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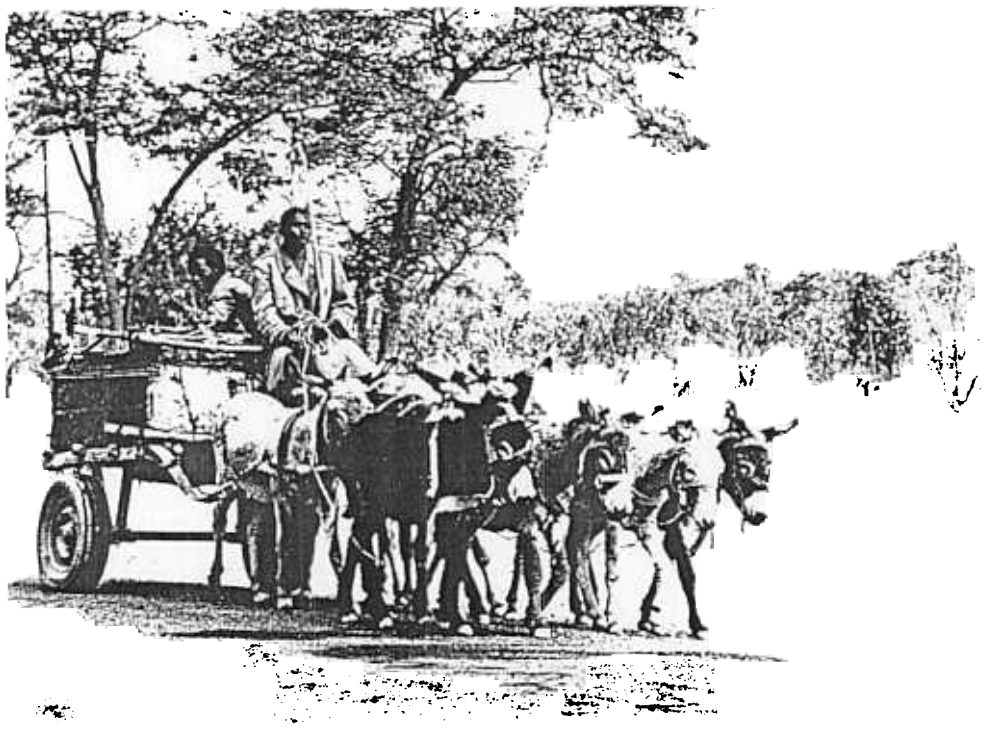
(Centre for Tropical Veterinary Medicine)
SILSOE RESEARCH INSTITUTE

IMPROVING THE PRODUCTIVITY OF DRAUGHT ANIMALS IN SUB SAHARAN AFRICA

A RAPID RURAL APPRAISAL OF SEMUKWE, CHIKWANDA AND SEBUNGWE COMMUNAL FARMING AREAS

(WITH EMPHASIS ON THE USE OF DRAUGHT ANIMALS)



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A RAPID RURAL APPRAISAL OF SEMUKWE, CHIKWANDA AND SEBUNGWE COMMUNAL FARMING AREAS

CONTENTS

ABBREVIATIONS

AFC	Agricultural Finance Corporation
AGRITEX	Department of Agricultural, Technical Services and Extension Services
CA	Communal area
CARD	Coordinated agriculture and rural development programme
CMB	Cotton Marketing Board
CRI	Cotton Research Institute
CSC	Cold Storage Commission
CTC	Cotton Training Centre
DAP	Draught Animal Power
DDF	District Development Fund
DRSS	Department of Research and Specialist Services
FRD	Farmer Recommendation Domain
GMB	Grain Marketing Board
HH	Households
HoH	Head of Household
NGO	Non Government Organisation
NRI	Natural Resources Institute
NR	Natural Region
ODA	Overseas Development Administration
RRA	Rapid rural appraisal
SSA	Sub Saharan Africa
VIDCO	Village Development Committee
WADCO	Ward Development Committee
ZESA	Zimbabwe Electricity Supply Authority
ZFU	Zimbabwe Farmers' Union

EXCHANGE RATES

Zimbabwe $12 = £ Sterling 1 (September 1994)

Conversion Factor

ha = 2,54 acres

1 SUMMARY, CONCLUSIONS AND HYPOTHESIS, FURTHER RESEARCH ACTIVITIES

1.1 SUMMARY

This RRA was conducted in three semi-arid areas of Zimbabwe (Semukwe in NR V, Chikwanda in NR IV and Sebungwe in NR III/IV). In Semukwe, donkeys provide most of the DAP requirements; in Chikwanda cattle are the predominant DAP source and in Sebungwe donkeys have largely been replaced by cattle as the main DAP source since tsetse was eradicated from the area. Table 1.1 provides a comparative profile of DAP in the three areas.

Table 1.1: Cattle and donkey ownership

ITEM	SEMUKWE			CHIKWANDA			SEBUNGWE		
	TOTAL No	AVERAGE No per household	RANGE	TOTAL No	AVERAGE No per household	RANGE	TOTAL No	AVERAGE No per household	RANGE
Cattle	8962	1.93	0-25	30771	3.25	0-6	59383	10.23	0-100
Donkeys	15808	3.41	0-15	1519	0.16	0-6	8724	1.50	0-6
Cattle: donkey ratio	0.57			20.26			6.81		
Households without draught animals	60%			45%			20%		
Households with inadequate DAP	75%			60%			50%		
Livestock deaths as a result of the drought	up to 75%			28%			10%		

Household objectives in all three areas largely focus on food security giving priority to production of food crops under risk minimisation strategies, generating cash from food surpluses in good years (Chikwanda), growing a cash crop (cotton in Sebungwe) or selling livestock (Semukwe) and seeking non farm income when farming cannot provide (Semukwe and Chikwanda).

Farming systems are broadly similar in all three areas with similar cropping patterns, management practices, livestock and implement ownership patterns. Major differences are:

- Larger areas are cropped in Semukwe and Sebungwe
- More donkeys are found in drier areas
- Although maize is grown in all three areas, small grains are more important Semukwe

Crop and livestock systems are interdependent, with crop enterprises being dependant on cattle and donkeys for manure, primary tillage and cultivation. Livestock are dependant on crop residues for their survival in the dry months. Both crops and cattle provide outputs for domestic consumption and cash generation. Donkeys provide input for crop production and are increasingly important for transport purposes.

For the longer term cattle provide opportunity for capital accumulation. Cash surpluses are often invested in cattle, with there being a constant demand for more cattle as few farmers are satisfied with their present herd size.

The RRA revealed increasing shortages of DAP following the 1991/92 drought. In all areas, cattle losses especially amongst older and larger animals were much higher than for donkeys. This has resulted in a general increase in the use of donkeys, although cattle remain the preferred source of draught power.

Donkeys are increasingly used in heavier cropping operations such as ploughing. Despite this, management of donkeys remains poor with little consideration given to health, nutrition or work ability.

Although grazing is generally of poor quality and quantity animals were in fairly good condition, partly due to the lower stocking rates resulting from high livestock mortalities during the drought as well as availability of largely *mopane* browse. Supplementation of animals with stover appears to be widespread and although there are no apparent health problems, this area needs further investigations.

As a result of the DAP shortage with up to 60% (in Semukwe) of households having no DAP, the area of crop production has decreased since 1991/92. Little information is available on the distribution of DAP between households but for those with inadequate DAP the biggest constraint is non availability when needed. In order to overcome these problems barter arrangements are common, for instance herding cattle in exchange for ploughing services. Land may be lent for ploughing services. Although relatives and friends may assist, such practices are becoming less common. DAP contracting services are rare and are only provided when the farmer has completed his own lands. Payments vary from Z$ 100 to over Z$ 300 per ha.

Tractors are considered, unreliable, costly and inefficient although demand for their services always outstrips supply.

Particular points of concern raise by farmers included:

- Draught shortages had increased hand tillage, encouraged greater use of donkeys, cows and young cattle, often in mixed spans
- Hand tillage was unpopular as resulting yields were low
- Shallow ploughing, because existing ploughs were too heavy, resulted in inadequate moisture conservation and low yields
- Cow fertility as a result of their use for DAP was decreasing
- Non availability of adequate manure was leading to declining soil fertility and decreased yields
- Inadequate time was available for undertaking primary tillage operations

However, calculations indicate that there should be no shortage of DAP, if existing DAP was used more efficiently.

Ownership of DAP is the overriding factor effecting the availability and management of DAP. Farmers have been characterised into a number of recommendation domains as indicated in table 1.2.

Table 1.2: Farmer recommendation domains

RURAL HOUSEHOLDS							
NO ANIMALS OWNED		ANIMAL OWNERS					
		INADEQUATE DAP			ADEQUATE DAP		
No access to DAP	Some Access to DAP	Donkeys only	Donkeys and cattle	Cattle only	Donkeys only	Donkeys and cattle	Cattle only

Other important factors effecting the availability of DAP include the extent of non farm income, sex of HoH, area of land cultivated annually and the age of the farmer.

1.2 CONCLUSIONS AND HYPOTHESIS

As a result of the RRA a number of conclusions or hypothesis have been made. These will be tested during the course of further research activity. These include:

- Where there is predominance of donkeys cattle are still the preferred DAP source for ploughing, while donkeys are preferred for cartage and cultivations.
- Middle aged farmers are generally have adequate DAP
- Female heads of household with no outside sources of income are likely to have inadequate DAP
- Farmers with adequate DAP will only assist others or provide DAP contracting services after their own lands have been completed. This leads to those with inadequate DAP being late in ploughing and planting leading to reduced yields.
- The availability of DAP could be increased by encouraging contracting and exchange arrangements at off peak periods in particular early ploughing, increasing the days worked per animal and increasing the use of animals of limited draught capability
- The present shortage and high price of cattle and donkeys is a major constraint to increasing DAP availability

With the increased importance of the donkey in cropping operations, particularly ploughing, there is need for more information on the capabilities of this species. Use and management of the available feed resources especially communal grazing and home-grown supplements, can be improved. Appropriate recommendations based on research findings would then be made available to the farmer.

A more detailed formal survey on the use of draught animals will provide the necessary information necessary to focus on areas of future studies. On-farm studies are planned to test the applicability of results from on-station research work and to encourage farmers to participate in the development of appropriate technologies.

With specific regard to DAP implements the following conclusions/hypothesis have been made:

- Farmers consider that ploughs presently being used are too heavy for a span of 4 donkeys or 2 small oxen and cannot easily be handled by women. In these circumstances its use results in inefficient and shallow ploughing. There is therefore a need for lighter ploughs.
- However the fact that most farmers already own a plough make it unlikely that they will readily purchase a new plough. Low cost attachments that can be readily fitted to existing ploughs or plough beams are more likely to be purchased. This will include rippers, tie ridgers, weeders and seeders.
- Most farmers weed using a plough, hoe or a combination of both. There is a need for simple low cost single animal cultivation equipment.
- The need to reduce DAP for ploughing make it essential that minimum tillage and ripping techniques be examined
- An evaluation of existing scotch carts and low cost improvements is required
- Harnessing arrangements for donkeys are inadequate, despite the existence of improved designs at IAE. An extension programme aimed at both harness makers and donkey users is required to improve the availability and promote the use of suitable harnesses.

1.3 FURTHER RESEARCH ACTIVITIES

Further research to be undertaken in terms of this project will include:

FARMER RECOMMENDATION DOMAINS

- Testing the validity of the conclusions and hypothesis of the RRA
- Characterisation of the FRDs and interdomain linkages
- Prioritising further research areas

Formal surveys will be carried out in Semukwe, Chikwanda and Sebungwe and close monitoring of 24 farmers, three (two male and one female) from each FRD over a 12 month period will be undertaken in Semukwe. This will allow detailed profiles of farmers in each FRD to be developed. This will include whole farm analysis, income-expenditure-cash flow patterns, enterprise gross-margins, use of purchased inputs, labour and DAP.

ANIMAL STUDIES

- On station work output studies will evaluate the draught capabilities of donkeys, cattle and mixed donkey-cattle mixed spans, using the traditional ox and lighter donkey plough on different soil types. Nutrition and other management practices will be similar to that provided by CA farmers
- On farm studies repeating on station work using farmers' animals under their management.
- The ability of donkeys to carry out other draught tasks, such as carting, harrowing and weeding will be evaluated.
- Information that will assist in improving management practices will be investigated, in particular:

  Donkey condition at key times during the year taking into account nutrition, health and workload
  The relationship between certain body measurements and live weight
  The effect of work on feed and water intake and digestibility of roughage

IMPLEMENT STUDY

Evaluation on station and on farm of:

- Primary tillage equipment

  The main ox ploughs currently in use (the Zimplow Mealie Brand Champion and BSP Silver\medal)
  The WALCO donkey plough
  A dryland tine that is fitted to the beam of the ox plough
  The "CONTIL" ripper, also attached to the plough beam

- Cultivators

  The main cultivator presently in use (Zimplow S51)
  The WALCO light donkey weeder
  The CONTIL light weeder and other cultivation attachments including tie maker

- Transport

  Existing scotch carts
  Low cost modification to existing carts.

2 INTRODUCTION

2.1 Purpose of the Rapid Rural Appraisal (RRA)

This RRA has been undertaken as part of an ODA/NRI financed project entitled "Increasing the productivity of draught animals in sub Saharan Africa". This project, funded under the Livestock Production and Health Programme of the RNRA strategy comprises three interrelated studies:

- Nutrition, health and management aspects of draught animals of limited capability
- The use of existing and possible new implements for draught animals of limited capability
- Socio-economic issues allowing identification of current practices and the characterisation of specific target groups of farmers using draught animals

The main purposes of the RRA were:

i) To identify representative areas in communal farming areas of Natural Regions III, IV and V, where the availability of draught animals is:

   - o primarily donkeys
   - o primarily cattle
   - o a mix of donkeys and cattle

ii) To describe within these areas farming systems particularly agronomic practices related to the use of draught animals

iii) To identify issues and constraints in crop production associated with the use of DAP through discussion with farmers, extension staff and other key informants in the identified areas.

iv) To identify and characterize with the available information appropriate recommendation domains for possible intervention and related research

v) To ensure the correct focus of research activities in addressing farmers' needs related to:

   - o nutrition, health and management of DAP
   - o the use and availability of DAP implements with respect to reduced power needs

vi) To establish those activities necessary for further quantification and development of recommendation domains for research and extension relating to DAP

2.2 Animal traction in sub Saharan Africa

Worldwide it is estimated that 400 million draught animals (bovines and equines) are being used in agricultural operations. Starkey (1988) estimated that of these some 18.6 million animals are employed in SSA agriculture. These are predominantly work oxen but include donkeys, mules, horses and cows.

Table 2.1 Estimated number of draught animals in SSA in 1985

Oxen	Equines	Total
11 315 000 (61%)	7 315 000 (39%)	18 630000 (100%)

Source: Starkey (1988)

A review by Mrema (1993) of the utilization of DAP in SSA showed that of the 11.3 million draught oxen in use nearly 80% are found in five countries - Ethiopia (53%), Zimbabwe (7.1%), Kenya (6.2%) and Tanzania and Uganda each with 5.3%. In these countries the % of draught oxen in the total cattle population was greatest. This is shown in table 2.2.

Table 2.2: Cattle and draught oxen in selected countries in SSA ('000s)

COUNTRY	CATTLE Nos	% OF TOTAL IN SSA	DRAFT OXEN	% OF TOTAL	DRAFT OXEN AS A % OF TOTAL CATTLE
SSA (TOTAL)	162463	100%	11315	100%	7.0%
Ethiopia	31000	19.1%	6000	53.0%	19.4%
Tanzania	13500	8.3%	600	5.3%	4.4%
Kenya	9800	6.0%	700	6.2%	7.1%
Zimbabwe	5700	3.5%	800	7.1%	14.0%
Uganda	3910	2.4%	600	5.3%	15.3%
TOTAL	63,910	39%	8,700	77%	60%

Source: Mrema and Mrema (1993)

Very little information is available on the use of equines as the preferred draught animals is oxen. Those countries with large populations of equines particularly donkeys have little information on current use, management and performance. FAO (1994) statistics indicate those countries having the highest proportions of equines relative to cattle are Ethiopia, Mali, Niger, Chad and Nigeria.

Mrema (1993) identifies the main benefits generally associated with using DAP as being:

Increasing the productivity of labour
Expanding the area under cultivation
Increasing the intensity of land use
Improving the quality and timeliness of performing key farming operations
Reduction in drudgery associated with hand tool agriculture which comprises some 80% of the cultivated land in SSA

Problems associated with adoption of DAP include:

The lack of animals for traction
Competing demands for livestock products
Disease problems, particularly trypanosomiasis in tsetse areas

Lack of available feed and environmental concerns of over utilization of grazing areas
Lack of suitable implements
Increasing the work burden for manual operations, especially that of women
A poor image of DAP among opinion formers and elites in SSA.
Preference for tractors even when they are not cost effective

DAP has the potential to play a major role in increasing agricultural production in SSA providing the benefits can be realised and the problems avoided or minimised.

2.3 Animal traction in Zimbabwe

In Zimbabwe the use of draught animals is widespread and long established outside tsetse infected areas. There are some 900 000 households in the communal sector for whom mixed farming is the main activity. Arable plots are commonly 2-3 hectares. Livestock particularly cattle play a vital role in the farming system. The main economic roles associated with cattle are the provision of draught power, manure and milk for household consumption. Donkeys have limited value other than the provision of draught. This comparison is shown in Table 2.3 following.

Table 2.3 Estimate of economic output of CA cattle

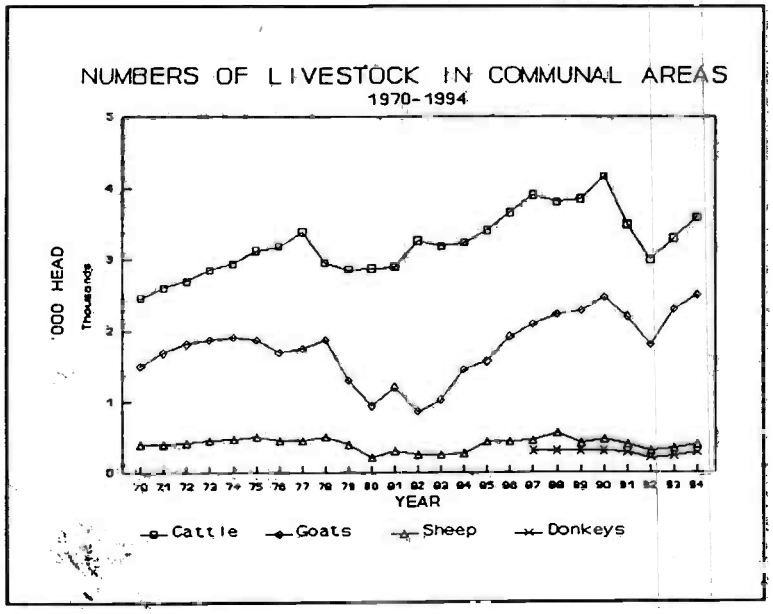
ECONOMIC USE	% OF TOTAL VALUE	
	CATTLE (a)	DONKEYS (b)
Draught	63.6	95
Milk	13.6	-
Manure	3.9	2
Meat	8.5	-
Herd growth	10.4	3-5
TOTAL	100	100

Source: (a) Barrett (1992), (b) RRA team estimate through discussion with farmers

While cattle have important social and cultural functions, which include wealth storage and sale to meet crisis payments, these are generally secondary to their economic functions. Donkeys have little use besides provision of draught and some use of manure.

Prior to the drought in 1991/92 the communal cattle herd exceeded 4 million animals with stocking rates exceeding sustainable carrying capacities in many areas. The number of donkeys was estimated to be 3-400 000[1]. The drought reduced the cattle herd to less than 3 million and the number of donkeys to 2-300 000 as shown in Figure 1.

Figure 1: Estimates of livestock in the communal areas (1970-1994)



Source: Central Statistics Office (Quarterly statistics)[2]

The main problems associated with cattle production in the CAs were considered by Geza and Reid (1983) to be:

Too many cattle for the amount of fodder available
Poor herd composition
Poor calving
Late weaning
Poor management
Too few cattle for draught, especially ploughing and manure

The concept of carrying capacity is controversial and the concept that this is generally exceeded has been questioned from both economic and ecological standpoints. Nevertheless pressure on land through increasing use of grazing and deforestation by way of increasing livestock and human populations is a matter for concern in most CAs. At the same time shortage of DAP is recognized as being a major constraint to increased crop production.

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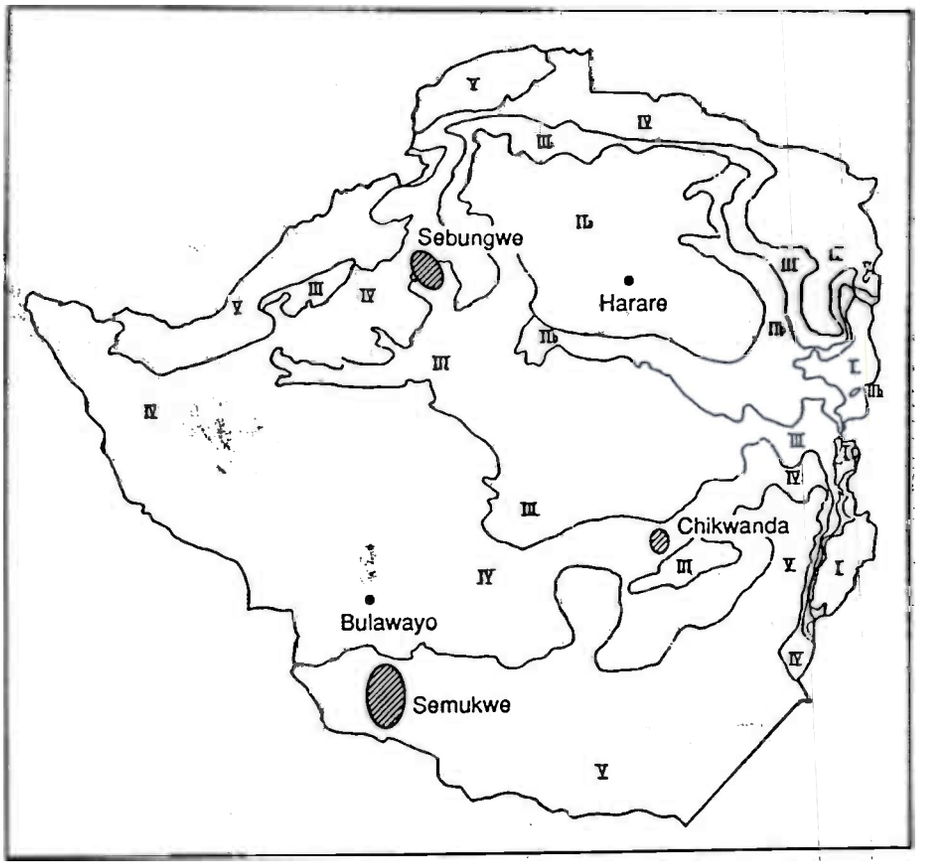
[1] Statistics on donkeys are generally unavailable. This estimate was derived through discussion with AGRITEX officials

[2] Detailed cattle, sheep and goat statistics are available up to 1990, thereafter AGRITEX estimates. Donkey statistics indicative only.

2.4 Location of the RRA

Three areas were selected, Semukwe CA in Matobo District of Matabeleland South, Chikwanda CA in Gutu District of Masvingo and Sebungwe CA in, Gokwe North District of Midlands province. These are shown on Map 1. These three contrasting sites, situated in Natural Regions III, IV, and V are broadly representative of conditions found in the semi-arid parts of Zimbabwe.

Map Zimbabwe Natural Region and Farming Area Map Indicating Location of the RRA



More than 1000mm rainfall. Specialised and diversified farming region. Suitable for afforestation, fruit, plantation crops and intensive livestock production.

750-1000mm rainfall. Intensive farming area. Suitable for intensive systems of crop and livestock production.

650-800mm rainfall. Semi-intensive farming region, suitable for livestock (assisted by production of fodder crops) and cash crops under good management on soils of high available moisture potential.

NR IV 450-650mm rainfall. Semi-extensive farming region. Suitable for livestock production and drought resistant fodder crops.

Less than 600mm rainfall. Extensive farming region. Suitable only for extensive cattle or game production. Rainfall is too low and erratic for even drought resistant fodder and grain crops.

2.5 Methodology

The techniques used in this RRA have been based on participatory approaches, with a multi-disciplinary team consulting with local leaders, groups, individual farmers and support institutions promoting agricultural development. The team comprised:

Jim Ellis-Jones (Socio-economist - SRI)
Philip Msara (Agricultural engineer, IAE, AGRITEX)
Forbes Muvirimi (Agricultural economist, AGRITEX)
Edward Nengomashe (Livestock scientist, DRSS)

Information on household and farming systems relating to draught animal power was obtained. Issues, constraints and development potential imposed by other systems and environments were also investigated. The main informants and information obtained is shown in Table 2.4.

Table 2.4: Main informants and information obtained

INFORMANTS	INFORMATION SOUGHT
AGRITEX	Agricultural resource base Resource utilisation and farming systems Issues, constraints development potential and thrust Other institutional support
Department of Veterinary Services	Prevalence and control of diseases Stock numbers
AFC	Use of credit Loans recovery Demand and supply of different loan categories
Chiefs and Headmen	Historical aspects
VIDCO and WADCO Councillors	Political framework Development issues as discussed in council
Farmer groups	Similar issues as above but giving farmers' perspectives
Individual farmers	An understanding of the farmer's environment Confirmation of issues addressed in group discussions Inspection of individual lands, livestock and implements

Following field visits, the RRA team met to discuss findings, identify recommendation domains and develop hypotheses. A final meeting was then held at Matopos to summarise the findings and preparation of the report.

The detailed programme and a list of those consulted is shown in Appendix I and II respectively.

3 NATURAL ENVIRONMENTS

3.1 Natural region and rainfall

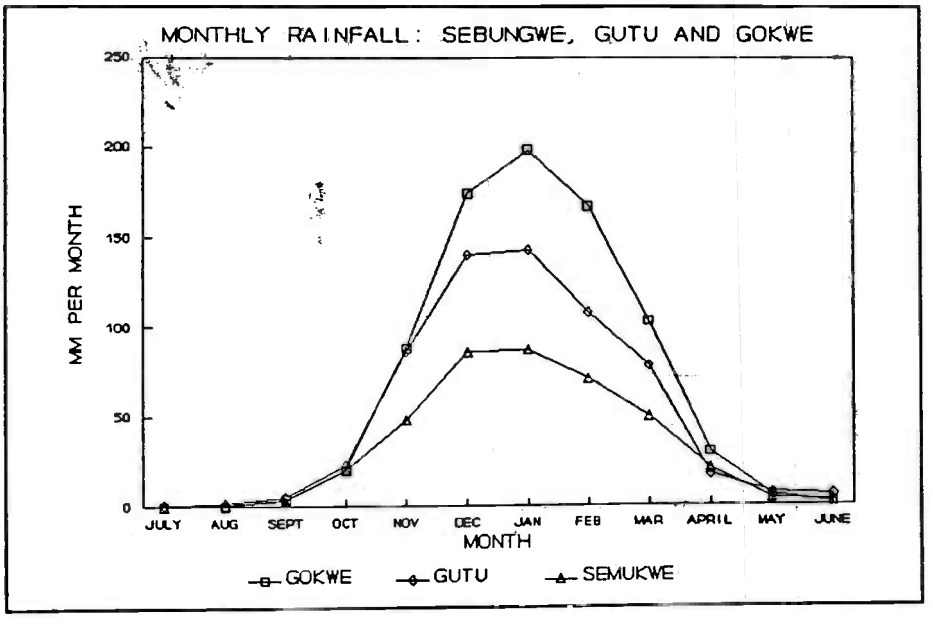
Table 3.1 following provides detail of the Natural Region, altitude and mean annual rainfall of the three areas of the RRA.

Table 3.1: Natural Region, altitude and mean annual rainfall

COMMUNAL AREA	SEMUKWE	CHIKWANDA	SEBUNGWE
Rainfall Station	Semukwe	Gutu	Nembudziya
NATURAL REGION	V	1V	III/IV
Altitude (masl)	960	1020	850
Mean annual rainfall (mm)	395	616	648

The location of each is shown on Map 1.

The distribution of annual rainfall for the rainfall stations is shown in Figure 2. following.



Source: Department of Meteorological Services (1977) as quoted in NRI (1993)

Most rain comes in heavy storms causing problems of compaction, high run off and erosion particularly on heavier soils. Rainfall patterns are extremely variable and unpredictable with localised showers and long dry spells occurring at any time during the season.

3.2 Dominant vegetation types, main soils and arable land classes

Each area has a variety of topographical settings, vegetation associations and soil types. These are shown in table 3.2 following.

Table 3.2: Dominant vegetation and soil associations

AREA	DOMINANT VEGETATION TYPES		SOIL TYPES
	TREES	GRASSES	
Semukwe NR V	Colophospermum mopane Terminalia spp Combretum spp	Eragrostis curvula Heteropogon contortus Aristida spp	Sandy clay loams and clays Sodic soils in the drainage lines
	Acacia tortillis Albizzia spp		Clays
	Combretum spp Terminalia spp		Sands derived from granite
Chikwanda NR IV	Brachystegia spp Julbernardia globiflora	Eragrostis spp Andropogon spp Aristida spp Digitaria pensii Tristachyia spp	Gently undulating granite sands on the toplands
	Terminalia spp Burkea spp		Medium textured yellow red soils increasing in texture as the vlei is approached
	Parinari curatellifolia Syzygium cordata	Hyperhenia/ Hyperthelia spp	Sandy loams and sandy clay loams in the wetland areas
Sebungwe NR III/IV	Colesphernum mopane, Adonsonia digitata (Baobab)	Grass cover very poor, largely annuals with some perrennials	Sandy clay loams and clays Sodic soils in the drainage lines
	Acacia spp		Heavy clays
	Combretum spp (Jesse bush)		Sands

Rainfall variation combines with variations in soil types to make agricultural production risky and uncertain. Heavier soils require more rain before effective crop production can occur. However their higher natural fertility mean that in good rainfall conditions production will be higher than on sandier soils. Sandy soils on the other hand can be planted earlier and are more likely to provide some yield even in low rainfall conditions. However low natural fertility mean that without significant inputs of fertiliser or manure yields will be low even with good rainfall.

Variations in topography can be particularly important in providing a soil catena with a gradation from topland through transition zones to *vlei* areas at the bottom of the slope. This is particularly important in Chikwanda where the *vleis* are an important resource allowing the production of two crops per year. Initial planting occurs as early as mid August (Maize and groundnuts) with a second planting in mid December (beans or maize).

SOCIO-ECONOMIC ENVIRONMENT

4.1 Area, population and household size

Demographic statistics of the three areas are shown in Table 4.1 following.

Table 4.1: Area, population densities and mean household size

COMMUNAL AREA	AREA (ha)	POPULATION	POPULATION DENSITY (persons/km2)	HOUSEHOLDS	HOUSEHOLD SIZE
Semukwe	130 752	28 641	21.9	4 642	6.2
Chikwanda	104 500	48 288	46.2	9 457	5.1
Sebungwe	102 125	33 518	32.8	5 805	5.8

Source: Central Statistics Office (1992)

The area of highest population density is Chikwanda with considerable out migration having occurred from this and other areas of Gutu to Gokwe and Sebungwe areas. This has resulted in heads of households being considerably younger in the Sebungwe area.

4.2 Household objectives and income sources

Household objectives largely focus on food security giving priority to production of food crops under risk minimization strategies, generating cash from food surpluses in good years (Chikwanda), growing a cash crop (cotton in Sebungwe) or selling livestock (Semukwe) and seeking non farm of income when farming cannot provide (Semukwe and Chikwanda).

In Semukwe sale of livestock (primarily cattle and goats) provide the major source of income from agriculture. Crops are grown by all farmers primarily for home consumption with occasional surpluses for sale in good years. The sale of mopane caterpillars for consumption also contributes to family income. However the major source of income is from remittances from within Zimbabwe, but increasingly Botswana and South Africa.
In Chikwanda maize sales provide the main income from agriculture with cattle being sold mainly to meet crisis payments. Income from livestock provides less than 10% total income. Communal gardens provide some surplus vegetables for sale especially in the winter months, although most vegetables sold in the Gutu market are imported from Harare. Migrants remittances as with Semukwe are an additional source of income.

Cotton and maize sales in Sebungwe provide most income. Despite the large numbers of livestock in the area livestock sales are almost non existent. Few people work outside the area, hence remittances are low.

MLARR (1993) data confirms that non farm incomes are important in most areas and contribute nearly 50% to total income. The cotton growing areas of the Midlands Province are a major exception to this.

4.3 Land tenure

Semukwe, Chikwanda and Sebungwe are CAs, formerly Tribal Trust Lands, renamed from Native Reserves. These were created by white settlers in the late 19th and early 20th centuries. The tenure system provides for individual usufruct of homesteads, home gardens and arable land allocations. Grazing areas are communally utilized with no restriction on the number of stock that can be grazed. This tenure system has been a subject of discussion over the years with the first real attempt at change being in 1951 with the Land Husbandry Act. This failed as it was essentially cohesive and therefore not politically acceptable. Currently a Land Tenure Commission has been set up to look into suitable tenure systems for Zimbabwe.

Tsetse and non availability of water meant that the Gokwe district remained unassigned until the middle of the twentieth century. The consequences are that the density of people remains low. However from the mid 1960s onwards it has been subject to inflows of people migrating from other areas, notably Gutu.

4.4 Institutional framework

The main development organisations institutions working in the area are:

Government Departments

AGRITEX provides agricultural extension and technical support to farmers. Extension workers are operational level field workers and are mainly involved with supporting farmers. Normally they will be responsible for a Ward and work closely with WADCOs.

The Department of Veterinary Services is responsible for disease control and enforcement of veterinary statutes, represented at field level by Veterinary Assistants. Dip attendants are responsible for dipping.

Parastatals

District Development Fund (DDF)

In all the areas DDF provides contract ploughing for farmers under the government drought recovery programme. The work is limited due to constant breakdowns and few tractors[3]. Farmers complained that tractors are unreliable, often behind schedule, and frequently undertook work paid for up to two years previously.

Agricultural Finance Corporation (AFC)

AFC provides loan finance to farmers at lower interest rates than commercial banks. Funds are recovered through stop order and direct farmer payments. AFC has two arms, a commercial and a development one, the latter catering for small farmers, at low interest rates, presently 22%. The provision of annual input loans to individual farmers has largely been abandoned. Instead credit is provided to loans groups (typically 15-20 individuals) on the basis that they will be jointly and severally liable for the loan. This change in policy resulted from the high default rates, (often over 80%) for individual loans during the 1980s. The change in policy is resulting in lower default rates.

Many farmers in Chikwanda remain in arrears with loans and are not keen to borrow further from AFC. Farmers try to avoid repayment by not sending produce to GMB marketing outlets, where AFC can easily recover their money. Instead they market through shops even though they may be required to spend half the total amount in the shop and receive the rest as cash.

In parts of Gutu, up to 40% of loans have been used for livestock purchases. The repayment can be spread over two to three years depending on the viability, and is expected to come from crops. Generally the default rate has been low but funds for this purpose are limited, even though farmers are keen to purchase heifers and oxen.

In Sebungwe before the drought, medium term loans were available for draft oxen and tractors. At the moment, loans are primarily short term for input purchase on the understanding that the farmers will build a base from where he can purchase his own animals.

In Semukwe before the drought loans were available for crop production. However serious defaulting (over 80%) led to a switch in policy away from individual to group lending schemes with greater emphasis on livestock production. From mid '85 DAP has not been funded because of low crop yields. Donkeys have not

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[3] DDF tractors comprise: two in Chikwanda, two in Matobo and 26 in Gokwe districts

been considered for loans, but could be if the farmer has goats or cattle which could be used as collateral for the loan.

Local government

Headmen and chiefs, as traditional leaders, have a role in land allocation, resolving land disputes and other minor offences.

VIDCOS and WADCOS are comprised of elected individuals and play a key role in local development proposals and activities, which could include promoting group activities, improved grazing management and improved use of grazing resources.

Non Government organisations

Jairos Jiri is involved in contract ploughing on a subsidised basis in Semukwe and Sebungwe. Commercial farmers provide a similar service in Chikwanda on a commercial basis. Heifer Project International, a USA based NGO with offices in Gweru are active in distributing cattle (heifers) and donkeys to farmers with the intention that farmers will pass on the first female progeny to another household. It has provided limited assistance on this basis in Sebungwe

Farmers' organisations

The Zimbabwe Farmers' Union is active in all areas promoting the formation of farmers' groups to voice development problems and act as pressure groups for local improvements.

In Chikwanda the AGRITEX - CARD programme had been particularly active in group formation, in particular *Gutai* groups for conservation tillage, *Pfumai* groups for improving livestock and grazing, *Taguta* groups for vegetable production in communal gardens.

4.5 Infrastructure

The main road network is generally good in Semukwe and Chikwanda with access being possible by light vehicles even during the rainy season. In Sebungwe heavy transport carrying maize and cotton to market outlets have damaged the main roads necessitating the use of high clearance, preferably 4x4, vehicles. Access off the main roads is poor in all areas.

Telephone or radio communication is limited to the main business centres and Government offices. No public facilities exist.

No ZESA power facilities are available. Only in Sebungwe, probably due to higher incomes was there some incidence of solar generated electricity.

5 FARMING SYSTEMS

5.1 An overview

Selected data on household and agricultural produce derived from MLARR (1993) for the 1998/89 season is shown in Appendix III. This indicates that farming systems are broadly similar in NR III, IV and V. Similar cropping patterns, management practices, livestock and implement ownership patterns are found. The major differences are:

- Larger areas are cropped in drier areas
- Increased ownership of donkeys is found in the drier areas.
- Although maize is grown in all areas small grains are more important in NR V

Components of the farming systems have a high degree of interdependence. Crop enterprises are dependant on cattle and donkeys for land preparation and provide manure. Livestock are dependant on crop residues for survival during the dry months. Both crops and cattle provide outputs for domestic consumption and cash generation. Donkeys provide input for crop production and are playing an increasing role in transport of water.

For the longer term cattle provide opportunity for capital accumulation. Cash surpluses are often invested in cattle, with their being a constant demand for more cattle as very few farmers are satisfied with their present herd size.

5.2 Cropping systems in Semukwe, Chikwanda and Sebungwe

The farming systems in the three areas are similar with respect to the interdependence of crop and livestock enterprises. There are important differences determined by soils, rainfall and market opportunities.

Table 5.1 overleaf compares data obtained, through discussion with AGRITEX, on areas available for cropping, cropped areas and the relative importance of each crop.

The main operations for which DAP is required are shown with a typical farming calendar in Table 5.2.

Table 5.2: Farming calendar indicating main periods for DAP requirement

OPERATION	J	F	M	A	M	J	J	A	S	O	N	D
Ploughing			*	*	*				*	*	*	*
Manuring								*	*			
Planting	*							* vleis	* vleis	*	*	*
Cultivations weeding and Pest control	*	*	*									*
Harvesting	*	*	*	*	*	*						*

The peak demands for labour are during the cultivation/weeding period in December, January and February. Peak demand for DAP is for ploughing from the end of September, October, November and early December.

Although AGRITEX recommend that winter ploughing be undertaken immediately after harvest, to conserve man time and use animals in good condition, most farmers plough in September, October and November usually after the first rains.

Land prepared by hand was common in all areas after the drought, though most farmers complained that yields were very low.

Conservation tillage (pot holes and tied ridges) has been promoted by AGRITEX. On the lighter soils trial results have been disappointing. The construction of ridges before planting requires additional DAP and is therefore not popular. Planting on the flat then ridging at weeding time with a plough is increasingly popular.

FSRU (1994) compared AGRITEX recommendation practices and farmer practices in Chivi CA (NR V) for both crops and livestock. These are shown in Appendices IV and V. These are included in full, as they demonstrate the extreme difference between recommendations and farmer practices. If research is to be relevant to CA farmers it is essential that existing farming systems form the base for research improvements.

Table 5.1: **Arable and cropped areas, crops grown and average yields**[4]

ITEM	SEMUKWE			CHIKWANDA			SEBUNGWE		
Arable areas	2-6			1.5-3			2-6		
Cropped area	1-3			1-3			1-6		
Main crops	% FARMERS GROWING	% OF TOTAL AREA	AVERAGE YIELDS (kg/ha)	% FARMERS GROWING	% OF TOTAL AREA	AVERAGE YIELDS (kg/ha)	% FARMERS GROWING	% OF TOTAL AREA	AVERAGE YIELDS (kg/ha)
Maize	100	21	400	100	80	600	98	50	1000
Sorghum	90	37	450	10	2	-	20	1	500
Pearl millet	90	28	450	30	10	900	28	1	500
Finger millet	10	2	180	2	-	900	48	1	500
Cotton	-	-	-	-	-	-	90	45	500
Groundnuts	50	8	500	50	2	500	48	1	500
Beans	20	3	200	30	2	900	-	-	-
Rice	-	-	-	50 in vleis	1	900	-	-	-
Sunflowers	10	2	120	30	2	750	58	1	500
Melons Pumpkins	80	intercropped with maize	na	40	-	-	-	-	-

Source: AGRITEX records, discussion with local farmers and DRSS/SRI (1993)

4 Poor farmers achieve half these yields, with good farmers achieving up to 100% more.

Semukwe

The favoured method of land preparation is ploughing using oxen during March or April and possibly a second time at planting time. However shortages of DAP result in many variations from zero tillage (shallow holing out with a badza at planting), ploughing planting rows only, ploughing and hence planting in January, the use of mixed animal teams (oxen, bulls, cows and donkeys in any combination) so long as a crop is planted. Winter ploughing is preferred though not often achieved.

Seed is largely retained from year to year, except maize, where hybrids are purchased from local shops.

Due to the low rainfall, smaller areas are planted to maize and more for the drought tolerant crops. Typically maize will be grown on sandier or wetter soils. Sorghum and small grain are grown on topland soils with sorghum grown on heavier soils. Planting starts from the late September continuing until early or late January. Although not recommended this spreads the risk of crop failure, allows labour and DAP peaks to be reduced and can provide green crops over a long period. Intercropping with sweet melons, pumpkins is widespread, with the crops being an important supplementary feed for livestock.

Most farmers would use manure if available. However it is limited to livestock owners and therefore used by a minority of farmers and even then in very limited amounts.

Fertiliser use is largely confined to that donated as part of the drought recovery programme. In Semukwe the burning of crops by fertiliser, through use inadequate rain, has been a disincentive to its use. As a result the plastic bag often has a higher value than the contents.

Pesticide use is almost non existent.

Weeding is usually undertaken by hand due to non availability of animals. Where DAP is available a plough with old share may be used some 4 weeks after emergence. Conservation tillage practices have not been utilised because of increased DAP and labour requirements.

Sale of crops is limited to either occasional surpluses after consumption needs have been met or when small amounts of cash are required. Groundnuts and beans are important in this regard.

Chikwanda

Arable and grazing areas are reducing as population increases. This has resulted in increase use of *vleis,* which are an important resource providing greater productivity than topland soils, with planting occurring from August and harvesting in December, when a second crop can be planted. Planting on toplands starts from October and continues into January, with farmers indicating that late planted maize can yield well.

Sebungwe

Average areas cropped are greater than Chikwanda with some 6 ha ploughed annually, though the range is from 2-25 ha.

Due to the higher rainfall and wider availability of DAP winter ploughing is common, especially after a maize crop. After a cotton crop ploughing after the first rain is normal.

Wider availability of tractors provides a greater choice to farmers but in general tractors are regarded as costly, unreliable and no better than oxen.

Crops grown are predominantly maize and cotton, both being important cap crops. Cotton production was initiated in the early 1970's, at the time that tsetse was eradicated. It is thought that income from cotton was largely invested in cattle, leading to the replacement of donkeys as the main source of DAP.

5.3 Livestock systems, use and management

The farming system in all three areas is geared towards crop production, with the major role of both cattle and donkeys being to support this activity. Goats and sheep are kept mainly for domestic meat consumption but are sold when cash is required. Goats have an important part in socio-cultural activities particularly when no cattle are owned. This and the in general hardiness leads to large numbers being kept, especially in the drier areas.

Table 5.3 following provides detail on cattle and donkey ownership together with some indication of the numbers of households without adequate DAP

Table 5.3: Cattle and donkey ownership and households with inadequate DAP

ITEM	SEMUKWE			CHIKWANDA			SEBUNGWE		
	TOTAL No	AVERAGE per household	RANGE	TOTAL No	AVERAGE per household	RANGE	TOTAL No	AVERAGE per household	RANGE
Cattle	8962	1.93	0-25	30771	3.25	0-6	59383	10.23	0-100
Donkeys	15808	3.41	0-15	1519	0.16	0-6	8724	1.50	0-6
Cattle: donkey ratio	0.57			20.26			6.81		
Households without draught animals	60%			45%			20%		
Households with inadequate DAP	75%			60%			50%		
Livestock deaths as a result of the drought	up to 75%			28%			10%		

Livestock losses in Semukwe as high as 75% were reported, in Chikwanda 30% and in Sebungwe 10% Cattle losses were generally higher than for donkeys. As a result there has been a general increase in the use of donkeys for DAP in all three areas.

In all areas there is a shortage of DAP with up to 60% of HH in Semukwe having no DAP. As a result the area of crops grown has decreased since 1991/92. Little information is available on the distribution of DAP between households, but for those with inadequate DAP the biggest constraint is non availability at the right time. Various arrangements have been developed to gain access to DAP. These include:

Barter arrangements, for instance herding cattle in exchange for ploughing.
Land may be lent in return for ploughing services.
Close relatives may assist with ploughing.

DAP contracting services are not common and will only be provided when the farmer has completed his own land. Payment varies from nothing up to over Z$ 300, with $80/ha being often quoted.
DDF do provide limited tractor ploughing services at $160 per ha as against an estimated actual cost of $320[5] per ha, but are largely regarded as not viable or sustainable.

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5 Based on the use of a new tractor. The age of tractors in the CAs is high. How does this effect the price.

Typical structures of cattle and donkey herds before and after the drought are shown in table 5.4 below.

Table 5.4: Typical structure of cattle and donkey herds

CATTLE	CATTLE (% of total)		DONKEYS	DONKEYS (% of total)	
	Before the drought (a)	After the drought (a)		Before the drought (b)	After the drought (b)
Bulls	8.1	6.5	Jacks and castrates	40	30
Oxen	22.5	17.8			
Cows	34.5	21.9	Jills	40	30
Steers	5.7	8.1	Young donkeys	20	40
Heifers	20.8	37.7			
Female calves	5.7	5.7			
Male calves	2.4	2.4			
TOTAL	100	100	TOTAL	100	100

Source: (a) FSRU (1994) Chivi CA, (b) RRA team estimates

The table shows that as a result of deaths of mature and larger animals during the drought there was a decline in older cows and oxen relative to younger and smaller animals. A similar trend occurred with donkeys.

Where there are sufficient oxen as in Sebungwe, DAP is supplied primarily by oxen, but as numbers decrease, the burden of DAP is shared between oxen, cows and donkeys. Shortages of DAP also reduce the manure available for crop production.

Semukwe

Traditionally hand hoe cultivation was widely practised, but as available labour decreased due to increased schooling, this resulted in increased use of draught animals.

Prior to 1992 DAP availability was not an issue, but with up to 75% of cattle perishing in the drought, shortage of DAP has become the major problem in the district. Although average ownership per household is 2 cattle and 3 donkeys, over 60% of households are without DAP. This makes it extremely difficult for most households to undertake primary tillage.

DDF and Jairos Jiri tractors provide subsidised services, but demand far exceeds supply and requests are often serviced late or not at all.

Most farmers would prefer to use oxen for ploughing as they are faster and stronger than donkeys. Other lighter operations notably weeding and transport would be undertaken using donkeys. In households where cattle are available they are used as far as possible for ploughing and donkeys for other operations. Where donkeys are used for ploughing, depth is often inadequate and moisture conservation poor.

Weeding is undertaken either by donkeys using a plough, or by hand. General transport is almost entirely undertaken using donkeys.

Contract DAP ploughing does occur, but at a high cost of $357 per ha (12m x 70m costs Z$30). For those without access to DAP zero tillage (holing out with hoe at planting time) is practised.

Communal grazing constitutes the main feed source for animals, although most farmers supplement their animals with stover, pumpkins or melons as grazing becomes scarce. Grazing has improved as a result of decreased stocking pressures but improved *veld* management is still required. AGRITEX land use plans have not yet been implemented.

Little management is applied to donkeys. Grazing is free range. No routine veterinary practices are adopted even though donkeys suffer from intestinal worms, blackleg, or (sores about the mouth) and harness sores. Serious wounds may be treated. Males are usually castrated to stop them wandering, although no information on how and when donkeys should be castrated is available. There are no recommended breeding programmes, with the result that breeding is random and selection of (male) jack-asses is based purely on phenotypic characteristics. Mistreatment of donkeys to make them work harder or faster is common. However, treatment has improved since the drought, as prices have risen. Breast band harnesses for donkeys and a yoke for cattle are normally used.

Because of their higher economic value cattle are generally better managed than donkeys. However the increasing importance of donkeys as a source of DAP is contributing to some improvements in their management.

Cattle and donkey theft has become a widespread problem.

CSC/AFC/Agritex are encouraging restocking but problems of scarcity of suitable stock, high costs, high interest rates (currently 22%) are major constraints to acquiring DAP[6].

Chikwanda

As a result of the drought, shortage of DAP led to hand hoeing minimum tillage techniques being commonly practised. However yields were low and people are now keen to plough. Ploughing is considered by farmers to be important to bury weeds and trash and conserve moisture, while zero tillage leads to early wilting. Insufficient DAP now leads to less land being ploughed. Lack of manure is also contributing to a general decline in soil fertility.

Cattle are the main source of DAP, although the use of donkeys, cows and young animals has increased. Cattle spanned with donkeys is now a common site with the number of donkeys increasing as they survived the drought better. Unfortunately yokes are extensively used on donkeys. This is attributed to both the unavailability of and high price of harnesses ($20 each) and a belief by farmers that yokes are more efficient.

Ploughing is undertaken, provided DAP is available from April onwards. DAP contract ploughing rates are typically $80-120 per ha by cattle and $145-280 per ha by tractor. People with animals are said to dictate prices. Those without animals may herd for those with or pay cash in exchange for late and usually shallow ploughing.

Where donkeys are used a span of 4 are capable of pulling an ox plough. Farmers say donkeys are harder working than oxen, being able to work all day. In fact donkeys can endure longer working periods as they are usually in better condition. Supplementary feed is not purchased but crop residues are stored for feeding to all DAP cattle, donkeys and goats.

Sebungwe

AGRITEX indicate that up to some 50% of farmers have inadequate DAP even though on average farmers own over 15 animals (cattle and donkeys) per household in the area. Poor distribution of DAP is apparent

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Before the drought donkeys were valued at Z$20-50. This has now increased to Z$400 and prices as high as $700 have been obtained.

with some areas having more than adequate whilst other areas have serious shortages. Cattle are the predominant DAP source, though donkeys are widely used primarily for transport.

Recent migrants from Masvingo and Matabeleland are less supportive of donkeys although interest is growing. Availability, high cost and theft are however problems, which reduce the demand for or desire to own donkeys.

5.4 Ownership and use of equipment

Ownership and use of agricultural equipment in the three areas is similar. Most has been manufactured by the large scale animal drawn equipment manufacturers, Bulawayo Steel Products and Zimplow. Table 5.5 provides an estimate of ownership of equipment by farmers.

Table 5.5: % Farmers owning equipment

IMPLEMENT	SEMUKWE (a)	CHIKWANDA (a)	SEBUNGWE (b)
Tractor	-	-	5
Plough	80	90	92.5
Cultivator	30	30	85
Ridger	5	5	7.5
Harrows	15	15	50
Planter	-	-	-
Cart	50	40	67.5

Source (a) RRA team estimate (b) DRSS/SRI (1993)

Private tractors were only found in Sebungwe. However in all areas Jairos Jiri and DDF provide limited ploughing services, for those with no DAP, at a cost of $70 per ha, these often have to be booked 2 years in advance and come after the ploughing season.

Despite the lack of ownership of DAP nearly every household owns a plough, from a time when animals were owned. Ownership of other implements (cultivators, harrows and planters) is extremely limited other than in Sebungwe. Up to 50% of households own a scotch cart.

The implement owned by most of the farmers is the mouldboard plough. The BS 41 adjustable cultivators the next more commonly owned implement. Of significance is the old age of equipment, especially ploughs, many of which were over 15 years old. Most equipment is purchased out of non farm income and is regarded as an asset to be passed on from father to son.

6 ANIMAL TRACTION ISSUES

6.1 Draught animal availability

In all areas farmers indicated that ploughing was the most critical DAP operation. Assuming that one third of cattle are working oxen, two thirds of donkeys are suited for work and that a span comprises 4 oxen or 6 donkeys, the available spans would be:

AREA	OXEN SPANS	DONKEYS SPANS	AVAILABLE SPANS
Semukwe	747	2 634	3 381
Chikwanda	2 654	253	2 907
Sebungwe	4 948	1 454	6 402

However farmers indicated that they use young stock, bulls and female cattle. Assuming that 8.0% of cattle are too young to be used, the potential spans are therefore:

AREA	WORKING CATTLE	CATTLE SPANS	TOTAL SPANS	% INCREASE
Semukwe	8 236	2 059	4 693	139
Chikwanda	28 279	7 069	7 322	251
Sebungwe	54 573	13 643	15 097	236

The inclusion of all but 8% of the cattle increases the potential spans by between 140% and 250%. The number of spans per household will be:-

AREA	OXEN AND DONKEYS ONLY	CATTLE AND DONKEYS
Semukwe	0.57	0.79
Chikwanda	0.31	0.77
Sebungwe	1.1	2.6

Assuming 12 days are available for land preparation, and one span can plough 0.2 ha per day, the potential land which can be ploughed in any one season per farmer is:

AREA	OXEN AND DONKEYS ONLY	CATTLE AND DONKEYS
Semukwe	1.37	1.90
Chikwanda	0.75	1.85
Sebungwe	2.64	6.24

These figures demonstrate that there would be no shortage of DAP, given even distribution. This is however not the case. It means that most animals are in fact under worked. This indicates a need to:

- Encourage DAP contracting and exchange schemes.
- Increase the number of days animals work.
- Increase daily work output.
- Investigate the most efficient means of using animals of limited draught.

6.2 Nutrition

In all three areas inadequate animal nutrition appeared a common problem. This is mainly due to the lack of resources (particularly communal grazing) and inadequate management of those resources. Animals have access to the available grazing throughout the day, although in many cases where the grazing areas are distant or the animals are working, the feeding time is restricted, leading to low productivity. The quality of the grazing is generally poor, although observations revealed animals in fair to good condition. Reduced livestock numbers due to high mortalities during the drought, have led to lower stocking rates, and therefore improved grazing. Donkeys are usually in better body condition than cattle at the start of the ploughing season. This reflects the donkeys' ability to thrive better in conditions of scarce nutrient supply. Extensive and strategic use of home-grown supplements mainly stovers and melons (Semukwe) will also have contributed to maintain animals' body condition. Crop residues are usually removed from the lands and stored in racks above the *kraals* for easy access. Improvement in storage methods could improve quality. There is very limited use of bought-in supplements because of cost. However, the use of other supplements such as fruit pods and multipurpose tree species could alleviate seasonal nutritional deficiencies.

6.3 Health

There appear to be few health problems, apart from occasional outbreaks of Lumpy Skin disease in cattle and injuries caused by use of cattle yokes and poor harnesses in donkeys. Although cattle are dipped regularly, this is not the case with donkeys. Further investigation is required into the effect of tick-borne diseases on donkeys. Problems of tick-borne diseases and internal parasites are not apparent, though the effect of these on the overall productivity of draught animals, particularly donkeys, needs further investigation. Some farmers purchase low cost medicines such as healing oils from the Veterinary Department for treating donkey harness/yoke sores, but in general the high cost of veterinary products is a disincentive to improved animal health management, particularly donkeys.

6.4 Management

Management of livestock is inadequate due largely to lack of resources, particularly finance. Lack of information on the appropriate management especially of donkeys contributes to poor management practices. Donkeys receive little or no management, largely due to their low economic value and their ability to withstand poor treatment. However, in Semukwe, where donkeys are the major source of draught power, indications are that management practices are improving. Due to the shortage of draught power, when timeliness of cropping operations is crucial, draught animals are often prescribed tasks exceeding their capabilities. This is further compounded, particularly for donkeys where inappropriate implements, such as the heavier ox-drawn plough, are used due to lack of lighter implements. In areas like Chikwanda, farmers resort to using mixed spans of cattle and donkeys. The (in)efficiency of this systems needs investigation.

Housing for both cattle and donkeys consists of traditional *kraals*, with no roofing. This is likely to lead to reduced DAP performance during cold and/or wet weather. Simple low cost improvements require investigation.

Castration of male cattle and donkeys is commonly practised, although little information on how and when donkeys are castrated was available. There are certainly no recommended breeding programmes for donkeys, with the result that breeding is random and selection of (male) jack-asses is based purely on pheno-typic characteristics. Investigation is required on the selection of jack-asses that will improve DAP characteristics.

Only in the Kezi area is there widespread use of breast band harnesses for donkeys and the traditional yoke for cattle. In Chikwanda and Semukwe yokes are extensively used for donkeys. This is attributed to both the unavailability of harnesses, their high price and the belief by farmers that yokes are more efficient. Much work has been done on improving the design of harnessing. This needs to be brought to the attention of harness manufacturers and donkey owners in areas where yokes are still used.

6.5 Gender and age considerations

There appears to be a direct correlation between cattle ownership and age of HoH. HH with inadequate DAP are likely to comprise younger families. HoH, between 40 and 50 years old, appear to own greatest numbers of DAP, with older HoHs having smaller numbers having given animals to their sons (for *lobola*) or slaughtering animals for funerals.

Labour operations tend to be labour specific as demonstrated in Table 6.1.

Table 6.1: Labour differentiation between men and women

OPERATIONS MAINLY UNDERTAKEN BY MEN	OPERATIONS MAINLY UNDERTAKEN BY WOMEN
Ploughing with animals	Planting behind the plough
Planting with planter	Hand weeding
Weeding with cultivator	Head transport
Transport by cart	Most domestic tasks
Marketing produce	

Men undertake most work with animals, while women undertake manual operations. If no men are available women will handle the DAP with operations with donkeys being favoured because of their easier handling.

It will be important to consider the gender implications of new technologies. Reducing DAP through promoting minimum tillage (rippers, tynes, etc) may increase hand weeding at a later stage.

6.6 Reducing power needs

Tillage operations undertaken by farmers in all areas are similar. Ploughing with the mouldboard plough has the highest draught requirement. Since most farmers use this tillage method, the risk of not completing timeously is high. Spreading of the ploughing period is best achieved by winter ploughing; it is therefore important that methods of promoting this are investigated.

However, readily available implements are not necessarily the most suitable especially for animals of limited draught capability. Small manufacturers are able to manufacture low draught equipment such as cultivator tines, ripper tines, ripper blades and some innovative implements such as the low cost planter. Such implements require evaluation, testing and modification if necessary. Local blacksmiths are able to fabricate plough parts. Efficient distribution of such implements and parts require consideration.

6.7 Environmental concerns

Early work (Sandford 1982, Cleghorn 1964) estimated CA's to be seriously overstocked with much of the grassland bare or in poor condition.

Such work has been criticised as being based primarily on *veld* condition and assessment in commercial farming areas and not taking into account the strategic use of high potential sites such as *vleis*, drainage lines and browse.

The concept of carrying capacity is unpopular because it alludes to overstocking and possible destocking. It is, however, important that total biomass production and use by animals is optimised as one strategy in increasing DAP availability. Such investigations are required to ensure that available fodder resources can be sustained.

6.8 Costs, benefits and indicative profitability of DAP

The costs and benefits associated with the use of DAP are shown in Table 6.2 following:

Table 6.2: Costs and Benefits of DAP

COSTS	BENEFITS		
OXEN, COWS AND DONKEYS	OXEN	COWS	DONKEYS
Purchase price Maintenance costs Feed Housing Veterinary products	Draught Manure Resale (or residual value) Social rights	Calves Milk Draught Manure Resale or residual value Social benefits	Draught Manure

There is little doubt that the potential benefits from cows exceeds that of both oxen and donkeys, provided that fertility and milk production do not suffer.

Farmers' perceptions of the relative performance of cattle and donkeys as determined in the RRA and confirmed by Hagmann and Prasad (1994) is shown in Table 6.3 following:

Table 6.3: Farmers' perceptions of the relative performance of cattle and donkeys as draught animals

PERFORMANCE CRITERIA	CATTLE	DONKEYS
Disease tolerance	Less	More
Need for feed supplement	More	Less
Ability to withstand drought	Less	More
Water requirement	More	Less
Condition at end of winter	Worse	Better
Training requirement for work	More	Less
Ease of handling for work	Less	More
Ploughing ability/depth	Better/Quicker/Deeper	Worse/slower
Depth of ploughing	Deeper	Shallower
Cultivating ability	Suitable	More suitable
Use of scotch cart	Suitable	More suitable
Availability of suitable implements	Plentiful	Can use cattle implements
Working life	Oxen 8 years, Cows 6 years	Males up to 30 years Females up to 25 years
Working females	Can effect fertility	Can effect fertility

Most people would prefer to plough by oxen and weed by donkey if the animals were available.
A comparison has been made using indicative costs and benefits of owning and using alternative draught teams. These are:

2 large oxen
4 smaller oxen
4 cows or heifers
4 larger possibly male donkeys
6 smaller possibly female donkeys

A cropped area of either 2 or 4 hectares have been assumed. Detail of the assumptions and calculations are shown in Appendix V, and the annual cost shown in Table 6.4 following.

Table 6.4: **Annual cost of alternative sources of DAP for cultivating 2ha and 4ha on a per ha basis**

DRAUGHT ANIMAL	CROPPED AREA	
	2 HECTARES	4 HECTARES
2 Large oxen	435	229
4 Small oxen	377	200
4 cows or heifers	440	232
4 larger/stronger donkeys	249	137
6 smaller/weaker donkeys	258	141

Costs have taken into account differences in the purchase and resale values of the animals, the length of their working lives, depreciation on a plough, yokes and harnesses, labour and feed supplement costs.

On this basis, the cost of donkeys is substantially less than that of cattle.

However, the calculations have not taken into account the value of manure, milk, herd growth other social benefits. Quite clearly oxen do not give milk nor they are responsible for herd growth. They are however part of a system of cattle production and use and when all benefits are accounted for on the basis that each draft team is part of a system a different picture emerges. This is shown in Table 6.5 following.

Table 6.5: **Economic cost of alternative sources of DAP for cultivating 2ha and 4ha on a per ha basis.**

DRAUGHT ANIMAL	CROPPED AREA	
	2 HECTARES	4 HECTARES
2 Large/strong oxen	307	166
4 Small/weak oxen	235	129
4 cows or heifers	275	149
4 larger/stronger donkeys	245	134
6 smaller/weaker donkeys	253	139

This demonstrates the importance of other benefits of cattle in reducing DAP costs and once these are taken into account there is little difference between cattle and donkeys. Of particular note is the fact that cattle of limited draught capability are less costly than larger oxen.

Donkeys could be substantially less costly if their meat were eaten, their milk was suitable for human consumption and had other social benefits.

IDENTIFICATION OF FARMER RECOMMENDATION DOMAINS

The RRA confirmed that those having access to DAP had considerable economic advantage over those no access. Farmer recommendation domains have therefore been identified on the basis of animal ownership and access to DAP as demonstrated in Table 7.1.

Table 7.1: Farmer recommendation domains

RURAL HOUSEHOLDS							
NO ANIMALS OWNED		ANIMAL OWNERS					
		INADEQUATE DAP			ADEQUATE DAP		
No access to DAP	Some Access to DAP	Donkeys only	Donkeys and cattle	Cattle only	Donkeys only	Donkeys and cattle	Cattle only

Tractors have not been included as their contribution to draft is small; they are unreliable, non viable and not sustainable within the farming systems examined. In Sebungwe, where tractor numbers are greater, owners indicated that they were more important for transporting produce than contract ploughing.

Numbers of animals alone do not indicate adequacy or inadequacy of DAP. Such terms are relative, depending on the amount of land to be worked, the time available for working and the ability of the animals to undertake the work. Inadequacy has been taken to indicate households without adequate animals to work an area of three to five hectares in a season. Animals of limited capability are regared as those animals harnessed in a normal span, unable to provide adequate draft to undertake the work efficiently. A normal span is taken as two, four or six cattle or four, six or eight donkeys able to work for at least four hours per day. An animal of limited capability is not capable of working effectively for this period.

8 ALLEVIATION OF DAP SHORTAGES

Two alternative strategies for alleviating the shortages of DAP are possible. These are:

8.1 Increasing the supply of DAP

Such measures include:

- Improving the performance of existing animals, through improved feed quantity and quality, improved health and condition of animals and improved power transfer (largely through improved harnesses for donkeys

  Improved feed supplies can be achieved by restoring denuded land and improving plant species through appropriate grazing management. At the same time measures need to be taken to increase the availability and quality of crop residues and feeding these in peak periods of DAP demand. The cultivation of additional fodder through introduction of pastures and fodder trees require investigation.

- Increasing the number of draught animals, through reducing mortalities, increasing birth rates and utilising cows, younger cattle and donkeys more efficiently.

  The introduction of larger animals should not be considered due to problems of communal grazing, inadequate management and the lack of available feed.

- Encouraging the use of DAP outside the peak months of October, November and December is an important consideration.

- Promoting the role of DAP contracting, exchange and hiring schemes.

In all cases there is a need to improve nutrition supplies and ensure that health standards are maintained. Any increase in the number of animals, including restocking after the drought, needs to avoid further denudation of the *veld* and strive for long term sustainability.

8.2 Reducing the demand for DAP

- Promoting minimum tillage practices with implements requiring less power. Examples are tyne rippers or cultivators to replace ploughing.

- Introducing implements that can be used by smaller animals, in particular lighter ploughs and single animal drawn weeders and cultivators.

Such equipment should be affordable, low cost and compatible with existing equipment.

9 FUTURE RESEARCH ACTIVITIES

9.1 Development of recommendation domains

This will give attention to characterising each domain and examining possible interventions, in greater detail, in particular:

Demographic aspects
Resource endowments
Farming practices, operations and labour management
Draught sharing and exchange arrangements
Animal management practices
Output and productivity

Other activities will include identifying and quantifying limitations, determining the objectives and aspirations of farmers, generating further hypothesis which can be used to carry out further research, identifying innovators and laggards in DAP systems, and determining research priorities.

There is a conspicuous influence of the larger environment on recommendation domains. It is desirable to credit this larger environment but keeping the recommendation domains as simple as possible. The above domains would be referred to as **Homogeneous Animal Power Groups**. The name is intended to reflect homogeneity of problems farmers face as a group. The larger environment will be described using the following nomenclature; The **Draft Power System** to reflect the regional differences in density and distribution of draft animals; The **Draft power Sub-system** to reflect the particular animals used for various crop operations; and the **Homogeneous Animal Power Area (HAPA)** to reflect major constraint due to communally owned resources.

9.2 Draught animal management

Attention will be given to increasing the supply of DAP through improved increased productivity of DAP through better manageemnt practices. This could include:

- determining the draught power resource and capabilities of working animals available to the farmer, particularly donkeys, cows and younger cattle.

- determining the appropriate management and feeding practices of draught animals

- determining the health aspects affecting the productivity of draught animals.

9.3 Implement design and manufacture

This will give particular attention to reducing the demand for DAP through evaluation, testing and redesign of existing and innovative low cost implements, particularly ploughs, tyne rippers, cultivators and transport equipment.

On-farm evaluation will be key to assessing the acceptibility of such implements. The situation where different animals, animals of different sexes and sizes are harnessed together will be an important aspect in on-farm testing and assessing possible adoption.

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APPENDIX I Programme

14.8 Initial team meeting at Matopos Research

Travel to Kezi
0900 Hrs meet Agritex Officers
1100 Hrs meet Animal Health Inspector
1400 Hrs meet Chief and councillor in Semukwe communal area

Travel to Matobo
AM meet farmers and AEW at Sontala primary school Semukwe
PM meet farmers at St Anna primary school-Semukwe

17.8 Travel to Esigodini
AM meet DAEO for Matobo District
PM travel to Gwanda meet provincial staff
Travel to Masvingo
Meeting to discuss findings on Semukwe

AM meet provincial staff-Maswingo
PM travel to Gutu- meet District staff

19.8 AM meet local leaders Chikwanda
PM meet farmers and AEWs

20.8 AM meet individual farmers
PM travel to Matopos
Meeting to discuss findings from Chikwanda

21.8 Free

22.8 AM travel to Gweru and meet Provincial staff
PM Travel to Gokwe South and meet Animal Health Inspector
Travel to Sanyati

23.8 AM meet Gokwe North District staff
PM meet local leaders Sebungwe

24.8 Meet farmers Sebungwe
Meeting to discuss findings from Sebungwe

25.8 Travel to Kadoma Cotton training center
Meet CTC staff
Travel to Bulawayo

26.8 Meeting at Matopos

APPENDIX II List of people contacted

MATABELELAND SOUTH
Mr Grrek Ncube (District Agricultural Officer -Esokodini)
Mr Ali Baba (Crop Specialist, Matabeleland South)
Mrs Hunda (AGRITEX Officer, Matobo District)
Mr Ndlovhu (Extension Supervisor)
Mr R Ntini (extension Supervisor)
Mrs E Nyati (Extension worker)
Mr Mikha (AFC Matobo)
Mrs Ndlovu (AFC Gwanda)
Chief Semukwe (Semukwe)
Mr W Sibanda (WADCO Councillor)
200 farmers (Sontala primary School)
Alfred Dube (Farmer)
Mrs Genesis (Farmer)
25 Farmers (St Anna's School)
Mrs Sibanda (Farmer)
Mr Sibanda (Farmer)

MASVINGO PROVINCE
Mr E Danda (AGRITEX, Chief Agricultural Extension Officer)
Mr Gutu (Conservation Specialist)
Mr J Hagmann (GTZ-IAE Contil project)
Mr E Chuma (GTZ-IAE Contil project)
Mrs Munyaradzi (AGRITEX, Acting DAEO, Gutu)
Mr Mpofu (AFC, Gutu)
Mr (AGRITEX, AEO, Chikwanda)
Mr Damson (CSC, Livestock Meat Grader)
5 Extension workers (AGRITEX, Mawere, Chikwanda)
4 Small scale commercial farmers
10 farmers (Chikwanda)
Mr Shumbaimwe (District councillor)
Mr Jairos Mashambe (Rural blacksmith/farmer) and 5 farmers
Mr Tiraro (Farmer, Chikwanda)
Mr Makondo (Farmer, Chikwanda)

MIDLANDS PROVINCE
Mr Zishiri (AGRITEX, Chief AEO)
Mr Gondo (Principal AEO AGRITEX)
Mr Simbanegavi (AGRITEX, Pastures specialist)
Mr Mahowa (AGRITEX, Mechanisation specialist)
Mrs Chiwara (AGRITEX, Crops specialist)
Mr J Shumba (Heifer Project International)
Mr Chikwitiri (Senior Animal Health Inspector, Gokwe)
Mr Machida (AFC, Gokwe)
Chief Nembudzia (Nebudzia)
Mr Chiwara (councillor)
Mr Musavengana (AGRITEX Supervisor Sebungwe)
Mr (AGRITEX, AEW, Nembudziya)
Mr Matanga (AGRITEX, Sanyati)
Mr Matsweru (AGRITEX, Sanyati)
Mr Shumba (AGRITEX, Nembudziya)
Mr Simon Ridzai (Farmer, Membudziya)
Mrs Muchini (Farmer, Nembudziya)

COTTON RESEARCH INSTITUTE
Mr Graham Rabie (Head of Station)
Mr TT Mashavira (Cotton Research Agronomist)

DRSS
Mr Bright Mombeshora
Mr Maxwell Mudhara

APPENDIX III Selected data on household and agricultural production for communal areas

Natural Region	II	II	III	IV	IV	V	All areas
Communal Area	CR	CW	CM	BU	NY	ZV	
No of households surveyed	50	54	53	57	60	56	173
Average No of members per household	10	4.9	6.9	7.2	12	10.9	8.8
Income							
Net farm income	289	204	301	714	211	901	509
Non farm income	209	345	57	174	585	1477	484
Total household income	498	549	358	888	796	2378	993
Average arable area	2.72	1.41	2.46	3.86	5.06	6.45	3.72
Crop area grown	2.46	2.14	3.19	7.02	5.65	4.08	4.09
% Winter ploughing	24%	7%	81%	58%	45%	50%	45%
% applying manure	44%	7%	81%	49%	45%	50%	50%
% buying inputs	76%	100%	87%		78%	52%	82%
% households receiving AFC loan	12%	52%	8%	0%	3%	0%	12%
% of cropped area							
Maize	81%	64%	59%	44%	47%	37%	49%
Cotton	1%						
Groundnuts	10%	16%	15%	15%	10%	9%	12%
Sunflowers	5%	8%	2%	8%	7%	9%	7%
Sorghum				1%	4%	7%	3%
Rapoko			1%	8%	5%	16%	7%
Mhunga	1%	4%	20%	9%	17%	3%	9%
Bambara nuts		22%	1%	13%	5%	38%	6%
Average number of livestock							
Livestock units owned	8.47	3.35	9.12	7.74	6.9	7.36	7.14
Cattle	86%	55%	88%	78%	73%	67%	74%
Goats	48%	16%	58%	85%	81%	91%	64%
Sheep	10%	2%	2%	15%	10%	5%	7%
Donkeys	0%	2%	4%	5%	25%	48%	15%
Percentage of households owning							
Plough	82%	59%	87%	82%	70%	79%	76%
Harrow	24%	19%	26%	17%	7%	11%	14%
Cultivator	50%	33%	28%	7%	5%	20%	23%
Scotch cart	54%	20%	45%	33%	27%	36%	35%

Key: CR : Chirau. CW: Chiweshe. CM: Chirumanzu. BU: Buhera. NY: Nyajena. ZV: Zvishavane.

Source: Ministry of Lands, Agriculture and Rural Resettlement (1993)

APPENDIX IV Cropping extension recommendations and farmer practice (Clivi CA)

Cropping Activity	Extension recommendation	Farmer practice
Crop varieties	Maize: R201, R200, R215; Sorghum: SV2; Mhunga: PMV1; Rapolo: 25C; Sunflower: Peredovik, Musasa; Groundnuts: Plover, natal common, GMB spanish; cotton: G501, K602	As recommendations mixed in with local varieties for sorghum and millets
Land preparation	Winter plough (June-July) to 20-25cm; early manuring (August-September)	5% of area winter ploughed, to c. 10-15cm depth; 6% of area manured
Planting	Early planting dates from first effective rains in November until late December	Staggered from dry planting of millets in October to late planting of replacement crops (e.g. sunflower) in February/March. Other crops staggered
	Seeding rates (25kg/ha for maize, 15kg/ha for sorghum, 10kg/ha for millets, 8kg/ha for sunflower) and 90 x 45cm for maize spacing. Plant with hand-hoe or ox-drawn planter in straight rows	Variable seed rates and spacing according to seed availability and field conditions. Row planting with hoes for maize, cotton; otherwise broadcast
Fertility management	For grain crops inorganic fertilizer (basal at 100-200kg D/ha and top at 100kg AN/ha). Blanket D and split top dressing application. Oil seeds - sunflower: 150kg L/ha and 100kg AN/ha; groundnuts: 200kg SSP/ha and 200kg gypsum/ha	6% of area with basal fertilizer applied; > 1% with top dressing. Low concentration, spot applications for certain crops (maize, cotton); otherwise none
	8 tonnes of manure per hectare. 1 sack per 9m intervals and shallow ploughed	6% of area with manure applied. Low application rates, careful rotation, focused on particular soils
Weeding and cultivation	Intensive weeding for first 8 weeks. 2-3 weedings recommended. Use hoe, mouldboard plough or cultivator	80% of area with 1 weeding; 20% no weeding; 20% weeded twice; > 1% weeded 3-4 times. Weeding depends on crop. Hoe weeding dominates. > 5% of farmers with cultivator
Pest and disease control	Various pesticides; e.g. for maize - Deptrex or Thiodan 4-6 weeks to control stalk borer	No pesticides used, except on cotton
Intercropping relay cropping, late planting, in-filling	No recommendations	Common practice. 75% of maize area intercropped. Relays following crop failure important. In-filling widely practised
Rotations	Alvord rotation: Maize (with manure 37t/ha), then sorghum/maize, then legume crop, then millet crop	Various, but most common is maize-maize-maize
Agroforestry	Previously all trees supposed to be removed from fields. Now agroforestry encouraged. Boundary and home garden planting with exotics recommended	Indigenous trees (especially fruit trees) retained in fields. Growing trees protected and nurtured if valued highly. Some limited planting around homes
Field water management	Deep winter ploughing; ridges, tied ridges and furrows; early planting; weeding	Use of microenvironments; water harvesting using bunds; ridging on heavy soils; soil pits; winter ploughing if possible; organic matter management (leaf litter, stover, etc.); manipulation of plant populations
Soil conservation	Standard contours; construction of waterways and storm drains; planting on contour; manure application; green manure and cover crops	Contour bunds; planting along contour; soil harvesting in microenvironments or pits; applications of organic matter (manure, leaf litter, etc. if available); high plant populations

Source: FSRU (1994)

APPENDIX V Livestock extension recommendations are farmer practice (Clivi CA)

Livestock activity	Extension recommendation	Farmer practice
Cattle		
Breeds	Exotic "improved" breeds	Indigenous breeds
Objectives	Beef production	Multi-purpose use, especially draft power
Stocking rates	10ha per livestock unit	2 ha per livestock unit
Grazing management	Rotational grazing in fenced paddocks - grazing schemes	Key resource grazing, use of high potential sites (e.g. dambos, drainage lines, etc.)
Fodder management	Legume reinforced pastures in grazing areas	Browse management
	Supplementary feeding, salt licks, etc	None, except in extreme drought
	Stover collection and preparation with urea	Stover collection and storage only
	Agroforestry including planting of *Leucena*, etc.	Some agroforestry planting; browse management
Drought management	Destocking - early sales; movement discouraged and highly regulated	Movement to other areas; supplementary feeding, distress sales
Disease control	Weekly (wet season) and fortnightly (dry season) dipping; dosing; antibiotics; movement controls	Dipping regime followed except in drought; traditional herbs used to treat disease
Smallstock	Few recommendations with respect to management, disease control, etc.	Indigenous practices
Chickens	Improved breeds; improved chicken huts; mash feed, etc.	Indigenous breeds, free ranging, little management

Source: FSRU (1994)

APPENDIX VI Indicative costs of owning and using draft animals

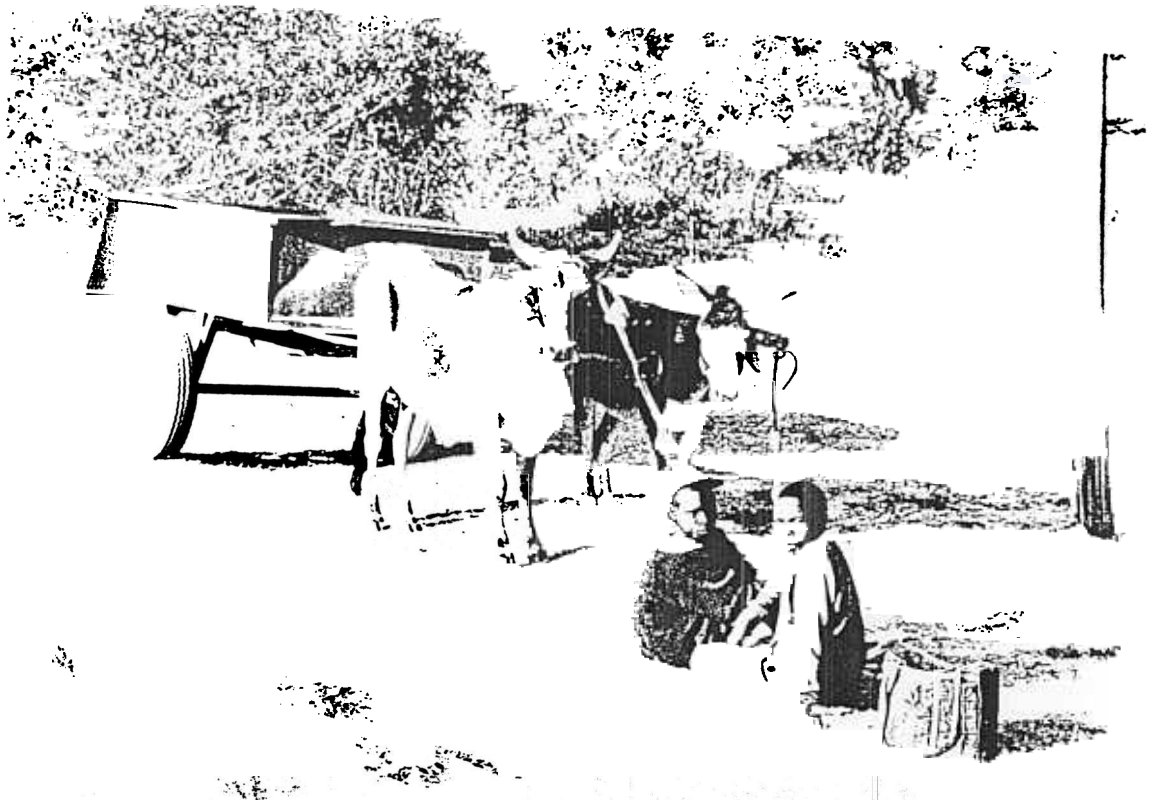
WORK ANIMALS										
Small/weak oxen	4	4								
Large/strong oxen			2	2						
Cows/heifers					4	4				
Small/weak donkeys							6	6		
Large/strong donkeys									4	4
ASSUMPTIONS										
Purchase cost	6000	6000	4000	4000	4800	4800	1200	1200	1200	1200
Sale price	8000	8000	3000	3000	4800	4800	0	0	0	0
Working years	8	8	7	7	6	6	10	10	10	10
Cultivation days per year	16	32	16	32	16	32	16	32	16	16
Hectares cultivated per year	2	4	2	4	2	4	2	4	2	450
New plough cost	450	450	450	450	450	450	450	450	450	450
Yoke cost ($30 each)	60	60	30	30	60	60				
Harness cost ($20 each)							120	120	80	80
ANNUAL EQUIPMENT COST CALCULATIONS										
Annual animal (ap)depreciation (Cost - sale price/working life)	-250	-250	143	143	0	0	120	120	120	120
Annual plough depreciation 10%	45	45	45	45	45	45	45	45	45	45
Annual yoke/harness depreciation 20%	12	12	6	6	12	12	24	24	16	16
Repairs and maintenance 10%	45	45	48	48	51	51	57	57	53	53
Interest on capital 25%	814	814	560	560	664	664	221	221	216	216
Management/Veterinary	40	40	20	20	60	60	0	0	0	0
Labour for ploughing ($2 per day)	32	64	32	64	32	64	32	64	32	64
Feed supplimentation ($1 per day)	16	32	16	32	16	32	16	32	16	32
TOTAL ANNUAL COST	754	802	870	918	880	928	515	563	498	546
Direct cost per ha	377	200	435	229	440	232	258	141	249	137

OTHER BENEFITS	CATTLE	DONKEYS									
Manure	3.9%	2.0%	29	29	22	22	31	31	2	2	2	2
Milk	13.6%	0.0%	102	102	117	117	136	136	0	0	0	0
Herd growth	10.4%	5.0%	78	78	59	59	83	83	6	6	6	6
Social benefits	10.0%	0.0%	75	75	57	57	80	80	0	0	0	0
TOTAL			284	284	255	255	330	330	8	8	8	8
NET ANNUAL BENEFIT/COST			-470	-518	-614	-662	-549	-597	-507	-555	-490	-538
Cost per ha taking benefits into account			-235	-129	-307	-166	-275	-149	-253	-139	-245	-134

ANIMAL PRICE ASSUMPTIONS	350 kg Ox	450 kg Ox	Cow Heifer	Large Donkey	Small Donkey
Purchase Price	1500	2000	1200	300	200
Sale Price	2000	1500	1200	0	0

Donkeys are increasingly being used for ploughing, when cattle are unavailable Semukwe CA

arge oxen pulling ridge making equipment
(Makaholi Experiment Station)



he use of mixed spans of cattle and donkey is an increasingly common site Guta CA

Large and small cattle used together Sebungwe CA