Institution: Royal Veterinary College
Unit of Assessment: A 6 Agriculture, Veterinary and Food Science
Title of case study: African swine fever risk reduction as an exemplar of cogent policy advice

1. Summary of the impact (indicative maximum 100 words)

RVC's Veterinary Epidemiology, Economics and Public Health team (VEEPH) has been at the forefront of applying and evaluating new techniques for modelling disease risk, for policy and decision makers to use in surveillance and control of animal and zoonotic infections. Application of their recommendations, including European 'Commission Decision' legislation, is contributing to ensuring that Europe remains free from African swine fever (ASF). The status of FAO Reference Centre in Veterinary Epidemiology, awarded by the United Nations' Food and Agriculture Organisation in 2012, recognises the RVC as a centre of excellence in this field and reinforces its role in guiding policies relating to animal health.

2. Underpinning research (indicative maximum 500 words)

The VEEPH team, led by Dirk Pfeiffer (Professor of Veterinary Epidemiology since 1999), is highly interdisciplinary, with staff contributing different areas of expertise, including field epidemiology, quantitative and qualitative analysis, dynamic disease modelling, animal health economics, risk assessment, risk communication and risk management. The team has produced over 200 peer-reviewed publications in the last five years.

A particular strength has been in the novel application of generic statistical and epidemiological tools, emerging from mathematical and statistical research, to real-world problems in animal and public health. Pfeiffer has championed a holistic approach to providing decision makers with more effective and comprehensible tools for effective surveillance and infection management strategy planning [1]. Shortly after joining the RVC, Pfeiffer published a paper with colleagues from Massey University applying spatial analysis techniques to data from the UK BSE epidemic demonstrating the power of this technique in disease surveillance and the recommendation of control measures [2].

This led to work on ASF commencing in 2005, supported by a Wellcome Trust programme grant in collaboration with the Pirbright Institute and various European partners. In 2009, the VEEPH team, with Pirbright and international collaborators, reviewed the risk of global spread of ASF, and highlighted loss associated with outbreaks as well as the immense cost of eradication methods [3, 4].

The role in the Wellcome Trust project identified RVC as a key partner for contributing the risk assessment component of the EU 7th Framework Programme (FP7) project 'Evaluating and controlling the risk of African Swine Fever in the EU' (ASFRISK): leading Work Package 3 – 'Risk Assessment of the introduction of ASFV into the EU'. RVC, together with University of Belfast (working on diagnostics), were the only UK members of the 17 party international consortium.

In 2011, Barbara Wieland (originally a post-doc on the Wellcome Trust programme promoted to lecturer in Epidemiology 2007 - 2012) led the risk assessment aspect of the working group of the European Food Safety Authority (EFSA) on ASF resulting in the development of a qualitative model to assess the impact of control measures on the spread of ASF. The hierarchical model has a limited number of key steps, but with very detailed sub-steps, allowing disassociation of steps in risk pathways and avoidance of pre-conceived notions of final risk estimates. Overall risk estimates for pathways can be derived by using systematic combination matrices. The model has particular value in data-scarce environments. [5]. In addition, in 2011, research undertaken by Wieland and Pfeiffer informed the first quantitative risk assessment for ASF virus entering the EU via legal import of live pigs [6, 7], identifying geographical areas and time periods of increased risk, thus informing development of targeted risk-based surveillance and control strategies. The model produced a flexible and easily updated risk-based tool for use by policy makers.

Complementing the disease-specific assessments, in 2011, Pfeiffer published an evaluation of spatial modelling approaches to highlight advantages and limitations of different methods [8]. This noted that decision makers generally require a binary map requiring selection of a threshold value to convert probabilistic outputs generated by modelling, and also that the most extensively used spatial modelling method – the generic algorithm for rule set production – has been shown to be one of the worst performing methods in comparison with others. Two methods with highest performance, boosted regression trees and maximum entropy, have been infrequently used to date in modelling disease distribution.

The particular expertise of the group and outputs from the ASFRISK project helped secure funding for the EU FP7 ASFORCE project, in which RVC has played a key role – in leading the modelling and economic analysis - in an international consortium of 17, focussed particularly on the threat of ASF from Eastern Europe.

Other Quality Indicators
D Pfeiffer. African swine fever virus: Development of vaccines and epidemiological investigations. Wellcome Trust. 2005-11. £2,200,000
D Pfeiffer. ASFRISK - Evaluating and controlling the risk of African Swine Fever in the EU. EU FP7. 2008-12. €175,000.
D Pfeiffer. ASFORCE - Targeted research effort on African swine fever. EU FP7. 2012-15. €150,000.

3. References to the research (indicative maximum of six references)

1. Clements, A, Pfeiffer, D, Martin, V. Application of knowledge-driven spatial modelling approaches and uncertainty management to a study of Rift Valley fever in Africa. 2006 International Journal of Health Geographics; 5: 57 DOI:10.1186/1476-072X-5-57
2. Stevenson, MA, Wilesmith, JW, Ryan, JB, Morris, RS, Lawson, AB, Pfeiffer, DU, Lin, D. Descriptive spatial analysis of the epidemic of bovine spongiform encephalopathy in Great Britain to June 1997. 2000 Veterinary Record; 147(14):379-84 doi:10.1136/vr.147.14.379
3. Costard, S, Wieland, B, de Glanville, W, Jori, F, Rowlands, R, Vosloo, W, Roger, F, Pfeiffer, DU, Dixon, LK. African swine fever: how can global spread be prevented? 2009 Philosophical Transactions of the Royal Society B: Biological Sciences; 364: 2683 – 2696 DOI: 10.1098/rstb.2009.0098
4. Costard, S, Porphyre, V, Messad, S, Rakotondrahanta, S, Vidon, H, Roger, F, Pfeiffer, DU. Multivariate analysis of management and biosecurity practices in smallholder pig farms in Madagascar. 2009 Preventive Veterinary Medicine; 92: 199-209 doi.org/10.1016/j.prevetmed.2009.08.010
5. Wieland, B, Dhollander, S, Salman, M, Koenen, F. Qualitative risk assessment in a data-scarce environment: a model to assess the impact of control measures on spread of African Swine Fever. 2011 Preventive Veterinary Medicine; 99: 4 -14 doi.org/10.1016/j.prevetmed.2011.01.001
6. Mur, L, Martinez-Lopez, B, Martinez-Alviles, M, Costard, S, Wieland, B, Pfeiffer, D U, Canchez-Vizcaino, S. Quantitative risk assessment for the introduction of African swine fever virus into the European Union by legal import of live pigs. 2012 Transboundary and Emerging Diseases; 59(2): 134 – 44 DOI: 10.1111/j.1865-1682.2011.01253.x
7. Costard S, Jones, BA, Martinez-Lopez, B, Mur L, de la Torre A, Martinez M, Sanchez-Vizcaino, F, Sanchez-Vizcaino J-M, Pfeiffer DU, Wieland, B. Importation of African Swine Fever in the European Union through illegal importation of pork and pork-related products. 2013 PLoS One; 8 (4) e61104 doi:10.1371/journal.pone.0061104
8. Stevens, KB, Pfeiffer, DU. Spatial modelling of disease using data- and knowledge-driven approaches. 2011 Spatial and Spatio-temporal Epidemiology; 125 – 133 doi.org/10.1016/j.sste.2011.07.007

4. Details of the impact (indicative maximum 750 words)

ASF is a devastating disease with mortality approaching 100% of infected animals. Its introduction into some countries has resulted in the loss of between 30 and 50% of the pig population. There is no vaccine and no treatment available. It has become endemic in many infected territories and

(outside Africa) its principal impact has been economic, through loss of status for international trade and costly control strategies to eliminate the disease. In Spain, this has been estimated as US$92 million over 5 years. The net benefit of preventing ASF introduction in the USA is accounted to be almost US$4,500 million – nearly 5% of the value of total pork product sales. Defra cites the scale of concern in Europe by comparison with classical swine fever (CSF) outbreaks: in East Anglia in 2000/2001 control costs were £4.4 million and the total cost of a large outbreak of CSF in the Netherlands in 1997 was estimated at $2.3 billion.

For these reasons, it is considered crucial to avoid ASF progressing into and across European Union territories (infection within the EU is currently limited to Sardinia). The presence of ASF in relatively near-border Russian Federation territories has caused grave concern to the European Union.

The ASFRISK consortium project has enabled RVC, as leaders of work package 3, to contribute to the first risk assessment for ASF virus introduction via live pig importation for the EU [a]. The identification of geographical areas and time periods of highest risk has helped improve the effectiveness of surveillance programmes, as well as improved biosecurity policies.

RVC contributed to the EFSA's ASF working group, and led the development of a generic qualitative model underpinning this risk assessment. This was applied to assess risks of different routes of transmission of ASF from the Trans Caucasus countries and Russian Federation into the EU. The model considered ASF remaining endemic in domestic pigs and/or in wild boars in these territories and spreading; and the risk of it becoming endemic in EU domestic pigs and or wild boars if introduced. The conclusions informed EFSA's Scientific Opinion on ASF requested by the European Commission [b c].

The transparency of the model enabled decision-makers at the European Commission to recognise the critical points and also the uncertainties affecting the risk estimates, allowing improvement in mitigation measures. The Chief of the Animal Health Service, Animal Production and Health Division of the FAO notes: "*The group contributes both through written reports and direct contact with decision makers, including participation in advisory committees […] in developing a generic qualitative model for risk assessment, they created a tool that […] has the additional and broader value that it can be adapted to assessment of risk of other diseases, spread through pig, and potentially other, livestock trade*."[d]

Following the guidance from the risk assessment, in February 2011, the Official Journal of the European Union published a Commission Decision, 'in accordance with the opinion of the Standing Committee of the Food Chain and Animal Health' relating specifically to addressing risk of ASF transmission from Russia [e]. The issue remains under regular consideration by the Committee, on behalf of the Commission [f].

The Commission has publicly reported its use of the ASFRISK outputs, in control strategies for ASF, and in promoting its willingness to provide training and help neighbouring countries to manage the problem, to the FAO and Russia [g,h]. The presentations from the Directorate-General for Health and Consumers (DG-SANCO) also reference the 2011 Commission Decision and the formal EFSA Scientific Opinion.

The ASF research provides a specific example of how VEEPH under the leadership of Pfeiffer and their holistic approach to veterinary infectious disease problems allows rapid translation of the results of their research into government policy and surveillance schemes. Members of the VEEPH team are disseminating the outputs of their research and contributing to evidence-based policy making both through written reports and through direct contact with decision makers: Advisory activities and consultancies are regularly undertaken for national governmental and international development organisations including Defra, European Commission, European Food Safety Authority, the United Nation's Food and Agriculture Organisation and International Livestock Research Institute. Pfeiffer is an advisor to the European Commission's DG SANCO on surveillance strategy. His experience as a veterinary epidemiologist working in animal and public

health led to his appointment as Chair of the AHVLA's independent Surveillance Advisory Group tasked to develop recommendations for a new more effective and affordable approach to veterinary surveillance in UK. As Chair, Pfeiffer used his research findings to inform the overall structure and priorities of the group. The group's recommendations have been accepted by Defra, and are now in the process of being implemented under the Surveillance 2014 project, for which Pfeiffer has been appointed to the Project Board [i]. In addition, Pfeiffer was asked to join the Exotic Disease Subgroup of Defra's Science Advisory Council, which acts as a policy advisory body to the Chief Scientific Advisor and Chief Veterinary Officer regarding Defra's preparedness to manage outbreaks of exotic diseases such as ASF. Furthermore, the RVC is a member of the Global African Swine Fever Alliance which promotes international knowledge exchange to fight this disease [j].

In July 2012 the United Nation's Food and Agriculture Organisation (FAO) awarded the RVC the status of FAO Reference Centre in Veterinary Epidemiology, a reflection of the global recognition of the RVC as a centre of excellence in veterinary epidemiology [k]. It is currently one of four such centres in the world and the only one of its kind in the UK. It delivers impact through:

- Providing advice and expertise on risk-based animal disease surveillance to FAO and FAO member countries;
- Informing FAO of changes in epidemiologic situations of animal diseases;
- Assessing risks associated with animal diseases and provide advice on appropriate surveillance methods; and
- Contributing to capacity building programmes in FAO member countries or at a regional level.

5. Sources to corroborate the impact (indicative maximum of 10 references)

a. Risk assessment of the introduction of ASFV into the EU http://www.asfrisk.eu/index.php?option=com_content&view=article&id=49:work-package-3&catid=36:task-1&Itemid=60 [accessed 1 Mar 2013]
b. EFSA (2010) 'Scientific Opinion on African Swine Fever' 19 April EFSA Journal 8(3): 1556 [online] http://www.efsa.europa.eu/en/efsajournal/pub/1556.htm [accessed 1 Mar 2013]
c. Details of RVC contribution available from EFSA Animal Health and Welfare Unit on request.
d. Statement from Chief Veterinary Officer, Chief, Animal Health Service, Animal Production and Health Division, FAO. Held by RVC.
e. Commission Decision 3/2/11 regarding prevention of transmission of ASF from Russia to the EU http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:030:0040:0043:EN:PDF [accessed 1 Mar 2013]
f. Standing Committee on the Food Chain and Animal Health. Summary record of meeting 8-9/3/12 http://ec.europa.eu/food/committees/regulatory/scfcah/controls_imports/sum_0809032012_en.pdf Item 4b pages 3-4. [accessed 1 Mar 2013]
g. Presentation from European Commission: 'African Swine Fever – What is the EU doing?' http://www.fao.org/fileadmin/user_upload/Europe/documents/Events_2012/ASF/EC_DG_en.pdf [accessed 1 Mar 2013]
h. Presentation from European Commission: 'African Swine Fever – the EU Perspective' http://www.fsvps.ru/fsvps-docs/ru/news/files/3610/francisco-reviriego.pdf [accessed 1 Mar 2013]
i. Surveillance Advisory Group (2012) Final Report. http://www.defra.gov.uk/ahvla-en/files/pub-sag-final-report.pdf [accessed 1 Mar 2013]
j. http://www.ars.usda.gov/GARA/partners.htm [accessed 18 Nov 2013]
k. http://empres-i.fao.org/eipws3g/index.html?animalProdNetwork=yes [accessed 31 Jul 2013]