THE DEVELOPMENT OF
A DECISION SUPPORT SYSTEM
FOR AN ANIMAL DISEASE EMERGENCY

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Robert Lawrence Sanson

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ABSTRACT

An epidemiological information management system (EpiMAN) has been developed to aid the Ministry of Agriculture & Fisheries (MAF) contain and eradicate a foot-and-mouth disease (FMD) epidemic, should one ever occur. Design objectives for the information management elements of the system included the need to manage the vast quantities of data that eradication procedures for an epidemic would be expected to generate within a very short time; the ability to apply current epidemiological understanding of disease spread to the data processing tasks; to reduce some of the foreseen processing bottlenecks; and to provide decision support to the data entry personnel. Design objectives for the veterinary management elements of the system included the presentation of up-to-date status reports in formats that facilitate national decision-making; the ability to optimize manpower resource allocation; and the capacity to evaluate the relative merits of alternative technical decisions, each of which carried different implicit risks.

The system combines a database management system (DBMS), a geographic information system (GIS), expert system elements, various models of specific aspects of FMD epidemiology, and a statistical analysis capability. EpiMAN comprises tightly coupled spatial and textual databases. Farm locations and other geographical information are managed by the GIS, while the textual component incorporating farm profile information and epidemic data is manipulated by the DBMS. The models of spread of FMD and the expert systems jointly provide the epidemiological knowledge components. The models are linked to the databases to help quantify the risks of FMD spread and allow the evaluation of management options, based on the current situation. The expert systems advise various operational sections of the emergency headquarters (EHQ) on priorities for control activities. The analytical system (termed the epidemiologist's workbench) is an integrated suite of tools which allows the state of the epidemic to be examined and control options to be evaluated.

The system has been designed as a transportable system to operate wherever the EHQ is set up. It is implemented as a multi-user system, with the database server and the GIS each residing on a UNIX workstation, with IBM-compatible PCs used as terminals. Communications links to MAF's computer network are provided for.

It is hoped the system will never need to be used for a FMD emergency in New Zealand. However the system can be easily adapted for use in other countries, and the methodology is also being extended to other disease syndromes.

A number of studies were conducted to assess the risk of FMD entry into New Zealand, and examine the potential for disease spread through normal farm movement patterns. The best current estimate of the risk of an FMD outbreak is about once in 50 years (0.0199). The mean expected

number of FMD infected secondary properties under MAF's exotic diseases and pests responses programme is 61 (median 33, range 1 to 1103). In order to contain 95% of the movements that might occur off an index farm prior to diagnosis, an infected area would have to have a radius of 100 km around the property. A cost benefit analysis supported the development of EpiMAN.

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Robert L. Sanson
Department of Veterinary Clinical Sciences
Massey University
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