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Density Maps Highlight Areas with Chronic Bovine Tuberculosis and Enable Targeting of Resources to Eradicate Disease

J. O’Keeffe, R.F. Hammond and G. McGrath

Introduction

In 1999 the Government initiated a policy defined as the Programme for Prosperity and Fairness (PPF). Within this programme Government and the Social Partners agreed on a series of objectives to be met dealing with economic and social matters. The Department of Agriculture, Food and Rural Development (DAFRD) established a Wildlife Unit to implement a national programme for wildlife control when and where wildlife control measures are implicated in on-farm bovine tuberculosis outbreaks. The Veterinary Epidemiology and Tuberculosis Investigation Unit (VETIU) had published a wide range of detailed data, arising from wildlife studies, improved data management, and computer technology. This progression has allowed disease management strategies to be more focussed at national and local levels.

Development of a Methodology

Geographical Information System (GIS) methods have been developed that show disease patterns pictorially at a national level. Initially, this focus was based on thematic maps of reactors per thousand animals tested (APT) statistics at District Electoral Division (DED) level. To sharpen this focus a refinement was made to the disease distribution thematic map by mapping the areas of non-agricultural land, *viz.* land above 300 m, and raised and blanket bogs. This modification excluded areas where cattle were absent or were present were at a very low density.

Further to this modification, software programmes developed in the mid 1990s for spatial density solutions then enabled the visualisation of areas where tuberculin test-positive animals were identified at farm level. The resultant density type format, where contours were used to describe the local manifestation of reactors, has been used to define the areas that will now be the focus of the Wildlife Unit’s activity. Further analysis has enabled the production of a density map that segregates herds into roughly a 70:30 ratio of herds located in what is classified as “agricultural land”.

On this quantitative basis the Wildlife Unit will meet the “objectives of the agreement” utilising a proactive approach. Nationally, DAFRD is to assign 75 dedicated staff to the removal of all sources of *Mycobacterium bovis* infection in the 20% of the country which have annually yielded 50% of the total number of tuberculosis reactors in recent years.

Application of the Methodology

Because tuberculosis in cattle occurs in clusters of animals in areas containing herds that can be classified as chronically infected, the focus of a programme to control the spill-over of tuberculosis between cattle and badgers should be on areas where tuberculosis problems recur each year. The data set chosen to visualise these sets of circumstances was based on the numbers of standard reactors (bovine – avian skin increase => 5 mm) identified during the years 1998, 1999 and 2000. Each herd that had standard

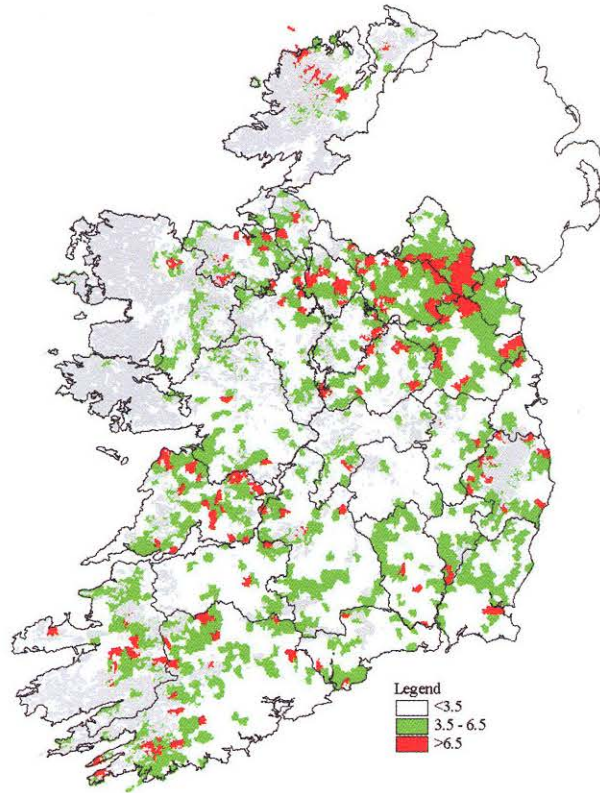
reactors identified was assigned co-ordinates based on the mid-point of the farm. Disclosure of standard reactors to the tuberculin test identified the herds to be assigned to this point. To achieve some smoothing of the data, a GIS search was instituted based on a 5 km. search area for each of the 140,000 active herds on the national database. All standard reactors found within this search radius were assigned to the co-ordinates of each base herd. Finally, densities were defined by trial and error until an area was chosen which contained within its outline the 25% of the country where roughly 70% of all standard reactors were identified during the years, 1998,1999 and 2000.

Maps, such as those shown in Figures 1 and 2, demonstrate the evolution of the mapping methodologies, from the APT/DED maps through the contour maps to maps depicting the final specific representation of a chosen density level outline.

Conclusion

This approach will facilitate the allocation of resources to those areas with an endemic tuberculosis problem which to date has not been resolved by applying well established control measures that have been effective elsewhere in the country. The elimination of bovine tuberculosis from these areas will alleviate the hardships suffered by the local herdowners by restoring many of them to trading status on a more permanent basis. The removal of these major foci of *Mycobacterium bovis* will have a beneficial effect on the progress of the national programme of disease eradication by reducing the risk of exposure to such infection over a considerable area of the country. However, the success of this approach will be heavily dependent not alone on the scientific and technical inputs of DAFRD staff, but also upon the cooperation of herdowners and their advisers.

(a)



(b)

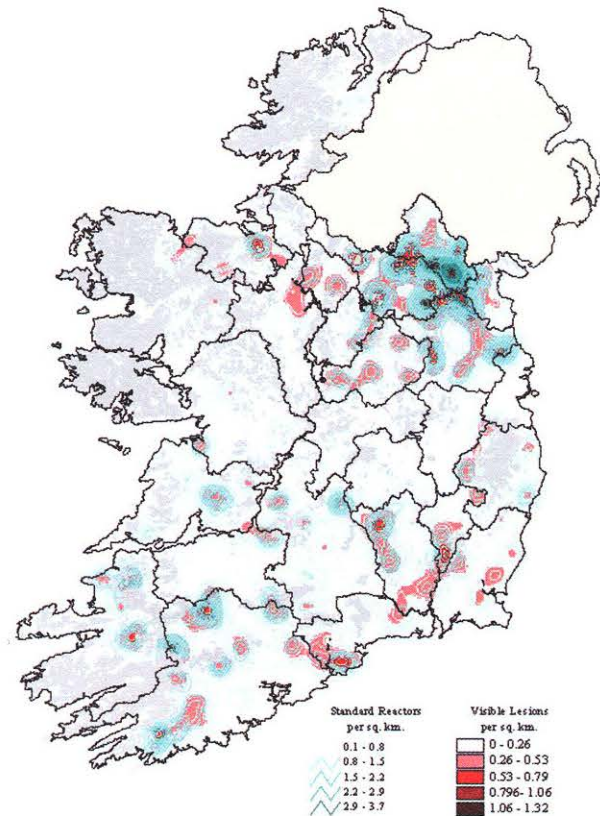


Fig 1. Bovine tuberculosis levels expressed as mean values for APT per DED (a) and density of herds with ≥ 2 standard reactors as contours and presence of a visible lesion per sq. kilometer as pixels (b) for the years 1998 - 2000.

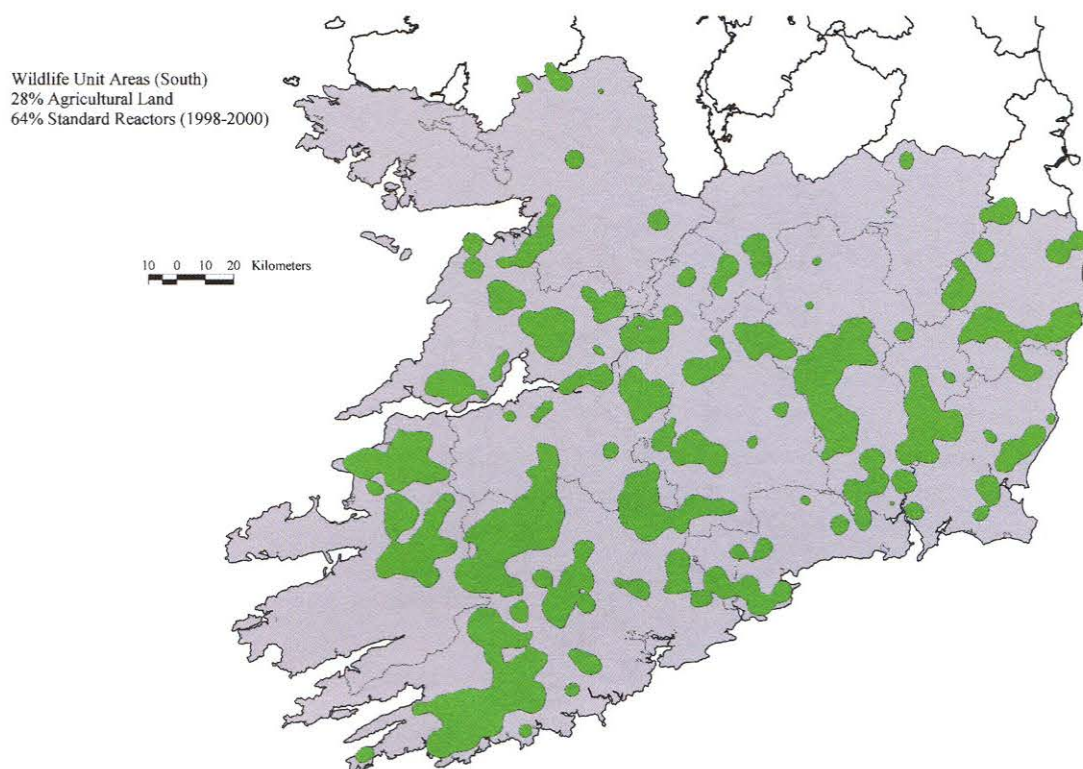
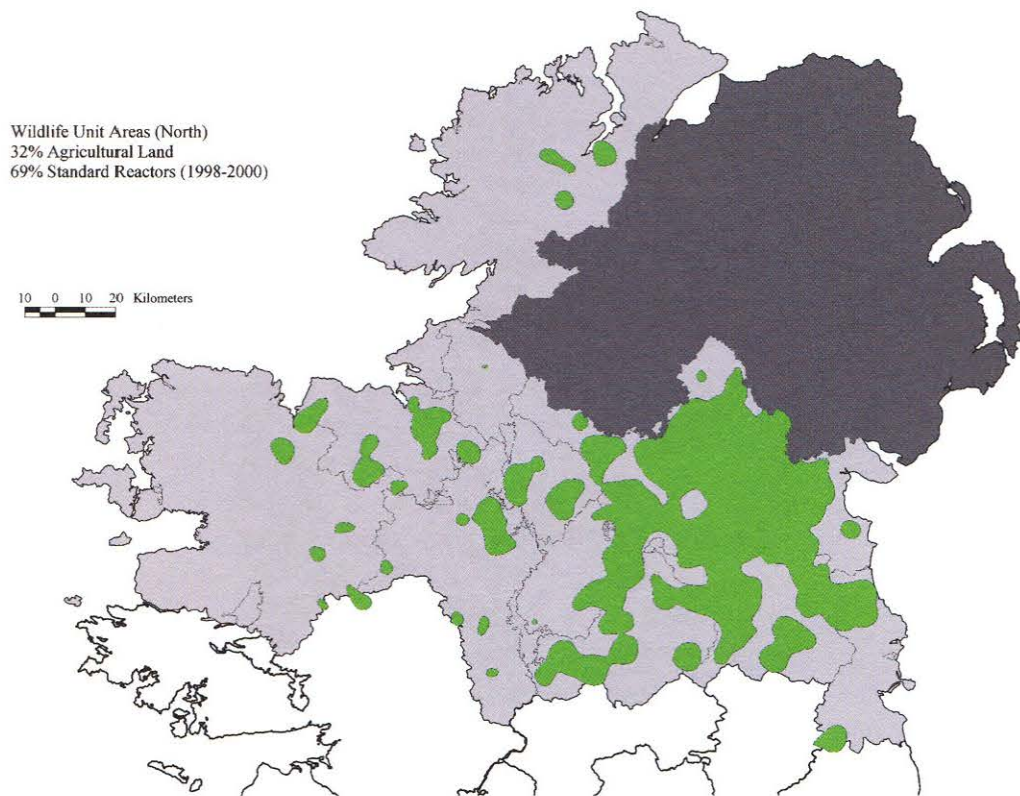


Fig 2. Distribution of standard tuberculin reactors in the North and South Wildlife Unit Areas.