



Natural Resources Conservation Service
CONSERVATION PRACTICE STANDARD
LIVESTOCK SHELTER STRUCTURE
CODE 576

(no)

DEFINITION

A permanent or portable structure to protect animals from negative environmental factors.

PURPOSE

This practice is used to accomplish one or more of the following purposes:

- To provide protection for animals from excessive heat, wind, cold, or snow.
- Improve the distribution of grazing animals to enhance wildlife habitat, reduce over-used areas, or correct other resource concerns resulting from improper animal distribution.

CONDITIONS WHERE PRACTICE APPLIES

This practice is applied to provide protection to sensitive areas by providing a source of shade or shelter that is located away from the existing shade or shelter in wooded areas, on stream banks, or in depressions.

This practice is applicable where animal productivity and well-being are adversely affected by negative environmental conditions such as direct and unimpeded sunshine, wind, or snow.

This practice can facilitate animal management under prescribed grazing to protect water quality and soil health.

This practice can be used to provide protection on range or pasture, cropland, or hayland used for grazing, winter feeding areas, or in an animal heavy use area.

This practice could be used in conjunction with exclusion of animals from the sensitive area.

CRITERIA

General Criteria Applicable to All Purposes and Structure Types

Transport of portable structure

Equip the portable structure with runners or wheels or other means to facilitate transport. Provide lateral support to vertical and horizontal structural members to prevent twisting and buckling during transport.

Location

Locate the structure to avoid adverse effects to cultural resources and endangered, threatened, or candidate species and the habitat of each respective species. Assess soil types, flood prone areas and seasonal water table zones when planning the location of the shelter structure. Select upland locations that are away from riparian areas and concentrated flow areas to avoid impairment of water quality. Locate structures a minimum of 100 feet from any surface water bodies, 150 feet from an up-gradient well, and 300 feet from a down-gradient well.

Erosion protection

Provide erosion protection as needed to protect site.

Materials

Construct the structure of durable materials that are commensurate with a minimum structure life of 10 years.

Additional Criteria for Shade Structures**Orientation**

Orient the longest axis in a north-to-south direction to maximize the amount of shade and to allow sunlight to dry the area under the structure.

Shade cover

Design the top of the structure to be relatively flat so that wind will have minimum load on the structural supports. Provide a minimum 1:25 pitch for the structure roof to allow runoff.

Anchor the four corners of the shade structure corners with tie-downs of adequate size and strength to meet the local wind conditions during season of use.

Use 80-percent light reduction shade cloth for protection of animals.

When installing a livestock shade structure kit, follow the manufacturer's recommendation.

Size

The minimum size requirements for a shade structure are shown in table 1. Portable structures may be smaller to facilitate movement. Multiple structures may be needed depending on the number of animals to be sheltered.

In prescribed grazing systems for high-producing animals, provide shade for at least 75 percent of the herd, particularly for dairy or beef cows.

Table 1. Minimum shade requirements

Animal Type	Area (square feet per head)	Height (feet)
Dairy	40	10
Beef		
400 lb calves	15	10
800 lb feeders	20	10
cows	30	10
Horse	50	12
Swine, sheep, or goats	10	7
Poultry	3	7

Location

Locate the structure a minimum of 50 feet from any existing structure that could obstruct the circulation of air. Use the location of the structure to create the desired animal distribution patterns. Move portable structures as needed to maintain healthy vegetation in the immediate area.

Additional Criteria for Wind Shelter Structures**Location**

Locate the wind shelter structure in an area where animal shelter from prevailing winds is desired. The site must be accessible by vehicle or equipment.

Locate the shelter on level, uninterrupted terrain, if possible. If the shelter must be located downwind of a hill, place the shelter as far downwind as possible. A shelter upwind of a hill shall be placed a minimum of 75 times the shelter height upwind of the base of the hill.

Locate the wind shelter perpendicular to the prevailing winter winds, where possible. Be careful that the wind shelter does not block summer breezes, increasing heat stress.

Shape and size

A wind shelter shall be 90° V-shaped structures, semicircular-shaped, or straight-line structures.

For optimum protection from wind and drifting snow, a V-shaped or semicircular structure is recommended. The shelter opening width (D) (perpendicular to the wind direction) should be no less than 10 and no more than 15 times the shelter height (H) (fig. 1).

"V-shaped" shelter

Construct a V-shaped shelter with a solid face to divert drifting snow around ends of the barrier. Wind speed reduction of 60–80 percent is possible in the protected area extending 5H downwind of the barrier (fig. 1). Orient the "V", or closed end, toward the direction of the winter and early spring prevailing winds. The shelter will cause the snow to be diverted around the shelter and deposited in drifts extending five times the shelter width (D) downwind.

Use figure 1 and tables 2 and 3 to compute the needed shelter zone. Table 3 shows the maximum wing length (L) to achieve a shelter opening (D) of 15 times the shelter height (H). The shelter structure will provide a shelter zone area based on the values in table 3.

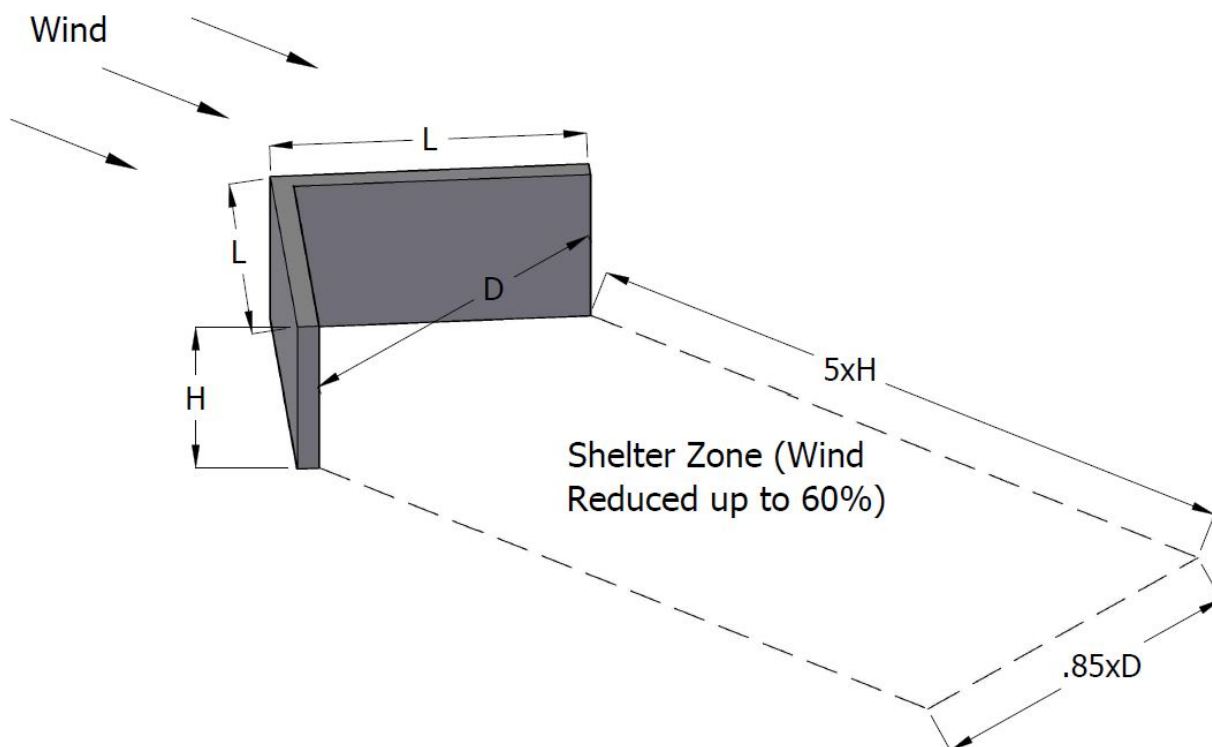


Figure 1. Snowdrift Protection from "V-shaped" Structures

Table 2. Minimum wind shelter requirements

Animal Type	Minimum Shelter Zone - Area (square feet per head)
Dairy, beef, or horse	40
Beef	
400 lb calves	15
800 lb feeders	20
cows	30
Horse	50
Swine, sheep, or goat	10
Poultry	3

Table 3. Shelter Zone Area at Maximum Wing Length (see fig. 3)

Barrier height, feet	L, feet	D, feet	Protected Area, square feet
6	60	84.8	3,964
8	80	113.1	7,047
10	105	148.5	11,823
12	125	176.8	16,828
14	145	205.1	22,714

Semicircular shelters

A semicircular-shaped shelter will function similar to a “V”-shaped shelter and can be built with approximately the same quantity of materials as the V-shaped structure. Multiply the protected area in table 3 by 1.27 to determine the protected area. Base the dimensions for the semicircular-shaped barrier on a radius equal to one-half D for the “V”-shaped structures as shown in table 3. The semicircular shape also tends to be self-bracing.

Straight-line shelters

Use a straight-line windbreak to provide effective wind protection for up to 15 to 20 times the height of the structure for solid and porous walls. Provide no more than a 1-foot gap at the base for a straight-line shelter.

General structural criteria

Perform stability and structural analyses on wind shelter structures. Develop wind loading for these analyses using the 3-second gust speed for a 50-year mean recurrence interval (MRI) according to American Society of Civil Engineers (ASCE) Standard 7-16, “Minimum Design Loads and Associated Criteria for Buildings and Other Structures.” Apply a 1.0 factor of safety for shelter stability. Anchor a portable shelter as necessary to meet this criterion for overturning and sliding. Design structural components of shelters according to industry standards (American Institute of Steel Construction, American Wood Council, etc) applicable to the materials of construction.

Any wood in contact with manure or soil must be a rot-resistant wood species or treated in accordance with ASTM D1760 “Standard Specification for Pressure Treatment of Timber Products.” For facilities that are for organic producers or that sell compost to organic producers, ensure that the treated lumber used in the shelter meets the requirements for organic production. It may be best to have the producer consult with the organic certifier as to the use and acceptability of treated lumber.

CONSIDERATIONS

Protect surface waters from nutrient and pathogen loading.

Protect wooded or sensitive areas from accelerated erosion and excessive compaction.

Consider the economics, the overall waste management system plan, and safety and health factors.

If the structure is permanent, consider applying NRCS Conservation Practice Standard (CPS) Heavy Use Area Protection (Code 561) where vegetation cannot be maintained underneath or within the structure.

When the shelter structure is installed to improve animal distribution to address resource concerns, NRCS CPS Prescribed Grazing (Code 528) could also be included in the resource management plan.

When applicable, use NRCS CPS Trails and Walkways (Code 575) when frequent travel to headquarters, grazing areas, or watering facilities is required.

With shade structures, recommend removing and storing the structure or fabric during winter months to extend the life of the shade cloth.

Remove and store mobile shade structures during stormy weather events.

For wind shelter structure, for stability analysis, apply a factor of safety greater than 1.0 to account for variable site conditions and soil properties, when needed.

For portable structures, monitor conditions and moving the structures frequently as advisable to avoid local degradation of vegetation, soils, and local hydrology.

During stability analysis of portable wind shelter requiring anchorage, when needed take into account the consequences and performance of an unanchored shelter.

For waste management purposes, design the structure to facilitate the distribution of manure across grazing lands in accordance with a nutrient management plan.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for an animal shelter structure according to this standard. Describe the requirements for applying the practice to achieve its intended purpose.

Include construction plans, drawings, implementation requirements, or other similar documents. Specify in these documents the requirements for installing the practice.

As a minimum, include—

- The type, location, and orientation of the shelter structure.
- Design wind speed and seasonal wind directions needed to determine the orientation of the structure.
- Implementation requirements or construction drawings.
- Construction specifications including dimensions of the structure and configuration.
- Materials, including the dimensions, amount, any coatings, and quality to be used.
- Describe the requirements for anchoring the portable shelter structure.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance (O&M) plan for the operator as indicated below.

General O&M Plan

- Inspect the structure annually and after major storm events.
- Replace or repair maintenance coatings on structural steel components as necessary.

Specific O&M Requirements for Shade Structures

- Maintain the structural and fabric components through the practice lifespan. Dispose of or recycle worn-out fabric or other nonstructural material as appropriate.
- Periodically tighten the shade cloth to minimize wind damage.
- Replace the fabric cover when it has deteriorated due to environmental conditions.

Specific O&M Requirements for Portable Structures

- Move portable structures periodically to prevent destruction of vegetation in the immediate area.
- Develop a plan for movement of the structure, if portable.
- Re-anchor portable structures following relocation.

REFERENCES

ASTM D A36, Standard Specification for Carbon Structural Steel; A120, D751, Standard Test Methods for Coated Fabrics; D1494, Standard Test Method for Diffuse Light Transmission Factor of Reinforced Plastics Panels; D1682, D-1760, D1910.

Federal Specification TT-P-641, Primer Coating; Zinc Dust-Zinc Oxide (For Galvanized Surfaces) Federal Test Method Standard No. 191, Method 5804.

Jairell, R.L. and R.A. Schmidt. 1991. Taming Blizzards for Animal Protection, Drift Control and Stock Water. USDA Forest Service. Washington, D.C.

Jairell, R.L. and R.A. Schmidt. 1988. Portable Animal Protection Shelter and Wind Screen. 56th Annual Western Snow Conference Proceedings, Kalispell, MT.

<https://westernsnowconference.org/sites/westernsnowconference.org/PDFs/1988Jairell.pdf>

Bates, E.M. and R.L. Phillips. 1980. Effect of a Solid Windbreak in a Cattle Feeding Area. Oregon State University and Eastern Oregon Agricultural Research Center. Accessed [date].

<https://pdfs.semanticscholar.org/ce5d/bafcd98f90918af370cfd62044017bf01e5.pdf>

Turner, Larry. 2000. Shade Options for Grazing Cattle. University of Kentucky. Agricultural Engineering Update, AEU-91. Lexington, KY.

Higgins, S.F., T.A. Carmen, and S.J. Wightman. 2011. Shade Options for Grazing Cattle. University of Kentucky. Agricultural Engineering Update, AEN-99. Lexington, KY.

Holcomb, K.E., C.B. Tucker, and C.L. Stull. Preference of domestic horses for shade in a hot, sunny environment. J. Animal Sci. 2014.92:1708-1717.doi:10.2527/jas2013-7386.