Mesonet Agweather Cattle Stress Advisor Description

Oklahoma's weather extremes can have a direct and dramatic impact on grazing livestock. When weather conditions are ideal and livestock are "comfortable", their performance and nutritional requirements are not affected. However, extreme weather conditions can dramatically alter feed intake, reduce daily weight gain, and increase nutritional requirements.

The Oklahoma Mesonet Cattle Stress Advisor is a tool to assist cattle producers in identifying stress periods, caused by extreme weather conditions. This index provides an indication of the level of stress outdoor cattle may experience from either heat or cold temperatures. This measure of cattle stress allows producers to know when to take appropriate action to reduce cattle stress. Both cold and heat stress indexes are run on a continuous basis.

HEAT STRESS

When ambient temperature and thermal radiation exceed the temperature of the animal's skin surface, the animal's body gains heat. Cattle shed heat primarily through evaporation from the skin and through respiration (breathing). As relative humidity increases, the effectiveness of evaporative heat loss diminishes. In fact, when relative humidity reaches 100 percent, evaporative heat loss is totally ineffective. The heat stress index is based on air temperature and relative humidity. The cattle heat stress index values are not the same as the human heat index or air temperature. The cattle heat stress index numbers are unique to outdoor cattle and cannot be used without additional interpretation for dairy cows or other livestock.

Heat stress can cause reduced productivity in beef and dairy cattle herds. The effects of severe heat stress are often seen in the form of reduced reproductive performance, reduced daily weight gain of growing cattle and reduced milk production. Cattle are more sensitive to heat stress than humans, although cattle do seem to have a wide range of heat tolerance. From an environmental perspective, heat stress is a combination of temperature, relative humidity, and wind speed. However, animal factors, such as age, hair coat length, hair coat color, and nutrition status, interact with these environmental factors to determine the severity of heat stress.

The Mesonet Cattle Stress Advisor index is a calculated value that is unique for livestock. The calculated value is not the same as the air temperature or human heat index.

When cattle heat stress is at 71 or lower, cattle are in the thermal neutral zone, meaning that they are comfortable and production will not be sacrificed due to severe environmental conditions. Values ranging from 72-79 indicate "Mild Stress." This is often when cattle will move to shade to cool themselves. Livestock managers should monitor the weather and prepare to take action if conditions worsen. Cattle heat stress values ranging from 80-89 indicate a "Moderate Stress." This is the time to implement management strategies to help reduce cattle stress. Values above 90 indicate "Severe Stress."

The cattle heat stress index formula is -
THI = tair - [0.55-(0.55*relh/100)]*(tairf-58.8)
where:
THI = Temperature-Humidity Index
tair = air temperature in Fahrenheit
relh = percent relative humidity

What can be done in a heat stress situation?

Provide ample water.

On days when the index is 72 or higher the cattle may need more than 2 gallons of water per 100 pounds of body weight. Provide enough tanks for cattle to be able to get the water they need. If possible, water should be cooled. Tanks should be cleaned weekly to encourage water consumption. Making water available under a shaded area will increase cattle water consumption.

Avoid handling cattle:
Handling cattle can elevate their body temperature by as much as 3.5°F. If cattle must be worked on days when the Cattle Stress Index is likely to go over 80, try to do the work before 8:00 AM and keep the maximum time in the holding facilities to no more than 30 minutes. On days when the index will be 80 or above, do not work cattle after 10:00 AM. The 60-hour forecast component of the cattle stress index, will allow you to schedule management practices to best maintain cattle health.

Change feeding patterns:
Shift the feeding schedule toward evening on days when the Cattle Stress Index is above 72. Try to deliver 70 percent of the daily scheduled feed two to four hours after the peak air temperature. Providing only small amounts of feed during the heat of the day, will decrease the metabolic heat of digestion.

Provide shade:
A shade tree is just as welcome a relief for cattle as humans on a hot summer day. Shade can also be constructed. Shade height should be 8-14 feet tall and should be large enough to provide 20-40 square feet per animal. The most effective shade is a solid reflective roof constructed of white colored, galvanized, or aluminum materials. Shading with wooden slats, plastic fencing, or other materials that allow flecks of sunlight to hit the animals are less effective. If possible two shaded areas are recommended, one over the feed area to increase feeding time, and another away from the feed area to encourage the cattle to rest. Water should be made available under both shaded areas, to increase the water consumption during heat stress period. If the structure is left up year-round, construct a frame adequate for snow load. Shade is insurance against mortality loss. Any performance benefits are a bonus.

Improve airflow:
Consider where the cattle are located and if there is any air restriction. Buildings, high fences, or vegetation can block airflow. A 6-foot high windbreak can obstruct airflow for 60 feet downwind.

Provide water mist:
Providing a spray of water will help to cool the animals down. However it is important to place misters over a clean, concrete area. Running misters over dirt creates mud and increases the potential for mastitis or other bacterial diseases. A timer should be used to run the mister long enough to cool, but not wet the cattle. Do not allow mist to wet nearby feed. Wet feed spoils rapidly with Oklahoma's summer heat.

Control biting flies:
Stable flies cause cattle to bunch and disrupt cooling. Monitor the situation and control the flies as needed. Eliminate any shallow pools or muddy areas nearby, since they are common breeding areas for flies.

COLD STRESS
Experienced livestock producers are well aware of the toll severe winter weather can have on animal health and performance. The Oklahoma Mesonet Cattle Stress Advisor provides livestock producers a measure of cold stress conditions.

Research indicates that the effects of cold, wind, wet hair coat and muddy pastures and pens are additive. These stresses can be managed to a limited degree. Beef cattle can be comfortable within a wide range of temperatures; from 20 to 70°F, depending largely on hair coat length and hair coat condition (dry, wet, muddy etc.). The lower critical temperature is defined as the effective ambient temperature at which energy intake must increase in order to minimize reduction in weight gain, in the case of growing cattle, or to prevent weight loss in mature cattle.

Calculation of cattle stress levels is complicated by cattle coat changes as they are exposed to seasonal temperature variations. As temperatures cool down in the fall cattle coat hair thickens to offer the animal more protection. The following table suggests guidelines for lower critical temperature for various hair coat conditions.

Estimated lower critical temperatures for beef cattle.

Coat Description	Lower Critical Temperature
Wet or summer coat	60°F
Dry fall coat	45°F
Dry winter coat	32°F
Dry heavy winter coat	19°F

Another factor that contributes to animal stress is rainfall. A wet cattle coat loses its insulative properties. In terms of stress, a wet coat is the same as a summer coat.

The cold stress experienced by outdoor cattle is based on air temperature, wind speed, and the presence of rain or snow. The Cattle Cold Stress Index numbers are based on human wind chill calculations developed using the 1945 Siple and Passel Index. As of November 2001, the National Weather Service is using a new human wind chill formula that will undergo additional refinement in 2002. The new human wind chill values are warmer than the values based on the 1945 Siple and Passel Index. Thus, the Cattle Cold Stress Index numbers are lower than the current human wind chill values. Since cattle management recommendations are based on the older wind chill formula, it will continue to be used until a more accurate formula is created, based on new cattle research.

The following is the basic formula used to calculate the Cattle Cold Stress Index when temperatures fall below 45°F.

WCT = 0.0817*[(3.71*wind0.5)+(5.81-0.25 wind)]*[(tair-91.4)+91.4]

where:
WCT = Wind Chill Temperature (traditional formula) tair = air temperature in Fahrenheit wind = wind speed in miles per hour

When temperatures are between 59°F and 46°F, the following formula is used.
CSI = [(tair-45F/14)] x tair + [(59F _ tair)/14] x WCT
where:

CSI = Cold Stress Index tair = air temperature in Fahrenheit WCT = Wind Chill Temperature (traditional formula)

The following table shows the Wind Chill Temperature ranges in Fahrenheit where "Mild, Moderate, and Severe" cold stress is likely. Actual cattle stress will vary with location, cattle breed, stage of hair growth, and wind exposure.

Cattle Coat Impact on Wind Chill Temperature Stress Levels

Cattle Coat	Dates	Mild	Moderate	Severe
Dry heavy winter	January 1 - March 31	19-10	9-0	<0
Dry spring	April 1 - April 30	45-32	31-18	<18
Dry summer	May 1 - October 15	59-46	45-32	<32
Dry fall	October 16 - November 30	45-32	31-18	<18
Dry winter	December 1 - December 30	32-20	19-7	<7
Wet	Year-round	59-46	45-32	<32

Whenever 0.1 of an inch of rain occurs in the last hour, the calculated cold stress is the same as if the animal had a summer dry coat.

The forecast advisor will indicate an alert if 0.1 of an inch of rain is forecast during the 6-hour period covered by the forecast advisor.

What can you do in a cold stress situation?
The combined effects of temperature and wind are often expressed as a wind chill index. The wind chill index, rather than ambient temperature, is used to estimate effective temperature when considering the severity of cold stress. For example, when the temperature is 20°F with no wind, the wind chill index is 20°. At the same ambient temperature, 5, 15 and 25 mph winds would result in a wind chill index (or effective temperature) of 13°, 4° and -7°F, respectively. Obviously, anything that can be done to reduce exposure to wind will dramatically reduce cold stress.

In general, a cow's energy requirements increase 1 percent for each degree the wind chill is below 32°F. For a wet cow, the increased energy requirement begins at 59°F and increases 2 percent for each degree drop.

In cold wet conditions, this increased energy need is often virtually impossible to accomplish with feedstuffs available on ranches. In addition, this amount of energy change in the diet of cows accustomed to a high roughage diet, must be made very gradually to avoid severe digestive disorders. Therefore, the more

common-sense approach is a smaller increase in energy fed during wet cold weather, and extending the increase into more pleasant weather to help regain energy lost during the storm.

For example, a cow consuming 16 pounds of grass hay per day and 5 pounds of 20 percent range cubes under mild weather, could have its feed in increased to 20 pounds of grass hay per day (also possibly offering a better quality hay) plus 6 to 7 pounds of range cubes during a severe weather event. This is not a doubling of the energy intake but extending this amount for a day or two after a storm may help overcome the energy loss during the storm and is done in a manner that does not cause digestive disorders.

A second approach that is often used is to reserve the highest quality hay for feeding during stressful cold periods.

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