Identify the Risk Factors in Dengue Haemorrhagic Fever (DHF) using GIS

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Abstract: Vector-borne diseases have been the most important worldwide health problem for many years and still represent a constant and serious risk to a large part of the world's population. GIS and RS is used to evaluate and model the relationships between environmental factors/indicators and the incidences of viral diseases. The aim of the study is to identify the risk factors in Dengue Haemorrhagic Fever DHF) from the highest prevalence area and lowest prevalence area in Sukhothai province, Thailand using statistical, spatial and GIS Modeling. Results obtained in the study of the Dengue show that it is now possible to identify and localize precisely environmental indicators and factors of viral diseases.

Keywords: GIS, Remote sensing, Dengue Haemorrhagic fever, risk zone.

1. Introduction

Data on 683 DF/DHF/DSS cases reported in Sukhothai province, Thailand, from January to December 1998 were extracted from Sukhothai Provincial Public Health office. In this paper, we propose a methodology based on exploratory spatio-environmental results obtained from remote sensing in relation to levels of incidence of Dengue to get insights in the relationships between these two elements. GIS modeling is first used to derive spatial categories of levels of incidence of the disease. Then Spatio-environmental indicators/factors are extracted from remote sensing results.

The approach is to identify different categories of levels of incidence of Dengue disease, and the to explore spatially through GIS modeling the relationship between these categories and categories of spatial and environmental characteristics obtained with remote sensing.

2. Geographical Distribution

Study area is Sukhothai province that located at the lower edge of the northern region of THAILAND (Figure 1). The province covers some 6,596 sq. km. and is divided into 9 Amphoes (Districts*):* Muang Sukhothai, Ban Dan Lan Hoi, Khiri Mat, Kong Krailat, Sawankhalok, Si Nakhon, Si Samrong, Si Satchanalai and Thung Saliam. The most occupations are agricultural products; sugarcane, cassava, corn. The climate is subtropical. The seasonal fluctuation of temperature is 22.9° C – 27.0° C. The average rainfall during 1969 to 2000 is 917.7 mm.

The geographic distribution of population density by district presented a geographic pattern similar to the one described for case of DHF incidence (Figure 2). District with highest population density is located in one area in Sukhothai province (Figure 3).

3. Remote sensing spatio-environmental classes, Dengue incidence and GIS modeling

The spatial distribution of the districts corresponding to the highest levels of incidence of DHF is calculated (Figure 4). The highest levels of incidence are constituted by the quartile 75% to 100%.

As shown in the following figure, analysis is demonstrating that the most prominent districts are in the southern part of the province. It appears that 23.6% of the area of the province is having the highest prevalence.

Mapping of these area of highest prevalence is showing (Figure 5) the geographic distribution of districts. These first results obtained in the study of the dengue show that it would be possible to be the based information and then to identify environmental indicators of the viral diseases. The levels of incidence are constituted by the 1st quartile (Q1), Median (Q2), 3rd quartile (Q3) and Maximum value (Q4).

The districts are organized in classes according to the distribution of the climate and incidence of DHF. Four classes (Figure 6) are obtained 4 different climate behaviors of administrative boundary and densities of the disease cases.

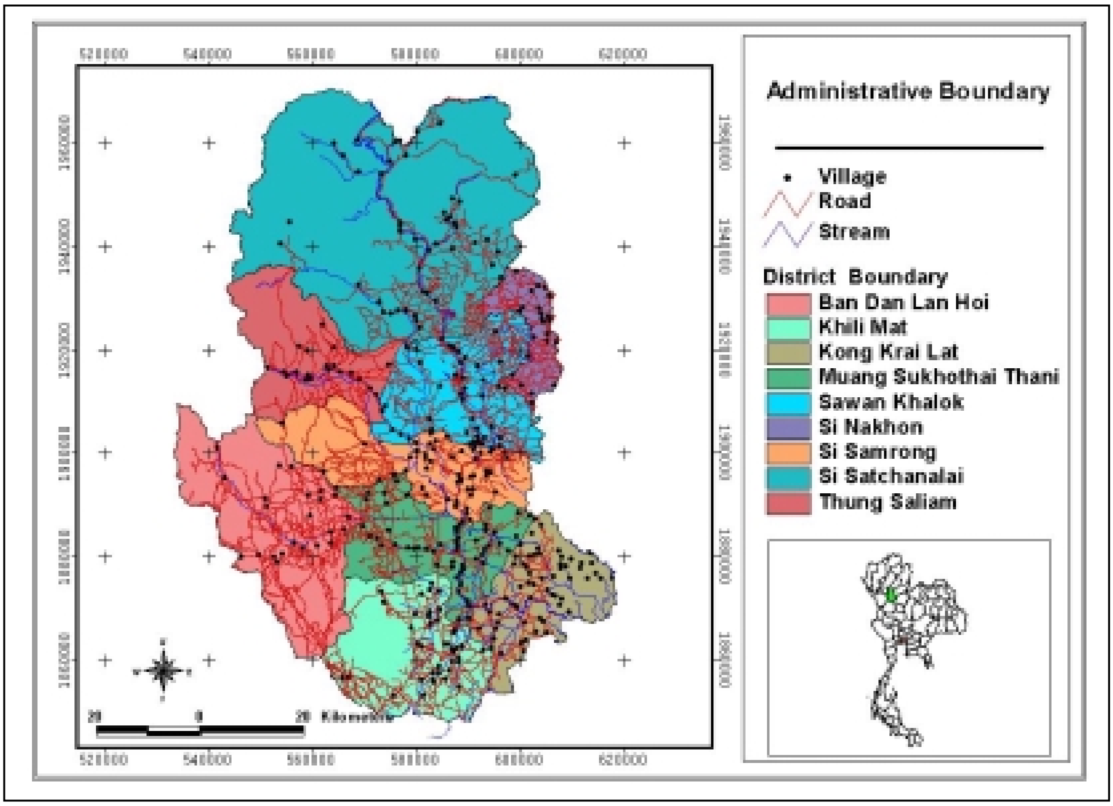

Figure 1 Sukhothai province, Thailand.

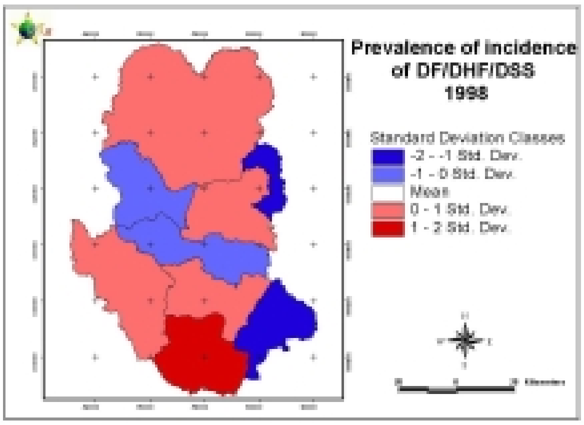

Figure 2 DHF incidence in Sukhothai province, Thailand, 1998.

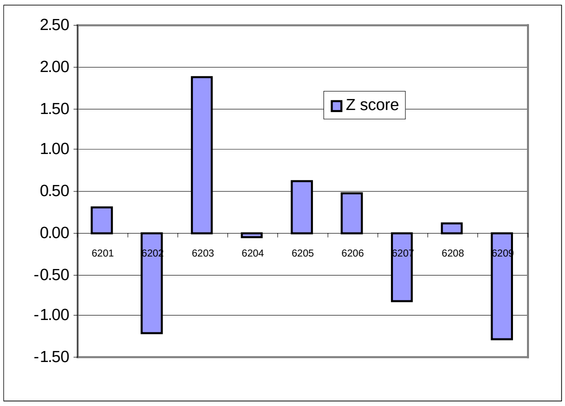

Figure. 4 Standardized DF/DHF/DSS rate in Sukhothai province.

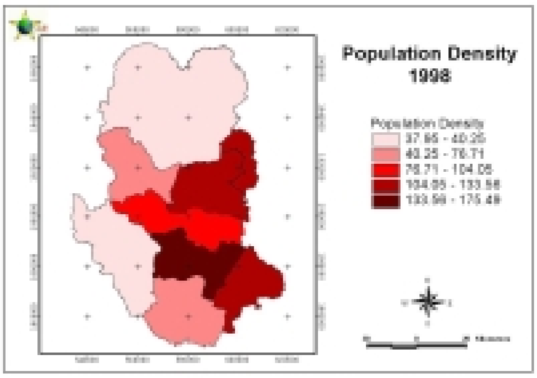

Figure 3 Population density in Sukhothai province.

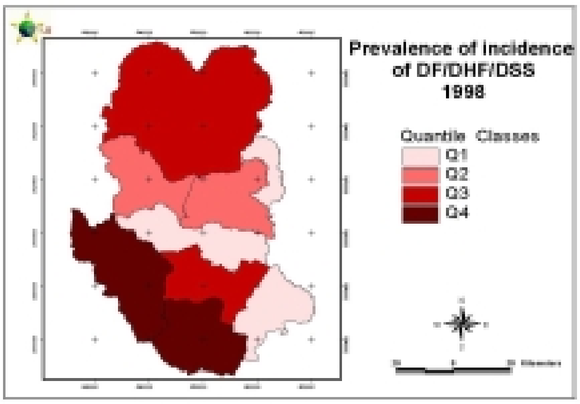

Figure 5 Map of prevalence of the DF/DHF/DSS cases.

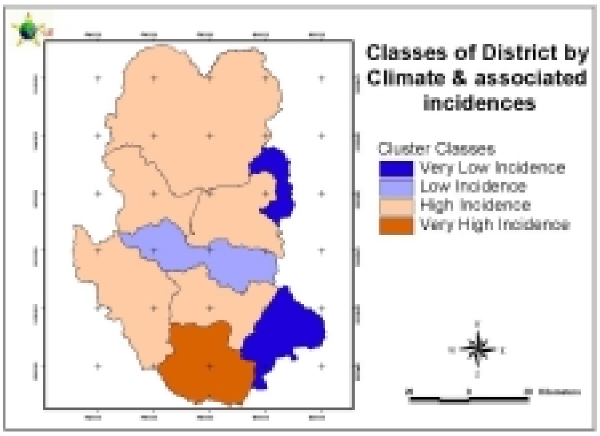

Fig. 6 Classes of districts by climate data and associated incidences.

4. Conclusions

There is no specific management of dengue infections, no vaccine is commercially available, and vector control is the only alternative for stopping the spread of the disease. *Aedes aegypti* and *Aedes pseudoscutellaris* bred in flower vases, drums, plant containers and tires, but preferentially in miscellaneous container such as tin cans, plastic food containers and, in coconut shells, old motor parts, in ground pools. However, these measurements take no account of the relative productivity of each larval habitat. An early warning system should be developed to predict, and an emergency response plan to control an epidemic. Current results obtained in the study of the Dengue that would be possible to identify indicators of viral diseases. A situation analysis as a first step towards identification of risk behaviors and would be possible to predict estimates of where the viral diseases could probably and spatial burst. Then developments would be in the modeling of the relationship between socio-economic and environmental factors and levels of incidences.

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