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# Scenario planning: The future of the cattle and sheep industries in Scotland and their resiliency to disease

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ABSTRACT

In this paper, we present a description of foresighting activities undertaken by EPIC, Scotland's Centre of Expertise on Animal Disease Outbreaks, to investigate the future uncertainty of animal health security in the Scottish sheep and cattle sectors. Using scenario planning methodologies, we explored four plausible but provocative long-term futures which identify dynamics underpinning the resilience of these agricultural sectors to animal disease. These scenarios highlight a number of important drivers that influence disease resilience: industry demographics, the role of government support and regulation and the capacity for technological innovation to support the industry to meet local and global market demand. Participants in the scenario planning exercises proposed creative, robust strategies that policy makers could consider implementing now to enhance disease control and industry resilience in multiple, uncertain futures. Using these participant-led strategies as a starting point, we offer ten key questions for policy makers and stakeholders to provoke further discussion about improving resiliency and disease preparedness. We conclude with a brief discussion of the value of scenario planning, not only for the development of futures which will inform disease contingency plans and improve industry resilience, but as a mechanism for dialogue and information sharing between stakeholders and government.



## 1. Introduction

Animal disease preparedness has been at the top of the UK animal health agenda for government policymakers, stakeholders and the public after a number of recent animal disease outbreaks (e.g. Bovine Spongiform Encephalopathy (BSE) in the 1990s, Foot and Mouth Disease (FMD) outbreaks in 2001 and 2007). In particular, the 2001 FMD epidemic led to increases in the complexity of thinking about mitigating animal health and food security risks posed by exotic animal diseases. It was the "single largest FMD epidemic the world had ever experienced" and one of the "most serious animal disease epidemics in the United Kingdom in modern times" (Rossides (2002) at page 831). In 2001, the long-term impact of the outbreak on the farming industry was not certain, but it was immediately clear that the consequences of the disease were not confined just to the livestock sector. The lack of preparedness by the British government, the need for military intervention and the economic effects on tourism and business activities had an important impact on society and on public confidence in science and scientists to produce trustworthy evidence for decisions in animal health policy (Boden et al., 2014). More fundamentally, the outbreak called into question the "role and public expectations of agriculture", its strengths and weaknesses, and its future, given its inter-dependent links with the wider rural economy (Rossides (2002) at page 831). Since then, there have been other smaller scale exotic animal disease outbreaks in the UK (e.g. FMD in 2007 (Anderson 2008), Bluetongue virus (Landeg, 2007)) and the emergence of novel pathogens such as Schmallenberg virus (Beer et al.,

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2013) which have maintained the risks associated with animal disease at the forefront of societal thinking.

Subsequently there has been a desire by both scientists and policy-makers to characterize, quantify and prioritise the risks that animal diseases pose for the near future. This aspiration has resulted in the generation of a portfolio of numerous probabilistic forecasting models and risk assessments (for example: Roberts et al., 2011; Del Rio Vilas et al., 2013). These tools have been refined as scientific knowledge and technology have evolved over time. However, these models typically rely on a single version of the future (Hopkins and Zappata, 2007), ideally parameterised with data from the present or recent past. Although they may be able to quantify uncertainty around the probability that risks will occur, their usefulness is contingent on knowing and identifying these risks in advance. Epidemiological, statistical or probabilistic models cannot take into account the uncertainty associated with 'unknown unknowns' (i.e. radical uncertainties (Nussbaum, 2011)) or the uncertainties and reflexivity inherent in the diverse range of factors (such as climate change, consumer preferences, politics, land use and commerce) which interact to compound risks over very long time periods (20–30 years).

The need to include uncertainty in the assessment of risks is the reason that the "contemporary logic" (Lentzos and Rose (2009) at page 236) of animal health security has a focus on resilience, a concept which goes beyond objective contingency planning and preparedness approaches. Resilience is the capacity to "better anticipate and tolerate disturbances in the world without collapse, to withstand shocks and rebuild as necessary" (Lentzos and Rose (2009) at page 243). It encompasses broad approaches to "thinking about change and societal responses to it" (Leach et al. (2010) at page 370) and thus is contingent on the context and perspectives of those whose resilience is at stake (Leach et al., 2010). Improving and evaluating resilience requires a paradigm shift in the way we rationally and scientifically think about multiple, uncertain futures. It is arguable that there is an increasing role for the incorporation of futures thinking in animal health using methodologies like scenario planning in order to:

- explore the joint impact of multiple but equivalent uncertainties,
- include elements which are difficult to model quantitatively (e.g. value shifts, or new regulations),
- challenge standard assumptions and highlight blind spots or ideas that may otherwise be ignored by decision makers,
- capture rich data on a range of possible and plausible futures which can be condensed into narratives which are easy to grasp and communicate to stakeholders.

(adapted from Schoemaker (1995) at pages 26–27).

In this study, we present a description of the scenario planning work undertaken by EPIC, Scotland's Centre of Expertise on Animal Disease Outbreaks, to investigate the future uncertainty of animal health security in the Scottish sheep and cattle sectors. We explore four future scenarios to make inferences about the resilience of these agricultural sectors to animal disease and offer ten key questions for policy makers and stakeholders to provoke further discussion about improving resiliency and disease preparedness. We conclude with a brief discussion of the value of scenario planning, as a mechanism for dialogue and information sharing between stakeholders and government.

## 2. Materials and methods

Scenario planning is a tool to facilitate qualitative, structured, medium to long-range strategic thinking about plausible and internally consistent futures. A number of different definitions and methodologies for scenario planning have been identified and described in the literature (Kahn and Wiener, 1967; Schoemaker, 1991, 1995; Bunn and Salo, 1993; Ratcliffe, 1999; Chermack et al., 2001). The EPIC workshops for Scottish cattle and sheep sectors included elements of the scenario planning process described by Schoemaker (1995). This process includes: defining the *scope* of the question, identification of *stakeholders*, identification of *basic trends*, identification of *key uncertainties*, construction of *initial scenario themes*, checking for *internal consistency and plausibility* of narratives through a back-casting exercise, development of *preliminary* (*learning*) *scenario narratives* and use of scenario narratives as *decision tools* (Schoemaker, 1995). The research approach was given ethical approval by the Animal Health and Welfare Division of Scottish Government and a James Hutton Institute ethics committee. Data were collected during four workshops: two held in 2013 (April and May, 2013) and two held in 2014 (February, 2014).

The *scope* of this study was encapsulated in the following focal question (that was addressed in separate cattle and sheep workshops): "What will the Scottish livestock industry look like in 2040 and how resilient will it be to livestock disease?" Participants in each workshop formed interdisciplinary teams including stakeholders from Scottish cattle or sheep sectors, farming, wildlife/forestry, Centres of Expertise on water and climate change, economists, agricultural and social scientists, veterinarians, epidemiologists, EPIC scientists and Scottish Government policy staff. Participants were given the role of scenario planners, tasked with engaging in strategic thinking through a series of carefully crafted exercises that resulted in the creation of four scenarios describing the situation in 2040 for each sector. *Basic trends* were considered through the creation of a historical timeline (Fig. 1). This process involved the identification and verification of important past events and influences on the development of the present day cattle and sheep industries. The timeline included directly relevant events but also other exogenous factors which may have had an indirect impact on sheep and cattle sectors (for example: climate change, increasing drug resistance, afforestation, the economy, the influence of energy prices and the cost and availability of labour). The historical timelines for the cattle and sheep sectors were created outwith the exercise, informed by expert opinion, with some further developments to the sheep timeline by participants at the workshop. In both cases, the historical timeline was a useful reference to 'ground-truth' (Lempert et al., 2003) the list of important driving influences for the future (from the categories of population, consumer and animal demographics, technology, economy, society, environment and politics). The list of drivers in this study was compiled in advance of each workshop and discussed in detail and refined with participants. A summary of the drivers is presented in Table 1. *Key uncertainties* were identified through a participant-driven process which resulted in a ranking of drivers separately for relative impact and uncertainty (i.e. the larger the range of plausible outcomes of a driver, the greater the uncertainty). High impact, high uncertainty drivers were clustered into themes, and hereafter referred to as critical uncertainties. Critical uncertainties were expressed as axes, representing a continuum of possibilities between two extreme endpoints. The axes for the cattle and sheep scenario planning events are presented together in Fig. 2. Two critical uncertainties were selected independently by participants at both workshops: (1) prioritisation of the industry by government and (2) technological innovation. The third parameter varied between the sectors, with government regulation chosen in the cattle sector workshops and market demand in the sheep sector workshops.

In each sector, four *initial scenario themes* were chosen in collaboration with workshop participants by selecting a combination of different positions on each of the three axes. Scenario development was guided by *plausibility, internal consistency*, diversity and poten-