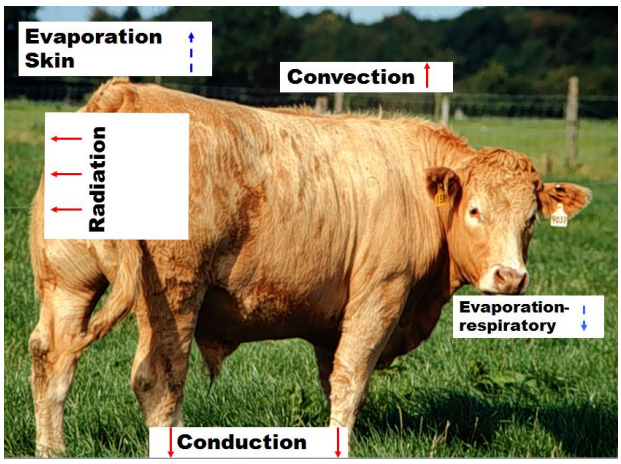

Heat Stress in Cattle

Animals produce heat from their metabolism and this heat can be lost to the environment by several routes:

- **Convection**: Transfer by flow of air
- **Radiation;** Transfer by emission of heat
- **Conduction;** Transmission by contact with another surface
- **Evaporation;** Transfer by evaporation of water e.g. panting or sweating

Compared to other animals cattle cannot dissipate their heat load very effectively. **Cattle do not sweat effectively and rely on respiration to cool down.** A compounding factor on top of climatic conditions is the **fermentation process within the rumen** which generates additional heat that cattle need to dissipate. Since cattle do not dissipate heat effectively they accumulate a heat load during the day and dissipate heat at night when it is cooler.

- Heavy cattle cannot handle heat stress compared to lighter weight cattle.
- Increased fat deposition prevents cattle from regulating their heat effectively.
- Solar radiation is a critical component that can lead to death loss from heat stress.
- Typically, more black hided cattle die during heat waves then other hide colours. Since cattle rely on respiration as a method to manage heat - respiratory function is important (Figure 1).
- Cattle that had severe respiratory disease early in the feeding period will have decreased ability to regulate their heat load.

Managing Heat Stress

- **Cattle water normal requirements** (Table 1). The water requirements of cattle increases during heat stress. Cattle lose water from increased respiration and perspiration (see figure 1). Additionally, consumption of water is the quickest method for cattle to reduce their core body temperature. Therefore, water consumption will be greater than typical metabolic requirements.
- Flies cause cattle to bunch up which decreases cooling. Minimizing breeding areas for flies and applying insecticides to decrease fly populations prior to heat stress times is worthwhile.
- During times of increased heat stress cattle should be observed closely to identify if additional strategies need to be implemented.
- As heat stress increases cattle will begin to salivate and respiration rates will increase. Eventually, cattle will begin to group together. In severe heat stress cattle will be open mouth breathing with a laboured effort.

- **Coat colour and type** - cattle with lighter coat colour tend to be more tolerant of heat.
- **Body condition** - heavier cattle tend to be more susceptible.
- **Adaptation** - cattle will adapt to heat provided the temperature change is gradual.
- **Health** - cattle with a prevailing health condition are less able to cope with changes in temperature.

Grazing management

- **Rotate cattle in the evening rather than the morning. The assumption is that the grass will be consumed in the evening and the 'heat of fermentation' or digestion is mostly dissipated by mid-morning, thereby reducing the heat load produced by the animal.**
- **Graze paddocks that allow access to temporary shade or trees during the heat of the day.**

Table 1. Approximate total daily water intake of cattle at 4°, 14° and 21°C

Animal type	Weight (kg)	Water intake (Litres) 4°C	14°C	21°C
Steers/Heifers/Bulls	180	15	19	22
Steers/Heifers/Bulls	270	20	25	30
Steers/Heifers/Bulls	360	23	30	35
Steers/Heifers/Bulls	[1]450	30	37	44
Steers/Heifers/Bulls	[1]540	35	42	50
Steers/Heifers/Bulls	[1]640	40	47	56
Suckler cow: Lactating		43	55	64
Suckler cow: Not Lactating		23	25	33
Mature bulls		33	41	48

[1]Estimated Source: National Research Council 1996

In hot weather, cattle requirements for water increase 1.5 to 2.0 times their normal requirement. Check water sources and ensure adequate access and availability for cattle.

The temperature humidity index

Temperature is the most important environmental factor affecting the physiological functions of cattle. Cattle have a thermal neutral zone (optimal experience of comfort in relation to environmental temperature), between the lower critical temperature **(LCT)** and the upper critical temperature **(UCT)** (Table 2). When cattle are within this thermo-neutral zone, they only have to expend minimal energy in order to maintain their body temperature and therefore, maintain performance. Once the ambient temperature goes above or below the thermo-neutral zone, the animal will be required to expend metabolic energy on heat production or heat dissipation therefore reducing the amount of energy available for other bodily functions. The LCT will vary depending on the condition of the animal's coat, as can be seen in Table 2. The UCT varies depending on humidity levels.

The temperature humidity index (THI), shown in Table 2, has been widely used as an indicator of thermal stress in livestock.

Table 2: Thom's Temperature and Humidity Index (extracted from: http;//www.eurometeo.com)

	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
42°	32	32	33	33	34	34	35	35	36	36	37	37	37	38	38	38
41°	31	32	32	33	33	34	34	35	35	35	36	36	37	37	37	37
40°	30	31	31	32	32	33	33	34	34	35	35	35	36	36	36	37
39°	30	30	31	31	32	32	33	33	34	34	34	35	35	35	36	36
38°	29	30	30	31	31	31	32	32	33	33	34	34	34	35	35	35
37°	28	29	29	30	30	31	31	32	32	32	33	33	33	34	34	34
36°	28	28	29	29	30	30	30	31	31	32	32	32	33	33	33	34
35°	27	27	28	28	29	29	30	30	30	31	31	32	32	32	33	33
34°	26	27	27	28	28	29	29	29	30	30	30	31	31	31	32	32
33°	26	26	27	27	27	28	28	29	29	29	30	30	30	31	31	31
32°	25	25	26	26	27	27	27	28	28	29	29	29	30	30	30	30
31°	24	25	25	26	26	26	27	27	27	28	28	28	29	29	29	30
30°	24	24	24	25	25	26	26	26	27	27	27	28	28	28	29	29
29°	23	23	24	24	25	25	25	26	26	26	27	27	27	27	28	28
28°	22	23	23	23	24	24	25	25	25	25	26	26	26	27	27	27
27°	22	22	22	23	23	23	24	24	24	25	25	25	26	26	26	26
26°	21	21	22	22	22	23	23	23	24	24	24	25	25	25	25	26
25°	20	21	21	21	22	22	22	23	23	23	23	24	24	24	25	25
24°	20	20	20	21	21	21	22	22	22	22	23	23	23	24	24	24
23°	19	19	20	20	20	21	21	21	21	22	22	22	22	23	23	23
22°	18	19	19	19	19	20	20	20	21	21	21	21	22	22	22	22

Up to 21°C	No discomfort
From 21 to 24°C	Less than half population feels discomfort
From 25 to 27°C	More than half population feels discomfort
From 28 to 29°C	Most population feels discomfort and deterioration of conditions
From 30 to 32°C	The whole population feels a heavy discomfort
Over 32°C	Very strong discomfort which may cause severe stress