

Management of the natural ecosystems of the Cape Peninsula: current status and future prospects

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The Cape Peninsula is an area of outstanding natural beauty and exceptional biodiversity, worthy of proclamation as a World Heritage Site. The area is dominated by fynbos vegetation, usually managed by means of prescribed burning, together with various programmes aimed at the control of invasive alien plant species. Effective management of the Peninsula is bedevilled by the fact that the area is controlled by no less than 14 different public bodies, resulting in fragmentation of effort and the lack of a standardized approach to management. Historically, many official and unofficial investigations have called for this problem to be resolved, without success. The lack of coherent, focused, and well funded fire and alien weed control management plans for the entire Peninsula is a serious deficiency. Despite this, considerable progress has been made towards the establishment of a database for the Peninsula, and the development of decision support systems that can utilize this database for rational management. Adoption of such a system would provide a powerful uniting framework that would standardize and influence the management approaches adopted by the various controlling authorities.

Keywords: fynbos; management; GIS; information systems; conservation policy.

Introduction

In the preceding papers of this issue, the conservation importance of the Cape Peninsula has been stressed (Cowling *et al.*, 1996; Picker and Samways, 1996; Trinder-Smith *et al.*, 1996a), and a network of reserves that would adequately conserve the area has been presented (Trinder-Smith *et al.*, 1996b). However, the simple proclamation of areas as nature reserves will not ensure the survival of the vegetation and all its unique biodiversity; active management is needed, especially to ensure the maintenance of appropriate fire regimes and to prevent invasion of conservation areas by alien plants (Richardson *et al.*, 1996).

Several features of the Cape Peninsula make it unique from the point of view of the managers charged with its conservation. The Peninsula is in essence a mountain range surrounded by urban development and the sea. Development pressure on the area is intense; the population of the greater Cape Town area is currently 2.2 million, and will reach 3.5 million by the year 2000, and 6.2 million by 2020, an annual increase of between 4 and 5%. This brings with it all the usual problems associated with the urban/wildland interface in a fire-prone environment. There is also an enormous tourist pressure on the

area. For example, approximately 400 000 tourists visit the Cape of Good Hope Nature Reserve each year; similar numbers ascend Table Mountain annually, leading to a need for measures to prevent congestion and impacts, and for the provision of facilities. Special measures are needed to protect the high numbers of endemic and rare plant species (Simmons and Cowling, 1996; Trinder-Smith *et al.*, 1996a) in the area, both from development and invasion by alien plants (Richardson *et al.*, 1996).

In this paper, I discuss the management of the Cape Peninsula's natural areas. I provide a brief review of the methods currently used in the management of fynbos ecosystems in general, and evaluate the policies and practices of the landowners in the Peninsula with reference to these methods. I discuss the history of proposals for the management of the area, and outline an appropriate management system for the Peninsula.

Management of fynbos and forest ecosystems on the Peninsula

Excluding the areas developed for housing, agriculture and plantation forestry, the rugged landscapes of the Cape Peninsula are covered mainly by fynbos vegetation, with small patches of indigenous forest (Cowling *et al.*, 1996). There are a variety of goals that underpin the management of these undeveloped areas. The most important of these are nature conservation, the reduction of fire hazard, enhancing water yield and catchment stability, and providing for recreation and tourism. Achievement of these aims on the Peninsula would normally be based on management practices developed elsewhere in the Western Cape Province.

The aims of nature conservation are chiefly achieved through prescribed burning and the eradication of alien trees and shrubs. Fynbos is a fire-prone vegetation type, and its component species are dependent on fire. Prescribed fires are usually conducted at intervals of 12–15 years, in late summer or early autumn (van Wilgen *et al.*, 1990, 1992). Alien trees and shrubs that replace fynbos are systematically contained, usually through a combination of felling and burning (van Wilgen *et al.*, 1992).

The reduction of fire hazard is usually also achieved through the application of prescribed fires which pre-empt wildfires during hot, dry and windy conditions; it also requires the removal of alien plants which increase fuel loads. In the Peninsula, where the problems associated with the urban/wildland fringe are prominent, systems of firebreaks have also been established in the past.

Many mountain areas in the Western Cape Province are important water catchment areas, and they are managed to enhance water yield and maintain catchment stability by means of regular burning and clearing of alien weeds. On the Peninsula the priorities are different, but there remain some dams that are locally important sources of water. More serious problems have been encountered with regard to the stability of some areas. The increases in fire intensity associated with intense fires in heavily invaded areas have resulted in increases in soil erosion and decreases in water quality. These changes are at least in part due to the formation of water-repellent layers in the soil after intense fires (Scott and van Wyk, 1990). In areas with a long history of invasion, chronic problems of fire and soil erosion have developed, for example on the slopes of Table Mountain (Scott *et al.*, 1991).

Tourism and recreation are important activities on the Peninsula. The most important of these include scenic drives, visits to special sites of interest (such as Cape Point, by road, or the top of Table Mountain, by cablecar), picnicking and hiking. These activities are catered

for through the provision of hiking trails and picnic sites, and are regulated through the prohibition of barbecue fires at certain times of the year.

Small indigenous forest patches occur in areas such as Orange Kloof and Newlands. The management of indigenous forest areas differs from fynbos in that alien plants are not as great a problem, and fires are actively excluded to promote forest succession.

Land ownership on the Cape Peninsula

Natural landscapes in the Cape Peninsula have been grouped into a land category known as a Protected Natural Environment. This status is conferred on deserving tracts of land in terms of South Africa's Environment Conservation Act. The act requires approval from the provincial premier for any subdivision of land or the erection of any building. Land within the Cape Peninsula Protected Natural Environment (CPPNE) is owned by a variety of private and public landowners, and proposals for development within the CPPNE are subjected to scrutiny and approval by a managing body known as the Management Advisory Committee (MAC), before they are forwarded to the premier.

Public land forms the largest proportion (80%) of the CPPNE and is distributed amongst 14 national, provincial, regional and local landowners (Table 1). The 20% of land in private ownership is divided among more than 150 landowners. The largest proportion (70%) of the CPPNE resorted under three authorities at the time of writing: the Regional Services Council of the Cape (a regional body responsible for regional planning and development), Cape Nature Conservation (the provincial conservation agency in the Western Cape Province) and the Cape Town Municipality (a local body representing the ratepayers of Cape Town). The South African National Defence Force (mainly the Navy) also controls a small but significant proportion (5.3%) of the area.

The division of ownership within the relatively small land area of the CPPNE leads to significant problems from an ecosystem management point of view. Land parcels are fragmented, complicating fire management and alien weed control, and increasing the need for interactions between neighbouring landowners. The distribution of public funds among many agencies results in ineffective utilization of the funds for efficient management. Priorities also differ between landowners, resulting in unco-ordinated or even counter-productive management initiatives. The implications are discussed further in the sections below.

Historic development of a management framework

A framework for the management of the Cape Peninsula has been the subject of considerable attention this century. Despite this, management has been, and still is, marked by divided control and accompanying deterioration. Conservationists have long recognized that the Cape Peninsula is an asset of national importance. As early as 1929, pleas were made by members of the Wildlife Society of Southern Africa for the establishment of a National Park on the Peninsula (Pringle, 1982). Successive Commissions of Enquiry have been appointed to address the problem of conservation management on the Peninsula. In 1951, the van Zyl Commission investigated the preservation of Table Mountain; in 1978 the report of the Hey Commission on the future control and management of Table Mountain and the Peninsula was published (Hey, 1978); 1994 saw the release of a draft of the Kahn Commission's report on the rationalization of

Table 1. Controlling authorities of public and private land on the Cape Peninsula Protected Natural Environment (CPPNE, total area = 29 119 ha)

| Authority | Status | Major areas controlled | Area (ha) |
|--|---|--|-----------|
| Department of Public Works | Central Government | Devil's Peak grazing paddocks for large ungulates | 479 |
| South African National Defence Force | Central Government | Mountains above Simonstown | 1567 |
| South African Forestry Company Limited | State-owned company | Tokai State Forest | 1400 |
| National Botanical Institute | Central Government | Kirstenbosch Botanical Gardens | 222 |
| Cape Nature Conservation | Provincial Government | Cecilia State Forest; Devils Peak State Forest | 3676 |
| Western Cape Regional Services Council | Local Authority | Cape of Good Hope Nature Reserve | 9882 |
| Cape Town City Council | Municipality | Table Mountain Nature Reserve; Silvermine Nature Reserve | 5217 |
| Fish Hoek Municipality | Municipality | Local mountains and dune areas; beaches | 257 |
| Simon's Town Municipality | Municipality | Local mountain areas; beaches | 541 |
| Constantia Valley Local Council | Local Council | Local mountain areas | No data |
| Llandudno Local Council | Local Council | Beaches | No data |
| Kommetjie Local Council | Local Council | Beaches | No data |
| Scarborough Local Council | Local Council | Beaches | No data |
| Cape Rural Council | Local Council | Local mountain areas | No data |
| Private land | Private land: some private nature reserves have been proclaimed | Various smallholdings | 5882 |

the management and control of the Cape Peninsula (Anon, 1994), as well as a report on policy for multipurpose use of the Cape Peninsula (UCT, 1994a, b).

Several private initiatives have added substance to the growing concerns. In 1974, the Cape Town Section of the Mountain Club of South Africa commissioned a report, based on the observations of their members, that the mountain was deteriorating 'so rapidly that only the most energetic measures could save it' (Hey, 1978). In 1976, members of the Botany Department at the University of Cape Town published a report on Table Mountain which concluded that the ecological status of the Mountain was 'generally fairly poor' (Moll and Campbell, 1976).

All of these reports concurred remarkably in a number of their recommendations. These included the need to control alien plants, to implement better fire management, to protect and conserve the unique diversity of the area, and to place the control of the area under a

single, authoritative body. A plethora of legislative steps have been taken as a result to protect the Peninsula, including the proclamation of areas as municipal, provincial, divisional council and private nature reserves, National Monuments, National Botanical Gardens, State Forests and Nature Areas (later termed Protected Natural Environments). However, the key problems, and the need for their solutions, remain. The area is managed by 14 different authorities, uncontrolled fires continue to wreak havoc regularly, and alien weed species prevail, and even expand, in many areas. Thirteen endemic plant species are known to have become extinct, and many more face imminent extinction (Trinder-Smith *et al.*, 1996a).

The latest recommendations contained in the UCT policy report (UCT, 1994a) call for a 'Cape Peninsula Heritage Area', to be proclaimed in terms of the National Parks Act (Act 57 of 1976 in South Africa), and managed by a single authority, to be named the Cape Peninsula Heritage Area Authority. In addition, they recommend that 'vigorous action' should be taken to have the area afforded the status of a World Heritage Site by UNESCO (the United Nations Educational, Scientific and Cultural Organization). Should this combined status be realized, the ability to address the deterioration of the area would be substantially enhanced.

Current policies, practices and funding

The policies of the various public landowners with regard to land management in the Cape Peninsula were surveyed during 1994 (Table 2). This information forms the basis of the discussion below.

Fire is of major importance in the management of fynbos ecosystems in the Cape Peninsula. The one policy that is common to all management agencies is their stated intention to combat wildfires. To this end, the Cape Peninsula Fire Protection Committee has been formed. This committee, with representatives from all of the authorities owning land in the CPPNE, is charged with co-ordinating fire-fighting activities in the area. This committee represents the only real forum where land managers co-operate and pool resources to a significant degree in the Peninsula. However, this committee has no brief to consider conservation matters, and has only functioned sporadically over the past few years.

The need for prescribed burning of fynbos vegetation on the Peninsula is recognized by some landowners. These include Cape Nature Conservation and the Cape Town City Council, who have stated policies to conduct prescribed burns. However, in practice this intention is frustrated by (often misguided) public sentiment against burning, and by a lack of funds. Other landowners stated that prescribed burning was not official policy, and yet others had no policy at all. The lack of a coherent, focused, and well-funded fire management plan for the entire Peninsula is a serious deficiency.

All public landowners stated that the control of alien weeds from their land was a priority. In some areas, considerable progress has been made towards this goal. For example, enormous progress has been made with the eradication of alien weeds from the Cape of Good Hope Nature Reserve (Macdonald *et al.*, 1989). In the Table Mountain Nature Reserve, success has been more limited, mainly due to a lack of funds (Moll and Trinder-Smith, 1992). Without these efforts in the past, the conservation status of the Peninsula and its unique species would have been far worse than it is today. Sporadic attempts at control of alien plants have been made by other agencies, but they are often

Table 2. Management policies adopted by major public authorities in the Cape Peninsula Protected Natural Environment. The public authorities listed are those that were in existence in December 1994

| Authority | Major policies with regard to: | | | Tourism and recreation |
|--|---|--|--|---|
| | Fire | Alien weeds | Nature conservation | |
| Department of Public Works | No stated policy exists, and no prescribed burning has been conducted or planned. Wildfires are combated | Alien weeds are controlled according to written plans | Natural pastures are maintained for ungulates such as eland, black wildebeest and zebra | Access is limited to areas outside of fenced pastures |
| South African National Defence Force | No policy with regard to prescribed burning; wildfires are combated | Alien weeds are controlled according to written plans | Broad policies on the conservation of fauna and flora, exist for all Defence Force land. Specific policies for the CPPNE lacking | No public entry allowed, due to strategic nature of installations |
| South African Forestry Company Limited | Policy aimed at protection of plantations of alien trees through maintenance of firebelts and selective silvicultural burning | Policy calls for management of weeds, but funding limits its application | Where possible, natural ecosystems, communities and species, especially rare and endangered species, are conserved | Public use encouraged. No entrance fees are charged, and picnic, hiking and other facilities are provided |
| National Botanical Institute | No prescribed burning conducted; wildfires are combated | Alien weeds are eradicated according to a plan | Conservation of all species is a primary aim | Public entry allowed and encouraged; nominal entrance fees charged; facilities provided |
| Cape Nature Conservation | Prescribed burning conducted, but programme impeded by public pressure and lack of funds | Alien weeds are eradicated according to a plan | Conservation is the primary aim of the organization | Free access and facilities provided for the public |

| | | | | |
|--|---|--|--|---|
| Western Cape Regional Services Council | Natural fires are allowed to burn when property not threatened; no prescribed fires unless specifically recommended | Alien weeds are eradicated according to a plan | Conservation of indigenous fauna and flora a primary goal; some exotic large mammals have been introduced as tourist attractions; baboons are 'controlled' | Public entry subject to entrance fees; facilities provided |
| Cape Town City Council | Prescribed burning is conducted (but programme impaired by public pressure), and wildfires are combated | Alien weeds are controlled according to a plan | Conservation of vegetation, fauna and rare species are called for in a formal policy document | Some areas have free access, others subject to entrance fees. Certain areas closed to the public to reduce fire risk to forest ecosystems |
| Fish Hoek Municipality | Prescribed fires conducted; wildfires combated | No formal plans exist to control alien weeds, but use is made of volunteer public groups | Concerns centre on dune stability; make use of CSIR guidelines on dune management (Council for the Environment, 1989) | Facilities maintained on beaches; parking fees are charged |
| Simon's Town Municipality | Fire Department conducts burns to control aliens only; firebreaks are burnt; wildfires are combated | Informal policy calls for control of weeds, but funds are limiting | Informal policy is frequently modified in consultation with local interest groups | Entrance subject to a low-cost permit, and certain areas around dams closed to the public. Facilities on beach only |
| Constantia Valley Local Council | Policies are those of the Western Cape RSC | Weeds are controlled according to RSC policies | Policy follows CPPNE and RSC guideline | No information |
| Llandudno Local Council | Policies are those of the Western Cape RSC | Weeds are controlled according to RSC policies | Policy follows CPPNE and RSC guideline | No information |
| Kommetjie Local Council | Policies are those of the Western Cape RSC | Weeds are controlled according to RSC policies | Policy follows CPPNE and RSC guidelines | Access allowed, no entrance fees |
| Scarborough Local Council | No policy | No policy | No policy | No policy |
| Cape Rural Council | Policies are those of the Western Cape RSC | Policies are those of the Western Cape RSC | Policies are those of the Western Cape RSC | No information |

frustrated by a lack of funds and expertise to conduct effective eradication campaigns. In addition, certain organizations have other priorities; for example, data on the distribution of alien plants show that the Defence Force are custodians of the worst infestations on the Peninsula, despite a policy aimed at the elimination of alien weeds. Again, the lack of a co-ordinated and directed plan for the management of alien weed infestations on the entire Peninsula is a glaring vacuum. In the case of both fire management, and alien weed eradication, the division of the pool of available staff among 14 agencies results in dilution of the necessary resources to a point where effectiveness is seriously impaired.

Two studies have documented the past attempts by management agencies to control alien invasive plants over time, based on resurveys of marked plots in the field (Macdonald *et al.*, 1989; Moll and Trinder-Smith, 1992). Macdonald and his co-workers showed that control attempts in the Cape of Good Hope Nature Reserve between 1941 and the late 1970s failed mainly because of a lack of both an understanding of the ecology of the species concerned, and a systematic control strategy. Once a systematic strategy had been devised and implemented in the late 1970s, significant progress was made with eradication (Richardson *et al.*, 1992). Moll and Trinder-Smith's study (conducted within the Table Mountain Nature Reserve) concluded that 'carefully planned and intensive clearing programmes' could contain and possibly eradicate aggressive aliens. However, due to a lack of funds, this was not being achieved, resulting in significant increases in the frequency of some invasive species. These studies called for the appointment of qualified ecologists, and a single management authority, to ensure that the identified shortcomings could be remedied. While ecologists are now employed by the larger agencies, the goals of a single authority and adequate funding remain elusive.

With regard to nature conservation, many agencies have commendable policies. These do differ from agency to agency, however, and reflect the different mindsets of policymakers. For example, large mammals such as mountain zebra, bontebok, hartebeest, eland, black wildebeest and others (most not, or only marginally, indigenous to the area) are maintained on the Peninsula for putative conservation reasons. Other agencies place more emphasis on the conservation of plant species. Others who have broad conservation objectives do not meet these in practice. A good example is the Navy, which maintains a shooting range in a wetland above Simonstown that contains numerous plant species found nowhere else in the world. These anomalies are not intentional, but result from ignorance or historic decisions in many cases. The effective conservation of biodiversity by local municipalities (who do not have the resources to acquire the necessary expertise), or national agencies such as the Navy (whose priorities obviously lie elsewhere) simply cannot be achieved.

Despite the calls for 'adequate funding' by concerned conservationists, it has proved extremely difficult to establish what has been spent in the past, and what should be regarded as adequate in the future. For example, the study on a draft policy (UCT, 1994b) tried, without success, to obtain information on the operating costs of managing the CPPNE. This failure was attributed to the fact that the area is managed by many different authorities and individuals, with different cost centres and overhead structures, with separate cost centres not being kept for the CPPNE, and with the same personnel and equipment often being used both within and outside the CPPNE. The UCT study concluded that '... as a consequence, it is not possible to compare the effectiveness and true cost of the current management of use of the CPPNE with that of similar undertakings elsewhere'. This is unfortunate, as common sense suggests that rationalization of staff and

resources under a single, united and goal-directed agency would surely be more efficient than the current situation.

A database for the Cape Peninsula

There is no question that an asset such as the Cape Peninsula deserves to be professionally managed. The management and policy decisions that affect the area should flow from dependable information on the area, coupled with the application of sound ecological principles that rely on good information as inputs. There is also a need to collect, store and retrieve information on the environment in order to monitor progress towards stated management goals, such as the achievement of a mosaic of post-fire ages, or the systematic control of alien plants.

Despite this need, no reliable database that could support professional management of the entire area exists. For much of the area, no fire records are kept, attempts at the control of alien plants go unrecorded, and there is no way of assessing the amount of money spent on the management of the area. Much of this problem arises from the divided control of the area. Where records are kept, they are not in a standard format.

However, there is a large amount of information available for the area. For example, the recently-completed study on a policy for multipurpose management of the area listed 454 references to studies carried out in the CPPNE. Tens of thousands of plant specimens are stored in herbaria (Trinder-Smith *et al.*, 1996a), and hundreds of phytosociological plots have been enumerated (Simmons and Cowling, 1996), resulting in the classification of vegetation for most areas (Cowling *et al.*, 1996). The soils and geology of the area have been mapped, and numerous ecological studies have been carried out. Fire records exist on maps for the main nature reserves. A collaborative venture between local ecologists from the CSIR, the University of Cape Town, and the Cape Town City Council has resulted in the collation of the information into a spatial database stored on a geographical information system (Table 3). This database has been used to support many of the analyses presented in the papers in this special issue. The database could also be used to underpin the management of the CPPNE by a future unified management agency. This proposal is discussed in the next section.

Using information technology in routine management

Advances in modern computer technology have enabled ecosystem managers to store, retrieve and analyse large amounts of spatial data. A number of computer-based management systems have been developed to enhance this ability, including one specifically aimed at the management of fire-prone fynbos ecosystems (Le Maitre *et al.*, 1993; Richardson *et al.*, 1994). The system comprises a central geographical information system for managing and processing spatial data, linked to personal computers with simple rule-based models for decision-making. The current applications include the prioritization of areas for burning, monitoring the success of fire management, mapping of fire hazard for fire control planning, and the production of management summaries and statistics. The database described in Table 3 was developed to be compatible with this system.

There are a number of advantages to using the system on the Cape Peninsula. These include:

Table 3. Salient features of an existing spatial database on the Cape Peninsula, with notes on its potential use in the management of the area. The database has been captured on a geographical information system (Arc/Info) in a format suitable for use by a customized ecosystem management system (see text)

| Data layer | Description | Source | Potential use to management |
|---------------------------------------|---|--|--|
| Vegetation | A classification of the vegetation, based on structural attributes and limited floristic data mapped on orthophotos at 1:10 000 scale | Institute for Plant Conservation, University of Cape Town | Management prescriptions can be based on vegetation type. Fuel characteristics are also related to vegetation type, and used to assess fire hazard for wildlife control |
| Indigenous plant species distribution | Compiled from over 22 000 herbarium records and over 800 phytosociological plots. Data are at a resolution of 1 km ² . Exact locality data for plants of the Proteaceae family have been collected as part of an atlas project | Bolus Herbarium, University of Cape Town; Proteaceae Atlas Project, University of Cape Town | Knowledge on the occurrence of endemic, rare and endangered species that could influence management decisions. Proteaceae are well known ecologically and can be used as indicator species for selecting appropriate fire intervals and seasons |
| Alien plant species | Data are recorded by species, divided into seven density classes based on aerial cover, and mapped on 1:10 000 orthophotos | CSIR Division of Forest Science and Technology | Knowledge on the occurrence of alien species will influence decisions of when and where to burn, and will be used to prioritize areas for clearing operations. Data are used as a basis for an expert system to advise on clearing methods, and for monitoring the progress of clearing operations |
| Fires | Coverages giving the perimeter and date of each fire (at a 1:10 000 scale). In some areas, coverage dates back to 1962; in other areas no records exist | Cape Town City Council, and Regional Services Council records | The post-fire age of the vegetation, and date of the last burn, are used to decide on priority areas for prescribed burning, the exclusion of fire, and (together with vegetation types) the calculation of fire hazard indices. Post-fire age is related to the vital attributes of indicator species to assist decisions |

| | | | |
|---|--|--|---|
| Land ownership and status; reserve boundaries | Boundaries of areas, with information on ownership (private or public land) at a 1:10 000 scale. Conservation status in terms of prevailing legislation | Cape Nature Conservation; Deeds Office | Useful in co-ordinating management actions. Legal requirements (e.g. notification of intention to burn) can be met |
| Rainfall | Isohyets of mean annual rainfall | Generated from a raingauge network database and standard algorithms by the Computing Centre for Water Research | Calculation of potential runoff, and erosion hazards |
| Management units | Boundaries of management units within the Table Mountain, Silvermine and Cape of Good Hope Nature Reserves, at 1:10 000 scale. These are parcels of land ranging from 100–500 ha in size | Cape Town City Council, and Regional Services Council records | Serve as a basis for conducting prescribed burns and alien weed control operations, and historically for record-keeping in general |
| Soils | A classification of the soils into homogenous units, at a 1:20 000 scale | Soil and Irrigation Research Institute | Useful for determining potential for development, locating roads and footpaths, and erosion potential |
| Infrastructure | Location of roads, footpaths, dams, beacons, radio towers, cableways and any other infrastructure, at 1:10 000 scale | Cape Town City Council, and Regional Services Council records | Knowledge of location of infrastructure in relation to management operations, especially prescribed burning and combat of wildfires |
| Contours, digital terrain model | Contours at 10 m intervals. Digital terrain model (giving slopes and aspects) generated by the geographic information system | Digitised from 1:10 000 orthophotos | Information on altitudes, slope and aspect. Calculation of visual impacts of development. Line of sight information for location of radio repeater stations |

- (i) Access to reliable and comprehensive information and rule-based models, to support management decisions. This is especially important for agencies that lack the resources needed to employ the necessary ecological expertise.
- (ii) Greater efficiency in the use of information. The enormous amount of information collected on the Cape Peninsula is both inaccessible and in danger of being lost. The costs of access can be greatly reduced by the system. Where information is lost, it is difficult to quantify the value. The environmental costs would manifest themselves as a result of poor management decisions, taken in the absence of (lost) information, or in the cost of gathering the information again.
- (iii) The adoption of a single management system, based on a database for the whole Peninsula, would provide a powerful unifying framework that would standardize and influence the management of the various controlling authorities.
- (iv) Strategic initiatives (such as the planning exercises routinely embarked upon) would derive enormous benefit from a standardized database.

Conclusions

The management of the Cape Peninsula suffers from a lack of funding and unco-ordinated control. The establishment of a Protected Natural Environment, and its Management Advisory Committee, has improved matters only marginally. In view of the threats facing the area (Richardson *et al.*, 1996), and its unquestionable value as a national and global asset (Cowling *et al.*, 1996), these drawbacks are highly undesirable. They have been recognized for a long time, and have now culminated in calls for the proclamation of the area as a National Park and a World Heritage Site, under the control of a unified management authority (UCT, 1994a). The fact that these recommendations arise from an exercise in which full public participation was used to determine a policy, makes the continued maintenance of the status quo even more questionable.

The consequences of continued failure to manage the Peninsula in a unified and professional manner would be serious for environmental quality in general, and for biodiversity in particular. Invasion by alien plants cannot be effectively controlled on a piecemeal basis, and failure to contain the invasions will result in a loss of biodiversity, increases in fire hazard and control problems, more erosion, and a loss of the unique character of the area. Fires, which require management to prevent damage to property and infrastructure, to prevent the spread of alien weeds and to ensure survival of the fire-adapted fynbos, also cannot be effectively managed by fragmented agencies. The inefficient expenditure of funds by numerous agencies that lack common goals and strategies represents a waste of public funds as well as a significant threat to the continued survival of many species of unique plants and animals.

The solution to the problem of effective and efficient management of the Cape Peninsula will require political will. If ever there was a situation that called for the cutting of the Gordian knot, the management of the Cape Peninsula epitomizes it. The successive calls for unified control have not succeeded in the past, though this solution is clearly needed, and desired by most people. The advantages are clear. They will result in far better protection of what amounts to a global resource, significantly help to control environmentally unsound development and environmental degradation, with positive spinoffs for the quality of life for local inhabitants, increases in tourism, and the creation of

jobs. If these advantages can be generally accepted, it should be possible to achieve the aim of unified professional management that has been so elusive up to now.

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