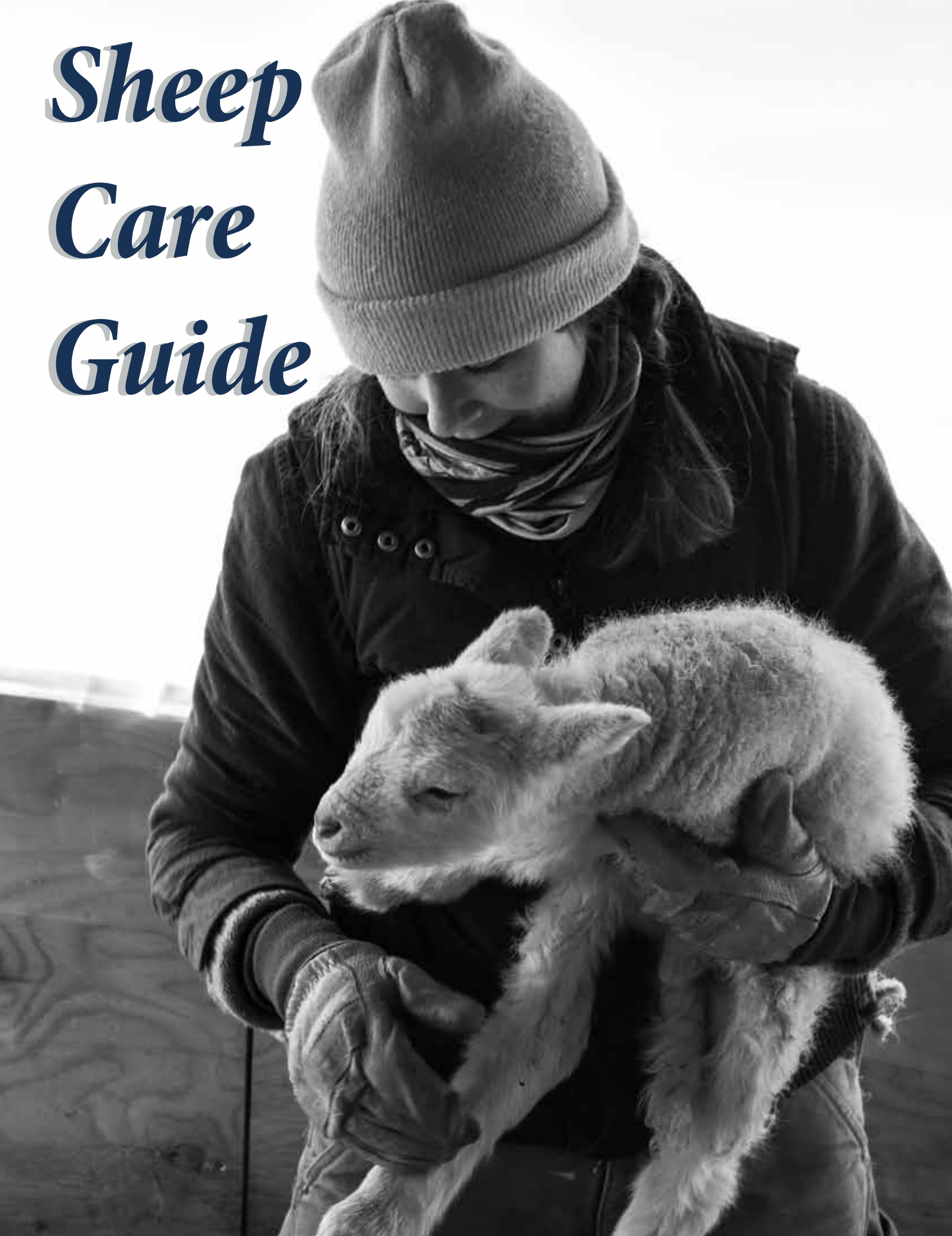
Sheep Care Guide



SHEEP CARE GUIDE

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TABLE OF CONTENTS

Preface 7

Introduction 7

Stress and the Criteria for Animal Well-Being 8

Facilities and Handling 8

Transportation 11

Managing Predation 12

Nutrition 15

Flock Health Program 18

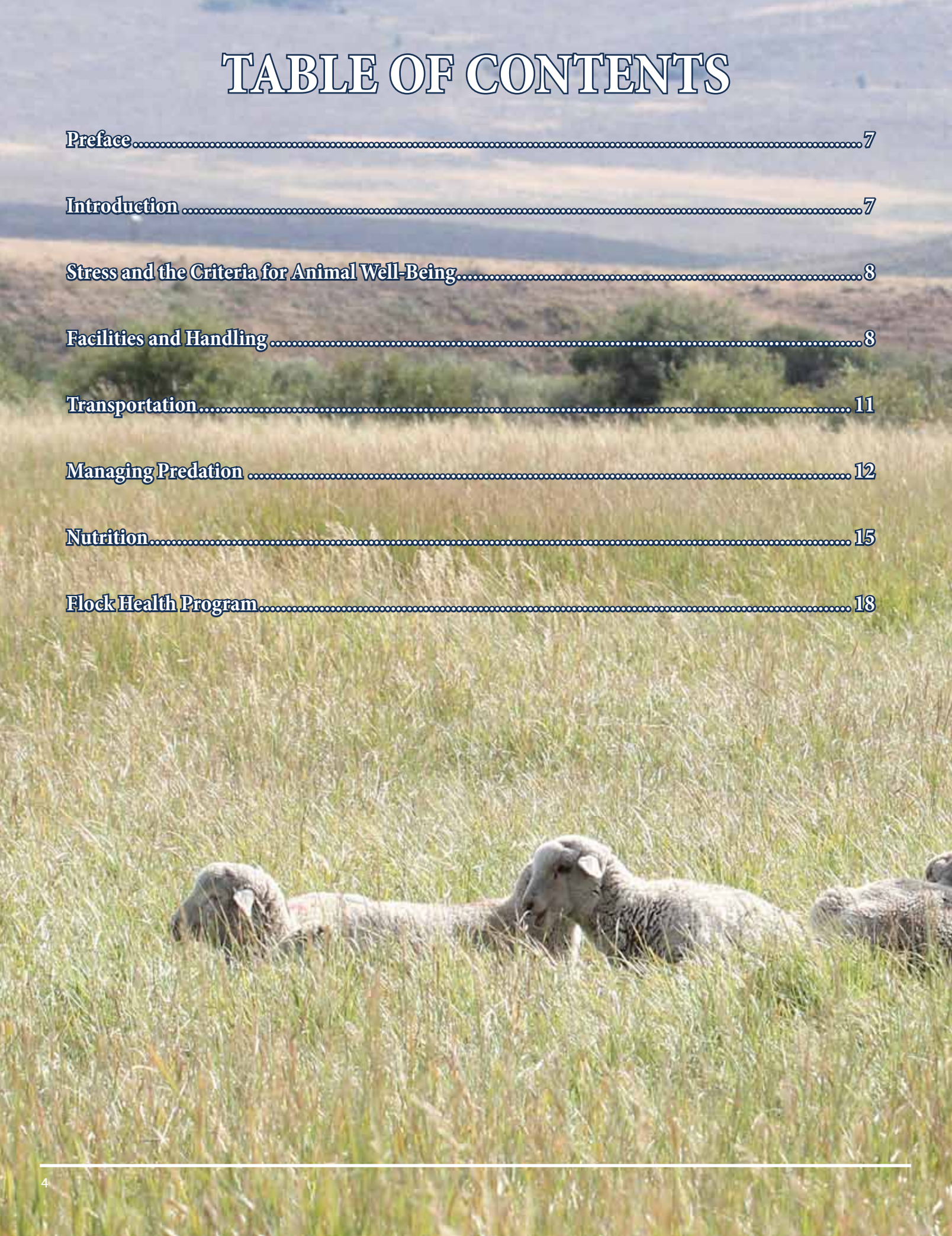


TABLE OF CONTENTS

Shearing 22

Hoof Trimming 24

Lambing and Care of the Lamb and Ewe 24

Exhibition Practices 26

Harvest Practices 27

In Summary 27

Additional Resources 28

References 29

PREFACE

The well-being of their sheep is an important consideration for all sheep producers. This *Sheep Care Guide* was developed to serve as a reference for the sheep producer using a variety of management and production systems and has been written in recognition of an ethical responsibility for the humane care of animals. It is not intended to be an exhaustive review of all aspects of animal care; supplemental information on such topics as breeding, feeding, housing, predation, health, and management is available in other publications including those listed in the References section. An attempt has been made to provide information about sheep care practices which are based on research findings and which are consistent with a program of quality assurance that is recommended by the American Sheep Industry Association.

The American Sheep Industry Association recognizes that each sheep producer's professional judgment, experience, and training are key factors in providing animal care. Interaction between sheep and their physical environment, as well as the producer's management style, are among the factors that may determine proper animal care. Awareness of animal well-being concerns and the application of educational programs help producers continue to improve their animal care skills. The American Sheep Industry Association encourages and supports scientific research to identify new ways to minimize undesirable animal stress and to improve the health and well-being of sheep, consistent with their commitment to continuous improvement

INTRODUCTION

Domestic sheep production has been part of the human way of life for thousands of years. Responsible sheep husbandry has always included a commitment to the well-being and humane treatment of the sheep, as well to good stewardship of the land. Sheep operations in the United States are very diverse because sheep are adaptable to a wide range of climates and management systems. As ruminants, sheep efficiently convert renewable forage resources to high quality food and fiber and can add tangible returns to the environment. In many areas of the country, sheep glean crop residues or utilize agricultural by-products or forage resources that are otherwise unusable by humans or most other livestock. Sheep can play an important role in the control of some noxious weeds, such as leafy spurge.

Resource base, climate, and geography strongly influence the management systems under which sheep are raised. Most sheep are raised in rangeland areas of the United States, often in large flocks, over mountainous and desert-like terrain with wide variation in forage and feeds. However, the number of family owned farm flocks is increasing throughout the

United States, providing the possibility for additional income as well as many non-monetary rewards of livestock ownership. Sheep are ideal animals for youth livestock projects in 4-H, FFA or other agricultural education programs that teach basic animal husbandry and production.

The guidelines in this publication are based upon current research literature from animal science, veterinary medicine, and agricultural engineering. In developing their flock-management program, sheep producers should have access to the American Sheep Industry Association's *Sheep Production Handbook* (2015 edition, vol. 8), and the *Sheep Safety and Quality Assurance Program Manual* (2013). Other important sources of information include the *Sheep Housing and Equipment Handbook* from the MidWest Plan Service (1994), and *Livestock Handling and Transport* (Grandin, 2016). This edition of the *Sheep Care Guide* has been updated using new information available from research and using suggestions provided by a review team from the Federation of Animal Science Societies, as well as many individuals actively engaged in the sheep industry. This review was based on the Animal Care Principles developed by the Animal Agriculture Alliance.

Throughout this Guide, the term "sheep producer" or "producer" is used in place of many other terms that might be used to describe those who care for sheep, such as farmers, ranchers, shepherds, woolgrowers, and lamb feeders.

STRESS AND THE CRITERIA FOR ANIMAL WELL-BEING

Stress has been defined as any environmental situation – and a stressor as any environmental factor – that produces an adaptive response (Curtis, 1983; Mader, 2010). This definition might also be expanded to include the presence of physical agents, such as pathogenic bacteria, or chemical agents as stressors. Not all stresses result in harm, and the adaptive response may result in a situation in which the stressor no longer causes a response. Such a situation might occur when a guardian dog is introduced to a flock for the first time. There is initial anxiety or fright on the part of the sheep, but eventually the sheep accept the dog as part of their normal environment. In the context of livestock production, an animal generally is considered to be stressed when it is required to make extreme adjustments to cope with the physical or environmental situation (Curtis, 1983; Mader, 2010).

Measuring stress or characterizing management and housing systems as stressful environments can be difficult. Plasma concentrations of cortisol, resistance to virus-induced disease, decreased performance, feather loss (in birds), and behavioral criteria have all been used to measure or describe stressful conditions in domestic animals. Assessing stress or, conversely, the state of well-being, is an active area of research. Presently, production traits, health, and reproductive variables continue to be the most readily measurable and practical indicators of well-being (Curtis, 1983; Fraser and Broom, 1990; Mader, 2010). In sheep, some indicators of stress might include:

- Panting or increased respiratory rate
- Tooth grinding
- Restlessness or nervousness
- Reduced feed consumption or grazing activity
- Poor growth rates
- Poor reproductive performance

Their presence indicates a need to evaluate the animals and their environment. Common management related procedures, such as gathering animals for deworming, sheltering, shearing, and lambing, may cause temporary expressions of stress but are not considered serious stress-related situations if conducted according to recognized guidelines for low-stress handling found in the American Sheep Industry Association's *Sheep Production Handbook*.

FACILITIES, HANDLING AND ENVIRONMENT

Sheep Behavior

Sheep have certain behavioral characteristics that producers can use to facilitate effective handling. Sheep are considered the ultimate prey species, for they have little means

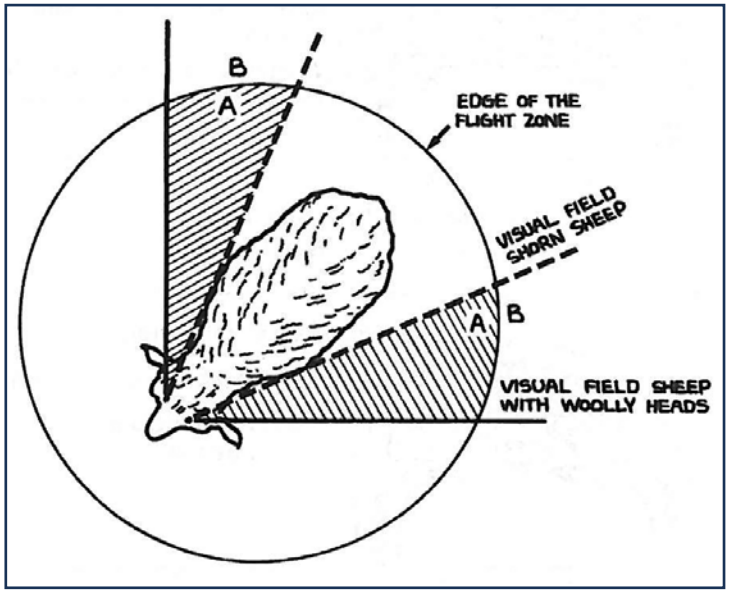


Figure 1. Flight Zone of Sheep.
The circle represents the edge of the flight zone. The handler should work on the edge of the flight zone. He moves to Position A to make the animal move forward and to Position B to make the animal stop. A sheep's visual field varies from 270 to 320 degrees depending on the amount of wool on the head. The handler should stay within the shaded area; if he moves too far forward, the sheep will back up.

of defense from predation, other than flight. Consequently, sheep express strong flocking behavior, and the social spacing and orientation they maintain is an example of species-specific behavior that is important for optimal management. Breed, stocking rate, topography, vegetation, shelter, and distance to water may affect how strongly such behaviors are exhibited, but isolation of individual sheep usually brings about signs of severe anxiety, and be injured if they become agitated enough to try to escape. Sheep tend to "follow" one another even in such activities as grazing, bedding down, reacting to obstacles, and feeding (Hutson in Grandin, 2016), so housing and handling sheep in groups reduces stress to individuals.

Sheep have above-average learning ability. They are capable of significant learning from one experience and can remember bad experiences for at least 12 weeks, and in some cases, for up to a year (Hutson, 1985). However, previously learned aversion to a stressful handling procedure may diminish over time if it is not repeated.

Sheep have good eyesight and a degree of color vision and depth perception. Their visual field is wide angle, about 270°, and binocular over about 45° (Hutson in Grandin, 2016). These characteristics enable sheep to see behind them without turning their heads. This enables them to readily detect and respond to movement behind them.

Physical Facilities

Because sheep are adaptable and their wool is a good insulator, adult sheep do not always need shelter. Sheep take advantage of surrounding terrain, such as hills, ridges, trees, and shrubs for shelter. When barns or sheds are provided, adequate ventilation and clean, dry surroundings are important to reduce bacterial and viral buildup and increase animal comfort. Specific guidelines for structures, feeding facilities, and equipment are available in the *Sheep Production Handbook* and in the *Sheep Housing and Equipment Handbook* from the MidWest Plan Service.

Handling facilities, such as chutes and raceways, are best constructed with smooth, solid sides free of projecting sharp objects or corners in order to reduce the potential for bruises and injury. Considerations that enable producers to move sheep effectively and safely include the following:

• Sheep prefer to move uphill in raceways, and inclines should be gradual.

• Keeping facilities uniformly lighted and free of shadows, along with moving sheep generally from darkened to light areas, helps reduce balking caused by reflections, bright spots, and shadows. Chutes that require sheep to move into blinding sunlight will cause balking.

• Curved pathways in raceways facilitate movement because they prevent animals from seeing chutes or working areas ahead of them. Sheep will follow other sheep in front of them. Curved facilities must be laid out correctly so that they do not appear to be dead ended.

• The instinctive nature of sheep to move into the wind should be considered when determining the location of working facilities and watering sites. This is especially important when sheep are kept on open range or in large pastures.

• Entry points to chutes should gradually "funnel" animals into them.

• Single file races prevent sheep from turning and crowding against one another.

• Handling animals quietly will reduce balking and facilitate movement. Conditioning sheep to the handling experience gradually and moving them through the race without stressful treatments can improve the efficiency and safety of handling. It is important that a sheep's introduction to a new facility is a positive experience. If sheep have an aversive experience the first time they go through a new handling system, they may develop a strong aversion to entering the facility later.

• Well-trained herding dogs can move sheep quietly and safely. Dogs should not bite sheep.

• Electric prods should not be used on sheep.

Training Programs

Single producers or families manage a substantial portion of the sheep in the United States. Many of these operations do not employ outside assistance. In these situations, formal training programs may not be appropriate, and formal standard operating procedures (SOPs) are of limited value. Nevertheless, all sheep producers should strive to regularly update themselves on new housing and handling information in order to provide for the welfare of their animals and improve efficiency. Sources for this information might include publications from the American Sheep Industry Association, industry sponsored training programs, Extension specialists, veterinarians and others.

Larger farms often employ non-family members and may have several units in different locations. These units should utilize formal training programs to teach employees about the importance of animal care and handling procedures and the proper use and maintenance of the facilities. On these units, written SOPs are valuable training tools and set the level of expectation for employees. Development of SOPs and sample plans are described in the *Sheep Safety and Quality Assurance Program Manual*. Managers should monitor the effectiveness of their plans by regularly observing employee performance. Information gleaned from timely post mortem examinations and from animal-harvesting facilities may also be used to assess the plan's effectiveness and the adequacy of handling facilities.

Though not every operation may have a formal training program that includes written SOPS, all producers are encouraged to devise an individual statement of their commitment to managing their sheep in conformance with best practices described in this Guide.

Manure Management

Responsible manure management is expected of all livestock owners. Because many sheep live much of their life on pastures and range, manure buildup or the need for its management is limited to those areas where sheep are temporarily confined for handling, lambing, or winter feeding. Some flocks are confined to buildings or open lots for a considerable portion of the year, and in lamb-feeding enterprises, animals are usually confined to structures or lots. Some facility designs make containment and handling of manure nutrients easier. Producers should consult the *Sheep Production Handbook*, the *Sheep Housing and Equipment Handbook*, or other sources such as Extension publications for information on their construction.

Some states require formal manure-management plans for livestock farms exceeding specified sizes. Guidelines for developing these plans are available from the state's Department of Agriculture or Environmental Protection division. Some agencies, such as Extension and the Natural Resources Conservation Service, also provide producers with assistance in developing those plans, as well as assistance in the design of new construction and renovation of existing facilities for handling and storage. Composting manure has become attractive in some areas because it can reduce, or eliminate, potential disease-causing organisms and improve the value of the manure as a soil amendment. Many states now conduct training programs in composting techniques.

Planning for Emergencies

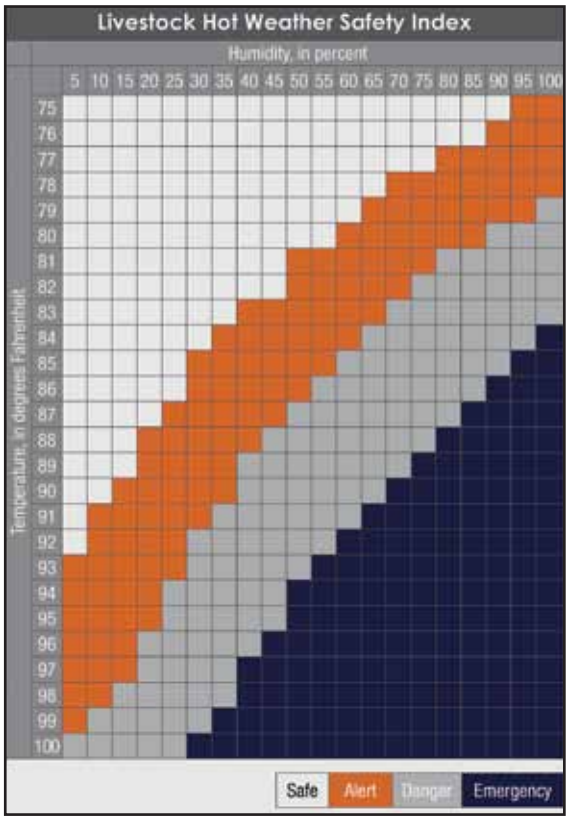
Accidents and family emergencies may befall all sheep operations. Small, family owned operations should consider the possible natural emergencies that might occur and develop a plan to respond to them. The plan should include a list of emergency contacts and contact information and the identification of neighbors, or others, who are familiar enough with the operation that they could care for the sheep during a family emergency. Larger operations need to develop written SOPs to respond to potential emergencies and the day-to-day disruptions of normal sheep care such as employee illness.

Natural disasters, acts of agro or bioterrorism, or accidental introduction of a foreign animal disease can create severe, and potentially long-lasting, problems in providing adequate care for sheep. As an example, the outbreak of foot and mouth disease in the United Kingdom in 2001 caused severe disruption of normal marketing and transportation of animals and feed supplies for several months, and large numbers of animals were destroyed "for welfare reasons" because they could not be adequately fed or cared for. Fortunately, such extreme situations are rare, but producers need to develop

animal care plans that address potential emergencies. Because of the wide variation in sheep production systems, it is beyond the scope of this Guide to provide details for all of them. However, all plans should include the following:

- Contact information for local law enforcement authorities
- Contact information for local fire and rescue squads
- Names and contact information for local veterinary practitioners and the state veterinarian's office
- Contact information for the local or regional Emergency Management Agency

This information should be displayed prominently so it will be readily available if needed. Plans may also include information about possible sources of emergency feed and water supplies should they become necessary.



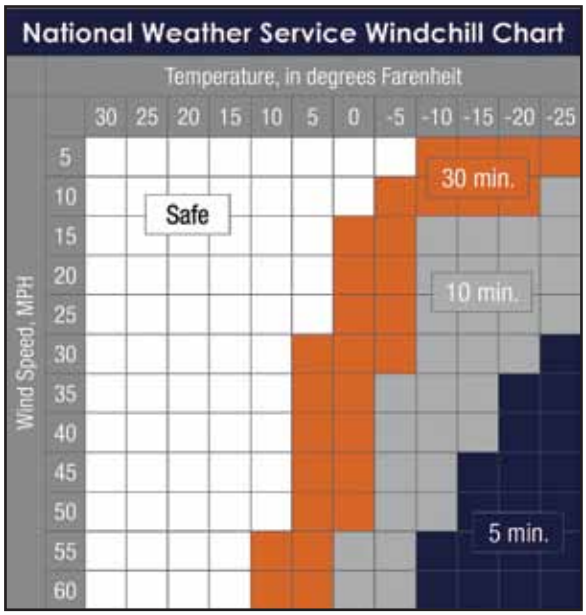


Figure 2.
Livestock Weather Safety Indexes should be used during appropriate times of the year. When weather conditions fall in the Danger or Emergency Zones, adjustments should be made to accommodate livestock.

Mortality Disposal

All sheep operations will experience some animal deaths. Proper disposal of dead animals is necessary to prevent environmental contamination, control disease, discourage predation, and to maintain a positive public perception. Typical disposal methods include deep burial, disposal in landfills, incineration or burning, rendering, and composting. Not all of these are legal options in many areas. Producers should familiarize themselves with state and local ordinances governing dead animal disposal and develop a plan to handle losses. In the case of certain diseases, such as anthrax, the state animal health code may specify that dead animals must be disposed of under the direction of the state or federal veterinarian. If animal mortalities exceed historical proportions, the state veterinarian's office or the state department of agriculture can provide guidelines or assistance for appropriate disposal.

TRANSPORTATION

Animal injuries, bruises, carcass damage, and pelt damage may occur during loading, transportation, and unloading. Rough handling, mixing animals, and poorly designed and maintained equipment account for most injuries and damage. Loading facilities should be designed with an understanding of the natural

behaviors of sheep, and should be in good repair without protruding sharp objects or corners.

Transporting sheep in groups that are uniform in weight and type will lower their risk of injury. Floors of loading and unloading areas and trucks can be made less slippery with bedding or sand. In a large vehicle, divider panels can help maintain sheep density and support. Guidelines for space allowance during transportation may be found in the *Recommended Trucking Practices* (Grandin, 2013), which concurs with spacing allowances published in the North American Meat Institute's *Recommended Animal Handling Guidelines* (NAMI, 2013). Vehicles should be well ventilated, and exhaust fumes should be directed above or away from the sheep. Some additional considerations follow:

- Transporters must be aware of the effects of wind chill. Transporting wet or shorn animals in open trailers in cold weather subjects them to extremes of wind chill that may be deadly.
- Transportation should be avoided during periods of extreme heat and humidity, but if transportation occurs during such periods, transporters must be familiar with the Livestock Weather Safety Index, found in *Recommended Trucking Practices* and NAMI's *Recommended Animal Handling Guidelines*. Air movement, sprinkling, and dampened bedding can reduce the stress of transportation and handling during hot weather. If the truck or trailer must stop for more than just a few minutes, the animals should be unloaded or the vehicle parked in an area where shade and natural ventilation are sufficient to prevent the animals from overheating.
- Transporting sheep full of green feed increases stress and soiling.
- If transportation time exceeds 48 hours, sheep should be unloaded and rested, or consideration should be given to allowing enough space for sheep to lie down (Grandin, 2016).
- Withholding feed for 15-18 hours prior to loading reduces animal stress if trips are 8 hours or less. Sheep should be lightly fed and watered two to three hours before loading if trips exceed 8 hours.
- Using a trained "lead" sheep can reduce handling stress, decrease loading time and minimize shrinkage.
- Loading ramps should have non-slip flooring.
- Incline of ramps should be gradual, (25 degrees or less).

Lame or crippled sheep, sheep weakened by disease or inadequate nutrition, and overcrowded trucks and trailers increase the risk of sheep becoming injured or trampled during transport. Give injured or diseased animals special consideration if they must be transported. Non-ambulatory (downer) animals should not be transported. They should be thoroughly evaluated, and if recovery is unlikely, they should be humanely euthanized on the farm in compliance with guidelines established by the American Veterinary Medical Association's Panel on Euthanasia (AVMA, 2013).

Producers should select a reputable livestock hauler with experience handling sheep, because experience specifically hauling livestock is critical. Contact information for reputable haulers may be available from other producers or harvest facilities. The condition of sheep following transportation is a reflection of both their condition when loaded and their transport experience. Information about injuries, non-ambulatory animals, and number of dead animals should be recorded. The condition of sheep arriving at their destination can be used to assess the hauler's ability to provide good animal care.

MANAGING PREDATION

Background

A predator is an animal that hunts and kills other animals for food. Predation is a fact of nature and occurs on a daily basis. For centuries, sheep have been bred to be docile and easily managed. Domestic sheep do not have the behavioral ability or defense capabilities to survive among predators without help from people. Protecting livestock from predators has been a part of animal husbandry since humans first domesticated animals. This is especially important in the management of sheep, as they are considered the ultimate

prey species because of the number of natural predators, and their relative inability to defend themselves. Predation from dogs and wild animals causes stress, suffering, and death for large numbers of sheep each year. The economic loss from predators is considerable. The objective of a predator management program is to remove or reduce the opportunity for predators to prey on sheep.

Predators

Coyotes, bears, wolves, mountain lions, foxes, bobcats, eagles, ravens, black vultures, wild swine, and domestic dogs are among the natural predators for sheep. Most wildlife, including predators, are protected by federal and state laws. Producers must become familiar with federal, state, and local laws governing predators that may prey on their sheep as they develop their prevention strategies.

Reducing Predation

Frequent flock observation will lower some types of predation losses, because the presence of humans will deter many predators. The use of herders, when possible, can help identify predation and reduce losses. However, herders are not a practical option in all areas of the United States.

When losses occur, producers should examine the sheep carcasses and all evidence around the death site in order to identify the type of predator responsible. Photographs are helpful, as are statistics and written records. In some cases, help is available from a veterinarian, Extension specialist, or federal or state Wildlife Services personnel to accurately assess predator problems and help find solutions.

Dead animals attract predators. Therefore, producers should remove their carcasses as soon as possible and appropriately dispose of them. Care should be given to injured sheep to limit further predation and fly strike. Injured sheep need examination and appropriate treatment. Severely injured animals that are unlikely to recover should be euthanized humanely.

Non-Lethal Control

Sheep producers frequently use non-lethal tools to deter predators. These may include frightening tactics, such as sirens and lights, net wire or electric fencing, and guardian animals, including guard dogs, donkeys, llamas, or other protective animals. For a guardian animal to perform its task well, adequate bonding of the animal with the sheep is essential. Producers should monitor their guardian animal and sheep's behavior closely, especially just after introducing them.

Lethal Control

Because some predators, especially the coyote, may quickly learn to evade or ignore non-lethal techniques, approved lethal control methods used by knowledgeable individuals are needed from time-to-time to protect the flock. Many producers get assistance from professionals employed in federal and state Wildlife Services agencies. These experts educate and assist producers in techniques used to remove offending predators. Usually producers find that an integrated approach using several tools is most successful in reducing predation.

An integrated approach is often most effective at reducing predation, and the factors will vary from operation to operation depending on environment, regional factors, and resources. To address every type of management system is beyond the scope of this Guide. An extensive chapter discussing predation and predation management is available in the *Sheep Production Handbook*.

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NUTRITION

Sheep are ruminants, which means they can utilize a wide variety of feedstuffs to meet their nutrient requirements. Extensively managed sheep operations typically use native forages, or improved pastures, and crop aftermath from grains, legumes, and vegetable crops. Intensively managed operations may use similar plant materials but may rely more heavily on harvested feeds including cereal grains. The nutritional needs of sheep in range flocks, farm flocks, and lamb feedlots vary greatly, and nutritional programs must be developed to address these specific, and sometimes unique, situations.

Basic nutrient groups include water, energy (carbohydrates and fats), protein, minerals, and vitamins. A sheep's nutrient requirements vary greatly and are heavily dependent upon such factors as age, sex, weight, body condition, stage of production, wool or hair cover, and environmental conditions, such as cold, wind, and mud. These factors are in a constant state of change, and the diet must be adjusted accordingly. The Nutrition chapter of the *Sheep Production Handbook* provides sheep producers the necessary information to evaluate their sheep's nutritional needs in the various stages of condition and production and shows how to formulate diets that will adequately meet the sheep's needs for maintenance, growth, and reproduction. Additional information is available in the National Research Council's publication, *Nutrient Requirements of Small Ruminants*.

Forage quality may vary considerably throughout the year and from year-to-year. Routine monitoring of quality, using forage nutrient analyses, is very important to optimize animal efficiency, reduce costs, and maximize animal welfare. Periodic review of the nutrition program by a qualified nutritionist is advised. This is especially useful for producers who own small flocks and who have minimal experience formulating diets. Records of feeds fed and sources of feed ingredients are important to document the nutrition program and any feed additives used.

Some general guidelines that promote overall animal well-being include:

- In order to avoid digestive upset, changes in diet should be made gradually to allow rumen microorganisms to adequately adapt.
- Use feeding and watering equipment designs that will avoid injury and contamination.
- Under most conditions, water should always be available. However, a sheep's water requirement can vary considerably depending on stage of production, weather, and the type of forage being grazed. In some management systems, lush forages or natural sources meet the requirement.
- Some regions of the United States are prone to deficiencies or excesses of certain micronutrients (i.e. selenium or copper). Producers should be familiar with conditions in their area and their nutritional program should account for these variations.
- In some regions of the United States, poisonous plants are a threat to sheep health. Producers should be alert to the presence of these plants and the potential for sheep to consume them, and can find additional information in the *Sheep Production Handbook*.

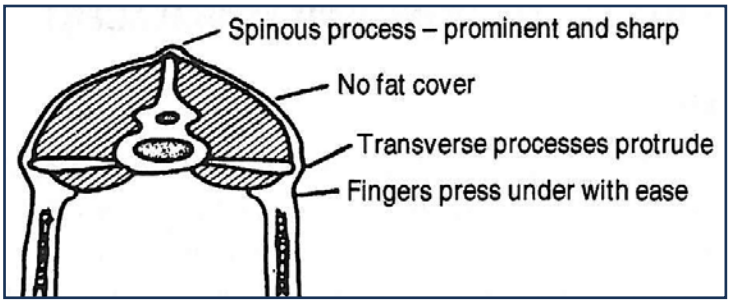

Figure 3. Body Condition Score 1
Sheep is extremely thin, unthrifty but agile. Skeletal features are prominent with no fat cover. No apparent muscle tissue degeneration. Has strength to remain with the flock.

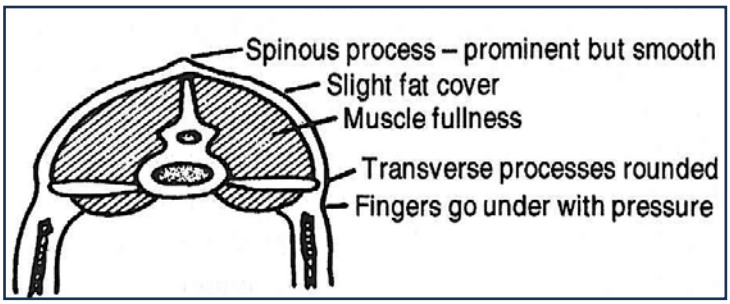

Figure 4. Body Condition Score 2
Sheep is thin but strong and thrifty with no apparent muscle structure wasting. No evident fat cover over the backbone, rump and ribs, but skeletal features do not protrude.

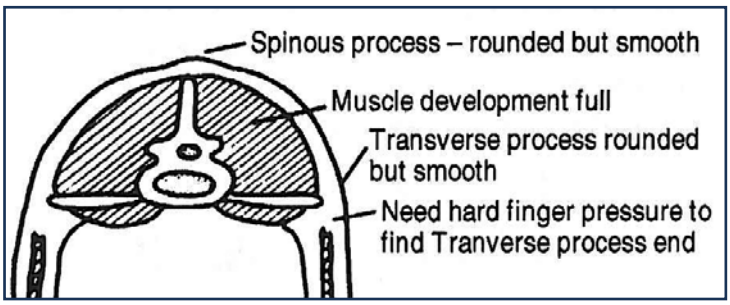

Figure 5. Body Condition Score 3
Sheep are thrifty with evidence of limited fat deposits in fore rib, over top of shoulder, backbone, and tail head. Hipbone remains visible.

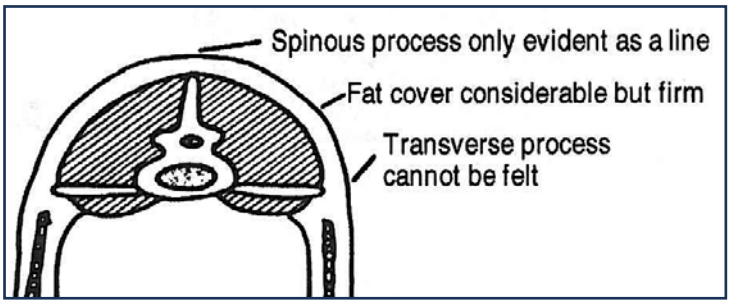

Figure 6. Body Condition Score 4
Moderate fat deposits give the sheep a smooth external appearance over the shoulder, back, rump, and fore rib. Hipbone is not visible. Firm fat deposition becomes evident in brisket and around the tail head.

Monitoring

Regular monitoring of health, body condition, and growth rates allows producers to evaluate the adequacy of flock nutritional programs. Producers can quickly learn to evaluate body condition scores and can use this tool routinely to assess the overall nutritional status of their sheep. The technique of body condition scoring and descriptions and diagrams of the various scores are available in the *Sheep Production Handbook* in the Nutrition chapter; Table 11 in that chapter provides targets for body condition in various stages of production. A livestock scale is very useful to monitor weight changes in both ewes and lambs. Periodically weighing growing lambs can tell the producer whether expected gains were achieved, and allows an assessment of the nutritional program throughout the various stages of growth. When feasible, sheep should be grouped by similar body condition and stage of production.

Equipment

Because of the great diversity in the types of sheep operations across the country, feeding equipment needs are very diverse. For example, large lamb feedlots of the West have considerably different requirements than farm feedlots found in the eastern part of the United States. Producers can consult regional experts for design in construction of feeding facilities. The *Sheep Housing and Equipment Handbook* from the MidWest Plan Service provides a number of examples for feeding systems that are appropriate in a variety of production settings.

Feed handling facilities should be designed and constructed to reduce the risk of feed contamination with chemicals, foreign materials, and disease-causing infectious agents. Protect feedstuffs, feed troughs, and water supplies from contamination by chemicals, foreign materials, and manure. Locate feeders and waterers away from each other in the feedlot. Implement strategies to protect against feed contamination with fecal material from pets, wild animals,

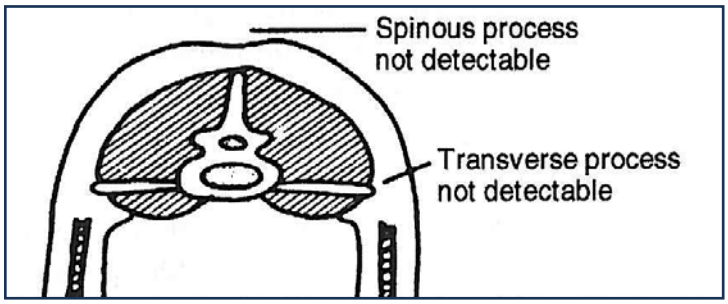

Figure 7. Body Condition Score 5
Sheep are extremely fat with the excess detectable over the shoulder, backbone, rump, and fore rib. Excess fat deposits in brisket, flank, and tail head regions lack firmness. Sheep appear uncomfortable and reluctant to move about. Quality fleeces are generally found.

and birds. As producers renovate or make new purchases, they should select equipment that will minimize fecal contamination and can be easily cleaned. Nutritionists, veterinarians, and Extension educators can advise producers about practical ways to protect and maintain clean feed and water supplies.

Accidental contamination from chemicals and disease-causing organisms can occur if feeds are not properly stored. Safe feed storage includes protection from chemicals, rodents and other animals. To keep feeds from becoming contaminated, fertilizers, herbicides, insecticides, fungicides, and other chemicals should be stored in facilities separate from feed. Store poisonous products in a locked room or cabinet. Protecting grains and forages from moisture prevents deterioration of feed and limits mold growth. Proper storage also helps to maintain feed quality.

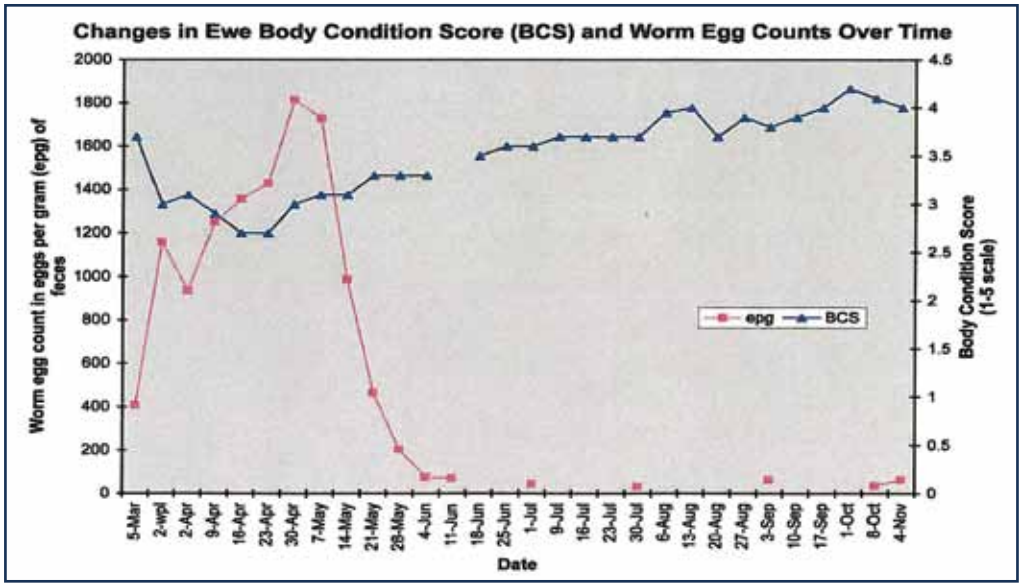

Figure 8. This graph illustrates changes in ewe body condition throughout a major portion of a year. In this example flock, lambs were born during the first three weeks of March. Note how body condition score dropped during lactation (a normal occurrence) and began to rise again after the lambs were weaned in the first week of June. Also, note the classic rise in worm egg counts (in feces) that occurs with the onset of lactation and persists for about six to eight weeks.

Record Keeping

Records can be handwritten or maintained on a computer; either system is acceptable. Records of changes in body weight or condition score allow sheep producers to track the success of their feeding programs throughout the year and from year-to-year. It is difficult to monitor nutrition, health or other management practices on a sheep operation without records. The information in these records allows producers to identify aspects of the nutrition program that may need improvement; especially in areas that may affect animal care. Such information is particularly useful for a nutritionist who may use this information to identify areas for improvement.

Sometimes various additives and medications are mixed in sheep feed to aid in the control of disease. Many such classes of drugs deemed medically important have been defined as "VFD drugs" and are limited to use under the supervision of a licensed veterinarian, with a written order, called a Veterinarian Feed Directive (VFD). All records of VFD feeds must be detailed and maintained in compliance with requirements of the Veterinarian Feed Directive Information required on a written VFD order includes:

- Veterinarian's name, address, and telephone number
- Client's name, business or home address, and phone number
- Premises at which the animals specified in the VFD are located
- Date of VFD issuance and expiration date
- Name of the VFD drug(s)
- Species and production class of animals to be fed the VFD feed
- Approximate number of animals to be fed the VFD feed by the expiration date of the VFD
- Indication for which the VFD is issued
- Level of VFD drug in the feed and duration of use
- Withdrawal time, special instructions, and cautionary statements necessary for use of the drug in conformance with the approval;
- Number of reorders (refills) authorized, if permitted by the drug approval, conditional approval, or index listing;
- Statement: "Use of feed containing this veterinary feed directive (VFD) drug in a manner other than as directed on the labeling";
- An affirmation of intent for combination VFD drugs as described in 21 CFR 558.6(b)(6) veterinarian's electronic or written signature;
- Maintain production records of all batches or runs including date run, ration, name or number, and amount of ration;
- Keep all records at least two years, and be able to conduct a recall if necessary.

A more complete discussion of record keeping requirements for producers who mix feeds is described in the *Sheep Safety and Quality Assurance Program.*

Certain medications such as those used to prevent coccidiosis are notable exceptions to the VFD.

FLOCK HEALTH PROGRAM

A flock health program that emphasizes disease prevention and that producers develop in consultation with a knowledgeable veterinarian offers many advantages. A healthy flock usually is more productive than a flock with disease problems, and may require less labor input. Veterinary advice can help producers improve production and reproductive efficiency through health and disease monitoring programs tailored specifically to a producer's needs. An effective flock health program contributes to the well-being of sheep.

Biosecurity

A biosecurity plan describes specific measures to prevent the introduction of disease agents and their spread to and from animal populations or their proximity. Biosecurity has three main components:1) Isolation: the confinement of animals away from other animals; 2) Traffic control: movement of people, animals, and equipment; and 3) Sanitation/husbandry: cleanliness and care of animals and their environment. Sheep producers should work with their veterinarian to develop a biosecurity plan and communicate it to those who work on their operation. Guidelines for developing a thorough biosecurity plan are provided by the American Sheep Industry Association, on their website, http://www.sheepusa.org/ and in the health chapter of the *Sheep Production Handbook*.

The most common way that new diseases are introduced into a flock is through the introduction of new animals. New animals and animals returning from exhibitions should be isolated from resident animals for at least four, and preferably eight weeks. During this time, isolated animals should not have nose-to-nose contact with resident sheep. Isolation areas (buildings and pens) should not share the same airspace as resident animals, and should ideally be as far from resident animals as practical, such as another set of buildings or pastures several hundred yards away.

BIOSECURITY PLAN

Three Main Components:

- Isolation: Confinement of animals away from other animals.
- Traffic Control: movement of people, animals and equipment.
- Sanitation/Husbandry: cleanliness and care of animals and their environment.

Health Monitoring and Diagnostic Services

Subclinical disease can be detected by routine examination of live animals, such as in the regular examination of rams before the breeding season, and by post-mortem examination of animals to determine the cause of death. Regular flock observation, examination of dead animals, and flock health records provide information for effective disease monitoring. Records that indicate increased incidence of disease or failure of previously successful treatment and prevention programs should signal the need for an aggressive approach to diagnosis. Most states provide diagnostic laboratory services, which are available to the producer either directly or through the flock veterinarian. Early and accurate diagnosis of disease is one of the most effective tools to inform a producer's approach to disease prevention and management. Disease prevention programs should be developed in cooperation with the veterinarian of record.

Parasite Control

Parasites are a major health concern for many flocks, and the type of parasite(s) vary with the environment. External and internal parasites rely on optimal conditions in their environment for transmission and proliferation.

External parasites include flies, lice, mites, keds, and ticks, and affect production because they feed on body tissue such as blood, skin, and fiber. Wounds caused by external parasites result in discomfort and irritation, and parasites can transmit diseases from sick to healthy animals. External parasites can be managed by use of topical insecticides.

Internal parasites are of concern in areas that receive significant rainfall. The life cycle of internal parasites involves the presence of infectious larvae on the forages sheep graze, and the presence of adult parasites in the host animals. Management strategies that interrupt more than one phase of a parasite's life cycle are most successful. Anthelmintics (dewormers) are most effective when used in combination with pasture management strategies.

Parasite management programs should be developed which take into account the best strategies for the flock and which minimize the risk of development of parasite drug resistance. A veterinarian or Extension specialist can assist producers in developing such a program. Perhaps the most comprehensive and practical producer reference for parasite control is found in the *Sheep Production Handbook*.

Analgesia, Anesthesia, and Euthanasia

Analgesia generally refers to the relief of pain without loss of consciousness. Anesthesia may be local or general, resulting in loss of sensation or consciousness. Certain common husbandry procedures, such as castration or tail docking performed on very young animals, may be conducted without anesthesia. However, some procedures, such as caesarean section or other procedures in older animals, may require anesthesia to avoid excessive pain. If these procedures are indicated, a veterinarian can determine the anesthesia of choice.

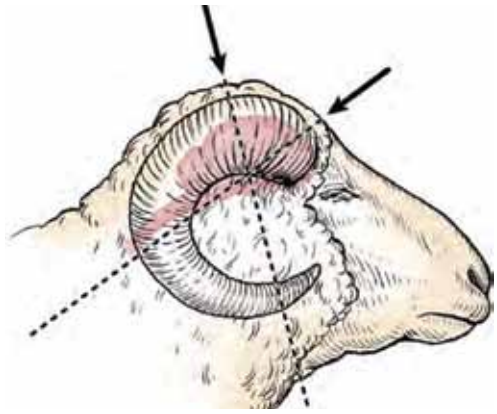

Figure 9. Recommended positioning for a captive bolt stunner and for gunshot placement for sheep euthanasia. Images from: Shearer JK and Nicoletti PN.

Euthanasia is a procedure that induces death in an animal quickly and painlessly. Euthanasia of sick sheep that probably will not recover is preferable to allowing disease to follow its natural course, or to reduce suffering in cases of catastrophic injury. Guidelines for euthanasia procedures are published by the AVMA (2013). A veterinarian can provide information concerning practical and appropriate methods for producers. An excellent resource on some of the techniques for humane euthanasia can be found at https://vetmed.iastate.edu/vdpam/about/production-animal-medicine/dairy/dairy-extension/humane-euthanasia. Producers may choose to use gunshot or a captive bolt device followed by exsanguination (bleeding out). They should familiarize themselves with the techniques and the landmarks for correct bolt or bullet placement, particularly as these critical landmarks have been recently updated It is important to note that the updated, correct landmark is determined by drawing a line from the poll to the mandible (jaw), with the shot directed at the poll downward; or alternatively by drawing a line perpendicular to the face, with the shot directed at the forehead below the poll, in line with the spinal column (Fig. 9).

Certain chemical agents used to euthanize animals can be toxic or fatal to other animals that ingest the carcass. If these products are used, the carcass must be disposed of both properly and immediately, in compliance with federal and location guidelines designed to prevent environmental contamination or poisoning of scavengers feeding from tissues was animals euthanized with barbiturates.

Using Animal Health Products

Appropriate use of animal drugs and vaccines is part of maintaining animal well-being in a well-designed, health management program. This involves monitoring flock health, treatment, and preventing disease when possible.

Using antibiotics and other antimicrobial products in animals has come under scrutiny because of the concern that their use may result in antibiotic resistance in organisms that may subsequently infect people. Antimicrobial therapy should be used only after a careful diagnosis is made and all options have been considered. The American Veterinary Medical Association (AVMA) has developed the following guidelines regarding the *Judicious Therapeutic Use of Antimicrobials* in animals

Judicious Use Principles:

- Preventive strategies, such as appropriate husbandry and hygiene, routine health monitoring, and vaccination, should be emphasized.
- Other therapeutic options should be considered prior to antimicrobial therapy.
- Judicious use of all antimicrobials should include appropriate veterinary oversight.
- Prescription, Veterinary Feed Directive, and extra-label use of antimicrobials must meet all the requirements of a veterinarian client patient relationship.
- Extra-label antimicrobial therapy must be prescribed only in accordance with the Animal Medicinal Drug Use Clarification Act amendments to the Food, Drug, and Cosmetic Act and its regulations.
- Veterinarians should work with those responsible for the care of animals to use antimicrobials judiciously, regardless of the distribution system through which the antimicrobial was obtained.
- Regimens for therapeutic antimicrobial use should be optimized using current pharmacological information and principles.
- Antimicrobials considered important in treating refractory infections in human or veterinary medicine should be used in animals only after careful review and reasonable

justification. Consider using other antimicrobials for initial therapy.

• Use narrow-spectrum antimicrobials whenever appropriate.

• Utilize culture and susceptibility results to aid in the selection of antimicrobials when clinically relevant.

• Therapeutic antimicrobial use should be confined to appropriate clinical indications. Inappropriate uses, such as for uncomplicated viral infections, should be avoided.

• Therapeutic exposure to antimicrobials should be minimized by treating only for as long as needed for the desired clinical response.

• Limit therapeutic antimicrobial treatment to ill or at risk animals, treating the fewest animals indicated.

• Minimize environmental contamination with antimicrobials whenever possible.

• Accurate records of treatment and outcome should be used to evaluate therapeutic regimens.

There are a limited number of drugs that a producer can legally use for sheep. FDA policy requires that livestock producers use drugs only in accordance with the label instructions. Uses that are contrary to label directions include ignoring labeled withdrawal times, using the product for a species not indicated on the label, using the drug to treat a condition not indicated on the label, administering the drug at a different dosage than stated on the label, or otherwise failing to follow label directions for use and administration of the drug. These uses are only allowed when directed by the veterinarian of record, with a valid veterinarian client patient relationship (VCPR) and are considered "extra-label drug use."

A valid VCPR exists when:

• The veterinarian has assumed the responsibility for making clinical judgments regarding the animal's health and its need for medical treatment, and the client has agreed to follow the veterinarian's instructions.

• The veterinarian has sufficient knowledge of the animal to initiate at least a general or preliminary diagnosis of the medical condition of the animal, which means that the veterinarian has recently seen and is personally acquainted with the keeping and care of the animal by virtue of an examination or medically appropriate and timely visits to the premises where the animal is kept.

• The veterinarian is readily available for follow-up evaluation in the event of adverse reactions or failure of the treatment regimen.

Extra-label Drug Use

There are two classes of drugs— those that can be purchased "over-the-counter" (OTC) and those available by prescription. OTC drugs can be purchased and used as directed on the label without establishing a relationship with a veterinarian. For example, the label on procaine penicillin G directs that one cc (milliliter) per hundred pounds be given intramuscularly. A 100 pound sheep would receive one cc. Producers are not allowed to adjust the dosage or route of injection without veterinary direction.

Prescription drugs can be used only on the order of a veterinarian within the context of a valid VCPR. Medications used in this fashion must contain an additional label showing the contact veterinarian and instructions given, including the withdrawal time. Drug cost is not considered a valid reason for extra-label drug use under the Animal Medicinal Drug Use Clarification Act (AMDUCA) or the regulations promulgated to implement the Act. Records of such use of medications must be kept in accordance with the criteria.

The extra-label drug usage policy of the FDA specifies the following criteria:

• A careful diagnosis is made by an attending veterinarian within the context of a VCPR.

• A determination is made that (1) there is no marketable drug specifically labeled to treat the condition diagnosed; or (2) treatment at the dosage recommended by the labeling was found clinically ineffective.

• Procedures are instituted to assure that the identity of the treated animal is carefully maintained.

• A significantly extended period is assigned for drug withdrawal prior to marketing the treated animal, and steps are taken to assure the assigned time frames are met so that no violative residue occurs. The Food Animal Residue Avoid-

ance Databank (FARAD) can aid the veterinarian in making these estimates.

Drug Compounding

The American Sheep Industry Association concurs with the position of the American Veterinary Medical Association (AVMA) in regards to drug compounding (which is any manipulation of a drug beyond that stated on the product's label, such as mixing two injectable solutions, or creating an oral suspension from crushed tablets or an oral injection). The position of the AVMA is that compounding is a necessary tool to provide individualized care for animals with specific needs not met by FDA-approved drugs. A classic example of compounding is creating an oral suspension from crushed meloxicam tablets, and is prescribed with growing frequency by veterinarians for mitigating pain with procedures (such as castration, tail docking, etc.) performed on animals older than several weeks of age.

Vaccines

Vaccines are available for a number of infectious diseases of sheep and may constitute a major step in prevention. Vaccines stimulate an animal's resistance to an infectious agent. They work best in healthy animals with adequate nutrition and require sufficient time for the development of a protective response. Vaccination programs that are tailored specifically for a region, flock, and management system are usually the most successful and cost effective. Vaccines should be used according to the manufacturer's guidelines or as directed by a veterinarian. Vaccination should be viewed as a part of a flock health program and not as absolute protection against disease.

Animal Identification

Some system of animal identification is necessary for producers to efficiently monitor various aspects of their flock breeding and management programs. Likewise, it is important for producers to be able to identify and track animals to which drugs were administered preceding the sale of meat or milk. A system of health records must be maintained that, at a minimum, identifies animal(s) treated (individual animals, pens, lots, etc.), the date(s) of treatment, the drug(s) administered, serial and lot number of product, who administered the drug(s), the amount administered, and the withdrawal time prior to harvest. A number of systems for on-farm use, usually ear tags and paint brands, have been used for animal identification for many years.

In 2001, the USDA, in cooperation with the sheep industry, launched a concerted effort to eradicate scrapie. The national scrapie eradication program has a federal requirement for individual identification, which usually takes the form of a uniquely numbered ear tag available directly to producers and veterinarians. Some states may have additional requirements, and the state veterinarian can be contacted to assist producers with this topic.

SHEARING

Wool is a naturally produced, high quality fiber with many uses. Because sheep do not shed their wool naturally, annual shearing is necessary for wool removal and for the physical well-being of the animal during certain times of the year. Some breeds of sheep grow hair instead of wool and shed it naturally without shearing. Producers who have difficulty finding a shearer may wish to consider raising hair sheep.

Facilities and Equipment

Facilities and methods used should be designed to protect the sheep, the shearer, and the resulting wool clip. The shearing facility should be clean and dry. It should include holding areas, chutes, and alleyways that provide easy movement for the sheep. The shearing floor should be solid, clean, and have a non-slip surface. Because sheep-shearing crews and their equipment have the potential to carry diseases from flock to flock, producers should provide their own shearing floors and equipment or require the shearing crew to disinfect their shearing floor, shearing trailer, and other equipment thoroughly prior to use

Diseases can also be transmitted from sheep to sheep under certain conditions. If unhealthy animals are in the flock at shearing time, special precautions can be taken to avoid the spread of disease. Shearing equipment should be kept clean, sharp, and well lubricated. Combs and cutters should be disinfected following each job.

The Shearer

It is important to select a reputable shearing crew. A good shearer is a skilled professional and understands the importance of handling sheep calmly to minimize stress. Proper shearing style positions the sheep to insure control and comfort of the animal, and though those details are beyond the scope of this Guide, the *Sheep Production Handbook* provides much more detail.

Pre-shearing Management

Keeping sheep off feed for six to 12 hours before shearing

reduces stomach fill, keeps them quieter and more comfortable during shearing, and helps prevent skin cuts. Only dry sheep should be sheared. A wet sheep is more difficult to handle, and the wool will lose value or be destroyed if it is packaged wet.

Post-shearing Management

Although particular care is taken by the shearer, cuts can happen. Animals that are accidentally cut during shearing should be assessed immediately to determine if they need to be treated to prevent infection. An antiseptic solution and, in warm weather, a fly repellent should be applied. Following shearing, the sheep should be turned into clean, dry areas. Recently shorn sheep need shelter in severe cold, wet, windy, or hot weather conditions.

Feeder-Lamb Shearing

In some cases, feeder lambs are shorn during the finishing period. Shorn lambs stay cleaner during the feeding period, and a reduction of mud and manure on the pelt reduces the potential for contamination of the carcass during fabrication. Shearing may improve lamb performance. The use of raised combs for shearing lambs, to leave a longer staple of wool, is suggested when lambs might be exposed to severe weather conditions following shearing. Removal from feed and water is not advised.

Ewe Shearing

Shearing or crutching are techniques usually done about one month prior to lambing, and the decision about which technique to use should take into consideration the climate and management system.

Crutching is the removal of wool from the areas around the vulva, udder, and the inside of the rear legs. It can generally be done in any season because relatively little wool is removed. Crutching ewes:

- Allows easy observation of the signs and progress of birth, reduces potential contamination of the lamb as it is born and of the ewe if assistance is needed,
- Makes it easier for lambs to find the teats to nurse and reduces the potential contamination of the teats and udder,
- Makes it easier to observe whether the lamb has actually begun nursing,
- Reduces the potential for fly strike during warm seasons of the year,
- Increases the value of the fleece when sheep are shorn later.

Pre-lambing shearing of the entire ewe may be preferred when lambing occurs during mild weather or when the ewe will lamb in a barn or shed which provides protection from weather extremes. Shearing provides the same benefits as crutching plus it:

- Reduces moisture and dirt buildup in the lambing shed or barn,
- Reduces the possibility of a lamb being caught under a ewe when she lies down,
- Reduces heat stress of ewes during warm periods or if the ewe delivers her lambs in a warm building or shed,
- Increases the ewe's appetite thus reducing the potential for pregnancy toxemia,
- Reduces space requirements for ewes housed during lambing,
- May make the ewe more conscious of cold weather and more likely to seek a more sheltered place for lambing.

Following shearing, adequate shelter, and perhaps extra feed to produce body heat, will need to be provided if cold weather is expected. Handling ewes for crutching and shearing during late pregnancy can create stress if not done carefully and in good facilities. If ewes are handled gently, the potential improvement in animal health and comfort at lambing outweighs the minimal stress of handling and shearing.

If the flock is large and lambing will occur in groups, separating ewes by expected lambing date can allow more efficient use of facilities, and special attention can be given to those closest to lambing. Technology, such as ultrasound pregnancy diagnosis, and staging of pregnancy can assist the producer in grouping sheep for special feeding needs and close attention at lambing.

For range and pasture lambing, shade, shelter, or windbreaks may need to be provided unless the natural terrain

provides them. If lambing will occur in confinement, the facility should be clean and dry. When lambing occurs over a period of several weeks in the same facilities, infectious disease agents tend to build up in the environment. Planning a break between lambing periods with cleaning, disinfection, and a short period with no animals present can reduce the potential for disease. Pens should be in good repair and provide adequate space. Feeds troughs and waterers should be located so that lambs will not be injured or trapped by them.

Guidelines for facilities can be found in the *Sheep Production Handbook* and the MidWest Plan Service *Sheep Housing and Equipment Handbook*.

HOOF TRIMMING

Routine hoof trimming is not always necessary. However, when sheep are maintained for long periods under conditions in which the hoof does not receive sufficient wear, trimming may be required to prevent lameness and to improve animal comfort. If contagious foot rot is present in a flock, then hoof trimming and hoof inspection will likely be routine. As with shearing, equipment and facilities are important. Restraining devices are commercially available and can make hoof trimming more comfortable for the sheep and the person doing the trimming. The Handling and Facilities and Animal Health chapters of the *Sheep Production Handbook* provide extensive descriptions of procedures and equipment used in hoof care.

LAMBING AND CARE OF THE LAMB AND EWE

Preparation for the Lambing Season

Handling ewes for crutching or shearing during late pregnancy can be stressful if not done carefully and in good facilities. If ewes are handled gently, the potential improvement in animal health and comfort at lambing outweighs the impact of handling and shearing.

If the flock is large and lambing will occur in groups, separating ewes by expected lambing date can allow more efficient use of facilities, and special attention can be given to those closest to lambing. New technology, such as ultrasound pregnancy diagnosis and staging of pregnancy, can assist the producer in grouping sheep for special feeding needs and close attention at lambing.

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Animal Care at Parturition

Breeding, management, and feeding programs that promote unassisted lambing foster animal well-being and reduce the need for help at lambing time. Dystocia, or difficulty during parturition may occur, and the producer should be familiar with the normal birth process and be prepared to assist ewes having trouble. If labor is prolonged before assistance is given, the ewe may become stressed and the lambs' survivability compromised.

When assistance is needed, it should be done in a sanitary fashion. The rear of the ewe should be thoroughly cleaned, the producer's hands and arms should be cleaned and covered by a clean plastic sleeve to protect both the ewe and the producer. A good quality, non-irritating lubricant will protect the ewe from irritation, reduce the possibility of injury, and facilitate the birth process. Shepherds can become familiar with the normal birth process and techniques used to assist the ewe by consulting with their veterinarian, Extension personnel, and experienced producers, and by reading appropriate materials such as the *Sheep Production Handbook* or viewing available videos on lambing management and obstetrical techniques. If the producer cannot readily deliver lambs or if abnormal conditions are present that are unfamiliar, skilled assistance should be sought. In normal lambings with healthy ewes and vigorous lambs, assistance is usually unnecessary and may be undesirable.

The ewe/lamb bonding process is critical to the survival of the lamb, and unnecessary disturbances can disrupt this process. Bonding of the ewe and lamb can be disrupted by the presence of predators, other animals, abnormal human activity (such as extensive or unnecessary handling), crowding, and illness in the ewe. Flocks should be conditioned to the presence of experienced producers moving among them at lambing time to avoid disturbances (Haughey, 1991). Ewes that fail to claim their lambs will often do so later if the producer discovers this early and encourages the bonding pro-

cess. Penning the ewe with her lambs and rubbing them with her birth fluids often accomplishes this. Aggressive ewes may need to be restrained by tying them or placing them in a stanchion to keep them from injuring the lamb until they decide to claim it. It is important to be sure that the lamb gets adequate colostrum and milk during this process.

Lamb Care Practices

Death, illness, or the ewe's unwillingness to claim any or all of her lambs may make it necessary to care for orphaned lambs. Generally, this is done by "grafting" the lamb to another ewe that has sufficient milk or by raising the lamb on milk replacer formulated for lambs. Grafting the lamb to another ewe offers many advantages to the lamb and assists the lamb in becoming part of the flock.

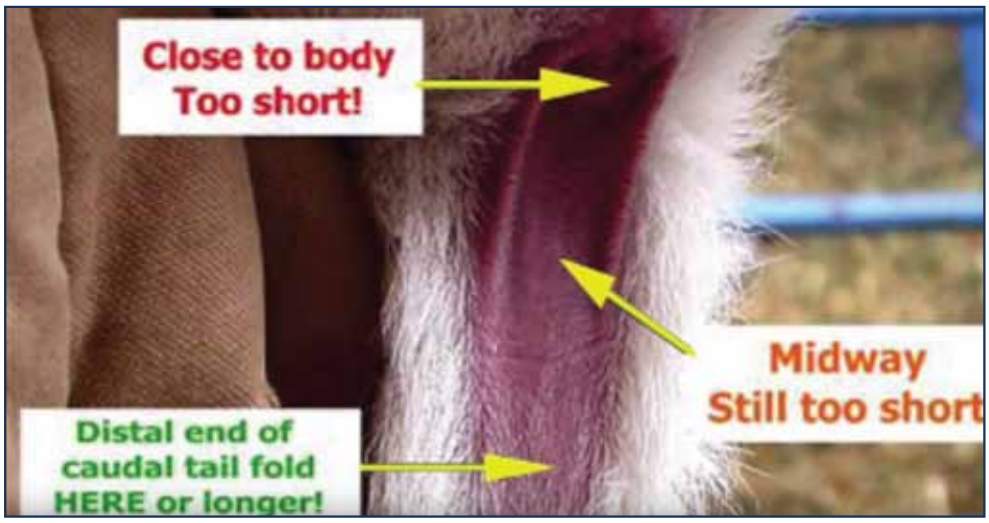
Reviewing flock history and utilizing a management system will provide information upon which to develop a disease prevention program for ewes and lambs near lambing time and during the first few weeks following lambing. Tetanus, enterotoxemia (Clostridium perfringens types C and D), and white muscle disease, for example, may occur during this period and can be prevented by vaccination of the ewe or lamb or by nutritional programs. Specific recommendations for each flock are best developed in consultation with a veterinarian.

Husbandry practices for lambs may include identification or ear tagging, tail docking, castration, and vaccination. Timing of these procedures should reflect concern for the well-being of the animals, and should consider inclement weather, age of the animal, and whether or not the practice will disrupt the ewe/lamb bond. Identification of lambs is usually done to maintain records for ownership and selection purposes and is necessary to keep track of treated animals to ensure compliance with all drug withdrawal requirements. Ear tags should be appropriately sized so they will be unlikely to snag on equipment, brush or fences. Tagging should be done with sanitary applicators, and tags should be placed in the ear in so they are unlikely to be torn out.

Tail docking of lambs is performed to reduce the possibility of soiling of the long tail with urine and feces and the subsequent development of fly strike, a frequently distressful or fatal condition. Docking can be accomplished by several means including rubber rings, hot iron cautery, surgical removal, and surgical removal following the application of an emasculator or emasculatome. Tail docking is understood to be a painful procedure, and it is clear that the use of local anesthetic reduces both behavioral and physiological measures of pain (Sutherland and Tucker, 2011). When possible, tail docking should be performed in lambs less than 6 weeks of age. It is recommended that local anesthetics be used under veterinary direction in lambs older than 6 weeks of age. Tails should not be docked excessively short because this can predispose the animal to rectal prolapse (Thomas et al., 2003). The AVMA has recommended that that lambs' tails be docked no shorter than at the level of the distal end of the caudal tail fold (http://avma.org/policies/animalwelfare.asp#sheep). It should be noted that there are a few breeds of sheep (Katahdin, Dorper, and Shetland for example) that have naturally short tails. Therefore, docking may not be a part of every sheep management scheme.

Castration is performed to prevent indiscriminate breeding, thereby exercising genetic control and regulating the lambing season. It also prevents the breeding of young female flock mates that may become pregnant but are not in adequate physical condition for pregnancy and lactation. Castration prevents the development of aggressive behavior in maturing males and the resulting injuries that frequently accompany this behavior. If performed at a relatively young age, it enhances pelt removal and meat quality. Castration is usually performed by application of rubber rings, crushing the spermatic cord with an emasculatome or the Burdizzo method, or by surgical removal of the testicles. Although castration is an accepted practice, it may be unnecessary if younger, lighter lambs will be marketed before sexual maturity.

Research does not clearly identify which methods of castration or tail docking ensure better welfare. What is much clearer is the evidence that that young animals feel less pain than older ones as the nerve networks are not fully developed (Shutt et al., 1988; Lester et al., 1991; Wood and Molony, 1992; FAWC, 1994). Therefore, because of the understand-



ing that age likely has greater impact than method alone, castration and tail docking should be done as soon as possible after birth. However, it is known that docking and/or castration performed on lambs less than 24 hours old may disrupt the critical bonding process and the normal nursing activity of the lamb that are so important in securing adequate colostrum. Therefore, performing these procedures as early in life as is possible, considering weather, nutritional stress, environmental sanitation, and the presence of complicating disease processes will promote overall lamb well-being.

Castration and docking of lambs older than about six weeks of age may require the use of anesthetics or analgesics to prevent/mitigate excessive pain. Some of the methods available include the use of a local anesthetic, such as lidocaine, used at the site of the application of a rubber band, which reduces the behavioral signs of pain as well and reduces serum cortisol concentrations compared to controls. A practice more commonly used among bovine veterinarians is drug compounding, or creating an oral suspension from meloxicam tablets, which is given at the time of painful procedures. It is the position of the American Sheep Industry Association that in light of evidence of the pain that is present with procedures such as tail docking and castration, every effort should be made to perform such procedures before lambs are 6 weeks old, and painful procedures on older animals should be performed with the use of analgesics or anesthetics, under the direction of a veterinarian. There may be instances where such procedures performed on more mature animals may require sedation and veterinary assistance. Sanitary conditions and clean or sterile equipment reduce the possibility of infections following castration and docking. In some flocks, tetanus antitoxin or the regular vaccination of the ewe may be necessary for prevention of tetanus following castration and docking. When performing castration, tail docking, identification, or vaccination, attention should be given to proper restraint. Properly engineered facilities and/or assistance from other people will reduce the risk of injury to the sheep and the producer and help insure that the procedure is carried out correctly.

Perhaps one of the most underestimated impacts of this entire topic is the impact of handling itself. In many cases, castration, tail docking, and other such management practices require separating lambs from ewes, even for a brief period. Separation is an event stressful enough, due to the nature of the strong flocking instinct of sheep, that it is one of the few instances where vocalization may be observed, and is an indicator of separation stress. Producers should be aware of the stress imposed on both lambs and ewes from this event alone, even without the imposition of other procedures. With this in mind, producers should make every effort to minimize the amount of time that lambs and ewes are separated. Procedures should be performed as efficiently as possible and lambs should be allowed to rejoin ewes as soon as possible.

Weaning

Lambs typically are weaned at varying ages depending upon the management system. Lambs can be weaned successfully at an early age if they are consuming sufficient nutrients (from a source other than milk) to meet their growth requirements. Early weaning may promote the well-being of the lamb and the ewe in some instances, such as during drought conditions. Lambs generally adapt well to weaning if they are allowed to remain in areas to which they are accustomed and if they are given familiar feeds while the ewes are moved to a different area. Nutritional programs at weaning may be designed for rapid gain or to maximize the use of available resources.

Ewes relieved from the demands of milk production require fewer nutrients in the immediate post-weaning period. In flocks with heavy milking ewes, limiting the ewes' feed and water for the first three to four days after weaning aids in reducing milk production and the accompanying "caking" and edema that may lead to udder damage. Depending upon the ewe's body condition, the nutritional program should be managed to return her to adequate condition as soon as possible.

EXHIBITION PRACTICES

The opportunity to exhibit breeding and market sheep should be considered a great privilege and responsibility, for it is a highly visible venue for a broad audience to gain exposure to the sheep industry. While in some cases, the priorities of the show ring may not always be directly reflective of the entire industry, this may be the only frame of reference the public has. Proper care and ethical treatment of exhibition animals cannot be emphasized enough. Exhibition provides a framework for family activity that reinforces

the development of personal qualities, such as responsibility, leadership, sportsmanship, cooperation, sensitivity, ethical behavior, and respect for others. Providing proper and ethical care for their animals is the highest responsibility of any exhibitor. Livestock projects in 4-H, FFA, and other agricultural education programs allow young people from both farm and non-farm backgrounds to learn about animal husbandry, economics of production, marketing, and ethics. Practices that artificially enhance the physical appearance of the animal (such as tail docking) do not promote animal well-being and jeopardize public confidence in the safety and wholesomeness of the sheep industry's products. Tails of exhibition animals should be docked no shorter than the distal end of the caudal tail fold, as recommended by the AVMA.

The National Institute for Animal Agriculture has an extensive collection of written and videotape resource materials concerning the use of animals in exhibition and educational programs. It also maintains a reference library for 4-H agents, FFA advisors and adult leaders.

HARVEST PRACTICES

As the primary aim of this guide is to provide overall guidance for producers, it's important to include recommended practices for harvest or slaughter. The sheep industry in the U.S. varies widely, and there are a great many outlets and demands for lamb. While a vast majority of U.S. lamb is harvested and processed in federally-inspected plants, it is not unusual that producers may harvest some animals for their personal consumption. In these instances, it is critical that producers are familiar with NAMI guidelines for humane handling and are trained in effective, humane slaughter techniques.

All federally inspected lamb plants are governed by the Humane Slaughter Act (USDA, 1958). This ensures a humane and painless death, where an animal must be rendered unconscious before it may be stuck, shackled, or hoisted. Notable exceptions to the enforcement of the Humane Slaughter Act include religious slaughter practices observed in the Kosher and Halal communities. It is important that these animals are handled with the same attention to minimizing stress, and that only a razor sharp knife without nicks is used. When performed correctly, animals may experience an endorphin release that prevents the perception of pain, and unconsciousness (collapse) is achieved ideally within 30 seconds. (Regenstein, 2012) . The NAMI Recommended *Animal Handling Guidelines* are a useful resource on this topic.

IN SUMMARY

Owning healthy, productive, and well-cared-for sheep is every producer's goal. Those who achieve this goal continually learn from other producers, resource people, research findings, educational materials, and by watching their sheep.

ADDITIONAL RESOURCES

Grandin, T. Recommended Trucking Practices. Revised 2013.
http://www.grandin.com/behaviour/rec.truck.html

National Institute for Animal Agriculture, Bowling Green, KY. Animal Handling and Youth Livestock Exhibition Educational Materials.
http://animalagriculture.org/

Religious Slaughter Resources
Joe M. Regenstein
Professor of Food Science
Head: Cornell Kosher and Halal Food Initiative Cornell University
http://www.avs.fr/pub/1055.pdf

General Resources
A Beginner's Guide To Sheep Production
Susan Schoenian, Sheep & Goat Specialist
University Of Maryland
http://www.sheep101.info/201/

Procedures for Humane Euthanasia: Humane Euthanasia of Sick, Injured and/or Debilitated Livestock
J.K. Shearer, DVM, MS and A. Ramirez, DVM, MPH, PhD
Iowa State University
https://vetmed.iastate.edu/sites/default/files/vdpam/Extension/Dairy/Programs/Humane%20Euthanasia/Download%20Files/EuthanasiaBrochure20130128.pdf

AVMA Resources
Judicial Therapeutic Use of Antimicrobials Policy
http://www.avma.org/issues/policy/jtua.asp

Animal Medicinal Drug Use Act
https://www.avma.org/KB/Resources/Reference/Pages/AMDUCA.aspx

Guidelines for the Euthanasia of Animals (2013)
https://www.avma.org/KB/Policies/Pages/Euthanasia-Guidelines.aspx

Welfare Implications of Tail Docking of Lambs (2014)
https://www.avma.org/KB/Resources/LiteratureReviews/Documents/lamb_tail_docking_bgnd.pdf

NAMI Resources
Recommended Animal Handling Guidelines & Audit Guide: A Systematic Approach to Animal Welfare
http://animalhandling.org/ht/a/GetDocumentAction/i/93003

USDA Resources
USDA Humane Slaughter Act
https://www.nal.usda.gov/awic/humane-methods-slaughter-act
https://www.gpo.gov/fdsys/pkg/USCODE-2014-title7/pdf/USCODE-2014-title7-chap48.pdf
https://www.gpo.gov/fdsys/pkg/CFR-2000-title9-vol2/pdf/CFR-2000-title9-vol2-part313.pdf

ADDITIONAL RESOURCES

Handbooks and Reference Publications

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H. H., ed. 1994. *Sheep Housing and Equipment Handbook*. MidWest Plan Service, Agricultural and Biosystems Engineering Dept., Iowa State University, Ames, IA.

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