Surveillance of Livestock Disease Using Gis in Salem District of Tamil Nadu, South India

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Abstract:

Disease surveillance in livestock is essential to know the quick status of animal diseases in a region for taking appropriate action. Geographical information system (GIS) is an effective tool to understand and identify the areas of disease prevalence in reference to the livestock. The study area records for the highest number of exotic breeds and contributes to the milk production of the State in a major way and for this reason disease surveillance is much required. Major outbreaks with attacks and deaths for each block were mapped based on mortality and morbidity analysis in Arch GIS 9.3. The major diseased pruned area (Site 1) was analyzed at the village level to identify the underlying cause for the disease spread and thematic maps were derived.

Keywords: Livestock diseases; GIS; Socio-economic status

Introduction:

The continued watchfulness over the distribution and trends of incidence through the systematic collection, consolidation and evaluation of morbidity and mortality reports and other relevant information and the regular dissemination of such data to all that need to know is defined as 'Disease surveillance'(Ward, 2007). Two specific reasons that animal disease surveillance being crucial is the first immediate impact to the human and the second, being an economic impact. Animal disease surveillance serves as sentinels for infectious disease epidemics among the livestock. As such, it is important to understand how animal disease occurs, mode of transmission, prevalence rates, anthropogenic pressure on livestock by humans and finally how the information could be obtained and monitored on a regular and timely basis. Outbreaks of highly contagious animal diseases severely affect the Indian economy, seriously disrupting domestic economies and the trade of livestock and animal commodities in India.

Animal husbandry is an integral component of agriculture supporting livelihood of more than two-thirds of the rural population and protection of the animal industry is vital in Tamil Nadu, as it plays a

significant role in the rural economy by providing gainful employment to a large number of small, marginal farmers and landless agricultural labourers and raising their economic status. Aside from the economic aspect of the issue, escalating the capacity of early response by enhancing diagnosis methods is essential for livestock health. In a government or a private sector that includes the trade of animals and animal products, the effective control of animal disease outbreaks require powerful crisis management tools. Information from the worldwide occurrence of emerging animal disease outbreaks and human health problems transcend local and international borders which requires attention to their geographic, spatial and temporal patterns before effective prevention and control implementations (Babalobi, 2007). Conventional tools for epidemiological data management and analysis has poor information on the geographical distribution of disease, as the relationships between adjacent or distant areas cannot be examined. Conversely, GIS offers the ability to include the spatial distribution of disease in the analysis of all aspects. One of the veterinary geo-informatics technologies employed in the information era for capture, storage, retrieval, update, analysis, mapping, display and rapid worldwide communication of data for the management of animal diseases is GIS (Freier, 2000). Salem district of Tamil Nadu is renowned for highest exotic breeds of cattle and leads in the milk production of the state (Department of Animal Husbandry and Veterinary Services, Chennai). Anthropogenic activities of humans pose a great threat to the ecosystems and contribute for the changes in environmental parameters such as rainfall, soil and water which play a crucial role in the spread of livestock diseases. The structural and functional integrity of the ecosystems are altered by rapidly changing climate, habitat fragmentation, invasion of alien species and pathogens, pollution, over-exploitation, and escalating human population, which are the most important factors responsible for ecosystem degradation worldwide (Barnosky *et al.,* 2011). Hence the objective of the study is to map the various disease outbreaks of the study area block wise and to identify the area of highest disease incidence to examine the factors that bind to the cause of disease spread in the particular area.

Materials and methods:

The study area lies between latitudes 11º19 and 11º57 and longitudes 77º38 and 78º51 and is shown in Fig. 1. The area occupies about 5205 sq.km. Toposheets numbering 58E and 58I (Scale of 1:250,000) was purchased from the Zoological Survey of India, Guindy, Chennai and was geo-referenced using Arc GIS, version 9.3 and thematic map for the district blocks was created. The information regarding disease occurrence in an area, disease type, and total number of animals affected and died were obtained from the Animal Disease Intelligence Unit Salem. The data were sorted for year and region wise from 2005 to 2013 and mortality and morbidity rate calculation formula (Thrusfield, 2007) was applied to identify the endemic regions for outbreaks and was depicted using dot analysis in Arc GIS 9.3 version.

$$\text{Morbidity rate} = \frac{\text{No. of animals showing signs of the particular disease}}{\text{Total number of susceptible animals under risk}} \times 100$$

$$\text{Mortality rate} = \frac{\text{No. of animals died due to the particular disease}}{\text{Total number of susceptible animals under risk}} \times 100$$

The zone of high incidence (Site 1) was identified and survey was conducted in those areas to indentify the socio - economic status and animal husbandry practices among the people to identify the cause that contribute to the spread of disease.

. **Results and Discussion:**

The data obtained from the Animal Husbandry division of Salem, was examined based on disease type and occurrence area. Four major outbreaks were endemic among the region namely FMD (Foot and mouth disease), Anthrax, Sheep Pox and PPR (Peste des petits ruminants) and FMD had more frequency of incidence among the district (Fig: 1). Anthrax was found endemic to Attur region and other regions showed the absence of the disease. Thalaivasal had medium rate of incidence and Tharamangalam had very low rate of incidence (Fig: 2). PPR (Peste des petits ruminants) was found endemic to Panamarathupatti, Attur and Valapady whereas Konganapuram and Veerapandi had medium attacks and the other remaining zones showed nonexistence (Fig: 3). Sheep pox was endemic to Panamarathupatti and Peddanaikenpalayam. Panamarathupatti had highest attacks whereas Peddanaikenpalayam had highest death rates for sheep pox (Fig: 4).

Disease attacks were also classified monthly wise where August and December had high attacks and lower rates were during the summer seasons of February, March, April and May (Fig: 5). Curriero *et al.,* (2001) confirmed that outbreaks due to surface water contamination showed statistically strongest association with extreme precipitation during the months of disease outbreaks. It is estimated that about 50% of waterborne outbreaks occur as a consequence of heavy rainfall events (Curriero *et al.,* 2001). The results clearly prove that diseases were predominant during the monsoon seasons where there would be highest rainfalls and also provide evidence that water acts a source for the transmission of animal diseases in the study area.

From the map analysis we identified the highest diseased pruned zone (Site 1) as Panamarathupatti and examined the socio - economic factors of the people in that site. Farmers were interviewed based on the land they possessed and were classified as large (possessed land more than 4 acres), medium (possessed 1 to 4 acres) and small scale farmers (less than 1 acre). Monthly income, illiteracy and experience in dairying were documented and classified. Results clearly indicated that small scale farmers were more affected due to livestock diseases (Fig: 6). In recent decades, the dairy sector has emerged as an important source of rural employment and income in the country. Income from dairying contributes nearly a third of the rural households' gross income and in the case of landless wage earning households, nearly a half (Pankaj, *et al*, 2005). Yet illiteracy and lack of proper experience and training in dairying contributes to the spread of diseases. Hence the animal husbandry sector should concentrate on the small scale farmers and should provide regular trainings which would help the farmers to understand the disease epidemiology and the cause for the disease spread.

Conclusion:

GIS is a good tool to identify the disease that is prevailing in an environment. The current study emphasizes on the proper understanding of the geographical distribution of disease which is essential for the establishment of disease free zones, and management of veterinary resources. The spatial analysis of disease distribution pattern through GIS is needed to be integrated with the existing data sources to achieve better data management and more efficient analyses for disease control in livestock.

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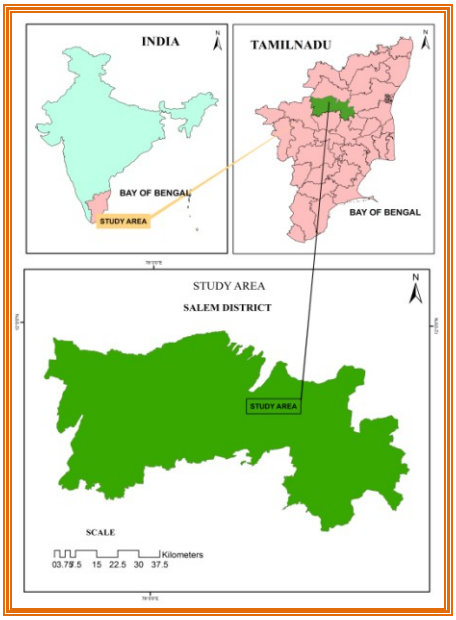

Fig 1: Study area

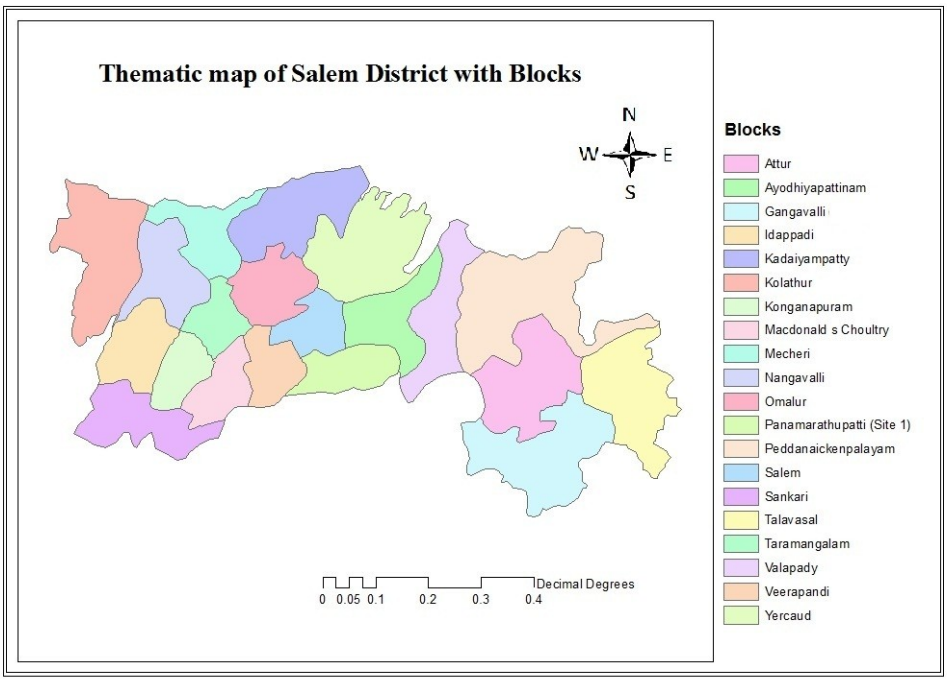

Fig 2: Thematic map of Salem District with Blocks

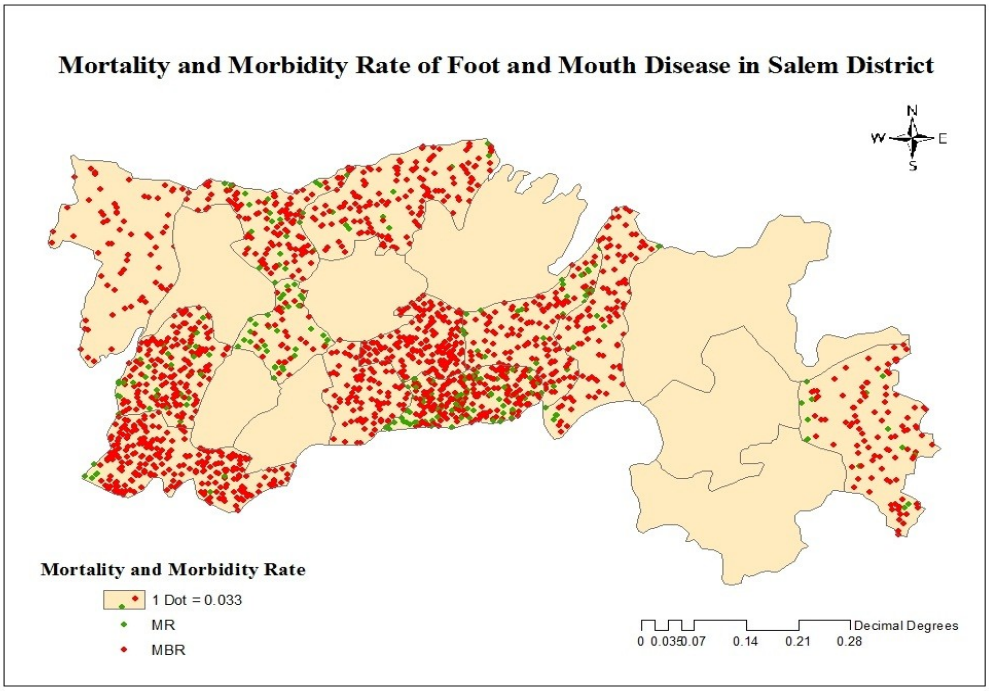

Fig 3: Mortality and Morbidity Rate of Foot and Mouth Disease

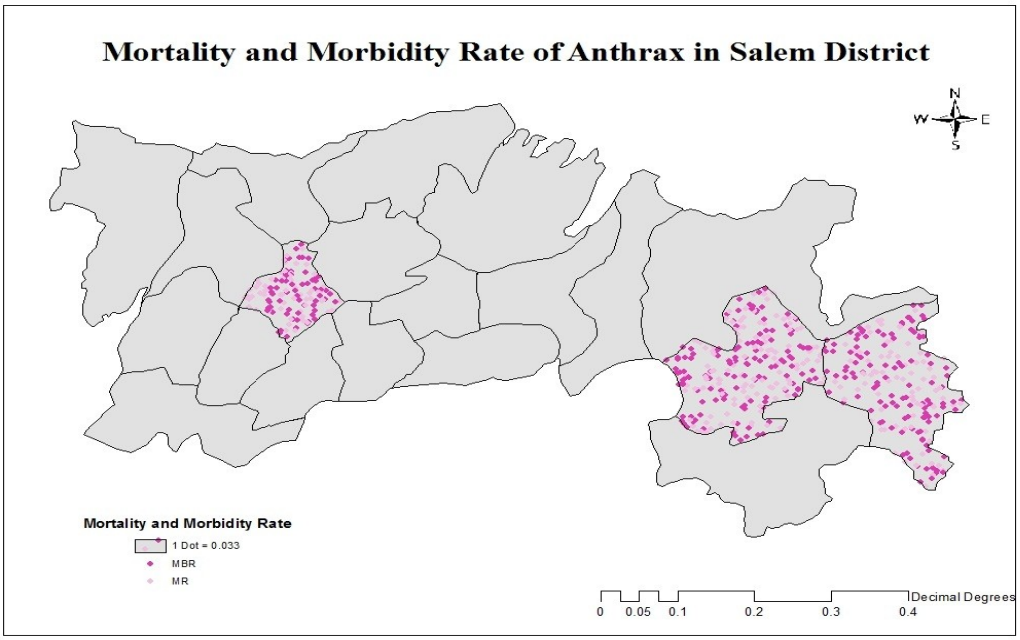

Fig 4: Mortality and Morbidity Rate of Anthrax

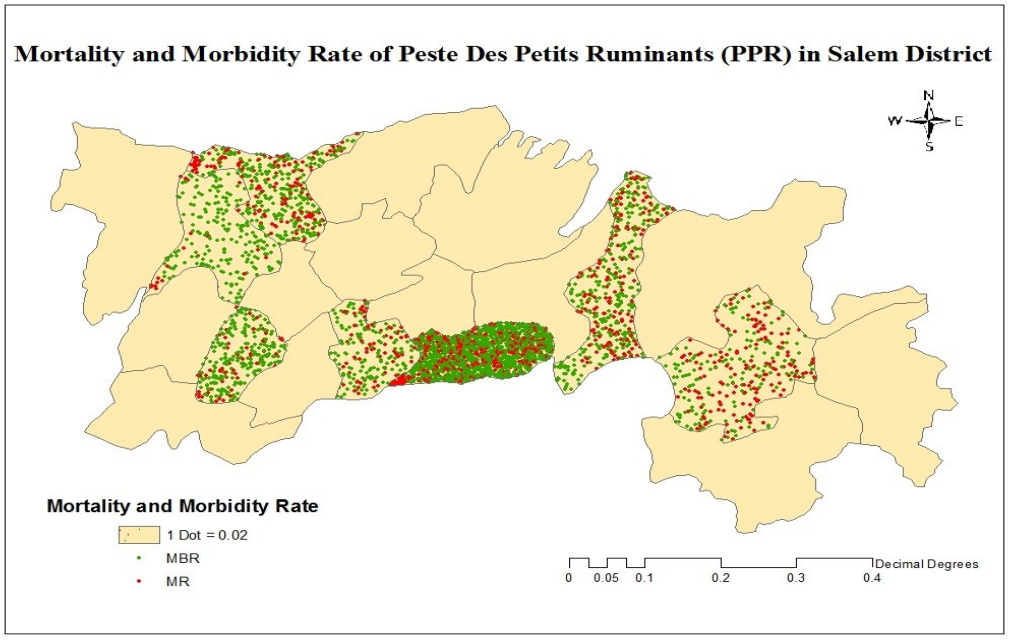

Fig 5: Mortality and Morbidity Rate of Peste Des Petits Ruminants (PPR)

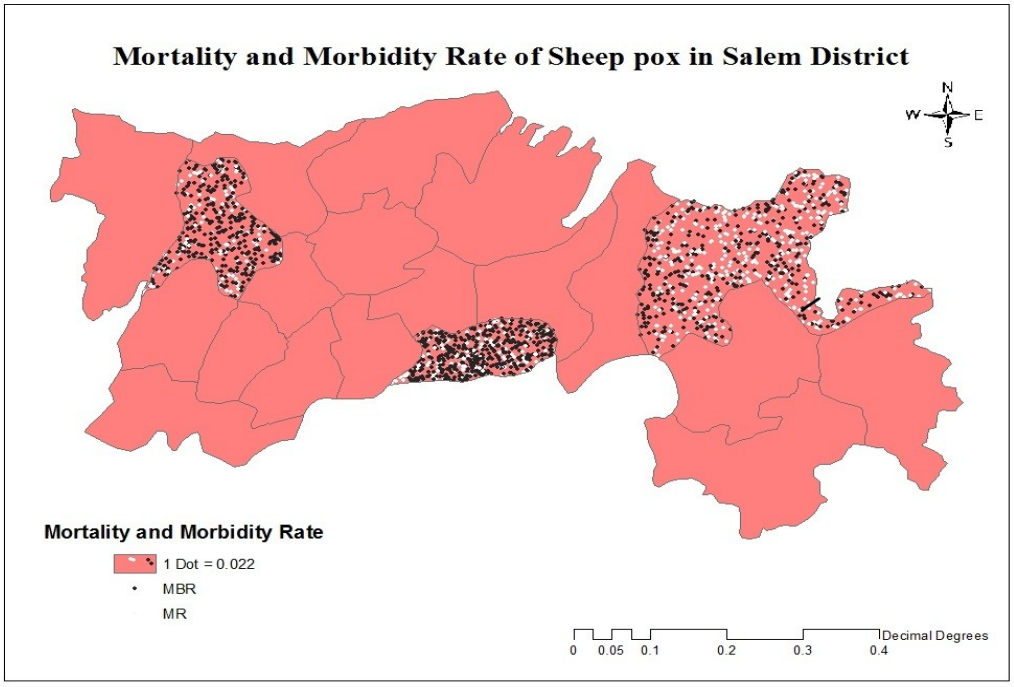

Fig 6: Mortality and Morbidity Rate of Sheep pox

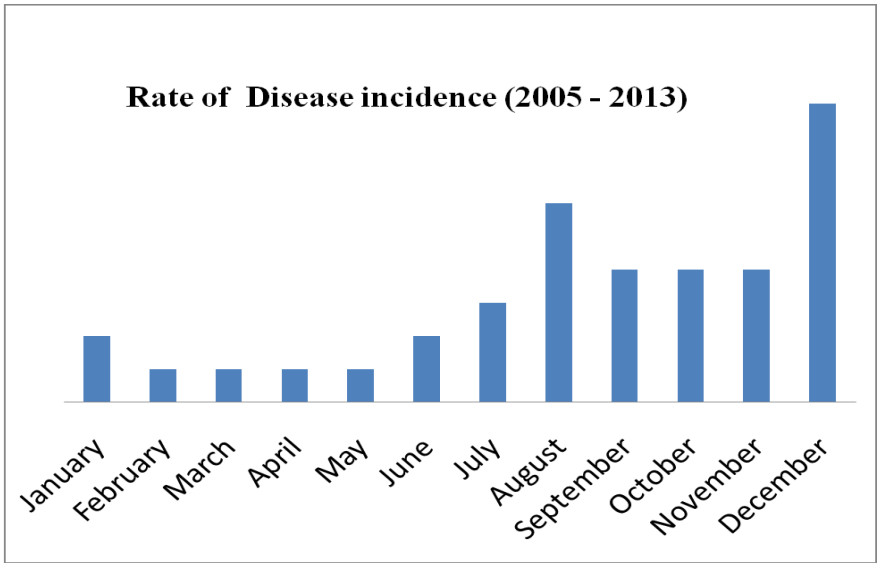

Fig 7: Rate of disease incidence in months

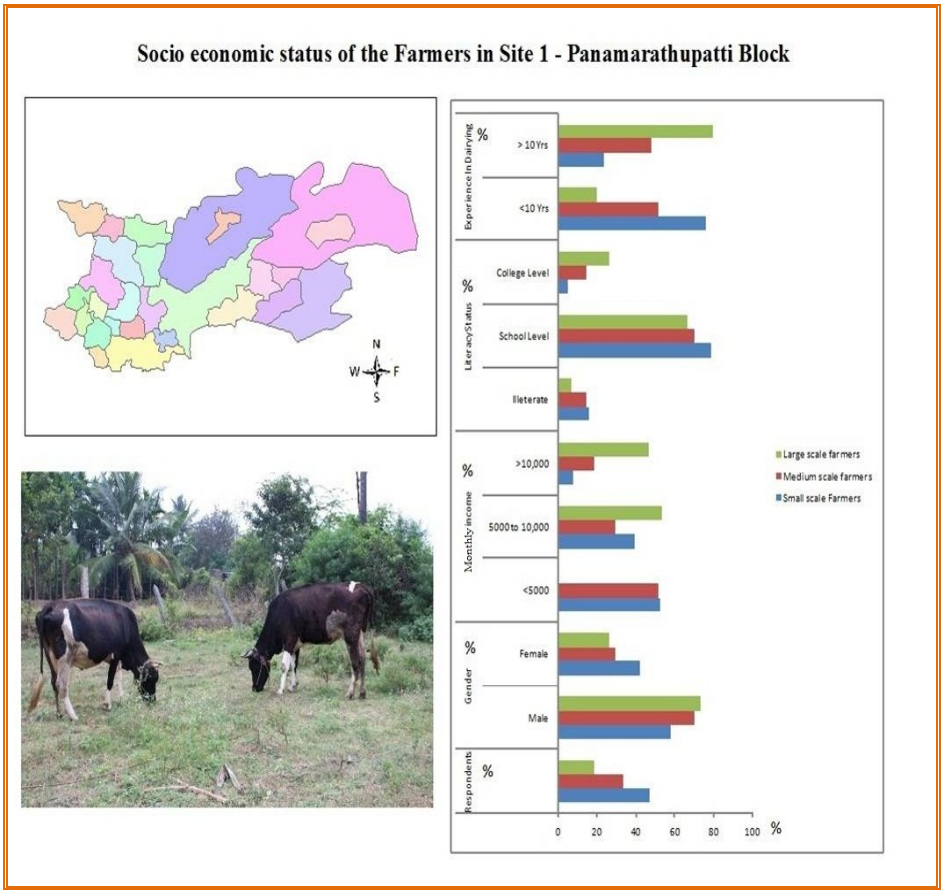

Fig 8: Socio - economic status of farmers in Site 1