

**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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University of Moratuwa  
Sri Lanka

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of Science

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April 2012

## DECLARATION

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Date

The above candidate has carried out research for the Masters thesis under my supervision

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Professor N.T.S. Wijesekera

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Date

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

A CASE STUDY OF BIRDS IN KALUTARA DISTRICT

## **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.



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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/E04 titled "Development of a GIS Model for the Identification, Planning and Management of Ecological Resources in the Kalutara District".

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