

Anthony Rebelo

Algorithms for Biodiversity Reserve Configurations



Born in Bellville, South Africa in 1959 and matriculated at the Settlers High School. Received a B.Sc. degree from University of Cape Town in 1980; honours in 1981 and Ph.D. in 1992 on "The preservation of the Cape Flora: status, causes of rarity, ideals and priorities". Most of my career has been spent in the fields of pollination and conservation biology, first at the University of Cape Town and later at the National Botanical Institute. I have published some 40 scientific articles in these fields, including "A preliminary synthesis of pollination biology in the Cape Flora." At present I am involved in the "Protea Atlas Project", an attempt to involve laymen in amateur botany so as to map and conserve the Cape Flora, for which I edit a quarterly *Newsletter*, manage the data base and produce annual distribution maps and conservation reports. I have been proposed as co-chairman of the IUCN Species Survival Commission's "Cape Flora Specialist Group", but the establishment of the group will have to await my return to the new South Africa. — Address: Conservation Biology Research Unit, National Botanical Institute, Kirstenbosch, Private Bag X7, Claremont 7735, South Africa.

The invitation to spend some months at the Wissenschaftskolleg came at an interesting time. Locally, scientists and conservationists were in the doldrums concerning the future of their fields, and the general populace in South Africa was gearing up for a new South Africa amid predictions which raged from total anarchy to a golden era. Careerwise, I had just finished writing up most of my Ph.D. papers and had to decide whether to continue in the field of prescribing local and regional conservation priorities or change back to a new field more in line with the urgent needs of third world aspirations.

Arriving in January half way through the development of the book on *Conserving Biodiversity*, it became apparent that, apart from my chapt-

ers, several key issues needed to be addressed, and I devoted my time to them. Briefly these included:

1. There are a variety of algorithms for finding the "optimal reserve configuration." But these do not yield the same results. This has two causes — inefficient algorithms, which should be abandoned, and a "neglect" of the implications of the answer yielded by the algorithm. There is currently too much emphasis on a single answer, when in fact, there is a whole constellation of equally acceptable configurations which allow all taxa to be preserved in the same minimal area. This flexibility in conservation systems is the only hope conservationists have of attaining the goal of preserving biodiversity in a world where economic development requires habitat destruction. With colleagues in South Africa, I explored ways of determining this flexibility, which turned out to be far more complex than I had imagined. Instead of discrete "islands" of solutions, a maze of archipelagos appears to be the rule, defying extrapolation from simple algorithms.
2. Just before leaving for Berlin, I was invited to present a configuration for preserving all the plant species in the province of Natal, South Africa. It became obvious that Natal could not hope to achieve this goal, but could readily achieve a less ambitious goal of preserving all the plant species which occurred predominantly in the province. This was unacceptable to the conservation authorities. At Berlin this dilemma — marrying locally perceived goals with "international requirement" — proved to be one of the more exciting debating points among fellows. It will be a while before the full extent of this conflict is realized — until now there has been little attempt to prescribe specific local conservation requirements in international terms, or to ascertain what national and local authorities see as their conservation goals. The ratification of the Rio Convention requires that countries take steps to document and conserve their biodiversity — little thought has been given to the implications of this requirement.
3. The availability of the large number of data bases accumulated by the Natural History Museum London, which were available for manipulation, revealed another unexpected problem. Analyses of different groups (hawkmoths, tigerbeetles, birds, plants) were resulting in different reserve configurations and thus establishing conflicting conservation goals depending upon the groups investigated. This is an unacceptable state of affairs: we cannot have proponents of butterflies proposing a different set of conservation priorities than that proposed by other interest groups. It turns out that this too is a bogus: provided flexibility is taken into account, these alternative data bases can be accommodated into a single, ranked set of flexible priority sites.

Adding new data (in the form of distributions for additional taxa) will not much influence the irreplaceable component of the ideal nature reserve configuration, although it may narrow down options among the flexible component and require additional sites. Details will vary from region to region, but we need many more comparative data bases before principles and guidelines can be determined.

A major problem with my brief stay at the college was that I was sandwiched in the middle of the evolution of the book. The structure, rationale and philosophy of the book changed dramatically as each co-author came and went. This was inevitable as each contributor had tackled different problems, at different scales, in different political arenas and using different types of data. As the book develops into its final stages, it will be instructive to look back at the first drafts and marvel at the extent to which the interaction at Berlin has matured our outlooks.

My stay in Berlin bridged the gap between the old and the new South Africa. From afar I was able to keep track of developments around the election. As I was continually reminded, Berlin offered a counterpoint to these changes — its "apartheid" had ended a few years previously, integration was proceeding and the new unity was growing apace. Eva Hund, in her German classes, introduced us to some of the emerging racial, political and economic problems. Coupled with extensive sightseeing around Berlin, I am still intrigued by which features have been completely eradicated, which structures remain unchanged and the grandiose future plans for the new capital. What will happen in South Africa?

I would like to thank the staff at the Wissenschaftskolleg for their efficient and friendly assistance, especially Dr. Hans Georg Lindenberg for the electronic services, Andrea Friedrich for so efficiently sorting out my visa problems, and Gerhard Riedel for providing services for keeping the family entertained. Our stay was greatly lubricated by our anchor-family, Dick, Hazel, Naomi and Coral Vane-Wright — their efforts resulted in our stay being thoroughly normal — anticipated cultural, language, travelling, shopping and child-minding difficulties were easily overcome. Both my daughters took to *Vorschule* and *Kindergarten* with an ease that still leaves me astonished. I should like to thank the families of the fellows for the excellent support which allowed my wife to take advantage of the opportunity to explore Berlin and surroundings with our two-year-old son.