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AGRICULTURAL AND ENVIRONMENTAL NEXUS: A HISTORICAL OVERVIEW

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AGRICULTU0RE AND ENVIRONMENT NEXUS: A HISTORICAL OVERVIEW

Historical account of environmental degradation in both the commercial and communal areas are given in detail by a number of authors (Whitlow, 1988; Murombedzi, 1990). Following Whitlow (1988) this literature review on environmental degradation in the communal areas of Zimbabwe is broken into phases. In addition to the five phases used by Whitlow, in this review two phases have been included.

Phase I: Pre 1926 - Creation of reserves

The first reserves, the Gwaai and Shangani Reserves were declared in 1894, and following pressure from the British government, additional areas of land were set aside for the exclusive use of indigenous population. By 1911 these native reserves comprised about 8.5 million hectares barely one fifth of the country. Despite this concentration of people on marginal land, degradation was not a problem since the population was low. Beach (1984) notes that of the estimated African population of 700 000 only 60 percent were in the native reserves.

Phase II: 1926 to 1951 - Centralisation

By the end of the 1920s there was evidence of degradation in the reserves as farmers increased land under cultivation. This increase in land under cultivation was attributed to increases in taxes and falling grain prices (Murombedzi, 1990). Murombedzi (1990) also notes that the number of cattle in the reserves was becoming too large whilst so much land was put under cultivation. In response to this increase in environmental degradation, a team of agriculturalist and demonstrators was appointed to assist peasant farmers (Kay, 1970). Spatial re-organisation of arable and grazing lands and settlements was thus initiated as a basis for improved farming and conservation. This spatial re-organisation was referred to as centralisation. Despite these efforts, resource degradation occurred and was evidenced by extensive erosion that took place.

In 1941 the Natural Resources Act was enacted. This act was intended to overcome degradation which was seen by the colonial government as a product of poor farming methods by the peasant farmers - use of the plough, and opening up of new land by the well-off class of plough owning farmers and use of sleighs. However, for the peasants degradation was seen as a result of low prices, government intervention in marketing, the increasing diversion of labour into conservation works and lack of adequate land (Murombedzi, 1990; Ranger, 1985). The Act provided for:

- the reservation of degraded lands against further use by people or domestic animals.
- the reduction of livestock numbers where there was evidence of overgrazing leading to resource deterioration.
- the obligatory maintenance of such soil conservation works carried out for the benefit of Africans by those people whose land was directly protected by these works (Kay, 1970).

Manpower and financial constraints prevented the proper implementation of this resource legislation, moreover the destocking measures which were carried out were very unpopular therefore compromising future conservation efforts. More crucial was that the reduction in livestock numbers was not combined with improved pasture management so that the benefits of reduced pressure were, at best, short-lived. Equally, the bitter resentment of peasant farmers to forced reduction of cattle numbers hardly provided a sound basis for encouraging participation in future conservation works.

Phase III: 1951 - 1962 - Agrarian reforms

After the end of World War II, colonial agriculture in Zimbabwe became a profitable venture. This necessitated the implementation of Land Tenure Act (LTA) and led to mass eviction of African 'squatters' from European land unless they entered into labour agreements with the white farmers. The result was a dramatic increase in the human and livestock population of the Reserves and a concomitant and inevitable rise in the rate and extent of resource degradation in the Reserves. The Native Land Husbandry Act of 1951, with its provisions for intensive conservation works: drain strips, gully dams, contour ridges, rotational grazing etc., was introduced against this background. The conservation measures of the NLHA were resisted by the smallholder farmers because it meant taking out of production land that was already not enough to guarantee even subsistence needs and farmers would spend most of their time attending to conservation works. The most important reason farmers resisted the NLHA was that it required them to limit livestock numbers so as to curb overgrazing (Cliffe 1986).

Registered grazing rights were given to farmers to regulate livestock numbers and thereby avoid overstocking. Despite the controversial and unpopular destocking in the mid 1940s and early 1950s many reserves were found overstocked, hence compulsory reduction of cattle numbers was insituted yet again. An added complication was that the maintenance of soil fertility in arable holdings was based on the principle of one head of cattle to supply manure for 0.4 hectares of cropland. On this basis few reserves had enough cattle to cope with planned areas of cropland. For example, in Chiweshe reserve, although rated slightly overstocked, to maintain fertility the reserve required at least three times the number of cattle present in 1957. This situation persists even today where farmers lack sufficient cattle for manure and draught power. There seemed to be very limited efforts to improve grazing management and to increase carrying capacities; the emphasis remained on destocking as the best way to stop degradation of grazing areas.

In addition, the attempt to change from a tribal communal system to an individual system of land tenure was opposed. The philosophy behind the introduction of individual land rights was that farmers would be more inclined to effect improvements on land when they had security of tenure and, at the same time, could be held accountable for any mismanagement of their land (Kay, 1970).

Phase IV: 1962 - 1969 - Uncertainty

With the abandonment of the NLHA and the changing political circumstances in the country, there was a period of uncertainty in the 1960s. Some progress was made in improving farming and conservation through the efforts of the Department of Conservation and Extension. In the face of growing population pressures, land degradation became widespread. For example, Table 1 shows that by 1966 some 39 percent of grazing land in the communal areas was bare to very overgrazed (Cleghorn, 1966).

Table 1: Condition of grazing in Communal Areas of Zimbabwe (Acres)

Natural Region	Bare	Very overgrazed	Moderate	Good
I	-	49 600	177 935	4 500
II	-	1 402 423	385 963	353 900
III	-	2 963 787	560 326	822 061
IV	789 226	4 883 106	2 736 889	8 047 220
V	3 301 989	2 217 352	826 590	2 096 514
TOTAL	4 091 215	11 516 268	4 687 708	11 324 195
% of total grazing area	13	36	15	36

Phase V: post 1969 - 1979 - Growing pressure

With their political and economic aspirations being blocked by the government the peasant farmers turned increasingly to supporting the guerrilla forces intent upon taking control of the country. With the deterioration in security during the civil war, conservation was neglected and this exacerbated an already serious problem. Since independence some progress has been made in resolving the conservation problem by, for example, afforestation and resettlement schemes.

During the 1970s conservation efforts were initiated in the previous decade continued to make progress. Grazing schemes, some initiated through the Tribal Authority Conservation Committees TLACC's (1966) (which had increased to 90 by 1970) were introduced in many areas to number over 500 by 1973. Some of these were very successful (Froude, 1974) but many were not managed properly and there was little improvement in veld condition or the livestock. As the civil war intensified, so it became increasingly difficult for extension staff to supervise conservation measures and for farmers to comply with these measures. Conservation works in arable lands were neglected and most of the grazing schemes collapsed.

In the early 1970s a policy of community development was conceived in which the state gave recognition to some of the institutional realities, particularly the role of chiefs, while still attempting to achieve the technical and economic objectives of the NLHA. These ideas were incorporated in the LTA of 1970 which gave legal recognition to what became known as the Tribal Land Authorities in communal areas or the Tribal Trust Land. The grazing schemes of the early 1970s were a direct result of this policy (Tawonezvi and Zindi 1994). The perceived benefits from the setting up of grazing schemes included improved livestock production leading to better calving rates, improved animal offtake arising from increased numbers as well as better veld management and reduced degradation, improved access to draught power, decreased labour requirements for herding and increase availability of labour for other farming operations (Cousins 1988). The grazing schemes were also expected to reduce the risk of irreversible environmental degradation as a result of perceived overgrazing and poor management.

Grazing land degradation in the communal areas was due to arable expansion brought about by inappropriate pricing policies and the colonial administration perception of the problem as being essentially a tenure problem, and their failure to prescribe solutions, i.e. land redistribution.

Phase VI: 1980 to 1990 - POST INDEPENDENCE ERA

At independence, there were pressing and sensitive political issues to be resolved and conservation was a low priority.

Subsequently, the problem of land degradation has been recognised clearly in national development plans (Republic of Zimbabwe, 1982, 1986). Though efforts have been made to improve on the condition of natural resources in the communal areas through the reafforestation programme, resettlement programme and re-organisation of administrative structures, the problem of natural resource degradation seem to continue unabated.

Over the years, the number of livestock has increased to levels beyond the carrying capacity of the grasslands[1]. This increase in livestock numbers[2] went hand in hand with an increase in the human population, without concomitant changes in the size of available land. The trend has been one of increasing cattle numbers and decreasing grazing resources as a result of increased cropping to satisfy the food needs of a rapidly expanding "peasant" population. However fluctuations were experienced primarily due to droughts. It is estimated that the size of the communal herd fell by 31 percent due to the 1991/92 drought (Tawonezvi and Zindi 1994). In many areas of the country, human and livestock numbers are greatly in excess of carrying capacity of these areas. It is estimated that 50 -60 percent are overstocked. The net result is over-use of the remaining pastures creating massive overgrazing. The consequences of this are gradual decline in plant vigour with the nutritive grass species having been overgrazed leaving hardy grass.

Arable expansion into grazing areas has continued almost unabated in post-colonial Zimbabwe. The resettlement programme, having managed to settle only 40 000 households out of the targeted 162 000 by 1984 has obviously not significantly relieved land pressure in the communal areas especially when one considers that employment in the non-agricultural sector has not increased at all while the population has grown at an annual rate of around 2.9 percent (Tawonezvi and Zindi 1994).

Table 1 illustrates the trend in land use that could explain the current state of environmental degradation in the communal areas. Over a 30 year period (1961/62 - 1991/92), the number of households increased by 285 percent and the number of livestock increased by 148 percent.

Table 1: Various trends in CAs (1961 - 1982).

	1961/62	1981/82	1991/92	% change
Land size (106 ha)	13.50	16.35	16.35	21.11
Households (106)	0.39	0.95	1.50	284.62
Cultivated ha (106)	1.15	3.50	4.25	269.57
Grazing ha (106)	12.35	12.85	12.10	-2.02
Livestock (106) Cattle	1.80	3.20	4.04	124.00
Goats	0.90	1.50	2.89	221.00
Total	2.79	4.70	6.91	147.67
Ratios:				
Grazing:Animal head	4.4 : 1	2.7 : 1	1.7 : 1	-61.36
Grazing:Cattle head	6.9 : 1	4.0 : 1	3.0 : 1	-56.52
Grazing:Arable ha	10.7: 1	3.7 : 1	2.8 : 1	-73.83

Source: (Stubbs, 1983; Mudimu, 1996).

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1 The livestock (this includes cattle, goats, sheep and pigs) numbers in the communal areas dramatically increased from 1.8 million in 1965 to 3.4 million in 1977, an increase of approximately 80 percent (Chigaru 1984). After stagnating in the late 1970s, the communal cattle herd has increased from approximately 2.9 million head at independence to approximately 4.4 million head in 1991, indicating an average annual growth rate of 3 percent (MLAWD 1993). During the period 1980 to 1990, the goat flock increased from 0.982 million to 2.6 million and that of sheep from 0.387 million to 0.6 million (MLAWD 1993).

2 The increase in livestock numbers is due to the multiple roles livestock play in the communal areas - draught power, manure, milk and social functions. Due to the multiple roles of cattle, low off-take rates resulted. In turn the low offtake rates results in increased overgrazing during the dry and drought seasons.

The current livestock development policy is largely a continuation of policies initiated since the 1920s. The assumptions underlying these policies as well as the prescriptions proposed to the perceived problems, have shown similar continuity. First, the livestock production in communal areas is seen in terms of milk and meat production. To this end the encouragement of small ruminant goes hand in hand with farmers objectives for increased meat production as well as milk from cattle. The Policy Statement (MLAW, 1993) argues that improvement in the efficiency of livestock production will lead to improved offtake rates and levels of income. Among other things, this is expected to be achieved by conservation of rangeland, control of livestock numbers and stocking rates, promotion of grazing schemes, and increased offtake rates encouraging cattle sales. How the conservation of the rangeland and control of livestock numbers and stocking rates are to be achieved is not spelled out.

The government objectives of increasing cattle off-take from the communal areas is in direct conflict with farmers' objectives. Steinfeld (1988) makes it clear that communal area farmers are not interested in reducing their cattle numbers by selling because they regard cattle as an investment. When their external value (market value) rises farmers regard this as an additional security as well as a form of increased wealth. It is therefore surprising that while the policy document acknowledges the functions of cattle based on recent research, and recognises the low levels of output from the communal sector, it proposes to consider increased offtake from cattle as an important thrust.

Another view which has been increasingly advocated is the one which sees the communal tenure system as the major constraint to sustainable livestock production. The rangeland is a common property resource with the right to its exploitation held by all members of a loosely defined community. It is argued that lack of accountability on the grazing resource in traditional communal rangeland has resulted in lack of commitment to improve grazing areas and its water resources. This in turn have led to mismanagement, land degradation and, consequently, poor livestock productivity (LDP 1992). While the policy paper recognises this problem of common property management, it only highlights the formation of grazing schemes and efficient use of the available livestock feed - mainly crop residues as the possible solutions to curbing the degradation of grazing areas. The policy document does not indicate how the problem of open access within a community can be resolved to ensure efficient and sustainable use of the range.

As far as natural forests are concerned, increases in human population has led to things: (i) an increase in the demand for forest products, i.e. wood fuel and poles for home building, and (2) expansion in arable land making it necessary to clear trees. It is estimated that 75, 000 ha are cleared annually for arable purposes.

Natural forests or woodland are the major source of energy for the rural population - wood for cooking and heating. Tree also use for poles for construction of houses and for fencing. Wood is the preferred source of fuel because it is cheap. Even in urban areas, wood is the cheapest source of energy, creating demand for wood which is harvested in rural areas and transported to urban areas.

Forests have a conservative role: protecting the soil; reducing wind velocity and contributing to maintaining soil fertility through the tree nutrient cycle. Trees and wood are essential for sustainable agriculture and are a cheap and adaptable system for capturing and storing solar energy. Therefore wood is a major renewable energy source.

Over the years there has been a gradual depletion of natural forests as a result of excessive cutting for energy use and clearing virgin land for arable purposes. Large areas surrounding population centres have been denude creating a shortage of fuelwood. In some communal areas and some urban areas there is growing commercialisation of the fuelwood system with prices rising continually indicating that demand for fuelwood is now outstripping supply. The severity of deforestation is supported by the following facts:

In 1953 an F.A.O. forest inventory study estimated that 60 percent of total communal areas were covered by woodland. This figure had reduced to 30 percent by 1978. The current estimate is put at 18 percent. This indicates that about 80 percent of the communal area woodland has been cleared.

Wood consumption in the communal areas is estimated at 57 percent of the total country wood consumption of 5 million m3 per year, i.e. communal areas consume 3.5 million m3 per year. Estimated firewood consumption per annum by 1981 are presented in Table 2.

Table 2: Estimated Firewood Consumption in Zimbabwe (1981)

Sector	Estimated Annual Consumption	
	Million m3 x 10	Million tonnes
Communal areas	3.5	2.38
Commercial farms	.68	.46
Mines	.13	.09
Urban Areas	.28	.19
Total	4.59	3.12

Source: J.C. Johnson, 1981

Consumption by 1981 was equivalent to clearing of 74 000 ha of woodland a year. Most of the clearing is due to agricultural expansion. Rough estimates showed 20-30 percent of fuelwood shortage in some communal areas.

Estimates by Hosier (1988) shows that fuelwood demand in the communal areas is 5.36 million tonnes and wood demand for construction is 1.49 million tonnes.

Some communal areas no longer have any natural forests. Areas still endowed with natural forests are now being cleared with the wood being transported to forest depleted areas for sale.

A survey by Whitlow (1988) showed the following:

- Of the 1.8 million hectares of eroded land, 1.5 million hectares were in the communal lands.
- he most extensive erosion was recorded in the communal lands, especially within Natural regions IV and V, but also within higher rainfall areas where nearly one tenth of the land was eroded. The area of eroded crop land in Zimbabwe was estimated at 842 400 hectares and for non-cropland, mainly grazing areas, the figure was 992 400 hectares. In the Communal Lands there were 768 200 hectares of eroded cropland and 760 300 hectares of eroded non-crop land.

The most important factor which accounted for statistical variation in erosion was population density, i.e. there was a direct positive correlation between increases in population density and increases in the extent of eroded terrain. This relationship was valid in the communal lands.

Table 3:Indicators of Environmental Degradation in Communal Areas

Environmental Problem/ Author	Variable and factor	Magnitude
SOIL EROSION		
Elwell (1983)	Soil loss due to sheet erosion from rainfall runoff in summer (November to March)	50 - 100t ha-1 yr-1
Vogel (1992)	Soil loss in cropped lands in an average rainfall season	6-8 t ha-1 yr-1
	In bare uncropped lands (bare fallow)	30-90 t ha-1 yr-1
	Sustainable soil loss	5 t ha-1 yr-1
	Soil loss pasturelands	75 t ha-1 yr-1
Stocking (1986)	Soil loss in cropped lands	50 t ha-1 yr-1
Whittlow (1988, 1993)	**Erosion in Communal Areas** seriously eroded moderately eroded heavily eroded	1988 26.9% 32.5% 8.5%
DEFORESTATION		
Whitsun Foundation (1988)	due to arable land clearing	74 000 ha yr-1
Touche Ross (1992)	for agriculture	100 000ha yr-1
World Bank (1995)	1981-1990 Annual average % of forest area	60 000ha yr-1 0.7%

Erosion on crop lands in the communal lands was more wide spread and severe, much of the erosion seems to date mainly from the 1960s when population pressures were increasing and conservation measures were neglected. A combination of late planting, shallow ploughing and limited fertiliser or manure application, contribute towards the high rates of soil erosion on these crop lands.

Wetland areas in communal lands were found to be under enormous pressure for grazing and cultivation and this has resulted in serious and very rapid gulling.

It is clear from the presentation above that the country has serious environmental degradation especially in the communal areas. Like Whitlow (1988) rightly pointed out, resolving this problem will require massive financial and man power inputs beyond the present means of the country. Thus this study proposes that empowering the local communities to manage their resources may be a cost effective means of conserving

the natural environment rather than wait for the central government to get organised, mobilise funds and manpower to resolve the degradation problem.

Table 3 summarises the extent of environmental degradation in the communal areas.

The institutional framework for natural resources management

The environmental institution in Zimbabwe may be the major cause of natural resource degradation in the communal areas (Annex 1, provides an overview of different government ministries and non-governmental organisations involved in environmental and natural resource management).

Of the ministries involved in environment, there is an overlap of functions and efforts. For example, many of the responsibilities of the Department of Natural Resources, under the Ministry of environment and Tourism, also within the remit of other government departments and agencies, particularly the legal statutes concerning natural resources and the environment. Their effectiveness in the communal areas where they are needed most, is impaired because some of the legal statutes do no apply to these areas. A lack of funds has also restricted their extension work to the district level (Katerere et al, 1993).

The largest extension organisation in Zimbabwe, AGRITEX (under the Ministry of Agriculture), emphasises soil conservation and land use planning at farm level in all tenurial sectors. The presence of AGRITEX officers at Ward level makes the department more effective than the Department of Natural Resources (under the Ministry of Environment and Tourism). AGRITEX has a responsibility to provide fully documented land-use plans for villages, but these are not always environmentally sensitive. Extension work by AGRITEX is biased towards increased crop production (despite the environmental consequences).

Rural development is the responsibility of the Ministry of Local Government, Rural and Urban Development through the administration of Provincial and District Development Committees and Ward and Village Development Committees (the latter being referred to as WADCOs and VIDCOs). These organisations have frequently conflicted with traditional institutions such as lineage leadership and customary law, which have found themselves without a function in the communal areas. As a result some of the traditional methods of environmental management have ceased, leading to localised environmental degradation. In practice, proposals and plans for environmental management and conservation drawn up by VIDCOs are rarely implemented and District Councils are usually unwilling to deal with environmental problems.

Community development at the village level is the responsibility of the Ministry of Employment Creation (formerly the Ministry of Community and Co-operative Development) which works through Village Development Workers. These frequently call on AGRITEX extension workers for assistance and, therefore, need more training in environmental issues so that they can provide on-the-spot advice.

Besides the Government's involvement in natural resources, there are a couple of nongovernmental organisations (NGOs) who are also involved. Assistance has been offered among other things in environmental management. Their efficiency is impaired by inadequate financial resources to support core organisational structures and a reluctance to fund institutional strengthening. They seldom document their research and this means that useful information, particularly on policy issues, is not available to others. Unfortunately most of the NGOs are not well equipped and lack adequate personnel for dealing with environmental issues (Katerere et al, 1993).

The Economic Structural Adjustment Programme

In 1991 the Government of Zimbabwe embarked on an Economic Structural Adjustment Programme (ESAP). Structural Adjustment Policies (SAPs) assume two major causes of economic distress and its associated technological stagnation: external shocks (e.g. oil price hikes) and internal shocks (e.g. droughts) and inappropriate domestic policies (e.g. over-expansionary fiscal and monetary policies). Consequently under SAPs, policy packages negotiated with the IMF and the World Bank have comprised three broad categories (Bagachwa, 1995):

(a) policies that seek to restrain demand in the economy by reducing expenditure on imports and releasing resources for exports (e.g. cuts in government spending and elimination of subsidies),
(b) supply switching measures aimed at providing incentives for shifting resources from non-tradables to tradables (e.g. decontrolling domestic prices), and
(c) long-term supply policies such as trade liberalisation and institutional restructuring (e.g. civil service and parastatal restructuring and privatisation).

However, when SAPs are implemented, there is lack of understanding of the linkage between environmental degradation and economic crisis; focus is on achieving the fiscal balance while environmental protection, which requires vast amounts of public expenditure, is ignored. Lending institutions do not usually accept to incorporate environmental considerations as part of their funding.

The exact nature of the complicated interaction between SAPs and the environment are not yet well understood. In the case of Zimbabwe, information on the impact of ESAP on the environment is scant. Other studies have identified a complex and differentiated set of structural parameters that may suppress or dilute the impact of a particular reform measure on the natural resource base. These parameters include local physical and geographical circumstances; prevailing traditional practices of cultivation and production; population pressure; poverty; social and gender relations; employment and migration; land tenure and the powers and competence of the government (Reed, 1992; Cromwell and Winpenny, 1993; Munasinghe, 1993). It appears that where SAPs have affected the environment adversely, these negative effects have been exacerbated by market failures, institutional constraints, poverty, unemployment and landlessness (Munasinghe et al., 1993; World Bank, 1994). In the case of Zimbabwe, there is therefore a need to study in great detail the impact of ESAP on the natural resource base on which the majority of the population depends on. This is particularly desirable as the government commences on the second phase of the programme.

COSTS OF ENVIRONMENTAL DEGRADATION

Overgrazing and deforestation interact with detrimental environmental and economic consequences. The combined effect of these is the serious undermining of the subsistence economy of the communal areas which depends on the productivity of the land for both crop and livestock production. The environmental consequences are:

(i) soil erosion,
(ii) siltation of rivers and dams, and
(iii) desertification in some areas.

In 1979 it was estimated that soil loss losses in the communal areas were on average 50 tonnes per hectare (Elwell, 1983) (Table 3). Most of the soil loss was due to soil runoff in summer, with the rains. Excessive soil loss in river catchment areas lead to siltation. These are indicators that vital water storage facilities in the communal areas and outside are heavily silted. Most of the major dams have their catchment areas in

the communal areas. it is stated that the country's major irrigation dams are 40 percent silted, and some dams, particularly in communal areas are 100 percent silted.

Excessive runoff of rain results in creation of gullies. This is evident in most communal areas. Most of the roads are impassable. For example, in Mhondoro-Ngezi, it is estimated that about 80 000 hectares of land (arable and grazing) has been lost to gulling; business centres, the St. Michael's Mission, schools and roads are threatened by the extensive gullies that have developed in the area. The case in Mhondoro-Ngezi is exacerbated by the fact that the soils in the area as sodic soils which erode easily.

The economic consequences of environmental degradation are:

(i) poor productivity of the grazing lands,
(ii) poor productivity of arable land,
(iii) loss of time for agricultural activities,
(iv) loss of animals in the drought seasons,
(v) loss of animals in gullies, and
(vi) loss of potential land for grazing and arable production.

The environmental effects are accompanied by economic effects. Soil erosion due to water and wind erosion has resulted in the removal of top soil on which most of the vegetation survive.

With overgrazing, the productivity of livestock is reduced. There is evidence that communal area cattle productivity is characterised by low birth rates, low growth rates, and generally poor condition at maturity. On marketing communal area cattle fetch very low prices. Poor reproductive and growth rates have contributed to shortage of draught animals which in turn undermines agricultural production. Draught animals are the source of farm power used for plowing and cultivation. Shortage of draught power leads to delayed planting which in turn results in low crop yields.

Shortage of thatch grass is another consequence of overgrazing. Households are now having to buy grass and most travel to commercial farms to purchase the grass.

Soil erosion in the arable lands is contributing to poor crop yields as most of the top soil is washed away by heavy rains. There is also a loss of inorganic fertilisers that are lost due to run-off and leaching, which is a social cost to the country.

Due to heavy deforestation, rural women now have to walk tens of miles in search of fuelwood. This is vital time lost that is needed in agricultural activities and other household chores. This has detrimental effects on agricultural output which has not been quantified.

Possible solutions to the environmental degradation problem

The following solutions to the environmental degradation problems in the communal areas have been suggested.

In the past, destocking was enforced so as to maintain the carrying capacity of the grazing land. people were asked to reduce the number of their cattle by two means, marketing or slaughter. The above attempt was accompanied by some enforcement. Every cattle owner was issued with a card that stated the size of his/her herd. fortnightly dipping was made a requirement. At the dip tanks cards were checked for regularity of dipping as well as for correspondence of numbers dipped and number registered. This type of enforcement was weak because families with excess cattle just rotated the animals for dipping while

maintaining the required number according to the dip card. This suggest that any attempt to control numbers need to be accompanied by strong and effective enforcement. Other strategies that have been suggested include the following:

- Creation and strengthening of existing communal enforcement structures
- Redefining of property rights - shifting from common property ownership to private ownership
- Reduction of livestock numbers that use a given pastureland
- creating conditions that will induce the farmers to market livestock
- reforestation on a national scale
- agroforestry
- do nothing solution
- a reduction in the population of the country

Each of these solutions are discusses briefly and analysed below.

Creation and strengthening of existing communal enforcement structures
This solution has been suggested for areas where there is plentiful pastures. Herders of livestock are required to practice rotational grazing to allow for the regrowth of grass. Violators of this requirement are then sanctioned by for example being brought to an open court. Embarrassment is an act of enforcement. However, in most communal areas there are very little pastures and there is no room for rotational grazing.

Another form of community enforcement is for the chief/headmen not to allocate arable land in grazing areas. Due to an increase population pressure, and that the right to grow crops is superior to grazing rights, this enforcement has fallen apart. As a result settlement and cultivation in grazing areas is now wide spread in the communal areas. Thus enforcement at community level using these two approaches, it has been concluded, is not likely to yield a solution.

Redefining of property rights - shifting from common property ownership to private ownership
Two approaches have been suggested in literature: division of grazing land into individual properties and the division of grazing lands into specific village properties. Other villages are excluded from using grazing that is not theirs.

The first alternative suggests a complete restructuring of society so that there are individual property rights that can be specified, exclusive, enforceable, transferable and divisible. This implies that the benefits and costs to grazing livestock will accrue to individual owners. Thus, it is suggested, an individual will have an incentive to limit the number of livestock so as to maximise benefits over time. There are several problems associated with this option:

(i) when the land is subdivided for several herders, the herders will include non-cattle owners. This has to be done to ensure equity. The result of this subdivision may be that each farmer may get a piece of land too small to sustain the critical number of livestock needed to sustain subsistence living. If the distribution of land excludes non-owners from the outset, it has to be done again in the future when those without will have acquired some. Thus it may be too costly to implement this option of grazing management.

(ii) some individuals with too many animals, may decide not to destock even when they have inadequate land to carry large numbers of cattle. Thus environmental degradation may also result even with individual ownership of land.

The second option entails the creation of exclusive property rights at village level rather than at individual household level. At village level, members are likely to exert pressure on each other so as not to create conditions that lead to overgrazing. This option may require some farmers to reduce their herd sizes to avoid overgrazing. Then the crucial issue is how to make these farmers agree to reducing their herd sizes. If the transaction costs - in terms of time for meetings, identification and demarcation of boundaries, and levels of violation of by-laws - are low, the formation of exclusive property rights at village level seem to be more attractive than formation of individual property rights. As noted before, during the colonial period peasant farmers objected to individual rights to grazing. It will be interesting to find out if the farmers are still against individual ownership of grazing.

Tradable grazing rights

With this system individual households are allocated grazing rights every year. The households include cattle and non-cattle owners for equity reasons. The reason for a yearly allocation of the grazing rights is to assess the veld carrying capacity on a yearly basis as this fluctuates depending on the rainfall patterns. Households with excess cattle then buy grazing rights from households with little or no cattle to fully use their grazing rights. If some households with large herds for their cattle cannot secure grazing rights for a particular year, then they have to destock. This option is attractive in that it results in income redistribution between cattle owners and non-cattle owners.

Taxing cattle owners

with this alternative a charge is levied for grazing so as to discourage ownership of large herds of cattle. Currently, the cash input for cattle production is very low. Farmers are not paying for grazing which have resulted in zero economic rents. A charge levied per animal is more effective than a charge on per grazing areas. The latter encourages keeping large cattle herds. However, the crucial question is the price of grazing going to be set? If the cost of grazing is set below its true cost, overgrazing will continue; if it is set too high, it may not make sense for the farmers to keep cattle which are the basis of their agricultural livelihood.

Improve market prices for cattle

This option suggests that a revision of market prices for cattle and small stock to reflect the true value of these animals will induce farmers to increase off-take. However, since cattle are a form of bank and security to the farmers, an increase in prices may result in farmers selling less animals to meet their needs resulting in worsening overgrazing. Thus this research seeks to identify the reasons why farmers sell cattle and how they will respond to changes in cattle prices.

There are several policy dilemmas associated with the above alternatives to management of grazing resources in the communal areas. These are:

i. As has been illustrated before, ownership of cattle is skewed and the number of cattle required to meet manure and draught needs is more than what the farmers have. Therefore, any policy that requires farmers to destock may be counterproductive. Besides, the reduction of cattle numbers is not politically viable, the liberation struggles was centred around the resistance by communal farmers against destocking measures by the colonial governments.

ii. Due to population pressure, there is a big demand for arable land for cultivation. This conflicts with the need to set aside land for grazing. Another dilemma is increased area under cultivation requires an increase in draught power output, but due to increased land under cultivation and the accompanying deterioration in veld condition, draught supply is decreasing.

Reforestation

Reforestation at national have been suggested to reverse the current level of woodland degradation. It could be desirable to have woodlots for individual households. The problem with reforestation is that trees take long to mature. This may not be appreciated as people want to see immediate benefits (but this does not happen with cattle, why?). If grazing is to remain community property rather than individual property, the feasibility of community ownership of woodlots have to be investigated.

Agro-forestry

Another suggested solution is to integrate agriculture and forestry i.e. to practice agro-forestry. Agro-forestry has been defined as ' ... a sustainable land management system which increases the overall yield of the land, combines the production of crops and forest plants and/or animals simultaneously or sequentially on the same unit of land and applies management practices that are compatible with the cultural practices of local populations' (King and Charles, 1978). This practice is being advocated in Zimbabwe. However, the problem is that this may need to be preceded by land reforms at least at community level. The current tenure system has resulted in individual households having pieces land scattered around the community and some land is located in grazing lands. There is, therefore, the need to consolidate land holding to maximise on the benefits of agro-forestry by minimising use of trees by other farmers other than the owners.

The problem is consolidation of land holdings to enable farmers to efficiently practice agro-forestry may be costly; people may not want to move unless they are moved by force.

Raising public awareness concerning environmental degradation

Some policy makers have argued that the solution may be for central authorities to provide massive awareness information to the local people about the effects of their actions on environmental degradation. It is hoped that with time, people will understand how they contribute to environmental degradation and will institute rules and regulations to control the exploitation of the natural resources. This approach, however, does not recognise that the people are aware of the deteriorating natural resources and the problem is the absence of effective common property institutions for the effective management of common property resources. The absence of effective common property institutions arose due colonial government interventions into the traditional management institutions. This, as discussed before, has resulted in dissolution of power of community chiefs and headmen, who no longer have effective control over land - the land belongs to the state and not to the local community.

Curbing population growth

The view taken is that high population growth has resulted in the breakdown of traditional management systems. The demand for natural resources have outstripped supply. Thus some policy makers suggest curbing population growth as a solution to the environmental problem. The following have been suggested as the ways of reducing population growth: increasing the opportunity costs of women's time in child bearing in the communal area; improving the quality of education together with increasing the costs of education (so that people have a disincentive to have many children); increasing the costs of child bearing; and improving health standards. According to the population policy, a maximum of four children per woman should be the average fertility rate. This project will forward several economic, political, cultural and social reasons of why population growth is not the cause of environmental degradation. Reducing population growth, it will be argued will not necessarily result in a decrease in environmental degradation. The solutions to environmental degradation, it will be argued, are creating appropriate management institutions and developing of improved technology to use the natural resources efficiently.

Annex A1.

Organisations with an environmental focus

Environmental institution arrangements in Zimbabwe can be simply described as shown in Figure A1 (Martin, 1994). This section aims to give a brief overview of the organisations which are taking part in ensuring that there is proper management of the environment.

1. Ministry of Environment and Tourism

This is the main ministry responsible for assisting in the use of natural resources by landholders, and monitoring how they are used sustainably. It is also responsible for the management, use and protection of state land resources. This ministry has two departments and a parastatal operating under it, namely:

- the Department of National Parks and Wildlife Management,
- Forestry Commission, and
-the Department of Natural Resources.

Also operating under this ministry is the Natural Resources board, which is the public trustee of all natural resources and the national co-ordinator of the grassroots conservation movements.

A National Conservation Strategy was formulated in 1987 by this ministry. Prior to 1987, the conservation strategy was based on the world conservation strategy.

The population policy was central to the National Conservation Strategy. The main concern is that the population growth rate is too high and it is putting pressure on natural resources such that even if other methods of conservation were used without control of the population, environmental degradation would persevere.

The principal means of achieving environmental accountability under the Strategy are persuasion, education and resource legislation. The goal of this strategy is to combine sustainable resource use with every image of the nation's social and economic development and to better those resources which had already been degraded (MNRT, 1987). The departments under this ministry, including some departments from other ministries would spearhead the implementation of this Strategy.

1.1 Department of National Parks and Wildlife Management

This department is accountable for the management of the national parks and wildlife. The major constraint is funding, especially with its fight against poaching of the rhino and elephants.

The department is also involved in assisting communal areas who have been granted Appropriate Authority (those communal areas under CAMPFIRE) in sustainable use of wildlife. In assisting these communities the DNPWM in collaboration with Zimbabwe Trust (an NGO) and the Centre for Applied Social Science (at the University of Zimbabwe) together with other donor agencies train communal people in wildlife management.

1.2 Forestry Commission

This is a parastatal set up to boost enlightenment and the knowledge of forestry industry by the GOZ and Zimbabweans. The commission is responsible for the preservation of forests and trees where it is necessary for the protection of the forest ecosystem. The national Afforestation Programme is under the direction of the Commission.

In the Commission there is the Division of Forestry Extension Services (FES) which has the mandate of ensuring that Zimbabwe's forest resources are managed for the lasting benefit of the people, that the forests are conserved, protected and preserved where necessary for the protection of water, soil, timber and other forest products as well as for scientific, ecological and aesthetic purposes. The Division also provides forestry advisory and management services as may be required by Central Government, local authorities and other bodies, and advises Government with regard to tree planting and forestry development in the communal lands, resettlement areas and State Lands.

The specific areas of activity by FES are Agroforestry, schools and colleges tree growing and tree care (TGTC) programme, woodland management, and the national tree planting day. Other activities include gum-pole treatment (treated poles last up to 45 years whereas untreated poles hardly go beyond 5 years) and bee keeping (for income generation).

Forestry extension strategies in agroforestry are:

- the identification and strengthening of existing practices in 8 pilot districts (one per province) and documentation of existing practices. The analysed information will be used for the promotion of relevant country wide agroforestry models.
- promoting new agroforestry technologies throughout the country that are based on successful trials in selected areas.

The TGTC programme, launched in 1984, aims at encouraging afforestation and environmental conservation in the community through the active participation of the education system. The main implementing agents of TGTC are the Ministry of primary and Secondary Education, Forestry Commission and Redd Barna (at least up to the end of 1995). Under this programme, schools and colleges participate in TGTC competitions covering nursery management, orchards, woodlot exotic, decorative shrubs, woodlot indigenous and school gardens.

Woodlot management entails the sustainable utilisation and conservation of woodlands for timber and non-timber forest products. The concept of woodland in communal areas covers a stand of trees and shrubs with reasonable canopy cover stretching normally over a hectare of land. However, communities are encouraged to manage and wood regeneration that benefits them.

The first Saturday of December each year is observed as the National Tree Planting Day. Since the day was launched in 1980, more than 15 million trees have been planted country wide.

1.3 Department of Natural Resources

This department was established as a public trustee of the natural resources and as the parent body to the conservation movement in Zimbabwe. Some of its functions include exercising the general supervision over natural resources, advising the Government over conservation policy and legislation, stimulating public interest in the natural resources and imposing restrictions where necessary, over the use of natural resources.

The department's functions include:

- encouraging the development and application of approaches that integrate environmental concerns in socio-economic policy planning and decision making,
- providing the public with environmental information,
- screening the environmental impact of new projects,

- promoting the adoption of objectives or standards relating to environmental quality and pollution control,
  carrying out environmental research and monitoring work.

The laws and legislation the department is required to enact deal mainly with the protection of land and its occupation.

2. Other Government Ministries

2.1 Ministry of Lands and Water Development/Ministry of Agriculture

This ministry is responsible for soil conservation practices and providing relevant extension support to farmers. The Department of Extension and Technical Services (AGRITEX) is responsible for disseminating information to communal area households.

The hydrological branch of the Department of Water resources processes and publishes information on daily water flowing in rivers throughout the country. The Branch also processes and keeps records on water distribution to consumers through water rights. The Branch is also concerned about siltation of rivers and dams. A silt survey team has been set up to monitor siltation rates in dams. The team also monitors siltation rates during rainy season on selected rivers.

The Department of Research and Specialist Services (DR&SS) have experiment stations in Harare, Masvingo, Matopo, Marondera and Mazowe. The Makoholi (Masvingo) and Matopo stations, among other things, develop sustainable livestock production and land use systems for semi-arid areas of Zimbabwe. Some of the research areas include rangelands/pasture utilisation and management, and agroforestry.

The Chemistry and Soil Research Institute, within DR&SS does the following:

- monitoring of pesticide and mycotoxin/aflatoxin contaminations in food, agricultural produce, the aquatic and terrestrial ecosystems,
- determination of pollution of soils and underground waters which takes place on agricultural land use of municipal sewage sludge and tannery waste. This is achieved through monitoring the downward movement in the soil and plant uptake of heavy metals, nitrates and other toxic substances, and
- monitoring of the degradation of the soil and the surface and ground water brought about by the use of organic and inorganic fertilisers, application of liming materials and irrigation using saline water.

2.2 Ministry of Mines

There is a Mine Ventilation and Environmental Control Centre in this ministry. This centre monitors and control environmental pollution and exposure of people to harmful conditions both in mines and within mining claims areas. It also investigates on complains on occupation hazards on mining properties, by either workmen or the mining community.

2.3 Ministry of local Government, Rural and Urban Development

In this ministry there is the Department of Rural Development. This department is responsible for National Intensive Resettlement Programmes. It aims at providing a framework for integrated rural development, planning, appraisal and co-ordination of rural development projects to ensure that those implemented are properly planned. This will generate information and data that will enable co-ordination of policy decisions on land reform and implementation to achieve an acceptable land management position in the country.

3. NGO's involvement in the environment

Non-Governmental Organisations (NGOs) assists and fund landholders (including the government) by being involved and funding projects and programmes of conservation.

3.1 International Union for Conservation of Nature and Natural Resources (IUCN) - The World Conservation Union

IUCN is a global union of states, Governments and NGOs promoting a common approach towards safeguarding the integrity and diversity of the natural world as well as ensuring that human use of the natural resources is sustainable, appropriate and equitable.

The World Conservation Union carries out a single integrated Programme. The Regional Office for Southern Africa (ROSA) co-ordinates programmes and activities in the SADC region. This includes support to national conservation strategies, environmental legislation, environmental impact assessments, wetlands management, training and communicating programmes related to natural resource management, coastal zone management, etc. Currently IUCN-ROSA manages three regional support programmes, namely:

- Wetlands Conservation and Management
- Social Science Perspectives in Natural Resource Management
- Communicating the Environment Programme (CEP)

For example the goal of CEP is to inform, motivate and empower people at all levels of environmental decision making in Africa which includes governments, NGOs and individuals to take action in achieving environmental degradation.

IUCN also publishes a wide range of material on regional and global environmental issues.

IUCN's work is driven by the needs of its members, and it does this by providing technical data and information on the latest technology.

3.2 World Wide Fund (WWF) for Nature

One of the projects being undertaken by WWF is the Multispecies Animal Production Systems. The objective of this project is to examine and develop multispecies animal production systems as an ecologically sustainable option for land use in Southern Africa. The project is working closely with a range of pilot projects in Zimbabwe and hopes to extent this experience through collaborative networks to neighbouring countries. The pilot projects involve a variety of wildlife and wildlife and livestock models. The projects cover both communal and commercial farming areas. In the case of pilot projects in the communal lands WWF works closely with the CAMPFIRE Association, Centre for Applied Social Studies (CASS) and Zimbabwe Trust (Zimtrust) in addition to the DNPWM and other relevant government and district authorities.

In the communal areas, wildlife utilisation and management in pilot project areas is still developing while in the commercial sector existing viable schemes were selected so that the production potential for multispecies systems could be more rapidly explored. The search for production systems in marginal lands is a major focus of the project.

Of the 26 potential Communal Land wildlife development areas in Zimbabwe the Multispecies Project in collaboration with the DNPWM, identified six with which to work. These are mainly in the Zambezi Valley and cover areas adjacent to Parks and Wildlife Land from which tsetse flies have been or are being eradicated.

3.3 Environment and Development Activities (ENDA)- Zimbabwe

This is an international NGO with headquarters in Senegal. However the national office operates independently with the scheming of programmes being done locally. Its work covers a wide range of issues involving the environment and economic development in Zimbabwe.

ENDA's approach to development is based on a methodology which seeks to empower target groups to participate fully in their own development activities. ENDA's development actions are classified into four divisions:

- Food Security
- Micro-Enterprise Development and Technology Transfer
- Environment
- Habitat

The food security programme involves research and action in all aspects of the food cycle from land management through seed production, irrigation, food processing, and grain storage and consumption.

Since a lot of school leavers can not find employment, ENDA seeks to generate jobs through technology development, production and transfer, as well as through micro-enterprise training and financing.

The environmental and resource management projects recognise that high human and livestock populations, poor soil structure and low and erratic rainfall are causing environmental degradation and serious social problems in the communal areas. problems such as declining crop yields, adult out migration, food insecurity and the resultant health problems are issues that are directly related to the health of the environment. The goal of this environment division is to ensure the sustainability and the health of the environment and of the population living within it.

One such project is the community-based management of indigenous woodlands: Chivi/Zvishavane Demonstration Project. This is an action research programme based on local knowledge, co-operation and control. Local nurseries, enrichment plantings of grazing areas, fields and gardens are some of the works involved. The programme's concept is of community management of common property resources.

The women's participation in forestry is another project. This project seeks to identify the role that women play in forestry. There are other projects which include:

- Resource Assessment on the Environment,
- Manicaland Resource Analysis and Fuelwood Project,
- Determination of the implications of pesticide use in the Gokwe communal lands of Zimbabwe,
- Use and value of indigenous fruit trees,
- Resource use on Guruguru mountain,
- A review of the state of the environment in some resettlement areas: A methodology for developing environmental research programmes in Zimbabwe's Resettlement and communal areas, and
- Environmental and food production in the Mushipi and Chesanga valleys of Mberengwa District.

In the Habitat Division, the projects are geared towards providing and improving housing through the use of low-cost materials and locally acceptable designs.

3.4 Regional Network of Environmental Experts (ZERO)

It is a network of regional expert specialising in research on the environment, energy and sustainable development in the SADC region. It encourages the formulation of internally developed policies and plans for the energy sector, through relevant information and studies which take into account the ecosystem.

3.5 The CAMPFIRE Association

It is a rural based programme that is involved in sustainable management and utilisation of natural resources such as wildlife and forestry produce. This association seeks to sustainably exploit wildlife in communal areas, curb land degradation caused by tilling by offering the alternative of sustainable wildlife production and enable rural communities to benefit directly from indigenous wildlife.

The Association also aims to minimise the threat posed by wildlife on humans, for example, the destruction of crops and human life. CAMPFIRE had an entrepreneurial approach to development based on wildlife management that uses market forces to achieve ecological and social sustainability.

4. Parastatals

4.1 University of Zimbabwe

In the faculty of agriculture, the main subject areas are: grazing management, soil erosion, crop production, agroforestry, environmental policy analysis, mine dump reclamation, rangeland resources inventory monitoring and research on semi-arid areas.

Other departments with an interest in natural resource research are the Institute of Environmental Studies (IES), the Geography Department and the Centre for Applied Social Studies (CASS).

4.2 The Zambezi River Authority (ZRA)

The authority is a Bi-national Authority which came into existence by simultaneous enactment of ZRA Act by the Governments of Zimbabwe and Zambia. The main area of concern is the Zambezi River common to Zambia and Zimbabwe including the Kariba complex consisting of Lake Kariba and upstream Telemetric stations.

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