Economic Development, Jobs, Transport and Resources

Heat, Cold & Animal Welfare

By Dr Ian Holmes

District Veterinary Officer, Benalla

Landcare Victoria

gecko CLaN

AGRICULTURE VICTORIA

Farming & Welfare

There are two approaches to ensure that welfare is optimised on a farm

- Fit the animal to the farm, or
- Fit the farm to the animal

Thermoregulation

- Livestock are warm blooded animals
- Maintaining body temperature takes energy.

- Energy for maintenance = a cost!
- Energy for production = profit!

Thermoregulation

- “Thermoneutral zone” requires no additional energy:
- High critical limit (~ +25 to +27°C)
- Low critical limit (-25°C to +25°C)

Physics: Heat Exchange

Depends on Temperature Gradient

- **Conduction**
  (insulation – animal & environment)
- **Convection**
  (insulation & cover/shelter)
- **Radiation**
  (coat colour, shade & shelter)
- **Evaporation**
  (most important when temp > 27°C)

Size & Shape

- Larger bodies are more resistant to temperature change
- Larger bodies have a lower surface area to body mass ratio
- Heat is exchanged through the skin
- A round body has the least skin for its body mass

Surface Area / Body Mass Ratio

- Fat round bodies are better adapted for cold (Eskimos & seals)
- More skin (folds) → greater heat exchange
- Thin bodies with long appendages are better adapted for heat (Masai & Brahman)

Size & Shape: Body Condition

Size & Shape: Breed

Coat Colour

- Light colours reflect heat
- Dark colours absorb heat

  Black Friesians absorb 92% sunlight

  White Friesians absorb 45% sunlight

(Lack of pigment in skin makes animals susceptible to skin cancer)

- So best is Light coat colour
  & Dark skin pigment

Coat Colour

Heat Exchange Factors

- Insulation - coat or fat
- Shade / direct sunlight
- Temperature difference between day and night - Can tolerate hot days if have cool nights
- Water / Mud / Sprinklers
- Groups vs Single (Mass & Shelter)
  eg Penguins

Wind Speed: Wind Chill Factor

- Wind Chill Factor (Cold Stress)
  = Effective Temperature

3km/hour ~= 1°C decrease in effective temperature.

- eg if trees reduce wind speed from 60 km/hour to 30 km/hour this increases the effective temperature on animal by 10°C.

Wind Speed: Wind Chill Factor

- Cold + Wind **+ Wet**
- Decreased temp → increased shivering ie wasted energy
- Western Districts:

Conception Rate (in dairy cows) is inversely proportional to rainfall and grain price

What Can You Do for Cold?

- Provide shelter from rain & wind
- Feed fibre to ruminants
- Ensure stock have a dry (high?) insulated place to lie down
- Keep stock in good condition
- Shear at the right time
- Coats for lambs & calves eg “Woolovers”

Where does Heat Load come from?

- **External**
- Air temperature
- Relative Humidity %
- Direct Sunlight
- **Internal (Metabolic)**
- Feeding / Digestion
  Fibre vs sugars
- Muscle activity
- Higher production → higher heat load
  (milk, growth, wool, pregnancy)

Temperature Humidity Index.

DEG F	DEG C	RELATIVE HUMIDITY 0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
72	22.2																				72	72
73	22.8																		72	72	73	73
74	23.3																72	72	73	73	74	74
75	23.9															72	72	73	73	74	74	75	75
76	24.4													72	72	73	73	74	74	75	75	76	76
77	25.0												72	73	73	73	74	74	75	75	76	76	77
78	25.6											72	73	73	74	74	75	75	76	76	77	77	77
79	26.1										72	73	73	74	74	75	76	76	77	77	78	78	79
80	26.7									72	72	73	73	74	74	75	76	76	77	78	78	79	79	80
81	27.2								72	72	72	73	74	74	75	76	77	77	78	78	80	80	81
82	27.8								72	73	73	74	74	75	76	77	77	78	79	79	80	81	81	82
83	28.3						72	73	73	74	74	75	76	77	78	78	79	80	80	81	82	82	83
84	28.9					72	73	73	74	75	75	76	77	78	78	79	80	80	81	82	83	83	84
85	29.4				72	72	73	74	75	75	76	77	78	78	79	80	81	81	82	83	84	84	85
86	30.0			72	73	74	74	75	76	77	78	78	79	80	81	81	82	83	84	84	85	86	
87	30.6		72	73	73	74	75	76	77	77	79	79	80	81	81	82	83	85	85	85	86	87	
88	31.1	72	72	73	74	75	75	76	77	78	79	80	81	81	82	83	84	85	86	86	87	88	
89	31.7	72	73	74	75	76	76	77	78	80	80	80	81	82	83	84	85	86	86	87	88	89	
90	32.2	72	73	74	75	76	77	78	79	79	80	81	82	83	84	85	86	86	87	88	89	90	
91	32.8	73	74	75	76	76	77	79	79	80	81	82	83	84	85	86	86	87	88	89	90	91	
92	33.3	73	74	75	76	77	78	79	80	80	82	83	84	85	85	86	87	88	89	90	91	92	
93	33.9	74	75	76	77	78	79	80	80	81	83	83	84	85	86	87	88	89	90	91	92	93	
94	34.4	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	
95	35.0	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	
96	35.6	75	76	77	78	79	80	81	82	83	85	85	87	88	89	90	91	92	93	94	95	96	
97	36.1	76	77	78	79	80	81	82	83	84	85	86	87	88	89	91	92	93	94	95	96	97	
98	36.7	76	77	78	79	80	82	83	84	84	86	87	88	89	90	91	93	94	95	96	97	98	
99	37.2	76	78	79	80	81	82	83	84	85	87	88	89	90	91	92	93	94	96	97	98	99	
100	37.3	77	78	79	80	82	83	84	85	86	87	88	90	91	92	93	94	95	97	98	99		
101	38.3	77	79	80	81	82	83	85	86	87	88	89	90	92	93	94	95	96	97	99			
102	38.9	78	79	80	81	83	86	85	86	87	89	90	91	92	94	95	96	97	98				
103	39.6	78	80	81	82	83	86	86	87	88	89	91	92	94	95	96	96						
104	40.0	79	80	81	82	84	85	86	88	89	90	91	93	94	95	96							
105	40.6	79	81	82	83	84	85	87	88	89	91	92	94	95	96	97							
106	41.1	80	81	82	86	85	86	88	89	90	92	93	94	95	97	98							
107	41.7	80	81	83	86	85	87	88	89	91	92	93	95	96	98								
108	42.2	81	82	83	85	86	87	89	90	92	93	94	96	97									
109	42.3	81	82	86	85	87	88	89	91	92	94	95	96	98									
110	43.3	81	83	86	86	87	88	90	91	93	94	96	97										
111	43.9	82	83	85	86	88	89	91	93	94	95	96	98										
112	44.4	82	86	85	87	88	90	91	94	94	96	97											
113	45.0	83	86	86	87	89	90	92	95	95	96	98											
114	45.4	83	85	86	88	89	91	92	94	96	97												
115	46.1	86	85	87	88	90	91	94	95	96	98												
116	46.7	86	86	87	89	90	92	94	95	97													
117	47.2	85	86	88	89	91	93	94	96	98													
118	47.3	85	87	88	90	92	93	95	97														
119	48.3	85	87	89	90	92	94	96	97														
120	48.9	86	88	89	91	93	94	96	98														
121	49.4	86	88	90	92	93	95	97															

NO STRESS

MILD STRESS

MODERATE STRESS

SEVERE STRESS

DEAD COWS

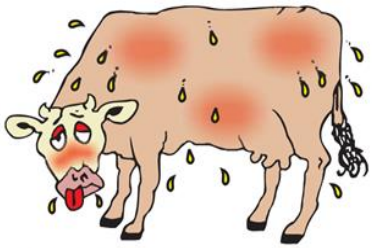
Source: Dr Frank Wiersama (1990) Dept. of Ag Eng, The University of Arizona, Tuscon, Arizona

Temperature Humidity Index (THI) is determined by equation from the relative humidity and the air temperature.

The principle of THI is that as the relative humidity at any given temperature increases, then the comfort factor decreases.

It becomes progressively more difficult for the body to cool itself. Results show that milk production begins to be affected above a **THI of 78** which will occur at 27ºC and 80% relative humidity, or 31ºC at 40% relative humidity.

Say temperature = 33.3ºC
Relative humidity = 85%
Reading is 89
This figure is on the edge of moderate heat stress, going into **severe.**



How Do Animals Cope with Heat?

- Sweating
- Panting - loss of CO2, pneumonia
- Salivation / drooling
- Conduction - standing/lying
- Drinking
- Vasodilation - away from gut
- Can store heat as increased body temperature

How Do Animals Cope with Heat?

- Behaviour
  - Seek shade
  - Seek breezes
  - Seek water / mud
- Less activity eg grazing, mating
- Active at night not day
- Eat less

What Can You Do for Heat?

- Select suitable animals for the environment.

  "Fit the animals to the farm".

- Alter management

  -time of calving

  -irrigate pasture

  -steers vs breeders

- Provide accessible water

What Can You Do for Heat?

- Move/graze at night
- Maintain/improve pasture quality
- Provide Shade

Dairy

- Feed concentrates during the day
- Do heat detection at night
- Air movement - fans
- Sprinklers

Shade & Shelter for Heat:

- Trees & shrubs
- Buildings: Solid roof
  >4 metres high, white roof, vented,
  north - south orientation
- Or permeable roof eg slats / shadecloth
- Other animals

How Do Animals Cope with Cold?

- Seek shelter, preferably dry
- Huddle together (penguins)
- Decrease surface area exposed to wind
  eg turn tails to wind
- Don't go out to graze (Preg tox & Grass Tetany)
- Shiver → decreased production

Ewes & Lambs Seek Shelter

Lambs sheltering in the lee of a tall wheatgrass hedge

Shelter Belt Design for Animals

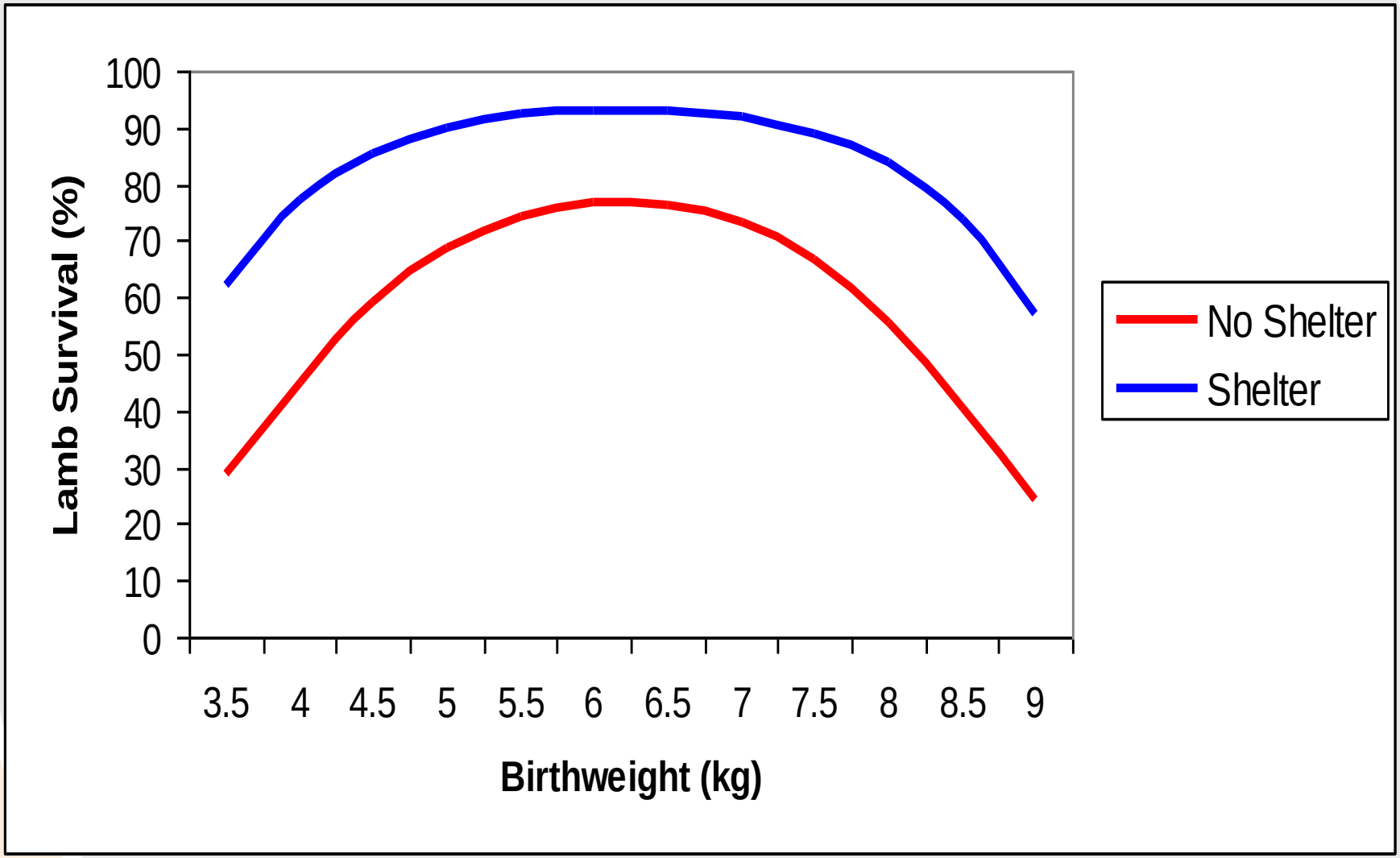
- Need low dense shelter for ~100% reduction in wind speed
  eg Phalaris, tall wheat grass, rushes, etc
- & high porous shelter
- Note open spaces under or around tall trees create wind tunnels which increase the wind speed on animals.
- Straight lines are bad
  → walking tracks = drains

Lamb Losses

- Shelter increases survival by
  8% for singles
  22% for multiples
  (Average of All Australian Studies)

- If half your ewes had twins and half singles for 1,000 ewes at $100 per lamb weaned (500 ewes with twins & 500 with singles)
  = **$15,000 loss** in an average year.

Shelter & Lamb Survival



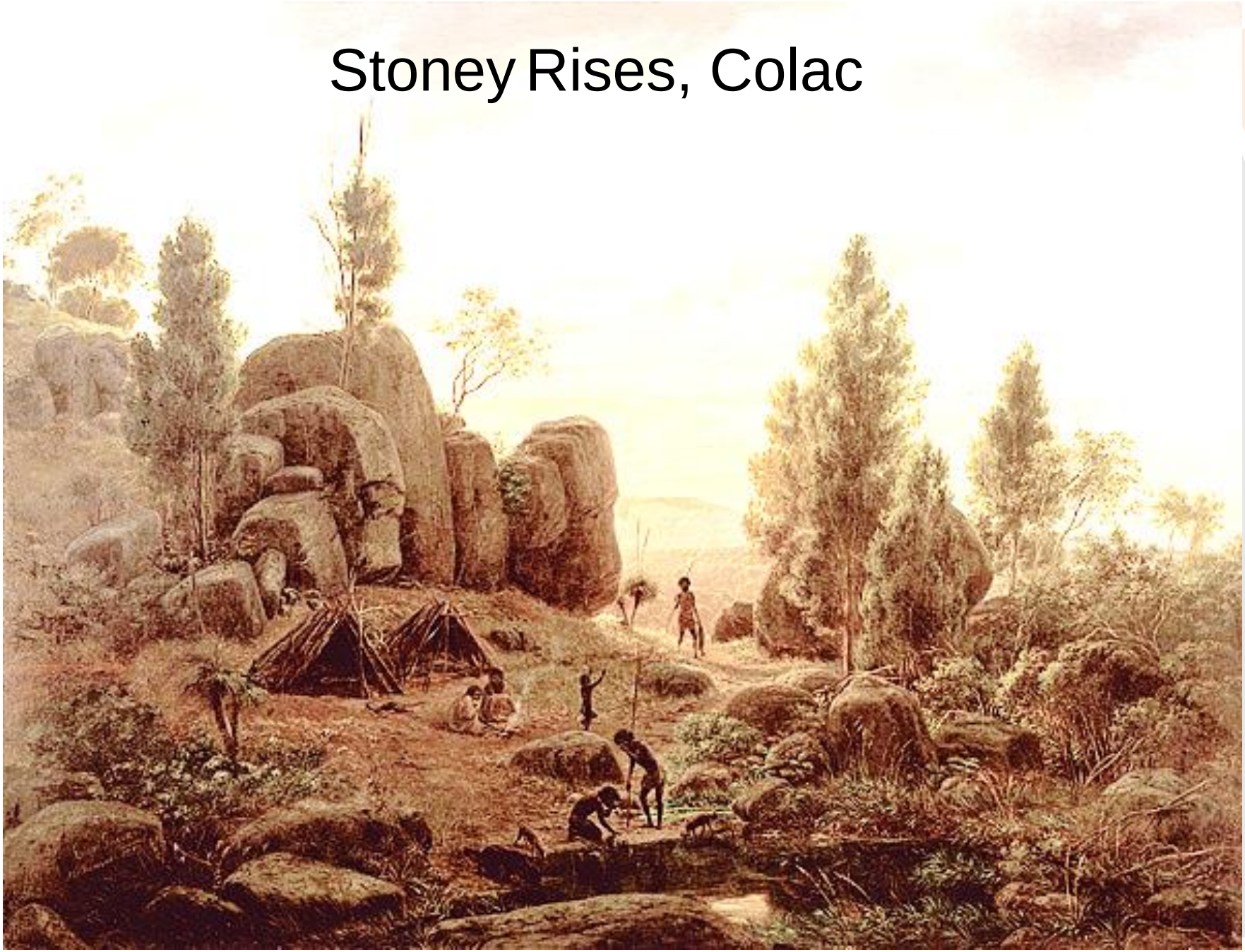
Nature is Messy

You must learn to tolerate and encourage mess!

- A messy environment = good
- A “clean barren” environment is bad
- Rough boundaries are good
- Straight lines are bad!

eg Stoney Rises, Colac

Stoney Rises, Colac



eg granite outcrops


Flat Open Pasture in “Clean” Paddocks

Great shade for summer, but has wind tunnels, so is poor for winter.

Solid Tree Belt and Good Rushes for local shelter.

Hedges & Tree belts in France

The ideal summer shelter

Animals are not Necessarily Intelligent!

- You may need to train the animals to seek shade or shelter (and water).
- Newborns especially need training or assistance.

Welfare: Public Perception

- Consumers and animal rights groups are becoming more concerned and active about animal welfare.

- Market Quality Control standards usually have welfare conditions in them. Eg
  - JBS Farm Assurance program
  - EU Accreditation
  - McDonalds

Welfare: The Law

- **Prevention of Cruelty to Animals Act 1986**
- **Cruelty 9(1) c** “does or omits to do an act with the result that unreasonable pain or suffering is caused, or is likely to be caused to an animal”

- **9(1) f** “is the owner or the person in charge of an animal which is confined or otherwise unable to provide for itself and fails to provide the animal with proper and sufficient food, drink or shelter”


Good shade and shelter leads to
happy animals & wealthy farmers!