CHAPTER 7

General Discussion

The need for conservation areas, in which biological diversity can be protected from external anthropogenic threats, is becoming increasingly important (Margules & Pressey, 2000). As human populations and their land-use requirements expand, so natural areas in which biodiversity can persist become more threatened. This is of crucial importance not just for the preservation of biodiversity, but for the continued existence of humankind. Biodiversity provides many goods and services on which humans are directly and indirectly reliant, without which our survival is questionable (Kunin & Lawton, 1996). Protected areas in which biodiversity is conserved already exist. However, these areas are inadequate both in terms of coverage and in their representation of biodiversity. The total global land area within conservation areas is estimated to be approximately 7.9%. In addition to this most of the current protected areas were proclaimed in a primarily *ad hoc* and opportunistic fashion, with little regard for the biological patterns and processes (Pressey *et al.*, 1993). These areas were mainly selected on the basis of tourism potential, scenic values, the presence of endemic disease and the lack of agricultural or forestry potential. The resultant biased representation of regional biodiversity and increased costs of achieving adequate representation have led to a rapid proliferation in techniques for the systematic selection of areas important to biodiversity conservation. These techniques aim to represent maximum biodiversity within minimum land area in a region and are relatively efficient in fulfilling this purpose (Williams, 1998). However, there are several obvious shortcomings in these procedures requiring urgent attention before these techniques can effectively be implemented in real-world conservation planning. This study therefore sets about to identify many of these shortcomings and to address them in an effort to improve conservation planning in the Northern Province of South Africa.

Due to the complexity of biodiversity, a complete inventory of biodiversity is generally unattainable (Prendergast *et al.*, 1993). Thus the first shortcoming identified and assessed deals with incomplete biodiversity databases, finding appropriate surrogate or substitute measures for biodiversity and testing their adequacy in conservation planning. The results illustrate that indicator taxa (taxa with well-known distributions and taxonomy) perform well at representing non-target taxa. However, two problem areas are highlighted: first, these conservation areas based on indicator taxa exclude many rare and endemic species of non-target taxa; and second, the assessment techniques used for testing the validity of indicator taxa as biodiversity surrogates are varied and provide different levels of support. As illustrated in both Chapters 2 and 3 levels of overlap between areas of conservation importance to different taxa may be low but are not an indication of the success with which indicator based conservation areas represent biodiversity. Rather one should look at the number of non-target species captured within these areas as a measure of success. This is in agreement with findings by Reid (1998), Howard *et al.* (1998), Prendergast *et al.* (1993) and Lombard (1995). Thus recommendations include the careful consideration of rare and endemic species, as well as the standardisation of assessment techniques.

The realisation that species are only one level of the biodiversity hierarchy has prompted the use of higher hierarchical levels of broad-scale environmental classes including vegetation and land types (Wessels *et al.* 1999). The use of these forms of data in conservation planning in the Northern Province illustrate that increased success in the representation of regional biodiversity (measured as species diversity) comes at an increased cost to land. The results illustrate that the best approach is a combined one using both environmental surrogates as well as species data. Once again the exclusion of rare and endemic biodiversity features through this surrogate-based approach is highlighted. Finally, in a similar fashion to work by Soulé and Sanjayan (1998) these results refute the recommended 10% protected area coverage, illustrating that this target results in the exclusion of many biodiversity features, particularly rare and endemic ones.

Existing conservation area selection techniques have focussed largely on the representation of biodiversity patterns (alpha diversity) and not on the processes responsible for these patterns or turnover in the patterns (beta diversity) (Rodrigues *et al.* 2000). In addition, not many of the existing techniques include measures of threat into conservation planning (Wessels *et al.* 2000). The study addresses these shortcomings through the inclusion of environmental and species gradients, beta diversity patterns and land-use threats into conservation area selection, making these techniques more useful conservation tools. These improvements in conservation planning unfortunately impose increased land costs, but the use of off-reserve management in the human matrix, rather than formal protection, can alleviate some of these demands. In recognition of the fact that current land-use patterns are not static and will expand, natural areas of high suitability for alternate land-uses (e.g. cultivation, forestry and mining) are identified and applied to conservation planning in the Northern Province.

Finally, all the methods developed in this study are used to identify areas of high importance to biodiversity (areas of high biodiversity value). However, the reality of the situation suggests that not all of these areas will receive immediate conservation attention. Therefore, the final analysis sets out to prioritise these areas of high biodiversity value using threat values of current and future land-use threats in an effort to identify those areas requiring immediate conservation attention.

Although this study goes a long way towards addressing many weaknesses highlighted in conservation planning techniques, there are still several problems encountered within the study that deserve mention. These shortcomings have implications for conservation planning and must be considered before implementation of the techniques in real world conservation planning scenarios. Several of these weaknesses are discussed in the introduction and include the lack of presence/absence species distribution data, selection unit size and the resolution of environmental and biological surrogate data. The ideal form of data for the identification of areas important to biodiversity conservation is presence/absence species distribution data, where all areas in the region of interest have been surveyed for the presence of all species. Obviously these data are very labour intensive to obtain and are subsequently scarce. The only such database for the Northern Province is the Bird Atlas Database (Harrison, 1992). The other databases are presence-only databases, including the mammal and butterfly databases. The major problem with datasets of this kind is the potential for false absences and therefore the possibility that areas of high conservation value may be excluded from conservation areas and areas of low value may be included. Therefore most of the study employs the bird data only, however there are sections that require data on other taxa (e.g. indicator work). This requirement, as well as the fact that the other datasets can still make an important contribution to conservation planning makes the inclusion of the other presence-only databases in parts of the study necessary. This is done, however, with full knowledge of these datasets' shortcomings and any conservation outcomes are treated with caution. Similarly the mapping of the vegetation and landtypes is at a very coarse scale, but once again this is the best data available and to exclude it from conservation planning would have more serious consequences for biodiversity conservation. Thus all of these shortcomings associated with the biological and environmental data were understood, acknowledged and taken note of in any recommendations. But until better databases are available, these data form an essential, albeit flawed, component of conservation area selection.

The selection units employed within the study are quarter degree grid squares (QDS's) with an average size of 600-700km^2. This is a large size for conservation planning, as this area can contain a multitude of different habitats and species within one grid square. To treat this then as one homogenous unit is very simplistic and misses out on a lot of heterogeneity. In addition many conservation areas are smaller than this planning unit size. Because of the heterogeneity present within the grid cell one cannot assume that a conservation area placed anywhere within that cell will capture and protect all biodiversity found within it. Therefore although these units are useful for assessing some of the questions posed in the study, they are not realistic planning units for conservation. Once again the limitations of the data available imply that we either have to work with the data available or sit back and wait for better data to become available. The latter option seems unadvisable considering the plight that much of biodiversity is in at the moment. One potential solution to this problem of the planning units (QDS's) is to realise the problems associated, the limitations this places on any conservation outputs, and investigate the areas identified at this scale at a more local scale (Wessels *et al.*, 2000). This was the approach taken by the study. Grid cells were used to identify areas of biodiversity conservation importance within the Northern Province. This set of grids is however not a final output of the conservation area selection procedure, it highlights areas which must then be investigated at the local scale in order to identify regions within the QDS's where conservation or off-reserve management in essential.

In conclusion, although the field of conservation planning is beset by weaknesses and inadequacies, it is still an essential component of effective biodiversity conservation. This thesis has succeeded in addressing many of these shortcomings, thereby contributing towards these techniques becoming real-world conservation tools. There are however still many problems with the techniques outlined above. This does not invalidate the techniques, it merely argues a degree of caution in the implementation of the techniques and requires additional local scale work. This does, however, illustrate that there is still much work to be done in the field of conservation planning, from the collection of data all the way to the implementation and management of the area selected. In the South African context, with shortages of conservation resources and funds, as well as land redistribution issues, conservation planning faces many difficulties. Therefore, the need to make these procedures as flexible, efficient, transparent and realistic as possible is essential. The role of off-reserve conservation areas is one that should also be investigated as a potential means for addressing these difficulties and ensuring the persistence of biodiversity in one of the world's most biodiverse regions.

References

Harrison, J.A. (1992). The South African Bird Atlas Project: Five years of growth. *South African Journal of Science* 88, 410-413.

Howard, P.C., Viskanic, P., Davenport, T.R.B., Kigenyi, F.W., Baltzer, M., Dickinson, C.J., Lwanga, J.S., Matthews, R.A. & Balmford, A. (1998). Complementarity and the use of indicator groups for reserve selection in Uganda. *Nature* 394, 472-475.

Kunin, W.E. & Lawton, J.H. (1996). Does biodiversity matter? Evaluating the case for conserving species. In *Biodiversity: A biology of numbers and difference.* (Ed. KJ Gaston), ch 11. Blackwell Science Ltd, Oxford, UK.

Lombard, A.T. (1995b). The problems with multi-species conservation: do hotspots, ideal reserves and existing reserves coincide? *South African Journal of Zoology* 30, 145-163.

Margules, C.R. & Pressey, R.L. (2000). Review article: Systematic conservation planning. *Nature* 405, 243-253.

Prendergast, J.R., Quinn, R.M., Lawton, J.H., Eversham, B.C. & Gibbons, D.W. (1993). Rare species, the coincidence of diversity hotspots and conservation strategies. *Nature* 356, 335-337.

Pressey, R.L., Humphries, C.L., Margules, C.R., Vane-Wright, R.I., & Williams, P.H. (1993). Beyond opportunism: Key principles for systematic reserve selection. *Trends in Ecology & Evolution* 8, 124-128.

Reid, W.V. (1998). Biodiversity hotspots. *Trends in Ecology & Evolution* 13, 275-280.

Rodrigues, A.S.L., Gregory, R.D. & Gaston, K.J. (2000). Robustness of reserve selection procedures under temporal species turnover. *Proceedings of the Royal Society, London (B)* 267, 49-55.

Soulé, M.E. & Sanjayan, M.A. (1998). Conservation targets: do they help? *Science* 279, 2060-2061.

Wessels, K.J., Freitag, S. & van Jaarsveld, A.S. (1999). The use of land facets as biodiversity surrogates during reserve selection at a local scale. *Biological Conservation* 89, 21-38.

Wessels, K.J., Reyers, B., Krüger, M. & van Jaarsveld, A.S. (2000). Incorporating land-cover information into regional biodiversity assessments in South Africa. *Animal Conservation* 3, 67-79.

Williams, P.H. (1998). Key sites for conservation: area selection methods for biodiversity. In *Conservation in a Changing World.* (Eds. G.M. Mace, A. Balmford & J.R. Ginsberg), pp 211-249. Cambridge University Press, UK.