sector-level farm income forecasts.

Source: USDA, Economic Research Service.

Equation Notation

The formulas used to forecast farm-level and farm household income are presented in this report using subscripts and superscripts. Three primary subscripts are used.

- i : denotes an observation in the Agricultural Resource Management Survey (ARMS) data
- t : the base year which is the latest year for which ARMS data is available
- $t+1$: the forecast year

Superscripts are used to indicate the source of the underlying data, where needed.

- ARMS: observation (farm-level data record) from the Agricultural Resource Management Survey
- Sector: sector level farm income data (to be referred to as the sector-level accounts, which includes both estimates and forecasts of farm income).

The February release includes two forecast years. Therefore, there would be additional equations for the second forecast year denoted as $t+2$.

Farm-level Forecast Model

The farm-level forecast model takes an observation (a farm-level data record) from the base year ARMS dataset and projects the major components of net cash farm income for this observation. The process is repeated for each observation in the base year ARMS dataset. Then summary statistics are calculated from the forecasted farm-level data generated by the model. This section provides detail on the components of the forecast.

Forecasting Net Cash Farm Income

Net cash farm income is a broad measure of profitability calculated as gross cash income less cash expenses. It is forecast by projecting each of the major components of net cash income and then aggregating to a forecasted total. Net cash farm income (*NETCSH*) is equal to the forecasted gross cash farm income (*GCFI*) less forecasted total expenses (*ETOT*). Note that only cash expenses are included in *ETOT*, while other non-cash expenses, such as capital consumption and noncash benefits to hired labor, are excluded. Operator dwelling expenses are also excluded. Forecasted net cash farm income is derived as follows:

$$NETCSH_{i,t+1} = GCFI_{i,t+1} - ETOT_{i,t+1} \quad (1)$$

Forecasting Gross Cash Farm Income

Gross cash farm income (*GCFI*) is revenue from or related to the farm operation that is received by the farm operation. It consists of seven components: animal/animal product sales (*Animal_sales*), crop sales (*Crop_sales*), net Commodity Credit Corporation loan activity (*CCC_loans*), Government payments (*GP*), machine hire and custom work income (*Machine_Custom_work*), commodity insurance indemnities (*Ins_indem*), and other cash farm-related income (*Other_farm_income*). Each of these components is discussed below.

$$\begin{aligned} GCFI_{i,t+1} = & Animal_sales_{i,t+1} + Crop_sales_{i,t+1} + CCC_loans_{i,t+1} \\ & + GP_{i,t+1} + Machine_Custom_work_{i,t+1} + Ins_indem_{i,t+1} \\ & + Other_farm_income_{i,t+1} \end{aligned} \quad (2)$$

Forecasting Animal/Animal Product and Crop Sales

The forecast for total animal/animal product and crop sales is the sum of the forecasts for 15 commodity subcomponents:⁹

- Animal/animal product sales, comprising:
 - Cattle cash sales
 - Hogs cash sales
 - Dairy cash sales
 - Poultry and eggs cash sales
 - Other animal/animal product cash sales
 - Animal/animal product income from production and marketing contracts

⁹ ARMS and the Census of Agriculture collect some data on cash sales differently in terms of commodity groupings. But in years when the Census of Agriculture is administered, the ARMS questionnaire is modified to match the Census questionnaire. Therefore, the cash sales categories in the farm-level model are modified to account for changes in data collection. In this report, we present the commodity groupings that are typically used in years in which the census was not conducted.

- Crop sales (including sales under marketing contracts), comprising:
 - Grains, oilseeds, dry beans, and dry peas cash sales
 - Tobacco, cotton, and cottonseed cash sales
 - Fruit, nuts, and berries cash sales
 - Nursery stock cash sales
 - Vegetables and melons cash sales (excluding potatoes)
 - Potato cash sales
 - Peanuts cash sales
 - Other crop cash sales
 - Crop income from current year marketing contracts

Each subcomponent of animal/animal product sales and crop sales are forecasted using the projected growth rate in cash receipts from the sector-level farm income data (to be referred to as the sector-level accounts). For example, cash sales for the cattle subcomponent are calculated as follows:

$$CATT_{i,t+1} = CATT_{i,t}^{ARMS} \times \frac{CATT_{t+1}^{Sector}}{CATT_t^{Sector}} \quad (3)$$

In equation (3), $CATT_{i,t}^{ARMS}$ is the value of cash sales for farm i in the ARMS dataset covering the base year, t . The ratio $CATT_{t+1}^{Sector} / CATT_t^{Sector}$ is the growth factor applied to adjust the ARMS-base value, and it is based on the sector-level cattle cash receipts. Specifically, $CATT_{t+1}^{Sector}$ is the value of cattle cash receipts subcomponent from the sector-level accounts for the forecast year, $t+1$, and $CATT_t^{Sector}$ is the value of cattle cash receipts subcomponent from sector-level accounts for the base year, t (see box, Conceptual Differences Between the Farm Sector and Farm-level Income Forecasts).¹⁰

¹⁰ For information on the methods used to derive the sector-level accounts, see the USDA, Economic Research Service publication *Forecasting Farm Income: Documenting USDA's Forecast Model* (McGath et al., 2009) and information on the FIWS data product page on the USDA, ERS website (USDA, ERS, 2024f).

Conceptual Differences Between the Farm Sector and Farm-level Income Forecasts

The tabulations from the farm-level forecast model described in this report are part of the USDA, Economic Research Service's (ERS) Farm Income and Wealth Statistics (FIWS) data product. FIWS refers collectively to the estimates and forecasts on farm income and wealth released three times a year and, in addition to the farm-level forecasts, it includes aggregate estimates and forecasts of U.S. farm sector income. These sector-level estimates are themselves an input into the farm-level forecast model.

The sector-level net farm income data measures the total profitability of U.S. production agriculture, which includes farm operations, production contractors (often called integrators), and landlords. Cash receipts, in the sector-level accounts, refers to the market value of agricultural commodities removed from the farm, regardless of who receives payments for the products (Hoppe & MacDonald, 2013). In contrast, the farm-level model forecasts only the revenue and expenses accruing to farm operations. It excludes revenues received by production contractors (rather than farmers) and any share of commodity sales going to landlords (through farm rental agreements). In this report, cash sales refer to the revenue received by the farm operation for crop and animal/animal product sales. In addition, income or fees may be received by the farm operation from marketing or production contracts; these are then added to farm sales in the farm-level forecasts.

Similarly, the farm-level income forecasts exclude Government payments received by landlords and expenses paid by landlords or production contractors.

While most of the forecasts for animal/animal product and crop sales are calculated using an equation similar to (3), there are four exceptions to account for the different levels or types of aggregations in the sector-level accounts and ARMS data. These four exceptions are for the commodity groupings described below, and all of them are forecast using a similar approach:

$$GroupSales_{i,t+1} = GroupSales_{i,t}^{ARMS} \times \sum_{j=1}^J \left(k_j \times \frac{SubGroup_{j,t+1}^{Sector}}{SubGroup_{j,t}^{Sector}} \right) \quad (4)$$

where $GroupSales_{i,t+1}$ refers to the forecast for the observation i from an ARMS aggregate commodity grouping, which the sector-level account breaks into J sub-groups. The sector-level growth rate for each sub-group, $\frac{SubGroup_{j,t+1}^{Sector}}{SubGroup_{j,t}^{Sector}}$, is weighted by each sub-group's share in the group total sales. Specifically, the four exceptions projected using this approach are: equation (5), animal/animal product income from contracts ($CONTLV_{i,t+1}$); equation (6), grains, oilseeds, dry beans, and dry peas sales ($CGRANOIL_{i,t+1}$); equation (7), tobacco and cotton sales ($TOBCOTT_{i,t+1}$); and equation (8), crop income from marketing contracts ($V2M_{i,t+1}$). In line with the approach described by equation (4), these were forecasted as follows:

$$CONTLV_{i,t+1} = CONTLV_{i,t}^{ARMS} \times \left(0.78 \times \frac{DAIRY_{t+1}^{Sector}}{DAIRY_t^{Sector}} + 0.11 \times \frac{HOGS_{t+1}^{Sector}}{HOGS_t^{Sector}} + 0.11 \times \frac{CATT_{t+1}^{Sector}}{CATT_t^{Sector}} \right) \quad (5)$$

$$CGRANOIL_{i,t+1} = CSGRANOIL_{i,t}^{ARMS} \times \left(0.09 \times \frac{FOODG_{t+1}^{Sector}}{FOODG_t^{Sector}} + 0.55 \times \frac{FEEDG_{t+1}^{Sector}}{FEEDG_t^{Sector}} + 0.36 \times \frac{OILC_{t+1}^{Sector}}{OILC_t^{Sector}} \right) \quad (6)$$

$$TOBCOTT_{i,t+1} = CSTOBCOT_{i,t}^{ARMS} \times \left(0.10 \times \frac{OTHCR_{t+1}^{Sector}}{OTHCR_t^{Sector}} + 0.90 \times \frac{COTT_{t+1}^{Sector}}{COTT_t^{Sector}} \right) \quad (7)$$

$$V2M_{i,t+1} = V2M_{i,t}^{ARMS} \times \left(0.29 \times \frac{FRUIT_{t+1}^{Sector}}{FRUIT_t^{Sector}} + 0.22 \times \frac{VEG_{t+1}^{Sector}}{VEG_t^{Sector}} + 0.49 \times \frac{ALLCR_{t+1}^{Sector}}{ALLCR_t^{Sector}} \right) \quad (8)$$

For example, in (5), $CONTLV_{i,t}$ refers to an estimate of animal/animal product income received by farm operators from contracts, and it includes animal/animal product income from marketing contracts, plus an estimate of the value of livestock moving through the operation under production contracts. For forecasting income (or sales) from contracts (equations 5 and 8), the growth in cash receipts for the relevant commodities is weighted by each commodity's share of total contract income from the most recent ARMS.¹¹ For forecasting aggregate sales (equations 6 and 7), the growth in cash sales for the related commodities is weighted by each commodity's share of the total based on the most recent cash receipt estimates from the sector-level accounts. These shares are updated once a year and the formulas above reflect 2022 shares from the August 2023 release of the FIWS data release. The list of variables from the sector-level accounts used in equations (5)–(8) is presented in table 1.

Table 1
Variables used in equations 5–8

Forecasted variables in the farm-level model		ARMS variables	Sector-level variables	
Notation	Description		Notation	Description
CONTLV	Animal/animal product income from production and marketing contracts	CONTLV	DAIRY	Dairy cash receipts
			HOGS	Hog cash receipts
			CATT	Cattle and calves cash receipts
CGRAINOIL	Grains, oilseeds, dry beans, and dry peas sales	CSGRANOIL	FOODG	Food grain cash receipts
			FEEDG	Feed crops cash receipts
			OILC	Oil crops cash receipts
TOBCOTT	Tobacco and cotton sales	CSTOBCOT	OTHCR	All other crop cash receipts
			COTT	Cotton cash receipts
V2M	Crop income from marketing contracts	V2M	FRUIT	Fruit and nuts cash receipts
			VEG	Vegetable and melon cash receipts
			ALLCR	All crop cash receipts

Source: USDA, Economic Research Service.

Forecasting Net Commodity Credit Corporation (CCC) Loans

Forecasted net CCC loans used in equation (2) for calculating gross cash farm income are set equal to the base year value because there is not currently a basis on which to forecast these loans at the farm level. For commodities covered by the program, the CCC provides farmers the option to place some portion of their crop with the CCC and receive the current commodity loan rate net of fees rather than marketing their production at harvest when prices are typically at their lowest. In addition, farmers pledge the harvest commodity as collateral for the loan, which can either be repaid within 9 months or the collateral can be forfeited. As a result, care must be taken to quantify the value and timing of the sale of crops placed with the CCC. In recent years, the value of CCC loans has been a very small share

¹¹ In ARMS, the income a farm operation receives from marketing and production contracts is reported separately from cash sales.

of total crop production. Still, including net CCC loans in the farm-level forecast enables a complete accounting of a farm's income.¹²

Forecasting Government Payments

Government payments (GP), a component of gross cash farm income (equation 2), are funds from the Federal Government paid directly to farmers and ranchers with no intermediaries. Typically, most direct payments to farmers and ranchers are administered by USDA using the Farm Bill or related authorities. Direct payments can also come from supplemental programs authorized by the U.S. Congress. The forecast for total Government payments is the aggregate of four subcomponent forecasts: conservation programs (*Conservation*), Farm Bill programs (*Farm_bill*), expiring programs (*Expiring_programs*), and all other Government payments (*All_other*) (table 2):

$$GP_{i,t+1} = Conservation_{i,t+1} + Farm_bill_{i,t+1} + Expiring_programs_{i,t+1} + All_other_{i,t+1} \quad (9)$$

Total Government payments are forecasted by subcomponent to capture any differences in year-to-year changes in payments by type of program. Programs may differ in how the payment amounts are triggered or funded. For example, payments administered through Farm Bill programs, such as the Price Loss Coverage (PLC) or Agricultural Risk Coverage (ARC), are triggered by declining commodity market conditions. In contrast, annual conservation payments can fluctuate based on additional appropriations. Expected changes in payments are reflected in the sector-level forecasts of direct Government payments by program or program type.

Each Government payment subcomponent is forecasted by multiplying the ARMS base year value by the change in the corresponding subcomponent value reported in the sector-level accounts. Below is an example of the forecasting method.

$$Conservation_{i,t+1} = Conservation_{i,t}^{ARMS} \times \frac{Conservation_{t+1}^{Sector}}{Conservation_t^{Sector}} \quad (10)$$

In equation (10), $Conservation_{i,t}^{ARMS}$ are conservation payments received by observation *i* in the ARMS base year data; $Conservation_{t+1}^{Sector}$ is the sector-level forecast for total conservation payments, and $Conservation_t^{Sector}$ is sector-level estimate for total conservation payments for the base year.

¹² CCC loan activity is reflected in the farm sector cash receipts estimates and forecasts but is not included in cash sales as reported in ARMS and used in the farm-level model.

Table 2

Government payment subcomponents used in the farm-level forecast model

Subcomponent (variable notation)	Description
Conservation programs (<i>Conservation</i>)	This subcomponent includes: • Conservation Reserve Program payments, • Conservation Stewardship Program payments, and • Environmental Quality Incentives Program payments.
Farm Bill programs (<i>Farm_bill</i>)	This subcomponent includes: • Agricultural Risk Coverage payments, • Price Loss Coverage payments, • marketing assistance loans, • loan deficiency payments, and • dairy program payments.
Expiring programs (<i>Expiring_programs</i>)	This subcomponent includes major ad hoc disaster assistance programs in which no new funding has been authorized but funding is still being administered. In various years, examples of such programs were the Market Facilitation Payment, Coronavirus Food Assistance Program, and Paycheck Protection program.
All other Government payments (<i>All_other</i>)	This subcomponent includes supplemental and ad hoc disaster assistance and all other programs, as a group. It is calculated as a difference between the total Government payments reported, and the three subcomponents defined above.

Source: USDA, Economic Research Service.

Forecasting Machine Hire and Custom Work, Insurance Indemnities, and Other Cash Farm-related Income

The farm-level model forecasts farm-level machine hire and custom work income, insurance indemnities, and other cash farm-related income using a similar method to Government payments by taking base year ARMS values and multiplying them by the change in the corresponding forecasts from sector-level accounts. Here, machine hire and custom work refers to payments received from custom work performed for other farmers using equipment owned by the servicing farm. As discussed in McGath et al. (2009), custom work measures the income from the farm assets acquired primarily for use in the farm's own business but also used to perform work on other farms or elsewhere when not required in the primary business. When equipment is purchased primarily to do custom work for others, income from this business would be recorded in the service sector rather than the production agriculture sector.

Insurance indemnities account for all insurance indemnity payments received by the farm operation. They include indemnity payments for all Federal and other crop and livestock insurance, casualty insurance, hail insurance, vehicles and equipment insurance, and blanket insurance policies. It also includes indemnities received on the producer's dwelling, if owned by the operation.

The final component of gross cash farm income (equation 2), other cash farm-related income, enumerates revenues accruing to farm operations from sources not accounted for elsewhere that involve the use of land, labor, or capital from the farm operation. This can include income from recreational activities (such as hunting, fishing, and camping); income from leasing grazing rights or carbon credits; and dividends received from farm cooperatives. It also includes income received by farms from the sale of forest products.

Forecasting Total Cash Expenses

Farm production expenses are the costs of inputs used in the production of farm commodities and farm-related income. Cash expenses are outlays made during a calendar year for purchased inputs, labor expenses, interest expenses, net rent to landlords, and property taxes. Cash expenses exclude capital expenditures (such as the purchase of land and machinery) and expenses related to operator dwellings. Total cash expenses (ETOT) are forecast across 20 expense categories:

- Interest expenses
- Insurance expenses
- Utility expenses
- Fertilizer, lime, and soil conditioner expenses
- Custom animal/animal product services and medical supplies
- Animal/animal product contractor expenses
- Cash rent and assets-under-management (AUM) fee expenses
- Property and real estate taxes
- Other variable expenses
- Machine hire and custom work expenses
- Land/building maintenance, repairs, improvement
- Repairs, parts, and accessories for equipment and vehicles
- Petroleum fuel and oil expenses
- Estimated capital lease expenses
- Seed expenses
- Contract labor expenses
- Hired labor expenses and labor fringe benefits expenses
- Animal/animal product leasing expenses
- Animal/animal product purchase expenses
- Feed expenses

Each expense category is forecast by multiplying the observed expenditure in the base year of the ARMS data by the forecasted change in expenditures in each category as reported in the farm-sector accounts. For example, seed expenses are calculated as follows:

$$SEED_{i,t+1} = SEED_{i,t}^{ARMS} \times \frac{SEED_{t+1}^{Sector}}{SEED_t^{Sector}} \quad (11)$$

In equation (11), $SEED_{i,t}^{ARMS}$ are seed expenses for farm i in the base year, t , from the ARMS data. The ratio $(SEED_{t+1}^{Sector} / SEED_t^{Sector})$ is the growth factor applied to adjust ARMS-based value, and is derived from the sector-level values. Specifically, $SEED_{t+1}^{Sector}$ are seed expenses from the sector-level accounts for the forecast year $t+1$, and $SEED_t^{Sector}$ are seed expenses from sector-level accounts for the base year t .

This farm-level forecast method (11) is modified for five out of 20 expense categories comprising the total cash expenses. Specifically, utility expenses (UTIL) are assumed to change with both the sector-level miscellaneous expenses (EMISC) and petroleum fuel and oil expenses (EFUEL):

$$UTIL_{i,t+1} = UTIL_{i,t}^{ARMS} \times \left(0.5 \times \frac{EMISC_{t+1}^{Sector}}{EMISC_t^{Sector}} + 0.5 \times \frac{EFUEL_{t+1}^{Sector}}{EFUEL_t^{Sector}} \right) \quad (12)$$

In equation (12), $UTIL_{i,t}^{ARMS}$ is the utility expenses paid by observation i in ARMS base year dataset.

Similarly, interest expense (INT) change is driven by the change in both sector-level nonreal estate interest expense (ENRINT) and sector-level real estate interest expense (ERINT):

$$INT_{i,t+1} = INT_{i,t}^{ARMS} \times \frac{ENRINT_{t+1}^{Sector} + ERINT_{t+1}^{Sector}}{ENRINT_t^{Sector} + ERINT_t^{Sector}} \quad (13)$$

Where $INT_{i,t}^{ARMS}$ is the interest expenses paid by observation i in the ARMS base year dataset.

Finally, three expense categories are currently assumed to remain unchanged from the base year: estimated capital lease expenses; land and building maintenance; and custom animal/animal product services and medical supplies.

Forecasting Depreciation for Use in the Farm Household Forecast Model

The farm-level forecast model produces a forecast of depreciation, $ENDEPR_{i,t+1}$, which is used as an input for the farm household forecast model. Depreciation forecast $ENDEPR_{i,t+1}$ is calculated for each observation i in the farm-level model as the base year depreciation reported by the household in ARMS multiplied by the rate of change in depreciation. The rate of change is calculated using the sector-level capital consumption expenditure forecast. Capital consumption represents the value of farm sector capital used up in the production process or damaged in a calendar year.

Farm-level Forecast Model Output

USDA, ERS reports farm-level average, calendar year net cash farm income (NCFI) for all farms and by the collapsed farm typology. Average NCFI is also reported by sales class (as measured by gross cash farm income (GCFI)), and for the family farms category. Additional data breakouts by Farm Resource Region and commodity specialization are reported for farm businesses, which are those farms with annual GCFI of at least \$350,000, or operations with less than \$350,000 in annual GCFI but that report farming as the operator's primary occupation. Farm Resource Regions are mutually exclusive regions defined using farm production regions, land resource regions, crop reporting districts, and farm characteristics (Heimlich, 2000). Commodity specialization is determined by a farm business having at least 50 percent of the value of production from a particular commodity. Farm businesses often produce multiple commodities, so average net cash farm income statistics should not be interpreted as resulting solely from the production and sale of the commodity highlighted as the specialization.

The most recent forecasts from the farm-level model can be found on the Farm Income and Wealth Statistics data product page on the USDA, ERS website (USDA, ERS, 2024a). Additionally, a written discussion of the forecasts along with map of the projected year-to-year change in average NCFI for farm businesses is available on the Farm Sector Income and Finances topic page (see USDA, ERS, 2024b).

Farm Household Forecast Model

The farm household forecast model produces forecasted medians and averages across principal operator households of family farms for the indicators listed below:

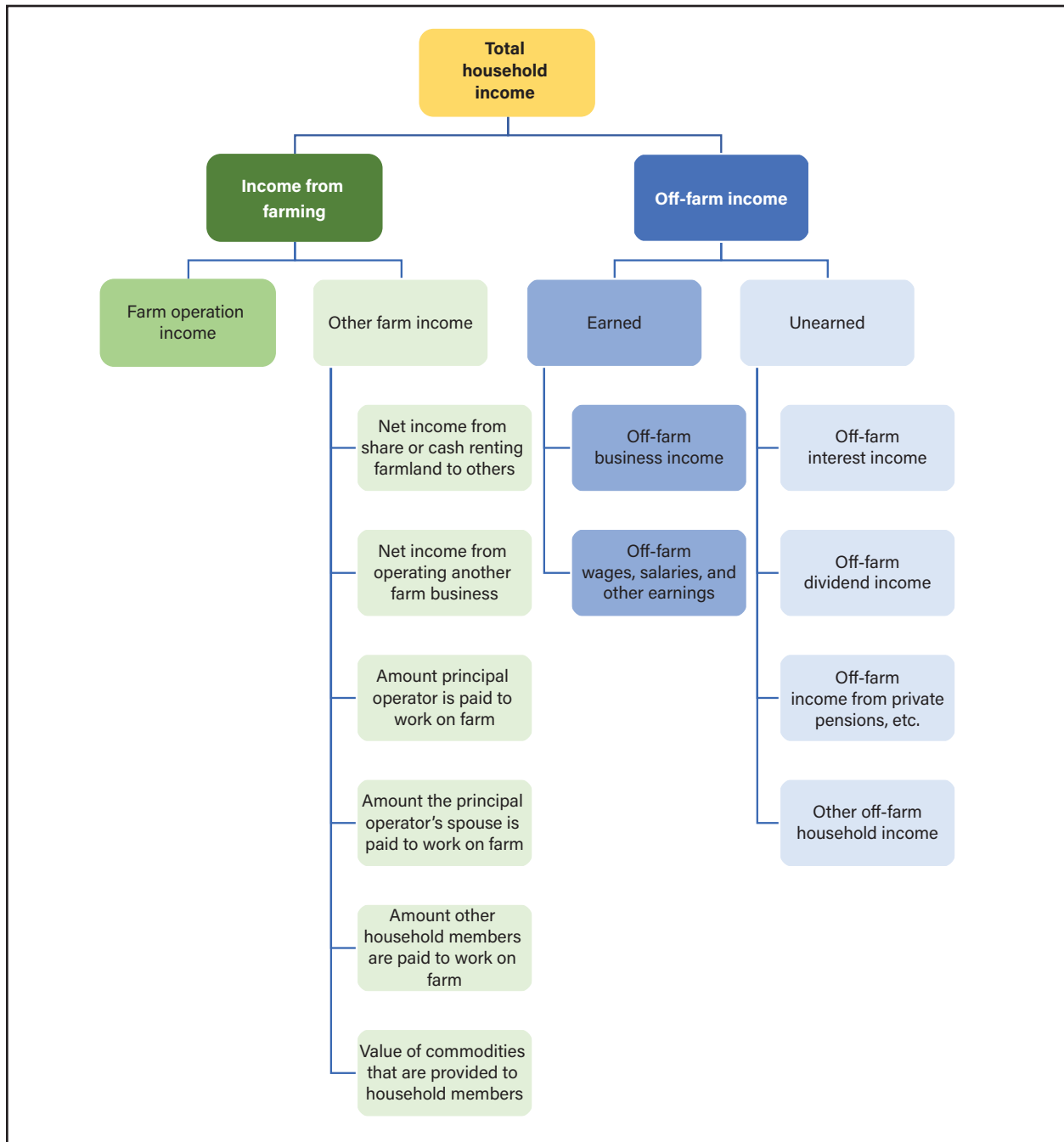
- Household income from farming
 - Farm operation income
 - Other farm income

- Household income earned from off-farm activities
 - Earned off-farm income
 - Unearned off-farm income
- Total household income

The components of the total household income are illustrated in figure 5.

Figure 5

Components of total household income



Source: USDA, Economic Research Service.

The model forecasts farm household income components for each household observation reported in the ARMS base year. The ARMS data and forecasts are used to calculate the reported farm household data product summary statistics, such as average or median total farm household income. In this section, we summarize the methods used for forecasting these key financial farm household indicators.

Household Income From Farming

Household income from farming (hereafter referred to using the shorthand—farm income, *FHHI*) is calculated as a sum of the income earned from the farm operation sampled for the ARMS base year survey (hereafter referred to using the shorthand—farm operation income, *FARMBHH*) and all other income from farming (hereafter referred to using the shorthand—other farm income, *OtherFARMHH*) received by the household:

$$FHHI_{i,t+1} = FARMBHH_{i,t+1} + OtherFARMHH_{i,t+1} \quad (14)$$

where i indexes operations in the ARMS dataset and $t+1$ is a forecast year.

The first component, farm operation income (*FARMBHH*), is based on the net cash farm income and depreciation output from the farm-level forecast model (see sections, Forecasting Net Cash Farm Income and Forecasting Depreciation for Use in the Farm Household Forecast Model). Depreciation is a non-cash expense that accounts for the decline in the value of capital assets owned by the operation. Depreciation is subtracted out in the calculation of farm operation income. The other subcomponent of the farm household income, *OtherFARMHH*, is the sum of income from the six sources defined in figure 5. The following subsections describe each component and subcomponent of farm household income from farming.

Household Farm Operation Income

The method of forecasting a household's farm operation income (*FARMBHH*) depends on the legal organization of the farm operation, which comes from the ARMS dataset (referred to as *FARMORG*). Farm operations can be legally organized as a:

- Sole proprietorship, when the farm is unincorporated and owned by one individual or two married individuals electing a qualified joint venture status for tax purposes (*FARMORG*=1)
- Legal partnership, a form of organization with multiple owners (*FARMORG*=2)
- C-corporation, an incorporated business with multiple owners (*FARMORG*=3)
- S-corporation, an incorporated business electing to be taxed as an S corporation with fewer than 100 owners and only individual or certain trusts or estates as owners (*FARMORG*=4)
- Other organization (e.g., estates, trusts, cooperatives, grazing associations) (*FARMORG*=5).

If a farm is legally organized as a C-corporation, the principal operator is entitled to dividends from the operation (*FOHHDIVC*) as a function of their ownership share of the farm operation if dividends are issued. In such cases, the forecasted principal operator's household farm operation income equals the value of corporate dividends received by the household as reported in the base year ARMS data:

$$FARMBHH_{i,t+1} = FOHHDIVC_{i,t}^{ARMS} \text{ if } FARMORG = 3 \quad (15)$$

For all other legal organizations (i.e., a sole proprietorship, legal partnership, S-corporation, or other type of organization), the principal operator's farm operation income is a function of their ownership

share of the farm operation, farm profitability, and farm depreciation. The household share of farm operation income is defined as the operation-level net cash farm income (*NETCSH*) less the operation's depreciation expense (*ENDEPR*) multiplied by the farm household's ownership share of the farm operation (*FOHHPCTI* / 100). The household income from the farm operation concept matches that from U.S. Department of Commerce, Bureau of the Census surveys of the self-employed, where self-employment income is equal to cash income less cash expenses and depreciation expenses. The only non-cash adjustment to income is depreciation.

The household forecast model uses forecasted *NETCSH* and *ENDEPR* values from the farm-level model to generate the forecasted household income from the farm operation (*FARMBHH*_{*i,t+1*}). The principal operator household ownership share of the farm operation (*FOHHPCTI*/100) comes from the ARMS base year data.

$$FARMBHH_{i,t+1} = (NETCSH_{i,t+1} - ENDEPR_{i,t+1}) \times \frac{FOHHPCTI_{i,t}^{ARMS}}{100} \text{ if } FARMORG = 1, 2, 4 \text{ or } 5 \quad (16)$$

Household Other Farm Income

Unlike the forecast for the farm operation income to the household (*FARMBHH*), the components for other farming income are carried forward from the base year amounts observed in ARMS and are not adjusted for inflation or projected income growth. The forecast of all other farm income to the household is defined as follows:

$$\begin{aligned} OtherFARMHH_{i,t+1} &= FARMRENT_{i,t}^{ARMS} + OTFBUSI_{i,t}^{ARMS} + OPPD_{i,t}^{ARMS} + SPPD_{i,t}^{ARMS} \\ &+ HMPD_{i,t}^{ARMS} + HH_COMM_{i,t}^{ARMS} \end{aligned} \quad (17)$$

Where the forecast of all other farm income to the household is the sum of the following income types:

- net income from share or cash renting farmland to others (*FARMRENT*),
- net income from operating another farm business (*OTFBUSI*),
- the amount the principal operator is paid to work on the farm (*OPPD*),¹³
- amount the principal operator's spouse is paid to work on farm (*SPPD*),
- amount the other household members are paid to work on farm (*HMPD*), and
- the value of commodities provided to household members (*HH_COMM*).¹⁴

The amount that the operator is paid to work on the farm (*OPPD*) is equal to 0 if the farm is organized as a sole proprietorship, partnership, or other organization (*FARMORG* = 1, 2, or 5), because those owner-operators do not receive a salary to work on the operation, but rather receive compensation

¹³ Operators of C- and S-corporations may also pay themselves a wage for operating the farm, and those payments are included both as an expense to the business and as income to the farm household when they are paid.

¹⁴ This includes the cash value of all commodities produced by the farm and consumed by family members. This also includes non-cash payments to members of the principal operator household who worked on the farm operation including the value of payments such as a percentage of crops, calves, etc. It excludes producer payments or draws.

for their work through business profits. This matches how these operations file their taxes in that compensation for their labor and management comes from the net income from the farm operation. If the operation is legally organized as a C- or S-Corporation (FARMORG = 3 or 4), then OPPD may be positive if the operator is an employee of the farm operation.

Household Off-farm Income

Six off-farm income sources reported in ARMS are used to calculate household off-farm income. The off-farm income sources reported in the ARMS base year are forecast to grow by the projected growth rate of the relevant economic indicator as obtained from Oxford Economics' Global Databank (table 3).

Table 3

Off-farm income sources: summary and forecast indicators

Off-farm income sources	Description	Oxford Economics indicator used
Earned income (EARNED)		
Off-farm business income (OFFBUSI)	Net cash income from operating any other nonfarm business (net of depreciation)	Industrial production index (Federal Reserve Board)
Off-farm wages, salaries, and other earnings (ADJWAGE)	Household members' wages and salaries excluding those received from the farm business	Employment cost index (Compensation: civilian workers, U.S. Department of Labor, Bureau of Labor Statistics)
Unearned income (UNEARNED)		
Off-farm interest income (OFFINT)	Interest income not accruing through the farm business	Gross Domestic Product (GDP) per capita, nominal (U.S. Department of Commerce, Bureau of Economic Analysis)
Off-farm dividend income (OFFDIV)	Dividend income not accruing through the farm business	Total fixed investment, nominal (Bureau of Economic Analysis)
Off-farm income from private pensions, private disability payments, and income from public sources (OFFSS)	Income from private pensions and private disability payments, public sources of income include Social Security payments, military, and other public retirement, veteran's benefits, public disability, unemployment, or other public assistance	Consumer price index (CPI-U, Bureau of Labor Statistics)
Other off-farm household income (OFFOTH)	Any other reported off-farm sources of income	Nominal GDP per capita (Bureau of Economic Analysis)

Source: USDA, Economic Research Service.

The forecasted household total off-farm income (*TOFFI*) is the sum of two income components: earned and unearned off-farm income.

$$TOFFI_{i,t+1} = EARNED_{i,t+1} + UNEARNED_{i,t+1} \quad (18)$$

Earned income (*EARNED*) includes forecasted household off-farm wages, salaries, and other earnings (*ADJWAGE*) and off-farm business income (*OFFBUSI*):

$$EARNED_{i,t+1} = ADJWAGE_{i,t+1} + OFFBUSI_{i,t+1} \quad (19)$$

Unearned income (*UNEARNED*) is the sum of the remaining off-farm income components: off-farm interest income (*OFFINT*), off-farm dividend income (*OFFDIV*), off-farm income from private pensions, disability, military, and other retirement, Social Security, unemployment, Veterans benefits, other public retirement and assistance (*OFFSS*), and other off-farm household income (*OFFOTH*):

$$UNEARNED_{i,t+1} = OFFINT_{i,t+1} + OFFDIV_{i,t+1} + OFFSS_{i,t+1} + OFFOTH_{i,t+1} \quad (20)$$

Total Household Income

Forecasted total household income (*HHI*) is the sum of forecasted household off-farm household income (*TOFFI*) and forecasted total household income from farming (*FHHI*):

$$HHI_{i,t+1} = TOFFI_{i,t+1} + FHHI_{i,t+1} \quad (21)$$

Farm Household Forecast Model Output

USDA, ERS reports median and average values for the total household income, household income from farming, and off-farm household income (total, earned, and unearned). The most recent estimates and forecasts of household income along with estimates of household assets and debt can be found on the Farm Household Income and Characteristics data product page on the ERS website (USDA, ERS, 2024c). Additionally, a written discussion of the current household forecast along with a chart is available on the Farm Household Well-being topic page (USDA, ERS, 2024d).

Conclusion

The USDA, ERS farm-level and farm household forecast models provide valuable insights into how changes in the farm sector and the broader U.S. economy impact the profits of farm operations and the households that operate them. This report provides transparency on how USDA, ERS forecasts these ARMS data-based financial indicators for farms and farm households.

The two USDA, ERS forecast models rely on observations (farm-level data) from ARMS. The first model, the farm-level forecast model, applies item-specific growth/decline rates from the sector-level farm income forecast to underlying income and expense categories as measured in the most recently available (the base year) ARMS data. The model forecasts income and expense categories for each farm in the base year ARMS data. The model output is then summarized as average farm-level net farm income values for all farms, as well as certain farm groupings. The second model, the farm household forecast model, uses forecasted net cash farm income and depreciation values from the farm-level forecast model as an input to forecast household income from farming. The model also forecasts off-farm household income using off-farm income reported in the base year ARMS and applying growth/decline rates for macro-economic forecast indicators reported by Oxford Economics. The household-level model output is then summarized as average and median farm household-level

values for total household income, household farm income, and household off-farm income across all family farms.

The models have important limitations. Farm operations are diverse and respond differently to changes in the farm economy. However, the farm-level forecast model assumes a uniform rate of growth or decline in expense items and cash sales for commodities produced in the base year. Similarly, the farm household forecast model considers the variety of income sources for each farm household but assumes a uniform rate of growth or decline rate in each off-farm income source across all farm households.

Despite these limitations, the farm-level and farm household-level forecasts are a valuable complement to the USDA, ERS forecast for the entire U.S. farm sector. The forecasts inform public and private decision makers about the ability of different farm groups, farm businesses, and farm households to meet their calendar year cash flow commitments. The forecasts are also informative about the degree of economic stress or prosperity of farms and how this differs by farm size, typology, commodity specialization, and region.

This technical bulletin provides consumers of the farm-level and farm household-level forecasts with essential information to better understand the forecasts and trends in the data. It also serves as a first step in considering model improvements to more accurately and effectively capture the diverse population of farm operations and households, and to explore alternative forecasting methods.

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Glossary

Agricultural Resource Management Survey (ARMS): Annual survey from USDA, National Agricultural Statistics Service (NASS) and USDA, Economic Research Service (ERS). ARMS is the USDA's primary source of information on the production practices, resource use, and economic well-being of America's farms and ranches. The results of this survey give farmers, ranchers, and many others factual insights into many aspects of farming, ranching, and conditions in agricultural communities.

Base year: In the forecast models described in this report, the most recent year for which data from the Agricultural Resource Management Survey (ARMS) are available.

Cash receipts: The market value of agricultural commodities removed from the farm, regardless of who receives payments for the products. In farm sector accounts, it includes sales accruing to farm operators and landlords, as well as sales under production and marketing contracts.

Cash expenses: The sum of farm origin (feed, livestock and poultry purchases, and seed), manufactured (fertilizer and lime, fuels and oils, electricity, and pesticides), interest, labor, property taxes/fees, and other cash expenses (such as repair and maintenance, machine hire and custom work, marketing, storage and transportation, and miscellaneous other expenses). These expenses exclude non-cash expenses such as capital consumption and noncash benefits to hired labor and expenses associated with operator dwellings.

Cash sales: The revenue received by the farm operation for crop and animal/animal product sales. In the farm-level model described in this report, it also includes income or fees from marketing or production contracts received by the farm operation.

Commercial farm: Any farm with \$350,000 or more in gross cash farm income, regardless of the principal operator's occupation, and can include all nonfamily farms.

Commodity specialization: Determined by the one commodity or group of commodities that makes up at least 50 percent of the farm's total value of agricultural production. If a farm does not have one commodity or one related group of commodities that makes up 50 percent of the total value of production, then the farm is classified as an other crop or other animal/animal product operation.

Data product: Refers to data sets created by USDA, ERS grouped around a particular topic. USDA, ERS continually assesses the needs of data users and provides a range of products that address those needs most effectively.

Economic Research Service (ERS): One of the agencies embodied in the U.S. Department of Agriculture. The mission of USDA, ERS is to anticipate trends and emerging issues in agriculture, food, the environment, and rural America and to conduct high-quality, objective economic research to inform and enhance public and private decision making.

ERS Farm Resource Regions: Defined in 2000 based on county-level farm, land, and soil characteristics from the 1970s to early 1990s. Farm Resource Regions are the Northern Great Plains, Heartland, Northern Crescent, Eastern Uplands, Southern Seaboard, Mississippi Portal, Prairie Gateway, Fruitful Rim, and Basin and Range.

ERS farm typology: Farm classification system that groups farms into size categories. The classification is based largely on the farm's annual gross cash farm income, the primary occupation of the principal operator, and ownership of the farm.

Family farm: Any farm in which the majority of the business is owned by an operator and any individuals related to them by blood, marriage, or adoption, including relatives who do not live in the operator's household.

Farm business: Any farm operation with an annual gross cash farm income of \$350,000 or more, or a farm operation where the principal operator's primary occupation is farming.

Farm household of principal operator: Comprised of all people who share dwelling units with the principal operators of family farms.

Government payments: Funds from the Federal Government paid directly to farmers and ranchers with no intermediaries. Typically, most direct payments to farmers and ranchers are administered by USDA using the Farm Bill or related authorities. Direct payments can also come from supplemental programs authorized by the U.S. Congress. Government payments do not include Federal Crop Insurance Corporation (FCIC) indemnity payments (listed as a separate component of farm income), USDA loans (listed as a liability in the farm sector's balance sheet), or direct payments from State or local government programs (included in other cash farm-related income).

Gross cash farm income: A measure of the farm's revenue (before deducting expenses) that includes sales of crops and animal/animal products, payments made under Federal agricultural programs, and other farm-related cash income, including fees or income from production contracts.

Intermediate farm: Any farm with less than \$350,000 in annual gross cash farm income and the principal operator reports farming as their primary occupation.

Net cash farm income: A measure of cash profits equal to gross cash farm income less total cash expenses.

Non-cash expenses: Include capital consumption and noncash benefits to hired labor.

Other cash farm-related income: Revenues accruing to farm operations from sources not included elsewhere and involve the use of land, labor, or capital from the farm operation. This can include payments received for use of the farmland and bodies of water for recreational purposes (such as hunting, fishing, and camping); income from leasing grazing rights; and dividends received from farm cooperatives. It excludes non-cash income, such as the gross imputed rental value of farm dwellings.

Principal operator: Person most responsible for the day-to-day decision-making on the farm.

Residence farm: Any farm with less than \$350,000 in annual gross cash farm income and the principal operator reports being retired or having a major occupation other than farming.

U.S. Farm Sector Income Forecast: USDA, ERS's forecasts of economic performance indicators for the U.S. farm sector as a whole.