



# Land Values Methodology and Quality Measures

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## Survey Methodology for Land Values

**Scope and Purpose:** Land values are estimated annually in August. Estimates are published for the United States and by State, except Alaska and Hawaii, and include the value per acre of all farm real estate, cropland, and pasture. Value per acre estimates are also published for States with a prevalence of both irrigated and non-irrigated cropland. In addition, the publication contains estimates for the total value of all farm real estate by State, except Alaska and Hawaii, and for the United States.

In 2021, the data were collected as part of the June Area Survey (JAS), a multipurpose survey used to estimate crop acreages and measure incompleteness of the NASS list frame for numerous other surveys. The JAS is conducted in all States except Alaska and Hawaii. In 2020, the Agricultural Land Values survey was conducted as a follow-on survey in which the same operators that were in segments of land from the 2019 JAS were contacted.

**Survey Timeline:** Presurvey screening began in late March to identify farm operators to be contacted. Data collection is conducted from the end of May through mid-June. The reference date for the June Area Survey is June 1. Regional Field Offices (RFOs) conduct editing and analysis from early June to the end of data collection. Once editing is complete, the data are summarized. Following summarization, RFOs review the survey results for States within their regions and submit State level recommendations to NASS headquarters in mid-July. A National review is completed and National estimates are established. The land values estimates are published annually in early August.

**Sampling:** The target population for the land values estimates is all farms and ranches with \$1,000 or more in agricultural sales (or potential sales). The JAS utilizes an area sampling frame. The area frame consists of all land in all States, except Alaska and Hawaii, and thus represents all farms and ranches. The frame in each State is divided into segments of land. For more intense agricultural regions, segments are about one square mile in size. An optimal sample is selected in each State with a National sample size of approximately 9,000 segments. The cost of building the frame and preparing materials for enumeration is significant, so sampled segments are in the survey for five consecutive years. About 20 percent of the segments are rotated out and replaced with new ones each year.

Field enumerators divide the segments into tracts, each tract representing a unique operating arrangement. Some of the tracts do not qualify under the farm definition and screen out; the remaining agricultural tracts become the sample for land values. Tracts identified on American Indian Reservations in Arizona, Nevada, New Mexico, and Utah as well as tracts in public land and non-agricultural land use strata in all States are excluded from the sample.

**Data Collection:** Each enumerator is responsible for several segments of land. Enumerators must account for all operations and land contained in their assigned segments. Segment photos and county maps were mailed to respondents at the start of data collection. Contact with each respondent is attempted by an enumerator and, when possible, a phone interview is conducted.

Questionnaire content and format are evaluated annually through a specifications process where requests for changes are evaluated and approved or disapproved. Input may vary from question wording or formatting to a program change involving the deletion or modification of current questions or addition of new ones. If there are significant changes to either the content or format proposed, a NASS survey methodologist will pre-test the changes for usability.

All federal data collections require approval by the Office of Management and Budget (OMB). NASS must document the public need for the data, show the design applies sound statistical practice, ensure the data do not already exist elsewhere, and that the public is not excessively burdened. The questionnaire must display an active OMB number that gives NASS the authority to conduct the survey, a statement of the purpose of the survey and the use of the data being collected, a response burden statement that gives an estimate of the time required to complete the form. It must also include a confidentiality statement that the respondent's information will only be used for statistical purposes in combination with other producers and a statement saying that response to the survey is voluntary and not required by law.

**Survey Edit:** As survey data are collected and captured, data are edited for consistency and reasonableness using automated systems. Reported data are edited as a batch of data when first captured. The edit logic ensures the coding of administrative data follows the methodological rules associated with the survey design. Relationships between data items (i.e. responses to individual questions) on the current survey are verified. Some data items in the current survey are compared to data items from earlier surveys to ensure certain relationships are logical. The edit will determine the status of each record to be either "dirty" or "clean" (i.e. failing or passing the edit requirements for consistency and reasonableness). Records that fail edit requirements must be updated or must be certified by an analyst to be exempt from the failed edit requirement. Only records that pass edit requirements are eligible for final summary.

**Analysis Tools:** Edited data are processed through an interactive analysis tool which displays data for all reports by item. The tool provides scatter plots, tables, charts, and special tabulations that allow the analyst to compare an individual record to similar records. Atypical responses and unusual data relationships become evident and RFO and Headquarters (HQ) staff review them to determine if they are correct. The tool allows comparison to an agricultural operation's previously reported data to detect large changes in the operation. Data found to be in error are corrected, while accepted data are retained.

**Outliers:** Both RFO and HQ statisticians conduct a review of value outliers to ensure the most accurate data and indications possible. The RFO statisticians review outliers for States within their regions and the HQ statistician examines outliers across all States. A determination is made as to whether an adjustment to final estimates will be required for each outlier. Many outliers trace back to unique situations that do not exist in the target population as much as the survey weight would indicate.

**Nonsampling Errors:** Nonsampling errors are present in any survey process. These errors include reporting, recording, and editing errors. Steps are taken to minimize these errors, such as comprehensive interviewer training, validation, and verification of processing systems, application of detailed computer edits, and evaluation of the data via the analysis tools.

**Nonresponse Adjustment:** Response to the June Area Survey is voluntary. Some producers refuse to participate in the survey, others cannot be located during the data collection period, and some submit incomplete reports. These nonrespondents must be accounted for if accurate estimates of land values are to be made. The weights for data items from reporting farms and ranches are not adjusted upward to account for the nonrespondents. For the land value questions, missing item level data are calculated by an imputation algorithm. All other missing item level data are made usable by manual imputation.

The land values imputation algorithm uses a nearest neighbor approach and requires a minimum of five complete reports within the nonresponse group to calculate the imputed value. If five complete reports are not available, the groups are collapsed until five complete reports are identified. The first nonresponse group is reports within the same segment. If five complete reports are not found, it then moves on to reports within the same county and in similar strata, all reports in that county, all reports in the same Agricultural Statistics District (ASD) and lastly the entire State.

**Estimators:** The primary estimators used to set land values estimates are the area frame item-to-item ratios. The estimators calculate the weighted average value per acre by taking the ratio of total dollars to acres. Two area frame estimators are utilized in the NASS estimation program. Items that pertain to data entirely within the segment boundaries are weighted by the sampling weight associated with the segment. Items that pertain to entire farm level data are weighted by the original segment sampling weight and by the proportion of the farm residing inside the segment boundaries. Cropland and pasture values are based on land within the segment boundaries; thus, the numerator and denominator are weighted by only the segment sampling weight. For farm real estate land values, the numerator and denominator are

multiplied by the proportion of the farm residing inside the segment and the original segment sampling weight. Ratio indications are calculated excluding and including the imputed data.

**Estimation:** The land values data are summarized from the June Area dataset. Since all RFOs conduct identical surveys, the State data can be summarized and National survey point estimates, or indications, computed. RFOs are responsible for performing a detailed review of the survey data for States within their regions. Any irregularities revealed by the analysis must be investigated and, if necessary, resolved. The summary results provide multiple ratio indications for each data series being estimated. RFOs interpret the survey indications and submit State recommendations to NASS headquarters, providing justification in cases where recommendations deviate from survey results.

For the National estimates, NASS assembles a panel of statisticians to serve as the Agricultural Statistics Board (ASB) which reviews the National results and establishes the National estimates. Since larger sample sizes yield more precise results, NASS employs the “top-down” approach by determining the National estimates first and reconciling the State recommendations to the National estimate. Using the acreage for each type of land for each State as a weight, State land value estimates are weighted to the National estimate. The ASB also enjoys an advantage in being able to examine results across States and compare the State recommendations. The same estimators used in the State summaries are produced by the National summary. The ASB follows the same approach the RFOs do in determining the National estimate. The historical relationship of the survey estimates to the official estimate is evaluated over time to determine accuracy and bias using tables and graphs. Each ASB member completes an independent interpretation of the survey results which are shared with the other members and a consensus is reached. Often the State recommendations weighted by acreage do not equal the National estimate. ASB members must reexamine the State results and revise some States to make the product of the State estimates agree with the National estimate.

## Quality Metrics for Land Values

**Purpose and Definitions:** Under the guidance of the Statistical Policy Office of the Office of Management and Budget (OMB), the United States Department of Agriculture's National Agricultural Statistics Service (NASS) provides data users with quality metrics for its published data series. The metrics tables below describe the performance data for the survey contributing to the publication. The accuracy of data products may be evaluated through sampling and nonsampling error. The measurement of error due to sampling in the current period is evaluated by the coefficient of variation for each estimated item. Nonsampling error is evaluated by response rates.

**Farm Tract** is a portion of a sampled segment that represents a unique operating arrangement that meets the definition of a farm.

**Sample Size** is the total number of farm tracts found in the sampled segments in the survey excluding tracts on American Indian Reservations in Arizona, Nevada, New Mexico, and Utah and tracts in public and non-agricultural land use strata in all States.

**Response rates** measure the proportion of the farm tracts in the land values sample that responded to the survey.

**Coefficient of Variation** provides a measure of the size for the standard error relative to the point estimate and is used to measure the precision of the results of a survey estimator.

**Survey Sample Size and Response Rates:** To assist in evaluating the performance of the estimates in the *Land Values* report, the sample size and response rates are displayed. The sample size changes from year to year as the number of farm tracts identified within the sampled segments varies.

## Sample Size and Response Rate – Region, State, and United States: 2020 and 2021

Region and State	Sample size		Response rate	
	2020 (number)	2021 (number)	2020 (percent)	2021 (percent)
Northeast .....	1,057	1,013	51.3	49.4
Connecticut .....	21	19	61.9	47.4
Delaware .....	56	56	35.7	14.3
Maine .....	42	42	31.0	45.2
Maryland .....	146	136	45.9	45.6
Massachusetts .....	27	30	55.6	60.0
New Hampshire .....	18	19	38.9	26.3
New Jersey .....	76	65	53.9	38.5
New York .....	235	217	56.6	60.8
Pennsylvania .....	354	347	54.0	53.9
Rhode Island .....	16	14	25.0	35.7
Vermont .....	66	68	57.6	44.1
Lake .....	2,787	2,737	53.6	57.7
Michigan .....	632	633	56.2	58.5
Minnesota .....	1,502	1,476	47.8	56.6
Wisconsin .....	653	628	64.3	59.6
Corn Belt .....	6,655	6,702	51.2	53.4
Illinois .....	1,549	1,587	53.4	57.8
Indiana .....	965	937	51.8	59.2
Iowa .....	1,547	1,527	54.1	55.1
Missouri .....	1,640	1,618	46.4	38.4
Ohio .....	954	1,033	50.4	62.3
Northern Plains .....	5,081	5,064	38.9	39.3
Kansas .....	1,509	1,552	32.3	27.1
Nebraska .....	1,229	1,201	39.1	47.8
North Dakota .....	1,295	1,260	43.1	46.4
South Dakota .....	1,048	1,051	43.1	39.3
Appalachian .....	2,718	2,625	65.2	59.3
Kentucky .....	671	670	59.9	50.9
North Carolina .....	611	597	61.4	55.4
Tennessee .....	919	868	68.8	63.9
Virginia .....	348	323	62.9	58.2
West Virginia .....	169	167	84.6	84.4

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**Sample Size and Response Rate – Region, State, and United States: 2020 and 2021 (continued)**

Region and State	Sample size		Response rate	
	2020 (number)	2021 (number)	2020 (percent)	2021 (percent)
Southeast .....	1,308	1,296	44.5	51.5
Alabama .....	416	378	55.0	73.3
Florida .....	202	226	41.6	50.0
Georgia .....	493	502	35.7	35.5
South Carolina .....	197	190	47.2	52.6
Delta .....	1,718	1,651	61.5	60.1
Arkansas .....	792	763	59.5	50.1
Louisiana .....	319	321	58.0	75.1
Mississippi .....	607	567	66.1	65.1
Southern Plains .....	4,108	4,070	53.2	51.7
Oklahoma .....	1,039	1,034	51.5	42.6
Texas .....	3,069	3,036	53.7	54.8
Mountain .....	2,384	2,792	47.4	57.0
Arizona .....	78	157	53.8	60.5
Colorado .....	594	638	43.6	51.3
Idaho .....	453	491	47.5	53.0
Montana .....	699	743	40.5	60.2
Nevada .....	14	23	71.4	82.6
New Mexico .....	134	318	46.3	47.5
Utah .....	246	252	70.7	80.2
Wyoming .....	166	170	51.2	52.9
Pacific .....	1,497	1,547	52.5	52.9
California .....	633	664	59.9	64.5
Oregon .....	402	430	56.5	49.5
Washington .....	462	453	39.0	39.3
United States .....	29,313	29,497	50.9	52.1

## Land Values Coefficient of Variation – Region, State, and United States: 2020 and 2021

Region and State	Coefficient of variation					
	Farm real estate		Cropland		Pasture	
	2020 (percent)	2021 (percent)	2020 (percent)	2021 (percent)	2020 (percent)	2021 (percent)
Northeast .....	6.1	3.9	4.4	3.2	7.2	9.7
Connecticut .....	0.8	4.1	(NA)	(NA)	(NA)	(NA)
Delaware .....	2.8	0.3	1.1	(Z)	(NA)	(NA)
Maine .....	10.0	6.5	(NA)	(NA)	(NA)	(NA)
Maryland .....	15.5	2.6	9.6	2.4	7.6	3.0
Massachusetts ...	5.2	10.2	(NA)	(NA)	(NA)	(NA)
New Hampshire ..	14.2	6.6	(NA)	(NA)	(NA)	(NA)
New Jersey .....	17.9	3.7	4.5	0.3	0.5	13.8
New York .....	7.5	6.8	6.5	4.9	5.1	16.3
Pennsylvania .....	9.0	5.2	7.8	5.3	6.4	12.9
Rhode Island .....	3.7	Z	(NA)	(NA)	(NA)	(NA)
Vermont .....	10.9	7.1	(NA)	(NA)	(NA)	(NA)
Lake .....	2.8	1.4	3.1	1.0	6.6	5.0
Michigan .....	6.8	1.6	12.1	1.8	18.9	18.8
Minnesota .....	2.5	1.7	2.2	1.3	4.5	7.1
Wisconsin .....	4.4	3.6	3.8	2.6	8.6	2.9
Corn Belt .....	1.4	0.8	1.0	0.6	2.2	3.3
Illinois .....	1.6	1.0	1.5	0.9	2.9	4.1
Indiana .....	3.1	2.9	2.6	1.6	8.4	10.4
Iowa .....	1.5	1.2	1.7	1.0	2.2	1.1
Missouri .....	2.9	0.7	1.5	0.7	3.3	4.2
Ohio .....	2.8	2.6	1.9	2.3	5.5	10.5
Northern Plains .....	2.1	1.2	1.5	0.9	2.2	1.7
Kansas .....	2.0	1.7	1.8	1.7	2.8	3.1
Nebraska .....	6.5	3.7	3.7	1.9	5.0	4.3
North Dakota .....	2.4	1.5	2.0	1.3	1.9	3.2
South Dakota .....	4.4	1.3	2.3	1.6	3.7	1.8
Appalachian .....	2.5	2.3	2.2	1.5	3.7	3.0
Kentucky .....	3.9	3.8	2.5	2.2	7.8	5.3
North Carolina .....	6.0	3.2	3.6	3.2	8.8	7.8
Tennessee .....	4.0	3.1	2.9	2.2	4.2	5.1
Virginia .....	8.8	8.5	7.3	6.1	7.9	5.7
West Virginia .....	5.8	10.8	7.2	6.5	5.1	5.8

See footnote(s) at end of table.

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**Land Values Coefficient of Variation – Region, State, and United States: 2020 and 2021 (continued)**

Region and State	Coefficient of variation					
	Farm real estate		Cropland		Pasture	
	2020 (percent)	2021 (percent)	2020 (percent)	2021 (percent)	2020 (percent)	2021 (percent)
Southeast .....	4.4	4.0	5.7	2.2	8.6	4.7
Alabama .....	6.1	3.7	5.0	2.2	4.2	7.3
Florida .....	8.3	6.5	5.6	3.2	6.2	5.2
Georgia .....	4.7	6.2	4.9	2.3	6.2	8.2
South Carolina .....	5.3	1.5	2.7	2.6	2.6	0.7
Delta .....	2.4	2.1	1.1	1.2	3.8	4.1
Arkansas .....	4.0	3.1	1.8	1.6	6.2	2.6
Louisiana .....	3.5	4.2	2.3	3.4	3.3	6.9
Mississippi .....	3.7	3.9	1.7	1.8	2.3	4.8
Southern Plains .....	16.0	3.3	3.9	2.6	5.9	2.9
Oklahoma .....	5.2	3.8	2.7	1.8	4.2	2.8
Texas .....	19.2	3.8	4.6	3.3	7.0	3.2
Mountain .....	21.8	4.5	7.1	2.8	7.7	7.6
Arizona .....	11.7	6.9	14.0	6.8	(NA)	(NA)
Colorado .....	33.9	7.7	14.7	6.2	15.3	3.6
Idaho .....	7.6	3.2	3.4	4.6	7.6	9.5
Montana .....	54.3	12.5	18.1	4.2	16.6	9.9
Nevada .....	8.7	2.3	(NA)	(NA)	(NA)	(NA)
New Mexico .....	62.5	2.2	28.5	14.5	2.7	17.5
Utah .....	12.5	16.2	14.2	6.7	15.0	13.9
Wyoming .....	12.3	6.3	3.8	7.8	9.3	1.8
Pacific .....	8.1	6.5	11.2	3.2	10.3	10.5
California .....	15.5	4.4	23.3	2.9	14.5	9.8
Oregon .....	12.4	8.1	11.4	7.2	5.6	17.2
Washington .....	8.2	23.9	6.9	5.3	9.8	25.7
United States .....	4.1	1.6	1.9	0.6	3.5	2.7

(NA) Not available.

(Z) Less than half of the unit shown.



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