Available online at www.sciencedirect.com
SCIENCE DIRECT®
ELSEVIER
Biological Conservation 112 (2003) 1–13
BIOLOGICAL CONSERVATION
www.elsevier.com/locate/biocon

Editorial

Introduction to systematic conservation planning in the Cape Floristic Region

Abstract

This paper provides an introduction and overview for the special issue on systematic conservation planning in the species-rich and highly vulnerable Cape Floristic Region. Firstly, we outline the three major problems that created the need for a systematic conservation plan and implementation programme in the region, namely an existing reserve system that is not representative of biodiversity patterns and processes, escalating threats to biodiversity, and diminishing institutional capacity. Secondly, we present the framework used for the planning and implementation process, place the contributions to the special issue in this context, and summarise current implementation initiatives. Thirdly, we extract from these studies and our own experience a number of lessons that were learnt during the planning process. Foremost amongst these lessons is a requirement for effective incorporation of implementation issues at all stages of the planning process. Other lessons include the need to consult and involve stakeholders at the local (municipal) level, the importance of a common planning framework for all teams contributing to the plan, the importance of mainstreaming biodiversity concerns as an implementation mechanism, the requirement for a critical level of home-grown capacity for undertaking ecoregional planning, and the value of expert knowledge when incorporated into a systematic planning framework. We conclude by suggesting that the approach used in this planning process, modified by accommodating the lessons learnt, has general applicability.

Keywords: Conservation implementation; Ecoregional conservation planning; Expert knowledge; Institutional capacity; Lessons learnt; Mainstreaming biodiversity

1. Introduction

The Cape Floristic Region (CFR), comprising an area of 87,892 km^2 at the south-western tip of Africa, is a recognised centre of diversity and endemism for plant (Goldblatt and Manning, 2002) and animal (e.g. Branch, 1988; Skelton et al., 1995; Picker and Samways, 1996) groups. Also, owing to the threats that this biodiversity faces (Rouget et al., 2003b), the CFR is recognised as a global biodiversity hotspot (Myers et al., 2000). The hallmark of the region is the huge diversification of a limited number of plant lineages and the consequent high compositional turnover along ecological and geographical gradients (Cowling et al., 1992). The evolutionary processes associated with this diversification have aroused much interest and received considerable attention (Linder, in press).

The CFR has had a long history of biological exploration (e.g. Gunn and Codd, 1981) and many of the collections and their distributional data are now archived digitally (e.g. Gibbs Russell, 1985; Lombard et al., 2003). Vegetation patterns have been well studied and several region-wide vegetation maps have been published (Cowling et al., 1997). In comparison to most other biodiversity centres, a great deal is known about ecological (e.g. Cowling et al., 1992) and evolutionary processes, especially for plants (Linder, in press).

Concerns about the conservation status of the CFR, which date to the early 1900s, were articulated in three landmark publications: Wicht (1945), Kruger (1977) and Rebelo (1992). Despite some impressive gains in securing land for conservation over the last three decades (Fig. 1), and the pioneering application in the CFR of systematic approaches to conservation planning (e.g. Rebelo and Siegfried, 1992), conservation concerns reached an all-time high in the mid to late 1990s (Gelderblom et al., 2003). These concerns were precipitated by a decade of declining budgets for conservation and a corresponding diminished capacity to deal with the rapidly escalating threats to the region's biodiversity (Rebelo, 1992; Gelderblom et al., 2003). With the establishment of a democratic state in South Africa post 1994 came opportunities for accessing international funds for conservation action in globally significant biodiversity nodes—such as the CFR. However, in order to use such funding to its best effect, there was a need for a comprehensive conservation plan that systematically identified geographic priorities

0006-3207/03/$ - see front matter
doi:10.1016/S0006-3207(02)00418-4

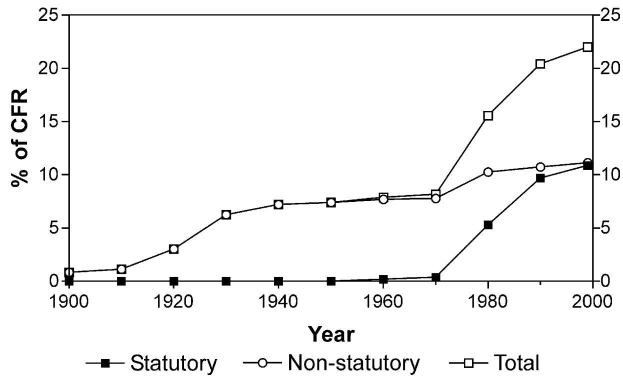

Fig. 1. Development over time of the statutory and non-statutory reserve system in the Cape Floristic Region. Reserved areas are expressed as a % of the Cape Floristic Region (87,892 km^2). Statutory reserves are supported by strong legal and institutional structures and controlled at the national and provincial level [National Parks, Department of Water Affairs and Forestry (DWAF) Forest Nature Reserves, and Provincial Reserves]; non-statutory reserves have a lower level of legal and institutional support (Local Reserves, Protected Natural Environments, Mountain Catchment Areas, Conservancies, Natural Heritage Sites, Private Nature Reserves and DWAF Demarcated Forests) (Rouget et al., 2003a).

and linked these to a realistic and effective implementation strategies.

The Cape Action Plan for the Environment (CAPE) Project was born out of this need. Launched in late 1998, this Project sought (i) to identify and establish a representative system of conservation areas, (ii) to ensure sustainable yields from biodiversity-based resources, and (iii) to improve conservation-related policies and legislation and strengthen the capacity to implement these (Younge and Fowkes, 2003). The CAPE Project, which ran for about 2 years, attempted to incorporate socio-economic, policy, legal and institutional issues into a systematic conservation planning process. As we point out later in this paper, it was not always successful in doing this. However, there are at least two outcomes of CAPE that suggest substantive progress over other ecoregional planning processes: (i) the simultaneous achievement of conservation targets for multiple biodiversity pattern and process features, and (ii) a sincere, albeit somewhat flawed, attempt to integrate implementation issues in the planning process.

The papers in this special issue are products of the CAPE Project. Many include analyses and data additional to those that appeared in the reports arising from the Project. They have been arranged under three headings: Introduction, Biodiversity issues, and Human issues. The Introduction, in addition to this paper, sets the scene with an overview of the CAPE planning process (Younge and Fowkes, 2003) and a description of the CAPE implementation strategy (Lochner et al., 2003).

The order of the nine papers in the section on ‘‘Biodiversity issues’’ accords with the sequence of steps in the protocol for systematic conservation planning modified from that of Margules and Pressey (2000) (Table 1). Lombard et al. (2003) assess the use of different types of data in conservation assessments. Rouget et al. (2003b) describe and model threats associated with land use pressures. Midgley et al. (2003) model the impacts of anthropogenic climate change on plant biodiversity. Pressey et al. (2003) provide a comprehensive account of the rationale and methods for setting conservation targets for the many pattern and process features used in the conservation plan, while Rouget et al. (2003a) assess the extent to which these targets are achieved by the existing reserve system. Moving into the realm of conservation planning, Cowling et al. (2003b) compare the outcomes of a systematic conservation assessment with a ‘‘wishlist’’ of priority conservation areas identified by experts (in this case conservation agency personnel). Kerley et al. (2003) describe a novel method for estimating the distributions and densities of an entire assemblage of large and medium-sized mammals and present the results of a conservation plan that achieves targets for all 41 species. Cowling et al. (2003a) describe the approach and outcomes of a conservation plan for the CFR that achieves targets for the full array of pattern and process features, including the mammals. Rouget (in press) concludes the biodiversity section with a comparison of planning outcomes conducted at fine and broad scales.

The four papers in the ‘‘Human issues’’ section of this issue deal with the socio-economic and institutional constraints and opportunities for implementing conservation actions. Turpie et al. (2003) document the significant economic value, both direct and indirect, of the CFR’s biodiversity. Pence et al. (2003) address the financial implications of different on- and off-reserve implementation strategies in a ‘‘real-world’’ case study, while Frazee et al. (2003) develop a model that predicts the costs of expanding the CFR’s conservation system to one that achieves biodiversity targets. The final paper by Gelderblom et al. (2003) outlines a process for translating the CAPE strategy and conservation planning outcomes into specific actions.

This paper provides an introduction and overview for the special issue. Firstly, we outline the problems that created the need for a systematic conservation plan and implementation programme for the CFR. Secondly, we present the framework used for the planning and implementation process, place the contributions to the special issue in this context, and summarise current implementation initiatives. Thirdly, we extract from these studies and our own experience, a number lessons that were learnt during the planning process for the CFR, so that they are now available for the benefit of future conservation planning programmes.

Table 1
Stages in the framework for systematic conservation planning for the Cape Action Plan for the Environment (CAPE) Project, and associated research outputs[a]

Stage	Relevant references[b]
1. Identifying and consulting key stakeholders	CSIR (1999), Fowkes (1999), **Lochner et al. (2003), Young and Fowkes (2003)**
2. Assessing policy, legal, institutional and socio-economic opportunities and constraints for conservation implementation	CSIR (1999), **Frazee et al. (2003), Gelderblom et al. (2003), Pence et al. (2003), Turpie et al. (2003)**
3. Identifying broad goals and strategies for conservation planning and implementation	CSIR (2002a), **Gelderblom et al. (2003), Lochner et al. (2003), Young and Fowkes (2003)**
4. Gathering and evaluating spatially explicit data on biodiversity features and factors that threaten their persistence	Cowling et al. (1999), Impson et al. (1999), Cole et al. (2000), Jones et al. (2000), Griffiths and Prochazka (2000), Prochazka and Griffiths (2000), Van Nieuwenhuizen and Day (2000), Boshoff et al. (2001, 2002), Cowling and Heijnis (2001), Boshoff and Kerley (1999, 2001), Awad et al. (2002), **Lombard et al. (2003), Midgley et al. (2003), Rouget (in press), Rouget et al. (in press, 2003b)**
5. Formulating targets for biodiversity features	Cowling et al. (1999), Cole et al., (2000), Van Nieuwenhuizen and Day (2000), **Kerley et al. (2003), Pressey et al. (2003)**
6. Reviewing the effectiveness of existing conservation areas	Cowling et al. (1999, **in press b**), CSIR (1999, 2002b), Cole et al. (2000), Jones et al. (2000), Griffiths and Prochazka (2000), Prochazka and Griffiths (2000), Van Nieuwenhuizen and Day (2000), Awad et al. (2002), **Rouget et al. (2003a)**
7. Selecting additional conservation areas	Cowling et al. (1999, **2003a**), Cole et al. (2000), Jones et al. (2000), Griffiths and Prochazka (2000), Prochazka and Griffiths (2000), Van Nieuwenhuizen and Day (2000), **Kerley et al. (2003)**
8. Implementing conservation action in selected areas	CSIR (2002b), **Cowling et al. (2003a), Frazee et al. (2003), Gelderblom et al. (2003), Pence et al. (2003), Rouget (in press), Turpie et al. (2003)**

[a] Adapted from Pressey and Logan (1997), Margules and Pressey (2000) and Pressey and Cowling (2001).
[b] Outputs included in the special issue are marked in boldface.

2. The problems

The decision in 1998 to develop a systematic conservation plan for the CFR was motivated by problems associated with the planning, implementation and management of existing conservation areas, both on- and off-reserve. Kruger (1977), Rebelo (1992) and Gelderblom et al. (2003) provide overviews of these problems. Here we draw attention to three issues: (i) an unrepresentative reserve system, (ii) escalating threats to biodiversity, and (iii) inadequate capacity to manage biodiversity.

2.1. Unrepresentative reserve system

The CFR has a long history of reserve establishment (Kruger, 1977; Hilton-Taylor and Le Roux, 1989; Rebelo, 1992). The first reserves, albeit non-statutory ones (i.e. not enjoying comprehensive legislative support at the provincial or national level, see Rouget et al., 2003a), were proclaimed for indigenous forest protection in the late 1800s (Rebelo, 1992; Fig. 1). There was a rapid increase in forestry reserves, earmarked for afforestation and to protect mountain catchment areas, in the 1920s and 1930s; by the late 1960s, these comprised almost 900,000 ha. Between 1971 and 1982, many of these catchment areas were proclaimed as statutory reserves (Kruger, 1977), i.e. reserves that are supported by strong legal and institutional structures and controlled at the national and provincial level (Rouget et al., 2003a). A further expansion of the statutory reserve system occurred in 1987–1988 when the majority of non-afforested water catchment land was transferred from the national-tier Department of Water Affairs and Forestry (which managed these areas for both sustainable water production and nature conservation) to the provincial conservation agency, as part of a nationwide restructuring of agency responsibilities (Hilton-Taylor and Le Roux, 1989). The expansion of statutory reserves during this period was also promoted by the provincial conservation agency's adoption of responsibility for proclaiming and managing reserves, in addition to its previous focus on off-reserve conservation and endangered fauna (Scott, 1986). A marked expansion in the non-statutory reserve system, comprising local authority reserves, private nature reserves and conservancies, more than compensated for the conversion of catchment areas (non-statutory reserves) to statutory reserves in 1970s and 1980s. Despite pleas by Kruger (1977) for a reserve system that represented each of the major phytogeographic zones (following the earlier recommendation by Wicht, 1945), and which comprised individual reserves large enough to sustain ecological processes, there was no coherent plan and implementation strategy for the expansion of the statutory and non-statutory reserve system.

Therefore, by the late 1990s—despite having more than 20% of its area under some form of conservation management (Fig. 1)—the CFR's reserve system, like most others in the world (Pressey, 1994), was not representative of biodiversity patterns or the processes that maintain and generate these (Rouget et al., 2003a). The reason for this, also shared with many other parts of the world, was that most reserves were proclaimed in those parts of the landscape where opportunity costs of conservation were low (Pressey, 1994). In the CFR, this meant a reserve selection bias in favour of rugged, inaccessible and infertile montane landscapes and a bias against productive and more densely populated lowland regions (Rebelo, 1992; Rouget et al., 2003a). Moreover, given the importance of ecological and evolutionary processes in maintaining biodiversity (Balmford et al., 1998; Cowling and Pressey, 2001), the poor representation in the reserve system of the physical features associated with these processes was especially alarming (Rouget et al., 2003a).

Since the pioneering work of Kruger (1977), the only other regional assessments of the CFR were those of Rebelo and Siegfried (1990, 1992). However, these studies, which adopted a systematic approach (sensu Margules and Pressey, 2000), targeted only Proteaceae and, consequently, identified priority sites in only that part of the region which supported Proteaceae-rich fynbos (see also Lombard et al., 2003).

Gap analysis (Edwards, 1974), concerted advocacy (e.g. Moll, 1982; Maze et al., 2002), and an expert-based scoring study (Jarman, 1986) had long recognised priority areas for conservation on the highly threatened lowlands, and from the mid 1990s, a number of systematic conservation planning studies were undertaken at the subregional scale in known priority areas (e.g. Trinder-Smith et al., 1996; Lombard et al., 1997; Heijnis et al., 1999). However, with some notable exceptions (Macdonald and Cowling, 1996; Heydenrych et al., 1999), few planning studies were followed by effective implementation of conservation action, and by the late 1990s, there was a real need for a region-wide assessment of conservation priorities and an implementation strategy for achieving targets for biodiversity patterns and processes.

2.2. Escalating threats to biodiversity

From the mid 1970s onwards, threats to the CFR's biodiversity began escalating dramatically. While the large-scale agricultural transformation of the lowlands was more-or-less completed by the late 1940s, the extent of alien tree and shrub infestation showed a marked increase in the early 1960s. Wicht (1945) was the first to draw attention to this problem, but concerted efforts to remove invasive plant species only began in the 1980s, chiefly in montane water catchment areas under the auspices of the Department of Water Affairs and Forestry (van Wilgen et al., 1992). However, owing to institutional restructuring in the 1980s, when responsibility for catchment management was devolved without an adequate accompanying budget to the provincial conservation agency, alien plant eradication programmes collapsed (Gelderblom et al., 2003).

With the lifting in 1986 of the legislation that restricted the settlement of black South Africans in urban areas throughout the CFR, urbanization, especially in the form of informal settlements, increased massively (Richardson et al., 1996). Furthermore, the emergence of post-apartheid South Africa and the concomitant political and economic stability saw an upsurge in investment in tourism facilities, especially along the coast where many habitats were already extensively transformed by resort development and alien plant infestations. As a consequence, even greater pressure was placed upon the biodiversity of lowland areas, which were already most in need of protection.

Subsidised cereal production in the 1980s continued to erode remnant lowland habitat as did the emergence of a new generation of crops, namely new wine cultivars and fynbos products such as buchu (*Agathosma betulina*), bush teas (*Aspalathus linearis*, *Cyclopia* spp.), and cut flowers. Unlike traditional crops, many of these new ones were suited to the lower slopes of the coastal mountains, which supported habitats and biodiversity that had hitherto been regarded as secure. The lifting of trade sanctions by the international community in the early 1990s, and a favourable financial exchange rate thereafter provided a major boost for increased production of the new crops.

By the late 1990s, the conservation situation in the CFR was dire (Gelderblom et al., 2003). While the state-funded *Working for Water* Programme, launched in 1995, had made considerable progress in reducing the alien plant problem in some montane water catchments (van Wilgen et al., 1996), everywhere else threats to the biodiversity of the CFR continued to escalate.

2.3. Diminishing institutional capacity

Prior to restructuring in the late 1980s, the Department of Water Affairs and Forestry managed most of the conservation estate in the CFR. This it did well, integrating the requirements for plantation forestry, water catchment management and nature conservation, and basing its actions on good research (van Wilgen et al., 1992; Gelderblom et al., 2003). The devolution of this function, in 1987–1989, to an ill-equipped and under-funded provincial agency, greatly compromised biodiversity conservation across the region. Management plans were no longer effectively implemented, some reserves were deproclaimed, and support for local authority reserves was discontinued (Rebelo, 1992). The better-capacitated national-tier conservation agency, South African National Parks, was a small player in the CFR, controlling five reserves totalling 30,000 ha. From the mid 1980s onwards, conservationists were pessimistic about the prospects for improved conservation management and saw no prospects for the proclamation of additional reserves (McDowell, 1986; Rebelo, 1992).

After the democratic election of 1994, the situation deteriorated further. The establishment of new provinces meant that the CFR now comprised three political regions: Western Cape (comprising the bulk of the CFR), Eastern Cape (comprising the far eastern sector), and Northern Cape (incorporating a very small part of the extreme north). By 1998, the capacity for conservation management in the Eastern Cape had virtually collapsed and the Western Cape authority was dogged by staff losses and an ever-shrinking budget. Moreover, declining capacity of other agencies responsible for land management decisions (e.g. land use planning, agriculture) in all three provinces, and a poor co-ordination between these and the conservation agencies, further compounded the woes of nature conservation in the CFR (Lochner et al., 2003; Gelderblom et al., 2003). Clearly, there was a need to build capacity within the conservation agencies and to ensure that biodiversity-friendly land use policies and practices were developed and aligned across all of the government agencies responsible for natural resource management, conservation and development.

3. The Cape Action Plan for the Environment (CAPE) Project: context, framework and implementation initiatives

3.1. Background

The post 1994 establishment of a democratic state in South Africa also provided numerous opportunities for conservation, as old systems of patronage and stasis were swept aside (Pierce et al., 2002). The new government was enthusiastic about conservation initiatives, provided they created opportunities for economic growth that benefited South Africans disadvantaged by the apartheid regime. Consequently, the state supported the labour-intensive *Working for Water* Programme (van Wilgen et al., 2002), and the proclamation of the Agulhas National Park for its ecotourism potential (Privett et al., 2002). The newly democratic South Africa also qualified for international aid for conservation projects. The Global Environment Facility (GEF) funded the first internationally supported initiative in the CFR. In late 1997, the GEF made a substantial grant of US$12.3 million in support of the establishment of a national park on the Cape Peninsula, a highly threatened and extremely biodiverse area adjacent to the rapidly growing Cape Town metropole (Macdonald and Cowling, 1996). A small part of this grant (US$1 million) was allocated to prepare a systematic conservation plan and implementation strategy for the entire CFR. This was known as the CAPE (Cape Action Plan for the Environment) Project and ran from November 1998 to September 2000. The project comprised four major steps: (i) situation assessment (including a conservation planning component), (ii) strategy development, (iii) action plan formulation, and (iv) fundraising. The formulation of this strategy is described elsewhere in this special issue (Lochner et al., 2003; Younge and Fowkes, 2003). The first phase (2002–2006) of the implementation programme, now known as Cape Action for People and the Environment (C.A.P.E.) (see www.capeaction.org.za), which will run for 20 years, is documented in Gelderblom et al. (2003); Cowling et al. (2003a) also discuss some implementation issues arising from the conservation planning process.

3.2. Planning framework

The overall approach for the CAPE Project was constrained by available funds (too little), time (too short) and existing capacity (barely adequate). In order to circumvent these constraints, the Project involved the services of international experts and wherever possible, used existing and derived data sets, and expert knowledge to assemble the requisite information. Thus, the terrestrial conservation planning component drew on the resources and experience of the New South Wales National Parks and Wildlife Service and used available data and expert knowledge to map land classes (Cowling and Heijnis, 2001), estimate mammal distributions and densities (Kerley et al., 2003) and identify the spatial surrogates for ecological and evolutionary processes (Rouget et al., in press).

The CAPE Project adopted a systematic approach for conservation planning that is encapsulated in the stages of the planning framework shown in Table 1. The framework was developed in Australia (Pressey and Logan, 1997) and modified during the course of the CAPE Project (Margules and Pressey, 2000; Pressey and Cowling, 2001; Table 1). The steps provide a logical and coherent path for arriving at planning outcomes and implementation strategies that are transparent and defensible (Pressey and Cowling, 2001). Each of the stages in the framework is addressed by one or more contributions to this special issue (Table 1). The framework for the CAPE process differed in two ways from the one advocated by Margules and Pressey (2000). Firstly, an additional stage (2 in Table 1) that involved a spatially inexplicit assessment of the policy, legal and institutional constraints and opportunities for biodiversity conservation, was included. In this stage, the Project attempted to unearth the root causes of biodiversity losses and opportunities for conservation gains and to place conservation planning within a broader strategy for biodiversity that also included sustainable management and capacity building. Secondly, the framework did not include as the final stage one that dealt with the maintenance and monitoring of existing conservation areas. This crucial stage will be incorporated into the implementation and review phases of C.A.P.E. (see www.capeaction.org.za). Despite attempts to incorporate implementation issues more fully into the framework, the approach still had many shortcomings. These are discussed in Section 4.

3.3. Current implementation initiatives

The action plan for the CAPE Project recognised 37 projects, organised within three broad themes, to fulfil its strategic goal. These themes are: (i) the protection of biodiversity in priority areas; (ii) the promotion of sustainable use of biodiversity; and (iii) the strengthening of institutions, the promotion of co-operative governance, and community involvement in conservation (Lochner et al., 2003; Gelderblom et al., 2003). Although action in all three themes is necessary to achieve the overall goal, we focus mainly on those initiatives in theme (i). Gelderblom et al. (2003) provide details on themes (ii) and (iii). Funding requirements for implementation are discussed in Cowling et al. (2003a), Frazee et al. (2003) and Pence et al. (2003).

In implementing the conservation plan, action has focused on both fragmented and extensive intact areas (Cowling et al., 2003a). With regard to fragmented landscapes, implementation is underway in the highly irreplaceable and highly vulnerable habitat remnants within the Cape Town Metropolitan Area (Maze et al., 2002) and on the Agulhas Plain (Privett et al., 2002). Fine-scale planning to identify areas suitable for conservation action is currently being conducted on the high priority areas of the western and south-western lowlands (Maze and von Hase, 2002) and within the Nelson Mandela Metropole, centred upon the city of Port Elizabeth on the lowlands of the extreme south-east (Stewart and Rogers, 2002). Additional fine-scale planning is envisaged for six other lowland regions over the next two years. An extension service to assist private landowners to conserve remnant habitat has been launched (Gelderblom et al., 2003) and the provincial and conservation planning agencies in the Western Cape Province have merged, and adopted the CAPE conservation plan as a guideline for assessing future development proposals (Gelderblom et al., 2002). Proposals to transform habitat in priority areas have already been refused. Finally, a start has been made to develop a manual and planning products for training municipal officials to incorporate the planning outcomes into local structure plans (see Section 4.1).

Work has begun on implementing three mega-reserves, destined to be >500,000 ha in extent and located in different biogeographic regions within the CFR. These reserves, which will incorporate extensive areas of public and private land, will be capable of accommodating a wide array of ecological and evolutionary processes required to sustain biodiversity (see Boshoff et al., 2000).

Thus far, these conservation initiatives appear promising. The real challenge will be to maintain the momentum and make good use of limited funds. The dual strategy of action in both fragmented and intact landscape will be costly (Frazee et al., 2003), but necessary to achieve the CAPE goal.

4. Lessons learnt

Conservation planning is young, self-conscious science that is developing rapidly on many fronts. In essence, conservation planning deals with space, time (in ecological and evolutionary contexts), and the choices that humans make (Vane Wright, 1996). Consequently, it is an integrative and transdisciplinary science that should draw on many long-established disciplines in the natural and social sciences. Most progress has been made in the former disciplines. For example, great strides have been made over the past 15 years in identifying spatial priorities (Margules and Pressey, 2000) and ever more sophisticated and elegant approaches and techniques are being hatched (Possingham et al., 2000). Many studies are now incorporating as biodiversity features the processes that operate over ecological and evolutionary timescales (e.g. Moritz and Faith, 1998; Desmet et al., 2002; Rouget et al., in press). Consequently, conservation planning is making excellent progress in addressing two of its three dimensions, namely space and time.

Unfortunately, much less progress has been made with integrating the other dimension: human choice. Why should this be so? There are probably many reasons. Foremost among these is the inability thus far of conservation planners to comprehensively and appropriately integrate implementation—or human choice for specific conservation actions—into their planning frameworks. This may be because conservation planning has its roots in the natural sciences while implementation draws on the social sciences. Unfortunately, despite pleas for consilience of knowledge traditions (Wilson, 1998), and some real successes in conservation-related transdisciplinary research (e.g. Gadgil, 1996), the natural- and social-science approaches to conservation planning appear to be diverging rather than converging (Knight and Cowling, submitted for publication a). This is unfortunate, as the effective union of natural and social sciences is fundamental to the successful implementation of conservation planning outcomes (Vane Wright, 1996).

Ensuring effective conservation outcomes will require that all three dimensions of the planning process are incorporated into implementation strategies and action plans. This is not a trivial task and much learning needs to be done. Unfortunately, there are very few accounts of lessons learnt from ecoregional conservation plans in the primary literature (Knight and Cowling, submitted for publication b). Therefore, we present below some of the lessons we learnt as participants of the CAPE planning process. Since failures are seldom, if ever, documented (Redford and Taber, 2000), we focus mainly on those lessons that can lead to improving ecoregional planning processes.

4.1. Incorporating implementation issues in the planning process

The CAPE Project made a concerted effort to introduce implementation issues into the planning framework (Table 1). However, a framework that introduced implementation issues after the actual conservation plan was completed, guided the Project. This was partly a result of the inexperience of the Project teams and partly a consequence of available best practice that advocated this approach. With hindsight, it would have been better to involve the team that undertook the policy, legal, institutional and socio-economic assessment more closely in the conservation planning component (Gelderblom et al., 2003). The interaction between these two teams might have ensured that the outcomes of the social assessment were more explicitly incorporated into the plan as spatially defined constraints and opportunities for implementation. This, in turn, would have provided better information for compiling the action plan for implementation.

A further consequence of not considering implementation issues during the planning process was the production of planning products that were inappropriate for local (municipal)-level land use planning. The Project teams did not identify municipal officials as key stakeholders (see Section 4.2) and, consequently, did not generate planning products appropriate for assisting them in fulfilling their legal obligations for accommodating biodiversity concerns in land use plans. This aspect has been subsequently addressed in a project that is preparing appropriate products and an explanatory handbook for municipal-level use throughout the CFR and adjacent ecoregions (see Section 3.3).

We suggest that implementation issues should be considered, in a spatially explicit manner where possible, in all stages of a planning framework. Indeed, as suggested by Knight and Cowling (submitted for publication a), the biodiversity planning component should be integrated into an implementation framework and not vice versa, which is usually the case. Most of the other lessons documented below follow from this fundamental flaw in the CAPE planning process.

4.2. Stakeholder involvement

The CAPE Project was very effective in involving in its deliberations ''inheritor '' stakeholders (executing agencies) and key interest groups (e.g. scientific community, environmental non-government organizations) (Younge and Fowkes, 2003). However, and possibly because implementation was not sufficiently stressed as part of this stage in the framework, it did not identify municipal-level decision makers as key stakeholders, even though most of the key decisions regarding biodiversity are made at the level. Furthermore, the Project did not identify civil society stakeholders at the subregional scale (i.e. district municipality) to champion the process and its outcomes within municipal structures. This approach was used with much success in Conservation International's Succulent Karoo Ecosystem Planning (SKEP) Project (Frazee, 2002) where it is likely to ensure a relatively smooth transition from planning to implementation. In the CAPE process, this transition was far from seamless (Gelderblom et al., 2003) and only now are subregional structures being established.

4.3. Co-ordination of planning frameworks

The final conservation plan did not explicitly include aquatic biodiversity features although targets were set for freshwater fish and amphibians (Pressey et al., 2003). However, the CAPE Project did include conservation assessments of freshwater, estuarine and marine biodiversity. The planning frameworks for aquatic biodiversity differed from the systematic framework adopted for terrestrial biodiversity (see Table 1). The freshwater assessment produced a map of geographic priorities based on an expert workshop (van Nieuwenhuizen and Day, 2000); the estuarine assessment prioritised entire estuaries using a scoring approach that combined biodiversity, vulnerability and ecosystem service criteria (Prochazka and Griffiths, 2000); and the marine assessment concluded that no additional reserves were required but there was a need for more effective controls on the harvesting of selected species outside of reserves (Griffiths and Prochazka, 2000).

Since none of the aquatic components generated a feature×planning unit matrix, and set targets for features, it was not possible to incorporate these into the final conservation plan. This was a missed opportunity to produce a plan and implementation strategy that integrated priorities for terrestrial and aquatic components. The lesson learnt is to ensure at the outset that there is a planning framework common to all biodiversity components. In contract-driven projects, such as CAPE, where the various components are contracted to teams with different backgrounds, strong co-ordination is required to ensure that all teams adopt a planning framework that enables integration of outcomes.

4.4. Scale

The spatial resolution of data collection, habitat classification, or the size of planning units (used as the building blocks for systems of conservation areas) can greatly affect the outcomes of conservation planning (Pressey and Logan, 1998). The conservation plan for the CAPE Project was undertaken at a relatively coarse scale (1:250,000) and most planning units are sixteenth degree squares, each covering about 4000 ha (Cowling et al., 2003a). Ideally, implementation would benefit from finer-scale data and cadastral boundaries as planning units. This was demonstrated (Pence et al., in press) on the species-rich and vulnerable Agulhas Plain part of the CAPE planning domain (Heydenrych et al., 1999; Privett et al., 2002) where a sub-regional conservation plan was undertaken—as part of the CAPE process—using data collected at the 1:10,000 scale and farm boundaries as planning units (Cole et al., 2000). In a study comparing the planning outcomes of this fine-scale plan with an earlier version of the CFR-wide plan (Cowling et al., 1999), Rouget (in press) concluded that fine-scale planning is only justified, in terms of minimizing cost and resources, in biologically heterogeneous (i.e. areas of high land class diversity) and highly fragmented areas. The implication for implementation of the CAPE Project is that additional fine-scale planning will be required for a limited number of areas of high heterogeneity where options for achieving targets are retreating rapidly. Elsewhere in the planning domain, the coarse-scale plan described here should suffice for implementation, although ground-truthing will be required to locate more accurately biodiversity features under threat, and to assess the naturalness of areas scheduled for protection, especially those designated for formal reservation. The lesson learnt with regards to scale issues is that, for effective implementation, fine-scale planning is required, and should be undertaken from the outset of the planning process, in that subset of areas having the characteristics identified by Rouget (in press). The existence of a fine-scale plan for the Agulhas Plain has resulted in the rapid implementation of conservation actions there (Privett et al., 2002).

4.5. Mainstreaming planning outcomes

Mainstreaming the outcomes of the CAPE conservation plan into those sectors that are responsible for ongoing biodiversity loss is an important, reasonably inexpensive but challenging implementation mechanism. Mainstreaming occurs in many ways (Pierce et al., 2002) and is realised when conservation issues are incorporated into policy and legislation; when conservation and sector gains are simultaneous; when sector activity is dependent on conservation; and when sector activities result in overall conservation gains. The CAPE Project was only partially effective in mainstreaming the conservation planning outcomes into land use planning, as a means of retaining habitat in priority areas (Gelderblom et al., 2002). It accomplished this by securing the agreement of the relevant statutory agencies and non-government organizations to sign and be party to a Memorandum of Understanding committing their administrations to support the outcomes of the CAPE Project. This has resulted in unprecedented cooperation between agencies and the realignment of their budgets to support the goals of CAPE (Gelderblom et al., 2003). The memorandum will also be a useful instrument to ensure that the conservation planning outcomes are mainstreamed into municipal level land use policies and practices (see Section 3.3).

The CAPE Project was less successful in mainstreaming biodiversity issues into biodiversity-based enterprises such as the burgeoning ecotourism, bush tea, wildlife and wildflower industries that Turpie et al. (2003) describe. There is a wide variety of potentially available mechanisms, ranging from financial incentives to ‘‘green branding’’, to effect this. Fortunately, this opportunity has been identified as a component—called ‘‘Conservation Livelihoods’’—of the first five year phase of C.A.P.E. (see www.capeaction.org.za). As a major opportunity for implementation, mainstreaming biodiversity concerns into biodiversity-based business needed to be addressed from the outset of the CAPE Project.

4.6. Capacity issues

The capacity for undertaking the CAPE Project was barely adequate. At the time that the Project was initiated, there was only a small corps of researchers with expertise in the wide range of skills required for conservation planning. Drawing on the expertise of the

New South Wales National Parks and Wildlife Service at a relatively early stage of the planning process greatly strengthened this group. After the initial plan was completed (Cowling et al., 1999), several postgraduate students adopted aspects of the process for developing their dissertations, resulting in important refinements and additional contributions that are published in this issue (Frazee et al., 2003; Pence et al., 2003; Rouget, in press; Rouget et al., 2003a,b).

The CAPE Project provided an excellent opportunity to build capacity for conservation planning and implementation that was only partly exploited. It was very successful in building the capacity of some individuals, a few university-based research institutions and one non-governmental organization. The Project also assisted the conservation agency for the Western Cape—Western Cape Nature Conservation Board—identify strategic objectives during its difficult transition from a government agency to a parastatal organization. Furthermore, one of the earliest outcomes of the CAPE Project was the establishment within this Board of a conservation planning unit whose task it will be to maintain and update all databases and conduct regular re-runs of the conservation plan in order to provide updates for users (Gelderblom et al., 2002; see http://cpu.uwc.ac.za and www.capenature.org.za). On the down side, however, insufficient attention was given to using the planning process to build the capacity of other conservation and land use agencies and for mentoring conservation planning and project management skills among disadvantaged South Africans.

There are at least three lessons with regard to capacity issues: (i) an effective planning process requires a critical level of local capacity with technical and leadership skills; (ii) this capacity can be augmented by drawing on the skills present in better-capacitated regions (but without losing control of the process); and (iii) in developing countries, such as South Africa, the process should be linked to a conscious capacity building process, thereby ensuring that the initial investment leads to improved local capacity for ongoing planning and implementation.

4.7. Expert knowledge and data

Although regarded as a data-rich region, data on biodiversity features available prior to the CAPE Project were inadequate for a systematic assessment of conservation priorities (Cowling and Heijnis, 2001; Rouget et al., in press; Lombard et al., 2003; Pressey et al., 2003). Even a comprehensive data base on the Proteaceae, comprising 183,181 records for 364 species, proved inadequate as a sole basis for the identification of priority sites across the whole planning domain (Lombard et al., 2003). Consequently, the Project relied heavily on expert knowledge to derive land classes (Cowling and Heijnis, 2001), mammal distributions and densities (Kerley et al., 2003), the spatial depiction of threats (Rouget et al., 2003b), and spatial surrogates for ecological and evolutionary processes (Rouget et al., in press). Expert knowledge was also used in the final stages of deriving the conservation plan (Cowling et al., 2003a).

The Project also demonstrated the shortcomings of using only priority areas identified by experts, in our case conservation agency personnel (Cowling et al., 2003b). The resulting system of so-called "wishlist" areas is limited in identifying priority conservation areas by a lack of transparency and biases associated with uneven knowledge and personal experience. These shortcomings ultimately manifest as a lack of defensibility and flexibility of the identified priority conservation areas.

Our lessons regarding expert knowledge and data for other ecoregional conservation planning processes are: (i) to not use lack of data as an excuse for a non-systematic, non-transparent approach, but instead use expert knowledge to assist with the identification and mapping of region-wide biodiversity features that can be targeted; and (ii) rather than emphasize the dichotomy between expert and systematic approaches (Prendergast et al., 1999; Dinerstein et al., 2000), devise ways of integrating them; in particular, priority areas identified by experts should be carefully considered against the backdrop of the outcomes of systematic conservation planning (Cowling et al., 2003b). Lesson 1 has already been applied in the Succulent Thicket Ecosystem Planning (STEP) Project in South Africa where great effort was directed at getting high-quality land use maps, derived from expert field workers (Vlok et al., in press), rather than compile species' records of marginal value in conservation planning (see Lombard et al., 2003). This was not the case for the SKEP Project where, in our opinion, too much effort was placed on compiling species records at a scale and collecting intensity too crude for planning. However, this did engender a sense of "buy-in" to the planning process by specific stakeholders (R.M. Cowling, personal observation).

5. General applicability of the CAPE approach

The problems facing the biodiversity of the CFR are common to many other parts of the world, especially the other hotspots identified by Myers et al. (2000). The CAPE Project has incorporated aspects of the several approaches to ecoregional planning that are currently being employed in different parts of the world (Dinerstein et al., 2000; Groves et al., 2000; Margules and Pressey, 2000; Noss et al., 2002). The approach we adopted includes some very useful characteristics, namely (i) a conscious effort to incorporate—albeit imperfectly—implementation issues in the planning process; (ii) the transparent analysis of more-or-less consistent data; (iii) combining expert judgement and data analysis; (iv) being explicitly target-driven; and (v) combining two forms of flexibility, namely opportunities to change data and targets, and opportunities to assess the options for achieving targets (Pressey and Cowling, 2001). Another positive and atypical feature was the accommodation of a persistence goal through the targeting of the spatial components of processes (Cowling et al., 2003a; Pressey et al., 2003). The plan identified as priorities both fragmented landscapes as well as large areas of intact habitat. The priority areas thus identified are generally amenable to implementation, although this will require a range of off-reserve mechanisms, especially in fragmented areas (Pence et al., 2003), and it will be costly (Frazee et al., 2003). Finally, the whole process, including the socio-economic, legal and institutional assessments, cost only US$1 million and was completed in less than two years. However, the refinements and additional studies included in the papers for this issue required a further two years to complete and were subsidised financially by postgraduate work and salaries contributed by institutions and agencies.

Our planning process did have its problems and some of these we have documented as lessons learnt. Nonetheless, we feel that the approach—with suggested modifications—does have general applicability for ecoregional planning. We urge that planning teams agree on a framework that embeds the technical components of the planning process in an implementation context, and collates, and uses, in a better way than we did, spatially explicit socio-economic data as constraints and opportunities for implementation. We look forward to seeing assessments of the effectiveness of such an approach, and suggestions for improvements, after it has been tried elsewhere.

Acknowledgements

Aspects of this study were funded by the Global Environment Facility through World Wide Fund—South Africa (WWF-SA), the University of Port Elizabeth, New South Wales National Parks and Wildlife Service and Conservation International's Southern African Hotspots Program. Andre Boshoff, Mandy Driver and Andrew Knight provided constructive comments on an earlier draft. We acknowledge with deep appreciation all of those—too numerous to mention—who participated in the CAPE process. We would also like to thank the following for reviewing the papers in this issue: Andrew Balmford, William Bond, John Bowers, Katrina Brandon, Thomas Brooks, Neil Burgess, Mark Burgman, Bruce Campbell, Bob Costanza, Gretchen Daly, Frank Davis, Simon Ferrier, Gustavo da Fonseca, Janet Franklin, Peter Goodman, Steve Higgins, Richard Kingsford, Kathy MacKinnon, Kate Newman, Nick Nicholls, David Olson, Hugh Possingham, Tony Rebelo, Kent Redford, Ana Rodrigues, Trevor Sandwith, Paul Skelton, David Stoms, Albert van Jaarsveld, Paul Williams, John Woinarski, and Ian Woodward.

References

Awad, A.A., Griffiths, C.L., Turpie, J.K., 2002. Distribution and endemicity patterns of marine benthic invertebrates in South Africa applied to the selection of priority conservation areas. Diversity and Distributions 8, 129–145.

Balmford, A., Mace, G, Ginsberg, J.R., 1998. The challenges to conservation in a changing world: putting processes on the map. In: Mace, G., Balmford, A., Ginsberg, J.R. (Eds.), Conservation in a Changing World. Cambridge University Press, Cambridge, pp. 1–28.

Boshoff, A., Cowling, R., Kerley, G., 2000. The Baviaanskloof Conservation Area: a conservation and tourism development priority. Terrestrial Ecology Research Unit Report No. 27. University of Port Elizabeth.

Boshoff, A.F., Kerley, G.I.H., 1999. Conservation planning in the Cape Floristic Region: distribution, conservation status and spatial population requirements of the medium- to large-sized mammals. Terrestrial Ecology Research Unit Report No. 26, University of Port Elizabeth.

Boshoff, A.F., Kerley, G.I.H., 2001. Potential distributions of the medium- to large-sized mammals in the Cape Floristic Region, based on historical accounts and habitat requirements. African Zoology 36, 245–273.

Boshoff, A.F., Kerley, G.I.H., Cowling, R.M., 2001. A pragmatic approach to estimating the distributions and spatial requirements of the medium- to large-sized mammals in the Cape Floristic Region, South Africa. Diversity and Distributions 7, 29–43.

Boshoff, A.F., Kerley, G.I.H., Cowling, R.M., 2002. Estimated spatial requirements of the medium- to large-sized mammals, according to broad habitat units, in the Cape Floristic Region. African Journal of Range and Forage Science 19, 29–44.

Branch, W.R., 1988. South African Red Data Book—reptiles and amphibians. South African National Programmes Report No 151. CSIR, Pretoria.

Cole, N.S., Lombard, A.T., Cowling, R.M., Euston-Brown, D., Richardson, D.M., Heijnis, C.E., 2000. Framework for a conservation plan for the Agulhas Plain, Cape Floristic Region, South Africa. IPC Report 0001, University of Cape Town.

Council for Scientific and Industrial Research (CSIR), 1999. Cape Action Plan for the Environment: an assessment and review of the current policy, legal, institutional, socio-economic and financial situation affecting the conservation of biodiversity in the Cape Floristic Kingdom. Parts 1 and 2. CSIR Report No.: ENV-S-C 99130 A. CSIR, Stellenbosch.

Council for Scientific and Industrial Research (CSIR), 2002a. Cape Action Plan for the Environment. Strategy. CSIR Report No.: ENV-S-C 99130 B. CSIR, Stellenbosch.

Council for Scientific and Industrial Research (CSIR), 2002b. Cape Action Plan for the Environment. Implementation programme report. CSIR Report No.: ENV-S-C 99130 C. CSIR, Stellenbosch.

Cowling, R.M., Heijnis, C.E., 2001. The identification of broad habitat units as biodiversity entities for a systematic conservation planning in the Cape Floristic Region. South African Journal of Botany 67, 15–38.

Cowling, R.M., Holmes, P.M., Rebelo, A.G., 1992. Plant diversity and endemism. In: Cowling, R.M. (Ed.), The Ecology of Fynbos: Nutrients, Fire and Diversity. Oxford University Press, Cape Town, pp. 62–112.

Cowling, R.M., Pressey, R.L., 2001. Rapid plant diversification: planning for an evolutionary future. Proceedings of the National Academy of Sciences of the United States 98, 5452–5457.

Cowling, R.M., Pressey, R.L., Lombard, A.T., Heijnis, C.E., Richardson, D.M., Cole, N., 1999. Framework for a Conservation Plan for the Cape Floristic Region (IPC Report 9902). Institute for Plant Conservation, University of Cape Town.

Cowling, R.M., Pressey, R.L., Rouget, M., Lombard, A.T., 2003a. A conservation plan for a global biodiversity hotspot—the Cape Floristic Region, South Africa. Biological Conservation 112, 191–216.

Cowling, R.M., Pressey, R.L., Sims-Castley, R., Baard, E., Burgers, C., Le Roux, A., Palmer, G., 2003b. The expert or the algorithm?—comparison of priority conservation areas identified by park managers and reserve selection software. Biological Conservation 112, 147–167.

Cowling, R.M., Richardson, D.M., Mustart, P.J., 1997. Fynbos. In: Cowling, R.M., Richardson, D.M., Pierce, S.M. (Eds.), Vegetation of Southern Africa. Cambridge University Press, Cambridge, pp. 99–130.

Desmet, P.G., Cowling, R.M., Ellis, A.G., Pressey, R.L., 2002. Integrating biosystematic data into conservation planning: perspectives from southern Africa's Succulent Karoo. Systematic Biology 51, 317–330.

Dinerstein, E., Powell, G., Olson, D., Wikramanayake, E., Abell, R., Loucks, C., Underwood, E., Allnutt, T., Wttengel, W., Ricketts, T., Strand, H., O'Connor, S., Burgess, N., 2000. A Workbook for Conducting Biological Assessments and Developing Biodiversity Visions for Ecoregion-Based Conservation. Part 1: Terrestrial Ecoregions. Conservation Science Program, WWF-USA, Washington DC.

Edwards, D., 1974. Survey to determine the adequacy of existing conserved areas in relation to vegetation types: a preliminary report. Koedoe 17, 3–38.

Fowkes, S., 1999. Public Involvement Programme for Phase 1: Situation Assessment and Review. Metaplan, Cape Town.

Frazee, S. (comp.), 2002. Succulent Karoo Ecosystem Planning. First phase report. Southern African Hotspots Program: Conservation International, Kirstenboch, South Africa.

Frazee, S., Cowling, R.M., Pressey R.L., Turpie, J.K., Lindenberg, N., 2003. Estimating the costs of conserving a biodiversity hotspot: a case study of the Cape Floristic Region, South Africa. Biological Conservation 112, 275–290.

Gadgil, M., 1996. Managing biodiversity. In: Gaston, K.J. (Ed.), Biodiversity. A Biology of Numbers and Difference. Blackwell Science, Oxford, pp. 345–366.

Gelderblom, C.M., Kruger, D., Cedras, L., Sandwith, T., Audouin, M., 2002. Incorporating conservation priorities into planning guidelines for the Western Cape. In: Pierce, S.M., Cowling, R.M., Sandwith, T., MacKinnon, K. (Eds.), Mainstreaming Biodiversity in Development. Case Studies from South Africa. World Bank, Washington DC, pp. 129–142.

Gelderblom, C.M., van Wilgen, B.W., Nel, J., Sandwith, T., Botha, M., Hauck, M., 2003. Turning strategy into action: implementing a conservation action plan in the Cape Floristic Region. Biological Conservation 112, 291–297.

Gibbs Russell, G.E., 1985. PRECIS: The National Herbarium's Computerised Information System. South African Journal of Science 81, 62–65.

Goldblatt, P., Manning, J., 2002. Plant diversity of the Cape Region of South Africa. Annals of the Missouri Botanical Garden 89, 281–302.

Griffiths, C.L., Prochazka, K., 2000. Cape Action Plan for the Environment: final report of the marine component. Zoology Department & Marine Biology Research Institute, University of Cape Town.

Groves, C., Valutis, L., Vosick, D., Neely, B., Wheaton, K., Trouval, J., Runnels, B., 2000. Designing a Geography of Hope. A Practitioner's Guide for Ecoregional Conservation Planning. The Nature Conservancy, Washington DC.

Gunn, M., Codd, L.E., 1981. Botanical Exploration of Southern Africa. A.A. Balkema, Cape Town.

Heijnis, C.E., Lombard, A.T., Cowling, R.M., Desmet, P.G., 1999. Picking up the pieces: a biosphere reserve framework for a fragmented landscape—the coastal lowlands of the Western Cape. Biodiversity and Conservation 8, 471–496.

Heydenrych, B.J., Cowling, R.M., Lombard, A.T., 1999. Strategic conservation interventions in a region of high biodiversity and high vulnerability: a case study from the Agulhas Plain at the southern tip of Africa. Oryx 33, 256–269.

Hilton-Taylor, C., Le Roux, A., 1989. Conservation status of the fynbos and karoo biomes. In: Huntley, B.J. (Ed.), Biotic Diversity in Southern Africa. Concepts and Conservation. Oxford University Press, Cape Town, pp. 202–223.

Impson, N.D., Bills, I.R., Cambray, J.A., Le Roux, A., 1999. The Primary Freshwater Fishes of the Cape Floristic Region: Conservation Needs for a Unique and Highly Threatened Fauna. Western Cape Nature Conservation Board, Stellenbosch.

Jarman, M.L., 1986. Conservation Priorities in Lowland Regions of the Fynbos Biome. South African National Programmes Report 87. CSIR, Pretoria.

Jones, G., van Nieuwenhuizen, G.D.P., Day, J.A., 2000. Cape Action Plan for the Environment: Selecting Priority Wetlands for Conservation: The Agulhas Plain as a Case Study. Freshwater Research Unit, Zoology Department, University of Cape Town.

Kerley, G.I.H., Pressey, R.L., Cowling, R.M., Boshoff, A.F., Sims-Castley, R., 2003. Options for the conservation of large and medium-sized mammals in the Cape Floristic Region. Biological Conservation 112, 169–190.

Knight, A., Cowling, R.M. Getting back on track: the evolution of regional conservation planning and the implementation crisis. Trends in Ecology and Evolution (submitted for publication).

Knight, A.T., Cowling, R.M. The quest for hallmarks of successful implementation: a review of lessons learnt from regional conservation planning projects. Conservation Biology (submitted for publication b).

Kruger, F.J., 1977. Ecological reserves in the Cape fynbos: toward a strategy for conservation. South African Journal of Science 73, 81–85.

Linder, H.P. The Cape Flora. Biological Review (in press).

Lochner, P., Weaver, A., Gelderblom, C., Peart, R., Sandwith, T., Fowkes, S., 2003. Aligning the diverse: the development of a biodiversity conservation strategy for the Cape Floristic Region. Biological Conservation 112, 29–43.

Lombard, A.T., Cowling, R.M., Pressey, R.L., Mustart, P.J., 1997. Reserve selection on the Agulhas Plain, South Africa: a flexible tool for conservation in a species-rich and fragmented landscape. Conservation Biology 11, 1101–1116.

Lombard, A.T., Pressey, R.L., Cowling, R.M., Rebelo, A.G., 2003. Efficiency of land class as surrogates for species in conservation planning for the Cape Floristic Region. Biological Conservation 112, 45–62.

Macdonald, I.A.W., Cowling, R.M., 1996. Guest editorial: Biodiversity and conservation of Table Mountain and the Cape Peninsula. Biodiversity and Conservation 5, 525–526.

Margules, C.R., Pressey, R.L., 2000. Systematic conservation planning. Nature 405, 243–253.

Maze, K., Kätzschner, T., Myrdal, B., 2002. Conserving an embattled flora: mainstreaming biodiversity issues in urban Cape Town. In: Pierce, S.M., Cowling, R.M., Sandwith, T., MacKinnon, K. (Eds.), Mainstreaming Biodiversity in Development. Case Studies from South Africa. World Bank, Washington DC, pp. 89–100.

Maze, K.E., von Hase, A., 2000. Cape lowlands project update. Veld & Flora 87, 162–164.

Midgley, G., Hannah, L., Millar, D., Thuiller, W., Booth, A., 2003. Developing regional and species-level assessments of climate change impacts on biodiversity: in the Cape Floristic Region. Biological Conservation 112, 87–97.

McDowell, C., 1986. Legal strategies to optimise conservation of natural ecosystems by private landowners—economic incentives. Comparative International Law Journal of Southern Africa 14, 460–473.

Moll, E.J. (Ed.), 1982. Proceedings of a symposium on coastal lowlands of the Western Cape, March 19–20, 1981. University of the Western Cape, Bellville.

Moritz, C., Faith, D., 1998. Comparative phylogeography and the identification of genetically divergent areas for conservation. Molecular Ecology 7, 419–429.

Myers, N., Mittermeier, R.A., Mittermeier, C.G., da Fonseca, G.A.B., Kent, J., 2000. Biodiversity hotspots for conservation priorities. Nature 403, 853–858.

Noss, R.F., Carroll, C., Vance-Borland, K., Wuerthner, G., 2002. A multicriteria assessment of the irreplaceability and vulnerability of sites in the Greater Yellowstone Ecosystem. Conservation Biology 16, 895–908.

Pence, G.Q.K., Botha, M.A., Turpie, J.K., 2003. Evaluating combinations of on-and off-reserve conservation strategies for the Agulhas Plain, South Africa: a financial perspective. Biological Conservation 112, 253–273.

Picker, M.D., Samways, M.J., 1996. Faunal diversity and endemicity of the Cape Peninsula, South Africa—a first assessment. Biodiversity and Conservation 5, 591–606.

Pierce, S.M., Cowling, R.M., Sandwith, T., MacKinnon, K. (Eds.), 2002. Mainstreaming Biodiversity in Development. Case Studies from South Africa. World Bank, Washington DC.

Possingham, H.P., Ball, I.R., Andelman, S., 2000. Mathematical methods for identifying representative reserve networks. In: Ferson, S., Burman, M. (Eds.), Quantitative Methods for Conservation Biology. Springer-Verlag, New York, pp. 291–306.

Prendergast, J.R., Quinn, R.M., Lawton, J.H., 1999. The gaps between theory and practice in selecting nature reserves. Conservation Biology 13, 484–492.

Pressey, R.L., 1994. Ad hoc reservations: forward or backwards steps in developing representative reserve systems? Conservation Biology 8, 662–668.

Pressey, R.L., Cowling, R.M., 2001. Reserve selection algorithms and the real world. Conservation Biology 15, 275–277.

Pressey, R.L., Cowling, R.M., Rouget, M., 2003. Formulation of conservation targets for biodiversity pattern and process in the Cape Floristic Region, South Africa. Biological Conservation 112, 99–127.

Pressey, R.L., Logan, V.S., 1997. Inside looking out: findings of research on reserve selection relevant to ''off-reserve'' nature conservation. In: Hale, P., Lamb, D. (Eds.), Conservation Outside Nature Reserves. University of Queensland, Centre for Conservation Biology, Brisbane, pp. 407–418.

Pressey, R.L., Logan, V.S., 1998. Size of selection units for future reserves and its influence on actual vs targeted representation of features: a case study in western New South Wales. Biological Conservation 85, 305–319.

Privett, S.D.J., Heydenrych, B.J., Cowling, R.M., 2002. Putting biodiversity to business on the Agulhas Plain. In: Pierce, S.M., Cowling, R.M., Sandwith, T., MacKinnon, K. (Eds.), Mainstreaming Biodiversity in Development. Case Studies from South Africa. World Bank, Washington DC, pp. 101–116.

Prochazka, K., Griffiths, C.L., 2000. Cape Action Plan for the Environment: Final Report of the Estuarine Component. Zoology Department & Marine Biology Research Institute, University of Cape Town.

Rebelo, A.G., 1992. Preservation of biotic diversity. In: Cowling, R.M. (Ed.), The Ecology of Fynbos. Nutrients, Fire and Diversity. Oxford University Press, Cape Town, pp. 309–344.

Rebelo, A.G., Siegfried, W.R., 1990. Protection of fynbos vegetation: ideal and real-world options. Biological Conservation 54, 17–34.

Rebelo, A.G., Siegfried, W.R., 1992. Where should nature reserves be located in the Cape Floristic region, South Africa? Models for the spatial configuration of a reserve network aimed at maximizing the protection of floral diversity. Conservation Biology 6, 243–252.

Redford, K.H., Taber, A., 2000. Writing the wrongs: developing a safe-fail culture in conservation. Conservation Biology 14, 1567–1568.

Richardson, D.M., van Wilgen, B.W., Higgins, S.I., Trinder-Smith, T.H., Cowling, R.M., McKelly, D.H., 1996. Current and future threats to plant biodiversity on the Cape Peninsula, South Africa. Biodiversity and Conservation 5, 607–647.

Rouget, M., 2003. Measuring conservation value at fine and broad scales: implications for a diverse and fragmented region, the Agulhas Plain. Biological Conservation 112, 217–232.

Rouget, M., Cowling, R.M., Pressey, R.L., Richardson, D.M. Identifying the spatial components of ecological and evolutionary processes for regional conservation planning in the Cape Floristic Region. Diversity and Distributions (in press).

Rouget, M., Richardson, D.M., Cowling, R.M., 2003a. The current configuration of protected areas in the Cape Floristic Region, South Africa—reservation bias and representation of biodiversity patterns and processes. Biological Conservation 112, 129–145.

Rouget, M., Richardson, D.M., Cowling, R.M., Lloyd, J.W., Lombard, A.T., 2003b. Current patterns of habitat transformation and future threats to biodiversity in terrestrial ecosystems of the Cape Floristic Region, South Africa. Biological Conservation 112, 63–85.

Scott, H.A., 1986. De Hoop Nature Reserve. Cape Conservation Series 7. Cape Nature Conservation, Jonkershoek, South Africa.

Skelton, P.H., Cambray, J.A., Lombard, A.T., Benn, G.A., 1995. Patterns of distribution and conservation status of freshwater fishes in South Africa. South African Journal of Zoology 30, 71–81.

Stewart, W., Rogers, G., 2002. Nelson Mandela MOSS receives a significant financial boost. African Wildlife 56 (1), 26–27.

Trinder-Smith, T.H., Lombard, A.T., Picker, M.D., 1996. Reserve scenarios for the Cape Peninsula: high- middle- and low-road options for conserving the remaining biodiversity. Biodiversity and Conservation 5, 649–669.

Turpie, J.K., Heydenrych, B.J., Lamberth, S.J., 2003. Economic value of terrestrial and marine biodiversity in the Cape Floristic Region: implications for defining effective and socially optimal conservation strategies. Biological Conservation 112, 233–251.

van Nieuwenhuizen, G.D.P., Day, J.A., 2000. Cape Action Plan for the Environment: The Conservation of Freshwater Ecosystems in the Cape Floral Kingdom. Freshwater Research Unit, Zoology Department, University of Cape Town.

van Wilgen, B.W., Bond, W.J., Richardson, D.M., 1992. Ecosystem management. In: Cowling, R.M. (Ed.), The Ecology of Fynbos: Nutrients, Fire and Biodiversity. Oxford University Press, Cape Town, pp. 345–371.

van Wilgen, B.W., Cowling, R.M., Burgers, C.J., 1996. Valuation of ecosystem services. BioScience 46, 184–189.

van Wilgen, B.W., Marias, C., Magadlela, D., Jezile, N., Stevens, D., 2002. Win-win-win: South Africa's *Working for Water* Programme.

In: Pierce, S.M., Cowling, R.M., Sandwith, T., MacKinnon, K. (Eds.), Mainstreaming Biodiversity in Development. Case Studies from South Africa. World Bank, Washington DC, pp. 5–20.

Vane-Wright, R.I., 1996. Identifying priorities for the conservation of biodiversity: systematic biological criteria within a socio-political framework. In: Gaston, K.J. (Ed.), Biodiversity. A Biology of Numbers and Difference. Blackwell Science, Oxford, pp. 309–344.

Vlok, J.H.J., Euston-Brown, D.I.W., Cowling, R.M. Acocks' Valley Bushveld 50 years on: new perspectives on the delimitation, characterisation and origin of subtropical thicket vegetation. South African Journal of Botany (in press).

Wicht, C.L., 1945. Preservation of the Vegetation of the South Western Cape. Special publication of the Royal Society of South Africa.

Wilson, E.O., 1998. Consilience. The Unity of Knowledge. Abacus, London.

Younge, A., Fowkes, S., 2003 The Cape Action Plan for the Environment: overview of an ecoregional planning process. Biological Conservation 112, 15–28.

R.M. Cowling
Terrestrial Ecology Research Unit and Southern African Hotspots Program: Conservation International
Department of Botany
University of Port Elizabeth
PO Box 1600, Port Elizabeth 6000
South Africa
E-mail address: rmc@kingsley.co.za

R.L. Pressey
New South Wales National Parks and Wildlife Service
PO Box 402, Armidale
NSW 2350 Australia

13 November 2002