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BVMS & MRCVS

Rod Welford qualified from the University of Edinburgh veterinary school in 1990.

Hailing from a mixed dairy farm in Yorkshire, the large animal side of general practice has always been his prime interest and he has worked for 25 years in the Millcroft Veterinary Group in Cockermouth. The practice covers farms that have sheep grazing the highest Fells in England.

A love of fell running across – and paragliding above – the Lakeland Fells has given Rod a privileged perspective of the landscape and he has witnessed the scenery change and alongside it the balance of disease.

0.75  
hours\*



\*Suggested Personal & Professional Development (PPD)

## Tick-borne disease in sheep – a changing landscape

Many of the diseases we witness are governed by landscape and climate. This is true for 'tick-borne disease' (TBD) that relies on the tick as a vector between hosts. The tick's habitat is a deep vegetative mat, such as is found on bracken, moor and heath. *Ixodes ricinus* is the major sheep tick in the North. *Haemaphysalis* and *Dermacentor* can affect areas of southern England and Wales.

Ticks live in the deep moist vegetation, taking a blood meal from various hosts (bird, rabbit or sheep) each year (Figure 1). In total they feed for only 10-14 days over their three-year life cycle and are active above 7°C, when they 'quest' by seeking a host before returning to their vegetative mat.

Spring and autumn peaks are recorded, but it is not uncommon to witness tick activity almost all year round; which is not surprising when you consider the many secluded south-facing slopes.

The north west quadrant of the Lake District National Park, where much of the high fell is common land, is grazed by the hefted Herdwick or Swaledale (Figure 2). Sheep are gathered from the fell for key interventions, such as tupping, lambing, clipping and weaning.

At these times a head count – historically conducted in local dialect, 'yan, tyan, tethera, methera, pimp...' – will indicate those sheep missing, or as they are colloquially termed, "lost to the fell". The variations can be profound, with areas recognised as 'dirty fells' and others as 'clean fells'. Farmers recognise specific parts of the fell as 'dirty' because they are often associated with higher losses from tick-borne disease (Figure 3).

'Dirty fells' can witness annual losses of 15 per cent of lambs

at foot and 10 per cent of gimmer yearlings returning to the fell. When naive sheep are put to dirty pasture these losses can exceed 50 per cent. Fell farmers report increasing losses in these locations, together with a greater incidence of 'cravocked' lambs – those lame, light and failing to thrive.

### Common tick-borne diseases

#### Louping ill

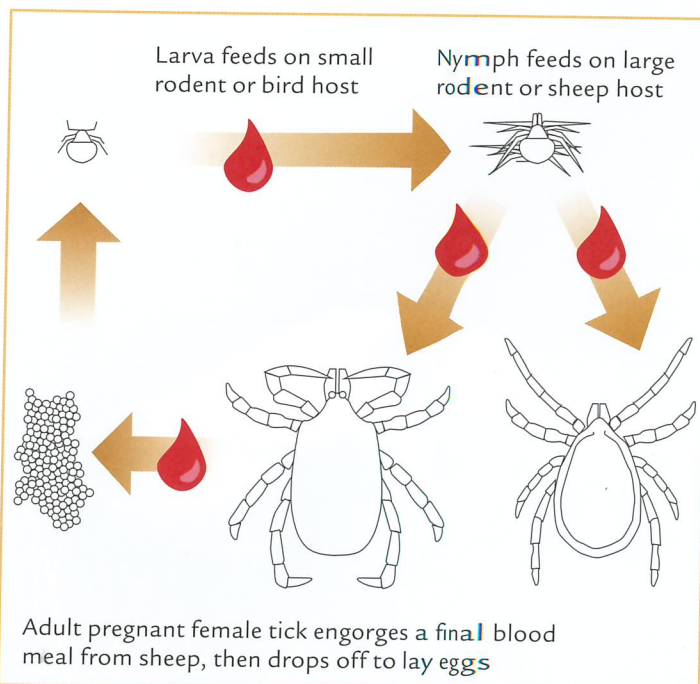
The infectious agent that causes louping ill is a flavivirus that induces signs

of encephalitis. Its name comes from the characteristic 'lolloping' gait that is exhibited when affected sheep are moved. Most, however, are found dead or in a state of terminal neurological extremis that generally indicates imminent death.

#### Tick pyaemia

This is a blood-borne staphylococcal infection introduced by the feeding tick. Tick pyaemia is a common sequel to tick feeding because the staphylococci are carried on a sheep's skin. With a high

**Figure 1.** A typical tick life cycle. The ticks found on sheep are the pregnant feeding adults, at the end of a three-year life cycle spent almost entirely within the vegetation. This final feeding stage (lasting 7-10 days) sees the tick engorge on a blood meal, becoming the size of a pea before dropping off to lay eggs. During this feeding, tick-borne disease can be passed to and from the tick.







**Figure 2.** The north west quadrant of the Lake District National Park, where much of the high fell is common land, is grazed by the hefted Herdwick or Swaledale.

**Figure 3.** A Swaledale ewe lamb turned to the fell in summer is found dead having succumbed to tick-borne disease. A post-mortem confirmed an overwhelming tick pyaemia with concurrent signs of tick-borne fever.



challenge, or in weakened sheep with concurrent tick-borne fever, for instance, it can induce losses or leave 'light' chronically lame lambs or 'cripples'.

**Tick-borne fever**

Tick-borne fever (TBF) is caused by *Anaplasma phagocytophilia*. This invades the white blood cells and 'drags down' the body's immune system, leaving it vulnerable to attack from other infections, such as the other two key tick-borne diseases listed above.

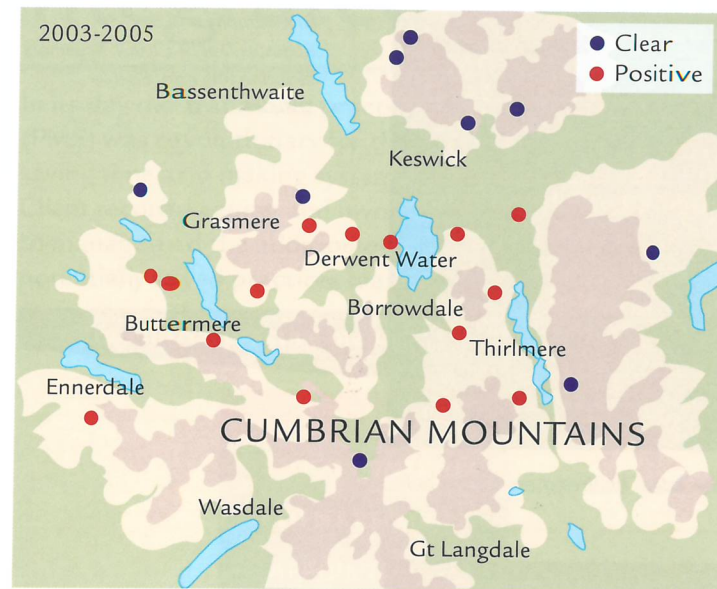
TBF alone is often a transient infection of sheep but the associated pyrexia can leave rams temporarily infertile, or cause abortion when pregnant ewes are exposed. Concurrent infection with louping-ill virus will precipitate losses.

It is interesting to note that a common practice on fell farms is to house newly purchased tupps prior to use, 'lest they will fail to leave lambs'. Considering the

pyrexia invariably associated with a fresh tup encountering TBF, there is more than a little credence to this folk law.

If your clients are finding ticks on sheep and witnessing losses or the clinical signs above, then it is important to distinguish which tick-borne diseases you are facing. Sheep presented in a terminal nervous state often look much alike and they are best sacrificed for post-mortem investigation. Immunohistochemistry is the definitive confirmation of louping ill virus, associated with non-suppurative encephalomyelitis. Suggestive neurological signs of the condition can be supported by acute phase IgM or retrospectively diagnosed from seroconversion via IgG. Bloods taken from a cohort of older sheep that graze the same area can indicate the wider picture.

TBF can be confirmed on haematology by the presence of Geimsa-stained inclusions



**Figure 4.** Fells and commons showing evidence of louping ill in 2003-2005.

within neutrophils. A polymerase chain reaction (PCR) test for TBF is available and undergoing validation.

Tick pyaemia is confirmed by culture of *Staphylococcus aureus*.

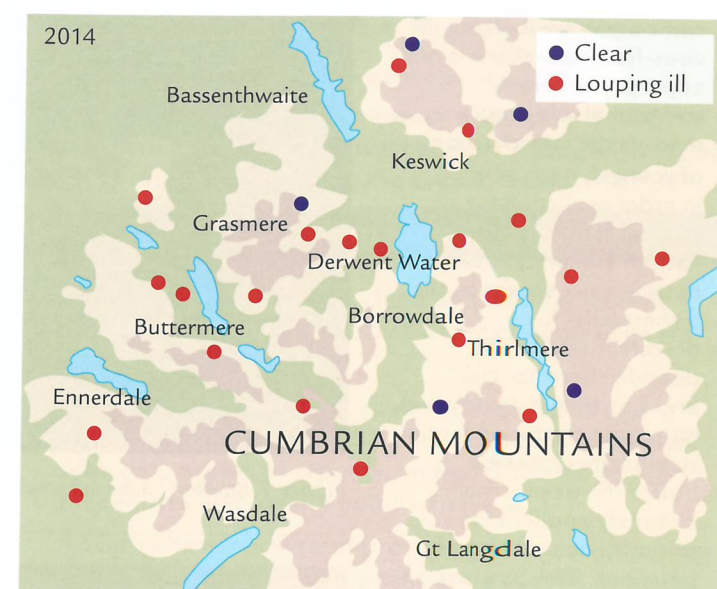
**Local survey results**

From the early 2000s, farmers in North West Cumbria were reporting a rising concern over tick-related disease. Millcroft Veterinary Group decided to investigate the tick diseases in order to map

out the dirty fells. During the clipping gathers of 2003-2005, we sampled six ewes from 24 farms that cover the north-west quadrant of the Lake District National Park. The results are shown in Figure 4.

The louping ill sero-negative fells were consistent with those locations seeing less tick-borne disease and termed 'clean fells'. In the summer of 2014, Chris Sharman, a local veterinary student, re-ran this study to assess the changing picture

**Figure 5.** A Herdwick ewe and lamb.



**Figure 6.** Fells and commons showing evidence of louping ill in 2014.

that was being fed back from some farms. This work was supported by Amanda Carson of the AHPA and the Herdwick Sheep Breeders Association (Figure 5).

The results show that the geographic range of louping ill has extended into previously clean areas (Figure 6). In 2003-2005, 41 per cent of holdings tested were clean. This had been reduced to 19 per cent clean by 2014.

We also tested for *Anaplasma phagocytophilia* 'tick-borne fever', both to help validate an evolving PCR test and to map its distribution. The results confirmed that tick-borne fever is fairly ubiquitous on the north west lakeland fells.

**Significance of findings**

The incidence of tick-borne disease is reported to have risen over recent years. Why should this be considering ticks and the diseases they carry are not new to the fells? What has changed is the way the fells are managed?

Environmental schemes have encouraged farmers to reduce stocking rates on the fell. The result is a noticeable increase in vegetation – such as bracken, that is ideal tick habitat –

alongside its distribution on the fells (Figure 7).

More sheep are wintered off the fell and hence have less opportunity to harden themselves to the tick-borne diseases by accruing gradual exposure and immunity. The result is two-fold – an increased challenge and a decreased immunity.

The expression of tick-borne disease is a balance of immune status versus tick-borne challenge. The implementation of some environmental schemes has seen the balance shift in favour of the disease. Sheep that are destined to live in areas of tick habitat need to acquire an immunity and become 'hardened to the fell'. The key is to recognise the naïve animals and buffer the challenge, allowing a gradual exposure rather than overwhelming challenge.

**Summary**

The following points are particularly important:

- obtain a diagnosis as it is important to know which tick-borne disease is part of the clinical picture. The aim is to reduce challenge whilst encouraging immunity –



some areas are louping ill virus-free, so vaccine is not appropriate here

- the general rule is to manage the introduction of younger, naïve sheep in order to encourage a gradual exposure and natural immunity – avoid putting naïve sheep on the dirtiest fells
- beware introducing outside sheep to tick areas as they may have no immunity to the endemic tick-borne diseases
- buffer the tick numbers by timely application of synthetic pyrethroid pour-ons. Tick prevention requires a line applied between the fleece (as opposed to the fan application indicated for blow-fly)
- where louping ill is of concern, a vaccine is available to help protect naïve sheep if used in advance of the challenge.

Finally, this article covers only the common tick-borne diseases in sheep. Those mentioned can affect species other than sheep and a wide range of less pathogenic TBDs can be found in sheep. ■



Figure 7. Bracken on the fell provides the ideal environment for the tick.

## PPD Questions

1. How old is the pea-sized sheep tick we commonly remove from dogs?

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2. Name the three major tick-borne diseases of sheep

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3. Where do ticks live?

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4. Where would you find *Anaplasma phagocytophilia* in the host?

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5. How can farmers manage tick exposure to reduce losses?

### Answers

1. This is the adult, three-year-old, female engorged with blood on its final host before dropping off to lay eggs
2. Louping ill, tick pyaemia, tick-borne fever
3. Anywhere there is a deep vegetative mat that provides a moist habitat between questing to find a host for their annual feed
4. In inclusion bodies within white blood cells whereby it expresses its immunosuppressive effect
5. Understand the basis of tick-borne diseases; manage the exposure of naive stock to tick-burdened land, with the aim of gradual exposure to tick diseases and buffering the tick challenge with synthetic pyrethroid (SP-pour-ons)

**Bibliography**  
 Radostits O et al (2006). *Veterinary Medicine* 10th edn. Elsevier Saunders, London.