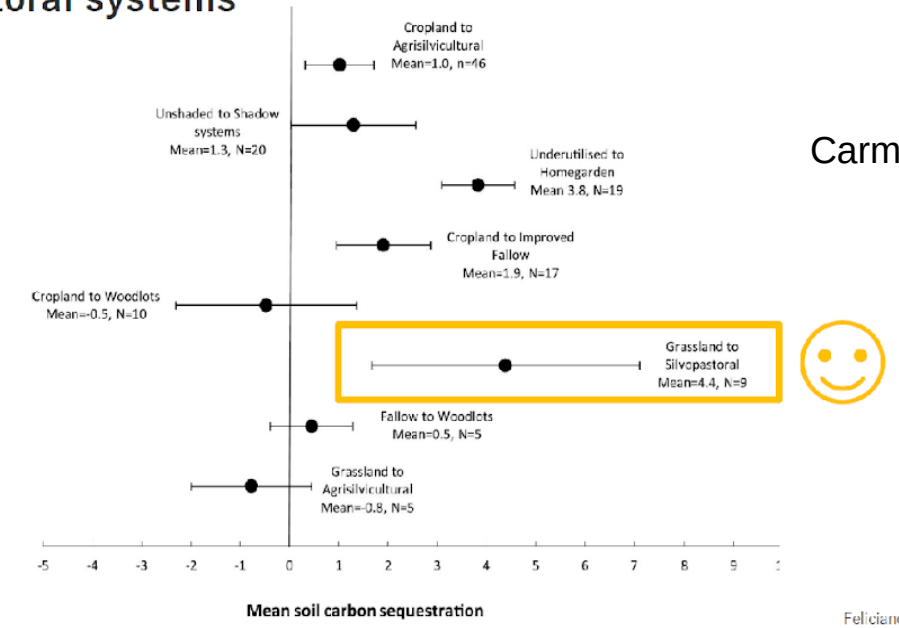

Animals and Trees
A balancing act
Dr Lindsay Whistance


Homeostatic equilibrium
balance
Physiological health
Emotional health
Natural behaviour
Animal welfare
‘Lives worth living’

Wiltshire, summer 2018

Soil carbon sequestration rates (t C ha^{-1} yr^{-1}) are higher in silvopastoral systems

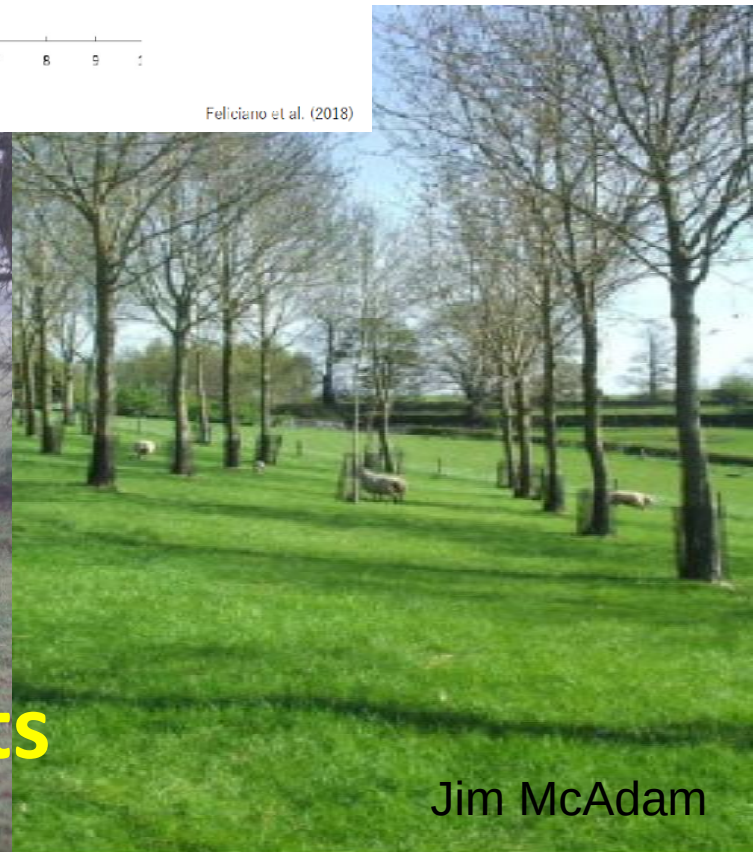


Feliciano et al. (2018)

Carmen Segura Quirante slide

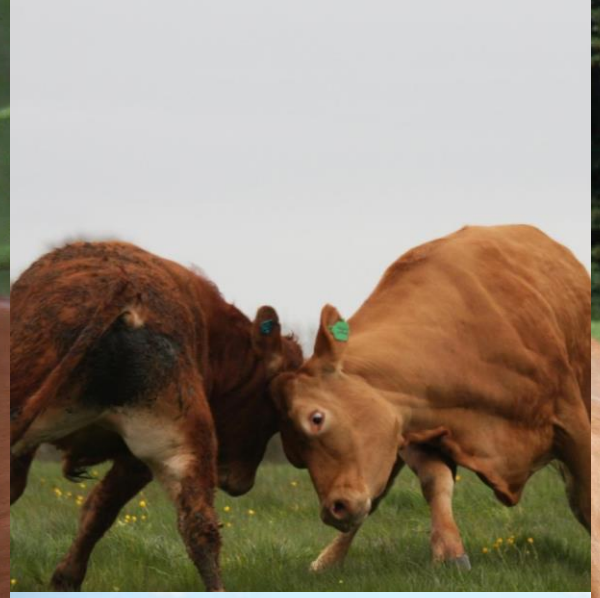
Andrew Barbour

Direct and indirect benefits



Jim McAdam

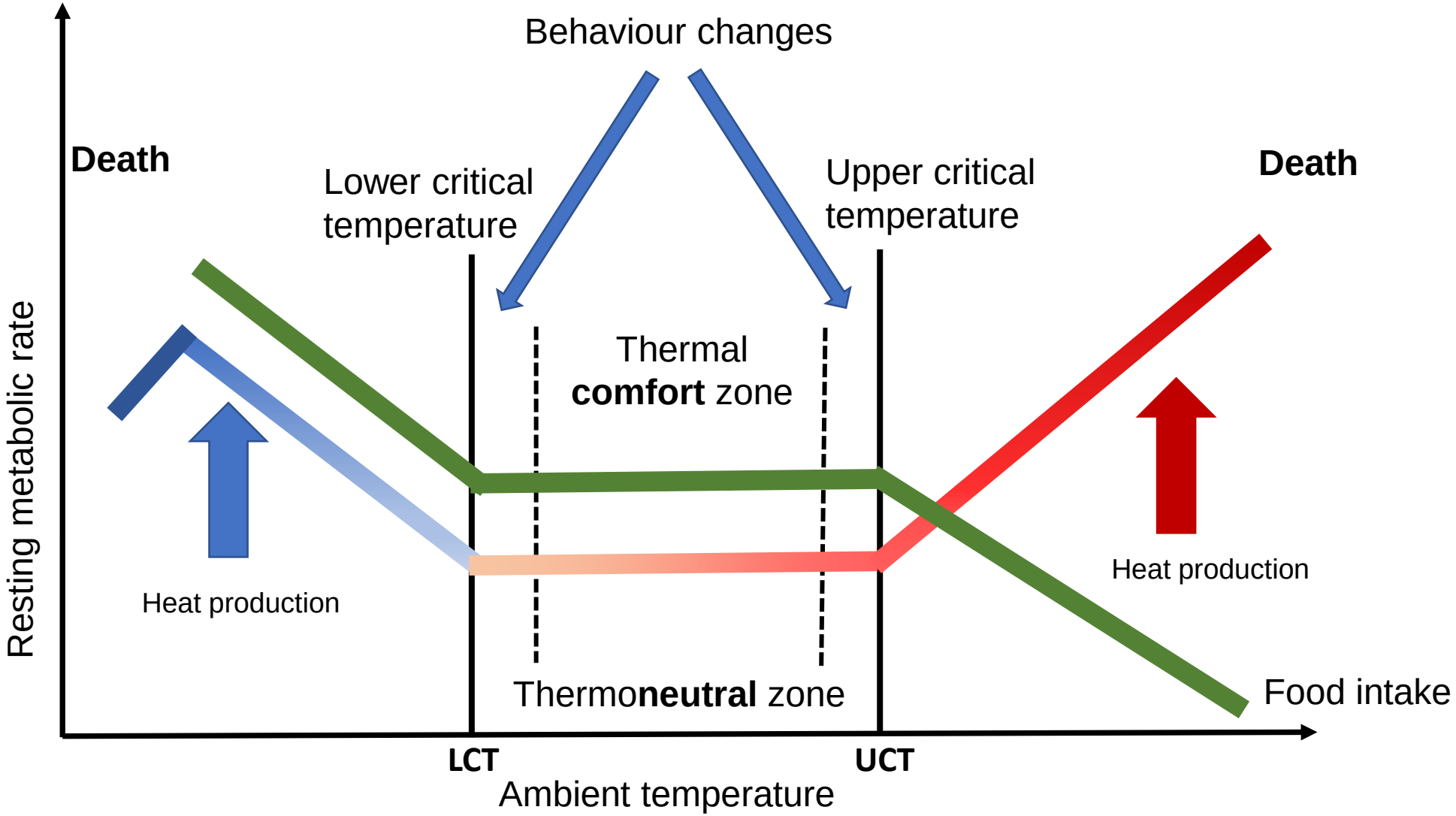
Social relationships



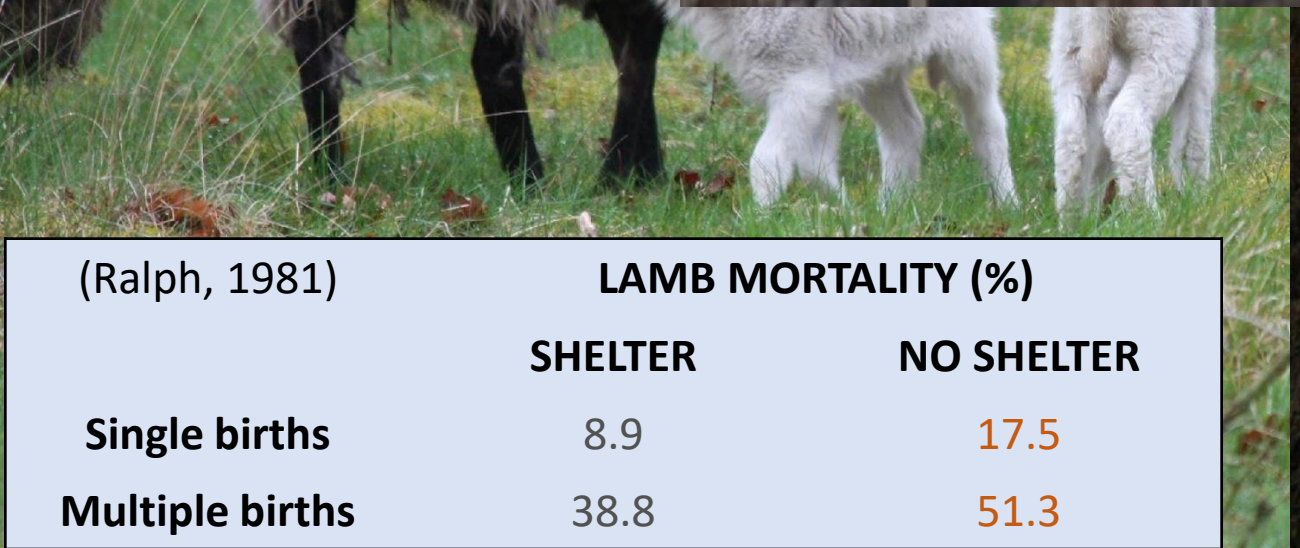

Body care
http://www.yourchickens.co.uk/care-and-advice/preen-to-clean-1-1513607
http://www.forestandwaterside.info/2014/10/pig-new-forest-pannage.html

Thermoneutral zone

Where metabolic rates are low/minimal



Cold stress



(Ralph, 1981)	LAMB MORTALITY (%)	
	SHELTER	NO SHELTER
Single births	8.9	17.5
Multiple births	38.8	51.3

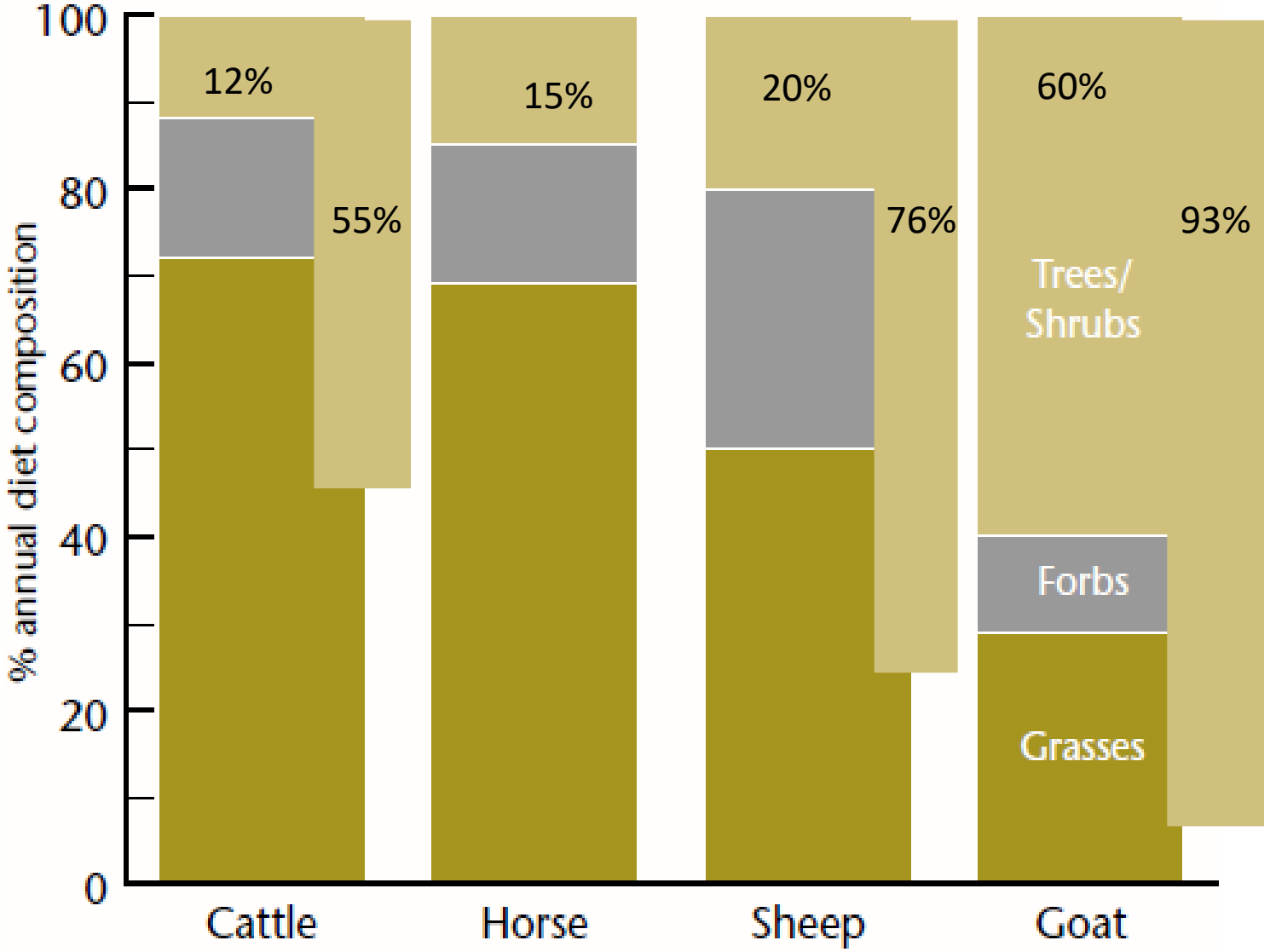
For every 1°C below an animal's LCT:
Beef: a 2% increase in energy requirements is needed
Newly shorn sheep: a 1.7% increase is needed.

Negative outcomes of heat stress

- Respiratory rate
- Stress hormones
- Feed intake
- Rumen microbes
- Metabolic disorders
- Inflammation
- Oestrus expression
- Embryo growth
- Foetal development
- Calf size
- Milk/colostrum amount/quality

Shade

Variation in the diet of domestic stock

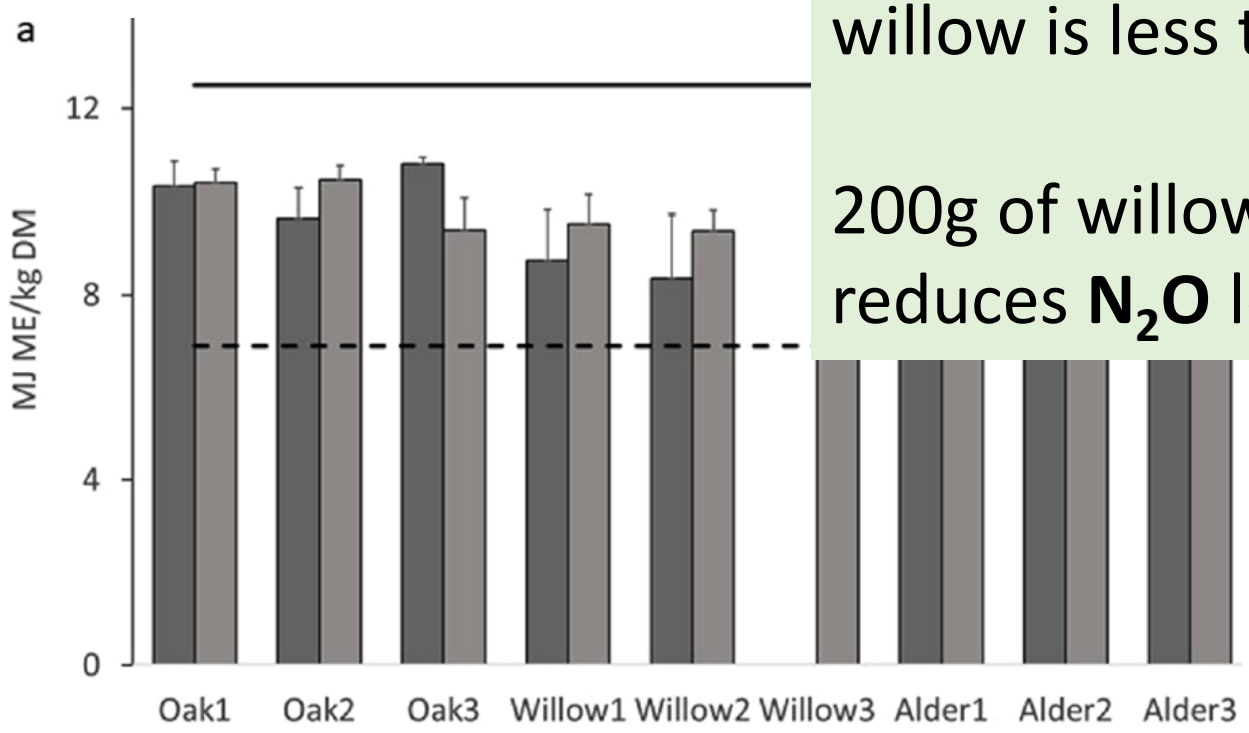


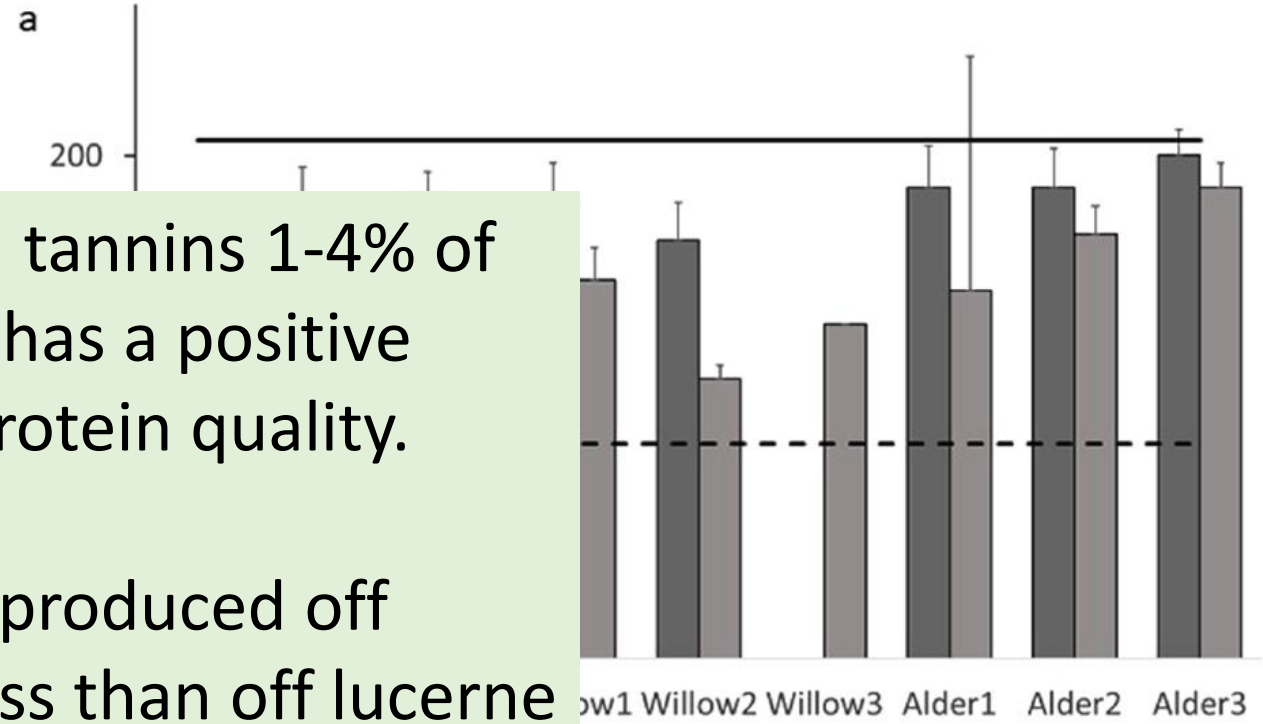
http://www.forestry.gov.uk; Dicko and Sikena, 1992

3 Species:
Oak, Alder, Goat willow

3 Sites:
Berkshire, Leicestershire
Gwynedd

2 months:
June (dark grey)
September (light grey)





Condensed tannins 1-4% of DM in diet has a positive effect on protein quality.

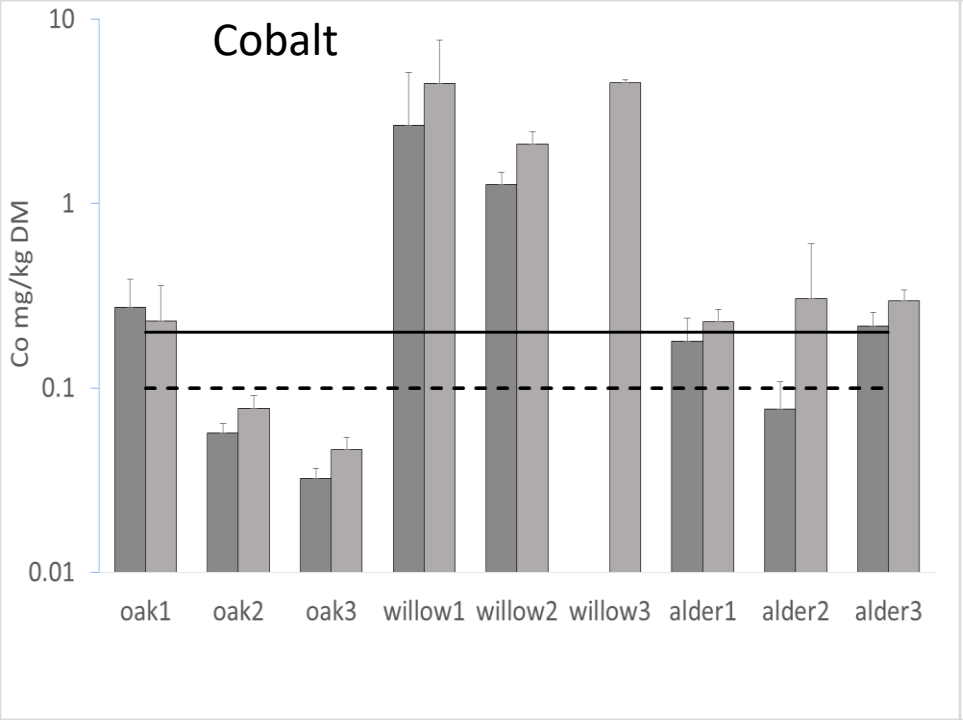
CH_4 (ml/g) produced off willow is less than off lucerne

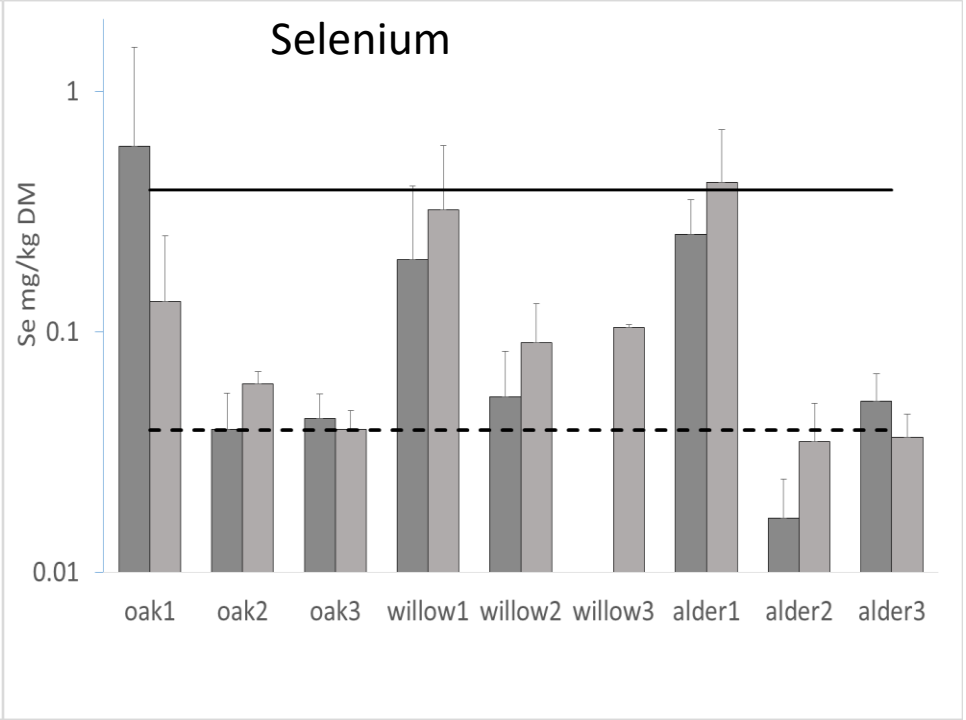
200g of willow leaves per day reduces **N_2O** levels in urine

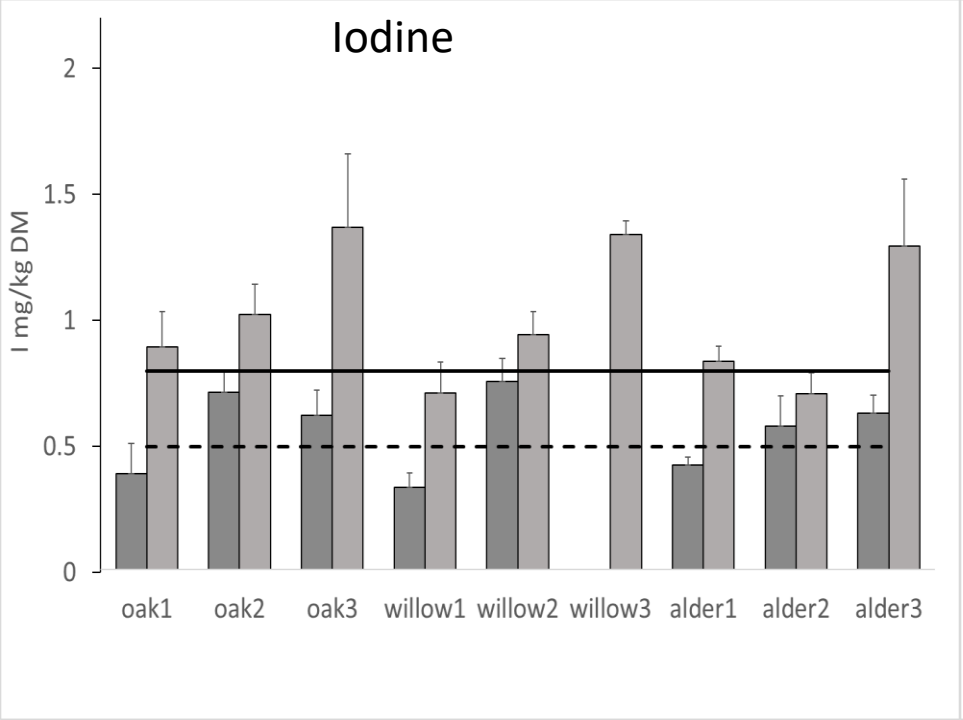
Growing lamb requirements:

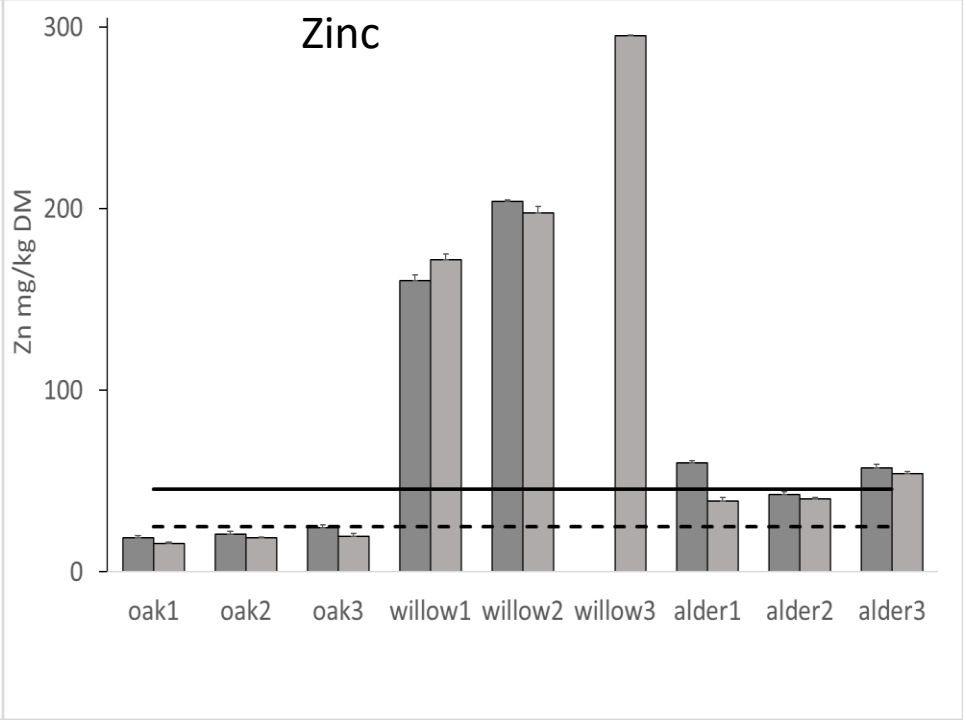
——— 20kg; 250g/d

- - - - - 40kg; 150g/d









Selected minerals
Sheep requirements:

——— Upper range

- - - - Lower range

Influences on mineral content: species, time of year and geographical location

	tree	site	time	treexsite	treextime	sitextime
Ca	***	**	***	***	**	*
P	ns	*	***	***	ns	*
Mg	***	ns	ns	***	*	*
Na	***	***	***	***	ns	**
K	***	***	ns	***	ns	**
Cu	***	***	***	***	ns	tr.
S	***	**	ns	*	***	***
Fe	***	***	ns	***	***	***
Mo	***	ns	ns	**	*	ns
Mn	*	*	***	***	*	ns
Pb	***	tr.	***	***	ns	*
Cd	***	***	ns	***	ns	ns
As	**	**	ns	***	**	**
B	*	ns	***	***	**	**
Al	ns	ns	**	*	ns	ns
Ni	**	ns	*	*	ns	tr.
Se	ns	**	ns	ns	ns	ns
Co	***	*	*	*	tr.	ns
Zn	***	***	ns	***	ns	ns

For minerals:

Species is the strongest single influence followed by location.

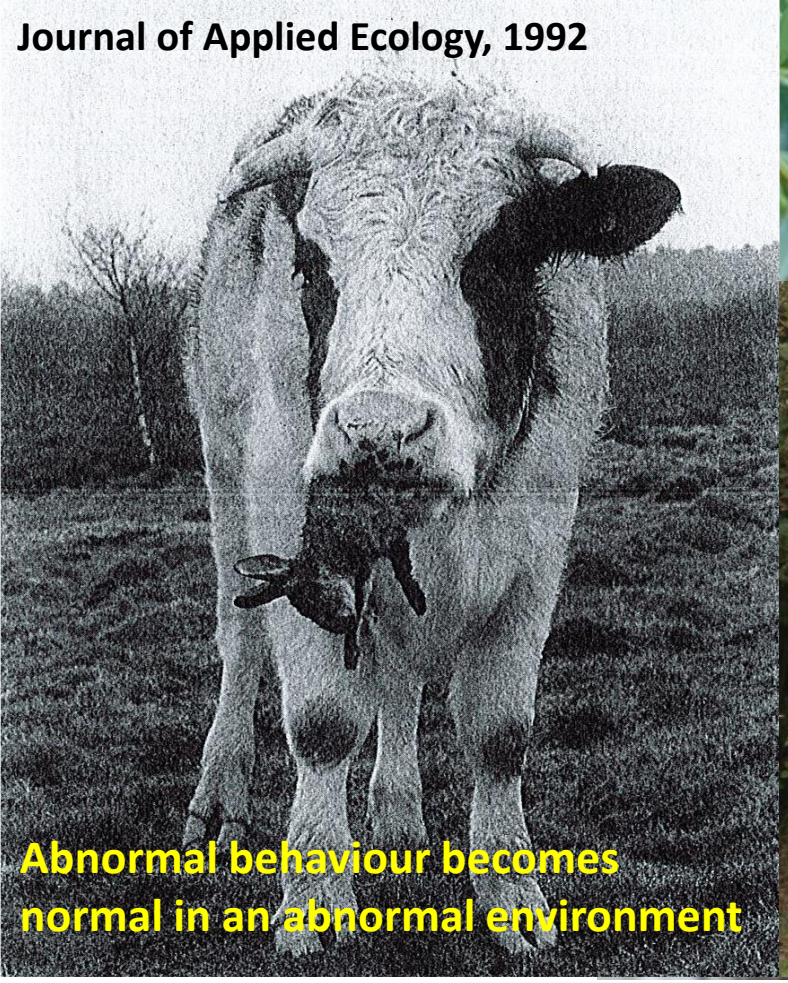
It appears that time of harvest is less important than for protein content.

Kendall NR, Smith J, Whistance LK, Stergiadis S, Stoate C, Chesshire H, Smith, AR (2021) Trace element composition of tree fodder and potential nutritional use for livestock. *Livestock Science* 250:104560 DOI: https://doi.org/10.1016/j.livsci.2021.104560

Minerals retained in stored tree fodder

Harvested July, Analysed fresh, Stored until following March. Analysed stored. Fed to housed cattle

	State	Fresh	Stored	Fresh	Stored	Fresh	Stored	Stored	Stored
Sample	Unit	**Ash**	**Ash**	**Elm**	**Elm**	**Goat willow**	**Goat willow**	Alder	Osier willow
Nitrogen DUMAS	% w/w	**1.78**	**2.21**	**2.23**	**2.31**	**2.66**	**2.16**	3.16	2.23
Phosphorus	mg/kg	**3144**	**3661**	**2292**	**2362**	**4243**	**5501**	2240	2971
Potassium	mg/kg	**14065**	**20015**	**14722**	**20884**	**13942**	**18977**	9051	10364
Calcium	mg/kg	**12776**	**15987**	**10998**	**16758**	**10204**	**14522**	13365	18769
Magnesium	mg/kg	**2235**	**2681**	**1889**	**2798**	**1930**	**2682**	2481	1764
Sulphur	mg/kg	**1840**	**2348**	**1313**	**1655**	**2056**	**2571**	1890	4124
Manganese	mg/kg	**25.5**	**31.6**	**37.2**	**37.9**	**35.5**	**46.3**	129	284
Copper	mg/kg	**7.4**	**9.6**	**6.5**	**9.3**	**7.6**	**10.9**	11.2	5.5
Zinc	mg/kg	**18.5**	**22.9**	**31.7**	**40.1**	**118**	**144**	53.2	245
Iron	mg/kg	**91.2**	**116**	**138**	**258**	**75.7**	**142**	91.6	73.1
Boron	mg/kg	**15.7**	**17.5**	**19.3**	**26.0**	**12.7**	**18.2**	28.9	36.7
		Fraxinus excelsior		**Ulmus minor**		**Salix caprea**		Alnus glutinosa	Salix viminalis



Salicin content in willow

Scientific name	Common Name	Salicylic Acid (mg/g FW)
S. daphnoides	European violet willow	3.21
S. caprea	Goat Willow	1.95
S. fragilis	Crack willow	1.65
S. viminalis	Osier willow	0.21
S. alba	White Willow	0.2

‘A high quality of life for farm animals requires provision rather than deprivation’

(Sommerville and Jones, 2013)

Thanks for listening