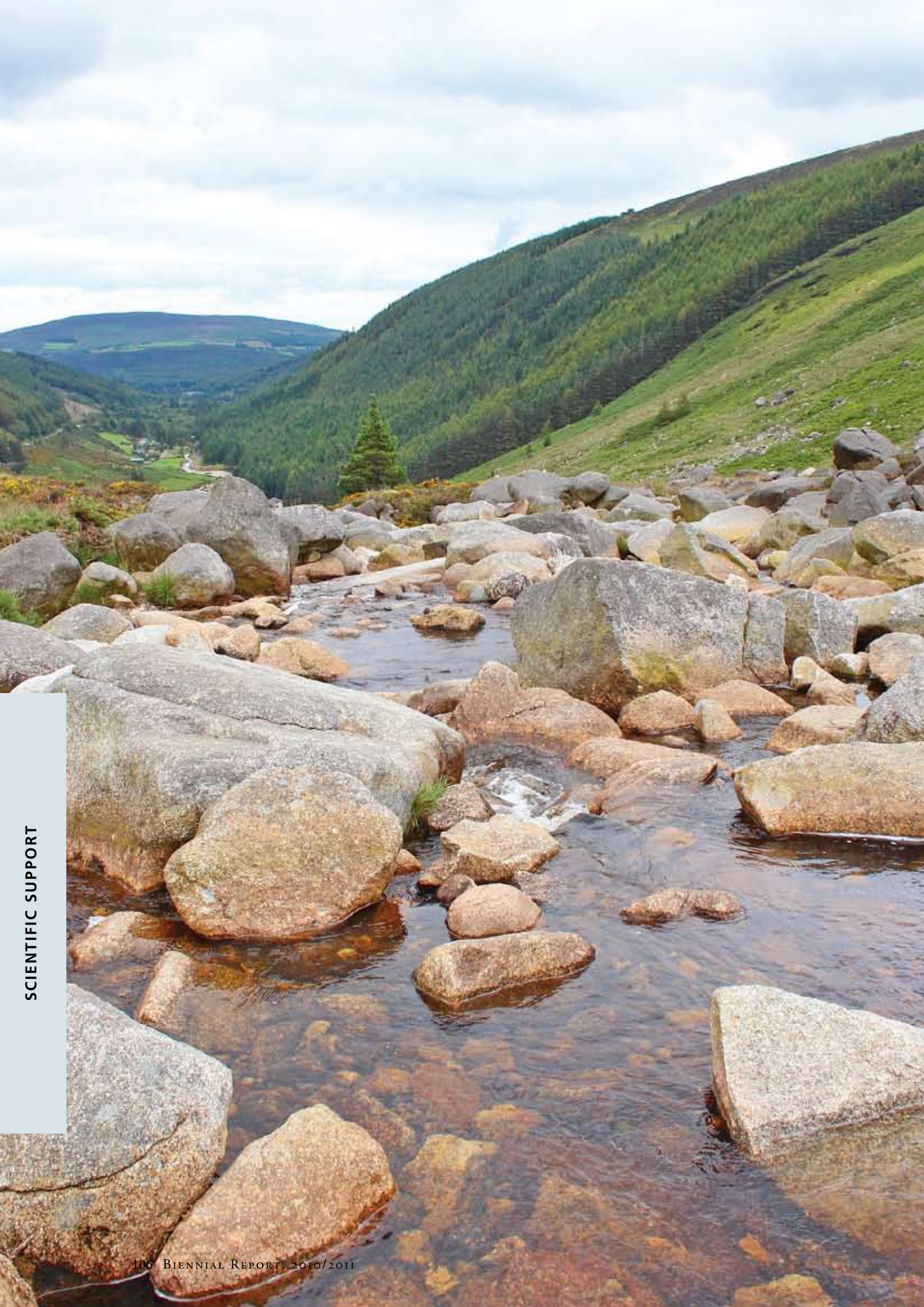

SCIENTIFIC SUPPORT

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Scientific support

Epidemiological support

Key CVERA contacts: Simon More, Inma Aznar, Mary Canty, Liz Lane

The UCD Centre for Veterinary Epidemiology and Risk Analysis (CVERA) provides epidemiological support in a wide variety of areas. CVERA staff are active in support of on-farm investigations by undergraduate veterinary students, and of research projects by postgraduate students, at University College Dublin (UCD). Working closely with colleagues in Ireland and internationally, they also collaborate, either in a lead or support role, on a broad portfolio of research projects, contributing epidemiological expertise to the design, conduct, analysis and finalisation of scientific research. CVERA continues to provide epidemiological training to staff of the Department of Agriculture, Food and the Marine (DAFM), through the 6-monthly epidemiological mentoring group. Epidemiological staff in CVERA increasingly work at the science-policy interface, providing scientific advice to support policy decision-making, both in Ireland and internationally. In Ireland, CVERA works closely with government organisations (including DAFM, the Food Safety Authority of Ireland (FSAI), and the Marine Institute) and with Animal Health Ireland (AHI). Internationally, CVERA staff contribute to the work of the European Food Safety Authority (EFSA). In general, epidemiological support is undertaken in collaboration with other CVERA staff, with expertise in statistics, geographic information systems and database maintenance and interrogation.

The following provide an overview of some of the epidemiological support provided by CVERA during the last 2 years:

Scientific information in support of national and international policy decision-making

Most of CVERA's work is conducted at the science-policy interface, with CVERA staff conducting scientific research and providing scientific information in support of policy decision-making.

In Ireland, CVERA works very closely with DAFM, principally in the broad area of regulatory animal health (including bovine tuberculosis, emergency disease preparedness and response, and animal welfare). CVERA staff work in close collaboration with AHI, providing scientific support through Technical Working Groups (TWGs; ongoing chair of the TWGs on Johne's disease and mastitis, past chair of the TWGs on biosecurity and calf health) and through applied scientific research, focused on key AHI issues. Simon More is a member of FSAI's Biological Safety Subcommittee.

Internationally, Simon More is a member of EFSA's Animal Health and Welfare Panel and has contributed to each of the following AHAW working groups:

- Meat inspection (chair, 2010-)
- Q fever (chair, 2010)
- The use of a gamma interferon test for the diagnosis of bovine tuberculosis (member, 2011-)
- Review of the European Union Summary Report on trends and sources of zoonoses, zoonotic agents and food-borne outbreaks in 2010 – specifically for the data related to bovine tuberculosis, Echinococcus, Q fever, brucellosis and non-food borne zoonoses (member, 2011-)
- TB in deer (member, 2009)

Since 2008, he has been a member of the Epidemiology & Wildlife Risks Programme Advisory Sub-Group, which forms part of Defra's Bovine TB Science Advisory Body in the UK.

Epidemiological teaching

UCD taught programmes

CVERA staff make a substantial contribution to UCD taught programmes, both to undergraduate and postgraduate students, in the following courses:

Veterinary Medicine

- *VET10030 Applications and Integration 1* (development of several problem-based learning exercises, 1st year MVB programme)
- *VET30170 Veterinary Herd Health and Population Medicine* (lectures, 4th year MVB programme)
- *VET30290 Veterinary Medicine* (practical classes & farm visits, 5th year MVB programme)
- *VET40180 Herd Health Investigations Skills* (module coordinator, online learning, Graduate Certificate in Bovine Health Management)
- *VET30070 Clinical reproduction programme* (lectures, 4th year MVB programme)
- *VET20020 & VET30390 Equine reproductive physiology* (lectures, 2nd year MVB programme)

Veterinary Nursing

- *VNUR10240 Veterinary Reception and Management Skills* (lectures, 1st year Veterinary Nursing Degree programme)
- *VNUR30310 Introduction to Research* (lecture, 3rd year Veterinary Nursing Degree programme)

Other taught programmes

- *AESC40020 Epidemiology and Zoonoses* (lecture, Masters students, Agricultural and Environmental Sciences)
- *ANSC30130 Animal health, welfare and behaviour* (lectures, Animal Science students)
- *MDSA10210 Science Medicine and Society* (lecture, Medicine and Medical Science)
- *Advances in Infection Biology* (lecture, Infection Biology Thematic PhD)

Non-UCD taught programmes

CVERA staff have also contributed to the following:

- *Certificate programme in stud management* (Liz Lane lectures on an approach to foaling mares, Irish National Stud)
- *European Diploma in Animal Reproduction sub species Bovine (DiplECAR (Bovine)).* (Liz Lane was the official supervisor for Marijke Beltman)

Epidemiological training for DAFM staff

CVERA coordinates an *epidemiological mentoring group*, to support veterinarians with an interest in the practical application of veterinary epidemiology in their work. The group met in Portlaoise, Co. Laois, in May 2010 and in February and November 2011. The meeting includes informal support for fundamental epidemiological issues (for example, 'writing scientific papers', epidemiological study designs' etc). In addition, a group of epidemiological mentors (from CVERA and elsewhere) are providing support to group members on epidemiological projects that they are leading. Some current projects include:

- Seán Ashe, Investigation of oyster mortality in Ireland
- Dorothy Bailey, Investigation of the piroplasmosis outbreak in horses during 2009
- Aidan Cahill, Factors affecting BSE sample quality

- Bosco Cowley, Prevalence of IBR and BVD write-up
- Mary Cullinane, Further analysis of the emergency slaughter data
- Anthony Duignan, Quality control in the national bovine TB programme
- Andrea Dwane, Critical review of the suckler welfare scheme
- Nicky Fennelly, Bovine TB trends in Kilkenny
- Martin Hayes, Correlation between SICCT and gamma-interferon tests
- Damien Kelly, Evaluating the concepts of risk-based surveillance in the national bovine TB programme
- Paddy Kelly, Evaluating an early warning system for on-farm animal welfare incidents
- Peter Mullowney, Management of herpesvirus infection in oysters
- Declan Murray, Analysis of single reactor breakdowns
- John O'Gorman, Analysis of AHCS form 1
- Eoin Ryan, Ongoing epidemiological work with BSE and Q fever

Several of these projects were recently published in the international peer reviewed literature.

Animal Health Ireland

CVERA has worked in close collaboration with a range of other partners towards the establishment of, and subsequently in support of, AHI, a not-for-profit, partnership-based organisation providing national leadership and coordination of non-regulatory animal health issues in Ireland. Partner organisations include livestock farmers, processors, service providers and government. In Ireland, as elsewhere, regulatory animal health issues are the responsibility of government. Until recently, however, there has been no national coordination of non-regulatory animal health issues. AHI was established specifically to fill this gap. For some years, CVERA sought to build a science-base in support of AHI's formation, providing a critical review of current performance in non-regulatory animal health in Ireland, and building a case for increased private sector involvement in non-regulatory animal health issues. Following AHI establishment in early 2009, CVERA has been heavily committed, with other partners, in providing scientific information in support of national decision-making in this area, through AHI's technical working groups, focusing on areas including biosecurity, calf health, Johne's disease and mastitis. CVERA is also leading or contributing to a number of highly applied research programmes in these areas.

Irish Veterinary Journal

In collaboration with Michael Doherty, the Editor-in-Chief, Simon More has worked to establish the *Irish Veterinary Journal* as an open access journal, within the BioMed Central (BMC) stable. BMC currently publish 227 international peer-reviewed journals, all open access, most in partnership with scientific societies. The journal, located at **www.irishvetjournal.org**, now has the potential to reach its full potential, providing an international showcase for high-quality Irish veterinary medical research. The journal is now indexed widely, including in PubMed, and highly visible internationally. As stated by Michael at its recent "re"-launch:

"The aspirations and achievements of the Irish veterinary profession and Irish veterinary science are world-class, in terms of patient care, national disease control, veterinary education and research. This exciting new relationship between Irish Veterinary Journal and BioMed Central, providing open access publishing and concomitant increased international standing, is entirely in keeping with those aspirations and achievements."

CVERA is leading the IVJ archiving project, which seeks to create a complete electronic archive of the *Irish Veterinary Journal*, from volume 1 in 1946. At this point, all peer-reviewed journal articles from volume 57 (2004) are available online.

Statistical scientific support

Key CVERA contacts: Tracy Clegg, Mary Canty

CVERA provides statistical support in a variety of areas ranging from study design, statistical analysis, interpretation of results and assistance with publishing results. Support is mainly provided to personnel in DAFM on various research areas. In addition, statistical support is provided to AHI technical working groups as requested and to researchers in UCD Veterinary Medicine and other organisations. Advice and technical expertise is also provided by CVERA for the statistical software packages SAS, STATA, SPSS and, to a lesser extent, WINBUGS.

During 2010-2011, in addition to core projects already described, CVERA provided statistical support and advice to a range of research projects as follows:

Department of Agriculture, Food and the Marine (DAFM)

Routine support

- Estimation of the potency of tuberculin supplied to Ireland. Around twice each year DAFM carries out trials on cattle that have already tested positive to the Single Intradermal Comparative Tuberculin Test (SICTT) in order to estimate the potency of tuberculin supplied to Ireland. CVERA receives the data from these trials and runs the appropriate models to estimate the potency of the tuberculin batches tested
- Selection of a random sample of herds for a surveillance programme on Bluetongue virus in the Irish cattle population
- Provide statistical support annually to assist in the quantitative comparison of the performance of individual private veterinary practitioners (PVPs) in relation to SICTT testing for bovine tuberculosis

Statistical support

- Provided statistical assistance with the data collection, descriptive analysis and the use of logistic regression for a study of bovine tuberculosis in animals slaughtered from single reactor breakdown at an Irish export meat plant
- Assisted with the sample selection and analysis of prevalence for a survey of the distribution of paratuberculosis (Johne's disease) in cattle herds in Ireland
- Provided statistical advice for a study of tuberculosis in goats on a farm in Ireland
- Assisted with descriptive analysis of bovine cases consigned under veterinary certification to emergency and casualty slaughter in Ireland during 2006 to 2008
- Advised on the study design to identify non-compliance of sheep identification
- Performed statistical analysis using survival analysis to compare the performance of SICTT testing carried out by TVIs compared with herds tested by pvps when testing herds for bovine tuberculosis
- Advised on the statistical analysis of the calving interval of cows in 5 beef herds by various risk factors

UCD School of Veterinary Medicine

Teaching

- *VNUR30310 Introduction to Research* (lecture, 3rd year Veterinary Nursing Degree programme) – lectures and tutorials on statistics

Statistical support

- Statistical advice provided on the appropriate non-parametric tests to use for the study: Comparison of ultrasound-guided versus "blind" techniques for intra-synovial injections of the shoulder area in horses: scapulohumeral joint, bicipital bursa and infraspinatus bursa
- Assisted with the statistical analysis for a study of a retrospective review of weight loss despite a good appetite in horses
- Statistical advice provided on the appropriate methods to use to compare SCC measurements for the study: A HACCP-based approach to mastitis control in dairy herds. Part 2: Implementation and evaluation
- Assisted with the descriptive data analysis of Delphi results from the study: Evaluation of current equine welfare issues in Ireland: Causes, desirability, feasibility and means of raising standards
- Advice provided on the study design to compare different diagnostic imaging techniques
- Assisted with the statistical analysis to compare biosecurity risks at horse events
- Assisted with the data analysis for a study of persistent-post breeding endometritis in mares comparing swabs taken before and after breeding from the vagina and uterus
- Contributed to a study on the number of herd restrictions due to bovine tuberculosis for a project based on herds in West Wicklow

Geographic Information Systems (GIS) scientific support

Key CVERA contacts: Guy McGrath, Daniel M. Collins

CVERA provides a broad range of GIS scientific support to research and disease eradication projects run by DAFM. Additionally, GIS support is provided to UCD Veterinary Medicine and other organisations. Listed is a sample of GIS work conducted in CVERA which is not credited formally through peer review.

The Wildlife Unit

a. An independent monitor

CVERA acts as an independent monitor for the National Parks and Wildlife Services (NPWS) within the Department of Arts, Heritage and the Gaeltacht to ensure operations of the Wildlife Unit (DAFM) are within pre-agreed criteria. This includes verifying individual badger removal licences and calculating a running total of the total area of land under treatment by county. Six-monthly reports are produced for the two government Departments.

b. Administration

In addition to monitoring and reporting on Wildlife Unit activities, CVERA maintain the GIS component of the Wildlife Unit administration centre in Johnstown Castle, Co. Wexford. This centre provides all District Veterinary Offices with the relevant maps and ortho-photography to complete badger surveys in areas where tuberculosis breakdowns in cattle have been attributed to wildlife. The badger setts found through surveying are digitised and maintained centrally on the GIS. Spatial queries are employed to validate sett location and reduce input errors.

c. Vaccine trial

A vaccine that protects badgers from bovine tuberculosis is currently being trialled. The field trial area in west Kilkenny was selected based upon location, herd count and cattle density, existing sett density, topology and land use using GIS. Additional locations in other counties have been identified to replace badger culling with vaccination as part of an additional trial. Ongoing GIS support will be provided for the maintenance and analysis of these projects.

d. General Wildlife Unit tasks

Specific queries and issues considered to be of local importance are dealt with on an *ad hoc* basis. This includes mapping neighbourhood TB testing history to assist in decision making in problem areas. All District Veterinary Offices are supplied with A0 maps annually showing the location of their setts and capture blocks.

Technical GIS support

Administrative

In the event of an outbreak of a Class A disease, CVERA provide GIS support to the DAFM's National Disease Control Centre. In the case of Foot and Mouth disease (FMD), CVERA liaise with the Irish meteorological office, Met Éireann, to establish the windborne risk of infection to farms in the vicinity of an index case. CVERA are currently involved in the process of unifying FMD zone mapping with our GIS counterparts in the Department of Agriculture and Rural Development, Northern Ireland. CVERA have provided contingency mapping support for diseases associates with bovine, avian, equine, porcine and ovine species.

Epidemiological

CVERA assist in the spatial components of a diverse array of epidemiological projects. These projects include:

- Selecting random sites nationally for the survey of Culicoides
- Herd selection by grid square for annual Bluetongue surveillance
- Cluster analysis of Johne's Disease
- Clustering of Cryptosporidium
- Associating local climatic events with poor performance on a study herd
- Aerial dispersion modelling
- Continuation of disease density 'green blob' maps 2007 through to 2010
- Mapping of lead levels in bovines in the Silvermines area

General administrative GIS support

CVERA provides regular GIS administrative reports to DAFM. Examples of GIS administrative reports to the Department include:

- Estimating the distance between main farms and their corresponding county District Veterinary Office (DVO)
- Calculating the catchment areas for DAFM Veterinary Laboratory Service regional offices
- Calculating DVO farm catchment areas
- Providing mapping assistance for the early stages of the N11 badger tracking project

Ad hoc *GIS support*

CVERA provides once-off GIS support to a range of projects conducted by the Department, UCD Veterinary Medicine and other collaborating agencies. Examples of recent GIS support include:

- Creating a map for DVOs showing live transport resting stops in France under EU welfare requirements (DAFM)
- Mapping the submission of equine cases to the UCD Veterinary Hospital (UCD)
- The location of roads studied for a paper on road casualty mammals (UCC)
- The territories and badger sett locations of Little Island, Co. Waterford (UCC)
- Maps illustrating various aspects of the Irish equine industry as part of a publication entitled "Challenges and solutions to support good equine welfare practice in Ireland" (UCD)
- Selection on a Control area for the N11 badger tracking project (DAFM)
- Construction of a national 10 metre Digital Terrain model (DTM) of Ireland
- Creation of a complete seamless Land Parcel Identification System (LPIS) coverage of Ireland from 1999 with spatial attribution applied to the most recent entries
- Trichinella maps and bovine density maps for DAFM Veterinary Laboratory Service
- Piroplasmosis mapping (DAFM)

Provision of geographic data

CVERA provide collaborative agencies with geographic data. Some of these projects include:

- The provision of Land Parcel Identification System (LPIS) to National Parks and Wildlife Services (NPWS) on an ongoing basis
- The provision of Four Area Project data and GIS assistance to The School of Natural Sciences in Trinity College Dublin
- The provision of data to the UCD School of Mathematical Sciences for a project based on herds in the West Wicklow area
- The provision of data for a project entitled "Effect of distance between a previously *Mycobacterium bovis*-infected herd and clear herds on the occurrence of bovine tuberculosis breakdowns in Ireland
- The provision of spatial data to model the badger populations in Ireland
- The provision of data for a project aimed at evaluating a risk-based approach to meat inspection for bovine tuberculosis in Ireland
- The conversion of Irish geographic XY location data to international lat/long standard
- The provision of mapping resources as part of veterinary student herd investigations
- Ann Valley catchment constructed wetland data support
- The provision of data for a national wildlife survey

Database scientific support

Key CVERA contact: Isabella Higgins

Provision and preparation of data for research projects for CVERA, PhD theses/publications and support for a range of projects from the mentoring group

Maintenance and conversion of the following databases to SAS® datasets

CVERA maintains a copy of the following national databases:

- Animal Health Computer System (AHCS) database
  - TB Herd test summary records
  - TB Animal level records
  - TB Factory surveillance database
- Animal Identification and Movements System (AIMS) database

Each is converted to SAS® datasets, to facilitate data extraction and analysis.

Data extraction

Data extraction from the above-mentioned databases has or is being used for a broad range of projects, including:

- Cost benefit analysis of Irish BVD eradication programme; descriptive data for suckler, dairy and beef fattening herds by herd size
- Calf wastage project to estimate calf mortality in Ireland; data extraction from AIMS and collation with ICBF data from milk-recording herds
- Wind distribution models; provision of assistance with the handling of raw data
- Thematic mapping of bovine TB incidence per square km; provision of APT figures on a DED basis (for kernel density with search radius at 10km) for the years 2010 and 2011
- Genetics of tuberculosis in Irish dairy cows; merging of linkable records from AHCS, AIMS (formerly CMMS, Cattle Movement Monitoring System) and the Irish Cattle Breeding Federation (ICBF) database to create animal and herd level records of animal breeding and disease control
- Provision of demographic data for a retrospective cohort study on the relationship between herd size, herd expansion and milk somatic cell counts
- Provision of demographic data on farms selected for the study on molecular epidemiology of *Cryptosporidium parvum* subtypes using multi-locus subtyping approach and geographic information system approach
- Identify key performance indicators (KPIs) that can be monitored to enhance the Early Warning System (EWS) for Animal Health and Welfare; data extraction from AIMS of the following data: Late registrations, Cattle exits by on-farm burial, Cattle moves to the knackery, Cattle moves to herd E800 and Total cattle exits (move to the factory, abattoir, mart, private sale, knackery, on-farm burial, locate or E800)
- Investigating the long-term survival and movement of BVD antigen positive animals to the knackery/laboratory, factory or other farms; provision of movement data from AIMS for these animals, as confirmed by DAFM Veterinary Laboratory Service during 2010
- Provision of episode based data and movement records as a follow up to previous work on the genetics of tuberculosis in Irish dairy cows. The main objective of this further study is to fine map the regions of the genome associated with TB and to investigate using beef animals and to create more accurate dependent variables (i.e. genetic merit for TB on sires)

General database support

CVERA provides general database support through each of the following:

- Support the structure of epidemiological data storage in SAS®
- Ensure timely and accurate management of epidemiological data
- Lead on-going data maintenance efforts
- Ensure epidemiological data is entered accurately
- Programming in SAS® requests for analyses of epidemiological data
- Assist with SAS® upgrades
- Recommend and assist in the implementation of process improvements for data exchange
- Create, edit and update epidemiological datasets as requested
- Interact with and respond to epidemiological data questions
- Participate in projects and department meetings to maintain awareness of changing needs as they relate to epidemiological data usage
- Identify new epidemiological data requirements and changes to existing epidemiological data

Creation of episode-based data

Detailed work was conducted to create a database of TB breakdown episodes for the period 1989-2010. This work will form the basis of extensive future work in the study of TB, including each of the following research projects:

- Compilation and validation of episode-based data for the Restocking Study and identification of the study population
- Provision of extensive tabulated data over the period 1995-2010 of bovine TB trends in Ireland as part of work in collaboration with England, Northern Ireland, Scotland and Wales using episode-based data, AHCS TB herd test summary records and TB animal test records
- The development and application of new measures of performance, relating to the management of the Irish TB eradication programme. This project will assist with ongoing programme review to enable ongoing measurement and to review programme progress