

**WILDLIFE CONSERVATION IN AFRICAN PARKS:
PROGRESS, PROBLEMS AND PRESCRIPTIONS.**

By

D H M Cumming.

World Wide Fund for Nature
Multispecies Animal; Production Systems Project

Project Paper No. 15

September 1990

Note: This paper was subsequently published as a chapter entitled "Conservation Issues and Problems in Africa" in: Lewis, D. M. and L. A. Carter (eds.) (1993) *Voices from Africa. Local Perspectives on Conservation*. World Wildlife Fund, Washington, D. C. The published chapter does, however, contain several errors introduced by a style editor who did not consult authors or give them the opportunity to check proofs.

WILDLIFE CONSERVATION IN AFRICAN PARKS: PROGRESS, PROBLEMS AND PRESCRIPTIONS.¹

D H M Cumming.

**"See the end in the mirror of the beginning and the beginning in
the mirror of the end." *Ancient proverb.***

Introduction

The crisis in conservation is perhaps nowhere more sharply drawn than in Africa where the problems of parks are intimately intertwined with basic human needs and the full range of resource conservation issues which face the continent. The crisis has its roots in the recent past and it is desirable to examine these roots, and present circumstances, before considering prescriptions for the parks of the future.

National parks originated in north America where they were essentially a cultural expression of values about pristine landscapes and nature. In central Africa they began as game reserves which many are today. The form taken by Parks, their aims and objectives and how they are managed will vary from one culture to the next and within one culture from one time to another. I am concerned with parks in relation to biological conservation, the objectives of which I take, in order of priority, to be:

1. To create the capacity for ecological and evolutionary processes to continue unimpaired.
2. To protect representative ecosystems
3. To prevent species extinctions

I will argue that although the establishment of large protected areas in southern central Africa has flourished these parks may no longer be sustainable. Why? Because protected areas are becoming increasingly isolated, both physically and culturally, from surrounding subsistence farmers who form the vast majority of the rural population in Africa. Biological conservation, if it is to succeed in the region, needs to encompass the entire landscape. Parks can function as no more than a core estate for such an enterprise. Greater emphasis on the management and sustainable utilization of indigenous wildlife resources, such as the large ungulates, may provide an economically viable vehicle to extend biological conservation beyond park boundaries and so serve to protect and integrate parks into the fabric of land use in southern central Africa (SCA) (Fig. 1)

I have purposefully avoided defining the objectives of National Parks themselves. They were often created to fulfil needs other than those of biological conservation.

The last Century

The trade in slaves and ivory, the scramble to colonize and partition Africa, and the

^{1/} This is a revised version of an invited paper "A prospect of parks in southern central Africa" presented at "Conservation 2100 - A Fairfield Osborne Symposium", convened by the New York Zoological Society and held at the Rockefeller University from 20-23 November, 1986. At the time the author was a member of the Zimbabwe Department of National Parks & Wild Life Management.

rinderpest epidemic of 1895 which destroyed 90 % of the region's livestock and its large wild herbivores, all conspired to create a culturally and biologically disrupted and impoverished land by the turn of the century. Despite human populations of one tenth their present levels famine was widespread by 1900. Development and burgeoning human populations have since changed the landscape of Africa and it is necessary to review however briefly how conservation objectives have fared during the last century.

Figure of SADC as it was in 1985 - i.e. less SA and the DRC

Fig. 1. Africa and the location of the Southern African Development Coordination Conference (SADCC) Region. Referred to here as southern central Africa (SCA)

Species and ecosystem conservation

The preservation of plant and vertebrate species has been successful. Too little is known of invertebrate faunas to judge their present status. Of the vertebrates only white rhino became extinct in the region and these were re-introduced to Zimbabwe, Botswana and Mozambique. They have probably again disappeared from Mozambique. I am not aware of any other extinctions of plants or animals from the region over the last century.

The IUCN Red Data Book lists 14 of the mammals in the region as being vulnerable (Table 1) while the giant sable and black faced impala are listed as endangered. Some 16 bird species are listed as rare, four reptiles as endangered and crocodiles are listed as vulnerable (Table 1).

TABLE 1. Endangered taxa in Central Southern Africa. (From MacKinnon and MacKinnon, 1986)

	Species	Status
Mammals:		
Pan troglodytes	Chimpanzee	Vulnerable
Lycaon pictus	Wild dog	Vulnerable
Hyaena brunnea	Brown hyaena	Vulnerable
Panthera pardus	Leopard	Vulnerable
Acinonyx jubatus	Cheetah	Vulnerable
Loxodonta africana	Elephant	Vulnerable
Equus zebra	Mountain zebra	Vulnerable
Equus zebra hartmannae	Hartmann's mountain zebra	Vulnerable
Hippotragus variani	Giant sable	Endangered
Kobus leche	Lechwe	Vulnerable
Aepyceros melampus petersii	Black faced impala	Endangered
Birds:		
Gyps coprotheres	Cape vulture	Rare
Spheniscus demersus	Jackass penguin	Special concern
Styerna dalaenarum	Damara tern	Rare
Bugeranus carunculatus	Wattled crane	Special concern
Agapornis nigreginus	Black cheeked lovebird	Rare
Swynnerton swynnertoni	Swynnerton's forest robin	Rare
Sheppardia gunningi	East coast akalat	Rare
Turdus fischeri	Spotted ground thrush	Rare
Chloropeta gracilirostris	Papyrus yellow warbler	Rare
Reptiles:		
Chelonia mydas	Green turtle	Endangered
Eretmochelys imbricata	Hawksbill turtle	Endangered
Lepidochelys olivacea	Olive Ridley	Endangered
Dermochelys coriacea	Leatherback turtle	Endangered
Caretta caretta	Loggerhead turtle	Vulnerable
Crocodylus niloticus	Nile crocodile	Vulnerable

Some populations of vertebrates have shown spectacular recoveries since the turn of the century. Elephant, for example, were thought likely to become extinct south of the Zambezi (Bryden 1903) but increased to more than 100,000 by 1980 (Cumming and Jackson 1984). Crocodiles were hunted to very low levels during the 1950's but have since recovered.

The Zambezian Floral Region, which covers most of SCA, probably has the richest and most diversified flora and vegetation types in the Afro-tropical realm (MacKinnon & MacKinnon 1986). The flora includes 8 500 species of which about 45% are endemic. The region also includes parts of Afro-mountain forest (Chimanimani and Uluguru-Mulanje systems), the Karroo-Namib, the Kalahari highveld and the Tongoland and Zanzibar mosaics.

Ecosystems in the region are mostly well represented in protected areas. Those not protected include patches of Guineo-congolian rainforest in Angola and Kalahari Acacia bushland. Dry evergreen forest, wetter miombo woodland, Zambesian woodlands and Itigi thicket in Tanzania are all under-represented and swamps are not adequately catered for (MacKinnon and MacKinnon 1986).

Increasingly the survival of many endangered species and the remnants of once intact ecosystems rests on the effective management and protection of national parks and other protected areas of the region.

Development of protected Areas

Unlike north America where the first national parks were declared to protect magnificent landscapes the first protected areas in southern Africa were declared initially as Game Reserves mainly to protect large mammals. They were large, mostly uninhabited, remote tracts of land, often infested by tsetse fly or in low lying malarious country. The first areas were declared during the initial decade of the century and then steadily enlarged upon (Fig. 2) through to the seventies. Protected areas (Fig. 3) now occupy some 511,000 km² or 9% of the region - a figure which does not include the large game management areas of Zambia and the further 20% of Botswana recently declared as wildlife management areas. The average size of protected area has declined and is now approximately 4,000 km² (Fig. 4). Except perhaps for Alaska both the extent and mean size of protected areas is probably unequalled.

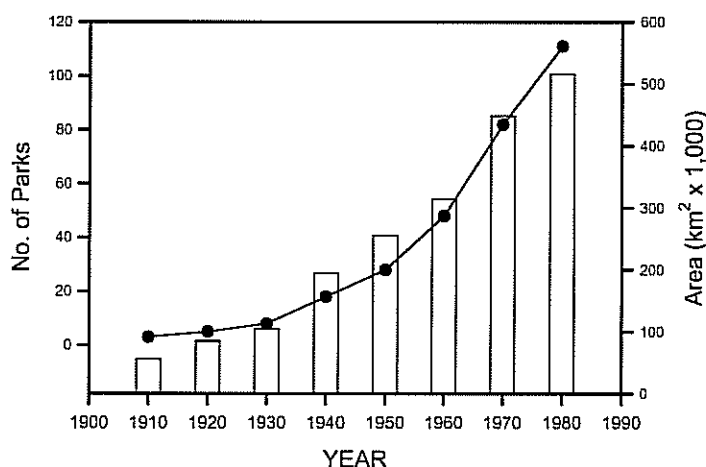


Fig. 2. The cumulative number and area (km²) of protected areas in southern central Africa by decade from 1900 to 1980.

The "Convention Relative to the Preservation of Fauna and Flora in their Natural State" held in London during 1933, often referred to as the African Convention, played a major role in influencing the concept and development of parks in Africa. A feature of that conference, compared for example with the Washington Convention of 1940, was its emphasis on biological conservation as a prime function of National Parks. This is borne out by a comparison of the key articles of those conventions. At the London Convention of 1933 a National Park was defined as an area:

- "a) placed under public control, the boundaries of which shall not be altered or any portion be capable of alienation except by the competent authority;
- b) set aside for the propagation, protection and preservation of fauna and flora and objects of aesthetic, geological, prehistoric, historical, archaeological, or other scientific interest for the benefit, advantage or enjoyment of the general public;

- c) in which the hunting, killing or capturing of fauna and the destruction or collection of flora is prohibited except by or under the direction and control of the park authorities. In accordance with the above provisions facilities shall, so far as possible, be given to the general public for observing the flora and fauna in national parks."

At the Washington Convention of 1940 a National Park was, in part, defined thus:

"1. The expression 'National Park' shall denote: areas established for the protection and preservation of superlative scenery, flora and fauna of national significance which the general public may enjoy and from which it may benefit when placed under public control." (Article 1, para. 1).

MAP

Fig.3. Distribution of the larger protected areas in southern central Africa.

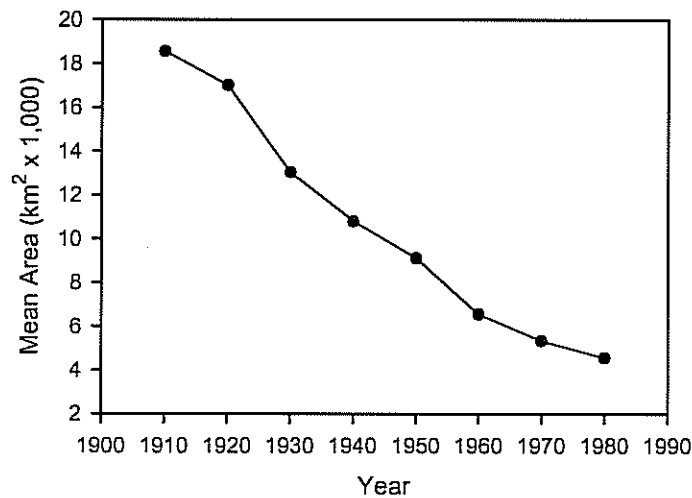


Fig. 4. The mean area (km²) of protected areas in southern central Africa during each decade.

Problems of Protected Areas

In establishing and managing protected area systems most national parks agencies have, over the past three decades, faced a range of ecological problems. More recently they have been faced with declining financial and manpower resources to protect and manage the resources under their control and increasing pressures from their neighbors who are mostly subsistence farmers. These difficulties are outlined below.

1. Ecological Problems

Habitat coverage. The major ecosystems of the region appear to be adequately represented in protected areas. However, the region has not been adequately surveyed ecologically and many habitats may well not be represented at all in the protected area system.

Incomplete ecosystems. As in many other parts of the world park boundaries were established before recent principles of protected area design were appreciated, or in the case of more recently declared parks, where more pressing constraints to the demarcation of boundaries existed. Serengeti National Park, for example, does not cover the ecosystem in which wildebeest carry out their annual migrations. Hwange National Park is mainly a wet season dispersal area cut off from river valleys and perennial water. The development of artificial water supplies has had considerable effects and implications for park management. In Botswana, a largely arid region, the parks system and associated veterinary fences do not cater for the migrations of large herbivores with severe consequences for both them and their ecosystems.

Park size. Although many of the parks in SCA are very large by world standards they nevertheless may be too small for many of the larger mammals. There is likely to be a relationship between body size and the area within which a population may be regulated without destroying or drastically altering its environment. If such a relationship exists it raises the question of what size national parks should be in order to allow population regulation of their largest species to occur without interference from man? Probably no areas in the region are now large enough to hold a fully protected but unmanaged elephant population. In Hawaii a large generalist herbivore (the goat) without a predator caused major changes to ecosystems and consequent species extinctions (Pimm, 1986).

Major changes have occurred to woodlands in African parks where elephant numbers have increased under protection and where they have been confined by fences or inimical surrounding land uses (Anderson and Walker, 1974, Cumming 1982, Guy, 1981). Apart from drought induced die offs in Tsavo National Park (Parker, 1984) elephant populations have been reduced either by illegal hunting or by culling before the end results of leaving elephant populations to grow indefinitely could be measured. In the absence of information on non-intervention, Park managers in southern Africa have taken a cautious approach and culled elephants (Cumming 1983). Alternative views which emphasize the importance of disturbance to maintaining species diversity in non-equilibrial savanna systems has been expressed by Walker et al (1987) and Walker (1989).

Large mammalian herbivores of all kinds have experienced dramatic population changes in parks over the last few decades but remarkably little is known about their effects on their environment or of the interaction between them and the savannas they inhabit (Frost, et al 1986).

Ecological isolation and effective population size. Fragmentation of populations and their subsequent reduction contribute to loss of genetic diversity. This is a very real problem for megaherbivores and for many of the larger carnivore species in Africa. Black rhino numbers, for

example, have declined to the level where no single population of the species is now large enough to avoid loss of heterozygosity. Effective breeding populations (N_e) of black rhino greater than 500 (the level required to avoid loss of heterozygosity) no longer exist in the wild (Cumming, du Toit and Stuart, 1990). The existing fragmented populations, even if fully protected, remain highly vulnerable to extinction because of the small sizes of their discrete populations (Gilpin, 1987). Similar considerations apply to white rhino, the fragmented elephant populations of West Africa and to some large predator populations (e.g. Starfield, et al, 1990).

In addition to questions of long term genetic viability there is also the question of supporting ecologically functional populations (Conner, 1988) of endangered species in protected ecosystems. Apart from Owen-Smith's (1987, 1988) hypotheses on the keystone role of elephants and other mega-herbivores in African ecosystems the question of what may constitute ecologically functional densities of species in protected ecosystems in Africa has not yet been addressed.

2. Financial & Manpower Problems

It would be surprising if there were more than 75 park biologists in the region which means one biologist to 7,000 km² of protected area. Taking the region as a whole and including university and museum research workers there is about 1 biologist to 32,000 km². Put another way this is about 1 biologist to 8 protected areas with an average size of 4,000 km². It is not surprising that rather little is known of our natural systems or even of the species they harbour. This lack of scientific manpower also has serious consequences for the ability of the region to monitor and scientifically manage ecosystems in protected areas. This is particularly true if we are to take seriously the suggestion that "wildlife management is at its best as scientific experimentation" (MacNab, 1983, 1985).

Probably the single greatest deficiency in the parks system in the region is the lack of financial resources both to employ staff and to meet their operational expenses. Apart from Zimbabwe and Namibia all countries in the region had budgets in 1981 which were about 5% to 20% of the level needed to adequately protect and manage the areas for which they were responsible (See Table 2 and Figs. 5 and 6). These budgets have since been eroded. In Zimbabwe although this figure remained above the US \$ 200 per km² considered to be the minimum expenditure density for adequate park management (Bell & Clarke, 1986) some 70% of the budget in 1990 was committed to staff salaries as opposed to 40% in 1980.

These data compare with a density expenditure of \$3,129 per km² for the United States Park Service land of 79.4 million acres (317,600 km²) and a staff density of 51.3 per 1000 km². For the lower 48 states these densities are much higher since Parks in Alaska comprise about 70% of the parks area but account for less than 5% of the budget.

While it is clear that the expenditures available or required in the USA do not necessarily apply to Africa they are pertinent because African park management has been modelled on North America and the guidelines provided by bodies such as the International Union for the Conservation of Nature and Natural Resources (IUCN). They thus provide a measure of the resources needed if traditional approaches to park management are to persist. The data are also pertinent because international pressures to set aside and preserve parks in Africa comes from Europe and North America.

Essentially similar considerations apply to staffing levels. Parker (1979) considered that the minimum density required to provide adequate protection in Africa is one man per 50 km² which requirement is met only in Zimbabwe (Fig. 7). Bell and Clarke (1986) consider a density of 1 man per 20 km² to be desirable for the protection of high priority species such as rhinos and gorillas. These

rules of thumb of \$200 per km² and 1 man to 50 km² were confirmed by a study of the decline of black rhino in the Luangwa valley (Leader-Williams and Albon, 1988). Since then alternative management approaches have shown that this figure may not be a necessary precondition to effective management and protection of wildlife in Africa (Lewis, Kaweche and Mwenya, 1990).

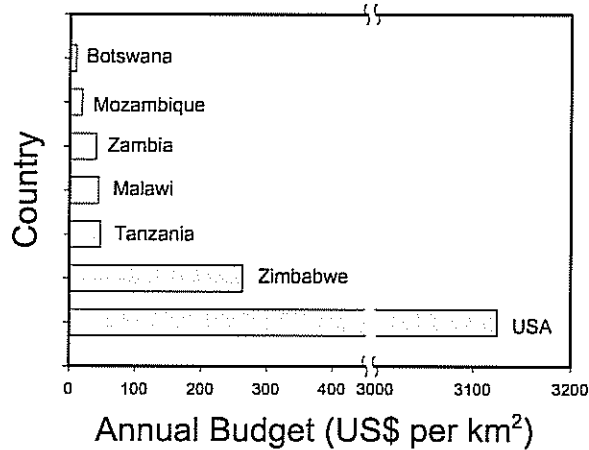


Fig. 5. The expenditure density (US \$ per km²) for parks within various countries of southern central Africa compared with that for the United States of America.

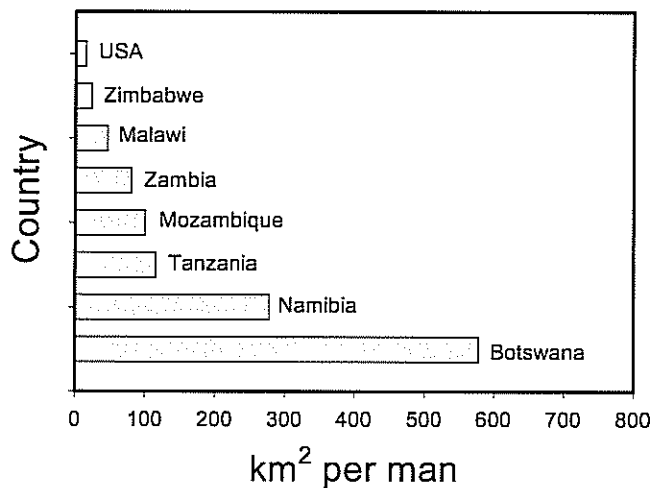


Fig. 6. The manpower density for parks staff in protected areas in various countries within southern central Africa compared to that for the United States of America.

3. Surrounding Areas and Land Use

Since 1900 human populations have increased by between ten and sixteen times. The population of Zimbabwe, for example, increased from about 500,000 in 1900 to just over 8 million souls in 1982. Cattle, the dominant domestic animal, have increased proportionately except in regions still infested by tsetse fly (Fig 7). The level of urbanization is low at less than 25% of the population (Table 2), and subsistence agriculture is the dominant form of land use with wood fuel as the primary source of energy (Bhagavan 1984, O'Keefe 1983).

Deforestation, overgrazing and consequent soil erosion are, besides human population growth, the greatest environmental problems faced by the region. Agricultural development, including forestry, has been confined largely to the introduction and husbandry of exotic plants and animals. There has been no significant investment in developing sustainable production of indigenous plant and animal resources.

Formerly large populations of wild ungulates have been reduced greatly by veterinary control measures either in the form of cordon fences or hunting to control tsetse fly in Botswana, Namibia and Zimbabwe (Taylor & Martin, 1987; Williamson, Williamson and Ngwamatsoko, 1988). The extension of livestock programmes with associated aid programmes for fencing also have had their effects. The ready availability of wire to make lethal snares has been a prime factor in reducing large ungulate populations. By far the greatest changes have been brought about simply by the growth of human populations and the expansion of subsistence agriculture. The major source of fuel is wood which is being harvested from indigenous woodlands well beyond sustainable levels. The consequent deforestation combined with shifting cultivation and overgrazing, has wrought great habitat changes over vast areas of the region.

Summary - the last 100 years

In summary then over the last 100 years human populations in SCA have increased more than 10 fold. Livestock populations, areas of arable land, and the extent of deforestation have similarly increased. Wars have also taken their toll. Yet despite these problems more land has been set aside as national parks than probably in any other region of similar size on earth. No species have gone extinct so far as we know and most habitats are reasonably well represented in protected areas. Some major indicator species such as elephants and crocodiles have increased. A few species are endangered in the wild but do not face extinction at present. The major problems are not species conservation or even perhaps ecosystem conservation but those of maintaining the capacity for evolutionary processes to proceed unimpaired into the future. In many respects the news so far is good news. Present trends and future prospects for the region are now examined which is essentially the bad news.

MAP

Fig. 7. Tsetse infested areas of southern central Africa. These occupy 33% of the region.

Table 2. Some basic indicators for human population size and growth, protected areas, agriculture and energy in the Southern African Development Coordination Conference (SADCC)) region.

SADCC: Pop./Dev./Land use	Angola	Botswana	Malawi	Mozambique	Tanzania	Zambia	Zimbabwe	Namibia
Area (sq. km)	1,246,700	600,372	118,484	783,030	945,087	752,614	390,245	824,292
Human Populations								
Numbers (millions): 1985	8.6	1.05	7.04	13.87	22.24	6.7	8.5	1.16
Numbers (millions): 2000	13.22	1.76	11.35	21.72	36.92	11.04	14.28	1.86
Numbers (millions): 2050	32.25	3.8	28.7	53.72	96.44	26.75	33.05	4.16
Growth rate (1995)	2.8	3.5	3.4	2.9	3.3	3.4	3.5	?
Growth rate (2000)	2.66	2.49	2.89	2.83	3	2.86	2.73	2.66
Ha per person (2000)	9.4	34.1	1	3.6	2.6	6.8	2.7	44.3
Rural Pop. (% tot. in 2000)	64.7	78.8	87.8	86.7	87.5	39.5	66.6	?
Protected Areas								
Total area (sq. km.)	82,307	103,953	12,622	32,250	108,307	59,451	49,418	63,661
% of country protected	6.6	17.3	10.7	4.1	11.5	7.9	12.7	7.7
sq. km. per 1000 people	6.2	59.1	1.1	1.5	2.9	5.4	3.5	34.2
Number of areas	13.0	9	21	9	15	19	30	12
Mean size (sq. km)	6,331.3	11550.3	601	3583.3	7220.5	3129	1647.3	5305
Men per 1000 sq. km. (1981)	?	1.7	21.8	9.9	8.7	12.5	43	3.6
Sq. km. Per man	?	578	45.8	100.5	115	79.8	23	278
Budget (US \$ per sq. km. 1981)	?	10	45	19	47.5	41	263	?
Agriculture								
Arable land (sq. km.)	35000	13600	23330	30800	52000	51580	2782	6570
Area under tsetse fly	372250	27500	7529	497030	587250	296250	62900	0
Grazing land	757143	455319	75003	22950	197530	345333	275145	754061.4
Cattle (1,000's)	3350	2900	910	1450	14000	2400	5800	2000
Sheep & Goats (1,000's)	1200	965	859	469	10200	392	1600	8300
TLU's per sq. km.	4.9	7	15.5	7.1	86.1	7.3	22.8	5.9
Energy								
Per capita consumption	14.9	27.3	26.8	26.9	24.5	26.1	33	?
Wood fuel as % of total fuel	77.3	56.1	94.3	89.1	91.4	58.3	52	?

The 21st Century - Problems and Prescriptions

Current projections and problems

Given the standard projections for human population growth we can expect to have five to eight times as many people as there are now in SCA by the year 2050 (Table 2). If subsistence agriculture continues to be the dominant form of land use environmental degradation on a grand scale is inevitable. Much of the region is arid so that a repetition of the Sahelian and Ethiopian experiences is likely. A key actor in this process is the stockman rather than the cultivator.

At the level of subsistence agriculture with no inputs of energy most of the region can sustain only one to two families per km² (Cumming 1985). The carrying capacity of the land has been exceeded in the more arid countries such as Botswana and Namibia (World Bank 1986), and in much of Zimbabwe, Malawi and parts of Zambia and Tanzania. The major thrust of current development is to open new land to subsistence agriculture. Present problems are being spread over a larger part of the region which means that the urgent need to find better ways of using existing agricultural land is being further delayed.

The impacts of these developments on protected areas are increasing pressures from surrounding communities through poaching, firewood collection, fires, illegal grazing of livestock and

the erection of fences for animal disease control. These problems are further aggravated by the lack of resources to protect and manage the parks system.

Parks within the region suffer from the usual set of problems which arise from boundaries which cut across ecosystems, animal migration routes or traditional grazing. The most immediate problems are, however, those of inadequate funds and land pressures on park boundaries.

With human populations doubling every 20 years or so the pressures of poaching, grazing, and harvesting timber mentioned earlier are escalating and the prospect of parks resisting these, even with increased budgets and manpower, is unlikely. Present trends suggest that the short term prospects (say next 20 years) for Parks could well be a continuing decline in financial and manpower resources leading to a collapse of the present protected areas system.

The projections and problems outlined above are endemic to most third world countries and certainly to most of Africa. While it is easy to pass them off as being an integral part of the syndrome of underdevelopment and poverty their ubiquity, in Africa at least, points to an underlying cultural or philosophical problem with parks. If the concept of parks is not appropriate to these countries then the provision of funds and equipment to support parks is merely a palliative treating symptoms rather than the underlying causes of the problem.

Parks are unwelcome among adjacent rural communities. Seldom do they derive any benefits from them. They are often a source of lions which attack livestock and elephants which eat crops. Antipathy to parks is not surprising under these circumstances when it is remembered that many early parks were created as game reserves in a political climate which prohibited local inhabitants from legally using their wildlife resources and that situation has persisted to the present.

Despite evident cultural conflicts surrounding their origin parks have survived and, in terms of area, flourished since countries in the region gained their independence. Again, this suggests differences of attitude and values between Governments and rural populations. The main users of parks are city dwellers and foreign tourists. These groups form a major constituency for some parks in Africa which tends to impose alien values on the management of parks and the use of indigenous wildlife resources. This cultural influence is very clear in western attitudes to the use of wildlife products such as ivory, leopard skins and crocodile hide. It is in keeping with the view that the prime purpose of nature conservation is its scientific, educational, recreational and inspirational value (Selman, 1985).

These considerations point to an imposed system of land use based upon values which are not in harmony with the majority of the population in the region. Timber, grazing, wildlife and water are considered free resources in rural Africa. Their presence within a National Park, where they are not available for use, represents a social cost to the community and to the country. That perceived (and real) social cost is not being paid and the system consequently holds little promise of being sustainable in its present form.

An alternative future and prescriptions

The first and perhaps most important problem which has to be addressed is the concept of parks and protected areas. In a very real sense the setting aside of protected areas represents a failure in our ability to manage land and resources so as to sustain the rich and varied tapestry of animal and plant life on the continent. Parks provide society with a false sense of security for the conservation of species, ecosystems and evolutionary processes. For the most part they are too small to meet the full requirements of biological conservation or the recreational and other needs of a

public they aim to serve. The budgetary and other problems which all third world parks systems face are unlikely to be resolved or improved without a radical change in the way parks are integrated into the fabric of rural development and land use. It should be noted that while in Europe and North America rural populations comprise less than 10% of the population in Africa they comprise 60-80% of the population.

Wildlife resources extend from the wilderness to city centers. Each component of the landscape, and human activity, has some capacity to contribute to the conservation of biological resources and diversity (Fig. 8). Often it requires only very minor changes in the way things are done, or used, to make an enormous difference to conservation and perhaps to the quality of life of those living in these areas. This is the challenge for administrators, agriculturists, ecologists, economists, and not least the responsibility of non-governmental organisations and individuals. The major battle is not one for ecological science, although it must get its act together in providing and properly communicating sound advice on managing ecosystems. Primarily the need is to change our social institutions - particularly those which involve developing the options for rural communities and their capacity to manage and benefit from wildlife resources.

This is essentially an argument for introducing more socially acceptable systems of alternative land use which can readily be integrated with the management of protected areas in southern central Africa. This means that the conservation/land use issue has to be taken beyond the limitations of current parks and protected areas philosophy. Without this it is not possible to correct the major deficiencies of parks as vehicles of biological conservation.

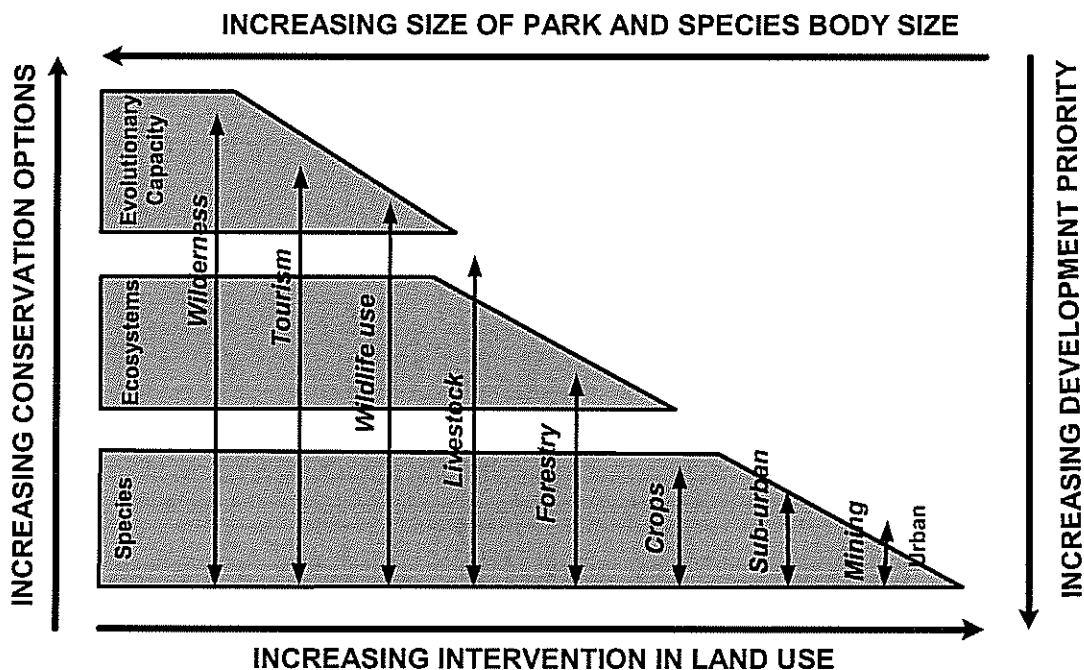


Fig. 8. Options for biological conservation in relation to land use.

The solutions lie in a number of concurrent programmes and approaches which address the broader issues of development, land use and environmental conservation. Apart from the overriding issue of human population growth the broader solutions lie, firstly, in an intensification of agricultural production in those areas suited by rainfall and soils to absorb and sustain higher inputs and populations. Secondly, the region is very well endowed with fossil fuels and industrialization, provided

it is clean, may be the only effective way to alleviate the growing pressure on the land. Thirdly, a comprehensive approach to land management is needed which fully explores the potential of the region's indigenous plant and animal resources. Parks then should become the biological, economic and cultural core to systems of land use rather than a collection of anachronistic ecological islands.

A promising start has been made in the region in the development of community based wildlife utilisation programmes (e.g. Lewis, Kaweche and Mwenya, 1990; Martin 1986, Bell, 1989; Owen-Smith) the extent of which has recently been reviewed by Cumming (1990). These still fragile initiatives face enormous hurdles, not least of which include a failure on the part of western environmental groups on the one hand, and the agricultural development establishment on the other, to appreciate their promise for both conservation and development.

The following are major issues requiring attention for a future in which parks are closely integrated with surrounding land use practices.

1. Cultural issues.

The present emphasis on wealthy overseas tourists raises problems for the cultural integration of parks within the region and has implications for the problem of visitor carrying capacity. If the park is filled with foreign tourists how does one make space for local visitors ?. If the park is open to large numbers of local visitors how will this affect foreign visitors. Should the facilities for differing types of tourist differ ? If so how can the implications of class differences be avoided ? Park planning and the multidisciplinary professionalism required to carry out this task effectively requires much closer attention than it has received to date. Further, a much better baseline of sociological information is required as well as information on human perceptions of wilderness.

2. Legal issues.

Sound management and exploitation of resources requires the development of an appropriate body of law on which to base government and private institutions. Legal developments follow rather than anticipate environmental problems so some measure of pro-active rather than retroactive legal development is needed.

There is a sufficient diversity of parks and wildlife legislation to compare the extent to which differing forms of legal structure may promote or inhibit effective conservation and park management. Much existing legislation is probably ill equipped to support the developing conservation, cultural and recreational goals for Parks. A key feature may be the extent to which legislative frameworks can be developed which will support a diversity of approaches to conservation and yet remain sufficiently coherent to allow consistent implementation and the achievement of diverse goals. In this context the cultural sanction of conservation law needs closer scrutiny because much of the existing law in Africa has its roots in colonial rather than African culture.

3. Economic issues.

A key question is: what are the costs of developing wilderness ?. Economists do not seem to have developed economic theory sufficiently to deal with this question and the associated problems of option foreclosure in land use. Just as the developed world expects Africa to maintain large areas of wilderness so it also expects the continent to forego the types of economic development that will place further strain on the earth's resources clean air and water. The true costs and benefits to Africa of its national parks system require analysis if an equitable sharing of those cost and benefits is to be developed.

There are important links between commodity prices and land use. The prices of cash crops may have immediate and often devastating impacts on land use in the third world. The environmental

consequences of these pricing structures need to be more fully understood. Similarly there is a need to examine the links between subsidies for agricultural produce and land use. There is little doubt that commodity prices and agricultural subsidies have much to do with the abuse of natural resources in Africa and the pressures faced by parks.

4. Institutional issues

Traditional annual allocations by central treasury are inappropriate to the management of natural resources with unpredictable seasonal and annual variations. For the most part national parks are state enterprises and it seems that they are such because of fears that if they were handed to private enterprise the reasons and ideals for which they were created would be lost to commercial interest and other forms of use and management. However, there is a good case for examining privatization (Mentis, 1989;) or the possibility of joint ventures between government and private enterprise for managing national parks². Conservation interests and, equally important, those of surrounding communities could be represented through Boards of Trustees appointed to oversee the management national parks run as joint ventures between government and large corporations or a range of smaller local private enterprises.

The establishment of a foundation, such as has been envisaged by Janzen (1986) for the Guanacaste National Park in Costa Rica, and perhaps even for the entire Costa Rican national parks system, is one option to consider. However, the foundation funds to run the Zimbabwe National Parks system, for example, on a sustained basis would amount to a billion dollar investment. The entire sum pledged in aid to Zimbabwe at Independence was of the order of a billion dollars. The likelihood of an amount of that magnitude being made available for parks and conservation is clearly remote. Equally unlikely is prospect of significant and sustainable increases in support from Governments, aid agencies and charitable organizations.

5. Manpower training

Changes in the balance of trained manpower are needed from the present emphasis on law enforcement to professional management soundly based on monitoring and research in a range of disciplines (ecology, agriculture, economics, law, accounting and administration) as well as extension and education aimed at administrators, decision makers, landowners and managers, and the public. Traditions within the park service both in Africa and elsewhere do not change easily and those of 80 years ago are still with us. If we want to change them the changes need to start now. The problems of how to introduce new traditions into highly conservative, non-professional organizations requires the services and skills of people not normally employed by parks.

6. Land use and management

Managing extensive semi-arid rangelands, which comprise much of the region, requires a greatly improved understanding of the species and ecosystems involved. Time worn concepts of equilibril systems and succession are being challenged and new resource management strategies and accompanying socio-economic models will have to be developed. (Walker, 1989; Westoby, Walker and Noy-Meir, 1989)

². / Further discussion on the question of privatisation of conservation in the southern Africa context can be found in the Bulletin of the South African Institute of Ecologists 89(1), "A controlled versus a free market environmentalism".

Monitoring systems and experimental management are either non-existent or very rudimentary in the majority of parks within the region. There is the need to develop appropriate and cost-effective techniques and to train managers and researchers alike to use all management actions as an opportunity to advance our knowledge (e.g. MacNab, 1983, 1985).

An impressive range of techniques is being developed for the intensive management of endangered species in zoological gardens and small parks. These techniques can clearly play an important role as interim emergency measures to save endangered species from extinction but it is the broader context of land use issues that require the most urgent attention. In a similar vein the research programmes associated with parks and protected areas require overhauling. The problem of matching research to the spatial and temporal scales of the problems of species and ecosystem conservation being faced in the region urgently needs to be addressed. Giles (1982) has drawn attention to the inability of traditional experimental research approaches, even allowing for increased funds, manpower and time, to tackle the wildlife research problems presently confronting resource managers. As Box (1976) remarked in a different context "It is inappropriate to be concerned with mice when there are tigers abroad".

Concluding comment

While this analysis and commentary has focused on the SADCC region many of the problems are equally applicable elsewhere in Africa and to developing nations in other parts of the world. Many are also applicable to the developed nations and indeed to North America (e.g. Chase, 1987) where the concept of National Parks arose

Waddington's (1975, 1977) concept of an "epigenetic landscape", applied initially to multifactorial development in morphogenesis and embryology, may provide a useful model for the development of ideas and institutions for land use and management. This concept can be extended to envisage a terrain of relative adaptive fitnesses for a biological system moving through time and existing over a range of environmental variables (Naveh and Lieberman, 1984). One may imagine a similar terrain of "land use fitnesses" as defined by appropriate criteria of human and resource benefits and the corresponding forms of land management for region's full range of landscapes. However, achieving a sustainable, or globally stable, landscape will be possible only with the development of appropriate, economic, legal and social institutions.

What concepts or institutions are now initiated will almost certainly have major implications for conservation in the future. The major immediate priority is to keep open our options for land use and resource management and to avoid, as far as possible, early foreclosure on those options. Institutional structures, traditions and attitudes are remarkably resistant to change. It is because they change so slowly that it is so important to lose no time in building for the 21st century.

Acknowledgements.

I thank Nick Carter, Meg Cumming, Dale Lewis, Tim Lynam and Rowan Martin for reading and commenting on earlier drafts of this chapter.

References.

- Anderson, G. D. and Walker, B. H. (1974) Vegetation composition and elephant damage in the Sengwa Wildlife Research Area, Rhodesia. *Journal of the Southern Africa Wildlife Management Association*, 4:1-14.
- Bhagavan, M. R. (1984) The woodfuel crisis in the SADCC countries. *Ambio* 13:25-27.
- Box, T. (1976) Science and statistics. *Journal of the American Statistical Association*, 71:791-799.

- Bryden, H. A. (1903) The decline and fall of the South African elephant. *Fortnightly Review*, 79:100-108.
- Bell, R. H. V. (1988) The concept of wildlife management areas: Experience in Zambia. pp 18-21, In: *Sustainable utilisation: the role of Wildlife Management Areas*. Kalahari Conservation Society, Gaborone
- Bell, R. H. V. and Clarke, J. E. (1986) Funding and financial control. pp. 543-555. In: Bell, R. H. V. and McShane-Caluzi, E. (Eds.) *Conservation and wildlife management in Africa*. Office of Training and Programme Support, U.S. Peace Corps. Washington, D.C.
- Chase, A. (1987) How to save our national parks. *The Atlantic Monthly* 260(1):35-44.
- Conner, R. N. (1988) Wildlife populations: minimally viable or ecologically functional? *Wildlife Society Bulletin*, 16:80-84.
- Cumming, D H M (1982) The influence of large mammals on savanna structure in Africa. pp. 217-2445. In: B. J. Huntley and B. H. Walker (Eds.) *Ecology of Tropical Savannas*. Springer-Verlag, Berlin.
- Cumming, D. H. M. (1983) The decision-making framework with regard to culling large mammals in Zimbabwe. pp. 173-186, In: Owen-Smith, N. O. (Ed.) *Management of large mammals in African conservation areas*. Haum, Pretoria.
- Cumming, D. H. M. (1985) Environmental limits and sustainable harvests. pp. 35-38. In: *Proceedings of the Conference/ Workshop on the Implementation of a National Conservation Strategy in Zimbabwe*. Ministry of Natural Resources and Tourism, Harare.
- Cumming, D. H. M. (1990) Developments in game ranching and wildlife utilisation in East and southern Africa. Paper presented at the 2nd International Wildlife Ranching Symposium, Edmonton, Canada. June, 1990. (In Press).
- Cumming, D. H. M. and Jackson, P. (Eds.) (1984) *The status and conservation of Africa's elephants and rhinos*. IUCN, Gland, Switzerland.
- Cumming, D. H. M., Martin, R. B. and Taylor, R. D. (1984) Questionnaire survey on the management and conservation of elephant and rhinos. pp. 46-62. In: Cumming, D. H. M. and Jackson, P. (Eds.) *The status and conservation of Africa's elephants and Rhinos*. IUCN, Gland, Switzerland.
- Cumming D. H. M., Du Toit, R. D. and Stuart, S. (1990) (Compilers). *African elephants and rhinos: Status survey and conservation action plan*. IUCN, Gland.
- Frost, P., Medina, E., Menaut, J.-C., Solbrig, O., Swift, M., and Walker, B. (Eds.) (1986) Responses of savannas to stress and disturbance. *Biology International. Special Issue 10*. IUBS, News Magazine.
- Giles, R. H. (1982) Management knowledge through wildlife research: A perspective. *Environmental Management* 6:185-191.
- Gilpin, M. E. (1987) Spatial structure and population vulnerability. pp. 125-139 In: Soule, M. E. (Ed.) *Viable populations for conservation*. Cambridge University Press, Cambridge.
- Guy, P. R. (1981) Changes in the biomass and productivity of woodlands in the Sengwa Wildlife research Area, Zimbabwe. *Journal of Applied Ecology*, 18:507-519.
- Janzen, D. H. (1986) Guanacaste National Park: tropical ecological and cultural restoration. Project Report to Servicio de Parques Nacionales de Costa Rica. Typescript, 39pp.
- Leader-Williams, N. and Albon, S. D. (1988) Allocation of resources for conservation. *Nature*, 336(6199):533-535.
- Lewis, D. M., Kaweche, G. and Mwenya, A. (1990) Wildlife conservation outside protected areas - lessons from an experiment in Zambia. *Conservation Biology*, 4:171-180.
- MacNab, J. (1983) Wildlife management as scientific experimentation. *Wildlife Society Bulletin* 11:92-94.

- MacNab, J. (1985) Carrying capacity and related slippery shibboleths. *Wildlife Society Bulletin*, 13:403-410.
- Mackinnon, J. and MacKinnon, K. (1986) *Review of the protected areas system of the Afrotropical realm*. IUCN, Gland. Switzerland.
- Martin, R. B. (1986) *Communal Areas Management Programme for Indigenous Resources (Campfire)*. Branch of Terrestrial Ecology, Department of National Parks & Wild Life Mangement, Zimbabwe.
- Mentis, M. T. (1989) Conservation: A controlled- versus free-market dialogue. pp. 80-92, In: Huntley, B. J. (Ed.) *Biotic diversity in southern Africa: Concepts and conservation*. Oxford University Press, Cape Town.
- Naveh, Z. and Lieberman, A. S. (1984) *Landscape Ecology: Theory and Application*. Springer-Verlag, New York. Pp. 356.
- O'Keefe, P. (1983) Fuel for people: Fuelwood in the third world. *Ambio*, 12:...
- Owen-Smith, N. O. (1987) Pleistocene extinctions: the pivotal role of megaherbivores. *Paleobiology* 13:351-353.
- Owen-Smith, N. O. (1988) *Megaherbivores: The influence of very large body size on Ecology*. Cambridge University Press, Cambridge. Pp. xiii + 369.
- Parker, I. S. C. (1979) *The ivory trade*. Report for the United States Fish & Wildlife Service. Typescript.
- Parker, I. S. C. (1983) The Tsavo story: An ecological case history. pp. 37-49, In: Owen-Smith, N. O. (Ed.), *Management of large mammals in African conservation areas*. Haum, Pretoria.
- Pimm, S. L. (1986) Which communities are fragile? Paper presented at Conservation 2100 - A Fairfield Osborne symposium convened by the New York Zoological Society and held at the Rockefeller University, New York, October, 1986.
- Selman, P. H. (1985) Responding to the World Conservation Strategy. *The Environmentalist*, 5:263-268.
- Starfield, A. M., Rowley, A. H., Quadling, H. and Foose, T. J. (1990) Genetic risk analysis of a small, wild lion population. *Bioscience*
- Taylor, R. D. and Martin, R. D. (1987) Effects of veterinary fences on wildlife conservation in Zimbabwe. *Environmental Management*, 11:327-334.
- Waddington, C. H. (1975) *A catastrophe theory of evolution. The evolution of an Evolutionist*. Cornell University Press, Ithaca, New York.
- Waddington, C. H. (1977) *Tools for thought*. Paladin, Granada Publications, Frogmore, England.
- Walker, B. H. (1989) Diversity and stability in ecosystem conservation. pp. 121-131. In: Western, D. and Pearl, M. (Eds.) *Conservation for the twenty first century*. Oxford University Press.
- Walker, B. H., Emslie, R. H., Owen-Smith, R. N. and Scholes, R. J. (1987) To cull or not to cull: Lessons from a southern African drought. *Journal of Applied Ecology*, 24:381-401.
- Westoby, M., Walker, B. H. and Noy-Meir, I. (1989) Opportunistic management for rangelands not at equilibrium. *Journal of Range Management*, 42:266-274.
- Williamson, D., Williamson, J. and Ngwamatsoko, K. T. (1988) Wildebeest migration in the Kalahari. *African Journal of Ecology*, 26:269-280.
- World Bank (1986) *Population growth and policies in sub-Saharan Africa*. The World Bank, Washington, D.C.