

**Investigation of Spatial Patterns of Animal Disease**

**Welcome to the course**

This individual module is designed to enable you to sample a discrete extract of learning, which is taken from our degree module, Advanced Statistical Methods in Veterinary Epidemiology.

The module is estimated to take approximately 70-hours to complete (study units and written assignment, if you choose to complete)

Software requirement

You will require access to a Windows-based computer and ArcGIS Pro software, a desktop GIS application.

Please contact the Course Administrator at [DLP@rvc.ac.uk](DLP@rvc.ac.uk%20) for further details on accessing ArcGIS Pro.

Note that ArcGIS Pro is not compatible with Apple Macintosh computers.

**Overview**

This course consists of four units:

1. Introduction to Geographic Data
2. Using a Geographic Information System
3. Exploring Spatial Data
4. Explaining of Spatial Data

Aims of each unit and your learning outcomes are outlined in the following section.

# **Unit 1: Introduction to Geographic Data**

# **Aims of the unit**

• To familiarise you with the different types of spatial information and how that information is stored and then used by a GIS.

• To outline the different methods of projecting geographic information and how data can be converted from one projection to another.

• To give you a first ‘hands-on’ experience of using a GIS.

# **What you will learn**

By the end of this unit you should be able to:

• List and describe attributes of geographic data and the types of spatial objects.

• Explain how spatial objects can be stored within a GIS using raster and vector data formats.

• Define georeferencing and describe different types of georeferencing systems.

• Describe why and how georeferences are converted from one system into another.

• Explain the importance of spatial autocorrelation in spatial data analysis.

• Outline the limitations of spatial interpolation.

• Briefly discuss uncertainty in geographic data.

# **Unit 2: Using a Geographic Information System**

# **Aims of the unit**

• To familiarize you with the use of a GIS.

• To familiarize you with basic spatial operations that be performed using a GIS.

• To familiarize you with the concept of ‘loose coupling’ – the process of moving information between a data management, GIS and statistics package.

* To familiarize you with a method for organizing a small-to-medium-scale GIS projects.

# **What you will learn**

By the end of this unit you should be able to:

• Display a map within the GIS package ArcView.

• Import tabular data into a GIS project, link it to a map projection and visualize the spatial features of the data.

• Perform basic query operations, using a GIS.

• Describe the advantages and disadvantages of choropleth mapping.

• Perform basic GIS calculations – determine the length of boundaries, areas of polygons, create buffer zones around defined areas.

Unit 3: Exploring Spatial Data

Aims of the unit

• To introduce methods for describing point data – particularly methods for describing the density of point data.

• To describe methods for describing spatial autocorrelation in point data.

• To familiarize you with the methods for describing disease count data, recorded on an area basis.

• To familiarize you with methods for describing spatial autocorrelation in area data.

# **What you will learn**

By the end of this unit you should be able to:

• Plot point data using the GIS package ArcView for Windows.

• Create a kernel density surface, based on plotted point data.

• Explain the term ‘extraction mapping’.

• Describe the situations in veterinary epidemiology where K-function plots of a spatial process would be useful.

• Explain the term ‘standardized mortality ratio’.

• Describe the use of Bayesian smoothing of disease count data collected on an area basis.

Unit 4: Modelling of Spatial Data

# **Aims of the unit**

• To familiarize you with fixed-effect Poisson regression models, as used in classical (frequentist) statistics.

• To introduce you to full Bayesian methods fixed-effect Poisson regression modelling – an alternative the frequentist approach.

• To enable you to use methods for detecting clusters of disease.

# **What you will learn**

By the end of this unit you should be able to:

• Describe the structure of a fixed-effects Poisson model of disease count data.

• Interpret the regression coefficients from a fixed-effects Poisson model of disease count data.

• Explain a Bayesian approach to analysis.

• Describe the situations where a Poisson model of disease count data that accounted for spatial autocorrelation would be preferred over a model that ignored spatial autocorrelation entirely.

• Interpret the regression coefficients from a mixed-effects Poisson model of disease count data.

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