A multicriteria assessment of regional sustainability options in the Northern Province, South Africa.

by

Belinda Reyers

Submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy (Zoology)

Faculty of Natural and Agricultural Sciences
University of Pretoria
Pretoria

February 2001

"And as the natural man within loses honour,
so too does nature without.
We no longer feel reverence for nature, and defoliation of spirit and landscape are everywhere to be seen...
That is why what is left of the natural world matters more to life
now than it has ever done before.
It is the last temple on earth which is capable of restoring man to an objective self
wherein his ego is transfigured and given life and meaning without end..."
Laurens van der Post, *Feather Fall*. (1994).

A multicriteria assessment of regional sustainability options in the Northern Province, South Africa.

Student: Belinda Reyers

Supervisor: Prof. Albert S. van Jaarsveld

Department: Zoology and Entomology, University of Pretoria

Degree: Doctor of Philosophy (Zoology)

Abstract

The need to protect biological diversity, the inadequacies of current protected areas and the need for scientific procedures for the identification of areas important to biodiversity conservation are well-known facts in conservation biology. Many conservation planning techniques developed, however, have a number of weaknesses. These shortcomings include incomplete biodiversity databases and the need for appropriate biodiversity surrogates. Although these procedures represent alpha diversity patterns successfully, without due consideration of underlying processes and turnover patterns, the long-term persistence of biodiversity within areas identified will not be guaranteed. As land-use changes pose the single most important threat to global biodiversity, the inclusion of land-use data in conservation planning is an essential, but often overlooked component. Current land-uses will expand with growing human populations and expected future land-uses should also be an important component of conservation area selection. This thesis addresses these weaknesses in developing a conservation plan for the Northern Province of South Africa. Incomplete datasets can be addressed by the use of indicator taxa and broad-scale environmental classes. However, these surrogates are not as effective at representing rare and endemic biodiversity features and the specific assessment technique used to test the validity of biodiversity surrogates affects the levels of support found. The inclusion of beta diversity and land-use threats (both current and potential) into conservation area selection highlights shortcomings in more traditional techniques. These forms of data make for more realistic conservation area outputs, however, this comes at an increased cost to land. In a final integrative assessment all areas identified as having high biodiversity value in the preceding analyses are assessed as to the threats they face in order to prioritise these areas for immediate conservation attention. This study addresses many weaknesses in conservation planning techniques, contributing to them becoming real-world conservation tools. In South Africa shortages of conservation resources, as well as land redistribution issues, make conservation planning even more challenging. The need to make these procedures flexible, efficient and realistic is essential. The role of off-reserve conservation areas may help address these difficulties and ensure the persistence of biodiversity in one of the world's most biodiverse regions.

Keywords: biodiversity, conservation, reserve selection, surrogacy, turnover, land-use, sustainability, Northern Province

Acknowledgements

My thanks go to Albert van Jaarsveld, my supervisor, for his generosity of advice, time, opportunities and humour. Much gratitude also goes to Dean Fairbanks and Konrad Wessels for all their time, experience and data. To my lab mates, both past and present, Stefanie Freitag, Stephanie Koch, Mariaan Booysen, Caron Foord, Marilyn Lever, Heath Hull, Louise Erasmus, Barend Erasmus, Berndt Janse van Rensberg, Jacolette Adam and Mrigesh Kshatriya, thank you for all your help and support. Special thanks to Stefanie Freitag for introducing me to reserve selection algorithm programming and GIS, to Stephanie Koch, Heath Hull and Caron Foord for all the time spent putting the species databases together, and to Ian Meiklejohn for sharing his knowledge of GIS so generously. Much appreciation goes to Anina Kockemoer for all her help in the final stages.

Funding for this study was provided by the National Research Foundation, Mellon Foundation Mentoring Program and the University of Pretoria, and is gratefully acknowledged. GIMS ® and ESRI are thanked for their Geographic Information Systems (GIS) software, training and support.

Data were generously provided by the Avian Demographic Unit, (University of Cape Town), Environmentek (Council for Scientific and Industrial Research), Institute for Soil, Climate and Water (Agricultural Research Council), National Botanical Institute, National Flagship Institute, Mr. C.J. Vorster (Council for Geoscience) and University of Pretoria.

Finally, my warmest thanks to my friends and family: to my parents, Fred and Lynne, my sister, Michelle, Jason and the rest of the clan for their love, support and unwavering belief in me, and of course their sense of humour and proportion, to Jeanne-Marie Viljoen for her friendship, interest and encouragement, and to Darryl Stander for his levelheadedness and support.

Disclaimer

This thesis consists of a series of chapters and appendices that have been prepared for submission to, or publication in, a range of scientific journals. As a result styles may vary between chapters and appendices in the thesis and overlap may occur to secure publishable entities.

Table of Contents