Indicators and trends

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Indicator name				Version
NA26 Prevalence of liver fluke (*Fasciola hepatica)* in cattle and sheep				**07/03/16**
Indicator type:	**Risk/opportunity**	**Impact**	**Action**	
		X		

SCCAP Theme	**SCCAP Objective**	**CCRA risk/opportunity**
Natural Environment	**N3**	**AG44 Livestock pests and diseases**

At a glance

- Liver fluke is a highly pathogenic parasite of sheep and cattle
- There has been an upward trend in prevalence in both cattle and sheep in Scotland over the last 15 years
- Traditional treatment methods are not sustainable and no longer permissible due to their environmental impact
- There is no effective vaccine and a lack of effective methods to control liver fluke sustainably
- Prevalence, seasonality and geographic spread of liver fluke are strongly affected by climatic conditions, especially temperature and rainfall.

Latest Figure

2013:

Proportion of diagnosable submissions due to fluke (Scotland)	
Cattle	16%
Sheep	17%

(Data source: Scottish Agricultural College: Veterinary Investigation Service (SAC VIS), 2013).

Trend

There has been a consistent increase in liver fluke incidence in Scotland in recent decades, from 3% and 1% in cattle and sheep, respectively, in 1993 to 16% and 17% in 2013 (data SAC VIS).

Why is this indicator important?

The liver fluke, *Fasciola hepatica*, is a highly pathogenic flatworm parasite of sheep and cattle. Animals become infected while grazing on pasture by ingesting fluke cysts shed by infected mud snails. Fluke can be particularly devastating in sheep and was responsible for considerable disease and death in Scottish sheep in winter/spring of 2012-2013. As well as death of livestock, fluke also causes significant production losses e.g. reduced live weight gain in sheep and cattle, poor reproductive performance and reduced milk yield in dairy cattle (Schweizer et al, 2005). Liver fluke also contributes significantly to the carbon footprint of livestock farming through reduced biological efficiency and increased waste (Williams et al, 2013).

It is predicted that with a changing climate infection of cattle and sheep with liver fluke will become an increasing risk in Scotland (see separate liver fluke risk indicator). This indicator monitors the prevalence of liver fluke disease in cattle and sheep as a proxy of the impact of fluke in Scotland.

Related Indicator:
NA21 Risk of liver fluke (*Fasciola hepatica)* in cattle and sheep

What is happening now?

The latest Scottish figures show the proportion of diagnosable submissions due to fluke at 16% for cattle and 17% for sheep (data SAC VIS, 2013), based on a sample of 1992 sheep and 3026 cattle.

	Diagnosable submissions	Total sample size
Sheep	343	1992
Cattle	480	3026

Farmers are possibly more aware of liver fluke now as a result of recent increased incidence but tend to be reactive rather than proactive and, typically, try to treat their way out of trouble using chemical flukicides. However, this approach is not sustainable and we are already seeing problems with the emergence of resistance to frontline flukicides, especially triclabendazole, the drug of choice for controlling fluke in sheep (Gordon et al, 2012).

What has happened in the past?

Liver fluke has been an issue for farmers over many decades, especially in the wetter west of Scotland; however its more recent spread into the east/northeast has caught many farmers unawares. There were significant fluke 'crises' in the UK as far back as the 1950s-60s, but at that time, farmers were encouraged (and permitted) to drain their land to reduce snail habitat and/or to treat their pasture with chemical molluscicides e.g. copper sulphate, to control the snails. Chemical flukicides only appeared around the 1960s; until that time farmers had to make best use of farm management strategies to control fluke on their farms.

As can be seen in Figure 1 below, there has been an upward trend in fluke diagnoses in both sheep and cattle over the past 10-15 years in Scotland.

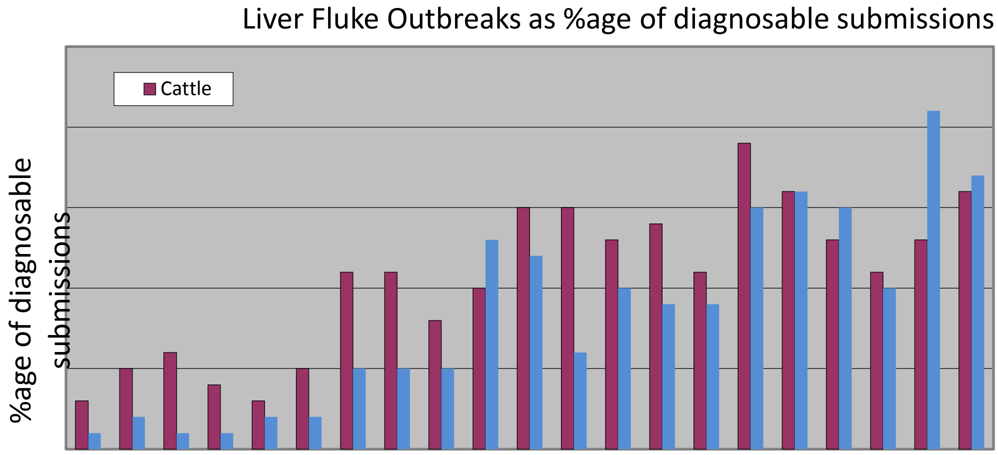

Figure 1: Liver fluke outbreaks as a percentage of diagnosable submissions (Source: SAC VIS)

There has also been a west-to-east/NE spread of fluke in recent years e.g. cattle (data SAC VIS, 2008).

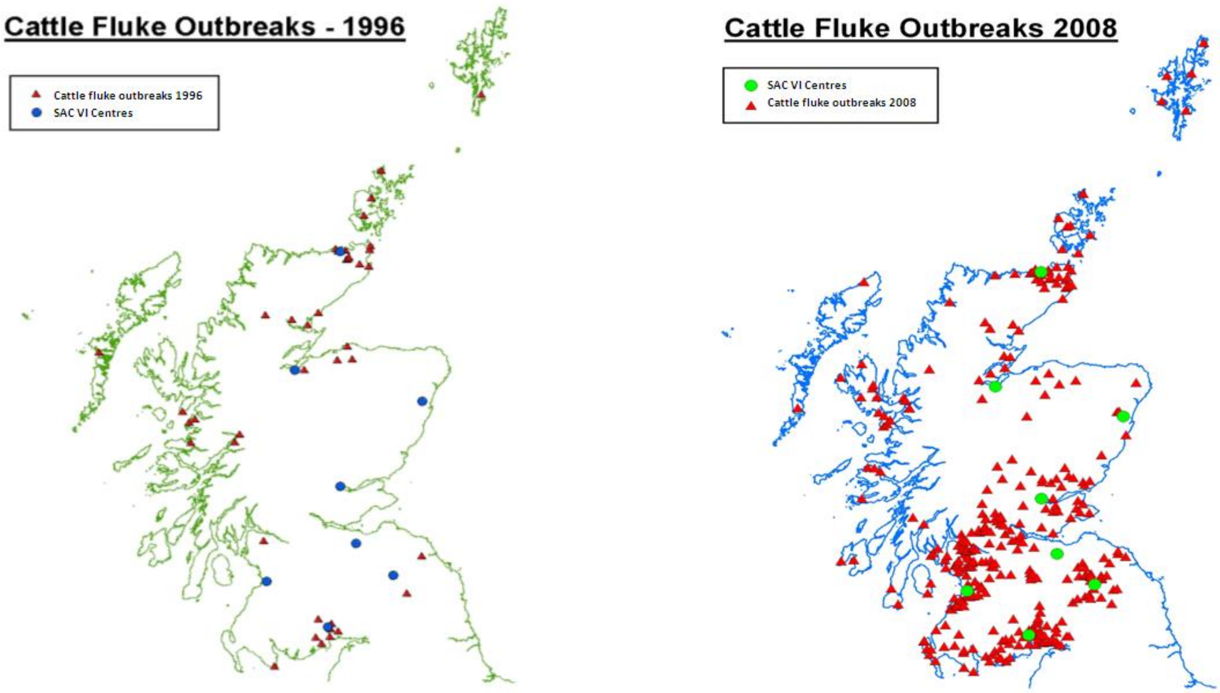

Figure 2 Cattle Fluke Outbreaks 1996 and 2008

What is projected to happen in the future?

There has been a consistent increase in liver fluke incidence in recent decades and that trend is expected to continue for the foreseeable future. Because liver fluke spends so much of its complicated life-cycle outside the host, either within the snails, or as cysts or eggs on pasture, its prevalence, seasonality and geographic spread are very much affected by climatic conditions, especially temperature and rainfall. It has been possible to forecast liver fluke risk, based on the summer infection of snails, using a formula devised in the 1950s (Ollerenshaw & Rowlands, 1959). The so-called 'Ollerenshaw index' is still used to provide regional fluke forecasts online at the National

Animal Disease Information Service[1]. Fox et al, (2011) used a modified Ollerenshaw formula, interfaced with UKCP09 climate projections, to model likely fluke risk across the UK up to 2070. Model outputs show unprecedented fluke risk in parts of the UK, as a combination of increasingly wet summers and mild winters, with serious epidemics predicted in Wales by 2050.

Patterns of change

As noted above, there has been a consistent increase in liver fluke incidence in recent decades and that trend is expected to continue for the foreseeable future. The graphs in Figure 3 below show levels of fluke incidence in the UK. Superimposed on the increasing trend line are 'spikes' of peak fluke incidence associated with extreme weather events e.g. summer rainfall 2012. Equally, reduced fluke incidence may be associated with less favourable weather conditions e.g. hotter drier summers.

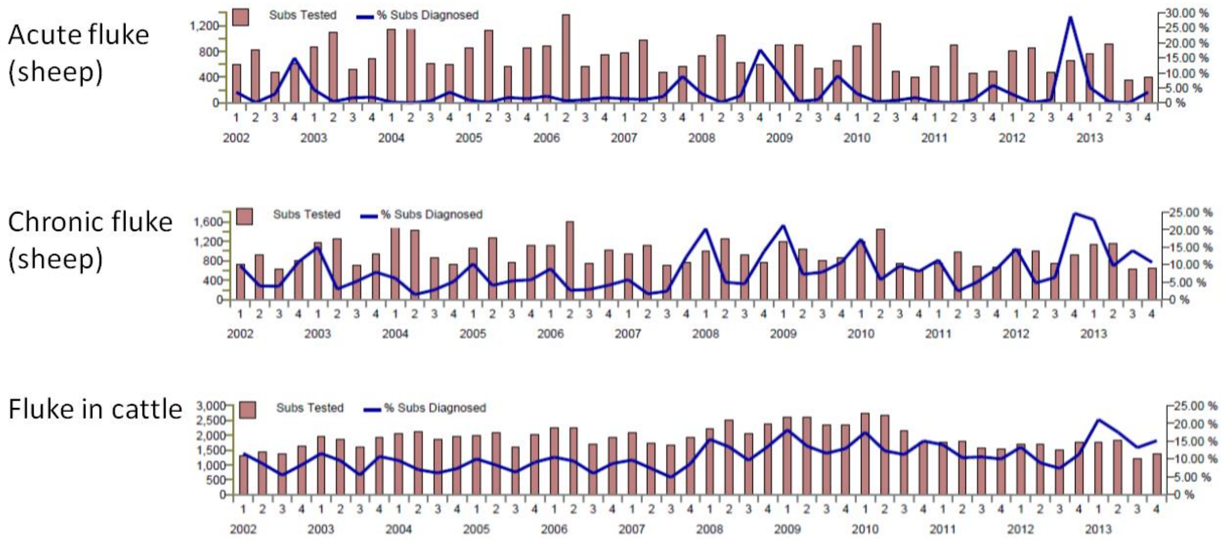

Figure 3: Levels of fluke incidence in the UK (Data Animal Health and Veterinary Laboratories Agency (AHVLA), 2013)

Interpretation of indicator trends

Changing weather patterns, specifically wet summers, mild winters and, possibly, flooding events, are undoubtedly one of the main drivers of changing liver fluke prevalence, but they are not the only explanation of recent changes (Kenyon et al, 2009). Animal movements contribute significantly to the spread of the parasite around the country and its establishment in previously fluke-free areas (Van Dijk et al, 2009), especially if bought-in livestock are not given an effective quarantine fluke treatment. The emergence of flukicide resistance is also a contributory factor in our inability to control the parasite in endemic areas (Gordon et al, 2012). Furthermore, wetland/agri-environment schemes, whether established to act as carbon sinks, to improve flood management or to enhance biodiversity, are an acknowledged liver fluke risk as they bring grazing animals into close proximity with ideal mud snail habitat (Pritchard et al, 2005). In fact, the liver fluke's intermediate host, the mud snail *Galba truncatula*, is often used as an indicator species for healthy wetland schemes. Furthermore, *Omphiscola glabra*, classed as an endangered species in Scotland and subject to conservation, is also an acknowledged liver fluke intermediate host. Wetland birds have also been

[1] National Animal Disease Information Service, see: www.nadis.org.uk

implicated in the spread of liver fluke as they are capable of transporting liver fluke-infected snails over long distances (Van Leeuwen et al, 2012).

Limitations

There are a number of limitations in our interpretation of recent and future trends of fluke risk. As stated above, changing weather patterns are one of the main drivers of liver fluke incidence, but not the only one. There are also, as yet unidentified, farm-specific factors that dictate a given farm's fluke risk that can override the influence of changing weather patterns. These may include the underlying geology of the land and/or specific farm management practices that can increase or reduce the fluke risk (McCann et al, 2010). There are also constraints on what farmers are allowed or incentivised to do in terms of farm management, as enshrined in legislation and ongoing CAP reform. There are also some limitations in the Ollerenshaw model itself in that it is based on forecasting the optimum conditions for summer infection of snails. It cannot as accurately predict winter infection of snails or overwinter survival of eggs and cysts on pasture. Research to fill some of these critical knowledge gaps is ongoing within the EUFP7 GLOWORM project[2].

There are also limitations in our ability to diagnose fluke effectively in the live animal and the fact that current information on fluke prevalence, seasonality and geographic distribution relies on passive rather than active surveillance. There are also limitations in our ability to control fluke sustainably, as a result of emerging flukicide resistance and the lack of an effective liver fluke vaccine to protect livestock from infection.

References

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Appendix One: Indicator meta data and methodology

Table 1: Indicator meta data

	Metadata
Title of the indicator	Prevalence of liver fluke (*Fasciola hepatica*) in cattle and sheep
Indicator contact: Organisation or individual/s responsible for the indicator	Ruth Monfries (CXC, Royal Botanic Garden Edinburgh)
Indicator data source	Veterinary Investigation Centres (SAC VIS and AHVLA data) and EBLEX data
Data link: URL for retrieving the indicator primary indicator data.	Not available.

Table 2: Indicator data

	Indicator data
Temporal coverage: Start and end dates, identifying any significant data gaps.	2014 From 1993 - 2013
Frequency of updates: Planned or potential updates	Monthly
Spatial coverage: Maximum area for which data is available	Scotland (UK)
Uncertainties: Uncertainty issues arising from e.g. data collection, aggregation of data, data gaps	Limitations in the ability to diagnose liver fluke effectively. Reliance on passive rather than active surveillance.
Spatial resolution: Scale/unit for which data is collected	Regional
Categorical resolution: Potential for disaggregation of data into categories	
Data accessibility: Restrictions on usage, relevant terms & conditions	Available on request and free of charge.

Table 3 Contributing data sources

Contributing data sources Data sets used to create the indicator data, the organisation responsible for them and any URLs which provide access to the data.

Figures on liver fluke prevalence come from 2 sources, (i) diagnoses of submitted samples/post mortem at regional Veterinary Investigation Centres (SAC VIS and AHVLA data) and (ii) recorded liver condemnations at slaughter (EBLEX data).

Table 4 Indicator methodology

Indicator methodology The methodology used to create the indicator data