GIS and Ecological Networks:

allowing the Web of Life, a Network of Space.

MSc (GIS)

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allowing the Web of Life, a Network of Space.

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ABSTRACT

Sustainability and stemming the sixth extinction is a global problem. Yet solving it must start at grass roots level. The problem spans numerous scales, both physically and organisationally. Ecological Networks are a spatially sound and dynamic concept, which can help to solve this problem. To bring Ecological networks into fruition requires planning, spatial design and implementation. The planning and implementation are very much dependent on the organisation. It is the design, which can be optimised using GIS.

The proposal was made to create a generic conceptual GIS model for the design of ecological networks. After consultation with an expert knowledge base, it became apparent that it is not possible to exclude species entirely. Species are inextricably linked to the purpose of an ecological network—the protection of species, and ensuring their sustainable existence. Utilising an expert knowledge base and available literature, related criteria were weighted accordingly. These results were used as the bases for the system requirements for the Ecological Network Design Model.

The ENDeM model is split into three sub-models, one for each of the basic components of an ecological network. Optimisation of the network, especially in the Corridor Sub-Model posed an interesting problem, in the model design. The ENDeM model provides a solution to optimising the design of ecological networks, at various scales. Being a fairly simple model, it may be implemented easily within any organisation. Its ultimate aim is to assist in stemming the sixth extinction by providing the web of life, a network of space.

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DISCLAIMER

The results presented in this thesis are based on my own research at the Faculty of Earth and Life Sciences of the Vrije Universiteit Amsterdam. All assistance from individuals and organisations has been acknowledged and full reference is made to all published and unpublished sources used.

This thesis has not been submitted previously for a degree at any institution.

Signed:

Date:

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SUMMARY

The problem of sustainability and stemming the sixth extinction is global. Yet solving it must start at grass roots level. The problem spans numerous scales, both physically and organisationally. Ecological Networks is one concept, which can help to solve the problem. To bring Ecological networks into fruition requires planning, design and implementation. The planning and implementation is very much dependent on the organisation. It is the design, which can be optimised.

Ecological Networks are fundamentally a spatial concept. The basic concept focuses on conserving biodiversity at different scales (the ecosystem, landscape and regional scales) using a structure of various core and buffer areas being linked to each other through a number of different types of corridors, to form a network.

Geographical Information Systems (GIS) handle spatial data and environmental data well. GIS can be coupled with environmental models to include the spatial component.

The combination of using GIS to design ecological networks seems an obvious choice. Up until recently this has not been the case. The proposal was made to create a generic GIS model for the design of ecological networks. After consultation with an expert knowledge base, it became apparent that it is not possible to exclude species entirely. Species are inextricably linked to the purpose of an ecological network—the protection of species, and ensuring their sustainable existence. Species along with ecosystems have been included in a generic way, where the decision maker only needs to select the species (or possible key species).

The expert knowledge base was asked to provide opinions on the importance of a number of criteria related to Ecological Networks. These opinions were analysed and the criteria were weighted accordingly. These results and the available literature were used as the bases for the system requirements for the Ecological Network Design Model (ENDeM).

The ENDeM model is split into three sub-models, one for each of the basic components of an ecological network. These need to run one after the other, starting with the Core Areas Sub-Model and ending with the Buffer Zone Sub-Model. This is as a result of the fact that corridors cannot be delineated, without a starting and ending point. Hence the results from the Core Areas Sub-Model form one of the inputs to the Corridor Sub-Model. Similarly the combination of the Core Areas Sub-Model and the Corridor Sub-Model forms one of the criteria for the Buffer Zone Sub-Model. The optimisation of the network, especially in the Corridor Sub-Model posed an interesting problem, in the model design.

The ENDeM model provides a solution to optimising the design of ecological networks, at various scales. It is a fairly simple model such that it may be implemented easily within any organisation. Its ultimate aim is to assist in stemming the sixth extinction by providing the web of life, a web of space.