DEVELOPMENT OF GIS DATABASE AND TOOLS FOR MANAGEMENT OF SPATIALLY DISTRIBUTED RESOURCES

A CASE STUDY OF BIRDS VARIATION IN KALUTARA DISTRICT

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Degree of Master of Science

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Thesis Submitted in Partial Fulfilment of the Requirements for the Degree of Master of Science

Supervised by

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April 2012

DECLARATION

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ABSTRACT

Geographic Information Systems (GIS) modelling enables rational management of spatially distributed resources. However, use of GIS for dynamic environmental resource management is an emerging area of research. Resource managers often face problems when managing environmental conservation or restoration works due to the lack of user friendly, spatially distributed modelling tools.

The present work developed a GIS database and management tools incorporating user friendliness, effective computation and manipulation of data to demonstrate the potential of GIS for spatially distributed environmental resource management. Kalutara District of Sri Lanka was selected with Grama Niladhari Division as the smallest spatial entity and taking birds as the environmental resource.

In this work GIS model was developed to identify locations indicating the spatial variation of bird availability. The developed model was based on the Analytical Hierarchy Process as described by (Sooriyabandara & Wijesekera, 2010). Tool development consisted of a ArcGIS model builder assembly to obtain modelled bird availability results. A button tool within the ArcGIS environment was incorporated to capture and manage bird availability results for decision making and visualization. Model and tools developed by the study incorporated the modelling results of Bird "Black Rumped Flameback" for model development and testing.

GIS tool and GIS model development presented a new approach compared to other software development processes. Four main user surveys were carried out to develop the best fit GIS tool and those were carried out one after the other. User comments and suggestions at each survey were incorporated in the model development. Questionnaires were used effectively for the identification of best tool. GIS model and Tool development in the present work is a

unique contribution to the use of GIS based resource management models for environmental resource management. This work developed and tested the model which incorporated the dynamic capability and the elimination of cross migration from the active ArcGIS environment.

The tool ensured user friendliness through the incorporation of tooltips, attractive buttons, verification messages and error messages. Consistency of the GUI were achieved by careful and unique design of buttons and sizes, button labels, graphics for prominence, interface titles, and interface arrangements. Tool coding requirements were changed to dynamically link multiple interfaces, objects and geographic locations. In this work, handling of multiple interfaces was added to the GIS tool as a ".dll" file which required incorporating of new codes. This semi-automated model is recursive, adaptive and it allows changing the weights of the parameters and also it is possible to carryout forecasting.

Developed GIS tool is capable of carrying out Database to Map, Map to Database and Database to Database operations.

This tool is capable of displaying the available resources in a selected area either according to resource type, or characteristics. The present study demonstrates the capability of the GIS model to support decision making under resource utilization, change of use, or in case of resource conservation. The present work carried out three case study scenarios to evaluate (i) climate change, (ii) Deforestation and the case of (iii) Water body enhancement with forestation.

Present work concluded the successful development of a GIS based System to demonstrate the potential of Geographic Information Systems for efficient management of spatially distributed environmental resources. The tool which enables use of available knowledge and the possibility of incorporating new findings was developed using ArcGIS, Visual Basic 6, Microsoft Access and the object oriented model builder tools eliminating cross migration from the present tool environment.

This research under the title "Development of GIS Database and Tools for Management of Spatially Distributed Resources – A Case Study of Birds in Kalutara District" was supported by University of Moratuwa Senate Research Grant Number SRC/LT/2009/20 under the theme "Development of a GIS Model for Environmental Resource Management" and the National Science Foundation Grant number RG/2007/E/04 titled "Development of a GIS Model for the Identification, Planning and Management of Ecological Resources in the Kalutara District".

ACKNOWLEDGMENT

At first the author wishes to forward his sincere gratitude to Professor N.T.S. Wijesekera, for his continuous supervision, encouragement and valuable advice throughout the study. He expresses his special appreciation to Professor J.M.S.J. Bandara and Professor H.S. Thilakasiri Research Coordinators, Department of Civil Engineering. Plnr. Pushpa Gamage, Director, Information System and GIS division, Urban Development Authority is thanked for serving as chairperson of the Thesis Evaluation Panel and for the support given by way of valuable suggestions.

This work was commenced with funding from the National Science Foundation Grant for RG/2007/E/04. The Moratuwa University Senate Research Grant supplemented the National Science Foundation funding during disbursement difficulties and this effort is gratefully acknowledged. The support given by Professor N.T.S. Wijesekera (Supervisor) and Professor Malik Ranasinghe (Vice Chancellor) to overcome logistic support problems of the National Science Foundation grant is acknowledged with deep gratitude.

The author would like to express his sincere thanks to the staff of the Department of Civil Engineering, especially of the Computer Laboratory and Hydraulic Laboratory for their support in providing facilities and services during the research.

Author's special gratitude goes to the International Center for Geoinformatics Application and Training (ICGAT), University of Moratuwa for providing field work assistance and for granting permission to use resources to make this research a success. Author would also like to thank all staff of ICGAT who supported successful completion of this research.

Finally the author extends his gratitude to his wife and children for their continuous support, tolerance and encouragement for successful completion of his higher studies.

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