

Data Training Webinar Transcript:
Resource Requirements of Food Demand

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Ashley Murdie: Good afternoon, everyone! I'm Ashley, your host for today's data training webinar. On behalf of USDA's Economic Research Service, welcome and thank you for joining us. Today's session will provide an overview of the new Resource Requirements of Food Demand data product, highlight its uses, and demonstrate how to access it on the ERS website. Before we begin, I'd like to note that this webinar is being recorded and will be posted to the ERS website. If you have any questions during the presentation, please submit them using the Q&A feature at the bottom of your screen, and we'll try to answer a few after the presentation. If we don't get to yours today, please email us. We're happy to follow up. Now, it's a pleasure to introduce today's speaker, ERS Economist Sarah Rehkamp, from our Food Economics Division. Thanks for sharing this new data product with us today, Sarah. I'll turn it over to you now.

Sarah Rehkamp: Great, thanks, Ashley. Hi, everyone. Thank you for being here today, and for your interest in this webinar. My name is Sarah Rehkamp, and I'm a research agricultural economist at the U.S. Department of Agriculture's Economic Research Service, or ERS. Today, I'll be presenting on the Resource Requirements of Food Demand.

I'd first like to share a few highlights from the Resource Requirements of Food Demand Data Product, which we also refer to as RRFD, its acronym. Domestic resources, which may be non-renewable or scarce, are key inputs into U.S. food production. Secondly, the U.S. food system's share of national resource use varies based on the resource considered. So, if you look to the right, you can see in this figure that food system resource use ranges from 11 percent of total energy to 16 percent of employment, to 29 percent of water in 2023. The data also show that the distribution of resources along the supply chain vary. Agricultural production requires energy, labor, and water, but substantial resources are also used in supply chain stages downstream from the farm.

So, on this slide, I have the outline, and this is a roadmap for the rest of today's webinar. I'll be giving an overview of what RRFD is and why it's important. Then, I'll discuss how RRFD was developed. Next, I'll demonstrate how the data are accessed and what's included in the data product. I'll give a few examples of how RRFD can be used, and then there should be time to take a few questions after that.

So, RRFD is the acronym we use for Resource Requirements of Food Demand, a new data product that our agency first released this past spring. RRFD measures the U.S. food

system's annual energy, labor, and water use. These data provide insights into how and where resources are being used throughout the food supply chain from farm to fork.

This slide is speaking to the motivation behind RRFD and why these data are relevant. The majority of food and beverages marketed and consumed in the United States are domestically produced, and domestic resources are key inputs. The figure shows that 84 percent of food and beverages were domestically produced in the United States, with 79 percent of domestic inputs based on the dollar value in 2023. In the future, changing food demand could be met with increasingly constrained resources.

Here, I'm going to summarize the steps in developing RRFD. To develop the data system and model, we link resources and physical units to economy-wide production activities that's shown in step three. But first, we need to develop the input data. We developed the resource data for employment, energy, and water, which involves estimating an annual time series. Secondly, we develop allocation metrics, which are additional data used to distribute the resources accurately to economic activities. For example, we need to map crop irrigation water to oilseed farming, or grain farming, or other model activities. Then, with the resources allocated, we're ready for step four, which is applying a resource multiplier model to generate embodied resource use linked to the U.S. food system. Our model is food system specific, so it captures salient attributes of the food system, such as the cold chain, or in other words, the refrigeration needed to keep food at an appropriate temperature. This generates the RRFD results that are in the data product. And this modeling approach we use allows for consistent boundaries of analysis and data output compared to other approaches, so the results are comparable and comprehensive.

Our scope is the U.S. food economy from farm inputs to households. We also measure the resources used to distribute and market imports. We're measuring that area in the middle of this simple Venn diagram, which represents the U.S. food system resources embodied in domestic consumption. We exclude the resources used in the food system's production of exports, and we also exclude the resources used in the country of origin in the production of direct imports, such as an international bottle of wine that may be part of the U.S. diet.

By embodied resources, we mean the total resource use, or direct plus indirect resource use throughout the system. For example, in the beef supply chain, we measure the water that the beef cattle drink, but also the water used to irrigate the crops that become livestock feed. We measure the water used by thermoelectric plants to generate electricity use throughout the beef supply chain, the water used in processing plants, and also the water used in home kitchens.

We use many public data...excuse me...We use many public government data sources to generate RRFD. First, we use the Agri-Food Economic Data System, or AG-FEDS, for the economic data. This is a data system that was developed at ERS, and we now make publicly available as a data set on the ERS website. For the resource data, the primary data source for employment comes from BEA, or the U.S. Bureau of Economic Analysis, the Energy Information Administration, or EIA, publishes the energy data, and we use water data from the U.S. Geological Survey, or USGS. We use some of these data inputs directly, and in some cases are estimating suppressed data or forecasting a time series. And you can get more information by following the QR code here on the screen.

We recently published 3 technical bulletins that are available on the ERS website if you'd like to dig deeper into our methods. So, the first report here describes how we link the resource data to economic activities. The middle report describes the development of Ag-FEDS, the economic data we use. And then the third report on the right-hand side describes how we bring these data together. We present the RRFD multiplier model application, and how the results are generated. So, all three of these reports together offered a detailed description of the methods with the matrix algebra and described how we've made advancements from previous work in this area. These advancements include developing a time series in the data, refining our allocation metrics of the resource data, and disaggregating the data further, such as adding food and beverage categories, which all show on the upcoming slides here.

The RRFD data have several different dimensions, allowing a comprehensive picture of resource use in the U.S. food system. The data are annual, and currently available from 2010 to 2023. The three resources covered are employment, energy, and water. Employment is measured in full or part-time employees. Energy is measured in billion British thermal units, or BTUs, and freshwater withdrawals unit of measurement is million gallons.

For energy, we have a further breakout into 14 energy sources, which are listed in the table here on the right. Some examples include electricity, natural gas, or petroleum products, which are the top three used in the food system. We usually are grouping these into categories that make sense in presenting the results such as a renewables category.

RRFD data can be broken out by marketing channel as well. The marketing channels include food at home, food away from home, alcohol at home, and alcohol away from home. These are in the darker blue headers in the table. For food away from home, there are seven sub-channels listed, such as food at full-service restaurants, or food at schools and colleges. We also have three sub-channels under alcohol away from home including full-service restaurants, limited-service restaurants, and other food and drinking places.

For the at-home marketing channels, we have breakouts of food and beverage categories. We are now able to look at 31 different categories listed the tables here. Some examples include cereals, bakery products, beef or wine. I wanted to have this comprehensive list here for you to see, but these categories can also be found on the RRFD webpage or in those technical bulletins.

Finally, the RRFD data can also be broken out into supply chain stages. There are up to 16 distinct stages for each resource, which are listed in the table. And I say up to since there are some categories where employment is mattered or the household related stages would only apply to food and beverages at home. We usually group these stages where it makes sense, such as combining the household-related stages. To provide an example of how detailed one could get with the dimensions, you could pull out the data on water use for the processing stage of at-home fresh milk in a particular year.

So, we just went through a lot of information on how the data can be disaggregated. This figure summarizes the hierarchical structure of the data tables, and you can find this on the RRFD webpage. So, this can be a good reference for those of you may be getting started using the data and figuring out the table numbering convention we use. This represents a bridge between what I described in words thus far in the webinar and what the data product looks like. For example, at-home food and non-alcoholic beverage categories such as bakery products or fresh milk have the table numbers that start with Xf11. When these categories are summed together, these data equal the parent category total XF1100 or all food and non-alcoholic beverages at home. We can also look at the sum of the rows in this figure. The categories Xf1200 (this number is in red representing food and non-alcoholic beverages away from home) plus Xf1100 (shown in blue representing food and non-alcoholic beverages at home) equal that parent category Xf1000 (shown at the end of the row with the purple background). Lastly, to get total food system resource use in RRFD, one could look at the table Xf0000. Alternatively, these data can be calculated as the sum of Xf1000, Xf2000, and Xf3000, which adds together all food and non-alcoholic beverages, all alcoholic beverages and home kitchen operations and transportation. So, this is shown here as a column sum on the right of this figure.

Now that I've described the RRFD data, I'm going to demonstrate how the data product can be accessed on our website. This is a screenshot of the ERS homepage at www.ers.usda.gov. From here, there's two ways to navigate to RRFD. First, you can click the data header outlined in red across the top.

Once clicking on that data header, you'll come to this drop down where you can select 'browse all data' or 'downloadable data files.'

You'll be navigated to this page with a listing of the data that ERS produces. You can then go to filter by keyword, which is at the bottom of the left navigation bar highlighted in red in this slide. Here you would type RRFD or if you prefer, Resource Requirements of Food Demand, to find the data product.

Back on the ERS homepage, you could alternatively go up to the search bar in the upper right and type in the search term RRFD or again, Resource Requirements of Food Demand, which would then bring up these results. Clicking on any of the results below the search bar will bring you to one of the RRFD webpages.

The third way to find the data product is to directly type this web address into your browser's address bar.

This will navigate you to the overview section of the Resource Requirements of Food Demand, where we give a brief summary of the data product.

We provide some additional webpages beyond the RRFD overview. The documentation page contains several sections including data sources, coverage of the data and others listed here in the bullet points. This is a good place to go to find some of the information I've covered already so far today. And you can navigate this page by clicking on 'documentation' in that left navigation bar.

You can also navigate down to the 'highlights and interactive charts' page. Here you can see the data visualizations that we put together using RRFD.

The first chart shows the food system's share of national resource use over time. For example, you can see that a higher percentage of water use is linked to the U.S. food system compared to employment or energy.

If you scroll down on the webpage, you'll see three horizontal stacked bars showing the breakout of U.S. food system resource use by supply chain stage. Here I'm using employment as an example. In the upper right you can interact with the data by selecting different years that you may be interested in. You can also select the different marketing channels. We have all food, which is the U.S. food system, food at home, or food away from home. In each visualization, there's a tooltip, which is that box that overlays the figure when you hover over a data point that gives more data and information. By looking at this figure, you can see that food services makes up a large share of U.S. food system employment, but when hovering over the food services segment in the visualization, you can see that a share is 51.5 percent in 2023.

These data can be used to compare resources across different marketing channels. For example, this figure compares employment by supply chain stage for food at home in the

top bar to food away from home in the bottom bar. You can see that most employees are linked to food wholesaling and retailing for food at home, which is that orange segment, whereas food service employees make up the greatest share for food away from home shown in dark blue.

Our third visualization shows food and beverage category share of food-at-home resource use organized by the share. Again, you can select different years and then in the second drop, here you can select which resource you're interested in. There are varying resources linked to food and beverage categories which is dependent on the production requirements and quantities purchased by U.S. consumers.

Using these data, one could compare the resource use of various food and beverage categories that we show in this figure. If we look at that first cluster of bars along the X axis, which is showing bakery products, the employment share of food at home resource use is higher than the energy and water shares. However, if you go to that last cluster of bars, you can see the reverse. The water share of food at home resource use for the sugar and sweets category is higher compared to the other resources.

Finally, we have an updated and revisions history page for RRFD. Data are evolving and we're always trying to improve what we do at ERS, so we use this page to document changes for users' awareness. There has been one version of the data published publicly, but we've had a couple updates already since our technical bulletins were published.

So now I'm going to demonstrate how you can access the data product. At the bottom of the RRFD overview webpage, you'll see the option to download files which I've outlined in red at the bottom of this page.

The zip file contains two files which will need to be extracted. The first is as CSV or a machine-readable file with the data. The second is a text file which provides a readme or a summary of information about the data.

Here's a screenshot of the readme. You can see that this is showing some of the information in the file such as distinct values or additional detail in each of the data columns.

Once you open the CSV file, here's an example of what the data will look like. We have the headings at the top describing what's in the columns. You can then read these data into your preferred statistical software. Or as I'll demonstrate next, you can review the CSV file as is or use excel to find the data you're interested in.

So, I have two examples I'd like to go through to show how to begin to work with the RRFD data. First, you may have the question, which table represents food and non-alcoholic beverages at home?

Going to the CSV data file, you could look at the table number and table description columns. You could easily scroll down to find food and non-alcoholic beverages at home's associated table number, which is Xf1100. So, the answer to the first question is Xf1100.

So, in the second example, here say you're interested in more information in food at home. You may ask the question, how much water was used for food and non-alcoholic beverages at home in 2023?

A good place to start would be to open the CSV file with excel, then to better work with the data, you can find the sort and filter button in the top panel towards the right-hand side, which I've outlined in red on this slide. By clicking on that, this will bring up these downward facing arrows in the column headings, which you can click on to see the distinct values in each column and how the data can be filtered.

From the first example, we know that the table number for food and non-alcoholic beverages at home is Xf1100. You could go to the table number column, click the filter, select Xf1100 and then click okay. This filtering pulls out the Xf1100 data from the full data set and this is our first step towards answering our question of interest.

Since we're interested in water, you could next go to the resource column. You could click the filter, select water, and click okay to generate these truncated results.

Finally, to answer the question, we'll want to filter by year. You'd filter the year column to only show 2023 data and then view the results.

Using these steps, we can look at the data below to find the relevant dimensions. We find the answer to our question in the first row, last column. We find that there were 15 trillion gallons of water linked to food and non-alcoholic beverages at home in 2023. We get 15 trillion annual gallons after converting for million gallons per year, the unit the data are recorded in. To provide a comparison, the 15 trillion gallons is equivalent to nearly 23 million Olympic size swimming pools.

Looking forward, the RRFD data that are available offer opportunities for additional research and modeling applications. In the past, ERS researchers have explored the resource requirements of different dietary patterns. We've also looked at how different policies or prices affect resource use. At this point, we're anticipating providing data updates. And that concludes the presentation part of the webinar. Thank you so much. I

really appreciate your time and attention today. And now I think we have some time to take a few questions if there are any, so I'll turn it back to Ashley. Thanks again.

Ashley: Wonderful. Thanks, Sarah. We'll take a few questions now from the Q&A box. Just a reminder, if we don't get to your question today, please email us at ers.press@usda.gov and we'd be happy to follow up with you. But for our first question, let's see here. Could you look at just one supply chain stage, such as processing?

Sarah: Yeah, definitely. So, using the filtering tool that I had described during the example, you could focus on the food processing stage for different marketing channels or even if you wanted to look at a specific food and beverage category.

Ashley: Thanks! Our next question asks does RRFD include any measures of production volumes or values by food category?

Sarah: I'm sorry, could you please repeat that question, Ashley?

Ashley: Absolutely, this question is asking does the data product include any measure of production volumes or values by food category?

Sarah: Thank you for that. So, what the RRFD data product does provide is the resource use associated with U.S. food expenditures.

Ashley: Got it. For our next question, do users need to use the CSV file to find the statistic that they're looking for?

Sarah: No, not necessarily. So, this is one way to get at our full data set, but a good place is going to our data visualization. And that's where you can start getting a feel for the types of questions that can be answered with the data.

Ashley: Thanks, Sarah. Next up, let's see here... are there food and beverage categories that stand out across all resources?

Sarah: You know, we see variation over time and across the different food and beverage categories and their associated resource use, but bakery products is a consistently higher resource user compared to the other categories. And, you know, as a reminder, the resource use is based on both the production requirements and also the quantities purchased by U.S. consumers.

Ashley: Thank you. Next step, will more recent data be released? If so, when will the additional data be available?

Sarah: Moving forward, we do anticipate updates and adding additional years of data about once a year.

Ashley: Thanks! Okay, let's see. Next question. What are the differences between all food, food at home, and food away from home?

Sarah: So, all food refers to the U.S. food system. Food at home and food away from home are the other marketing channels that we present in the data. Food at home would be food purchased at grocery stores, for example, and then food away from home is food purchased at other outlets, such as restaurants.

Ashley: Alright, next up, can we anticipate state or county level data in the near future, so that it can be merged with other data sets for research purposes?

Sarah: So, at this time, RRFD is output from a national level model. We do use some sub-national data to develop the estimates, but I would say not at this time do we have plans to regionalize this.

Ashley: Thanks, Sarah. Let's see... next up, how is Ag-FEDS related to this data product?

Sarah: So, Ag-FEDS is the underlying economic data system that we use to develop RRFD. And I would definitely recommend checking out the technical bulletins. There were the QR codes on the earlier slides. These are on our website and really present a lot of detailed information on Ag-FEDS.

Ashley: Thanks, Sarah. I think we have time for one more question. Let's see here... are there any limitations in the data to be aware of?

Sarah: Yeah, so as was addressed in the recent question here, is that this is a national level model, so this will not necessarily speak to regional variations. And then one thing I would mention as well is that we weren't able to allocate household resource use to the individual 31 food-at-home food and beverage categories, and that's indicated in a note in the data visualization. This also came up, but as a reminder, resource use is based on both production requirements and the quantities purchased by U.S. consumers, and these and other limitations are also documented on the RRFD webpage and also those technical bulletins, which I think are great resources that could provide further information.

Ashley: I know I just said last question, but this is the last, last one. What year do the data set cover?

Sarah: Thank you for that question. So, the data are currently from 2010 through 2023.

Ashley: Thank you so much, Sarah. Next slide, please. All right, for, or to learn more about ERS research and our available data products, please visit our website at www.ers.usda.gov. There, you can subscribe for topics of interest, including our popular charts of Notes series. You can also find us on social through LinkedIn and X. Again, thanks

for joining us today. We appreciate your time and interest and hope this was helpful. Have a wonderful day. This concludes our webinar.