ECONOMIC POLICY AND WILDLIFE MANAGEMENT IN ZIMBABWE

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1. WILDLIFE POLICY AND UTILISATION IN ZIMBABWE

1.1 Introduction

Wildlife is beginning to make a significant contribution to Zimbabwe's national economy and it would appear that tourism in general but particularly wildlife-based tourism, is the fastest growing sector in the economy.[1] The impacts of this development are far-reaching and will affect land-use systems in the state, private farming and communal sectors. There has been much interest in this wildlife development with emphasis placed on its potential role as a more sustainable land-use system than conventional agriculture in semi-arid zones and its potential to contribute to rural development.

Attitudes to wildlife make its rational exploitation more difficult than for any other natural resource. The sentimental perspective views wildlife as inherently different from domestic animals and in the extreme form is averse to any economic role for wild animals. At the other extreme are those who view wild animals as an impediment to serious development and would like to see all wild animals confined to zoos or at least contained in national parks in limited areas where no other development is possible.

In areas where wildlife resources are still abundant, the establishment of commercialisation schemes does not require major capital investment, involving the sale of concessions for offtake or viewing access to an existing under-utilised resource. Wildlife projects come into conflict with conventional agriculture when options are foreclosed or where returns to households are decreased.

The wildlife utilisation industry in Zimbabwe developed rapidly once legislation had been changed to allow landowners to benefit from wildlife conservation through utilisation. This concept has resulted in significant increases in wildlife in commercial ranching areas and has effectively halted the systematic elimination of wild animals in these areas. Recent empirical analysis has shown that wildlife enterprises have higher financial and economic returns than cattle in most of the more arid zones in Zimbabwe (Jansen, Bond and Child, 1992).

There have been various problems associated with wildlife prices

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[1] Currently growing at over 13% per annum and expected to be contributing some 5% to GDP in 1991 (ZTDC).

reflecting opportunity costs in view of the macro distortions, and particularly in communal areas, the relatively closed marketing system. More competitive marketing has changed this significantly in the last two years and the effects of better access to foreign currency and effective currency devaluation have all assisted in market prices which more closely approximate opportunity costs. However, in all sectors, it is unlikely that market prices can ever reflect the true social value of the wildlife resources. Some of the values including environmental impacts, genetic resources and existence/bequest values are not reflected by the market. Where the externalities are significant, attempts could be made to internalise them through a system of taxes/subsidies which would result in the market prices more closely reflecting their true social opportunity costs.

The most lucrative outputs from the wildlife industry in Zimbabwe are photographic tourism and safari hunting. Hunting is important for developing the wildlife option in areas with lower concentrations of wildlife and poor infrastructure. Some specialist wildlife production units are also offering increasingly lucrative options - e.g. crocodile and ostrich farming. However, meat, hides and horns are not the primary outputs of any but a few speciality farms and ivory sales are currently negligible because of CITES regulations.

Zimbabwe has an interesting landscape to offer tourists with very good opportunities for wilderness experiences, safari hunting and photographic safaris. The heavier tree-canopy than is common in East Africa makes game-spotting more difficult but carefully marketed this could be seen as an attraction rather than a detraction. Zimbabwe has an interesting network of well-run Parks, a growing game-ranching industry and twelve communal farming areas where hunting and some tourism are incorporated alongside traditional subsistence farming.

Zimbabwe is well endowed with large mammals including elephant which are under threat in other parts of Africa. The central highveld is intensively farmed with limited wilderness and wildlife but with some opportunities for recreational tourism. The periphery, however, there are large concentrations of game including some communal areas. The large-scale ranching areas are not allowed to run buffalo with cattle and buffalo were totally eradicated to comply with EEC veterinary regulations. This did not happen in all communal areas because tsetse fly precluded cattle and these areas which still have buffalo and elephant play an important role in the hunting industry, supplementing the plains game available on commercial ranches. The lack of buffalo significantly reduces returns to wildlife ranching and there is a movement to eliminate cattle and reintroduce buffalo to some ranching areas.

Zimbabwe follows a policy of sustainable utilisation and views all

its mammals, including elephant, as a renewable natural resource rather than following a policy of natural cycles allowing habitat destruction and population crashes. This philosophy is derived from the importance of utilising all resources to best advantage and from the fact that with limited land areas available, if a natural "boom and bust" cycle was followed there would be a strong possibility that the elephant population would never recover under the increasing human pressure. The protection of the species takes precedence over the protection of individuals and groups. The estimated elephant population in 1960 was 32700 and in 1988 it was up to 52000 despite the fact that 44500 elephants were culled during those 28 years (Martin, Craig and Booth, 1989). Elephants are very important in wildlife enterprises particularly in the peasant farm sector where they account for some 70% of the revenue. All those involved in wildlife utilisation have strong incentives to ensure that sustainable elephant populations are maintained.

Zimbabwe is at the forefront in the effort to ensure the survival of the black rhino in the wild but is under severe international poaching pressure and there are some who maintain that greater success would be achieved if trade in rhino horn were legalised and the revenue generated used in protection operations and to provide incentives for protection.

1.2 The Historical Perspective[2]

Wildlife ranged throughout Zimbabwe prior to the advent of white settlers. Most large mammals have been eliminated along the highveld and in the intensively farmed areas. The more solitary browsers, in particular kudu and duiker are still fairly common and baboon, vervet monkeys, wild pig, a few leapards and some of the smaller nocturnal cats can still be found in most farming areas. The elimination of habitat in favour of conventional cropping and cattle production was the major factor in the decline of wildlife throughout the country. Tsetse-fly and foot and mouth control did contribute to that decline as did the rindepest. It is only the white rhino which appears to have succumbed to hunting pressure - they are easy to hunt and were used extensively for meat to supply large gangs of porters. Child notes that although some 660 000 head of game were shot for tsetse control in relatively limited areas over a 50 year period, it is only the black rhino which is in jeopardy as a result. Both rhino species breed and grow slowly and their survival is dependant on the longevity of adults (Child,G., forthcoming). It appears that most other large mammals in Zimbabwe (with the possible exception of roan and red hartebeeste) have been able to withstand heavy harvesting but have been very sensitive to habitat eradication.

Wildlife utilisation is part of the African tradition and has been

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[2] Table A1 in the Appendix gives a summary of the mammals found in Zimbabwe

practiced for centuries, being the mainstay of hunter/gatherers and an important component of household income in certain remote areas even today [3]. The conflicts between man and other mammals becomes increasingly obvious as populations increase and production systems become more sophisticated. The elimination of wildlife as a source of income and food has often reduced nutrition levels and variety of diet and in some instances total income as agricultural production replaces indigenous woodlands. It is only in remote, underpopulated regions where wildlife still abounds that it contributes significantly to household income. Prior to white settlement free use of wildlife was curbed by various taboos and certain areas were protected as religious retreats or royal hunting preserves. Hunting was primarily engaged in for subsistence meat with valuable, tradable commodities such as ivory reserved for the Chief. These mechanisms were weak but adequate while wildlife was plentiful and could be killed only with primitive weapons by a scattered population moving on foot (Murphree, 1991). Increasing population pressure, in-migration and the diminishing control of tribal authorities has reduced the traditional conservation practices.

1.2.1 Development of a Wildlife Industry on Privately-owned land

With white settlers came European traditions, guns, transport, spreading agriculture and an Anglo-French concept of wildlife protection. Whites were granted the traditional privilages of the European nobility but in time even white farmers were prohibited from hunting on their own land except to protect life and property. It was difficult to enforce the legislation and attitudes to game were hostile. Widespread elimination of wildlife existed on these ranches but no market for wildlife developed since commercialisation was illegal. The State was also responsible for eradication of game during tsetse control operations (including specially protected species) and many government veterinarians advocated the elimination of all wildlife as a precaution against livestock disease. Farmers received no compensation from the State for the losses their wildlife was causing. They were required by law to protect animals and bear the costs involved whilst being denied any benefits. There was little or no benefit and there was widespread overt and covert elimination of wildlife on large-scale ranches (Mossman and Mossman, 1976). Despite the widespread antagonism towards wildlife there remained farmers who tolerated and protected game for aesthetic reasons especially where it did not impinge heavily on their livelihoods. Tolerance was for particular species where there was little conflict so that

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[3] Marks (1973) indicated that annual per capita game meat consumption in Luangua Valley was 91.5 kg. Murindagomo (1988) showed similar consumption patterns in the Zambezi Valley (99kg). Murindagomo further estimated that despite being illegal, wild animals contributed 74% of the value of subsistence income and wild flora and fauna together contributed 60% of total family income.

predators were treated as vermin and herbivores accepted while crop damage and competition was limited but tolerance fell in dry years. Child (G. forthcoming) has an interesting discussion of these issues and of how wildlife survived despite the law, not because of it.

By the late 1950s it was recognised that official attitudes to wildlife conservation must encompass the rights and needs of the landholders. From 1960 farmers were given increasing responsibility for their wildlife and were given various permits to utilise and trade in wildlife. The Department of National Parks and Wildlife Management noted the positive response and how quickly wildlife numbers recovered in certain areas. The Parks and Wildlife Act (14/1975) was finally implemented in 1975. It allocated full custodial rights over wild animals (except for Specially Protected[4]) to appropriate authorities (landholders) while the game is on their land. The Act retains the principle of **res nullius** and there are mechanisms which allow the local community to control abuses or, if it fails to do so, Central Government can apply sanctions against him/them. Specially Protected Animals can only be killed in defence of life and they and their parts and derivatives may not be traded. Restricted species may be utilised upon receipt of special permits. Local committees may also declare a species specially protected within its own area. In most instances however the animals do not benefit from this protection since it is loss of habitat rather than hunting which is the major danger. In some quarters it is argued that, in fact, the "protection" reduces populations by making the species valueless to the landholders.

No person can hunt, capture or remove any animal or plant from privately or communally-owned land without the appropriate authority/landholder's permission. The landholder may hunt or market any plant or animal on his land (except those species listed as Specially Protected or Restricted). However the landholder must first obtain a specific permit to sell a live animal or a trophy. The General Regulations under the Act control hunting methods, prohibiting and restricting certain methods and issuing proficiency licences to Professional Hunters, Guides and Trophy Delalers. Special procedures apply to the possession or transfer of ivory or rhino horn. The Control of Goods (Import and Export) (Wildlife) Regulations are the instrument used for implementing CITES regulations in Zimbabwe. "In addition the regulations list certain indigenous species from CITES Appendix II to which Zimbabwe applies trade control measures as if they were on Appendix I. Trade controls are extended to live fish, crustaceans and to all specially protected indigenous plants and parts thereof unless such plants have been artificially propagated" (Pangeti, 1989).

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[4] Table !2 in the Appendix gives a list of Specially Protected and Restricted species

Under the 1975 Act, appropriate authority was immediately granted to all landholders. In the communal areas where the land is owned by the President, authority remained with the State (Ministry of Internal Affairs) who became the wildlife custodians on behalf of the peasant farmers on communally-owned land.

The introduction of wildlife legislation allowing landholders access to their resource has been successful in the large-scale farming areas of Zimbabwe. It has resulted in widespread increases in wildlife in all the less arable farming areas and even in the intensive cropping zones where farmers are reintroducing game for aesthetic purposes or for tourism, live animal sales and hides (zebra). In 1960 there were only three game ranches and 350 sq. kms was designated for wildlife outside state land and by 1990 this had risen to 56 500 sq. kms (Jansen, Bond and Child, 1992). Wildlife has been recognised as a legitimate land use and there is a Wildlife Producers Association (WPA) with a membership of over 10% of Zimbabwe's large-scale farmers. Although membership has increased in recent years it has been the movement from passive to active membership which has been significant. In 1988 there were 114 active members and by 1990 there were 206 active members. Safari hunting is the most important component in large wildlife enterprises and registered safari operators have increased significantly since 1980. In the more predominantly agricultural zones, wildlife tourism is an increasing and supplementary enterprise with some farmers investing in visitor camps, lodges and recreational facilities. A local co-operative markets these farm visits which offer varying degrees of access to wildlife and wilderness.

The large wildlife enterprises are found in the arid areas of Zimbabwe (Natural Regions 4 and 5) where farmers concentrate on extensive game or mixed game and cattle ranching. The wildlife is not used for meat production, with most of the meat which is generated, sold locally at prices significantly lower than beef prices. Beef consumption has been subsidised in Zimbabwe both directly through artificial prices and by large State investments in its processing and marketing (Muir, 1983). This has had negative effects on the growth of all beef supplements, including game meat. In the ranching sector wildlife competes with cattle not for meat production but for or its recreational services.

Safari hunting is the dominant income earner for most wildlife enterprises. The ranch hunting is often sold as a complement to hunting safaris on State hunting concessions and in communal areas. The advantages of hunting for the development of the wildlife industry are that it requires less infrastructural development and lower animal densities than are necessary for general tourism. Sport hunting is not a mass-market activity and is generally suitable for the initial development of wildife utilisation. Once the infrastructure has been developed and areas become less remote, and when wildlife density is relatively high, the greater volume

feasible with photosafaris may ensure higher returns to capital, land or wildlife resources. Hunting and tourism expectations tend to be mutually exclusive and can only be combined where they can be temporally or spatially seperated. Gross income from safari hunting increased from US$2 million in 1984 to US$9.3 million in 1990. Jansen (1990) estimated that if the entire hunting quota (2% of animal populations in State hunting safari areas, communal areas and the private sector) was sold to foreign clients, gross revenue would be some US$50 million per annum.

Photosafaris and wildlife related tourism has grown significantly and relies heavily on the continued viablity and attractiveness of the National Parks and Wildlife Estate. From 1972-1982 there was effectively only one tour operator (UTC) but by 1990 there were over 50 registered operators. Many of the new companies concentrate on exclusive and adventure safaris rather than bulk tourism and even UTC have expanded this area of operations. Photosafaris on private landholdings are not as common as hunting safaris and it is only where there are very specific attractions that landholders specialise in tourist ventures. Hunting is the major revenue generator, particularly in arid areas but there are over 20 farms in the highveld and 80 in the Midlands, Lowveld and Matetsi which have some involvement in photosafaris, recreational tourism and school camps.

The value of live animals for breeding purposes has increased dramatically. The Department of National Parks and Wildlife Management (DNPWLM) operated a central allocation system based on subjective criteria resulting in long waiting lists for animals and a thriving pritave trade emerged in the late 1980s. In 1989 there was a waiting lists for approximately 5250 animals to restock private land with wildlife. Live animal prices in the private sector rose some 400% in three years. The development of private trade in live animals is hampered by veterinary regulations and more recently by the drought.

Crocodiles have been seriously overexploited in much of Africa. This included Zimbabwe prior to 1960 when crocodile ranching was encouraged with producers required to return a proportion of hatchlings to the wild. Wild numbers have increased significantly and earnings in the crocodile industry have increased from US$300000 in 1983 to US$2.6 million in 1989.

Ostrich populations had become seriously depeleted owing to habitat destruction and cattle fences but the encouragement of ostrich ranching has been very successful and it is estimated that there will be some 20 000 ostriches produced per year with 18 000 targetted for the new abbatoir. Where wild eggs are harvested a proportion of the chicks are returned to the wild. As with crocodiles those returned are a slightly greater proportion than has been estimated would normally surive to that stage. So that crocodile and ostrich ranching increases both domestic and wild

populations.

Ivory sales are important only in the State and communal sector where they earned almost $12 million between 1981 and 1988 from approximately 31000 tusks (Martin, Craig and Booth,1989). Technical expertise, equipment and patents hamper the emergence of more sophisticated, value-added industries in the production of high quality fashion leathers and garments. Italy and Japan source much of their raw leather from Southern Africa and more effort could be made to specialise in final products.

Table 1
LAND AREA WITH WILDLIFE ENTERPRISES IN ZIMBABWE

	Area (Sq. kms)	Percent
Parks and Wildlife Estate	49,695	12.7
Forest Reserves	4,185	1.1
Communal Land	19,500	5.0
Commercial Land	37,000	9.5
Total	110,380	28.3

Source: Jansen, Bond and Child. 1992

1.2.2 Development of a Wildlife Industry on Communally-owned Land

The communal farming areas in Zimbabwe were initially exempted from the benefits of the new legislation, since control was retained by the State as custodians on behalf of the people who received no returns. Since 1978 some revenues from the sales of hunting concessions and from culls in or near a communal area were returned to the District but very little reached the householders. Since 1980 the DNPWLM has managed the wildlife in these areas on behalf of the communities. They have leased hunting rights and collected the fees on behalf of the communities but were required to pass the revenue earned to the national treasury. Treasury were then supposed to reallocate those revenues to the concerned communities on the presentation of proposals for development projects. In practice this has not worked and Treasury retained a large proportion of the money earned: of the Z$5.8 million earned by safari hunting in communal areas in 1987/88 only Z$3.3 million was paid out to District Councils and Z$2.5 were held back by Treasury (Z.Govt. Hansard Series,1988 pp1628-1644).

The Department of National Parks and Wildlife Management was sensitive to the needs of the local population to benefit from wildlife and was responsible for the development of the Campfire concept. Progress towards community participation in wildlife management in Zimbabwe has been a logical progression from the legal framework evolved to cater for the use of wild life on privately owned land (Pangetti, 1989). Wildlife had become (and still is in most areas) a liability to peasant farmers who are excluded from legal exploitation and Murphree notes that the

existence of this context for so long has supressed the traditional cultural perspectives which linked wildlife conservation with sustainable exploitation (Murphree, 1988).

As noted earlier the Parks and Wildlife Act of 1975 did enable the Minister to designate District Councils in Communal Lands as appropriate authorities with full custodial rights to their wildlife but this only began to be implemented in 1988 under the Campfire umbrella. Historically Zimbabwe has ignored peasant farmers in the communal areas expecting them neither to contribute to, nor to draw resources from, the modern sector. Population pressures have resulted in the increased cultivation of marginal lands and serious degradation, reducing the value of the output, increasing pressure on grazing and fuelwood (Whitlow and Campbell, 1989) and in some areas eliminating many indigenous species of flora and fauna some of which were particularly important to the subsistence economies of poorer households.[5]

With the advent of Independence, technologies relevant to the large-scale, higher-rainfall sector were transferred to the peasant sector. Relatively small investments have produced dramatic increases in marketed output from the communal sector but these increases have been exclusively from higher rainfall zones. Output from the marginal areas (75% of communal areas) has remained static or even declined (Stanning, 1987). It has now been widely recognised that technologies and institutions which are effective in the higher rainfall zones are inappropriate in the marginal areas. It has become essential to direct research to higher value outputs for the marginal areas and to develop low-cost technologies for existing commodities.

Since Independence some of the State revenue generated in communal areas was returned to District Councils who used the funds for development throughout their district. Only a few communities in the district pay the cost and actually live with the wildlife which generates these revenues. For the most part these communities view the eradication of wildlife (especially large mammals) favourably. They see no contradiction in eliminating the species which cause depredation whilst maintaining those species which contribute so significantly to their subsistence diets. As a result outside poachers are both encouraged and assisted. If, however, these communities were able to benefit directly and to have some control over access, which has been denied, they may be more willing to pay the costs involved in conserving wildlife and wildlife habitat.

With effect from 1988, legal control over wildlife resources is

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[5] In some remote areas wild fauna and flora still contributes around 60% to total household income when it is valued at the price of domestic alternatives (Murindagomo,1988).

being granted to Districts who apply for it provided that they meet specified requirements. The introduction of Appropriate Authority status to communities has mushroomed and there are 12 communal lands in Zimbabwe with appropppriate authority and more than 19 500 sq. kms of communally-owned land officially designated to include wildlife in the land use system. These Districts with appropriate authority are managing their wildlife under the CAMPFIRE programme and are all members of the CAMPFIRE Association. [6]

1.2.2.1 CAMPFIRE
(Communal Areas Management Programme for Indigenous Resources)[7]
In the early 1960s there were three private game reserves designated in communal areas from which benefits, including revenue, would go to the neighbouring rural communities so as to generate an appreciation of the value of wildlife (Child,G forthcoming). The local community were intended to benefit from revenues generated in these areas but were in effect completely alienated from these resources until just before Independence. In 1978 DNPWM started elephant culling operations and the money generated (Z$960000 in 18 months) and meat was distributed to the local District and the operation was called Windfall (Wildlife Industries New Development for All). Initially, elephant poaching dropped dramatically and the project was considered successful but poaching was to increase again particularly with international incursions escalating. The project was abandoned after six years when reduced elephant populations no longer required culling. The programme was not very effective at incorporating the local community. According to Martin there was no direct link between conservation of the wildlife and the survival of the people so that there was nothing to keep them from poaching. "One cannot do someone else's conservation for them and pay them not to be involved" (Martin, 1986). Other problems included the long delays in payment and the fact that the Councils did not redistribute the funds to affected populations but throughout the area.

Many of the agricultural and natural resources projects and programmes targeted for this small-scale farmers throughout Africa have not been successful principally because agencies may have contacted 'locals' for project planning and implementation but they have rarely involved the users in the communities most closely affected by the programme. Thus professional local agriculturalists recomend increased coarse grain production in dry

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[6] Recent press reports indicate that 60% of communal areas have expressed an interest in joining the CAMPFIRE association and in becoming involved to a lesser or greater extent.

[7] Much has now been written on CAMPFIRE and readers are referred to the original document by Martin, 1986 and to Murphree,1988, Jansen, 1990, Child and Peterson, 1991 and in particular to Murombedzi, 1992.

areas without taking into account low demand; professional national foresters recommend eucalyptus for rural afforestation without considering effective local demand which is far greater for fruit, fodder and fuelwood and does not require straight poles. Even where benefits and costs are considered at user level the institutional framework necessary to relate these is seldom effectively implemented (Muir, 1989).

On the basic principles of

.. reducing resource degradation
.. increasing returns from marginal areas
.. relating costs and benefits to avoid overutilisation of communally-owned resources and
.. ensuring effective user participation,

institutions are being developed in Zimbabwe for remote farmers on communally-owned land. To reduce opposition from entrenched interests the initial projects were in tsetse infested areas with relatively abundant woodland and wildlife resources. CAMPFIRE is the most far advanced and it was originally conceived to

.. obtain the voluntary participation of communities in a flexible programme which incoporates long-term solutions to resource problems
.. introduce a system of group ownership with defined rights of access to natural resources but where users pay a royalty which is paid to the group to ensure more equitable access and to avoid overexploitation
.. develop institutions where resources can be sustainably managed and exploited by resident communities for their own direct benefit
.. provide technical and financial assistance to communities which undertake the sustainable exploitation of resources.

It was anticipated that communities would form natural resource cooperatives or management trusts or companies with membership open to all adult males and females in the community. Each community draws up their own constitution. The allocation of rights is affected by the population:resource ratio. Defining the boundaries of a communal resource area in the CAMPFIRE programme is a process of negotiation between the national, district and village representatives. Since wildlife relies on the vegetation and water it is the ultimate objective that in most of these units grazing, water, forestry and wildlife be closely controlled with specified community management and access strategies but with arable land being accorded individual responsibility.

The exact method of control would vary depending on the state and scarcity of the resource and the social norms of each community. Subsistence hunting and safari hunting are compatible but as quotas and selectivity are necessary to exploit wildlife on a sustained basis, the community may have to derive new rules of access and harvest. The exact management and allocation strategies would be designed by the villagers with advice from the technical agencies

on the options available, the management techniques and environmental limits. This is an integrated rural development strategy with strong emphasis on sustainable exploitation and local controls and enforcement. It has been primarily designed for marginal areas where multiple use tends to have higher returns than the economies of scale from monocultures. The incorporation of high returns from safari hunting and legal access to game meat is designed to act as the spur for locally implemented controls to limit overexploitation of resources.

In fact, appropriate authority is granted to the District Council and local communities have yet to be given the opportunity to form effective resource management units with management, control and distribution all still highly centralised and regulated - it is one step closer to villagers having moved from national government to district councils but most CAMPFIRE projects are still a long way from achieving the objectives of closely intergrating costs and benefits and of granting control over resources to local communities. CAMPFIRE has, however, succeeded in generating debate over access to resources and on the importance of resource renewability and may eventually fulfill some of its original goals. Most of the communities currently see CAMPFIRE as a means of increasing agricultural potential, which development could eventually reduce wildlife and undermine CAMPFIRE, thus creating tension between villagers and implementers. CAMPFIRE will have to be carefully integrated into current farming systems if it is to survive.

One of the major concerns is that council authorities receive all wildlife revenue and then allocate these revenues over a much wider population than that living with wildlife. Both wildlife and tree resources are generally viewed as belonging to all Zimbabweans in a similar way that wildlife resources are viewed in the USA. The right of individual communities to claim exclusive access is not widely accepted. This is despite the fact that it is recognised that these communities live in lands which are agriculturally marginal and therefore these people are much poorer than their counterparts elsewhere in the district. Greater emphasis on the direct and opportunity costs of living with wildlife has to be explicitly emphasised. Appropriate aurthority is technically only granted by the State where the proposed constitution ensures that at least half of the District revenue from wildlife is given to affected local communities but this is not always achieved and these requirements have not yet been enforced.

1.3 Current Situation and Future Prospects

It is extremely difficult to ascertain the value of Zimbabwe's wildlife industry. The industry is a relatively new industry growing rapidly and the country's national accounts are mostly out of date and the published statistics do not seperate tourism or wildlife based industries as a proportion of GDP. Various Ministerial statements have indicated that in recent years tourism

has earned between Z$300 million and Z$1 billion per annum or between 2 and 4% of GDP (depending on estimates of value added). The most credible revenue estimate appears to be around Z$500 million in 1990/91. Safari hunting and wildlife management services add another Z$50 million. Crocodiles and ostriches Z$35 million and other game products (skins, meat and ivory) at Z$1 million contribute more than formal sector sheep and goats but still account for less than 0.5% of agricultural income. Tourism and wildlife are thus not major direct contributors to national product. However, as with agriculture, the multiplier effects are strong and they are important contributors to foreign exchange earnings. Tourism operations qualifying for the export retention scheme claimed $165 million in 1990/91. It has been crudely estimated that during this period the wildlife sector generated Z$344 million in foreign exchange earnings (Jansen, 1992) - national data on export earnings are not available for this period yet but this is probably in the region of 20% of total.

Table 2
THE ROLE OF WILDLIFE IN THE ECONOMY[1] 1990/91

Sector	Total Earnings [Z$ million]	Forex Earnings [Z$million]	Numbers Employed
1. Tourism	500.0	300.0	35 000
2. Hunting	45.0	45.0	2 000
3. Wildlife Management services			375
a. Live animals sales	6.2	negl	25
4. Game Products (meat, hides/skins, horns)[2]	1.0	NA	100
5. Crocodile Production	15.0	15.0	500
6. Ostrich Production	20.0	20.0	800
TOTAL	587.2	380.0	38 800

[1] All of the figures must be considered very rough estimates due to severe data limitations
[2] This is particularly low because of the CITES ivory trade ban
Source: Jansen, Bond and Child (1992).

The industry has strong backward linkages with the manufacturing sector as well as some forward linkages with the informal sector. Most tourist related products are locally manufactured - luxury products such as scotch whiskey and film excepted. In the large hotel sector 80% of fixed costs are local expenditures whereas it is 100% for the safari camps and lodges. Of the variable costs, 85% is associated for all tourism ventures with local processing and manufacturing - the major linkages being food and beverages. The industry is a high foreign currency converter but relies heavily on adequate transport and communications facilities which are foreign currency dependent. The forward linkages are mainly in the form of arts and crafts - curio sales from one isolated community centre (Binga Craft Centre) was Z$80,683 with 68% of this gross value returned to the producers. Sales from one major Shona sculpture gallery was estimated at Z$5 million per annum, almost all in foreign currency (Bond, 1992).

Tourism has grown significantly since 1987 with bed occupancy up to 50% in 1990 despite an increase of 86% in the number of beds available. Employment grew 20% in three years compared with non-agricultural employment elsewhere in the economy which grew 0.5%. Non-consumptive tourism is considerably more labour intensive than sport hunting and over 50% of those employed in hotels and lodges could be drawn from unskilled local populations (Bond, 1992). The industry is also an important source of skilled and semi-skilled jobs and could play an important role in absorbing literate school leavers who make up an increasing proportion of the unemployed.

The role of wildlife in the economy is significantly increased if adjustments are made to reflect the opportunity cost of the foreign currency earned by the sector. According to Jansen and Rukovo (1992), the exchange rate was overvalued 77% in 1990. For most of the 1980s it was estimated that the average overvaluation was 50%. From mid 1991 the government started a deliberate policy of devaluation to realign the currency and current estimates of overvaluation are closer to 25%. In the table below 50% has been used to reflect local currency overvaluation.

Table 3
ADJUSTED CONTRIBUTION OF WILDLIFE TO THE ECONOMY, 1990/91)[1]
[Based on Equilibrium Exchange Rate]

Sector	Total Earnings [Z$ million]	Forex Earnings [Z$ million]
1. Tourism	731.0	531.0
2. Hunting	52.2	52.2
3. Wildlife Management services		
a. Live animals sales	62	negl
4. Game Products (excl crocs & ostriches) (meat, hides/skins, horns)	1.0	NA
5. Crocodile Production	26.6	26.6
6. Ostrich Production	35.4	35.4
TOTAL	852.4	645.0

Note [1] All of the figures must be considered very rough estimates due to severe data limitations
Source: Jansen, 1992.

Tourism in Zimbabwe is wildlife and wilderness based and has significant potential for expansion. In 1986 tourism in South Africa and Kenya earned ten times more than in Zimbabwe (Cumming and Bond, 1991). The high numbers of large mammals, particularly elephants, and the relatively sophisticated infrastructure accessing areas with a much stronger sense of wilderness, give Zimbabwe certain advantages which it has yet to effectively develop or market. The current structural adjustment programme will encourage investment in export industries with more realistic exchange rates and easier access to imported inputs. The international recession will have less effect on tourism to Zimbabwe which relies most on high-income tourism and not on the middle-income tourists whose travel plans are more income elastic. The negative publicity associated with the drought has affected

tourism in 1992 but this is a short-term phenomenon. Zimbabwe with its relatively efficient and sophisticated infrastructure, relatively unspoilt wilderness areas and abundance of elephant should be in a position to significantly expand wildlife tourism. The tourism industry does need to address a number of issues including the expansion of the international airport facilities and internal flight links as well as train government officials and industry employees in attitudes and service to visitors. [8]

Wildlife as a development tool in rural areas is still under-exploited with the potential for the community to become very much more closely involved in managing and selling the wildlife resource and in servicing the ventures so initiated. Very much more could be done to increase the multiplier effects for local communities from wildlife enterprises if e.g. the local communities were more closely involved in providing food and services (as is encouraged by Londlozi safaris in South Africa). Tourism ventures have more potential for local involvement than safari hunting.

2. ECONOMIC DEVELOPMENT AND WILDLIFE

2.1 The National Economy, the Resources and Land-use Systems

Zimbabwe lies within the tropics but given altitudes of between 600 and 1200 metres, most of the country has a subtropical climate which is perfect for year round tourism. The rainy season coincides with northern winters but even during this season the days are mostly sunny with the rain occuring in sporadic thunderstorms and late afternoon showers. Made up predominantly of granitic, other igneous and schistose rocks, Zimbabwe has greatly varied (known deposits of 40 different minerals), if not economically very rich, mineral resources with a total annual mineral contribution to GDP of some 8%. Whilst agriculture accounts for only some 10-14% of GDP, it has a major impact on growth through its backward and forward linkages, its contribution to export earnings and both formal and informal employment. The major constraint to development in Zimbabwe is the lack of foreign currency to purchase imported inputs and the severe restrictions and barriers to entry which have resulted from this shortage. Wildlife, whilst still a small direct contributor to GDP, is another sector with important multiplier effects and foreign-currency earning potential.

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[8] For a detailed analysis of the tourism industry in Zimbabwe readers are referred to Kaufman, 1992.

Table 4
THE NATIONAL ECONOMY

Indicator	1975	80	82	84	85	86	87	88	89	90
Pop. million	6.15	7.09	7.51	7.95	8.18	8.41	8.64	8.88	9.02	9.26
Pop growth %	3.02	2.99	2.87	2.85	2.89	2.81	2.74	2.70	2.68	np
Employed m.	1.05	101	1.05	1.03	np	np	np	np	np	np
Real growth GNP/cap	np	7.8	-0.2	-4.7	4.0	-0.2	-4.0	4.2	1.7	np
GDP $million	1990	3440	5200	6400	7020	8290	8930	10640	11270	13030
GAP* $million	200	450	670	750	1040	1120	950	1310	1390	1690
Exports $mil.	np	787	807	1271	1545	1700	1892	np	np	np
Agric. Exp. $m	np	294	388	590	788	901	934	np	np	np
US$1 = Z$	1.60	1.56	1.09	0.67	0.61	0.60	0.60	0.51	0.44	0.38
T of trade	118	100	108	120	123	120	103	np	np	np

Source: Zim. Govt. Central Statistical Office (CSO), Harare.

The Zimbabwean economy has shown disappointing growth since independence and by 1990 had a long-term external debt of some Z$12 billion. There have been some significant advances in the provision of social services with decreases in infant mortality and increases in education and access to physicians since independence. However, these achievements resulted in significant increases in government expenditure together with growing consumer food subsidies, significant expansion of the public service. The economy is highly regulated and biased towards large-scale production and barriers to entry abound which together with direct and indirect subsidies to the industrial sector and the large proportion of GDP spent on government consumption expenditure have resulted in very disappointing economic performance since independence with GDP per capita declining 7%. Access to foreign currency is considered to be the major constraint to growth.

Only 37% of the country receives more than the 700mm annual average considered necessary for semi-intensive farming, and in most parts less than a third of this area is actually arable. In the intensive farming systems followed in Zimbabwe, the natural growing season is confined to the rainy months and both the total rainfall and its distribution during the season are the overriding limiting factors in agricultural production. Average annual rainfall varies from below 300mm in the low-lying areas of the country to over 1000mm on the central watershed. Limited areas in the Eastern Border mountains receive over 1500mm annually.

Zimbabwe is broadly categorised into 5 natural regions, dominated by rainfall. Region 1 has the highest rainfall but because of topography, production is dominated by exotic timber plantations, tea, coffee and horticulture. Region 2 normally has more than 700 mm and is the main crop-growing region in the country. Regions 3, 4 and 5 are increasingly arid and although cultivated in communal areas, are predominantly only suited to extensive livestock production. The annual variations are large and the reliability of monthly rainfall is much lower than the seasonal total and decreases in general from north to south.

The indigenous vegetation is savanna grassland along the central plateau with wooded savanna throughout most of the rest of the country with some montane forest in the Eastern Boarder districts. In general the topography, soils and climate of Zimbabwe are not favourable for intensive agricultural production. More than seventy-five percent of the country is subject to conditions that make dryland crop production a risky venture.

Little is known of the early history of Zimbabwe, but the Zimbabwe Ruins indicate the remnants of a cohesive, organised and relatively advanced society such that a surplus was available to maintain the workmen who constructed the buildings and to feed a royal court practising an elaborate ritual. Archeological evidence indicates that sometime prior to 10 AD there was trade with the Orient. The first known Europeans to penetrate the area were the Portuguese in the early 16th century, who described the kingdom of Monomatapa as a fairly well developed governmental system where gold, fruit, cattle and elephants were plentiful. The Monomatapa kingdom subsequently waned and the cohesion and social organisation of the earlier era disintegrated.

The early white visitors and settlers came in search of ivory and gold. Although over 6 million hectares had been alienated to whites by 1899, most of this area was owned by speculative companies and was not farmed. When by 1903, it became obvious that minerals were not abundant and elephant populations had been severely depeleted, many settlers turned to farming and increasingly alienated the peasants from crop land close to markets. The Land Apportionment Act of 1929 (implemented in 1931) officially segregated the country and remained in effect, with some amendments, until it was replaced by the Land Tenure Act of 1969. This act designated 41,3% Tribal Trust Land (communally owned land) and 3,8% African Purchase Area (privately owned land). Forty percent of the land was held exclusively for purchase by whites. This dualism was further accentuated by discriminatory marketing and pricing policies and by a development strategy which viewed the peasant farming areas reservoirs to house the population not required for the formal economy, expecting them neither to draw from, nor to contribute directly to, the formal economy.

Since Independence in 1980 there are no longer **de jure** racial divisions but land-size categories remain effectively unchanged with permission to sub-divide almost impossible to obtain. Ownership of the land in the former Tribal Trust Lands is officially vested in the President but is farmed along traditional communal tenure arrangements with good security over homestead and arable land but with the grazing and woodland areas effectively open access. Land allocation remains a source of conflict within communal areas with local government, political parties and tribal authorities all having varying degrees of control. Current land classification and natural regions are outlined below. The commercial sector is made up predominantly of large-scale farms

from the former white farming area and a few smaller-scale freehold farmers from former African Purchase areas. The communal sector is that which is communally farmed and includes resettlement schemes where tenure is not freehold but retained by the state.

Table 5
LAND DISTRIBUTION BY NATURAL REGION

Natural Region	Ave. Annual rainfall mm	Commercial L-S + SSc %	Communal + resettlement	DNPWM	Forestry %	Total Km_2	Total %
I	>1000	64	19	7	10	7 050	1.8
II	750-1000	77	21	0.5	0.5	58 750	15.0
III	650-1000	52	39	7	2	72 900	18.6
IV	450-650	29	50	17	4	147 700	37.8
V	<450	36	46	17	1	104 500	26.7
TOTAL		40	45	13	2	390 900	100

Almost 90% of the Parks and Wildlife Estate is situated in areas unsuitable for cropping as is 75% of communally-owned land. The increasing population pressure and ever increasing area under cultivation on very marginal lands is a serious threat to widespread deforestation, erosion and desertification.
The government is involved in an active land resettlement programme and has declared its intention of taking over 50% of the large-scale sector for reallocation to smallholders. Tenure arrangements in the resettled areas are very uncertain with settlers having permits to reside and cultivate for as long as they farm it "correctly" and the lack of tenure may have serious implications for environmental integrity. The uncertainty of the resettlement programme has also created insecurity on large-scale farms which could also affect the environment. For most of the population, however, there are high expectations that old wrongs will be redressed soon. Given the limited capacity for government to implement the programme expeditiously a serious crisis of excpectations may result in attempts to settle people on all available land and this could have serious consequences for communal areas involved in wildlife where population densities are relatively low. There is, however, a reluctance to be settled in the arid areas and it is essential for Zimbabwe to develop production systems which can significantly increase the value of the output for these marginal areas without degrading the environment. At the same time these systems must ensure that maximum possible benefit is retained by the local population.

Despite a highly dualistic agricultural structure inherited at endependence with over 90% of all marketed agricultural output coming from 6000 large-scale white farmers, Zimbabwe has become reknowned for the success of its peasant agriculture since independence with a dramatic increase in maize and cotton marketed by the communal sector. However it is only the wealthier peasant farmers in the higher rainfall areas who have contributed to these increases. Although only 8% of the communal lands are in NR2 they

sold 85% of the officially marketed communal sector maize in 1987 (Muir & Takavarasha, 1989).

Zimbabwe's population is growing at 2-3% per annum and given the extreme poverty of communities in the marginal lands these population pressures could be translated into demands for access to resources in neighbouring parks. The overgrazing and the cultivation of poor land have led to widespread erosion, depletion of the forest and grass cover so that the neighbouring parks (even where these are on very poor agricultural land) appear to have resources desired to support the increasing population. There is a significant negative correlation between wildlife density and human population density, similar to that reported for elephants in seven communal areas in Zimbabwe by Parker and Graham, 1989.

Political support for wildlife is negligible and the wildlife sector still receives small allocations from central government. However this is changing with the increased awareness of the potential role of wildlife in generating growth through foreign currency generation and the strong backward linkages which exist in Zimbabwe for the tourist industry. However, the wildlife sector, despite the advances with CAMPFIRE, is still seen as white dominated and carries much resentment. Black entreprenuers need to be given exposure and opportunities to participate in this growth industry.

2.2 An Economic Analysis of Wildlife Utilisation

2.2.1 The Large-scale Commercial Ranching Sector

A survey of a random sample of cattle and wildlife ranches in Zimbabwe has recently been carried out in this sector to determine the comparative economics of cattle and wildlife ranching (Jansen, Bond and Child, 1992). All previous studies have been more or less incomplete with most surveys in South Africa concentrating on the percentage of gross farm income from game (Behr and Groenewald, 1990; Benson, 1986 and Colvin, 1984). Other research has used case studies to carry out gross margin analysis or consider the comparative economics of specific doemstic livestock versus game or single alternative wildlife commodities (e.g. springbuck or impala) and include Child, 1988; Berry, 1986; McDowell, Sisler et al, 1983, Conroy and Gaigher, 1982, Collinson,1979; Johnstone, 1973 and Dassman and Mossman,1960. A study of land use options for 71 000 ha of rangeland in Bophuthatswana estimated the NPV for wildlife was R24 million compared to R2 million for cattle and the wildlife option created 1214 jobs compared to 50 for ranching - the main factor being the proximitiy to the Vaal triangle and high domestic demand (Anderson, Colinson and Boonzaaier, 1991 in Cumming and Bond, 1991).

In an analysis of game ranching in Zimbabwe, Child, B. (1988) showed that in northern Matabeleland there were accumulated losses from cattle ranching and that the environment had suffered. It

appears that experiments with wildlife meat production were more profitable than beef production but that it was the introduction of safari hunting which dramatically increased both profitability and environmental conservation. Before incorporation into the Matetsi safari area in the early 1970s, Rosslyn ranch lost money for 8 out of 10 years from cattle and made money in 6 out of 10 years from wildlife with considerable increases from the introduction of safari hunting. Safari hunting doubled the income from the ranch although there was a 50% reduction in the mass of wild animals harvested. In 1984 in the Matetsi farming area, 35% was used for legitimate sustainable wildlife operations and the remainder for beef. An analysis showed that the gross margins of the cattle operations were much lower than for wildlife which were US$5 per hectare (Child, B., 1988).

Table 6
A COMPARISON OF PROFITS FROM CATTLE AND WILDLIFE IN 8 AREAS IN ZIMBABWE
(All prices in Zimbabwe cents - 1984 = 1.00)

Area	Wildlife	Cattle	Wildlife / cattle
Buffalo Range			1.2-1.4
Financial	24-27c/kg GI 0-3c/kg NM	20c/kg GI 2c/kg NM	0-1.5
best	15c/kg NM	15c/kg NM	1.0
Economic	9-11c/kg NM	-4c/kg NM	>>
best	19-35c/kg NM	4c/kg NM	>>
Environ. costs	490-621c/ha NM	-800c/ha NM	>> + >>
Iwaba Ranch	17-22.4c/kg NM	7-10c/kg NM	2+
best	54c/kg NM		5+
Midlands	20c/kg GI 17c/kg GM	20c/kg GI 7c/kg GM	1.0 2.4
Lowveld	37c/kg GI 32c/kg GM	20c/kg GI 7c/kg GI	1.9 4.6
Nuanetsi	2.6c/kg NM	1.7c/kg NM	1.2
best	6.3c/kg NM	9.1c/kg NM	0.69
Rosslyn	529/ha NM	unprofitable	>>
best	960/ha NM		>>
Nuanetsi ICA	613-1159/ha GI	182/ha GI (118/ha GM)	3.4-6.4
Nuanetsi Safari Area	514-1156/ha NM		

Note GI (gross income). GM (gross margin). NM (net margin) compared per hectare (ha) or per unit livemass (kgs)
>> means 'much greater than'
Source: Child, 1988.

Child also carried out a detailed time-series analysis of cattle and wildlife on Buffalo Range in the South-eastern lowveld. The analysis showed that the cattle section gross profits increased during the 1960s but fell rapidly from a peak of Z$350 000 in 1975 to losses in 1984. The analysis showed further, that the falling

profits were a result of declining herd productivity with calving rates dropping from 80%-40% and livemass gains falling off dramatically even before the major drought. A simple model was used to show that the declining herd productivity was primarily a result of veld degradation caused by over-stocking.

Child notes that cattle production on semi-arid rangelands is marginal and that once a cycle of degradation begins it is extremely difficult to break out of. The wildlife populations however continued to grow and the range was less degraded in that sector. In 1973 Taylor carried out transects on the ranch and the results between the cattle and wildlife sections were indeterminate (Taylor in Child, 1988). These transects were repeated in 1985 and this time environmental conditions in the game section were significantly better than in the cattle section. Child concluded that despite the heavy implicit subsidies for beef which favoured the cattle section in most years and the over-valued exchange rates which greatly disadvantaged wildlife, wildlife offered the most lucrative and sustainable option for Buffalo Range (Child, 1988, pp523).

Jansen, Bond and Child (1992)[9] carried out a survey of 89 cattle, wildlife and combined cattle/wildlife ranches in 1989/90 in the more arid Natural Regions 4 and 5 in order to determine returns to investment and to consider the comparative advantage of ranching cattle only, wildlife only and combined cattle and wildlife ranches. Their analysis indicated that whilst in general wildlife was more economic than cattle the results differed depending on the area and that there were situations where either, neither or both were appropriate land use systems.

Only 4 out of the 77 ranches producing beef had a greater than 10% return on investment. The speculative return on holding land was excluded from all analyses. Beef production appeared to be more viable for those ranchers who were able to sell their production through private butcheries. Cattle only enterprises had an average 1.8% return on investment and the return to cattle on ranches combining cattle and wildlife, was 2.6%. The weighted average return of cattle enterprises was Z$2.78 per ha. (with land selling for upwards of Z$120/ha). Only three cattle enterprises had returns greater than Z$25/ha. 39% of the cattle enterprises had a negative adjusted net revenue and to continue in operation most of the ranches were destocking or borrowing.

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[9] The full results of this survey are in press. The ranches were selected from cluster samples taken from large-scale ranches based in Natural Regions 4 and 5 so as to obtain a representative sample of cattle only ranches, wildlife only ranches and combined ranches in each area. A Summary of the Ranch Characteristics is given in the Appendix in Table A3.

The wildlife enterprises showed an average return on investment of 10.5%. Over half of the wildlife enterprises had a greater than 10% return on investment and only 4 had negative adjusted net revenue (compared to 30 cattle enterprises). Wildlife only ranches were the most financially viable with average returns on investment of 10.5% compared with 3.6% from both enterprises on combined ranches and 1.8% on cattle only ranches. (See Tables A4 and A5 in the Appendix which give details of returns on investment to the farmers).

An economic analysis of these returns was carried out using estimated opportunity cost prices to incorporate the effects of market prices not reflecting true social values with respect to the price of cattle, the exchange rate, price of land, the interest rate and the cost of degradation from overstocking. The assumptions used for this analysis were that the exchange rate is overvalued by 50% and that government is taxing the beef price by 25% (Jansen and Muir, 1991); the land price is Z$25 per acre (a conservative estimate not including speculative value); a 10% interest rate represents opportunity cost and $0.11/kg is charged for overstocking (calculated from Child, 1988).

This analysis showed both cattle and wildlife to be more economically than financially profitable with the average rate of return on investment for wildlife enterprises at 21.5% and 13.1% on cattle. Although wildlife was also more economically profitable than cattle; the increase over financial returns is greater for cattle than wildlife because of the beef price adjustment necessary to reflect the inefficiencies of the state marketing organisation which requires considerably more than the fifth quarter to cover costs. Tables A6 and A7 in the Appendix give the detailed economic results.

A Policy Analysis Matrix was used to determine comparative advantage. It shows that cattle ranches in the arid areas of Zimbabwe, with a DRC of 1.17 on average, are not efficient at converting domestic factors even when beef prices are adjusted upwards by 25% and adjustments are made for the overvalued local currency. Only in the Masvingo region does cattle have a comparative advantage with a DRC of 0.78 using the base run assumptions given above.

On average the DRC for wildlife enterprises was 0.99 indicating that under the base run assumptions, wildlife ranching does have a comparative advantage but as the DRC is so close to 1 this comparative advantage is obviously very sensitive to the assumptions. As with cattle, the results varied considerably between areas and amongst individual ranching operations.

Table 7

RELATIVE ECONOMIC EFFICIENCY OF CATTLE AND WILDLIFE ON EXTENSIVE RANCHES
(Average DRC by area and enterprise type, Base run)[1]

	Cattle Enterprises on		All cattle	Wildlife Enterprises on		All Wildlife wildlife
	Cattle ranches	Combined ranches		Wildlife ranches	Combined ranches	
Natural Region IV						
Hwange	neg	neg	neg	1.01	0.79	0.96
Bulawayo	1.19	1.08	1.12	--	0.84	0.84
Masvingo	0.78	--	0.78	--	--	
Sub-total	1.06	1.16	1.13	1.01	0.82	0.91
Natural Region V						
West Nicholson	1.24	1.16	1.18	1.17	0.74	0.80
Mwenezi	1.29	0.90	1.10	0.63	1.11	0.81
Chiredzi	1.74	1.27	1.39	1.15	1.97	1.55
Sub-total	1.37	1.19	1.25	0.99	1.15	1.09
Average all areas (IV + V)	1.18	1.16	1.17	1.00	0.98	0.99

Notes:
1. A positive DRC less than 1 indicates that an activity is economically efficient or profitable
2. These are the results for cattle enterprises on ranches that have both cattle and wildlife enterprises
3. These are the results for wildlife enterprises on ranches that have both cattle and wildlife enterprises.

Source: Jansen, Bond and Child (1992)

In Hwange area, wildlife has a clear advantage over cattle although the wildlife enterprises on combined ranches had the greatest comparative advantage with a DRC of .79. Wildlife was also the most efficient of the enterprises in Bulawayo and West Nicholson and again appeared more efficient on ranches with cattle - even though the cattle enterprises on these ranches had no advantage. The lower DRCs for wildlife enterprises on combined ranches may be because some of the capital costs are shared with the cattle enterprises. In Mwenezi, the situation differed because here cattle enteprises had a DRC of 0.90 on combined ranches but wildlife had a DRC of 1.11 on these combined ranches - again it may be something to do with the allocation of capital costs because wildlife only had the greatest comparative advantage with a DRC of 0.63. In Masvingo there were no wildlife operations so it was not possible to comment on their comparative advantage but the cattle enterprises were economically efficient. This was partially because some of the cattle ranchers supplied private butcheries and received significantly higher prices than those selling to CSC. In Chiredzi neither cattle nor wildlife enterprises, whether operated seperately or on combined ranches, were socially efficient. The results are more fully reported in the Appendix in Tables A8 and A9.

To some extent the results of the survey also reflect the efficiency of the individual ranches and should only be used as a

static indicator of actual comparative advantage and not of potential economic efficiency. When disaggregating it is possible to see that Chiredzi may have a comparative advantage if it was possible for it to market more aggressively and achieve prices closer to those achieved in Hwange. If, however, these results reflect full potential and Chiredzi cannot achieve higher prices because of its location, then neither cattle nor wildlife are viable forms of land use in Chiredzi.

The fact that cattle had DRCs consistently higher than 1 in most districts (even when producer prices are increased 25% and also adjusted for currency overvaluation) does indicate that the economics of cattle ranching should be questioned. A comprehensive study of the economics of using Natural Regions 4 and 5 for extensive, large-scale cattle ranching should be undertaken. Further ranch surveys are important to confirm and extend these preliminary results and a time series analysis of select case studies would be most useful.

Some simple regressions were run of the key performance indicators and it was found that on cattle enterprises costs per ha. and overstocking were significant at the 95% level of confidence. Average cattle sales price, turnover rate, calving rate and rainfall were also factors distinguishing efficient from inefficient operations. It was more difficult to identify key success factors for wildlife operations because of their heterogeneity but it appears that those with higher than average revenue per hectare were more successful and there was some evidence to indicate the importance of agressive marketing and diversification of wildlife revenue sources in successful wildlife enterprises.

With respect to employment, wildlife enterprises are less wage-labour intensive and require more skilled manpower than cattle enterprises making cattle the preferred option from an employment perspective. This resulted from the heavy concentration of the wildlife enterprises on safari hunting, tourism ventures have much greater employment capacity and are becoming an increasingly important component of the wildlife industry. On the other hand net foreign currency earnings are greater for wildlife than for cattle.

Beef is the preferred protein source throughout most of Zimbabwe (particularly for the politically vociferous public servants) and its promotion has been justified by food self-sufficiency and political criteria. Since the 1930s the beef industry has received significant support with the beef marketing parastatal receiving subsidies of some Z$40 million per annum since 1980. Prior to the exportation of beef to the EEC, the producer price was effectively subsidised although after 1985 it was consumers who were protected by government price policies (Jansen and Muir, 1991). These subsidies have been highly regressive with employed urban consumers

and large-scale farmers the main beneficiaries.

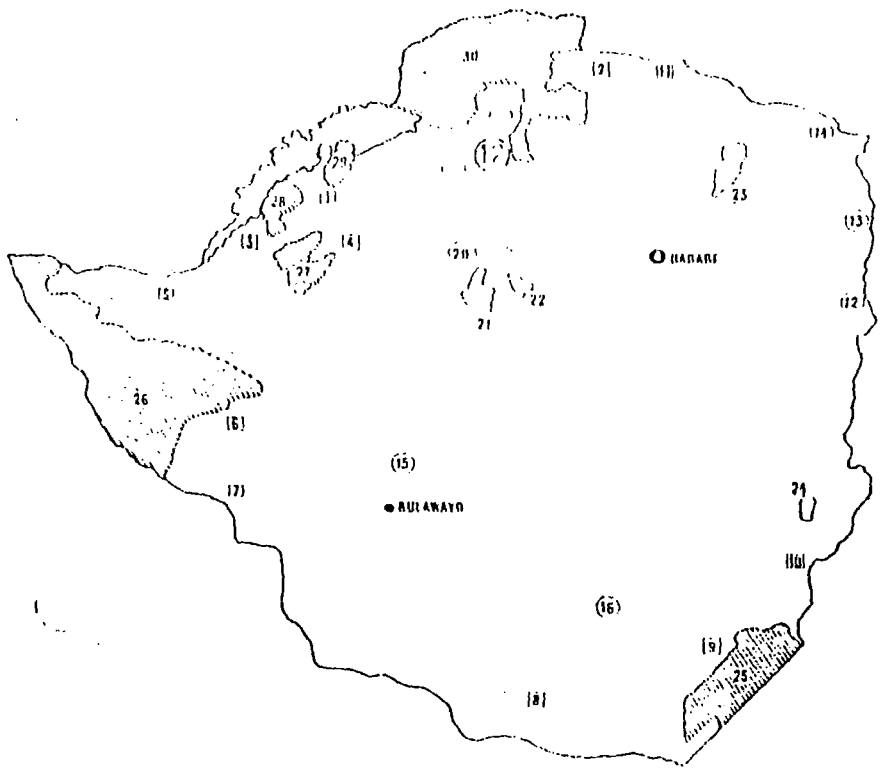
In many fora it has been hypothesised that wildlife is more sustainable than cattle because it is better adapted to the environment. This issue is discussed in more detail in section 4 but available evidence although limited and indeterminate indicates that the relative environmental impacts are less due to the unique effects of particular herbivores than to the degree of pressure - the stocking rate. It was calculated from the survey that economically wildlife produced Z$266/LSU whilst cattle produced Z$176/LSU thus implying that wildlife has an advantage for sustainable production since it can produce higher revenues with lower stocking rates.

2.2.2 The Communally-owned Small-scale Farm Sector

Between January 1989 and April 1991, twelve districts received "appropriate authority" over their wildlife, although in many districts not all wards have a wildlife resource. Figure 1 indicates the rough location of each district and shows that they are located in areas of low rainfall, suited to livestock and wildlife use (Natural Regions 4 and 5). It also shows that some are adjacent to protected areas, including national parks, safari areas and some forestry areas.

(21) Components of the Parks and Wild Life Estate that have potential as nuclei for community wildlife projects

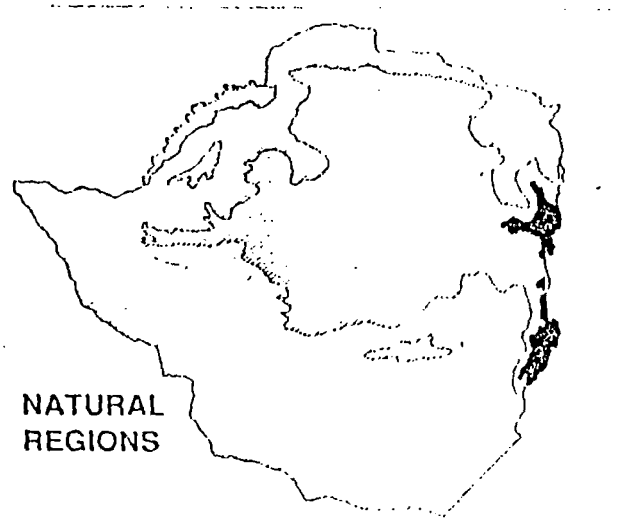
(22–24) Major Zimbabwean protected areas, including national parks, safari areas and some forestry areas

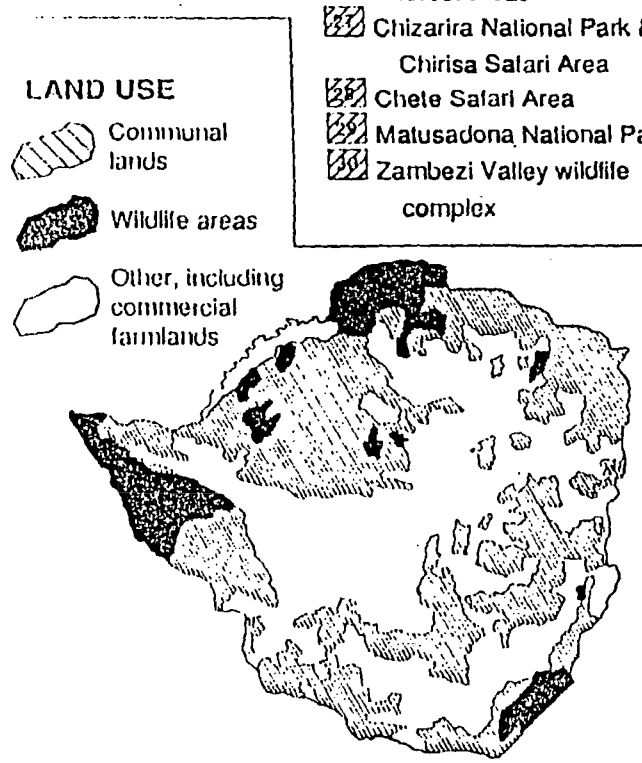


[3] Binga
[4] Gokwe
[5] Hwange
[6] Tsholotsho
[7] Bulalima Mangwe
[8] Beitbridge
[9] Gaza Khomanani
[10] Gazaland
[11] Mzarabani
(12) Hurungwe
(12) Gairezi River
(13) Rwenya
(14) Nyatana
(15) Kenilworth
(16) Maranda
(17) Mukwichi
(18) Poti III
(19) Hurungwe
(20) Sanyati

[21] Hartley "A" Safari Area
[22] Umfuli Recreational Area
[23] Umfurudzi Safari Area
[24] Chipinge Safari Area

[22] Gonarezhou National Park
[23] Hwange National Park and neighbouring safari and forest areas
[24] Chizarira National Park & Chirisa Safari Area
[28] Chete Safari Area
[29] Matusadona National Park
[30] Zambezi Valley wildlife complex





Source Jansen, 1992b

All these 12 districts are engaged in obtaining revenue from wildlife utilization (i.e entering into contracts with safari hunting companies and tour operators), are attempting to manage their wildlife (i.e. protecting it and setting quotas for its exploitation) and, finally, distributing benefits to the participating wards and "producer communities". Administratively communal areas are divided into District Councils which have legal status and are serviced by the Ministry of Local Government and Housing. These District Councils are then further sub-divided into Wards with WADCOs (Ward Development Committees) comprising a number of villages with Vidcos (Village Development Committees). The WADCOs and VIDCOs are recent political institutions and are more effective in some areas than others.

By 1992 CAMPFIRE had grown to encompass both a large area from which to market and manage wildlife and a large population among which the benefits of the wildlife are to be shared. The scope of the programme was clearly underestimated at its inception and had already by 1991 far exceeded the administrative and technical resources available to implement it in these twelve districts located throughout the country (see Fig. 1). Safari hunting dominates the revenue earned by Campfire projects. Most districts put their hunting quotas out to competitive tender and then sign agreements for hunting rights in the district to those operators with the highest tender offers. These safari operators then market the hunting internationally. Campfire revenue is strongly dependent on demand for international safari hunting accounting for over 85% of the revenue in most CAMPFIRE areas. Moreover, the bulk of the revenue is derived from elephant (over 70% of revenue in some ares). Any ban imports of elephant trophies into the major client regions -- Europe and the United States - would have a very negative impact on community wildlife schemes. Most Districts opt for most if not all their trophy animals to be sold for safari hunting. Quotas used for culling are normally restricted to those animals which have a limited safari market e.g. impala.

The communal areas play an important role in the safari hunting industry and complement the plains game hunting sold on most commercial ranches. 52% of all elephant and 39% of all buffalo trophies came from communal areas in 1990 (Bond, 1992).

2.2.2.1 Campfire Revenue Generation and Distribution

The question of the economics of wildlife is more complex in the communal sector than in the private sector because whilst in the former one considers the comparative economics of wildlife from the perspective of the nation (economic analysis) and the farmer (financial analysis); with the communal sector there is the householder, the village, the ward and the district all with varying perspectives on the financial viability of wildlife projects, in addition to social or economic viability from the national and international perspective.

Although Campfire programmes are administered by District Councils there are usually only a few wards which have the wildlife resources to be actively involved in wildlife projects. It would be desirable to devolve authority to ward or even village levels but this is not possible because the District Council is the lowest level of government with legal authority as opposed to advisory powers (Peterson, 1992). In addition the fugitive nature of the resource and the large areas required for safari hunting would make co-operation between neighbouring producer units important.

The total gross income from wildlife for Campfire Districts in 1991 was Z$3 million. The approximately Z$10 million generated by wildlife in Nyaminyami district (see Table 13) contrasts favorably with marketed revenue generated by any other commodities from semi-arid communal areas. All communal areas in Regions 4 and 5 contributing only an estimated Z$10-15 million in 1990 to marketed output (represented by sales to marketing boards). However, subsistence, not marketed agricultural production, dominates in these areas, is considerable and is probably seriously underestimated in official statistics.

The DNPWLM has issued "Campfire Guidelines" which recommend that no more than 15 percent of revenue be allocated to the district council in the form of a levy, and no more than 35 percent be spent on management costs, so that at least 50 percent of revenue can be passed on to the community in the form of cash or project benefits. The percentage distribution (Table 8) shows that these guidelines were not met in four of the nine districts for which data is available. In Nyaminyami and Guruve, community benefits were distributed as Ward dividends but represented only one-third of revenue and in Binga only 40 percent. In Hurungwe none of the wildlife revenue was distributed to the producer communities: the council spent all of it on a lorry. In contrast, Ward dividends represented considerably more than 50% of revenue in four districts: Tsholotsho, Bulamima Mangwe, Beitbridge and Gazaland.

Not all of the earned revenue is available for the provision of benefits--either in the form of cash or projects--to the communities. There are costs incurred in managing the wildlife, which are detailed in the Annex tables presenting the breakdown of revenue, costs and benefit distributions for each district. The larger programmes, such as Nyaminyami and Guruve, have wildlife managers who receive salaries and are provided with vehicles and housing and many districts choose to employ game guards whose main tasks are anti-poaching and problem animal control [PAC].

Table 8 CAMPFIRE REVENUES 1991

District/ (No. Campfire Wards)	Area (HA) *	Pop. ('000)	No. of ouseholds	-1991 Gross Earned Revenue- of which: TOTAL (Z$)	Hunting (Z$)	Tourism (Z$)	--1991 Revenue Allocation-- of which: Dist. C. (Z$)	W. Mgmt (Z$)	Wards (Z$)	--1991 Revenue Allocation Percentage Distribution Dist. C. (%)	W. Mgmt (%)	Wards (%)
1. Nyaminyami (12)	363,000	40,000	5,000	573,036	462,765	36,000	26,817	342,219	204,000	5%	60%	35%
2. Guruve (8)	415,700	24,600	3,100	699,736	690,580		55,594	426,411	217,731	8%	61%	31%
3. Binga (11)		37,000	4,900	237,355	199,658	17,772	40,500	102,189	94,666	17%	43%	40%
4. Gokwe (9)	225,734	66,480	8,300	429,255	214,303		20,477	182,319 ***	226,459	5%	42%	53%
5. Hwange (7)		28,500	3,800	63,187	60,082	0	NA	NA	NA	NA	NA	NA
6. Tsholotsho (7)		30,000	3,700	339,940	339,940		50,991	0	288,949	15%	0%	85%
7. Bulalima Mangwe (7)		30,000	4,000	218,150	218,150		43,630	30,544	143,976	20%	14%	66%
8. Beitbridge (3)		40,000	5,000	102,000	102,000		900	6,300	94,800	1%	6%	93%
9. Gaza Khomanani ( )				292,000	292,000		NA	NA	NA	NA	NA	NA
10. Gazaland (2)	52,132			70,800	70,800		10,320	5,740	54,740	15%	8%	77%
11. Muzarabani (10)	277,400	24,000	3,000	18,236	0	4,021	NA	NA	NA	NA	NA	NA
12. Hurungwe (6)	**	53,245	6,660	171,287	171,287		171,287	0	0	100%	0%	0%
TOTAL				$3,214,982	$2,821,565	$57,793						

Source: Jansen, 1992.

Notes:

* This is the area of the wards that are participating in the Campfire program. Except for Nyaminyami, this is not all the wards in the district.

** At least 50% of revenue comes from adjacent Chewore Safari Ara. Continued benefits to Hurungwe depend on maintenance of agreement with DNPWLM.

*** Includes $122,535 of capital costs for electric fencing (Rio Tinto matching contribution).

Capital costs, principally vehicles and electric fencing, have been provided by donors in several districts, and thus far earned Campfire revenue has not had to be used for capital costs[10]. There is a danger, however, that the recurrent, maintenance and eventual replacement costs of the donated capital assets may lead to increased management costs and thus result in a smaller percentage of the revenue being available for community benefits. Especially as the relevance of much of this equipment to generating wildlife revenues is in question, with much being used to support other Council activities.

The budget of Nyaminyami Wildlife Management Trust [NWMT], shows a build-up of a "wildlife management bureaucracy" with the danger that the Campfire Programme will simply replace the DNPWLM in policing the wildlife, with the cost of this policing paid out of the wildlife revenue. Recurrent costs have increased from $66,488 in 1989 $306,824 in 1991 (360% in two years) whereas revenue increased by 79% and if the cost of living with wildlife remains higher than the benefits received in the producer communities then the policing costs will continue to escalate as locals continue to encourage poaching and inmigration. The NWMT has capital assets (donated by Zimbabwe Trust) of nearly $800,000. In 1991 it withheld $40,000 of its net revenue of $266,000 (15 percent) for a depreciation reserve further reducing the revenue available for distribution when the relevance and efficacy of the programmes which require this capital equipment to sustain wildlife populations still to be proved.[11]

In the districts where the CAMPFIRE programme has been implemented more recently the proportion of wildlife revenue distributed to the wards is considerably higher and there this may be because the "wildlife management establishment" has not yet had an opportunity to be created. Alternatively, perhaps districts who are only just now beginning to implement CAMPFIRE (and the NGO collaborative group who assist them), are learning from the mistakes of the "pioneer" districts (Nyaminyami and Guruve) and will try to keep wildlife management costs within the 35 percent guideline. Mechanisms could be established which would give full control over utilisation and poaching to the concerned villages, giving them hunting access to those animals where there is little conflict with the more lucrative safari hunting and requiring them to pay royalties to the local village community to avoid overexploitation. The management costs in wildlife protection would be significantly reduced and the villagers would have greater incentives to report

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[10] Gokwe district is the exception. In 1991, it used Z$122,500 of its revenue for its share in an electric fence for which Rio Tinto provided a matching contribution.

[11] Tables giving details of revenue and expenditure are available in Jansen, 1992.

Table 9 CAMPFIRE WARD REVENUE DISTRIBUTION AND PERFORMANCE

District/ Campfire Wards	No. of Hshlds	Ward Benefits: Revenue/ ward (Z$)	Revenue/ hshld (Z$)	of which:. Cash (Z$)	Projects (Z$)	Progress/Problems to Date	Performance Ratings: Ward Level Partic.	Ward Level Benefits
1. NYAMINYAMI [Each ward regardless of wildlife contribution]	5,000	$204,000 $17,000	$41	$0	$204,000	All wards treated equally, most decisions made at district level; much of ward allocations remain unspent	Low	Some
2. GURUVE		$217,731				Only 3 wards have sizeable wildlife resources and these have active ward wildlife committees. But no expertise to implement projects and funds are largely unspent. Poaching on the increase as is immigration.	Fair	Varies by ward
Kanyurira	140	$89,293	$638	$56,000	$33,293			
Chisunga	499	$76,384	$153	$74,850	$1,534			
Chapoto		$44,395			$44,385			
Chitsungo		$1,356			$1,356			
Neshangwe		$4,937			$4,937			
Chiriwo		$1,366			$1,366			
Matsiwo A		$0			$0			
Matsiwo B		$0			$0			
3. BINGA [Each ward regardless of wildlife contribution]		$94,666 $8,606			$8,606	As for Nyaminyami	Low	Some
4. GOKWE	8,300	$226,459	$27					
Sai/Sengwa	8,310	$16,000	$2	$0	$16,000	For these wards, 1991 revenue may be one-off, since came from Sengwa Research Area cull.	Low	Very limited in future.
Jiri	1,100	$2,000	$2	$0	$2,000			
Sai/Mangidi	1,470	$24,000	$16	$0	$24,000			
Masuka & Huchu	750	$36,000	$48	$0	$36,000			
Nemangwe V	1,120	$6,000	$5	$0	$6,000	----------		
Madzivazvido	850	$37,365	$44	$0	$37,365	Each ward was allotted $19365 from the hunting concession in these wards.	Good	Good
Nenyunka	620	$31,365	$51	$0	$31,365		Good	Good
Simchembu	660	$54,365	$82	$0	$54,365		Improving	Good
Chireya I	1,100	$31,365	$29	$0	$31,365		Poor	Good
5. HWANGE	3,800	$63,187	$17		$63,187	None of the dividends have been allocated to date.	Improving	0
Sidinda					$0			
Nekatambe					$0			
Kachechete					$0			
Sidobe					$0			
Sinangani					$0			
Nemananga					$0			
Nekabandama					$0			

Table 9 CAMPFIRE WARD REVENUE DISTRIBUTION AND PERFORMANCE cont.

6. TSHOLOTSHO	3,700	$288,949	$78	$0	$288,949			
Ward 1		$29,025		$0	$29,025			
Ward 2		$16,875		$0	$16,875			
Ward 3		$57,500		$0	$57,500			
Ward 4		$16,875		$0	$16,875			
Ward 7		$39,150		$0	$39,150			
Ward 8		$12,150		$0	$12,150			
Ward 10		$0		$0	$0			
7. BULALIMA MANGWE	4,000	$143,979	$36		$143,979			
[Each ward regardless of wildlife contribution]		$20,568			$20,568			
8. BEITBRIDGE	5,000	$94,800	$19		$94,800		Very good	Good
Chipise								
Chikwarakwara vidco								
Chipise Vidco								
Malabe Vidco								
Maramani								
Masera								
9. GAZA KHOMANANI (Chiredzi) 17 wards		$292,000			$292,000			
10. GAZALAND (Chipinge)								
Mahenye	391	$54,740	$140	$54,740			Very Good	Good
Mutandahwe								
11. MUZARABANI (10 wards)	3,000							
12. HURUNGWE		$171,287			$171,287	All revenue spent on Council lorry.	Poor but apparently improving	0

Source: Jansen, 1992.

international poachers. It is widely accepted that self-policing is very much less expensive and more effective than centralised regulation. Murombedzi (1992) came seperately to the conclusion that the community needs to have more complete involvement in both the rights to and obligations of the resource and that developing institutions which would allow some traditional hunting would be a good beginning.

There is a tendency for DNPWLM to withdraw its anti-poaching and PAC (problem animal control) activities in districts that have been granted appropriate authority, even though these districts have not yet acquired the technical, administrative or financial capability to replace DNPWLM's services. A longer transition period may be useful to enable the communities to establish effective institutions which are not too expensive to manage and control its wildlife.

The distribution of revenue to wards and households is given in Table 9. In Nyaminyami householders have received no direct cash benefits from CAMPFIRE although they were able to purchase cheap impala meat from culls. Each ward received dividends which they were supposed to utilise for local projects, this dividend represented the equivalent of $38 per household in 1991 but as many of the wards lack implementation skills and some of the project money is still unspent. Thus although the District received Z$573036, the householders received very little for all the costs incurred from living with wildlife. In 1989 and 1990, the project paid damages to households of Z$26 680 and Z$42405 respectively (Cumming and Bond, 1991). The scheme was discontinued because it was considered too expensive - however it represented only 8% and 11% of revenue generated, and given the results of surveys which show lossess attributable to wildlife as considerable (Cumming and Bond, 1991), the damage is probably under rather than overestimated. There was some evidence that householders would deliberately encourage damage to obtain compensation and the administration of a damage compensation scheme was considered too complex. The villagers view this as simply a means to reduce their benefits from wildlife and retain revenues at the centre.

Bulalima Mangwe and Binga used the Nyaminyami equal distribution model but in Guruve, Gokwe and Tsholotsho the dividends were tied to the location of the trophies which had been sold. In addition in some of the wards the householders were consulted on whether the revenue should be distributed for households or projects. In Beitbridge and Gazaland (Chipinge) only the single Ward with wildlife received revenue and the householders decided on the proportion to be household dividend and that for projects. They were actively involved in decisions and actually received all the revenues due then personally making the contributions for projects, district and management levies.

2.2.2.2 Benefit Cost Analysis of Wildlife Utilisation in Communal areas

Land use planning in most of the communal lands of Zimbabwe to date have focused on rainfed and irrigated cropping projects, and on livestock or smallstock development projects. Very little analysis has been done of "wildlife" projects, and where it has been included, only peripherally, largely due to the lack of data.

The experience of the Campfire programme in several districts is now providing some data on which to begin an assessment of the returns of wildlife projects and to consider the wildlife resource as an alternative land use option, comparable to the perspective taken with respect to crops and livestock.

Tables 10 and 11 summarises the results of benefit/cost analyses for the CAMPFIRE "project" in three districts: Nyaminyami, Guruve and Gazaland (Chipinge). The analysis projects forward covering a ten year period, and begins with the first year of the CAMPFIRE programme in each district: 1989 in the case of Nyaminyami and Guruve, and 1990 in the case of Chipinge (Mahenye Ward).

Table 10 presents a "status quo" scenario, that is, assumes no change in management, dividend distribution, poaching and population immigration. This leads to a further decline in revenue (5% decline for hunting, static tourism revenue and 10% decline in cropping revenue), increases in costs (11% per annum in real terms) and in poaching and immigration (population increases 6%) in Nyaminyami and Guruve. In Mahenye, by contrast, the status quo is based on continued good management and benefit distribution and control of poaching and immigration. However the negative consequences if macroeconomic reforms are not implemented, especially exchange rates, affects all three districts. It is assumed that the Zimbabwe dollar remains overvalued by 25% thus undervaluing hunting and tourism revenue. All values in the tables are presented in constant 1991 Zimbabwe dollars and thus do not try to project the rate of inflation.

Table 11 is based on an optimistic scenario, and assumes that present constraints on performance, particularly in Nyaminyami and Guruve are eased and ESAP succeeds. It assumes that revenue increases by 10% annually as a result of devaluation of the Zimbabwe dollar and good wildlife populations due to declines in poaching activity and immigration. This scenario assumes that recurrent costs do not increase in real terms after 1993 due to improved management, capital costs are restricted to replacement, immigration is controlled and population increases by 3.5%. Ward benefits are distributed only to producer wards.

The results of from tables 10 and 11 are projected visually in Figure 2.

Table 10 Summary of Benefit Cost Anlaysis SCENARIO 1'

Table 10 Benefit/Cost Analysis of Nyaminyami, Guruve and Mahenye Campfire Programmes

Projections based on current management, poaching, immigration; ESAP falters

	Actuals			Estimate	Projections [1992 Z$]					
	1	2	3	4	5	6	7	8	9	10
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
NYAMINYAMI										
BENEFITS	319,353	384,302	573,036	939,515	1,102,000	1,097,000	1,042,000	989,975	940,754	894,176
LESS RECURRENT COSTS	86,581	276,278	326,765	333,384	386,325	430,140	470,972	521,482	582,420	646,641
LESS CAPITAL COSTS	127,940	153,709	516,085	0	50,000	305,000	260,000	343,000	50,000	310,000
EQUALS NET BENEFITS	104,832	(45,685)	(269,815)	606,131	665,675	361,860	311,028	125,493	308,334	(62,466
NET PRESENT VALUE										
(at 10% interest)	1,211,247									
(at 40% interest)	333,626									
SURPLUS FOR DISTRIBUTION	214,935	169,578	282,844	606,131	665,675	361,860	311,028	125,493	308,334	(62,466
ACTUAL WARD BENEFITS	198,000	96,996	204,000	515,211	565,823	307,581	264,373	106,669	262,084	(53,096
Number of Households	4,500	4,800	5,000	5,300	5,618	5,955	6,312	6,691	7,093	7,518
(Assp 6% pop increase)										
Distribution per household	$44	$20	$41	$97	$101	$52	$42	$16	$37	($7
GURUVE										
BENEFITS	236,214	654,638	699,736	594,212	596,212	595,212	569,312	544,752	521,461	499,370
LESS RECURRENT COSTS	98,432	250,542	304,497	178,000	194,800	213,280	233,608	255,969	280,560	307,622
LESS CAPITAL COSTS	0	334,085	18,067	20,000	10,000	10,000	230,000	120,000	10,000	120,000
EQUALS NET BENEFITS	137,782	70,011	377,172	396,212	391,412	371,932	105,704	168,783	230,895	71,748
NET PRESENT VALUE										
(at 10% interest)	1,448,657									
(at 40% interest)	532,020									
SURPLUS FOR DISTRIBUTION	236,214	419,096	419,784	396,212	391,412	371,932	105,704	168,783	230,895	71,748
ACTUAL WARD BENEFITS	61,340	230,575	217,731	198,106	195,706	185,966	52,852	84,392	115,447	35,874
Ward Benefits as % surplus:	26.0%	55.0%	54.5%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Number of Households	3,000	3,120	3,307	3,506	3,716	3,939	4,175	4,426	4,691	4,973
(Assp 6% pop increase)										
Distribution per household	$20	$74	$68	$57	$53	$47	$13	$19	$25	$7
MAHENYE WARD										
BENEFITS	28,000	68,000	300,000	358,000	358,000	358,000	358,000	358,000	358,000	358,000
LESS RECURRENT COSTS	0	4,240	5,000	5,500	5,500	5,500	5,500	5,500	5,500	5,500
LESS CAPITAL COSTS	0	0	0	0	0	0	0	0	0	0
EQUALS NET BENEFITS	28,000	63,760	295,000	352,500	352,500	352,500	352,500	352,500	352,500	352,500
NET PRESENT VALUE										
(at 10% interest)	1,589,131									
(at 40% interest)	450,727									
SURPLUS FOR DISTRIBUTION	28,000	65,760	295,000	352,500	352,500	352,500	352,500	352,500	352,500	352,500
ACTUAL WARD BENEFITS	28,000	54,740	246,325	352,500	352,500	352,500	352,500	352,500	352,500	352,500
Number of Households	390	391	405	419	434	449	464	481	497	515
(Assp 3.5% pop increase)										
Distribution per household	$72	$140	$609	$842	$813	$786	$759	$733	$709	$685

Notes:

1. Surplus for distribution = net benefits, plus donors' contributions less Council levy.

Source: Jansen, 1992b

Table II

SCENARIO 2

Scenario 2

Table II Benefit/Cost Analysis of Nyaminyami, Guruve and Mahenye Campfire Programmes

Projections based on improved wildlife and financial management; controls on immigration; ESAP success

	Actuals			Estimate	Projections (1992 Z$)					
	1	2	3	4	5	6	7	8	9	10
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
NYAMINYAMI										
BENEFITS	319,353	384,302	573,036	953,515	1,317,000	1,442,500	1,580,550	1,732,405	1,899,448	2,083,190
LESS RECURRENT COSTS	86,581	276,278	326,765	335,384	423,250	422,538	421,861	421,218	420,607	420,026
LESS CAPITAL COSTS	127,940	153,709	516,085	0	0	55,000	211,000	179,000	50,000	0
EQUALS NET BENEFITS	104,832	(45,685)	(269,814)	618,131	893,750	964,963	947,689	1,132,187	1,428,839	1,663,164
NET PRESENT VALUE										
(at 10% interest)	3,038,344									
(at 40% interest)	701,757									
SURPLUS FOR DISTRIBUTION 1/	227,579	169,578	282,844	618,131	893,750	964,963	947,689	1,132,187	1,428,839	1,663,164
ACTUAL WARD BENEFITS	198,000	96,996	204,000	556,318	804,375	868,466	852,920	1,018,969	1,285,955	1,496,847
Number of Households	4,500	4,800	5,000	5,175	5,356	5,544	5,738	5,938	6,146	6,361
(Assp 3.5% pop increase)										
Assp: Only 6 wards benefit										
No. of Beneficiary Households	2,250	2,400	2,500	2,588	2,678	2,772	2,869	2,969	3,073	3,181
Distribution per household	$88	$40	$82	$215	$300	$313	$297	$343	$418	$471
GURUVE										
BENEFITS	236,214	654,638	699,736	894,212	976,212	1,066,412	1,165,632	1,274,774	1,394,830	1,526,892
LESS RECURRENT COSTS	98,432	250,542	304,497	290,000	290,000	290,000	290,000	290,000	290,000	290,000
LESS CAPITAL COSTS	0	334,085	18,067	20,000	50,000	20,000	203,000	20,000	10,000	10,000
EQUALS NET BENEFITS	137,782	70,011	377,172	584,212	636,212	756,412	672,632	964,774	1,094,830	1,226,892
NET PRESENT VALUE										
(at 10% interest)	3,420,104									
(at 40% interest)	867,005									
SURPLUS FOR DISTRIBUTION 1/	236,214	419,096	419,784	584,212	636,212	756,412	672,632	964,774	1,094,830	1,226,892
ACTUAL WARD BENEFITS	61,340	230,575	217,731	525,591	572,591	680,771	605,369	868,297	985,347	1,104,203
Ward Benefits as % surplus:	26.0%	55.0%	41.9%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%
Number of Households	3,000	3,120	3,229	3,342	3,459	3,580	3,706	3,835	3,970	4,108
(Assp 3.5% pop increase)										
Distribution per household	$41	$148	$135	$315	$331	$380	$327	$453	$496	$538
(Assp: 50% are in producer wards)										
MAHENYE WARD										
BENEFITS	28,000	68,000	300,000	390,000	429,000	471,900	519,090	570,999	628,099	690,909
LESS RECURRENT COSTS	0	4,240	5,000	5,500	5,500	5,500	5,500	5,500	5,500	5,500
LESS CAPITAL COSTS	0	0	0	0	0	0	0	0	0	0
EQUALS NET BENEFITS	28,000	63,760	295,000	384,500	423,500	466,400	513,590	565,499	622,599	685,409
NET PRESENT VALUE										
(at 10% interest)	2,144,290									
(at 40% interest)	541,682									
SURPLUS FOR DISTRIBUTION 1/	28,000	63,760	295,000	384,500	423,500	466,400	513,590	565,499	622,599	685,409
ACTUAL WARD BENEFITS	28,000	54,740	246,325	384,500	423,500	466,400	513,590	565,499	622,599	685,409
Number of Households	390	391	405	419	434	449	464	481	497	515
(Assp 3.5% pop increase)										
Distribution per household	$72	$140	$609	$918	$977	$1,039	$1,108	$1,177	$1,252	$1,331

Notes:

1 Surplus for distribution = net benefits, plus donors' contributions less Council levy

Source: Jansen, 1992b

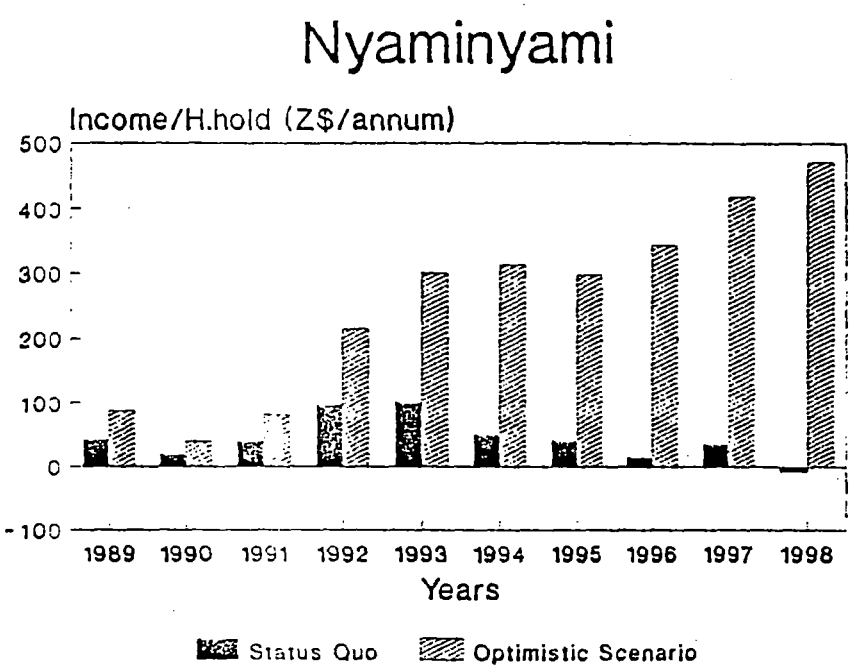
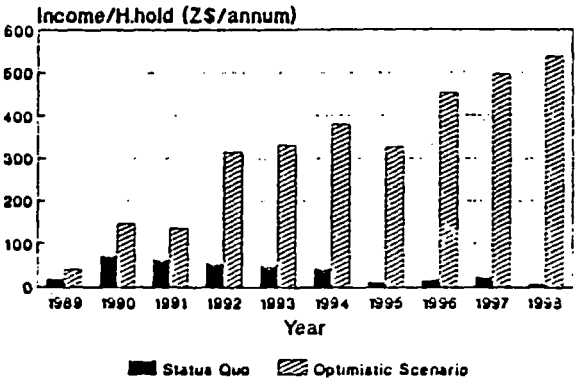
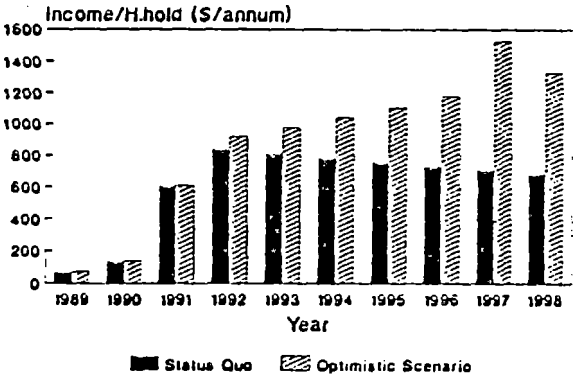


Figure 2: Comparison of Projected Household Incomes

Guruve



Mahenye Ward



In Nyaminyami there have been substantial increases in recurrent costs during the first 3 years. This is in part due to the inexperienced management and to the choice to employ 16 game guards with conditions of service similar to that provided by DNPWLM. It is important that the community find more cost-effective poaching control mechanisms. Scenario 1 assumes that this situation is not rectified: efforts to date to do so have failed. As a result it is assumed that recurrent costs increase at 11% percent rate in real terms.

Capital costs, which have been substantial and almost totally financed by donor aid (Zimbabwe Trust) are assumed to represent only replacement of existing assets, except in the case of buildings, since additional buildings are planned for NWMT. No distinction is made between the source of finance for the capital costs, since they represent a use of resources. If Zimbabwe Trust did not donate these resources for NWMT, they presumably would be available to finance other development projects, and thus are not in that sense a free resource--they have an opportunity cost. Despite the failures of continuing with the status quo, the NPV for the District is positive, $1.5 million using a discount rate of 10% and $333 000 using a discount rate of 40%. This would probably not be true over a longer period or if the assumptions of the negative effects of poaching and immigration are too conservative.

Scenario 2, is a more optimistic scenario including 25% adjustments for overvaluation of the Zimbabwe dollar[12]. It assumes that ESAP succeeds, management improves, poaching and immigration are controlled. As a result, the net present value to the District, based on a 10% discount rate, increases to Z$3,6 million and using a 40% discount rate the NPV remains positive at $700 000.

But this type of analysis, which represents traditional project analysis tools and indicators, fails to take into consideration the distribution of the net benefit stream. If the net benefits do not accrue to the producer community, the link between the benefits and costs of wildlife will not be made, and the current trend of encouraging wildlife eradication, immigration and increased cattle stocking will continue.

Scenario 1 also assumes that the ward benefits continue to be spread evenly among all 12 wards. As a result, benefits per household never exceed $100 per annum and in fact become negative after year 7. Thus even though this project has a positive NPV for the District, it <u>should not</u> be implemented, unless some alternative mechanism of allocating the net benefits is instituted. In other

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[12] Up to 1991, economists used a 50% overvaluation (Masters 1990, Jansen and Muir 1991) however, the consistent devaluation of the Zimbabwe dollar in recent years has reduced this.

words, a positive NPV is a necessary but not a sufficient criteria for going ahead with the project.

Scenario 2 shows that under a more optimistic scenario with respect to revenue generation, cost control, lower tax levy and lower population increase, the benefit per household increases and is $470 per annum (in real terms) in year 10. This assumes that the dividends are paid in the form of household cash dividends with social service or infrastructure projects paid directly by farmers.

Similar benefit-cost analysis for the CAMPFIRE project in Guruve District[13] show that like Nyaminyami, the project has received substantial capital investment donated by Zimbabwe Trust, and has a good revenue from hunting and tourism. Also like Nyaminyami, it has sizeable and increasing recurrent wildlife management costs. If the ward dividends were to be split in future between all 8 wards, as is the case in Nyaminyami, Scenario 1, shows that the benefits per household diminish and in fact become negative by year 10. Under the optimistic scenario 2, with benefits split between only 3 producer wards, the distribution increases to over $500 per household and could result in a viable wildlife utilisation option. This assumes that the link between the benefits and the wildlife resource is successfully established. This is not yet the case but the situation is improving steadily as institution building at the ward and village level is taking place. It should be noted that under both scenarios the NPV's are positive; the indicators of success, i.e. distribution per household, are significantly different.

Benefit-cost analyses of the CAMPFIRE project in the Mahenye ward of Gazaland District (Chipinge) indicates that here the hunting revenue is smaller, but so are the recurrent and capital costs. As a result the net benefits, and the NPV is just as large as in Nyaminyami and Guruve. Moreover, under the optimistic scenario 2, where the wildlife benefits remain distributed solely to the producer community (i.e. Mahenye ward), the household dividends steadily increase, and are significantly larger than in Nyaminyami and Guruve exceeding $1000 per household from 1993. Scenario 1 shows the effect of poor macroeconomic policies with household reveneue peaking at $813 in 1993 and declining thereafter.

A benefit-cost analysis of proposed CAMPFIRE projects was carried out for a USAID Natural Resources Management Project. The analysis indicated that Tsholotsho, Plumtree and Binga all had strongly positive net present values even under the worst-case scenaria but that in Hwange the success of the project, which would have to rely on adventure and scenic tourism, rather than wildlife and hunting, was sensitive to assumptions and even under the best case scenario had negative NPVs at interest rates greater than 10% if the aid

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[13] See Jansen, 1992b for the tables with the analysis

costs were added in to the calculation.

Sizeable ward dividends have been made available in Binga with some using these as household dividends and the project has been effectively community based although the District Councils have not all been effective at devolving authority and providing benefits to lower level institutions (Hitchcok and Nangati, 1992).

2.2.2.3 Summary of necessary conditions for success of Campfire projects

In order for wildlife to be a successful land-use option for producer communities it is essential that the benefits of wildlife both are, and are perceived to be, greater than the costs - either in terms of human, crop and livestock damage or as an opportunity cost with respect to alternative land uses. However there is no single successful model. The most appropriate institutions will be affected by the wildlife densities and general natural resource base, local institutions and traditions and the political environment. There are, however, a number of principles which can be universally applied. The most important of these is that the benefits must outwiegh the costs for the residents if they are to encourage wildlife by reducing poaching and habitat destruction.

A uniform distribution model of the benefits shared between all the wards in a district or even all the wards with some wildlife is unlikely to result in benefits outweighing costs in the important producing areas. Where wildlife revenue is used to fund social services and infrastructure projects in a district the links between costs and benefits become weak and implementers report that residents in these areas do not feel that they have benefited from wildlife revenue, poaching is on the increase and attitudes toward wildlife are negative.

With the fugitive nature of wildlife it is difficult to closely define the producer communities, particularly with the larger and more lucrative species, e.g. elephant. Even where it is possible to define boundaries it is difficult to ensure that those paying the highest costs receive the greatest benefits since within wards there are differences in animal densities and in crop and livestock damage due to wildlife. Hawkes, in a study of wildlife damage in Bulilima Mangwe district found inter-and intra-ward variability so large that "simply to compare wards with reference to wildlife damage obscures the real differences by areas"; He concludes:

> "Elephants are a serious problem only for the quarter of the households who live in the frontline areas (Zone 1). However, the return from safari hunting will go to the whole areas covered by the seven wards. Aside from questions of fairness, is this enough return from elephants to give residents of the frontline the sense of proprietorship.... that the CAMPFIRE philosophy assumes must develop" (Hawkes, 1991, pg 8)

Defining the producer community is difficult and even where the District has decided that the residents "living with wildlife" should be the principal beneficiaries this is difficult to determine. A number of criteria can be used - according to animal densities, according to the exact location of where the trophies were taken or based on relative crop and livestock damage. This cannot necessarily be done at a Ward level and as in Beitbridge district it may be one or more Vidcos. It is only when wildlife is accepted as "belonging" to those who live with it and pay its costs that the various models which enable the producer communities to receive larger shares will be accepted without creating community strife. Peterson, 1992 gives a good description of how the Mahenye community were able to persuade councillors from other Wards that the wildlife revenue belonged to those who lived with it.

It is important for communities to play an active role in deciding how the wildlife revenue is to be distributed but even if they are closely involved, there is often a problem with the implementation of community projects. This is largely due to lack of implementation skills at the district and ward levels. In many wards, the ward dividends remain in the bank, with their purchasing power eroding due to the high inflation rate in Zimbabwe. Also eroding is the link between the wildlife costs and wildlife benefits: the costs are felt immediately in terms of crop damage and threat to human life, while the benefits are delayed. These delays unfortunately parallel the delays these communities experienced in the past in getting wildlife revenue back from Treasury. It is possible that under CAMPFIRE the district council has simply replaced the central government in making promises regarding benefits from wildlife that fail to materialize in the short-run, and in the long-run may be too late to save the resource.

It is also essential that the communities receive an adequate proportion of the value of the wildlife sold from their land. Safari hunting involves very high overheads in marketing and operations but it is only with the introduction of more open and competitive marketing that prices paid by operators increase. In Hurungwe an initial approach by a potential safari operator was to pay $100 000 for a hunting concession, whilst his tender in a formal procedure was $623 000 (Bond,1992). The local communities need to establish openly competitive systems and to be trained and assisted in marketing their resources to operators with most Districts receiving less than 20% of the estimated gross revenue from hunting prior to 1992.

The significant increases in District revenues in 1992 and negotiated for 1993 are evidence that greater experience and more competitive marketing as well as the macroeconomic reforms are starting to ensure that wildlife revenues to the District more closely reflect opportunity costs. In Nyaminyami in 1993 the District will receive 40% of the gross revenue generated from

hunting. There is some question as to whether the safari operator will remain viable paying so much for the resource and it will be interesting to follow the results. An analysis of tenders shows most of the operators are now working on one-third of gross revenue generated from wildlife being retained by the District (Bond, personal communication).

2.2.3 Comparative Analysis of Wildlife and Subsistence Agriculture in Communal Areas

In the communal areas in Zimbabwe agropastoralism dominates and animal production regimes largely consist of cattle which are used primarily for draught power, as a store of wealth and for providing manure and milk. Small domestic animals are part of most household economies and in some of the more remote areas, wildlife plays an important role in subsistence income. In a few isolated areas where tsetse fly still exist, wildlife dominate with even small domestic livestock limited.

Household surveys have shown that in the more arid areas of the countries non-farm income is very important and that without off-farm income, government sponsored drought relief is necessary even in average rainfall years. Some districts, including Binga, have had households receiving drought relief since independence. Greater attention is now focusing on increasing incomes in the marginal areas both to reduce dependence and to contribut to national growth.

Table 12
GROSS MARGINS IN NATURAL REGIONS 4 AND 5

	Buhera (NR4)		Nyajena (NR4)		Zvishavane (NR5)	
	1989	1990	1989	1990	1989	1990
Maize	-75	57	-30	41	7	220*
Groundnuts	91	-96	165	-120	-256	-26
Pearl Millet	-95	-112	-95	-83	-160	-84
Sorghum		-183	-60	-96	-1407	-10
Ave GM per hhold	-35	-164	-5	-190	-104	447
Ave. Annual Net Farm income	655	289	650	211	680	509

* Despite low yields the margin is higher because of high prices on the local market.
Source: 1st and 2nd Annual Reports Communal Area Farm Management Data, MLARR.

Most agricultural officers and farmers prefer irrigation as a strategy for increasing incomes and generating revenues in the marginal areas. However, the irrigation schemes are generally uneconomic unless the cost of establishing water sources (particularly where dams or piped water schemes are required) are considered as sunk costs and not included in the calculations. Even when the water provision costs are excluded, the IRRs are

normally around 10-15% although there are some with returns of 40%, including a scheme proposed for Nabusenga, Siabuwa in Nyaminyami District. These higher return schemes tend generally to be small schemes with limited infrastructural investment. Even so for an additional 15 ha of irrigation at Nabusenga the development costs would be some Z$18 000 per ha for an annual average increment in agricultural output of Z$3500 per ha (Agritex, 1990). Individual households involved in the irrigation schemes considerably increase annual incomes but because even where it is economic, irrigation is not feasible in most of the marginal areas only a few communal farmers will be involved and rural stratification is increased.

The analysis of agricultural projects seldom include any of the subsistence benefit from wildlife since hunting is illegal. The prolific woodland resources are also seldom incorporated as an opportunity cost. This may be partially due to the fact that the irrigation schemes do not deplete the surrounding woodland but the increased population pressure will do so in the long term. These resources play an essential role in coping with drought and in improving the quality of nutrition, particularly for children and the impacts of reducing access to these resources must be incorporated in all development strategies, particularly in arid areas (Chimedza, 1992)

Other options must be developed to stimulate sustainable growth in arid areas and wildlife is put forward as one possible option in areas which still have the wildlife and the habitat to support it.

Wildlife has to date provided very little cash benefit on a consistent basis to households so it is difficult to make comparisons of the various land-use systems. Comparing their sustainability is even more difficult as there is so little evidence available. In 1986 Clarke et al (in Martin, 1986) provided a hypothetical model which showed that wildlife returns were some Z$23 per ha whereas those from cattle were Z$14. However the model used a very conservative stocking rate for cattle of 1:15 LU/ha instead of 1:3 LU/ha which is the normal average in communal areas. Furthermore although gross returns from wildlife were greater, returns to the producer community were only Z$10.57/ha (Cumming and Bond, 1991) so that to them cattle was preferable even at conservative stocking rates.

The real and perceived benefits of cattle are high for peasant farmers and the costs are low since the farmer costs of food and care are negligible; the community bears the costs of depletion of the open access grazing resources and the government bears the cost of most veterinary costs with their animal health and dipping programmes.

Barrett,1992, shows cattle in communal farm systems as generating more than $30 per ha for the householders. However, there may be an estimation or data error with the calculation of the value per

beast. If it is accurate then the annual value per beast when multiplied by average holding comes to significantly more than estimated total farm revenue in all NRs but particularly in 4 and 5 as reported in numerous household surveys. Average household incomes have probably been understated by not including many subsistence (and therefore unpriced) commodities and services, but even if survey results are doubled, the revenue from cattle is far greater than total revenue. Since cattle is an input into total revenue, this is not possible.

In a more recent attempt to compare household returns from agriculture and wildlife a survey was carried out in four wards in the Sebungwe region of the Zambezi Valley (Murindagomo, forthcoming). These areas represent the transition from a predominantly wildlife system (Negande A and B in Omay, Nyaminyami) to a predominantly cattle system in Gokwe with cattle only in Chireya Ward 3 and cattle and wildlife in Nenyunka ward. The Omay wards fall within the Nyaminyami Wildlife Trust and Nenyunka under Gokwe District Council.

The survey showed that in Gokwe over 80% of annual household income is from cropping (including grain retentions) and 8-10% from off-farm employment with 5-15% from livestock sales and if wildlife earnings had been paid out in cash they would have represented 2-4%. In the Omay on the other hand over 70% is from off-farm employment and only 17% from croppping (3% from sales and 14% from grain retention). Livestock sales were around 3% and the household revenue from wildlife would have been 4% if it had been paid out in cash and not retained by the Ward for projects. The survey also showed that incomes in non-cattle areas are half those in cattle areas. Similar income differentials were observed in Gutsa (mid-Zambezi valley) between houses with and without access to draught power (Barrett, 1992) and in most household surveys, access to draught power has been the most important variable in determining income levels. This is explained by the importance of draught in adding value to crops through the expansion of area cultivated and timely cultivation.

Even though the CAMPFIRE project is active in three out of the four wards surveyed and considerable wildlife still exists in these areas, it plays a very small role in household revenue generation, particularly where these revenues are retained at Ward level for projects. It plays a more significant role in household costs but these have not been estimated. In Table 13 they are implicitly assumed by the increased agricultural production in the with and without wildlife scenarios.

Both the Omay and Nenyunka which have a relatively abundant wildlife population are faced with land pressure resulting from potential immigrants with cattle as a result of tsetse fly eradication. At this stage of development, where access to land is not the limiting factor, the existing households welcome immigrants

because they bring with them the potential of access to cattle for draught power and increased populations give them a stronger case for access to government services (roads, schools, clinics etc).

The CAMPFIRE programme was partially instituted to reduce this pressure because of fear that severe environmental degradation would occur in these semi-arid zones which are considered fragile. However, there is still little, if any, incentive for householders to opt for wildlife systems and to restrict immigration. Producer communities will need to be much more narrowly defined with direct revenues per household of at least $200 per annum (in 1991 terms) before householders will seriously consider the wildlife option in preference to increased immigration and access to draught power.

On the other hand if the CAMPFIRE programme can be developed so that it can accommodate cattle and some population increases in the area, then it could conceivably continue to be used as a major source of District or Ward funding, provided that the producer communities are compensated for wildlife damages. If they are not, then regardless of how much these districts invest in punitive centralised law enforcement, the locals will continue to encourage habitat destruction and poaching and the proverbial goose will whither. The first best option is to create direct links between the communities and their wildlife and not to centralise management and control at District level but the political environment may preclude this in some areas. It is important, that the centre is then explicitly aware of the effects of not ensuring that both direct and opportunity costs must be compensated for or the wildlife resource lost.

There are many unknowns and much research still required but the recent evidence has highlighted the fact that it is only under very particular circumstances with very poor agronomic conditions, that wildlife can substitute for cattle at the household level, unless a considerably increased proportion of the revenue generated by wildlife can be retained by producers. Draughft power is the most valuable output from cattle and it is possible that where wildlife and cattle cannot be compatible, other forms of draught power may reduce the opportunity costs of wildlife versus cattle for the households. Measures to reduce wildlife predation (e.g. fencing of cropping zones) may also reduce opportunity costs. Localised control systems which include allowing individual hunting may also result in substantial increases in household welfare at small losses, and possibly substantial gains, to wildlife numbers (similar conclusion have been seperately reached by Murombedzi,1992). There are, therefore, a number of options for making wildlife more attractive to local communities even if it is not possible to ensure cash benefits which cover all the costs. These will, bowever, only achieve full local co-operation to the extent that all the measures together match full costs.

Despite the importance of cropping and maize in revenue generation

in the non-wildlife areas, maize gross margins are mostly negative when the cost of own labour and draught power is included in the calculations. The decision to grow maize is rational when the cost of producing the maize is compared to the cost of importing from major urban centres, particularly when the risk of poor access is added to the landed cost. It is, therefore, possible that if markets were more effectively integrated that householders would not need to rely on expensive self-sufficiency strategies and that wildlife production systems which included high-value production of speciality outputs, may become more financially attractive to peasant households and considerably increase both rural and national growth.

Given the difficulties of comparing cattle and wildlife in peasant farming communities, since cattle are mostly an input, it may to be better to estimate opportunity costs of cattle by comparing the with and without scenarios. This is carried out in Table 13 below where the assumption is that having cattle and population densities similar to those in Chireya 3, precludes the option of wildlife but brings with it concommitant increases in average household incomes as a result of livestock incomes, increased cropping incomes and reduced losses from wildlife. Total area cultivated also increases because there are more households farming.

However, it must be remembered that income distribution is highly skewed in rural areas and less than 20% of the population normally own adequate cattle for draught. Thus much of the increase in average incomes may simply go to the immigrants and it is not certain to what extent natives will benefit from the cattle and immigrants moving in. A detailed household study of these issues would be most useful and could be undertaken in those areas which have experienced significant increased immigration. Cattle ownership is privatised at the household level but the resource base (the grazing commanage) is open access causing environmental and social problems with cattle owners encouraged to overstock, paying no individual costs for grazing but incurring costs shared by the entire community.

Wildlife has the potential to reduce, or at least not to increase, income differentiation if the new institutions developed to manage and share benefits and costs are carefully established. If, however, households in the densely settled areas with access to catttle and little or no loss to wildlife predation, benefit equally with those in the wildlife areas it too will increase socio-economic stratification.

There is little empirical evidence on the relative merits of cattle or wildlife from an environmental perspective. What evidence there is suggests that the most important factor is to avoid overstocking, regardless of the animal mix. However, Child (1988) did indicate that overgrazing (on a well-managed ranch which, however, overstocked by 40% against the recommended levels) reduced

productivity by 60% from 18 to 11 kg meat/ha/year and over ten years a profitable cattle ranch became unviable because of overgrazing. Child estimated the NPV of future losses because of degradation to be conservatively estimated at over $25 per hectare. The wildlife enterprise on the other hand became increasingly viable and Child maintains that this was because lower animal densities were possible and the wildlife enterprises became more effectively marketed by the rancher as profits from the cattle enterprise reduced. These findings were on a ranch which over the period had an average stocking rate of 1:8 LU/ha this compares to stocking rates of 1:3 LU/ha in the communal sector (Cumming and Bond, 1991).

Communal farmers are not primarily concerned with meat production from cattle and it is probably more economic for them to accept higher cattle densities and lower productivity. There is an urgent need to carry out investigations into economically sustainable stocking rates for communal agropastoral systems rather than those which reflect the objectives of individually-owned beef ranches.

Under current revenue distribution, wildlife is only rarely more viable to the individual householder than subsistence agriculture. The question remains - is wildlife the more economically viable option in communal areas at the national level?

An example is given below of the opportunity costs of wildlife and subsistence agriculture using Nyaminyami District. The estimates used are very crude but all the assumptions used in making them have been clearly outlined and the analysis is designed to highlight anomalies rather than provide a definitive answer..

Despite considerably higher international revenue generated by wildlife, wildlife has high opportunity costs for households. The total revenue generated by wildlife and current subsistence in 1992 is estimated at Z$40 per hectare whereas if there was no wildlife and agricultural income was doubled the total revenue generated in Nyaminyami would be Z$14 per hectare. The agricultural income all accrues to the households whereas only a small proportion of the wildlife income accrues to the households - only just over Z$1 per hectare.

Total revenue generated by wildlife alone is US$7 (Z$35) per hectare but only US$0.24 per ha. accrues to communal farmers.

Table 13

Comparative Analysis of Wildlife and Subsistence Agriculture
Total Revenue Estimates Using Nyaminyami District, Zimbabwe

US dollars per annum 1992

	Inter-national	National	District	Houshold	All individ.	Wild Individ.
Direct Revenues						
Hunting	1034066[1]	827252[2]	212000[3]			
Tourism	781250[4]	625000[5]	7200[6]			
Total	1815316	1452252	219200	70667[7]	14[8]	35[9]
Airfares	450000[10]					
Outfitting	200000[11]					
Taxidermy	51703[12]	51703				
Curios	10000[13]	10000		6000[14]		
Meat	20000[15]	20000		10000		
Ivory?						
Total	2547019	1533956	219200	86667	17	43
Environ. protection						
Genetic resources						
Bequest						
Existence						
Total Wildlife						
Subsistence Agriculture with wildlife - Current situation						
5000 hholds agric	262000	262000[16]	219200	262000	52	52
TOTAL (incl wild)	2809019	1795956		348667	70	96
Subsistence Agriculture with no wildlife						
10000	1048000[17]	1048000		1048000	105[18]	105
7500	786000	786000		786000	105	105
5000	524000	524000		524000	105	105
Best Option: Retain Wildlife and Have Cattle and Better Agric.						
7500 hholds	3014641[19]	2128211	219200	872667	122	148
5000 hholds	3071019	2057956	219200	610667	122	148

International refers to revenue generated for the world population
National refers to the revenue generated which remains within Zimbabwe: Wildlife revenue US$1.53 million = Z$9.6 million when assuming 25% overvaluation or Z$7.7 million at the official rate.
District refers to the proportion paid to District Council.
Household refers to proportion of income accruing to producers.
All Individuals refers to per household distribution based on 5000.
Wild Individuals per household based on estimated 2000 living with wildlife.

Notes and sources for the estimations given in Table 13

1. The estimated total value from the hunting sold based on tenders submitted for 1993 with 5% deducted for international inflation. International safari prices have not in fact risen and it is possible that the 1992 value should be the same as that for 1993 but a conservative estimate was preferred.

2. A deduction of 20% to cover external marketing costs, convention, wholesaler and agents commissions and fees. The remainder is what is paid into Zimbabwe.

3. The trophy and concession fees paid to the District Council (Z$1 060 000 converted to US$ at 5:1)

4. An estimate of the revenue earned by Bumi Hills Safari Lodge and Tiger Bay because of the wildlife in Omay. If there was no wildlife it is estimated that Bumi would loose 50% of its custom and Tiger Bay 25% (it is closer to the national park and caters more heavily to fishermen). Both were estimated at 5000 bed nights, Bumi at US$250 per night and Tiger Bay at US$125 per night, full board and tours.

5. A deduction of 20% for external marketing agents fees etc - this is probably too high as much of the marketing costs and fees may be retained locally.

6. The tourism revenue estimate for 1992 was calculated as lower than 1991 (particularly for Bumi) because of the effect of drought on international visitors. Assuming that the per visitor fee to be paid to the District Council in 1992 is higher, the revenue to the DC, is assumed to be the same as in 1991 (Z$36000).

7. Assume that the DC pays 33% of its total earnings as Ward dividends (as for 1991)

8. Assumes that the Ward dividends are distributed evenly between the 5000 households (whether as cash or projects)

9. Assumes that the revenue is shared only by those living in areas with substantial wildlife resources (Omay). The number of households is estimated to be 2000.

10. It is guesstimated that there are 145 hunters and companions based on the number of hunts.

11. Assumes that each safari party spends $1400 in their home country on equipment and outfitting.

12. Each client spends 5% on mounting trophies

13. An estimate based on Binga sales of Z$80000 - estimated that the handicraft centre would at Bumi will earn Z$50000.

14. The producers retain 60%. Although averaged over all Omay residents (assumed to be 2000), in fact it is likely to be much more concentrated income.

15. Includes meat, hides, etc, from cropping, problem animal control - assumes less available but at higher price so remains same as 1991. National social price is doubled as meat was sold at subsidised price. Opportunity cost value not adjusted at household level because for those individuals the opportunity cost is hunting time and illegality risk which may even be less than the money saved by access to cheap meat.

16. Based on Z$262 per household per annum currently generated by crop, livestock and beer sales and grain retentions (average crop returns for Negande Ward in Murindagomo, 1992). Most household income is from off-farm work. Z$262 by 5000 households converted to US dollars.

17. Using survey results of vidcos with and without cattle (Zhomba and Ntamo, Nenyunka Ward, Gokwe in Murindagomo, 1992) average farm income doubles. This would be as a result of increased access to draught power, immigrants with greater access to cash or credit for input purchases and reduced wildlife depradation. It is assumed that there are no agronomic differences between the vidcos which may have caused the differential. It is further assumed that with the elimination of tsetsefly and increased demand for land, immigrants move in and the population is doubled resulting in increased habitat destruction and poaching which reduce wildlife to insignificance.

The calculation is double Z$262 multiplied by 10 000 households converted to US dollars.

18. This assumes that the increased incomes are evenly distributed when in fact they are usually highly concentrated with those who own cattle. The current residents will benefit from increased access to cattle, more people in the area to lobby for services and to sell beer to, but it is unlikely that they will in fact double their current incomes.

19. Some wildlife experts maintain that it is not currently desirable to incorporate cattle into subsistence agriculture systems in wildlife areas and furthermore that any increases in population would not be sustainable. However, it seems that reorganisation including possibly greater seperation of people and wildlife, access to alternative draught or livestock holding pens etc could be used to try to enable increased agricultural production alongside continued wildlife enterprises - this has been achieved in the commercial ranch sector. It is more difficult in the communal sector but may be possible.

The calculation assumes that the same per capita agricultural productivity is achieved diminishing wildlife revenues by only 12.5% but with only half the new immigrants so that the population is 7500 households.

The analysis shows that the best option internationally is for wildlife with improved agricultural output but with no increase in population. This is because the increase in human populations does reduce wildlife revenue and as the international community as a whole benefits by 20% more than the nation, it has a larger stake in the wildlife option.

The best option for the nation is wildlife with population increasing to 7500 households because of the additional income generated by more people farming in the area. The crude assumption was that household farm income doubled with improved agriculture by reorganising the current systems in a best case scenario with wildlife revenue only declining by 12.5%. If agricultural incomes cannot be improved while retaining wildlife, the wildlife only option is preferred from a national social welfare perspective.

This option would also be best for the households since they would achieve the increased incomes from better agriculture as well as the wildlife revenue. IF agricultural incomes cannot be improved with wildlife then the best option for the farmers is to eliminate wildlife and encourage immigrants and cattle. The bases for these estimates are very crude and rely heavily on untested assumptions - e.g. that 10000 households would mean that wildlife was no longer viable.

The analysis has been made in order to reflect the contraditions and to clearly indicate the beneficiaries and the trade-offs involved and possible magnitudes. It has been made in order to highlight the importance of devising institutions which will ensure far greater returns to households from wildlife, if they are to actively participate in and choose wildlife as a land-use option. Wildlife projects should also incorporate some agricultural improvement strategies so as to reduce the opportunity costs of living with wildlife.

Another aspect which has important policy implications is the trade-off between significantly increased national income by retaining the wildlife option and the employment potential of resettling the land to subsistence agriculture. Local, bureaucratic and national politics may find it convenient to resettle these areas with people despite foreclosing wildlife options. It is, therefore, important that more accurate estimates of the trade-offs are made to ensure informed policy choices. It also highlights the importance of developing wildlife enterprises which increase employment by involving local communities more directly in providing services and inputs. This would also have useful local multiplier effects which, taken altogether, may, in the long run, result in the area absorbing more people as well as increasing output and incomes.

It is imperative to ensure that the "trickle-down" is considerably greater than it is at present. The issue of greater producer participation in CAMPFIRE has been extensively addressed in this paper and by Murombedzi (1992) and is essential to the continued existence of wildlife in this area. The issue of greater producer share in the hunting and tourism industry revenue is essential if wildlife is to continue to be available and Districts must develop institutions which return a greater share to the producers. The safari operators must find mechanisms to ensure that a greater

proportion of the revenue generated is returned to the Districts (the prognosis in 1993 looks good). If they have been making excessive profits it is essential for wildlife survival that they pass on more of these to the local communities in future. IF there were no barriers to entry and they were not making excessive profits, then operational and marketing efficiency must be improved so that they **can** pay higher returns to producer communities or the wildlife habitat will decline and poaching will continue to increase. As most of these operators have limited direct long-term interests in the area, it may be necessary to find other mechanisms to ensure that the market prices to local communities more closely approximate social values. District Councils have been receiving less for their wildlife than that sold in State safari areas and in 1992 Nyaminyami received some 20% of total revenue. The indications are that the communities are increasing their proportion of the revenue as: the market become more open and transparent; as they become more skilled negotiatiors and as macroeconomic conditions improve and safari operator profitability increases. In 1993 Nyaminyami has sold its hunting for 40% of total revenue.

3 THE POLICY ENVIRONMENT AND ITS IMPACT ON THE FUTURE OF WILDLIFE

3.1 The Macro-policy environment

The Zimbabwean economy is characterised by its highly centralised and heavily regulated structure with widespread state ownership and parastatals. The structure was inherited at Independence but was reinforced and expanded during the 1980s. International borrowing subsidised the expansion of the civil service and social services and by 1990 budget expenditure was 48% of GDP. Exports have increased but total imports have been stagnant as debt service payments have risen to 37% of exports in 1987 from 4% in 1980. Real GNP per capita stagnated during this period falling far short of the economic expectations from peace and the involvement of the majority in the economy. One of the main factors has been very low levels of investment which was at levels barely adequate to maintain capital stock and insufficient to raise productivity. These low investment levels have resulted from

(i) limited access to imported investment and intermediate goods
(ii) the high transaction costs of non-tariff barriers to trade
iii the high transaction costs of operating in the heavily regulated business environment involving price controls, labour market restrictions and investment sanctioning
(iv) the numerous barriers to competition arising out of the regulations and the controlled access to foreign exchange
(v) the real and perceived risks of operating in an economy with unsustainable deficits

The disappointing economic performance of the 1980s was compounded by the shortage of skilled manpower and several droughts. The economic policies outlined above which have limited investment and growth throughout the economy have also had negative effects on the wildlife industry. In an effort to increase investment and growth

and reverse the trends the Government embarked on a structural adjustment programme (ESAP) with part of the adjustment funded by grants and soft loans from the international community.

3.2 The Impact of Macroeconomic Policies in the Wildlife Sector

3.2.1 Foreign Exchange

The exchange rate is controlled and Jansen and Rukovo estimate that between 1981 and 1990 it was overvalued by between 50 and 80%. There was a 34% effective depreciation between January and October 1991 and by early 1992 the overvaluation estimate was was closer to 25%. The overvalued exchange rate by taxing exportables has had a very negative effect on the wildlife industry where most of the revenue for tourism, hunting, crocodile and ostrich products are exported. Not only has it undervalued the sector's contribution to the economy but it has reduced incomes and investment in the sector.

This overvaluation together with policies which have discouraged exports have resulted in a severe shortage of foreign exchange and a multiplicity of controls over access to foreign currency. The limited access has severely constrained access to imported inputs, particularly vehicles and the luxury commodities high-value tourism and hunting demands. The regulations pertaining to access have significantly increased transaction costs and have favoured established industries and firms, affecting industry growth and effectively reducing returns to CAMPFIRE (see below). In a survey of safari operators the most significant constraint to growth was cited as the shortage of foreign exchange. This shortage was particularly severe for vehicles and spare parts and resulted in the industry having to turn down potential clients (Jansen, 1992).

The wildlife sector was more adversely affected than manufacturing and mining and arguably more than agriculture. These sectors had access to donor-financed comodity import programmes, export revolving funds and export promotion programmes. In addition the manufacturing sector has since UDI been given extremely high priority in the administrative allocation of foreign exchange - usually in inverse proportion to comparative advantage (Jansen and Muir, 1991).

Recent changes under ESAP have considerably improved the wildlife sector's access to foreign exchange with the introduction of the export retention scheme (ERS) in July 1990. This scheme allows exporters the right to utilise 35% of export earnings to import inputs which are not on the negative list. Although it favours existing operators, ERS quotas are now tradeable at a premium of between 20 and 50%, and that has helped new entrants. There are still considerable transaction costs in accessing these rights and delays in clearing imported inputs but the situation has improved markedly. The increased retention has reduced incentives to engage in illegal foreign currency deals and under-invoicing. Some of the

items on the "negative list" (imported luxuries and vehicles above a certain value) are necessary for the industry but still require import permits and involve long bureaucratic delays.

3.2.2 Investment Policy

As part of the structural adjustment programme the Zimbabwe Investment Centre (ZIC) has been established to facilitate and encourage private sector investment and simplify project accessment and approval procedures. Despite these objectives there are still considerable delays but of more importance to the wildlife and tourism sector is the fact that government policy places a premium on investment in the mining and manufacturing sectors. Investments in the wildlife sector which may make a greater contribution to income, foreign exchange earnings and employment than investment in manufacturing and mining, are prejudiced by being given a lower priority (Jansen, 1992).

There are also a number of problems associated with the poorly developed environmental impact assessment institutions and with the fact that Ministry of Environment and Tourism is only consulted after approval has been granted by the ZIC. This makes it more difficult to modify plans to maximise environmental benefits and places subtle pressure on the Ministry to approve the development unless there are major environmental problems. Whilst regulations and approval procedures should be minimised and those retained operated to reduce transaction costs where possible, it is also important that an effective screen is in place for particularly sensitive areas or activities.

3.2.3 Fiscal Policy

The Ministry of Environment and Tourism (which includes DNPWLM) received 0.68% of total government expenditure in 1990/91. National expenditure on DNPWLM was only half of the expenditure on Veterinary Services (Jansen, 1992). In 1990/91 the Ministry of Political Affairs received Z$50 million compared to Z$30 million for DNPWLM. This was after the announcement of the structural adjustment programme and is an indication of the low priority accorded wildlife despite its potential for growth. The 1992/93 Budget allocated Political Affairs replacement, National Affairs, Z$60 million compared to Z$37 million for DNPWLM. These actions call the seriousness and committment of the government to adjustment and growth into question. Military expenditure has consistently been the second-highest after Education and continued in the 1992/93 with a budgeted Z$1.3 billion dollars including a significant increase in the aircraft maintenance budget which cannot be caused by the Mocambique war, normally cited as the cause of high defense expenditure.

The result of this policy has (together with the inappropriate bureaucratic structure) resulted in a decline in the capacity of DNPWLM to service the rapidly expanding wildlife industry and more importantly, to sustain the national parks estate, its flora and

fauna and to expand access to these resources. The viability of the wildlife industry in Zimbabwe rests very heavily on an effective national parks structure both in its importance in attracting visitors to Zimbabwe and in its service role in terms of research, genetic resources, animal stocks and technical expertise. In addition to the very low budget, DNPWLM has had to service an increasing mandate and has had to face significant increases in international poaching. Time, skills, financial and other resources have been directed away from traditional concentration on park management and research to service all these new demands. The decline in funding has resulted in deterioration of roads, boreholes, buildings, plant, vehicles and equipment. It has also affected research, extension and interpretive services, park management and law enforcement, sthus threatening wildlife conservation, habitat protection and the economic productivity of the wildlife sector as a whole.

3.2.4 Monetary Policy

One area in which the government does appear to be committed to structural adjustment is in the area of monetary policy where interest rates have been forced up by requiring the banks to remain very liquid. This has been part of the policy to contain inflation but unfortunately this tight monetary policy has not been matched by a tight fiscal policy. The position has been made significantly worse by the drought which has forced government to incur large deficits importing essential food and raw materials normally produced locally and exported. In addition they have had to support a large drought relief programme for both food and inputs. Given the lack of progress by government on containing non-drought related expenditure the prognosis for the future must include the burden of very high national debt.

Monetary policy alone can only control inflation at the expense of growth, with supply severely constrained by high interest rates. These high interest rates also affect the wildlife industry although, provided that the exchange rate closely mirrors the equilibrium rate, this sector which exports most of its products and services will be less affected since higher earnings will offset the higher interest rates. This situation, however, does exclude small businesses and particularly new entrants with limited collateral and will therefore exaccerbate the trend of a white dominanted industry. Specific action is required in developing skills and providing access to finance for historically disadvantaged sectors of the community. This will have to include access to foreign currency since the ERS system favours existing enterprises.

3.2.5 Employment

The government is very concerned about increasing employment and reducing underemployment. It is unlikely that the industrial sector can grow fast enough to absorb the rapidly increasing population and the resettlement programme is supposed to assist.

The exercise is considerably slowed by the requirement that full facilities and services are provided for the resettled farmers so that they can be productive. The slow pace means that the current trend for informal settlement will continue to threaten communal areas which are not overpopulated which includes many of the CAMPFIRE areas. Most wildlife options are land intensive and absorb very few people relative to subsistence agriculture. It is important to develop institutions and technologies which enable wildlife systems to employ or at least can accommodate more people without reducing wildlife densities - its important to find ways of changing the established negative relationship between human population and wildife.

3.3 The Impact of Sectoral Policies on the Wildlife Industry

3.3.1. Land

The Zimbabwe government inherited the dualistic structure referred to above and the current land policy aims to reallocate some land from the large-scale freehold sector to the small-scale sector but to retain the same basic dualistic structure. There are calls for a land policy which would encourage subdivision increasing access to freehold land to more people reducing the sharp divisions between the two sectors. The country is to introduce a land tax which will encourage large-scale farmers to utilise those areas of their properties currently underutilised and on areas which cannot be used for agriculture, there may be increasing investments in wildlife and recreational tourism. Regulations which discourage sub-division will reinforce this trend since the farmers will not be able to sell the land they are not using for agriculture.

There is some uncertainty as to the nature of the land tax with some inferrence that it may be used to affect production systems. If this is the case the subsequent distortions will have severe impacts on the economic efficiency of agriculture and, given the generally negative attitudes to wildlife as a productive land-use system will prejudice it. There is currently no mechanism for the state to enforce its production choices but there is fear in the large-scale sector that land used for wildlife will be considered un or under-utilised, therefore, exposing the farmer to the risk of land appropriation for resettlement.

The negative attitudes of most of the agricultural bureaucracy to wildlife derives from uncertainty over its actual economic value as well as lack of expertise in and technologies for wildlife enterprises. This has more serious consequences in the communal areas and resettlement schemes where land-use planners hesitate to allocate land to wildlife. Those responsible for resettlement find wildlife to be land intensive and very restrictive to their mandate to resettle the maximum number of people from over-crowded communal farming areas.

The economics of wildlife still needs to be more clearly and widely established and at the same time technical materials and training

are urgently required. DNPWLM cannot service all the potential wildlife areas and agriculturalists operating in these areas should be more actively involved.

3.3.2 Marketing and Price Policies

In the large-scale sector cattle are the major competitor with wildlife for land. Beef production has been heavily supported by government since the inception of controlled marketing in the 1930s which was introduced to assist farmers during the Depression. This includes large marketing and processing investment in beef by the state. Producers or consumers (and at times both) have been directly and indirectly subsidised by government marketing and pricing policies for beef over the decades. This has affected both production and consumption patterns ecouraging beef at the expense of all other animal production including wildlife. In a study of the CSC by Pilborough (in Muir, 1983) the effectiveness of state support to new industries is highlighted by the brief involvement of the CSC in establishing the pig and poultry industries. The distortions created by the implicit and explicit support for beef have particurly affected the development of the goat industry and have probably had similar effects on game meat. Since independence the CSC has received direct subsidies of Z$40 million per annum. Prior to 1985 producers and consumers were subsidised but subsequently it has been inefficient marketing and consumers who have been subsidised by the State and indirectly by farmers who received prices below export parity.

3.3.3. **Veterinary and Health Controls**

The erection of fences and the eradication of buffalo from large-scale ranches has had negative effects on both the economy and the viability of wildlife enterprises on ranches. It is unlikely that the value of the buffalo eradicated in order to allow for beef exports to Europe can ever be recouped despite the very high prices obtained from privaleged access to their controlled markets. No analysis has been carried out on the economics of the fences nor on their impact on wild animal migrations. However, the continued effect of disallowing buffalo in cattle areas continues to affect wildlife profitability since buffalo add significantly to the value of hunting on ranches (see Child, 1988 for a discussion of these issues).

Movement controls implemented to satisfy EEC requirements considerably increase the cost of live animal sales by requiring long quarantine periods.

There are also a number of municipal and national regulations which restrict the free movement of game meat sales and require various inspections. There is no analysis of the impact of these on meat production but the availability of relatively cheap beef is more likely to have affected the expansansion of game meat production. Most of the meat produced is currently consumed in the rural areas.

3.3.4. External Trade Controls

Exports of wildlife products and of live animals are subject to various permits, licences and restrictions. These restrictions are normally either to fulfill the requirements of international conventions (e.g. CITES) or are an attempt to build up the local industry. The restrictions on the sale of live animals are controversial, particularly for sable, ostriches and crocodiles. The restrictions were recently temporarily lifted on sable and a breeding herd of 20 was sold for Z$400000 for export to South Africa.

The export of game meat and other wildlife products are severely restricted by various controls in the importing countries.

3.3.5. Sale and Utilisation Controls

Although landholders/appropriate authorities may utilise wild animals found on their land (except Specially Protected Species) the method and sale of various services and products are controlled (see Booth, 1992 for a comprehensive list of regulations).

In the communal areas residents are still officially prohibited from hunting any wild animals even in Districts which have been granted appropriate authority because of fears that access cannot be controlled. Whilst enforcement is very weak, particiularly outside CAMPFIRE projects, negative attitudes to wildlife result from these prohibitions

Various municipal and national regulations have negative effects on downstream industries, reducing returns to producers e.g. wood and stone carvers are restricted by law from selling direct to tourists and must sell their products to licenced dealers and all people working with ivory or gemstones must be licenced. This results in much "illegal" hawking and reduces profits to producers.

The Zimbabwean economy is very highly regulated and these national, municipal and industry restrictions often act as barriers to entry and have restricted the growth of wildlife and tourism ventures, particularly where the existing entreprenuers are those involved in decisions on licencing and permits.

3.4 Conclusions

Cattle

Wildlife in the commercial ranch sector is more profitable than ~~wildlife~~ under most circumstances. An improved macro-economic environment and a less regulated economy will contribute to its viability and continued growth. The CAMPFIRE programme appears to be the most economic option from a social welfare perspective but it is seldom the rational choice for households living in these areas. More effective mechanisms and institutions need to be developed so that the gainers compensate the loosers or the resource will become non-renewable as communities reduce wildlife habitat and encourage poaching.

Where international social welfare is maximised by choosing a wildlife option which may not be socially optimal for the nation then it may be possible to call upon those sectors of the international community who benefit to contribute so that benefits and costs are more closely linked. As Table 13 showed the direct benefits to the world community from retaining wildlife can be considerable. If these are added to the global environmental advantages of the wildlife option over subsistence agriculture (by greater tree coverage, less degradation and greater species diversity) and the bequest and existence values, then in certain areas the international community clearly benefits from land allocated to wildlife. Institutions and mechanisms need to be found which link costs and benefits at the international level as well as those already discussed at the household level.

The communities have received some non-economic benefits from the CAMPFIRE programme including greater empowerment as they begin to realise that they have a resource which is desireable and the institutional experience for Districts and Wards has contributed to this. The promotion of debate and interest on the finite nature of indiginous resources and a greater awareness of, and more positive attitudes towards, wildlife at the district and national levels, have resulted from the CAMPFIRE programmes. This now needs to be translated to the household level and has been achieved in some areas such as Mahenya and Beitbridge.

4. RELATIVE ENVIRONMENTAL IMPACTS OF WILDLIFE

4.1. Introduction

The diverse large mammal faunas, typical of African savannas, suggests the occurrence of a long evolutionary relationship between wild herbivores and the structure and composition of the savanna vegetation. The introduction of domestic herbivores into southern Africa was relatively recent (having been thought to have taken place only some 1000 years ago (Epstein, 1971), although domestic herbivores are now far more abundant than wild herbivores over most of Zimbabwe.

Concerns about the deterioration of Zimbabwean rangelands due to excessive numbers of livestock were already being expressed by government officials early this century (Watt, 1913), and have continued to be so ever since then. Concerns about overgrazing and rangeland degradation have played a central role in the shaping of the national livestock policy, particularly giving rise to various schemes of limiting stock numbers and in some cases of actually destocking. Concerns about detrimental impacts of herbivores has not been confined to livestock and attention has been drawn to the impacts especially of elephants in the destruction of woodlands.

Excessive stocking rates are commonly stated to lead to overgrazing, degradation and desertification, components of which include changes in vegetation and soils that result in a

permanently diminished ability to support secondary animal production. Detailed descriptions of the degradation process for Zimbabwean rangelands are given by Ivy (1969) and Child (1988). Both describe changes in vegetation and soil structure, which lead to a reduction in the quantity or quality of fodder being produced, so resulting in reduced animal production on commercial cattle ranches. Degradation is seen as manifesting itself where a plant community which is dominated by perennial grasses and where rainfall is thus used efficiently in the production of a relatively stable supply of fodder, changes to a community that includes a greater proportion of woody species, annual grasses and bare ground, and where, consequently, more rainfall is wasted, less fodder is produced and the fodder supply is more variable from year to year.

Initially utilization results in changes in the herbaceous species composition of the veld, especially from perennial grasses to a combination of annual grasses and less palatable perennial grasses, with reduced vigour. Ground cover and litter cover decreases, so leading to increased soil compaction and crusting, and thus enhanced run-off and erosion. Rainfall infiltration is reduced substantially and, because the density of grass roots near the soil surface is lower, a greater proportion of the water that does enter the soil becomes available to deeper rooted woody species. This gives them a competitive advantage, which they are able to maintain at the expense of grasses, so that the supply of fodder is permanently reduced. As bush encroachment and the above induced drought conditions continue to develop, sheet and gulley erosion become more widespread, and previously permanent streams become more intermittent.

There is an active ongoing debate as to exactly what does constitute degradation, how degradation can be assessed, and the significance of observed environmental changes under high stocking rates (Abel and Blaikie, 1989; Barrett, Brinn and Timberlake, 1991; Behnke and Scoones, 1992; Child, 1988; Scoones, 1990; Stocking, 1992; Warren and Agnew, 1988). These studies have directly challenged the assessment of the mainstream view that excessive livestock numbers have brought about widespread degradation of rangelands. There is a general consensus that it is necessary to establish both that primary production is declining or has declined, and that the change is irreversible within a certain time scale, and that the observed changes have resulted in a decline in secondary production (eg meat, or milk or output of draft power, or manure production) with increased stocking rate on a per unit area basis, in order to provide conclusive evidence of degradation. This debate is of direct relevance to the comparison of the environmental impacts of different herbivore systems.

The aim of this report is to review the Zimbabwean literature pertaining to the impacts of herbivores on their environment, and particularly to produce a comparison of the relative environmental

impacts of wildlife and livestock production systems. The available literature is discussed under three categories: 1. national surveys documenting the extent of environmental change over the whole country; 2. specific studies relating to particular animal production systems (most studies fall into this category); and studies concerning direct comparisons between wildlife and livestock production systems. These results are discussed both in relation to current ideas on the structure and functioning of savanna systems, which are themselves in the process of undergoing considerable change, and in the current forum of debate concerning environmental degradation.

4.2.The Evidence on Herbivore Impacts on Zimbabwean Rangelands

4.2.1 National Surveys

The extent and patterns of two aspects of environmental change, deforestation and soil erosion, have been surveyed on a countrywide basis through studies of aerial photographs (Whitlow, 1980, 1988), giving a comprehensive geographic picture of these two phenomena in both map and statistical format.

For Zimbabwe as a whole, over the ten year period from 1963 to 1973, closed woodland and open woodland declined in area by 4% and 16% respectively, whilst the area of sparse woodland and cultivated land increased by 12% and 8% respectively (Whitlow, 1980). The main decreases in woody vegetation were recorded in areas of high to moderate population densities, particularly within the communal lands. This was ascribed by Whitlow (1980) primarily to the expansion of cultivated lands into previously wooded areas, and to a lesser extent to the collection of firewood and building materials from woodlands. Deforestation on commercial farmland was patchy and generally much less severe than for the communal lands. Attention was also drawn to the rapid rate of destruction of woodlands on some of the state land in the west and northwest of Zimbabwe, which was ascribed mainly to the build up of high elephant densities within these areas, with fire as a contributory factor.

The second national survey (Whitlow, 1988) documents the distribution and severity of soil erosion throughout the country, as observed on aerial photographs taken between 1979 and 1984. The total area affected by erosion in Zimbabwe was estimated to be 1.81 million ha, or 4.7% of the country, 46% of which comprised croplands and the remaining 54% on non-croplands or rangelands.

The extent of erosion differed strikingly on lands under the three major categories of land tenure, with erosion being most pronounced for the communal lands, intermediate for the commercial farm lands and least extensive on the protected state lands. The 1,528,500 ha of eroded communal land comprises 83% of all the eroded lands in the country, although the communal lands occupy only 46% of the total area. The protected state lands occupy 15% of the country but account for only 2% of the total erosion. Erosion on the

commercial farm lands, which occupy the remaining 39% of the country, was intermediate (15%). Likewise the erosion of rangelands (non-croplands) is most marked in the communal lands (77% of the total eroded rangelands), intermediate on the commercial farm lands (21%) and least on the state lands 3%.

Whitlow and Campbell (1989) showed that the extent of erosion is related much more strongly to human factors (human population density, land tenure and cropland area) than to physical factors such as erosion hazard (based on erosivity of rainfall, erodibility of soils, plant cover and average slope), natural region and rock outcrops). Of these six variables population density was most closely correlated with erosion followed by land tenure and cropland area.

These two surveys clearly demonstrate that it is the communal lands which have been most affected by deforestation and soil erosion. Although land use is extremely varied within each of these broad categories of land tenure, these results clearly suggest that the communal land rangelands have been more severely impacted than those on the commercial farms and protected state areas, in terms of both deforestation and soil erosion.

4.2.2 Commercial Livestock Production Systems

Results of the numerous trials undertaken in Zimbabwe concerning grazing stock on rangelands are reviewed by Kennan (1969) and Clatworthy (1989), whilst O' Connor (1985) provides a more general synthesis of all long term experiments carried out in southern Africa concerning the grass layer of savanna systems. The major emphasis of the Zimbabwean trials has been on the effects of different stocking rates and grazing systems on veld condition and animal performance.

Stocking rate has repeatedly been shown to have a marked effect on both rangeland composition and animal productivity, to the extent that Clatworthy (1989) concludes that stocking rate is the overriding factor to be considered in any livestock enterprise based on rangelands. A number of experiments have shown a consistent trend for perennial grass cover to decline with increasing stocking rate, whilst for animal performance both wet season gain and dry season losses are affected by stocking rate, with the former decreasing and the latter increasing as the stocking rate is increased. Richardson (1983) has further shown the importance of the stocking rate of dams on the post-weaning performance of young stock, at least until slaughter age of steers.

Different grazing systems, in contrast, have been shown to have little effect on animal performance except that where stock are forced to eat less palatable herbage animal productivity is reduced. In terms of vegetation, it appears that it is the management of stock during the growing season that is critical in maintaining rangeland condition. During the dormant season factors

of veld management other than the stocking rate are likely to have little effect. In virtually all the studies of grazing management conducted in Zimbabwe since 1970, in time, distinct changes have occurred in the botanical composition, plant density and basal cover, but for a given stocking rate, the wide range of grazing procedures examined have had almost no differential effects on botanical composition, or on the condition of the veld.

Kennan (1969), O'Connor (1985) and Clatworthy (1989) all emphasize that the impact of livestock on veld condition is dependant on both rainfall and soil conditions. A number of studies have demonstrated that long term rainfall variability has an overriding effect on herbaceous compositional trends, independent of grazing regimes, particularly in the drier rangelands where rainfall is more variable and primary production is strongly limited by soil moisture availability. In moister savannas annual variability in rainfall is lower and the relationship between vegetation production and rainfall is less marked. Because of this influence of rainfall on primary production, the influence of grazing varies correspondingly from the semi-arid to more mesic savannas, with the most pronounced effects being observed in low rainfall regions. In the high rainfall regions of Zimbabwe, the herbaceous vegetation composition appears to be much less influenced by grazing by cattle.

Similarly the effects of grazing appear to be both more rapid and extreme on heavier textured soils than on sandveld. On heavy soils perennial grasses are extremely sensitive to heavy summer grazing and soon give way to "pioneer" species of little grazing value. Prolonged summer grazing can also result in marked changes in species composition in sandveld, but such changes take much longer to come about. In addition, once perennial grasses on heavy soils are eliminated, long periods of protection are generally required before they re-establish.

Studies on the impacts of livestock on the environment have generally been related to changes in vegetation, whilst only very limited attention has been given to the impact of herbivores on soil properties. Within Zimbabwe the only detailed study of this nature is that of Gambiza (1987). This comprised a comparison of a variety of physical and chemical soil properties between four sites on a semi-arid rangeland with granite derived soils, which had been subjected to grazing by cattle at four different intensities.

Although grazing resulted in marked reductions in the basal cover of herbaceous species, and increased soil erosion, no effect was shown on soil fertility. In particular the organic matter content had not been reduced at all by high stocking intensities. All plots had a relatively high abundance of woody shrubs and trees, and Gambiza (1987) hypothesized that the woody vegetation plays an important role in the maintenance of soil structure and fertility

in these conditions, and that this overrides any grazing effects on soil fertility status.

4.2.3 Wild Herbivore Systems

Despite the diversity of large herbivores, which is a characteristic of African savanna communities, only a limited number of species have been reported as having dramatic effects on the environment. Analysis of the composition of a range of wild herbivore communities (Cumming, 1982), shows that communities tend to be dominated by only a few large species such as elephant, hippopotamus, buffalo, zebra and wildebeeste, all of which are bulk-roughage feeders, and it is these species which have been reported as having dramatic effect on the environment.

The most dramatic effect of wild herbivores within Zimbabwe is undoubtedly the destruction of woodlands by elephants (Anderson and Walker, 1974; Childes, 1984; Conybeare, 1991; Coulson, 1992; Guy,1981, 1989; and Thompson, 1975). This can result in the dramatic alteration of the structure and composition of savanna woodlands over a very short period of time, as has been observed elsewhere in Africa (Cumming, 1982).

The impact of tree-felling activities of elephants on woodland structure will be determined in part by the both tree density and the density of elephants. The loss of canopy trees is likely to result in an increase in herbaceous production, which in the absence of heavy grazing, is likely to lead to an increased frequency and intensity of fires. Frequent intense fires can suppress the recovery of woodlands and thus maintain the previously wooded vegetation in a more open state of shrubby grassland (Thompson, 1975; Childes, 1984).

According to this hypothesis, relating the destruction of woodlands to both tree-felling by elephants and a more frequent and intense fire regime, it should be possible to control the rates of loss of trees and recovery of woodlands, through management of elephant densities and the fire regime. Craig (1992) and Martin (1992), on the basis of a simple model, have calculated that elephant densities need to be held below about 0.5 animals per km^2, in order to maintain existing woodland canopy cover intact. This is far lower than the densities currently occurring in many of the National Parks and Safari Areas, which in 1991 were estimated to range from 0.25 to 2.12 animals per km^2.

This destruction of woodlands provides the rationale for the elephant culling programme which was initiated in the 1970's and is still ongoing.

The rates of destruction of woodland mentioned above are remarkable for their rapidity. The long term relationships between elephants and savanna structure has been debated extensively (Cumming, 1982; Dublin, Sinclair and McGlade, 1990). Numerous hypotheses on this

topic have been forthcoming, but the lack of any sufficiently long term studies, preclude the attainment of any definite conclusions as yet. An understanding of this elephant-woodland relationship is important for management purposes, in order to be able to predict the future influence of elephants on the environment.

Concern has in the past been expressed about the possible deleterious impact of concentrations of large herbivores, especially buffalo, along the Zambezi River during the dry season (Kerr, 1972). However, a detailed study of the patterns of habitat use by buffalo in Mana Pools National Park (Swanepoel, 1989), showed that such concentrations of buffalo only occur during the dry season, and thus their impact on the vegetation is less likely to be marked. Similarly year-to-year and within-year variations in rainfall over six years, have been shown to have an overriding effect on the herbaceous species composition and biomass production of grasslands on the Zambezi river floodplain in Mana Pools National Park (Dunham, 1990). Despite the heavy levels of utilization by herbivores recorded in this study, it was concluded that fluctuations in year-to-year rainfall and small scale differences in soils had a greater impact on herbaceous species composition and production than did grazing.

Although the large bulk roughage feeders are the animals that have the most obvious impacts on savanna vegetation, the smaller species, gazelle, porcupines etc. may be having equally dramatic, although perhaps less noticeable effects. Although studies have been carried out elsewhere such documented cases are available in Zimbabwe.

4.2.3 Communal Land Agro-Pastoral Systems

Since early in the colonial period overstocking and degradation of communal land rangelands have caused concern. For much of this century, and continuing to the present, government officials have sought ways in which to control or even reduce livestock numbers in the communal lands. Stocking rates in the communal lands, frequently of the order of 2-3 ha per livestock unit, are typically higher than those found on other types of land. Livestock, particularly cattle form an integral part of the agropastoral farming system practiced by communal land residents, particularly through the provision of draught power for land preparation and of manure which is widely used to maintain or improve soil fertility. Recent studies such as those by Swift et al (1989) on nitrogen cycling in communal land farming systems and Barrett (1992) on the economic role of cattle in communal land farming systems, indicate that the majority of households do not own sufficient livestock to satisfy their needs for draught power and manure. Thus the numbers of livestock can be expected to remain high in the communal lands.

Despite the widespread concern about the deterioration of communal land rangelands, remarkably little research has been directed at this problem. This has been highlighted by a number of recent

studies which question the official view of degradation in the communal lands, as to the extent and significance of degradation in these areas (Abel and Blaikie, 1989; Barrett et al, 1991; Sandford, 1982; Scoones, 1990; Warren and Agnew, 1988).

Scoones (1990) examined livestock production records over several decades for seven heavily stocked communal lands (grouped into six districts) in southern Zimbabwe, centred around Masvingo. Government officials, in 1944, considered the stocking rates of six of the seven communal lands studied by Scoones to be in excess of the recommended carrying capacities for these areas, by between 9 and 66% (Director of Native Agriculture, Annual Report, 1944, in Scoones 1990). Yet for each communal land, the 1986 cattle population density (these being the latest given by Scoones) was considerably in excess of its 1944 stocking rate. Despite large fluctuations in response to rainfall, cattle populations appeared to have been successfully maintained over the last 25 years for all communal lands, thus indirectly suggesting that degradation had not had a serious impact on the ability of these systems to support the production of cattle. Likewise Scoones interpreted data on annual calving rates as a simple density dependent relationship, rather than having been impaired by degradation as argued by Child (1988) for the commercial beef system.

This study revealed an apparent contradiction, in that there were obvious signs of soil erosion on the rangelands and yet there was no evidence that cattle populations were declining, and neither was their potential productivity being detrimentally impacted. The implication is that although erosion is occurring, its impact is not yet being seriously felt. Scoones (1990) suggested that this could be explained either temporally, in that the impact of erosion on secondary production is sufficiently low as to not be felt on a relatively short time scale, or else spatially, in that the sites where erosion is occurring might not contribute significantly to the overall livestock production, or both. Data on primary production showed that the environment of these areas was extremely heterogeneous, and that certain "key" patches, such as vleis and stream banks, contributed a disproportionately large part of the overall primary production and were utilized far more heavily by livestock than the topland areas. Thus, if it is the bottomland areas that are the most productive and important components of the landscape, then erosion on topland may not seriously impact secondary production. The conclusion arrived at by Scoones (1990) was that this study failed to provide any evidence of long term degradation.

The Save study (Campbell **et al**, 1989) however, perceived the environment as being degraded through deforestation, overgrazing, loss of soil, loss of soil fertility, siltation of rivers and increased run-off, and that there was a severe imbalance between the human population and the resource base, such that the environment was less able to satisfy the needs of current and

future human populations.

4.2.4 Comparative Studies

Kelly (1973) undertook a comparative study of four sites under different land tenure, which were apparently similar in every respect except for the type and intensity of grazing and browsing by large herbivores. Fifteen years later De Jager (1988) repeated measurements of vegetation and range condition in an attempt to identify trends that could be related to the different forms of land use and herbivore utilization.

Kelly's study concluded that the intensively utilized communal land site was in fact degraded in comparison to the other three sites, in that the perennial grasses had largely been replaced by annual grasses; herbaceous production was more variable between years (as a result of the dominance of annuals); and litter cover and rates of infiltration were lower. Woody vegetation varied tremendously amongst plots within the four sites, thus masking any differences that might have resulted from the different intensities of utilization by herbivores.

The intensive utilization of vegetation in the communal land had apparently resulted in a change in dominance of herbaceous vegetation from perennial to annual grasses, which in turn had lead to high year to year fluctuations in seasonal production, a large proportion of bare soil, reduced infiltration and increasing run-off of rain water.

De Jager's follow up study failed to reveal any firm evidence of directional trends that could be related to differences in the intensity of utilization by herbivores. The herbaceous vegetation of the communal land site was still dominated by annual grasses as opposed to perennials on the other three sites. Basal cover of grasses was also lowest for the communal land site, as was the litter cover and the rate of infiltration. There were indications that the communal land soils were now of lower fertility (in terms of organic carbon, total nitrogen and exchangeable calcium) than those of the other three sites, but none of these differences were significant. Woody vegetation had changed considerably in density and once again the heterogeneity among plots within sites tended to mask differences between sites.

A comparison of separate game and cattle enterprises, which have been run since 1960 on adjoining, ecologically very similar areas, under the same overall management was undertaken on Buffalo Range (Child, 1988). Rangeland condition has been assessed in detail in 1973, in 1986 (Child 1988) and 1990, although the results of this latest survey have not yet been made available.

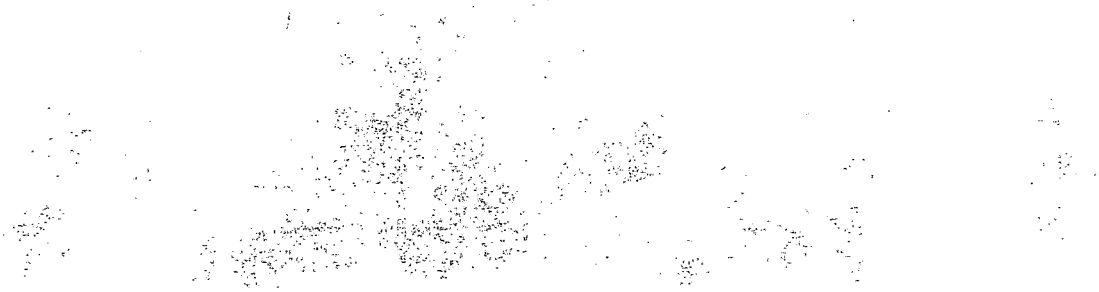
In 1973 herbaceous cover abundance, grass height and litter cover were all higher in the cattle section whilst soil capping and erosion were more evident in the game section which had been

previously degraded and the density of shrubs was higher there, all indicating that the cattle section was ecologically in better condition than the game section at this time. Thirteen years later there were definite indications that range condition on the game section had improved, whereas it had deteriorated on the cattle section. Herbaceous cover abundance, grass height and litter cover had all decreased on the cattle section, to levels now lower than those recorded on the game section. The area under cattle now exhibited twice as much erosion as that under game, and although there was an increase in soil capping on both the cattle and game sections, the increase on the former was threefold that of the latter. Woody plants had increased significantly on both sections.

These changes in range condition can be related directly to trends in secondary production. The levels of meat harvested from the game and cattle sections of the ranch fluctuated on an annual basis, but the average meat yields over a 26 year period show the two systems yielding very similar amounts of meat at about 6kg/ha per annum. The most striking aspect of the cattle productivity data is that during a run of relatively high rainfall years after 1974 the rate at which cattle gained weight, the average weight gains per unit area, and the annual calving rate, all declined significantly, whilst over the same period wildlife populations and the offtake of meat were expanding rapidly.

Child (1988) relates this declining cattle productivity to the overstocking, suggesting that the effects of overstocking would have been particularly marked during the drier years of the early 1970's when cattle numbers were maintained at fairly constant levels through this period. The stocking rate of wildlife fluctuated considerably, increasing rapidly during the high rainfall years of the 1970's but declining massively during the drought years from 1982-1984. After 1984 populations increased through natural growth at a slower rate than on the cattle section which was restocked with cattle from elsewhere. At no point in time has the stocking rate of wild herbivore grazers on the game section ever exceeded that of cattle on the cattle section. At the time of the 1986 measurements the cattle stocking rate was some 1.5 times that of game.

This study suggests that the production potential of the cattle and game enterprises is similar and that rangeland impact is largely a function of the stocking rate of herbivores. Child (1988) makes the important point that the generation of revenue from the cattle enterprise is directly related to the secondary production of cattle, whereas for the wildlife enterprise the major form of revenue generation is through safari hunting operations rather than meat production which is dependent on the production of trophy animals rather than the production of maximum biomass, thus enabling more conservative stocking rates to be maintained.



4.3. The Major Factors Influencing Environmental Impacts

Herbivores interact with their environment in an extremely complex manner giving rise to a wide variety of different impacts, of which the removal of plant matter during feeding is the most obvious. Yet this is accompanied by a complex variety of additional and interacting effects, such as: changes in microtopography caused by trampling, rolling and the formation of paths; and the loosening or compaction of the soil surface through hoof action, either way affecting the infiltration of water into the soil. The excessive removal of plant cover will leave soils exposed to rainfall and so lead to erosion. The distribution of nutrients both in space and, through impact on the rates of nutrient cycling, in time, will be modified. Plant population dynamics will be influenced through the effects of herbivory on seed dispersal, seedling establishment, the growth, reproduction, competitive interactions and mortality of plants. Such animal induced impacts will act intermittently both in space and time, in both natural and managed herbivore systems. The total animal impact on an environment will thus be effected through a multitude of probabilistic, intermittent and interactive weak forces, as listed above, which act through complicated and intersecting pathways.

These effects of animals will further be regulated by the underlying patterns of soil and climate. The reviews of Kennan (1969), Clatworthy (1989) and O Connor (1982) all suggest that herbivore impacts are most marked on environments with heavy textured soils and in low rainfall situations. For semi-arid rangelands with erratic and variable rainfall, year-to-year fluctuations in rainfall appear to have an overriding effect on vegetation composition irrespective of the grazing regime (Ellis and Swift, 1988, Walker, Matthews and Dye, 1986). For these systems vegetation changes will best be described by non-equilibrium models in which system structure is seen largely as being a result of episodic and stochastic events, rather than traditional equilibrium models in which system structure is seen as being a result of density dependent feed back controls such as grazing by herbivores. Under such non-equilibrium conditions, environmental degradation can only be said to have occurred where the vegetation has crossed some critical threshold, which prevents or severely inhibits its subsequent return to a more productive state. There is no single biological optimal carrying capacity which can be defined independently of the different management objectives associated with different forms of animal exploitation. Thus for semi-arid rangelands, which are subjected to erratic rainfall and characterized by large fluctuations in plant species composition, cover and biomass, the problem becomes one of distinguishing between drought induced fluctuations and permanent changes in vegetation states. It is doubtful that our current knowledge of savanna systems allows these distinctions to be made at present with any degree of confidence.

Given that the primary impact of herbivores on their environment is

through the removal of plant matter in the process of feeding, it is reasonable to seek an understanding of the different impacts of different herbivores through studying their feeding behaviour. Body size has a tremendous influence on the ecology of large mammalian herbivores including their feeding behaviour (Western, 1979). Smaller species require a higher quality diet because of their higher metabolic rate per unit of body tissue. Large herbivores, with correspondingly lower metabolic rates and voluminous digestive systems, can afford slower rates of passage of food through the alimentary canal, so enabling more complete digestion of plant matter. Thus large herbivores can cope with a much lower quality diet than that selected by smaller herbivores.

Wild herbivore communities can be expected to be dominated by large non-selective herbivores, which in any given environment have a much greater biomass of food available to them than the small, selective feeders. Analyses of the structure of wild herbivore communities, in terms of biomass of different classes of feeders, confirms this pattern (Cumming, 1982). Thus despite the diversity of herbivores occurring in natural wildlife systems, these are typically dominated by just a few species of large, bulk and roughage feeders, such as elephant, hippo, buffalo, zebra and wildebeest. Small concentrate feeders, in contrast, contribute very little to the total biomass or energy flow of such systems and accordingly their impact on the structure and functioning of the systems is unlikely to be great.

Comparisons of herbivore community structure between wildlife and domestic livestock systems, in terms of the biomass contributions of the different classes of feeders, leads to the important conclusion that the impact of wild as opposed to domestic herbivores on the environment, is more likely to be a question of degree rather than of fundamentally different kind, associated with the unique effects of different herbivore species (Cumming, 1982).

The comparison of Child (1988) between wildlife and a commercial cattle system further suggests that the environmental impacts of wildlife and cattle are determined largely by the stocking rate, rather than the different types of herbivores, and this is supported by the literature reviewed by Clatworthy (1989) in which he concludes that stocking rate is the major factor to be considered in any livestock system from the management point of view.

The research reviewed above further suggests that, particularly in semi-arid environments, vegetation changes are unreliable indicators of rangeland degradation. Under such non-equilibrium conditions rates of soil loss and other deleterious changes in soil chemistry and physical properties may be more reliable indicators of irreversible changes. Important parameters will be the rate of soil loss, particularly with respect to the reduction of soil depth

and the loss of fertile top soil through sheet erosion, and possibly also the rate of infiltration of rainwater due to increased run-off. Both rates of soil loss and infiltration of water into soils are strongly related to vegetation cover. On this basis Abel and Blaikie (1989) have developed a simple model for Zimbabwean rangelands, whereby the effects of stocking intensity can be related to rates of soil erosion, through the effects of livestock on vegetation cover.

The core of the model is a curve depicting the relationship between the rate of soil erosion and effective vegetation cover, taken as including all plant matter, whether alive or dead. The negative exponential shape of this curve is important, implying that rates of soil erosion remain low until vegetation cover drops below a critical value, but thereafter increases dramatically with further decreases in cover. In this model the critical value of cover is shown as being 30-35%. Elwell and Stocking (1974) arrived at the same figure (30%)measuring soil losses on experimental plots with different cover values. Abel and Blaikie (1989) suggest that for a particular site, the cover value below which the rate of soil erosion increases rapidly might provide a socially acceptable limit for soil erosion, although the actual value for this point would be expected to vary for different soils and other conditions.

A major limitation to using the rate of soil erosion as an indicator of rangeland degradation, is that although rates of soil loss can be predicted reasonably accurately at a field level, these rates cannot as yet be related to soil loss at the catchment level. Inevitably not all eroded material is actually removed from the system. Some soil will merely be transported and redeposited elsewhere in the landscape, such as on flatter bottomland areas. There is a clear need for further research into the dynamics of soil movement at a landscape level.

A further field of understanding that needs to be developed is the relationship between soil depth and primary productivity. On shallow soils it appears that primary production is directly related to soil depth. Thus a set rate of soil erosion may be far more significant on a shallow soil than for a deeply weathered soil. Much the same consideration applies to the distribution of nutrients through the soil profile. In drier areas, where soils have not been intensively leached, the concentration of nutrients within the surface layer is likely to be less marked than for highly leached soils from wetter areas.

Given that the environmental impacts of different herbivore communities are determined essentially by the stocking rate rather than the types of herbivores involved, some consideration of the stocking rates required to meet the specific objectives of different animal production systems, becomes important. Data from Buffalo Range illustrate that wildlife can be profitably stocked at a significantly lower rate than that required for cattle, due to

the high values associated with hunting safaris. Studies of communal land farming systems show that the current high livestock numbers, consistently fall far short of the populations required to satisfy the multiple needs of farmers, and thus the communal lands are always likely to be heavily stocked.

Impacts of herbivores result through a complicated variety of interacting forces, the outcome of which are dependent in part on external environmental parameters, such as rainfall and soil conditions. Generally animal impacts are most pronounced in low and variable rainfall areas, and on heavier textured soils rather than on sandy soils. In particular, the dynamics of the drier semi-arid savannas will be controlled by stochastic external forces or combinations of conditions, rather than through stable equilibrial forces. Here, for most of the time herbivore impacts are likely to be unimportant as determinants of vegetation dynamics, with the erratic rainfall conditions playing a central role. Spatial heterogeneity at the landscape level is also an important influence of the pattern of utilization of rangelands by herbivores, and hence of their environmental impacts. The temporal pattern of utilization of resources is of equal importance.

Impacts on the environment as a result of different herbivore systems are not difficult to measure. Assessing the ecological significance of such changes is much more difficult, since this requires measurements of productivity over time. Degradation is commonly defined as occurring only when the environment undergoes irreversible change. The challenge thus becomes one of determining what does or does not constitute permanent change. The great spatial and temporal heterogeneity, characteristic particularly of the semi-arid savannas of Zimbabwe, make this a difficult task. Changes in plant species composition are certainly not an adequate indicator, since these are likely to be reversible barring any major changes in soils. The only manner in which degradation can be inferred from primary production, is through long term trends, over and above the noise introduced by variations in rainfall. The same applies to secondary production.

Soil erosion, is a potential indicator of degradation, but comprises a continuous process even in the absence of herbivory. Erosion does not start or stop on either side of some arbitrary line. This makes it necessary to attempt to define socially acceptable goals of soil loss, which once again requires information on the rates of loss rather than an absolute measurement of actual change at a particular point in time. Acceptable levels of soil loss will be defined in part by the production requirements of the particular system, commercial cattle ranching or communal agriculture or else from a national welfare perspective.

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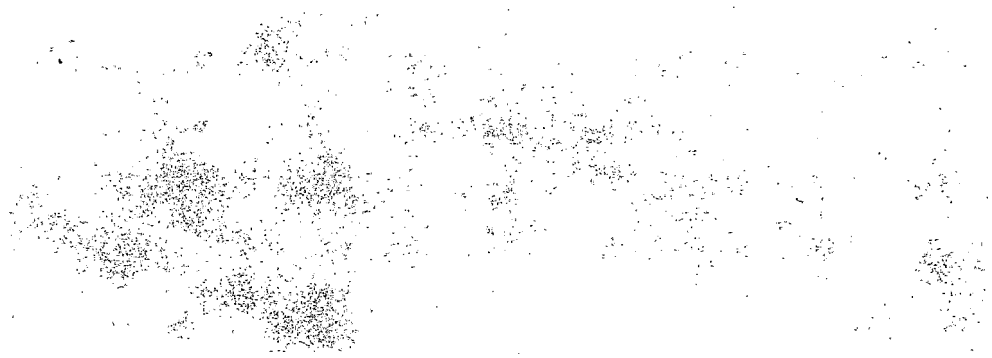

Table A1

SUMMARY OF MAMMALS FOUND IN ZIMBABWE

Artiodactyla 2 Suids (Pigs) 1 Hippopotamus 1 Giraffe 23 Bovids/Antelopes	Insertivora 14 + shrews 1 hedgehog 2 golden moles	Primates 3 galogos 1 baboon 2 monkeys
Carnivora 1 Aardowolf 2 hynaena 6 Felids (cats) 4 Canids (dogs) 4 Musteids (otter badgers) 14 Viverrids (Mongoose)	Lagamorpha 3 hares	Proboscidea 1 Elephant
Chiroptera 60 bats	Perrisodactyla 2 Rhinos 1 Zebra	Rodentia 1 molerate 1 porcupine 1 springhare 2 dormouse 3 squirrels 2 cane rates 28 + Murids (mice/rats)
Hyracoidea 2 dassies	(Philodota) 1 Pangolin	Tubulideutata 1 Antbear

(Smithers and Wilson, 1979)

Table A2

SPECIALLY PROTECTED AND RESTRICTED ANIMAL SPECIES IN ZIMBABWE

SPECIALLY PROTECTED[1]	RESTRICTED[2]
MAMMALS Pangolin Black rhino Wild dog	MAMMALS Aardwolf Cheeter Gemsbok Lichtenstein's Hartebeest
BIRDS Wattled Crane White Stock Cape Vulture Martial Eagle Peregrine Falcon Blue Swallow	BIRDS Crowned Crane Other Vultures Cape's Hawk Eagle Black sparrowhawk Lanner Falcon Secretary Bird Taito Falcon Ostrich Black Checked Lovebird Lilian's Lovebird
REPTILES AND AMPHIBIANS Johnston's Rava	

1. No exploitation allowed can be killed in direct defense of life only and all killings must be immediately reported.
2. Restricted = Section 48 permit required for their exploitation

Table A3 Summary Data on Survey Ranches

Number of Ranches	Natural Region IV				Natural Region V				REGION IV + V
	Hwange	Bulawayo	Masvingo	Total Reg. IV	West Nic	Mwenez	Chiredzi	Total Reg. V	
Cattle	1	12	9	22	7	10	6	23	45
Wildlife	7	0	0	7	1	1	3	5	12
Both	5	10	0	15	7	4	6	17	32
Total	13	22	9	44	15	15	15	45	89
Average rainfall (mm)									
Ranches Estimate (10 yr)	559	513	528		393	383	503		477
Met Station (30 yr)	725	593	556		490	425	574		
Average size of ranch (ha)	14,460	21,980	10,636		33,207	17,244	30,804		22,235
Average cattle herd size	477	3,631	1,563		3,357	1,863	2,636		2,922
Stocking Rates (Ha/LSU)									
Actual cattle	28.6	9.2	13.5		17.2	14.0	21.0		
Actual wildlife	32.9	84.4	303.7		87.2	42.4	35.1		
Actual total (C+W)	22.6	7.5	12.7		14.2	12.9	13.8		
Recommended total	11.9	13.1	13.6		20.6	21.7	17.1		
Percent overstocked(understocked (-)	-47.3	175%	107%		145%	168	124%		

Source: A3 - A9 Jansen, Bond and Child, 1992.

Table A4 Cattle Enterprises, Base Run Financial Results

	# Enter-prises	Percent Return on Investment (Frequency Distribution) <0%	Up to 10%	Equal or > 10%	Percent Profitable 1/	Wted Mean	Adjusted Net Revenue/Hectare < 0	< $25	Equal or > $25	Percent Over $25	Wte Mea [Z$]
CATTLE ONLY RANCHES	45	15	27	3	7%	1.8%	15	27	3	7%	2.5
Natural Region IV											
Hwange	1	1	0	0	0%	-11.7%	1	0	0	0%	-9.6
Bulawayo	12	3	8	1	8%	1.5%	3	8	1	8%	2.3
Masvingo	9	2	6	1	11%	6.7%	2	5	2	22%	9.5
Sub-total	22	6	14	2	9%	2.9%	6	13	3	14%	4.3
Natural Region V											
West Nicholson	7	4	3	0	0%	0.5%	4	3	0	0%	-0.4
Mwenezi	10	3	6	1	10%	3.2%	3	7	0	0%	4.5
Chiredzi	6	2	4	0	0%	-4.4%	2	4	0	0%	-4.6
Sub-total	23	9	13	1	4%	0.5%	9	14	0	0%	0.7
COMBINED RANCHES (C+W	32	15	16	1	3%	2.6%	15	17	0	0%	2.9
Natural Region IV											
Hwange	5	5	0	0	0%	-7.1%	5	0	0	0%	-6.9
Bulawayo	10	4	6	0	0%	2.7%	4	6	0	0%	4.2
Masvingo	0	0	0	0			0	0	0		
Sub-total	15	9	6	0	0%	2.1%	9	6	0	0%	3.2
Natural Region V											
West Nicholson	7	2	5	0	0%	3.7%	2	5	0	0%	3.3
Mwenezi	4	1	3	0	0%	5.4%	1	3	0	0%	5.9
Chiredzi	6	3	2	1	17%	0.9%	3	3	0	0%	0.7
Sub-total	17	6	10	1	6%	3.0%	6	11	0	0%	2.8
ALL CATTLE ENTERPRISES	77	30	43	4	5%	2.3%	30	44	3	4%	2.7
Natural Region IV											
Hwange	6	6	0	0	0%	-8.1%	6	0	0	0%	-7.7
Bulawayo	22	7	14	1	5%	2.2%	7	14	1	5%	3.4
Masvingo	9	2	6	1	11%	6.7%	2	5	2	22%	9.5
Sub-total	37	15	20	2	5%	2.5%	7	22	8	22%	3.8
Natural Region V											
West Nicholson	14	6	8	0	0%	2.4%	6	8	0	0%	2.47
Mwenezi	14	4	9	1	7%	4.0%	4	10	0	0%	5.1
Chiredzi	12	5	6	1	8%	-0.5%	5	7	0	0%	-0.47
Sub-total	40	15	23	2	5%	2.0%	15	25	0	0%	2.2

Notes: 1. Percent profitable = percent with return equal or greater than 10 percent.

Table A5 Wildlife Enterprises, Base Run Financial Results

	# Enterprises	Percent Return on Investment (Frequency Distribution) <0%	Up to 10%	Equal or > 10%	Percent rofitable 1/ 1/	Wted Mean	Adjusted Net Revenue/Hectare <0	< $25	Equal or > $25	Percent Over $25	Wted Mean [Z$]
WILDLIFE ONLY RANCHES	12	0	5	7	58%	10.5%	0	12	0	0%	5.47
Natural Region IV											
Hwange	7	0	3	4	57%	7.4%	0	7	0	0%	5.22
Bulawayo	0										
Masvingo	0										
Sub-total	7	0	3	4	57%	7.4%	0	7	0	0%	5.22
Natural Region V											
West Nicholson	1	0	1	0	0%	9.9%	0	1	0	0%	6.67
Mwenezi	1	0	0	1	100%	56.9%	0	1	0	0%	10.25
Chiredzi	3	0	1	2	67%	10.6%	0	3	0	0%	3.78
Sub-total	5	0	2	3	60%	16.7%	0	5	0	0%	5.76
COMBINED RANCHES (C+W	32	4	11	17	53%	9.7%	4	24	4	13%	6.09
Natural Region IV											
Hwange	5	0	3	2	40%	11.6%	0	4	1	20%	6.98
Bulawayo	10	1	4	5	50%	9.0%	1	7	2	20%	12.18
Masvingo	0										
Sub-total	15	1	7	7	47%	9.5%	1	11	3	20%	10.15
Natural Region V											
West Nicholson	7	1	1	5	71%	17.4%	1	5	1	14%	8.83
Mwenezi	4	1	1	2	50%	9.8%	1	3	0	0%	5.81
Chiredzi	6	1	2	3	50%	3.1%	1	5	0	0%	1.15
Sub-total	17	3	4	10	59%	9.9%	3	13	1	6%	4.10
TOTAL WILDLIFE	44	4	16	24	55%	10.0%	4	36	4	9%	5.81
Natural Region IV											
Hwange	12	0	6	6	50%	17.3%	0	11	1	8%	5.64
Bulawayo	10	1	4	5	50%	9.0%	1	7	2	20%	12.18
Masvingo	0										
Sub-total	22	1	10	11	50%	8.6%	7	22	8	36%	7.24
Natural Region V											
West Nicholson	8	1	2	5	63%	15.7%	1	6	1	13%	8.43
Mwenezi	5	1	1	3	60%	33.9%	1	4	0	0%	8.47
Chiredzi	9	1	3	5	56%	6.2%	1	8	0	0%	2.26
Sub-total	22	3	6	13	59%	12.3%	3	18	1	5%	4.76

Notes: 1. Percent profitable = percent with return equal or greater than 10 percent.

Table A 6. Cattle Enterprises, Base Run Economic Results

	# Enter-prises	Percent Return on Investment (Frequency Distribution) <0%	Up to 10%	Equal or > 10%	Percent Profitable 1/	Wted Mean	Adjusted Net Revenue/Hectare < 0	< $25	Equal or > $25	Percent ver $25	Wted Mean [Z$]
CATTLE ONLY RANCHES	45	3	15	27	60%	12.4%	3	27	15	33%	18.53
Natural Region IV											
Hwange	1	1	0	0	0%	-6.3%	1	0	0	0%	-6.33
Bulawayo	12	0	5	7	58%	11.7%	0	8	4	33%	19.35
Masvingo	9	0	1	8	89%	19.8%	0	2	7	78%	29.75
Sub-total	22	1	6	15	68%	13.9%	1	10	11	50%	22.14
Natural Region V											
West Nicholson	7	0	3	4	57%	10.7%	0	6	1	14%	15.07
Mwenezi	10	1	5	4	40%	11.7%	1	8	1	10%	17.30
Chiredzi	6	1	1	4	67%	5.3%	1	3	2	33%	6.45
Sub-total	23	2	9	12	52%	10.7%	2	17	4	17%	15.07
COMBINED RANCHES (C+W	32	8	11	13	41%	13.6%	8	16	8	25%	17.35
Natural Region IV											
Hwange	5	3	2	0	0%	-5.9%	3	2	0	0%	-5.39
Bulawayo	10	2	4	4	40%	13.3%	2	4	4	40%	23.62
Masvingo	0	0	0	0			0	0	0		
Sub-total	15	5	6	4	27%	12.3%	5	6	4	27%	22.41
Natural Region V											
West Nicholson	7	2	1	4	57%	15.1%	2	5	0	0%	14.83
Mwenezi	4	0	2	2	50%	20.0%	0	2	2	50%	24.31
Chiredzi	6	1	2	3	50%	11.4%	1	3	2	33%	11.39
Sub-total	17	3	5	9	53%	14.6%	3	10	4	24%	14.88
ALL CATTLE ENTERPRISES	77	11	26	40	52%	13.1%	11	43	23	30%	17.05
Natural Region IV											
Hwange	6	4	2	0	0%	-6.0%	4	2	0	0%	-5.54
Bulawayo	22	2	9	11	50%	12.6%	2	12	8	36%	21.13
Masvingo	9	0	1	8	89%	19.8%	0	2	7	78%	29.75
Sub-total	37	6	12	19	51%	13.1%	6	16	15	41%	21.25
Natural Region V											
West Nicholson	14	2	4	8	57%	14.1%	2	11	1	7%	15.37
Mwenezi	14	1	7	6	43%	14.5%	1	10	3	21%	19.74
Chiredzi	12	2	3	7	58%	9.8%	2	6	4	33%	10.13
Sub-total	40	5	14	21	53%	13.1%	5	27	8	20%	14.68

Notes: 1. Percent profitable = percent with return equal or greater than 10 percent.

Table A7 Wildlife Enterprises, Base Run Economic Results

		Percent Return on Investment (Frequency Distribution)					Adjusted Net Revenue/Hectare				
	# Enter-prises	<0%	Up to 10%	Equal or > 10%	Percent Profitable 1/	Wted Mean	≤0	< $25	Equal or > $25	Percent Over $25	Wted Mean [Z$]
WILDLIFE ONLY RANCHES	12	0	2	10	83%	20.9%	0	11	1	8%	12.01
Natural Region IV											
Hwange	7	0	2	5	71%	18.5%	0	6	1	14%	14.13
Bulawayo	0										
Masvingo	0										
Sub-total	7	0	2	5	71%	18.5%	0	6	1	14%	14.13
Natural Region V											
West Nicholson	1	0	0	1	100%	16.0%	0	1	0	0%	12.40
Mwenezi	1	0	0	1	100%	72.0%	0	1	0	0%	13.27
Chiredzi	3	0	0	3	100%	19.7%	0	3	0	0%	7.64
Sub-total	5	0	0	5	100%	25.5%	0	5	0	0%	9.61
COMBINED RANCHES (C+W	32	1	6	25	78%	22.0%	1	24	7	22%	14.82
Natural Region IV											
Hwange	5	0	2	3	60%	21.9%	0	4	1	20%	17.15
Bulawayo	10	0	3	7	70%	20.3%	0	6	4	40%	29.69
Masvingo	0										
Sub-total	15	0	5	10	67%	21.9%	0	10	5	33%	24.78
Natural Region V											
West Nicholson	7	0	1	6	86%	35.3%	0	6	1	14%	19.57
Mwenezi	4	0	0	4	100%	22.0%	0	3	1	25%	10.66
Chiredzi	6	1	0	5	83%	11.3%	1	5	0	0%	4.46
Sub-total	17	1	1	15	88%	22.2%	1	14	2	12%	9.92
TOTAL WILDLIFE	44	1	8	35	80%	21.5%	1	35	8	18%	13.47
Natural Region IV											
Hwange	12	0	4	8	67%	28.0%	0	10	2	17%	14.79
Bulawayo	10	0	3	7	70%	20.3%	0	6	4	40%	29.69
Masvingo	0										
Sub-total	22	0	7	15	68%	24.3%	0	16	6	27%	18.44
Natural Region V											
West Nicholson	8	0	1	7	88%	30.7%	0	7	1	13%	18.25
Mwenezi	5	0	0	5	100%	44.7%	0	4	1	20%	12.23
Chiredzi	9	1	0	8	89%	14.8%	1	8	0	0%	5.80
Sub-total	22	1	1	20	91%	23.4%	1	19	2	9%	9.80

Notes: 1. Percent profitable = percent with return equal or greater than 10 percent.

Table A8 Cattle Enterprises, Base Run Pam Results

		FINANCIAL PROFITABILITY		ECONOMIC PROFITABILITY AND EFFICIENCY					
						Distribution of DRCs			
	No. Ent.	Profits D	PCR C/(A-B)	Profits H	DRC G/((E-F)	Neg or >5	Betw 2-5	Betw 1-2	< 1
CATTLE ONLY	45	(202,488)	2.71	(51,692)	1.18	3	5	21	16
Natural Region IV									
Hwange	1	(169,301)	-9.68	(157,988)	-337.30	1	0	0	0
Bulawayo	12	(270,391)	2.83	(69,038)	1.19	0	1	8	3
Masvingo	9	(95,683)	1.60	74,531	0.78	0	0	2	7
Sub-total	22	(193,185)	2.33	(18,800)	1.06	1	1	10	10
Natural Region V									
West Nicholson	7	(258,322)	3.05	(78,401)	1.24	0	1	5	1
Mwenezi	10	(167,070)	2.52	(68,120)	1.29	1	3	3	3
Chiredzi	6	(185,765)	8.10	(95,742)	1.74	1	0	3	2
Sub-total	23	(210,297)	3.26	(87,411)	1.37	2	4	11	6
COMBINED (C+W)	32	(374,941)	2.52	(91,611)	1.16	9	7	5	11
Natural Region IV									
Hwange	5	(110,350)	-5.03	(106,705)	-6.01	4	1	0	0
Bulawayo	10	(445,006)	2.60	(54,916)	1.08	2	2	3	3
Masvingo	0	0							
Sub-total	15	(333,455)	2.86	(94,361)	1.21	6	3	3	3
Natural Region V									
West Nicholson	7	(505,394)	2.23	(136,191)	1.16	2	1	1	3
Mwenezi	4	(163,223)	1.63	53,335	0.90	0	1	1	2
Chiredzi	6	(443,148)	3.07	(142,366)	1.27	1	2	0	3
Sub-total	17	(411,547)	2.35	(123,206)	1.19	3	4	2	8
TOTAL CATTLE	77	(274,114)	2.60	(68,281)	1.17	13	12	27	27
Natural Region IV									
Hwange	6	(279,651)	-5.72	(115,252)	-8.04	5	1	0	0
Bulawayo	22	(715,397)	2.69	(62,619)	1.12	2	3	11	6
Masvingo	9	(95,683)	1.60	74,531	0.78	0	0	2	7
Sub-total	37	(526,640)	2.57	(49,433)	1.13	7	4	13	13
Natural Region V									
West Nicholson	14	(763,716)	2.42	(107,296)	1.18	2	2	6	4
Mwenezi	14	(330,293)	2.09	(33,417)	1.10	2	4	5	5
Chiredzi	12	(628,913)	3.62	(128,054)	1.39	2	2	3	5
Sub-total	40	(621,844)	2.62	(102,624)	1.25	6	8	14	14

Table A9 Wildlife Enterprises, Base Run Pam Results

		FINANCIAL PROFITABILITY		ECONOMIC PROFITABILITY AND EFFICIENCY					
						-------Distribution of DRCs ----------			
	No. Ent.	Profits D	PCR C/(A-B)	Profits H	DRC G/((E-F)	Neg or >5	Betw 2-5	Betw 1-2	< 1
WILDLIFE ONLY	12	(104,233)	1.59	(523)	1.00	0	1	5	6
Natural Region IV									
Hwange	7	(136,827)	1.78	(2,417)	1.01	0	1	2	4
Bulawayo	0								
Masvingo	0								
Sub-total	7	(136,827)	1.78	(2,417)	1.01	0	1	2	4
Natural Region V									
West Nicholson	1	(75,241)	1.62	(31,790)	1.17	0	0	1	0
Mwenezi	1	70,565	0.77	146,374	0.63	0	0	0	1
Chiredzi	3	(95,989)	1.62	(34,646)	1.15	0	0	2	1
Sub-total	5	(58,600)	1.33	2,128	0.99	0	0	3	2
COMBINED (C+W)	32	(43,987)	1.55	2,847	0.98	3	4	10	15
Natural Region IV									
Hwange	5	(31,390)	1.49	25,687	0.79	2	0	0	3
Bulawayo	10	(32,150)	1.33	28,497	0.84	0	2	2	6
Masvingo	0	0							
Sub-total	15	(31,896)	1.37	27,561	0.82	2	2	2	9
Natural Region V									
West Nicholson	7	(13,915)	1.13	45,668	0.74	0	1	3	3
Mwenezi	4	(17,606)	1.44	(6,437)	1.11	0	0	2	2
Chiredzi	6	(126,884)	3.05	(102,707)	1.97	1	1	3	1
Sub-total	17	(54,655)	1.74	(18,960)	1.15	1	2	8	6
TOTAL WILDLIFE	44	(60,417)	1.57	1,928	0.99	3	5	15	21
Natural Region IV									
Hwange	12	(92,895)	1.72	9,293	0.96	2	1	2	7
Bulawayo	10	(32,150)	1.33	28,497	0.84	0	2	2	6
Masvingo	0	0				0	0	0	0
Sub-total	22	(65,284)	1.57	18,022	0.91	2	3	4	13
Natural Region V									
West Nicholson	8	(21,625)	1.20	35,986	0.80	0	1	4	3
Mwenezi	5	28	1.00	24,125	0.81	0	0	2	3
Chiredzi	9	(116,585)	2.25	(80,020)	1.55	1	1	5	2
Sub-total	22	(55,551)	1.57	(14,167)	1.09	1	2	11	8

Table A. 10 Benefit/Cost Analysis of Nyaminyami Campfire Program

Scenario 1: Management does not improve: Tourism development hindered; immigration increases, poaching increases, hunting revenue declines; ESAP falters.

	Actuals			Estimate		Projections [1992 Z$]				
	1	2	3	4	5	6	7	8	9	10
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
BENEFITS	319,353	384,302	573,636	939,515	1,102,000	1,097,000	1,042,000	989,975	940,754	894,176
Hunting Revenue	272,187	346,506	467,765	861,000	1,000,000	1,000,000	950,000	902,500	857,375	814,506
Tourism Revenue	0	0	30,000	36,000	40,000	40,000	40,000	40,000	40,000	40,000
Cropping Revenue	35,910	28,720	48,484	31,515	50,000	45,000	40,500	36,450	32,805	29,525
PAC Revenue	11,256	7,917	8,999	9,000	10,000	10,000	9,500	9,025	8,574	8,145
Other	0	1,159	16,788	2,000	2,000	2,000	2,000	2,000	2,000	2,000
LESS RECURRENT COSTS	86,581	270,278	326,705	333,384	380,325	430,140	470,972	521,482	582,420	646,841
Wages & Benefits	15,839	110,575	163,864	180,250	198,275	218,103	239,913	263,905	290,295	319,325
Manager's salary	0	0	0	0	0	0	0	0	0	0
Cropping expenses	20,326	22,456	23,282	15,133	24,000	24,000	20,000	20,000	20,000	20,000
Wildlife compensation	26,680	42,405	3,000	0	0	0	0	0	0	0
Vehicle fuel & maint	844	13,210	82,392	100,000	125,000	143,750	165,313	190,109	218,626	251,420
Equip & stores	176	1,915	2,609	3,000	3,600	4,320	5,184	6,221	7,465	8,958
Gen office expenses	223	5,294	2,485	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Protective clothing	0	13,524	1,262	3,000	3,450	3,967	4,563	5,247	6,034	6,939
Ammunition & PAC matls	0	1,000	5,589	6,000	6,000	6,000	6,000	6,000	6,000	6,000
Annual Gen Meeting	0	4,345	6,699	6,000	6,000	6,000	6,000	6,000	6,000	6,000
Other	2,400									
ADA funded	0	0	3,188	0	0	0	0	0	0	0
Zimtrust funded	20,093	61,554	33,385	0	0	0	0	0	0	0
Fence maintenance	0	0	0	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Building maintenance	0	0	0	2,000	2,000	6,000	6,000	6,000	10,000	10,000
LESS CAPITAL COSTS	127,940	153,709	516,086	0	50,000	305,000	260,000	343,000	50,000	310,000
Funded by ZimTrust										
Fencing	0	0	78,212	0	0	0	0	0	0	0
Motor Vehicles	67,186	113,000	136,107	0	0	200,000	200,000	250,000	0	250,000
Radio Comms	17,037	0	231,914	0	0	50,000	0	0	50,000	0
Camping/cropping	53,717	0	5,503	0	0	55,000	0	10,000	0	0
Rifles	0	40,709	32,263	0	0	0	60,000	33,000	0	60,000
Buildings	0	0	32,086	0	50,000	0	0	50,000	0	0
EQUALS NET BENEFITS	104,832	(45,685)	(269,815)	606,131	665,675	361,860	311,028	125,493	308,334	(62,466)
NET PRESENT VALUE										
(at 10% interest)	1,211,247									
(at 40% interest)	333,026									
SURPLUS FOR DISTRIBUTION	214,935	169,578	282,844	606,131	665,675	361,860	311,028	125,493	308,334	(62,466)
(equals net benefits,	104,832	(45,685)	(269,815)	606,131	665,675	361,860	311,028	125,493	308,334	(62,466)
plus donors' contributions,	148,033	215,263	552,659	0	0	0	0	0	0	0
less 15% DC levy)	37,930	25,437	42,427	90,920	99,851	54,279	46,654	18,824	46,250	(9,370)
ACTUAL WARD BENEFITS	198,000	96,990	204,000	515,211	565,823	307,581	264,373	106,669	262,084	(53,096)
Number of Households	4,500	4,800	5,000	5,300	5,618	5,955	6,312	6,691	7,093	7,518
(Assp 6% pop increase)										
Distribution per household	$44	$20	$41	$97	$101	$52	$42	$16	$37	($7)

Source: Jansen, 1992b