

Generally Accepted Agricultural and Management Practices for the Care of Farm Animals

January 2021

Michigan Commission of
Agriculture & Rural Development
PO BOX 30017
Lansing, MI 48909

Michigan Department of AGRICULTURE & Rural Development

In the event of an agricultural pollution emergency such as a chemical/fertilizer spill, manure lagoon breach, etc., the Michigan Department of Agriculture and Rural Development and/or the Michigan Department of Environment, Great Lakes, and Energy (EGLE) should be contacted at the following emergency telephone numbers:

Michigan Department of Agriculture and Rural Development: 800-405-0101
Michigan Department of Environment, Great Lakes, and Energy's Pollution Emergency Alerting System (PEAS): 800-292-4706

If there is not an emergency, but you have questions on the Michigan Right to Farm Act or items concerning a farm operation, please contact the:

Michigan Department of Agriculture and Rural Development
Right to Farm Program
P.O. Box 30017
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PREFACE

The Michigan legislature passed into law the Michigan Right to Farm Act, (Act 93 of 1981, as amended), which requires the establishment of Generally Accepted Agricultural and Management Practices (GAAMPs). These practices are written to provide uniform, statewide standards and acceptable management practices based on sound science. These practices can serve producers in the various sectors of the industry to compare or improve their own managerial routines. New scientific discoveries and changing economic conditions may require revision of the practices. The GAAMPs are reviewed annually and revised as considered necessary.

The GAAMPs that have been developed are as follows:

1) 1988 - Manure Management and Utilization
2) 1991 - Pesticide Utilization and Pest Control
3) 1993 - Nutrient Utilization
4) 1995 - Care of Farm Animals
5) 1996 - Cranberry Production
6) 2000 - Site Selection and Odor Control for New and Expanding Livestock Facilities
7) 2003 - Irrigation Water Use
8) 2010 - Farm Markets

These practices were developed with industry, university and multi-governmental agency input. As agricultural operations continue to change, new practices may be developed to address the concerns of the neighboring community. Agricultural producers who voluntarily follow these practices are provided protection from public or private nuisance litigation under the Right to Farm Act.

This GAAMP does not apply in municipalities with a population of 100,000 or more in which a zoning ordinance has been enacted to allow for agriculture, provided the ordinance designates existing agricultural operations present prior to the ordinance's adoption as legal non-conforming uses as identified by the Right to Farm Act for purposes of scale and type of agricultural use.

The website for the GAAMPs is at http://www.michigan.gov/righttofarm

OVERVIEW

These voluntary Generally Accepted Agricultural and Management Practices (GAAMPs) are intended to be used by the livestock industry and other groups concerned with animal welfare as an educational tool in the promotion of animal husbandry and care practices. The recommendations do not claim to be comprehensive for all circumstances; but attempt to define general standards for livestock production and well-being on farm operations.

Scientifically derived guidelines and handbooks for species care are referenced in each section of the GAAMPs for the purpose of providing more detailed guidance when required. Certain references used within this document must also be carefully considered based on production objectives. The National Research Council (NRC) publishes various documents containing the nutrient requirements of domestic animals. These documents are referenced frequently herein. In general, NRC requirements are for growing and reproducing animals experiencing different levels of productivity or performance. That level of productivity or performance may not be sought or required in all situations. Thus, referral to NRC herein is meant to serve as a guideline or resource, and not intended to be used as the minimum acceptable practice. In all cases, the animal's nutritional needs for health and well-being must be met. The assistance of a nutrition consultant in recognizing these needs in each production situation and subsequently in establishing a feeding program for that situation, is recommended.

These GAAMPs can serve producers in the various sectors of the livestock industry to compare or improve their own managerial routines. It should be understood, new scientific discoveries, legislation, and changing economic conditions may make necessary revision of the GAAMPs. In addition, farm operations may be engaged in producing animals to certain specifications that are audited and certified such as the National Organic Program, animal welfare or natural programs. Farmers producing honey, meat, milk, eggs, and other products should reference the program standards to adhere to animal care specifications. The GAAMPs herein are written to address animal care across the board spectrum of farm operations in the state of Michigan.

Proper animal management is essential to the well-being of animals and the financial success of livestock operations. A sound animal husbandry program provides a system of care that permits the animals to grow, mature, reproduce and maintain health. Specific operating procedures depend on many objective and subjective factors unique to individual farm operations and the local environment.

In addition to husbandry, animal well-being is also a function of many environmental variables, including physical surroundings, nutrient intake, and social and biological interactions. Environmental conditions should minimize disease, death loss and behavioral problems and enhance performance. Components of the environment that should be managed include housing, space concentrations, pests, nutritional factors and water. Domestic animals readily adapt to a wide range of environments.

Sometimes procedures that result in temporary stress and even some pain are necessary to sustain the long-term welfare of the animals. Some of these procedures reduce aggressive behavior and injuries among animals. These practices have developed over generations of animal care and husbandry and include, but are not limited to: beak-trimming, dehorning, tail docking and castration of males. Various humane techniques are available, but at present, no technique can be recommended as ideal under all circumstances for any species.

The livestock industry is involved in many activities that require the movement of animals. The handling of livestock in shows, exhibitions, fairs, and races should always be done with primary concern for handler, public, and animal safety. Animals need to be humanely trained, shown, and exhibited using safe and non-harmful devices and procedures. Animal care under exhibition conditions can differ from farm conditions; but, the basic needs of animals remain the same.

Transportation by road, boat, rail and air requires careful planning to reduce adverse effects on animals. Animal should be fit and able to withstand transport. Any preconditioning of the animals to the conditions they will face will ease their stress during transportation. Vehicles should be of adequate size and strength for the animals carried. Floors, in particular, should be in good repair and sufficiently solid to prevent animals from breaking through. The inside walls and lining should have no sharp edges or protrusions likely to cause injury. Vehicles should be constructed of materials that are easily cleaned and kept as clean as possible. Enclosed vehicles must have adequate ventilation, especially when stationary.

A complete manure management plan is suggested when caring for farm animals. The goals of this plan should be to:

- Maintain acceptable levels of animal health and production through clean facilities;
- prevent pollution of water, soil, and air;
- minimize generation of odors and dust;
- minimize vermin and parasites; and,
- compliance with local, state, and federal laws, regulations, and policies.

A farm or farm operation that conforms to these and other applicable GAAMPs adopted under the Michigan Right to Farm Act according to the Michigan Right to Farm Law (Act 93 of 1981, as amended), shall not be found to be a public or private nuisance. This protection also covers farm operations that existed before a change in the land use or occupancy of land within one mile of the boundaries of the farmland, if before that change, the farm would not have been a nuisance. Likewise, this conditional protection applies to any of the following circumstances (Section 3):

(a) A change in ownership or size.
(b) Temporary cessation, or interruption, of farming.
(c) Enrollment in governmental programs.
(d) Adoption of innovative technology.
(e) A change in type of farm product being produced.

Domestication of livestock has made farm animals dependent on humans. Consequently, humans have accepted this dependence as a commitment to practice humane conduct towards domestic animals and to prevent avoidable suffering at all stages of their lives. These voluntary GAAMPs represent a step toward meeting that commitment. These GAAMPs include care for the major farm animals raised in Michigan.

Owners of calves raised for veal, gestating sows, or egg-laying hens need to be aware of Act No. 117, Public Acts of 2009. This law identifies some specific care standards for these types of animals on farms. Requirements for veal calves became effective October 1, 2012. Requirements for gestating sows and egg-laying hens became effective in 2020 (10 years after the law was enacted).

BEEF CATTLE AND BISON

MANAGEMENT OVERVIEW

Because of similarities among production practices between beef cattle and bison, GAAMPs for care of these animals will be similar in many cases. Unless specified otherwise, the term “cattle” used throughout this section will refer to both beef cattle and bison. Genetic variation among cattle species, breeds and individuals makes it possible for them to thrive in a wide range of natural conditions and artificial environments. When behavioral and physiological characteristics of cattle are matched to local conditions, cattle thrive in virtually any natural environment in Michigan without artificial shelter. Protection, however, may be beneficial, especially for newborns, during adverse weather conditions. Cattle reside on pastures and woodlots, in small dry lot facilities, in a variety of diverse types of feedlots, and in confinement. Programs and manuals covering the proper care and management of beef cattle can be found at the websites listed for Beef Quality Assurance and for bison at the website for National Bison Association (see references).

MANAGEMENT PRACTICES

Nutrition: Feed and water should be presented to cattle in ways that minimize contamination by urine, feces, and other materials. Feed bunks, where used, should be monitored and kept clean. Animals should be fed and watered in a manner consistent with one of the following publications: Nutrient Requirements of Beef Cattle (National Research Council, 1984, 2000, and National Academies of Sciences, Engineering, and Medicine, 2016); Beef Cattle Handbook (Midwest Plan Service, 1999; Bison Producers Handbook (1st and 2nd edition; National Bison Association); and Buffalo Producer’s Guide to Management and Marketing (Dowling, 1990). Avoid feed and water interruption that lasts longer than 24 hours.

Cattle may vary considerably in body weight during grazing and reproductive cycles. Feeding programs should make it possible for animals to regain the body weight lost

during the normal periods of negative energy balance. Cattle should have frequent or free access to a source of clean water. When continuous access to water is not possible, individual animals should have access to water for a minimum of 30 minutes daily. Warmer weather conditions, greater amounts of feed consumed, and higher levels of animal production may increase this suggested minimum access time. Snow has been shown to be an acceptable source of water for a short period of time (Degen and Young, 1990[a] and Degen and Young, 1990[b]).

Manure Management and Sanitation: Manure management should conform to the recommendations presented in the current Manure Management and Utilization GAAMPs (Michigan Agriculture Commission). Midwest Plan Service (1993) has a publication on recommended waste handling facilities. For the pasture-based systems, manure management and sanitation are less of a concern, but care should be taken to protect surface waters and prevent erosion. When surface waters are used as a water source, it is recommended that cattle have controlled crossing and drinking access to lakes, streams, and wetlands (Rector and Powers. 2008). Cattle crossings and watering sites should be constructed to minimize erosion and water pollution.

Cattle may be managed indoors on a bedded pack, which combines manure storage with a permeable and/or moisture-absorbing bedding material. Materials used for bedding vary, but often consist of crop straws, crop residues, grain hulls, wood shavings, or sawdust. Maintenance of a firm, relatively dry environment that maintains cattle health and comfort, depends on management of cattle stocking rate, adequate air ventilation, bedding addition frequency, and periodic manure removal (Pastoor, et al., 2012; Endres and Schwartzkopf-Genswein, 2018).

Animal Handling and Restraint: Some aggressive behaviors of larger farm animals risk the health and well-being of herd mates as well as the humans handling these animals. Such behaviors may be modified, and their impact reduced by a number of acceptable restraint devices (e.g., hobbles, squeeze chutes, and stanchions) and practices. Restraint should be the minimum necessary to control the animal and still ensure the safety of attendants. Restraints and chutes should be free of sharp edges and ramps should have solid sides and cleats eight inches apart on the floor to reduce slips and falls. Cattle should be moved at a normal and comfortable pace. Proper design of the handling facility will facilitate safe animal movement (Grandin, 2014; National Cattleman's Beef Association, 2019, Midwest Plan Service, 1987). Roping of cattle is necessary under certain conditions (e.g., in pastures when an animal needs treatment and no restraining facility is readily available). It is strongly encouraged to apply the principles of low stress handling when moving cattle and bison (Bartlett and Swanson, n.d., and Grandin et al., 2015).

Bison are less domesticated than cattle and require special handling facilities. Specific practices can be obtained from the Bison Producers Handbook (National Bison Association. 2016) and Buffalo Producer's Guide to Management and Marketing (Dowling, 1990). Bison are much more nervous and excitable in close quarters. Work bison slower and calmer than you would other stock. Handling facilities will need to be

stronger and taller than pasture fences. Facilities for capturing, sorting, treating, testing, loading out, or confining your bison should be strong, long lasting, cost efficient, and most importantly, safe for animals and the operator (National Bison Association).

Transportation: Safety and comfort should be the primary concerns in the transportation of any animal. A delay or cancellation of transport should occur for animals that appear unhealthy, dehydrated, exhausted, unable to stand, and unfit to withstand travel (AABP 2019). When animals are transported, they should be provided with proper ventilation and a floor surface that minimizes slipping. Animal injuries, bruises, and carcass damage can result from improper handling of animals during transport. Recommendations on facility design for loading and unloading trucks and restraint of animals have been published (Grandin, 2000).

Additional information is available on the Beef Quality Assurance section of the National Cattlemen's Beef Association website (http://www.bqa.org/resources/manuals). Transport and handling stresses can be aggravated greatly by adverse weather conditions, especially when the weather is changing rapidly. Water and feed must be readily available for long trips as described in Federal Regulations (Transportation of Animals statute 49 USC Sec. 80502). The maximum transportation duration is based on the 28-hour rule. Stocking density and bedding should be adjusted for extreme weather conditions. More information on handling cattle can be found at Beef Quality Assurance website (see references). All Michigan cattle moving to show, sale or exhibition on or after March 1, 2007 are required to have an official (Michigan Animal Industry Act. Act 466 of 1988. MCL section 287.711b) Radio Frequency Identification (RFID) ear tag. This includes all out-of-state cattle exhibited in Michigan.

RECOMMENDATIONS FOR THE ENVIRONMENT

Cattle on pasture and woodlots are often monitored less directly and less frequently than cattle raised in other indoor systems. Cattle in woodlot and pasture systems are more likely to be affected by weather, predators, insects, internal and external parasites, poisonous plants, and variation in feed supply. Hot or extremely cold weather is stressful and special accommodations may be needed (National Research Council, 1981). In extreme heat, cattle will be more comfortable with provision of shade and free access to water. Air temperature, humidity, and movement should be considered to ensure animal comfort and dietary alterations to reduce heat stress. Likewise, cattle exposed to extreme cold and wind chill should be provided extra feed and shelter from the wind. A properly maintained perimeter fence is required for the safety of the animals and surrounding community (Michigan Fences and Fence Viewers. Act 34 of 1978. Cattle in backgrounding facilities or feed yards must be offered adequate space for comfort, socialization, and environmental management. Periodic pen maintenance and cleaning are strongly encouraged. When muddy conditions exist, realistic intervention, such as addition of bedding, should be employed.

The strength and height of fencing is more important for bison than beef cattle. Many producers recommend an exterior fence of six feet in height. If a bison can get its nose

over the fence and wants to be out, it is likely the animal will try to jump or push over the fence. Grown bulls can make a standing six foot jump, if so inclined (National Bison Association).

FACILITIES AND EQUIPMENT

Cattle may be housed in intensive management systems, either indoors or in open lots, with or without overhead shelter. Proper airflow and ventilation are essential in confinement facilities to control for gas and particulate matter. For open lots, south-sloping exposure, mounds, and a windbreak are recommended so dry areas with low air velocities are available for the cattle to rest. Floors in housing facilities should be properly drained. Barns and handling alleys should provide adequate traction to prevent injuries to animals and handlers. Additionally, handling alleys and pens should be free of sharp edges and protrusion to prevent injuries. Handling facilities should be designed to encourage safe animal movement as much as possible. When handling the animals, excessive noise should be avoided. Hydraulic and mechanical equipment should be adjusted to the size of the animal to minimize injuries.

For additional information, see the Structures and Environment Handbook (Midwest Plan Service, 1987), Grandin, 2000, Boyles, et al. 2002, and the Beef Housing and Equipment Handbook (Midwest Plan Service, 1987).

HEALTH CARE AND MEDICAL PROCEDURES

Adequate health care is an essential part of a profitable cattle operation. A health care program should be planned to address potential problems as appropriate for local conditions. Appropriate health care involves: 1) methods to prevent, control, diagnose, and treat diseases and injuries; 2) training and guidance to animal caretakers on appropriate antibiotic therapy; 3) instruction on proper handling of pharmaceuticals and biologicals and withdrawal times, and, 4) adequate record keeping systems. All confined animals must be observed daily for signs of illness, injury, or unusual behavior.

Methods of prophylaxis, diagnosis, therapy, vaccination, and disease control should follow currently accepted practices. Assistance from a veterinarian in establishment of a health care program is recommended. Organic production programs should work with a veterinarian to ensure adequate protection and treatment for sick animals.

Pharmaceutical Use: It is imperative that those engaged in raising livestock and poultry for human consumption understand the prudent and legal use of pharmaceutical products. To help ensure that health and welfare of livestock and poultry and the safety of food they produce for the public, a veterinary-client-patient relationship (VCPR) is highly recommended. In most cases, a valid VCPR is mandatory for acquiring and using pharmaceutical products in food producing animals. Michigan currently follows the federal definition for a VCPR which states that a VCPR is considered valid if the following is observed (Code of Federal Regulations 530.3) (http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/ucm460406.htm):

1. A licensed veterinarian has assumed the responsibility for making medical judgments regarding the health of (an) animal(s) and the need for medical treatment, and the client (the owner of the animal or animals or other caretaker) has agreed to follow the instructions of the veterinarian;
2. there is sufficient knowledge of the animal(s) by the veterinarian to initiate at least a general or preliminary diagnosis of the medical condition of the animal(s); and,
3. the veterinarian is readily available for follow-up in case of adverse reactions or failure of the regimen of therapy. Such a relationship can exist only when the veterinarian has recently seen and is personally acquainted with the keeping and care of the animal(s) by virtue of examination of the animal(s), and/or by medically appropriate and timely visits to the premises where the animal(s) are kept.

Euthanasia: Animals that are seriously injured or ill and show no promise for recovery after 2 days of treatment should be euthanized immediately. Methods can be physical (captive bolt gun or firearm) or chemical and one of the approved methods recommended by the American Veterinary Medical Association Guidelines on Euthanasia (AVMA, 2020). Manually applied blunt force trauma is unacceptable.

Dead Animal Disposal: Animal tissue, whole carcasses, or portions thereof, must be disposed of according to the Michigan Bodies of Dead Animal Act, Act 239 of 1982, Amended Act No. 311, Public Acts of 2008, December 18, 2008.

Non-Ambulatory (Downed) Cattle: A prompt examination should be performed on non-ambulatory animals to determine whether extended care or euthanasia is recommended. If the animal is not in extreme distress and continues to eat and drink, it is recommended that the producer contact a veterinarian for assistance/advice and provide food, water, shelter, and appropriate nursing care to keep the animal comfortable. If the animal is in extreme distress and the condition is obviously irreversible, the animal should be euthanatized immediately. Downed animals should be moved carefully to avoid compromising animal welfare. Dragging downed animals is unacceptable. Non-ambulatory animals are not fit for transport and must not be sent to a livestock market or to a processing facility (AABP, 2019).

<u>Beef Quality Assurance</u>

Beef Quality Assurance (BQA) and Beef Quality Assurance Transportation (BQAT) are training and certification programs supported by Beef Checkoff funding to ensure cattle are properly cared for and a safe and nutritious product is presented to consumers. It is recommended all owners/managers of cattle consider receiving training on the proper handling and care of livestock, antibiotic stewardship, and transportation of cattle. Certification in BQA and BQAT is mandatory for commercial truckers and owners/managers of cattle entering some cattle processing facilities.

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DAIRY

MANAGEMENT OVERVIEW

Michigan's female dairy cattle population is currently over 426,000 mature dairy cows (USDA's National Agricultural Statistics Service) and about 378,000 calves and heifers. The remainder of the dairy population consists of castrated calves used for veal, dairy steers raised for beef and approximately 4,000 bulls used for breeding purposes. Proper care of dairy animals consists of providing a clean, comfortable environment, adequate access to quality feed and water while employing management techniques designed to limit injuries, stress, diseases, and disorders. Proper care of animals can be maintained with either confinement or pasture management systems.

Dairy cows, because of milk production, have special needs that require proper management every day. Calves and heifers should be managed to minimize health problems and to provide for adequate growth and development. Application of sound management practices will result in healthy dairy cows, and healthy, properly grown calves and heifers.

MANAGEMENT PRACTICES

Management practices on a dairy farm are specific for five classes of dairy cattle: calves, heifers, dry cows, lactating cows, and bulls. Calf mortality and morbidity from birth to weaning can be minimized by utilizing sound management practices (Raising Dairy Replacements; Midwest Plan Service, 2003).

Newborn Calves: Calves should be born in a clean, dry environment and receive an adequate amount (12-15% of body weight) of high-quality colostrum soon after birth. Hand feeding ensures that each calf receives an adequate amount of colostrum (Raising Dairy Replacements, 2003, Feeding the Newborn Calf, Pennsylvania State Extension, 2003). To ensure their health, calves are normally removed from their mothers immediately or as soon as the calf's hair coat is dry to reduce risk of exposure to infectious pathogens (Raising Dairy Replacements, 2003). Newborn calves remain healthier when housed individually in a clean, properly ventilated environment (Raising Dairy Replacements, 2003, Penn State for Calf and Heifer Housing, The Welfare of Veal Calves, 1994). Young calves are normally fed milk or milk replacer during the first 6-8 weeks of life. Calves should be observed several times a day. The amount of feed and times fed per day should increase as temperatures decrease in the winter.

Some farms use automated or robotic nursing machines during part of this stage of a calf's life which may involve group pens with adequate clean and dry bedding and proper ventilation. Stocking rates of no more than 25 calves per nipple are advised, calves can be started on feeders by day 7 to day 14. Prior to moving calves, monitoring immune levels and individual housing help determine if calves are healthy and eating well (James et al, 2017). Increased calf density will impact air quality as well. Sick calves should be isolated to minimize disease spread.

Calves and Heifers: Calves are normally weaned when adequate intake of dry feed has been reached (NRC 2001). All calves should have access to clean, fresh water and nutritionally adequate diets to support an appropriate growth rate. Proper heifer growth can be achieved with varied management systems (Raising Dairy Replacements, 2003). Heifer and intact male calves can be housed together from 2-6 months but bull calves should be separated after that to prevent early pregnancies. Heifers should be managed in groups to ensure adequate access to feed and water. The number of groups will depend on herd size. Each group of heifers should be fed a balanced ration (NRC 2001) to maintain adequate growth.

Underfeeding delays normal heifer development. Overfeeding may result in overly fat heifers that may cause health problems at first calving.

Heifers may be bred upon reaching an adequate size and weight (Raising Dairy Replacements, 2003, Midwest Plan Service). Use of artificial insemination or natural service (bull) are acceptable practices to breed heifers and/or cows.

Dry Cows: Cows benefit from a dry period prior to a subsequent lactation. Restricting feed intake a few days prior to dry-off is an acceptable practices that will aid cessation of milk secretion and improve udder health (Managing the Dry Cow for More Profit, 1996). Nutrition must be adequate to allow mammary involution and the support the needs of the fetus.

Proper management of the lactating cow starts during the dry period. Since approximately 70 percent of health problems in a dairy herd are associated with calving, proper management of pre-calving, calving and post calving periods will improve the health of mother and calf. A clean and dry environment should be provided for bred heifers and dry cows. In addition, access to good nutritional diets that maintain appetite and feed intake should also be provided. Nutrition for the majority of dry cows should follow a maintenance program according to NRC requirements (NRC 2001). Nutrition and housing needs will change 2-3 weeks prior to calving.

Lactating Cows: Nutrition programs for dairy cows should provide for adequate intake of the essential nutrients needed for maintenance, growth, milk production and proper development of the fetus (NRC 2001). Grouping cows according to nutrient needs will help meet the nutrient requirements of any cow. Good quality, fresh water must be available at all times.

Animal Handling: Facilities designed specifically to handle dairy cattle for health checks or treatment, vaccinations, weighing, or hoof trimming and for handling bulls during hand-mating will decrease risk of injury to cattle and people, as well as, reducing the stress of handling. All traffic areas should have non-skid surfaces that avoid causing excessive hoof wear. Several restraint devices are acceptable, such as halters, hobbles, breeding chutes, squeeze chutes, headlocks, tables and stanchions. Restraint should be the minimum necessary to control the animal and ensure the safety of the animal and attendants. Proper design of the handling facility will facilitate animal movement.

Transportation: Safety and comfort of dairy cattle should be the primary concerns in their transportation. A delay or cancellation of transport should occur for animals that appear unhealthy, dehydrated, or exhausted and unfit to withstand travel (AABP, 2014). Animals should be provided with adequate ventilation and a floor surface to minimize slipping. Animal injuries, bruises, and carcass damage can result from improper handling of animals during transport. Recommendations on facility designs for loading and unloading trucks and restraint of animals have been published (Grandin 2000, Cattle Handling and Transport, 2007). Transport and handling stresses can be aggravated greatly by adverse weather conditions, especially when the weather is changing rapidly. Water and feed should be readily available for long trips as described in Federal Regulations (the Transportation of Animals statute from the U.S. Code (49 USC Sec. 80502 Reference). All Michigan cattle moving to show, sale or exhibition on or after March 1, 2007 are required to have an official RFID ear tag. This includes all out-of-state cattle exhibited in Michigan.

RECOMMENDATIONS FOR THE ENVIRONMENT[1]

Proper management of the environment enhances animal production and minimizes animal disease, death loss, and behavioral problems. Dairy cattle are bred for growth, production, and reproduction in a variety of environments to which they can readily adapt. hey can be raised outdoors on pasture, dry lot, and in hutches, or indoors in stalls and pens.

Environmental temperature affects an animal's comfort that, in turn, affects an animal's behavior, metabolism, and performance. Even though cattle are adaptable and can thrive in almost any region of the world, they must be protected from heat and cold stress caused by extreme weather events. Access to shelter can be beneficial even in moderate climatic regions. Heat stress adversely affects animal comfort as does cold stress. Windbreaks, sunshades, or solid-roofed shelters are needed if trees or other landscape features do not provide adequate protection from winter storms and extremely cold or hot temperatures. Sunshades, sprinklers, misting, fans, and other methods of cooling, as well as dietary alterations, will reduce heat stress during hot weather. Air temperature, humidity, quality, and movement should be considered to ensure animal comfort and prevent diseases.

FACILITIES AND EQUIPMENT

Housing for calves, heifers, and cows varies widely. However, each housing facility should provide adequate space per animal for eating, drinking, and resting (Dairy Freestall Housing and Equipment - MWPS #7. 2000, Bickert, W., and R. Stowell. 1994). Calf housing systems are varied, but it is recommended that calves be housed individually with cold housing preferred. Cold housing ranges from calf hutches to larger naturally ventilated barns. Bedding should be kept clean and dry. Adequate housing for heifers can range from bedded packs to free stalls to pasture. Housing should be well ventilated and keep heifers clean and dry. Heifers should be protected from winter winds. Summer resting areas may need shade.

Feed bunks or feeding areas should be designed to allow animals to eat with a natural motion. Watering sites should be easily accessible to provide adequate water intake without risk of injury. Adequate feed space per animal should be provided (Dairy Freestall Housing and Equipment- MWPS #7. 2000).

Milking equipment should be designed, installed, and maintained correctly to provide for maximum comfort of the cow at milking (Milking Systems and Parlors, 2001, Building Freestall Barns and Milking Centers. 2003). To eliminate the potential of stray voltage at time of milking, feeding, or watering, guidelines for proper wiring of a farm should be followed. (Stray Voltage and Dairy Farms, 2003, Effects of Electrical Voltage/Current on Farm Animals. 1991).

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[1] Condensed from environment chapter in Caring for Dairy Animals Reference Guide, 1994.

HEALTH CARE AND MEDICAL PROCEDURES

Proper care of dairy animals includes the establishment of a herd health program that covers all ages of cattle and emphasizes disease prevention. Dairy farmers should establish a valid veterinarian/client/patient relationship with a licensed veterinarian to assist them in providing proper health care to their herd. An ongoing preventive herd health program designed for each farm by the veterinarian and farmer will result in healthy animals. This includes a veterinarian designed vaccination program for cows, calves, and heifers. Appropriate health care involves: 1) methods to prevent, control, diagnose, and treat diseases and injuries; 2) training and guidance to animal caretakers on appropriate antibiotic therapy; 3) instruction on proper handling of pharmaceuticals and biologicals and withdrawal times; and, 4) accurate record keeping systems with proper animal identification. All confined animals should be observed daily for signs of illness, injury, or unusual behavior. Management practices to reduce the risk of introduction and spread of infectious disease should be implemented. Health programs for heifers are designed to prevent disease and increase efficiency of growth. Organic production programs should work with a veterinarian to ensure adequate protection and treatment for sick animals.

External and internal parasites need to be controlled. Pasturing may increase risk of internal parasites and will increase exposure to diseases carried by wild animals.

Suggested husbandry procedures such as castration, dehorning, removal of extra teats, etc. should be carried out by skilled personnel. These procedures are best done when calves are small, but may be done at other times. All procedures should follow the veterinarian's recommendations or accepted management practices. These techniques can be done with little discomfort to calves, heifers, or cows (Seykora, 3rd Edition).

Pharmaceutical Use: It is imperative that those engaged in raising livestock and poultry for human consumption understand the prudent and legal use of pharmaceutical products. To help ensure that health and welfare of livestock and poultry and the safety of food they produce for the public, a veterinary-client-patient relationship (VCPR) is highly recommended. In most cases, a valid VCPR is mandatory for acquiring and using pharmaceutical products in food producing animals. Michigan currently follows the federal definition for a VCPR which states that a VCPR is considered valid if the following is observed (Code of Federal Regulations 530.3) (http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/ucm460406.htm):

1. A licensed veterinarian has assumed the responsibility for making medical judgments regarding the health of (an) animal(s) and the need for medical treatment, and the client (the owner of the animal or animals or other caretaker) has agreed to follow the instructions of the veterinarian;
2. there is sufficient knowledge of the animal(s) by the veterinarian to initiate at least a general or preliminary diagnosis of the medical condition of the animal(s); and,

3. the veterinarian is readily available for follow-up in case of adverse reactions or failure of the regimen of therapy. Such a relationship can exist only when the veterinarian has recently seen and is personally acquainted with the keeping and care of the animal(s) by virtue of examination of the animal(s), and/or by medically appropriate and timely visits to the premises where the animal(s) are kept.

Non-Ambulatory (Downed) Cattle: A prompt examination should be performed on non-ambulatory animals to determine whether extended care or euthanasia is recommended. If the animal is not in extreme distress and continues to eat and drink, it is recommended that the producer contact a veterinarian for assistance/advice and provide food, water, shelter, and appropriate nursing care to keep the animal comfortable. If the animal is in extreme distress and the condition is obviously irreversible, the animal should be euthanized immediately. Downed animals should be moved carefully to avoid compromising animal welfare. Dragging downed animals is unacceptable. Non-ambulatory animals must not be sent to a livestock market or to a processing facility.

Euthanasia: Animals that are seriously injured or ill and show no promise for recovery should be euthanized immediately. Methods can be physical (captive bolt gun or firearms) or chemical and one of the approved methods recommended by the AVMA Guidelines on Euthanasia (AVMA, 2020). Manually applied blunt force trauma is unacceptable.

Dead Animal Disposal: Animal tissue, whole carcasses, or portions thereof, must be disposed of according to the Michigan Bodies of Dead Animal Act, Act 239 of 1982, Amended Act No. 311, Public Acts of 2008, December 18, 2008.

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VEAL

MANAGEMENT OVERVIEW

Most veal comes from dairy calves. Three types of veal in the United States include: Bob veal, which are fed a milk-based liquid diet and marketed at less than three weeks of age and at less than 150 lbs., grain-fed veal, which are fed a milk-based liquid diet and possibly hay, pasture or other feeds including grain, and formula-fed veal (also known as milk-fed or special-fed), which are fed a milk-based liquid diet throughout the feeding period (Schwartz, 1990). Formula-fed veal is the most common in Michigan and these recommendations will be specific to this type.

MANAGEMENT PRACTICES

Veal calves should be handled with the same management practices afforded to dairy calves. Special care, gentleness, and patience are recommended management practices for all dairy calves. Until they are selected for veal production systems, they should receive the same husbandry practices as dairy replacement heifers. Young dairy animals not intended for dairy herd replacements or formula-fed veal should follow beef management recommendations.

It is recommended that veal producers observe calves several times a day. The herdsperson should monitor the feed intake and health of each calf (Guide for the Care and Production of Veal Calves, 1994) and provide appropriate health care.

Individual stall housing is a management recommendation for formula-fed veal production to minimize calf-to-calf contact which limits the spread of infectious diseases (Guide for the Care and Production of Veal Calves, 1994, Raising Dairy Replacements. 2003, The Welfare of Veal Calves, 1994). This management practice is important, considering that veal calves are usually grouped together from many dairy farms, and the calves may have been exposed to disease at the collecting facilities. Revision of the Michigan Animal Industry Act 446 of 1988, Sec 46(1) by Act 117, effective March 31, 2010 provides for the following regulations for calves raised for veal after October 1, 2012: 1) Calves should be able to fully extend all limbs without touching the side of an enclosure, and 2) turn around in a complete circle without any impediment, including a tether, and without touching the side of an enclosure or another animal. If calves are to be housed in groups, it is recommended that calves be kept in individual pens for at least 1 to 2 months of age for health reasons (Roy, 1980, Stephens, 1982, van Putten and Elshop, 1982). Ohio Livestock Care Standards for Veal recommend veal calves not be housed in group pens until 10 weeks of age and then a minimum of two veal calves in an area with a minimum of 14 square feet per calf. Ohio guidelines are supported by the American Veal Association (personal communication - Dale Bakke, AVA President). Size of groups and space per animal for group pens that calves are initially placed into should be considered as is done with weaned dairy calves to reduce stress caused by competition for food and space. Determination of area requirements should be based on

body size, head height, stage of life cycle, behavior, health, and weather conditions. (Guide for the Care and Use of Agricultural Animals in Research and Teaching 2010). Draft control within a group pen should be accomplished by draft barriers (Raising Dairy Replacements, 2003).

Diets should be formulated to meet nutrient requirements for both maintenance and growth (NRC, 2001). Feeding calves individually assures that competition among animals does not result in some animals receiving insufficient quantities of feed. More efficient growth results because the farmer can feed calves differently, depending on weight, appetite, and individual calf differences.

Transportation: Safety and comfort should be the primary concerns in the transportation of any animal. A delay or cancellation of transport should occur for animals that appear unhealthy, dehydrated, or exhausted and unfit to withstand travel (AABP, 2014). Animals should be provided with adequate ventilation and a floor surface to minimize slipping. Animal injuries, bruises, and carcass damage can result from improper handling of animals during transport. Recommendations on facility design for loading and unloading trucks and restraint of animals have been published (Grandin 2000, Cattle Handling and Transport, 2007, Modern Veal Production, 1989). Transport and handling stresses can be aggravated greatly by adverse weather conditions, especially when the weather is changing rapidly. Water and feed should be readily available for long trips as described in Federal Regulations (the Transportation of Animals statute from the U.S. Code 49 USC Sec. 80502 Reference).

RECOMMENDATIONS FOR THE ENVIRONMENT

A clean, dry, draft-free building or outside surrounding is recommended for animal comfort and performance. For enclosed “warm” buildings, ventilation rates in winter should be sufficient to remove moisture produced in the building. Rates should be increased as the weather warms to provide temperature control. Recommendations for calculating ventilation rates are similar to those for dairy calves in warm housing (Midwest Plan Service, 2000). It is important that the building air inlets are properly positioned and can supply the airflow for the exhaust fans when veal calves are housed indoors.

Thermostats can be effectively used for automatic control of the fans and temperature. Heating and ventilation systems should be planned simultaneously. Control of temperature is important to the health of calves, and is a factor in feed conversions. Michigan's climate can be erratic; therefore, producers should attempt to provide a comfortable temperature and level of relative humidity. Sudden fluctuation in temperature should be avoided.

During daylight periods, natural or artificial indoor lighting intensity should allow for every housed calf to be seen clearly for inspection (Ohio Livestock Care Standards for Veal).

FACILITIES AND EQUIPMENT

The internal surfaces of barns and holding systems for veal calves should be made of materials that can be cleaned and disinfected effectively and routinely. Surfaces of barns, stalls, pens, and other equipment accessible to the calves should have no sharp edges or projections. All floor surfaces should be designed, constructed, and/or maintained to avoid injury or stress to the calves.

HEALTH CARE AND MEDICAL PROCEDURES

Individual stalls for veal calves are recommended for health reasons in contrast to housing of dairy replacements in groups after weaning. Calves housed individually can be observed more closely, facilitating early detection of problems. Disease spread is reduced because of reduced calf-to-calf contact and cross-suckling (The Welfare of Veal Calves, 1994; Raising Dairy Heifers, 2003).

Proper care of animals includes the establishment of a health program that emphasizes disease prevention. Veal farmers, including those participating in organic programs, should establish a valid veterinarian/client/patient relationship with a licensed veterinarian to assist them in providing proper health care to their animals. An ongoing preventive health program designed for each farm by the veterinarian and producer will result in healthy animals. This includes a veterinarian designed vaccination program. Appropriate health care involves: 1) methods to prevent, control, diagnose, and treat diseases and injuries; 2) training and guidance to animal caretakers on appropriate antibiotic therapy; 3) instruction on proper handling of pharmaceuticals and biologicals and withdrawal times; and, 4) accurate record keeping systems with proper animal identification. All confined animals should be observed daily for signs of illness, injury, or unusual behavior. Management practices to reduce the risk of introduction and spread of infectious disease should be implemented. Preventive and therapeutic health programs, and medical procedures including castration and dehorning should follow a veterinarian's recommendation.

Pharmaceutical Use: It is imperative that those engaged in raising livestock and poultry for human consumption understand the prudent and legal use of pharmaceutical products. To help ensure that health and welfare of livestock and poultry and the safety of food they produce for the public, a veterinary-client-patient relationship (VCPR) is highly recommended. In most cases, a valid VCPR is mandatory for acquiring and using pharmaceutical products in food producing animals. Michigan currently follows the federal definition for a VCPR which states that a VCPR is considered valid if the following is observed (Code of Federal Regulations 530.3) (http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/ucm460406.htm):

1. A licensed veterinarian has assumed the responsibility for making medical judgments regarding the health of (an) animal(s) and the need for medical treatment, and the client (the owner of the animal or animals or other caretaker) has agreed to follow the instructions of the veterinarian;

2. there is sufficient knowledge of the animal(s) by the veterinarian to initiate at least a general or preliminary diagnosis of the medical condition of the animal(s); and,
3. the veterinarian is readily available for follow-up in case of adverse reactions or failure of the regimen of therapy. Such a relationship can exist only when the veterinarian has recently seen and is personally acquainted with the keeping and care of the animal(s) by virtue of examination of the animal(s), and/or by medically appropriate and timely visits to the premises where the animal(s) are kept.

Non-Ambulatory (Downed) Calves: A prompt examination should be performed on non-ambulatory animals to determine whether extended care or euthanasia is recommended. If the animal is not in extreme distress and continues to eat and drink, it is recommended that the producer contact a veterinarian for assistance/advice and provide food, water, shelter, and appropriate nursing care to keep the animal comfortable. If the animal is in extreme distress and the condition is obviously irreversible, the animal should be euthanatized immediately. Downed animals should be moved carefully to avoid compromising animal welfare. Dragging downed animals is unacceptable. Non-ambulatory animals must not be sent to a livestock market or to a processing facility.

Euthanasia: Animals that are seriously injured or ill and show no promise for recovery should be euthanized immediately. Methods can be physical or chemical and one of the approved methods recommended by the AVMA Guidelines on Euthanasia (AVMA, 2020).

Dead Animal Disposal: Animal tissue, whole carcasses, or portions thereof, must be disposed of according to the Michigan Bodies of Dead Animal Act, Act 239 of 1982, Amended Act No. 311, Public Acts of 2008, December 18, 2008.

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SWINE

MANAGEMENT OVERVIEW

In Michigan, swine can be raised humanely in a variety of production systems, provided they are given ample protection from extreme cold, excessive wind, solar radiation, and precipitation. Production systems used include: 1) environmentally controlled buildings in which the pigs remain inside; 2) open front buildings that permit the pigs to go outside; and, 3) outside lot or pasture production with portable shelters. Well maintained facilities and sound management practices optimize animal comfort and well-being regardless of the type of production system. The swine care practices described herein are relative to domestic swine production. National Pork Board - Swine Care Handbook, Pork Quality Assurance Plus (PQA Plus), Youth Quality Assurance and Transport Quality Assurance programs are available to swine producers wanting additional information on swine management and production (https://www.pork.org/production).

MANAGEMENT PRACTICES

Observation: Pigs must be observed daily, but more frequently during specific events such as farrowing or recovery from illness. Drinkers and feeders must be monitored to make sure pigs have access to both fresh water and feed. Pigs should be examined for signs of health problems, physical discomfort, or injuries. Facilities need to be inspected to be sure they are functioning properly. Producers need to be aware of these responsibilities during normal work hours, nights, holidays, and weekends. Caretakers are encouraged to adopt neutral or positive animal interactions to improve the well-being of the pigs.

Managing Sick and Injured Animals: With daily observations, caretakers can develop a method for tracking and identification of healthy and non-healthy pigs. A pig is considered non-ambulatory if it cannot get up or if unable to stand without support and unable to bear weight on two of its legs. Handling of non-ambulatory pigs should include equipment appropriate for size and age and condition of the animal. Dragging of conscious animals by any body part is unacceptable, however in the rare case whereby a pig must be moved from a life-threatening situation. In addition, a caretaker might have to reposition a pig to perform the euthanasia safely and effectively.

Identification and Records: Pigs may have some form of identification that can be easily read. These identification methods may include ear notches, ear tattoos, electronic transponders, ear tags, body tattoos, or by temporary mark. Pigs not individually identified but kept in groups can be identified as a group by using group identification. Identification is important to maintain records and track pigs as they are moved through the various production phases. Several types of management records that may be kept include health programs, housing location, genetic lineage, and nutrition. The farm should have its own premise identification number (PIN) assigned for

the appropriate tracking of diagnostic submissions and other regulatory purposes such as a VFD.

Piglet care: After birth, any of the following procedures may be performed on piglets by a skilled individual as a part of routine husbandry or to help reduce the risk of disease and infections: disinfection of navel, clipping or grinding of needle teeth tips, supplementing iron by injection or orally, docking of tail, identifying permanently, and castrating males.

Herd Health Management Program: The overall goals of a herd health program are to eliminate or minimize disease by reducing exposure or controlling existing disease. The management plan should include Standard Operating Procedures (SOP) and compliance for biosecurity, vaccination, daily observation, timely euthanasia, vector control, pig flow, entry and culling, management of compromised pigs, treatment and mortality records.

Nutrition: Livestock should have access to clean drinking water. Swine are raised on a variety of feeds. Feedstuffs should be free from harmful molds, mycotoxins, or impurities. If the presence of any of these substances or organisms is suspected, samples should be submitted for laboratory testing. Feed with unrecognized nutritional value and lacking in wholesomeness should not be used. The diet should meet the nutritional needs to support the intended performance of swine in a given phase of production (i.e., age specific growth, pregnancy, lactation, active and inactive breeding males).

High intake of rations may cause excessive weight gain during gestation. Sows allowed ad libitum access to feed will become obese negatively impacting her ability to raise born piglets. Restriction of energy intake is suggested for gestating females. This may be done by decreasing daily feed intake, adding fiber to the diet, or feeding everyone to three days. This is also true for boars. Consult your specialist for suggestions on how to adjust feed intake for breeding animals. Pigs in other phases of production are generally given ad libitum access to feed and water.

Manure Management and Sanitation: Manure handling and utilization systems for swine facilities should conform to practices adopted by the Michigan Agriculture Commission in its document entitled *GAAMPs for Manure Management and Utilization*.

Pigs should be kept comfortable and healthy. Defecating and resting preferences should be considered in designing facilities and in the day-to-day operation of those swine facilities. The frequency of manure removal from swine facilities is dependent on several factors including: pen size, animal density, temporary manure storage capacity and flooring type. Building interiors, corridors, storage space, and other work and production areas should be kept clean and free of any sharp edges or protrusions which may cause injury to pigs passing by.

Animal Handling: An understanding of the behavioral characteristics of pigs will aid in handling and moving of swine, as well as increase productivity, improve meat quality, and help reduce undesirable stress. At all stages, pigs should be handled with care, gentleness, time for acclimation, time for rest, and patience. Pigs have wide angle vision in excess of 330 degrees. Although this allows them to almost see behind themselves completely without turning their heads, it also causes them to be sensitive to sharp contrasts in light and dark. Pigs may balk if they encounter shadows, puddles, bright spots, a change in flooring type or texture, drains, metal grates, or flapping objects.

Pigs will stop when a solid barrier is placed in front of them. Small portable panels will allow efficient moving and sorting. A light aluminum, plastic or wood panel is useful in separating pigs from a pen.

For physical examination, collection of samples, and other clinical procedures, pigs can be restrained manually or with handling aids, such as snout snares, restraint stocks or stalls. It is important that these devices be the right size and designed for the pig being held and that they are operated properly to minimize injury.

Zero Tolerance for pig abuse or purposeful neglect: At all levels of production, training must emphasize that there will be zero tolerance for pig abuse or purposeful neglect. Egregious acts of abuse include, but are not limited to:

- Intentionally applying electric prods to sensitive parts of the animal such as the eyes, ears, nose, genitals, or rectum. Excessive prod use could qualify as a willful act of abuse.
- Malicious hitting/beating of an animal. This includes forcefully striking an animal with closed fist, foot, handling equipment (e.g., sorting board, rattle paddle, etc.), or other hard/solid objects that can cause pain, bruising or injury.
- Driving pigs off high ledges, platforms or steps while moving, loading, or unloading (animals are falling to the ground).
- Dragging of conscious animals by any part of their body except in the rare case where a non-ambulatory animal must be moved from a life-threatening situation Non-ambulatory pigs may be moved by using a drag mat
- Purposefully dropping or throwing animals.
- Causing physical damage to the snout or tusks of a boar as a means to reduce aggression (this excludes nose ringing and tusk trimming)
- Failure to provide food, water, and care that results in significant harm or death to animals. This includes the intentional failure to provide food, water or care that falls outside of normal husbandry practices and would reasonably be considered neglect

Transportation: Recommendations of facility design for loading and unloading trucks have been published (Grandin, 1988 and 2000) and by the National Pork Board. Weak, sick, or fatigued pigs should not be loaded or transported with healthy ones. Appropriate steps should be taken immediately to segregate sick pigs and care for their special

needs. Injuries and bruises can result when pigs are improperly managed during loading and transport. Lights inside a building or inside a truck will attract pigs because they have a tendency to move from a darker area to a more brightly lit area. Funnel-shaped pens should not be used to load pigs because pigs have a tendency to continue to press forward. Loading ramps with solid sides are more efficient than "see through" sides because they decrease distractions.

Safety and comfort should be a primary concern when transporting pigs. When pigs are transported, ventilation should be adequate, and the floor should be slip-resistant. Animals should be shipped in groups of uniform weight and provided with adequate space (Grandin, 1988; Grandin, and Shultz-Kaster, 2001). Truck beds should be clean and equipped with a non-slip floor.

Transport stresses can be intensified by adverse weather and wide temperature fluctuations. Hot weather is a time for particular caution. While in transit in warm weather, pigs should be protected from heat stress by being shaded, wetted, and bedded with wet sand or shavings. Prompt unloading in hot weather is essential because heat builds up rapidly in a stationary vehicle.

During transportation in cold weather, pigs should be protected from cold stress. Wind protection should be provided when the air temperature drops below 32˚F, but ventilation must always be adequate. When trucks are in transit in cold weather for more than a few minutes, pigs should be bedded with sufficient material that has high insulating properties. Water and feed should be readily available for long trips as described in the Transportation of Animals statute from the U.S. Code (49 USC Sec. 80502).

Truck beds should be clean and dry and equipped with a bedded, non-slip floor.

RECOMMENDATIONS FOR THE ENVIRONMENT

Production systems should be designed with consideration of the environment of the pigs, the protection of air and water, and the working environment of the producer and employees.

Social: All classes and groups of pigs form an order of social dominance. These orders are formed by competition soon after birth or when the pigs are first grouped together. Addition of new pigs or regrouping of pigs will usually lead to reestablishment of social order. Adult boars that have not been living together should not be regrouped.

Females can be bred to farrow at any time of the year. Three mating options are: 1) pen mating (placing a boar with a group of sows without observation of mating); 2) attended or hand mating; and, 3) artificial insemination (utilizing semen collected from boars).

During gestation sows may be housed individually or in groups (CAST, 2009). Resolution 3 of the American Association of Swine Veterinarians, and the American Veterinary Medical Association states: The American Veterinary Medical Association supports the use of sow housing configurations that: 1) minimize aggression and competition between sows; (2) protect sows from detrimental effects associated with environmental extremes, particularly temperature extremes; 3) reduce exposure to hazards that result in injuries; 4) provide every animal with daily access to appropriate food and water; 5) facilitate observation of individual sow appetite, respiratory rate, urination and defecation, and reproductive status by caretakers; and, 6) allow sows to express most normal patterns of behavior (Vet Med Today: Sow Housing Task Force, 2005). Public Act No. 117 of October 12, 2009 requires, by April 1, 2020, all gestating sows be housed so that they are able to fully extend their limbs and turn around freely. Sows may be housed in individual pens or stalls which are large enough to do so, until they are determined pregnant. For further information on this enactment and exemptions see Rozeboom et al. (2019). Housing in groups in pens may be most easily applied and affordable. When housed in pens and in groups, pregnant sows may be fed to meet all nutrient requirements by providing a variable number of meals per day using one or more of the following methods: clean solid flooring, a common trough, in individual feeders within individual feeding stalls, controlled access to a self-feeder, or an electronic sow feeder.

Sows can farrow in pens, farrowing stalls, or pasture huts. Pens and pasture huts allow the sow to move around freely but may result in higher newborn piglet death loss because the sow may accidentally crush her newborn piglets (McGlone and Blecha, 1987; Stevermer, 1991). Stalls allow the sow to stand, lie, eat, and drink, but not to turn around. Restricting the movement of the sow in some manner during lactation allows the piglets more opportunity to escape being crushed when the sow lies down.

Weaning most often takes place at 2 to 5 weeks of age. Weaned pigs should be provided a warm, dry, and draft free environment and proper nutrition. Growing pigs should be provided space as summarized by the National Pork Board (2003; Tables 3, 4, and 5).

Thermal: With outdoor production, trees can provide adequate shade. Facilities to provide shade can be constructed to also serve as protection from wind and cold during winter. Adequate dry bedding must be maintained during cold weather.

Ventilation typically is the primary means of maintaining the desired air temperature and humidity and gas concentrations for pigs housed inside of buildings. The amount of ventilation depends on the size, number, type, age, and dietary regimen of the pigs, the manure management system, and atmospheric conditions.

Appropriate, effective temperatures ranges for pigs have been summarized by the National Pork Board (2018).

Air quality: Air quality refers to the effects that the air has on the health and well-being of animals. Gases, dusts, and microorganisms are present in pig facilities, and, to a lesser extent, in outdoor operations. Harmful amounts of gases and dust in the air should be avoided in or around buildings (Meyer et al., 1991). Acceptable air quality can usually be achieved with proper ventilation and air distribution, regular cleaning and sanitation, feed dust control, and manure gas control.

Photoperiod: Lighting should give enough illumination to permit practicing good husbandry, inspecting the pigs adequately, maintaining their well-being, and working safely (ASABE, 2005; Clarke and Chambers, 2006). Compared with some species, the domestic pig is less sensitive to its environmental lighting and no particular daily photoperiod regimen is necessary.

FACILITIES AND EQUIPMENT

Swine housing systems may be as simple as a fenced pasture with man-made shelters, or they may be much more complex. Whatever the system, it should be appropriate for the age of the pigs and the local climate. In enclosed structures, the system should be capable of maintaining environmental conditions within an acceptable range of temperature, humidity, chemical emissions and particulates. Descriptions of cold and warm housing systems have been given by the National Pork Board (2018).

Swine facilities should conform to applicable building codes unless deviations and variances are justified and approved. Physical facilities should be well maintained and clean. Facilities and equipment should be inspected, repaired, and maintained regularly to provide a safe environment for animals and people. The MWPS publications and publications of other organizations provide guidance for planning, specifications, cost estimates, and construction of commercial agricultural swine facilities in different parts of the U.S.

Feeders and waterers: Feeders should provide adequate access to feed. Feeders should be cleaned regularly to prevent feed accumulation and spoilage, and be maintained with no rough edges to injure the pigs. Waterers should be positioned to ensure pigs have adequate access.

HEALTH CARE AND MEDICAL PROCEDURES

Adequate health care is an essential part of a pork production enterprise. Appropriate health care involves: methods to prevent, control, diagnose and treat diseases and injuries; training of and guidance to animal caretakers on antibiotic therapy; instruction on proper handling of pharmaceuticals and biologicals and withdrawal times; and adequate record keeping programs. Animals should be observed daily for signs of illness or injury.

Methods of prophylaxis, diagnosis, therapy, and disease control should follow a herd health monitoring program based on Good Production Practices outlined in the PQA Plus practices. Animals should receive appropriate treatment even if marketing must be delayed or forgone due to withdrawal time indicated by the product. Assistance of a veterinarian in establishment of a health care program is recommended. Organic production programs should work with a veterinarian to ensure adequate protection and treatment for sick animals.

Pharmaceutical Use: It is imperative that those engaged in raising livestock and poultry for human consumption understand the prudent and legal use of pharmaceutical products. To help ensure that health and welfare of livestock and poultry and the safety of food they produce for the public, a veterinary-client-patient relationship (VCPR) is highly recommended. In most cases, a valid VCPR is mandatory for acquiring and using pharmaceutical products in food producing animals. Michigan currently follows the federal definition for a VCPR which states that a VCPR is considered valid if the following is observed (Code of Federal Regulations 530.3) (http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/ucm460406.htm):

1. A licensed veterinarian has assumed the responsibility for making medical judgments regarding the health of (an) animal(s) and the need for medical treatment, and the client (the owner of the animal or animals or other caretaker) has agreed to follow the instructions of the veterinarian;
2. there is sufficient knowledge of the animal(s) by the veterinarian to initiate at least a general or preliminary diagnosis of the medical condition of the animal(s); and,
3. the veterinarian is readily available for follow-up in case of adverse reactions or failure of the regimen of therapy. Such a relationship can exist only when the veterinarian has recently seen and is personally acquainted with the keeping and care of the animal(s) by virtue of examination of the animal(s), and/or by medically appropriate and timely visits to the premises where the animal(s) are kept.

Euthanasia: Animals that are seriously injured or ill and show no promise for recovery should be euthanized immediately. Methods can be physical or chemical and one of the approved methods recommended by the American Association of Swine Veterinarians, which is consistent with the AVMA Guidelines on Euthanasia (AVMA, 2020). See the manual On-Farm Euthanasia of Swine- Recommendations for the Producer (National Pork Board, 2016). In the event of a foreign animal disease or major market disruptions, a large number of swine may need to be depopulated. See the AASV guidelines for Depopulation of Swine (American Association of Swine Veterinarians, 2020).

Dead Animal Disposal: Animal tissue, whole carcasses, or portions thereof, must be disposed of according to the Michigan Bodies of Dead Animal Act, Act 239 of 1982, Amended Act No. 311, Public Acts of 2008, December 18, 2008.

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EQUINE

MANAGEMENT OVERVIEW

The equine industry in Michigan is large and diversified. Management systems include breeding farms; training facilities; show, exhibition, and racing enterprises; mare and foal operations; transportation companies; horses used for work on farms or for transportation; boarding stables, pleasure horse operations and riding stables. Equine management systems include operations with only a few animals to those with several hundred on one premise. The industry has statewide distribution and the various components are integrated to provide specialized services. The show and racing operations accommodate horses throughout the country; therefore, a large number of horses are transported into and out of this state on a regular basis.

The seasonal changes and climate extremes of this state present possible management and health problems which need to be considered and managed Housing and pasture systems may vary and be modified to meet the needs of the enterprise, to use existing facilities, and to be economically feasible Emphasis on safety and minimizing stress, are important factors when transporting one or several horses. Herd health, disease prevention and emergency care programs should be individually developed and implemented for each equine operation. These programs need to be reviewed and modified as disease potential and needs change. Since horses are athletes and perform different tasks, nutritional programs need to meet the growth and performance requirements of each horse.

Federal and state laws concerning horse protection, animal cruelty, riding stables, and sale barns need to be understood by the industry and individual horse owners, complied with, and enforced.

MANAGEMENT PRACTICES

Nutrition: Proper nutrition is important in maintaining health. Nutritional demands vary depending on age, size, and use. The amount and composition of feed required is governed by body weight, individual metabolism, age, pregnancy, lactation, and the amount of work the animal does. Horses need to be adequately fed to maintain their body weight and health; however, idleness, overfeeding and obesity are undesirable and often harmful. Horses are kept for a much longer time than most farm animals, and feeding programs should support the development of sound feet and legs that will sustain a long and athletic life.

Nutritional demands are usually met with good quality, properly harvested forages and pastures combined with grains and supplements as needed to balance the diet. To maintain optimum health, most mature horses should derive the majority of their nutrition from good quality roughage, typically 1.5-2.0% of their weight in roughage daily. There may be exceptions to this forage intake, however, based on individual and

workload. Horses utilize hay or other roughages more efficiently than do other non-ruminants; however, consistency and nutrient quality are essential for optimum productivity and health. Because horses are particularly sensitive to toxins found in spoiled feeds, grains and roughages should be of good quality and free from visible mold. Feeding of dusty feeds should be kept to a minimum because of their tendency to initiate or aggravate respiratory problems.

When horses are fed in groups, adequate feeding space should be provided so that dominant animals do not prevent others from eating. Horses should be fed regularly, and since they have a relatively limited capacity for roughage at any one time, they should have frequent access to it. A horse should be rested after eating large grain meals before strenuous work starts.

Availability of clean water is essential. Water requirements depend largely upon environment, amount of work being performed, the nature of the feed, and the physiological status of the horse. Extreme water temperatures (very hot or cold) may reduce water intake and lead to dehydration. Horses should be offered water during long exercise bouts and immediately following exercise and several hours throughout the recovery period.

Transportation: Trailers and vans should be free of protruding objects on the sides and top and should be of adequate height for the animal. When appropriate, protective devices such as helmets, leg wraps, boots, blankets, and tail wraps can be used to further protect the animal from injury.

Available hay in the trailer will help prevent boredom during transit. Suitable non-slippery flooring, e.g. rubber mats, straw, shavings, or a combination of these, should be available for transits The vehicle exhaust system should not pollute the air inside the trailer. When trips are over 24 hours, an ample rest stop, fresh feed and water should be given. On shorter trips, a walking rest stop with water may be appropriate depending on the length of the trip. The ability to lower their head during transit (especially long distance) may reduce the incidence of shipping fever. Seriously debilitated or non-ambulatory animals should not be transported unless they can be appropriately accommodated without further injury or distress and the purpose of transport is to obtain medical care. A delay or cancellation of transport should occur for animals that appear unhealthy, dehydrated, or exhausted and unfit to withstand the travel.

For the safety of the equine and handlers, the tranquilization of horses during transit is acceptable. Products should be administered by a person knowledgeable about the product and in consultation with a veterinarian. Administration of mineral oil may be helpful in preventing intestinal stasis during long trips.

Training: Horses in training, exhibition, racing and work should be treated in a humane manner. The acceptable standards for training, exhibition, racing and work are those which an informed and recognized equine association (e.g., United States Equestrian Federation Rule Book, 2013, and American Quarter Horse Association Official

Handbook, 2013) has developed and shall be in compliance with the Federal Horse Protection Act and Michigan cruelty to animals laws.

RECOMMENDATIONS FOR THE ENVIRONMENT

Proper illumination in barns and indoor riding arenas are important for the convenience and safety of both the horse and the attendant.

As a rule, horse owners can obtain adequate housing for their horses with non-insulated buildings. In northern regions, insulated buildings and supplemental heat are more commonly used to protect the animals and attendants from severe winter weather. Healthy horses with adequate diet and good body condition only require protection from the wind. Heated barns may be used for show horses to keep them in show condition throughout the year. Overcrowding should be avoided to minimize injuries and parasite problems.

Pastures should have adequate shelter where horses can get out of the sun, wind, rain, and other inclement weather. These may include, but are not limited to: open barns, lean-tos, constructed windbreaks and woodlots. There should be enough space to accommodate all animals comfortably. Riding stables licensed by Michigan Department of Agriculture and Rural Development are required to have constructed shelters per R 285.154.5.

If horses are confined to small spaces, manure should be stored away from the horse housing to decrease fly and parasite exposure. The manure should be stored, transferred, and utilized in compliance to practices outlined by the GAAMP for Manure Management and Utilization.

FACILITIES AND EQUIPMENT

The basic purpose of horse housing is to provide an environment that protects the horses from temperature extremes, keeps them dry and out of the wind, eliminates drafts through the stables, provides fresh air in both winter and summer and protects the horses from injury. See reference section for more information on general housing requirements.

In cold non-insulated or insulated barns, fresh air is usually provided by natural air movement through wall openings and ridge vents or devices. Examples of wall openings may be small windows, wall panels or slots under the eaves. In tight, warm barns, fans, and spaced air inlets may be necessary. Adequate air exchange and distribution should be provided to remove moisture generated within the barn. If using supplemental heat, adequate ventilation will be required. Adequate air exchange and air distribution systems to provide adequate cooling should be provided during hot weather.

In most horse barns, some box stall space is necessary for sick animals, mares at foaling time and foals. Stall walls should be tight, smooth, and free of loose wires,

protruding objects such as bolts and nails, and anything else that might injure the horse as it moves about and lies down. The walls should be flush with the floor, so a horse cannot get its feet under the partition. The walls should be constructed from material and in a manner that will withstand pushing and kicking from the horses and that, if damaged, will not become a potential hazard to the horse (e.g., a horse kicks a hole in sheet metal). Wooden kick boards should be placed at least up to 4 feet for the average 1000pound. horse. For riding horses (1000 pound. average) a typical box stall would be 10 feet by 10 feet. Stalls of 16 feet by 20 feet, or larger, are useful for foaling mares. Box stalls for ponies and miniature horses may be smaller, depending on the size of the animal.

Tie stalls require about half the area, use less bedding, are easier to clean than box stalls, and can often be constructed in existing buildings suitable for box stalls. A possible example of a typical tie stall is 5 feet by 9 feet (3 feet by 6 feet for ponies and miniature horses), although stall lengths up to 12 feet are often used. For either box stalls or tie stalls, construction materials must be strong enough to contain the animal.

Packed rock-free clay on a well-drained base make comfortable and practical floors for stables. However, they are difficult to keep clean and must be renewed from time to time. Packed, crushed limestone makes a good stall surface in that it drains readily, has reduced maintenance, and has a reduced odor. Wood plank stall floors or wood block floors on concrete are preferred by some, but such floors are difficult to keep dry and free of odors. Concrete floors are the least desirable; and if used, a considerable amount of bedding is needed. Many stall floors, regardless of the stall base, are covered with some type of stall mat to reduce stall maintenance, bedding requirements and/or provide a more desirable surface for the horse to stand on. Floor finishes that are slippery should be avoided.

Common fencing materials are wood, pipe, PVC, electrical wire or tape, smooth, non-electrical wire, rubber belt and woven wire (the mesh should be small enough that a horse or foal cannot get their feet through). The perimeter fence should provide an adequate physical barrier that is not dependent on electricity for containment. Electric fencing can be used as a psychological barrier to keep horses from leaning on the fence, reduce fighting over the fence or provide an interior fence. The fence should be free of sharp projections, such as nails, bolts and latches. Single or double strand wire fences may lack visibility and have the potential for severe cuts to horses entangled in them. More visible products are available for wire fencing or large strips of plastic or cloth can be tied to wire to increase visibility. Fences should be approximately 5 feet in height for light horses with additional height necessary for stallions and draft horses. Overcrowding in pastures and lots should be avoided to minimize injuries due to kicking and fighting.

Bands of horses may be housed in open sheds. If halters are left on in the pasture, they should be of a material that will break if the halter becomes caught on an object. (i.e., breakaway or thin leather halters).

Where animals are housed for any lengthy period, clean bedding should be provided regularly. Animals should be provided with daily exercise to maintain healthy skeletal – muscle system and reduce behavioral problems. Daily exercise could be in the form of free exercise provided by turnout or forced exercise like lunging or riding for at least 30 minutes per day.

HEALTH CARE AND MEDICAL PROCEDURE

Disease and injury prevention can best be achieved through nutritional management, adequate housing, vaccination programs, parasite control, cleanliness, and general equine husbandry in consultation with a veterinarian.

A healthy horse is active, drinks readily, has clear eyes and nose, a clean skin, and a good general body condition, without being excessively fat. A moderate body condition score of 4.5 – 6.5 ensures adequate energy reserves without excessive weight that could predispose a horse to nutritional or skeletal problems. The health of the horses should be routinely assessed to recognize appropriate signs of illness, so that care may be instituted. Management plays a significant role in the prevention of disease and injury.

A proper preventive vaccination program should be developed for individual horse needs. Effective vaccines are available to protect horses from fatal diseases including: Tetanus, Encephalomyelitis, West Nile Virus, and Rabies. The manufacturer's and/or veterinarian's recommendations should be followed for all vaccines.

Internal parasitism is one of the most serious of all equine diseases. Parasitism is associated with general un-thriftiness, poor hair coat, and a high incidence of colic. Stable and pasture management can be helpful in parasite control. A parasite control program should be developed and implemented for all horses. If grazing, appropriate grazing management strategies should be employed to minimize parasitic infestation.

Horses' teeth should be examined periodically and floated when necessary. Elongated enamel points on the teeth can cause trauma and constant irritation and result in improper chewing. Excessive salivation or dropping of feed from the mouth indicate the mouth should be examined and may indicate that dental care is needed.

Proper foot care is essential to maintain normal health of the foot and to prevent lameness. The hooves should be examined regularly and trimmed or shod as needed. For stabled horses, clean, dry bedding should be maintained. Excessive dryness of the hoof should be avoided.

Pharmaceutical Use: It is imperative that those engaged in raising livestock and poultry for human consumption understand the prudent and legal use of pharmaceutical products. To help ensure that health and welfare of livestock and poultry and the safety of food they produce for the public, a veterinary-client-patient relationship (VCPR) is highly recommended. In most cases, a valid VCPR is mandatory for acquiring and using pharmaceutical products in food producing animals. Michigan currently follows the federal definition for a VCPR which states that a VCPR is considered valid if the following is observed (Code of Federal Regulations 530.3) (http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/ucm460406.htm):

1. A veterinarian has assumed the responsibility for making medical judgments regarding the health of (an) animal(s) and the need for medical treatment, and the client (the owner of the animal or animals or other caretaker) has agreed to follow the instructions of the veterinarian;
2. there is sufficient knowledge of the animal(s) by the veterinarian to initiate at least a general or preliminary diagnosis of the medical condition of the animal(s); and,
3. the practicing veterinarian is readily available for follow-up in case of adverse reactions or failure of the regimen of therapy. Such a relationship can exist only when the veterinarian has recently seen and is personally acquainted with the keeping and care of the animal(s) by virtue of examination of the animal(s), and/or by medically appropriate and timely visits to the premises where the animal(s) are kept.

Euthanasia: Animals that are seriously injured or ill and show no promise for recovery should be euthanized immediately. Methods can be physical or chemical and one of the approved methods recommended by the AVMA Guidelines on Euthanasia (AVMA, 2020).

Dead Animal Disposal: Animal tissue, whole carcasses, or portions thereof, must be disposed of according to the Michigan Bodies of Dead Animal Act, Act 239 of 1982, Amended Act No. 311, Public Acts of 2008, December 18, 2008.

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ADDENDUM: CURRENT STATE AND FEDERAL LAWS

The Michigan Penal Code, Act 328 of 1931, as amended, MCL 750.50--A person who willfully, maliciously and without just cause or excuse kills, tortures, mutilates, maims, or disfigures an animal or who willfully and maliciously and without just cause or excuse administers poison to an animal, or exposes an animal to any poisonous substance, other than a substance that is used for therapeutic veterinary medical purposes, with the intent that the substance be taken or swallowed by the animal, is guilty of a felony, punishable by imprisonment for not more than 4 years, or by a fine of not more than $5,000.00, or community service for not more than 500 hours or any combination of these penalties.

Michigan Public Act, Act 93 of 1974, as amended, MCL 287.112--A person, firm, or corporation shall not own or operate a riding stable (any establishment in which, for business purposes, six or more horses or ponies are rented, hired, or loaned for riding) or sale barn (any establishment where horses or ponies owned by others are sold or offered for sale) without first having obtained a license. A person who violates this Act is guilty of a misdemeanor.

Michigan Animal Industry Act, Act 466 of 1988, as amended, MCL 287.739--A facility for exhibition of livestock shall be constructed to allow sufficient separation of each exhibitor's livestock. The facility shall be constructed of a material that can be adequately cleaned and disinfected. An exhibition building or yarding facility shall be cleaned and disinfected with USDA-approved disinfectant used in accordance with label instructions before livestock are admitted by removing from the premises all manure, litter, hay, straw, and forage from pens, runways and show rings, and thoroughly disinfecting walls, partitions, floors, mangers, yarding facilities, and runways in a manner approved by the director.

Michigan Penal Code, Act 328 of 1931, as amended, MCL 750.60 Docking Horses Tails--Any person who shall cut the bone of the tail of any horse for the purpose of docking the tail, or any person who shall cause or knowingly permit it to be done upon the premises of which he is the owner, lessee, proprietor or user, or any person who shall assist in or be present at such cutting, shall be guilty of a misdemeanor, punishable by imprisonment in the county jail of not more than one year or by a fine of not more than $500.00. Provided, that such cutting of the bone of the tail of any horse for the purpose of docking the tail shall be lawful when a certificate of a regularly qualified veterinary surgeon shall first be obtained certifying that such cutting is necessary for the health or safety of such horse.

The Federal Horse Protection Act was passed in 1970 and amended in 1976. The legislation is aimed at stopping the cruel and inhumane practice of having horses take part in a horse show or sale while they are "sore". A horse is deemed to be sore if it suffers abnormal pain, distress, inflammation, or lameness when it walks, trots, or otherwise moves. Generally, soring refers to any application, infliction, injection, or practice which makes a horse sore in a way that exaggerates its gait, producing a

flourish prized by show judges and viewers. The law forbids the entering of sore horses in shows, exhibitions, sales, or auctions; permitting such an entry to occur; and transporting horses for such an entry. Regulations further forbid acts that may cause horses to become sore at regulated events. Criminal offenses are prosecuted in federal courts.

SPECIFIC REFERENCES

Horse Riding Stables and Sale Barns, 1974 PA 93, as amended, MCL 287.111-287.119.

Animal Industry Act, Act 466 of 1988, as amended, MCL 287.701-287.747.

Michigan Penal Code (Excerpts), 1931 PA 328, as amended, MCL 750.49-750.70.

The Horse Protection Act, Code of Federal Regulations, Title 9, Chapter I, Subchapter A, Part II.

PRIVATELY OWNED CERVIDAE

MANAGEMENT OVERVIEW

The Michigan Animal Industry Act, Act 466 of 1988, as amended, describes farmed cervidae (hence known as privately owned cervidae, or cervids) as members of the cervidae family including, but not limited to, deer, elk, moose, reindeer and caribou living under the husbandry of humans. Because of their unique behavioral characteristics, a high degree of skill and sensitivity need to be exercised when raising cervidae as livestock (Coon et al. 2001). Cervids are generally less easy to tame than other domestic species and, therefore, have special management, environmental, facility and health care requirements. Though exact husbandry systems may vary by species and/or location, all farmed deer require adequate nutrition, shelter, holding/handling facilities, and health management. Recommended husbandry and handling procedures for cervids can be found at: http://www.nfacc.ca/pdfs/codes/deer_code_of_practice.pdf.

MANAGEMENT PRACTICES

Handling: Handling cervidae requires care and caution to minimize undue noise and/or commotion, thereby avoiding over-excitement of the animals. To minimize stress, handling should occur as infrequently as possible. However, familiarization with routine management and facilities from an early age may reduce animal apprehension. Routine management procedures such as weighing, identification, vaccination, and anthelmintic (dewormer) administration need to be carefully scheduled and performed simultaneously when feasible. To decrease the chances of animal or human injury during handling, antlers may be removed before the onset of rut. Handling equipment designed specifically for use with privately owned captive cervidae should be used. Tranquilization may be required if proper handling facilities are not available. A veterinary/client relationship is needed to handle these medications without direct veterinary supervision. Working cervidae with dogs is not recommended. If used, dogs must be well-trained on cervidae and used under the direction of experienced handlers.

Nutrition: Adequate feed and water are vital to all animals and farmed cervidae provide no exception. Access to clean, fresh drinking water is essential for all cervidae. Nutritional requirements vary both between and within species. There are differences between those species that are primarily grazers and those that prefer to browse. Within species, nutritional requirements differ among adult males, adult females, and growing animals. In addition, seasonal variation exists within each of these animal classifications and must be taken into consideration to meet their nutritional requirements throughout the year.

Reproduction: Reproductive characteristics vary somewhat between cervidae species, but all are highly seasonal. Important management considerations to achieve good reproductive performance include: Paddock size and female: male ratio during

breeding; aggressive behavior by males in the rut; normal parturition (birthing) behavior; environmental needs of newborns; and specific requirements at weaning. Information from veterinarians, experienced individuals and/or reliable published sources can be valuable (see references).

Transportation: Transporting cervidae successfully requires specific attention to several key details. Cervids should be separated according to species, age, and sex when handling or transporting. Quiet handling and darkened transport crates or trailers tend to enhance outcomes.

Adequate ventilation is required, and confinement during transport for over 12 hours necessitates provision of feed and water. Extra caution should be exercised in transporting the following cervidae and should be done only when the cervidae welfare is at stake: males with antlers in velvet; females due to give birth within two months; and lactating females and offspring when those fawns/calves are less than one month of age. Bucks and bulls in hard antler should be transported individually or in separate compartments. A delay or cancellation of transport should occur for animals that appear unhealthy, dehydrated, or exhausted and unfit to withstand travel. Finally, transportation of cervidae should be avoided in extremely hot weather to minimize associated stress.

RECOMMENDATIONS FOR THE ENVIRONMENT

Farmed cervidae can be successfully raised under a wide variety of systems. Their environmental needs vary from those of major livestock species based mainly on their behavioral differences. Accordingly, requirements often differ among individual cervidae species. For example, paddock size and stocking density should be determined by species preference toward social and gregarious behavior, and the relative proportions of open pasture and forested land should be based on species preference for browsing versus grazing. Cervidae must become habituated to their environment, and disruptions by people, other animals, or machines should be minimized. Newborn cervidae require cover for hiding and shelter from inclement weather in some situations. Though most cervidae are quite tolerant of climatic fluctuations, provision of shelter to temper climatic extremes can be beneficial. As with other aspects of cervidae farming, environmental design should utilize expert input.

FACILITIES AND EQUIPMENT

For the most part, the facilities and equipment needed for cervidae farming are dictated by the requirements in handling, nutrition, reproduction, transportation, and environment. Fences should be tall enough to avert jumping by the species of interest, and sharp protrusions in the confined areas should be strictly eliminated. Recommendations and specifications for fencing and other facility requirements for privately owned cervidae can be found on the Michigan Department of Natural Resources website: https://www.michigan.gov/dnr/0,4570,7-350--165414--,00.html

HEALTH CARE AND MEDICAL PROCEDURES

In managing the health of farmed cervidae, aggressive prevention of disease and injury is much preferred to treatment. Reliable success with both prevention and treatment is more likely if a veterinarian skilled in cervidae management is involved. Adherence to regulatory requirements must be observed in the transport and transfer of cervidae. Development of a herd-specific health management program in consultation with a local veterinarian is recommended. This program should incorporate routine herd health evaluations appropriate for the particular management, environment, and facilities involved. Vaccination, anthelmintic administration, antler removal, and other health management practices can then be appropriately executed in a timely manner. Organic production programs should work with a veterinarian to ensure adequate protection and treatment for sick animals.

Pharmaceutical Use: It is imperative that those engaged in raising livestock and poultry for human consumption understand the prudent and legal use of pharmaceutical products. To help ensure that health and welfare of livestock and poultry and the safety of food they produce for the public, a veterinary-client-patient relationship (VCPR) is highly recommended. In most cases, a valid VCPR is mandatory for acquiring and using pharmaceutical products in food producing animals. Michigan currently follows the federal definition for a VCPR which states that a VCPR is considered valid if the following is observed (Code of Federal Regulations 530.3) (http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/ucm460406.htm):

1. A licensed veterinarian has assumed the responsibility for making medical judgments regarding the health of (an) animal(s) and the need for medical treatment, and the client (the owner of the animal or animals or other caretaker) has agreed to follow the instructions of the veterinarian;
2. there is sufficient knowledge of the animal(s) by the veterinarian to initiate at least a general or preliminary diagnosis of the medical condition of the animal(s); and,
3. the veterinarian is readily available for follow-up in case of adverse reactions or failure of the regimen of therapy. Such a relationship can exist only when the veterinarian has recently seen and is personally acquainted with the keeping and care of the animal(s) by virtue of examination of the animal(s), and/or by medically appropriate and timely visits to the premises where the animal(s) are kept.

Euthanasia: Animals that are seriously injured or ill and show no promise for recovery should be euthanized immediately. Methods can be physical or chemical and one of the approved methods recommended by the AVMA Guidelines on Euthanasia (AVMA, 2020).

Dead Animal Disposal: Animal tissue, whole carcasses, or portions thereof, must be disposed of according to the Michigan Bodies of Dead Animal Act, Act 239 of 1982, Amended Act No. 311, Public Acts of 2008, December 18, 2008.

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SHEEP and GOATS

MANAGEMENT OVERVIEW

The sheep industry is segmented into four major groups. Commercial flocks produce market lambs and wool, the lamb feeding industry specializes in market lamb production, the registered flocks produce breeding stock and exhibition animals, and the small, special interest flocks are involved in specialty fiber production, rare breeds, etc. In addition, the dairy sheep industry, still in its infancy, has begun in Michigan to produce specialty cheeses and other milk products.

The goat industry is smaller than the sheep industry and is divided differently. There are a very small number of Grade A dairy farms, and the rest of the dairy goats are kept in small herds for home milk production, 4-H youth projects, and exhibition. Angora goats are kept for mohair production. The meat goat industry is currently in a state of growth. The meat goat industry had a by-product of the Angora and dairy goat herds but more recently has become more specialized utilizing breeds specifically for carcass quality. References are provided for more specific guidance on the care of sheep and goats.

MANAGEMENT PRACTICES

Most sheep and goats in Michigan are seasonal breeders, breeding in the fall and giving birth in the spring each year. The marketing period is extended however by different production systems and lamb/kid feeding strategies. Indoor birth is to lamb/kid indoors typically early in the calendar year. Drop lot birth which comprises the majority of Michigan production generally occurs March-June and involves outdoor birth near a barn or similar facility followed by brief individual housing of mother and offspring to facilitate bonding and subsequent release on pasture. Pasture birth system involves birth on actively growing pasture during warm periods (commonly May-June) without individual housing and is the least laborious system. Accelerated lambing, currently in minor adoption in Michigan, may use a combination of the above systems and utilizes breeds that are aseasonal in breeding and can reduce the birth interval to 6-8 months. Layered on top on these production systems are different rearing strategies that vary the rate of lamb/kid growth to effectively extend the marketing season and take advantage of seasonal feeding opportunities. The major system involves early growth on pasture followed by finishing in confinement. Other strategies include complete confinement or pasture rearing.

Nutrition: The nutritional program is of paramount importance in production of sheep and goats and largely determines animal well-being and closely associated profitability of animal production. Sheep and goats at all stages of production should be fed and watered in a consistent manner to supply requirements as established by the National Research Council publication *Nutrition of Small Ruminants: Sheep, Goats, Cervids, and New World Camelid*s (NRC, 2007). These guidelines detail nutritional requirements according to physiological state and emphasize the importance of matching nutrition to

physiological state. Sheep and goats are commonly litter bearing species and require a higher plane of nutrition in proportion to litter size during the last month of pregnancy. This requires a more concentrated diet due to this increased demand coupled with constraints on voluntary intake imposed by the pregnant uterus. Proper feeding during late pregnancy also sets the stage for subsequent lactation performance. The requirements of lactation are dependent on litter size and require a much higher plane of nutrition than other states of production. Special attention must be given to animals that are still in their growth phase during pregnancy and lactation. These animals should be fed to meet all requirements (growth and lactation or pregnancy) without providing excess nutrients during pregnancy which can create problems with dystocia (difficult birth). In addition to the ensuring adequate macronutrient supply as outlined above, micronutrient supply is also an important consideration especially as it relates to mineral nutrition. Iodine and selenium are deficient in Michigan soils and supplementation must be provided to small ruminants. This can be done most effectively in the form of mineral or grain supplement. Copper toxicity can be a problem for sheep. They have a much lower copper requirement than other livestock species and care should be taken to avoid feeding feeds formulated for other species to prevent toxic accumulation.

Water requirements can be met by routine access to water. Animals can meet water requirements by consumption of lush forage and or snow depending on seasonal conditions. Water consumption in its various forms must be sufficient to allow appropriate dry matter intake for each stage of production. In practice, ewes fed a dry diet during late pregnancy and lactation and lambs fed a dry diet during finishing will have higher requirements for water and will benefit from continuous access to water.

Transportation: Transportation of sheep and goats should be handled with regard to climatic conditions and productive stage of the animals. Temperature extremes should be avoided and transport of late pregnant animals or debilitated and non-ambulatory animals should be done with caution. Sheep in short fleece should be transported in trailers designed to minimize drafts during sub-freezing weather. Proper hydration of animals is especially important before and after shipment during hot, humid conditions. During hot, humid conditions, transport periods should be minimized, and consideration given to night travel to reduce animal stress. Animals should be handled carefully and quietly during loading and unloading. A ramp is advised for animal and human safety when animals need to make large changes in elevation. A delay or cancellation of transport should occur for animals that appear unhealthy, dehydrated, or exhausted and unfit to withstand travel.

RECOMMENDATIONS FOR THE ENVIRONMENT

Nutrition, air quality and in the case of sheep, length of fleece, are primary considerations in the housing of animals during cold weather. Adult sheep, in particular, can be housed outdoors all year round if certain conditions are met. During winter, sheep housed outdoors need sufficient wool cover and improved quality and or quantity of feed to maintain body weight and condition depending upon temperature, precipitation, and wind speed. Wind breaks, either man made or natural, are effective in

reducing heat loss and thereby reduce nutrient requirements for heat production and are advised under extreme winter conditions If adult animals are housed indoors during winter, adequate ventilation should be provided to prevent humid conditions which promote the spread of respiratory disease. Buildings should be designed to allow adjustment of air turnover by natural or mechanical means depending on climatic conditions and animal density.

During the summer, housed animals require a more frequent rate of air change to prevent excessive temperature, humidity, and gas exposure that can lead to respiratory disease. This increased ventilation can be met by natural ventilation in properly designed buildings or facilitated with the aid of mechanical ventilation in other buildings.

Shearing should be performed by skilled personnel using techniques designed to minimize animal stress. There are shearing schools available in Michigan that provide quality training in this skill. Sheep and angora goats should be shorn at least annually but care should be taken to avoid release of freshly shorn animals during cold, wet weather. The stress of such climatic conditions can be minimized by adjusting shearing combs to leave extra wool stubble. The practice of providing extra wool stubble is also advised for pre-lambing shearing during indoor winter lambing periods. Shearing pregnant ewes in this manner 2-4 weeks prior to lambing, reduces humidity in the barn at animal level and provides adequate fleece to protect from the cold while also improving maternal feed intake.

Newborn lambs and kids are very susceptible to hypothermia, and therefore outdoor birth periods need to be chosen to coincide with favorable conditions for newborn survival. Newborns vary in their ability to mount an adequate heat response and seek milk according to birth size and genetics. Soil temperature above 50° F provides a reasonable lower limit for outdoor birth. Outdoor birth is also possible when soil temperature is less than 50°F but the option of shelter should be available nearby under these conditions. Indoor birth offers the opportunity for lambing/kidding year round but facilities should be designed to minimize drafts at animal level while maintaining adequate air turnover to prevent humid conditions. A draft-free environment should be provided during very cold or wet conditions. In the case of newborns especially susceptible to hypothermia under extreme conditions, supplemental heat in the form of a forced air, warming box or zone heat in early rearing areas may be beneficial.

FACILITIES AND EQUIPMENT

Pastures should be fenced to minimize predator entry and reduce escapes and entrapment of horned or heavily fleeced animals in the fence itself. Innovations in fencing have made this task easier. Portable electric fencing allows great flexibility in secure fencing options. Dry lots should be of sufficient size and well drained to prevent excessive mud during times of prolonged rainfall.

Minimum space recommendations for sheep in confinement can be found in the Midwest Plan Service, Sheep Housing and Equipment Handbook (MWPS, 1994).

Recommendations for goats can be found in the National Goat Handbook (1992). Feeders should be designed to avoid waste and minimize fecal contamination of feed. Feeder designs for sheep are often inappropriate for goats. For this reason, sheep and goats are not usually housed together in close confinement. Additionally, horned goats tend to dominate polled goats and sheep. Extra space must be allowed when horned animals are kept.

Well designed, well-lit facilities can aid in minimizing stress to the animals and the livestock attendants. Sheep and goats have a strong flocking/herding instinct and handling systems take advantage of this. Possible causes of accident or trauma to the animals or handlers should be eliminated. Gates and feed room doors should be securely fastened with livestock-proof latches to avoid illness and/or deaths that occur when animals suddenly have access to large amounts of feed without adequate fermentable fiber. Shearing facilities should be kept clean and dry and shearing equipment disinfected between flocks.

HEALTH CARE AND MEDICAL PROCEDURES

A health care program should be devised for the particular farm based on its production system and goals. A health care program should emphasize preventative procedures and be thoroughly integrated with the farm's nutritional program. Assistance of nutrition and veterinary consultants (MSU Extension or private) are advised in developing such a program. A parasite control program will be an important part of such a program and should emphasize strategic de-worming along with control measures that prevent the development of anthelmintic resistant parasite populations (example grazing management).

Husbandry procedures, such as disbudding, castrating and tail docking of sheep, should be carried out by skilled personnel, while the animals are still small, preferably during the first two weeks of life. If lambs are to be tail docked the dock should be performed at the distal end of the caudal fold where the fold meets the tail to prevent rectal prolapse (Thomas, et al. 2003).

Animals that are lame should be treated promptly to minimize pain or distress. Foot rot is a contagious disease that is endemic in many flocks. There are sound economic and welfare reasons why foot rot eradication should be carried out. Recognition should be given to the fact that certain sheep and goat diseases are potentially transmissible to people, and appropriate precautions should be taken (Goelz, 2002). Animals that are suffering and/or dying should be treated or euthanized. All carcasses should be disposed of promptly and in accordance with state and local regulations. Organic production programs should work with a veterinarian to ensure adequate protection and treatment for sick animals.

Pharmaceutical Use: It is imperative that those engaged in raising livestock and poultry for human consumption understand the prudent and legal use of pharmaceutical products. To help ensure that health and welfare of livestock and poultry and the safety

of food they produce for the public, a veterinary-client-patient relationship (VCPR) is highly recommended. In most cases, a valid VCPR is mandatory for acquiring and using pharmaceutical products in food producing animals. Michigan currently follows the federal definition for a VCPR which states that a VCPR is considered valid if the following is observed (Code of Federal Regulations 530.3) (http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/ucm460406.htm):

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3. The veterinarian is readily available for follow-up in case of adverse reactions or failure of the regimen of therapy. Such a relationship can exist only when the veterinarian has recently seen and is personally acquainted with the keeping and care of the animal(s) by virtue of examination of the animal(s), and/or by medically appropriate and timely visits to the premises where the animal(s) are kept.

Euthanasia: Animals that are seriously injured or ill and show no promise for recovery should be euthanized immediately. Methods can be physical or chemical and be one of the approved methods recommended by the AVMA Guidelines on Euthanasia (AVMA, 2020).

Dead Animal Disposal: Animal tissue, whole carcasses, or portions thereof, must be disposed of according to the Michigan Bodies of Dead Animal Act, Act 239 of 1982, Amended Act No. 311, Public Acts of 2008, December 18, 2008.

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LAYING CHICKENS

MANAGEMENT OVERVIEW

Nearly all commercial birds are kept in confinement housing with light control, power ventilation and mechanical feeding. Confinement housing varies from a few birds per house to more than 100,000 birds per house. In addition, there are many small and some commercial flocks that utilize a variety of free range and/or confinement shelters and housing.

MANAGEMENT PRACTICES

Nutrition: Feed and clean water shall be available to the birds and when new birds are placed in the system, care must be taken to ensure that the birds find the feed and water sources. Knowing that all birds do not feed or drink at the same time, an average of 2.2 inches of feeder space and 1 inch of trough watering space per bird is acceptable for most systems, but may vary based on bird type. A maximum of 20 birds per mechanical water cup or nipple is recommended. In situations where high environmental temperatures may be encountered, fewer birds per cup or nipple is recommended.

Laying hens normally enter a natural molt period after 8-12 months of producing eggs, and therefore, it is considered sound management to induce this molt so that all the birds molt at the same time. To accomplish this molt, it may be necessary to put the birds on a dietary regime in which feed may be altered but not withdrawn for a period of time allowing the birds a period of rest from egg production. As a result of this molting program, the birds' productive life will be prolonged.

Stocking Density: Regardless of the type of enclosure or system of management used, all birds should have sufficient freedom of movement. Minimum space allowance should be in the range of 67 to 86 square inches of usable space per bird housed in conventional cages (United Egg Producers, 2016).

Beak Trimming and Dubbing: Due to the temperament of chickens toward feather picking, fighting and cannibalism, the beaks of domestic birds can be trimmed to remove their sharp tips. Trimming should be done by properly trained workers and should be done at prescribed times, usually prior to 10 days of age. More detailed guidelines on beak trimming are available in the United Egg Producers Animal Husbandry Guidelines (2016).

Partial removal of the comb at one day of age is commonly called dubbing and is an acceptable management practice. It is usually done at the hatchery before shipment of the chicks. In laying strains that develop large combs, dubbing reduces injury and

bleeding caused by contact with their peers, as well as cages and/or equipment during feeding and drinking.

Transportation: Safety and comfort of the animals are of prime importance when transporting poultry. Poultry in transit should be provided with proper ventilation for the conditions; clean, sanitized vehicles and equipment; and a floor surface that minimizes slipping. A delay or cancellation of transport should occur for birds that appear unhealthy, dehydrated, or exhausted and unfit to withstand travel. More detailed guidelines are available in the United Egg Producers Animal Husbandry Guidelines.

Chick delivery: The day-old chick delivery vehicle should have the capability of maintaining a uniform temperature of 75˚F (24˚C) to 80˚F (27˚C) regardless of ambient temperature. Air circulation must always be maintained around all chick boxes regardless of their location in the vehicle. The vehicle should not stop from the time it is loaded until it reaches its destination. Provisions for maintenance of proper ventilation and temperature control should be provided in case of vehicle's mechanical failure or any other unforeseen vehicle stop(s). The transportation vehicle should be properly cleaned and sanitized between deliveries.

Adult poultry delivery: When adult poultry are transported, adequate ventilation, space and flooring should be provided. Hot weather is a time for particular caution. The birds should be protected from heat stress by being shaded and/or moved during the dark hours. Prompt unloading and/or auxiliary ventilation is essential when the birds reach their destination.

During transportation in cold weather, birds should be protected by use of windbreaks, partial covering, etc. Ventilation must always be adequate.

RECOMMENDATIONS FOR ENVIRONMENT

Ventilation and Lighting: Ventilation in the layer house should provide a healthy level of moisture, gases and temperature maintained without drafts or dead air pockets.

Lighting should be provided to allow effective inspection of all the birds and sufficient light for the birds to eat and drink. Light intensity within the house should average between 0.125 and 1.0 foot candle during the daily light period.

The housing should provide shelter from disturbing noises, strong vibrations, or unusual stimuli, regardless of origin.

FACILITIES AND EQUIPMENT

Housing: The design, construction and management of a poultry housing system must meet the birds' need for shelter against undesirable environmental conditions such as

extreme cold, excessive heat, rain and wind and modify these climatic conditions to conform to an adequate environment for laying hens. They shall be constructed to minimize transmission of disease, parasites and other vermin infestation and optimize the principles of disease prevention. The housing should also protect the birds from all forms of predators and allow for daily visual inspection and care. Public Act No. 117 of October 12, 2009 will require that by April 1, 2020 all egg laying hens be housed so that they are able to fully extend their limbs and turn around freely. Hens may be housed in a variety of housing arrangements such as aviary, single tier systems or colony systems that are large enough to do so with a minimum of 1 square foot per hen.

Housing in cages: Cages shall be designed, constructed, and maintained to avoid injury to the birds and allow bird comfort and health. The cages must be so constructed as to allow the safe placement and removal of birds. Cage height shall allow a minimum of 14 inches with a floor slope not to exceed 8.5 degrees. As stated above conventional battery cage systems will be eliminated as a housing option on April 1, 2020.

Housing on floors: All flooring shall be designed, constructed, and maintained to avoid injury and allow comfort and health to the birds. More complete guidelines for floor space, nesting area, feed and water spacing and litter management are available in the United Egg Producers Animal Husbandry Guidelines (2016) or standards set by certification bodies for special label marketing purposes.

Maintenance: When mechanical systems are utilized for feeding, watering, ventilating, egg collecting, manure removal, etc., properly trained personnel shall regularly check the operation of these systems and adjust and maintain them when necessary to prevent injury to the birds and maintain the health and comfort of the laying hens. All aspects of the housing facility must be checked regularly to assure both the structure and systems are operating correctly.

Cleaning of poultry houses: Poultry houses should be cleaned periodically to provide a healthy environment for the birds. The length of time between cleaning depends upon the type of housing, mechanical systems installed, removal of birds from the house and other factors peculiar to each individual farm. Typically, cleaning is done in the time period after depopulation of the old flock and before the arrival of the new flock. Manure management should conform to the recommendations presented in the current Right to Farm Practices (Michigan Manure GAAMPs).

HEALTH CARE AND MEDICAL PROCEDURES

Optimal management practices are essential to maintain good health status in the egg production facilities and may be in consultation with a veterinarian. A program of disease prevention and control should be established for both conventional and organic production programs.

Only federally approved medications and vaccines shall be used, following label directions in accordance with state and federal regulations.

Pharmaceutical Use: It is imperative that those engaged in raising livestock and poultry for human consumption understand the prudent and legal use of pharmaceutical products. To help ensure that health and welfare of livestock and poultry and the safety of food they produce for the public, a veterinary-client-patient relationship (VCPR) is highly recommended. In most cases, a valid VCPR is mandatory for acquiring and using pharmaceutical products in food producing animals. Michigan currently follows the federal definition for a VCPR which states that a VCPR is considered valid if the following is observed (Code of Federal Regulations 530.3) (http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/ucm460406.htm):

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2. there is sufficient knowledge of the animal(s) by the veterinarian to initiate at least a general or preliminary diagnosis of the medical condition of the animal(s); and,
3. the practicing veterinarian is readily available for follow-up in case of adverse reactions or failure of the regimen of therapy. Such a relationship can exist only when the veterinarian has recently seen and is personally acquainted with the keeping and care of the animal(s) by virtue of examination of the animal(s), and/or by medically appropriate and timely visits to the premises where the animal(s) are kept.

Euthanasia: Animals that are seriously injured or ill and show no promise for recovery should be euthanized immediately. Methods can be physical or chemical and one of the approved methods recommended by the AVMA Guidelines on Euthanasia (AVMA, 2020). On the farm euthanasia recommendations are also available in the United Egg Producers Guidelines (2016).

Dead Animal Disposal: Animal tissue, whole carcasses, or portions thereof, must be disposed of according to the Michigan Bodies of Dead Animal Act, Act 239 of 1982, Amended Act No. 311, Public Acts of 2008, December 18, 2008.

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BROILERS, TURKEYS, AND GAMEBIRDS

MANAGEMENT OVERVIEW

Nearly all commercial turkeys and commercial broiler facilities are kept in confinement housing with light control, power ventilation and mechanical feeding. Commercial gamebirds facilities, along with small farm hobby and backyard flocks, utilize a wide variety of free range and/or confinement shelters and housing.

These GAAMPs are intended to assist the broiler, turkey, and gamebird producer in attaining and maintaining a high quality of bird comfort and well-being in broiler, turkey, and gamebird production facilities and will focus on the birds' basic requirements.

MANAGEMENT PRACTICES (INCLUDING TRANSPORTATION)

Nutrition: Feed and clean water should always be available to the birds and when new birds are placed in the system, care must be taken to ensure that the birds find the feed and water sources. Birds should be fed a feed that is appropriate for the stage of life of the particular species and formulated for that species. Commercial turkeys typically are raised on 6 to 7 different diets starting with a 28 percent protein content in the feed and ending with a 16 percent protein in the feed. Commercial broilers typically are fed two, sometimes three different diets in their production period. In situations where high environmental temperatures can be encountered, additional water space per bird is recommended.

Beak trimming and specs: Due to the temperament of chickens, turkeys, and gamebirds toward feather picking, fighting and cannibalism, the beaks of birds can be trimmed to remove their sharp tips as an aid in prevention of these actions. Trimming should be done by properly trained workers and should be done at the prescribed times, generally at the hatchery. In addition, specs or blinders may be attached to the beak of the bird so that the birds can see to the right or left, but not straight ahead. This should be done by properly trained workers and should be done when the birds are of sufficient age to readily find the feed, water, and other visual environmental necessities.

Toe trimming: Due to the tendency of turkeys to inflict bodily damage upon each other with their toenails in confinement situations, one or more toenails (generally the inside and middle toes on both feet) may be removed. Toe trimming (or declawing) should be done by properly trained workers and is generally done at the hatchery.

Transportation: Safety and comfort of the animals are of prime importance when transporting live poultry and gamebirds. When poultry and gamebirds are transported, they should be provided with proper ventilation for the conditions, and clean sanitized

vehicles and equipment. A delay or cancellation of transport should occur for birds that appear unhealthy, dehydrated, or exhausted and unfit to withstand travel.

Chick and poultry delivery: The day-old chick and poultry delivery vehicle should have the capability of maintaining a uniform temperature of 75˚F (24˚C) to 80˚F (27˚C) regardless of ambient temperature. Air circulation must always be maintained around all chick-poultry boxes regardless of their location in the vehicle. The vehicle should not stop from the time it is loaded until it reaches its destination. Provisions for maintenance of proper ventilation and temperature control should be provided in case of vehicle's mechanical failure or any other unforeseen vehicle stop(s). The transportation vehicle should be properly cleaned and sanitized between deliveries.

Adult poultry and gamebird delivery: When adult poultry and gamebirds are transported, adequate ventilation, space and flooring should be provided. Hot weather is a time for particular caution. The birds should be protected from heat stress by being shaded and/or moved during the dark hours. Prompt unloading and/or auxiliary ventilation is essential when the birds reach their destination. During transportation in cold weather, birds should be protected by use of windbreaks, partial covering, etc. Ventilation must always be adequate.

Range rearing: The growing of chickens, turkeys, and gamebirds in range pens, after the brooding period, is an accepted practice and may be the system of choice, especially for several species of gamebirds. Range reared birds should have adequate space (see references) as well as protection from extremes in climatic conditions, predators and disease inherent with this growing system.

RECOMMENDATIONS FOR THE ENVIRONMENT

Ventilation and lighting: Ventilation in the grower house shall be such that a healthy, acceptable level of moisture, gases, dust, and temperature is maintained without drafts or dead air pockets (UEP, 2016). The ventilation system should be adjusted daily, or more often, as the environmental conditions dictate.

Lighting should be provided to allow effective inspection of all the birds and sufficient light for the birds to eat and drink. Light intensity within the house should be a minimum of 0.4 foot candles.

The housing should provide shelter from disturbing noises, strong vibrations, or unusual stimuli, regardless of origin.

FACILITIES AND EQUIPMENT

Housing: The design, construction and management of a poultry housing system should meet the birds' need for shelter against undesirable environmental conditions such as extreme cold, excessive heat, rain and wind and modify these climatic conditions to conform to an adequate environment for broilers, turkeys, and gamebirds.

They shall be constructed to minimize transmission of disease, parasites and other vermin infestation and optimize the principles of disease prevention. The housing should also protect the birds from all forms of predators and allow for daily visual inspection and care.

Broilers: Brooding and growing space requirements and water and feeder space should conform to the general needs as outlined in the particular broiler company's management guide, if applicable, e.g., Cobb's Broiler Manual (2012) or Ross Broiler Management Guide, 2012.

Turkeys: Brooding and growing space allowances and feeder and water space for turkeys should conform to the general needs as outlined by Berg and Halvorson (1985).

Gamebirds: Brooding and growing space allowances and feeder and water space for gamebirds should conform to the general needs as outlined by Flegal and Sheppard (1981) and Eleazer, et al., (1990).

Litter: Many different types of litter can be used. All litter must be dry and of acceptable quality. It is acceptable to reuse litter for several successive flocks if ammonia and insects are controlled and there has been no disease outbreak.

Manure management should conform to the recommendations presented in the current Right to Farm Practices (Michigan Manure GAAMPs).

HEALTH CARE AND MEDICAL PROCEDURES

Optimal management practices are essential to maintain good health status in the production facilities and may be in consultation with a licensed veterinarian. A program of disease prevention and control should be established, including producers participating in organic production programs. Only federally approved medications and vaccines shall be used, following label directions in accordance with state and federal regulations.

Pharmaceutical Use: It is imperative that those engaged in raising livestock and poultry for human consumption understand the prudent and legal use of pharmaceutical products. To help ensure that health and welfare of livestock and poultry and the safety of food they produce for the public, a veterinary-client-patient relationship (VCPR) is highly recommended. In most cases, a valid VCPR is mandatory for acquiring and using pharmaceutical products in food producing animals. Michigan currently follows the federal definition for a VCPR which states that a VCPR is considered valid if the following is observed (Code of Federal Regulations 530.3) (http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/ucm460406.htm):

1. A veterinarian has assumed the responsibility for making medical judgments regarding the health of (an) animal(s) and the need for medical treatment, and the client (the owner of the animal or animals or other caretaker) has agreed to follow the instructions of the veterinarian;

2. there is sufficient knowledge of the animal(s) by the veterinarian to initiate at least a general or preliminary diagnosis of the medical condition of the animal(s); and,
3. the practicing veterinarian is readily available for follow-up in case of adverse reactions or failure of the regimen of therapy. Such a relationship can exist only when the veterinarian has recently seen and is personally acquainted with the keeping and care of the animal(s) by virtue of examination of the animal(s), and/or by medically appropriate and timely visits to the premises where the animal(s) are kept.

Euthanasia: Animals that are seriously injured or ill and show no promise for recovery should be euthanized immediately. Methods can be physical or chemical and one of the approved methods recommended by the AVMA Guidelines on Euthanasia (AVMA, 2020).

Dead Animal Disposal: Animal tissue, whole carcasses, or portions thereof, must be disposed of according to the Michigan Bodies of Dead Animal Act, Act 239 of 1982, Amended Act No. 311, Public Acts of 2008, December 18, 2008.

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DOMESTIC RABBITS

MANAGEMENT OVERVIEW

Rabbits are raised for research, meat, wool, pelts, show, pets, and as a hobby (Cullere and Zotte, 2018). They are maintained under a wide variety of conditions ranging from single backyard hutches to large environment-controlled commercial production units. Rabbits are adaptable to a wide range of housing and management systems provided their needs for shelter, nutrition and health care are met.

If rabbits are raised and sold for laboratory use, they must be raised according to the provisions of the Animal Welfare Act (1966). Rabbitries producing rabbits for laboratory use must also be licensed by the U.S. Department of Agriculture.

MANAGEMENT PRACTICES

Nutrition: Rabbits must be fed a sufficient quantity of wholesome, palatable feed to meet their nutrient requirements. Each pen should be provided with suitable feed receptacles (typically a crock or metal feeder and a hay manger if loose hay is fed) to allow easy access to uncontaminated feed.

Rabbits must have access to clean, fresh water daily. Water receptacles (crocks, water bottles, etc.) or automatic waterers may be used. Frequent watering or use of heating systems should be employed to assure that an adequate supply of drinking water is available to the animals during freezing temperatures.

Feeding young newly weaned rabbits between the ages of 5 and 10 weeks of age requires special attention as they are prone to infectious digestive disorders such as epizootic rabbit enteropathy. With new rules regarding the feeding of antibiotics, feeding and management strategies that establish healthy growth, resistance to digestive problems, and promote a strong immune system should be employed.

Handling and Transportation: Proper handling of rabbits will help prevent injury to the animals, as well as to the handlers. Recommended methods for handling and examining rabbits are given in Rabbit Production (Cheeke, et al. 2000) and in the Domestic Rabbit Guide (ARBA, undated).

The safety and comfort of the animals are of prime importance when transporting rabbits. Wire carrying cages are recommended for transporting rabbits. Carrying cages should be of sufficient size to allow the rabbits to turn about freely and make normal postural adjustments. Carrying cages with wire (½ inch by 1 inch) floors suspended above solid bottoms are recommended. Cat carriers are not recommended for transporting rabbits, as rabbits could be injured when removing them from the carrier. Rabbits should be provided with a non-toxic absorbent bedding material to prevent leakage in transit. Loading rabbits into transport crates or cages should be conducted

with care. Carefully placing each rabbit into the transport crate or cage can help to minimize fear and distress associated with transport. Handlers must avoid hurried loading and rough handling such as inappropriate lifting and must not carry and throw rabbits into the crates.

Rabbits being transported should be observed frequently and should have access to feed and water (or feed that will satisfy their water needs) if in transit for more than 6 hours. A delay or cancellation of transport should occur for animals that appear unhealthy, dehydrated, or exhausted and unfit to withstand travel. During hot weather, precautions should be taken to guard against heat stress.

RECOMMENDATIONS FOR THE ENVIRONMENT

It is essential that good sanitation and vermin (insects, ectoparasites, and avian and mammalian pests) control be provided whether rabbits are housed indoors or out-of-doors. The use of screens and approved sprays and baits are suggested to help control insects in the rabbitry. Pens, feed, and watering equipment should be cleaned and sanitized periodically. Accumulations of hair on rabbit pens should be removed. Frequent removal of manure from under the cages will help prevent unpleasant odors and ammonia fumes, as well as, reduce environments that are conducive to insect propagation. All feed and bedding should be stored in bins or containers in a cool, dry, area which would not attract rodents.

FACILITIES AND EQUIPMENT

Housing: Although rabbits may be housed under a variety of conditions, they should be provided a comfortable environment which will limit stress and risk of injury, and afford good ventilation and protection from the elements. If rabbits are raised in outside hutches, the hutches should have watertight roofs. Hutches should be designed to protect the rabbits from wind, snow, rain, sun, and predators, yet allow for sufficient ventilation for removal of hot air in summer and moisture in winter. Hutches suspended above the ground with welded wire floors and sides are conducive to good air circulation and sanitation, as opposed to solid wooden hutches. The size of hutch required will depend on the size and number of the rabbits to be housed (see pens below).

When rabbits are housed in a building, the building should provide adequate ventilation and drainage to maintain a healthy environment for the animals. Ventilation may be natural or by mechanical means (fans) when natural air movement is not sufficient. Typically, in indoor housing, single-tiered, all-wire pens are suspended. Single-tiered pens facilitate animal care and sanitation and are preferred over multi-tiered pens. Concrete or dirt floors with pits under the pens to contain the droppings are recommended for indoor rabbitries. Automatic pit cleaners are desirable but not essential. Disposal of manure should be in accordance with Michigan Manure GAAMPs.

Rabbits are herbivorous animals and under semi-wild conditions may spend up to 70 percent of their day searching for food and feeding (Torcino and Xiccato, 2004). Rabbits

have an innate need to gnaw or chew. The provision of enrichments such as gnawing sticks within intensive cage or hutch environments may reduce the incidence of abnormal behavior. Cage biting is one abnormal behavior associated with barren environments and can cause tooth damage. Provision of enrichments may improve growth and carcass characteristics for meat rabbits (Verga, et al. 2004). For example, recent research conducted with New Zealand White rabbits has indicated the provision of gnawing sticks can improve carcass traits and body weights (Mohammed and Nasr, 2016).

Pens: Rabbit pens must be clean, dry, and of sufficient size to allow the animals to perform their normal physiological functions, including rest, sleep, grooming, defecation, breeding, kindling, and raising young. Giant breeds of rabbits require larger pens than the small breeds. Suggested pen sizes for various size rabbits are given by Cheeke, et al. (2000), and the American Rabbit Breeders Association (see references). Pens should be structurally sound and constructed of durable, non-toxic materials which resist corrosion and are conducive to good sanitation. The pens should be maintained in good repair and afford protection to the rabbits from injury and predators.

It is desirable to house rabbits in wire bottom pens suspended above the ground to allow feces and urine to fall through the pen floors and for ease in removal of these waste products from under the pens. Wire mesh (½ inch by 1 inch) floors are recommended and should be of woven or flat construction. Flat is more easily cleaned. Recent research comparing different floor types and its impact on rabbit foot health, soiling of fur, parasite control and the sanitation of pens indicate flat metal slatted floors kept rabbits' cleaner and lowered parasite counts (Tillman et al.2019). Another study examined the impact of stocking density and collective housing on behavior and stress in male and female rabbits (Torcino et al. 2018). They found that floor type (wooden slats) was more challenging to rabbit welfare than higher stocking density regardless of gender. Solid floored pens may be more suitable for some giant breeds of rabbits that are prone to foot problems. Rabbits in wire bottom cages could be given a section of drywall (plaster board) or pegged board for a resting place and to help eliminate foot problems. Solid floored pens should be provided with clean, dry litter and should be cleaned frequently. A solution of household bleach with water and sunshine are effective disinfectants.

Bred does should be provided with an adequate sized nest box in which to raise their young during the first few weeks after kindling. The nest box should contain a suitable bedding material and should be placed in the pen a few days prior to kindling. Several types of bedding, including straw, wood chips or sawdust (do not use cedar which is a respiratory irritant or walnut which can be toxic), crushed/shredded sugar cane, and newspaper, can be used. Nest boxes may be constructed of wood, metal, plastic, or wire. Disposable liners should be used with wire nest boxes. In non-heated rabbitries during cold weather, well insulated nest boxes should be provided or the does should be moved to a warm area to kindle and raise their litters for the first few weeks. Good nest box sanitation is essential. Studies on the impact of group housing on breeding does indicate issues with maintaining health status, kit survivability, and stress (Pérez-

Fuentas et al. 2020; Zomeña et al. 2018). A recent review of research outcomes on doe housing was published by Szendró, et al. 2019.

HEALTH CARE AND MEDICAL PROCEDURES

Optimal management practices are essential to maintain good health status in the rabbitry. A program of disease prevention and control should be established and may include consultation with a veterinarian. Rabbit breeders should be on the lookout for signs of illness. Any sick or injured animals should be immediately treated, or if necessary, humanely euthanized. Rabbits that are under quarantine or suspected of having an infectious disease should be separated from other rabbits to minimize the spread of disease. Organic production programs should work with a veterinarian to ensure adequate protection and treatment for sick animals.

Pharmaceutical Use: It is imperative that those engaged in raising livestock and poultry for human consumption understand the prudent and legal use of pharmaceutical products. To help ensure that health and welfare of livestock and poultry and the safety of food they produce for the public, a veterinary-client-patient relationship (VCPR) is highly recommended. In most cases, a valid VCPR is mandatory for acquiring and using pharmaceutical products in food producing animals. Michigan currently follows the federal definition for a VCPR which states that a VCPR is considered valid if the following is observed (Code of Federal Regulations 530.3) (http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/ucm460406.htm):

1. A licensed veterinarian has assumed the responsibility for making medical judgments regarding the health of (an) animal(s) and the need for medical treatment, and the client (the owner of the animal or animals or other caretaker) has agreed to follow the instructions of the veterinarian;
2. there is sufficient knowledge of the animal(s) by the veterinarian to initiate at least a general or preliminary diagnosis of the medical condition of the animal(s); and,
3. the veterinarian is readily available for follow-up in case of adverse reactions or failure of the regimen of therapy. Such a relationship can exist only when the veterinarian has recently seen and is personally acquainted with the keeping and care of the animal(s) by virtue of examination of the animal(s), and/or by medically appropriate and timely visits to the premises where the animal(s) are kept.

Euthanasia: Animals that are seriously injured or ill and show no promise for recovery should be euthanized immediately. Methods can be physical or chemical and one of the approved methods recommended by the AVMA Guidelines on Euthanasia (AVMA, 2020).

Dead Animal Disposal: Animal tissue, whole carcasses, or portions thereof, must be disposed of according to the Michigan Bodies of Dead Animal Act, Act 239 of 1982, Amended Act No. 311, Public Acts of 2008, December 18, 2008.

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FARM-RAISED MINK AND FOX

MANAGEMENT OVERVIEW

The humane raising of mink or fox under farm conditions requires a thorough knowledge of the animals' natural life cycle and their normal behavior including breeding cycles, whelping and lactation behavior, weaning and separation procedures, growing and furring periods. The mink or fox farmer must have a working knowledge or access to the nutritional needs of the animals throughout their life cycle It is imperative to have adequate facilities to supply and maintain proper housing, a reliable supply of clean drinking water and storage capabilities for quality feed. Proper protocols must be in place for the daily recording and treatment of sick or injured animals, the monitoring of death losses, extreme environmental conditions, manure management, pest control and euthanasia The mink or fox farmer must assure the welfare of their mink, which includes developing the skills of observation and the management knowledge/training to properly ensure quality welfare for the mink, as well as ensuring that employees on the farm are competent, properly trained individuals who have a good understanding of all the farm management protocols that they will be involved with. The mink or fox farmer should develop a site plan of the farm, and ensure it is present on the farm. A written entrance biosecurity policy for both farm employees and visitors to the farm should be in place with signage to identify bio-secure areas and directions and/or contact information to instruct visitors. Farm employees who are involved with the care of the mink or fox must be trained to practice proper animal handling and understand proper animal husbandry. A record should be kept by the farm indicating when each employee was trained, and the employee must sign-off that he/she completed the training. There should be an employee Code of Conduct developed to instruct all employees that all farm specific protocols and biosecurity measures must be adhered to, that all mink or fox need to be handled with care and require that all employees, if they witness any practice that causes avoidable pain or suffering, that employee must immediately notify a supervisor.

These GAAMPs for the care of farm-raised mink and fox were compiled primarily from the Standard Guidelines for Operation of Mink Farms in the United States Fur Commission U.S.A., 2019 and the Standard Guidelines for the Operation of Fox Farms in the United States (North Central Fox Producers and U.S. Fox Shipper’s Council, 2006). These guidelines were developed by the Fur Commission U.S.A. (mink) and the North Central Fox Producers and U.S. Fox Shipper’s Council (fox) and adopted by the mink and fox farming industries to promote sound husbandry and humane treatment of these animals in accordance with current accepted moral and ethical standards. Other pertinent guidelines include the Code of Practice for the Care and Handling of Mink (National Farm Animal Care Council, 2013) and the Code of Practice for the Care and Handling of Farmed Fox (National Farm Animal Care Council, 2013).

MANAGEMENT PRACTICES

Nutrition: Mink and fox should be fed a complete diet that fulfills the animals' various nutritional needs and modified as nutritional requirements of the life stages of the mink or fox change. Nutritional information is available from a variety of sources (National Research Council, 1982; Rouvinen-Watt et al., 2005). The farm should have a nutritionally balanced ration developed through consultation with a nutritionist or purchase a fully balanced complete feed. Analysis of mixed food rations, when needed, should be obtained from a qualified laboratory. Feed ingredients should be tested for nutritional value (protein, carbohydrates, fat, moisture) and for bacterial levels (plate count). The total mixed ration should be tested for nutritional value (protein, carbohydrates, fat, moisture) and bacterial levels (plate count) at least quarterly throughout the year. Complete dry and/or complete ready-mixed wet foods must be stored and fed according to the manufacturer's instructions. Ready access to potable water is particularly important to animals fed dry diets and during extremely warm weather and periods of freezing temperatures.

Feed Storage and Preparation: When the farmer is handling fresh and frozen animal by-products that can deteriorate quickly, the collection, storage and preparation of feed should be carried out under sanitary conditions. Transport vehicles and containers used for collection of animal by-products should be drip-proof and be thoroughly washed after each collection. Animal by-products should be refrigerated or preserved to ensure freshness and nutritional value. Feed preparation machinery, grinders, mixers, and blenders should be cleaned after use and regularly maintained. Dry foods such as cereals and supplements should be stored under dry and pest-free conditions. Individuals involved with feed preparation should be properly trained.

Feed Distribution: Sufficient feed must always be given to ensure the health and well-being of the animals. Feed should be placed in such a position that animals can easily reach it. This is particularly important with young animals and during periods of extreme cold. Feed must be provided at least daily to growing and mature animals. Once full growth is achieved, it may be desirable to skip feed occasionally to aid conditioning. Feed carts used to deliver wet feed, hoppers for dry feed and the wet feed area of cages should be cleaned and maintained on a routine schedule. Waste feed should be disposed of in accordance with the farm's waste management plan.

Watering Systems: Farmers must ensure that clean, fresh water is always readily available to animals. When either a fully automatic or semiautomatic system is used, an alternative supply of water should be available. Care must be taken so that automatic water systems remain clean and that individual valves or nipples function properly. Regular maintenance must be carried out to prevent leaking of valves and connections that can cause wet areas on the farm. The watering system must ensure easy access to drinking water and the system should be checked during hot weather to ensure uninterrupted availability. In areas where weather can be uncomfortably warm in the summers, water mist systems in the sheds are recommended to ensure the comfort of animals. The farm's water source should be tested for its component content (i.e. pH,

nitrates, nitrites, lead, salt) and bacterial content at least once yearly or after any major repair work is done on the system. The farm should have a written back up plan in place in the event the primary watering system fails (i.e., equipment breakdown, power failure, freezing). The watering systems must be checked daily to be sure that they are functioning.

Handling and Transportation: Precautions must be taken when handling mink and fox to prevent injury to the animals and the handler. Mink are routinely handled with heavy leather gloves, while fox are most commonly handled with metal tongs.

Transportation of mink and fox requires special attention to traveling crates design, care of the animals in transit, and where required, proper documentation. A delay or cancellation of transport should occur for animals that appear unhealthy, dehydrated, or exhausted and unfit to withstand travel. Detailed recommendations for transportation of mink and fox can be found in the Standard Guidelines for Operation of Mink Farms in the United States (Fur Commission U.S.A., 2019) and the Standard Guidelines for the Operation of Fox Farms in the United States (North Central Fox Producers and U.S. Fox Shipper's Council, 2006), respectively.

RECOMMENDATIONS FOR THE ENVIRONMENT

The mink or fox farmer must develop an effective hygienic and sanitary program to promote a healthy environment. Farmers must observe all local, state, and federal laws intended to protect ground and surface water quality and should cooperate with officials in their jurisdictions to develop appropriate management practices. The farm should follow a written waste management plan and have a water quality control program. Sheds/barns should be designed to keep rainwater off the manure. Feed preparation buildings and surroundings areas must be kept clean. Pens and nest boxes must be cleaned regularly as dictated by the time of year. The farm should have a plan in place to address manure buildup on false cage bottoms. The farm should have a written pest management plan that addresses the housing area and the feed storage and preparation areas.

FACILITIES AND EQUIPMENT

Site: A new mink or fox farm's location must be carefully selected. Due consideration must be given to local environmental conditions, artificial light, foreseeable neighborhood development, and subsequent development of the farm. The location must comply with local, state, and federal environmental regulations. A protective fence must be constructed around the perimeter of the area where mink or fox are housed or the buildings housing the animals are closed to protect the animals from predators and/or disease-carrying wildlife, and to keep unconfined mink or fox from exiting a bio-secure environment. A site plan of the farm needs to be available at the farm office, showing all sheds and describing the types, number, dimensions, maximum animal densities of the specific pens, date of construction and date of any major repairs of all

pens within the specific sheds. The farm must have a process in place to capture any mink that have escaped. Live traps must be checked daily or as appropriate.

Sheds: Any building erected to house mink or fox must provide proper ventilation as well as clean, hygienic conditions, and at the same time afford protection from the elements. The sheds should be constructed to allow for adjustments to protect against weather extremes and the farm should develop a written plan to address extreme heat or cold. The sheds should be constructed in a way that allows for adequate light to observe the animals and designed to allow for exposure to natural or artificial light that mimic the needed natural photoperiod stimulation. Sheds may be constructed to hold any number of rows, providing air quality and farm manure management protocols are met. Air quality can be measured by determining ammonia levels at the cage level; 25 ppm is the standard and maximum acceptable level. Sheds should be designed to keep the rainwater off the manure found below the pens. The areas under the pens must allow the efficient removal of manure and used bedding materials. The pens that house mink or fox should be a minimum of 12 inches above ground level to allow feces to fall out of the pen. The alleyways between the pens should be wide enough to allow for ease in observing and handling the animals and allow movement of any needed equipment.

Pens: Mink and fox are typically reared singly or in pairs or as littermates (foxes) from weaning through pelting. It is recommended that breeder mink be housed singly while breeder fox may be housed singly or in breeding pairs. Pens must provide sufficient area for animals to perform natural physical movement and must allow for comfort activities such as rest, sleep, grooming, defecation, and in the case of breeding pens, the rearing of young. Recommended pen sizes for mink and fox are provided in the Standard Guidelines for the Operation of Mink Farms in the United States (Fur Commission U.S.A., 2019) and the Standard Guidelines for the Operation of Fox Farms in the United States (North Central Fox Producers and U.S. Fox Shipper's Council, 2006), respectively. Current guidelines for mink (Fur Commission U.S.A., 2013) state that whelping pens should have a volume of 4,300 cubic inches and furring pens of 3,800 cubic inches for the first two animals and 900 cubic inches for each additional mink. The nesting box volume counts as additional space when attached to the outside of the pen. To ensure timely weaning of kits, the minimum height all pens should be 12 inches. Pens containing single breeder females should have a minimum width of 6 inches and those containing single breeder males, a minimum width of 7.5 inches. Pens designed for single mink should have a minimum of 2,500 cubic inches.

Guidelines for minimum dimensions of pens constructed after January 1, 2019 are given in the table on the following page.

New Pen Construction Table

Pen density	**Minimum height**	**Minimum width**	**Nest box size**	**Minimum living space (floor, nest box, shelf)**
Single female	15 inches	7.5 inches	45 sq. inch minimum	225 sq. inch minimum (shelf is not counted)
Single male	15 inches	9 inches	60 sq. inch minimum	275 sq. inch minimum (shelf is not counted)
Female with litter	15 inches	12 inches	80 sq. inch minimum	440 sq. inch minimum (100 sq. inch max countable living space for a shelf)
2 juveniles	15 inches	12 inches	80 sq. inch minimum	440 sq. inch minimum (100 sq. inch max countable living space for a shelf)
More than 2 juveniles				75 sq. inches of living space per each additional female and 100 sq. inches of living space per each additional male

Pens should be durably constructed with non-toxic, corrosion-resistant materials to contain the animals securely and to prevent animals from injuring themselves or those in adjacent pens. Pens should be of sufficient height above the ground to allow feces to fall from the pen and to allow for clearing of manure. In the case of mink, breeding pens should permit the fitting of a false floor to prevent the young from falling to the ground.

The arrangement of pens should enable visual and physical inspection of all areas and all housed animals. In each pen, there should be a fresh water source available that is easily accessible by the animal and allows inspection and cleaning by the farmer. All pens need some form of enrichment that adds complexity to the pen environment (jump-up nest box, drop-in nest box, feed board, shelf, hammock, tube and/or manipulative enrichment fulfill this requirement).

Nest Boxes: Each pen should be provided with a clean, dry nest box or "nester" in the form of a wooden box or wire-nester of adequate size where the mink or fox can rest or sleep comfortably. A clean, dry nester should be designed to accommodate appropriate nesting materials such as marsh hay, straw, wood shavings, excelsior, or crushed sugarcane. Nesters should be designed to provide sufficient space according to the sex and size of the animal, to permit each animal to rest and sleep comfortably. Breeder

nest boxes should allow sufficient space for the mother and her litter. Special consideration should be given at time of whelping to methods of avoiding unnecessary exposure of the mother and her young. Guidelines for minimum nest box sizes for pens constructed after January 1, 2019 are given above.

HEALTH CARE AND MEDICAL PROCEDURES

Developing a close working relationship with a licensed veterinarian will facilitate development of a program of disease prevention and control. The mink or fox farmer should consult with their veterinarian at least once per year. Mink and fox farmers and their employees must be aware of the well-being of the animals and must be able to detect signs of a distressed or sick animal including abnormal behavior, change in appetite, abnormal feces and other indicators of ill health. All mink and fox should be observed at least once a day. Any sick or injured animals should be immediately treated or, depending upon the severity of their condition, humanely euthanized. A veterinarian should investigate unexplained deaths, if possible. The farm should keep written treatment records and written records of daily mortalities. The farm should maintain some basic medicines and supplies to treat basic illnesses and injuries through consultation with a veterinarian. An abnormal increase of mortalities should be investigated by a veterinarian. The mink or fox farm should have a vaccination protocol developed through consultation with a veterinarian and the mink farm should have an Aleutian Disease Virus testing protocol through consultation with a veterinarian.

When mink herds are infected with Aleutian Disease virus, animals should be tested, infected animals culled, facilities appropriately cleaned and disinfected with parvocidal disinfectants and biosecurity improved. Recommendations for biosecurity procedures can be found in Appendix (Biosecurity Protocols for the Operation of Mink Farms in the United States) of the Standard Guidelines for Operation of Mink Farms in the United States (Fur Commission U.S.A., 2013).

Pharmaceutical Use: It is imperative that those engaged in raising livestock understand the prudent and legal use of pharmaceutical products. To help ensure that health and welfare of livestock, a veterinary-client-patient relationship (VCPR) is highly recommended. In most cases, a valid VCPR is mandatory for acquiring and using pharmaceutical products in food producing animals. Michigan currently follows the federal definition for a VCPR which states that a VCPR is considered valid if the following is observed (Code of Federal Regulations 530.3) (http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/ucm460406.htm):

1. A licensed veterinarian has assumed the responsibility for making medical judgments regarding the health of (an) animal(s) and the need for medical treatment, and the client (the owner of the animal or animals or other caretaker) has agreed to follow the instructions of the veterinarian;
2. there is sufficient knowledge of the animal(s) by the veterinarian to initiate at least a general or preliminary diagnosis of the medical condition of the animal(s); and,

3. the veterinarian is readily available for follow-up in case of adverse reactions or failure of the regimen of therapy. Such a relationship can exist only when the veterinarian has recently seen and is personally acquainted with the keeping and care of the animal(s) by virtue of examination of the animal(s), and/or by medically appropriate and timely visits to the premises where the animal(s) are kept.

Euthanasia: It is imperative that mink and fox farmers utilize humane techniques for euthanasia of their animals. Euthanasia methods used must have an initial depressive action on the central nervous system to ensure immediate insensitivity to pain without causing fear and anxiety. The Standard Guidelines for Operation of Mink Farms in the United States (Fur Commission U.S.A., 2019) and the Standard Guidelines for the Operation of Fox Farms in the United States (North Central Fox Producers and U.S. Fox Shipper's Council, 2006) recommend acceptable procedures for euthanasia of mink and fox that are described in the AVMA Guidelines on Euthanasia (AVMA, 2020). The American Veterinary Medical Association (AVMA) and Fur Commission USA (FCUSA) recommend pure, carbon monoxide or carbon dioxide in cylinders. The farm should have a written euthanasia protocol and all personnel involved with the euthanasia of mink and fox should be trained and have a documented understanding of the euthanasia protocol. The euthanasia chamber should be purpose built and in good repair. The chamber should be mobile, easy to clean and provide for consistent performance, ease of operation and safety to the operator. Carbon monoxide is a highly toxic gas. Since it has no odor, it must be used only under well-ventilated conditions, and personnel administering it must adhere strictly to appropriate safety practices. Carbon monoxide euthanasia chambers must be charged at a minimum rate of 4 percent carbon monoxide by volume. Carbon dioxide euthanasia chambers must be charged at a minimum rate of 80 percent carbon dioxide by volume. When animals are removed from the chamber, they must be checked to ensure that death has occurred.

Dead Animal Disposal: Animal tissue, whole carcasses, or portions thereof, must be disposed of according to the Michigan Bodies of Dead Animal Act, Act 239 of 1982, Amended Act No. 311, Public Acts of 2008, December 18, 2008.

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AQUACULTURE SPECIES

MANAGEMENT OVERVIEW

Aquaculture is regulated and afforded rights of agriculture enterprises under the Michigan Aquaculture Development Act (Act 199 of 1996). The definition of aquaculture as stated within this act is: “the commercial husbandry of aquaculture species on the approved list of aquaculture species, including, but not limited to, the culturing, producing, growing, using, propagating, harvesting, transporting, importing, exporting, or marketing of aquacultural products under an appropriate permit or registration”.

Aquaculture facilities are required to obtain an aquaculture registration from the Michigan Department of Agriculture and Rural Development. Rearing of fishes for the aquarium trade in closed indoor systems is exempted from registration. People involved in production of fishes for stocking public waters shall also obtain a permit from the Michigan Department of Natural Resources and fishes must be certified free of specific diseases prior to release into public waters. Michigan complied laws and permit requirements for aquaculture and baitfish industries are summarized on the North Central Regional Aquaculture Center (NCRAC) website: http://www.ncrac.org/Info/StateImportRegs/michigan.htm.

Michigan aquaculturists are composed mainly of small firms concentrating on trout production which includes a mixture of food fish and shrimp, fee-fishing, planting stock sales, and aquaponics.

Because of the diversity of aquaculture species approved for aquaculture production and the variety of husbandry systems used, recommendations for their care must be general in nature. More specific management practices for a wide variety of aquatic species can be found through the search engine on the NCRAC home web page: http://www.ncrac.org/.

MANAGEMENT PRACTICES

Stock Procurement: An established list of approved species for aquaculture production is contained in the Michigan Aquaculture Development Act. Only aquaculture species on the approved list are allowed for purposes of aquaculture production. Any movement, importing, or exporting of aquaculture species must be in compliance with the Animal Industry Act, 1988 PA 466, MCL Section 287.729a; as amended.

Aquaculture species should be obtained from a source with a history of freedom from disease. Live fishes obtained from an out-of-state hatchery must be certified as being free of certain diseases which are summarized on the North Central Regional Aquaculture Center website: “State Importation and Transportation Requirements for Cultured Aquatic Animals”. Pre-entry permits must also be obtained from the Michigan

Department of Agriculture and Rural Development prior to importation of fish to an aquaculture facility from outside the state.

Newly acquired aquaculture species should be checked to determine that they are in good condition, regardless of the availability of health history information. Healthy aquaculture species should show good coloration with no obvious abrasions or lesions.

Transportation: Healthy aquaculture species may be safely and easily transported as long as care is taken to reduce the associated stress. Feed should be withheld from farm-reared species for two days prior to transport to reduce fouling of the transport water. Since the stress of transport often results in animals going off feed, withholding feed for one or two days after receipt, followed by a gradual return to normal feeding levels, may be beneficial.

To minimize stress, the temperature of transport water should remain as close as possible to the supplier's ambient water temperature. However, aquaculture species will generally travel better in cool water because of lowered oxygen requirements and higher levels of available dissolved oxygen. Salt, in a mild concentration (0.1-1.0 percent), is commonly used to reduce stress during transportation of freshwater fish depending on the species. Also, a mild anesthesia may be employed during transport; however, this is usually unnecessary.

Small numbers of aquaculture species are commonly shipped in plastic bags with use of pure oxygen (oxygen bagging). Plastic (polyethylene) bags should be filled about third with water, the remaining air being expelled and replaced with pure oxygen. The top of the bag should be firmly tied by twisting and bending over on itself. The bag should preferably be placed inside another similar one and then placed in a protective container or box for short term shipping. For long term direct and air shipments, oxygen bagging, followed by packaging in insulated containers is also common practice and a method recommended by the International Air Transport Association (IATA). Ice packs could be placed inside the insulated container if necessary, for cold water species. Most aquaculture species packed in this manner may be shipped for period of 48 hours without inducing significant stress and subsequent diseases.

It is difficult to generalize on the number or weight of an aquaculture species that may be safely transported in each volume of water. Safe transport densities vary according to species, age, water temperature, oxygenation, and the distance and length of time over which they are to be transported.

The same general principles apply to transporting eggs; however, eggs may be extremely susceptible to damage at certain stages in their incubation. For example, Salmonid eggs may be transported for a period of approximately two days immediately after fertilization and water hardening (1-2 hours), or after they have become "eyed" (eyes of the embryo visible through the shell). Between these periods, eggs should not be transported or handled.

Handling: Handling should be minimized to reduce stress and damage to the skin leading to bacterial and fungal disease. Nets and other materials for handling aquaculture species should be sanitized before and after use to reduce disease transfer.

Nutrition: Active feeding is often a good indicator of the health status of aquaculture species. Sick animals often quit eating before other disease signs become noticeable. Commercially prepared pellets are available for a variety of aquaculture species which are often acceptable to other similar species. Live feeds may be required for rearing some aquaculture species; however, live feeds may not meet the nutritional needs of the aquaculture species unless multiple species of feed items are used.

Optimum feeding rates vary depending on species, size, feed composition, water temperature, and desired growth response (maintenance vs. maximum growth rate). Feeding tables have been developed for some aquaculture species which can be used for general care recommendations. Feeding once or twice a day for the five working days is usually adequate; however, larval stages and young animals may require more frequent feedings which should extend throughout the entire week.

RECOMMENDATIONS FOR THE ENVIRONMENT

Aquaculture species are in constant, intimate contact with their aquatic environment and even minor changes in water quality may cause stress that predisposes them to disease. Chemical, physical, and biological factors in the water environment will affect different aquaculture species in different ways.

Water temperature is an important environmental factor. Aquaculture species are, with a very few exceptions, unable to physiologically control their body temperature. Most body functions, such as rate of growth, appetite, respiration, and heart rate, are temperature dependent. Each aquaculture species has a preferred temperature that is affected by its acclimation temperature. In general, the preferred temperature range for cold water fishes is 46-60˚F, for cool water fishes is 60-68˚F, for warm water fishes is 64-72˚F, and for tropical fishes is 73-86˚F. Temperatures outside these ranges may, however, prove perfectly acceptable, depending on the species and other variables involved.

The acclimation of aquaculture species to a new temperature, either when introducing new animals to a facility or when adjusting temperatures within a facility, should proceed as gradually as possible. If possible, changes should be limited to between 1–3 degrees Fahrenheit per hour and should be even more gradual at the extremes. Aquatic animals should be carefully observed for 1–2 weeks after transport and/or handling for signs of stress induced bacterial diseases. When adjusting water temperatures, all other stresses (e.g., handling) should be minimized.

Oxygen (O_2): Oxygen is another key factor in aquaculture, and oxygen concentrations are closely related to temperature. As the temperature of water rises, its holding

capacity for O_2 decreases. At the same time however, the O_2 requirements of the aquaculture species increases because of an increased metabolic rate. At temperatures in the preferred range, decreasing availability with increasing demand usually causes no problem as there is still enough O_2 available. When waters are above preferred temperature ranges, polluted or heavily overstocked, there may be insufficient O_2 available. Respiratory stress syndrome may occur if energy expenditures in obtaining the limited O_2 available exceed the potential energy gain. Respiratory stress syndrome can result in death.

Variables other than temperature, that under normal circumstances affect O_2 requirements, include: species - active aquaculture species require more O_2 than slower moving aquaculture species; size – within an aquaculture species smaller animals require relatively more O_2 per unit of body mass than larger animals; and plane of nutrition - aquaculture species require additional O_2 for metabolism of feeds. As a general guide, it is recommended to maintain O_2 concentrations at or above 5-6 ppm for cold water fish and 23 ppm for warm water fish whenever possible.

Spring, well, and surface water can be acceptable sources of water for aquaculture in Michigan. Spring and well water are generally excellent water sources for aquaculture. The ground acts as a filter to remove microbial flora and parasites. Ground water temperatures at most locations will remain relatively constant, often varying by little more than 2 degrees throughout the year However, water temperatures will vary considerably across the state. Levels of dissolved oxygen can be low and well waters may be supersaturated with nitrogen or carbon dioxide. Under such conditions aeration/degassing systems, such as packed columns, cascading weirs or pure oxygen systems may be essential in order to add oxygen to the water and to drive off other supersaturated gases. Surface waters are generally less bio-secure than closed (non-open) sources of water.

FACILITIES AND EQUIPMENT

Facilities and equipment needed for farming aquaculture species are primarily dictated by the species and life stage of the animals being raised and the type of operation. Aquaculture species can be raised in tanks, ponds, raceways, cages, and net pens. The design and suitability of these systems depend on water availability and quality. Expert input needs to be sought and incorporated in the designs of systems to meet specific needs of the aquaculture species and production system.

HEALTH CARE AND MEDICAL PROCEDURES

Stressors, such as changes in water quality or handling, may predispose aquaculture species to disease. However, most aquatic animal diseases can be treated and controlled, especially when caught at early stages.

Observation is a critical component in the health care of aquaculture raised aquatic animals. The earliest signs of disease are usually changes in behavior. For example, aquaculture species may aggregate at the inflow if O_2 levels are too low. Conversely, they may accumulate at the outflow of the tank, if a toxic substance is present in the inflow. Sick animals usually lose their appetite. Certain conditions may cause animals to whirl or spiral in the water or, in the case of some external parasites, show their irritation by "flashing" which is where they appear to be scraping themselves off the sides or bottom of the tank. Individuals that become sickly usually separate from the group and will frequently be found at the sides of tanks or riding higher in the water column that most of the fish, often in the lower end of the rearing unit in rectangular flow-through tanks and raceways; and they will also prove less active in their response to stimuli. Loss of vertical equilibrium can also be indicative of some bacterial infections.

Various changes in appearance also signal disease problems. Examples include a change in color (lighter or darker), excessive mucus production in gills and on skin, lesions, and fungal growth. Fungi are frequent secondary invaders on virtually any skin or fin lesion, regardless of its primary cause.

Very often parasites and microorganisms that have the potential to cause disease may be isolated from diseased aquaculture species. This can be accomplished at the facility, depending on the experience of the aqua-culturist, or diagnosed from samples in an aquatic animal health laboratory. The advantage of sending samples to a laboratory is the ability to obtain a full evaluation including hematology, histopathology, biochemistry and microbiology. Disadvantages of laboratory diagnostics include cost (e.g. cost prohibitive), the proximity of the laboratory to the facility, and/or the time required to obtain results may be far too long for a producer to take meaningful action. Aquatic animal health specialists and/or the Michigan Department of Agriculture and Rural Development should be consulted when a serious or reportable disease outbreak occurs.

The treatment of external parasitic, fungal, or bacterial disease includes the use of baths, flushes and dips with chemicals specifically approved for use with that specific aquaculture species. Treatment of some systemic diseases may require therapeutic agents administered in the feed to those animals still feeding. Such agents may act both externally and internally, being absorbed from the water. Drugs approved for disease treatment of fish in registered aquaculture facilities are very limited in number and are required to meet U.S. Food and Drug Administration and U.S. Fish and Wildlife Service (FWS) restrictions and regulations. A list of approved drugs for aquaculture use and additional information is available on the FWS website: https://www.fws.gov/fisheries/aadap/home.htm.

Disease prevention is much preferred over disease treatment. The aquaculturist can help prevent disease by paying close attention to the long-term health history of the facilities and brood stocks from which they source their eggs and fish for importation to their facilities. Careful observation of populations within a facility, paired with close attention to maintaining a clean rearing environment are of the utmost importance. Other measures, including staying under stressful biomass levels and having dedicated fish culture tools and implements for each rearing unit are also critical.

Pharmaceutical Use: It is imperative that those engaged in raising livestock and poultry for human consumption understand the prudent and legal use of pharmaceutical products. To help ensure that health and welfare of livestock and poultry and the safety of food they produce for the public, a veterinary-client-patient relationship (VCPR) is highly recommended. In most cases, a valid VCPR is mandatory for acquiring and using pharmaceutical products in food producing animals. Michigan currently follows the federal definition for a VCPR which states that a VCPR is considered valid if the following is observed (Code of Federal Regulations 530.3) (http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/ucm460406.htm):

1. A licensed veterinarian has assumed the responsibility for making medical judgments regarding the health of (an) animal(s) and the need for medical treatment, and the client (the owner of the animal or animals or other caretaker) has agreed to follow the instructions of the veterinarian;

2. There is sufficient knowledge of the animal(s) by the veterinarian to initiate at least a general or preliminary diagnosis of the medical condition of the animal(s); and

3. The veterinarian is readily available for follow-up in case of adverse reactions or failure of the regimen of therapy. Such a relationship can exist only when the veterinarian has recently seen and is personally acquainted with the keeping and care of the animal(s) by virtue of examination of the animal(s), and/or by medically appropriate and timely visits to the premises where the animal(s) are kept.

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SOUTH AMERICAN CAMELIDS

MANAGEMENT OVERVIEW

The Camelidae family consists of camels from Africa and Asia (Bactrian and Arabian) and those from South America (llamas, vicunas, alpacas and guanacos). Llamas and alpacas make up the domestic population of camels owned in the United States. Llamas are most popular with fewer alpacas. Vicunas and guanacos are not as tame and considered less adaptable to domestic environments. Llamas and alpacas are used as pack animals, for producing textiles and clothing from their wool, as guard animals for sheep and goats, as companion animals, and in rare cases for meat and milk products; however recent indicators point to camelids playing a greater role in world food security (Zarrin, et al. 2020).. Unlike our common species of farm livestock, information on the biological needs, breeding, genetics, behavior, nutrition and health management of camelids has not been studied as extensively. Owners of South American camelids should become knowledgeable to avoid problems associated with poor camelid welfare and management (Gunsser, 2013; see: Llama and Alpaca Care… 2014).

Llamas and alpacas can be kept in conditions similar to cattle. They thrive more under natural conditions such as pasture, range and well-managed dry lots, compared to confined areas such as stalls. They are ruminant-like animals similar to cattle, sheep and goats but walk on foot pads rather than hooves. Llamas and alpacas can be thrifty and have water conservation capability under dry conditions. They are considered medium sized animals with males being larger than females at maturity. Llamas are the largest of the South American camelids with males weighing up to 300 pounds. Alpacas are smaller and weigh up to 175 pounds. Both are considered docile animals with temperaments suited for domestic conditions. They may spit when threatened or provoked and can be protective of their offspring (cria).

MANAGEMENT PRACTICES

Nutrition: Llamas and alpacas are three stomached animals. They are not true ruminates but possess complex multi-compartmentalized stomachs that engage foregut rather than hind gut fermentation. However similar to cattle, sheep, and goats regurgitate and chew cud (San Martin and Van Saun, 2014). They are efficient foragers and browsers. Alpacas have similar nutritional habits and demands as llamas except alpacas are better browsers than grazers. Both can be fed grain concentrates to provide supplemental energy or protein. Grass or legume hays or grazing on quality pasture are excellent sources of roughage and general nutrition. Protein requirements for these camelids are lower than for common species of domestic livestock and range from 10 to 16 percent depending on stage of development or physiological state such as gestation and lactation (see NRC, 2007). As with other domestic livestock, water

should be potable and easily accessible whether supplied from natural streams or ponds or artificial means such as buckets, troughs or automatic devices. Troughs, buckets or other containers should be regularly cleaned. If animals are pastured, forage should be suitable for grazing and free of poisonous plants. Plants considered toxic to common livestock are also toxic to llamas and alpacas. Concentrate feeds or simple grains used for feeding other ruminant livestock are suitable for feeding llamas and alpacas. Texturized feeds, such as steam rolled corn and barley mixed with soy pellets, rather than a fully pelleted ration are preferred and result in less choking and compaction. Supplementation with mineral mix and salt is recommended. In selenium deficient areas supplementation with selenium is recommended along with Vitamin E. Good quality hay, free of molds and spoilage, can be fed in round or square bales and serve as a source of roughage when concentrates and/or brassicas are fed. The use of body condition scoring can assist in determining nutritional status of camelids. A body condition score of three (1 – 5 scale) or six (1 - 10), with one being thin and three or six as obese, is considered to be ideal. Remedial action should be taken when body condition score is too low or too high. Monitoring of the body condition is recommended for females during pregnancy and lactation, cria during growth and all animals during the winter months. Feeder or trough and watered space should be sufficient to ensure that no distress or injury to animals is caused by competition for food and water. Camelids are hierarchal by nature and subordinate animals may get less feed or water when housed and fed in group situations.

Reproduction: Camelids are different from large livestock in reproductive traits. They are induced ovulators and behaviorally receptive to breeding throughout the year. Breeding occurs while the female is lying down. The normal length of camelid gestation is 335 to 365 days. The use of pasture and pen breeding is most common and an acceptable strategy. Consideration should be given to time of breeding with respect to season and average daily temperature at the time of birth. Winter births require close management of mother and young and can be difficult for the cria. Shelter should be provided for winter birthing and periods of inclement weather. Keeping the cria warm and vigilance with respect to energy intake is important to managing winter births.

Handling: The llama and alpaca are a social herd-dwelling prey animal. They respond best to calm, slow and quiet handling. Camelids are best handled using calm and gentle encouragement and visual and audio cues rather than physical contact. They are smart and instinctual animals and if they perceive danger they will take flight. Social order is kept through maintenance of a social hierarchy. Pregnant females or females with nursing young can be temperamental and protective. Intact males may show dominance and require more experienced handlers. Understanding the natural behavior of llamas and alpacas will help avoid injury to animals and human handlers. Llamas and alpacas can be halter broken and led. Halters should be adjusted so nose bands ride in the middle of the nose. Low riding nosebands may cut off breathing.

When loose, llamas and alpacas can be herded as a group. Llamas and alpacas may panic if separated from the herd. Unless specifically trained to calmly accept well-trained stock dogs, the use of dogs to herd llamas or alpacas is not recommended.

Restraining chutes or stocks that are adjusted to accommodate size and body shape work well for conducting preventative or therapeutic health procedures or standard care practices such as nail trimming. Depending on size, docility and training, many common care procedures can be carried out with minimal restraint. Camelids should not be hit, lifted by fleece, head, neck, ears or tails twisted. Electric prods are not recommended for use with camelids.

Transportation: Llamas and alpacas can be conditioned to ride in a variety of transport vehicles including trucks and trailers designed for livestock or vans that have been properly prepared for the animal and avoid injury or interference with the driver. Safety and comfort should be of primary importance in the transport of llamas or alpacas. Llamas and alpacas can be loaded loose into a transport vehicle or led by halter and loaded. Larger animals can walk or lightly jump into the transport vehicle. Small adult or young llamas or alpacas can be carried into the vehicle. Principles of calm and quiet handling are important to low stress transport. Llamas and alpacas tend to lie down during transport and should not be tied inside the vehicle. Space allotment should sufficiently accommodate lying down, resting posture and standing-up without struggle or seriously impacting an adjacent animal if more than one animal is being transported. Attention to weather conditions such as high heat or extreme cold, vehicle ventilation and animal coat condition (wool or sheared) are important to avoiding heat or cold stress. Seriously debilitated or non-ambulatory animals should not be transported unless they can be appropriately accommodated without further injury or distress and the purpose of transport is to obtain medical care. A delay or cancellation of transport should occur for animals that appear unhealthy, dehydrated or exhausted and unfit to withstand travel.

RECOMMENDATIONS FOR THE ENVIRONMENT

Alpaca and llamas are known as being tidy. They tend to defecate in specific areas away from grazing and feeding areas. These areas should be cleaned of dung piles periodically depending on size of paddock. In barn situations manure should be managed to prevent significant build up or wet areas. Areas should be kept bedded and dry within covered facilities. Pastures should be managed to maintain forage base (if principle source of nutrition) and minimize parasite loads. A general rule of thumb for stocking rate on a good quality pasture is 2 – 3 llamas or 4-5 alpacas per 2 acres. Dry lots should be of sufficient size and well drained to avoid mud conditions during rainy periods and retain cover to prevent dusty conditions when dry. Protection of surface waters and conservation practices to minimize soil erosion is part of good environmental stewardship. As with any livestock operation good hygiene and adherence to local, state (Michigan GAAMPs) and federal guidelines and requirements is important to maintaining good community relations.

FACILITIES AND EQUIPMENT

Shelter: Llamas and alpacas are suited to outdoor and semi-confined housing systems such as three-sided sheds and barns of various configurations. Attention should be

given to provision of space within the shelter so that it is easily accessible to all animals in the group. As wool bearing animals, special attention to hot conditions and the mitigation of heat stress through shearing and/or the provision of shade from natural or constructed shelter is recommended. Alpacas are especially hardy and adapted to cold weather conditions under normal cold conditions and under good care. The timing of shearing should be adapted to account for local weather conditions as the status of the fleece carries significant impact on the animal's vulnerability to weather conditions (Gerken, 2010). For animals housed outdoors, natural shelter belts or artificial shelters should be available for relief during extreme cold or inclement conditions. Crias are more susceptible to cold stress for a week after birth and should be sheltered during this period. Indoor housing should provide enough space such that all camelids are able to lie down and rest simultaneously and be kept dry and well ventilated. Waste and contaminated bedding material should not accumulate to the extent it poses a health threat to the animals. Waste disposal should be in accordance with Michigan Manure GAAMPs.

Fencing: Exterior fencing should be higher than fencing used for common domestic livestock and should keep deer out. Deer fencing or custom constructed livestock fencing with heights sufficient to prevent escape or entrapment are strongly recommended. Electric fencing is not recommended for containment of camelids.

HEALTH CARE AND MEDICAL PROCEDURES

Health care programs for llamas and alpacas include addressing nutritional requirements, preventative health care measures such as vaccinations, parasite control, foot care, and emergency procedures in case of injury or illness as appropriate to local conditions (Björklund et al. 2019; Jones and Boileau, 2009; *see* Llama and Alpaca Care.., 2014). All animals should be observed daily for signs of illness, injury or abnormal behavior. Procedures requiring invasion of the body cavity (like castration) or that result in pain or distress should be carried out by a veterinarian or properly trained and experienced individual. Assistance of a veterinarian in developing a health care program is strongly recommended.

Pharmaceutical Use: It is imperative that those engaged in raising livestock and poultry for human consumption understand the prudent and legal use of pharmaceutical products. To help ensure that health and welfare of livestock and poultry and the safety of food they produce for the public, a veterinary-client-patient relationship (VCPR) is highly recommended. In most cases, a valid VCPR is mandatory for acquiring and using pharmaceutical products in food producing animals. Michigan currently follows the federal definition for a VCPR which states that a VCPR is considered valid if the following is observed (Code of Federal Regulations 530.3) (http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/ucm460406.htm):

1. A licensed veterinarian has assumed the responsibility for making medical judgments regarding the health of (an) animal(s) and the need for medical

treatment, and the client (the owner of the animal or animals or other caretaker) has agreed to follow the instructions of the veterinarian;

2. There is sufficient knowledge of the animal(s) by the veterinarian to initiate at least a general or preliminary diagnosis of the medical condition of the animal(s); and

3. The veterinarian is readily available for follow-up in case of adverse reactions or failure of the regimen of therapy. Such a relationship can exist only when the veterinarian has recently seen and is personally acquainted with the keeping and care of the animal(s) by virtue of examination of the animal(s), and/or by medically appropriate and timely visits to the premises where the animal(s) are kept.

Euthanasia: Animals that are seriously injured or ill and show no promise for recovery should be euthanized immediately. Methods can be physical or chemical and one of the approved methods recommended by the AVMA Guidelines on Euthanasia (AVMA, 2020).

Dead Animal Disposal: Animal tissue, whole carcasses or portions thereof, must be disposed of according to the Michigan Bodies of Dead Animal Act, Act 239 of 1982, Amended Act No. 311, Public Acts of 2008, December 18, 2008.

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BEEKEEPING AND APIARY MANAGEMENT

MANAGEMENT OVERVIEW

European honey bees (*Apis mellifera L*.) play a critical role in Michigan and U.S. agriculture. At least 60 of Michigan's important fruit and vegetable crops (including apple, blueberry, cherry, cucumber, and pumpkins) rely on honey bee pollination. Without honey bees to supply pollination services, much of Michigan's rich fruit and vegetable production would not be possible, and producers would be forced out of business. In short, Michigan's agricultural industry would be devastated.

Despite the importance of honey bees, the beekeeping industry has struggled since the introduction of two parasitic mites to the U.S. in the mid-1980s. The introduction of the Tracheal Mite (*Acarapis woodii*) and Varroa mite (*Varroa destructor*) has nearly eliminated the feral (wild) honey bee population in the United States. (Kraus and Page, 1995). The number of beekeepers managing honey bee colonies also declined due to the more complicated management requirements caused by the mites. In 1993, Michigan's Apiary law was changed to open the state for free movement of honeybee colonies as beekeepers sought to take colonies to southern states where they could better manage for mite control during the winter months. In recent years, Michigan beekeepers have moved bees to California for almond pollination, Florida for pickle pollination, and to Maine and Mississippi for blueberry pollination. Michigan has become a migratory beekeeping state.

The Michigan Department of Agriculture and Rural Development provides inspection service to beekeepers needing a certificate of health for movement of their bees. However, because of the varied requirements for health certificates for movement, many of them voluntary, there is not a reliable estimate of the number of colonies moved into and out of the state each year.

Beekeepers now use an array of management tools, including miticides, antibiotics, and insecticides for the management of mites, the small hive beetle (Aethina tumida), brood diseases, and microsporidian parasites. As research on colony strength continues, the use of dietary supplements for stimulating hive buildup and to maintain colony health has increased.

As part of the national strategy to reduce the losses of honey bees and other pollinators, Michigan has developed a managed pollinator protection (MP3), Communication Strategies for Reducing Pesticide Risk for Managed Pollinators in Michigan. It's designed to improve and protect the health of pollinators in Michigan by mitigating the risk of pesticide exposure, while recognizing that pesticides are important tools for crop, property, and human health protection. To view the document, visit this link https://www.michigan.gov/mdard/0,4610,7-125-2390_76976---,00.html.

MANAGEMENT PRACTICES

Understanding some basic bee biology and beekeeping will facilitate your inspection of the hives, gauging of quality/strength of the hives, and help maximize the use of bees for your pollination.

Social Structure: Honey bees are social insects and only the sterile female workers do all the in-hive work (cleaning, drying nectar into honey, feeding young) and outside work (foraging for water, pollen, nectar and propolis, and colony defense). The queen's only job is to lay about 2,000 eggs per day and releases queen mandibular pheromone to let the workers know that she is present and healthy. The males' (drones) only job is to mate with queens and are produced only during May to August. A typical colony of bees has about 30,000 – 60,000 workers, one queen and a few to hundreds of drones. About 1/3 of these workers are foragers. Foragers show flower constancy so they tend to focus on flowers of a single species, resulting in more efficient pollination.

Internal Factors Affecting Foraging Behavior: To provide adequate pollination, honey bee colonies must be of sufficient strength, free of diseases and parasites, have a laying queen, and have adequate "brood" (immature stages which include eggs, larvae and pupae). A newly installed package bee colony, with 2 pounds of bees, would start with about ~9,000-11,000 workers and would not be considered ready for pollination work. Such a colony would concentrate heavily on brood rearing and only have about 1,000-2,000 foragers. Stronger colonies would send out about 30 percent of bees as foragers. A typical median strength over-wintered colony would have about 30,000 workers and can send out 10,000 foragers. With adequate resources, colonies can develop a work force of 60,000 or more workers at the peak of the season. Brood frames should be inspected for the presence of chalkbrood, American and European foulbrood, parasitic mites and symptoms of virus or other pathogens of honeybees. In general, 3-5 frames of solid brood suggest a fertile queen and a healthy colony. Bees should be periodically inspected for presence of Nosema disease.

External Factors Affecting Foraging Behavior: Environmental factors affect honey bee foraging. Bees do not work in the rain and work less on cloudy days. Foraging activity is positively related to temperature, with a linear relationship from 60-90°F. -Foraging activity slows when it gets too hot (over 90°F). High winds (above 20 mph) will alter or inhibit flying activity, with bees choosing flight paths that are less affected by wind. As an example, honeybees placed for pollination of orchards will concentrate their efforts near the orchard floor under windy conditions, leaving the orchard crop poorly pollinated. By contrast, bumble bees can forage at lower temperature and lower light conditions.

Hive Density Recommendations for Pollination: Because Varroa mites had wiped out most of our feral (wild) honey bee populations, recommended rates for pollination prior to 1987 have to be increased to compensate for the lack of "free" honey bees. The table below lists recommended rates for hive density. From an economic point of view, it is best to start with the highest number of hives you can afford, and then alter your

hive count based on your observations. As new fruit and vegetable varieties are released, review pollination recommendations made by the developer, and then monitor pollination activity. (See also: http://www.pollinator.ca/canpolin/)**Table 1.** Recommended density of honey bee colonies (per acre) for Michigan crops:

Crop	Colonies	Notes
Apple	1-3	The more high density varieties need more hives
Sweet cherry	1	Balaton may need more
Pear, Plum, Peach	1	
Blueberry	3	Cultivars vary in their dependence on pollination
Cranberry	3	
Raspberry, strawberry	1	
Pickles	3	

Hive Density Recommendations for Neighbor Relations: One of the primary limitations to keeping bees is the real or perceived interaction between the bees and the people who live in or use the surrounding area. The following practices are intended to minimize potential conflicts between people and honeybees. Hive density (colonies per acre), placement and orientation of hives in relation to property boundaries, and providing a barrier between hives and neighboring properties to interrupt and prevent the direct line of flight from a colony into living areas on neighboring properties are important factors to accomplish this objective.

Table 2a. Recommended maximum density of honey bee colonies relative to lot size

Lot/Acreage	Number of Colonies
Up to 1/4 acre (1/4 acre=10,890 sq. ft., roughly 50 ft. x 215 ft.)	2
More than 1/4 acre, less than 1/2 acre (1/2 acre = 21,780 sq. ft., roughly 100 ft. x 218 ft.)	4
More than 1/2 acre, less than 1 acre (1 acre = 43,560 sq. ft., roughly 150 ft. x 290 ft.)	6
1 acre or more	8

Table 2a provides general guidelines for the maximum number of bee colonies to keep on small lots. Other limitations for placement of bees on small lots include the orientation of colonies in relation to adjacent and nearby developed property as described in the sections for ‘Hive Placement’ and ‘Recommendations for Considerate Hive Management’.

Table 2b. Recommended density of honey bee colonies regardless of lot size

Condition	Number of Colonies
If all hives are situated at least 200 feet in any direction from all property lines of the lot on which the apiary is situated	No limit
As long as all adjoining property that falls within a 200-foot radius of any hive is undeveloped property	No Limit

Table 2b is used when lot size is larger than one acre, where colonies will be located at least 200 feet from property lines and any adjoining or nearby developed portion of property.

Hive Placement: Correct placement of hives is an important consideration for responsible beekeeping in urban/suburban situations.

- Hives must be located in a quiet area of the lot.
- Hives must be oriented so that a direct line of flight from the hive entrance does not impact living areas on neighboring properties.
- When placing hives on small lots (Table 2a) or at locations within 200 feet of any developed portion of property, a solid fence, wall, or dense vegetative barrier capable of interrupting the direct flight of bees shall be used to redirect the bee's flight pattern and prevent a direct line of flight from the hives into neighboring properties. The barrier shall start at the ground, be a minimum of six feet in height and shall extend beyond the direct line of sight from the entrance of the hive to the neighboring or adjacent property.
- Hives must not be placed along property lines unless a solid fence, wall or dense vegetative barrier capable of interrupting the direct flight of bees forms the property boundary.
- Hives placed in elevated locations need to be placed so bees do not have a direct line of flight to neighboring properties with elevated living areas.
- Do not place hives next to roads, sidewalks, and public rights of way.
- Hive entrances should face so that bees fly across your property. If this is impossible, use barriers (hedges, shrubs, or fencing six to twelve feet high) to redirect the bees' flight pattern.

Swarming: Swarming is a natural instinct of honeybees that occurs chiefly from spring to early summer. Swarms should be collected to prevent their becoming a nuisance. Honeybee colonies can and should be managed to prevent or minimize swarming. For example, brood chamber manipulation, colony division, adding supers for brood rearing and honey storage, and replacing old or failing queens can all reduce the swarming impulse. These and other management practices to control swarming are explained in detail in good beekeeping textbooks. Beekeepers who learn of a swarm should take reasonable measures to see that the swarm is retrieved.

Provision of Water: Beekeepers should assure an adequate source of fresh water for their bees prior to establishing an apiary. Where adequate fresh water from a nearby pond or stream is not available, beekeepers should establish a water source that will be available throughout the active flight season. Bees prefer a sunny place where they can gather surface moisture, for example wet sand or gravel or the edge of a birdbath. If you establish such water sources, your bees will become habituated to them and will be less likely to visit swimming pools or hot tubs. Remember that in very hot weather, bees use a large amount of water to maintain temperature and humidity within the hive.

Queens: In most cases, European honeybees are considered gentle. When a colony exhibits unusually defensive characteristics (stinging or attempting to sting without provocation), or exhibits a frequent tendency to swarm, it is the beekeeper's duty to re-queen from European stock. Queens should also be replaced as they get older, or as they begin to fail to ensure that the colony maintains strong numbers of healthy brood.

Robbing Behavior: When nectar is scarce, honeybees may rob honey from other hives. Under such conditions, beekeepers should work hives for only a very short time, if at all. Exposing honey (especially sticky honeycombs) outdoors often encourages robbing. All spilled honey should be cleaned up immediately. To prevent robbing, buildings and trailers used for honey extraction must be made bee-proof, as far as is practicable.

Transportation of Hives: Beekeepers must take appropriate care when transporting hives of honeybees. All loads of hives and supers of honey should be secured. Bees being transported should have entrance screens or be secured under netting.

Migratory Movement of Honeybees and use of Consolidation Yards: Migratory beekeeping practices include the use of temporary consolidation yards where beekeepers bring hundreds to thousands of honeybee colonies together to facilitate inspection and shipment of colonies for migratory purposes. Likewise, large number of colonies may be temporarily unloaded upon return from migratory movement.

Beekeepers must be aware of the impact caused by congregating large numbers of colonies in one location, and take appropriate steps to mitigate the impact to their neighbors.

In most cases it is to the beekeepers benefit to quickly disperse excess colonies from a consolidation yard. However, unforeseen factors including weather and the timing of pollination needs can inhibit the dispersal of colonies and must be taken into account when deciding where to unload the bees.

During periods of cold, honeybees cluster in the colony and little or no activity is observed. On sunny or mild days, honeybees will leave the colony for cleansing flights, but they quickly return to their colony. Overwintering large numbers of colonies in one location has benefits to the beekeeper and is considered an acceptable practice as long

as the beekeeper arranges to disperse the colonies before the bees become active in the spring.

Honeybees being prepared for migratory movement are brought to one location to facilitate loading and shipping. A beekeeper may consolidate from 100 to several thousand colonies of honeybees in one location, depending on the number of colonies to be placed on a truck, and the number of trucks to be loaded at a single time. If warm weather is anticipated, large numbers of colonies should not be consolidated in a location where they can impact developed properties.

The beekeeper must anticipate the length of time colonies will be at the site and provide adequate food and water to address the foraging needs of the colonies for the time of year. The beekeeper must anticipate the time needed to complete inspections, prepare the colonies for movement, and schedule transportation to move the bees. A beekeeper must provide a consolidation yard with enough setback from developed property that, with appropriate food and water resources, the beekeeper will mitigate the activity of honeybees around neighboring homes and farmsteads. Tables 2a and 2b address setback distances for normal beekeeping activity and should not be considered as guides for consolidation yards.

Colonies brought to Michigan from southern states are, in general, stronger than colonies that were overwintered in Michigan. When moved into Michigan, southern raised colonies will have an active field force and will immediately begin searching for water and food resources. Adequate food and water must be provided no later than at the time the bees are unloaded. A consolidation yard must be located so that the distance from developed properties coupled with adequate food and water resources prevents honeybees from invading developed properties.

Disbursal of colonies from receiving yards to pollination or honey production locations should occur as soon as possible. It is to the beekeepers advantage to minimize the number of times bees are moved. For this reason, unload large numbers of colonies further from neighbors if constraints of weather or the timing of pollination activities prohibits immediate movement.

Recommendations for Considerate Hive Management: Beekeepers should take into account that weather conditions influence bee behavior and plan to work bees when conditions are favorable. They should make sure that neighbors are not working or relaxing outdoors when they open hives and should try to perform hive manipulations as quickly as possible, with minimum disturbance to the bees. Extended hive manipulations, particularly removing honey, should be carefully planned to accommodate neighbors' activities. Beekeepers should use smoke when working bees and should smoke hive entrances before mowing or trimming in the hive area. Clippings and exhaust should be directed away from hive entrances.

Adherence to the following list of beekeeping and apiary management practices will help beekeepers avoid conflicts with neighbors and demonstrate good beekeeping management:

1. Situate hives away from lot (property) lines and occupied buildings.

2. Locate hives away from roads and areas frequented by pedestrian and animal traffic.

3. In populated areas, use fences and hedges as screens to conceal hives and to elevate the bees' flight path. Vegetation and fences also serve as windbreaks.

4. Do not situate hives on or next to utility right- of -ways (power lines, pipelines or underground cables).

5. Avoid placement of hives near schools, recreation areas, picnic grounds or other locations that may result in adverse honey bee/public interactions.

6. Provide a water source so the bees don't fix on neighborhood swimming pools, birdbaths, livestock/pet water sources, etc. The water source must be established before the weather gets hot so the bees are trained to it. Provide fresh water on a regular basis.*

7. Keep no more than 4 hives on a lot less than 1/2 acre.

8. Maintain gentle colonies. If hives become defensive, determine the cause and requeen with gentle stock if necessary. Skunks are often the reason for hives to suddenly become defensive.

9. Work bees when neighbors are not in their yard. Minimize robbing behavior.

10. Manage hives for swarm prevention.

11. When mowing the grass in front of hives, direct the clippings and exhaust away from the entrance.

12. Share your enthusiasm and knowledge of beekeeping with the community.

***** Common water sources include birdbaths, pebble filled sections of gutter with end caps, plastic wading pools and entrance feeders. Pieces of carpet screen stapled to wooden frames, Styrofoam floats, and stones and pebbles provide ample footing for the bees to prevent drowning. The addition of salt (water softener, pickling, and sea) or sugar often aids in the training process of honey bees.

HEALTH CARE

Disease Control: There are a number of honeybee diseases and pests, of which American Foulbrood (AFB) is the most serious. Other brood diseases, including European Foulbrood, Chalkbrood, Nosema, and viruses must be considered when caring for honeybee colonies. Beekeepers should be extremely cautious about mixing hive equipment or purchasing hives from sources that are not certain to be disease-free. Finally, it is incumbent on beekeepers to manage parasitic mites and other pests responsibly for both colony health and honey quality.

Pharmaceutical Use: It is imperative that those engaged in raising livestock (including bees) and poultry for human consumption understand the prudent and legal use of pharmaceutical products. To help ensure that health and welfare of livestock and poultry and the safety of food they produce for the public, a veterinary-client-patient relationship (VCPR) is highly recommended. In most cases, a valid VCPR is mandatory for acquiring and using pharmaceutical products in food producing animals. Michigan currently follows the federal definition for a VCPR which states that a VCPR is considered valid if the following is observed (Code of Federal Regulations 530.3) (http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/ucm460406.htm):

1. A licensed veterinarian has assumed the responsibility for making medical judgments regarding the health of (an) animal(s) and the need for medical treatment, and the client (the owner of the animal or animals or other caretaker) has agreed to follow the instructions of the veterinarian;

2. There is sufficient knowledge of the animal(s) by the veterinarian to initiate at least a general or preliminary diagnosis of the medical condition of the animal(s); and

3. The veterinarian is readily available for follow-up in case of adverse reactions or failure of the regimen of therapy. Such a relationship can exist only when the veterinarian has recently seen and is personally acquainted with the keeping and care of the animal(s) by virtue of examination of the animal(s), and/or by medically appropriate and timely visits to the premises where the animal(s) are kept.

Pest Management during Pollination: Always make growers mindful that honeybees are active on their farm and that they need to follow appropriate practices to protect your honeybees. The use of broad-spectrum insecticides when flowers are open should always be avoided. Pesticide labels, as well as precautions regarding honeybee toxicity to a pesticide or combination of pesticides should be heeded by growers.

Bee hives should be removed immediately after pollination if post-bloom pesticide applications are planned. By monitoring for pest problems carefully during bloom, growers can help minimize the need for pest control. If an insecticide application is necessary during bloom, the compounds that are least toxic to bees should be used,

with careful observation of the pollinator-restrictions on the label. If an application is required, the beekeeper should carefully determine whether the bees need to be moved prior to the application event.

In general dusts, wettable powers and emulsifiable concentrate formulations are more harmful to honey bees. Applications conducted in the morning or daytime are not as safe for bees as evening applications. Ask the grower to inform the beekeeper before a spray so that colonies can be moved or shut down for 1-2 days with wetted-burlap blocking entrances, especially if highly toxic insecticides have to be used. This database lists the toxicity of various pesticides to honey bees: http://apiculture.com/databases/pesticides.htm.

Our appreciation to the Maine State Beekeepers Association for allowing us to use their excellent material in this document. Their full document can be seen at mainebeekeepers.org.

DEFINITIONS

Apiarist and beekeeper: A person keeping bees

Apiary: A place where honeybee hives are kept

Apiculture and Beekeeping: The management of beehives

Bee sting: Injury sustained and inflicted by a worker honeybee

Beehive: Removable framed housing for a honeybee colony

Brand: Identification for marking frames and hives

Consolidation Yard: A location where large numbers of colonies are placed temporarily to accommodate migratory shipping needs or winter management practices

Flight path: The distinct route taken by many bees leaving from or returning to their hive

Foraging bees: Bees seeking water or food - Bees naturally forage flowers for nectar and pollen. In abnormal circumstances, when natural sources of food and water are scarce, bees may forage supplies of animal feed, water or protein.

Hive: A honey bee hive, being a nucleus colony or a standard size colony

Honey extraction: The removal of honey from combs

Honey flow: The gathering of nectar from flora by honeybees

Honeycomb: Removable frames, containing wax cells which house honey, pollen, and/or brood (eggs, larvae, pupae)

Package bees: A number of adult bees, with or without a queen, contained in a ventilated shipping cage transported via USPS or other carriers

Pollination: The transfer of pollen by honeybees from anthers to stigmas of flowers for the purpose of plant fertilization

Robbing: Bees attempting to access honey stored or spilled in another hive

Strong hive: A populous honeybee colony

Super: Box or boxes containing frames placed above the bottom or brood

Swarm: Cluster of flying mass of honeybees including workers, queen, and drones

Undeveloped Property: Means idle land that has no structures or facilities intended for human use or occupancy. Property used exclusively for streets, highways, or commercial agriculture is considered undeveloped property.

Water supply: Taps, hoses, pools, hot tubs, streams, ponds, puddles, etc.

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