SPATIAL PATTERN AND HOTSPOT ANALYSES OF *Ganoderma* DISEASE IN OIL PALM PLANTATIONS USING THE GEOGRAPHICAL INFORMATION SYSTEM

IDRIS, A S; AZAHAR, T*; WAHID, O; HASNOL, O and TARMIZI, A M

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MPOB INFORMATION SERIES • ISSN 1511-7871 • JUNE 2009 MPOB TS No. 62

The growing demand for localized predictions, spatial pattern and hotspot analyses over large regions has prompted the application of the Geographical Information System (GIS) and geostatistics that can be used to analyse and manage plant disease information data. GIS has been used most extensively for mapping distributions of disease or specific genotypes of plant pathogen (Nelson *et al*., 1994). Spatial pattern and hotspot analyses have been applied in the field of plant pathology on a variety of scales, from single plots to agricultural regions, to analyse the interactions between pathogens, hosts and the environment in relation to plant disease epidemics. The study of spatial pattern and hotspots can provide quantitative information on population dynamics, aid in the design of epidemiological studies and sampling programmes for disease or pathogen monitoring, and can be used to generate hypotheses about underlying ecological processes. This article describes spatial pattern and hotspots of basal stem rot (BSR) disease in oil palm naturally infected by *Ganoderma* fungus using GIS technology.

PROCEDURES

A summary of the processes involved is presented in *Figure 1*. The processes involved are as follows:

Data Input

The data input includes a plantation map, a road map, a palm tree map, a digital terrain model, GPS data and census of BSR incidence.

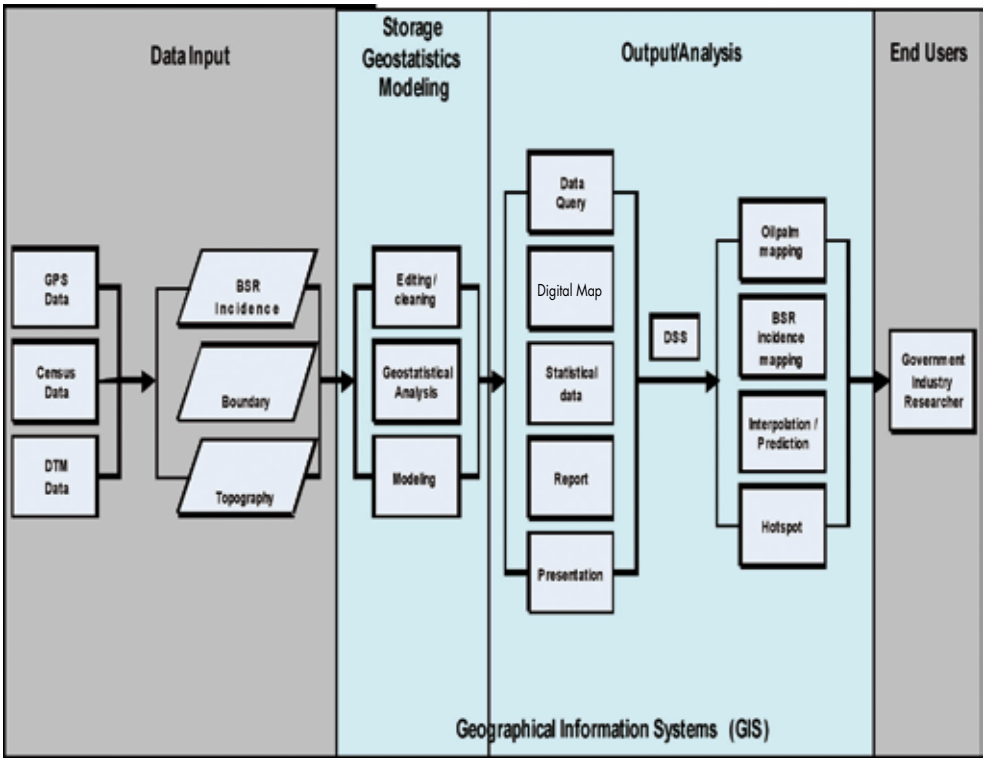

Figure 1. The overall process.

* *University Kuala Lumpur (UniKL), Kuala Lumpur, Malaysia.*

ISSN 1511-7871
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Storage/Geostatistics/Modeling

The map will be layered using the ArcMap of the ArcGIS software. A spatial autocorrelation analysis will be performed on the data. For this purpose, a semi-variogram or Moran I will be used as spatial autocorrelation tools. The variogram and Moran I will provide a description of how data are correlated with distance, or in other words it is a measure of the degree of spatial dependence between BSR incidences.

Analysis/Output

This step will involve the use of kriging for interpolation (prediction) and kernel density estimator for hotspot analysis (*Figure 2*). The results of the analysis will be reproduced as a layer in the GIS and can be printed out for specific purposes.

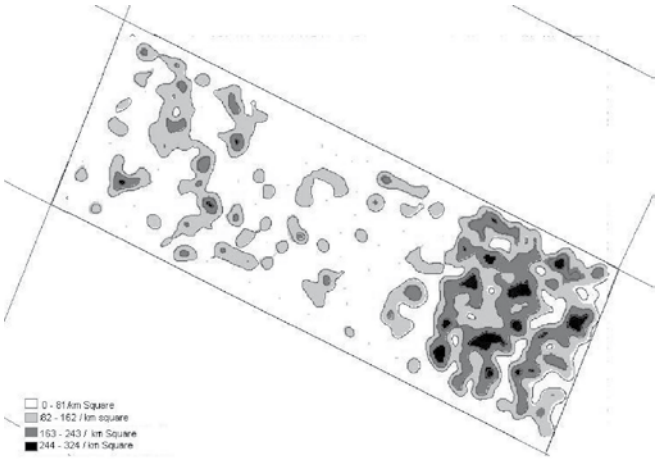

Figure 2. An example of hotspot analysis of basal stem rot (BSR) incidence.

SERVICE OFFERED

The BSR disease spatial pattern and hotpots analysis is offered as a service to anyone who is interested. A report on the results will be given together with recommendations on the action to be taken. Apart from that, the services also offer the mapping of the sites and the mapping of BSR disease incidence in order to cater to the needs of oil palm growers.

BENEFITS

GIS spatial and hotspot analysis products are very useful for an effective and comprehensive BSR disease management programme in oil palm plantations. The combination of the GIS and the Global Positioning System (GPS) enhances the quality of spatial and non-spatial data for analysis and decision-making by providing an integrated approach to disease control and for surveillance at local, regional and/or national levels.

COST

The cost of the services will vary depending on the data storage size required, type of analysis, and whether single or multiple datasets are required in the process.

REFERENCE

NELSON, M R; FELIX-GASTELUM, R; ORUM, T V; STOWELL, L J and MYERS, D E (1994). Geographic information systems and geostatistics in the design and validation of regional plant virus management programs. *Phytopathology, 84*: 898-905.

For more information kindly contact:

Director-General
MPOB
P. O. Box 10620
50720 Kuala Lumpur, Malaysia.
Tel: 03-87694400
Website: www.mpob.gov.my
Telefax: 03-89259446