Mesonet Cattle Comfort Advisor Description

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INTRODUCTION

Comfortable cattle are productive cattle. Comfortable cattle gain better and maintain a higher level of health. The Mesonet Cattle Comfort Advisor provides an estimate of cattle comfort based on data from the Oklahoma Mesonet and forecasts from the National Weather Service. Stress levels are calculated using a formula developed by animal scientists affiliated with the University of Nebraska.

TEAM MEMBERS

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FORMULA

The Mesonet Cattle Comfort Advisor model was developed and introduced as the Comprehensive Climate Index by Terry L. Mader and Leslie J. Johnson at the University of Nebraska and John B. Gaughan at the University of Queensland in Gatton, Australia.

> (Reference: A comprehensive index for assessing environmental stress in animals. 2010. T.L. Mader, Leslie J. Johnson and John B. Gaughan. Journal of Animal Science 2010, Volume 88: pages 2153-2165. The formula was corrected as Erratum in Journal of Animal Science 2011, Volume 89: page 2955. The 2011 corrected formula is included here.)

Oklahoma Mesonet weather variables used to calculate the Mesonet Cattle Comfort index are:

- Air temperature at 1.5 meters
- Wind speed at 2 meters
- Relative humidity at 1.5 meters
- Solar radiation

The equation on page 2158 is incorrect and should be as follows:

$$\left[\frac{-6.56}{e^{\left\{\left\langle\frac{1}{(2.26\times WS+0.23)^{0.45}}\right\rangle\times\left\langle 2.9+1.14\times10^{-6}\times WS^{2.5}-\log_{0.3}(2.26\times WS+0.33)^{-2}\right\rangle\right\}}}\right]-0.00566\times WS^2+3.33.$$

The author regrets the error.

Mader, T. L., L. J. Johnson, and J. B. Gaughan. 2010. A comprehensive index for assessing environmental stress in animals. J. Anim. Sci. 88(6):2153–2165.

The model Mader, Johnson and Gaughan have proposed has some important advantages over previous stress models. These include:

- A single model is used to calculate both heat and cold stress.
- The model runs year round.
- Sunlight is included as a heat enhancer and cold mitigator weather variable.
- Relative humidity has been added as an additional negative cold weather variable.
- Wind has been added as a heat mitigator weather variable.

The cautions when using the Mader, Johnson and Gaughan model include:

- The model does not factor in continuous moisture.
- There are no ranges based on hair coat thickness.

The Mesonet Cattle Comfort Advisor uses the North American Mesoscale Forecast System (NAM) model forecast, updated every 6 hours. This 12 kilometer gridded forecast comes from the National Weather Service's National Center for Environmental Prediction.

The Cattle Comfort category ranges in the following table are for healthy animals that have developed a hair coat appropriate for the season and are receiving nutrient supplies compatible to the level of environmental exposure. Continuous moisture will increase the stress associated with cold temperatures. Young or non-acclimated animal cold stress levels should be adjusted up by 25°F. For example, the Cattle Comfort Cold Danger value for a young calf, unhealthy animal or newly arriving cattle from a warmer climate should be raised from -20°F to 5°F.

CATEGORIES

Heat and cold stress level categories for the Mesonet Cattle Comfort Advisor are:

Mesonet Cattle Comfort Categories	Mader et.al. Comprehensive Climate Index Categories	Impacts	Cattle Comfort Index °C	Cattle Comfort Index °F
Heat Danger	Hot conditions: Extreme and Extreme Danger	Animal deaths may exceed 5%	>40	>105
Heat Caution	Hot conditions: Moderate and Severe	Decreased production, 20% or more.	>30 to 40	>85 to 105

		Reduced conception, as low as 0%		
Comfortable	Hot conditions: Mild Comfortable Cold conditions: Mild		-10 to 30	15 to 85
Cold Caution	Cold conditions: Moderate and Severe	18-36% increase in dry animal feed	<-10 to -30	<15 to -20
Cold Danger	Cold conditions: Extreme and Extreme Danger		<-30	<-20

Mesonet Cattle Comfort Index values are reported as degrees Fahrenheit to fit the temperature scale most cattle producers commonly use. The values do not represent exact temperatures. They do represent the approximate hot and cold levels an animal is being exposed to and is dealing with physiologically.

OUTPUT PRODUCTS

Statewide Maps

Statewide maps provide a regional view of cattle comfort conditions. The maps are color coded to indicate general level of stress conditions. Values on the map are for conditions at the local Mesonet site.

Statewide maps on the website include:

- *Two Days Ago Daily Average Cattle Comfort Map* – map of the daily average index values for 2 days ago from midnight to midnight Central Time.
- *Yesterday's Daily Average Cattle Comfort Map* – map of the daily average index values for the previous day from midnight to midnight Central Time.
- *Yesterday's Maximum Cattle Comfort Map* – map of the highest index values for the previous day from midnight to midnight Central Time.
- *Yesterday's Minimum Cattle Comfort Map* – map of the lowest index values for the previous day from midnight to midnight Central Time.

- *Current Map* – updated every 5 minutes

- *Today's Forecast Maximum Cattle Comfort Map* – map of the highest forecast index values for the current day beginning at midnight Central Time.
- *Today's Forecast Minimum Cattle Comfort Map* – map of the lowest forecast index values for the current day beginning at midnight Central Time.
- *Tomorrow's Forecast Maximum Cattle Comfort Map* – map of the highest forecast index values for tomorrow beginning at midnight Central Time.
- *Tomorrow's Forecast Minimum Cattle Comfort Map* – map of the lowest forecast index values for tomorrow beginning at midnight Central Time.

- *Two Days Ahead Forecast Maximum Cattle Comfort Map* – map of the highest forecast index values for two days ahead beginning at midnight Central Time.
- *Two Days Ahead Forecast Minimum Cattle Comfort Map* – map of the lowest forecast index values for two days ahead beginning at midnight Central Time.

Local Mesonet Site

Local Mesonet site products show values calculated from Mesonet weather data or nearby forecast data for an individual Mesonet site.

Local Mesonet site products include:

Past 10 Days and Forecast Cattle Comfort Graph

Graph of hourly Cattle Comfort Index values for the previous 10 days with data dropped when the next hour of Mesonet data is available. The forecast cattle comfort values are based on the National Weather Service North American Meso (NAM) model. Mesonet 1.5 meter air temperature and NAM air temperature forecast are included for reference.

Past 45 Days Cattle Comfort Graph

Graph of hourly Cattle Comfort Index values for the previous 45 days with data dropped when the next hourly Mesonet data is available. Mesonet 1.5 meter air temperature is included for reference.

Past 45 Days Cattle Comfort Table

Table of hourly Cattle Comfort Index values for the previous 45 days with data dropped when the next hourly Mesonet data is available. The table includes weather variables used to calculate Cattle Comfort Index values and the adjustment for each variable to the Mesonet 1.5 meter air temperature.

Forecast Cattle Comfort Table

Table of hourly forecast Cattle Comfort Index values for the next 48 hours. The forecast Cattle Comfort values are based on the National Weather Service North American Meso (NAM) model. The table includes forecast weather variables used to calculate Cattle Comfort Index values and the adjustment for each variable to the Mesonet 1.5 meter air temperature.

Past Years

Graph and table display products can be used to compare daily Cattle Comfort Index averages for two different years to the long-term daily average.

Past years products include:

Past Years Cattle Comfort Comparison Graph

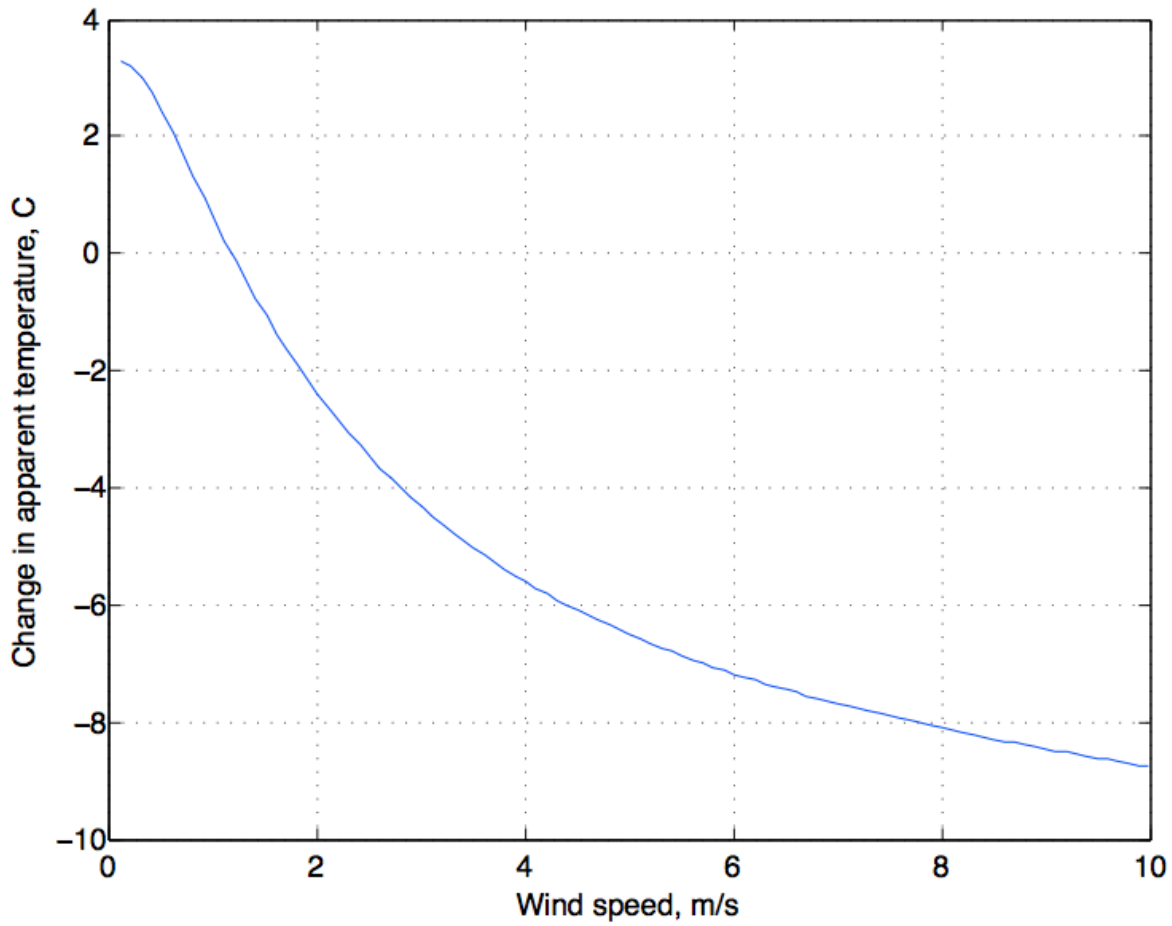
Interactive graph of daily Cattle Comfort Index averages for two years that can be selected by the user. The default years shown are the current and previous years. The long term average is included for reference.

Past Years Cattle Comfort Comparison Table

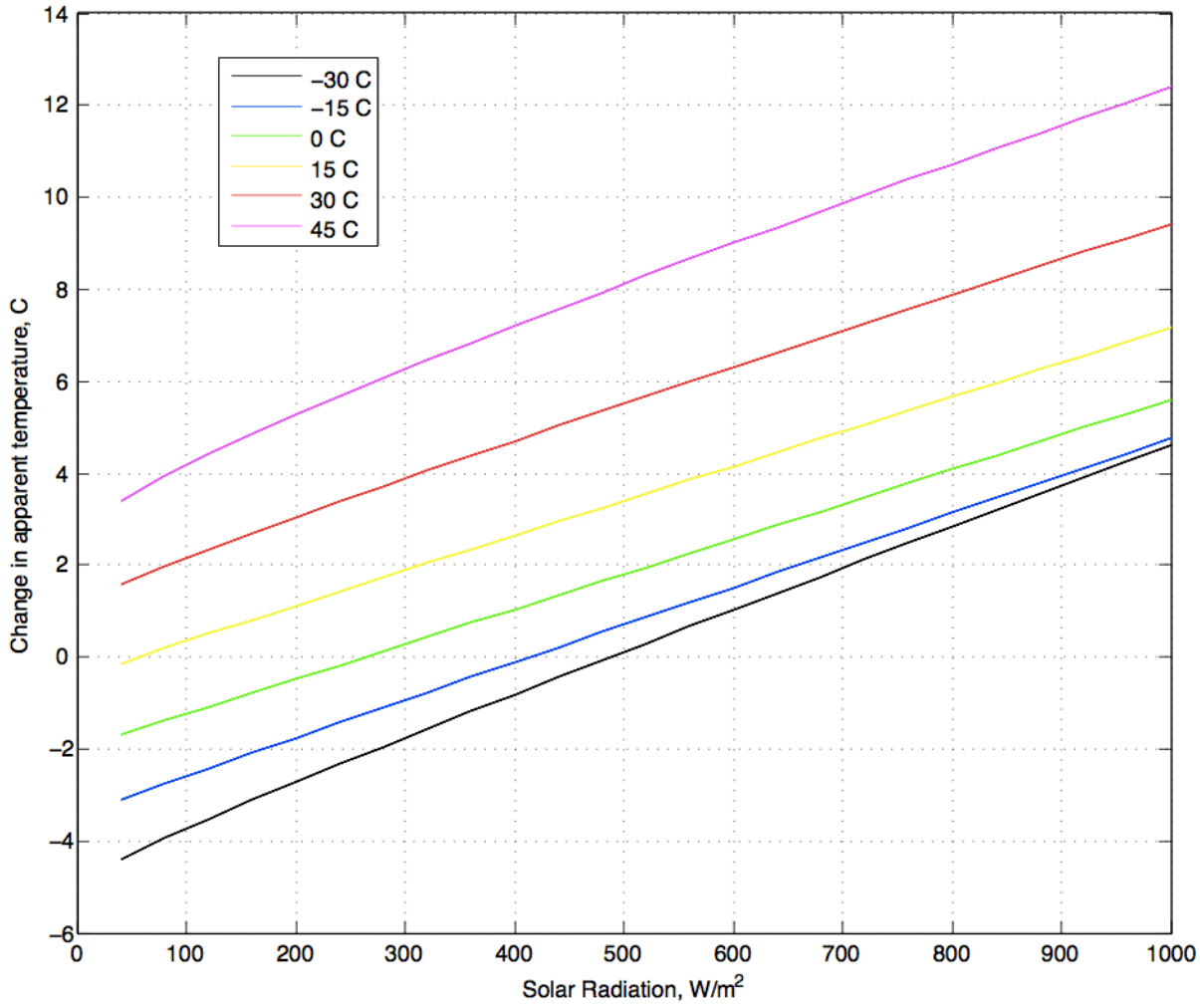
Interactive table of daily Cattle Comfort Index averages for two years that can be selected by the user. The default years shown are the current and previous years. The long term average is included for reference.

REFERENCE GRAPHS

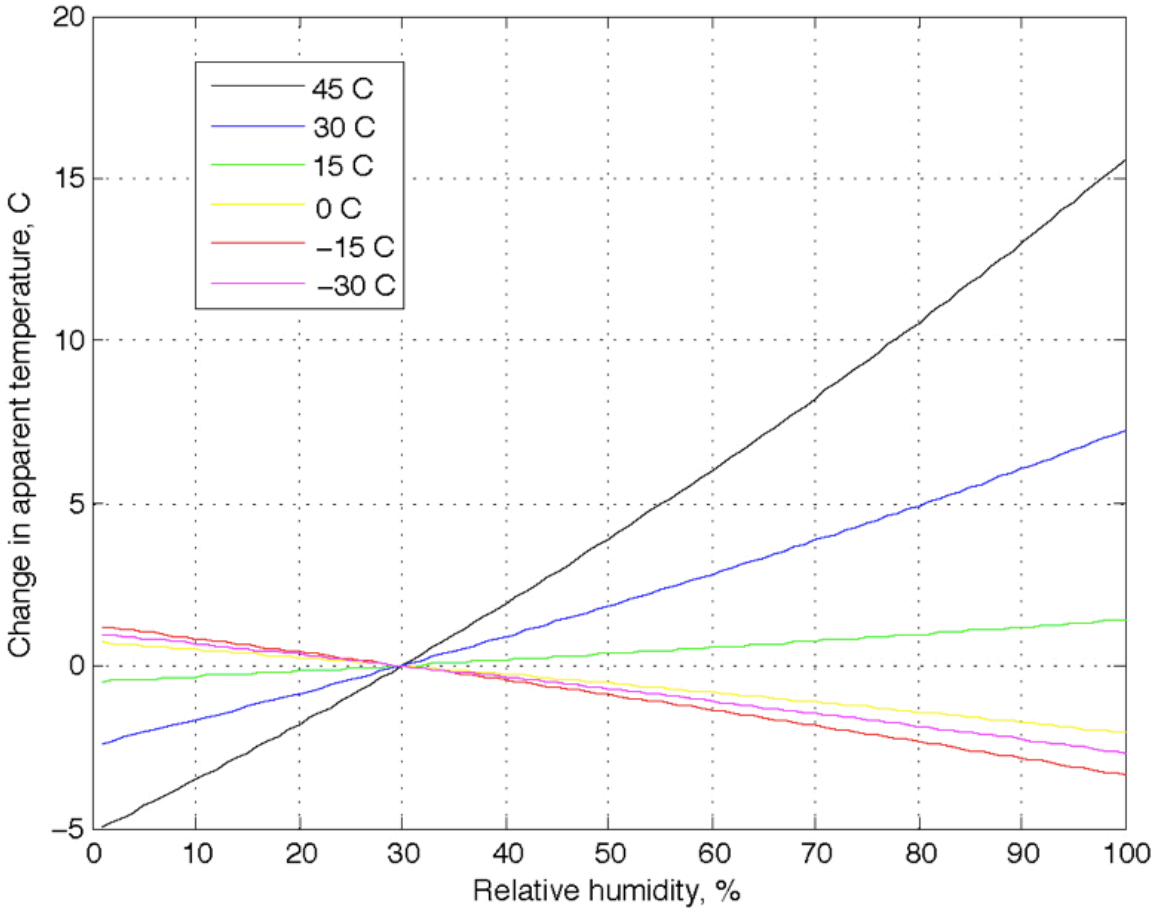
Wind



Solar Radiation



Relative Humidity



REFERENCES

Mader, T.L., Johnson, L.J. and Gaughan, J.B. *A comprehensive index for assessing environmental stress in animals*. 2010. Journal of Animal Science 2010, June, Issue 6, Volume 88: pages 2153-2165.

(The formula in the original manuscript was corrected in Mader, T.L., Johnson, L.J. and Gaughan, J.B. *Erratum in*. 2011. Journal of Animal Science 2011, September, Issue 9, Volume 89: page 2955.)