The Application of the "Near Analysis" and the "Conversion" ArcGIS tools in Determining Distance Variation and Accessibility to Doctors Surgeries in Cardiff United Kingdom.

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Abstract— several approaches have been used to examine the accessibility and Distance variation of health facilities in GIS. Very common is the Buffer and Kernel density. This study, gives a different approach as it used the near analysis and the Conversion toolset to evaluate the closeness of the Doctors Surgeries to all the people living in Cardiff. The "Near" analysis tool functions better on point to point feature data hence the population map is first converted from polygon to raster and to point feature using the conversion tool. This enhances Location accuracy as compared to other methods previously used for facility location. From the attribute table, the computed distances were re-categorized into six (6) groups and these groups were again converted from point to raster and back to polygons. The outcome of this study is a clear and correct presentation of how the Doctors Surgeries' are available both in magnitude and in proximity to the total population in Cardiff. The new map is correct, simple and easily interpreted by any user. Numerical accuracy and pictorial differentiation is therefore achieved.

Index Terms - Facility Location, Near Analysis and Data conversion.

1   INTRODUCTION

Cardiff is the capital city of Wales in the United Kingdom. Area is 2.568 sq miles (6.652 km²). The transportation system is quite effective with good road and rail network which includes the sub-urban. There are six main junctions linking all the other roads. According to the 2001 CASWEB data there are about 305,353 people living in Cardiff. Of this, only 65 Doctors Surgeries are available. Two questions therefore arise: Are this Doctors Surgeries adequate for this population? What is the closeness functionality in times of emergency? Even with the effective transportation system in the city, the availability of Doctors surgeries to the unevenly distributed population matters so much especially during emergencies. So many approaches have been used to study facility location using the Arc Tool box in ArcGIS. More importantly is the fact that many researchers have used census data in examining the availability of health care facilities but very little or no attention has been paid to the "Near" analysis tool. Yang et al (2006) used the two – step floating catchment area (2SFCA) method in integration with the Kernel density to examine the closeness of Health care facilities to a defined census tract boundary. The buffer and the kernel density were the main analysis tool adopted. Brabyn and Skelly (2002) carried out spatial modelling to estimate the time it takes for a certain geographical location to access the nearest hospital. This study integrates the census data but again attention was on the buffer tool and the thiessen polygon. The Near analysis tool is an analysis tool which has the analytical capabilities of inte-

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grating group data in any defined range. A major advantage of this analysis over the traditional multiple buffers is the fact that there is a well defined boundary between classes of the variables been studied. A good GIS for public health demand and supply must have an excellent correlation between the resultant map been displayed and the inherent spatial attributes (Luis, 2004).

2   METHODOLOGY

2.1   Data – Cardiff population shapefile is downloaded from the Census Area statistics Web (CASWEB). Population distribution is presented as polygon. The shapefile for Doctors Surgeries is a point data gotten from the L drive (local study area) of the student library, university of Glamorgan.

2.2   Conversion of Data - The Near analysis tool works when both the input features and the near features Data are in the same format. The population polygon was therefore converted from polygon to raster and from raster to point data. This was achieved using the respective conversion tools. One other beauty of this conversion is that it gives a better quantitative display of the Doctors Surgeries inside the population tract.

2.3   Computation Using 'Near' Analysis ArcGIS tool - Near analysis was carried out to determine the distances between the Doctors Surgeries and every point location in the population tract. Input feature is Doctors Surgeries while near feature are the population tract.

2.4   Categorization of Computed Data – Selections were made on the derived 'Near Distance' from the attribute table of the population tract in order to group the distances. Six (6) groups were created, each selected and converted into new Layers. The symbology and font of these Layers were changed for clearer

differentiation.

2.5 Re – Conversion of Data - After the new Layers were categorized, they were again converted from points to raster and finally to polygons. As polygons, each of these new layers is a class of distance from the population tract to the nearest Doctors Surgeries. Further computations can be carried out to determine the exact number of people and the number of Doctors Surgeries in each of these layers.

facility in Honduras.

Most interestingly is the fact that more layers can be created using this method to show time travel to the nearest Doctor Surgery. Mere looking at the map and knowing any particular location inside it, one can easily tell the distance to the nearest Doctors Surgery and if there is a clear traffic, the travel time can also be determined as velocity = distance / time.

Map as Raster

3   Discussion of Result

There are no sure limitations to this method of Facility Location. The only issue is the numerous conversions and computations involved. One other advantage of this method is a pictorial presentation of derived results. The Map is easy to interpret unlike using the multiple buffers. Apart from the fact that multiple buffers have the tendencies of shielding some details, it also has short comings in delineating between boundaries of feature classes Xiang (1993, p. 818).   Black et al., (2004) also recognised the relevance of adopting methods which has both the visual and spatial capabilities of displaying multiple geographic layers. They also used population data as an input data in determining accessibility to Health care

3.1 Each Layer represents a time frame it takes to the nearest Doctors Surgery

Distance Variations to Doctors Surgeries Within Cardiff Total Population
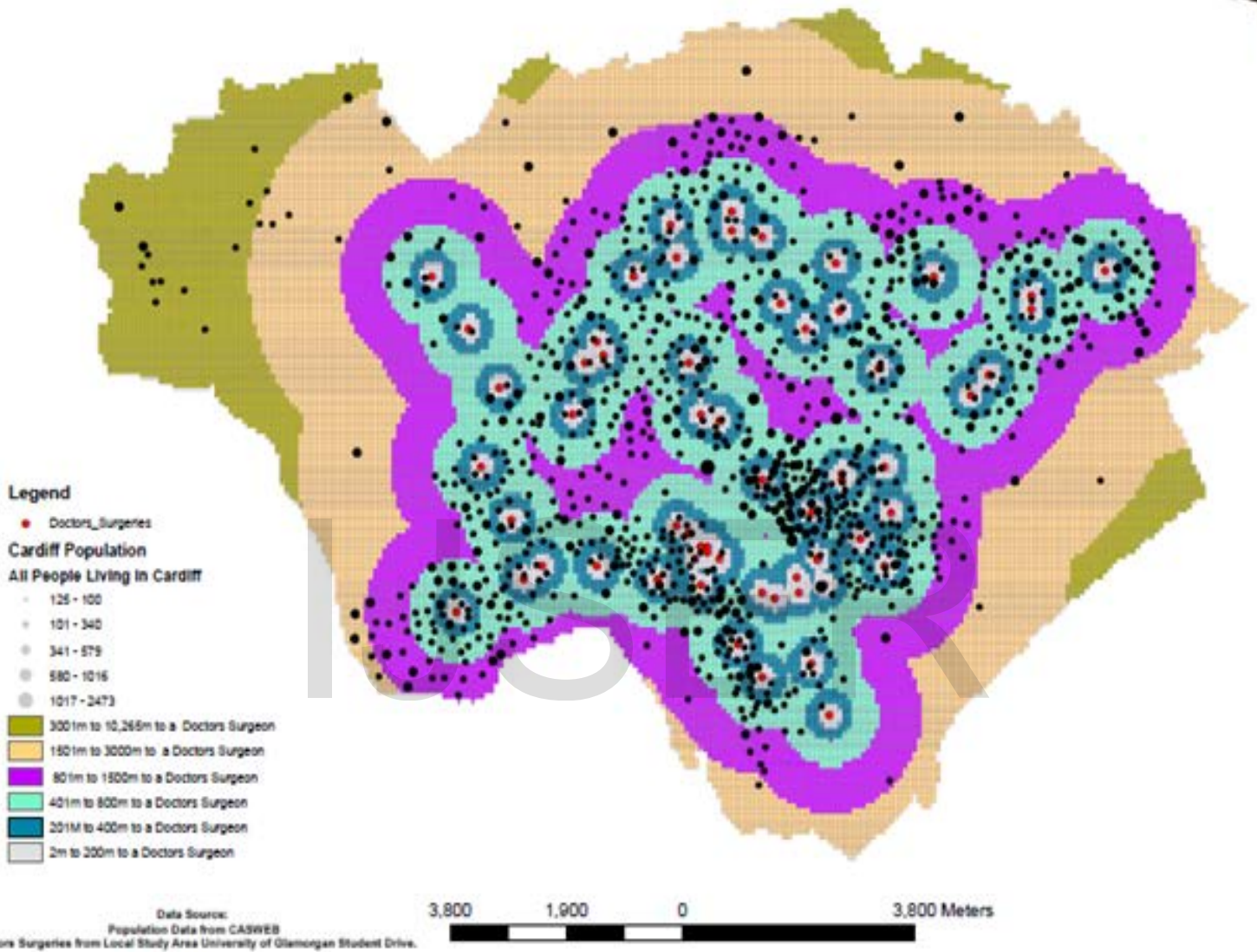
3.2 Sample of the equivalent of this map using the commonly adopted multiple buffer technique is shown below:

4. Conclusion

In the Arc tool box are numerous analysis and statistical tool Sets. The results of which are often presented as maps and charts. A good map should therefore be simple enough to depict the subject matter irrespective of the operators employed. The obtained map of this study is an easily understood and at the same time a detailed presentation of some complex operators used to explain how viable and assessable the doctor's Surgeries within the entire population tract are in a developed society. The outcome of this study as presented on the map is that the doctor's surgeries are actually relative to areas of high population but not evenly distributed to the entire population tract. This might not be too favourable especially during emergencies.

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