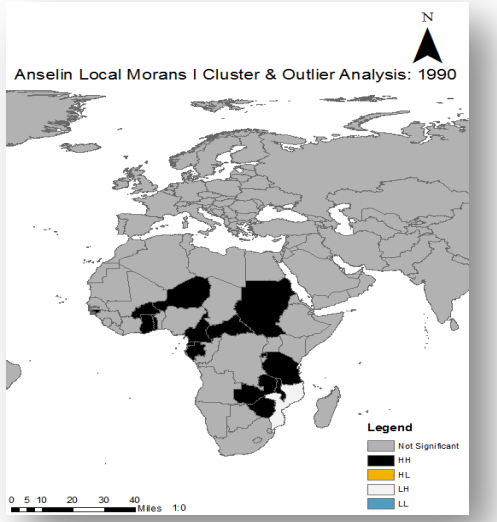
The Spatial Distribution of Malaria Based on Temperature and Population Density

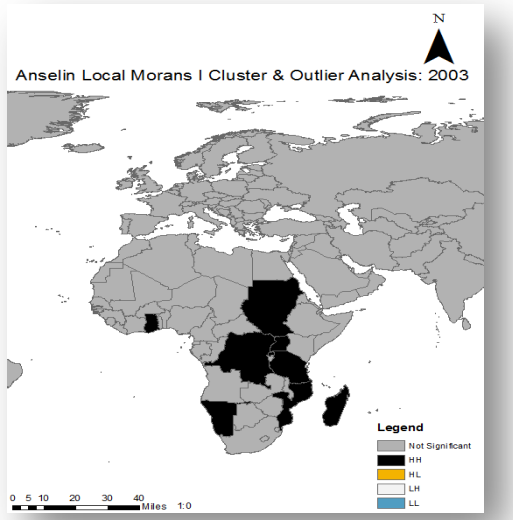
Introduction & Objective

Malaria is a mosquito-borne infectious disease of humans and other animals caused by parasitic protozoans (World Health Organization, 2013). Commonly, the disease is transmitted by a bite from an infected female Anopheles mosquito, which introduces the organisms from its saliva into a person's circulatory system (World Health Organization, 2013). Every year, there are approximately 350 - 500 million cases of malaria. More than one million people die from the disease annually. Some 3.2 billion people live in areas at risk of malaria transmission. Even though the disease is one of the biggest killers in Africa, it is also one of the easiest diseases to prevent (World Health Organization, 2013). A similar study was conducted by Marlize Booman and her associates on a similar study area, which as the foundations for GIS technology for studying malaria within Africa. Sustainable control of malaria in sub-Saharan Africa is jeopardized by dwindling public health resources resulting from competing health priorities that include an overwhelming acquired immunodeficiency syndrome (AIDS) epidemic .

Objective

The goal of this assessment is to use spatial analysis tools and geographic information systems to analyze various hot spots and determine whether climate or population density are altering factors of malaria case abundance. The presented data will be expressed as a Cluster and Outlier Analysis, Hot Spot Analysis, and GWR for future malaria outreach programs in various African countries. Our exploratory variables are population density and temperature. We will be analyzing all of these variables and comparing the data from 1990 to 2003.





Methods

- I. Hot spot analysis (Getis- Ord G) from the spatial statistical tool found under mapping clusters.
- II. Cluster and Outlier Analysis (Anselin Local Morans I) from the spatial statistical tool found under mapping clusters.
- III. Average Nearest Neighbour Spatial Autocorrelation (Moran I) found under the spatial statistical tools.
- IV. Geographically Weighted Regression (GWR) from the modelling spatial relationship tools.
- V. Spatial Distribution of Malaria cases.

Results & Discussion

The average nearest neighbour distance of cases is 7.6 expected and 5.7 observed. Therefore, since the ratio is 0.729, which is below 1, the distribution is clustered. Temperature has a z-score of 2.5 while population density has a z-score of 16. Therefore, for the variable regarding population density it has the best positive spatial autocorrelation and the most clustering of high values and there is strength of association. Therefore, population density has a higher effect and more prominent effect on malaria cases in Africa then temperature. In conclusion, movement of malaria cases in Africa moves in a south-eastern pattern. Also, there are more cases along the coast and more surface area is covered in 2003, which depict future predictions. The spatial distribution pattern is clustered and therefore related regarding malaria cases. Regarding the exploratory values, temperature and population density, and population density has the closest relationship with malaria cases on average overall. But, temperature in 1990 was still the more directly related.