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Health and Management Practices on U.S. Bison Operations, 2022

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Items of Note

The Bison 2022 study, conducted in all States, provides pertinent information on health and management practices on U.S. bison operations. These findings are directly relevant to study participants, stakeholders, and the bison industry as a whole. Most estimates in this report refer to the reference period of July 1, 2021, through June 30, 2022.

For analysis, operations were divided into four geographic regions: Northeast, Southeast, North Central, and West (see map on page 4). The West region likely contains more climatic, environmental, and topographical diversity than the other regions. Sample size limitations prevented further breakdown of regions. Operations also were divided into four size categories: very small (1 to 9 bison), small (10 to 24 bison), medium (25 to 99 bison), and large (100 or more bison). The size ranges correspond to those used in the NAHMS Bison 2014 study. They were created based on the distribution of bison operations in the United States and chosen so that the number of operations within each operation size category was large enough to meet the pre-specified precision criteria in the study design and avoid disclosing operation identities. It is crucial to study operations of all sizes because they might have different operation and health management practices, risk perceptions and tolerances, and resource and knowledge bases that can impact the industry's health differently.

The following items describe specific data from the study to present a general overview of some results. For more information on each topic, please see the indicated page.

Inventory (as of July 1, 2022)

Overall, 56.5 percent of responding bison operations were in the West region, 24.3 percent in the North Central region, 10.3 percent in the Northeast region, and 8.8 percent in the Southeast region. By operation size, the highest percentage of operations (46.2 percent) were very small operations (1 to 9 bison), and the lowest percentage (11.9 percent) were large operations (100 or more bison). Slightly less than one-fourth of operations (23.7 percent) were medium operations (25 to 99 bison), and 18.3 percent were small operations (10 to 24 bison). [page 6]

Overall, the operation average total number of bison on responding operations was 137, with an average of 24 bison on operations in the Northeast region, about 42 bison on operations in the Southeast and North Central regions, and 201 bison on operations in the West region. [page 7]

Female bison composed two-thirds (67.3 percent) of the total bison inventory, with more than one-third (35.1 percent) of the July 1, 2022, total inventory being female bison more than 3 years old. Male bison composed one-third of the bison inventory (32.7 percent), with only 5.0 percent of all bison being males more than 3 years old. [page 7]

Deaths

Almost one-half of all operations (45.3 percent) had any bison die or euthanized due to natural causes, including health problems, injury or trauma, predation, or injury related to handling- or weather-related problems. These deaths were not for slaughter or other production reasons. The percentage of operations that had bison die due to natural causes increased as herd size increased, ranging from 20.4 percent of very small operations to 85.4 percent of large operations, most likely related to the statistical probability that where there are more animals, there are more chances for an animal to become ill or injured. [page 22]

Overall, 4.0 percent of bison, as a percentage of the July 1, 2022, inventory, died of natural causes or were euthanized from July 1, 2021, through June 30, 2022. In general, the percentage of bison that died decreased with operation size, from 38.4 percent for very small operations to 3.5 percent for large operations. [page 23]

Reasons for keeping bison

Many operations participate in multiple aspects of the business. More than two-thirds of all operations (67.9 percent) were involved in bison cow-calf production. About two-fifths of operations had bison for seedstock production (43.6 percent), or finishing on grass (40.5 percent). One-third of operations kept bison as a hobby or pasture pet (34.0 percent), and 29.9 percent kept bison for conservation reasons. Other common reasons operations kept bison included agritourism/ecotourism (19.9 percent), backgrounding/stocking (12.5 percent), game ranch/hunting on the operation (12.2 percent), and feedlot (10.4 percent). [page 28]

A lower percentage of very small operations kept bison for bison cow-calf production (35.9 percent), seedstock production (24.9 percent), finishing on grass (20.5 percent), and preparation/sale of byproducts (4.2 percent), compared with operations of all other size categories. A higher percentage of large operations (35.2 percent) kept bison for backgrounding/stocking than operations in the other size categories, and a higher percentage of large operations (33.6 percent) kept bison for feedlot than operations in the three smaller size categories. The percentage of operations that kept bison for hobby/pasture pet decreased with operation size. [page 28]

Operations typically had one purpose or product that was the focus of the business. Among all bison operations, almost one-half (45.5 percent) raised bison primarily for cow-calf production, and about one-seventh (15.1 percent) kept bison primarily as a hobby or pasture pet. [page 31]

Number of years raising bison

Almost 50 percent of all bison operations (45.6 percent) had raised bison at the location for more than 20 years. A higher percentage of large operations (10.6 percent) had raised bison at the current location for more than 50 years than operations in the three smaller size categories, with no very small or small operations having raised bison at the location that long. A higher percentage of very small operations (13.6 percent) than medium (2.8 percent) or large (2.4 percent) operations had raised bison at the current location for 0 to 5 years. A higher percentage of very small operations (48.0 percent) than operations in the three larger size categories had raised bison at the current location for 11 to 20 years. [page 40]

Future plans for the herd

For all operations, almost three-fourths planned to maintain their herd size (55.6 percent) or increase the herd size (17.6 percent) over the upcoming year. About one-fourth of operations planned to decrease herd size (17.9 percent) or get out of the business (8.9 percent). A lower percentage of very small operations (6.6 percent) planned to decrease herd size during the following year than small (24.2 percent), medium (25.2 percent), or large (19.1 percent) operations. [page 42]

Pasturing and grazing practices

Almost all operations (93.7 percent) grazed at least some of their bison on range/pastures at some point during the reference period. Of these operations, more than three-fourths (77.3 percent) kept them on range/pasture for 12 months, and less than 5.0 percent of all operations (3.8 percent) used range/pasture for less than 6 months. Stocking rates varied considerably depending on region and size of operation. [page 43]

Among the 93.7 percent of operations that kept any bison on range/pasture, 55.4 percent used a continuous grazing system, 30.7 percent used a rotational system, and 12.6 percent used a holistic grazing system as their primary grazing system. [page 49]

Animal identification

During the project period, more than half of operations (55%) did not use any system for identifying either the herd owners or individual animals. Higher percentages of large (80.1 percent) and medium (62.4 percent) operations had some type of herd and/or unique individual-animal ID for at least some bison on the operation than small (33.4 percent) or very small (22.2 percent) operations. [page 57]

Bison contact with other farmed animals

Overall, about 70 percent of operations had other farmed animals ever present on the operation during the reference period. Almost 40 percent of operations had horses, donkeys, or other equids, and a little over one-third (36.4 percent) of all operations had beef or dairy cattle. Almost one-third had deer, elk, or other cervids (29.0 percent). [page 75]

There was no difference in the size of the operation that had any type of farmed animal present. A higher percentage of very small operations (14.5 percent) than operations in the other size categories had sheep or lambs. No large operations had sheep or lambs. A higher percentage of very small operations (17.9 percent) than medium (6.3 percent) or large (4.3 percent) operations had any goats. [page 75]

Overall, almost three-fourths of operations (73.1 percent) had neighboring operations with “any” farmed animals, including bison, cattle, sheep or lambs, goats, and/or deer, elk, or other cervids ever located within 1 mile of the operation’s bison during the timeframe of the study. A similar number of operations had neighboring farmed beef or dairy cattle within 1 mile of the operation’s bison (69.2 percent). Almost 14 percent of all operations had neighboring farmed sheep or lambs, and almost 15 percent had neighboring farmed goats within 1 mile of the operation’s bison. [page 78]

Bison contact with wild animals

Overall, almost three-fourths of operations (72.3 percent) had ever seen “any” wild animals inside the operation’s perimeter fence during the reference period. About two-thirds of operations (66.8 percent) had seen deer, elk, or other cervids inside the operation’s perimeter fence. For pronghorn, deer, elk, or other cervids, and for “any” wild animal, a higher percentage of large operations than operations in the other size categories had seen these types of wild animals inside the perimeter fence. By far, the largest percentages of wild animals ever seen inside the perimeter fence for all regions were deer, elk, or other cervids, ranging from 40.4 percent of operations in the Northeast region to 75.7 of operations in the Southeast region. [page 82]

Overall, almost one-fourth of all operations (24.9 percent) reported that they took any actions to control wild animals or prevent them from accessing operation property or resources. [page 85]

Bison movements and operation practices for isolating new or returning bison

Overall, about one-eighth of operations (13.1 percent) had any new bison brought onto the operation, or any bison leave and return. A higher percentage of medium (18.0) and large (19.8 percent) operations than very small operations (5.3 percent) brought any new bison onto the operation or had any bison leave and return. [page 87]

For operations that brought any new bison onto the operation or had any bison leave and return, about one-fourth (24.2 percent) had temporarily brought bison of either sex from other herds onto the operation for breeding purposes. Almost one-fourth of operations (22.5 percent) brought on male bison temporarily or permanently, and 3.1 percent brought on female bison. [page 87]

For operations that had bison leave the operation and return, about one-fourth (25.6 percent) of operations always isolated returning bison before commingling them with the rest of the operation’s herd. About three-fifths of operations (62.5 percent) never isolated bison returning to the operation before commingling them with the rest of the operation’s herd. [page 89]

For operations that brought on new bison temporarily or permanently, about seven-tenths of operations always (50.3 percent) or sometimes (20.3 percent) isolated new bison joining the operation permanently or temporarily. Less than one-third (29.4 percent) of operations adding new bison permanently or temporarily never isolated the new bison. [page 90]

For operations that isolated returning or new bison, about one-half isolated returning bison (53.3 percent) or new bison (47.8 percent) for 30 or more days. [page 90]

Patterns of visitation to the operation

Many operations have various types of business and other people visiting the operation, and it is important that operations consider appropriate biosecurity protocols for these visitors. Regarding business visitors, overall, about three in ten operations were visited by private or government veterinarians or animal health workers (30.0 percent) or feed (hay or grain) haulers (27.5 percent). About one-fourth were visited by consumers seeking an activity (23.0 percent) or consumers seeking bison products (22.0 percent). About one-seventh of operations were visited by school and other field trip visitors (17.5 percent); a livestock hauler (15.4 percent); or a bison trader, order buyer, or dealer/broker (11.5 percent). [page 95]

For other types of visitors, almost two-thirds of operations had visits from family, neighbors, and/or friends, etc. (66.1 percent). Almost one-fourth were visited by other types of visitors, such as home maintenance personnel, delivery or general services personnel, utility workers, etc. (22.5 percent). About one-fifth of operations were visited by employees who did not live on the operation (21.2 percent). [page 95]

Reproduction

Overall, 75.6 percent of operations had any bison bred on the operation. A lower percentage of very small operations (34.9 percent) had any bison bred on the operation compared with small, medium, and large operations. For the three larger size categories, more than 90 percent of operations had any bison bred on the operation during the reference period. [page 110]

For the 75.6 percent of operations that bred any bison, 11.2 percent used body-condition scoring during the most recent breeding season, 9.6 percent used breeding-soundness exams for bulls, 9.8 percent used palpation for pregnancy, 9.7 percent used ultrasound, and 3.2 percent used some “other” reproductive practice. A higher percentage of large operations used body-condition scoring (27.1 percent), breeding-soundness exams for bulls (21.1 percent), palpation for pregnancy (29.7 percent), and/or ultrasound (34.0 percent) than operations in the other size categories. [page 112]

For the 75.6 percent of operations that bred any bison, 21.0 percent of operations used random selection only as the primary basis for selecting new breeding bison, 23.8 percent used size/conformation only, 8.5 percent used behavior/manageability only, 9.4 percent used genetics only, and 27.0 percent used multiple bases equally. [page 116]

Deworming and parasite-control practices

Internal parasites were the most common health problem noted by producers and were present in at least some bison on 22.5 percent of operations [page 146]. Three-fourths of operations (75.0 percent) had dewormed at least some bison during the survey reference period. A lower percentage of very small operations (65.5 percent) dewormed any bison compared with medium (82.5 percent) and large (82.2 percent) operations. [page 129]

Many factors influence parasite burden in bison herds, including stocking density, pasture characteristics and management, climate, and nutrition. A parasite-control program requires an integrated approach that considers these factors as well as the dewormer itself and its administration. About one-half (50.6 percent) of all operations rotated pastures as a method of parasite control, and more than one-third (37.8 percent) rotated dewormer type. Nearly one-quarter of operations performed laboratory testing for intestinal parasites (23.2 percent) or reduced stocking density (23.2 percent). [page 135]

Vaccination practices

Almost one-third of operations (31.9 percent) vaccinated at least some bison on pasture against a disease or pathogen. Roughly one-fifth of operations vaccinated bison on pasture against *Clostridium* species (23.7 percent), brucellosis (18.1 percent), bovine viral diarrhea virus (15.4 percent), and/or bovine respiratory syncytial virus (14.3 percent). About one-tenth of operations vaccinated bison on pasture against infectious bovine rhinotracheitis (12.6 percent), leptospirosis (11.6 percent), *Mycoplasma bovis* (10.8 percent), parainfluenza 3 virus (9.7 percent),

and/or *Pasteurella* species (9.0 percent). A higher percentage of large operations (65.9 percent) gave any vaccinations to any bison on pasture than operations in the other size categories. [page 140]

Overall, 56.4 percent of operations that had any bison in feedlot vaccinated any bison during the study reference period. Almost one-half of operations (47.4 percent) vaccinated bison against *Clostridium* species (e.g., tetanus, blackleg). Nearly one-third of operations vaccinated bison against bovine viral diarrhea virus (29.9 percent). Approximately one-quarter of operations vaccinated bison in feedlot against brucellosis (25.2 percent), bovine respiratory syncytial virus (28.2 percent), infectious bovine rhinotracheitis (27.5 percent), *Mycoplasma bovis* (27.5 percent), and/or *Pasteurella* species (20.8 percent). About one-tenth of operations vaccinated bison on feedlot against rotavirus/coronavirus (13.0 percent) and/or anthrax (7.9 percent). [page 142]

Producer-reported disease occurrence

Internal parasites were the most common health problem reported and were present in at least some bison on 22.5 percent of operations. Problems with being off feed/weight loss were present in at least some bison on 13.4 percent of operations, and diarrhea was present in at least some bison on 13.0 percent of operations. Arthritis/lameness problems were present on at least 10.9 percent of operations. [page 146]

Higher percentages of operations reported problems with internal parasites in bison more than 3 years old and bison 1 to 3 years old (21.0 percent and 21.5 percent, respectively) than in bison less than 1 year old (12.2 percent). Higher percentages of operations reported problems with arthritis/lameness (10.1 percent) in at least some bison more than 3 years old compared with the other age categories. Higher percentages of operations reported problems with at least some bison off feed or with weight loss or diarrhea in at least some bison more than 3 years old (11.8 percent and 10.6 percent, respectively) and 1 to 3 years old (8.6 percent and 9.9 percent, respectively) compared with bison less than 1 year old (4.3 percent and 5.2 percent, respectively). [page 147]

Antibiotic use

Overall, 13.9 percent of operations used antibiotics to treat any individual bison that became sick on the operation. A higher percentage of large operations (25.4 percent) used antibiotics to treat any individual bison that became sick on the operation than very small (6.3 percent) and small (10.1 percent) operations. Approximately three-fifths of operations that used antibiotics to treat any individual bison that became sick on the operation always noted information in a record-keeping system. More than one-half of operations that used antibiotics to treat any individual bison that became sick on the operation reported that veterinarian recommendations (82.7 percent), personal experience (70.3 percent), approved route by which an antibiotic is given (59.1 percent), and duration of action (72.6 percent) were very or extremely important factors in the selection of an antibiotic for treatment of a health problem. [page 149]

Death loss from disease

Overall, 14.1 percent of operations had bison die from unknown health problems. Parasitism was a primary cause of bison deaths on 4.3 percent of operations, and “other disease” resulted in deaths on 4.1 percent of operations. Bison deaths were caused by other respiratory illness/pneumonia on 3.9 percent of operations and *Mycoplasma bovis* on 3.5 percent of operations. There were *Mannheimia/Pasteurella* caused bison deaths on 2.3 percent of operations, digestive illness on 2.0 percent of operations, nutritional deficiency on 0.9 percent of operations, and malignant catarrhal fever on 0.3 percent of operations. It is important to note that although a cause of death might have occurred on a low percentage of operations, it could have affected a high percentage of the bison on those operations. [page 152]

Disease testing

Overall, about one-third of operations (34.5 percent) had ever tested any bison for bovine tuberculosis (TB), either on the farm or prior to purchase/arrival on the farm. The percentage of operations that had tested for TB either on the farm or prior to purchase/arrival on the farm increased, in general, as operation size increased. A higher percentage of large operations (57.6 percent) had ever tested any bison for TB than operations in the other size categories, and a higher percentage of medium operations (41.2 percent) had ever tested any bison for TB than very small operations (22.0 percent). [page 160]

Bison shipments and movements

Information about movement of animals on and off operations—including the sources and destinations involved, the distances traveled, and the seasonality of shipments—is very important in understanding potential pathways of disease spread and planning for response in the event of a disease incident.

For bison added to the operation from offsite sources

For operations that added bison to the operation's herd from offsite sources during the study reference period, an average of 2.3 shipments arrived from private-sale sources, with an average of 7.1 bison per shipment. An average of 1.4 shipments, carrying an average of 6.8 bison, came from auctions/sale barns. [page 173] In general, the most likely distance traveled by shipments of bison was 274 miles for bison obtained through private sale, 321 miles for bison obtained via trade, and 217 miles for bison acquired from auctions/sale barns. [page 177] About two-thirds of shipments of bison being added to the operation from offsite sources were made during the winter and spring periods. [page 178]

For bison shipped permanently to offsite destinations

Overall, about one in six operations shipped bison permanently to offsite slaughter or directly to another bison operation. Almost one-half of large operations (46.2 percent) shipped bison directly to offsite slaughter, a higher percentage than for medium, small, and very small operations (23.4 percent, 11.3 percent, and 3.5 percent, respectively). [page 180] For operations that shipped bison permanently to offsite destinations during the reference period, an average of 7.2 shipments, with an average of 11.9 bison per shipment, were sent directly to offsite slaughter. An average of 2.6 shipments, carrying an average of 12.0 bison, carried bison permanently to other bison operations. Although only 1.9 shipments, on average, were sent directly to feedlots, each shipment transported an average of 43.7 bison. [page 182] In general, the most likely distance traveled by shipments of bison was about 140 miles for bison being taken to offsite slaughter, about 236 miles for bison being moved to feedlots, about 159 miles for bison being delivered to auctions/sale barns, and about 183 miles for bison being delivered to another bison operation. [page 185] About one-third of shipments of bison being sent permanently to offsite destinations were made during the fall season, and one-fourth were made during winter and spring periods. [page 188]

Association membership and sources of bison health information

One-half of the producers (50.0 percent) were in one or more bison or cattle associations. About one-third were in regional, State, and/or local bison associations (34.1 percent) and/or the National Bison Association (34.0 percent). [page 189]

The percentage of operations belonging to the National Bison Association generally increased with increasing operation size, from 9.8 percent of very small operations to 74.1 percent of large operations, with higher percentages of medium (51.4 percent) or large operations than operations in the two smaller size categories being members of the NBA. The percentage of operations belonging to regional, State, and/or local bison associations increased with increasing operation size, from 8.4 percent of very small operations to 62.6 percent of large operations. The percentage of operations belonging to "any" of the subject associations increased with increasing operation size, from 20.9 percent of very small operations to 87.7 percent of large operations. [page 189]

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Acknowledgments

The Bison 2022 study is a collaborative, nationwide effort between two U.S. Department of Agriculture (USDA) agencies: the National Agricultural Statistics Service (NASS) and Veterinary Services' National Animal Health Monitoring System (NAHMS), which is within the Animal and Plant Health Inspection Service (APHIS). As such, the study and its results underscore the importance of our collective work.

NAHMS focuses on working with a variety of entities to collect, analyze, and provide essential information on animal health, management, and productivity across the United States to stakeholders who need this information. NAHMS studies provide nationally representative data on the health and health management of domestic livestock, poultry, equine, and aquaculture populations.

We want to thank NASS for its many contributions to the study: reviewing the study questionnaire and creating an online version, helping to promote the study among bison stakeholders, allowing the use of its list frame, mailing questionnaires and study information to bison producers, and administering the questionnaire by telephone to producers who did not complete either the mail or online version.

Several collaborators invaluably participated in the study by testing fecal and forage biological samples collected by producers. We are very grateful to USDA–APHIS National Veterinary Services Laboratories, South Dakota State University, North Carolina State University, Virginia Polytechnic Institute and State University (Virginia Tech), and the USDA Agricultural Research Service's Animal Parasitic Diseases Laboratory for their expertise and significant contributions. Results from the biological sampling components of the study will be published in other short reports, information sheets, and publications.

We also extend our heartfelt gratitude to the bison producers whose voluntary efforts made the Bison 2022 study possible. Their contributions are indispensable. Finally, we thank the National Bison Association for its instrumental help in promoting the study, providing expertise, and reviewing the questionnaire and report.

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Photograph courtesy of USDA Photo Media by Lance Cheung.

Introduction

The Bison 2022 study was conducted by the National Animal Health Monitoring System (NAHMS) with assistance from the National Agricultural Statistics Service (NASS). NAHMS is a nonregulatory program of the United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS).

The purpose of NAHMS is to gather, analyze, and distribute essential information on animal health, management, and productivity across the United States. To meet this goal, NAHMS works with stakeholders—including producers and stewards, other industry representatives, government animal-health officials, and researchers and extension agents—to identify the information they need and to design the study to collect critical data. NAHMS studies gather nationally representative data on the health and health management of U.S. domestic livestock, poultry, equine, and aquaculture populations. By studying animal groups on a rotating basis, NAHMS provides up-to-date and trend information that helps monitor animal health, support trade decisions, assess research and product-development needs, answer questions for consumers, and guide policy. As a recognized statistical unit in the Federal government, NAHMS provides important Federal animal production statistics.

NAHMS collected data on the health and management practices of the U.S. bison industry in one previous study, Bison 2014. The Bison 2014 study was designed and conducted in response to a request from the National Bison Association (NBA) to do an epidemiological investigation of *Mycoplasma bovis* in bison. It was determined that the first step was to conduct a study to develop baseline information about the bison industry and the health of ranched bison. The study was a census of all U.S. bison operations.

The purpose of the Bison 2014 study was to compile the most needed information about the industry regarding bison health, production, and management. The descriptive report, available on the NAHMS website, provides more information.

The Bison 2022 study was developed to update information gathered in the 2014 study and provide more detailed information about certain topics. It also included a biological sampling component to evaluate bison parasite levels, enteric microbe status, and pasture forage nutritional quality. Based on input from a survey of information needs, reviews from the scientific literature, and input from government and industry researchers, the following primary study objectives were identified.

- Describe the status and changes in the U.S. bison industry from 2014 to 2022, including operation characteristics (such as inventory, size, and type), production purposes, and marketing practices.
- Describe the current U.S. bison industry production practices and challenges, including animal management and welfare, nutrition and range management, and environmental stewardship.
- Describe current bison health management and biosecurity practices.
- Estimate producer-reported occurrence of select health problems, associated management practices or actions, and causes of bison mortality.
- Estimate the prevalence of select economically--important pathogens for bison and pasture forage quality.

A questionnaire was developed to obtain as much information as possible and mailed—based on the NASS list frame—to all U.S. producers with bison. In general, the study questions covered the period from July 1, 2021, through June 30, 2022. Additional information about the methods used and the number of respondents in the study can be found in the Methodology section at the end of this report.

This report, “Health and Management Practices on U.S. Bison Operations, 2022,” is the first of materials containing national information from the NAHMS Bison 2022 study.

NAHMS depends on voluntary participation of producers and stewards and is committed to protecting the confidentiality of those who take part in NAHMS national studies. NAHMS protects collected data under CIPSEA (P.L. 115-435, Title III) or as confidential business information (19 CFR 201.6), as required by the study. Data collected by the NAHMS program are for statistical purposes only.

For more information about NAHMS or questions about using the data for statistical research, please email NAHMS@usda.gov, call 1-866-907-8190, or visit the NAHMS webpage at https://www.aphis.usda.gov/nahms.

Terms Used in This Report

Abnormally high death loss: A term used in the study survey referring to a level of death loss in the herd more than twice what the producer or steward would normally expect for the herd.

Animal identification: Animal identification is a process of marking animals in some way so that they can be recognized as members of a herd and/or as individuals. It is done for a variety of reasons, including verification of ownership; record-keeping for health and management practices, such as vaccination, deworming, and reproductive success; use in biosecurity practices; and tracing of animals for research, disease response, or other agricultural purposes.

- *Herd identification* uses a tag, brand, or other marker that indicates a bison is a member of an operation's herd.
- *Individual identification* uses a unique identifier for each animal that enables it to be distinguished from all other bison in the herd.

Antibiotic: An antimicrobial that inhibits and/or kills certain bacteria. Appropriately used antibiotics are very effective against specific illnesses caused by bacteria.

Antimicrobial: Any substance of natural, semisynthetic, or synthetic origin that kills or inhibits the growth of microorganisms. All antibiotics are antimicrobials, but not all antimicrobials are antibiotics.

Auction/sale barn: A location where livestock are bought and sold. This might include association-sponsored sales.

Biosecurity: A set of practices and/or procedures used by an operation to prevent introduction of infectious diseases into the herd and to minimize further transmission among animals, if a disease is introduced. Biosecurity practices reduce the risk of infectious diseases being carried onto the property by people, animals, equipment, or vehicles and are considered an essential part of sustainable agricultural development. Examples of biosecurity include restricting visitors from physical contact with bison, quarantining new bison before they are co-mingled with the operation's herd, and requiring vehicles that come from off the site to park away from the herd.

Brucellosis: A contagious, costly reproductive disease of ruminant animals that also affects humans. Although brucellosis can affect other animals, its main threat is to cattle, bison, cervids, and swine. The disease is also known as contagious abortion or Bang's disease and is caused by a group of bacteria known scientifically as the genus *Brucella.*

Cervid: A mammal of the deer family (*Cervidae*). Common examples include deer, elk, moose, and reindeer.

Contact: As used for the survey, having contact with operation bison refers to touching/handling live bison and/or walking through areas or facilities where bison are or have recently been kept.

Data collection: For this study, the process of administering the study questionnaire to bison producers and stewards. Participants could complete the questionnaire using their choice of one of three modes: a paper questionnaire, an online web survey, or a telephone interview with a NASS enumerator.

Diatomaceous earth: The remains of fossilized marine algae called diatoms; considered by some to be a natural dewormer for livestock.

Epizootic hemorrhagic disease (EHD)/bluetongue: EHD and bluetongue are related hemorrhagic diseases caused by viruses and spread by a biting midge. They can affect a variety of wild and domestic ruminant hosts, including white-tailed deer, sheep, goats, bison, and cattle. Clinical signs and the severity of disease vary among host species, individual animals, and viral serotype.

Extension agent/service: A person or service provided by a State entity or local university in association with the USDA National Institute of Food and Agriculture that provides agricultural production expertise to operators either on a regular basis or upon request.

Heifer: A heifer is a young female bison that is 1 year of age or older and has not yet had a calf.

Isolate *(isolation of animals)*: For this survey, isolate means to prevent nose-to-nose contact and to prevent the sharing of feed, drinking water, and equipment with other animals already present on the operation.

Livestock: Cattle, bison, poultry, goats, sheep, swine, horses, other equines, cervids, aquaculture species, bees, and other farm animals raised for home use and/or sale.

Malignant catarrhal fever (MCF): An infectious disease of ruminants caused by a gammaherpesvirus. The sheep-associated form of the disease is infectious to and fatal in bison.

***Mycoplasma bovis*:** A bacterial pathogen that has become a major concern in the North American bison industry because of the high rates of illness and death it can cause in bison herds. *Mycoplasma bovis* occurs in cattle and, often in conjunction with other pathogens, may cause disease, including pneumonia, mastitis, arthritis, and ocular infection. In bison, *Mycoplasma bovis* appears to be a primary pathogen, causing severe pneumonia, pleuritis, polyarthritis, and other problems associated with disseminated infection, especially in cows and feedlot cattle. In this report, *Mycoplasma bovis* will always be spelled out to preclude confusion with a different pathogen, *Mycobacterium bovis* (bovine tuberculosis).

National Agricultural Statistics Service (NASS): A USDA agency responsible for providing timely, accurate, and useful statistics in service to U.S. agriculture. NASS conducts the Census of Agriculture every five years, providing consistent, comparable, and detailed agricultural data for every county in the country. From its surveys, NASS maintains the list of U.S. bison producers that was used for the NAHMS Bison 2022 study.

National Animal Health Monitoring System (NAHMS): The USDA began developing the National Animal Health Monitoring System (NAHMS) in 1983 to collect, analyze, and disseminate essential information on animal health, management, and productivity across the United States. NAHMS is a principal source of Federal animal production statistics and one of 16 recognized statistical agencies and units in the Federal government.

The NAHMS program conducts nationally representative studies on the health and health management of U.S. domestic livestock, poultry, equine, and aquaculture populations. NAHMS works with stakeholders—including producers and stewards, allied industry members, researchers, and State and Federal animal-health representatives—to ensure that the studies are designed to collect data these stakeholders need. In general, each animal group is studied on a rotating basis, providing up-to-date and trend information needed to monitor animal health, support trade decisions, assess research and product-development needs, answer questions for consumers, and guide policy.

NAHMS is committed to protecting the confidentiality of the participants who voluntarily take part in NAHMS national studies. NAHMS relies on voluntary participation and provides protection of collected data under CIPSEA (P.L. 115-435, Title III) or as confidential business information (19 CFR 201.6), as required by the study. Data collected by the NAHMS program are for statistical purposes only.

For more information about NAHMS, please email NAHMS@usda.gov, call 1-866-907-8190, or visit the NAHMS webpage at https://www.aphis.usda.gov/nahms.

Necropsy: A necropsy, or autopsy, is an examination of an animal after its death to determine the cause of death. It will typically involve dissection (including collection of samples for laboratory analysis), observation, interpretation, and documentation to evaluate any disease or injury that may be present.

Operation: For the purposes of this study, an “operation” is defined as a person or entity raising one or more bison that are under common ownership (public or private) and kept on one or more locations for commercial or conservation purposes. This includes conservation herds. For example, an operation might consist of one location for commercial bison cow-calf production and another location for a bison finishing operation. For the study, respondents were asked to include all bison raised on the operation, whether owned by the operation or raised under contract for another owner, and to exclude bison raised on another person’s or entity’s operation, even if the respondent owned the bison.

Operation size: Number of ranched or farmed bison on an operation. The four categories were defined as very small (1 to 9 bison), small (10 to 24 bison), medium (25 to 99 bison), and large (100 or more bison). It is important to consider operations of all sizes because of differing management practices and risks to animal health and disease transmission.

Pasture: An enclosed area of untilled ground covered with vegetation and grazed by animals.

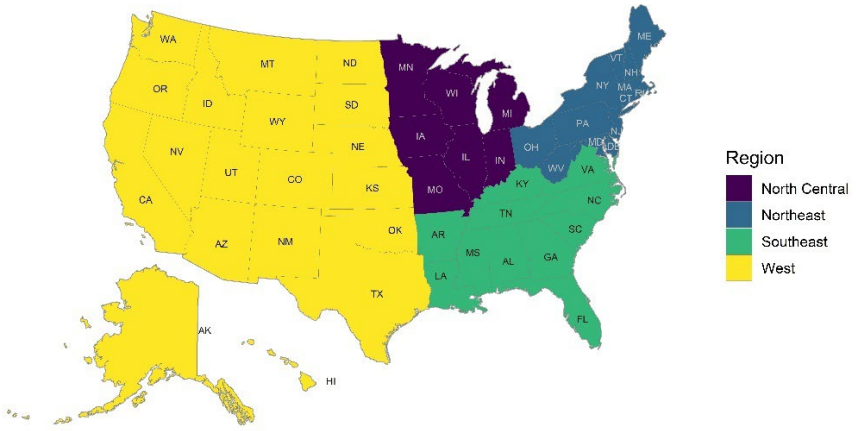
Population estimates: Point estimates in this report (weighted percentages or averages) are provided with a measure of precision called the standard error. The confidence intervals used to make comparisons in the text of this report were computed using the methods described in Section II.D.2 (page 196). These confidence intervals require more information than is published in the report to compute, but an approximate 95-percent confidence interval can be computed with bounds equal to the estimate, plus or minus two standard errors. If the only error is sampling error, the confidence intervals created in this manner will contain the true population value about 95 out of 100 times. For example, an estimated proportion of 7.5 with a standard error of 1.0 results in limits of 5.5 and 9.5 (two times the standard error above and below the estimate). When estimates are reported as being "higher" or "lower" than other estimates, a statistical difference is implied by the absence of overlap between 95-percent confidence intervals for the estimates being compared but was not directly tested. Not all statistically different estimates are mentioned in the text of this report. Occasionally, the word "numerically" is used to describe estimates that appear to be statistically different but are actually not different based on the overlap of the 95-percent confidence intervals (this can occur, for example, when standard errors are very large, perhaps because of a large estimate distribution or small sample size). Most estimates in this report are rounded to the nearest tenth. If the estimate is rounded to 0.0 or 100.0, the standard error was reported (0.0). If there were no reports of the event (0.0 percent) or if all operations reported the event (100.0 percent), no standard error was reported (—).

Reference period: The year-long period from July 1, 2021, through June 30, 2022. Many questions in the Bison 2022 questionnaire referred to or quantified activities or events that occurred during this period.

Regions:

Northeast: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, West Virginia
Southeast: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia
North Central: Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Wisconsin
West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, Wyoming

Bison 2022 Study Regions



Renderer: A renderer collects waste animal tissues, including bones, fat, blood, scraps, some internal organs, etc., for recycling into high-quality fat, such as lard or tallow, and protein products, such as meat and bone meal. The most common animal sources are beef, pork, sheep, and poultry.

Sales barn: (See Auction barn.)

Shipment: A shipment is a group of bison (one or more) that are moved together on the same day, regardless of the number of vehicles required to move them.

Tuberculosis (TB): An infectious disease of humans and other animals, in many cases fatal, that is caused by various strains of mycobacteria, usually *Mycobacterium bovis* in cattle, bison, and other ruminants. Tuberculosis typically affects the lungs but can also affect other parts of the body.

Section I: Population Estimates

Note: Where applicable, column or row totals are shown as 100.0 to aid in interpretation; however, estimates may not sum to 100.0 due to rounding.

Note: Because large operations (100 or more bison) had a smaller sample size and no upper limit, this category had much greater variability, and the standard errors were sometimes much larger. This means that in some cases, results that seem as though they should be considered different from those for the smaller size categories cannot be considered different because of the large standard errors.

Note: Unless otherwise noted, tables in this section refer to the period July 1, 2021, through June 30, 2022. Also, this section presents inventory information on the number of bison present on the operation on July 1, 2022, and the sexes and ages of those animals.

A. Inventory, Additions, and Removals

1. Operation bison inventory

Almost one-half of responding operations (46.2 percent) were in the very small size category with 1 to 9 bison. About one-fifth (18.3 percent) were in the small category with 10 to 24 bison, one-fourth (23.7 percent) were in the medium category with 25 to 99 bison, and about one-tenth (11.9 percent) were in the large category with 100 or more bison.

A.1.a. Percentage of sampled sites by size of operation:

Percent Sites

Size of Operation (total inventory)

Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
46.2	(NR)	18.3	(NR)	23.7	(NR)	11.9	(NR)	100.0	(NR)

NR: not reported.

Overall, more than one-half of bison operations (56.5 percent) were in the West region, about one-fourth (24.3 percent) in the North Central region, and about one-tenth in the Northeast (10.3 percent) and Southeast (8.8 percent) regions.

A.1.b. Percentage of sampled sites by region:

Percent Sites

Region

Northeast		**Southeast**		**North Central**		**West**		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
10.3	(NR)	8.8	(NR)	24.3	(NR)	56.5	(NR)	100.0	(NR)

NR: not reported.

Overall, the operation average total number of bison on responding operations was 137, ranging from an average of 24 bison on operations in the Northeast region to 201 bison in the West region.

A.1.c. Operation average total number of bison on July 1, 2022, by region:

Region	Operation average number of bison*	Std. error
Northeast	24	(4)
Southeast	42	(9)
North Central	43	(4)
West	201	(26)
All operations	137	(16)

*Rounded to nearest whole number.

Overall, 98.0 percent of responding operations had one or more bison on July 1, 2022. A few operations (2.0 percent) had bison during the study reference period of July 1, 2021, through June 30, 2022, but had no bison on July 1, 2022. About 94 percent of operations had female bison, and about 86 percent had male bison. For both male and female bison, a higher percentage of operations had bison more than 3 years old than bison 1 to 3 years old or less than 1 year old.

A.1.d. Percentage of operations by sex and by age of bison present on July 1, 2022:

	Percent Operations							
	Age (years)							
	More than 3		1 to 3		Less than 1		Total	
Sex	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Female	88.9	(1.6)	69.3	(1.9)	65.2	(1.9)	93.7	(1.2)
Male	76.2	(1.9)	64.2	(2.0)	59.0	(1.8)	85.5	(1.6)
Either	93.5	(1.2)	76.9	(1.8)	71.1	(1.8)	98.0	(0.7)

Female bison composed two-thirds (67.3 percent) of the total bison inventory on July 1, 2022, with the percentage decreasing as the age of the bison decreased. A little more than one-third (35.1 percent) of all bison on operations were females more than 3 years old. Male bison composed about one-third of the bison inventory (32.7 percent), with only 5.0 percent of all bison being males more than 3 years old.

Overall, about two-fifths (40.1 percent) of all bison were more than 3 years old, one-third (36.0 percent) were aged 1 to 3 years, and slightly less than one-fourth (23.8 percent) of all bison were less than 1 year old.

A.1.e. Percentage of July 1, 2022, bison inventory, by sex and by age of bison:

Percent Bison

Age (years)

	More than 3		1 to 3		Less than 1		Total	
Sex	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Female	35.1	(1.6)	19.8	(1.1)	12.4	(0.8)	67.3	(1.3)
Male	5.0	(0.6)	16.3	(1.7)	11.4	(0.8)	32.7	(1.3)
Either	40.1	(1.9)	36.0	(2.6)	23.8	(1.6)	100.0	(—)

Large operations accounted for a higher percentage (81.7 percent) of the total bison inventory than operations in the three smaller size categories. Medium operations contained a higher percentage (12.4 percent) of the total bison inventory than very small (1.0 percent) and small (4.9 percent) operations.

A.1.f. Percentage of total bison inventory on July 1, 2022, by size of operation:

Percent Bison Inventory

Size of Operation (number of bison)

Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Total**
1.0	(0.1)	4.9	(0.6)	12.4	(1.6)	81.7	(2.2)	100.0

The West region was home to a higher percentage of the bison inventory (86.3 percent) than operations in the other regions. The North Central region contained a higher percentage of the bison inventory (9.1 percent) than operations in the Northeast and Southeast regions.

A.1.g. Percentage of total bison inventory on July 1, 2022, by region:

Percent Bison Inventory

Region

Northeast		Southeast		North Central		West		
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Total**
2.4	(0.4)	2.3	(0.6)	9.1	(1.2)	86.3	(1.7)	100.0

2. Operation location

Overall, 17.3 percent of all operations had bison at more than one location from July 1, 2021, through June 30, 2022. A higher percentage of large operations (50.3 percent) had bison at more than one location than operations in the other size categories.

A.2.a. Percentage of operations with bison at more than one location from July 1, 2021, through June 30, 2022, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
12.1	(3.2)	7.0	(2.2)	13.8	(2.6)	50.3	(4.4)	17.3	(1.6)

The percentage of operations with bison at more than one location did not differ by region.

A.2.b. Percentage of operations with bison at more than one location from July 1, 2021, through June 30, 2022, by region:

Percent Operations

Region

Northeast		Southeast		North Central		West	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
13.2	(7.0)	17.5	(4.7)	15.0	(3.0)	18.6	(2.0)

3. Bison added to the operation

About one-fifth of all operations (18.7 percent) added any bison to the herd during the study reference period. A higher percentage of large (30.8 percent) and medium (23.6 percent) operations than very small operations (7.7 percent) added any bison to the operation.

A.3.a. Percentage of operations that added any bison to the herd from July 1, 2021, through June 30, 2022, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
7.7	(2.4)	20.3	(3.6)	23.6	(3.0)	30.8	(4.0)	18.7	(1.6)

The percentage of operations that added any bison to the herd did not differ by region.

A.3.b. Percentage of operations that added any bison to the herd from July 1, 2021, through June 30, 2022, by region:

Percent Operations

Region

Northeast		Southeast		North Central		West	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
20.1	(7.2)	20.7	(6.2)	19.6	(3.1)	17.9	(1.9)

Overall, operations that added any bison added a number of animals roughly equal to one-third (32.7 percent) of the July 1, 2022, inventory.

A.3.c. For the 18.7 percent of operations that added any bison to the herd from July 1, 2021, through June 30, 2022 (Table A.3.a.), percentage of bison added, as a percentage of July 1, 2022, inventory, by size of operation:

Percent Bison Added*

Size of Operation (number of bison)

Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
57.0	(19.7)	19.9	(4.3)	14.5	(2.2)	35.6	(10.3)	32.7	(9.2)

*As a percentage of bison inventory on July 1, 2022.

For operations that added any bison, operations in the Southeast region added a lower percentage of the July 1, 2022, inventory (3.6 percent) than operations in the other three regions.

A.3.d. For the 18.7 percent of operations that added any bison to the herd from July 1, 2021, through June 30, 2022 (Table A.3.a.), percentage of bison added, as a percentage of July 1, 2022, inventory, by region:

Percent Bison Added*

Region

Northeast		Southeast		North Central		West	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
19.6	(3.7)	3.6	(0.5)	16.7	(5.7)	36.3	(10.0)

*As a percentage of bison inventory on July 1, 2022.

For operations that added any bison during the study reference period, three-fourths (75.6 percent) of operations obtained bison through private sale, 17.7 percent from auctions/sale barns, and 5.6 percent through trade. Less than 5 percent of operations obtained bison either from "other" sources or dealers/brokers.

There were few substantive differences by operation size in the sources of bison added. Very small operations were the only size category to obtain bison from dealers/brokers and the only size category that did not obtain bison through trade.

A.3.e. For the 18.7 percent of operations that added any bison to the operation's herd from July 1, 2021, through June 30, 2022 (Table A.3.a.), percentage of operations that added bison from listed sources, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Source	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Private sale	69.2	(14.6)	81.4	(8.4)	75.2	(5.9)	73.2	(6.8)	75.6	(4.0)
Trade	0.0	(—)	5.5	(4.4)	6.9	(2.8)	6.8	(3.6)	5.6	(1.8)
Auction/sale barn	15.7	(9.6)	5.5	(4.4)	24.1	(5.8)	23.2	(6.4)	17.7	(3.2)
Dealer/broker	13.0	(10.1)	0.0	(—)	0.0	(—)	0.0	(—)	1.8	(1.4)
Other	16.5	(13.6)	0.0	(—)	0.0	(—)	9.4	(4.2)	4.7	(2.3)

By region, the majority of operations obtained bison to be added to the operation through private sale. About one-fifth of operations in the North Central and West regions obtained bison from auctions/sale barns, and about one-fifth of operations in the Northeast region used "other" sources.

A.3.f. For the 18.7 percent of operations that added any bison to the operation's herd from July 1, 2021, through June 30, 2022 (Table A.3.a.), percentage of operations that added bison from listed sources, by region:

Percent Operations

Region

	Northeast		**Southeast**		**North Central**		**West**	
Source	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Private sale	78.6	(16.9)	100.0	(—)	81.0	(6.0)	68.8	(5.6)
Trade	0.0	(—)	0.0	(—)	(D)	(D)	(D)	(D)
Auction/sale barn	0.0	(—)	0.0	(—)	22.7	(6.7)	22.1	(4.6)
Dealer/broker	0.0	(—)	0.0	(—)	0.0	(—)	3.0	(2.5)
Other	21.4	(16.9)	0.0	(—)	(D)	(D)	(D)	(D)

Values of (D) denote too few to report.

A higher percentage of operations added bison aged 1 to 3 years than added bison in the other age groups. Overall, 65.3 percent of operations that added any bison added bison aged 1 to 3 years, whereas 37.0 percent added bison aged more than 3 years, and 19.1 percent added bison less than 1 year old. Of operations that added bison, almost one-half (45.9 percent) added bison aged 1 to 3 years that were obtained through private sales and almost one-third (31.0 percent) added bison aged more than 3 years that were obtained through private sales.

A.3.g. For the 18.7 percent of operations that added any bison to the operation's herd from July 1, 2021, through June 30, 2022 (Table A.3.a.), percentage of operations that added bison, by source and by age of added bison:

Percent Operations

Age (years) **of Bison Added**

	More than 3		1 to 3		Less than 1	
Source	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Private sale	31.0	(4.4)	45.9	(4.6)	16.8	(3.4)
Trade	1.5	(0.8)	4.1	(1.6)	0.0	(—)
Auction/sale barn	4.2	(1.6)	14.3	(2.9)	6.1	(1.9)
Dealer/broker	0.0	(—)	1.8	(1.4)	0.0	(—)
Other	3.2	(2.1)	4.7	(2.3)	0.0	(—)
Any	37.0	(4.5)	65.3	(4.5)	19.1	(3.5)

For operations that added bison, and for all bison added, 89.5 percent were obtained through private sale and 8.8 percent came from auction/sale barn sources. A total of 1.7 percent of bison added came from trade, dealers/brokers, or "other" sources.

A.3.h. For the 18.7 percent of operations that added any bison to the operation's herd from July 1, 2021, through June 30, 2022 (Table A.3.a.), percentage of bison added, by source and by age of added bison:

Percent Bison Added*

Age (years) **of Bison Added**

	More than 3		1 to 3		Less than 1		Total	
Source	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Private sale	2.3	(1.2)	75.4	(12.5)	11.8	(6.9)	89.5	(5.7)
Trade	0.0	(0.0)	0.3	(0.2)	0.0	(—)	0.3	(0.2)
Auction/sale barn	0.8	(0.5)	3.6	(2.1)	4.5	(3.0)	8.8	(5.0)
Dealer/broker	0.0	(—)	0.1	(0.1)	0.0	(—)	0.1	(0.1)
Other	0.1	(0.1)	1.2	(0.9)	0.0	(—)	1.3	(0.9)
Total	3.2	(1.7)	80.5	(10.4)	16.3	(9.1)	100.0	(—)

*As a percentage of bison added.

Respondents who had added bison were also asked whether they had imported bison from other countries during the reference period. Four operations had imported bison from Canada.

4. Live bison permanently removed from the operation

Overall, almost three-fifths of all operations (58.0 percent) had any live bison permanently leave the operation, including bison slaughtered on the operation. Higher percentages of medium (78.5 percent) and large (86.6 percent) operations than very small (26.8 percent) and small (59.6 percent) operations had any bison permanently leave the operation. A higher percentage of small operations than very small operations had live bison permanently leave the operation.

A.4.a. Percentage of operations that had any live bison permanently leave the operation's herd (including bison slaughtered on ranch) from July 1, 2021, through June 30, 2022, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
26.8	(4.0)	59.6	(4.6)	78.5	(3.1)	86.6	(3.1)	58.0	(2.0)

Higher percentages of operations in the West (60.9 percent) and North Central (60.6 percent) regions than in the Southeast region (35.5 percent) had any live bison permanently leave the operation's herd.

A.4.b. Percentage of operations that had any live bison permanently leave the operation's herd (including bison slaughtered on ranch) from July 1, 2021, through June 30, 2022, by region:

Percent Operations

Region

Northeast		**Southeast**		**North Central**		**West**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
54.2	(7.6)	35.5	(7.2)	60.6	(3.8)	60.9	(2.5)

Overall, for operations that had any live bison permanently leave (including bison slaughtered on ranch), the bison that departed equaled 39.1 percent of the bison inventory on July 1, 2022. The bison leaving very small operations represented almost three-fourths of the July 1, 2022, inventory for that size category.

A.4.c. For the 58.0 percent of operations that had any live bison permanently leave the operation's herd (including bison slaughtered on ranch) from July 1, 2021, through June 30, 2022 (Table A.4.a.), percentage of bison removed, by size of operation:

Percent Bison*

Size of Operation (number of bison)

Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
73.8	(21.0)	29.2	(3.2)	27.2	(1.8)	41.1	(4.7)	39.1	(4.0)

*As a percentage of bison inventory on July 1, 2022.

For operations that had bison permanently leave the operation, bison departing from operations in the West region represented a higher percentage (41.2 percent) of the July 1, 2022, inventory than the bison departing operations in the other three regions. Bison departing from operations in the North Central region represented a higher percentage (26.0 percent) of the July 1, 2022, inventory than the bison departing operations in the Southeast region (17.8 percent).

A.4.d. For the 58.0 percent of operations that had any live bison permanently leave the operation's herd (including bison slaughtered on ranch) from July 1, 2021, through June 30, 2022 (Table A.4.a.), percentage of bison removed, by region:

Percent Bison*

Region

Northeast		**Southeast**		**North Central**		**West**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
21.0	(4.1)	17.8	(1.8)	26.0	(2.2)	41.2	(4.5)

*As a percentage of bison inventory on July 1, 2022.

For all operations that had any bison permanently leave the operation, about two-fifths had bison leave by being slaughtered on ranch (42.7 percent) or being sent directly to offsite slaughter/packer (41.3 percent), and about one-fifth (21.9 percent) had bison depart through private sale for breeding stock.

There were few differences by size of operation, although a higher percentage of large operations than very small and small operations sent bison directly to offsite slaughter/packer. Also, a higher percentage of large operations than medium operations sent bison directly to a feedlot, while no very small or small operations sent bison directly to a feedlot.

A.4.e. For the 58.0 percent of operations that had any live bison permanently leave the operation's herd (including bison slaughtered on ranch) from July 1, 2021, through June 30, 2022 (Table A.4.a.), percentage of operations by method of bison removal and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Method of removal	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Slaughtered on ranch	40.3	(8.3)	45.7	(5.4)	36.7	(3.8)	50.4	(4.6)	42.7	(2.5)
Direct to offsite slaughter/packer	23.8	(6.7)	32.3	(5.4)	43.0	(3.9)	59.8	(4.6)	41.3	(2.5)
Direct to feedlot	0.0	(—)	0.0	(—)	7.5	(2.4)	29.6	(4.2)	9.6	(1.3)
Sold at auction/sale barn	7.2	(4.5)	16.5	(4.5)	11.2	(2.0)	14.1	(3.2)	12.6	(1.7)
Sold to dealer/broker	0.0	(—)	1.9	(1.5)	4.5	(1.7)	4.5	(1.8)	3.1	(0.8)
Private sale—for breeding stock	26.7	(7.1)	19.5	(4.5)	20.5	(3.2)	23.4	(3.8)	21.9	(2.1)
Private sale—onsite hunting	6.7	(4.1)	6.7	(3.0)	12.9	(2.7)	17.7	(3.6)	11.5	(1.6)
Private sale—for meat or other products	0.0	(—)	17.5	(3.9)	20.8	(3.0)	25.6	(3.8)	17.9	(1.7)
Traded or given away	7.2	(4.6)	1.4	(1.2)	6.4	(1.9)	9.6	(2.4)	6.0	(1.2)
Lost or stolen	3.6	(3.2)	4.6	(2.4)	6.8	(2.1)	6.2	(2.1)	5.6	(1.2)
Other	6.6	(4.1)	1.9	(1.5)	2.0	(0.9)	7.5	(2.4)	4.0	(1.0)

There were few differences by region in the methods operations used to remove live bison permanently from the herd. A higher percentage of operations in the West region than in the North Central region sent bison directly to a feedlot or sold them privately for onsite hunting.

A.4.f. For the 58.0 percent of operations that had any live bison permanently leave the operation's herd (including bison slaughtered on ranch) from July 1, 2021, through June 30, 2022 (Table A.4.a.), percentage of operations by method of bison removal, by region:

Percent Operations

	Region							
	Northeast		Southeast		North Central		West	
Method of removal	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Slaughtered on ranch	55.3	(10.4)	25.3	(10.5)	33.6	(4.4)	45.5	(3.1)
Direct to offsite slaughter/packer	33.8	(8.0)	40.4	(12.9)	46.9	(4.8)	40.4	(3.1)
Direct to feedlot	0.0	(—)	7.5	(6.1)	3.7	(1.3)	13.1	(2.0)
Sold at auction/sale barn	14.7	(8.5)	25.3	(11.6)	10.5	(2.4)	11.9	(2.0)
Sold to dealer/broker	0.0	(—)	0.0	(—)	(D)	(D)	(D)	(D)
Private sale—for breeding stock	10.6	(6.3)	41.8	(11.8)	16.1	(3.2)	23.8	(2.7)
Private sale—onsite hunting	3.9	(3.3)	8.9	(7.5)	1.8	(1.0)	16.2	(2.4)
Private sale—for meat or other products	14.5	(7.0)	32.9	(12.4)	18.4	(3.4)	17.0	(2.0)
Traded or given away	0.0	(—)	0.0	(—)	7.0	(2.1)	7.0	(1.7)
Lost or stolen	3.9	(3.2)	16.4	(9.5)	4.5	(2.0)	5.3	(1.4)
Other	0.0	(—)	0.0	(—)	(D)	(D)	(D)	(D)

Values of (D) denote too few to report.

Overall, for operations that had any bison permanently leave the operation (including bison slaughtered on ranch), the percentage of operations that had bison leave differed with the age of bison that left. About two-thirds of operations had bison 1 to 3 years old leave (65.7 percent) or bison more than 3 years old leave (64.3 percent), whereas a lower percentage (26.0 percent) had bison less than 1 year old permanently leave the operation.

For bison aged more than 3 years old or 1 to 3 years old, the methods of removal used by the highest percentages of operations were slaughtered on ranch and direct to offsite slaughter/packer. For bison less than 1 year old, the methods of removal used by the highest percentages of operations were private sale—for breeding stock, sold at auction/sale barn, and direct to feedlot.

A.4.g. For the 58.0 percent of operations that had any bison permanently leave the operation's herd (including bison slaughtered on ranch) from July 1, 2021, through June 30, 2022 (Table A.4.a.), percentage of operations by method of removal and by age of bison removed:

	Percent Operations					
	Age (years)					
	More than 3		**1 to 3**		**Less than 1**	
Method of removal	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Slaughtered on ranch	28.9	(2.4)	22.0	(2.2)	1.4	(0.6)
Direct to offsite slaughter/packer	22.4	(2.0)	29.7	(2.2)	1.1	(0.5)
Direct to feedlot	1.4	(0.5)	3.7	(0.8)	5.7	(1.1)
Sold at auction/sale barn	6.1	(1.3)	7.1	(1.3)	7.7	(1.5)
Sold to dealer/broker	1.5	(0.5)	1.3	(0.6)	0.8	(0.4)
Private sale—for breeding stock	9.3	(1.5)	13.6	(1.7)	6.6	(1.3)
Private sale—onsite hunting	7.5	(1.3)	5.3	(1.1)	1.0	(0.6)
Private sale—for meat or other products	7.9	(1.3)	11.4	(1.5)	3.7	(0.9)
Traded or given away	2.0	(0.7)	2.8	(0.9)	1.8	(0.5)
Lost or stolen	3.1	(0.8)	1.5	(0.7)	2.1	(0.8)
Other	2.5	(0.8)	1.5	(0.6)	0.8	(0.4)
Any	64.3	(2.5)	65.7	(2.5)	26.0	(2.2)

Overall, for operations that had any bison permanently leave the operation, more than one-half of bison removed (54.3 percent) were sent directly to offsite slaughter/packer and 13.9 percent were sent to a feedlot.

More than two-thirds (69.6 percent) of bison aged 1 to 3 years were sent directly to offsite slaughter/packer, a higher percentage than for the other age categories. For bison less than 1 year old, almost three-fourths were removed by one of three methods: sent directly to a feedlot (29.4 percent), directly to offsite slaughter/packer (24.0 percent), or to auctions/sale barns (21.0 percent). For bison more than 3 years old, 29.6 percent were sent directly to offsite slaughter/packer and 28.6 percent were slaughtered on ranch; this latter percentage was higher than the percentage for bison in the younger age categories.

A.4.h. For the 58.0 percent of operations that had any bison permanently leave the operation (including bison slaughtered on ranch) from July 1, 2021, through June 30, 2022 (Table A.4.a.), percentage of bison removed, by method of removal and by age of bison:

	Percent Bison*							
	Age (years)							
	More than 3		**1 to 3**		**Less than 1**		**Total**	
Method of removal	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Slaughtered on ranch	28.6	(6.7)	6.4	(2.0)	0.4	(0.2)	8.7	(1.7)
Direct to offsite slaughter/packer	29.6	(6.1)	69.6	(6.1)	24.0	(15.3)	54.3	(6.9)
Direct to feedlot	17.6	(7.7)	8.2	(3.7)	29.4	(8.5)	13.9	(3.2)
Sold at auction/sale barn	3.9	(1.2)	3.2	(1.4)	21.0	(9.4)	6.9	(2.9)
Sold to dealer/broker	0.9	(0.4)	0.2	(0.1)	0.5	(0.3)	0.4	(0.1)
Private sale—for breeding stock	3.0	(0.8)	2.3	(0.6)	5.8	(2.0)	3.1	(0.7)
Private sale—onsite hunting	3.6	(1.0)	0.5	(0.2)	0.8	(0.7)	1.1	(0.3)
Private sale—for meat or other products	8.6	(2.6)	6.9	(2.5)	8.2	(3.3)	7.4	(1.9)
Traded or given away	1.3	(0.7)	0.5	(0.2)	5.1	(3.4)	1.5	(0.7)
Lost or stolen	0.6	(0.2)	0.1	(0.0)	0.9	(0.6)	0.3	(0.1)
Other	2.2	(0.9)	2.1	(1.7)	3.8	(3.0)	2.5	(1.3)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

*As a percentage of bison removed.

Note that the denominator for each column is different due to some item non-response for each age group.

Overall, 12.7 percent of operations that had any bison permanently leave the operation used mobile units for slaughtering bison. The percentage of operations using mobile slaughter units did not differ by size of operation.

A.4.i. For the 58.0 percent of operations that had any live bison permanently leave the operation's herd (including bison slaughtered on ranch) from July 1, 2021, though June 30, 2022 (Table A.4.a.), percentage of operations on which mobile units were used for slaughter of any bison on the operation, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
9.8	(4.7)	14.7	(3.8)	9.1	(2.4)	18.3	(3.4)	12.7	(1.6)

The percentage of operations that used mobile slaughter units did not differ by region, except for the Southeast region, where operations did not use mobile slaughter units.

A.4.j. For the 58.0 percent of operations that had any bison permanently leave the operation's herd (including bison slaughtered on ranch) from July 1, 2021, through June 30, 2022 (Table A.4.a.), percentage of operations on which mobile units were used for slaughter of any bison on the operation, by region:

Percent Operations

Region

Northeast		**Southeast**		**North Central**		**West**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
7.4	(4.7)	0.0	(—)	9.5	(2.7)	15.7	(2.2)

Overall, more than one-third of operations (37.0 percent) used mobile slaughter units primarily because the area lacked a nearby processing facility or availability. About one-fourth of operations (23.9 percent) used mobile slaughter units primarily for animal-welfare reasons.

Almost three-fourths of very small operations (73.4 percent) used mobile slaughter units primarily because processing was not available nearby, which was also the case for small (37.2 percent) and medium (49.3 percent) operations. For large operations, almost two-fifths (38.7 percent) used mobile slaughter units primarily for reasons of animal welfare, and more than one-third (33.7 percent) used them primarily for marketing reasons.

A.4.k. For the 7.4 percent of operations that had bison permanently leave the operation's herd and used mobile units for slaughter of any bison on the operation from July 1, 2021, through June 30, 2022 (Table A.4.i.),* percentage of operations by primary reason for use of mobile units and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Primary reason	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Hunter-killed bison	0.0	(—)	25.6	(12.7)	8.1	(6.7)	13.2	(6.9)	13.9	(4.9)
Animal welfare	0.0	(—)	22.1	(12.9)	17.7	(8.2)	38.7	(10.4)	23.9	(5.8)
Transportation reasons	26.6	(22.0)	15.1	(11.5)	0.0	(—)	0.0	(—)	7.5	(4.5)
Lack of nearby processing facility or availability	73.4	(22.0)	37.2	(15.9)	49.3	(13.5)	14.4	(8.4)	37.0	(7.1)
Marketing reasons	0.0	(—)	0.0	(—)	0.0	(—)	33.7	(10.0)	11.2	(3.7)
Other	0.0	(—)	0.0	(—)	24.9	(13.5)	0.0	(—)	6.5	(4.1)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

*These estimates come from the 58.0 percent of operations that had any bison permanently leave the operation's herd (including bison slaughtered on ranch) (Table A.4.a.), of which 12.7 percent of operations used mobile units for slaughter of any bison on the operation from July 1, 2021, through June 30, 2022 (Table A.4.i.).

All operations in the Northeast region that used mobile slaughter units used them primarily because there was no nearby processing facility or availability; this was also the primary reason for use by about one-third (35.0 percent) of operations in the West region and one-fourth (25.8 percent) of operations in the North Central region. More than one-half of North Central operations (54.8 percent) used the units primarily for animal-welfare reasons. As noted previously in Table A.4.i., responding operations in the Southeast region did not use mobile slaughter units.

A.4.l. For the 7.4 percent of operations that had bison permanently leave the operation's herd and used mobile units for slaughter of any bison on the operation from July 1, 2021, through June 30, 2022 (Table A.4.i.),* percentage of operations by primary reason for use of mobile units, by region:

Percent Operations

	Region							
	Northeast		Southeast		North Central		West	
Primary reason	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Hunter-killed bison	0.0	(—)	NA	NA	0.0	(—)	17.7	(6.1)
Animal welfare	0.0	(—)	NA	NA	54.8	(16.7)	19.1	(6.3)
Transportation reasons	0.0	(—)	NA	NA	19.4	(15.7)	5.6	(4.5)
Lack of nearby processing facility or availability	100.0	(—)	NA	NA	25.8	(13.5)	35.0	(8.2)
Marketing reasons	0.0	(—)	NA	NA	0.0	(—)	14.4	(4.7)
Other	0.0	(—)	NA	NA	0.0	(—)	8.3	(5.2)
Total	100.0	(—)	NA	NA	100.0	(—)	100.0	(—)

*These estimates come from the 58.0 percent of operations that had any bison permanently leave the operation's herd (including bison slaughtered on ranch) (Table A.4.a.), of which 12.7 percent of operations used mobile units for slaughter of any bison on the operation from July 1, 2021, through June 30, 2022 (Table A.4.i.).
NA indicates that no operations in the Southeast used mobile units.

For all operations that used mobile slaughter during the reference period, more than three-fourths (75.2 percent) indicated that the COVID-19 pandemic did not affect their use of the units. The remaining 24.8 percent of operations were roughly split between operations that saw increased use of mobile slaughter (14.4 percent) during the pandemic and those that saw decreased use (10.4 percent).

The majority of operations within each size category maintained the same level of use of mobile slaughter units during the pandemic.

A.4.m. For the 7.4 percent of operations that had bison permanently leave the operation's herd and used mobile units for slaughter of any bison on the operation from July 1, 2021, through June 30, 2022 (Table A.4.i.),* percentage of operations by effect of the COVID-19 (SARS-CoV-2) pandemic on use of mobile units during 2021 and 2022, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Did pandemic affect use of mobile slaughter?	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Yes—increased use	0.0	(—)	22.1	(12.9)	(D)	(D)	(D)	(D)	14.4	(4.9)
Yes—reduced use	0.0	(—)	15.1	(11.5)	(D)	(D)	(D)	(D)	10.4	(4.5)
No—maintained same use	100.0	(—)	62.8	(15.9)	86.0	(8.2)	68.7	(9.5)	75.2	(6.4)
Other	0.0	(—)	0.0	(—)	0.0	(—)	0.0	(—)	0.0	(—)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

*These estimates come from the 58.0 percent of operations that had any bison permanently leave the operation's herd (including bison slaughtered on ranch) (Table A.4.a.), of which 12.7 percent of operations used mobile units for slaughter of any bison on the operation from July 1, 2021, through June 30, 2022 (Table A.4.i.).
Values of (D) denote too few to report.

Respondents who had bison permanently leave the operation were asked whether they had exported live bison or bison products to other countries. No operations had exported bison to other countries during the reference period.

5. Bison deaths due to natural causes

Respondents were asked to report the number of bison that died or were euthanized because of natural causes, such as disease, injury, or weather-related problems. Overall, almost one-half of operations (45.3 percent) had any bison die due to natural causes. The percentage of operations that had any bison die due to natural causes increased as herd size increased, ranging from 20.4 percent of very small operations to 85.4 percent of large operations.

A.5.a. Percentage of operations on which any bison died or were euthanized due to natural causes from July 1, 2021, through June 30, 2022, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
20.4	(3.4)	37.4	(4.4)	60.0	(3.7)	85.4	(3.2)	45.3	(1.9)

A higher percentage of operations in the West region (49.1 percent) than in the Northeast region (27.8 percent) had any bison die or be euthanized because of natural causes.

A.5.b. Percentage of operations on which any bison died or were euthanized due to natural causes from July 1, 2021, through June 30, 2022, by region:

Percent Operations

Region

Northeast		Southeast		North Central		West	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
27.8	(5.5)	49.9	(6.6)	40.7	(3.4)	49.1	(2.6)

Overall, 4.0 percent of bison, as a percentage of the July 1, 2022, inventory, died or were euthanized due to natural causes. Very small operations had a higher percentage of bison die due to natural causes (38.4 percent) than operations in the other size categories. Small operations had a higher percentage (10.2 percent) of bison die due to natural causes than medium (6.1 percent) or large (3.5 percent) operations.

A.5.c. For the 45.3 percent of operations that had any bison die or euthanized due to natural causes from July 1, 2021, through June 30, 2022 (Table A.5.a.), percentage of bison that died, by size of operation:

Percent Bison*

Size of Operation (number of bison)

Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
38.4	(7.9)	10.2	(0.8)	6.1	(0.7)	3.5	(0.7)	4.0	(0.6)

*As a percentage of bison inventory on July 1, 2022.

There were no differences by region in the percentage of bison that died or were euthanized because of natural causes.

A.5.d. For the 45.3 percent of operations on which any bison died or were euthanized due to natural causes from July 1, 2021, through June 30, 2022 (Table A.5.a.), percentage of bison that died, by region:

Percent Bison*

Region

Northeast		Southeast		North Central		West	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
4.2	(0.8)	4.6	(1.5)	5.5	(0.6)	3.9	(0.7)

*As a percentage of bison inventory on July 1, 2022.

Overall, of operations that had any bison die, more than one-half (54.1 percent) attributed bison deaths or euthanization to disease, disorder, or other health problems. About one-fourth of operations had bison die from unknown causes (28.9 percent) or because of injury or trauma not related to predation, handling, or weather (22.5 percent). About one-tenth of operations had bison die because of handling-related problems (12.6 percent) or weather-related problems (8.0 percent), and 5.3 percent had bison die because of predation. About one-ninth of operations (11.0 percent) had bison die because of "other cause" of death, which primarily included old age.

There were few differences in natural causes of death by operation size, although a higher percentage of large operations (27.5 percent) than small (5.8 percent) or medium (5.8 percent) operations had bison die because of handling-related problems. No very small operations lost bison to a weather-related problem, and no small operations lost bison to predation.

A.5.e. For the 45.3 percent of operations on which any bison died or were euthanized due to natural causes from July 1, 2021, through June 30, 2022 (Table A.5.a.), percentage of operations by cause of death and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Cause of death	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Disease, disorder, or other health problem	50.7	(9.8)	44.2	(7.8)	57.1	(4.5)	59.0	(4.9)	54.1	(3.1)
Injury/trauma not related to predation, handling, or weather	14.5	(7.2)	26.7	(6.6)	23.1	(3.9)	23.2	(3.9)	22.5	(2.5)
Predation	11.9	(6.2)	0.0	(—)	5.4	(2.0)	5.2	(2.2)	5.3	(1.4)
Handling-related problem	10.1	(6.3)	5.8	(3.6)	5.8	(2.3)	27.5	(4.4)	12.6	(1.9)
Weather-related problem (e.g., lightning, flood)	0.0	(—)	13.3	(5.7)	4.7	(1.7)	12.9	(3.3)	8.0	(1.6)
Other cause	9.4	(5.8)	16.3	(6.0)	10.3	(2.8)	9.2	(3.0)	11.0	(2.0)
Unknown	39.2	(9.2)	20.9	(6.0)	29.1	(4.2)	28.7	(4.4)	28.9	(2.7)

There were few differences by region in the percentage of operations on which any bison died or were euthanized due to natural causes. No bison died because of predation in the Northeast or Southeast regions. No bison died or were euthanized due to weather-related problems or “other cause” in the Northeast region.

A.5.f. For the 45.3 percent of operations on which any bison died or were euthanized due to natural causes from July 1, 2021, through June 30, 2022 (Table A.5.a.), percentage of operations by cause of death, by region:

Percent Operations

	Region							
	Northeast		**Southeast**		**North Central**		**West**	
Cause of death	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Disease, disorder, or other health problem	43.5	(12.3)	48.2	(12.0)	60.3	(5.3)	54.1	(3.9)
Injury/trauma not related to predation, handling, or weather	14.5	(8.6)	15.5	(8.7)	25.8	(4.6)	23.3	(3.2)
Predation	0.0	(—)	0.0	(—)	9.6	(3.7)	5.2	(1.8)
Handling-related problem	14.9	(12.3)	27.4	(10.0)	6.8	(2.5)	12.1	(2.2)
Weather-related problem (e.g., lightning, flood)	0.0	(—)	14.3	(8.5)	4.3	(2.1)	9.1	(2.1)
Other cause	0.0	(—)	7.7	(6.6)	5.2	(2.5)	14.3	(2.8)
Unknown	56.1	(13.5)	36.3	(11.1)	23.3	(4.5)	26.8	(3.3)

Overall, for operations that had any bison die or be euthanized due to natural causes, a higher percentage of operations lost bison more than 3 years old (71.2 percent) than lost bison 1 to 3 years old (32.0 percent) or less than 1 year old (40.7 percent).

For all three age categories, the highest percentage of operations had bison die or be euthanized because of disease, disorder, or other health problems. A higher percentage of operations lost bison more than 3 years old (38.7 percent) than bison 1 to 3 years old (16.6 percent) or bison less than 1 year old (18.7 percent) to disease, disorder, or other health problem.

A.5.g. For the 45.3 percent of operations on which any bison died or were euthanized due to natural causes from July 1, 2021, through June 30, 2022 (Table A.5.a.), percentage of operations by cause of death and by age of bison:

	Percent Operations					
	Age (years)					
	More than 3		**1 to 3**		**Less than 1**	
Cause of death	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Disease, disorder, or other health problem	38.7	(2.9)	16.6	(2.1)	18.7	(2.3)
Injury/trauma not related to predation, handling, or weather	9.2	(1.8)	8.7	(1.6)	7.9	(1.6)
Predation	1.7	(0.6)	1.2	(0.6)	3.3	(1.2)
Handling-related problem	4.3	(1.3)	5.4	(1.4)	3.2	(0.9)
Weather-related problem (e.g., lightning, flood)	4.9	(1.3)	1.5	(0.8)	3.4	(1.0)
Other cause	10.3	(2.0)	0.4	(0.3)	0.4	(0.3)
Unknown	17.9	(2.4)	7.6	(1.5)	10.5	(1.6)
Any	71.2	(2.7)	32.0	(2.7)	40.7	(2.9)

Overall, of bison that died or were euthanized due to natural causes, the majority died because of disease, disorder, or other health problems (71.2 percent). About 5 percent died because of injury/trauma not related to predation, handling, or weather (5.2 percent). Less than 3 percent died because of predation, handling-related problems, weather-related problems, or "other cause."

Within each age group, the highest percentage of deaths was caused by disease, disorder, or other health problems. More than 70 percent of natural deaths of bison more than 3 years old (71.6 percent) or 1 to 3 years old (79.8 percent) were attributed to disease, disorder, or other health problems. For bison less than 1 year old, more than 50 percent of natural deaths (53.9 percent) resulted from disease, disorder, or other health problems. More than one-fourth of deaths in bison less than 1 year old (26.3 percent) had unknown causes.

A.5.h. For the 45.3 percent of operations on which any bison died or were euthanized due to natural causes from July 1, 2021, through June 30, 2022 (Table A.5.a.), percentage of bison deaths by cause of death and by age of bison:

Percent Bison*

Age (years)

	More than 3		1 to 3		Less than 1		Total	
Cause of death	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Disease, disorder, or other health problem	71.6	(6.4)	79.8	(5.9)	53.9	(8.7)	71.2	(5.1)
Injury/trauma not related to predation, handling, or weather	4.5	(1.3)	4.8	(1.5)	7.4	(2.0)	5.2	(1.0)
Predation	1.7	(0.7)	1.4	(0.8)	4.3	(1.9)	2.1	(0.8)
Handling-related problem	2.0	(0.8)	2.6	(1.0)	1.9	(0.7)	2.2	(0.5)
Weather-related problem (e.g., lightning, flood)	2.9	(1.0)	1.1	(0.4)	5.9	(2.1)	2.8	(0.7)
Other cause	6.2	(1.9)	0.1	(0.1)	0.3	(0.3)	2.6	(0.7)
Unknown	11.0	(3.2)	10.2	(4.5)	26.3	(7.9)	13.8	(4.0)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

*As a percentage of bison that died.

B. Operation Management

Note: Unless otherwise noted, tables in this section refer to the period July 1, 2021, through June 30, 2022.

1. Reasons for having bison and plans for herd

The bison industry has multiple facets and offers bison stewards numerous commercial uses and other outcomes for their bison. Many operations participate in multiple aspects of the business. More than two-thirds of all operations (67.9 percent) were involved in bison cow-calf production. About two-fifths of operations raised bison to be used as seedstock (43.6 percent) or finished on grass (40.5 percent). Roughly one-third kept bison as a hobby or pasture pet (34.0 percent) or for conservation purposes (29.9 percent). About one-fifth of operations kept bison for agritourism/ecotourism (19.9 percent), and more than one-tenth of operations raised bison for use of their byproducts (14.8 percent), backgrounding/stocking (12.5 percent), game ranch/hunting (12.2 percent), and feedlot production (10.4 percent). Most of the other reasons specified for keeping bison related to a love for bison and/or bison meat.

A lower percentage of very small operations kept bison for bison cow-calf production (35.9 percent), seedstock production (24.9 percent), finishing on grass (20.5 percent), and preparation/sale of byproducts (4.2 percent), compared with operations of all other size categories. Higher percentages of large operations than very small operations kept bison for backgrounding/stocking, feedlot placement, and game ranch/hunting on the operation. The percentage of operations that kept bison for hobby/pasture pet decreased as operation size increased. A higher percentage of very small operations (11.2 percent) than large operations (3.1 percent) had bison for training cutting horses. There were no differences by size of operation for conservation, agritourism, and cultural use.

B.1.a. Percentage of operations by reason(s) bison were kept on the operation from July 1, 2021, through June 30, 2022, and by size of operation:

Percent Operations

Size of Operation (number of bison)

Reason	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Bison cow-calf production (offspring intended for meat production)	35.9	(3.7)	73.9	(4.0)	86.0	(2.7)	95.0	(1.7)	67.9	(1.8)
Seedstock production (offspring intended for breeding purposes)	24.9	(3.6)	49.7	(4.5)	50.4	(3.6)	62.1	(4.1)	43.6	(2.0)
Finishing on grass (bison finished on pasture/grass for slaughter)	20.5	(3.6)	46.0	(4.7)	56.2	(3.5)	47.6	(4.2)	40.5	(2.0)
Backgrounding/stocking (young bison prepared for a feedlot)	3.8	(1.7)	7.9	(2.4)	13.8	(2.4)	35.2	(3.9)	12.5	(1.2)
Feedlot (bison from this or other operations finished on feed for slaughter)	0.8	(0.7)	7.4	(2.4)	11.1	(2.0)	33.6	(4.2)	10.4	(1.1)
Game ranch/hunting on this operation	7.4	(2.4)	10.4	(3.0)	13.4	(2.6)	23.3	(3.7)	12.2	(1.4)
Preparation/sale of byproducts (e.g., hides, skulls, horns, hair)	4.2	(1.6)	17.0	(3.3)	23.6	(3.1)	18.5	(3.1)	14.8	(1.3)
Conservation	25.5	(3.7)	30.3	(4.3)	30.8	(3.3)	37.1	(4.2)	29.9	(2.0)
Hobby/pasture pet	58.8	(4.2)	40.0	(4.5)	17.6	(2.7)	1.0	(0.9)	34.0	(1.9)
Agritourism/ecotourism	15.7	(2.9)	15.5	(3.5)	27.4	(3.0)	22.1	(3.5)	19.9	(1.6)
Cultural use	5.0	(1.8)	11.7	(2.9)	9.7	(2.2)	11.2	(2.6)	8.8	(1.2)
Cutting horse training	11.2	(2.7)	2.5	(1.6)	6.0	(1.8)	3.1	(1.3)	6.4	(1.1)
Other	13.5	(2.7)	16.7	(3.2)	11.1	(2.3)	16.8	(3.5)	14.1	(1.4)

A higher percentage of operations in the Southeast region (56.9 percent) kept bison on the operation for finishing on grass than operations in the West region (34.9 percent). A higher percentage of operations in the Southeast region (36.7 percent) kept bison on the operation for agritourism/ecotourism than operations in the West (18.1 percent) or North Central (13.8 percent) regions. A higher percentage of operations in the West region than in the North Central region kept bison for game ranch/hunting on the operation (15.3 percent and 4.3 percent, respectively) or conservation (35.0 percent and 19.6 percent, respectively). A higher percentage of operations in the North Central region (21.5 percent) than in the Northeast region (8.4 percent) kept bison for preparation/sale of byproducts.

B.1.b. Percentage of operations by reason(s) bison were kept on the operation from July 1, 2021, through June 30, 2022, by region:

Percent Operations

	Region							
	Northeast		Southeast		North Central		West	
Reason	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Bison cow-calf production (offspring intended for meat production)	56.2	(6.1)	65.1	(7.7)	74.4	(3.4)	68.0	(2.2)
Seedstock production (offspring intended for breeding purposes)	34.5	(7.1)	58.1	(7.8)	47.0	(4.0)	41.9	(2.6)
Finishing on grass (bison finished on pasture/grass for slaughter)	41.6	(6.9)	56.9	(7.8)	49.9	(3.8)	34.9	(2.6)
Backgrounding/stocking (young bison prepared for a feedlot)	4.3	(3.9)	6.0	(3.7)	13.4	(2.5)	14.3	(1.6)
Feedlot (bison from this or other operations finished on feed for slaughter)	3.7	(3.2)	8.8	(4.2)	9.2	(2.0)	12.1	(1.4)
Game ranch/hunting on this operation	15.0	(5.9)	6.5	(4.1)	4.3	(1.7)	15.3	(1.9)
Preparation/sale of byproducts (e.g., hides, skulls, horns, hair)	8.4	(2.8)	15.3	(5.7)	21.5	(2.9)	13.4	(1.7)
Conservation	13.9	(6.3)	38.3	(8.5)	19.6	(3.1)	35.0	(2.6)
Hobby/pasture pet	28.6	(7.7)	41.9	(6.5)	29.5	(3.4)	35.4	(2.5)
Agritourism/ecotourism	29.1	(7.8)	36.7	(7.5)	13.8	(2.7)	18.1	(1.9)
Cultural use	11.5	(4.1)	13.1	(5.5)	4.8	(1.5)	9.2	(1.6)
Cutting horse training	0.0	(—)	6.5	(4.1)	1.7	(1.1)	9.1	(1.7)
Other	2.1	(1.8)	9.1	(4.0)	9.3	(2.3)	18.4	(2.1)

Although many respondents kept bison for multiple reasons (Table B.1.a.), operations typically had one purpose or product that was their primary reason for keeping bison. Among all bison operations, almost one-half (45.5 percent) raised bison primarily for cow-calf production, and about one-seventh (15.1 percent) kept bison primarily as a hobby or pasture pet.

A lower percentage of very small operations (20.9 percent) kept bison primarily for bison cow-calf production than operations in the three larger size categories. A higher percentage of large operations (69.3 percent) than small operations (47.2 percent) kept bison primarily for bison cow-calf production. A higher percentage of small operations (10.6 percent) than large operations (1.8 percent) kept bison primarily for seedstock production. A higher percentage of large operations (7.5 percent) kept bison primarily for feedlot than medium (0.6 percent) or very small operations (0.0 percent). A higher percentage of very small operations (34.6 percent) kept bison primarily for hobby/pasture pet than operations in the three larger size categories, and no large operations kept bison primarily for hobby/pasture pet. Only very small operations (8.7 percent) kept bison primarily for training cutting horses.

B.1.c. Percentage of operations by **primary** reason(s) bison were kept on the operation from July 1, 2021, through June 30, 2022, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Reason	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Bison cow-calf production (offspring intended for meat production)	20.9	(3.3)	47.2	(4.5)	61.2	(3.7)	69.3	(3.9)	45.5	(2.0)
Seedstock production (offspring intended for breeding purposes)	5.4	(1.8)	10.6	(2.6)	8.2	(2.1)	1.8	(1.0)	6.9	(1.1)
Finishing on grass (bison finished on pasture/grass for slaughter)	5.1	(1.9)	6.4	(2.1)	5.8	(1.6)	3.4	(1.6)	5.4	(1.0)
Backgrounding/stocking (young bison prepared for a feedlot)	1.0	(0.8)	1.8	(1.1)	1.2	(0.7)	0.0	(—)	1.1	(0.4)
Feedlot (bison from this or other operations finished on feed for slaughter)	0.0	(—)	2.7	(1.6)	0.6	(0.5)	7.5	(2.2)	2.0	(0.5)
Game ranch/hunting on this operation	4.6	(2.0)	2.2	(1.2)	7.1	(2.1)	1.1	(0.9)	4.1	(0.9)
Preparation/sale of byproducts (e.g., hides, skulls, horns, hair)	0.0	(—)	0.0	(—)	1.6	(1.0)	1.0	(0.9)	0.6	(0.3)
Conservation	9.1	(2.6)	5.0	(2.3)	3.9	(1.3)	7.1	(2.1)	6.4	(1.1)
Hobby/pasture pet	34.6	(4.1)	10.8	(2.8)	3.3	(1.4)	0.0	(—)	15.1	(1.6)
Agritourism/ecotourism	8.3	(2.3)	2.2	(1.3)	3.0	(1.2)	2.8	(1.6)	4.5	(0.9)
Cultural use	0.0	(—)	2.1	(1.3)	1.2	(1.1)	2.2	(1.2)	1.2	(0.5)
Cutting horse training	8.7	(2.4)	0.0	(—)	0.0	(—)	0.0	(—)	2.9	(0.8)
Other	2.4	(1.2)	8.7	(2.7)	2.9	(1.2)	3.8	(1.8)	4.3	(0.9)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

No operations in the Northeast (0.0 percent) or Southeast (0.0 percent) regions kept bison primarily for backgrounding/stocking, preparation/sale of byproducts, or cultural use. Only the West region had any operations that kept bison primarily for cutting horse training.

B.1.d. Percentage of operations by **primary** reason(s) bison were kept on the operation from July 1, 2021, through June 30, 2022, by region:

	Percent Operations							
	Region							
	Northeast		Southeast		North Central		West	
Reason	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Bison cow-calf production (offspring intended for meat production)	37.2	(6.8)	30.7	(7.3)	48.5	(3.8)	47.9	(2.5)
Seedstock production (offspring intended for breeding purposes)	7.8	(4.8)	15.3	(5.8)	10.1	(2.3)	4.4	(1.1)
Finishing on grass (bison finished on pasture/grass for slaughter)	12.5	(5.1)	9.3	(4.6)	7.2	(2.2)	3.0	(0.9)
Backgrounding/stocking (young bison prepared for a feedlot)	0.0	(—)	0.0	(—)	1.5	(0.9)	1.3	(0.6)
Feedlot (bison from this or other operations finished on feed for slaughter)	(D)	(D)	0.0	(—)	(D)	(D)	2.5	(0.7)
Game ranch/hunting on this operation	8.5	(5.5)	0.0	(—)	3.8	(1.7)	4.2	(1.1)
Preparation/sale of byproducts (e.g., hides, skulls, horns, hair)	0.0	(—)	0.0	(—)	2.1	(1.3)	0.3	(0.2)
Conservation	12.1	(6.2)	3.3	(2.9)	4.2	(1.5)	6.7	(1.4)
Hobby/pasture pet	7.8	(5.0)	28.9	(6.8)	17.1	(2.8)	13.6	(2.0)
Agritourism/ecotourism	(D)	(D)	9.8	(4.1)	(D)	(D)	3.7	(1.0)
Cultural use	0.0	(—)	0.0	(—)	1.0	(0.8)	1.6	(0.8)
Cutting horse training	0.0	(—)	0.0	(—)	0.0	(—)	4.8	(1.3)
Other	0.0	(—)	2.8	(2.2)	1.9	(1.1)	6.1	(1.4)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

Values of (D) denote too few to report.

Almost two-thirds of bison on all operations (64.6 percent) were kept primarily for cow-calf production.

A lower percentage of bison on very small operations (27.4 percent) were kept primarily for bison cow-calf production than on operations in the other size categories. A lower percentage of bison on large operations (0.4 percent) were kept primarily for seedstock production than on operations in the other size categories. No bison on large operations (0.0 percent) were kept primarily for backgrounding/stocking, hobby/pasture pet, or cutting horse training. Very small operations had the highest percentage of bison kept primarily for hobby/pasture pet (26.0 percent). Medium (8.8 percent of bison) and small (4.4 percent of bison) operations had higher percentages of bison kept primarily for game ranch/hunting than large operations (0.2 percent of bison).

B.1.e. Percentage of bison by **primary** reason(s) bison were kept on the operation from July 1, 2021, through June 30, 2022, and by size of operation:

Percent Bison*

Size of Operation (number of bison)

Reason	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Bison cow-calf production (offspring intended for meat production)	27.4	(4.9)	51.0	(5.2)	58.3	(4.4)	66.8	(7.0)	64.6	(5.7)
Seedstock production (offspring intended for breeding purposes)	6.1	(2.5)	11.5	(3.0)	8.3	(2.8)	0.4	(0.2)	2.0	(0.5)
Finishing on grass (bison finished on pasture/grass for slaughter)	7.8	(3.7)	8.4	(3.1)	4.4	(1.3)	10.7	(6.3)	9.7	(5.2)
Backgrounding/stocking (young bison prepared for a feedlot)	0.6	(0.5)	2.4	(1.7)	1.2	(0.9)	0.0	(—)	0.3	(0.1)
Feedlot (bison from this or other operations finished on feed for slaughter)	0.0	(—)	1.8	(1.2)	0.7	(0.7)	5.4	(1.9)	4.6	(1.5)
Game ranch/hunting on this operation	3.1	(1.7)	4.4	(2.4)	8.8	(2.9)	0.2	(0.2)	1.5	(0.5)
Preparation/sale of byproducts (e.g., hides, skulls, horns, hair)	0.0	(—)	0.0	(—)	1.4	(1.0)	0.2	(0.1)	0.3	(0.2)
Conservation	8.8	(2.8)	4.5	(2.4)	5.3	(2.0)	8.5	(3.7)	7.9	(3.0)
Hobby/pasture pet	26.0	(4.7)	6.6	(2.3)	4.0	(1.7)	0.0	(—)	1.1	(0.3)
Agritourism/ecotourism	10.9	(4.0)	2.2	(1.6)	2.2	(1.0)	4.9	(3.5)	4.5	(2.9)
Cultural use	0.0	(—)	2.0	(1.4)	1.6	(1.4)	2.2	(1.4)	2.1	(1.2)
Cutting horse training	7.3	(2.7)	0.0	(—)	0.0	(—)	0.0	(—)	0.1	(0.0)
Other	2.2	(1.1)	5.1	(2.2)	3.7	(1.8)	0.8	(0.5)	1.4	(0.5)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

*As a percentage of July 1, 2022, inventory.

A lower percentage of bison on operations in the West region (1.4 percent) were kept primarily for seedstock production than on operations in the North Central region (6.0 percent). A lower percentage of bison on operations in the Southeast region (0.3 percent) were kept primarily for conservation purposes than on operations in the West (8.3 percent) and North Central (6.3 percent) regions.

B.1.f. Percentage of bison by **primary** reason(s) bison were kept on the operation from July 1, 2021, through June 30, 2022, by region:

	Percent Bison*							
	Region							
	Northeast		Southeast		North Central		West	
Reason	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Bison cow-calf production (offspring intended for meat production)	59.9	(9.9)	71.5	(12.7)	68.1	(5.5)	64.1	(6.6)
Seedstock production (offspring intended for breeding purposes)	4.9	(3.6)	7.3	(4.9)	6.0	(1.8)	1.4	(0.5)
Finishing on grass (bison finished on pasture/grass for slaughter)	13.1	(5.3)	6.4	(4.2)	4.1	(1.5)	10.3	(5.9)
Backgrounding/stocking (young bison prepared for a feedlot)	0.0	(—)	0.0	(—)	1.7	(1.2)	0.1	(0.1)
Feedlot (bison from this or other operations finished on feed for slaughter)	2.9	(2.6)	0.0	(—)	1.6	(1.2)	5.1	(1.8)
Game ranch/hunting on this operation	4.6	(3.9)	0.0	(—)	4.9	(3.3)	1.1	(0.3)
Preparation/sale of byproducts (e.g., hides, skulls, horns, hair)	0.0	(—)	0.0	(—)	2.0	(1.3)	0.2	(0.1)
Conservation	7.4	(4.9)	0.3	(0.3)	6.3	(2.5)	8.3	(3.5)
Hobby/pasture pet	1.9	(1.6)	2.2	(0.9)	3.5	(1.5)	0.8	(0.3)
Agritourism/ecotourism	5.5	(4.1)	2.3	(1.5)	0.3	(0.3)	4.9	(3.3)
Cultural use	0.0	(—)	0.0	(—)	0.8	(0.7)	2.3	(1.4)
Cutting horse training	0.0	(—)	0.0	(—)	0.0	(—)	0.1	(0.0)
Other	0.0	(—)	10.0	(8.7)	0.7	(0.6)	1.3	(0.5)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

*As a percentage of July 1, 2022, inventory.

Respondents were also asked about the second-most important reason they kept bison, though not all respondents provided a secondary reason. Roughly one-seventh of all operations kept bison secondarily for seedstock production (18.4 percent), cow-calf production (15.0 percent), finishing on grass (15.0 percent), or hobby/pasture pet (13.3 percent). Higher percentages of very small (24.9 percent) and small (19.1 percent) operations than medium (6.2 percent) and large (0.0) operations kept bison secondarily as hobby/pasture pet. A higher percentage of large operations (17.8 percent) than operations in the other size categories kept bison secondarily for feedlot purposes.

B.1.g. Percentage of operations by **secondary** reason(s) bison were kept on the operation from July 1, 2021, through June 30, 2022, and by size of operation:

Percent Operations

Size of Operation (number of bison)

Reason	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Bison cow-calf production (offspring intended for meat production)	11.4	(3.4)	18.6	(3.7)	17.0	(2.8)	11.7	(2.9)	15.0	(1.6)
Seedstock production (offspring intended for breeding purposes)	16.4	(3.9)	19.1	(4.0)	18.0	(3.0)	21.2	(3.7)	18.4	(1.8)
Finishing on grass (bison finished on pasture/grass for slaughter)	9.7	(3.3)	17.2	(3.7)	18.2	(2.7)	14.2	(3.5)	15.0	(1.7)
Backgrounding/ stocking (young bison prepared for a feedlot)	0.0	(—)	0.0	(—)	3.7	(1.6)	7.6	(2.4)	2.5	(0.7)
Feedlot (bison from this or other operations finished on feed for slaughter)	0.0	(—)	0.0	(—)	5.2	(1.6)	17.8	(3.6)	4.7	(0.8)
Game ranch/hunting on this operation	1.4	(1.2)	1.4	(1.3)	1.3	(0.8)	3.6	(1.7)	1.7	(0.6)
Preparation/sale of byproducts (e.g., hides, skulls, horns, hair)	1.6	(0.8)	2.0	(1.2)	(D)	(D)	(D)	(D)	1.4	(0.4)
Conservation	13.0	(3.4)	10.1	(3.1)	5.9	(1.7)	7.0	(2.5)	9.0	(1.4)
Hobby/pasture pet	24.9	(4.9)	19.1	(3.9)	6.2	(1.8)	0.0	(—)	13.3	(1.7)
Agritourism/ecotourism	1.4	(1.2)	2.0	(1.3)	11.1	(2.3)	6.0	(2.1)	5.4	(1.0)
Cultural use	1.6	(1.4)	1.8	(1.6)	(D)	(D)	(D)	(D)	1.7	(0.6)
Cutting horse training	2.5	(1.5)	1.7	(1.5)	2.5	(1.5)	0.0	(—)	1.9	(0.7)
Other	16.3	(4.1)	7.0	(2.6)	8.5	(2.2)	7.6	(2.5)	10.0	(1.5)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

Values of (D) denote too few to report.

Percentages of operations differed little by region in their secondary reasons for keeping bison.

B.1.h. Percentage of operations by **secondary** reason(s) bison were kept on the operation from July 1, 2021, through June 30, 2022, by region:

	Percent Operations							
	Region							
	Northeast		Southeast		North Central		West	
Reason	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Bison cow-calf production (offspring intended for meat production)	26.3	(8.2)	24.1	(7.0)	19.6	(3.8)	10.9	(1.7)
Seedstock production (offspring intended for breeding purposes)	21.0	(7.4)	12.1	(6.0)	23.5	(3.7)	17.2	(2.3)
Finishing on grass (bison finished on pasture/grass for slaughter)	16.9	(5.4)	12.1	(6.0)	21.5	(3.6)	13.0	(2.1)
Backgrounding/stocking (young bison prepared for a feedlot)	0.0	(—)	3.6	(2.9)	2.1	(1.0)	2.8	(0.9)
Feedlot (bison from this or other operations finished on feed for slaughter)	0.0	(—)	0.0	(—)	3.6	(1.3)	6.3	(1.2)
Game ranch/hunting on this operation	0.0	(—)	4.2	(3.6)	0.0	(—)	2.2	(0.8)
Preparation/sale of byproducts (e.g., hides, skulls, horns, hair)	0.0	(—)	0.0	(—)	2.1	(0.9)	1.5	(0.6)
Conservation	0.0	(—)	16.3	(6.9)	1.4	(0.8)	11.6	(1.9)
Hobby/pasture pet	19.8	(7.1)	0.0	(—)	11.9	(2.9)	14.7	(2.4)
Agritourism/ecotourism	6.7	(4.1)	15.6	(6.2)	4.6	(1.8)	4.1	(1.0)
Cultural use	5.9	(5.2)	0.0	(—)	0.0	(—)	2.0	(0.8)
Cutting horse training	0.0	(—)	4.2	(3.6)	1.5	(1.3)	1.9	(0.9)
Other	3.4	(2.9)	7.8	(4.7)	8.2	(2.6)	11.7	(2.1)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

About one-third of bison (35.4 percent) were on operations that secondarily kept bison for feedlot purposes. Roughly one-tenth of bison were on operations that secondarily kept bison for cow-calf production (11.0 percent of bison), finishing on grass (11.0 percent of bison), conservation (10.9 percent of bison), or seedstock production (10.2 percent of bison).

A higher percentage of bison (29.8 percent) were kept on very small operations than on large operations (8.3 percent) secondarily for seedstock production. A higher percentage of bison (41.8 percent) were kept on large operations than on operations in the other size categories secondarily for feedlot purposes.

B.1.i. Percentage of bison by **secondary** reason(s) bison were kept on the operation from July 1, 2021, through June 30, 2022, and by size of operation:

Percent Bison*

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Reason	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Bison cow-calf production (offspring intended for meat production)	13.6	(4.2)	20.5	(4.7)	14.2	(2.6)	10.0	(3.9)	11.0	(3.3)
Seedstock production (offspring intended for breeding purposes)	29.8	(6.7)	21.7	(5.0)	18.2	(3.5)	8.3	(2.2)	10.2	(2.0)
Finishing on grass (bison finished on pasture/grass for slaughter)	13.7	(4.9)	20.0	(4.8)	18.8	(3.2)	9.4	(3.1)	11.0	(2.7)
Backgrounding/stocking (young bison prepared for a feedlot)	0.0	(—)	0.0	(—)	3.5	(1.3)	10.6	(4.5)	9.2	(3.7)
Feedlot (bison from this or other operations finished on feed for slaughter)	0.0	(—)	0.0	(—)	6.7	(2.8)	41.8	(8.8)	35.4	(7.8)
Game ranch/hunting on this operation	0.0	(—)	1.5	(1.4)	1.0	(0.6)	0.8	(0.4)	0.8	(0.3)
Preparation/sale of byproducts (e.g., hides, skulls, horns, hair)	2.3	(1.2)	2.0	(1.4)	0.9	(0.5)	0.4	(0.3)	0.6	(0.3)
Conservation	9.1	(2.8)	8.0	(2.7)	6.2	(2.0)	11.8	(5.5)	10.9	(4.6)
Hobby/pasture pet	19.2	(5.7)	14.9	(3.8)	5.6	(2.0)	0.0	(—)	1.5	(0.4)
Agritourism/ecotourism	0.2	(0.2)	0.8	(0.5)	13.6	(3.0)	2.1	(1.0)	3.4	(1.0)
Cultural use	0.6	(0.5)	1.6	(1.4)	1.0	(0.5)	1.2	(0.9)	1.2	(0.7)
Cutting horse training	3.2	(2.2)	0.5	(0.5)	1.2	(0.7)	0.0	(—)	0.2	(0.1)
Other	8.3	(2.9)	8.5	(3.7)	9.2	(2.9)	3.7	(1.6)	4.6	(1.4)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

*As a percentage of July 1, 2022, inventory.

A higher percentage of bison on operations in the North Central region (27.0 percent) than on operations in the West region (8.4 percent) were kept secondarily for seedstock production. A lower percentage of bison on operations in the Southeast region (1.3 percent) than on operations in the other three regions were kept secondarily for finishing on grass. A higher percentage of bison on operations in the Northeast region (9.7 percent) than on operations in the West region (1.1 percent) were kept secondarily for hobby/pasture pet. A higher percentage of bison on operations in the Southeast region (46.2 percent) than on operations in the West region (1.8 percent of bison) were kept secondarily for agritourism/ecotourism.

B.1.j. Percentage of bison by **secondary** reason(s) bison were kept on the operation from July 1, 2021, through June 30, 2022, by region:

	Percent Bison*							
	Region							
	Northeast		Southeast		North Central		West	
Reason	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Bison cow-calf production (offspring intended for meat production)	25.2	(8.2)	14.6	(6.9)	12.5	(3.6)	10.5	(3.7)
Seedstock production (offspring intended for breeding purposes)	20.6	(7.2)	13.0	(9.2)	27.0	(6.8)	8.4	(2.0)
Finishing on grass (bison finished on pasture/grass for slaughter)	21.1	(8.1)	1.3	(0.8)	19.7	(3.9)	10.3	(3.0)
Backgrounding/stocking (young bison prepared for a feedlot)	0.0	(—)	4.5	(3.8)	3.0	(1.5)	10.1	(4.3)
Feedlot (bison from this or other operations finished on feed for slaughter)	0.0	(—)	0.0	(—)	10.8	(6.6)	39.3	(8.5)
Game ranch/hunting on this operation	0.0	(—)	0.0	(—)	0.0	(—)	0.9	(0.4)
Preparation/sale of byproducts (e.g., hides, skulls, horns, hair)	0.0	(—)	0.0	(—)	5.3	(3.4)	0.2	(0.1)
Conservation	0.0	(—)	1.0	(0.7)	1.5	(1.0)	12.3	(5.2)
Hobby/pasture pet	9.7	(3.8)	0.0	(—)	4.4	(1.9)	1.1	(0.3)
Agritourism/ecotourism	15.9	(8.6)	46.2	(18.2)	5.8	(2.6)	1.8	(0.7)
Cultural use	4.3	(3.9)	0.0	(—)	0.0	(—)	1.3	(0.8)
Cutting horse training	0.0	(—)	1.8	(1.6)	0.0	(0.0)	0.2	(0.1)
Other	3.2	(2.8)	17.4	(13.7)	9.8	(4.1)	3.8	(1.5)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

*As a percentage of July 1, 2022, inventory.

For about one-third of all operations, the primary and secondary reasons for keeping bison were cow-calf production and seedstock production (35.0 percent) or cow-calf production and finishing on grass (33.4 percent). A higher percentage of large operations (33.5 percent) kept bison primarily for cow-calf production and secondarily for feedlot purposes than operations in the other size categories, with no very small or small operations providing this combination. No large operations kept bison primarily for cow-calf production and secondarily for hobby/pasture pet.

B.1.k. Percentage of operations by top five combinations of primary and secondary reasons for raising bison from July 1, 2021, through June 30, 2022, and by size of operation:

Percent Operations

Size of Operation (number of bison)

Combination of primary and secondary reasons	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Bison cow-calf production and Seedstock production	30.4	(9.6)	35.6	(7.0)	33.2	(5.2)	40.8	(6.6)	35.0	(3.4)
Bison cow-calf production and Finishing on grass	33.8	(11.0)	35.3	(6.8)	37.3	(5.0)	24.0	(6.2)	33.4	(3.4)
Bison cow-calf production and Feedlot	0.0	(—)	0.0	(—)	7.8	(2.5)	33.5	(6.4)	9.6	(1.7)
Bison cow-calf production and Hobby/pasture pet	25.4	(10.2)	20.4	(5.4)	7.9	(3.0)	0.0	(—)	12.7	(2.5)
Seedstock production and Bison cow-calf production	10.3	(7.4)	8.8	(4.2)	13.7	(3.9)	1.7	(1.5)	9.2	(2.2)

There were few differences by region in the percentages of operations citing the listed top five combinations of primary and secondary reasons for raising bison. No operations in the Northeast or Southeast regions kept bison primarily for cow-calf production and secondarily for feedlot purposes, and no operations in the Southeast region kept bison primarily for cow-calf production and secondarily for hobby/pasture pet.

B.1.l. Percentage of operations by top five combinations of primary and secondary reasons for raising bison from July 1, 2021, through June 30, 2022, by region:

Percent Operations

Region

Combination of primary and secondary reasons	Northeast		Southeast		North Central		West	
	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Bison cow-calf production and Seedstock production	26.3	(11.1)	42.5	(17.0)	41.0	(6.0)	33.1	(4.5)
Bison cow-calf production and Finishing on grass	29.2	(8.9)	29.9	(15.6)	37.2	(5.8)	32.8	(4.8)
Bison cow-calf production and Feedlot	0.0	(—)	0.0	(—)	5.5	(2.2)	14.3	(2.8)
Bison cow-calf production and Hobby/pasture pet	22.3	(8.8)	0.0	(—)	7.4	(2.9)	14.7	(3.8)
Seedstock production and Bison cow-calf production	22.3	(12.2)	27.6	(15.8)	9.0	(3.0)	5.0	(1.9)

Almost 80 percent of all operations had raised bison at their current location for at least 11 years. About two-fifths of all operations (43.1 percent) had raised bison at the current location for 21 to 50 years, and one-third (32.8 percent) had raised bison at the current location for 11 to 20 years.

A higher percentage of very small operations (13.6 percent) than medium (2.8 percent) or large (2.4 percent) operations had raised bison at the current location for 0 to 5 years. A higher percentage of very small operations (48.0 percent) than operations in the three larger size categories had raised bison at the current location for 11 to 20 years. A lower percentage of very small operations (24.7 percent) than small (47.0 percent), medium (48.5 percent), or large (65.3 percent) operations had raised bison at the current location for 21 to 50 years. A higher percentage of large operations (10.6 percent) had raised bison at the current location for more than 50 years than operations in the three smaller size categories, with no very small or small operations having raised bison at the location that long.

B.1.m. Percentage of operations by number of years bison had been raised at the current location from July 1, 2021, through June 30, 2022, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Years	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
0 to 5	13.6	(3.0)	5.3	(2.1)	2.8	(1.3)	2.4	(1.4)	6.8	(1.2)
6 to 10	13.7	(3.0)	18.5	(3.7)	16.5	(2.6)	8.2	(2.4)	14.8	(1.6)
11 to 20	48.0	(4.1)	29.2	(4.1)	29.2	(3.4)	13.5	(3.0)	32.8	(2.0)
21 to 50	24.7	(3.9)	47.0	(4.1)	48.5	(3.6)	65.3	(4.0)	43.1	(2.0)
More than 50	0.0	(—)	0.0	(—)	3.0	(1.0)	10.6	(2.7)	2.5	(0.5)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

Other than there being no operations in the Northeast that had raised bison at the location for more than 50 years, there were no regional differences in the number of years bison had been raised at the location.

B.1.n. Percentage of operations by number of years bison had been raised at the current location from July 1, 2021, through June 30, 2022, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Years	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
0 to 5	14.4	(6.6)	3.2	(2.9)	4.9	(1.9)	6.8	(1.4)
6 to 10	18.0	(6.9)	24.3	(6.7)	14.3	(3.0)	13.0	(1.9)
11 to 20	29.1	(7.5)	35.5	(7.3)	28.3	(3.7)	34.5	(2.5)
21 to 50	38.5	(7.8)	34.3	(7.6)	50.8	(3.8)	42.5	(2.6)
More than 50	0.0	(—)	2.7	(2.1)	1.7	(0.7)	3.2	(0.7)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

Developing a bison herd requires significant time and resources. The past few decades, and the past few years, have brought challenges to the industry in the form of weather extremes, marketing challenges, and the pandemic, among others. With many consumers trying bison meat for the first time during the pandemic and continuing to choose it, the industry is now experiencing new growth and expansion opportunities.

Respondents were asked about their plans for their bison herd for the following year. For all operations, more than one-half planned to maintain their herd size (55.6 percent), and 17.6 percent planned to increase the herd size over the upcoming year. On the other hand, 17.9 percent planned to decrease herd size and 8.9 percent planned to get out of the business.

A lower percentage of very small operations (6.6 percent) planned to decrease herd size during the following year than small (24.2 percent), medium (25.2 percent), or large (19.1 percent) operations. A higher percentage of very small operations (16.4 percent) planned to get out of the business in the next year compared with medium (3.2 percent) or large (2.6 percent) operations.

B.1.o. Percentage of operations by plan for the bison herd in the next year, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Plan	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Increase herd size	15.8	(3.1)	14.2	(3.2)	19.6	(3.0)	23.1	(3.4)	17.6	(1.6)
Maintain same herd size	61.2	(4.1)	52.2	(4.3)	52.0	(3.6)	55.2	(4.3)	55.6	(2.1)
Decrease herd size	6.6	(1.9)	24.2	(3.6)	25.2	(3.0)	19.1	(3.4)	17.9	(1.4)
Get out of the business	16.4	(3.2)	9.4	(2.6)	3.2	(1.1)	2.6	(1.4)	8.9	(1.3)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

Percentages of operations did not differ by region in operation plans for the bison herd during the year following the study.

B.1.p. Percentage of operations by plan for the bison herd in the next year, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Plan	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Increase herd size	20.8	(6.6)	30.2	(7.4)	17.2	(3.1)	15.4	(1.9)
Maintain same herd size	56.4	(7.4)	51.8	(8.3)	56.5	(3.9)	55.7	(2.7)
Decrease herd size	8.4	(3.4)	5.8	(3.5)	18.5	(3.0)	20.9	(2.0)
Get out of the business	14.5	(6.2)	12.2	(5.2)	7.8	(2.2)	8.0	(1.6)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

2. Pasturing and grazing practices

Bison tend to balance nutrient demands by consuming a diet dominant in grasses. Bison prefer to consume grasses, sedges, and some seasonal forbs, and they may browse woody plants and other plants when preferred forage is unavailable. Almost all operations (93.7 percent) had at least some bison on range/pasture at some point during the reference period. Very small operations had a lower percentage (83.1 percent) of bison on range/pasture compared with the other three size categories.

B.2.a. Percentage of operations that had any bison on range/pasture from July 1, 2021, through June 30, 2022, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
83.1	(3.2)	98.9	(1.1)	98.6	(0.9)	99.3	(0.6)	93.7	(1.1)

There were no differences by region of operation in the percentage of operations that had any bison on range/pasture.

B.2.b. Percentage of operations that had any bison on range/pasture from July 1, 2021, through June 30, 2022, by region:

Percent Operations

Region

Northeast		**Southeast**		**North Central**		**West**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
91.7	(5.6)	96.8	(2.8)	96.7	(1.6)	92.5	(1.5)

The amount of time bison spend on range/pasture depends on the local climate, the forage plants on the pasture, and the management system used. Of operations that had any bison on range/pasture, 77.3 percent had bison on range/pasture for 12 months, 18.9 percent for 6 to 11 months, and 3.8 percent for less than 6 months. A higher percentage of medium (26.5 percent) and large (24.6 percent) operations had bison on range/pasture for 6 to 11 months than very small operations (9.9 percent). A lower percentage of medium operations (68.2 percent) had bison on range/pasture for 12 months than very small operations (86.0 percent).

B.2.c. For the 93.7 percent of operations that had any bison on range/pasture from July 1, 2021, through June 30, 2022 (Table B.2.a.), percentage of operations by number of months bison were kept on pasture, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Months	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Less than 6	4.1	(1.8)	3.5	(1.9)	5.4	(1.5)	1.1	(0.9)	3.8	(0.8)
6 to 11	9.9	(2.9)	16.4	(3.5)	26.5	(3.3)	24.6	(3.6)	18.9	(1.6)
12	86.0	(3.4)	80.0	(3.9)	68.2	(3.4)	74.3	(3.7)	77.3	(1.8)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

No operations in the Southeast region had bison on range/pasture for less than 6 months. Otherwise, there were no differences by region of operation in the number of months bison were on range/pasture.

B.2.d. For the 93.7 percent of operations that had any bison on range/pasture from July 1, 2021, through June 30, 2022 (Table B.2.a.), percentage of operations by number of months bison were kept on pasture, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Months	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Less than 6	7.6	(4.9)	0.0	(—)	5.0	(1.9)	3.4	(1.0)
6 to 11	16.7	(5.7)	22.6	(4.9)	19.0	(3.1)	18.6	(2.2)
12	75.7	(7.5)	77.4	(4.9)	76.0	(3.4)	78.0	(2.3)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

Of operations that kept any bison on range/pasture, 61.1 percent rounded up or gathered the majority of their pastured bison as a group at least once (30.9 percent, one time; 14.1 percent, two times; 16.1 percent, three or more times). Almost two-fifths of operations that had any bison on range/pasture (38.9 percent) did not round up or gather the majority of their pastured bison.

Higher percentages of very small and small operations than medium or large operations did not round up or gather their pastured bison. A higher percentage of medium operations (24.8 percent) than large operations (9.5

percent) did not round up or gather the majority of their pastured bison. A higher percentage of large operations (69.1 percent) than operations in the other three size categories rounded up or gathered the majority of their pastured bison one time. A higher percentage of medium operations (34.7 percent) than very small or small operations rounded up or gathered the majority of their pastured bison one time. A lower percentage of large operations (7.3 percent) than medium size operations (21.0 percent) rounded up or gathered the majority of their pastured bison as a group three or more times.

B.2.e. For the 93.7 percent of operations that had any bison on range/pasture from July 1, 2021, through June 30, 2022 (Table B.2.a.), percentage of operations by the number of times they rounded up or gathered the majority of the pastured bison as a group, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Number of times	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
0	60.5	(4.6)	50.9	(4.6)	24.8	(3.2)	9.5	(2.9)	38.9	(2.0)
1	16.0	(3.5)	17.0	(3.5)	34.7	(3.4)	69.1	(4.0)	30.9	(1.8)
2	7.7	(2.4)	15.3	(3.2)	19.5	(2.8)	14.0	(3.1)	14.1	(1.4)
3 or more	15.8	(3.5)	16.8	(3.5)	21.0	(3.0)	7.3	(2.3)	16.1	(1.6)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

A higher percentage of operations in the Northeast region (39.4 percent) than in the North Central (14.1 percent) and West (13.0 percent) regions gathered pastured bison three or more times.

B.2.f. For the 93.7 percent of operations that had any bison on range/pasture from July 1, 2021, through June 30, 2022 (Table B.2.a.), percentage of operations by the number of times they rounded up or gathered the majority of the pastured bison as a group, by region:

Percent Operations

Region

	Northeast		**Southeast**		**North Central**		**West**	
Number of times	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
0	29.2	(7.8)	46.7	(7.5)	46.2	(4.1)	36.7	(2.5)
1	22.2	(7.9)	21.6	(6.2)	26.4	(3.3)	35.4	(2.3)
2	9.2	(3.8)	15.3	(5.8)	13.2	(2.5)	15.0	(1.8)
3 or more	39.4	(8.5)	16.4	(5.5)	14.1	(2.6)	13.0	(2.0)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

Producers who kept any bison on range/pasture and rounded up or gathered the majority of pastured bison as a group (57.3 percent) were asked to provide the reason(s) that bison were rounded up most recently. Bison on all operations were most commonly gathered for deworming (65.7 percent), shipping (59.2 percent), tagging/identification (51.9 percent), vaccination (50.9 percent), and weaning (42.4 percent).

A higher percentage of large operations gathered bison for tagging/identification (77.2 percent), vaccination (76.2 percent), weaning (70.6 percent), and pregnancy checking (51.8 percent) than operations in other size categories. A higher percentage of large operations (67.0 percent) and medium operations (66.0 percent) than very small operations (42.1 percent) rounded up bison for shipping. A higher percentage of large operations (77.2 percent) and medium operations (58.5 percent) than very small operations (16.8 percent) rounded up bison for tagging/identification.

B.2.g. For the 57.3 percent of operations that had any bison on range/pasture and rounded up or gathered the majority of the pastured bison as a group from July 1, 2021, through June 30, 2022 (Table B.2.e.),* percentage of operations by reason(s) bison were gathered most recently, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Reason	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Tagging/identification	16.8	(5.4)	39.8	(6.8)	58.5	(4.0)	77.2	(3.7)	51.9	(2.5)
Vaccination	27.5	(6.9)	42.3	(6.3)	49.6	(4.1)	76.2	(3.7)	50.9	(2.6)
Deworming	59.8	(7.8)	62.2	(6.4)	66.5	(3.8)	71.7	(4.1)	65.7	(2.6)
Pregnancy checking	8.7	(4.5)	6.8	(3.4)	20.1	(3.4)	51.8	(4.5)	23.5	(2.1)
Disease testing	5.5	(3.3)	5.0	(2.9)	8.9	(2.2)	20.9	(3.7)	10.5	(1.5)
Other veterinary need (e.g., physical exam, treatment for illness)	16.0	(5.4)	16.3	(5.4)	14.4	(2.9)	24.8	(4.0)	17.8	(2.1)
Weaning	0.0	(—)	28.6	(6.2)	52.0	(4.0)	70.6	(4.0)	42.4	(2.4)
Shipping (e.g., to slaughter, pasture)	42.1	(7.3)	53.0	(6.9)	66.0	(3.8)	67.0	(4.1)	59.2	(2.7)
Other	15.0	(5.7)	3.2	(2.8)	1.4	(1.2)	2.3	(1.4)	4.5	(1.4)

*These estimates come from the 93.7 percent of operations that had any bison on range/pasture (Table B.2.a.), of which 61.1 percent of operations rounded up or gathered the majority of pastured bison as a group (Table B.2.e.).

For the most recent time the majority of pastured bison were rounded up as a group, no operations in the Northeast (0.0 percent) gathered bison for disease testing, whereas 17.1 percent of operations in the Southeast region gathered bison for disease testing. A higher percentage of operations in the Southeast region (88.3 percent) rounded up pastured bison for tagging/identification than operations in the other three region categories. A higher percentage of operations in the Southeast region (100.0 percent) gathered pastured bison for deworming than any of the other three regions. A lower percentage of operations in the Northeast region (22.2 percent) rounded up pastured bison for vaccination compared with operations in the Southeast (69.3 percent) and West (55.2 percent) regions. A higher percentage of operations in the West region (50.0 percent) than in the Northeast (15.5 percent) and North Central (30.5 percent) regions rounded up pastured bison for weaning.

B.2.h. For the 57.3 percent of operations that had any bison on range/pasture and rounded up or gathered the majority of the pastured bison as a group from July 1, 2021, through June 30, 2022 (Table B.2.e.),* percentage of operations by reason(s) bison were gathered most recently, by region:

	Percent Operations							
	Region							
	Northeast		Southeast		North Central		West	
Reason	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Tagging/identification	45.7	(9.9)	88.3	(6.8)	41.9	(4.8)	51.4	(3.1)
Vaccination	22.2	(8.2)	69.3	(10.5)	46.3	(5.1)	55.2	(3.3)
Deworming	49.0	(9.2)	100.0	(—)	66.3	(5.3)	64.2	(3.3)
Pregnancy checking	8.9	(5.1)	36.1	(10.2)	15.1	(3.4)	27.1	(2.7)
Disease testing	0.0	(—)	17.1	(8.1)	6.5	(2.1)	12.9	(2.1)
Other veterinary need (e.g., physical exam, treatment for illness)	11.4	(6.9)	35.1	(9.5)	17.5	(3.7)	16.7	(2.6)
Weaning	15.5	(6.8)	51.0	(10.9)	30.5	(4.9)	50.0	(3.0)
Shipping (e.g., to slaughter, pasture)	68.7	(9.8)	45.9	(11.0)	48.0	(5.4)	62.7	(3.3)
Other	12.4	(7.6)	6.3	(5.4)	4.4	(2.6)	2.9	(1.3)

*These estimates come from the 93.7 percent of operations that had any bison on range/pasture (Table B.2.a.), of which 61.1 percent of operations rounded up or gathered the majority of the pastured bison as a group (Table B.2.e.).

Stocking rate refers to the total number of animal units stocked on a farm/ranch in relation to the total number of acres available for grazing; data were collected in terms of acres per animal unit. Establishing the optimal stocking rate is essential to optimizing forage utilization, minimizing endo- and ectoparasite problems, and maintaining a high level of animal performance. Stocking rate is an important management decision and is impacted by many factors, including management goals, acres available for grazing season, rainfall, and forage type, among others. Out of all the management tools available, stocking rate has the largest impact on the health of the grassland resource and on animal performance. Overstocking a pasture can lead to a decline in forage quality, decreased soil productivity, and health issues, including increased parasite load. For more information on determining stocking rates in a particular region, contact the local extension office.

Of the 93.7 percent of operations that kept any bison on range/pasture, 13.3 percent had an average acres per animal unit of less than 2 acres, 40.3 percent had an average acres per animal unit of 2 to less than 6 acres, 22.1 percent had an average acres per animal unit of 6 to less than 15 acres, and 24.3 percent had an average acres per animal unit of 15 or more acres. A higher percentage of large operations (40.4 percent) than very small (17.5 percent) or medium (18.0 percent) operations had an average of 15 or more acres per animal unit. A higher percentage of small (19.9 percent) and medium (17.6 percent) operations than large operations (1.4 percent) had an average of less than 2 acres per animal unit.

B.2.i. For the 93.7 percent of operations that had any bison on range/pasture from July 1, 2021, through June 30, 2022 (Table B.2.a.), percentage of operations by number of acres per animal unit, and by size of operation:

Percent Operations

Size of Operation (number of bison)

Acres per animal unit	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Less than 2	10.5	(3.2)	19.9	(4.1)	17.6	(2.8)	1.4	(1.3)	13.3	(1.6)
2 to less than 6	47.7	(5.0)	35.8	(4.6)	45.1	(3.8)	26.0	(3.9)	40.3	(2.2)
6 to less than 15	24.3	(4.4)	15.8	(3.4)	19.3	(3.1)	32.2	(4.2)	22.1	(1.9)
15 or more	17.5	(3.8)	28.5	(4.6)	18.0	(3.0)	40.4	(4.3)	24.3	(1.9)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

Stocking rates can be affected by regional factors, including rainfall, topography, soil conditions, types of plants, and health of the grasslands. Managers should account for changing weather conditions and natural events, such as fires, as they calculate the stocking rate and carrying capacity of the pasture.

Of the 93.7 percent of operations that kept any bison on range/pasture, a higher percentage of operations in the Northeast (31.1 percent) and North Central (23.5 percent) regions than in the West region (8.3 percent) had an average of less than 2 acres per animal unit. A lower percentage of operations in the West region (25.6 percent) than operations in the Southeast (64.2 percent) and North Central (66.9 percent) regions had an average of 2 acres to less than 6 acres per animal unit. However, a higher percentage of operations in the West region (30.9 percent) had an average of 6 to less than 15 acres per animal unit than in the North Central region (4.4 percent). A higher percentage of operations in the West region (35.2 percent) had an average of 15 or more acres per animal unit when compared with the Northeast (7.6 percent) and North Central (5.1 percent) regions. It is important to note that the West region likely varies more than other regions in terms of geographic, range/pasture, and climatic conditions.

B.2.j. For the 93.7 percent of operations that had any bison on range/pasture from July 1, 2021, through June 30, 2022 (Table B.2.a.), percentage of operations by number of acres per animal unit, by region:

Percent Operations

Region

Acres per animal unit	Northeast		Southeast		North Central		West	
	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Less than 2	31.1	(8.6)	3.5	(3.2)	23.5	(3.7)	8.3	(1.9)
2 to less than 6	47.5	(8.5)	64.2	(7.8)	66.9	(4.0)	25.6	(2.7)
6 to less than 15	13.8	(6.9)	15.3	(4.9)	4.4	(1.4)	30.9	(2.8)
15 or more	7.6	(4.9)	16.9	(6.4)	5.1	(1.6)	35.2	(2.8)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

Some type of grazing system is necessary to provide adequate forage resources for bison and to improve rangeland health. A grazing management protocol can help avoid overstocking and overgrazing. The grazing system is dependent on a number of factors, including time of rut, time of calving, social groups of the bison involved, areas of the pastures preferred during different times of year, access to water, and other herd behaviors. Grazing systems take into account the amount of time bison graze on a pasture, allowing for rest and recovery of the pasture. Overgrazing is avoided by short grazing periods followed by time for recovery after grazing.

Among the 93.7 percent of operations that kept any bison on range/pasture, slightly more than one-half (55.4 percent) used a continuous grazing system, almost one-third used a rotational system (30.7 percent), and one-eighth (12.6 percent) used a holistic grazing system as their primary grazing system. A higher percentage of large operations (43.7 percent) used a rotational grazing system as their primary grazing system than very small operations (17.4 percent). A lower percentage of large operations (27.7 percent) used a continuous grazing system as their primary grazing system than operations in the other size categories. A higher percentage of large operations (27.6 percent) used a holistic grazing system as their primary grazing system than very small (4.2 percent) and small (7.9 percent) operations. Responses specified for the “Other” category included a combination of grazing systems and provision of additional feed by the operation.

B.2.k. For the 93.7 percent of operations that had any bison on range/pasture from July 1, 2021, through June 30, 2022 (Table B.2.a.), percentage of operations by primary grazing system used, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Primary grazing system	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Rotational	17.4	(3.6)	31.8	(4.5)	35.8	(3.6)	43.7	(4.3)	30.7	(2.0)
Continuous	77.2	(4.0)	58.8	(4.7)	46.3	(3.7)	27.7	(4.1)	55.4	(2.2)
Holistic*	4.2	(1.9)	7.9	(2.5)	16.5	(2.7)	27.6	(3.7)	12.6	(1.3)
Other	1.2	(1.1)	1.5	(1.2)	1.4	(0.9)	1.0	(0.8)	1.3	(0.5)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

*Requires some site-based evaluation and decision making to assess regeneration and determine schedule for moving animals among paddocks.

The primary grazing system used by operations that kept any bison on range/pasture did not differ by region.

B.2.l. For the 93.7 percent of operations that had any bison on range/pasture from July 1, 2021, through June 30, 2022 (Table B.2.a.), percentage of operations by primary grazing system used, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Primary grazing system	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Rotational	38.0	(8.8)	39.8	(7.7)	31.1	(3.8)	28.1	(2.5)
Continuous	47.5	(9.1)	54.3	(8.0)	57.6	(4.2)	55.9	(2.7)
Holistic*	14.5	(5.1)	5.9	(3.6)	9.5	(2.3)	14.5	(1.7)
Other	0.0	(—)	0.0	(—)	1.8	(1.2)	1.5	(0.8)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

*Requires some site-based evaluation and decision making to assess regeneration and determine schedule for moving animals among paddocks.

Bison need access to minerals and vitamins on a regular basis. Grazing bison are often provided with minerals via various methods, including lick blocks and supplements. Free-choice feeding of minerals is probably the simplest and most common practice. Selection of a mineral package for supplementation should be based on whether bison are primarily on a forage-based diet or a diet consisting mostly of grains. Feed analysis of forages and pasture clippings will help determine which minerals are available and which may be deficient and should be provided. It is also useful to evaluate the hay/roughage that is provided to determine the quality of the feed. Vitamin supplementation can occur throughout the year. Vitamins are required in adequate amounts to enable animals to efficiently use other nutrients. Consultation with a professional nutritionist or veterinarian could be useful in determining a supplementation plan for bison that are kept on range/pasture.

Of the 93.7 percent of operations that kept any bison on range/pasture, 91.8 percent ever provided mineral supplements and 90.4 percent ever provided hay/roughage while the bison were on range/pasture. Slightly more than one-half of operations ever provided vitamin supplements (52.0 percent) and a little more than two-fifths of operations (44.0 percent) ever provided energy/concentrates while bison were on range/pasture.

In general, a lower percentage of large operations than operations in other size categories provided any of the listed items to pastured bison. A lower percentage of large operations (75.6 percent) than very small (94.5 percent) and medium (96.9 percent) operations ever provided hay/roughage while bison were on range/pasture. A higher percentage of medium operations (98.8 percent) than very small (84.4 percent) or large (86.5 percent) operations ever provided mineral supplements while bison were on range/pasture. A higher percentage of medium operations (60.6 percent) than large operations (40.9 percent) ever provided vitamin supplements while bison were on range/pasture. A higher percentage of very small operations (54.5 percent) than large operations (31.0 percent) ever provided energy/concentrates while bison were on range/pasture.

B.2.m. For the 93.7 percent of operations that had any bison on range/pasture from July 1, 2021, through June 30, 2022 (Table B.2.a.), percentage of operations that ever provided the following items to pastured bison, and by size of operation:

Percent Operations

Size of Operation (number of bison)

Items	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Hay/roughage	94.5	(2.3)	88.4	(3.2)	96.9	(1.4)	75.6	(3.6)	90.4	(1.3)
Mineral supplements	84.4	(3.5)	96.1	(2.0)	98.8	(1.0)	86.5	(2.9)	91.8	(1.3)
Vitamin supplements	52.6	(4.7)	49.0	(4.7)	60.6	(3.4)	40.9	(4.1)	52.0	(2.2)
Energy/concentrates (e.g., grain)	54.5	(4.8)	46.9	(4.6)	38.6	(3.5)	31.0	(4.0)	44.0	(2.2)

Mineral concentrations and plant nutrition, including protein and energy concentration of the plants, can vary by region. Different climates and soil quality can impact dietary composition, including minerals found in the feed. For mineral supplementation, the preparations can vary by region and a veterinarian or nutritionist can help to determine what is best for the area.

More than 85 percent of operations in each region ever provided hay/roughage and/or mineral supplements to bison on range/pasture.

B.2.n. For the 93.7 percent of operations that had any bison on range/pasture from July 1, 2021, through June 30, 2022 (Table B.2.a.), percentage of operations that ever provided the following items to pastured bison, by region:

Percent Operations

Region

Items	Northeast		Southeast		North Central		West	
	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Hay/roughage	95.3	(4.1)	96.6	(2.9)	95.5	(1.7)	86.9	(1.9)
Mineral supplements	95.3	(4.4)	93.3	(4.0)	96.6	(1.8)	89.2	(1.8)
Vitamin supplements	62.3	(8.1)	51.4	(8.1)	57.4	(3.8)	48.5	(2.8)
Energy/concentrates (e.g., grain)	48.3	(9.0)	51.4	(7.3)	39.4	(3.6)	43.8	(2.9)

3. General production practices and record keeping

In recent years, more people have learned about the many beneficial aspects of bison agriculture, including the taste and nutritional advantages of bison meat and the generally natural and sustainable production practices. Respondents were asked whether they used several specific production practices that appeal to some consumers and might be important for producers in terms of marketing and product labelling.

Overall, 64.7 percent of operations raised bison without using antibiotics. Almost one-half of all operations (47.7 percent) raised animals without genetically modified organism (GMO) feeds. About one-third of operations (35.2 percent) raised bison to meet USDA's or the American Grassfed Association's grass-fed criteria. Bison were certified to USDA organic standards on 6.0 percent of operations, and 5.1 percent of operations had been certified for animal welfare through entities supporting humane agriculture.

A higher percentage of medium operations (71.6 percent) raised bison without using antibiotics than very small operations (55.8 percent).

B.3.a. Percentage of operations by production practice, and by size of operation:

	Percent Operations									
	Size of Operation (number of bison)									
	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Production practice	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Certified to USDA organic standards	8.5	(2.4)	6.7	(2.3)	4.5	(1.6)	2.2	(1.2)	6.0	(1.1)
Grass-fed[1]	35.7	(4.2)	34.1	(4.2)	34.7	(3.4)	36.9	(4.2)	35.2	(2.1)
Raised without antibiotics	55.8	(4.1)	66.4	(4.0)	71.6	(3.2)	68.8	(3.7)	64.7	(2.0)
Raised without GMO feeds	48.8	(4.1)	50.3	(4.6)	45.2	(3.6)	45.8	(4.0)	47.7	(2.0)
Certified for animal welfare[2]	3.9	(1.8)	6.4	(2.5)	5.2	(1.9)	5.1	(1.8)	5.1	(1.0)

[1] Raised to meet USDA or American Grassfed Association grass-fed criteria.

[2] Such as Global Animal Partnership (GAP) certified, Certified Humane®, American Humane Certified™

There were no differences by region in the percentage of operations that used the listed production practices.

B.3.b Percentage of operations by production practice, by region:

Percent Operations

Region

Production practice	Northeast Pct.	Northeast Std. error	Southeast Pct.	Southeast Std. error	North Central Pct.	North Central Std. error	West Pct.	West Std. error
Certified to USDA organic standards	4.3	(4.0)	9.3	(4.4)	2.6	(1.3)	6.9	(1.5)
Grass-fed[1]	24.8	(5.9)	34.6	(8.0)	38.2	(3.5)	35.9	(2.8)
Raised without antibiotics	70.2	(8.0)	53.0	(8.2)	68.2	(3.4)	64.3	(2.5)
Raised without GMO feeds	44.9	(7.1)	34.4	(7.8)	47.5	(3.5)	50.1	(2.7)
Certified for animal welfare[2]	3.7	(3.2)	9.3	(4.6)	2.3	(1.2)	5.7	(1.4)

[1] Raised to meet USDA or American Grassfed Association grass-fed criteria.

[2] Such as Global Animal Partnership (GAP) certified, Certified Humane®, American Humane Certified™

Testing the forage quality, soil composition, and water quality is important for producers to know whether bison are obtaining the nutrients and sustenance they need and avoiding potentially harmful components. For all operations, about one-third (29.7 percent) had tested the operation's soil in the previous 5 years, whereas about one-fifth of operations had tested the forage (20.3 percent) or water (18.6 percent). Higher percentages of large (50.0 percent) and medium (39.7 percent) operations than very small (15.1 percent) operations had tested the soil in the previous 5 years. Similarly, higher percentages of large (46.8 percent) and medium (30.3 percent) operations than small (9.1 percent) and very small (7.7 percent) operations had tested the forage in the previous 5 years. The percentage of large operations that had tested for forage was higher than that for medium operations. A higher percentage of large operations (39.7 percent) had tested the water than operations in the three smaller size categories.

B.3.c. Percentage of operations that conducted any of the following testing in the previous five years, and by size of operation:

Percent Operations

Size of Operation (number of bison)

Testing type	Very small (1–9) Pct.	Very small (1–9) Std. error	Small (10–24) Pct.	Small (10–24) Std. error	Medium (25–99) Pct.	Medium (25–99) Std. error	Large (100 or more) Pct.	Large (100 or more) Std. error	All operations Pct.	All operations Std. error
Forage	7.7	(2.2)	9.1	(2.7)	30.3	(3.4)	46.8	(4.2)	20.3	(1.6)
Soil	15.1	(3.0)	25.4	(4.0)	39.7	(3.5)	50.0	(4.4)	29.7	(1.8)
Water	11.7	(2.8)	14.1	(3.2)	18.6	(2.8)	39.7	(4.2)	18.6	(1.6)

A higher percentage of operations in the Southeast region (65.7 percent) than in the North Central (34.0 percent) and West (21.5 percent) regions had tested the soil in the past 5 years.

B.3.d. Percentage of operations that conducted any of the following testing in the previous five years, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Testing type	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Forage	26.8	(6.8)	20.7	(6.2)	19.4	(3.1)	19.5	(1.9)
Soil	38.5	(7.0)	65.7	(7.5)	34.0	(3.2)	21.5	(2.1)
Water	27.0	(7.6)	23.9	(6.3)	15.3	(2.7)	17.6	(1.9)

Some livestock producers keep records to track performance measures and health information, such as sales and purchases, animal growth rate, reproductive performance, health condition and problems, and vaccination status. Almost three-fourths of bison operations (71.4 percent) maintained some handwritten or electronic records. Also, close to three-fourths of operations (70.1 percent) maintained records on purchases and sales. Almost one-half of operations kept records on health (46.3 percent) or breeding (42.7 percent), and about one-third maintained records on treatment of individual bison with antibiotics (35.6 percent) or pasture/natural resource conditions (34.8 percent).

Higher percentages of large (98.5 percent) and medium (86.8 percent) operations than small (64.8 percent) or very small (49.1 percent) operations maintained any records. Higher percentages of large and medium operations than small or very small operations maintained records on purchases and sales, health, or treatment of individual bison with antibiotics. A lower percentage of very small operations (18.7 percent) than operations in the larger size categories maintained any electronic or handwritten records on breeding. A higher percentage of large operations (63.6 percent) than operations in the smaller size categories maintained any electronic or handwritten records on pasture/natural resource conditions.

B.3.e. Percentage of operations by record type(s) maintained (in handwritten or electronic form) from July 1, 2021, through June 30, 2022, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Record type	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Purchases and sales*	42.0	(6.0)	59.4	(4.9)	83.9	(3.0)	97.6	(1.4)	70.1	(2.3)
Breeding*	18.7	(4.3)	46.8	(4.8)	47.3	(3.8)	63.3	(4.5)	42.7	(2.3)
Health	27.0	(3.8)	41.3	(4.3)	60.3	(3.6)	70.5	(4.2)	46.3	(2.0)
Treatment of individual bison with antibiotics*	19.1	(4.4)	26.3	(4.9)	47.5	(4.3)	58.1	(5.1)	35.6	(2.4)
Pasture/natural resource conditions*	20.3	(4.1)	27.7	(4.8)	36.6	(3.7)	63.6	(4.5)	34.8	(2.2)
Other	3.3	(1.6)	3.0	(1.5)	(D)	(D)	(D)	(D)	2.6	(0.7)
Any	49.1	(4.6)	64.8	(4.3)	86.8	(2.4)	98.5	(1.2)	71.4	(2.0)

*Estimates in the rows for these record types are for only those operations that had purchases and sales, bred any bison, treated individual bison with antibiotics, or raised bison on pasture, respectively.

Values of (D) denote too few to report.

There were few differences by region in the percentages of operations that maintained different types of records, although a higher percentage of operations in the West region (71.5 percent) than in the Southeast region (47.3 percent) kept records on purchases and sales.

B.3.f. Percentage of operations by record type(s) maintained (in handwritten or electronic form) from July 1, 2021, through June 30, 2022, by region:

	Percent Operations							
	Region							
	Northeast		Southeast		North Central		West	
Record type	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Purchases and sales*	80.3	(8.8)	47.3	(9.3)	70.8	(4.5)	71.5	(2.8)
Breeding*	62.1	(10.1)	47.3	(10.0)	49.2	(4.1)	37.4	(2.9)
Health	48.8	(7.9)	52.0	(7.4)	49.6	(3.5)	44.0	(2.7)
Treatment of individual bison with antibiotics*	39.8	(11.4)	42.1	(8.1)	38.2	(4.8)	33.3	(2.9)
Pasture/natural resource conditions*	26.3	(9.1)	41.6	(8.6)	32.9	(4.1)	35.4	(2.8)
Other	0.0	(—)	3.3	(2.8)	3.8	(1.4)	2.5	(1.0)
Any	82.6	(7.5)	60.0	(7.5)	71.6	(3.5)	71.2	(2.6)

*Estimates in the rows for these record types are for only those operations that had purchases and sales, bred any bison, treated individual bison with antibiotics, or raised bison on pasture, respectively.

4. Animal identification

Having a way to identify each bison on the operation can be crucial for keeping track of health management practices and health issues, recording individual calving rates, tracking exposures to other animals, and responding to diseases. On 45.0 percent of operations, at least some bison included in the July 1, 2022, inventory had herd and/or unique identification (ID)—therefore, on 55.0 percent of operations, no bison had herd or unique ID. Higher percentages of large operations than operations in the other three size categories had some type of ID for at least some bison on the operation. Higher percentages of large (80.1 percent) and medium (62.4 percent) operations than small (33.4 percent) or very small (22.2 percent) operations had some type of herd and/or unique individual-animal ID for at least some bison on the operation.

B.4.a. For the July 1, 2022, total bison inventory, percentage of operations that had any bison with herd **and/or** unique individual identification, and by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
22.2	(3.6)	33.4	(4.3)	62.4	(3.4)	80.1	(3.6)	45.0	(1.9)

By region, there were no differences in the percentages of operations on which at least some bison included in the July 1, 2022, inventory had herd and/or unique ID.

B.4.b. For the July 1, 2022, total bison inventory, percentage of operations that had any bison with herd **and/or** unique individual identification, by region:

Percent Operations

Region

Northeast		Southeast		North Central		West	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
47.3	(8.8)	55.7	(6.1)	43.6	(3.8)	43.6	(2.3)

Overall, on about 3 in 10 operations (28.1 percent), some bison present on July 1, 2022, had some sort of identification that indicated they were part of the operation's herd. On 13.1 percent of operations, 81 or more percent of the July 1, 2022, inventory had herd identification.

More than three-fourths of very small (87.0 percent) and small (81.8 percent) operations had no bison with herd ID, and these percentages were higher than those for medium (61.4 percent) and large (39.5 percent) operations. On a higher percentage of large (19.6 percent) and medium (12.3 percent) operations than on very small operations (1.6 percent), 41 to 80 percent of the July 1, 2022, inventory had herd identification. On a higher percentage of large operations (32.4 percent) than on operations in the three smaller size categories, 81 or more percent of the July 1, 2022, inventory had herd identification.

Overall, on about 4 in 10 operations (36.4 percent), some bison present on July 1, 2022, had some sort of unique identification that enabled them to be recognized separately from all other bison in the operation's herd. On 17.5 percent of all operations, 81 or more percent of the July 1, 2022, inventory had unique animal identification.

More than three-fourths of very small (82.9 percent) and small (76.2 percent) operations had no bison with unique individual-animal ID, and these percentages were higher than for medium (50.2 percent) and large (27.1 percent) operations. Operators with very small or small herds might be able to distinguish bison based on physical characteristics, such as scars, hair color, conformation, or other features. On a higher percentage of large (31.0 percent) and medium (20.2 percent) operations than on very small (0.8 percent) operations, 41 to 80 percent of the July 1, 2022, inventory had individual-animal identification. On a higher percentage of large operations (37.2 percent) than on operations in the three smaller size categories, more than 81 percent of the July 1, 2022, inventory had individual-animal identification.

B.4.c. Percentage of operations by percentage of July 1, 2022, total bison inventory that had herd and/or unique individual identification, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Percent inventory	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Herd Identification										
0	87.0	(2.9)	81.8	(4.0)	61.4	(3.9)	39.5	(4.5)	71.9	(1.8)
1 to 40	3.8	(1.7)	1.4	(1.2)	12.9	(3.0)	8.5	(2.7)	6.3	(1.1)
41 to 80	1.6	(1.0)	8.2	(3.0)	12.3	(2.6)	19.6	(3.8)	8.7	(1.2)
81 or more	7.5	(2.3)	8.6	(2.7)	13.5	(2.6)	32.4	(4.4)	13.1	(1.4)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)
Unique Identification										
0	82.9	(3.3)	76.2	(4.0)	50.2	(3.8)	27.1	(3.9)	63.6	(1.9)
1 to 40	2.3	(1.2)	7.3	(2.3)	10.9	(2.6)	4.8	(1.9)	6.1	(1.0)
41 to 80	0.8	(0.6)	9.2	(2.7)	20.2	(2.9)	31.0	(4.0)	12.8	(1.2)
81 or more	14.0	(3.2)	7.4	(2.5)	18.7	(3.0)	37.2	(4.1)	17.5	(1.5)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

Higher percentages of operations in the North Central (74.3 percent) or West (75.4 percent) regions than operations in the Southeast region (53.7 percent) had no bison in the July 1, 2022, inventory with herd identification.

A higher percentage of operations in the West region (64.5 percent) than in the Southeast region (47.2 percent) had no bison in the July 1, 2022, inventory with unique animal identification. A higher percentage of operations in the Southeast region (34.6 percent) than operations in the North Central (12.7 percent) or West (16.1 percent) regions had 81 or more percent of July 1, 2022, inventory with unique animal identification.

B.4.d. Percentage of operations by percentage of July 1, 2022, total bison inventory that had herd and/or unique individual animal identification, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Percent inventory	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Herd Identification								
0	63.1	(8.8)	53.7	(6.0)	74.3	(3.8)	75.4	(2.2)
1 to 40	15.3	(5.5)	3.0	(2.4)	6.5	(2.3)	5.3	(1.3)
41 to 80	12.1	(6.4)	16.3	(5.5)	6.7	(2.4)	7.6	(1.3)
81 or more	9.5	(3.9)	27.0	(6.2)	12.5	(2.5)	11.8	(1.7)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)
Unique Identification								
0	65.4	(8.6)	47.2	(6.2)	67.2	(3.8)	64.5	(2.3)
1 to 40	2.4	(1.9)	2.9	(2.2)	10.6	(2.7)	5.7	(1.3)
41 to 80	11.9	(5.2)	15.3	(5.3)	9.5	(2.2)	13.7	(1.5)
81 or more	20.3	(6.7)	34.6	(6.2)	12.7	(2.4)	16.1	(1.9)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

Of operations that had any bison with herd and/or unique animal identification, 92.1 percent of operations had unique animal identification for bison aged 1 year and older. There were no differences by operation size in the percentage of operations that had individual animal identification for bison aged 1 year and older.

B.4.e. For the 45.0 percent of operations that had any bison with herd and/or unique individual animal identification on July 1, 2022 (Table B.4.a.), percentage of operations that had unique individual animal identification for **bison 1 year or older**, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
93.7	(3.5)	95.3	(4.1)	90.2	(3.2)	91.7	(2.5)	92.1	(1.7)

Of operations that had any bison with herd and/or unique animal identification, all operations in the Northeast and Southeast regions had unique animal identification for bison aged 1 year and older. About 90 percent of operations in the North Central (93.6 percent) and West (89.2 percent) regions had individual animal identification for bison aged 1 year and older.

B.4.f. For the 45.0 percent of operations that had any bison with herd and/or unique individual animal identification on July 1, 2022 (Table B.4.a.), percentage of operations that had unique individual animal identification for bison 1 year or older, by region:

Percent Operations

Region

Northeast		Southeast		North Central		West	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
100.0	(—)	100.0	(—)	93.6	(3.1)	89.2	(2.5)

Overall, more than three-fourths of operations (77.1 percent) that had unique animal identification for bison aged 1 year and older had unique animal identification for 81 or more percent of the July 1, 2022, inventory. A higher percentage of large operations (88.6 percent) than medium operations (67.5 percent) had unique animal identification for 81 or more percent of the July 1, 2022, inventory.

B.4.g. For the 41.4 percent of operations that had any bison with herd and/or unique individual animal identification and had unique individual animal identification for bison 1 year or older (Table B.4.e.),* percentage of operations by percentage of July 1, 2022, total bison inventory that had unique individual animal identification for bison 1 year or older, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Percent inventory	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
1 to 40	3.0	(2.2)	21.3	(7.4)	15.2	(4.2)	3.7	(2.0)	10.6	(2.1)
41 to 80	15.0	(7.4)	8.4	(5.2)	17.3	(4.3)	7.7	(2.8)	12.3	(2.3)
81 or more	82.1	(7.7)	70.3	(8.5)	67.5	(5.4)	88.6	(3.4)	77.1	(2.9)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

*These estimates come from the 45.0 percent of operations that had any bison with herd and/or unique individual animal identification (Table B.4.a.), of which 92.1 percent of operations had unique individual animal identification for bison 1 year or older (Table B.4.e.).

For operations that had unique animal identification for bison aged 1 year and older, all operations in the Northeast region (100 percent) had unique animal identification for 81 or more percent of the July 1, 2022, inventory. There were no other differences in the percentages of operations by region by the percentage of July 1, 2022, inventory that had unique animal identification.

B.4.h. For the 41.4 percent of operations that had any bison with herd and/or unique individual animal identification and had unique individual animal identification for bison 1 year or older (Table B.4.e.),* percentage of operations by percentage of July 1, 2022, total bison inventory that had unique individual animal identification for bison 1 year or older, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Percent inventory	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
1 to 40	0.0	(—)	11.8	(6.6)	17.7	(5.4)	9.5	(2.7)
41 to 80	0.0	(—)	10.9	(6.2)	18.8	(5.6)	12.3	(3.1)
81 or more	100.0	(—)	77.3	(8.4)	63.5	(6.3)	78.1	(3.9)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

*These estimates come from the 45.0 percent of operations that had any bison with herd and/or unique individual animal identification (Table B.4.a.), of which 92.1 percent of operations had unique individual animal identification for bison 1 year or older (Table B.4.e.).

For operations that had any bison with herd and/or unique individual animal identification and had unique animal identification for bison aged 1 year and older, three-fourths of operations (75.0 percent) had at least some bison identified by other metal ear tags or plastic tags. About three-fifths of operations (62.2 percent) had some bison identified by official ear tags. About one-fifth of operations (18.2 percent) had some bison identified by electronic ear tags, and about one-tenth (11.6 percent) had bison identified by tattoo/freeze brand.

For operations that had any bison with herd and/or unique individual animal identification and had unique animal identification for bison aged 1 year and older, a higher percentage of large operations (40.3 percent) than operations in the three smaller size categories had at least some bison identified by electronic ear tags.

B.4.i. For the 41.4 percent of operations that had any bison with herd and/or unique individual animal identification and had unique individual animal identification for bison 1 year or older (Table B.4.e.),[1] percentage of operations that had any bison identified by the following methods, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Method	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Official ear tag[2]	49.6	(11.5)	54.8	(9.2)	62.3	(5.3)	71.7	(4.2)	62.2	(3.3)
Other metal ear tag or plastic ear tag	57.0	(11.5)	85.3	(6.9)	71.9	(4.9)	81.4	(3.9)	75.0	(3.1)
Electronic ear tag[3]	4.6	(4.0)	0.0	(—)	12.1	(3.7)	40.3	(4.7)	18.2	(2.3)
Electronic implant/microchip	0.0	(—)	4.9	(3.9)	1.9	(1.1)	8.3	(2.6)	4.2	(1.2)
Tattoo/freeze brand	17.4	(8.4)	0.0	(—)	15.9	(4.0)	10.1	(2.8)	11.6	(2.2)
Other	(D)	(D)	0.0	(—)	(D)	(D)	4.6	(2.3)	2.6	(1.0)

[1] These estimates come from the 45.0 percent of operations that had any bison with herd and/or unique individual animal identification (Table B.4.a.), of which 92.1 percent of operations had unique individual animal identification for bison 1 year or older (Table B.4.e.).

[2] For example, for brucellosis vaccination, national uniform ear tagging system, etc.

[3] Radio-frequency identification (RFID)

Values of (D) denote too few to report.

For operations that had any bison with herd and/or unique individual animal identification and had unique animal identification for bison aged 1 year and older, operations in the Northeast region used only official ear tags or other metal ear tags or plastic ear tags to identify bison. There were few other differences by region in the percentages of operations that had at least some bison identified by the listed methods.

B.4.j. For the 41.4 percent of operations that had any bison with herd and/or unique individual animal identification and had unique individual animal identification for bison 1 year or older (Table B.4.e.),[1] percentage of operations that had any bison identified by the following methods, by region:

Percent Operations

	Region							
	Northeast		Southeast		North Central		West	
Method	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Official ear tag[2]	29.7	(14.7)	52.7	(10.6)	59.5	(6.8)	69.3	(3.9)
Other metal ear tag or plastic ear tag	84.9	(13.1)	70.9	(8.5)	70.4	(6.5)	75.9	(4.0)
Electronic ear tag[3]	0.0	(—)	33.5	(9.1)	15.2	(4.6)	18.3	(2.8)
Electronic implant/microchip	0.0	(—)	10.9	(5.1)	5.7	(2.7)	2.9	(1.4)
Tattoo/freeze brand	0.0	(—)	17.2	(8.2)	7.1	(3.3)	13.2	(3.0)
Other	0.0	(—)	(D)	(D)	(D)	(D)	2.5	(1.3)

[1] These estimates come from the 45.0 percent of operations that had any bison with herd and/or unique individual animal identification (Table B.4.a.), of which 92.1 percent of operations had unique individual animal identification for bison 1 year or older (Table B.4.e.).

[2] For example, for brucellosis vaccination, national uniform ear tagging system, etc.

[3] Radio-frequency identification (RFID)

Values of (D) denote too few to report.

For operations that had any bison with herd and/or unique individual animal identification and had unique animal identification for bison aged 1 year and older, the operation average percentage of bison that had other metal ear tags or plastic ear tags was 62.8 percent for all operations. The operation average percentage of bison 1 year or older that had official ear tags was about two-fifths (43.8 percent) for all operations and about one-eighth (13.0 percent) had electronic ear tags.

The operation average percentage of bison aged 1 year or older with electronic ear tags was higher on large operations (30.5 percent of bison) than on operations in the three smaller size categories. The operation average percentage of bison of that age with official ear tags was higher on large operations (55.6 percent of bison) than on medium operations (36.7 percent of bison).

B.4.k. For the 41.4 percent of operations that had any bison with herd and/or unique individual animal identification and had unique individual animal identification for bison 1 year or older (Table B.4.e.),[1] operation average percentage of bison of that age identified by the following methods, and by size of operation:

	Operation Average Percent Bison									
	Size of Operation (number of bison)									
	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Method	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Official ear tag[2]	40.3	(10.8)	38.8	(7.8)	36.7	(4.0)	55.6	(4.4)	43.8	(3.0)
Other metal ear tag or plastic ear tag	51.6	(11.2)	54.7	(8.6)	62.0	(5.1)	73.0	(4.0)	62.8	(3.2)
Electronic ear tag[3]	4.6	(4.0)	0.0	(—)	6.5	(2.4)	30.5	(4.2)	13.0	(1.8)
Electronic implant/microchip	0.0	(—)	4.9	(3.9)	1.0	(0.8)	2.0	(0.9)	1.8	(0.8)
Tattoo/freeze brand	8.7	(4.3)	0.0	(—)	7.1	(2.5)	6.0	(2.1)	5.8	(1.3)
Other	2.7	(2.0)	0.0	(—)	1.0	(0.8)	2.7	(1.5)	1.6	(0.6)

[1] These estimates come from the 45.0 percent of operations that had any bison with herd and/or unique individual animal identification (Table B.4.a.), of which 92.1 percent of operations had unique individual animal identification for bison 1 year or older (Table B.4.e.).

[2] For example, for brucellosis vaccination, national uniform ear tagging system, etc.

[3] Radio-frequency identification (RFID)

For operations that had any bison with herd and/or unique individual animal identification and had unique animal identification for bison aged 1 year and older, no bison in the Northeast region had electronic ear tags, electronic implants/microchips, or tattoos/freeze brands, as indicated above. There were no other differences by region in the operation average percentage of bison that had the listed methods of identification.

B.4.l. For the 41.4 percent of operations that had any bison with herd and/or unique individual animal identification and had unique individual animal identification for bison 1 year or older (Table B.4.e.)[1], operation average percentage of bison of that age identified by the following methods, by region:

Operation Average Percent Bison

Region

	Northeast		Southeast		North Central		West	
Method	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Official ear tag[2]	19.4	(13.1)	41.0	(9.7)	39.1	(6.1)	49.0	(3.6)
Other metal ear tag or plastic ear tag	78.9	(13.9)	61.1	(8.1)	51.8	(6.4)	64.3	(4.1)
Electronic ear tag[3]	0.0	(—)	14.3	(5.5)	10.5	(4.1)	15.2	(2.5)
Electronic implant/microchip	0.0	(—)	1.6	(1.0)	3.8	(2.2)	1.6	(1.1)
Tattoo/freeze brand	0.0	(—)	8.0	(5.0)	1.7	(1.2)	7.3	(1.9)
Other	0.0	(—)	3.1	(2.4)	1.9	(1.6)	1.4	(0.8)

[1] These estimates come from the 45.0 percent of operations that had any bison with herd and/or unique individual animal identification (Table B.4.a.), of which 92.1 percent of operations had unique individual animal identification for bison 1 year or older (Table B.4.e.).

[2] For example, for brucellosis vaccination, national uniform ear tagging system, etc.

[3] Radio-frequency identification (RFID)

For operations that had any bison with herd and/or unique individual animal identification, 45.0 percent of all operations had unique individual animal identification for bison less than 1 year old. No very small operations had unique individual animal identification for bison less than 1 year old; there were no other differences by operation size.

B.4.m. For the 45.0 percent of operations that had any bison with herd and/or unique individual animal identification on July 1, 2022 (Table B.4.a.), percentage of operations that had unique individual animal identification for bison **less than 1 year old**, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
0.0	(—)	42.6	(12.6)	39.6	(5.5)	54.1	(5.3)	45.0	(3.7)

For operations that had any bison with herd and/or unique individual animal identification, there were no differences by region in the percentages of operations that had unique individual animal identification for bison less than 1 year old.

B.4.n. For the 45.0 percent of operations that had any bison with herd and/or unique individual animal identification on July 1, 2022 (Table B.4.a.), percentage of operations that had unique individual animal identification for bison **less than 1 year old**, by region:

Percent Operations

Region

Northeast		Southeast		North Central		West	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
48.6	(14.6)	63.7	(11.9)	41.0	(6.8)	41.4	(4.6)

For the operations that had any bison with herd and/or unique individual animal identification and had unique individual animal identification for bison less than 1 year old, more than four-fifths of all operations (85.3 percent) had unique individual animal identification for 81 percent or more of the July 1, 2022, inventory, and this was consistent for small (80.6 percent), medium (81.4 percent), and large (89.7 percent) operations. No operations in the very small size category used unique individual animal identification for bison less than 1 year old.

B.4.o. For the 20.3 percent of operations that had any bison with herd and/or unique individual animal identification and had unique individual animal identification for bison less than 1 year old (Table B.4.m.),* percentage of operations by percentage of July 1, 2022, total bison inventory that had unique individual animal identification for bison less than 1 year old, and size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Percent inventory	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
1 to 40	NA	NA	19.4	(14.6)	3.4	(3.2)	10.3	(4.5)	8.6	(3.1)
41 to 80	NA	NA	0.0	(—)	15.3	(6.9)	0.0	(—)	6.1	(3.0)
81 or more	NA	NA	80.6	(14.6)	81.4	(7.3)	89.7	(4.5)	85.3	(4.1)
Total	NA	NA	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

*These estimates come from the 45.0 percent of operations that had any bison with herd and/or unique individual animal identification (Table B.4.a.), of which 45.0 percent of operations had unique individual animal identification for bison less than 1 year old (Table B.4.m.).

NA indicates that no operations in the Very small category used unique individual animal identification for bison less than 1 year old.

For the operations that had any bison with herd and/or unique individual animal identification and had unique individual animal identification for bison less than 1 year old, all operations in the Northeast and North Central regions had unique individual animal identification for 81 or more percent of the July 1, 2022, inventory.

Operations in the Southeast and West regions did not differ in the percentage of operations by percentage of July 1, 2022, total bison inventory that had unique individual animal identification for bison less than 1 year old.

B.4.p. For the 20.3 percent of operations that had any bison with herd and/or unique individual animal identification and had unique individual animal identification for bison less than 1 year old (Table B.4.m.),* percentage of operations by percentage of July 1, 2022, total bison inventory that had unique individual animal identification for bison less than 1 year old, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Percent inventory	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
1 to 40	0.0	(—)	10.3	(7.9)	0.0	(—)	12.2	(4.8)
41 to 80	0.0	(—)	24.3	(12.9)	0.0	(—)	2.5	(1.9)
81 or more	100.0	(—)	65.4	(14.3)	100.0	(—)	85.3	(5.1)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

*These estimates come from the 45.0 percent of operations that had any bison with herd and/or unique individual animal identification (Table B.4.a.), of which 45.0 percent of operations had unique individual animal identification for bison less than 1 year old (Table B.4.m.).

For operations that had any bison with herd and/or unique individual animal identification and had unique individual animal identification for bison less than 1 year old, two-thirds of operations (66.8 percent) had any bison identified by other metal ear tags or plastic ear tags. About two-fifths of operations (44.1 percent) had any bison identified by official ear tags, and about one-fifth (22.6 percent) had any bison identified by electronic ear tags. Less than one-twelfth of operations had any bison identified by tattoos/freeze brands (7.9 percent) or electronic implants/microchips (6.9 percent).

A higher percentage of large operations (64.6 percent) than medium operations (27.7 percent) had any bison identified by official ear tags, and a higher percentage of large operations (42.2 percent) than medium operations (6.7 percent) had any bison identified by electronic ear tags.

B.4.q. For the 20.3 percent of operations that had any bison with herd and/or unique individual animal identification and had unique individual animal identification for bison less than 1 year old (Table B.4.m.),[1] percentage of operations that had any bison identified by the following methods, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Method	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Official ear tag[2]	NA	NA	19.6	(15.1)	27.7	(7.4)	64.6	(7.0)	44.1	(5.3)
Other metal ear tag or plastic ear tag	NA	NA	60.9	(18.8)	56.2	(8.7)	77.3	(5.4)	66.8	(4.8)
Electronic ear tag[3]	NA	NA	0.0	(—)	6.7	(3.6)	42.2	(6.8)	22.6	(4.0)
Electronic implant/microchip	NA	NA	(D)	(D)	(D)	(D)	7.5	(4.1)	6.9	(2.8)
Tattoo/freeze brand	NA	NA	0.0	(—)	3.5	(3.2)	13.5	(4.9)	7.9	(2.7)
Other	NA	NA	0.0	(—)	0.0	(—)	7.5	(4.1)	3.5	(2.0)

[1] These estimates come from the 45.0 percent of operations that had any bison with herd and/or unique individual animal identification (Table B.4.a.), of which 45.0 percent of operations had unique individual animal identification for bison less than 1 year old (Table B.4.m.).

[2] For example, for brucellosis vaccination, national uniform ear tagging system, etc.

[3] Radio-frequency identification (RFID)

Values of (D) denote too few to report.

NA indicates that no operations in the Very small category used unique individual animal identification for bison less than 1 year old.

For operations that had any bison with herd and/or unique individual animal identification and had unique animal identification for bison less than 1 year old, a higher percentage of operations in the West region (77.5 percent) than operations in the North Central region (37.5 percent) had some bison identified by other metal ear tags or plastic ear tags. Operations in the Northeast region used only other metal ear tags or plastic ear tags.

B.4.r. For the 20.3 percent of operations that had any bison with herd and/or unique individual animal identification and had unique individual animal identification for bison less than 1 year old (Table B.4.m.),[1] percentage of operations that had any bison identified by the following methods, by region:

Percent Operations

	Region							
	Northeast		Southeast		North Central		West	
Method	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Official ear tag[2]	0.0	(—)	44.9	(15.5)	41.3	(10.3)	52.6	(6.8)
Other metal ear tag or plastic ear tag	81.8	(15.9)	53.3	(12.9)	37.5	(11.3)	77.5	(5.7)
Electronic ear tag[3]	0.0	(—)	20.6	(8.8)	17.5	(7.4)	29.0	(6.2)
Electronic implant/microchip	0.0	(—)	(D)	(D)	(D)	(D)	7.2	(4.1)
Tattoo/freeze brand	0.0	(—)	11.5	(8.7)	0.0	(—)	10.6	(4.0)
Other	0.0	(—)	10.3	(7.9)	0.0	(—)	2.8	(2.3)

[1] These estimates come from the 45.0 percent of operations that had any bison with herd and/or unique individual animal identification (Table B.4.a.), of which 45.0 percent of operations had unique individual animal identification for bison less than 1 year old (Table B.4.m.).
[2] For example, for brucellosis vaccination, national uniform ear tagging system, etc.
[3] Radio-frequency identification (RFID)

Values of (D) denote too few to report.

For operations that had any bison with herd and/or unique individual animal identification and had unique animal identification for bison less than 1 year old, the operation average percentage of bison of that age that had other metal ear tags or plastic ear tags was 62.9 percent for all operations. The operation average percentage of bison less than 1 year old that had official ear tags was 36.2 percent for all operations. About one-fifth of these young bison (20.9 percent) had electronic ear tags.

The operation average percentage of bison less than 1 year old with official ear tags was higher on large operations (52.3 percent of bison) than on medium operations (22.4 percent of bison) or very small operations. The operation average percentage of bison less than 1 year old with electronic ear tags was higher on large operations (41.1 percent of bison) than on operations in the three smaller size categories.

B.4.s. For the 20.3 percent of operations that had any bison with herd and/or unique individual animal identification and had unique individual animal identification for bison less than 1 year old (Table B.4.m.),[1] operation average percentage of bison of that age identified by the following methods, and by size of operation:

	Operation Average Percent Bison									
	Size of Operation (number of bison)									
	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Method	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Official ear tag[2]	NA	NA	19.6	(15.1)	22.4	(5.8)	52.3	(6.5)	36.2	(4.6)
Other metal ear tag or plastic ear tag	NA	NA	60.9	(18.8)	52.2	(8.6)	72.6	(5.8)	62.9	(4.9)
Electronic ear tag[3]	NA	NA	0.0	(—)	3.7	(2.5)	41.1	(6.6)	20.9	(3.8)
Electronic implant/microchip	NA	NA	4.9	(3.7)	2.4	(2.1)	7.5	(4.1)	5.1	(2.2)
Tattoo/freeze brand	NA	NA	0.0	(—)	2.3	(2.0)	9.4	(4.0)	5.4	(2.1)
Other	NA	NA	0.0	(—)	0.0	(—)	5.9	(3.5)	2.8	(1.7)

[1] These estimates come from the 45.0 percent of operations that had any bison with herd and/or unique individual animal identification (Table B.4.a.), of which 45.0 percent of operations had unique individual animal identification for bison less than 1 year old (Table B.4.m.).

[2] For example, for brucellosis vaccination, national uniform ear tagging system, etc.

[3] Radio-frequency identification (RFID)

NA indicates that no operations in the Very small category used unique individual animal identification for bison less than 1 year

For operations that had any bison with herd and/or unique individual animal identification and had unique animal identification for bison less than 1 year old, there were no substantive differences by region in the percentage of bison less than 1 year old that had the listed method of identification. As noted above, operations in the Northeast region used only other metal ear tags or plastic ear tags.

B.4.t. For the 20.3 percent of operations that had any bison with herd and/or unique individual animal identification and had unique individual animal identification for bison less than 1 year old (Table B.4.m.),[1] operation average percentage of bison of that age identified by the following methods, by region:

Operation Average Percent Bison

Region

	Northeast		Southeast		North Central		West	
Method	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Official ear tag[2]	0.0	(—)	31.1	(12.5)	41.1	(10.3)	42.9	(6.2)
Other metal ear tag or plastic ear tag	81.8	(15.9)	53.3	(12.9)	37.5	(11.3)	70.5	(6.0)
Electronic ear tag[3]	0.0	(—)	20.6	(8.8)	17.5	(7.4)	25.8	(5.7)
Electronic implant/microchip	0.0	(—)	10.3	(7.9)	5.8	(4.9)	3.9	(2.3)
Tattoo/freeze brand	0.0	(—)	11.5	(8.7)	0.0	(—)	6.1	(2.5)
Other	0.0	(—)	10.3	(7.9)	0.0	(—)	1.4	(1.2)

[1] These estimates come from the 45.0 percent of operations that had any bison with herd and/or unique individual animal identification (Table B.4.a.), of which 45.0 percent of operations had unique individual animal identification for bison less than 1 year old (Table B.4.m.).

[2] For example, for brucellosis vaccination, national uniform ear tagging system, etc.

[3] Radio-frequency identification (RFID)

5. Other operation husbandry

Handling systems can be very important in working bison for many reasons, such as vaccination, disease testing, examination and treatment of ailing bison, sorting, and loading or unloading for transportation. The number of bison on an operation and the operation's reasons for raising bison influence whether it needs handling facilities, and if so, what kind. Almost 70 percent of all operations (69.3 percent) had facilities for handling/restraining bison.

The percentage of operations that had facilities for handling/restraining bison generally increased as operation size increased. As might be expected, higher percentages of large (93.6 percent) and medium (88.2 percent) operations had facilities for handling/restraining bison than small (68.5 percent) and very small (42.1 percent) operations.

B.5.a. Percentage of operations that had facilities for handling/restraining bison, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
42.1	(4.6)	68.5	(4.3)	88.2	(2.3)	93.6	(2.5)	69.3	(2.0)

There were no differences by region in the percentages of operations that had facilities for handling/restraining bison.

B.5.b. Percentage of operations that had facilities for handling/restraining bison, by region:

Percent Operations							
Region							
Northeast		Southeast		North Central		West	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
63.0	(8.7)	78.4	(6.7)	71.7	(3.7)	68.2	(2.6)

Given some of their unique attributes, bison might be more easily and safely worked with facilities and equipment designed specifically for them. These systems are developed to accommodate bison behavior and conformation. Although they can be a large investment, well-designed bison-specific systems maximize human and animal safety, minimize stress on the bison, and increase efficiency of the process. Of the 69.3 percent of operations with facilities for handling/restraining bison, 78.8 percent had facilities specifically designed for bison.

In general, the percentage of operations with bison-specific facilities increased as operation size increased. Higher percentages of large (97.2 percent) and medium (89.8 percent) operations than small (72.4 percent) and very small (47.0 percent) operations had handling facilities designed specifically for bison.

B.5.c. For the 69.3 percent of operations with facilities for handling/restraining (Table B.5.a.), percentage of operations with facilities designed specifically for bison, by size of operation:

Percent Operations									
Size of Operation (number of bison)									
Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
47.0	(6.5)	72.4	(5.0)	89.8	(2.5)	97.2	(1.6)	78.8	(2.1)

The percentages of operations with handling/restraining facilities designed specifically for bison did not differ by region.

B.5.d. For the 69.3 percent of operations with facilities for handling/restraining (Table B.5.a.), percentage of operations with facilities designed specifically for bison, by region:

Percent Operations							
Region							
Northeast		Southeast		North Central		West	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
86.4	(7.0)	80.4	(6.8)	80.3	(4.0)	76.9	(2.8)

Flies contribute to the transmission of certain diseases (e.g., pink eye) and can be irritating enough to animals to affect their health and growth rate. Fly control can reduce the occurrence of fly-related issues in the herd. A wide variety of products and methods exist to help control flies, including chemical insecticides, biological-control insects, and natural alternatives.

Over one-half of operations (57.8 percent) used some method of fly control. This percentage was consistent across all operation size categories. Topical products were used by 28.7 percent of operations, other environmental fly control (e.g., sprays, foggers, strips, zappers) by 23.8 percent, oral products by 16.4 percent, diatomaceous earth by 13.2 percent, and garlic salt by 11.7 percent.

Higher percentages of large (19.9 percent) and medium (16.6 percent) operations than very small operations (5.0 percent) used garlic salt to help control flies.

B.5.e. Percentage of operations by type of fly-control method(s) used from July 1, 2021, through June 30, 2022, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Method	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Diatomaceous earth (environmentally, topically, and/or orally)	8.9	(2.6)	13.5	(3.2)	17.9	(2.7)	13.3	(3.2)	13.2	(1.5)
Other environmental fly control (e.g., sprays, foggers, strips, zappers)	26.7	(3.7)	23.5	(4.1)	22.5	(3.0)	20.6	(3.5)	23.8	(1.9)
Topical products (e.g., dust bags, dips, sprays, backrubs)	27.0	(4.0)	23.3	(4.0)	33.9	(3.2)	31.5	(4.1)	28.7	(1.9)
Oral products (e.g., feed-through larvicides)	15.0	(3.1)	18.4	(3.8)	19.9	(3.2)	10.3	(2.6)	16.4	(1.7)
Treated ear tags	1.1	(1.0)	5.8	(2.3)	2.1	(1.1)	3.2	(1.5)	2.8	(0.7)
Biological control (e.g., predator wasps)	4.1	(1.6)	3.8	(1.6)	5.3	(1.8)	3.3	(1.6)	4.2	(0.9)
Garlic salt	5.0	(2.0)	9.3	(2.9)	16.6	(2.6)	19.9	(3.3)	11.7	(1.3)
Other	(D)	(D)	0.0	(—)	2.6	(1.1)	(D)	(D)	1.1	(0.4)
Any	51.4	(4.4)	58.3	4.6	65.9	(3.4)	56.1	(4.3)	57.8	(2.1)

Values of (D) denote too few to report

There were few differences by region in the types of fly control operations used. A higher percentage of operations in the Southeast region (36.5 percent) used oral products (such as feed-through larvicides) than operations in the North Central (13.8 percent) or West (14.3 percent) regions.

B.5.f. Percentage of operations by type of fly-control method(s) used from July 1, 2021, through June 30, 2022, by region:

	Percent Operations							
	Region							
	Northeast		Southeast		North Central		West	
Method	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Diatomaceous earth (environmentally, topically, and/or orally)	19.9	(6.3)	13.9	(4.8)	15.1	(3.0)	11.3	(1.8)
Other environmental fly control (e.g., sprays, foggers, strips, zappers)	38.2	(7.5)	35.5	(7.6)	24.7	(3.6)	19.4	(2.3)
Topical products (e.g., dust bags, dips, sprays, backrubs)	28.2	(7.2)	37.7	(6.6)	34.0	(3.8)	25.5	(2.4)
Oral products (e.g., feed-through larvicides)	16.5	(6.7)	36.5	(7.1)	13.8	(3.0)	14.3	(2.0)
Treated ear tags	0.0	(—)	6.3	(4.0)	1.5	(0.9)	3.2	(1.0)
Biological control (e.g., predator wasps)	6.3	(3.9)	3.2	(3.0)	5.1	(1.7)	3.8	(1.1)
Garlic salt	11.6	(5.1)	14.4	(4.6)	10.7	(2.2)	11.7	(1.7)
Other	0.0	(—)	3.2	(2.7)	1.1	(0.6)	1.0	(0.5)
Any	65.6	(7.0)	72.0	(6.6)	61.0	(4.1)	53.3	(2.9)

C. Biosecurity

Biosecurity practices are vital in protecting bison health and it is important to have a good biosecurity plan. Biosecurity practices include measures that reduce risk of disease introduction on an operation, such as controlling animal vectors and isolating animals when they arrive or return to the operation, as well as measures that minimize the chances for disease spread once a disease occurs on an operation. Knowing who visits an operation and cleaning and disinfection of vehicles and shared vehicles and equipment are important parts of good biosecurity.

Note: Unless otherwise noted, tables in this section refer to the period July 1, 2021, through June 30, 2022.

1. Contact with other animals

Overall, about 70 percent of operations had any farmed animals ever present on the operation during the reference period. Almost two-fifths (39.8 percent) of operations had horses, donkeys, or other equids, and a little over one-third (36.4 percent) of all operations had beef or dairy cattle. Almost one-third (29.0 percent) had deer, elk, or other cervids. Less than one-tenth of operations had sheep or lambs (6.7 percent), goats (9.8 percent), or swine (9.3 percent). “Other” responses included yaks, llamas, camels, alpacas, antelope, and zebras.

There was no difference in the size of operation that had any type of farmed animal present. A higher percentage of very small operations (14.5 percent) than operations in the other size categories had sheep or lambs. No large operations had sheep or lambs. A higher percentage of very small operations (17.9 percent) than medium (6.3 percent) or large (4.3 percent) operations had any goats. A higher percentage of very small (47.4 percent) than medium operations (24.8 percent) had any cattle present.

C.1.a. Percentage of operations by type(s) of farmed animal ever present on the operation from July 1, 2021, through June 30, 2022, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Farmed animal	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Cattle (beef or dairy)	47.4	(4.4)	37.4	(4.2)	24.8	(3.1)	32.1	(3.9)	36.4	(2.1)
Sheep or lambs	14.5	(3.3)	3.7	(1.7)	4.1	(1.3)	0.0	(—)	6.7	(1.2)
Goats	17.9	(3.4)	6.7	(2.2)	6.3	(1.7)	4.3	(1.8)	9.8	(1.3)
Horses, donkeys, etc.	47.4	(4.3)	34.9	(4.4)	30.2	(3.2)	48.1	(4.2)	39.8	(2.1)
Swine	14.3	(3.2)	9.9	(2.7)	3.5	(1.2)	7.8	(2.4)	9.3	(1.3)
Poultry	28.1	(3.8)	26.9	(4.1)	24.8	(2.8)	13.1	(2.9)	24.5	(1.9)
Deer, elk, or other cervids	29.2	(4.1)	31.5	(4.1)	25.6	(3.0)	30.8	(4.1)	29.0	(1.9)
Other	1.4	(0.8)	4.1	(1.8)	2.8	(1.3)	2.0	(0.9)	2.5	(0.7)
Any	75.3	(3.6)	72.6	(4.0)	60.4	(3.5)	73.1	(3.6)	70.2	(1.9)

A higher percentage of operations in the West region (73.7 percent) had any farmed animals ever present on the operation compared with the North Central region (60.0 percent) during the reference period. A higher percentage of operations in the West region (49.3 percent) had farmed horses or donkeys present than operations in the Northeast region (23.4 percent) or North Central region (24.3 percent). A higher percentage of operations in the Southeast region (45.0 percent) than in the North Central region (13.6 percent) had farmed deer, elk, or other cervids ever present on the operation during the reference period.

C.1.b. Percentage of operations by type(s) of farmed animal ever present on the operation from July 1, 2021, through June 30, 2022, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Farmed animal	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Cattle (beef or dairy)	29.1	(7.6)	30.7	(7.9)	33.1	(3.5)	39.6	(2.7)
Sheep or lambs	10.3	(5.9)	3.2	(3.0)	4.1	(1.8)	7.6	(1.6)
Goats	12.3	(5.0)	5.8	(3.6)	7.4	(2.5)	10.9	(1.8)
Horses, donkeys, etc.	23.4	(6.8)	29.7	(7.4)	24.3	(3.6)	49.3	(2.8)
Swine	18.0	(6.6)	12.2	(5.2)	11.2	(2.7)	6.8	(1.5)
Poultry	32.8	(5.9)	27.0	(6.9)	22.4	(3.2)	23.6	(2.5)
Deer, elk, or other cervids	38.0	(8.6)	45.0	(7.1)	13.6	(2.5)	30.6	(2.5)
Other	3.7	(3.2)	3.2	(2.7)	3.0	(1.5)	2.1	(0.7)
Any	67.0	(7.1)	74.7	(6.6)	60.0	(4.1)	73.7	(2.4)

Overall, about 45.2 percent of operations had any farmed animals with which bison could have had contact. On roughly one-fifth of operations, bison could have had contact with cattle (20.1 percent); horses, donkeys, or other equids (18.2 percent); or deer, elk, or other cervids (20.2 percent). On less than one-tenth of operations, bison could have had contact with poultry (6.9 percent), goats (4.0 percent), sheep or lambs (3.2 percent), or swine (2.2 percent).

A higher percentage of very small operations (56.1 percent) had any farmed animals that could have had contact with the operation's bison when compared with medium operations (37.5 percent). A higher percentage of very small operations (31.2 percent) than small operations (15.1 percent) or medium operations (12.3 percent) had beef or dairy cattle that could have had contact with the operation's bison.

C.1.c. Percentage of operations by type(s) of farmed animal bison could have had contact with on the operation from July 1, 2021, through June 30, 2022, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Farmed animal	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Cattle (beef or dairy)	31.2	(4.0)	15.1	(3.3)	12.3	(2.4)	17.8	(3.2)	20.1	(1.8)
Sheep or lambs	5.9	(2.2)	2.3	(1.4)	2.8	(1.1)	0.0	(—)	3.2	(0.8)
Goats	5.8	(2.2)	4.7	(1.8)	2.2	(1.0)	2.3	(1.4)	4.0	(0.9)
Horses, donkeys, etc.	25.0	(3.7)	11.0	(2.6)	13.7	(2.4)	22.9	(3.6)	18.2	(1.6)
Swine	2.5	(1.3)	2.3	(1.4)	1.7	(0.8)	2.1	(1.3)	2.2	(0.6)
Poultry	6.5	(2.2)	6.6	(2.3)	9.2	(2.0)	4.2	(1.8)	6.9	(1.1)
Deer, elk, or other cervids	18.8	(3.4)	22.9	(3.7)	18.3	(2.7)	22.5	(3.8)	20.2	(1.7)
Other	0.7	(0.7)	1.1	(1.0)	2.2	(1.3)	1.0	(0.7)	1.3	(0.5)
Any	56.1	(4.3)	40.6	(4.5)	37.5	(3.5)	43.2	(4.3)	45.2	(2.2)

Overall, a lower percentage of operations in the North Central region (32.1 percent) than in the West region (49.0 percent) had any farmed animals that could have had contact with bison on the operation. A higher percentage of operations in the West region (25.1 percent) than in the other three regions had horses, donkeys, or other equids that could have had contact with bison on the operation. A higher percentage of operations in the Southeast region (36.0 percent) than in the North Central region (9.1 percent) had deer, elk, or other cervids that could have had contact with bison on the operation. These differences are related to the regional distribution of farmed animals reported in Table C.1.b.

C.1.d. Percentage of operations by type(s) of farmed animal bison could have had contact with on the operation from July 1, 2021, through June 30, 2022, by region:

Percent Operations

	Region							
	Northeast		Southeast		North Central		West	
Farmed animal	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Cattle (beef or dairy)	11.8	(5.2)	19.0	(6.3)	13.3	(2.9)	23.9	(2.4)
Sheep or lambs	4.2	(4.1)	3.2	(3.0)	1.1	(1.0)	3.8	(1.1)
Goats	6.2	(4.2)	3.2	(3.0)	3.2	(1.6)	4.0	(1.1)
Horses, donkeys, etc.	0.0	(—)	9.5	(4.7)	10.8	(2.5)	25.1	(2.5)
Swine	0.0	(—)	6.3	(3.9)	3.7	(1.7)	1.4	(0.6)
Poultry	10.1	(4.2)	6.3	(3.9)	8.3	(2.0)	5.9	(1.4)
Deer, elk, or other cervids	21.5	(7.2)	36.0	(6.8)	9.1	(2.2)	21.7	(2.2)
Other	0.0	(—)	3.2	(2.7)	1.1	(1.1)	1.3	(0.6)
Any	47.1	(8.1)	48.7	(7.8)	32.1	(3.9)	49.0	(2.8)

Overall, almost three-fourths of operations (73.1 percent) had neighboring operations with “any” farmed animals, including bison; cattle; sheep or lambs; goats; and/or deer, elk, or other cervids ever located within 1 mile of the operation’s bison during the timeframe of the study. A similar percentage of operations (69.2 percent) had neighboring farmed beef or dairy cattle within 1 mile of the operation’s bison. Almost 14 percent of all operations had neighboring farmed sheep or lambs and almost 15 percent had neighboring farmed goats within 1 mile of the operation’s bison.

By operation size, some differences existed in neighboring farmed animals within 1 mile of the operation's bison. For both cattle and "any" type of neighboring farmed animal, a lower percentage of very small, small, and medium operations than large operations had neighboring farmed animals within 1 mile of the operation's bison.

C.1.e. Percentage of operations by type(s) of neighboring farmed animal ever located within 1 mile of the operation's bison from July 1, 2021, through June 30, 2022, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Neighboring farmed animal	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Bison	6.9	(2.4)	5.1	(2.0)	5.7	(1.7)	12.3	(2.9)	7.0	(1.1)
Cattle (beef or dairy)	64.9	(4.1)	60.6	(4.6)	71.9	(3.3)	86.4	(3.1)	69.2	(2.0)
Sheep or lambs	11.9	(3.0)	12.7	(3.0)	14.8	(2.5)	16.1	(3.3)	13.5	(1.5)
Goats	17.5	(3.6)	17.8	(3.5)	13.8	(2.6)	6.5	(2.1)	14.9	(1.6)
Deer, elk, or other cervids	25.0	(4.2)	21.3	(3.4)	22.6	(3.2)	25.3	(3.8)	23.5	(1.9)
Any of the above	70.7	(4.2)	65.1	(4.4)	73.5	(3.2)	89.9	(2.7)	73.1	(2.0)

Overall, a higher percentage of operations in the Southeast (84.7 percent) and West (79.4 percent) regions than in the Northeast region (45.2 percent) had any neighboring farmed animals located within 1 mile of the operation's bison. A lower percentage of operations in the Northeast region (33.4 percent) than in the other three regions had neighboring farmed beef or dairy cattle within 1 mile of the operation's bison. A higher percentage of operations in the Southeast region (41.2 percent) than operations in the North Central region (9.2 percent) had neighboring farmed deer, elk, or other cervids located within 1 mile of the operation's bison.

C.1.f. Percentage of operations by type(s) of neighboring farmed animal ever located within 1 mile of the operation's bison from July 1, 2021, through June 30, 2022, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Neighboring farmed animal	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Bison	8.1	(5.2)	0.0	(—)	6.3	(1.9)	8.1	(1.5)
Cattle (beef or dairy)	33.4	(7.4)	75.5	(6.8)	59.9	(4.1)	77.1	(2.5)
Sheep or lambs	14.2	(6.2)	12.4	(4.6)	9.5	(2.2)	15.0	(2.1)
Goats	17.8	(7.1)	12.9	(5.0)	11.4	(2.4)	16.0	(2.2)
Deer, elk, or other cervids	17.3	(7.3)	41.2	(7.5)	9.2	(2.3)	26.9	(2.5)
Any of the above	45.2	(9.2)	84.7	(5.7)	62.9	(3.9)	79.4	(2.4)

More than two-fifths of operations (45.1 percent) had neighboring farmed animals that could have had fence-line contact with the operation's bison. A little more than one-third of all operations (35.6 percent) had neighboring farmed beef or dairy cattle that could have had fence-line contact with the operations bison and almost one-fifth (19.2 percent) had neighboring farmed deer, elk, or other cervids could have had fence-line contact with the operation's bison.

Bison could have had fence-line contact with neighboring farmed cattle on a higher percentage of large operations (64.2 percent) than operations in the other size categories. Bison could have had fence-line contact with "any" neighboring farmed animals on a higher percentage of large operations (70.3 percent) compared with operations in the other size categories.

C.1.g. Percentage of operations by type(s) of neighboring farmed animal bison could have had fence-line contact with from July 1, 2021, through June 30, 2022, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Neighboring farmed animal	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Bison	1.7	(1.0)	2.3	(1.3)	1.8	(0.8)	7.8	(2.4)	2.8	(0.6)
Cattle (beef or dairy)	26.1	(3.6)	26.7	(3.8)	38.1	(3.3)	64.2	(4.2)	35.6	(1.8)
Sheep or lambs	1.2	(1.0)	2.7	(1.6)	6.2	(1.6)	6.7	(2.3)	3.8	(0.8)
Goats	3.4	(1.7)	4.5	(2.0)	5.6	(1.8)	1.1	(1.0)	3.9	(0.9)
Deer, elk, or other cervids	18.3	(3.7)	15.8	(3.2)	20.3	(3.1)	24.3	(3.7)	19.2	(1.7)
Any of the above	37.9	(4.2)	35.8	(4.2)	47.6	(3.5)	70.3	(4.0)	45.1	(2.0)

A higher percentage of operations in the West region (48.5 percent) had bison that could have had fence-line contact with neighboring farmed cattle than operations in the other three regions. A higher percentage of operations in the Southeast (39.3 percent) and West (22.2 percent) regions had bison that could have had fence-line contact with neighboring farmed deer, elk, or other cervids than operations in the North Central region (7.6 percent). A higher percentage of operations in the Southeast (53.7 percent) and West (56.9 percent) regions had bison that could have had fence-line contact with "any" neighboring farmed animal than operations in the Northeast region (14.0 percent) or North Central region (22.1 percent). These data support the regional distribution of neighboring farmed animals reported in Table C.1.e.

C.1.h. Percentage of operations by type(s) of neighboring farmed animal bison could have had fence-line contact with from July 1, 2021, through June 30, 2022, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Neighboring farmed animal	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Bison	3.7	(3.1)	0.0	(—)	1.5	(0.9)	3.6	(0.9)
Cattle (beef or dairy)	6.0	(3.7)	22.5	(6.4)	17.3	(2.9)	48.5	(2.5)
Sheep or lambs	8.0	(4.7)	0.0	(—)	1.0	(0.8)	4.7	(1.0)
Goats	8.2	(4.9)	0.0	(—)	2.1	(1.2)	4.5	(1.2)
Deer, elk, or other cervids	8.3	(5.3)	39.3	(7.7)	7.6	(2.2)	22.2	(2.3)
Any of the above	14.0	(6.3)	53.7	(8.5)	22.1	(3.2)	56.9	(2.7)

Overall, almost three-fourths of all operations (72.3 percent) had ever seen any of the listed wild animals inside the operation's perimeter fence during the reference period. About two-thirds of operations (66.8 percent) had seen deer, elk, or other cervids inside the operation's perimeter fence.

By operation size, some differences existed regarding what types of wild animals were seen inside the operation's perimeter fence. For pronghorn, deer, elk, or other cervids, and for "any" wild animal, a higher percentage of large operations than operations in the other size categories had seen these types of wild animals inside the perimeter fence. For feral swine or wild boars, a higher percentage of very small operations (16.6 percent) than large operations (4.8 percent) had seen this type of wild animal inside the perimeter fence. "Other" responses included coyotes, wild turkeys, bears, foxes, mountain lions, and racoons.

C.1.i. Percentage of operations by type(s) of wild animal ever seen inside the perimeter fence from July 1, 2021, through June 30, 2022, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Wild animal	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Bison	1.0	(0.9)	1.0	(0.9)	2.9	(1.2)	3.1	(1.5)	1.8	(0.5)
Pronghorn (antelope)	3.5	(1.6)	8.2	(2.5)	8.3	(1.6)	40.0	(3.9)	11.8	(1.0)
Sheep (e.g., bighorn) or goats	1.0	(1.0)	2.2	(1.4)	1.0	(0.8)	4.9	(2.0)	1.9	(0.6)
Deer, elk, or other cervids	55.6	(4.4)	58.5	(4.6)	73.2	(3.3)	91.1	(2.7)	66.8	(2.0)
Feral swine or wild boars	16.6	(3.1)	9.9	(2.3)	12.4	(2.2)	4.8	(2.0)	11.9	(1.2)
Other	14.6	(3.1)	15.4	(3.2)	24.2	(2.9)	24.6	(3.8)	19.0	(1.6)
Any	62.6	(4.4)	62.0	(4.5)	80.9	(2.9)	93.2	(2.1)	72.3	(1.9)

The types of wild animals listed in the following table seen inside an operation's perimeter fence will depend on the geographical distribution of the wild animals. Higher percentages of operations in the West (79.7 percent) and Southeast (78.8 percent) regions had seen "any" of the listed animals inside the perimeter fence than operations in the Northeast region (46.7 percent). For all regions, the wild animals ever seen inside the perimeter fence for the highest percentage of operations were deer, elk, or other cervids, ranging from 40.4 percent of operations in the Northeast region to 75.7 percent of operations in the Southeast region. A higher percentage of operations in the West region (73.3 percent) than operations in the Northeast region (40.4 percent) or North Central region (56.8 percent) had seen deer, elk, or other cervids inside the operation's perimeter fence.

A higher percentage of operations in the West region (19.0 percent) than in the other three regions had seen pronghorn inside the perimeter fence. A higher percentage of operations in the West region (16.5 percent) than operations in the North Central region (2.1 percent) had seen feral swine or wild boars within the operation's perimeter fence.

C.1.j. Percentage of operations by type(s) of wild animal ever seen inside the perimeter fence from July 1, 2021, through June 30, 2022, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Wild animal	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Bison	2.1	(1.7)	0.0	(—)	1.1	(1.0)	2.3	(0.8)
Pronghorn (antelope)	0.0	(—)	3.2	(2.7)	0.0	(—)	19.0	(1.7)
Sheep (e.g., bighorn) or goats	0.0	(—)	3.2	(2.7)	0.0	(—)	2.8	(1.0)
Deer, elk, or other cervids	40.4	(6.7)	75.7	(6.7)	56.8	(4.0)	73.3	(2.6)
Feral swine or wild boars	4.3	(4.0)	12.6	(5.3)	2.1	(1.3)	16.5	(1.7)
Other	10.5	(2.6)	26.5	(6.7)	18.6	(3.1)	19.4	(2.2)
Any	46.7	(7.7)	78.8	(6.1)	60.0	(4.0)	79.7	(2.4)

Roughly four-fifths of operations (81.7 percent) had ever seen “any” of the listed wild animals just outside the perimeter fence during the reference period. More than three-fourths of all operations (78.0 percent) had ever seen deer, elk, or other cervids just outside the perimeter fence. Less than one-tenth of operations had seen bison (1.8 percent) or sheep or goats (4.5 percent) just outside the perimeter fence. Slightly more than one-tenth of operations had seen pronghorn (13.9 percent) or feral swine or wild boars (12.6 percent) just outside the perimeter fence. Slightly more than two-fifths of all operations (23.9 percent) had seen “other” wild animals outside of the perimeter fence.

For a few of the wild animal types listed in the table below, there were differences by operation size in whether the wild animal type was ever seen just outside the perimeter fence. No very small or small operations had seen bison just outside the perimeter fence. A higher percentage of large operations (97.0 percent) had seen “any” wild animals outside the perimeter fence than operations in the other size categories. A higher percentage of large operations than operations in the other size categories had seen any deer, elk, or cervids (94.7 percent) or pronghorn (40.9 percent) just outside the perimeter fence.

C.1.k. Percentage of operations by type(s) of wild animal ever seen just outside the perimeter fence from July 1, 2021, through June 30, 2022, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Wild animal	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Bison	0.0	(—)	0.0	(—)	2.3	(1.1)	6.6	(2.7)	1.8	(0.6)
Pronghorn (antelope)	5.2	(1.9)	9.7	(3.0)	11.2	(2.2)	40.9	(4.2)	13.9	(1.3)
Sheep (e.g., bighorn) or goats	5.8	(2.3)	4.4	(2.2)	2.8	(1.4)	5.2	(2.1)	4.5	(1.1)
Deer, elk, or other cervids	68.6	(4.3)	77.0	(4.3)	79.1	(3.3)	94.7	(1.9)	78.0	(1.9)
Feral swine or wild boars	17.8	(3.1)	9.9	(2.6)	13.0	(2.3)	6.1	(2.3)	12.6	(1.2)
Other	24.1	(4.2)	22.1	(4.1)	22.9	(2.9)	27.4	(4.0)	23.9	(2.0)
Any	72.8	(4.1)	80.8	(4.1)	83.5	(2.9)	97.0	(1.5)	81.7	(1.8)

More than two-thirds of operations in each region had seen any of the listed types of wild animals just outside the perimeter fence during the reference period. More than three-fifths of operations in each region reported deer, elk, or other cervids seen just outside the perimeter fence, ranging from 61.4 percent in the Northeast region to 88.8 percent in the Southeast region. A higher percentage of operations in the West region (22.1 percent) than operations in the other three regions had seen pronghorn just outside the perimeter fence. A higher percentage of operations in the West (16.5 percent) and Southeast (25.0 percent) regions had seen feral swine or wild boars just outside the operation's perimeter fence than operations in the North Central (1.6 percent) or Northeast (0.0 percent) regions. Only in the West region did any operations report having seen bison just outside the perimeter fence (2.8 percent).

C.1.l. Percentage of operations by type(s) of wild animal ever seen just outside the perimeter fence from July 1, 2021, through June 30, 2022, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Wild animal	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Bison	0.0	(—)	0.0	(—)	0.0	(—)	2.8	(0.9)
Pronghorn (antelope)	0.0	(—)	3.9	(3.3)	0.0	(—)	22.1	(2.0)
Sheep (e.g., bighorn) or goats	4.6	(4.0)	3.9	(3.1)	0.0	(—)	6.2	(1.6)
Deer, elk, or other cervids	61.4	(8.0)	88.8	(5.7)	74.0	(3.9)	80.3	(2.5)
Feral swine or wild boars	0.0	(—)	25.0	(7.0)	1.6	(1.0)	16.5	(1.7)
Other	25.1	(8.0)	36.4	(7.7)	21.1	(3.3)	23.0	(2.5)
Any	66.7	(8.4)	92.5	(4.7)	74.6	(3.8)	84.8	(2.2)

USDA–APHIS Wildlife Services provides assistance to producers who would like to develop a wildlife mitigation plan for their bison and operation. Producers may consult the toll-free number 1-866-4USDA-WS (1-866-487-3297) or their Wildlife Services State Office (USDA APHIS | Wildlife Services State Offices) to work with a specialist and explore ways to develop a wildlife management plan.

Overall, almost one-fourth of all operations (24.9 percent) reported that they took any actions to control wild animals or prevent them from accessing operation property or resources.

C.1.m. Percentage of operations that took any actions to control wild animals or prevent them from accessing operation property or resources from July 1, 2021, through June 30, 2022, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
30.5	(4.0)	27.3	(4.1)	19.5	(2.8)	19.2	(3.6)	24.9	(1.9)

There were no differences by region in the percentage of operations that took any actions to control wild animals.

C.1.n. Percentage of operations that took any actions to control wild animals or prevent them from accessing operation property or resources from July 1, 2021, through June 30, 2022, by region:

Percent Operations							
Region							
Northeast		Southeast		North Central		West	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
29.1	(7.6)	33.3	(7.3)	18.6	(3.2)	25.2	(2.4)

2. Movement of bison onto and off of the operation

Overall, about one-eighth of operations (13.1 percent) had any new bison brought onto the operation (temporarily or permanently) or had any bison leave and return. A higher percentage of medium (18.0 percent) and large (19.8 percent) operations than very small operations (5.3 percent) brought any new bison onto the operation or had any bison leave and return.

C.2.a. Percentage of operations that brought any new bison onto the operation (temporarily or permanently) or had any bison leave and return* from July 1, 2021, through June 30, 2022, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
5.3	(2.0)	13.7	(3.1)	18.0	(2.7)	19.8	(3.2)	13.1	(1.3)

*Such as being bred or grazed offsite, taken to a show and returned, etc.

There were no differences by region in the percentages of operations that brought any new bison onto the operation (temporarily or permanently) or had any bison leave and return.

C.2.b. Percentage of operations that brought any new bison onto the operation (temporarily or permanently) or had any bison leave and return* from July 1, 2021, through June 30, 2022, by region:

Percent Operations

Region

Northeast		**Southeast**		**North Central**		**West**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
13.7	(5.6)	18.0	(5.9)	13.1	(2.5)	12.2	(1.6)

*Such as being bred or grazed offsite, taken to a show and returned, etc.

For operations that brought any new bison onto the operation (temporarily or permanently) or had any bison leave and return, about one-fourth (24.2 percent) had temporarily brought bison of either sex from other herds onto the operation for breeding purposes. Almost one-fourth of operations (22.5 percent) brought on male bison temporarily or permanently, and 3.1 percent brought on female bison.

Across operation sizes, there were no substantial differences by sex of bison in the percentage of operations that temporarily brought bison onto the operation for breeding purposes. Very small and small operations did not bring on any female bison for breeding purposes.

C.2.c. For the 13.1 percent of operations that brought any new bison onto the operation (temporarily or permanently) or had any bison leave and return* from July 1, 2021, through June 30, 2022 (Table C.2.a.), percentage of operations that temporarily brought any bison from other herds onto the operation for breeding purposes, by bison sex and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Sex	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Male	42.3	(20.1)	21.0	(9.3)	16.3	(5.6)	22.6	(8.1)	22.5	(4.9)
Female	0.0	(—)	0.0	(—)	4.7	(2.5)	5.9	(4.5)	3.1	(1.4)
Either sex	42.3	(20.1)	21.0	(9.3)	21.0	(6.1)	22.6	(8.1)	24.2	(4.9)

*Such as being bred or grazed offsite, taken to a show and returned, etc.

For operations that brought any new bison onto the operation (temporarily or permanently) or had any bison leave and return, a higher percentage of operations in the Northeast region (70.6 percent) than operations in the West region (19.7 percent) brought on male or either sex of bison for breeding purposes; operations in the Northeast region did not bring any female bison onto the operation for breeding purposes. Operations in the Southeast region did not bring any bison from other herds onto the operation temporarily for breeding purposes.

C.2.d. For the 13.1 percent of operations that brought any new bison onto the operation (temporarily or permanently) or had any bison leave and return* from July 1, 2021, through June 30, 2022 (Table C.2.a.), percentage of operations that temporarily brought any bison from other herds onto the operation for breeding purposes, by bison sex and by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Sex	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Male	70.6	(15.4)	0.0	(—)	16.6	(7.6)	19.7	(5.6)
Female	0.0	(—)	0.0	(—)	8.9	(4.8)	2.3	(1.8)
Either sex	70.6	(15.4)	0.0	(—)	25.5	(8.7)	19.7	(5.6)

*Such as being bred or grazed offsite, taken to a show and returned, etc.

No operations sent any bison to other operations for breeding purposes and had them returned. This might be an effect of the COVID-19 pandemic.

Overall, 3.4 percent of operations that brought any new bison onto the operation or had any bison leave and return had any bison sent off the operation for grazing and then returned. No very small or small operations had any bison sent off for grazing and returned. Almost 6 percent of medium (5.6 percent) and large (5.9 percent) operations had any bison sent off for grazing and returned.

C.2.e. For the 13.1 percent of operations that brought any new bison onto the operation (temporarily or permanently) or had any bison leave and return* from July 1, 2021, through June 30, 2022 (Table C.2.a.), percentage of operations that sent any bison off the operation for grazing and had them returned, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
0.0	(—)	0.0	(—)	5.6	(4.2)	5.9	(4.5)	3.4	(1.9)

*Such as being bred or grazed offsite, taken to a show and returned, etc.

For operations that brought any new bison onto the operation or had any bison leave and return, only operations in the West region (6.0 percent) sent any bison off the operation for grazing and had them returned.

C.2.f. For the 13.1 percent of operations that brought any new bison onto the operation (temporarily or permanently) or had any bison leave and return* from July 1, 2021, through June 30, 2022 (Table C.2.a.), percentage of operations that sent any bison off the operation for grazing and had them returned, by region:

Percent Operations

Region

Northeast		Southeast		North Central		West	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
0.0	(—)	0.0	(—)	0.0	(—)	6.0	(3.3)

*Such as being bred or grazed offsite, taken to a show and returned, etc.

Respondents who sent bison off the operation for grazing were asked about the types of animals bison were commingled with when they were off the operation for grazing and then returned. The options provided for animal types that bison might have commingled with on other operations included bison, cattle, and sheep, lambs, or goats. The results cannot be reported because very few operations had bison that commingled with any of these animal types from other operations.

For operations that had bison come onto the operation under either of the scenarios presented in Table C.2.g., respondents were asked how long the bison were isolated from the rest of the operation's herd before being commingled. For the first scenario—operations that had bison leave the operation and return—about one-fourth (25.6 percent) of operations always isolated returning bison before commingling them with the rest of the operation's herd. About three-fifths of operations (62.5 percent) never isolated bison returning to the operation before commingling them with the rest of the operation's herd. These operations might have had full knowledge of the animals their bison might have encountered while off the site and determined that commingling the bison without an isolation period would not place the other animals at risk.

For the second scenario, however, about seven-tenths of operations always (50.3 percent) or sometimes (20.3 percent) isolated new bison joining the operation permanently or temporarily. Less than one-third of operations adding new bison permanently or temporarily never isolated the new bison. Operations adding new bison may have been less certain about the environments the new bison were coming from and things they might have been exposed to and therefore taken more precautions when these new bison joined the operation.

C.2.g. For the 13.1 percent of operations that brought any new bison onto the operation (temporarily or permanently) or had any bison leave and return[1] from July 1, 2021, through June 30, 2022 (Table C.2.a.), percentage of operations by how often these bison were kept isolated before being commingled with the rest of the operation's herd, and by scenario:

Percent Operations

How Often Bison Were Isolated

	Always		Sometimes		Never		
Scenario	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Total**
Bison returning to the operation[2]	25.6	(8.1)	11.9	(5.1)	62.5	(9.0)	100.0
New bison joining the operation permanently or temporarily[2]	50.3	(6.1)	20.3	(4.6)	29.4	(5.9)	100.0

[1] Such as being bred or grazed offsite, taken to a show and returned, etc.

[2] For the 33.0 and 77.8 percent of operations that had any bison return to the operation and had any new bison join the operation permanently or temporarily, respectively.

The numbers of days returning bison or new bison were isolated before being commingled with the operation's herd were generally similar regardless of whether bison were returning to or new to the operation. For operations that isolated returning or new bison, about one-half isolated returning bison (53.3 percent) or new bison (47.8 percent) for 30 or more days. About one-third of operations isolated returning bison (32.5 percent) or new bison (28.1 percent) for 14 to 29 days. An isolation period of 30 days is often recommended to minimize disease transmission.

C.2.h. For operations that always or sometimes isolated new or returning bison* from July 1, 2021, through June 30, 2022 (Table C.2.g.), percentage of operations by number of days bison were typically isolated, and by scenario:

Percent Operations*

Number of days	Scenario: Bison returning to the operation		Scenario: New bison joining the operation permanently or temporarily	
	Percent	Std. error	Percent	Std. error
1 to 13	14.1	(10.5)	24.0	(6.0)
14 to 29	32.5	(16.8)	28.1	(6.7)
30 or more	53.3	(16.5)	47.8	(7.3)
Total	100.0	(—)	100.0	(—)

*Refers to the 1.6 and 7.2 percent of operations that always or sometimes isolated returning or new bison, respectively, from July 1, 2021, through June 30, 2022. These estimates come from the 13.1 percent of operations that brought any new bison onto the operation (temporarily or permanently) or had any bison leave and return (Table C.2.a.), of which 33.0 and 77.8 percent of operations had any returning or new bison, respectively (Table C.2.g.), of which 37.5 and 70.6 percent of operations always or sometimes isolated returning or new bison, respectively (Table C.2.g.).

3. Equipment use

Trucks and trailers used for transporting bison are a large expenditure and might be used only once or a few times a year, so producers might consider sharing transportation vehicles to mitigate the expense. Equipment shared by multiple operations without proper disinfection between uses can contribute to the spread of disease among herds. Overall, 13.0 percent of operations transported bison in trucks and/or trailers shared with other livestock operations at some time during the period of July 1, 2021, through June 30, 2022.

A higher percentage of large operations (29.6 percent) than operations in the three smaller size categories transported bison in trucks and/or trailers shared with other livestock operations. Larger operations likely have the greatest need for trucks and trailers to transport bison, and they might need multiple vehicles for short time frames.

C.3.a. Percentage of operations that ever transported bison in trucks and/or trailers shared with other livestock operations from July 1, 2021, through June 30, 2022, by size of operation:

Percent Operations

Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
5.3	(1.9)	11.5	(2.8)	14.1	(2.6)	29.6	(3.8)	13.0	(1.3)

There were no differences by region in the percentage of operations transporting bison in trucks and/or trailers shared with other livestock operations, with roughly one-tenth of operations in each region sharing transportation vehicles.

C.3.b. Percentage of operations that ever transported bison in trucks and/or trailers shared with other livestock operations from July 1, 2021, through June 30, 2022, by region:

Percent Operations							
Region							
Northeast		Southeast		North Central		West	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
11.6	(4.3)	6.0	(3.7)	10.3	(2.5)	15.2	(1.8)

Overall, 10.3 percent of operations shared equipment, such as tractors, chutes, and feeding equipment with other operations. There were no differences by size of operation in the percentages of operations that ever shared any equipment, other than trucks or trailers, with other livestock operations during the reference period.

C.3.c. Percentage of operations that ever shared any equipment, other than trucks or trailers (e.g., tractors, chutes, feeding equipment, manure spreaders) with other livestock operations from July 1, 2021, through June 30, 2022, by size of operation:

Percent Operations									
Size of Operation (number of bison)									
Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
7.2	(2.2)	11.5	(2.7)	9.5	(2.3)	16.3	(3.1)	10.3	(1.3)

There were no differences by region in the percentages of operations that ever shared any equipment, other than trucks or trailers, with other livestock operations during the reference period.

C.3.d. Percentage of operations that ever shared any equipment, other than trucks or trailers (e.g., tractors, chutes, feeding equipment, manure spreaders) with other livestock operations from July 1, 2021, through June 30, 2022, by region:

Percent Operations							
Region							
Northeast		Southeast		North Central		West	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
4.0	(2.4)	9.5	(4.7)	11.1	(2.7)	11.2	(1.7)

Overall, two-fifths of operations (41.1 percent) that ever shared any equipment other than trucks or trailers during the reference period cleaned the shared equipment prior to use. There were no differences by size of operation.

C.3.e. For the 10.3 percent of operations that ever shared any equipment from July 1, 2021, through June 30, 2022 (Table C.3.c.), percentage of operations that cleaned shared equipment (other than trucks or trailers) prior to use, by size of operation:

Percent Operations									
Size of Operation (number of bison)									
Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
30.5	(15.6)	36.3	(12.6)	54.3	(13.6)	46.1	(12.3)	41.1	(6.9)

All operations in the Northeast region that ever shared any equipment other than trucks or trailers during the reference period cleaned the shared equipment prior to use. About one-third to two-fifths of operations in the other three regions cleaned shared equipment prior to use.

C.3.f. For the 10.3 percent of operations that ever shared any equipment from July 1, 2021, through June 30, 2022 (Table C.3.c.), percentage of operations that cleaned shared equipment (other than trucks or trailers) prior to use, by region:

Percent Operations							
Region							
Northeast		**Southeast**		**North Central**		**West**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
100.0	(—)	33.3	(25.4)	40.7	(13.3)	40.3	(8.6)

For operations that ever shared equipment and cleaned the shared equipment prior to use during the reference period, slightly more than one-half (54.5 percent) washed equipment with water or steam only. About one-third of operations (36.2 percent) washed and chemically disinfected equipment, and about one-tenth (9.3 percent) only chemically disinfected the equipment. Both washing and chemically disinfecting equipment is recommended. Typically, chemical disinfectants are more effective if the equipment/surfaces are washed to remove most foreign matter and contaminants before the disinfectants are applied. Disinfectants include chemical products such as 1:10 bleach dilution, phenolic products, an accelerated hydrogen peroxide product, or lime.

C.3.g. For the 4.2 percent of operations that ever shared any equipment and cleaned that shared equipment (other than trucks or trailers) prior to use from July 1, 2021, through June 30, 2022 (Table C.3.e.),* percentage of operations by cleaning procedure typically used, and by size of operation:

	Percent Operations	
Cleaning procedure	**Pct.**	**Std. error**
Wash equipment with water or steam only	54.5	(11.6)
Chemically disinfect only	9.3	(7.9)
Wash equipment and chemically disinfect	36.2	(11.4)
Other	0.0	(—)
Total	100.0	(—)

*These estimates come from the 10.3 percent of operations that ever shared any equipment (Table C.3.c.), of which 41.1 percent of operations cleaned shared equipment (other than trucks or trailers) prior to use from July 1, 2021, through June 30, 2022 (Table C.3.e.).

4. Patterns of visitation to the operation

An important component of biosecurity protocols concerns visitors to operations. Visitors can bring pathogens to animals, as well as acquire them from livestock and carry them to other susceptible animals. Respondents were asked a variety of questions about visitors on their operations for the period June 2021 through May 2022; for some operations, these numbers were very difficult to quantify, and respondents provided their best estimates. Visitors were categorized as business visitors, non-business visitors, and offsite employees. A group of people visiting at the same time were to be counted as a single visit. To provide a framework for responses, respondents were asked to break down the visits by the following seasons: Summer (June, July, and August 2021), Fall (September, October, and November 2021), Winter (December 2021, January and February 2022), and Spring (March, April, and May 2022).

For the business visitor category, overall, about one-third of operations were visited by private or government veterinarians or animal health workers (30.0 percent) or feed (hay or grain) haulers (27.5 percent). About one-fourth were visited by consumers seeking an activity (23.0 percent) or consumers seeking bison products (22.0 percent). About one-seventh of operations were visited by school and other field trip visitors (17.5 percent); a livestock hauler (15.4 percent); or a bison trader, order buyer, or dealer/broker (11.5 percent). Less than 10 percent of operations received visits from the other listed types of business visitors.

For the non-business visitor category, almost two-thirds of operations had visits from family, neighbors, friends, etc. (66.1 percent). Almost one-fourth received visits from other types of visitors not yet mentioned, such as home maintenance personnel, delivery or general services personnel, utility workers, etc. (22.5 percent).

About one-fifth of operations were visited by employees who did not live on the operation (21.2 percent). Employees who live off of the operation might have livestock on their properties and/or encounter livestock at other facilities, which could provide additional paths for disease transmission.

There are a variety of differences in the percentages of operations by size that are visited by the various visitor categories; the following text describes the substantive differences for the visitor types that visited higher percentages of operations.

Higher percentages of large and medium operations than very small operations were visited by private or government veterinarians or animal health workers, feed (hay or grain) haulers, or consumers seeking an activity. Higher percentages of large (25.4 percent), medium (35.8 percent), and small (24.7 percent) operations than very small operations (6.7 percent) were visited by consumers seeking bison products. Higher percentages of large (31.5 percent) and medium (25.3 percent) operations than small (10.9 percent) and very small (8.9 percent) operations were visited by school and other field trip visitors. Higher percentages of large operations than medium, small, and very small operations were visited by a nutritionist or feed company consultant or a livestock hauler.

For nonbusiness visitors, a higher percentage of large operations (37.4 percent) than small (16.6 percent) or very small (17.4 percent) operations were visited by other types of visitors not yet listed, such as home maintenance personnel, delivery and general services personnel, utility personnel, etc.

For offsite employees, a higher percentage of large operations (40.1 percent) than small (17.8 percent) or very small (9.8 percent) operations were visited by offsite employees. A higher percentage of medium operations (26.5 percent) than very small operations (9.8 percent) were visited by offsite employees.

C.4.a. Percentage of operations with any visits by the listed visitor type from June 1, 2021, through May 31, 2022, and by size of operation:

	Percent Operations									
	Size of Operation (number of bison)									
	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Visitor type	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Business Visitors										
Private or government veterinarian or animal health worker	17.5	(3.4)	25.4	(4.1)	33.5	(3.4)	56.0	(4.3)	30.0	(1.9)
Extension agent	2.1	(1.4)	2.4	(1.5)	7.6	(1.9)	7.0	(2.2)	4.4	(0.9)
Nutritionist or feed company consultant	0.0	(—)	2.3	(1.5)	1.7	(0.9)	15.6	(3.1)	3.6	(0.7)
Other consultant(s)	1.8	(1.1)	1.7	(0.9)	5.4	(1.8)	8.7	(2.3)	3.9	(0.7)
Bison trader, order buyer, or dealer/broker	4.2	(1.9)	10.2	(3.0)	20.1	(2.9)	13.5	(2.8)	11.5	(1.3)
Video auction representative	0.0	(—)	0.0	(—)	1.9	(1.2)	9.2	(2.4)	2.0	(0.5)
Livestock hauler	9.8	(2.9)	6.1	(2.3)	12.4	(2.4)	45.3	(4.0)	15.4	(1.4)
Feed (hay or grain) hauler	16.7	(3.3)	22.7	(3.6)	31.3	(3.4)	50.3	(4.4)	27.5	(1.7)
Manure hauler	2.6	(1.3)	0.0	(—)	3.9	(1.6)	10.6	(2.7)	3.6	(0.8)
Mobile slaughter team	1.0	(0.9)	7.3	(2.0)	8.4	(2.2)	14.0	(2.8)	6.7	(0.9)
Renderer	0.0	(—)	0.0	(—)	0.8	(0.7)	0.0	(—)	0.2	(0.2)
Consumer seeking bison products (e.g., meat, hides, skulls)	6.7	(2.1)	24.7	(3.9)	35.8	(3.6)	25.4	(3.6)	22.0	(1.6)
Consumer seeking activity (e.g., agri- or eco-tourism, game ranch/hunting)	12.3	(2.8)	18.4	(3.8)	37.0	(3.5)	28.1	(3.9)	23.0	(1.7)
School and other field trip visitors	8.9	(2.5)	10.9	(2.9)	25.3	(3.2)	31.5	(4.1)	17.5	(1.5)
Any of the above business visitors	41.1	(4.7)	55.8	(4.6)	79.5	(2.8)	88.8	(2.8)	62.9	(2.1)
Non-business Visitors										
Family, neighbors, friends, etc.	60.7	(4.1)	65.3	(4.4)	69.9	(3.4)	71.7	(3.5)	66.1	(2.0)
Other types of visitors not yet listed (home maintenance personnel, delivery, general services personnel, utility personnel, etc.)	17.4	(3.3)	16.6	(3.4)	25.0	(3.1)	37.4	(4.1)	22.5	(1.8)
Offsite Employees										
Employees who do not live on the operation	9.8	(2.5)	17.8	(3.5)	26.5	(3.3)	40.1	(4.3)	21.2	(1.7)

There are a few differences in the percentages of operations by region that are visited by the various visitor categories. Please note that for several business visitor types (nutritionist or feed company consultant, video auction representative, manure hauler, mobile slaughter team, and renderer), operations in one or more regions had no visits from the visitor type. A higher percentage of operations in the Southeast region than in the North Central or West regions was visited by extension agents or consumers seeking activity.

For the two types of nonbusiness visitors, there were no differences by region in the percentages of operations receiving visits.

For offsite employees, a higher percentage of operations in the Southeast region (37.2 percent) than in the West region (17.4 percent) were visited by offsite employees.

C.4.b. Percentage of operations with any visits by the listed visitor type from June 1, 2021, through May 31, 2022, by region:

	Percent Operations							
	Region							
	Northeast		Southeast		North Central		West	
Visitor type	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Business Visitors								
Private or government veterinarian or animal health worker	24.9	(7.4)	39.5	(7.7)	25.1	(3.4)	31.3	(2.4)
Extension agent	2.0	(1.7)	16.4	(6.1)	2.3	(0.9)	3.9	(1.0)
Nutritionist or feed company consultant	3.5	(3.1)	0.0	(—)	2.8	(1.2)	4.4	(0.9)
Other consultant(s)	2.0	(1.7)	2.9	(2.2)	3.9	(1.5)	4.3	(1.0)
Bison trader, order buyer, or dealer/broker	15.9	(6.6)	9.6	(4.7)	11.9	(2.6)	10.8	(1.6)
Video auction representative	0.0	(—)	0.0	(—)	0.0	(—)	3.3	(0.9)
Livestock hauler	17.4	(7.3)	6.7	(4.3)	10.9	(2.6)	17.9	(1.7)
Feed (hay or grain) hauler	18.1	(5.4)	22.6	(6.3)	27.6	(3.3)	29.8	(2.3)
Manure hauler	0.0	(—)	3.4	(3.0)	1.7	(0.8)	4.9	(1.1)
Mobile slaughter team	0.0	(—)	0.0	(—)	7.8	(1.7)	8.4	(1.3)
Renderer	0.0	(—)	0.0	(—)	1.0	(0.9)	0.0	(—)
Consumer seeking bison products (e.g., meat, hides, skulls)	23.2	(4.6)	25.1	(7.1)	26.4	(2.8)	19.8	(2.2)
Consumer seeking activity (e.g., agri- or eco-tourism, game ranch/hunting)	21.8	(5.9)	43.7	(7.2)	13.1	(2.7)	23.7	(2.2)
School and other field trip visitors	19.8	(5.9)	27.9	(7.4)	15.2	(2.6)	16.4	(1.9)
Non-business Visitors								
Family, neighbors, friends, etc.	50.9	(8.0)	60.0	(8.0)	69.1	(3.5)	68.6	(2.6)
Other types of visitors not yet listed (home maintenance personnel, delivery, general services personnel, utility personnel, etc.)	13.6	(4.3)	31.7	(7.6)	20.1	(3.5)	23.6	(2.3)
Offsite Employees								
Employees who do not live on the operation	33.1	(7.5)	37.2	(7.7)	19.2	(3.1)	17.4	(1.9)

For the business visitor category overall, operations received about 4,400 visits during the year from consumers seeking activity, 36 visits from school and other field trip visitors, and 15 visits from consumers seeking bison products. Please note that for the estimates for consumers seeking activity, the mean is high because of several operations with very high traffic; the median would be considerably lower. Additionally, given the higher standard errors, there were no differences in the number of visits made by consumers seeking activity to operations in the different size categories. Operations received about five visits from feed (hay or grain) haulers, one visit from private or government veterinarians or other health workers, and one visit from a livestock hauler.

Large operations received a higher number of visits than medium, small, or very small operations from a nutritionist or feed company consultant, livestock hauler, feed (hay or grain) hauler, and/or mobile slaughter team. Large operations received a higher number of visits than medium or very small operations from private or government veterinarians or animal health workers. Medium operations received a higher number of visits than small operations from consumers seeking bison products.

For other types of nonbusiness visitors, large operations received a higher operation average number of visits during the year (32.5 visits) than medium (8.3 visits), small (3.7 visits), or very small (2.3 visits) operations.

Given the higher standard errors, there were no differences in the number of visits offsite employees made to operations in the different size categories.

C.4.c. Operation average number of visits during the year from June 1, 2021, through May 31, 2022, by visitor type, and by size of operation:

	Operation Average Number of Visits									
	Size of Operation (number of bison)									
	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Visitor type	No.	Std. error	No.	Std. error	No.	Std. error	No.	Std. error	No.	Std. error
Business Visitors										
Private or government veterinarian or animal health worker	0.5	(0.2)	1.2	(0.5)	0.8	(0.1)	3.1	(0.6)	1.2	(0.2)
Extension agent	0.3	(0.2)	0.0	(0.0)	0.2	(0.1)	0.3	(0.1)	0.2	(0.1)
Nutritionist or feed company consultant	0.0	(—)	0.0	(0.0)	0.0	(0.0)	0.6	(0.2)	0.1	(0.0)
Other consultant(s)	0.0	(0.0)	0.0	(0.0)	0.2	(0.1)	0.6	(0.3)	0.2	(0.1)
Bison trader, order buyer, or dealer/broker	0.2	(0.1)	0.1	(0.1)	0.5	(0.1)	0.8	(0.3)	0.4	(0.1)
Video auction representative	0.0	(—)	0.0	(—)	0.0	(0.0)	0.1	(0.0)	0.0	(0.0)
Livestock hauler	0.4	(0.2)	0.1	(0.0)	0.6	(0.2)	4.8	(1.4)	1.1	(0.2)
Feed (hay or grain) hauler	0.9	(0.3)	1.3	(0.5)	2.1	(0.4)	24.0	(5.6)	5.1	(0.9)
Manure hauler	0.1	(0.0)	0.0	(—)	0.2	(0.1)	2.3	(1.2)	0.4	(0.2)
Mobile slaughter team	0.0	(0.0)	0.2	(0.1)	0.2	(0.1)	1.2	(0.4)	0.3	(0.1)
Renderer	0.0	(—)	0.0	(—)	0.0	(0.0)	0.0	(—)	0.0	(0.0)
Consumer seeking bison products (e.g., meat, hides, skulls)	13.2	(9.7)	3.6	(1.1)	31.3	(9.4)	9.6	(2.9)	15.1	(4.1)
Consumer seeking activity (e.g., agri- or eco-tourism, game ranch/hunting)	53.9	(25.9)	2,053.2	(1,299.1)	946.9	(630.9)	22,486.0	(16,233.3)	4,408.4	(2,690.8)
School and other field trip visitors	27.6	(20.0)	46.6	(27.9)	30.6	(15.9)	43.1	(27.4)	35.6	(11.3)
Non-business Visitors										
Family, neighbors, friends, etc.	17.5	(3.2)	18.8	(7.7)	23.7	(3.0)	17.7	(2.2)	19.5	(2.3)
Other types of visitors not yet listed (home maintenance personnel, delivery, general services personnel, utility personnel, etc.)	2.3	(0.7)	3.7	(1.1)	8.3	(2.0)	32.5	(9.1)	9.2	(1.6)
Offsite Employees										
Employees who do not live on the operation	65.1	(51.5)	17.9	(7.4)	40.2	(10.5)	115.0	(50.3)	55.0	(19.0)

Operations in the West region received a higher number of visits than operations in the Southeast or North Central regions from livestock haulers and feed (hay and grain) haulers. Operations in the Northeast region received a higher number of visits (58.0 visits) than operations in the North Central region (6.4 visits) from consumers seeking bison products. Given the large standard errors, there were no differences by region in the number of visits from consumers seeking activity or school and other field trip visitors.

For the other types of visitors not yet listed in the non-business visitor type, operations in the West region received a higher operation average number of visits during the year (11.6 visits) than operations in the North Central region (3.5 visits).

There were no differences in the number of visits offsite employees made to operations by region.

C.4.d. Operation average number of visits during the year from June 1, 2021, through May 31, 2022, by visitor type, by region:

	Operation Average Number of Visits							
	Region							
	Northeast		Southeast		North Central		West	
Visitor type	No.	Std. error	No.	Std. error	No.	Std. error	No.	Std. error
Business Visitors								
Private or government veterinarian or animal health worker	1.6	(0.8)	2.5	(1.3)	0.7	(0.2)	1.0	(0.2)
Extension agent	0.2	(0.2)	0.4	(0.2)	0.1	(0.0)	0.2	(0.1)
Nutritionist or feed company consultant	0.1	(0.1)	0.0	(—)	0.1	(0.0)	0.1	(0.0)
Other consultant(s)	0.0	(0.0)	0.0	(0.0)	0.2	(0.1)	0.2	(0.1)
Bison trader, order buyer, or dealer/broker	0.7	(0.4)	0.2	(0.1)	0.4	(0.1)	0.4	(0.1)
Video auction representative	0.0	(—)	0.0	(—)	0.0	(—)	0.0	(0.0)
Livestock hauler	0.5	(0.4)	0.1	(0.0)	0.3	(0.1)	1.6	(0.4)
Feed (hay or grain) hauler	2.2	(1.3)	1.0	(0.3)	1.9	(0.5)	7.3	(1.5)
Manure hauler	0.0	(—)	0.2	(0.2)	0.1	(0.0)	0.7	(0.3)
Mobile slaughter team	0.0	(—)	0.0	(—)	0.1	(0.1)	0.4	(0.1)
Renderer	0.0	(—)	0.0	(—)	0.0	(0.0)	0.0	(—)
Consumer seeking bison products (e.g., meat, hides, skulls)	58.0	(24.2)	14.5	(8.0)	6.4	(1.3)	11.0	(5.3)
Consumer seeking activity (e.g., agri- or eco-tourism, game ranch/hunting)	3,289.9	(2,812.6)	582.9	(430.8)	54.7	(31.4)	6,689.2	(4,461.0)
School and other field trip visitors	41.2	(31.5)	12.8	(8.7)	66.4	(36.5)	27.2	(12.6)
Non-business Visitors								
Family, neighbors, friends, etc.	12.9	(3.3)	22.6	(8.2)	13.9	(2.1)	22.1	(3.5)
Other types of visitors not yet listed (home maintenance personnel, delivery, general services personnel, utility personnel, etc.)	10.5	(4.5)	4.6	(1.8)	3.5	(0.9)	11.6	(2.6)
Offsite Employees								
Employees who do not live on the operation	54.1	(22.1)	31.8	(13.6)	16.9	(5.6)	71.9	(31.2)

In general, visits to operations by almost all visitor types were consistent across the seasons. For non-business visitors, a higher percentage of operations had visits from family, neighbors, friends, etc., during June through August 2021 than December 2021 through February 2022.

C.4.e. Percentage of operations that had any visits by the listed visitor type from June 1, 2021, through May 31, 2022, and by season:

	Percent Operations							
	Season							
	June–August 2021		September–November 2021		December 2021–February 2022		March–May 2022	
Visitor type	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Business Visitors								
Private or government veterinarian or animal health worker	12.1	(1.4)	16.7	(1.5)	11.5	(1.3)	12.6	(1.4)
Extension agent	2.6	(0.6)	2.7	(0.7)	1.8	(0.6)	2.3	(0.6)
Nutritionist or feed company consultant	2.7	(0.6)	2.0	(0.5)	1.8	(0.5)	1.8	(0.4)
Other consultant(s)	3.1	(0.7)	1.8	(0.5)	1.1	(0.3)	2.0	(0.6)
Bison trader, order buyer, or dealer/broker	2.9	(0.7)	4.7	(0.8)	4.3	(0.8)	4.7	(0.8)
Video auction representative	0.3	(0.2)	1.0	(0.4)	0.5	(0.2)	0.5	(0.3)
Livestock hauler	6.4	(1.0)	8.4	(1.1)	7.5	(1.1)	6.9	(0.9)
Feed (hay or grain) hauler	17.5	(1.6)	17.4	(1.5)	15.6	(1.4)	15.1	(1.4)
Manure hauler	2.0	(0.6)	2.8	(0.7)	1.6	(0.5)	2.1	(0.7)
Mobile slaughter team	2.8	(0.7)	3.2	(0.6)	4.0	(0.8)	3.2	(0.7)
Renderer	0.2	(0.2)	0.0	(—)	0.0	(—)	0.0	(—)
Consumer seeking bison products (e.g., meat, hides, skulls)	14.5	(1.3)	16.0	(1.4)	13.1	(1.2)	15.1	(1.3)
Consumer seeking activity (e.g., agri- or eco-tourism, game ranch/hunting)	14.4	(1.4)	17.2	(1.5)	14.0	(1.4)	14.3	(1.4)
School and other field trip visitors	9.8	(1.3)	10.6	(1.3)	5.6	(1.0)	10.2	(1.2)
Any of the above business visitors	45.8	(2.1)	49.1	(2.1)	46.4	(2.1)	43.0	(2.0)
Non-business Visitors								
Family, neighbors, friends, etc.	58.6	(2.2)	55.1	(2.2)	46.9	(2.2)	52.6	(2.2)
Other types of visitors not yet listed (home maintenance personnel, delivery, general services personnel, utility personnel, etc.)	19.6	(1.7)	18.1	(1.6)	19.1	(1.7)	20.1	(1.7)
Offsite Employees								
Employees who do not live on the operation	18.2	(1.6)	18.6	(1.6)	18.1	(1.6)	18.9	(1.6)

For all visitor types, the operation average number of visits did not differ substantially by season. For business visitors, the only visitor types with an operation average number of visits greater than one for each season were consumer seeking activity, school and other field trip visitors, consumer seeking bison products, and feed (hay or grain) hauler.

C.4.f. Operation average number of visits by the listed visitor type from June 1, 2021, through May 31, 2022, and by season:

	Operation Average Number of Visits							
	Season							
	June–August 2021		September–November 2021		December 2021–February 2022		March–May 2022	
Visitor type	No.	Std. error	No.	Std. error	No.	Std. error	No.	Std. error
Business Visitors								
Private or government veterinarian or animal health worker	0.3	(0.1)	0.4	(0.1)	0.2	(0.0)	0.2	(0.0)
Extension agent	0.1	(0.0)	0.1	(0.0)	0.0	(0.0)	0.0	(0.0)
Nutritionist or feed company consultant	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)
Other consultant(s)	0.1	(0.0)	0.1	(0.0)	0.0	(0.0)	0.0	(0.0)
Bison trader, order buyer, or dealer/broker	0.1	(0.0)	0.1	(0.0)	0.1	(0.0)	0.1	(0.0)
Video auction representative	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)
Livestock hauler	0.2	(0.0)	0.4	(0.1)	0.2	(0.0)	0.2	(0.1)
Feed (hay or grain) hauler	1.1	(0.2)	1.7	(0.4)	1.2	(0.3)	1.1	(0.2)
Manure hauler	0.2	(0.1)	0.1	(0.0)	0.1	(0.1)	0.1	(0.1)
Mobile slaughter team	0.1	(0.0)	0.1	(0.0)	0.1	(0.0)	0.1	(0.0)
Renderer	0.0	(0.0)	0.0	(—)	0.0	(—)	0.0	(—)
Consumer seeking bison products (e.g., meat, hides, skulls)	3.6	(0.9)	5.0	(1.8)	3.0	(1.0)	3.5	(0.9)
Consumer seeking activity (e.g., agri- or eco-tourism, game ranch/hunting)	1,355.0	(714.0)	1,030.2	(669.3)	975.7	(668.5)	1,051.4	(669.6)
School and other field trip visitors	9.6	(3.8)	6.7	(2.3)	5.2	(2.2)	14.1	(5.3)
Non-business Visitors								
Family, neighbors, friends, etc.	5.7	(0.6)	4.9	(0.6)	4.2	(0.6)	4.7	(0.6)
Other types of visitors not yet listed (home maintenance personnel, delivery, general services personnel, utility personnel, etc.)	2.3	(0.4)	2.3	(0.4)	2.2	(0.4)	2.3	(0.4)
Offsite Employees								
Employees who do not live on the operation	14.2	(4.9)	13.6	(4.7)	12.9	(4.5)	14.4	(4.9)

To assess the potential for disease spread from an operation, it is important to know whether visitors to the operation had contact with the bison. For these questions, a visitor is considered to have had contact with operation bison if the visitor touched or handled live bison or walked through areas where bison were at the time or had recently been kept.

Most of the business visitor types typically had contact with bison during visits to the operation. On more than two-thirds of operations, private or government veterinarians or animal health workers (72.9 percent of operations); livestock haulers (71.0 percent of operations); bison traders, order buyers, or dealers/brokers (69.9 percent of operations); and mobile slaughter teams (69.8 percent of operations) had contact with bison during visits to the operation. On about one-half of operations, video auction representatives (48.7 percent of operations) and consumers seeking activity (48.6 percent of operations) had contact with bison during visits. On about one-third of operations, manure haulers (34.7 percent of operations), nutritionists or feed company consultants (34.6 percent of operations), or school and other field trip visitors (34.1 percent of operations) had contact with bison during visits to the operation.

On a higher percentage of large operations (85.8 percent) than very small operations (46.9 percent), private or government veterinarians or animal health workers typically had contact with operation bison during the visit. On a higher percentage of large operations (46.7 percent) than operations in the other size categories (all 0.0 percent), nutritionists or feed company consultants typically had contact with operation bison during the visit. On a higher percentage of large and medium operations than small and very small operations, other consultants and video auction representatives typically had contact with operation bison during the visit. On a higher percentage of large (48.3 percent) and very small (40.2 percent) operations than medium and small operations (both of which were 0.0 percent), manure haulers typically had contact with operation bison during the visit.

C.4.g. For operations with visitors of the listed type from June 1, 2021, through May 31, 2022 (Table C.4.a.), percentage of operations on which visitors typically had contact with operation bison during the visit, by visitor type and by size of operation:

	Percent Operations									
	Size of Operation (number of bison)									
	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Visitor type	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Business Visitors										
Private or government veterinarian or animal health worker	46.9	(11.0)	71.6	(8.8)	76.6	(5.8)	85.8	(4.2)	72.9	(3.6)
Extension agent	0.0	(—)	50.0	(32.7)	19.1	(10.3)	0.0	(—)	16.4	(7.7)
Nutritionist or feed company consultant	NA[1]	NA	0.0	(—)	0.0	(—)	46.7	(10.6)	34.6	(9.1)
Other consultant(s)	0.0	(—)	0.0	(—)	48.0	(17.3)	14.4	(10.7)	23.0	(8.7)
Bison trader, order buyer, or dealer/broker	100.0	(—)	57.8	(15.7)	74.1	(7.3)	62.9	(10.5)	69.9	(6.0)
Video auction representative	NA	NA	NA	NA	32.7	(26.5)	54.1	(14.4)	48.7	(13.7)
Livestock hauler	52.5	(15.6)	78.1	(17.9)	83.8	(10.1)	72.2	(5.5)	71.0	(5.2)
Feed (hay or grain) hauler	19.5	(8.9)	14.6	(5.8)	22.8	(5.9)	10.3	(3.5)	16.4	(2.9)
Manure hauler	40.2	(25.6)	NA	NA	0.0	(—)	48.3	(12.6)	34.7	(10.1)
Mobile slaughter team	100.0	(—)	47.5	(17.0)	66.5	(15.8)	85.1	(8.2)	69.8	(7.8)
Renderer	NA	NA	NA	NA	0.0	(—)	NA	NA	0.0	(—)
Consumer seeking bison products (e.g., meat, hides, skulls)	31.3	(15.8)	31.3	(8.2)	19.7	(4.9)	21.9	(6.7)	24.6	(3.9)
Consumer seeking activity (e.g., agri- or eco-tourism, game ranch/hunting)	32.8	(11.7)	64.9	(10.5)	46.2	(6.3)	52.4	(8.3)	48.6	(4.6)
School and other field trip visitors	24.9	(12.7)	58.4	(14.4)	31.2	(6.9)	30.6	(6.8)	34.1	(4.7)
Any of the above business visitors[2]	47.9	(7.4)	62.0	(6.2)	70.2	(4.1)	74.4	(4.2)	64.6	(2.7)
Non-business Visitors										
Family, neighbors, friends, etc.	37.2	(5.6)	38.6	(5.6)	39.9	(4.5)	35.1	(4.9)	37.9	(2.7)
Other types of visitors not yet listed (home maintenance personnel, delivery, general services personnel, utility personnel, etc.)	29.2	(9.8)	25.1	(8.9)	11.5	(4.6)	5.9	(3.4)	16.9	(3.4)
Offsite Employees										
Employees who do not live on the operation	71.3	(11.5)	60.5	(12.4)	84.6	(5.4)	86.0	(4.8)	77.9	(4.2)

[1] NA indicates no operations had visitors for that visitor type and size combination.

[2] For operations that had any of the above business visitors, percentage of operations on which any of these business visitors typically had contact with operation bison during the visit.

The percentages of operations on which visitors typically had contact with bison were consistent across regions for most visitor types. About two-thirds of operations in the North Central (66.0 percent) and West (70.6 percent) regions, compared with no operations in the Northeast and Southeast regions, had visits from mobile slaughter teams who typically had contact with operation bison. About one-fourth of operations in the North Central (25.0 percent) and West (24.6 percent) regions, compared with no operations in the Northeast and Southeast regions, had visits from other consultants who typically had contact with operation bison. Almost one-half of operations in the West (48.7 percent) region, compared with no operations in the Northeast, Southeast, and North Central regions, had visits from video auction representatives who typically had contact with operation bison.

For the non-business visitors and employees who did not live on the operation, there were no differences by region in the percentages of operations on which visitors typically had contact with bison.

C.4.h. For operations with visitors of the listed type from June 1, 2021, through May 31, 2022 (Table C.4.a.), percentage of operations on which visitors typically had contact with operation bison during the visit, by region:

	Percent Operations							
	Region							
	Northeast		Southeast		North Central		West	
Visitor type	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Business Visitors								
Private or government veterinarian or animal health worker	61.1	(16.7)	61.5	(11.9)	65.2	(7.7)	79.1	(4.1)
Extension agent	(D)	(D)	(D)	(D)	(D)	(D)	0.0	(—)
Nutritionist or feed company consultant	0.0	(—)	NA	NA	(D)	(D)	(D)	(D)
Other consultant(s)	0.0	(—)	NA	NA	25.0	(18.7)	24.6	(10.6)
Bison trader, order buyer, or dealer/broker	57.2	(26.2)	64.9	(26.2)	61.6	(10.6)	76.7	(7.0)
Video auction representative	NA	NA	NA	NA	NA	NA	48.7	(13.7)
Livestock hauler	76.1	(18.9)	50.0	(32.7)	92.8	(6.0)	67.6	(5.8)
Feed (hay or grain) hauler	30.6	(16.0)	14.9	(11.6)	24.5	(7.7)	12.3	(2.9)
Manure hauler	NA	NA	0.0	(—)	(D)	(D)	(D)	(D)
Mobile slaughter team	NA	NA	NA	NA	66.0	(16.3)	70.6	(8.7)
Renderer	NA	NA	NA	NA	0.0	(—)	NA	NA
Consumer seeking bison products (e.g., meat, hides, skulls)	8.7	(7.0)	27.0	(15.5)	26.0	(7.2)	26.8	(5.4)
Consumer seeking activity (e.g., agri- or eco-tourism, game ranch/hunting)	49.0	(15.9)	52.2	(12.1)	19.9	(9.5)	52.8	(5.7)
School and other field trip visitors	28.0	(15.2)	9.9	(8.9)	31.5	(8.7)	43.4	(6.8)
Non-business Visitors								
Family, neighbors, friends, etc.	40.8	(10.6)	27.6	(9.6)	34.0	(4.7)	40.3	(3.5)
Other types of visitors not yet listed (home maintenance personnel, delivery, general services personnel, utility personnel, etc.)	17.4	(13.8)	10.6	(8.6)	19.8	(7.8)	17.2	(4.5)
Offsite Employees								
Employees who do not live on the operation	70.7	(13.7)	82.4	(10.1)	79.3	(8.2)	78.4	(5.3)

Values of (D) denote too few to report.

NA indicates either no operations had visitors for that visitor type and region combination, or no operations answered the question.

Many types of business visitors traveled a long way to visit bison operations. For all operations, the operation average most likely one-way distance was 348 miles for consumers seeking activity and 285 miles for video auction representatives. The operation average most likely one-way distance was 193 miles for other consultants, 161 miles for consumers seeking bison products, 158 miles for livestock haulers, and 120 miles for bison traders, order buyers, or dealers/brokers.

For non-business visitors, the operation average most likely one-way distance was 149 miles for family, neighbors, friends, etc., and 44 miles for other types of visitors not yet listed.

The operation average most likely one-way distance traveled to the operation by livestock haulers was higher for large operations (238.2 miles) than for medium (71.5 miles), small (45.9 miles), and very small (82.2 miles) operations. The operation average most likely one-way distance traveled to the operation was higher for large operations than for medium and small operations and higher for very small operations than small operations for bison traders, order buyers, or dealers/brokers and for school and other field trip visitors. The operation average most likely one-way distance traveled to the operation was higher for large operations than for small operations for feed (hay or grain) haulers and private or government veterinarians or animal health workers.

The operation average most likely one-way distance traveled to the operation by family, neighbors, friends, etc. was higher for large operations (410.2 miles) than for medium (113.0 miles), small (59.7 miles), and very small (96.0 miles) operations. The operation average most likely one-way distance traveled to the operation by other types of visitors not yet listed (such as home maintenance personnel, delivery and general services personnel, utility personnel, etc.) was higher for large operations (62.8 miles) than for medium (28.3 miles) and small (25.9 miles) operations.

The operation average most likely one-way distance traveled to the operation by employees who did not live on the operation was higher for large operations (28.2 miles) than for medium (14.5 miles), small (12.5 miles), and very small (11.7 miles) operations.

C.4.i. For operations with visitors of the listed type from June 1, 2021, through May 31, 2022 (Table C.4.a.), operation average most likely one-way distance (miles) traveled to the operation by the visitor, and by size of operation:

	Operation Average Distance (miles) **Size of Operation** (number of bison)									
	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Visitor type	**Miles**	**Std. error**	**Miles**	**Std. error**	**Miles**	**Std. error**	**Miles**	**Std. error**	**Miles**	**Std. error**
Business Visitors										
Private or government veterinarian or animal health worker	28.3	(6.5)	21.3	(3.3)	30.2	(5.8)	48.1	(4.2)	33.8	(2.7)
Extension agent	(D)	(D)	(D)	(D)	20.8	(2.4)	45.2	(11.1)	37.1	(7.6)
Nutritionist or feed company consultant	NA	NA	(D)	(D)	(D)	(D)	67.1	(15.7)	61.6	(14.3)
Other consultant(s)	(D)	(D)	(D)	(D)	226.2	(147.2)	249.9	(72.6)	192.8	(65.3)
Bison trader, order buyer, or dealer/broker	150.0	(31.7)	63.1	(11.7)	83.5	(14.5)	255.5	(70.5)	119.7	(18.9)
Video auction representative	NA	NA	NA	NA	1.0	(0.0)	390.1	(144.7)	284.6	(123.7)
Livestock hauler	82.2	(21.5)	45.9	(22.0)	71.5	(15.9)	238.2	(37.7)	157.9	(22.7)
Feed (hay or grain) hauler	66.2	(23.5)	32.3	(10.4)	92.1	(21.3)	116.3	(22.2)	84.2	(11.4)
Manure hauler	(D)	(D)	NA	NA	(D)	(D)	19.3	(3.0)	13.6	(2.7)
Mobile slaughter team	(D)	(D)	(D)	(D)	32.1	(9.7)	80.8	(18.4)	51.5	(8.1)
Renderer	NA	NA	NA	NA	(D)	(D)	NA	NA	(D)	(D)
Consumer seeking bison products (e.g., meat, hides, skulls)	57.8	(11.7)	52.2	(17.7)	247.2	(174.5)	109.1	(22.2)	160.8	(89.2)
Consumer seeking activity (e.g., agri- or eco-tourism, game ranch/hunting)	333.3	(174.5)	145.9	(46.5)	351.1	(183.5)	527.1	(156.7)	347.5	(102.2)
School and other field trip visitors	42.3	(8.9)	27.7	(7.2)	28.1	(2.8)	109.9	(31.8)	55.7	(10.4)
Non-business Visitors										
Family, neighbors, friends, etc.	96.0	(32.1)	59.7	(13.2)	113.0	(26.5)	410.2	(123.6)	148.7	(26.6)
Other types of visitors not yet listed (home maintenance personnel, delivery, general services personnel, utility personnel, etc.)	54.4	(26.4)	25.9	(7.7)	28.3	(3.5)	62.8	(8.1)	43.9	(6.8)
Offsite Employees										
Employees who do not live on the operation	11.7	(2.7)	12.5	(2.6)	14.5	(1.8)	28.2	(5.1)	18.1	(1.9)

Values of (D) denote too few to report.

NA indicates no operations had visitors for that visitor type and size combination.

For a number of visitor types, the operation average most likely one-way distance traveled to the operation was higher for the West and/or North Central regions. The operation average most likely one-way distance traveled to the operation by private and government veterinarians or animal health workers was higher for operations in the West (38.0 miles) and North Central (30.9 miles) regions than for operations in the Northeast region (15.6 miles). The operation average most likely one-way distance traveled to the operation was higher for operations in the West region than for operations in the Northeast region for bison traders, order buyers, or dealers/brokers; livestock haulers; and feed (hay or grain) haulers. The operation average most likely one-way distance traveled to the operation by consumers seeking activity was higher for operations in the West (465.7 miles) region than for operations in the Southeast region (69.6 miles). The operation average most likely one-way distance traveled to the operation by school and other field trip visitors was higher for operations in the West (70.8 miles) and North Central (48.7 miles) regions than for operations in the Northeast (23.4 miles) and Southeast (22.4 miles) regions.

The operation average most likely one-way distance traveled to the operation by family, neighbors, friends, etc. was higher for operations in the West (181.4 miles) and North Central (93.9 miles) regions than for operations in the Northeast region (13.7 miles). The operation average most likely one-way distance traveled to the operation by other types of visitors not yet listed (such as home maintenance personnel, delivery and general services personnel, utility personnel, etc.) was higher for operations in the West (50.0 miles) and North Central (40.3 miles) regions than for operations in the Northeast region (12.0 miles).

The operation average most likely one-way distance traveled to the operation by employees who did not live on the operation did not differ by region.

C.4.j. For operations with visitors of the listed type from June 1, 2021, through May 31, 2022 (Table C.4.a.), operation average most likely one-way distance (miles) traveled to the operation by the visitor, by region:

	Operation Average Distance (miles)							
	Region							
	Northeast		**Southeast**		**North Central**		**West**	
Visitor type	**Miles**	**Std. error**	**Miles**	**Std. error**	**Miles**	**Std. error**	**Miles**	**Std. error**
Business Visitors								
Private or government veterinarian or animal health worker	15.6	(2.3)	22.6	(5.4)	30.9	(3.2)	38.0	(3.8)
Extension agent	(D)	(D)	35.6	(12.0)	(D)	(D)	44.7	(12.1)
Nutritionist or feed company consultant	NA	NA	NA	NA	32.5	(7.6)	69.7	(17.3)
Other consultant(s)	(D)	(D)	(D)	(D)	68.3	(11.6)	264.7	(95.9)
Bison trader, order buyer, or dealer/broker	45.3	(7.0)	90.5	(33.9)	107.5	(25.4)	143.8	(29.4)
Video auction representative	NA	NA	NA	NA	NA	NA	284.6	(123.7)
Livestock hauler	42.4	(7.7)	NA	NA	50.2	(16.5)	191.2	(27.9)
Feed (hay or grain) hauler	14.8	(4.1)	152.1	(94.3)	48.8	(16.7)	93.9	(13.2)
Manure hauler	NA	NA	(D)	(D)	(D)	(D)	15.9	(3.3)
Mobile slaughter team	NA	NA	NA	NA	46.9	(9.9)	52.8	(10.0)
Renderer	NA	NA	NA	NA	(D)	(D)	NA	NA
Consumer seeking bison products (e.g., meat, hides, skulls)	93.0	(53.7)	43.4	(15.3)	44.9	(7.0)	250.7	(162.6)
Consumer seeking activity (e.g., agri- or eco-tourism, game ranch/hunting)	184.6	(70.2)	69.6	(20.3)	200.3	(63.8)	465.7	(157.7)
School and other field trip visitors	23.4	(4.1)	22.4	(5.3)	48.7	(7.0)	70.8	(17.3)
Non-business Visitors								
Family, neighbors, friends, etc.	13.7	(2.2)	180.7	(108.8)	93.9	(27.8)	181.4	(38.8)
Other types of visitors not yet listed (home maintenance personnel, delivery, general services personnel, utility personnel, etc.)	12.0	(2.7)	23.7	(3.9)	40.3	(8.4)	50.0	(9.6)
Offsite Employees								
Employees who do not live on the operation	10.0	(2.1)	17.3	(3.6)	17.8	(3.7)	19.7	(3.0)

Values of (D) denote too few to report.

NA indicates either no operations had visitors for that visitor type and region combination, or no operations answered the question.

D. Reproduction

Note: Unless otherwise noted, tables in this section refer to the period July 1, 2021, through June 30, 2022.

1. Breeding and breeding practices

Overall, 75.6 percent of operations had any bison bred while on the operation. A lower percentage of very small operations (34.9 percent) bred any bison compared with operations in the other size categories. More than 90.0 percent of operations in the small, medium, and large categories had any bison bred on the operation during the reference period.

D.1.a. Percentage of operations that had any bison bred while on the operation from July 1, 2021, through June 30, 2022, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
34.9	(4.1)	90.1	(3.0)	98.4	(0.9)	98.2	(1.0)	75.6	(1.8)

A higher percentage of operations in the North Central region (85.1 percent) than in the Northeast region (68.0 percent) or the Southeast region (62.5 percent) had any bison bred while on the operation.

D.1.b. Percentage of operations that had any bison bred while on the operation from July 1, 2021, through June 30, 2022, by region:

Percent Operations

Region

Northeast		**Southeast**		**North Central**		**West**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
68.0	(4.6)	62.5	(7.5)	85.1	(2.8)	75.4	(2.5)

Almost one-half of bison operations that had any bison bred on the operation during the reference period had been breeding bison on the operation for 21 or more years. More than two-fifths of operations (41.7 percent) that had any bison bred on the operation during the reference period had been breeding bison from 21 to 40 years, and 7.2 percent had been breeding bison more than 40 years.

A higher percentage of large operations (60.0 percent) than very small, small, or medium operations had bison bred while on the operation for 21 to 40 years, whereas a smaller percentage of large operations (13.4 percent) than operations in the other size categories had bison bred on the operation for 11 to 20 years. A higher percentage of large operations (15.4 percent) than very small or small operations had bison bred on the operation for more than 40 years.

D.1.c. For the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), percentage of operations by number of years bison had been bred on the operation, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Years	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
0 to 5	10.1	(4.4)	5.5	(2.5)	3.9	(1.4)	2.5	(1.5)	5.0	(1.1)
6 to 10	18.2	(5.5)	19.5	(4.1)	19.3	(3.0)	8.7	(2.5)	17.0	(1.9)
11 to 20	47.1	(7.5)	31.8	(4.4)	28.5	(3.4)	13.4	(3.1)	29.0	(2.2)
21 to 40	24.5	(6.4)	38.8	(4.5)	40.6	(3.6)	60.0	(4.4)	41.7	(2.2)
More than 40	0.0	(—)	4.3	(1.8)	7.7	(1.8)	15.4	(3.1)	7.2	(1.1)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

For operations that had any bison bred on the operation during the reference period, there were no differences in the percentages of operations that had been breeding bison on the operation for the listed time frames, except for the Northeast region having no operations that had been breeding bison for more than 40 years.

D.1.d. For the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), percentage of operations by number of years bison had been bred on the operation, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Years	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
0 to 5	15.0	(7.7)	5.1	(4.4)	3.7	(1.6)	4.0	(1.2)
6 to 10	23.6	(8.8)	28.0	(8.3)	16.7	(3.5)	14.7	(2.3)
11 to 20	27.5	(9.1)	33.1	(8.1)	27.7	(4.0)	29.3	(2.8)
21 to 40	33.8	(8.4)	29.6	(9.2)	44.3	(3.8)	43.5	(2.9)
More than 40	0.0	(—)	4.3	(3.4)	7.7	(2.0)	8.5	(1.5)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

For some livestock species in the United States, reproductive practices, such as artificial insemination and embryo transfer, are in common use. Of the 75.6 percent of bison operations that bred any bison, all had used natural breeding (bulls placed with cows and heifers) during the most recent breeding season. A very small percentage of operations (0.2 percent) had also used artificial insemination and/or embryo transfer during the most recent breeding season.

D.1.e. For the 75.6 percent of operations that had any bison bred while on the operation (table D.1.a), percentage of operations by practice(s) used during the most recent breeding season:

Practice	Percent Operations	Std. error
Natural breeding (bulls placed with cows and heifers)	100.0	(—)
Artificial insemination	0.2	(0.2)
Embryo transfer	0.2	(0.2)

Several management practices may be used to optimize reproductive success in the herd. Body-condition scoring and breeding-soundness exams for bulls are indicators of reproductive soundness and breeding potential. Rectal palpation and ultrasound to verify pregnancy can help identify bred and open cows for purposes of herd management, sales, or removals.

For the 75.6 percent of operations that bred any bison, 11.2 percent had used body-condition scoring during the most recent breeding season, 9.6 percent used breeding-soundness exams for bulls, 9.8 percent used palpation for pregnancy, 9.7 percent used ultrasound, and 3.2 percent used some “other” technique.

A higher percentage of large operations used body-condition scoring (27.1 percent), breeding-soundness exams for bulls (21.1 percent), palpation for pregnancy (29.7 percent), and/or ultrasound (34.0 percent) than operations in the other size categories.

D.1.f. For the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), percentage of operations by reproductive techniques used for or during the most recent breeding season, and by size of operation:

	Percent Operations									
	Size of Operation (number of bison)									
	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Practice	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Body condition scoring	7.8	(4.0)	5.0	(2.2)	8.4	(2.1)	27.1	(3.8)	11.2	(1.4)
Bull breeding soundness exam	2.1	(1.6)	7.4	(2.7)	7.7	(2.1)	21.1	(3.6)	9.6	(1.3)
Palpation for pregnancy	0.0	(—)	3.7	(1.9)	7.3	(1.8)	29.7	(4.0)	9.8	(1.2)
Ultrasound	0.0	(—)	2.7	(1.7)	4.9	(1.5)	34.0	(4.0)	9.7	(1.1)
Other	5.8	(3.7)	0.0	(—)	5.8	(1.9)	1.0	(0.8)	3.2	(0.9)

Except for ultrasound, there were no differences by region in the percentages of operations using the listed reproductive practices. No operations in the Northeast region had used ultrasound, and a higher percentage of operations in the West region (13.3 percent) than in the North Central region (2.7 percent) had used ultrasound.

D.1.g. For the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), percentage of operations by reproductive techniques used for or during the most recent breeding season, by region:

Percent Operations

	Region							
	Northeast		**Southeast**		**North Central**		**West**	
Practice	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Body condition scoring	11.7	(6.0)	9.3	(5.7)	7.8	(2.4)	12.8	(1.9)
Bull breeding soundness exam	10.9	(5.7)	23.0	(8.0)	7.3	(1.9)	8.7	(1.6)
Palpation for pregnancy	3.1	(2.6)	14.4	(7.0)	6.6	(1.7)	11.5	(1.6)
Ultrasound	0.0	(—)	14.4	(7.0)	2.7	(1.1)	13.3	(1.6)
Other	3.1	(2.7)	14.4	(6.5)	1.2	(1.0)	2.5	(1.1)

Overall, 64.7 percent of operations that bred any bison bred heifers on the operation during the most recent breeding season. A higher percentage of large operations (85.3 percent) than operations in the other size categories had bred heifers. A higher percentage of medium operations (70.4 percent) than small operations (46.7 percent) had bred heifers during the most recent breeding season.

D.1.h. For the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), percentage of operations that bred heifers on the operation during the most recent breeding season, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
57.0	(7.3)	46.7	(4.8)	70.4	(3.6)	85.3	(3.0)	64.7	(2.3)

There were no differences by region in the percentages of operations that bred heifers on the operation during the most recent breeding season.

D.1.i. For the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), percentage of operations that bred heifers on the operation during the most recent breeding season, by region:

Percent Operations

Region							
Northeast		**Southeast**		**North Central**		**West**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
62.6	(9.6)	74.2	(8.7)	62.0	(4.0)	64.9	(3.0)

For operations that had bred heifers during the most recent breeding season, more than two-thirds of operations (67.7 percent) bred heifers when they were 24 to 30 months old. A higher percentage of large operations (79.2 percent) than very small (35.9 percent) or small operations (54.3 percent) first bred heifers aged 24 to 30 months. A higher percentage of medium operations (76.5 percent) than very small operations (35.9 percent) first bred heifers aged 24 to 30 months. A higher percentage of very small (36.6 percent) and small (32.2 percent) operations than medium (10.6 percent) and large (8.4 percent) operations first bred heifers aged 31 to 36 months. A higher percentage of very small operations (21.6 percent) than large operations (1.5 percent) first bred heifers aged more than 36 months.

D.1.j. For the 48.9 percent operations that had any bison bred while on the operation and bred cows or heifers naturally during the most recent breeding season (Table D.1.g.),* percentage of operations by age (months) of heifers when first bred, and by size of operation:

Percent Operations

	Size of Operation (number of bison)									
	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Age (months)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Less than 24	5.8	(4.7)	8.6	(3.9)	8.2	(2.6)	10.8	(2.9)	8.8	(1.6)
24 to 30	35.9	(10.1)	54.3	(7.7)	76.5	(3.9)	79.2	(4.1)	67.7	(2.9)
31 to 36	36.6	(10.2)	32.2	(7.6)	10.6	(2.8)	8.4	(3.0)	17.6	(2.5)
More than 36	21.6	(8.4)	5.0	(3.0)	4.6	(2.0)	1.5	(1.3)	5.9	(1.5)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

*These estimates come from the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), of which all operations bred cows or heifers naturally during the most recent breeding season (Table D.1.e.), of which 64.7 percent of operations bred heifers on the operation during the most recent breeding season (Table D.1.g.).

There were few substantive differences by region in the percentages of operations that bred heifers on the operation during the most recent breeding season at the listed ages.

D.1.k. For the 48.9 percent operations that had any bison bred while on the operation and bred cows or heifers naturally during the most recent breeding season (Table D.1.g.),* percentage of operations by age (months) of heifers when first bred, by region:

Percent Operations

Region

Age (months)	**Northeast**		**Southeast**		**North Central**		**West**	
	Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Less than 24	0.0	(—)	0.0	(—)	7.9	(3.2)	11.2	(2.3)
24 to 30	47.6	(12.9)	64.8	(12.5)	68.1	(5.5)	70.6	(3.5)
31 to 36	52.4	(12.9)	27.4	(11.5)	16.3	(4.5)	12.3	(2.7)
More than 36	0.0	(—)	7.8	(6.1)	7.7	(3.3)	5.9	(2.0)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

*These estimates come from the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), of which all operations bred cows or heifers naturally during the most recent breeding season (Table D.1.e.), of which 64.7 percent of operations bred heifers on the operation during the most recent breeding season (Table D.1.g.).

Breeding animals generally are chosen to improve or maintain qualities and characteristics desired in the herd. Of the 75.6 percent of operations that bred any bison, 21.0 percent used random selection (such as choosing every third group at handling time) only as the primary basis for selecting new breeding bison, 23.8 percent used size/conformation only, 8.5 percent used behavior/manageability only, 9.4 percent used genetics only, and 10.2 percent used an "other" basis only. Other bases included use of family groups, average daily gains, and quality of mothers. More than one-fourth of operations (27.0 percent) used multiple bases equally to choose breeding bison.

Random selection was the only primary basis for selecting new bison for breeding on a lower percentage of large operations (7.5 percent) than on operations in the other three size categories. Size/conformation was the only primary basis for selecting new bison for breeding on a lower percentage of very small operations (2.7 percent) than on operations in the other three size categories. A higher percentage of large operations (38.0 percent) than small operations (19.1 percent) used multiple bases equally in selecting breeding bison.

D.1.l. For the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), percentage of operations by primary basis for selecting new breeding bison, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Basis	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Random selection only (e.g., choosing every third group at handling time, or gate cut)	33.3	(8.3)	29.9	(4.3)	18.7	(2.9)	7.5	(2.4)	21.0	(1.9)
Size/conformation only	2.7	(2.3)	21.4	(4.0)	26.4	(3.3)	33.1	(4.1)	23.8	(2.0)
Behavior/manageability only	15.6	(6.3)	11.2	(3.2)	8.1	(2.1)	2.3	(1.4)	8.5	(1.5)
Genetics only (DNA testing for parentage, ancestral line, genetic diversity, or cattle hybridization)	9.6	(4.7)	7.2	(2.6)	10.4	(2.4)	10.6	(2.8)	9.4	(1.4)
Other only	11.4	(5.6)	11.4	(3.4)	9.8	(2.2)	8.6	(2.5)	10.2	(1.5)
Size/conformation and behavior/manageability equally	12.4	(6.0)	11.6	(3.1)	14.0	(2.4)	7.9	(2.4)	11.8	(1.6)
Size/conformation, behavior/manageability, and genetics equally	0.0	(—)	1.4	(1.4)	4.6	(1.8)	8.5	(2.2)	4.0	(0.9)
Size/conformation and genetics equally	(D)	(D)	(D)	(D)	3.4	(1.5)	7.0	(2.0)	3.4	(0.8)
All other combinations	(D)	(D)	(D)	(D)	4.5	(1.6)	14.6	(3.2)	7.8	(1.4)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

Values of (D) denote too few to report.

There were no differences by region in the percentages of operations that used the listed bases for selecting breeding bison.

D.1.m. For the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), percentage of operations by primary basis for selecting new breeding bison, by region:

Percent Operations

	Region							
	Northeast		Southeast		North Central		West	
Basis	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Random selection only (e.g., choosing every third group at handling time, or gate cut)	33.0	(5.8)	17.9	(8.1)	24.5	(3.4)	18.2	(2.5)
Size/conformation only	21.7	(7.0)	17.0	(8.0)	20.1	(3.4)	26.5	(2.6)
Behavior/manageability only	3.3	(2.9)	6.0	(5.1)	5.9	(2.4)	10.7	(2.1)
Genetics only (DNA testing for parentage, ancestral line, genetic diversity, or cattle hybridization)	6.7	(4.2)	17.0	(8.0)	10.1	(2.5)	8.7	(1.8)
Other only	12.5	(6.1)	5.1	(4.0)	11.9	(2.8)	9.7	(2.1)
Size/conformation and behavior/manageability equally	6.7	(4.0)	10.1	(4.7)	15.5	(3.1)	11.2	(2.1)
Size/conformation, behavior/manageability, and genetics equally	0.0	(—)	6.0	(5.5)	2.1	(0.8)	5.2	(1.4)
Size/conformation and genetics equally	0.0	(—)	16.1	(7.8)	3.3	(1.4)	2.4	(0.8)
All other combinations	16.1	(7.9)	5.1	(4.0)	6.6	(2.3)	7.4	(1.6)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

2. Calf Survival and Weaning

For the 75.6 percent of operations that bred any bison, 79.1 percent of heifers and 81.1 percent of cows bred in 2021 had a calf born in 2022 that survived until weaning. There were no differences in the operation average percentage of heifers that had a calf born in 2022 that survived until weaning by size of operation. A lower percentage of cows bred in 2021 on small operations (73.7 percent) had a calf born in 2022 that survived until weaning than the percentage of cows on medium (84.9 percent) or large (87.1 percent) operations.

D.2.a. For the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), operation average percentage of heifers and cows bred in 2021 that had a calf born in 2022 that survived until weaning, and by size of operation:

Operation Average Percent

Size of Operation (number of bison)

	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Heifers	72.4	(8.7)	78.9	(5.4)	76.8	(2.8)	84.6	(1.6)	79.1	(1.9)
Cows	74.8	(5.8)	73.7	(3.1)	84.9	(1.3)	87.1	(1.2)	81.1	(1.3)

By region, the operation average percentage of cows bred in 2021 that had a calf born in 2022 that survived until weaning was higher on operations in the Northeast region (92.0 percent) than on operations in the North Central (79.7 percent) or West (80.5 percent) regions.

D.2.b. For the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), operation average percentage of heifers and cows bred in 2021 that had a calf born in 2022 that survived until weaning, by region:

Operation Average Percent

Region

	Northeast		Southeast		North Central		West	
	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Heifers	85.5	(5.9)	85.5	(6.0)	79.2	(3.0)	77.4	(2.6)
Cows	92.0	(2.9)	77.2	(5.1)	79.7	(2.2)	80.5	(1.7)

For the 75.6 percent of operations that bred any bison, the operation average annual percentage of bred bison that bore a calf that survived until weaning was 80.6 percent for heifers and 84.0 percent for cows. The operation average annual percentage of bred cows that bore a calf that survived until weaning was lower on small operations (82.4 percent) than on large operations (87.7 percent).

D.2.c. For the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), operation average **annual** percentage of bred heifers and bred cows that bore a calf that survived until weaning, and by size of operation:

Operation Average Annual Percent

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
	Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Heifers	77.3	(5.9)	79.3	(2.9)	80.5	(1.7)	83.4	(1.4)	80.6	(1.2)
Cows	78.9	(5.1)	82.4	(1.8)	84.9	(1.0)	87.7	(0.8)	84.0	(0.9)

By region, the operation average annual percentage of heifers that bore a calf that survived until weaning was higher on operations in the Northeast region (90.6 percent) than on operations in the North Central (75.0 percent) or West (81.7 percent) regions.

D.2.d. For the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), operation average **annual** percentage of bred heifers and bred cows that bore a calf that survived until weaning, by region:

Operation Average Annual Percent

Region

	Northeast		**Southeast**		**North Central**		**West**	
	Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Heifers	90.6	(2.7)	78.7	(4.9)	75.0	(2.2)	81.7	(1.6)
Cows	89.8	(3.6)	85.3	(2.0)	79.8	(1.6)	84.8	(1.3)

For the 75.6 percent of operations that bred any bison, the average annual percentage of bred heifers that bore a calf that survived until weaning was less than 50 percent for 6.4 percent of operations, 50 to 74 percent for 16.8 percent of operations, 75 to 99 percent for 59.4 percent of operations, and 100 percent for 17.4 percent of operations.

In general, the percentage of operations on which 75 to 99 percent of bred heifers bore a calf that survived until weaning increased as operation size increased; a higher percentage of large operations (80.7 percent) had 75 to 99 percent of bred heifers bear a calf that survived until weaning than very small (18.2 percent) or medium operations (57.5 percent). Not surprisingly, the percentage of operations on which 100 percent of bred heifers bore a calf that survived until weaning was higher on very small operations (47.9 percent) than on operations in the larger size categories. However, the only operations to have an average annual percentage of zero calves survive from bred heifers were in the very small category (4.9 percent of operations).

D.2.e. For the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), percentage of operations by average **annual** percentage of bred **heifers** that bore a calf that survived until weaning, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Average annual percent	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
0	4.9	(4.4)	0.0	(—)	0.0	(—)	0.0	(—)	0.7	(0.6)
>0 but <50	7.9	(5.0)	7.0	(3.4)	6.0	(1.9)	3.3	(1.6)	5.7	(1.3)
50–74	21.1	(7.8)	16.2	(4.3)	18.9	(3.3)	12.2	(3.0)	16.8	(2.0)
75–99	18.2	(7.5)	61.1	(6.8)	57.5	(4.4)	80.7	(3.7)	59.4	(2.8)
100	47.9	(9.7)	15.8	(5.4)	17.5	(3.6)	3.8	(1.8)	17.4	(2.4)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

By region, only the West region contained any operations with an average annual percentage of more than zero for bred heifers that did not bear a calf that survived until weaning (1.1 percent). Only the Northeast region had at least 50 percent of all bred heifers bear a calf that survived until weaning.

D.2.f. For the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), percentage of operations by average **annual** percentage of bred **heifers** that bore a calf that survived until weaning, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Average annual percent	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
0	0.0	(—)	0.0	(—)	0.0	(—)	1.1	(1.0)
>0 but <50	0.0	(—)	6.1	(5.5)	6.7	(2.6)	6.1	(1.8)
50–74	10.9	(6.4)	27.6	(10.3)	29.9	(4.2)	11.2	(2.3)
75–99	51.9	(13.8)	45.9	(11.3)	50.7	(4.9)	65.3	(3.5)
100	37.3	(13.2)	20.4	(9.6)	12.8	(3.6)	16.4	(3.0)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

For the 75.6 percent of operations that bred any bison, the average annual percentage of bred cows that bore a calf that survived until weaning was less than 50 percent for 2.6 percent of operations, 50 to 74 percent for 14.0 percent of operations, 75 to 99 percent for 69.2 percent of operations, and 100 percent for 14.2 percent of operations. On more than two-thirds of operations in each size category, the average annual percentage of bred cows that bore a calf that survived until weaning was at least 75 percent.

As with heifers, it is not surprising that the percentage of operations on which 100 percent of bred cows bore a calf that survived until weaning was generally higher on very small operations (37.8 percent) than on operations in the larger size categories. Again, the only operations to have an average annual percentage of zero calves survive from bred cows were in the very small category (4.0 percent of operations). A higher percentage of small (65.6 percent), medium (73.9 percent), and large (89.9 percent) operations than very small operations (29.2 percent) had an average annual percentage of bred cows that bore a calf that survived until weaning of 75 to 99 percent.

D.2.g. For the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), percentage of operations by average **annual** percentage of bred **cows** that bore a calf that survived until weaning, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Average annual percent	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
0	4.0	(3.6)	0.0	(—)	0.0	(—)	0.0	(—)	0.5	(0.5)
>0 but <50	6.4	(4.1)	1.2	(0.9)	2.4	(1.0)	0.0	(—)	2.1	(0.7)
50–74	22.6	(6.9)	17.3	(4.2)	12.1	(2.3)	7.9	(2.6)	14.0	(1.8)
75–99	29.2	(7.2)	65.6	(5.1)	73.9	(3.4)	89.8	(2.8)	69.2	(2.4)
100	37.8	(8.4)	16.0	(4.4)	11.6	(2.8)	2.3	(1.3)	14.2	(2.0)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

By region, only the West region contained any operations with an average annual percentage of more than zero for bred cows that did not bear a calf that survived until weaning (0.9 percent). Only the Northeast and Southeast regions had at least 50 percent of all bred cows bear a calf that survived until weaning. A higher percentage of operations in the Northeast region (39.7 percent) than in the North Central region (4.7 percent) had an average annual percentage of bred cows that bore a calf that survived until weaning of 100 percent.

D.2.h. For the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), percentage of operations by average **annual** percentage of bred **cows** that bore a calf that survived until weaning, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Average annual percent	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
0	0.0	(—)	0.0	(—)	0.0	(—)	0.9	(0.8)
>0 but <50	0.0	(—)	0.0	(—)	4.5	(2.0)	1.7	(0.9)
50–74	11.3	(7.5)	16.1	(7.4)	18.5	(3.6)	12.4	(2.3)
75–99	49.0	(11.7)	72.0	(9.7)	72.4	(4.2)	70.3	(2.9)
100	39.7	(12.0)	11.9	(7.0)	4.7	(2.1)	14.8	(2.6)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

Choosing how and when to wean bison calves can be influenced by the size of the herd and ease of working the bison, the intended purpose of the calves, feeding practices, and/or the availability of feed needed for calves to grow efficiently and for females to keep up with the nutritional demands of lactation. For all operations, two-thirds opted to have calves weaned naturally by mother bison, and one-third chose to wean calves by separating them from their mothers.

A higher percentage of large operations (65.0 percent) than operations in the other three size categories used separation weaning. Conversely, a smaller percentage of large operations (35.0 percent) used natural weaning by the mother than operations in the three smaller size categories. Medium operations also showed the same pattern as large operations with respect to very small and small operations.

D.2.i. For the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), percentage of operations by typical manner of weaning calves, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Method	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Natural weaning by mother bison	90.7	(4.2)	81.5	(3.7)	63.1	(3.4)	35.0	(4.2)	66.8	(2.0)
Separation weaning/ management practice	9.3	(4.2)	18.5	(3.7)	36.9	(3.4)	65.0	(4.2)	33.2	(2.0)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

There were no differences by region in the methods operations used to wean bison calves.

D.2.j. For the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), percentage of operations by typical manner of weaning calves, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Method	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Natural weaning by mother bison	77.8	(7.0)	70.5	(9.3)	69.1	(3.8)	63.8	(2.6)
Separation weaning/management practice	22.2	(7.0)	29.5	(9.3)	30.9	(3.8)	36.2	(2.6)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

For the 75.6 percent of operations that bred any bison, the operation average age of calves at weaning was 8.9 months. The average age at weaning did not differ by operation size.

D.2.k. For the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), operation average age (months) of calves at weaning, by size of operation:

Operation Average Age at Weaning (months)

Size of Operation (number of bison)

Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Mo.	**Std. error**	**Mo.**	**Std. error**	**Mo.**	**Std. error**	**Mo.**	**Std. error**	**Mo.**	**Std. error**
9.3	(0.7)	9.0	(0.3)	8.8	(0.2)	8.4	(0.3)	8.9	(0.2)

The average age at weaning did not differ by region.

D.2.l. For the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), operation average age (months) of calves at weaning, by region:

Operation Average Age at Weaning (months)

Region

Northeast		Southeast		North Central		West	
Mo.	**Std. error**	**Mo.**	**Std. error**	**Mo.**	**Std. error**	**Mo.**	**Std. error**
9.9	(0.6)	9.2	(0.8)	8.5	(0.3)	8.8	(0.2)

Of the 75.6 percent of operations that bred any bison, three-fourths of operations (75.2 percent) typically weaned calves when they were from 6 to 11 months of age.

A higher percentage of large operations (63.4 percent) typically weaned calves at 6 to 8 months of age than medium (44.6 percent) or small (33.4 percent) operations.

D.2.m. For the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), percentage of operations by age (months) at which calves were typically weaned, and by size of operation:

Percent Operations

Size of Operation (number of bison)

Age (months)	**Very small** (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
	Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Less than 6	9.5	(4.6)	6.8	(2.6)	7.0	(1.9)	2.5	(1.6)	6.3	(1.2)
6 to 8	41.5	(8.0)	33.4	(4.8)	44.6	(3.6)	63.4	(4.4)	45.3	(2.3)
9 to 11	30.3	(7.6)	35.1	(4.9)	30.9	(3.6)	21.6	(3.8)	29.9	(2.3)
12 or more	18.7	(6.2)	24.7	(4.6)	17.5	(2.9)	12.5	(3.1)	18.5	(1.9)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

A higher percentage of operations in the West region (47.8 percent) than in the Northeast region (20.5 percent) weaned bison calves when they were 6 to 8 months old.

D.2.n. For the 75.6 percent of operations that had any bison bred while on the operation (Table D.1.a.), percentage of operations by age (months) at which calves were typically weaned, by region:

Percent Operations

Region

Age (months)	**Northeast**		**Southeast**		**North Central**		**West**	
	Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Less than 6	10.0	(4.3)	11.8	(7.0)	7.8	(2.6)	4.5	(1.4)
6 to 8	20.5	(8.4)	50.4	(10.8)	46.8	(4.5)	47.8	(3.0)
9 to 11	44.5	(9.2)	11.8	(6.5)	24.5	(4.2)	31.9	(3.1)
12 or more	25.1	(7.8)	25.9	(8.6)	20.9	(3.6)	15.8	(2.5)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

E. Diseases, Parasites, and Health Management

Similar to other animals, bison are susceptible to various pathogens and gastrointestinal parasites. Diseases that can affect bison health include bovine tuberculosis (TB), brucellosis, bovine viral diarrhea (BVD), malignant catarrhal fever (MCF), clostridial disease, epizootic hemorrhagic disease (EHD), respiratory disease associated with *Mannheimia*/*Pasteurella*, *Mycoplasma bovis*, pinkeye, and internal parasites, including *Cooperia*, *Haemonchus*, *Ostertagia*, *Trichostrongylus*, and *Trichuris*. Common signs of illness that producers can monitor for include emaciation, lethargy, and coughing. Being familiar with diseases found in bison and knowing what signs to look for, as well as regularly observing the bison herd, are important aspects of herd health management practices.

Note: Unless otherwise noted, tables in this section refer to the period July 1, 2021, through June 30, 2022.

1. Producer familiarity with diseases and frequency of visual observation of bison

More than one-half of the operations knew some basics, were fairly knowledgeable, or were extremely knowledgeable with bovine tuberculosis (63.9 percent), brucellosis (69.4 percent), and bovine viral diarrhea (53.0 percent). More than one-third of operations had never heard of malignant catarrhal fever (37.0 percent), clostridial diseases (38.2 percent), *Mannheimia*/*Pasteurella* (46.3 percent), and *Mycoplasma bovis* (37.8 percent). Less than 10 percent of all operations were extremely knowledgeable about any of the listed diseases.

E.1.a. Percentage of operations by how familiar the respondent was with the following diseases in bison:

	Percent Operations										
	How Familiar										
	Never heard of it		Recognize the name, not much else		Know some basics		Fairly knowledge-able		Extremely knowledge-able		
Disease	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Total
Bovine tuberculosis (TB)	6.8	(1.1)	29.3	(2.0)	34.2	(2.1)	22.4	(1.7)	7.3	(1.1)	100.0
Brucellosis	7.7	(1.3)	22.9	(1.9)	31.8	(2.0)	28.3	(1.8)	9.3	(1.2)	100.0
Bovine viral diarrhea (BVD)	20.8	(1.8)	26.2	(1.9)	27.1	(1.9)	20.1	(1.6)	5.8	(1.0)	100.0
Malignant catarrhal fever (MCF)	37.0	(2.1)	20.9	(1.8)	19.0	(1.7)	17.2	(1.6)	5.9	(1.0)	100.0
Clostridial diseases	38.2	(2.1)	25.1	(1.9)	18.7	(1.7)	13.0	(1.4)	5.0	(0.9)	100.0
Epizootic hemorrhagic disease (EHD)/bluetongue	33.2	(2.1)	30.3	(2.0)	19.3	(1.6)	12.1	(1.3)	5.1	(1.0)	100.0
Mannheimia/ Pasteurella	46.3	(2.2)	24.9	(1.9)	13.4	(1.4)	10.1	(1.3)	5.3	(0.9)	100.0
Mycoplasma bovis	37.8	(2.1)	21.9	(1.8)	18.5	(1.5)	14.0	(1.5)	7.8	(1.0)	100.0

Nearly two-fifths of all operations (37.7 percent) were fairly or extremely knowledgeable about brucellosis and almost one-third (29.6 percent) were fairly or extremely knowledgeable about bovine tuberculosis (TB).

Overall, a higher percentage of large operations were fairly or extremely knowledgeable about the listed diseases in bison. A higher percentage of large operations were fairly or extremely knowledgeable about brucellosis (62.5 percent), bovine TB (53.4 percent), *Mycoplasma bovis* (52.1 percent), bovine viral diarrhea (40.2 percent), *Mannheimia*/*Pasteurella* (33.6 percent), or epizootic hemorrhagic disease/bluetongue (32.9 percent) than operations in the other size categories. A higher percentage of large operations were fairly or extremely knowledgeable about malignant catarrhal fever (35.8 percent) than very small (16.8 percent) and small (19.4 percent) operations.

E.1.b. Percentage of operations in which the respondent was fairly or extremely knowledgeable with the following diseases in bison, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Disease	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Bovine tuberculosis (TB)	25.1	(3.8)	23.6	(3.8)	26.4	(3.1)	53.4	(4.2)	29.6	(1.9)
Brucellosis	26.5	(3.9)	32.3	(4.4)	41.2	(3.5)	62.5	(4.3)	37.7	(2.0)
Bovine viral diarrhea (BVD)	23.6	(3.7)	20.9	(3.6)	24.6	(3.0)	40.2	(4.1)	25.9	(1.8)
Malignant catarrhal fever (MCF)	16.8	(3.4)	19.4	(3.7)	26.3	(3.0)	35.8	(4.3)	23.1	(1.8)
Clostridial diseases	16.8	(3.3)	13.5	(3.1)	15.9	(2.5)	31.0	(3.8)	18.1	(1.6)
Epizootic hemorrhagic disease (EHD)/bluetongue	16.3	(3.2)	12.8	(3.1)	12.7	(2.2)	32.9	(3.9)	17.2	(1.6)
Mannheimia/Pasteurella	16.2	(3.3)	12.0	(3.1)	6.5	(1.8)	33.6	(3.9)	15.4	(1.6)
Mycoplasma bovis	16.4	(3.3)	14.4	(3.3)	17.0	(2.7)	52.1	(4.2)	21.8	(1.7)

There were no regional differences by producer familiarity with the listed pathogens. Although not significant, a higher percentage of operations in the Southeast region (26.1 percent) were fairly or extremely knowledgeable with epizootic hemorrhagic disease (EHD)/bluetongue compared with operations in the other three regions. Bluetongue is a virus transmitted by biting midges and is more common in the Southeast.

E.1.c. Percentage of operations in which the respondent was fairly or extremely knowledgeable with the following diseases in bison, by region:

	Percent Operations							
	Region							
	Northeast		Southeast		North Central		West	
Disease	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Bovine tuberculosis (TB)	18.5	(6.2)	35.1	(6.5)	38.6	(3.7)	27.4	(2.4)
Brucellosis	20.6	(6.6)	41.4	(6.9)	38.0	(3.6)	39.8	(2.7)
Bovine viral diarrhea (BVD)	24.3	(6.7)	29.7	(6.9)	26.9	(3.3)	25.3	(2.3)
Malignant catarrhal fever (MCF)	22.7	(6.2)	20.7	(6.4)	24.0	(3.2)	23.2	(2.3)
Clostridial diseases	22.7	(6.6)	21.2	(6.7)	21.5	(3.3)	15.6	(1.9)
Epizootic hemorrhagic disease (EHD)/bluetongue	14.4	(5.9)	26.1	(5.6)	16.3	(2.9)	16.6	(2.0)
Mannheimia/Pasteurella	12.3	(5.6)	18.0	(6.1)	15.0	(3.0)	15.6	(2.0)
Mycoplasma bovis	16.4	(6.1)	21.2	(6.3)	18.7	(3.1)	23.9	(2.2)

By visually inspecting the bison regularly for general health purposes, the producer can more quickly recognize, identify, and address any health concerns for individuals or the herd. Producers can monitor for illness by observing bison for any weight loss, diarrhea, coughing, lethargy, or voluntary exclusion from the herd.

Almost three-quarters of all operations (73.5 percent) had someone on the operation who undertook a visual inspection of the bison for general health purposes at least once every few days. Almost one-half of operations (44.7 percent) undertook a visual inspection once a day. Slightly more than one-tenth of operations (11.1 percent) undertook a visual inspection less than once a week.

A higher percentage of very small operations (64.5 percent) undertook a visual inspection once a day than operations in other size categories. A higher percentage of large operations (30.1 percent) undertook a visual inspection once a week than very small (5.8 percent) or medium (15.5 percent) operations.

E.1.d. Percentage of operations by how often someone on the operation undertook a visual inspection of the bison for general health purposes from July 1, 2021, through June 30, 2022, and by size of operation:

	Percent Operations									
	Size of Operation (number of bison)									
	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
How often	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Once a day	64.5	(4.4)	37.0	(4.3)	35.9	(3.5)	30.6	(3.9)	44.7	(2.2)
Once every few days	18.5	(3.4)	34.3	(4.3)	38.1	(3.5)	25.6	(3.6)	28.8	(1.9)
Once a week	5.8	(2.1)	17.8	(3.6)	15.5	(2.6)	30.1	(4.1)	15.2	(1.5)
Once every two weeks	3.5	(1.5)	4.2	(1.7)	5.8	(1.6)	6.4	(2.1)	4.8	(0.8)
Once a month or less often	7.7	(2.5)	6.7	(2.3)	(D)	(D)	(D)	(D)	6.3	(1.1)
Other	0.0	(—)	0.0	(—)	(D)	(D)	(D)	(D)	0.3	(0.2)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

Values of (D) denote too few to report.

There were no regional differences by how often someone on the operation undertook a visual inspection of the bison for general health purposes.

E.1.e. Percentage of operations by how often someone on the operation undertook a visual inspection of the bison for general health purposes from July 1, 2021, through June 30, 2022, by region:

	Percent Operations							
	Region							
	Northeast		Southeast		North Central		West	
How often	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Once a day	56.0	(8.4)	33.8	(7.2)	47.7	(3.9)	43.2	(2.8)
Once every few days	21.9	(6.5)	40.1	(6.9)	31.9	(3.5)	27.2	(2.4)
Once a week	11.7	(5.4)	14.4	(5.1)	12.3	(2.2)	17.0	(2.0)
Once every two weeks	0.0	(—)	2.7	(2.1)	3.8	(1.4)	6.2	(1.3)
Once a month or less often	10.3	(4.8)	9.0	(4.5)	(D)	(D)	(D)	(D)
Other	0.0	(—)	0.0	(—)	(D)	(D)	(D)	(D)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

Values of (D) denote too few to report.

2. Deworming and parasite-control practices

Internal parasites in bison can contribute to weight loss or poor weight gain, rough hair coat, diarrhea, inappetence, and in some cases, death. Using dewormers in bison can help offset these health problems and improve body condition, calf rate of gain and weaning weights, and feed efficiency; however, overuse of these products might lead to anthelmintic resistance.

Three-fourths of operations (75.0 percent) had dewormed at least some bison during the survey reference period. A lower percentage of very small operations (65.5 percent) dewormed any bison compared with medium (82.5 percent) and large (82.2 percent) operations.

E.2.a. Percentage of operations that dewormed any bison from July 1, 2021, through June 30, 2022, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
65.5	(3.8)	74.4	(4.0)	82.5	(2.7)	82.2	(3.2)	75.0	(1.8)

Parasite types and burden can vary by geographic location, and parasite-control programs should be tailored for the specific location. A lower percentage of operations in the West region (68.1 percent) dewormed any bison compared with operations in the Southeast (93.7 percent) and North Central (84.2 percent) regions.

E.2.b. Percentage of operations that dewormed any bison from July 1, 2021, through June 30, 2022, by region:

Percent Operations

Region

Northeast		**Southeast**		**North Central**		**West**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
79.2	(7.4)	93.7	(3.8)	84.2	(2.9)	68.1	(2.5)

For the 75.0 percent of operations that dewormed any bison, 38.5 percent dewormed the majority of their bison twice and 35.7 percent dewormed the majority once during the reference period. More than one-fourth (25.9 percent) of all operations dewormed three or more times. A higher percentage of large operations (62.0 percent) dewormed bison one time compared with all other size categories.

E.2.c. For the 75.0 percent of operations that dewormed any bison from July 1, 2021, through June 30, 2022 (Table E.2.a.), percentage of operations by number of times the majority of bison were dewormed, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Number of times	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
1	28.3	(5.1)	33.1	(4.9)	29.4	(3.5)	62.0	(4.7)	35.7	(2.3)
2	43.1	(5.3)	42.2	(5.2)	39.1	(4.0)	24.7	(4.2)	38.5	(2.4)
3	13.7	(3.8)	8.6	(3.1)	17.7	(2.8)	10.7	(2.8)	13.2	(1.7)
4	10.7	(3.4)	5.8	(2.4)	11.0	(2.7)	0.0	(—)	7.8	(1.4)
5 or more	4.1	(2.0)	10.2	(3.4)	2.9	(1.0)	2.6	(2.4)	4.9	(1.1)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

For the 75.0 percent of operations that dewormed any bison, a higher percentage of operations in the West region (47.1 percent) dewormed bison once compared with operations in the other regions. A higher percentage of operations in the Northeast (56.7 percent) and North Central (51.3 percent) regions dewormed bison twice compared with operations in the West region (30.9 percent). Numerically, a higher percentage of operations in the Southeast (48.0 percent) dewormed bison three or more times compared with operations in the West region (22.1 percent).

E.2.d. For the 75.0 percent of operations that dewormed any bison from July 1, 2021, through June 30, 2022 (Table E.2.a.), percentage of operations by number of times the majority of bison were dewormed, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Number of times	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
1	15.5	(7.8)	22.1	(7.1)	25.8	(3.9)	47.1	(3.2)
2	56.7	(9.0)	29.9	(7.6)	51.3	(4.0)	30.9	(3.2)
3	12.5	(4.8)	21.6	(6.0)	11.8	(2.3)	12.2	(2.4)
4	10.7	(5.7)	20.2	(7.0)	6.2	(1.9)	5.3	(1.6)
5 or more	4.6	(3.9)	6.2	(3.7)	5.0	(1.5)	4.6	(1.6)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

Various natural and commercialized chemical products are available and used for deworming bison, and consumer demand for natural or organic meat products can create a need for alternatives to traditional anthelmintic drugs. Of the 75.0 percent of operations that dewormed any bison, 95.1 percent used conventional dewormers, 15.2 percent used natural/alternative dewormers, and 5.8 percent used "other" dewormers, which included walnut tincture, pumpkin seeds, and Basic-H® cleaner.

The types of dewormers used did not differ by operation size, and some operations in each size category used more than one type of dewormer.

E.2.e. For the 75.0 percent of operations that dewormed any bison from July 1, 2021, through June 30, 2022 (Table E.2.a.), percentage of operations by type(s) of dewormer used, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Dewormer	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Conventional[1]	94.0	(2.6)	95.8	(2.1)	96.6	(1.2)	93.6	(2.9)	95.1	(1.1)
Natural/ alternative[2]	10.3	(3.5)	17.2	(4.0)	18.4	(3.0)	14.7	(3.6)	15.2	(1.7)
Other	4.8	(2.4)	6.2	(2.6)	9.2	(2.5)	1.2	(1.0)	5.8	(1.2)

[1] Such as Ivermectin, Safeguard®, or Doramectin.

[2] Such as diatomaceous earth, botanicals, cayenne pepper, or garlic salt.

Of the 75.0 percent of operations that dewormed any bison, all operations in the Northeast region used conventional dewormers, and about one-fifth (20.6 percent) also used natural/alternative dewormers. There were few substantive differences by region in operations' use of dewormers.

E.2.f. For the 75.0 percent of operations that dewormed any bison from July 1, 2021, through June 30, 2022 (Table E.2.a.), percentage of operations by type(s) of dewormer used, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Dewormer	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Conventional[1]	100.0	(—)	97.1	(2.2)	97.0	(1.4)	92.9	(1.8)
Natural/alternative[2]	20.6	(7.9)	20.6	(4.5)	17.0	(3.0)	12.2	(2.3)
Other	5.3	(3.2)	9.6	(4.3)	3.0	(1.4)	6.4	(1.8)

[1] Such as Ivermectin, Safeguard®, or Doramectin.

[2] Such as diatomaceous earth, botanicals, cayenne pepper, or garlic salt.

The operation average cost of treating bison with a dewormer was $13.70 per animal per treatment using a conventional dewormer, $6.72 per animal using a natural/alternative dewormer, and $16.29 per animal using an "other" type of dewormer.

Larger operations might have a cost advantage because of bulk pricing for conventional dewormers. The average cost per bison per treatment with conventional dewormers was less for large operations ($4.39) compared with all other operation sizes; it also was less for medium operations ($10.58) compared with small ($17.38) and very small ($18.91) operations. There were no substantial cost differences by size of operation in the use of natural/alternative or "other" dewormer treatments.

E.2.g. For operations that dewormed any bison with the following dewormers[1] from July 1, 2021, through June 30, 2022 (Table E.2.e.), operation average cost per bison per treatment, by type of dewormer and by size of operation:

Operation Average Cost per Bison per Treatment ($)

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Dewormer	**Dollar**	**Std. error**	**Dollar**	**Std. error**	**Dollar**	**Std. error**	**Dollar**	**Std. error**	**Dollar**	**Std. error**
Conventional[2]	18.91	(1.93)	17.38	(2.52)	10.58	(0.87)	4.39	(0.50)	13.70	(0.91)
Natural/ alternative[3]	8.97	(3.49)	9.18	(3.66)	4.85	(1.24)	3.00	(0.77)	6.72	(1.35)
Other	29.33	(11.89)	(D)	(D)	8.40	(1.61)	(D)	(D)	16.29	(4.38)

Values of (D) denote too few to report.

[1] For the 71.3, 11.4, or 4.4 percent of operations that used conventional, natural/alternative, or other dewormers, respectively, from July 1, 2021, through June 30, 2022. These estimates come from the 75.0 percent of operations that used any dewormers (Table E.2.a.), of which 95.1, 15.2, and 5.8 percent of operations used conventional, natural/alternative, or other dewormers, respectively (Table E.2.e.).

[2] Such as Ivermectin, Safeguard®, or Doramectin.

[3] Such as diatomaceous earth, botanicals, cayenne pepper, or garlic salt.

There were no regional differences in the average cost per bison per treatment for conventional or natural/alternative dewormers. The average cost of "other" dewormer treatments per animal per treatment was numerically higher in the West region ($20.63) than for operations in the North Central region ($5.33).

E.2.h. For operations that dewormed any bison with the following dewormers[1] from July 1, 2021, through June 30, 2022 (Table E.2.e.), operation average cost per bison per treatment by type of dewormer, by region:

Operation Average Cost per Bison per Treatment ($)

Region

	Northeast		Southeast		North Central		West	
Dewormer	**Dollar**	**Std. error**	**Dollar**	**Std. error**	**Dollar**	**Std. error**	**Dollar**	**Std. error**
Conventional[2]	12.46	(1.53)	13.55	(2.73)	13.64	(1.51)	13.94	(1.35)
Natural/alternative[3]	2.24	(1.46)	10.77	(3.29)	9.33	(3.29)	5.44	(1.85)
Other	(D)	(D)	(D)	(D)	5.33	(1.04)	20.63	(6.96)

Values of (D) denote too few to report.

[1] For the 71.3, 11.4, or 4.4 percent of operations that used conventional, natural/alternative, or other dewormers, respectively, from July 1, 2021, through June 30, 2022. These estimates come from the 75.0 percent of operations that used any dewormers (Table E.2.a.), of which 95.1, 15.2, or 5.8 percent of operations used conventional, natural/alternative, or other dewormers, respectively (Table E.2.e.).

[2] Such as Ivermectin, Safeguard®, or Doramectin.

[3] Such as diatomaceous earth, botanicals, cayenne pepper, or garlic salt.

Choice of dewormer depends on several factors, including the type of parasites targeted and the method of administration. Each method has advantages and disadvantages that must be considered. For example, dewormers that are injected allow for more accurate and specific dosing for each animal, but they require handling the bison. On the other hand, dewormers administered in mineral blocks are easy to administer and do not require handling of bison but might not be consumed by all bison in the necessary dosage to achieve adequate parasite control.

Of the 75.0 percent of operations that dewormed any bison, about one-half (48.7 percent) had administered dewormer using a feed or water additive, and roughly one-third had used injectable dewormer (38.8 percent), pour-on dewormer (32.0 percent), or mineral additive (31.1 percent). Only 15.9 percent administered dewormer directly into the mouth.

In general, the percentage of operations using an injectable dewormer increased as operation size increased. A higher percentage of large operations (69.3 percent) than operations in the other size categories used an injectable dewormer, and a higher percentage of medium operations (50.4 percent) than small (29.6 percent) and very small (15.1 percent) operations used an injectable dewormer. A higher percentage of large operations (28.7 percent) than small (9.4 percent) and very small (11.5 percent) operations administered dewormer directly into the mouth. A lower percentage of large operations (28.6 percent) than operations in the other size categories administered dewormer using a feed or water additive.

E.2.i. For the 75.0 percent of operations that dewormed any bison from July 1, 2021, through June 30, 2022 (Table E.2.a.), percentage of operations by method(s) used to administer dewormer on the operation, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Method	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Pour-on	33.2	(5.4)	36.2	(4.7)	29.1	(3.7)	29.5	(4.5)	32.0	(2.4)
Injectable	15.1	(3.9)	29.6	(4.8)	50.4	(4.0)	69.3	(4.6)	38.8	(2.2)
Directly into the mouth (e.g., drench, bolus, paste)	11.5	(3.5)	9.4	(3.2)	17.7	(3.0)	28.7	(4.4)	15.9	(1.7)
Feed or water additive	50.2	(5.5)	53.0	(5.0)	55.6	(3.8)	28.6	(4.5)	48.7	(2.4)
Mineral additive	33.5	(5.2)	35.8	(5.1)	31.2	(3.7)	20.7	(3.9)	31.1	(2.2)

Overall, there were few regional differences in the methods used to administer dewormer. A smaller percentage of operations in the North Central region (19.0 percent) than operations in the Northeast (54.0 percent) and West (35.5 percent) regions administered pour-on dewormer. A higher percentage of operations in the West region (43.2 percent) than operations in the North Central region (29.6 percent) administered injectable dewormer, and conversely, a higher percentage of operations in the North Central region (65.7 percent) than operations in the West region (40.2 percent) administered dewormer as a feed or water additive. Also, a smaller percentage of operations in the North Central region (6.5 percent) than in the Southeast (31.7 percent) and West (16.8 percent) regions administered dewormer directly into the mouth.

E.2.j. For the 75.0 percent of operations that dewormed any bison from July 1, 2021, through June 30, 2022 (Table E.2.a.), percentage of operations by method(s) used to administer dewormer on the operation, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Method	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Pour-on	54.0	(9.8)	22.6	(7.0)	19.0	(3.5)	35.5	(3.3)
Injectable	27.8	(8.0)	47.0	(7.5)	29.6	(3.3)	43.2	(3.1)
Directly into the mouth (e.g., drench, bolus, paste)	16.0	(6.2)	31.7	(7.0)	6.5	(2.0)	16.8	(2.3)
Feed or water additive	43.8	(9.3)	58.7	(8.2)	65.7	(4.1)	40.2	(3.2)
Mineral additive	38.1	(8.0)	38.4	(7.3)	34.0	(3.9)	26.9	(3.1)

Stocking density, pasture characteristics and management, climate, and nutrition all influence parasite burdens in bison herds. A parasite-control program requires an integrated approach that considers these factors as well as the dewormer itself and its administration. Approximately one-half (50.6 percent) of all operations rotated pastures as a method of parasite control, and more than one-third (37.8 percent) rotated dewormer type. Nearly one-quarter of operations performed laboratory testing for intestinal parasites (23.2 percent) and/or reduced stocking density (23.2 percent). About 16 percent of operations used a different dose of dewormer in bison than the labeled dose for cattle, 9.4 percent gave a combination of two or more dewormer drugs at once, and 2.1 percent used an “other” activity as part of a parasite-control program, which included maintaining pastures, providing feed in open areas, and controlling flies.

A higher percentage of large operations (42.1 percent) performed laboratory testing for intestinal parasites than small (16.3 percent) and very small (14.0 percent) operations. A lower percentage of very small operations (27.1 percent) rotated dewormer type than medium (45.5 percent) and large (46.6 percent) operations. A higher percentage of large operations (77.5 percent) than operations in the other size categories rotated pastures, and a higher percentage of medium operations (56.4 percent) rotated pastures than very small operations (32.2 percent). A higher percentage of large operations (34.5 percent) reduced stocking density than small (16.7 percent) and very small (17.8 percent) operations.

Recent information suggests that rotating dewormers to reduce development of anthelmintic resistance is not effective, and this practice is no longer recommended by livestock parasitologists.

E.2.k. Percentage of operations by activity(-ies) performed as part of a parasite-control program from July 1, 2021, through June 30, 2022, and by size of operation:

	Percent Operations									
	Size of Operation (number of bison)									
	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Activity	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Perform laboratory (fecal) testing for intestinal parasites	14.0	(2.8)	16.3	(3.5)	29.2	(3.3)	42.1	(4.2)	23.2	(1.7)
Rotate dewormer type to deter parasite resistance	27.1	(4.1)	36.3	(4.5)	45.5	(3.5)	46.6	(4.5)	37.8	(2.1)
Give a combination of two or more dewormer drugs at once	3.4	(1.5)	5.2	(2.2)	17.5	(2.8)	12.9	(3.0)	9.4	(1.2)
Use a different dose of dewormer in bison than the labeled dose recommended for cattle	11.6	(2.9)	21.6	(4.1)	16.0	(2.8)	13.5	(3.0)	15.6	(1.6)
Rotate pastures	32.2	(4.5)	48.9	(4.8)	56.4	(3.7)	77.5	(3.7)	50.6	(2.2)
Reduce stocking density	17.8	(3.4)	16.7	(3.5)	28.0	(3.3)	34.5	(4.3)	23.2	(1.8)
Other	3.1	(1.6)	0.8	(0.6)	0.9	(0.5)	4.0	(1.8)	2.1	(0.6)

A higher percentage of operations in the Southeast region (40.9 percent) performed laboratory testing for internal parasites than operations in the West region (20.7 percent). A higher percentage of operations in the Southeast region (27.3 percent) gave a combination of two or more dewormer drugs at once compared with operations in all other regions.

E.2.I. Percentage of operations by activity(-ies) performed as part of a parasite-control program from July 1, 2021, through June 30, 2022, by region:

	Percent Operations							
	Region							
	Northeast		Southeast		North Central		West	
Activity	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Perform laboratory (fecal) testing for intestinal parasites	26.6	(7.1)	40.9	(7.2)	20.9	(2.9)	20.7	(2.1)
Rotate dewormer type to deter parasite resistance	46.2	(8.2)	50.9	(7.4)	41.4	(4.0)	33.2	(2.7)
Give a combination of two or more dewormer drugs at once	5.2	(2.8)	27.3	(6.0)	7.9	(2.2)	7.8	(1.4)
Use a different dose of dewormer in bison than the labeled dose recommended for cattle	19.7	(7.0)	26.0	(7.4)	16.7	(3.0)	12.9	(2.0)
Rotate pastures	71.5	(8.2)	60.0	(8.2)	46.7	(4.0)	47.5	(2.8)
Reduce stocking density	20.2	(5.5)	22.1	(6.9)	16.8	(3.0)	26.3	(2.5)
Other	0.0	(—)	6.5	(3.7)	2.4	(1.2)	1.6	(0.7)

Of the 23.2 percent of operations that performed laboratory testing for internal parasites, the majority of the fecal testing was completed by a private veterinarian for 45.1 percent of all operations, by a state/university laboratory for 22.4 percent of operations, by the producer or an employee on the operation for 14.9 percent of operations, by a private laboratory for 12.5 percent of operations, and by "other" for 5.1 percent of operations. A private veterinarian completed the majority of the testing on a higher percentage of small operations (70.1 percent) than on large operations (30.8 percent).

E.2.m. For the 23.2 percent of operations that performed laboratory (fecal) testing for intestinal parasites from July 1, 2021, through June 30, 2022 (Table E.2.k.), percentage of operations by person/entity performing majority of fecal tests, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Person	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Self or employee on the operation	29.1	(11.9)	11.3	(7.4)	13.6	(4.9)	8.8	(4.1)	14.9	(3.4)
Private veterinarian	49.9	(12.6)	70.1	(10.4)	42.2	(6.8)	30.8	(6.0)	45.1	(4.4)
State/university laboratory	7.3	(6.3)	11.3	(7.0)	28.6	(6.1)	31.8	(6.1)	22.4	(3.3)
Private laboratory	9.3	(8.5)	0.0	(—)	7.0	(3.0)	28.6	(5.2)	12.5	(2.6)
Other	4.5	(3.4)	7.2	(6.2)	8.6	(4.1)	0.0	(—)	5.1	(1.9)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

Of the 23.2 percent of operations that performed laboratory testing for internal parasites, there were no regional differences in the person/entity performing the majority of the fecal testing. In the Northeast region, no operations used state/university laboratories or “other” persons/entities to perform the majority of fecal tests, and in the Southeast region, no operations used private laboratories to perform the majority of fecal tests.

E.2.n. For the 23.2 percent of operations that performed laboratory (fecal) testing for intestinal parasites from July 1, 2021, through June 30, 2022 (Table E.2.k.), percentage of operations by person/entity performing majority of fecal tests, by region:

	Percent Operations							
	Region							
	Northeast		Southeast		North Central		West	
Person	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Self or employee on the operation	24.1	(15.8)	20.8	(10.0)	13.2	(5.3)	11.8	(4.1)
Private veterinarian	59.6	(17.1)	36.3	(11.6)	54.6	(8.1)	41.3	(5.7)
State/university laboratory	0.0	(—)	27.4	(10.2)	19.8	(6.5)	26.6	(4.7)
Private laboratory	16.3	(14.8)	0.0	(—)	5.2	(3.1)	18.0	(3.4)
Other	0.0	(—)	15.5	(8.3)	7.2	(4.1)	2.3	(1.8)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

3. Vaccination practices and use of veterinarian

Vaccines are designed to prevent or minimize the impact and/or spread of specific diseases. Choosing which vaccines are appropriate for a vaccination program depends on whether the bison are susceptible to the disease and their risk of developing the disease (this, for example, may depend on the geographic region or management practices).

Producers were asked if they had vaccinated any bison against listed diseases or pathogens while they were on range/pasture or in a feedlot. Almost one-third (31.9 percent) of operations vaccinated at least some bison against a disease or pathogen while the animals were on pasture. Roughly one-fifth of operations vaccinated bison on pasture against *Clostridium* species (23.7 percent), brucellosis (18.1 percent), bovine viral diarrhea virus (15.4 percent), and/or bovine respiratory syncytial virus (14.3 percent). About one-tenth vaccinated bison on pasture against infectious bovine rhinotracheitis (12.6 percent), leptospirosis (11.6 percent), *Mycoplasma bovis* (10.8 percent), parainfluenza 3 virus (9.7 percent), and/or *Pasteurella* species (9.0 percent).

A higher percentage of large operations (65.9 percent) gave any vaccinations to any bison on pasture than operations in the other size categories. A higher percentage of medium operations (38.3 percent) than small (19.4 percent) and very small (16.2 percent) operations vaccinated any bison on pasture.

For specific diseases, in general, the percentage of operations that vaccinated bison on pasture was higher for larger operations than for smaller operations.

E.3.a. For the 93.7 percent of operations that had any bison on range/pasture from July 1, 2021, through June 30, 2022 (Table B.2.a.), percentage of operations that vaccinated any bison on **pasture** against the following diseases or pathogens, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Disease/pathogen	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Anthrax	2.2	(1.4)	2.4	(1.4)	3.5	(1.3)	6.5	(2.0)	3.4	(0.7)
Brucellosis	7.8	(2.6)	12.9	(3.1)	19.9	(3.0)	39.7	(4.1)	18.1	(1.6)
Bovine respiratory syncytial virus (BRSV)	8.9	(2.7)	7.7	(2.3)	13.6	(2.5)	34.5	(4.2)	14.3	(1.4)
Bovine viral diarrhea virus (BVDV)	8.0	(2.7)	7.8	(2.4)	16.5	(2.8)	37.3	(4.3)	15.4	(1.5)
Clostridium species (tetanus, blackleg; e.g., 7-way)	10.3	(3.0)	12.7	(3.1)	28.0	(3.3)	55.2	(4.4)	23.7	(1.7)
Infectious bovine rhinotracheitis (IBR)	5.9	(2.3)	6.2	(2.2)	11.6	(2.4)	34.8	(4.1)	12.6	(1.3)
Leptospirosis	5.9	(2.3)	7.0	(2.3)	15.5	(2.6)	21.6	(3.6)	11.6	(1.3)
Mycoplasma bovis	1.3	(1.2)	6.3	(2.3)	8.5	(1.8)	37.2	(4.2)	10.8	(1.1)
Parainfluenza 3 virus (PI3)	6.3	(2.5)	3.9	(1.9)	10.0	(2.3)	23.3	(3.6)	9.7	(1.2)
Pasteurella species	2.5	(1.6)	2.4	(1.4)	7.3	(1.8)	31.8	(4.1)	9.0	(1.1)
Rotavirus/coronavirus	1.3	(1.1)	2.4	(1.4)	2.5	(1.1)	9.8	(2.6)	3.4	(0.7)
Other	1.6	(1.5)	4.4	(2.0)	5.6	(1.9)	2.9	(1.3)	3.7	(0.9)
Any	16.2	(3.7)	19.4	(3.7)	38.3	(3.6)	65.9	(4.2)	31.9	(1.9)

A higher percentage of operations in the West region (36.0 percent) than operations in the North Central region (21.6 percent) vaccinated at least some bison against a disease or pathogen while the animals were on pasture. No operations in the Northeast region vaccinated bison on range/pasture against anthrax, *Pasteurella* species, or rotavirus/coronavirus. A higher percentage of operations in the West region (23.8 percent) than operations in the North Central region (10.6 percent) vaccinated bison on range/pasture against brucellosis. A higher percentage of operations in the Southeast (24.1 percent) and West (17.3 percent) regions than in the North Central region (7.6 percent) vaccinated animals against bovine viral diarrhea virus. Also, a higher percentage of operations in the Southeast (32.4 percent) and West (27.1 percent) regions than in the North Central region (11.6 percent) vaccinated at least some bison on range/pasture against *Clostridium* species. A higher percentage of operations in the West region (15.3 percent) than in the North Central region (3.5 percent) vaccinated any bison against *Mycoplasma bovis.* A higher percentage of operations in the West region than in the North Central region vaccinated any bison for Parainfluenza 3 virus or for *Pasteurella* species.

E.3.b. For the 93.7 percent of operations that had any bison on range/pasture from July 1, 2021, through June 30, 2022 (Table B.2.a.), percentage of operations that vaccinated any bison on **pasture** against the following diseases or pathogens, by region:

Percent Operations

	Region							
	Northeast		**Southeast**		**North Central**		**West**	
Disease/pathogen	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Anthrax	0.0	(—)	3.3	(2.8)	1.2	(1.1)	4.7	(1.1)
Brucellosis	8.6	(4.4)	8.8	(4.3)	10.6	(2.4)	23.8	(2.3)
Bovine respiratory syncytial virus (BRSV)	10.4	(4.7)	24.1	(5.7)	9.5	(2.3)	15.2	(1.9)
Bovine viral diarrhea virus (BVDV)	12.7	(5.1)	24.1	(5.7)	7.6	(2.2)	17.3	(2.0)
Clostridium species (tetanus, blackleg; e.g., 7-way)	21.3	(6.7)	32.4	(6.0)	11.6	(2.6)	27.1	(2.2)
Infectious bovine rhinotracheitis (IBR)	8.6	(4.4)	18.1	(5.3)	6.4	(1.9)	14.5	(1.8)
Leptospirosis	10.9	(4.6)	18.1	(5.3)	6.8	(1.8)	12.5	(1.8)
Mycoplasma bovis	4.0	(3.4)	6.2	(3.6)	3.5	(1.1)	15.3	(1.7)
Parainfluenza 3 virus (PI3)	6.3	(3.9)	12.6	(4.8)	4.6	(1.4)	11.6	(1.7)
Pasteurella species	0.0	(—)	12.1	(4.1)	2.4	(1.0)	12.3	(1.6)
Rotavirus/coronavirus	0.0	(—)	6.0	(3.5)	1.8	(0.8)	4.1	(1.1)
Other	11.1	(5.7)	6.0	(3.7)	3.4	(1.3)	2.2	(0.9)
Any	28.3	(7.7)	32.4	(6.0)	21.6	(3.2)	36.0	(2.6)

Overall, 56.4 percent of all operations that had any bison in feedlot vaccinated at least some bison during the reference period. Nearly one-half (47.4 percent) of all operations vaccinated bison in feedlot against *Clostridium* species. Nearly one-third of operations vaccinated bison against bovine viral diarrhea virus (29.9 percent). Approximately one-quarter of operations vaccinated bison in feedlot against brucellosis (25.2 percent), bovine respiratory syncytial virus (28.2 percent), infectious bovine rhinotracheitis (27.5 percent), *Mycoplasma bovis* (27.5 percent), and/or *Pasteurella* species (20.8 percent). Approximately one-tenth of operations vaccinated bison on feedlot against rotavirus/coronavirus (13.0 percent) and/or anthrax (7.9 percent).

E.3.c. For operations that had any bison in feedlot from July 1, 2021, through June 30, 2022 (Table B.1.a.), percentage of operations that vaccinated bison in **feedlot** against the following diseases or pathogens, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Disease/pathogen	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Anthrax	0.0	(—)	13.8	(10.8)	5.0	(3.6)	9.2	(4.1)	7.9	(2.9)
Brucellosis	11.3	(8.6)	21.6	(12.2)	22.3	(7.1)	32.0	(6.9)	25.2	(4.4)
Bovine respiratory syncytial virus (BRSV)	11.3	(8.6)	13.8	(10.8)	13.6	(6.0)	46.5	(7.4)	28.2	(4.7)
Bovine viral diarrhea virus (BVDV)	11.3	(8.6)	23.7	(12.7)	18.6	(6.7)	43.6	(7.4)	29.9	(4.8)
Clostridium species (tetanus, blackleg; e.g., 7-way)	29.5	(21.2)	23.7	(12.7)	43.4	(9.6)	62.8	(7.0)	47.4	(5.4)
Infectious bovine rhinotracheitis (IBR)	0.0	(—)	23.7	(12.7)	18.6	(6.7)	41.7	(7.4)	27.5	(4.6)
Leptospirosis	11.3	(8.6)	13.8	(10.8)	13.6	(5.9)	16.2	(5.5)	14.5	(3.6)
Mycoplasma bovis	0.0	(—)	23.7	(12.7)	10.0	(4.9)	45.6	(7.3)	27.5	(4.5)
Parainfluenza 3 virus (PI3)	0.0	(—)	23.7	(12.7)	8.6	(4.9)	28.1	(6.4)	19.0	(3.9)
Pasteurella species	0.0	(—)	23.7	(12.7)	0.0	(—)	37.3	(7.2)	20.8	(4.2)
Rotavirus/coronavirus	29.5	(21.2)	23.7	(12.7)	0.0	(—)	12.4	(4.6)	13.0	(4.2)
Other	0.0	(—)	0.0	(—)	5.0	(3.7)	6.1	(3.3)	4.1	(1.8)
Any	40.8	(20.6)	31.5	(13.8)	52.0	(9.9)	71.7	(6.7)	56.4	(5.5)

For operations that had any bison in feedlot, there were few regional differences in the types of diseases or pathogens bison were vaccinated against. Operations in the Northeast region vaccinated bison only for *Clostridium* species and rotavirus/coronavirus.

E.3.d. For operations that had any bison in feedlot from July 1, 2021, through June 30, 2022 (Table B.1.a.), percentage of operations that vaccinated bison in **feedlot** against the following diseases or pathogens, by region:

Percent Operations

	Region							
	Northeast		Southeast		North Central		West	
Disease/pathogen	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Anthrax	0.0	(—)	27.0	(19.1)	0.0	(—)	8.0	(3.1)
Brucellosis	0.0	(—)	27.0	(19.1)	15.5	(8.4)	30.3	(5.5)
Bovine respiratory syncytial virus (BRSV)	0.0	(—)	(D)	(D)	(D)	(D)	36.0	(5.9)
Bovine viral diarrhea virus (BVDV)	0.0	(—)	27.0	(19.1)	21.3	(11.3)	36.0	(5.9)
Clostridium species (tetanus, blackleg; e.g., 7-way)	35.5	(24.4)	50.0	(20.8)	45.2	(13.2)	49.2	(6.1)
Infectious bovine rhinotracheitis (IBR)	0.0	(—)	27.0	(19.1)	21.3	(11.2)	32.6	(5.6)
Leptospirosis	0.0	(—)	(D)	(D)	(D)	(D)	16.2	(4.3)
Mycoplasma bovis	0.0	(—)	27.0	(19.1)	13.6	(10.1)	33.7	(5.5)
Parainfluenza 3 virus (PI3)	0.0	(—)	27.0	(19.1)	21.3	(11.2)	20.2	(4.6)
Pasteurella species	0.0	(—)	27.0	(19.1)	13.6	(10.1)	24.3	(5.1)
Rotavirus/coronavirus	35.5	(24.4)	27.0	(19.1)	13.6	(10.1)	8.0	(3.1)
Other	0.0	(—)	0.0	(—)	0.0	(—)	5.9	(2.5)
Any	35.5	(24.4)	50.0	(20.8)	53.0	(13.6)	60.6	(6.3)

Values of (D) denote too few to report.

Veterinarians can assist with many aspects of herd health, such as disease prevention, pregnancy and bull-fertility testing, diagnosis and treatment of disease, and postmortem examinations. Almost one-third of operations (30.8 percent) had a veterinarian visit the operation in person concerning its bison. A limiting factor for veterinary visits, however, is the relative scarcity of veterinarians in some areas, and especially of those that regularly care for bison.

A higher percentage of large operations (61.7 percent) than operations in any other size category, and a higher percentage of medium operations (40.1 percent) than small (24.2 percent) and very small (12.3 percent) operations, had a veterinarian visit the operation in person concerning its bison.

E.3.e. Percentage of operations that had a veterinarian visit the operation in person for reasons concerning its bison from July 1, 2021, through June 30, 2022, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
12.3	(2.9)	24.2	(3.8)	40.1	(3.5)	61.7	(4.1)	30.8	(1.8)

There were no regional differences in the percentage of operations that had an in-person visit by a veterinarian concerning its bison.

E.3.f. Percentage of operations that had a veterinarian visit the operation in person for reasons concerning its bison from July 1, 2021, through June 30, 2022, by region:

Percent Operations

Region

Northeast		**Southeast**		**North Central**		**West**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
27.0	(6.9)	31.9	(6.3)	24.2	(3.2)	33.7	(2.3)

Of the 30.8 percent of operations that had a veterinarian visit the operation in person concerning its bison, 62.7 percent had a veterinarian visit for vaccination; 40.2 percent for health certificate issuance; 36.0 percent for medical treatment of bison, for illness or injury; 33.2 percent for a reproductive procedure; and 27.8 percent for disease testing/sample collection. Less than one-fifth of operations had a veterinarian visit for consultation (15.8 percent), postmortem exam/necropsy (15.3 percent), tranquilization/handling (11.0 percent), employee training (9.3 percent), “other” reasons (8.6 percent), or euthanasia (3.8 percent). “Other” reasons for veterinary visits included general health checks and assistance with paperwork/records.

A higher percentage of large operations (53.2 percent) than very small operations (11.5 percent) had a veterinarian visit to issue health certificates. No very small operations had a veterinarian visit for a reproductive procedure or euthanasia. A higher percentage of large operations (57.3 percent) than medium (31.6 percent) and small (16.9 percent) operations had a veterinarian visit for a reproductive procedure. A higher percentage of large operations (27.9 percent) than medium operations (10.1 percent) had a veterinarian visit for a postmortem exam/necropsy.

E.3.g. For the 30.8 percent of operations that had a veterinarian visit the operation in person concerning its bison from July 1, 2021, through June 30, 2022 (Table E.3.e.), percentage of operations by reason(s) for visit and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Reason	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Medical treatment of bison, for illness or injury	41.1	(12.0)	29.1	(8.9)	42.3	(5.4)	31.3	(5.1)	36.0	(3.4)
Consultation, such as nutrition or reproduction	25.4	(10.4)	9.7	(5.5)	9.1	(2.2)	22.9	(4.6)	15.8	(2.4)
Vaccination	46.6	(13.6)	46.5	(9.9)	68.8	(5.2)	71.8	(5.0)	62.7	(3.6)
Health certificate issuance	11.5	(6.7)	41.5	(9.8)	38.0	(5.1)	53.2	(5.4)	40.2	(3.4)
Reproductive procedure (e.g., pregnancy check)	0.0	(—)	16.9	(6.7)	31.6	(5.2)	57.3	(5.4)	33.2	(3.2)
Disease testing/sample collection	14.8	(8.5)	15.9	(7.4)	22.7	(4.3)	45.4	(5.3)	27.8	(3.0)
Tranquilization/handling	14.8	(8.5)	9.7	(5.4)	8.9	(3.2)	12.5	(3.8)	11.0	(2.2)
Euthanasia	0.0	(—)	4.9	(4.0)	3.4	(1.9)	5.3	(2.5)	3.8	(1.3)
Postmortem exam/necropsy	6.2	(4.7)	9.7	(5.4)	10.1	(2.9)	27.9	(4.7)	15.3	(2.3)
Employee training	13.8	(8.2)	4.9	(4.0)	3.0	(1.8)	17.1	(3.9)	9.3	(2.0)
Other	33.3	(13.1)	4.9	(4.0)	3.0	(1.6)	7.2	(2.9)	8.6	(2.3)

Of the 30.8 percent of operations that had a veterinarian visit the operation in person concerning its bison, there were few regional differences in the reason for the visit. A smaller percentage of operations in the West (7.9 percent) and North Central (6.5 percent) regions than in the Southeast region (43.5 percent) had a veterinarian visit for tranquilization/handling.

E.3.h. For the 30.8 percent of operations that had a veterinarian visit the operation in person concerning its bison from July 1, 2021, through June 30, 2022 (Table E.3.e.), percentage of operations by reason(s) for visit, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Reason	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Medical treatment of bison, for illness or injury	35.5	(13.3)	79.7	(11.6)	31.2	(7.1)	31.6	(4.1)
Consultation, such as nutrition or reproduction	0.0	(—)	9.9	(7.8)	17.7	(4.9)	18.4	(3.3)
Vaccination	43.5	(17.3)	71.8	(12.5)	69.5	(6.7)	62.3	(4.3)
Health certificate issuance	26.2	(14.0)	28.2	(12.1)	47.5	(7.9)	42.1	(4.2)
Reproductive procedure (e.g., pregnancy check)	7.5	(6.2)	40.7	(13.8)	28.8	(6.6)	36.9	(3.9)
Disease testing/sample collection	20.6	(12.6)	53.5	(12.4)	18.5	(4.9)	27.5	(3.6)
Tranquilization/handling	7.5	(6.2)	43.5	(12.9)	6.5	(3.9)	7.9	(2.5)
Euthanasia	7.5	(6.2)	9.9	(7.8)	0.0	(—)	3.5	(1.4)
Postmortem exam/necropsy	15.0	(7.7)	18.3	(9.9)	6.9	(3.1)	17.1	(2.9)
Employee training	0.0	(—)	9.9	(7.8)	4.0	(3.0)	11.9	(2.7)
Other	22.9	(14.1)	0.0	(—)	4.0	(3.0)	9.0	(2.8)

4. Health problems present in bison on the operation

One of the main health problems that bison face are internal parasites, which need a routine deworming program based on test results of the types and numbers of parasites found on the operations. Diarrhea, going off feed, and weight loss are non-specific health problems, and if identified, an underlying cause may be determined to help guide treatment. Bison are also susceptible to different types of pneumonia and respiratory problems, including *Mannheimia* pneumonia, bovine respiratory disease complex, and bovine respiratory syncytial virus, among others.

Internal parasites were the most common health problem reported and were considered problematic in at least some bison on 22.5 percent of operations. Problems with being off feed/weight loss were present in at least some bison on 13.4 percent of operations, and diarrhea was present in at least some bison on 13.0 percent of operations. Arthritis/lameness problems were present on at least 10.9 percent of operations. Each of the other listed health problems were present on less than 10.0 percent of operations. “Other” health problems included lameness, *Mycoplasma*, cancer, coccidiosis, and pinkeye.

Higher percentages of operations reported problems with internal parasites in bison more than 3 years old and bison 1 to 3 years old (21.0 percent and 21.5 percent, respectively) than bison less than 1 year old (12.2 percent).

Higher percentages of operations reported problems with arthritis/lameness (10.1 percent) in at least some bison more than 3 years old compared with bison in the other age categories. Higher percentages of operations reported problems with at least some bison off feed/weight loss or diarrhea in at least some bison more than 3 years old (11.8 percent and 10.6 percent, respectively) and 1 to 3 years old (8.6 percent and 9.9 percent, respectively) compared with bison less than 1 year old (4.3 percent and 5.2 percent, respectively).

E.4.a. Percentage of operations by health problem(s) present (suspected or confirmed) in any bison from July 1, 2021, through June 30, 2022, and by age of bison:

	Percent Operations							
	Age (years)							
	More than 3		**1 to 3**		**Less than 1**		**All operations**	
Health problem	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Pneumonia/respiratory	5.9	(0.9)	6.1	(0.9)	4.2	(0.7)	9.4	(1.1)
Abortion/reproductive disorder	4.7	(0.8)	2.1	(0.6)	NA	NA	5.2	(0.8)
Arthritis/lameness	10.1	(1.3)	3.4	(0.7)	1.7	(0.5)	10.9	(1.3)
Internal parasites	21.0	(1.8)	21.5	(1.8)	12.2	(1.3)	22.5	(1.7)
Off feed/weight loss	11.8	(1.4)	8.6	(1.2)	4.3	(0.8)	13.4	(1.4)
Diarrhea	10.6	(1.4)	9.9	(1.3)	5.2	(0.9)	13.0	(1.5)
Oral erosions	0.5	(0.3)	0.3	(0.2)	0.4	(0.2)	0.8	(0.4)
Eye lesions	6.9	(1.0)	5.6	(0.9)	4.2	(0.7)	9.4	(1.2)
Toxin exposure	0.3	(0.2)	0.3	(0.2)	0.3	(0.2)	0.3	(0.2)
Other	1.3	(0.4)	1.1	(0.4)	0.9	(0.4)	2.3	(0.5)

NA indicates “abortion/reproductive disorder” was not asked about in bison less than 1 year old.

For the most part, higher percentages of large operations than very small or small operations had health problems present in any bison. A larger percentage of medium operations (38.7 percent) and large operations (34.9 percent) knew of any bison with internal parasites than very small (9.8 percent) or small (12.9 percent) operations. A higher percentage of large operations (24.8 percent) had any bison off feed or with weight loss than very small operations (7.9 percent) or small operations (8.0 percent). A higher percentage of large operations had any bison with pneumonia/respiratory problems (29.7 percent) and arthritis/lameness (29.8 percent) than operations in the other size categories. A higher percentage of large operations (13.9 percent) than very small (2.0 percent) or small (3.9 percent) operations had any bison with abortion or reproductive disorder problems.

E.4.b. Percentage of operations by health problem(s) present (suspected or confirmed) in any bison from July 1, 2021, through June 30, 2022, and by size of operation:

	Percent Operations									
	Size of Operation (number of bison)									
	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Health problem	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Pneumonia/respiratory	3.1	(1.5)	7.6	(2.5)	7.4	(1.9)	29.7	(4.1)	9.4	(1.1)
Abortion/reproductive disorder	2.0	(0.9)	3.9	(1.8)	5.5	(1.5)	13.9	(3.1)	5.2	(0.8)
Arthritis/lameness	6.0	(2.2)	4.8	(2.1)	11.4	(2.4)	29.8	(4.0)	10.9	(1.3)
Internal parasites	9.8	(2.9)	12.9	(3.1)	38.7	(3.7)	34.9	(4.4)	22.5	(1.7)
Off feed/weight loss	7.9	(2.4)	8.0	(2.7)	18.5	(3.1)	24.8	(3.8)	13.4	(1.4)
Diarrhea	8.8	(2.5)	9.7	(2.7)	19.9	(3.2)	15.8	(3.1)	13.0	(1.5)
Oral erosions	1.1	(0.9)	0.0	(—)	0.9	(0.5)	1.3	(1.1)	0.8	(0.4)
Eye lesions	4.4	(1.9)	4.2	(1.9)	13.9	(2.6)	20.1	(3.1)	9.4	(1.2)
Toxin exposure	0.0	(—)	0.0	(—)	1.1	(0.6)	0.0	(—)	0.3	(0.2)
Other	0.0	(—)	1.8	(1.0)	4.7	(1.4)	3.9	(1.8)	2.3	(0.5)

A higher percentage of operations in the West region (13.2 percent) had any bison with pneumonia/respiratory problem than bison in the North Central region (3.5 percent). A higher percentage of operations in the Southeast region had any bison with diarrhea (27.9 percent) than operations in West region (10.3 percent).

E.4.c. Percentage of operations by health problem(s) present (suspected or confirmed) in any bison from July 1, 2021, through June 30, 2022, by region:

Percent Operations

	Region							
	Northeast		**Southeast**		**North Central**		**West**	
Health problem	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Pneumonia/respiratory	2.4	(2.0)	5.8	(3.5)	3.5	(1.5)	13.2	(1.7)
Abortion/reproductive disorder	2.4	(2.0)	6.2	(3.7)	7.4	(1.8)	4.7	(1.0)
Arthritis/lameness	6.7	(4.2)	9.3	(4.6)	8.8	(1.9)	12.6	(1.8)
Internal parasites	30.1	(7.8)	35.2	(6.4)	21.6	(3.2)	19.6	(2.1)
Off feed/weight loss	18.6	(7.4)	17.7	(5.2)	9.1	(2.2)	13.5	(1.8)
Diarrhea	16.7	(6.7)	27.9	(7.3)	12.5	(2.5)	10.3	(1.7)
Oral erosions	0.0	(—)	0.0	(—)	1.2	(0.7)	0.9	(0.6)
Eye lesions	4.3	(3.7)	6.5	(3.9)	8.4	(2.0)	10.9	(1.6)
Toxin exposure	0.0	(—)	0.0	(—)	(D)	(D)	(D)	(D)
Other	4.9	(2.5)	5.5	(3.1)	2.1	(1.2)	1.5	(0.5)

Values of (D) denote too few to report.

A higher percentage of large operations (25.4 percent) than very small (6.3 percent) and small (10.1 percent) operations used antibiotics to treat any individual bison that became sick on the operation. A higher percentage of medium operations (19.3 percent) used antibiotics to treat any individual bison that became sick on the operation than very small operations (6.3 percent).

E.4.d. Percentage of operations that used antibiotics to treat any individual bison that became sick on the operation, by size of operation:

Percent Operations

Size of Operation (number of bison)										
Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
6.3	(2.0)	10.1	(2.7)	19.3	(2.7)	25.4	(3.6)	13.9	(1.3)

There were no regional differences in the percentage of operations that used antibiotics to treat any individual bison that became sick on the operation.

E.4.e. Percentage of operations that used antibiotics to treat any individual bison that became sick on the operation, by region:

Percent Operations							
Region							
Northeast		Southeast		North Central		West	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
8.7	(2.9)	25.6	(5.8)	15.2	(2.8)	12.6	(1.7)

Approximately three-fifths of operations that used antibiotics to treat any individual bison that became sick on the operation always noted information in a record-keeping system related to date(s) treated (64.5 percent), antibiotic given (62.8 percent) and antibiotic dose, regimen, or protocol (59.5 percent).

E.4.f. For the 13.9 percent of operations that used antibiotics to treat any individual bison that became sick on the operation (Table E.4.d.), percentage of operations by how often the listed information was noted in a record-keeping system:

	Percent Operations						
	How Often Information was Noted in Record-Keeping System						
	Always		Sometimes		Never		
Information	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Total
Date(s) treated	64.5	(4.9)	15.5	(3.6)	19.9	(4.4)	100.0
Antibiotic given	62.8	(5.1)	15.5	(3.8)	21.7	(4.5)	100.0
Antibiotic dose, regimen, or protocol	59.5	(5.1)	13.2	(3.4)	27.3	(4.9)	100.0

More than one-half of operations that used antibiotics to treat any individual bison that became sick on the operation reported that veterinarian recommendations (82.7 percent), personal experience (70.3 percent) approved route by which an antibiotic is given (59.1 percent), and duration of action (72.6 percent) were very or extremely important factors in the selection of an antibiotic for treatment of a health problem. Less than one-quarter of operations reported that cost of an antibiotic (11.3 percent) or over the counter availability (23.1 percent) were very or extremely important factors when selecting an antibiotic for treatment of a health problem. Most operations (90.9 percent) reported that drug company advertisement was not important or slightly important when selecting an antibiotic for treatment of a health problem.

E.4.g. For the 13.9 percent of operations that used antibiotics to treat any individual bison that became sick on the operation (Table E.4.d.), percentage of operations by level of importance of the following factors in the selection of an antibiotic for treatment of a health problem:

	Percent Operations										
	Level of Importance										
	Not		Slightly		Moderately		Very		Extremely		
Factor	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Total
Veterinarian recommendations	7.8	(2.9)	1.5	(1.2)	8.0	(3.0)	27.9	(4.6)	54.8	(5.2)	100.0
Other producers' recommendations	31.1	(4.7)	12.9	(3.6)	20.1	(4.2)	29.3	(4.5)	6.6	(2.5)	100.0
Laboratory test results	25.6	(4.4)	9.2	(3.1)	17.8	(4.2)	20.8	(4.3)	26.6	(4.4)	100.0
Drug company advertisement	73.4	(4.4)	17.5	(3.8)	7.5	(2.5)	1.5	(1.3)	0.0	(—)	100.0
Personal experience (past response rates)	13.1	(3.5)	1.2	(0.9)	15.4	(4.0)	39.6	(5.0)	30.7	(4.6)	100.0
Cost of an antibiotic	40.9	(5.2)	20.5	(3.9)	27.3	(4.9)	6.6	(2.4)	4.7	(2.4)	100.0
Approved route by which an antibiotic is given	18.1	(3.9)	7.3	(2.4)	15.4	(3.8)	32.0	(4.8)	27.1	(4.7)	100.0
Duration of action (e.g., needs to be given only once)	10.3	(3.3)	6.7	(2.3)	10.4	(3.3)	36.3	(5.2)	36.3	(5.0)	100.0
Drug withdrawal time	35.1	(4.9)	13.7	(3.3)	13.7	(4.1)	20.9	(4.0)	16.6	(4.1)	100.0
Over the counter availability (i.e., no prescription required)	40.7	(5.1)	17.9	(3.9)	18.2	(4.0)	12.4	(3.6)	10.7	(3.6)	100.0
Other	93.8	(2.7)	0.0	(—)	2.8	(1.6)	0.0	(—)	3.5	(2.2)	100.0

5. Death loss and carcass disposal

Overall, 14.1 percent of operations had bison die from unknown health problems. Parasitism was thought to be a primary cause of bison deaths on 4.3 percent of operations, and “other disease” resulted in deaths on 4.1 percent of operations. Other respiratory illness/pneumonia was thought to have caused deaths on 3.9 percent of operations, and *Mycoplasma bovis* on 3.5 percent of operations. *Mannheimia/Pasteurella* was believed to have caused bison deaths on 2.3 percent of operations, digestive illness on 2.0 percent of operations, nutritional deficiency on 0.9 percent of operations, and malignant catarrhal fever on 0.3 percent of operations. It is important to note that although these diseases were thought to be a cause of death on a low percentage of operations, they could have also negatively affected a high percentage of the bison on those operations.

The percentage of operations that had any bison die because of the listed diseases, disorders, or health problems differed little by age of bison affected. A higher percentage of operations reported deaths in bison more than 3 years old (9.5 percent) due to an unknown health problem than bison 1 to 3 years old (4.2 percent). “Other disease” causes of death included Johne’s disease, coccidiosis, and hardware disease.

E.5.a. Percentage of operations that had any bison die because of the following diseases, disorders, or health problems from July 1, 2021, through June 30, 2022, and by age of bison:

Percent Operations

Age (years)

	More than 3		1 to 3		Less than 1		All operations	
Cause of death	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Mycoplasma bovis (confirmed by vet or lab)	2.9	(0.5)	2.7	(0.5)	1.6	(0.4)	3.5	(0.6)
Malignant catarrhal fever (MCF)	0.2	(0.1)	0.3	(0.2)	0.0	(—)	0.3	(0.2)
Epizootic hemorrhagic disease (EHD)/bluetongue	0.9	(0.3)	0.5	(0.3)	0.4	(0.2)	0.9	(0.3)
Parasitism as primary cause of death	2.2	(0.5)	2.6	(0.6)	2.5	(0.6)	4.3	(0.8)
Mannheimia/Pasteurella	0.9	(0.4)	1.6	(0.5)	0.8	(0.3)	2.3	(0.5)
Other respiratory illness/pneumonia	2.1	(0.6)	1.9	(0.5)	1.3	(0.4)	3.9	(0.7)
Digestive illness	0.7	(0.4)	1.3	(0.5)	0.5	(0.2)	2.0	(0.5)
Neurologic disorder	0.0	(—)	0.0	(—)	(D)	(D)	(D)	(D)
Nutritional deficiency	0.5	(0.2)	0.4	(0.2)	0.6	(0.3)	0.9	(0.3)
Other disease	3.1	(0.7)	0.5	(0.3)	1.3	(0.5)	4.1	(0.8)
Unknown health problem	9.5	(1.2)	4.2	(0.8)	6.8	(1.0)	14.1	(1.4)

Values of (D) denote too few to report.

In general, the percentage of operations that had any bison die because of any of the listed diseases, disorders, or health problems increased as operation size increased.

Only large operations reported any bison lost due to epizootic hemorrhagic disease/bluetongue. A higher percentage of large operations than smaller operations had bison die because of *Mycoplasma bovis* (17.9 percent), *Mannheimia/Pasteurella* (13.2 percent), or other respiratory illness/pneumonia (13.8 percent). A higher percentage of medium operations (11.8 percent) than small (2.0 percent) and very small (0.7 percent) operations reported having bison die because of primary parasitism.

E.5.b. Percentage of operations that had any bison die because of the following diseases, disorders, or health problems from July 1, 2021, through June 30, 2022, by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Cause of death	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Mycoplasma bovis (confirmed by vet or lab)	0.0	(—)	1.2	(1.0)	1.6	(0.7)	17.9	(3.2)	3.5	(0.6)
Malignant catarrhal fever (MCF)	0.0	(—)	0.0	(—)	0.6	(0.5)	1.2	(0.9)	0.3	(0.2)
Epizootic hemorrhagic disease (EHD)/bluetongue	0.0	(—)	0.0	(—)	0.0	(—)	5.7	(2.0)	0.9	(0.3)
Parasitism as primary cause of death	0.7	(0.6)	2.0	(1.2)	11.8	(2.4)	2.7	(1.6)	4.3	(0.8)
Mannheimia/Pasteurella	0.0	(—)	0.0	(—)	1.2	(1.1)	13.2	(2.9)	2.3	(0.5)
Other respiratory illness/pneumonia	1.7	(1.0)	3.5	(1.7)	1.7	(1.1)	13.8	(3.1)	3.9	(0.7)
Digestive illness	0.7	(0.6)	0.0	(—)	1.7	(1.2)	8.8	(2.4)	2.0	(0.5)
Neurologic disorder	0.0	(—)	0.0	(—)	(D)	(D)	0.0	(—)	(D)	(D)
Nutritional deficiency	0.0	(—)	0.0	(—)	1.6	(0.8)	3.1	(1.7)	0.9	(0.3)
Other disease	1.8	(1.2)	2.3	(1.4)	7.9	(1.9)	5.6	(2.1)	4.1	(0.8)
Unknown health problem	6.1	(2.0)	12.4	(3.0)	19.4	(2.9)	26.0	(3.9)	14.1	(1.4)

Values of (D) denote too few to report.

The percentages of operations that had bison die because of the listed diseases, disorders, or health problems did not differ much by region. A higher percentage of operations in the Southeast region (11.5 percent) than in the West region (2.9 percent) reported having bison die because of parasitism as a primary cause of death.

E.5.c. Percentage of operations that had any bison die because of the following diseases, disorders, or health problems from July 1, 2021, through June 30, 2022, by region:

Percent Operations

	Region							
	Northeast		Southeast		North Central		West	
Cause of death	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Mycoplasma bovis (confirmed by vet or lab)	0.0	(—)	0.0	(—)	(D)	(D)	(D)	(D)
Malignant catarrhal fever (MCF)	0.0	(—)	0.0	(—)	0.0	(—)	0.6	(0.3)
Epizootic hemorrhagic disease (EHD)/bluetongue	0.0	(—)	0.0	(—)	0.0	(—)	1.5	(0.5)
Parasitism as primary cause of death	2.0	(1.7)	11.5	(3.4)	6.7	(1.8)	2.9	(0.9)
Mannheimia/Pasteurella	0.0	(—)	2.9	(2.2)	0.0	(—)	3.5	(0.8)
Other respiratory illness/pneumonia	0.0	(—)	3.0	(2.3)	0.0	(—)	6.1	(1.2)
Digestive illness	0.0	(—)	3.0	(2.3)	1.1	(0.7)	2.6	(0.8)
Neurologic disorder	0.0	(—)	0.0	(—)	(D)	(D)	0.0	(—)
Nutritional deficiency	0.0	(—)	0.0	(—)	1.8	(0.9)	0.9	(0.4)
Other disease	2.0	(1.7)	3.0	(2.7)	6.1	(2.0)	3.9	(1.0)
Unknown health problem	8.1	(3.2)	12.9	(5.5)	15.3	(2.7)	15.0	(1.9)

Values of (D) denote too few to report.

Overall, 15.7 percent of operations with any bison deaths had a necropsy performed on one or more of the operation’s dead bison. A higher percentage of large operations (33.2 percent) than all other operation sizes performed necropsies.

E.5.d. For the 45.3 percent of operations that had any bison die or be euthanized due to natural causes from July 1, 2021, through June 30, 2022 (Table A.5.a.), percentage of operations that had necropsies performed on any of the operation's dead bison, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
3.8	(2.9)	6.3	(3.7)	11.3	(3.0)	33.2	(4.4)	15.7	(1.9)

A higher percentage of operations in the Southeast region (39.2 percent) than in the North Central (8.5 percent) and West (14.6 percent) regions had a necropsy performed on one or more of the operation's dead bison.

E.5.e. For the 45.3 percent of operations that had any bison die or be euthanized due to natural causes from July 1, 2021, through June 30, 2022 (Table A.5.a.), percentage of operations that had necropsies performed on any of the operation's dead bison, by region:

Percent Operations

Region

Northeast		Southeast		North Central		West	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
9.0	(7.5)	39.2	(9.3)	8.5	(2.6)	14.6	(2.2)

Of operations that had necropsies performed on any bison, 42.6 percent of operations had the majority of necropsies performed by a private veterinarian, 33.4 percent performed by owner/manager/staff, 15.7 percent performed by a Federal or State veterinarian, and 8.3 percent by "other."

E.5.f. For the 7.1 percent of operations that performed necropsies on any dead bison from July 1, 2021, through June 30, 2022* (Table E.5.d.), percentage of operations by person who performed the majority of necropsies:

Person	Percent operations	Std. error
Owner/manager/staff	33.4	(6.2)
Private veterinarian	42.6	(6.6)
Federal or State veterinarian	15.7	(3.9)
Other	8.3	(4.1)
Total	100.0	(—)

*These estimates come from the 45.3 percent of operations that had any bison die or be euthanized due to natural causes (Table A.5.a.) of which 15.7 percent performed necropsies on any dead bison from July 1, 2021, through June 30, 2022 (Table E.5.d.).

Of the operations that had bison die or be euthanized due to natural causes, nearly one-half used onsite burial (47.4 percent) as the primary method of disposing of dead bison, and 36.7 percent used no disposal method—that is, leaving the carcass to nature/scavengers. A higher percentage of very small operations (71.8 percent) than medium (41.7 percent) and large (38.6 percent) operations used on-site burial.

E.5.g. For the 45.3 percent of operations that had any bison die or be euthanized due to natural causes from July 1, 2021, through June 30, 2022 (Table A.5.a.), percentage of operations by primary method of disposing of dead bison, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Primary disposal method	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Composted	3.2	(2.6)	0.0	(—)	13.0	(3.0)	9.7	(2.8)	8.1	(1.5)
Onsite burial	71.8	(8.9)	53.5	(7.6)	41.7	(4.6)	38.6	(4.7)	47.4	(3.0)
Sent to landfill	5.3	(4.7)	0.0	(—)	1.0	(0.8)	1.2	(1.0)	1.5	(0.8)
Rendered	0.0	(—)	0.0	(—)	1.3	(1.2)	1.2	(0.9)	0.8	(0.5)
Incinerated	3.8	(2.9)	6.7	(3.8)	3.3	(1.3)	0.0	(—)	3.0	(1.0)
No disposal method (left to nature/scavengers)	15.8	(7.4)	36.5	(7.5)	37.5	(4.4)	46.1	(4.7)	36.7	(2.8)
Other	0.0	(—)	3.4	(3.1)	2.1	(1.0)	3.2	(1.8)	2.4	(0.9)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

A higher percentage of operations in the West region (44.8 percent) than in the North Central region (22.8 percent) used no disposal method as the primary method of disposing of dead bison.

E.5.h. For the 45.3 percent of operations that had any bison die or be euthanized due to natural causes from July 1, 2021, through June 30, 2022 (Table A.5.a.), percentage of operations by primary method of disposing of dead bison, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Primary disposal method	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Composted	15.2	(9.4)	5.4	(4.2)	12.3	(4.0)	6.6	(1.6)
Onsite burial	69.5	(11.0)	59.5	(9.5)	58.0	(6.0)	40.3	(3.7)
Sent to landfill	0.0	(—)	0.0	(—)	0.0	(—)	2.3	(1.3)
Rendered	0.0	(—)	0.0	(—)	2.5	(2.3)	0.6	(0.4)
Incinerated	0.0	(—)	5.4	(4.2)	4.3	(1.9)	2.6	(1.3)
No disposal method (left to nature/scavengers)	15.2	(9.4)	24.4	(8.3)	22.8	(4.8)	44.8	(3.7)
Other	0.0	(—)	5.4	(4.2)	0.0	(—)	2.8	(1.2)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

6. Abnormally high death loss within the past 5 years

Producers were asked whether the operation experienced one or more months of abnormally high disease-related death loss within the bison herd within the past 5 years. Abnormally high death loss was defined as a level of death loss in the herd more than twice what the producer would normally expect.

Overall, 12.7 percent of operations experienced 1 or more months of abnormally high death loss in the bison herd within the past 5 years. A higher percentage of large operations (30.4 percent) than all other operation size categories had experienced 1 or more months of abnormally high death loss.

E.6.a. Percentage of operations that had 1 or more months of abnormally high disease-related death loss in the bison herd within the past 5 years, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
6.0	(2.0)	8.5	(2.6)	13.7	(2.3)	30.4	(4.0)	12.7	(1.3)

There were no substantial differences by region in the percentages of operations that had experienced 1 or more months of abnormally high death loss in the bison herd within the past 5 years.

E.6.b. Percentage of operations that had 1 or more months of abnormally high disease-related death loss in the bison herd within the past 5 years, by region:

Percent Operations							
Region							
Northeast		Southeast		North Central		West	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
6.0	(3.7)	20.9	(5.8)	12.1	(2.4)	12.7	(1.7)

During the more recent period of abnormally high death loss, over one-half of operations experienced abnormally high death loss in bison more than 3 years old, 1 to 3 years old, or less than 1 year old. Approximately one-fifth of operations (21.1 percent) experienced abnormally high death loss of fetuses.

E.6.c. For the 12.7 percent of operations that experienced 1 or more months of abnormally high disease-related death loss within the past 5 years (Table E.6.a.), percentage of operations by age of bison affected during the most recent period of abnormally high death loss:

Age	Percent operations*	Std. error
More than 3	66.9	(5.4)
1 to 3	60.7	(5.6)
Less than 1	52.4	(5.9)
Bison fetuses (spontaneous abortions)	21.1	(4.9)

*For operations that had the age group present during the most recent period of abnormally high death loss.

During the most recent period of abnormally high death loss, nearly three-quarters of operations observed severe weight loss (74.8 percent) or isolation from the herd (67.7 percent) before they died. Slightly more than three-fifths of operations observed reluctance to move (64.1 percent), and about one-half of operations observed coughing or breathing difficulty (50.3 percent) and/or diarrhea/scours (47.3 percent). Nearly one-third of operations observed lameness (29.9 percent) in bison before they died.

E.6.d. For the 12.7 percent of operations that experienced 1 or more months of abnormally high disease-related death loss within the past 5 years (Table E.6.a.), percentage of operations by sign(s) observed in bison before they died during the most recent period of abnormally high death loss:

Sign seen	Percent operations	Std. error
Reluctance to move	64.1	(5.4)
Lameness	29.9	(4.9)
Coughing or breathing difficulty	50.3	(5.3)
Severe weight loss	74.8	(4.6)
Diarrhea/scours	47.3	(5.4)
Isolation from the herd	67.7	(5.3)

During the most recent period of abnormally high death loss, 33.8 percent of operations received a confirmed diagnosis of *Mycoplasma bovis* from a veterinarian or diagnostic laboratory. About one-fifth of operations received a diagnosis of internal and/or external parasitism (21.3 percent) and/or “other” causes (19.9 percent), and 1.5 percent had malignant catarrhal fever confirmed. Parasites identified included *Haemonchus* and coccidia. “Other” diseases identified included toxicities, epizootic hemorrhagic disease, *Mannheimia/Pasteurella*, and Johne’s disease.

E.6.e. For the 12.7 percent of operations that experienced 1 or more months of abnormally high disease-related death loss within the past 5 years (Table E.6.a.), percentage of operations that received a confirmed diagnosis for the following diseases from a veterinarian or diagnostic laboratory during the most recent period of abnormally high death loss:

Disease	Percent operations	Std. error
Mycoplasma bovis	33.8	(4.8)
Malignant catarrhal fever (MCF)	1.5	(1.2)
Parasitism (internal and/or external)	21.3	(4.7)
Other	19.9	(4.2)

F. Disease Testing Practices

1. Testing for bovine tuberculosis (TB)

Bovine tuberculosis (TB) is a contagious, infectious disease of animals and humans caused by *Mycobacterium bovis*. In bison, the disease is spread by direct contact, inhalation of infected droplets from sick animals, and ingestion of contaminated feed. Bison usually show no clinical signs of TB unless the disease has affected multiple organ systems and is very advanced, which is uncommon. Testing for TB depends on using an effective testing technique with an intradermal injection of tuberculin. To test bison for TB, producers can work with a veterinarian who will conduct and evaluate the results of tuberculin tests. Producers can reduce their risk of getting the disease by adding only test negative livestock from known negative herds to their own herds.

Overall, about one-third of operations (34.5 percent) had ever tested any bison for TB, either on farm or prior to purchase/arrival on farm. A higher percentage of large operations (57.6 percent) had ever tested any bison for TB than operations in the other size categories. A higher percentage of medium operations (41.2 percent) had ever tested any bison for TB than very small operations (22.0 percent).

F.1.a. Percentage of operations that ever had any bison tested for TB, either on farm or prior to purchase/arrival on farm, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
22.0	(3.5)	28.1	(4.5)	41.2	(3.6)	57.6	(4.0)	34.5	(2.0)

There were no regional differences in the percentage of operations that had ever tested any bison for TB, either on farm or prior to purchase/arrival on farm.

F.1.b. Percentage of operations that ever had any bison tested for TB, either on farm or prior to purchase/arrival on farm, by region:

Percent Operations

Region

Northeast		**Southeast**		**North Central**		**West**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
30.0	(7.2)	41.4	(7.6)	36.5	(3.8)	33.5	(2.5)

For the 34.5 percent of operations that had ever had any bison tested for TB, more than 5 years had passed since the last TB test for 43.8 percent of operations. For 12.5 percent of operations, less than 1 year had passed since the most recent test. Less than 1 year had passed since the last TB test for a higher percentage of large operations (22.8 percent) than very small operations (2.3 percent).

F.1.c. For the 34.5 percent of operations that had ever had any bison tested for TB (Table F.1.a.), percentage of operations by years since most recent TB test for any of the operation's bison, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Years since TB test	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Less than 1	2.3	(1.7)	17.0	(6.8)	7.9	(2.6)	22.8	(4.8)	12.5	(2.1)
1 to 2	14.2	(7.0)	5.8	(4.8)	19.2	(4.3)	19.6	(4.2)	15.8	(2.5)
2 to 3	11.7	(6.1)	9.2	(5.6)	10.1	(3.4)	13.0	(3.7)	11.1	(2.3)
3 to 5	21.0	(7.7)	13.8	(6.1)	17.7	(4.3)	14.6	(4.0)	16.8	(2.7)
More than 5	50.9	(8.8)	54.2	(9.0)	45.1	(5.6)	29.9	(5.0)	43.8	(3.4)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

For the 34.5 percent of operations that had ever had any bison tested for TB, no operations in the Southeast region had any bison tested for TB in less than one year. A higher percentage of operations in the Northeast region (48.4 percent) than in the North Central (10.9 percent) or West (9.5 percent) regions had 1 to 2 years pass since any bison had been tested for TB. A higher percentage of operations in the North Central region (65.7 percent) than the West region (39.4 percent) had more than 5 years pass since any bison were tested for TB.

F.1.d. For the 34.5 percent of operations that had ever had any bison tested for TB (Table F.1.a.), percentage of operations by years since most recent TB test for any of the operation's bison, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Years since TB test	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Less than 1	(D)	(D)	0.0	(—)	(D)	(D)	16.4	(2.9)
1 to 2	48.4	(14.3)	33.6	(9.5)	10.9	(3.1)	9.5	(2.7)
2 to 3	(D)	(D)	7.6	(7.0)	(D)	(D)	15.2	(3.3)
3 to 5	0.0	(—)	22.9	(10.0)	13.3	(4.7)	19.5	(3.7)
More than 5	26.7	(12.4)	35.9	(10.9)	65.7	(5.8)	39.4	(4.4)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

Values of (D) denote too few to report.

For the 34.5 percent of operations that had ever had any bison tested for TB, almost one-half (48.7 percent) had only specific bison tested during the most recent test. About one-quarter (24.2 percent) had the entire herd tested.

A higher percentage of very small operations (65.8 percent) than operations in all other size categories had the entire herd tested during the most recent test. In keeping with this finding, a higher percentage of small operations (56.8 percent), medium operations (53.4 percent), and large operations (62.6 percent) than very small operations (16.2 percent) had only specific bison tested during the most recent test.

F.1.e. For the 34.5 percent of operations that had ever had any bison tested for TB (Table F.1.a.), percentage of operations by bison tested for TB during the operation's most recent test, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Bison tested	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Entire herd	65.8	(8.2)	18.0	(6.8)	9.9	(3.0)	13.4	(3.6)	24.2	(3.2)
Bison less than 1 year only	8.4	(4.9)	6.3	(3.9)	26.1	(5.3)	8.8	(3.2)	13.9	(2.4)
Bison 1 year and older only	5.4	(3.1)	18.9	(7.4)	8.0	(2.7)	10.1	(3.6)	10.0	(2.1)
Specific bison only	16.2	(6.3)	56.8	(9.1)	53.4	(5.7)	62.6	(5.7)	48.7	(3.5)
Other	4.2	(3.6)	0.0	(—)	2.7	(1.5)	5.0	(2.3)	3.2	(1.1)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

For operations that had ever had bison tested for TB, there were no regional differences in the percentage of operations by bison tested for TB during the operation's most recent test.

F.1.f. For the 34.5 percent of operations that had ever had any bison tested for TB (Table F.1.a.), percentage of operations by bison tested for TB during the operation's most recent test, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Bison tested	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Entire herd	27.1	(14.5)	28.2	(10.8)	27.5	(5.7)	21.7	(4.0)
Bison less than 1 year only	12.4	(10.3)	15.3	(8.5)	9.9	(4.1)	15.4	(3.2)
Bison 1 year and older only	19.6	(11.4)	6.5	(5.1)	10.9	(4.0)	8.9	(2.5)
Specific bison only	40.9	(13.7)	42.4	(11.3)	48.3	(6.3)	51.4	(4.6)
Other	0.0	(—)	7.6	(6.3)	3.4	(1.9)	2.7	(1.2)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

Operations that had ever had any bison tested for TB were asked why the bison were tested for TB during the most recent test. Respondents could select as many reasons as were applicable. For operations that had ever had any bison tested for TB, three-fifths (59.5 percent) had bison tested because of a movement requirement and slightly more than one-half (55.2 percent) had bison tested because of a sale requirement. More than one-third (35.8 percent) had bison tested because of a State requirement.

There were no size differences in the percentage of operations by reason for most recent test for TB.

F.1.g. For the 34.5 percent of operations that had ever had any bison tested for TB (Table F.1.a.), percentage of operations by reason(s) for most recent test for TB, and by size of operation:

Percent Operations

Size of Operation (number of bison)

Reason	Very small (1–9) Pct.	Std. error	Small (10–24) Pct.	Std. error	Medium (25–99) Pct.	Std. error	Large (100 or more) Pct.	Std. error	All operations Pct.	Std. error
Herd accreditation for TB-free status	32.6	(9.0)	8.7	(5.3)	10.7	(3.4)	12.1	(3.5)	15.1	(2.6)
Movement requirement	68.4	(9.0)	62.6	(8.9)	57.3	(5.7)	53.6	(5.7)	59.5	(3.4)
Show or exhibition requirement	5.2	(4.6)	16.6	(7.5)	27.3	(5.2)	25.1	(4.9)	20.2	(2.8)
State requirement	33.8	(8.8)	34.9	(8.9)	35.9	(5.7)	37.9	(5.4)	35.8	(3.4)
Veterinarian (nonregulatory, private practitioner) recommendation	13.3	(5.7)	24.0	(7.9)	18.7	(4.9)	5.8	(2.5)	15.0	(2.6)
Sale requirement	49.7	(9.1)	50.3	(9.2)	61.1	(5.7)	55.3	(5.7)	55.2	(3.5)
Other	10.8	(6.2)	0.0	(—)	3.8	(2.4)	5.1	(2.3)	4.9	(1.7)

During the most recent test for TB, no operations in the Northeast region had any bison tested for herd accreditation for TB-free status. A higher percentage of operations in the Northeast region (80.4 percent) than operations in the other regions had bison tested most recently for a State requirement.

F.1.h. For the 34.5 percent of operations that had ever had any bison tested for TB (Table F.1.a.), percentage of operations by reason(s) for most recent test for TB, by region:

Percent Operations

Region

Reason	Northeast Pct.	Std. error	Southeast Pct.	Std. error	North Central Pct.	Std. error	West Pct.	Std. error
Herd accreditation for TB-free status	0.0	(—)	23.6	(9.9)	20.9	(5.4)	13.7	(3.4)
Movement requirement	68.0	(12.5)	77.7	(10.2)	48.5	(6.3)	58.9	(4.6)
Show or exhibition requirement	26.7	(12.8)	15.3	(8.6)	14.7	(4.7)	22.2	(3.8)
State requirement	80.4	(11.7)	22.3	(9.9)	26.1	(4.8)	35.1	(4.4)
Veterinarian (nonregulatory, private practitioner) recommendation	24.9	(13.4)	15.3	(8.2)	9.5	(3.4)	15.5	(3.5)
Sale requirement	33.8	(13.6)	70.7	(11.4)	44.2	(6.4)	59.9	(4.4)
Other	12.4	(10.3)	(D)	(D)	(D)	(D)	4.5	(2.0)

Values of (D) denote too few to report.

An accredited herd is one that has passed at least two consecutive official TB tests of all eligible animals conducted at 9- to 15-month intervals and has no evidence of, or exposure potential to, bovine TB. Accredited herd status is maintained through annual testing. Official TB tests are conducted by State or Federal animal health veterinarians or other Accredited Veterinarians.

For the 34.5 percent of operations that had ever had any bison tested for TB, 4.5 percent of all operations had an Accredited Herd for Tuberculosis designation or were in the process of becoming an accredited herd. No small operations had an Accredited Herd for Tuberculosis designation or were in the process of becoming an accredited herd. Otherwise, there were no differences in operation size in the percentages of operations with or in the process of obtaining accreditation. By becoming an accredited herd, an operation helps with the control and eradication of bovine TB in the United States.

F.1.i. For the 34.5 percent of operations that had ever had any bison tested for TB (Table F.1.a.), percentage of operations that had an Accredited Herd for Tuberculosis designation or were in the process of becoming an Accredited Herd, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
7.4	(4.7)	0.0	(—)	6.5	(2.9)	3.2	(2.0)	4.5	(1.5)

No operations in the Northeast region had an Accredited Herd for Tuberculosis designation or were in the process of becoming an accredited herd.

F.1.j. For the 34.5 percent of operations that had ever had any bison tested for TB (Table F.1.a.), percentage of operations that had an Accredited Herd for Tuberculosis designation or were in the process of becoming an Accredited Herd, by region:

Percent Operations

Region

Northeast		**Southeast**		**North Central**		**West**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
0.0	(—)	6.5	(5.9)	5.0	(2.1)	4.5	(2.0)

2. Testing for brucellosis

About one-third of all operations (31.8 percent) had ever had any bison tested for brucellosis. The percentage of operations that had tested for brucellosis at some point increased, in general, as operation size increased; a higher percentage of large operations (53.3 percent) had ever tested bison for brucellosis than small (22.9 percent) or very small (22.5 percent) operations.

F.2.a. Percentage of operations that had ever had any bison tested for brucellosis, either on farm or prior to purchase/arrival on farm, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
22.5	(3.5)	22.9	(4.3)	38.1	(3.4)	53.3	(4.4)	31.8	(2.0)

There were no differences by region in the percentages of operations that had ever had any bison tested for brucellosis.

F.2.b. Percentage of operations that had ever had any bison tested for brucellosis, either on farm or prior to purchase/arrival on farm, by region:

Percent Operations

Region

Northeast		Southeast		North Central		West	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
21.0	(6.0)	36.7	(8.0)	28.0	(3.6)	34.1	(2.5)

Operators that had ever had any bison tested for brucellosis were asked why the bison were tested during the most recent test; respondents could provide more than one purpose for testing. Almost two-thirds of operations (64.5 percent) had most recently tested bison for brucellosis because of a sale requirement, and about three-fifths (61.3 percent) had tested for a movement requirement. About two-fifths (42.9 percent) had tested most recently for a State requirement. Roughly one-fifth had tested for a show or exhibition requirement (21.8 percent), veterinarian recommendation (18.3 percent), or herd accreditation for brucellosis-free status (16.7 percent).

There were few differences by operation size in the reasons given for the most recent brucellosis testing. No very small operations tested for a show or exhibition requirement. A higher percentage of very small operations (39.8 percent) than medium (12.0 percent) or large (13.2 percent) operations had tested bison most recently based on a veterinarian recommendation. A higher percentage of medium operations (79.8 percent) than very small (50.6 percent) or large (56.8 percent) operations had tested most recently for a sale requirement.

F.2.c. For the 31.8 percent of operations that had ever had any bison tested for brucellosis (Table F.2.a.), percentage of operations by reason(s) for most recent test for brucellosis, and by size of operation:

	Percent Operations									
	Size of Operation (number of bison)									
	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Reason	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Herd accreditation for brucellosis-free status	29.1	(8.5)	14.6	(7.0)	8.4	(2.7)	17.4	(4.3)	16.7	(2.8)
Movement requirement	76.5	(7.4)	45.4	(10.0)	54.7	(5.9)	66.0	(5.8)	61.3	(3.6)
Show or exhibition requirement	0.0	(—)	18.5	(8.2)	30.1	(5.4)	32.7	(5.5)	21.8	(2.9)
State requirement	50.3	(8.6)	33.6	(9.6)	36.4	(5.6)	50.3	(5.7)	42.9	(3.6)
Veterinarian (nonregulatory, private practitioner) recommendation	39.8	(8.8)	9.2	(5.2)	12.0	(4.0)	13.2	(4.1)	18.3	(3.0)
Sale requirement	50.6	(9.0)	66.9	(9.4)	79.8	(4.7)	56.8	(5.9)	64.5	(3.5)
Other	4.6	(3.8)	(D)	(D)	(D)	(D)	5.9	(2.8)	4.0	(1.4)

Values of (D) denote too few to report.

There were few differences by region for the reason(s) operations had tested for brucellosis most recently. No operations in the Northeast region had tested for brucellosis most recently for herd accreditation, which might be because States in the Northeast are considered free of brucellosis.

F.2.d. For the 31.8 percent of operations that had ever had any bison tested for brucellosis (Table F.2.a.), percentage of operations by reason(s) for most recent test for brucellosis, by region:

	Percent Operations							
	Region							
	Northeast		Southeast		North Central		West	
Reason	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Herd accreditation for brucellosis-free status	0.0	(—)	16.4	(9.2)	15.9	(5.6)	18.6	(3.7)
Movement requirement	70.3	(16.5)	74.7	(11.3)	48.7	(7.8)	61.9	(4.3)
Show or exhibition requirement	40.5	(17.5)	17.8	(10.1)	18.1	(5.6)	21.8	(3.4)
State requirement	59.5	(17.2)	24.0	(10.5)	35.5	(7.0)	46.5	(4.5)
Veterinarian (nonregulatory, private practitioner) recommendation	18.9	(14.5)	7.5	(5.8)	9.7	(3.8)	22.5	(4.1)
Sale requirement	40.5	(17.5)	76.0	(10.8)	76.2	(6.9)	61.6	(4.4)
Other	10.8	(9.3)	0.0	(—)	4.1	(2.3)	3.9	(1.9)

Overall, 9.6 percent of operations that had ever had any bison tested for brucellosis had a Certified Brucellosis-free Herd designation or were in the process of acquiring that designation. There were no substantial differences in this percentage by size of operation.

F.2.e. For the 31.8 percent of operations that had ever had any bison tested for brucellosis (Table F.2.a.), percentage of operations that had a Certified Brucellosis-free Herd designation or were in the process of becoming a Certified Brucellosis-free Herd, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
2.5	(1.8)	11.4	(6.6)	10.4	(3.6)	13.3	(4.3)	9.6	(2.1)

No operations in the Northeast region had ever had bison tested as part of the process for acquiring a Certified Brucellosis-free Herd designation. For the other three regions, there were no differences in the percentages of operations that had a Certified Brucellosis-free Herd designation or were in the process of trying to acquire that designation.

F.2.f. For the 31.8 percent of operations that had ever had any bison tested for brucellosis (Table F.2.a.), percentage of operations that had a Certified Brucellosis-free Herd designation or were in the process of becoming a Certified Brucellosis-free Herd, by region:

Percent Operations

Region

Northeast		**Southeast**		**North Central**		**West**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
0.0	(—)	15.1	(8.8)	6.9	(3.2)	10.3	(2.7)

3. Producer concern about disease testing

Handling or working bison for any reason, including disease testing, can be costly, time-consuming, and potentially harmful for both the bison and the humans. In general, producers were more concerned about stress on the bison from testing and bison injuries or deaths from handling than about the other four issues (expense of testing, reliability of tests, amount of time required for testing, and lack of facilities to restrain bison for testing). About one-half of respondents were not concerned about lack of facilities to restrain bison for testing (52.0 percent), reliability of tests (50.1 percent), expense of testing (44.9 percent), or amount of time required for testing (44.6 percent).

F.3.a. Percentage of operations by how concerned respondent was about the following issues and challenges related to testing bison for diseases:

	Percent Operations										
	How Concerned										
	Not		Slightly		Moderately		Very		Extremely		
Issue/challenge	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Total
Expense of testing	44.9	(2.2)	14.0	(1.4)	23.6	(1.9)	11.3	(1.4)	6.2	(1.0)	100.0
Stress on bison from testing	25.9	(2.0)	9.0	(1.3)	23.5	(1.9)	25.0	(1.9)	16.6	(1.6)	100.0
Bison injuries or deaths from handling	26.0	(2.0)	13.1	(1.5)	21.4	(1.9)	24.4	(1.8)	15.1	(1.6)	100.0
Reliability of tests (e.g., false-positive results)	50.1	(2.2)	19.7	(1.7)	17.2	(1.6)	8.9	(1.2)	4.1	(0.8)	100.0
Amount of time required for testing	44.6	(2.2)	15.1	(1.5)	21.4	(1.8)	12.8	(1.4)	6.0	(1.0)	100.0
Lack of facilities to restrain bison for testing	52.0	(2.2)	10.6	(1.3)	11.9	(1.5)	9.7	(1.4)	15.9	(1.7)	100.0

To evaluate responses about operator concerns associated with disease testing of bison by operation size, responses of “moderately,” “very,” and “extremely” concerned were combined. Overall, more than three-fifths of operation respondents were moderately, very, or extremely concerned about stress on bison from testing (65.1 percent) and bison injuries or deaths from handling (60.9 percent). About two-fifths of operation respondents were moderately, very, or extremely concerned about the expense of testing (41.1 percent), amount of time required for testing (40.2 percent), and lack of facilities to restrain bison for testing (37.5 percent).

A lower percentage of very small operations (45.5 percent) than operations in the other size categories were moderately, very, or extremely concerned about stress on bison from testing. Also, a lower percentage of very small operations than medium or large operations were moderately, very, or extremely concerned about bison injuries or deaths from handling or the amount of time required for testing. A higher percentage of very small operations (47.5 percent) than medium (31.5 percent) or large (19.1 percent) operations were moderately, very, or extremely concerned about the lack of facilities to restrain bison for testing.

F.3.b. Percentage of operations in which respondent was moderately, very, or extremely concerned about the following issues and challenges related to testing bison for diseases, by size of operation:

	Percent Operations									
	Size of Operation (number of bison)									
	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Issue/challenge	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Expense of testing	34.4	(4.3)	46.6	(4.9)	40.5	(3.6)	48.1	(4.2)	41.1	(2.1)
Stress on bison from testing	45.5	(4.6)	68.0	(4.5)	74.8	(3.3)	82.6	(3.4)	65.1	(2.1)
Bison injuries or deaths from handling	45.9	(4.5)	62.4	(4.6)	72.4	(3.3)	68.8	(4.1)	60.9	(2.1)
Reliability of tests (e.g., false-positive results)	24.5	(3.9)	30.8	(4.5)	30.9	(3.4)	39.2	(4.1)	30.2	(2.0)
Amount of time required for testing	27.2	(4.1)	39.1	(4.9)	47.5	(3.6)	55.4	(4.3)	40.2	(2.1)
Lack of facilities to restrain bison for testing	47.5	(4.5)	43.8	(4.9)	31.5	(3.5)	19.1	(3.7)	37.5	(2.2)

A higher percentage of operations in the Southeast region (65.6 percent) than in Northeast (26.8 percent) or West (38.8 percent) regions were moderately, very, or extremely concerned about the expense of testing bison for diseases.

F.3.c. Percentage of operations in which respondent was moderately, very, or extremely concerned about the following issues and challenges related to testing bison for diseases, by region:

	Percent Operations							
	Region							
	Northeast		Southeast		North Central		West	
Issue/challenge	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Expense of testing	26.8	(6.9)	65.6	(7.4)	43.8	(4.2)	38.8	(2.8)
Stress on bison from testing	48.3	(8.7)	68.8	(6.7)	66.5	(3.5)	66.8	(2.8)
Bison injuries or deaths from handling	53.0	(8.7)	72.1	(6.7)	60.8	(3.6)	60.5	(2.8)
Reliability of tests (e.g., false-positive results)	26.8	(7.3)	31.2	(7.0)	30.8	(3.6)	30.4	(2.6)
Amount of time required for testing	41.4	(8.3)	49.8	(7.1)	41.9	(4.1)	38.1	(2.7)
Lack of facilities to restrain bison for testing	36.1	(8.7)	40.9	(7.9)	40.5	(3.7)	36.1	(2.8)

G. Bison Shipments and Movements

Information about animal movement on and off operations, including the sites from which animals are obtained and the final destinations to which they are sent, as well as the distances traveled, can help researchers and government agencies prepare for and respond to potential disease outbreaks and provide a better understanding about how diseases spread across the United States. Animal movements are an important piece of information related to potential disease spread.

The sample sizes for this section were smaller than those in other sections. To facilitate some of the analyses later in the section, the operations were categorized as small (1 to 99 bison, combining the usual very small, small, and medium categories) or large (100 or more bison). Similarly, the operation regions were recategorized as West and Other (combining Northeast, Southeast, and North Central).

1. Bison added to the operation from offsite sources

About one-fifth of all operations (19.5 percent) added bison to the herd from offsite sources during the reference period. Higher percentages of large (32.3 percent) and medium (29.5 percent) operations than very small operations (6.0 percent) added bison to the herd from offsite sources.

G.1.a. Percentage of operations that added any bison to the herd from offsite sources from July 1, 2021, through June 30, 2022, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
6.0	(2.2)	17.3	(3.6)	29.5	(3.4)	32.3	(4.4)	19.5	(1.7)

The percentages of operations that added bison to the herd from offsite sources during the reference period did not differ by region.

G.1.b. Percentage of operations that added any bison to the herd from offsite sources from July 1, 2021, through June 30, 2022, by region:

Percent Operations

Region

Northeast		Southeast		North Central		West	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
18.9	(6.7)	25.9	(7.1)	20.6	(3.4)	18.3	(2.0)

About one in seven operations added bison to the operation's herd through private sales. A lower percentage of very small operations (5.4 percent) obtained bison through private sale than large (25.3 percent) or medium (17.7 percent) operations.

G.1.c. Percentage of operations that added any bison to the herd from offsite sources from July 1, 2021, through June 30, 2022, by source of bison and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Source	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Private sale	5.4	(2.2)	13.6	(3.4)	17.7	(3.2)	25.3	(4.2)	13.9	(1.5)
Trade	0.0	(—)	1.3	(1.1)	1.5	(0.8)	2.4	(1.2)	1.1	(0.4)
Auction/sale barn	1.5	(0.9)	2.7	(1.6)	6.2	(1.7)	8.1	(2.6)	4.1	(0.8)
Dealer/broker	(D)	(D)	0.0	(—)	(D)	(D)	0.0	(—)	0.5	(0.3)
Other	0.0	(—)	0.0	(—)	0.0	(—)	(D)	(D)	(D)	(D)

Values of (D) denote too few to report.

The only source of bison used by operations in all regions was private sale, and the percentages of operations that added bison through private sale did not differ by region. Almost 5 percent of operations in the Southeast, North Central, and West regions, and no operations in the Northeast region, added any bison to the operation's herd from auctions/sale barns.

G.1.d. Percentage of operations that added any bison to the herd from offsite sources from July 1, 2021, through June 30, 2022, by source of bison, by region:

Percent Operations

Region

	Northeast		Southeast		North Central		West	
Source	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Private sale	18.9	(6.7)	22.9	(6.7)	15.6	(3.3)	11.3	(1.7)
Trade	0.0	(—)	0.0	(—)	0.0	(—)	1.8	(0.7)
Auction/sale barn	0.0	(—)	4.1	(3.5)	4.1	(1.7)	4.8	(1.1)
Dealer/broker	0.0	(—)	0.0	(—)	(D)	(D)	(D)	(D)
Other	0.0	(—)	0.0	(—)	(D)	(D)	0.0	(—)

Values of (D) denote too few to report.

For operations that added bison to the operation's herd from offsite sources during the reference period, an average of 2.3 shipments, with an average of 7.1 bison per shipment, arrived from private-sale sources. An average of 1.4 shipments, carrying an average of 6.8 bison, came from auctions/sale barns.

G.1.e. For the operations that added any bison to the operation's herd from the following offsite sources from July 1, 2021, through June 30, 2022 (Table G.1.c.), operation average number of shipments and number of bison per shipment, by source of bison:

Shipments and Bison per Shipment (number)

Source	Average Number of Shipments		Average Number of Bison per Shipment	
	Number	Std. error	Number	Std. error
Private sale	2.3	(0.7)	7.1	(1.4)
Trade	1.0	(0.0)	1.6	(0.2)
Auction/sale barn	1.4	(0.2)	6.8	(1.0)
Dealer/broker	1.0	(0.0)	1.7	(0.2)
Other	(D)	(D)	(D)	(D)

Values of (D) denote too few to report.

Overall, operations that added bison to their herd from the listed offsite sources during the reference period received an average of 2.3 shipments from private sales, 1.4 shipments from auctions/sale barns, and one shipment each from trade sources or dealers/brokers.

Note: As described above in the opening paragraphs for this section, it was necessary to combine some of the operation-size and region categories to enable further analysis. To evaluate the average number of shipments of bison added to operations by size of operations, the very small, small, and medium size categories were combined into one size category ("small," with 1 to 99 bison). The Northeast, Southeast, and North Central regions were combined into one category ("Other") for comparison with the West region.

There were no differences in the average number of shipments received by operation size, with the exception that large operations did not receive any shipments from dealers/brokers. Numerically, large operations received an average of 4.9 shipments of bison from private sales, compared with 1.3 for small operations.

G.1.f. For the operations that added any bison to the operation's herd from the following offsite sources from July 1, 2021, through June 30, 2022 (Table G.1.c.), average number of shipments of added bison, by source of bison and by size of operation:

Average Number of Shipments

	Size of Operation* (number of bison)					
	Small (1–99)		**Large** (100 or more)		**All operations**	
Source	**No.**	**Std. error**	**No.**	**Std. error**	**No.**	**Std. error**
Private sale	1.3	(0.1)	4.9	(2.5)	2.3	(0.7)
Trade	1.0	(0.0)	1.0	(0.0)	1.0	(0.0)
Auction/sale barn	1.4	(0.2)	1.4	(0.3)	1.4	(0.2)
Dealer/broker	1.0	(0.0)	NA	NA	1.0	(0.0)
Other	NA	NA	(D)	(D)	(D)	(D)

*Size categories "very small," "small," and "medium" were combined into one category to increase the number of reportable estimates.

Values of (D) denote too few to report.

NA denotes that no operations of that size had any shipments of bison from that source.

Although there were no differences in the average number of shipments received by operations in the two regions, operations in the West region received an average of 3.4 shipments from private sales, compared with 1.2 shipments for operations in the Other region. Operations in the Other region did not receive any shipments from trade sources.

G.1.g. For the operations that added any bison to the operation's herd from the following offsite sources from July 1, 2021, through June 30, 2022 (Table G.1.c.), average number of shipments of added bison, by source of bison, by region:

Average Number of Shipments

	Region*			
	West		**Other**	
Source	**No.**	**Std. error**	**No.**	**Std. error**
Private sale	3.4	(1.5)	1.2	(0.1)
Trade	1.0	(0.0)	NA	NA
Auction/sale barn	1.3	(0.2)	1.7	(0.4)
Dealer/broker	(D)	(D)	(D)	(D)
Other	NA	NA	(D)	(D)

*Region categories "Northeast," "Southeast," and "North Central" were combined into one category to increase the number of reportable estimates.

Values of (D) denote too few to report.

NA denotes that no operations of that size had any shipments of bison from that source.

For all operations, shipments of bison added to operations from private sales contained an average of 7.1 bison, and shipments from auctions/sale barns contained 6.8 bison. Shipments from dealers/brokers and trade sources on average contained fewer than 2 bison.

Shipments to large operations from private sales contained a higher average number of bison per shipment (17.2 bison) than shipments to small operations (3.3 bison).

G.1.h. For the operations that added any bison to the operation's herd from the following offsite sources from July 1, 2021, through June 30, 2022 (Table G.1.c.), average number of bison per shipment of added bison, by source of bison and by size of operation:

Average Number of Bison per Shipment

Size of Operation* (number of bison)

	Small (1–99)		**Large** (100 or more)		**All operations**	
Source	**No.**	**Std. error**	**No.**	**Std. error**	**No.**	**Std. error**
Private sale	3.3	(0.5)	17.2	(4.3)	7.1	(1.4)
Trade	(D)	(D)	(D)	(D)	1.6	(0.2)
Auction/sale barn	5.0	(0.7)	10.1	(2.5)	6.8	(1.0)
Dealer/broker	1.7	(0.2)	NA	NA	1.7	(0.2)
Other	NA	NA	(D)	(D)	(D)	(D)

*Size categories "very small," "small," and "medium" were combined into one category to increase the number of reportable estimates.

Values of (D) denote too few to report.

NA denotes that no operations of that size had any shipments of bison from that source.

There were no differences in the average number of bison per shipment from the listed offsite sources to operations in the West and Other regions. As noted above, operations in the Other region did not receive any shipments from trade sources.

G.1.i. For the operations that added any bison to the operation's herd from the following offsite sources from July 1, 2021, through June 30, 2022 (Table G.1.c.), average number of bison per shipment of added bison, by source of bison, by region:

Average Number of Bison per Shipment

	Region*			
	West		Other	
Source	**No.**	**Std. error**	**No.**	**Std. error**
Private sale	10.5	(2.7)	4.1	(0.7)
Trade	1.6	(0.2)	NA	NA
Auction/sale barn	5.5	(0.8)	11.3	(3.5)
Dealer/broker	(D)	(D)	(D)	(D)
Other	NA	NA	(D)	(D)

*Region categories "Northeast," "Southeast," and "North Central" were combined into one category to increase the number of reportable estimates.

Values of (D) denote too few to report.

NA denotes that no operations of that size had any shipments of bison from that source.

Given the high standard errors for mileage data, the shortest, most likely, and longest distances traveled by shipments of bison being added to the operation's herd did not differ by the source of the bison. In general, the most likely distance traveled by shipments of bison was 274 miles for bison obtained through private sale, 321 miles for bison obtained via trade, and 217 miles for bison acquired from auctions/sale barns. Although the distances are not statistically different, this might indicate that producers are willing to travel farther to obtain bison from specifically targeted sources than from auctions or sale barns.

G.1.j. For the operations that added any bison to the operation's herd from the following offsite sources from July 1, 2021, through June 30, 2022 (Table G.1.c.), operation average shortest, most likely, and longest one-way distance traveled (miles) from the following sources to the operation, by source of bison:

Average Distance Traveled to Operation (miles)

	Shortest		Most Likely		Longest	
Source	**Miles**	**Std. error**	**Miles**	**Std. error**	**Miles**	**Std. error**
Private sale	253.3	(64.9)	274.2	(69.0)	324.7	(68.3)
Trade	321.3	(96.3)	321.3	(96.3)	321.3	(96.3)
Auction/sale barn	209.8	(31.4)	217.1	(36.1)	266.3	(47.9)
Dealer/broker	55.6	(13.0)	(D)	(D)	100.0	(0.0)
Other	(D)	(D)	(D)	(D)	(D)	(D)

Values of (D) denote too few to report.

For all operations (and as noted in the Most Likely column of Table G.1.j.), the average most likely one-way distance traveled by shipments of added bison from the offsite source to operations was about 274 miles for bison from private sales, 321 miles for bison being added through trade, and 217 miles for bison from auctions/sale barns. The average most likely one-way distance traveled from auctions/sale barns to large operations (about 368 miles) was higher than that for small operations (about 117 miles).

G.1.k. For the operations that added any bison to the operation's herd from the following offsite sources from July 1, 2021, through June 30, 2022 (Table G.1.c.), operation average most likely one-way distance traveled (miles) from the listed source to the operation, by source of bison and by size of operation:

Average Most Likely One-way Distance Traveled from Source to Operation (miles)

Size of Operation* (number of bison)

	Small (1–99)		**Large** (100 or more)		**All operations**	
Source	**Miles**	**Std. error**	**Miles**	**Std. error**	**Miles**	**Std. error**
Private sale	168.9	(36.1)	509.6	(209.7)	274.2	(69.0)
Trade	293.9	(111.0)	372.5	(169.5)	321.3	(96.3)
Auction/sale barn	116.9	(29.6)	367.5	(36.9)	217.1	(36.1)
Dealer/broker	(D)	(D)	NA	NA	(D)	(D)
Other	NA	NA	(D)	(D)	(D)	(D)

*Size categories "very small," "small," and "medium" were combined into one category to increase the number of reportable estimates.

Values of (D) denote too few to report.

NA denotes that no operations of that size had any shipments of bison from that source.

There were no differences between the West and Other regions in the average most likely one-way distance traveled by shipments of bison being added to operations from the listed sources.

G.1.I. For the operations that added any bison to the operation's herd from the following offsite sources from July 1, 2021, through June 30, 2022 (Table G.1.c.), operation average most likely one-way distance traveled (miles) from the listed source to the operation by source of bison, by region:

Average Most Likely One-way Distance Traveled from Source to Operation (miles)

	Region*			
	West		**Other**	
Source	**Miles**	**Std. error**	**Miles**	**Std. error**
Private sale	193.4	(37.9)	376.8	(148.5)
Trade	321.3	(96.3)	NA	NA
Auction/sale barn	213.2	(42.0)	240.2	(8.4)
Dealer/broker	NA	NA	(D)	(D)
Other	NA	NA	(D)	(D)

*Region categories "Northeast," "Southeast," and "North Central" were combined into one category to increase the number of reportable estimates.

Values of (D) denote too few to report.

NA denotes that no operations of that size had any shipments of bison from that source.

For operations that added bison to the operation's herd from offsite sources during the reference period, about two-thirds of shipments of bison were made during the winter and spring periods. No operations in the very small category added any bison to the operation's herd during the winter or summer periods, and small operations had a lower percentage of shipments of bison added (7.8 percent of shipments) than large operations (43.4 percent of shipments) during the winter period.

G.1.m. For the 19.5 percent of operations that added any bison to the operation's herd from offsite sources from July 1, 2021, through June 30, 2022 (Table G.1.a.), percentage of total shipments of added bison by season the shipments occurred, and by size of operation:

Percent Total Shipments

Size of Operation (number of bison)

Season	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Summer (June–August 2021)	0.0	(—)	19.0	(9.0)	17.4	(5.7)	9.0	(1.8)	11.5	(2.0)
Fall (September–November 2021)	34.1	(14.9)	23.4	(12.0)	22.2	(5.7)	19.9	(2.3)	21.9	(2.7)
Winter (December 2021–February 2022)	0.0	(—)	7.8	(6.9)	37.8	(8.9)	43.4	(4.6)	34.7	(5.5)
Spring (March–May 2022)	65.9	(14.9)	49.8	(13.4)	22.6	(6.6)	27.6	(5.4)	31.9	(5.1)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

For the Northeast region, about two-thirds of shipments of bison added to operations from offsite sources were made during the spring season, and no shipments were made during the fall or winter seasons. A higher percentage of shipments of added bison occurred during the winter months for the West region (41.6 percent of shipments) than for the North Central region (7.2 percent of shipments).

G.1.n. For the 19.5 percent of operations that added any bison to the operation's herd from offsite sources from July 1, 2021, through June 30, 2022 (Table G.1.a.), percentage of total shipments of added bison by season the shipments occurred, by region:

Percent Total Shipments

Region

Season	Northeast		Southeast		North Central		West	
	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Summer (June–August 2021)	36.4	(25.2)	15.3	(9.9)	22.6	(7.2)	8.2	(1.8)
Fall (September–November 2021)	0.0	(—)	28.2	(13.2)	29.2	(7.8)	21.0	(2.9)
Winter (December 2021–February 2022)	0.0	(—)	28.2	(12.7)	7.2	(3.5)	41.6	(4.9)
Spring (March–May 2022)	63.6	(25.2)	28.2	(13.2)	41.0	(8.6)	29.2	(5.5)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

2. Bison shipped permanently to offsite destinations

About one-third of all operations shipped bison permanently to offsite destinations during the reference period. Higher percentages of large (62.0 percent) and medium (48.2 percent) operations than small or very small operations shipped any bison permanently to offsite destinations.

G.2.a. Percentage of operations that shipped any bison permanently from the operation's herd to offsite destinations from July 1, 2021, through June 30, 2022, by size of operation:

Percent Operations

Size of Operation (number of bison)

Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
11.8	(2.7)	25.3	(4.1)	48.2	(3.5)	62.0	(4.1)	33.0	(1.7)

A higher percentage of operations in the West region (37.2 percent) shipped any bison permanently to offsite destinations than operations in the Northeast (19.9 percent) and Southeast (15.8 percent) regions.

G.2.b. Percentage of operations that shipped any bison permanently from the operation's herd to offsite destinations from July 1, 2021, through June 30, 2022, by region:

Percent Operations

Region

Northeast		**Southeast**		**North Central**		**West**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
19.9	(4.9)	15.8	(5.8)	33.9	(3.4)	37.2	(2.3)

Overall, about one in six operations shipped bison permanently to offsite slaughter or directly to another bison operation. Almost one-half of large operations (46.2 percent) shipped bison directly to offsite slaughter, a higher percentage than for medium, small, and very small operations (23.4 percent, 11.3 percent, and 3.5 percent, respectively). About one-third of large operations (31.6 percent) shipped bison permanently to another bison operation, a higher percentage than for small (9.0 percent) and very small (5.7 percent) operations. About one-fifth of large operations (19.8 percent) shipped bison permanently to feedlots, a higher percentage than for operations in the other size categories. A higher percentage of medium operations than very small and small operations shipped bison direct to offsite slaughter or direct to another bison operation, and a higher percentage of medium than very small operations also shipped bison direct to auctions/sale barns.

G.2.c. Percentage of operations that shipped any bison permanently from the operation's herd to the following offsite destinations from July 1, 2021, through June 30, 2022, by destination of bison and by size of operation:

Percent Operations

Size of Operation (number of bison)

Destination	Very small (1–9) Pct.	Very small (1–9) Std. error	Small (10–24) Pct.	Small (10–24) Std. error	Medium (25–99) Pct.	Medium (25–99) Std. error	Large (100 or more) Pct.	Large (100 or more) Std. error	All operations Pct.	All operations Std. error
Direct to offsite slaughter	3.5	(1.6)	11.3	(2.7)	23.4	(2.7)	46.2	(4.4)	17.6	(1.3)
Direct to feedlot	0.0	(—)	1.2	(1.1)	7.6	(2.1)	19.8	(3.5)	5.5	(0.8)
Direct to auction/sale barn	1.0	(1.0)	6.0	(2.1)	11.3	(1.8)	2.8	(1.3)	5.3	(0.8)
Direct to dealer/broker	1.7	(1.1)	4.3	(1.9)	0.6	(0.5)	2.1	(1.2)	2.1	(0.6)
Direct to another bison operation (for any reason)	5.7	(1.9)	9.0	(2.7)	20.7	(2.8)	31.6	(3.9)	14.7	(1.3)
Other	3.0	(1.5)	2.6	(1.5)	2.0	(0.8)	2.0	(1.1)	2.5	(0.7)

There were few differences by region in the percentage of operations that shipped any bison permanently to the listed destinations during the reference period. Operations in the North Central and West regions shipped bison to all listed destinations, whereas no operations in the Northeast shipped bison directly to a feedlot, an auction/sale barn, or an "other" destination, and no operations in the Southeast shipped bison directly to a dealer/broker or an "other" destination. "Other" destinations included private sale or horse trainer.

G.2.d. Percentage of operations that shipped any bison permanently from the operation's herd to the following offsite destinations from July 1, 2021, through June 30, 2022, by destination of bison, by region:

Percent Operations

Region

Destination	Northeast Pct.	Northeast Std. error	Southeast Pct.	Southeast Std. error	North Central Pct.	North Central Std. error	West Pct.	West Std. error
Direct to offsite slaughter	12.5	(2.1)	13.0	(5.4)	18.4	(2.6)	18.9	(1.7)
Direct to feedlot	0.0	(—)	2.9	(2.3)	1.7	(0.8)	8.1	(1.3)
Direct to auction/sale barn	0.0	(—)	3.4	(3.2)	6.2	(1.8)	6.2	(1.1)
Direct to dealer/broker	3.7	(3.1)	0.0	(—)	2.2	(1.4)	2.1	(0.7)
Direct to another bison operation (for any reason)	3.7	(3.2)	15.8	(5.8)	12.6	(2.3)	17.1	(1.8)
Other	0.0	(—)	0.0	(—)	1.1	(0.6)	3.7	(1.1)

For operations that shipped bison from the operation's herd permanently to offsite destinations during the reference period, an average of 7.2 shipments, with an average of 11.9 bison per shipment, were sent directly to offsite slaughter. An average of 2.6 shipments, carrying an average of 12.0 bison, carried bison permanently to other bison operations. Although only 1.9 shipments, on average, were sent directly to feedlots, each shipment transported an average of 43.7 bison.

G.2.e. For the operations that shipped any bison from the operation's herd permanently to the following offsite destinations from July 1, 2021, through June 30, 2022 (Table G.2.c.), operation average number of shipments and number of bison per shipment, by destination of bison:

	Shipments and Bison per Shipment (number)			
	Average Number of Shipments		**Average Number of Bison per Shipment**	
Destination	**Number**	**Std. error**	**Number**	**Std. error**
Direct to offsite slaughter	7.2	(0.9)	11.9	(1.5)
Direct to feedlot	1.9	(0.2)	43.7	(6.0)
Direct to auction/sale barn	1.3	(0.2)	10.6	(1.1)
Direct to dealer/broker	1.2	(0.1)	3.9	(0.7)
Direct to another bison operation (for any reason)	2.6	(0.3)	12.0	(1.6)
Other	2.1	(0.5)	3.3	(0.8)

Overall (and as noted in Table G.2.e. above), operations that shipped any bison from their herd to the listed offsite destinations sent an average of 7.2 shipments directly to offsite slaughter, 2.6 shipments directly to another operation, 1.9 shipments directly to feedlot, 1.3 shipments directly to auctions/sale barns, and 1.2 shipment to dealers/brokers.

To evaluate the average number of shipments of bison sent offsite to the listed destinations by operation size, the very small, small, and medium size categories were combined into one size category ("small," with 1 to 99 bison). Large operations sent a higher average number of shipments (12.3 shipments) directly to offsite slaughter than small operations (3.4 shipments). Large operations sent a higher average number of shipments directly to another bison operation (4.4 shipments) and directly to feedlot (2.4 shipments) than small operations (1.7 shipments and 1.1 shipments, respectively).

G.2.f. For the operations that shipped any bison from the operation's herd permanently to the following offsite destinations from July 1, 2021, through June 30, 2022 (Table G.2.c.), average number of shipments of bison, by destination of bison and by size of operation:

	Average Number of Shipments					
	Size of Operation* (number of bison)					
	Small (1–99)		**Large** (100 or more)		**All operations**	
Destination	**No.**	**Std. error**	**No.**	**Std. error**	**No.**	**Std. error**
Direct to offsite slaughter	3.4	(0.4)	12.3	(1.9)	7.2	(0.9)
Direct to feedlot	1.1	(0.1)	2.4	(0.3)	1.9	(0.2)
Direct to auction/sale barn	1.3	(0.2)	1.0	(0.0)	1.3	(0.2)
Direct to dealer/broker	1.1	(0.1)	1.5	(0.3)	1.2	(0.1)
Direct to another bison operation (for any reason)	1.7	(0.2)	4.4	(0.8)	2.6	(0.3)
Other	2.2	(0.5)	1.5	(0.3)	2.1	(0.5)

*Size categories "very small," "small," and "medium" were combined into one category to increase the number of reportable estimates.

As for operation size, to evaluate the average number of shipments of bison sent permanently to offsite destinations by operations by region, the Northeast, Southeast, and North Central regions were combined into one category (Other region). Operations in the West region sent a higher average number of shipments (2.0 shipments) directly to feedlot than operations in the Other region (1.0 shipment).

G.2.g. For the operations that shipped any bison from the operation's herd permanently to the following offsite destinations from July 1, 2021, through June 30, 2022 (Table G.2.c.), average number of shipments of bison by destination of bison, by region:

	Average Number of Shipments			
	Region*			
	West		**Other**	
Destination	**No.**	**Std. error**	**No.**	**Std. error**
Direct to offsite slaughter	8.3	(1.4)	5.2	(0.9)
Direct to feedlot	2.0	(0.2)	1.0	(0.0)
Direct to auction/sale barn	1.4	(0.3)	1.1	(0.1)
Direct to dealer/broker	1.1	(0.1)	1.3	(0.2)
Direct to another bison operation (for any reason)	2.4	(0.2)	3.2	(0.9)
Other	2.2	(0.5)	2.0	(0.5)

*Region categories "Northeast," "Southeast," and "North Central" were combined into one category to increase the number of reportable estimates.

Overall, shipments of bison sent directly to feedlot contained about 44 bison; shipments sent directly to offsite slaughter, auction/sale barn, or another bison operation contained about 12 bison; and shipments sent directly offsite to dealer/broker or "other" contained fewer than 5 bison.

Shipments from large operations contained a higher number of bison per shipment sent directly to feedlot (64.2 bison), another bison operation (24.3 bison), or offsite slaughter (23.8 bison) than shipments sent from small operations (16.5 bison, 5.7 bison, and 3.7 bison, respectively).

G.2.h. For the operations that shipped any bison from the operation's herd permanently to the following offsite destinations from July 1, 2021, through June 30, 2022 (Table G.2.c.), average number of bison per shipment of bison, by destination of bison and by size of operation:

Average Number of Bison per Shipment

Size of Operation* (number of bison)

	Small (1–99)		**Large** (100 or more)		**All operations**	
Destination	**No.**	**Std. error**	**No.**	**Std. error**	**No.**	**Std. error**
Direct to offsite slaughter	3.7	(0.8)	23.8	(3.2)	11.9	(1.5)
Direct to feedlot	16.5	(2.3)	64.2	(7.5)	43.7	(6.0)
Direct to auction/sale barn	10.0	(1.1)	15.9	(4.9)	10.6	(1.1)
Direct to dealer/broker	(D)	(D)	(D)	(D)	3.9	(0.7)
Direct to another bison operation (for any reason)	5.7	(0.7)	24.3	(3.7)	12.0	(1.6)
Other	(D)	(D)	(D)	(D)	3.3	(0.8)

*Size categories "very small," "small," and "medium" were combined into one category to increase the number of reportable estimates.

Values of (D) denote too few to report.

Shipments from operations in the West region contained a higher number of bison per shipment sent directly to feedlot (46.9 bison), offsite slaughter (16.5 bison), or another bison operation (14.2 percent) than shipments sent from operations in the Other region (17.5 bison, 3.0 bison, and 5.7 bison, respectively).

G.2.i. For the operations that shipped any bison from the operation's herd permanently to the following offsite destinations from July 1, 2021, through June 30, 2022 (Table G.2.c.), average number of bison per shipment of bison by destination of bison, by region:

	Average Number of Bison per Shipment			
	Region*			
	West		Other	
Destination	No.	Std. error	No.	Std. error
Direct to offsite slaughter	16.5	(2.3)	3.0	(0.3)
Direct to feedlot	46.9	(6.7)	17.5	(2.5)
Direct to auction/sale barn	11.6	(1.4)	8.2	(2.0)
Direct to dealer/broker	3.7	(0.9)	4.4	(1.2)
Direct to another bison operation (for any reason)	14.2	(2.0)	5.7	(0.9)
Other	3.0	(0.7)	6.5	(3.0)

*Region categories "Northeast," "Southeast," and "North Central" were combined into one category to increase the number of reportable estimates.

Given the high standard errors for mileage data, there were few differences among the shortest, most likely, and longest distances traveled by shipments of bison being moved permanently to an offsite destination. In general, the most likely distance traveled by shipments of bison was about 140 miles for bison being taken to offsite slaughter, about 236 miles for bison being moved to feedlots, about 159 miles for bison being delivered to auctions/sale barns, and about 183 miles for bison being delivered to another bison operation. The longest average distance bison shipments traveled direct to another bison operation was significantly higher than the shortest average distance.

G.2.j. For the operations that shipped any bison from the operation's herd permanently to the following offsite destinations from July 1, 2021, through June 30, 2022 (Table G.2.c.), operation average shortest, most likely, and longest one-way distance traveled (miles) from the operation to the following destinations, by destination of bison:

	Average Distance Traveled to Destination (miles)					
	Shortest		Most Likely		Longest	
Destination	Miles	Std. error	Miles	Std. error	Miles	Std. error
Direct to offsite slaughter	107.0	(12.9)	140.2	(16.1)	170.7	(20.2)
Direct to feedlot	212.0	(43.4)	235.8	(47.6)	269.1	(56.1)
Direct to auction/sale barn	158.4	(17.8)	158.9	(17.7)	169.3	(19.9)
Direct to dealer/broker	111.5	(32.5)	136.2	(27.2)	138.2	(31.9)
Direct to another bison operation (for any reason)	157.1	(18.9)	182.7	(21.0)	257.3	(25.1)
Other	151.4	(84.6)	189.1	(94.9)	198.0	(97.6)

For all operations (and as noted above in the Most Likely column of Table G.2.j.), the average most likely one-way distance traveled by shipments of bison sent directly to the listed offsite destinations was about 236 miles to feedlot, 183 miles to another bison operation,159 miles to auction/sale barn, 140 miles to offsite slaughter, and 136 miles to broker/dealer.

Shipments of bison traveled a higher average most likely one-way distance directly to offsite slaughter from large operations (224.4 miles) than small operations (82.6 miles).

G.2.k. For the operations that shipped any bison from the operation's herd permanently to the following offsite destinations from July 1, 2021, through June 30, 2022 (Table G.2.c.), operation average most likely one-way distance traveled (miles) from the operation to the listed destination, by destination of bison and by size of operation:

Average Most Likely One-way Distance Traveled to Destination (miles)

Size of Operation* (number of bison)

	Small (1–99)		**Large** (100 or more)		**All operations**	
Destination	**Miles**	**Std. error**	**Miles**	**Std. error**	**Miles**	**Std. error**
Direct to offsite slaughter	82.6	(12.0)	224.4	(31.9)	140.2	(16.1)
Direct to feedlot	219.5	(63.4)	249.4	(69.1)	235.8	(47.6)
Direct to auction/sale barn	161.9	(19.1)	128.4	(30.5)	158.9	(17.7)
Direct to dealer/broker	108.5	(30.4)	232.5	(36.2)	136.2	(27.2)
Direct to another bison operation (for any reason)	208.2	(29.5)	127.9	(14.0)	182.7	(21.0)
Other	(D)	(D)	(D)	(D)	189.1	(94.9)

*Size categories "very small," "small," and "medium" were combined into one category to increase the number of reportable estimates.

Values of (D) denote too few to report.

Shipments of bison traveled a higher average most likely one-way distance directly to offsite slaughter from operations in the West region (176.8 miles) than operations in the Other region (67.4 miles).

G.2.I. For the operations that shipped any bison from the operation's herd permanently to the following offsite destinations from July 1, 2021, through June 30, 2022 (Table G.2.c.), operation average most likely one-way distance traveled (miles) from the operation to the listed destination, by region:

	Average Most Likely One-way Distance Traveled to Destination (miles)			
	Region*			
	West		**Other**	
Destination	**Miles**	**Std. error**	**Miles**	**Std. error**
Direct to offsite slaughter	176.8	(23.1)	67.4	(8.6)
Direct to feedlot	209.4	(46.3)	419.3	(159.2)
Direct to auction/sale barn	140.9	(17.1)	208.7	(40.4)
Direct to dealer/broker	116.0	(33.7)	170.1	(30.8)
Direct to another bison operation (for any reason)	164.9	(21.3)	221.9	(46.5)
Other	(D)	(D)	(D)	(D)

Region categories "Northeast," "Southeast," and "North Central" were combined into one category to increase the number of reportable estimates.

Values of (D) denote too few to report.

For operations that shipped bison from the operation's herd permanently to offsite destinations during the reference period, about one-third of shipments of bison were made during the fall season and one-fourth made during winter and spring periods. Very small operations made a higher percentage of shipments (61.9 percent of shipments) than medium (29.4 percent of shipments) or large operations (19.0 percent of shipments) during the spring season.

G.2.m. For the operations that shipped any bison from the operation's herd permanently to the following offsite destinations from July 1, 2021, through June 30, 2022 (Table G.2.c.), percentage of total shipments of bison by season the shipments occurred, and by size of operation:

Percent Total Shipments

Size of Operation (number of bison)

	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
Season	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Summer (June–August 2021)	0.0	(—)	8.4	(3.9)	18.5	(2.2)	20.2	(2.4)	18.3	(1.7)
Fall (September–November 2021)	22.3	(10.7)	24.3	(6.6)	25.2	(2.9)	37.4	(5.4)	32.9	(3.7)
Winter (December 2021–February 2022)	15.8	(8.3)	27.5	(5.7)	26.9	(3.2)	23.3	(2.4)	24.3	(1.9)
Spring (March–May 2022)	61.9	(12.3)	39.8	(9.6)	29.4	(3.9)	19.0	(2.2)	24.5	(2.1)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

During the fall, higher percentages of shipments of bison being moved permanently to offsite destinations were sent from operations in the North Central (46.4 percent of shipments) and West (29.4 percent of shipments) regions than from the Northeast region (5.9 percent of shipments). During the winter, higher percentages of shipments were moved to offsite destinations from operations in the West region (28.2 percent) than from the North Central region (10.1 percent).

G.2.n. For the operations that shipped any bison from the operation's herd permanently to the following offsite destinations from July 1, 2021, through June 30, 2022 (Table G.2.c.), percentage of total shipments of bison by season the shipments occurred, by region:

Percent Total Shipments

Region

	Northeast		Southeast		North Central		West	
Season	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Summer (June–August 2021)	11.8	(5.9)	11.7	(6.4)	20.2	(5.5)	18.1	(1.7)
Fall (September–November 2021)	5.9	(4.8)	43.3	(15.9)	46.4	(11.5)	29.4	(3.1)
Winter (December 2021–February 2022)	39.7	(15.4)	17.6	(6.0)	10.1	(2.7)	28.2	(2.2)
Spring (March–May 2022)	42.6	(17.0)	27.5	(8.3)	23.2	(6.1)	24.3	(2.1)
Total	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)

H. Organization Membership and Bison Health Information Sources

Industry associations can provide support to producers in many ways, including addressing concerns about issues within the industry and providing information and other resources to members to improve management and production practices. Overall, one-half of producers (50.0 percent) were in one or more bison or cattle associations. About one-third were in regional, State, and/or local bison associations (34.1 percent) and/or the National Bison Association (34.0 percent).

The percentage of operations belonging to the National Bison Association (NBA) generally increased with increasing operation size, from 9.8 percent of very small operations to 74.1 percent of large operations, with higher percentages of medium (51.4 percent) or large operations than operations in the two smaller size categories being members of the NBA. The percentage of operations belonging to regional, State, and/or local bison associations increased with increasing operation size, from 8.4 percent of very small operations to 62.6 percent of large operations. As with membership in the NBA, higher percentages of medium (52.1 percent) or large operations (62.6 percent) than operations in the two smaller size categories were members of regional, State, and/or local bison associations. The percentage of operations belonging to “any” of the listed associations increased with increasing operation size, from 20.9 percent of very small operations to 87.7 percent of large operations.

H.1. Percentage of operations by membership in the following bison or cattle associations, and by size of operation:

Percent Operations

Size of Operation (number of bison)

	Very small (1–9)		**Small** (10–24)		**Medium** (25–99)		**Large** (100 or more)		**All operations**	
Association	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
National Bison Association	9.8	(2.4)	21.7	(3.8)	51.4	(3.5)	74.1	(3.9)	34.0	(1.7)
Regional, State, and/or local bison associations	8.4	(2.2)	30.9	(4.1)	52.1	(3.6)	62.6	(4.0)	34.1	(1.7)
InterTribal Buffalo Council	0.0	(—)	1.4	(1.2)	1.2	(0.7)	7.8	(2.3)	1.9	(0.5)
Regional, State, and/or local Tribal bison associations	0.0	(—)	1.4	(1.2)	2.1	(1.2)	2.7	(1.5)	1.3	(0.5)
Canadian Bison Association	1.0	(0.9)	0.0	(—)	2.4	(1.0)	7.8	(2.4)	2.2	(0.6)
National Cattlemen’s Beef Association	1.4	(0.9)	2.0	(1.3)	3.8	(1.4)	7.1	(2.1)	3.1	(0.6)
U.S. Cattlemen’s Association	0.7	(0.7)	0.9	(0.7)	0.6	(0.5)	3.3	(1.3)	1.1	(0.4)
R-CALF USA	0.7	(0.7)	0.0	(—)	1.2	(1.0)	4.5	(1.8)	1.3	(0.4)
Regional, State, and/or local cattle associations	6.8	(2.1)	6.4	(2.3)	10.9	(2.4)	13.1	(3.0)	8.8	(1.2)
Other	2.1	(1.4)	1.5	(1.3)	0.8	(0.6)	1.0	(0.9)	1.4	(0.6)
Any	20.9	(3.3)	41.1	(4.7)	72.1	(3.3)	87.7	(3.0)	50.0	(1.9)

A lower percentage of operations in the Southeast region (20.2 percent) than in the North Central region (42.7 percent) belonged to regional, State, and/or local bison associations. There were no differences by region in the percentage of operations belonging to any bison or cattle associations, with about one-half of operations in each region belonging to at least one bison, cattle, or other association.

H.2. Percentage of operations by membership in the following bison or cattle associations, by region:

	Percent Operations							
	Region							
	Northeast		Southeast		North Central		West	
Association	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
National Bison Association	23.2	(4.5)	41.4	(7.5)	26.0	(3.2)	37.5	(2.3)
Regional, State, and/or local bison associations	28.2	(5.4)	20.2	(5.6)	42.7	(3.7)	34.2	(2.3)
InterTribal Buffalo Council	0.0	(—)	(D)	(D)	(D)	(D)	2.5	(0.8)
Regional, State, and/or local Tribal bison associations	0.0	(—)	2.7	(2.1)	1.1	(0.5)	1.4	(0.7)
Canadian Bison Association	2.0	(1.7)	2.7	(2.1)	1.1	(0.7)	2.5	(0.8)
National Cattlemen’s Beef Association	0.0	(—)	8.5	(3.8)	3.3	(1.6)	2.7	(0.7)
U.S. Cattlemen’s Association	0.0	(—)	0.0	(—)	2.1	(1.3)	1.1	(0.4)
R-CALF USA	0.0	(—)	0.0	(—)	1.2	(1.1)	1.7	(0.6)
Regional, State, and/or local cattle associations	6.2	(4.2)	14.8	(5.2)	2.1	(1.3)	10.7	(1.6)
Other	9.7	(5.2)	3.2	(2.7)	0.0	(—)	0.3	(0.2)
Any	48.1	(8.0)	49.9	(7.2)	51.5	(3.5)	49.8	(2.5)

Values of (D) denote too few to report.

In addition to associations, producers can obtain information about bison health from a variety of other sources, including other producers, magazines or newsletters, university/extension offices, veterinarians, and feed and drug sales representatives. Almost one-fifth of operation respondents (18.0 percent) rated veterinarians as extremely important sources of bison health information. The percentage of operations that rated feed and drug salespeople decreased from 60.1 percent for not important to 1.3 percent for extremely important.

H.3. Percentage of operations by respondent's view of the level of importance of bison health information sources:

	Percent Operations										
	Level of Importance										
	Not		Slightly		Moderately		Very		Extremely		
Health information source	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Total
Bison association resources/ meetings	34.5	(2.1)	13.9	(1.6)	22.5	(1.8)	20.3	(1.7)	8.7	(1.1)	100.0
Producer gatherings (informal)	43.2	(2.1)	15.8	(1.6)	21.8	(1.7)	14.0	(1.3)	5.2	(0.9)	100.0
Other producers—individually	37.5	(2.1)	12.8	(1.6)	21.1	(1.7)	21.3	(1.7)	7.3	(1.1)	100.0
Internet	30.5	(2.1)	14.9	(1.6)	27.8	(2.0)	19.3	(1.7)	7.5	(1.1)	100.0
Magazines/newsletters	32.0	(2.1)	22.1	(1.8)	30.8	(2.0)	12.0	(1.3)	3.0	(0.7)	100.0
University/extension	37.4	(2.2)	18.2	(1.8)	24.0	(1.9)	14.1	(1.4)	6.3	(1.1)	100.0
Veterinarians	22.3	(2.0)	13.2	(1.6)	19.9	(1.7)	26.7	(1.9)	18.0	(1.6)	100.0
Feed and drug sales people	60.1	(2.1)	20.8	(1.8)	13.1	(1.4)	4.7	(0.9)	1.3	(0.5)	100.0
Other	91.1	(1.4)	3.3	(0.8)	3.5	(0.9)	0.7	(0.4)	1.3	(0.5)	100.0

To evaluate the importance of various bison health information sources by operation size, the values for moderately, very, and extremely important categories were combined. Overall, about one-half of operations rated the following sources of bison health information as moderately, very, or extremely important: bison association resources/meetings (51.5 percent), other producers—individually (49.7 percent), internet (54.6 percent), magazines/newsletters (45.9 percent), university/extension (44.4 percent), and veterinarians (64.6 percent).

A higher percentage of large (78.6 percent) and medium (66.6 percent) operations than operations in the two smaller size categories considered bison association resources/meetings to be moderately, very, or extremely important sources of bison health information. Also, a higher percentage of small operations (48.7 percent) than very small operations (28.4 percent) considered bison association resources/meetings to be moderately, very, or extremely important. A lower percentage of very small operations than operations in the other size categories considered other producers—individually to be moderately, very, or extremely important.

H.4. Percentage of operations in which respondent considered various bison health information sources to be moderately, very, or extremely important, by size of operation:

Percent Operations

Size of Operation (number of bison)

Health information source	Very small (1–9)		Small (10–24)		Medium (25–99)		Large (100 or more)		All operations	
	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Bison association resources/meetings	28.4	(4.1)	48.7	(4.8)	66.6	(3.5)	78.6	(3.8)	51.5	(2.1)
Producer gatherings (informal)	20.8	(3.5)	35.5	(4.6)	57.2	(3.6)	63.1	(4.3)	41.0	(2.0)
Other producers—individually	27.5	(3.8)	48.2	(4.9)	65.0	(3.5)	72.5	(4.0)	49.7	(2.1)
Internet	45.8	(4.3)	54.8	(4.8)	59.8	(3.7)	63.6	(4.3)	54.6	(2.2)
Magazines/newsletters	33.4	(4.0)	43.2	(4.7)	54.7	(3.6)	60.9	(4.4)	45.9	(2.1)
University/extension	37.5	(4.2)	45.5	(4.7)	43.6	(3.7)	58.7	(4.5)	44.4	(2.2)
Veterinarians	53.2	(4.4)	64.8	(4.5)	67.9	(3.5)	82.3	(3.6)	64.6	(2.1)
Feed and drug sales people	14.2	(2.9)	19.5	(3.9)	22.5	(3.1)	22.5	(3.5)	19.0	(1.7)
Other	9.3	(2.7)	4.0	(2.0)	3.7	(1.5)	3.1	(1.4)	5.6	(1.1)

There were few differences by region in the percentage of operations that considered the listed sources to be moderately, very, or extremely important sources of bison health information. A higher percentage of operations in the North Central region (58.7 percent) than in the Northeast region (35.1 percent) considered other producers--individually to be moderately, very, or extremely important sources of bison health information.

H.5. Percentage of operations in which respondent considered various bison health information sources to be moderately, very, or extremely important, by region:

	Percent Operations							
	Region							
	Northeast		Southeast		North Central		West	
Health information source	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Bison association resources/meetings	43.6	(7.0)	59.5	(7.7)	52.2	(4.0)	51.5	(2.7)
Producer gatherings (informal)	31.5	(5.8)	49.8	(8.2)	47.4	(4.1)	38.9	(2.5)
Other producers—individually	35.1	(6.7)	50.2	(8.2)	58.7	(4.1)	48.9	(2.6)
Internet	47.9	(8.5)	59.5	(7.7)	60.0	(4.0)	53.0	(2.8)
Magazines/newsletters	45.8	(7.7)	55.8	(7.4)	51.2	(4.0)	42.5	(2.7)
University/extension	30.2	(7.6)	53.5	(8.2)	50.5	(4.1)	43.3	(2.9)
Veterinarians	66.6	(7.0)	58.6	(8.0)	69.3	(3.8)	63.4	(2.9)
Feed and drug sales people	8.0	(3.8)	9.8	(5.0)	20.2	(3.5)	21.8	(2.3)
Other	8.5	(4.7)	6.5	(4.1)	4.1	(1.7)	5.4	(1.5)

Section II: Methodology

A. Study Purpose and Needs Assessment

NAHMS develops study objectives by exploring existing literature and contacting industry members about their informational needs and priorities during a needs assessment phase. A driving force of the needs assessment was the desire of NAHMS to receive as much input as possible from a variety of operators, as well as from industry experts and representatives, veterinarians, extension specialists, universities, bison organizations, allied industry groups, and other stakeholders. Information was collected via a needs assessment survey.

The objective of the needs assessment survey for the NAHMS Bison 2022 study was to identify critical information needs concerning bison management and health. The online survey gathered opinions from a variety of stakeholders regarding what they perceived to be the most important bison management priorities, health priorities, risks and burdens to the industry, and participation incentives to encourage participation in the study. The survey was available online from October 1, 2020, to November 25, 2020. The online survey was distributed via USDA stakeholder announcements, updates on the NAHMS website, social media posts, and email lists through industry groups, universities, and extension agencies. All individuals involved in the bison business and/or conservation were encouraged to participate, regardless of bison ownership. In total, 179 individuals from at least 33 States completed the study's needs assessment survey.

Respondents to the needs assessment survey represented the following affiliations:

- Bison producers or operators, 56 percent of respondents
- Tribal bison herd managers or producers, 9 percent
- Non-governmental organization representatives, 8 percent
- Veterinary practitioners, 7 percent
- Federal or State personnel (including Federal or State bison herd managers), 5 percent
- Allied industry members (including processors, marketers), 4 percent
- Tribal government representatives, 3 percent
- University or extension personnel, 3 percent
- Other affiliation, 5 percent

Based on input from the needs assessment, reviews from the scientific literature, and input from government and industry researchers, primary study objectives were identified:

1. Describe the status and changes in the U.S. bison industry from 2014 to 2022, including operation characteristics (such as inventory, size, and type), production purposes, and marketing practices.
2. Describe the current U.S. bison industry production practices and challenges, including animal management and welfare, nutrition and range management, and environmental stewardship.
3. Describe current bison health management and biosecurity practices.
4. Estimate producer-reported occurrence of select health problems, associated management practices or actions, and causes of bison mortality.
5. Estimate the prevalence of select economically important pathogens for bison and quality of pasture forage.

B. Sampling and Estimation

1. State selection

Typically, the goal for NAHMS national studies is to include States that account for at least 70 percent of the animals and operations being studied. This method helps to ensure that the representation of the sample collected, and the statistical inferences made based on the sample data, can be generalized to the target population.

For the Bison 2022 study, population-level information published by NASS in the NASS 2017 Census of Agriculture and unpublished NASS data were used to identify the number and distribution of operations with one or more bison in the United States. All operations with one or more bison in the United States listed on the NASS list frame were selected for inclusion in the study. All States were included in the study except for Rhode Island, which had no operations with one or more bison listed on the NASS list frame.

2. Operation selection

The list frame from which operations were sampled is managed by NASS and was updated with information from the 2017 Census of Agriculture, as well as regular list frame management activities prior to sample selection. The total sample size was computed to achieve prespecified precision criteria at the 95-percent confidence level, while accounting for the estimated population size, design effect, and expected response rate. The estimated sample size exceeded the number of U.S. bison operations on the NASS list frame and so a census of those operations was taken, barring the operations that were marked as office hold operations. In total, 2,054 operations were selected for participation in the study.

Operations also were divided into four size categories: very small (1 to 9 bison), small (10 to 24 bison), medium (25 to 99 bison), and large (100 or more bison). The size ranges correspond to those used in the NAHMS Bison 2014 study. They were created based on the distribution of bison operations in the United States and were chosen so that the numbers of operations within each operation size category were large enough to both meet the pre-specified precision criteria in study design and to avoid disclosure of operation identities. It is important to study operations of all sizes because they can present different risks to animal health.

3. Population inferences

The target population for the study was all operations with one or more bison in the United States. Because the study was a census of bison operations on the NASS list frame, the selection weight for each operation was equal to 1. Nonresponse was accounted for using an additional adjustment according to the proportion of nonrespondents within each stratum, using a propensity score model. Calibration to population totals was performed using information available for respondents and nonrespondents. Estimates in this report represent data from 37.6 percent of the U.S. operations with 1 or more bison, after taking into account the survey design (Section II.E.1.).

SUDAAN software (RTI, version 11.0.4) was used to produce population estimates and their standard errors. The SUDAAN software allows estimation of standard errors for complex sampling designs using Taylor series linearization.

C. Data Collection

Respondents had the chance to complete surveys on paper forms sent through the mail, online using a web-based survey, or over the telephone with a NASS enumerator. Pre-survey packets, which included information letting the producer know about the upcoming study survey and describing the study, were mailed to selected producers the week of June 20, 2022. Survey packets, which included the paper survey and a web code that the producer could use to complete the survey online, were mailed to selected producers the week of July 1, 2022. From August 1, 2022, through August 26, 2022, producers who hadn’t completed the study survey using the paper or online forms were called to complete the survey via a computer-assisted telephone interview (CATI). The survey took an average of 53 minutes to complete.

At the end of the survey, producers were asked to provide consent to allow NASS to turn contact information over to NAHMS for the opportunity to participate in Biologics Phase of the study. NASS provided the list of producers who indicated that they were willing to participate in the second phase of the study to NAHMS so that NAHMS could begin contacting producers for the Biologics Phase of the study. Results from the Biologics Phase will be reported in future publications.

D. Data Analysis

1. Validation

Data were entered by NASS staff into an electronic data file and checked for validity. NAHMS staff independently performed data validation checks on the data set to identify consistency and statistical issues. Consistency issues include logical inconsistencies within a survey and were identified using summaries of responses to check for invalid responses (e.g., a response of '3' for a 0/1 response variable); threshold checks (e.g., identifying invalid total sums of bison inventory); and if-then checks (e.g., if a respondent marked that they didn't add bison to the herd, they shouldn't also have marked that bison were sourced from private sales).

Statistical issues were identified by investigating summary measures of responses for variables; data analysts and subject-matter experts investigated extreme outliers. Inconsistencies were identified using SAS software, and electronic survey data was reviewed by data analysts and subject-matter experts. Identified inconsistencies were addressed using item-level imputation measures if appropriate values could be logically deduced.

2. Estimation and confidence interval calculations

Summarization and estimation were performed using SUDAAN software, which accounts for the survey study design. Confidence intervals were computed for estimated proportions, means, and ratios using the methods described in detail in the SUDAAN Language Manual for SUDAAN version 11[1] and described briefly here. For percentages, a logit transformation was used to enforce bounding of the confidence interval bounds between 0 and 1. Student's *t* confidence interval bounds are computed on the logit scale and are then back-transformed to the percentage scale. For means and ratios, standard Student's *t* confidence intervals are computed directly on the scale of the data.

Estimates were generated by one analyst, and numbers and estimation code were reviewed by a second analyst, to ensure accurate reporting of estimates.

E. Sample Evaluation

This section provides counts and percentages of operations by response category, which can be used to compute various measures of response. Historically, the term "response rate" was used as a catch-all parameter, but there are many ways to define and calculate response rates. Therefore, counts and percentages of operations by response code category are presented below so that response rates can be calculated according to the preferred definition of "response rate."

Additionally, the Office of Management and Budget (OMB) has provided guidance regarding the calculation and reporting of response rates in their Standards and Guidelines for Statistical Surveys (2006), Section 3.2. The response rate advocated in the OMB guidance estimates the percentage of eligible operations that completed the survey. The calculation of this specific response rate is presented for the NASS Phase of the study below.

[1] Research Triangle Institute (2012). SUDAAN Language Manual, Volumes 1 and 2, Release 11. Research Triangle Park, NC: Research Triangle Institute.

1. Phase I response rates

Of the 2,054 operations selected for participation, 494 were ineligible (no bison from July 1, 2021, through June 30, 2022, out of business, or otherwise out of scope). Of the 1,560 eligible operations, 832 were not contacted (office holds, purposefully not contacted, and inaccessible operations). Of the 728 eligible operations that were contacted, 460 (212 + 248) provided complete survey data. Of those, 212 operations agreed to be contacted for the Biologics Phase of the study.

Response category group label	Response category group	Response category	Number of operations	Percent operations
(a)	In-scope-complete	Completed NASS Phase survey, signed consent for Biologics Phase	212	10.3
		Completed NASS Phase survey, refused consent for Biologics Phase	248	12.1
(b)	In-scope- refused	Refused	268	13.0
(c)	Out of scope	Zero bison from July 1, 2021, through June 30, 2022, out of business, or otherwise out of scope	494	24.1
(d)	Not contacted	Inaccessible or office hold	832	40.5
		Total	2,054	100.0

According to the OMB guidance, the response rate for this study would be calculated according to the following formula:

$$\frac{a}{(a+b)+\rho*(d)}$$

Letters $a, b,$ and d represent the counts (or percentages) of operations in each response-category group in the table above and ρ is the proportion of the noncontacted operations expected to be in-scope. Specifically,

$$\rho = \frac{(a+b)}{(a+b+c)} = \frac{728}{1{,}222} \approx 0.596$$

Thus, the OMB guidance-based response rate for Phase I of the NAHMS Bison 2022 study is calculated as follows:

$$\frac{460}{728+0.596*832} \approx 0.376$$

Approximately 37.6 percent of eligible operations completed the NASS Phase survey. The weighted OMB guidance-based response rate for the NASS Phase of the NAHMS Bison 2022 study is also 37.6 percent because the selection weights were equal to 1, which means that NASS Phase survey information is available for approximately 37.6 percent of bison operations in the United States.

Additionally, due to the high number of operations that were not contacted, it is instructive to observe the cooperation rate (the American Association of Public Opinion Research's defined cooperation rate number 3)[2]. This rate is defined according to the following formula.

$$\frac{a}{(a+b)} = \frac{460}{728} \approx 0.632$$

Or approximately 63.2 percent of contacted eligible operations were willing to complete the NASS Phase survey.

[2]American Association of Public Opinion Research (2023) Standard Definitions, Final Dispositions of Case Codes and Outcome Rates for Surveys. https://aapor.org/wp-content/uploads/2023/05/Standards-Definitions-10th-edition.pdf.

2. Communicating response rates

The unweighted response rate, 37.6 percent, for the NASS Phase is the rate that will be used, generally, to communicate the response rate for the NASS Phase of the NAHMS Bison 2022 study, as it represents the likelihood that eligible operations completed the survey.

In addition, when communicating specifically about cooperation, the cooperation rate (63.2 percent) will be used to communicate the likelihood that contacted, eligible producers were willing to complete NASS Phase of the NAHMS Bison 2022 study.

Photograph courtesy of Mike W. Stepien.

Appendix I: Sample Profile

1. Herd size

Herd size (number head)	**Number of responding operations**
Very Small (1–9)	115
Small (10–24)	97
Medium (25–99)	153
Large (100 or more)	95
Total	460

2. Regions

Region	**Number of responding operations**
Northeast (CT, DE, ME, MD, MA, NH, NJ, NY, OH, PA, RI, VT, WV)	33
Southeast (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA)	33
North Central (IL, IN, IA, MI, MN, MO, WI)	127
West (AK, AZ, CA, CO, HI, ID, KS, MT, NE, NV, NM, ND, OK, OR, SD, TX, UT, WA, WY)	267
Total	460

Appendix II: Target Population

While the design of the NAHMS Bison 2022 study was based on counts of operations and bison from the NASS 2017 Census of Agriculture, the counts from the NASS 2022 Census of Agriculture give a more current size of the industry.

		Year			
		2017[1]		2022[2]	
Region	State	Number of operations	Number of bison	Number of operations	Number of bison
Northeast	Connecticut	4	342	9	91
	Delaware	5	148	–[3]	–
	Maine	12	239	9	247
	Maryland	5	43	12	159
	Massachusetts	3	8	–	–
	New Hampshire	15	306	5	93
	New Jersey	4	100	2	NA
	New York	27	1,089	27	3,230
	Ohio	30	986	51	1,451
	Pennsylvania	58	1,251	69	1,686
	Rhode Island	–	–	–	–
	Vermont	7	149	5	219
	West Virginia	4	NA	15	521
Southeast	Alabama	23	153	18	311
	Arkansas	13	206	9	273
	Florida	9	60	20	205
	Georgia	16	147	18	234
	Kentucky	17	1,936	30	4,865
	Louisiana	5	78	5	(D)[4]
	Mississippi	11	171	8	52
	North Carolina	12	264	18	274
	South Carolina	15	71	20	374
	Tennessee	25	350	22	536
	Virginia	8	729	17	1,366
North Central	Illinois	22	703	50	952
	Indiana	31	811	58	2,032
	Iowa	60	2,386	34	1,337
	Michigan	68	2,722	54	2,789
	Minnesota	67	2,897	53	3,109
	Missouri	52	1,213	69	1,979
	Wisconsin	71	5,899	83	6,754
West	Alaska	10	1,518	11	1,489
	Arizona	1	NA	7	112
	California	37	1,396	47	595
	Colorado	82	11,119	110	9,555
	Hawaii	2	(D)	2	(D)
	Idaho	50	18,634	42	5,361
	Kansas	95	5,727	101	8,672
	Montana	80	19,157	69	20,466
	Nebraska	70	28,047	74	32,206
	Nevada	3	16	5	54

	New Mexico	23	4,942	36	4,412
	North Dakota	69	12,127	71	12,487
	Oklahoma	68	4,162	77	7,137
	Oregon	28	1,888	33	1,489
	South Dakota	99	30,035	105	33,995
	Texas	246	7,512	298	8,187
	Utah	27	1,048	22	805
	Washington	39	975	41	1,037
	Wyoming	47	9,755	45	8,715
Total U.S.		1,755	183,780	1,986	192,477

[1] Source: NASS, 2017 Census of Agriculture

[2] Source: NASS, 2022 Census of Agriculture

[3] Values of – denote operation and inventory counts estimated to be zero in the given year.

[4] Values of (D) denote values that are suppressed due to low sample size.