

# Heat Stress in Feedlot Cattle

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# Overview

- Cattle Production
- Environmental Conditions
- Economic Losses
- Animal Susceptibility
- Management Options
- Management for the Future
- Need for Forecast Information



# Cattle Production in USA

Cow-Calf Operations  
Located throughout the  
USA - both large and  
small herds



Calves are weaned and  
moved to a feedlot  
operation – sometimes  
moved great distances



Feedlot Operations –  
highly concentrated  
operations – fed high  
grain diets

# Cattle Heat Stress

## CATTLE IN FEEDLOTS

- Environment
  - Black soil
  - Shade?
- Diet
  - Concentrated Energy
- Animals
  - High animal density
  - Finished animals (Fat)



## CATTLE IN PASTURES

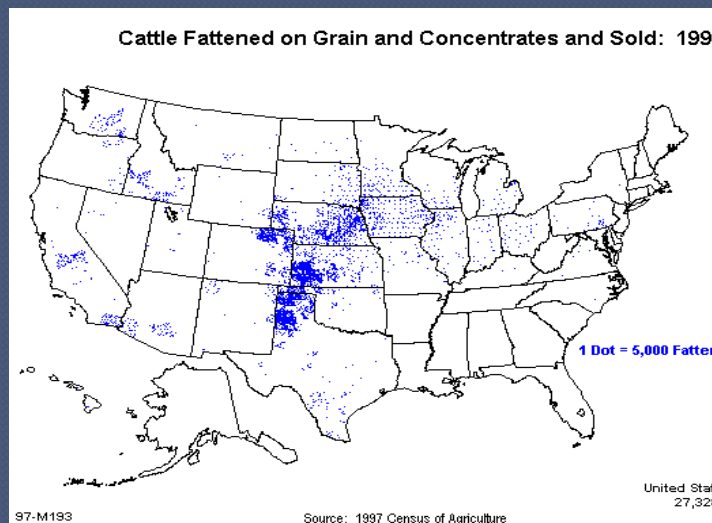
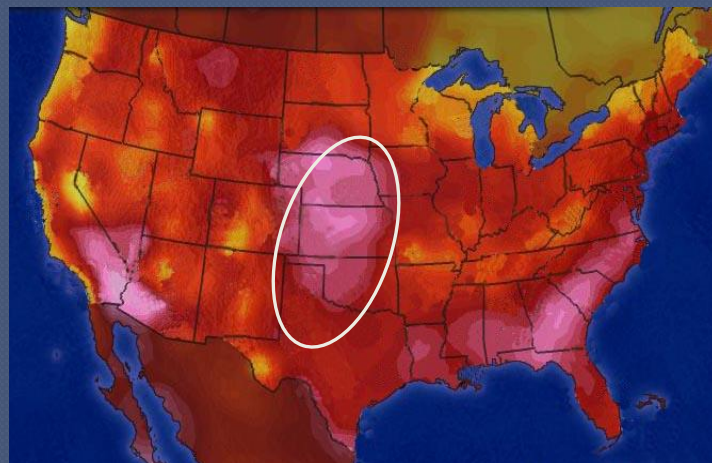
- Environment
  - Grass
  - Access to Trees or Pond?
- Diet
  - High Fiber – Low Energy
- Animals
  - Low animal density
  - Thinner animals



# Introduction

## Heat Stress in Feedlot Cattle

- Heat Waves are a recurring phenomenon in the Mid-West Region
- Most of the Feedlot cattle
- Death to thousands of animals
- Millions of dollars in lost revenue



# Devastating Heat Waves

July, 1995  
Western  
Iowa

- ~ 3,750 head of cattle
- Direct losses ~ \$2.8 M
- Production losses ~\$28.0 M

July, 1999  
Northeast  
NE

- > 5,000 head of cattle
- Total losses reported between \$21.5 and \$35 M

July, 2005  
Northeast  
NE

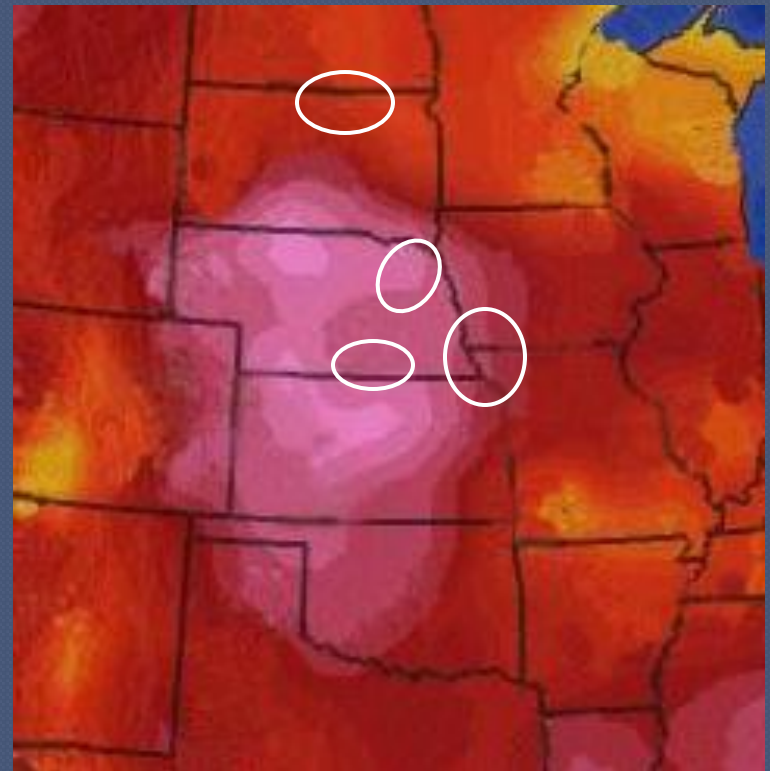
- ~ 1250 head of cattle

July, 2007  
N-Central  
SD

- > 2000 head of cattle

June, 2009  
Central NE

- 4000 head of cattle

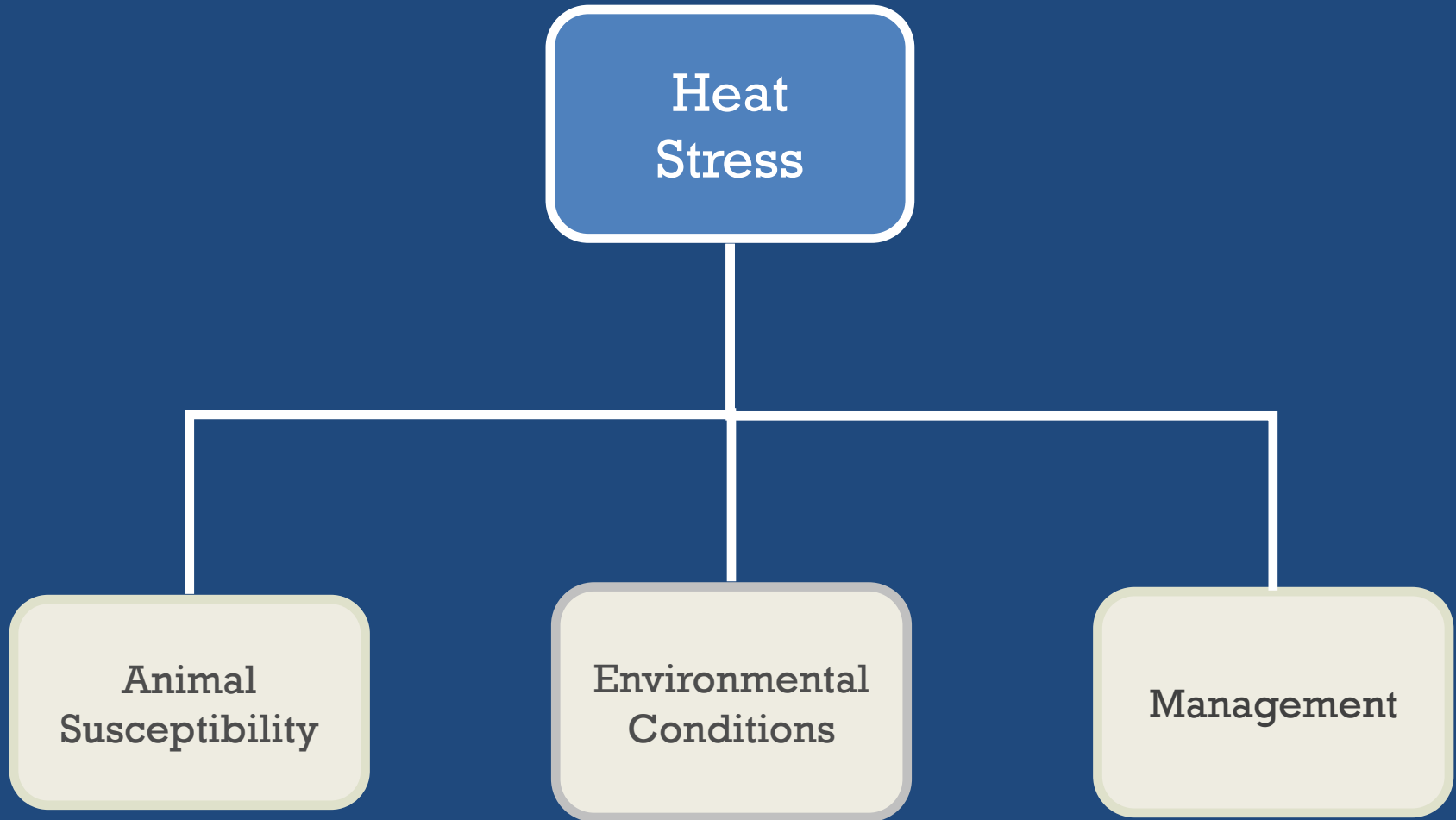


# Annual Economic Losses

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- Economic Losses for all animal species average \$2.4 Billion from heat stress
  - Dairy - \$897 Million
  - **Beef - \$369 Million**
  - Swine - \$299 Million
  - Poultry - \$128 Million

## 3 Components of Heat Stress





# Environmental

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Environmental  
Conditions

```
graph TD; A[Environmental Conditions] --- B[Temperature]; A --- C[Humidity]; A --- D[Solar Radiation]; A --- E[Wind Speed];
```

Temperature

Humidity

Solar Radiation

Wind Speed

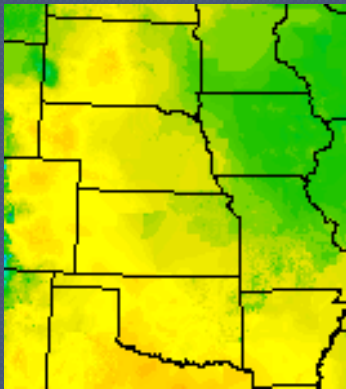
# Background

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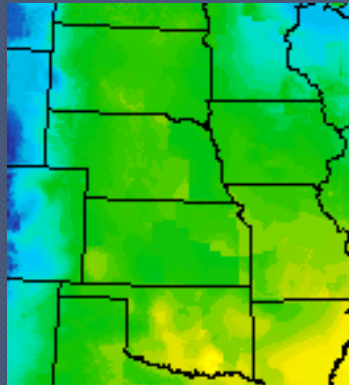
- Many Index Values have been developed
  - Black Globe
  - Temperature Humidity Index
  - Adjusted THI (Mader et al.)
  - Heat Load Index (Gaughan et al.)
  - Estimated Respiration Rate (Eigenberg et al.)
  - Others?

# Development of Management Tools

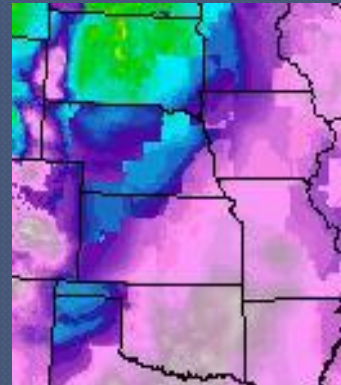
$$RR_{est} = 5.1t_{db} + 0.58RH - 1.7v_w + 0.039r_s - 52.8$$



Temperature



Relative Humidity

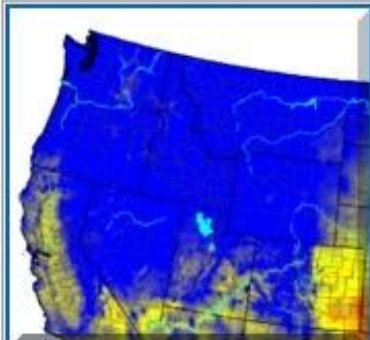


Wind Speed



Cloud Cover

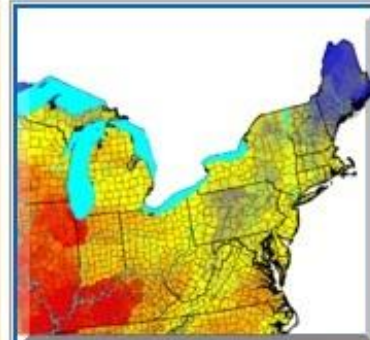
Click on a region for the 7 day forecast.



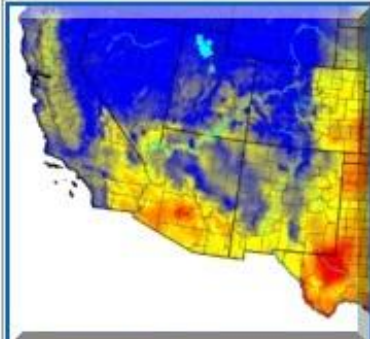
Tue, Jun. 7, 11 110607



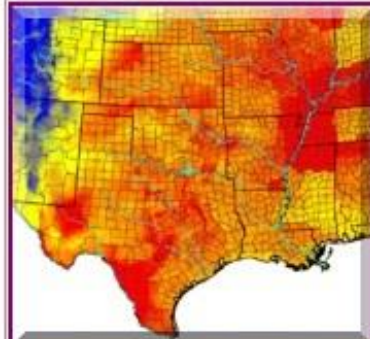
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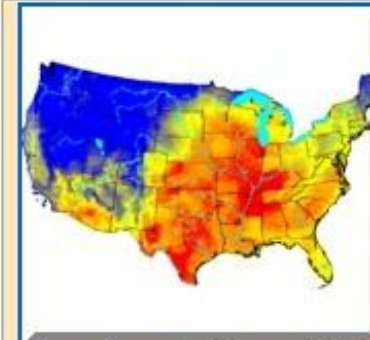
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Heat stress forecasts produced as a partnership of USDA-ARS with National Oceanic & Atmospheric Administration (NOAA) National Weather Service



**NORMAL**

**ALERT**

**DANGER**

**EMERGENCY**

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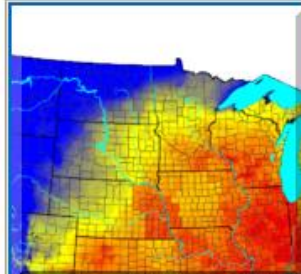
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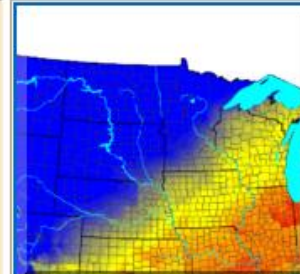
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# Forecast Originated on Tuesday, Jun. 7, 2011

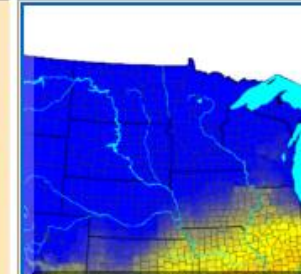
Click on a day for the detailed forecast map.



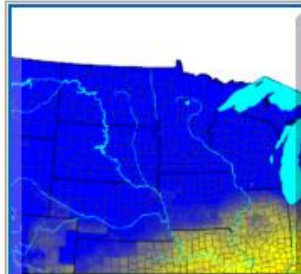
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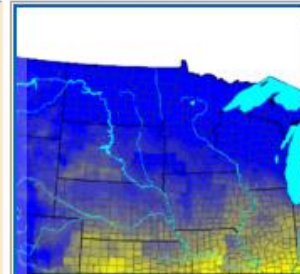
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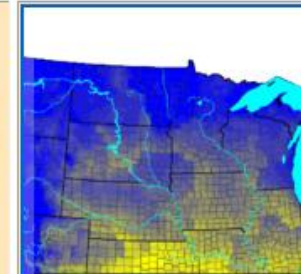
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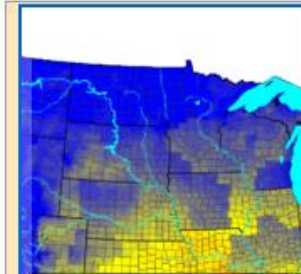
Fri, Jun. 10, 11 110607



Sat, Jun. 11, 11 110607



Sun, Jun. 12, 11 110607



Mon, Jun. 13, 11 110607

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## Forecast Originated on Tuesday, Jun. 7, 2011

### Forecast for Wednesday, Jun. 8, 2011



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Tue, 7



Wed, 8



Thu, 9



Fri, 10



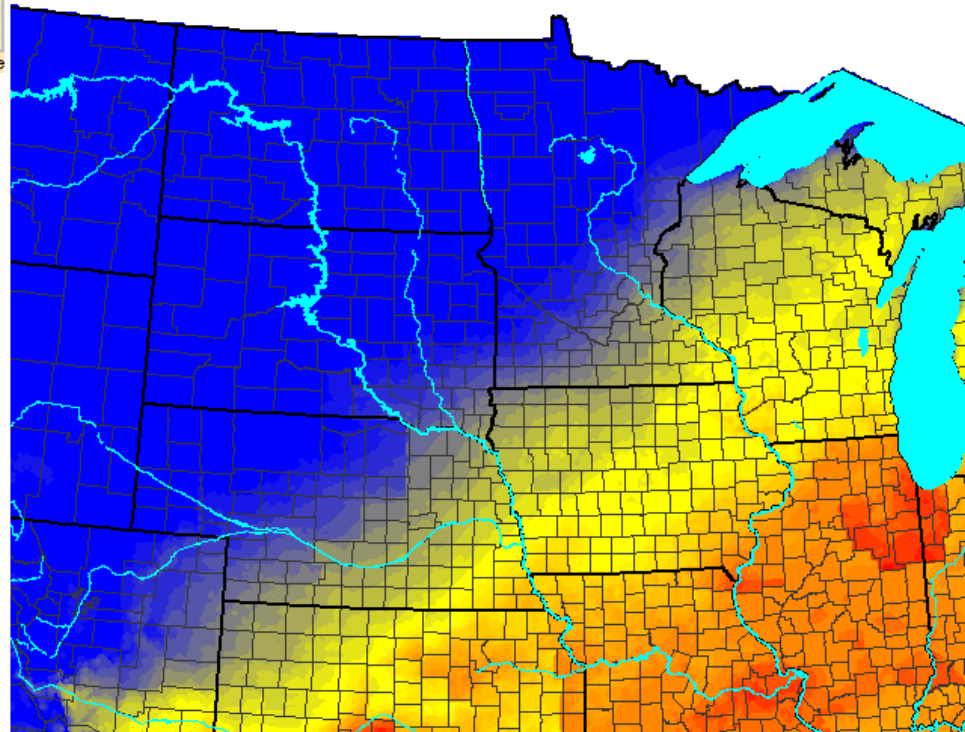
Sat, 11



Sun, 12



Mon, 13



Wednesday, Jun. 8, 2011

110607:1119

**NORMAL**

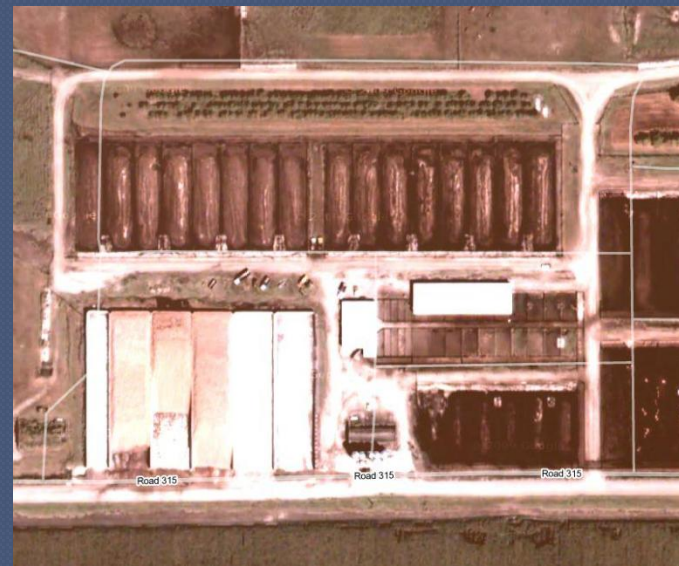
**ALERT**

**DANGER**

**EMERGENCY**

# Other Environmental Factors

- High overnight lows
  - High dew-point
- Extreme conditions for two or more consecutive days
- Saturated soils
  - Rain
  - Irrigated cropland
  - Leaking stock tanks
  - Soil Type ?
- Wind Breaks
- Local Landscape

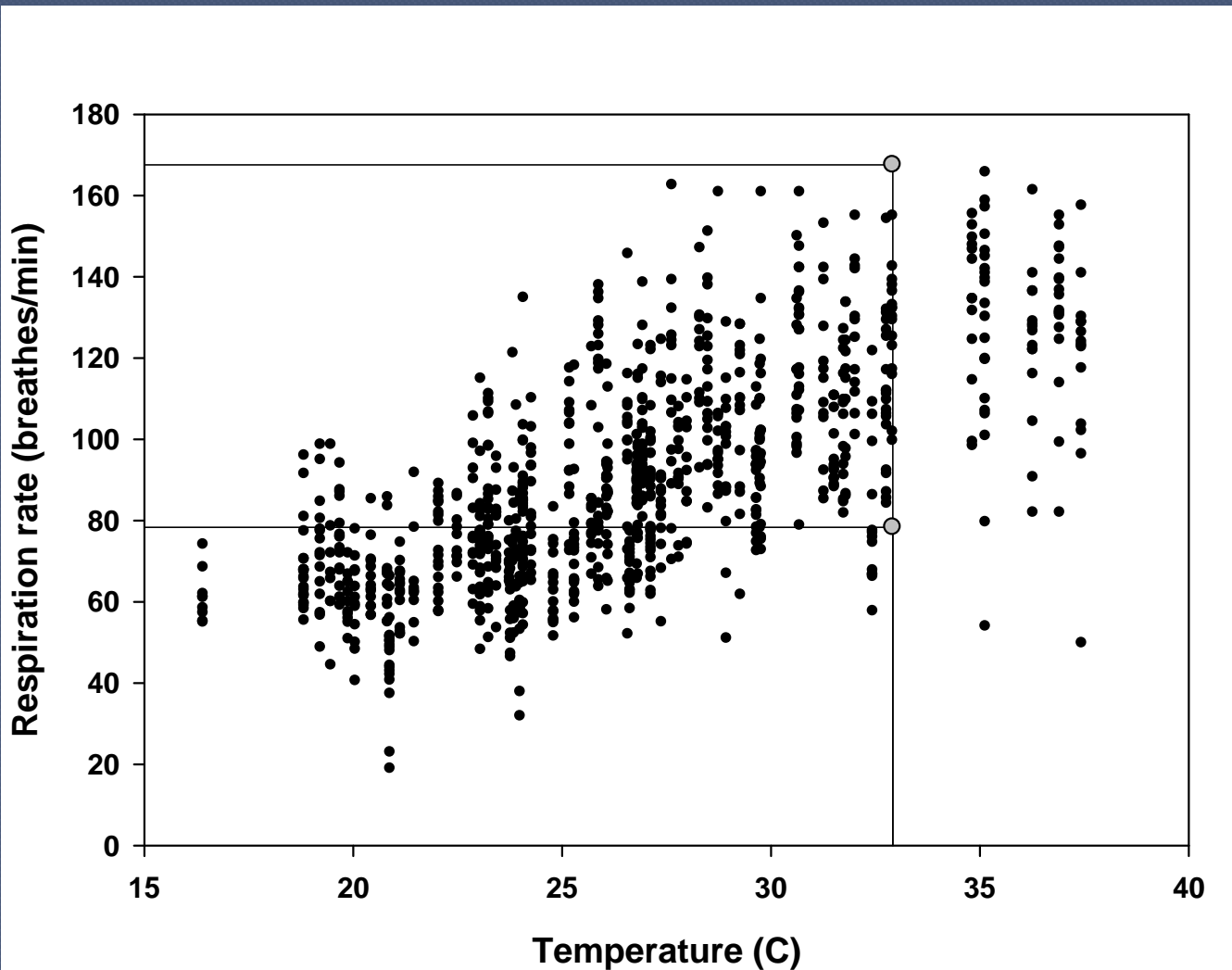


# Animal Susceptibility

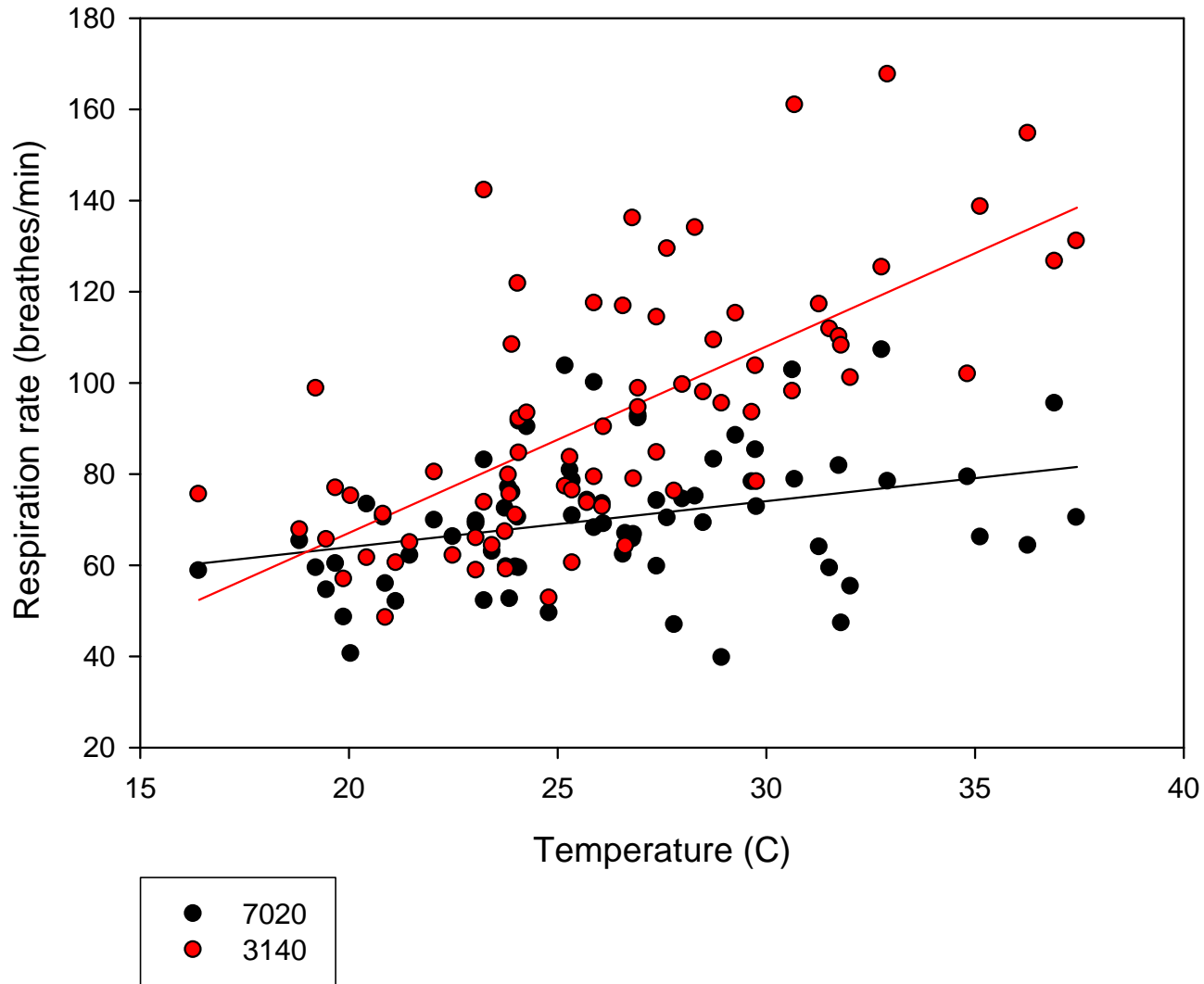




# Response to Heat Stress



# Animal Specific Response

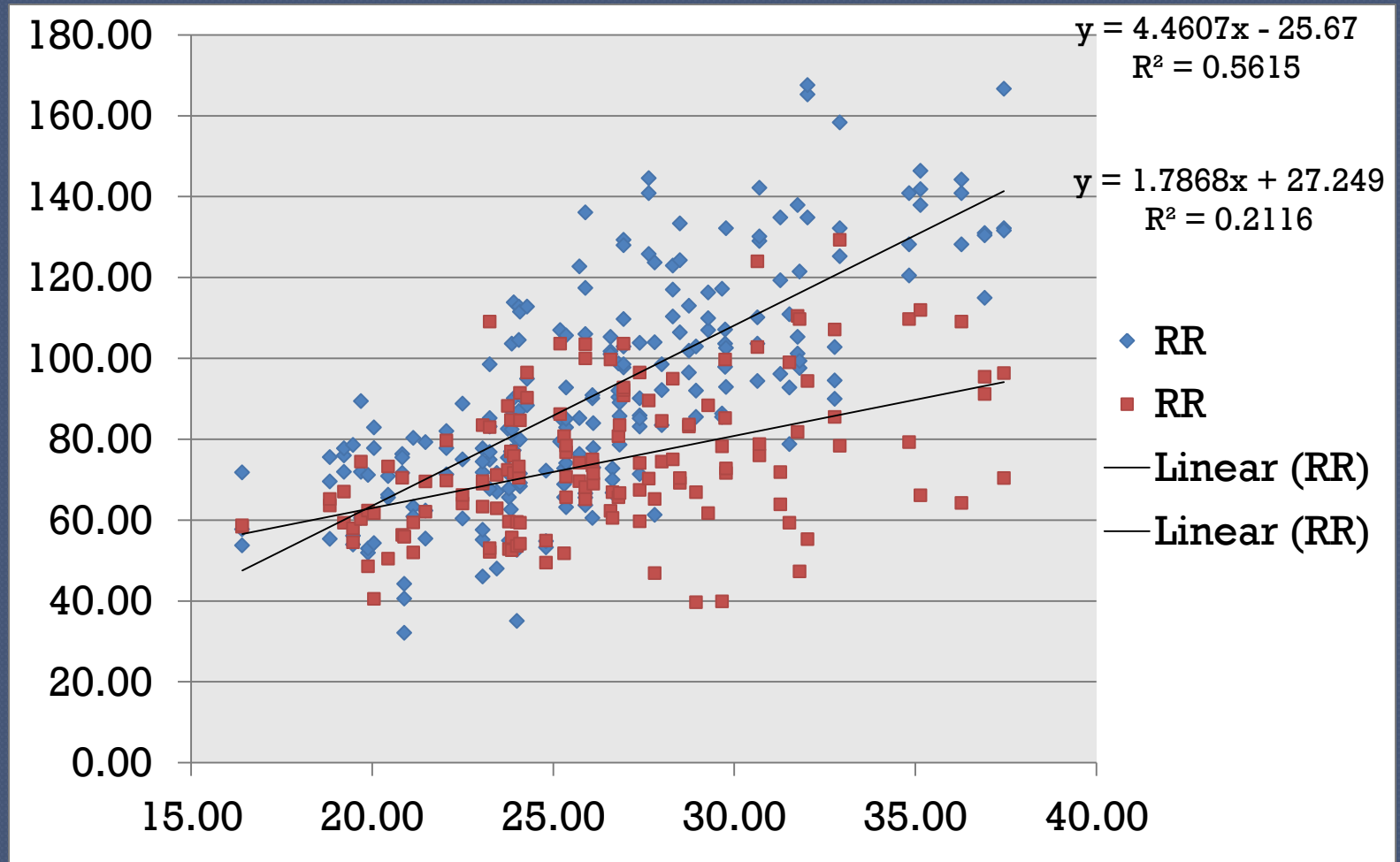


# Heat Stress Risk Factors

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- Are certain animal more prone to heat stress than others
- Color
- Health
- Condition Score
- New to the feedlot
- Excitable
- Acutely Stress
- Heifer vs. Steer
- Coat Thickness
- *Bos Taurus* vs. *Bos Indicus*

# 2007 Data – Susceptibility 2 vs. 5



# Management Options



# Sprinkling

# Sprinkling

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## ○ Pros

- Will aid in reducing the heat load on the cattle

## ○ Cons

- Can cause wet spots in the yard
- Could increase odors
- Could increase humidity
- Increased cost
- Animals may become dependant on it

Shade



# Shades

## ○ Pros

- Will eliminate a large portion of the solar load
  - Greatly reducing stress
- Has been shown to reduce or eliminate death losses in an extreme event



## ○ Cons

- Expensive
- Require maintenance
- Consider removing in the fall.
  - Need to consider snow load !

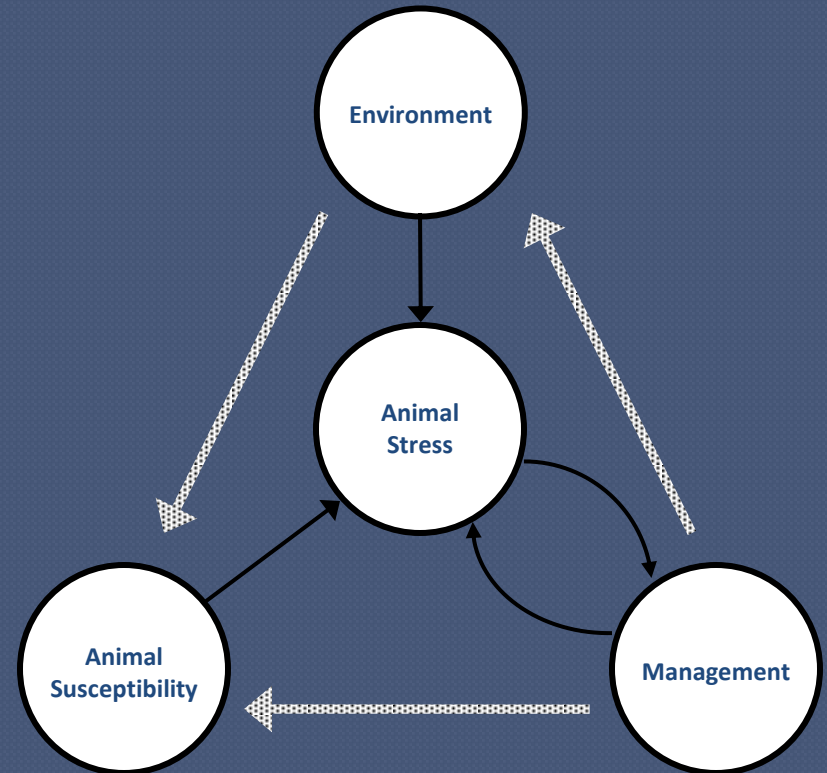
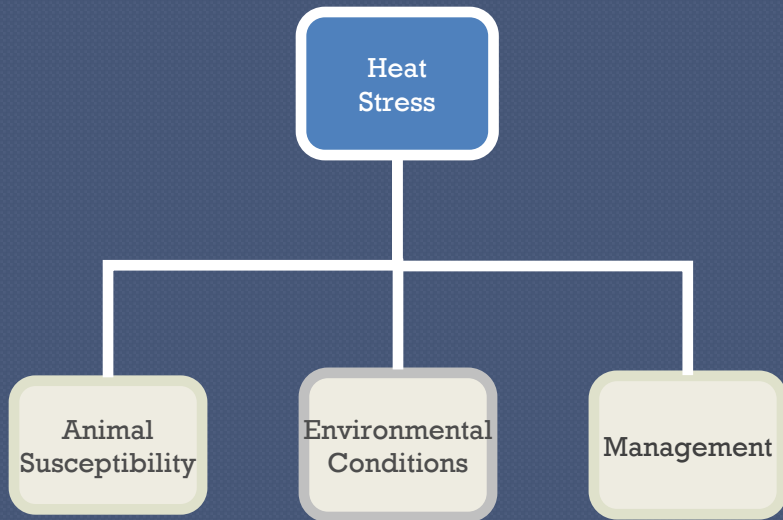


# Future Management?

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Precision Animal Management and Expert Systems

# Precision Animal Management



# Materials and Methods

- Study was conducted over 3 summers
- 384 head feedlot heifers of four different breed/crossbred
- Angus, MARC III, MARC I, and Charolais
- A total of 32 head/breed/year

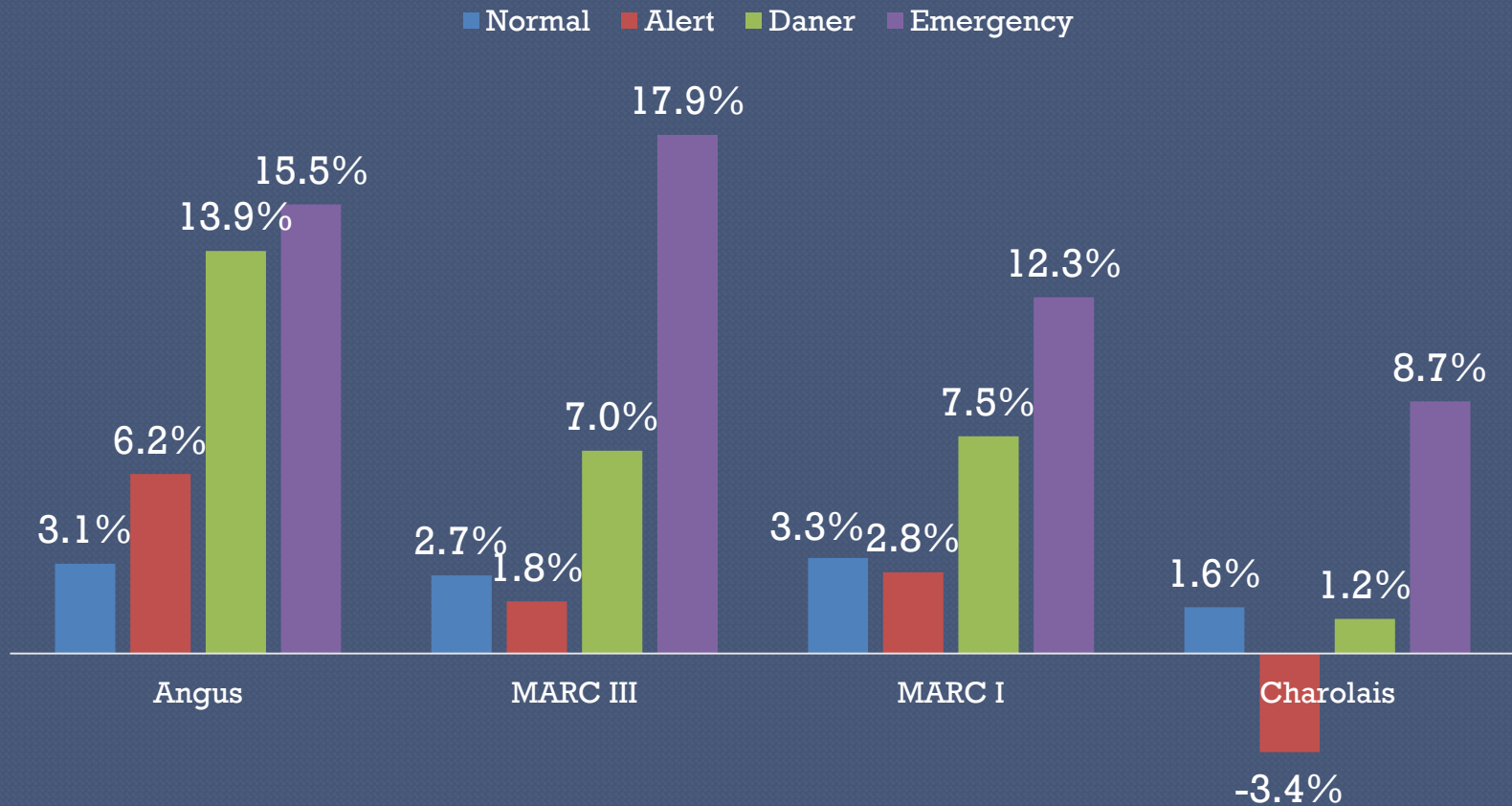


# Shade did not improve animal performance

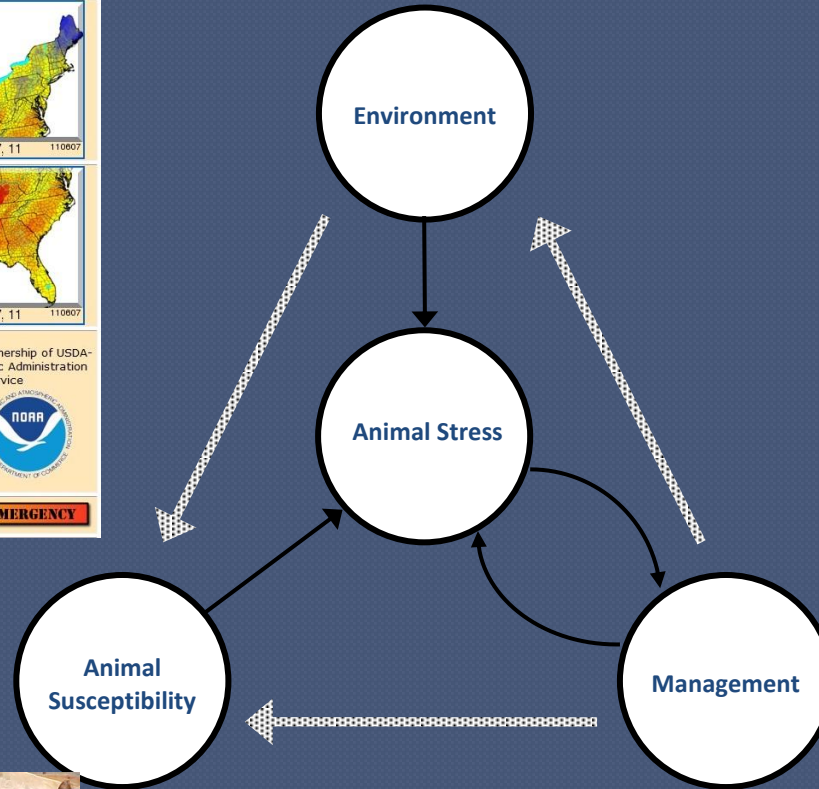
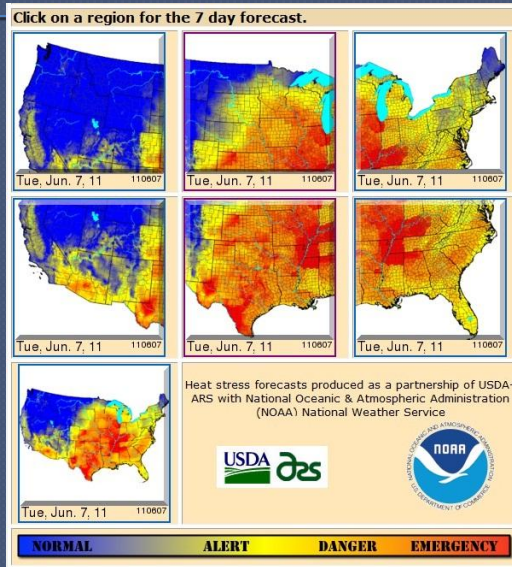
Breed	Angus	MARC III	MARC I	Charolais
Weight Gain	1.31±0.03	1.30±0.03	1.26±0.03	1.27±0.03



# Reduction in respiration rates with the additional of shade



# Precision Animal Management



# Thank you

