

INTEGRATING A GEOGRAPHIC INFORMATION SYSTEM WITH ANIMAL HEALTH MANAGEMENT

McGinn T.J.¹, Cowen P.², Wray D.W.¹

Geographic Information Systems (GIS) are electronic data systems that can manipulate and display cartographically, large volumes of data. Geographic Information Systems have been widely used in many data intensive disciplines such as urban planning, natural resource management and optimal facilities location analysis. GIS is a relatively new tool for veterinary epidemiologist. This presentation will provide information on the initial GIS applications developed by the North Carolina's Animal Health Geographic Information System including development of notification lists of farms surrounding a newly infected Aujeszky's Disease farm, Aujeszky's disease containment and elimination strategies based on GIS analysis, optimization of farm service truck routes and emergency preparedness. Future application examined include real time disease notification systems using GIS, geographic molecular epidemiology, examination of the effect of density on productivity and animal waste management environmental impact studies.

Geographic information systems (GIS) have revolutionized decision making in many data intensive activities such as urban planning and land resource utilization. Geographic Information Systems are an applied tool that creates visual and analytical capabilities unavailable to veterinarians prior to recent advances in electronic technology. North Carolina's Animal Health Geographic Information System began in 1989 with the establishment of the Aujeszky's Disease (AD) eradication program. Initial efforts to provide unique identification for all swine in the control program led to the development of a 10-digit number which could be easily translated in latitudinal and longitudinal coordinates. Initial maps were produced at commercial facilities and on personnel computer based programs with limited results. In 1992, an investment in state of the art equipment (ARC/INFO software and Sun workstation) and a medical geographer yielded good progress. Initial applications include: lists of all farms within 1.5 miles of a disease outbreak for notification purposes, AD containment and elimination strategies, optimization of service truck routing and emergency preparedness information systems. Applications following are new or under development at the present time.

REAL TIME DISEASE OUTBREAK NOTIFICATION

The collaborative reporting of individual producer's disease status is a major advancement in the elaboration of disease information useful for the control of infectious diseases. In North Carolina, regulations require animal health officials to inform producers when disease AD positive animals are to be moved to farms in their area. This information allows producers to object to such movements or change management strategies to compensate for the increased risk of disease spread. Such disease consciousness led to the use of GIS as a planning tool to build new farms in low density, low risk areas. The GIS was also used as a notification system to report newly identified farms that were circulating AD virus. The original method of disseminating this information was the postal system. We have now adapted GIS so that a "real time" disease reporting system has been instituted. With the use of a fax and compatible software, maps, letters and printouts are merged into a single page that is transmitted electronically to producers minutes after notification from the diagnostic laboratory. Automated phone service is used to collect disease data from over 1,000 farms and transferred to the GIS. This data is transformed into a visual display of current disease risk and then transmitted back by fax to each of the participating farming systems.

GEOGRAPHIC MOLECULAR EPIDEMIOLOGY

The ability to rapidly identify strains of pathogenic microorganism has become a commonplace laboratory activity. It is possible to identify highly virulent and invasive strains such as the phage 4 variant of Salmonella enteritidis and E. coli 0157:H7. Employing a geographic information system to map the distribution of strain differences can depict the diffusion of emerging new variants of pathogenic bacteria. Representative sampling procedures and costs are considerations for this application.

WASTE MANAGEMENT

Management of animal waste in production facilities requires a comprehensive systems based approach to develop optimal strategies. Concerns for swine farms include odor, ground water contamination, and nitrogen and phosphorus concentrations in adjacent rivers and disease spread. Geographic information systems are an ideal tool for analysis as such problems accrue from the number of farms and animals in a given watershed. Data on animal numbers can be combined with hydrology, soil characteristics, land use patterns and human population data to determine areas which are most likely to experience adverse effects resulting from inadequate efforts to manage animal waste. Comparison of contributions from animal, human and agricultural use is crucial.

¹ North Carolina Department of Agriculture and

² College of Veterinary Medicine, North Carolina State University, 4700 Hillsborough, Raleigh, NC 27606 USA