Climate Change & Livestock Agriculture:

threats to opportunities

Outline:
Climate crisis
Heat load/stress
Drought strategies
Cold stress
Earning C credits
Reducing GHGe
& Defending beef

TIME SPOTLIGHT STORY WHAT AMANDA GORMAN LEARNED FROM AN UNPRECEDENTED YEAR SIGN IN

CLIMATE

'Cows Are the New Coal.' How the Cattle Industry Is Ignoring the Bottom Line When It Comes to Methane Emissions

Cow farming is a significant source of methane emissions, a potent greenhouse gas contributor to climate change. Fabrice Coffrini—/AFP/Getty Image

BY ARYN BAKER DECEMBER 2, 2021 10:57 AM EST

Peter Windsor
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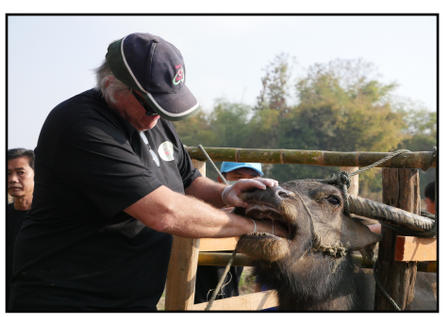
Professor Emeritus

Sydney School
of Veterinary Science

THE UNIVERSITY OF SYDNEY

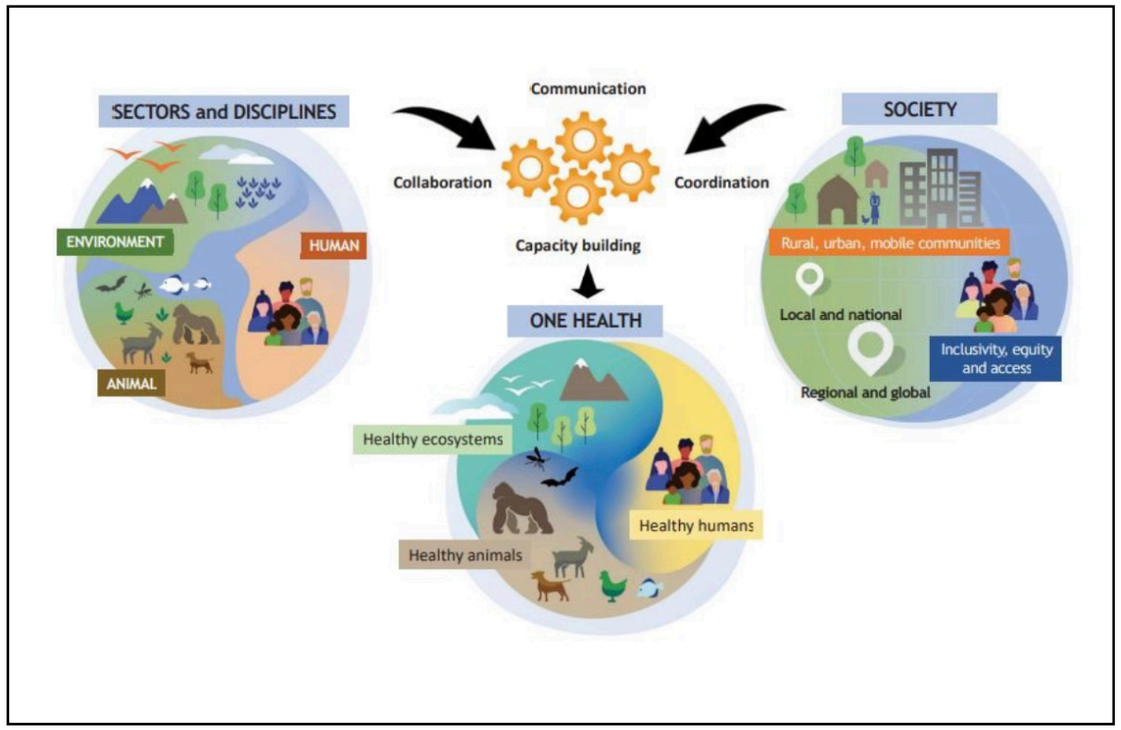
Fig. 3. Collection of a blood sample from the coccygeal vein of a carabao on Catanduanes Island for serosurveillance for foot and mouth disease in 1999.

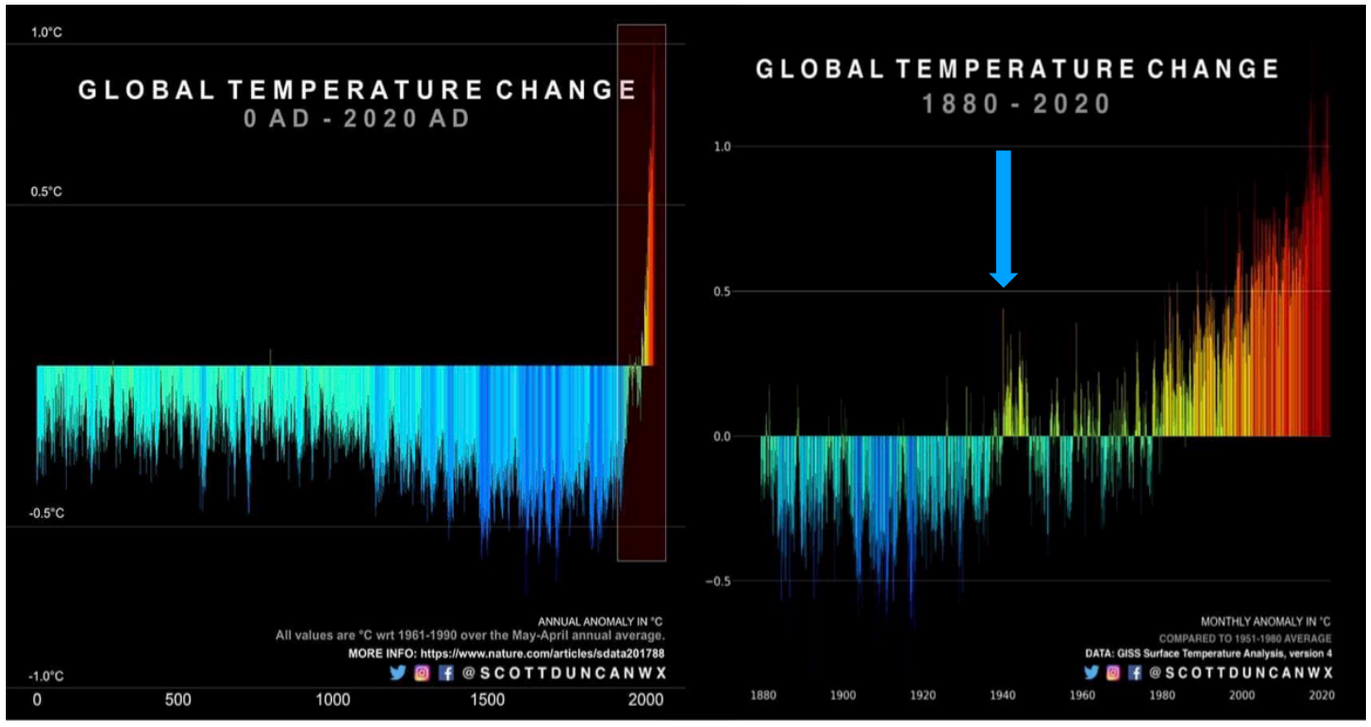


Climate Crisis: volatility in a land of droughts, flooding plains & seriously increasing disinformation

If you are not vaccinated you are on the side of the virus. Prof Peter Doherty

If you are not supporting action to address anthropogenic climate change you on the side of a self-destructive fossil-fuel pollution industry. PW





Climate change boosted Australia bushfire risk by at least 30%

Pallab Ghosh
Science correspondent, BBC News

4 Mar 2020 | Science & Environment

The 2019-2020 fire season was particularly challenging for Australia

Scientists have published the first assessment quantifying the role of climate change in the recent Australian bushfires.

Global warming boosted the risk of the hot, dry weather that's likely to cause bushfires by at least 30%, they say.

Canadian doctor diagnoses woman in British Columbia with 'climate change' after breathing problems during summer of heatwaves and wildfires

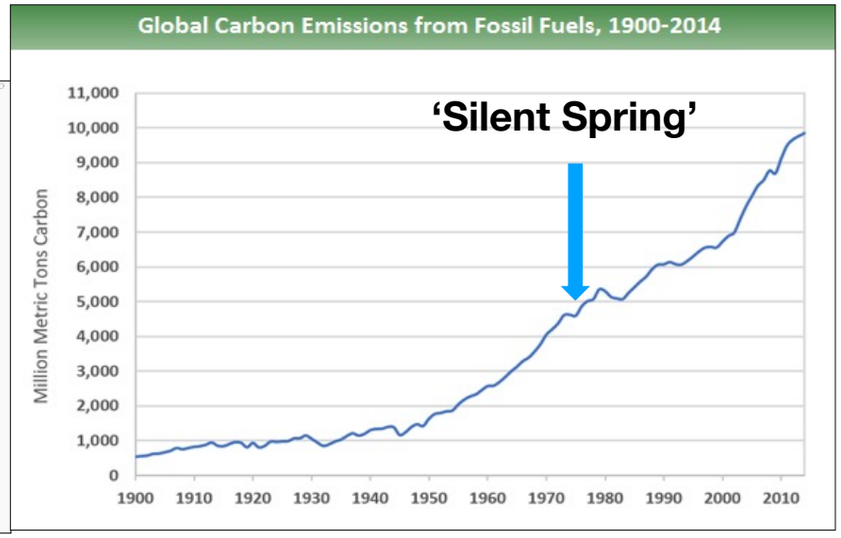
17:14, Wednesday 10 November 2021

After 100mm in 24 hours, the usually dry Todd River was a torrent this morning. (Supplied: Eloise Beyer)

BOM forecasts heavy rain, flooding as more wet weather descends upon eastern Australia

By Kate Doyle
Updated 10 Nov 2021 5:27pm AEDT

November rain records have already been smashed through Australia's west and centre — now the focus is moving east.



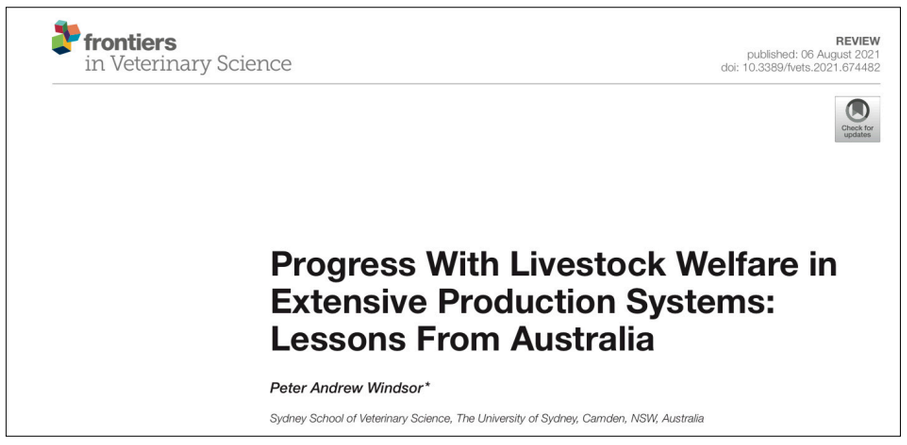
Climate Crisis: ENSO: El Niño v La Ninja & SOI; IOD: Indian Ocean Dipole; SAM: Southern Annular Mode

Australia's climate warmed on average by 1.44± 0.24◦C since 1910
Increasing frequency of extreme heat events
Declines of ~16% (April-October) and ~20% (May-July) in rainfall, since 1970
SE Australia, a decline of ~12% (April-October) rainfall since late 1990s
Decreasing streamflow at most gauges across southern Australia since 1975
Rainfall & streamflow increased across parts of northern Australia since 1970's

Radiative forcing of GHG's: CO2/CH4/N2O = greenhouse effect & acidification of waters
Climate change = **increased impacts of temperature extremes**
Periodic heat-associated stress or cold-induced hypothermia losses
Increased vigilance & careful management required to reduce:

- temperature-induced & nutritional-deficiency stress **during & after drought**
- **risk of extreme fire weather** and the length of the fire season
- across large parts of the country since the 1950s, especially in southern Australia

This millenium: 2 most severe drought periods on record

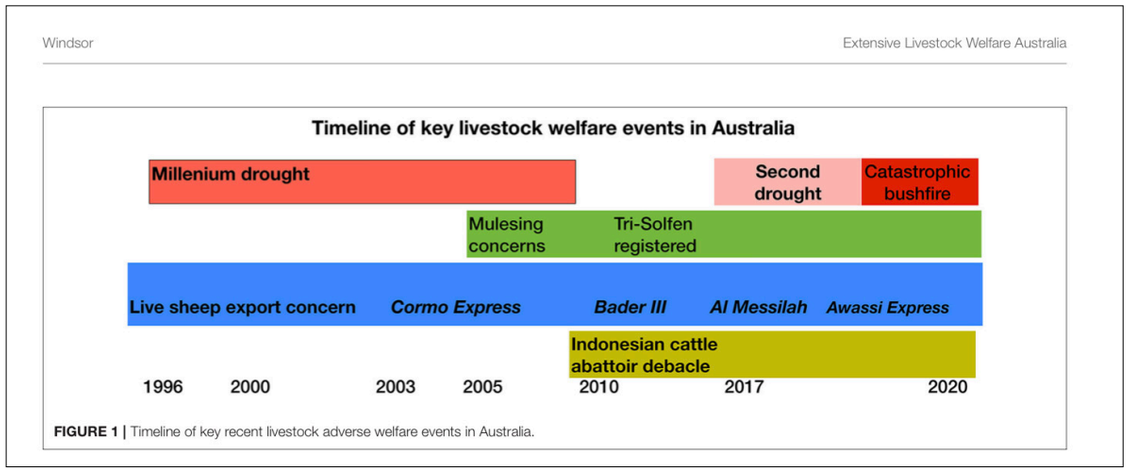

frontiers in Veterinary Science

REVIEW
published: 06 August 2021
doi: 10.3389/fvets.2021.674482

Progress With Livestock Welfare in Extensive Production Systems: Lessons From Australia

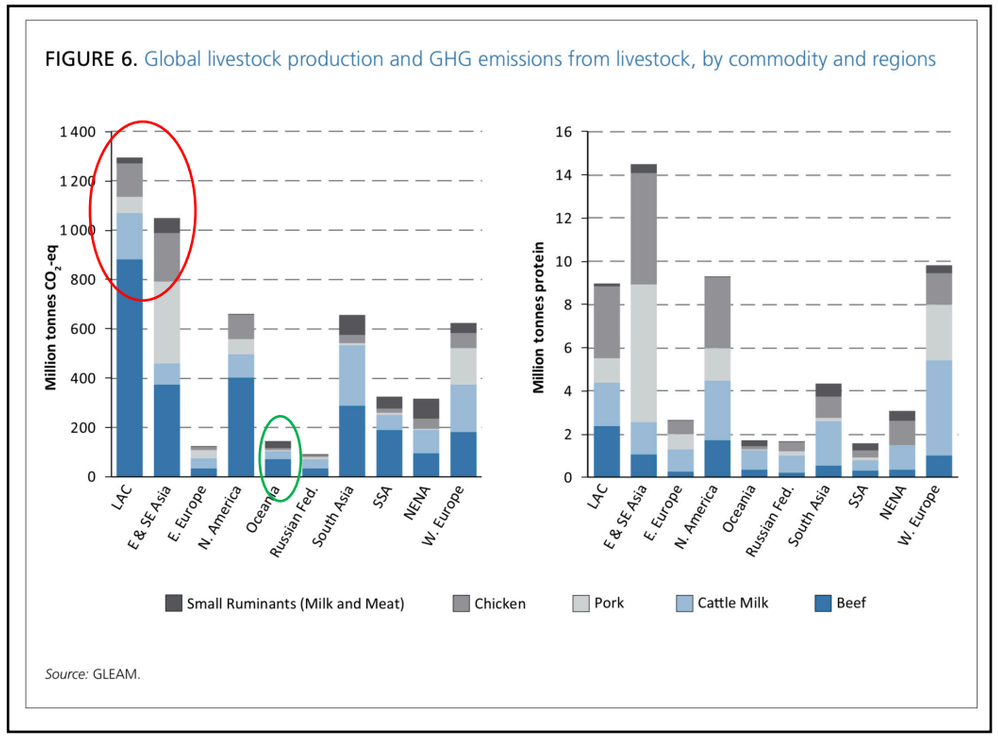
Peter Andrew Windsor*

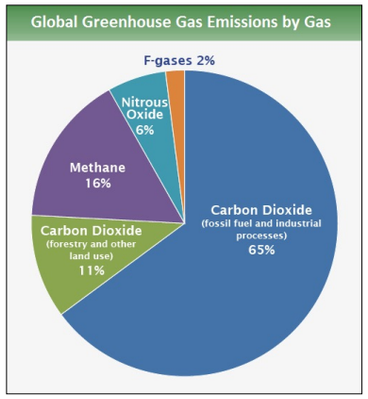
Sydney School of Veterinary Science, The University of Sydney, Camden, NSW, Australia

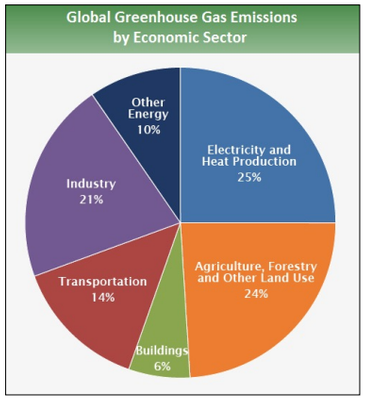


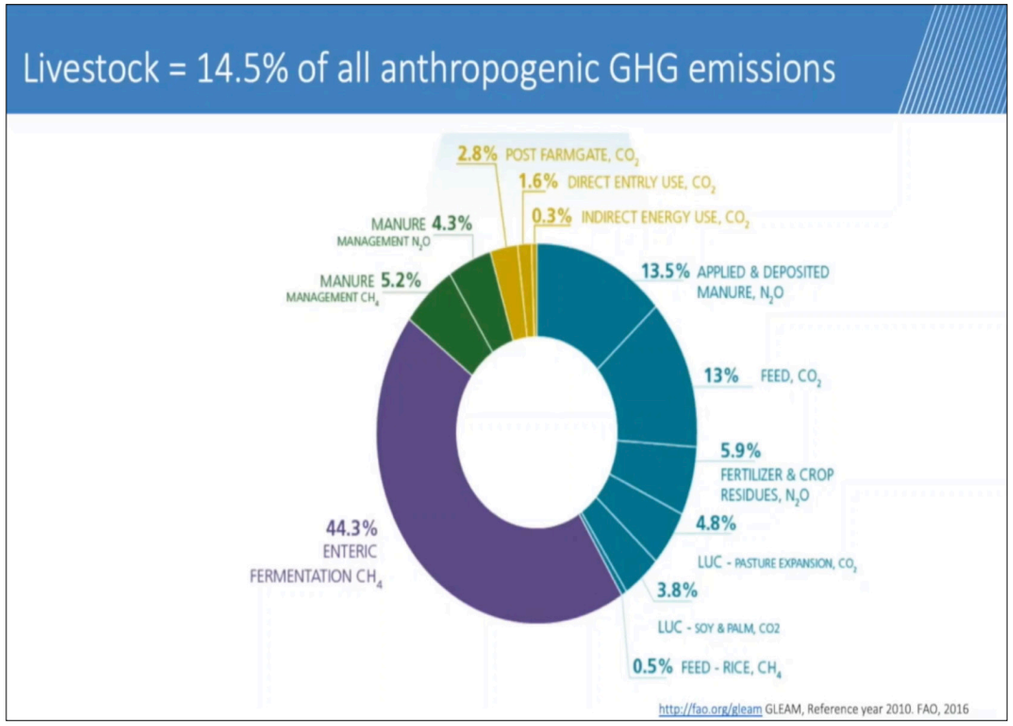
Understanding Geological v Biogenic Carbon Cycles

Geological cycle emissions from industrial **fossil fuel activities**:
esp. coal & gas leakage: wells, drill sites, pipelines etc
Relatively recent polluting transfers of C from long-term geological sinks to the atmosphere; i.e transferring C **from 'slow' geological C cycle to 'fast' biological C cycle**
Emissions from biogenic sources recycle C between the atmosphere and biosphere; they **do not** contribute to increased CO2 concentrations
Ag mainly an emitter of CH4 & N2O









Source: FAO (2013)

Source: IPCC (2014)

Heat & Cold Stress reflect thermo-neutral zones

High ambient temperature, relative humidity & solar radiation reduce an animal's ability to dissipate body heat, **increasing core body temperature**

Thermo-neutral zone: range temp. where **no energy required maintain desirable core temp.**:

- *Bos taurus*: 2°C - 21°C
- *B. indicus*: 10°C - 27°C
- W. Buffalo: 13°C - 18°C
- Sheep: fleece = tolerant but variable vulnerability

TABLE 27 ADG and Feed Efficiency of Lambs Grown at Different Ambient Temperatures and Fed *Ad Libitum*

Temperature (°C)	ADG (g)	Feed Efficiency (gain/feed)
- 5	73	0.04
0	130	0.08
5	170	0.11
10	192	0.15
15	197	0.14
20	184	0.13
30	107	0.08
35	41	0.04

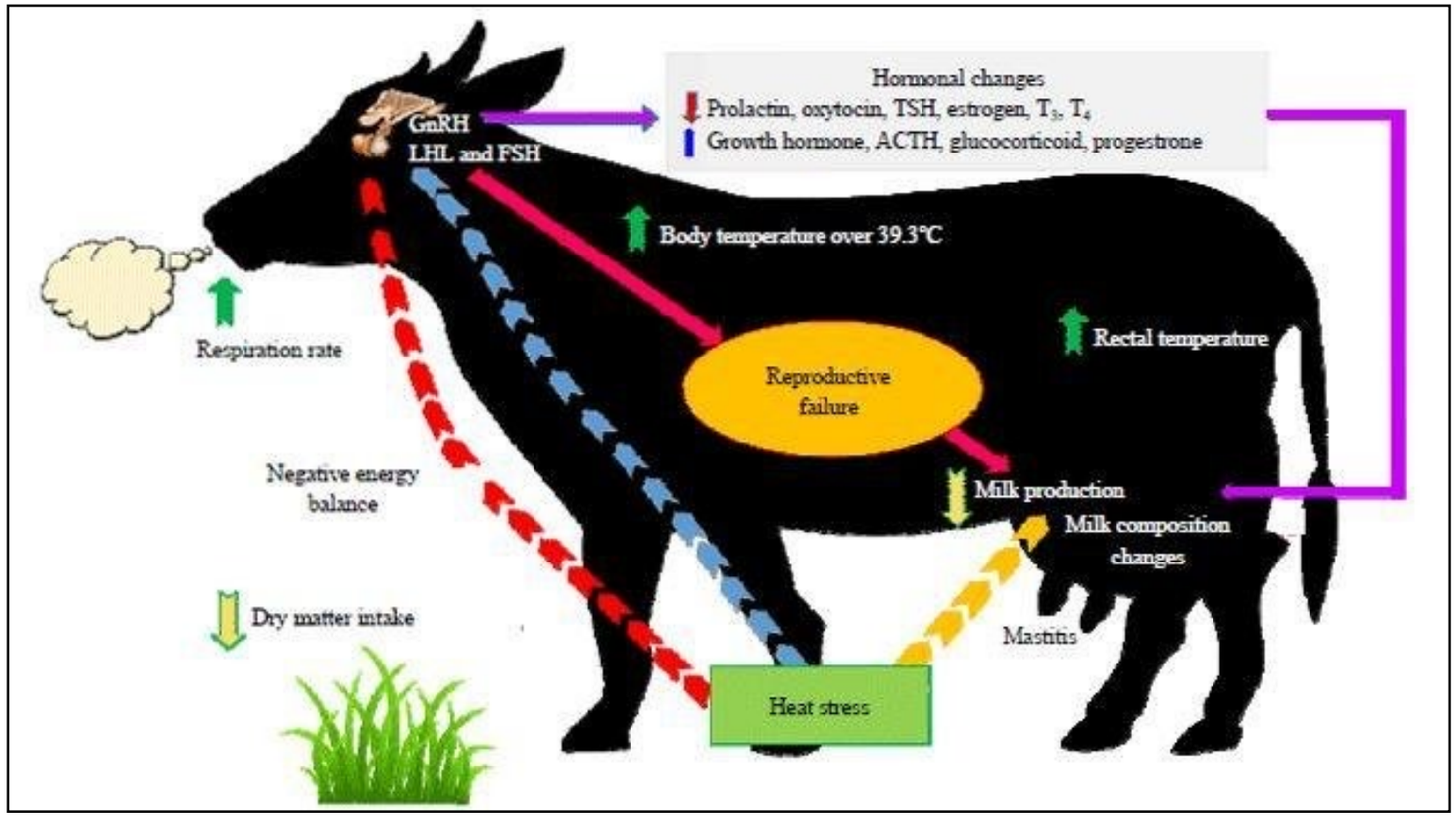
SOURCE: Ames and Brink, 1977.

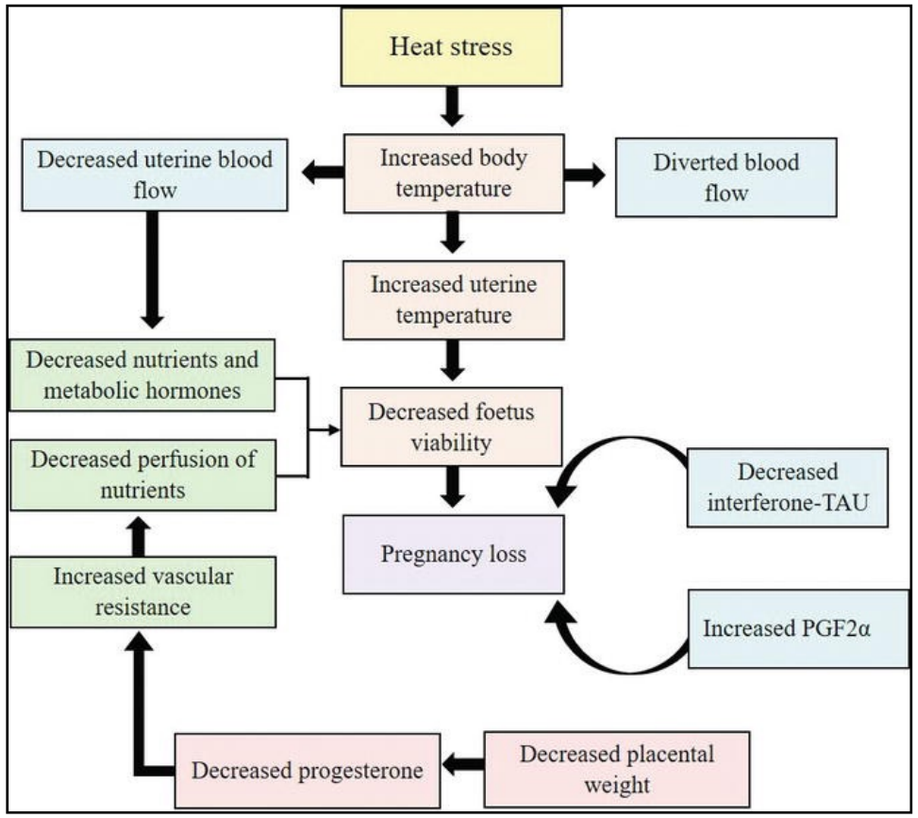
Heat Load, Strain & Stress: physiological impacts

Heat stress is **harmful when animals unable to adapt**
Adaptive response variable: species, genetics, production stage & previous HS exposure
Ensuring survival impedes efficient conversion of feed energy into production
When **heat load exceeds adaptive responses** to compensate, the heat strain causes:

- reduced productivity, well-being & **potential mortality**
- **decreased feed intake & body weight gain**
- reduced reproductive efficiency & **pre-natal effects** on performance
- altered carcass composition & **meat quality**
- **adverse welfare concerns**

Needs effective mitigation to support productivity during high thermal heat load periods





Signs of Hyperthermia: panting score

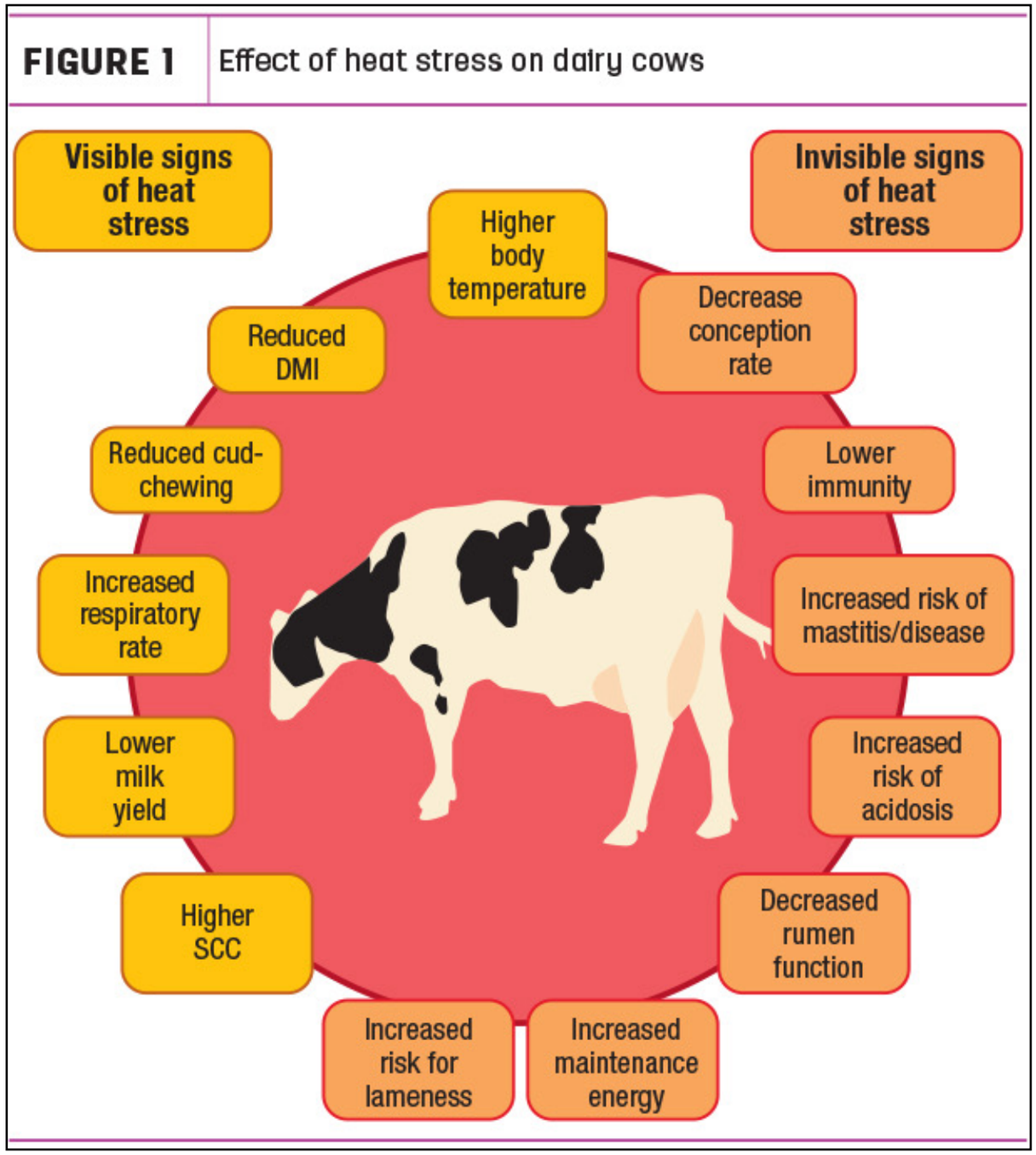


Table 4.3: Panting score used in the assessment of heat stress in cattle

Breathing Pattern	Panting score (PS)	Respiratory rate (per minute)
Normal - No panting, difficult to see chest movement.	0	<40
Slight panting, mouth closed, no drool or foam. Easy to see chest movement.	1	40-70
Fast panting, drool or foam present. No open mouth panting.	2	70-120
As for 2 but without occasional open mouth. Tongue not protruding.	2.5	70-120
Open mouth + some drooling. Neck extended and head usually up.	3	120-160
As for 3 but with tongue out slightly & occasionally fully extended for short periods. Excessive drooling.	3.5	120-160
Open mouth with tongue fully extended for prolonged periods + excessive drooling. Neck extended and head up.	4	>160
As for 4 but with head held down. Cattle 'breath' from flank, drooling may cease	4.5	Variable - RR may decrease

Hyperthermia Mitigation

Aim to **maintain productivity during high thermal-heat loads**
Depends on: region, species, breed, & resources: economic & environmental
Management for higher animal welfare standards by reduced heat loads & stress

- avoiding heat stress periods of day; earlier work
- cooling: shade: **tree & shelter belts; housing: ventilation, fans & water**
- nutritional adjustments e.g. roughage
- genetic improvements e.g. *Bos indicus*

Outbreaks of heat stress must be treated as an emergency.

On land, options are to:

- Ensure there is unlimited access to clean, cool water for all animals.
- Minimise handling and disturbance of animals. Essential activities should be conducted at the coolest times of the day, usually early in the morning or late at night.
- Reduce stocking densities.
- Use low stress stock handling techniques.
- Erect shade that encourages air flow including over loading and unloading ramps.
- Consider moving affected animals to cooler pens with reduced stocking density, shade and better air flow.
- Remove barriers to wind.
- Provide fan-forced airflow.
- Temporarily reduce or cease feeding of concentrate and consider a higher roughage proportion in ration until other emergency measures are implemented.

Drought Planning is mandatory

Better drought management: ‘***I haven’t got another drought left in me***’

- improved carrying capacity decisions: triggers to **de-stock by class**
- enhanced **nutritional & water reserves**
- better **financial reserves** & literacy
- preparedness to pay for **independent** advice

Investors in drought preparedness disadvantaged by assistance to non investors

A need to cease drought hand-outs for the industry to better manage this recurrent risk

Beware the ‘green drought’ when rains commence: preganacy toxaemia, ketosis

FLOCK & HERD

CASE NOTES

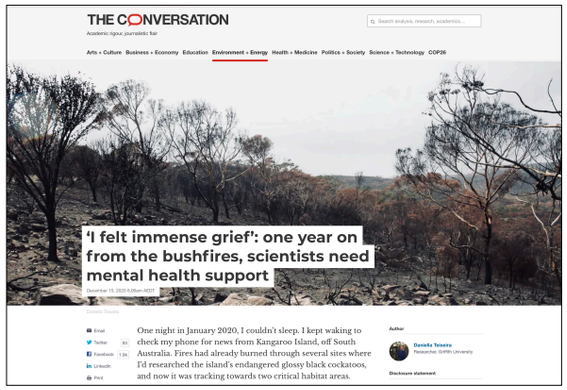
LESSONS FROM THE 2018 DROUGHT ON THE CENTRAL TABLELANDS

Bruce Watt, Central Tablelands Local Land Services

Posted Flock & Herd December 2019

INTRODUCTION

‘Despite the recurrent but unpredictable nature of environmental disasters our memories of their biological and environmental toll are short. This may be merciful but…there is every possibility that the next…drought will prove to be more severe than any that have gone before.’ (Lovett 1972)



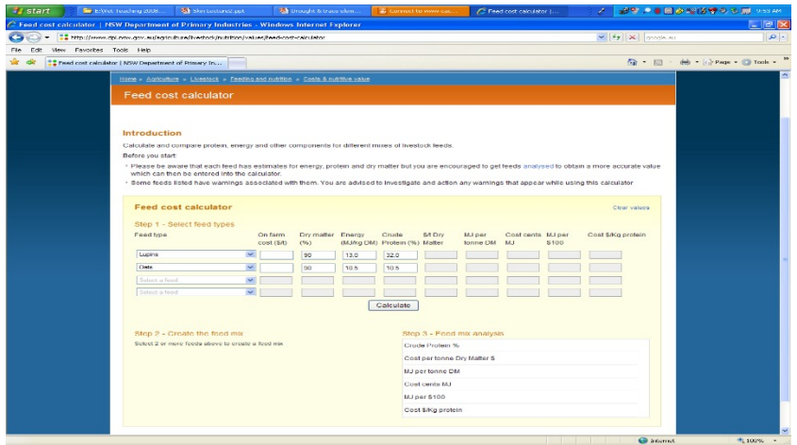
Western Sydney GP Dr Kim Loo has started to dread the soaring summer temperatures. Source: SBS News

Subscribe SBS News

Climate Change

Australian doctors have made a dire prediction on bushfire deaths

A new report, endorsed by some of the country's top medical colleges, warns the effects of climate change will place immense pressure on Australia's hospitals in the next 10 years.



Cold Stress/Hypothermia: mass mortalities

Extreme cold weather events may lead to hypothermia: core temperature <37.8°C
Due to exposure (gradual) or immersion (acute) or both

Exposure: steady loss of body heat in a cold environment through respiration, evaporation
- lack of adequate hair coat, body condition or weather protection.
- old, young or thin are most vulnerable.

Immersion: rapid loss of body heat due to a wet saturated hair coat in a cold environment.
- most often after birth or during **sudden cold rain & wind** = **wind chill factor**

Thermo-neutral zones where no energy required to maintain a desirable core temperature:
- *Bos taurus*: 2°C - 21°C
- *B. indicus*: 10°C - 27°C
- W. Buffalo: 13°C - 18°C
- Sheep: fleece = tolerance
- Beware:
'wind chill factor'

Trop Anim Health Prod
DOI 10.1007/s11250-011-9975-1

ORIGINAL RESEARCH

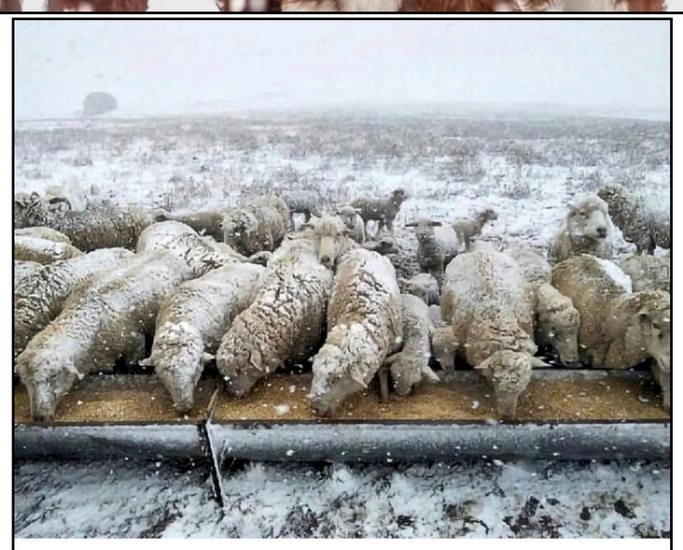
Significant mortality of large ruminants due to hypothermia in northern and central Lao PDR

Syseng Khounsy · Sonevilay Nampanya · Phout Inthavong · Moua Yang · Bounkhoung Khamboungheung · Michaela Avery · Russell Bush · Luzia Rast · Peter A. Windsor

> 40,000 large ruminants died in Vietnam & Laos
Rapid unseasonal decline in ambient temperature with rain & wind: overnight >30°C to <6°C
Only Buffalo survivors were housed, heated & fed

Signs of hypothermia: cascade

Signs: **vigorous shivering** with increased heart rate & respiration rate; nostrils & feet cold.
Severe: **pallor**, hypoxia & reduced perfusion; shivering ceases, muscle **rigidity** ensues.
Pulse & respiration slow as body temp. declines; by 34.5°C, organs cooled
Cell metabolism affected: **confusion**, unconsciousness & risk of death
If core temperatures <30°C, pulse undetectable & respiration rate = 4–5 breaths/min



Sheep graziers warned ahead of ice blast on

ANDY MEDDICK
ANIMAL JUSTICE PARTY

Preventing hypothermia: protection/warmth

Sheep graziers alert warnings
Calendar of operations: Timing of shearing, calving
- Timing of weaning & weaning; autumn v spring

Adequate wind breaks, access protected areas, shelters/coats
Increased **energy content of feed** is critical for survival
- **colostrum for neonates:** bank
- dairy calf risk

Heat lamps, open fires & warming boxes in
- housing areas alleviate risks of mortality

Ventilation is critical if housed
- reduced risk of infectious pneumonia post-exposure

GHGe global perspective: reduce emissions intensity

Global **meat & milk production increases**: 19% & 33% by 2030 respectively

Sustainable livestock production = **need less GHGe's in livestock supply chains**

Requires 'Best practice' **feeding, health, husbandry, manure management & marketing**

GHGe ex livestock ~7.1 gigat CO_2-eq pa; 14.5% of all human-induced emissions

Mostly from cattle: ~ 4.6 gigat CO_2-eq; 65%

- Beef ~2.9 gigat CO_2-eq; 41%,
- Dairy ~1.4 gigat CO_2-eq; 20%,
- Buffalo milk/meat ~0.6 gigat CO_2-eq; 8%,
- Small ruminant milk & meat; 6%.

Silver bullet?:

Open Access Article

Safety and Transfer Study: Transfer of Bromoform Present in *Asparagopsis taxiformis* to Milk and Urine of Lactating Dairy Cows

by Wouter Muizelaar [1,2,*], Maria Groot [3], Gert van Duinkerken [1], Ruud Peters [3] and Jan Dijkstra [2]

What works:

ANIMAL PRODUCTION SCIENCE

Food, fibre and pharmaceuticals from animals

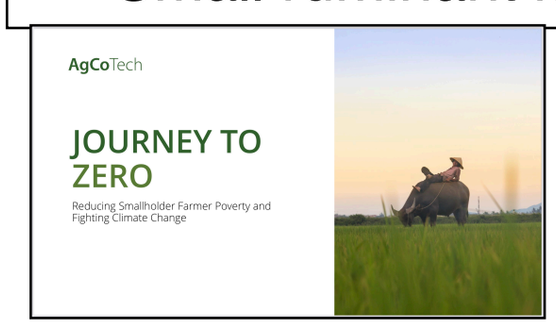
RESEARCH ARTICLE (Open Access)

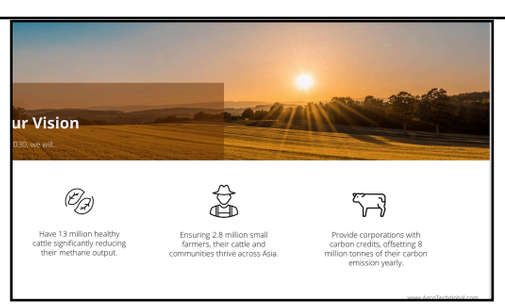
Provision of urea–molasses blocks to improve smallholder cattle weight gain during the late dry season in tropical developing countries: studies from Lao PDR

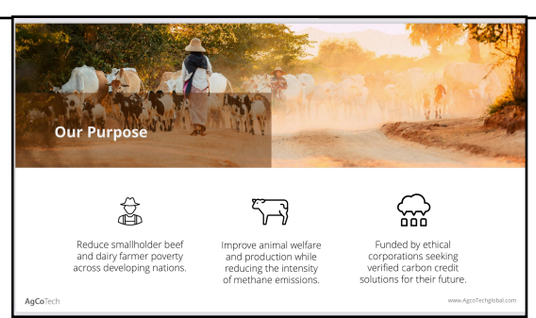
P. A. Windsor [A,D], S. Nampanya [A,B], L. Olmo [A], S. Khounsy [B], P. Phengsavanh [C] and R. D. Bush [A]

Animal Production Science 61(5) 503-513 https://doi.org/10.1071/AN20517

Submitted: 22 September 2020 Accepted: 19 November 2020 Published: 14 December 2020







Open Access Article

Improved Milk Production from Supplementation of Swamp Buffalo with Molasses Nutrient Blocks Containing 10% Urea

by Peter Windsor [1,*], Susan Martin [2], Syseng Khounsy [3], James Young [1], Peter Thomson [1] and Russell Bush [1]

[1] Faculty of Science, The University of Sydney, Camden, NSW 2570, Australia

[2] Luang Prabang Buffalo Dairy, Luang Prabang, Laos

[3] Department of Livestock and Fisheries, Vientiane, Laos

[*] Author to whom correspondence should be addressed.

Dairy **2021**, 2(1), 90-103; https://doi.org/10.3390/dairy2010009

Earning carbon credits on farms farms

CARBON FARMERS OF AUSTRALIA

ABOUT | CO2 FARMING | CO2 TRADING | CFC HUB | ERF | TRAINING | BLOG | CONTACT

What can I do on farm to earn a carbon credit?

It is important to know that earning a Carbon Credit that you can sell to a polluter does NOT depend on the Emissions Reduction Fund (now Climate Solutions Fund). You can put in a project under a number of approved 'methods'. What follows is a Plain English Summary of each of the methods which YOU may be able to turn into a project and Earn a Carbon Credit.

For more information on any of them, please don't hesitate to contact me.

Don't forget – YOU can join with others in a Landcare or Grower or other group to turn a small project into a bigger one.

The 5 most popular available methods farmers can use

1. Storing carbon in your soils
2. Planting native trees and shrubs (Native Forest)
3. Managing stock to allow native forest to regrow
4. Beef Herd Improvement – reducing methane
5. Reducing nitrous oxide emissions from irrigated cotton

Want to maximise your earning potential from on farm carbon?

Find out how you can, with our Whole of Farm Carbon Plan.

Enquire now

6 questions you should always ask a carbon agent to find out if Carbon Trading is a good enterprise for you

Read more

4. Earn Carbon Credits by reducing methane in your Cattle Herd

In the Beef Herd Improvement method, **you can be rewarded for reducing the methane coming from your cattle**. It is suited to larger herds, but could also be very good for a Cattle Group who believe they are turning off cattle earlier or have some other improvements which will reduce the methane from the herd.

Please note that the 'action' to reduce methane is not restricted – so if you have some new technology – go for it. **You must use the Beef Herd Calculator.** For further information or to talk it over, contact Louisa on 0417 280 540.

Some examples of the Beef Herd Improvement method are:

- Improvement in the live weight gain for age enables target weights to be reached earlier.
- Supplementary feed.
- Install fencing on rangeland properties, (grazing management).
- Sell larger numbers of cattle to a finisher.
- Genetics.
- Other activities allowed so long as they can be shown to have an effect on emissions. Better feed, etc.
- Does not prohibit changes in herd composition. Age etc.

The mechanics of the Beef Herd Improvement method are:

- Liveweight gain values are used to derive emissions intensity values.
- Emissions are related to feed intake per day, the duration of that feed intake and the protein content and DM digestibility of the feed. These factors are incorporated in abatement calculations, **and where a change in diet is a project activity, details of the change are required as an input to calculations.**

Note:

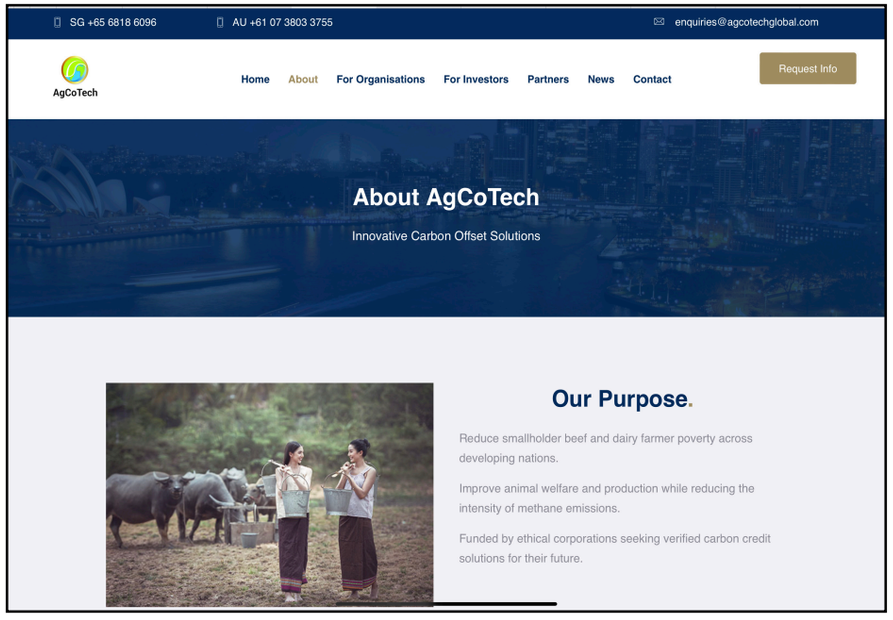
1. Liveweight and LWG Liveweight can be done by weighing, or where this is not practical, through verifiable alternative means.
2. Need records from 3 of the last 7 years (don't have to be sequential) But as close to date of application as possible. LWG must be greater than zero.
3. Majority of feed has to be pastures.
4. Need some evidence that the 'new' practice will reduce emissions.
5. Must be able to identify members of each group of animals as defined by, the

Adapting to the future is required now

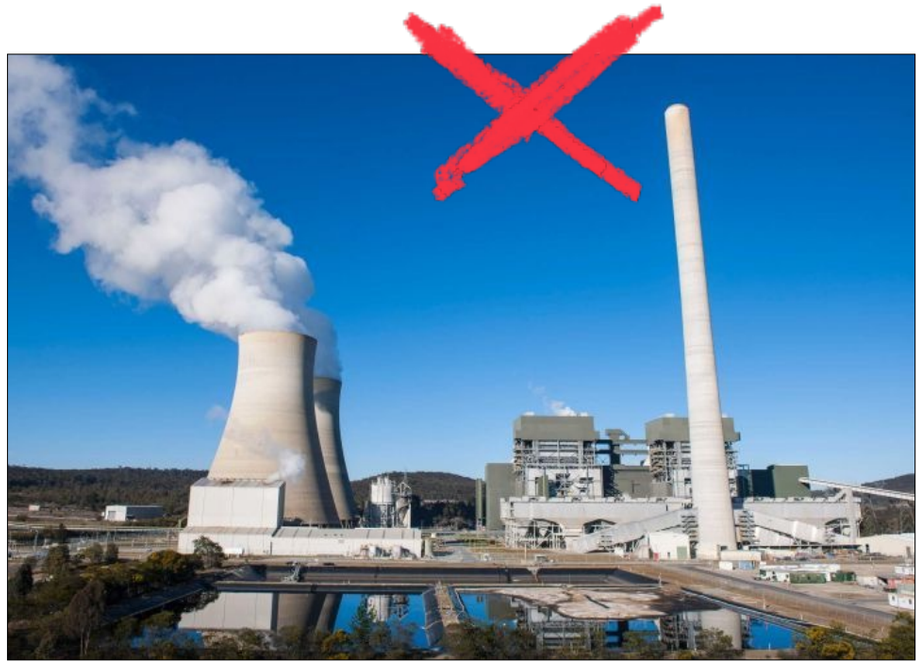
Challenge:improved productivity in a warming world: reduced GHGe intensity

Reduce GHGe: - reduce land clearing, heat (shade) & cold stress (protection), food wastage

- C seq. in soils/trees, improve feeding, genetics, repro, health, welfare etc



Human animals also prefer it not too hot or cold, & we need to improve understanding & defence of truth…



ELSEVIER

Animal

Volume 15, Issue 12, December 2021, 100392

Net protein contribution and enteric methane production of pasture and grain-finished beef cattle supply chains

D.T. Thomas [a], Y.G. Beletse [b], S. Dominik [c], S.A. Lehnert [d]

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https://doi.org/10.1016/j.animal.2021.100392

Net protein contribution/NPC:
Grain-finished beef: 1.96
Grass-fed beef: 1,597.00
But grass-fed = higher CH4 intensity
Grazing converts low-quality forage to high value human edible protein.
Efficiency: system, land use & intakes affecting enteric CH4 production: improve?
Also need: improved overall assessment of the C production footprint from livestock.

Carbon neutrality: Medicated blocks have cattle emissions licked

Mark Phelps
@MarkQCL

23 Sep 2020, 9:10 a.m.

https://www.fao.org/news/story/en/item/197623/icode/