VETGIS©-STYRIA – A TOOL FOR VETERINARY EPIDEMIOLOGICAL INVESTIGATIONS

J. Köfer * [1], K. Fuchs [2], P. Wagner [1]

[1] *Department of Veterinary Administration in Styria*
e-mail: fa8c@stmk.gv.at, *Zimmerplatzgasse 15, 8010 Graz, Austria*
[2] *Joanneum Research, Institute of Applied Statistics,*
e-mail: klemens.fuchs@joanneum.at, *Steyrergasse 25°, 8010 Graz, Austria*

Abstract

A geographical information system (GIS) is an innovative software technology to analyse spatial data. GIS are widely used in epidemiology to process spatial and temporal information about the outbreak and spread of diseases in order to be able to implement adequate control systems (e.g. surveillance programmes). GIS are also used to detect clusters of rare diseases or to define areas with high exposure. Georeferencing of animal data allows the determination of spatial sampling plans, too. VETGIS© Styria contains the coordinates of 41,227 farms, the boundaries of the Styrian provinces and municipalities, a digital network of roads and yearly updated data on the number and kind of animals kept on the farms. VETGIS© Styria is used for the determination of protection and surveillance zones in the case of outbreaks of classical swine fever, for epidemiological investigations relating to BVD/MD, for Salmonella screening of pork and poultry and finally for the Styrian antimicrobial resistance monitoring programme.

INTRODUCTION

A geographical information system (GIS) is a software tool designed to obtain, store, process, analyse and plot spatial data. With the help of GIS spatial data of different resolutions can be readily combined and analysed. The simplest GIS application is a dot map, where symbols of different colours, shapes or sizes are used to visualise spatial phenomena such as herd sizes or herd health status. Choroplet maps for example can be used to describe the temporal spread of a disease outbreak in space or to show the population density. With different analytical tools distances between farms or the shortest distance to the next slaughterhouse can be calculated or various scenarios visualised. The most important advantage of a GIS is the possibility to overlap several layers in order to obtain a better impression of the overall picture. Although GIS technologies were developed 30 years ago, it was not until the early 1990s that they were successfully used in epidemiological projects (Clarke et al., 1996).

MATERIALS AND METHODS

Based on their experience in combating classical swine fever, the Department of Veterinary Administration considered the possibility of using GIS as a device for the control of animal epidemics. Finally in 1999 the Institute of Applied Statistics (Joanneum Research) was instructed to digitise all 41,227 Styrian farms and to implement a GIS (called VETGIS© Styria) based on these data. The geographical coordinates are in GAUSS-Krueger format and the "LFBIS" number (identification code of Austrian farms) is used as primary key, which allows the spatial data to be linked to the data of the official livestock census. Furthermore VETGIS© Styria contains the coordinates of all slaughterhouses, dairies and meat processing plants, information on the Styrian topography,

geology, traffic, lakes and rivers and a land use map. VETGIS© Styria is based on ARC/VIEW™ (Esri, 1996).

RESULTS AND DISCUSSION

GIS applications represent an important part of modern decision support systems, which help to find the most effective and cheapest combating strategy (Stärk et al., 1998). In the case of an outbreak of classical swine fever the corresponding ordinance requires a protection zone of 3 km radius and a surveillance zone of 10 km radius to be set up around the suspect farm. Moreover all farms and the number of pigs within these two zones must be reported to the EU immediately. Figure 1 shows a simulated outbreak of classical swine fever in a region of high pig density. With the help of VETGIS© Styria the two zones can be drawn, all farms within these zones can be identified and the number of pigs can be calculated very easily.

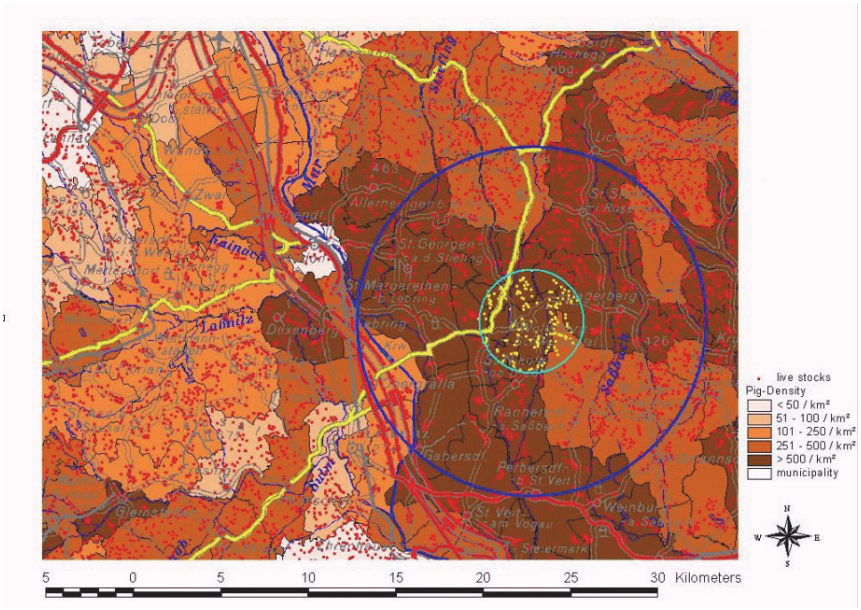
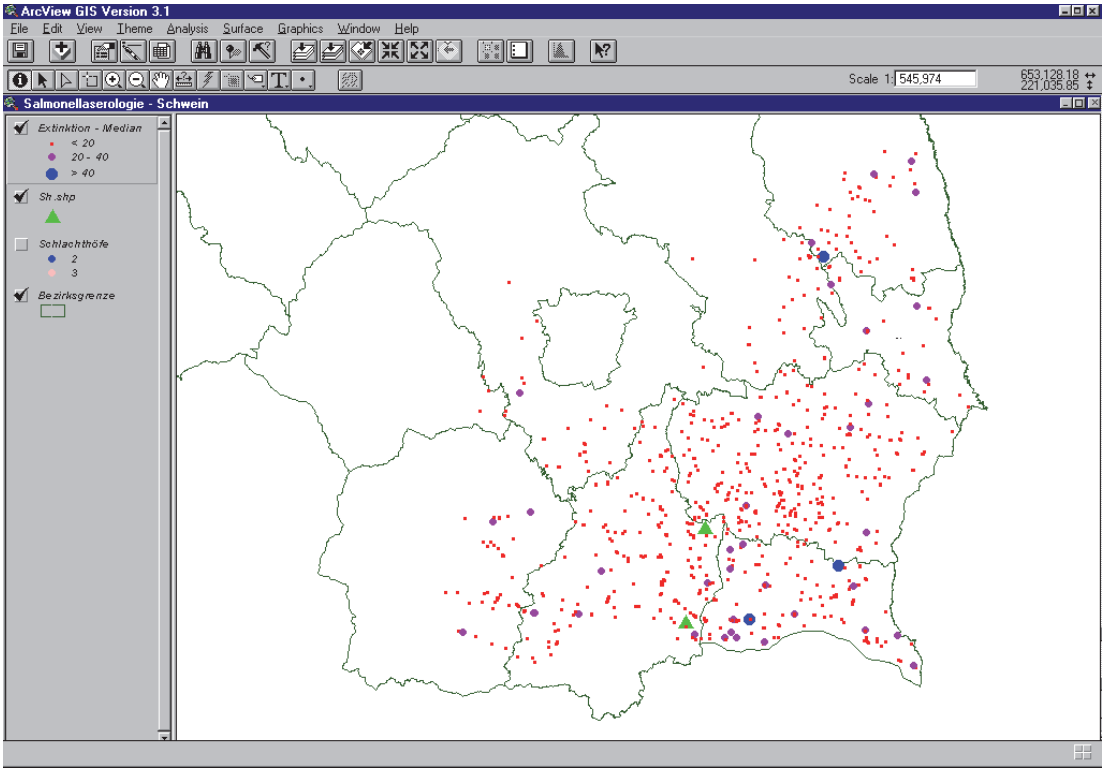


Figure 1. *Protection and surveillance zone for a simulated outbreak of classical swine fever*

An example of epidemiological investigations relating to BVD/MD using GIS is described in Wagner et al. (2000). In this project 9,321 bulk milk samples were collected from December 1999 to May 2000 and tested for antibodies to BVDV. 67.8% of the samples showed an OD value less/equal to 0.24 and can be classified as non-suspect, while 32.2% exceeded this value. The spatial distribution, however, varied considerably, ranging from 7.0% positive samples in the south to 54.3% in the north-west. Figure 2 shows the spatial distribution of bulk milk OD values and the proportion of mountain pasture area per municipality.

Figure 2. *Spatial distribution of bulk milk OD values and proportion of mountain pasture area per municipality*



The Styrian salmonella screening programme provides yet another example of GIS usage (Köfer et al., 2000). Based on a biometrical sampling plan, blood samples of pigs from fattening and breeding farms were collected and tested for antibodies to Salmonella. A total of 1002 farms were involved in 1999 and 10 blood samples per farm were tested (Fuchs et al., 1999). Figure 3 shows a dot map of the mean extinction values per farm using VETGIS Styria. A cluster of higher values can be seen in the south.

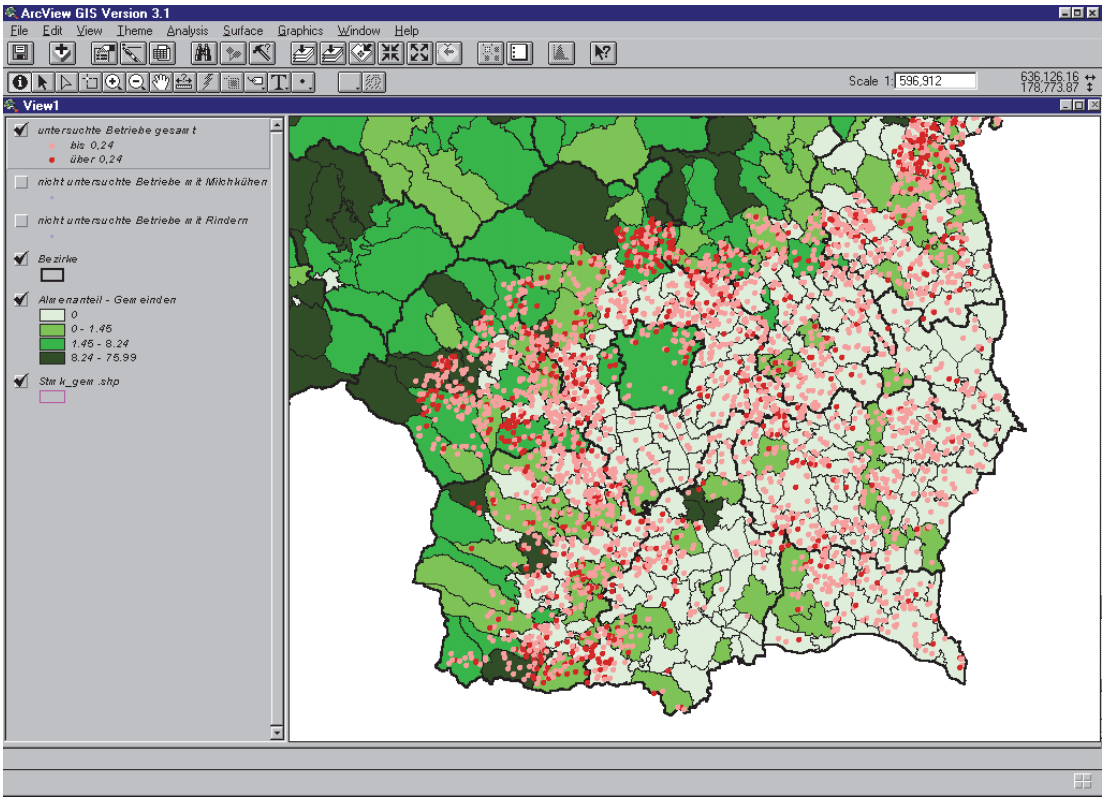


Figure 3. *Dot map of mean extinction values of farms*

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