CIRAD EMVT - ZIMBABWE
Agritex
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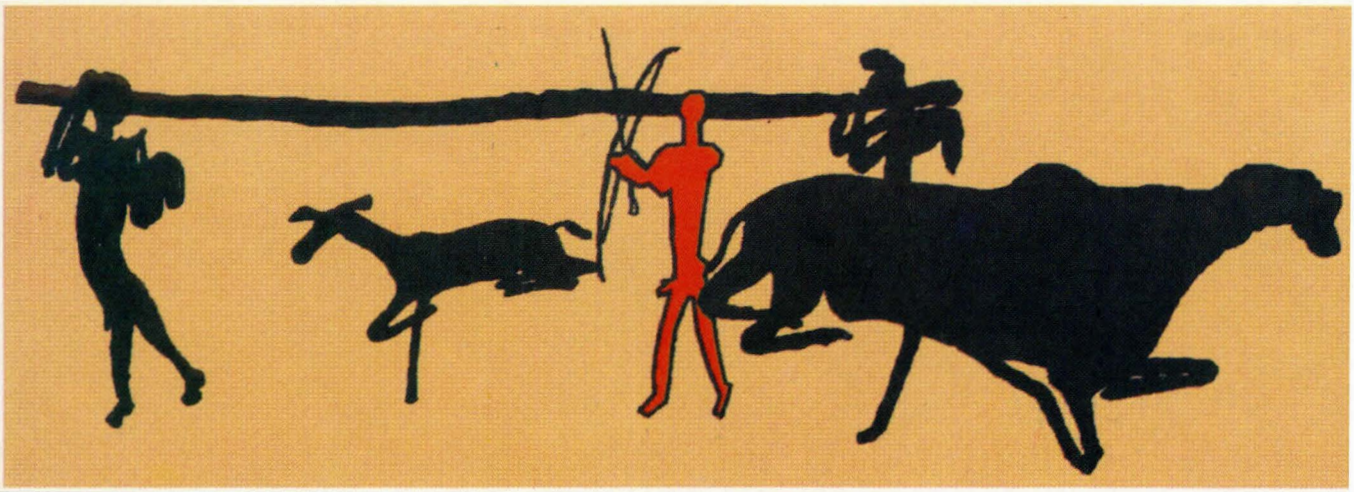
DR&SS

GOAT PRODUCTION IN COMMUNAL LANDS



ERRATUM

REPRODUCTION IN FEMALES

In all three areas studied, the period ...was not different from ...

MANAGEMENT OF MALE GOATS

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GENERAL PRESENTATION OF THE SURVEY

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A.INTRODUCTION

A survey of 6000 goats, owned by 250 smallholder in the commnal areas of 3 provinces in Zimbabwe (Mashonaland, Matabeleland, Masvingo) was conducted by the French Veterinary Project.

Recommendations appropriate to Zimbabwe were obtained by comparing the daily practices of the goat keepers in communal areas.

General presentation of the survey

B.THE OBJECTIVES OF THE SURVEY

The death rate of kids in the communal areas of Zimbabwe appears to be one of the major constraints of goat breeding. The French Cooperation team at the request of the Zimbabwean Government and with the support of the Ministry of Agriculture (Veterinary Services, DR&SS, UZ, Agritex) conducted a survey on goat production in the communal areas with the following objectives:

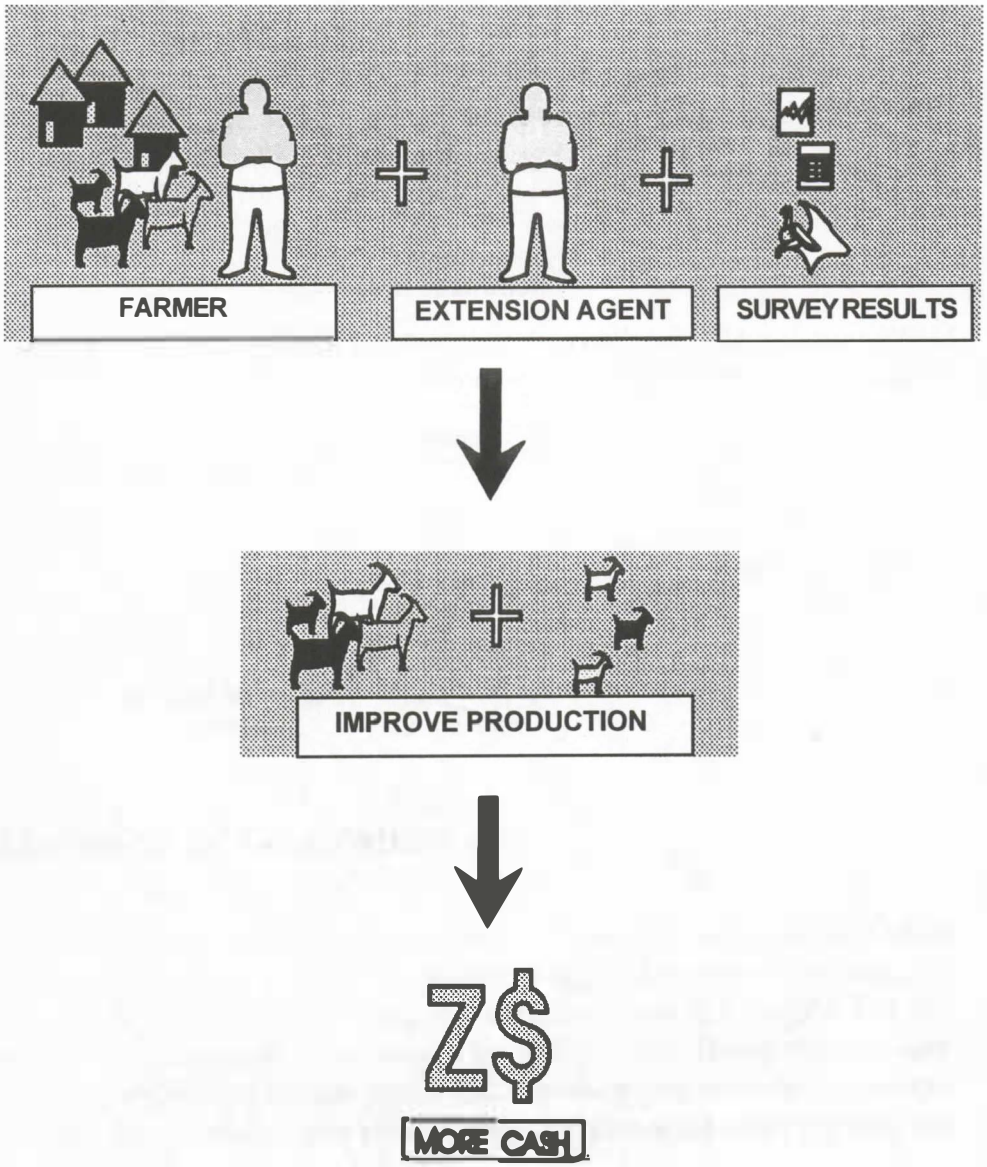
1. **Describing the characteristics goats** and sheep in the communal areas of Zimbabwe.

2. **Describing the management practices and techniques** of goat production noting its socio-economic importance in the communal areas.

3. **Analysing the constraints** which affect the production of small ruminants and in particular the diseases which affect the kids.

4. **Suggesting practical solutions** which will enable the improvement of goat production.

5. **Disseminating results** to all people and organisations involved in goat production.


FARMER
EXTENSION AGENT
SURVEY RESULTS
IMPROVE PRODUCTION
Z$
MORE CASH

C. SURVEY TEAMS

After a request to all the people and bodies working in the communal areas, 9 survey teams were set up in order ot cover all the goat breeding systems present in the communal areas.

Six thousands goats and sheep were monitored in 250 flocks thanks to an enumerator employed full-time by the project.

Figure 1: Geographical Location of the teams

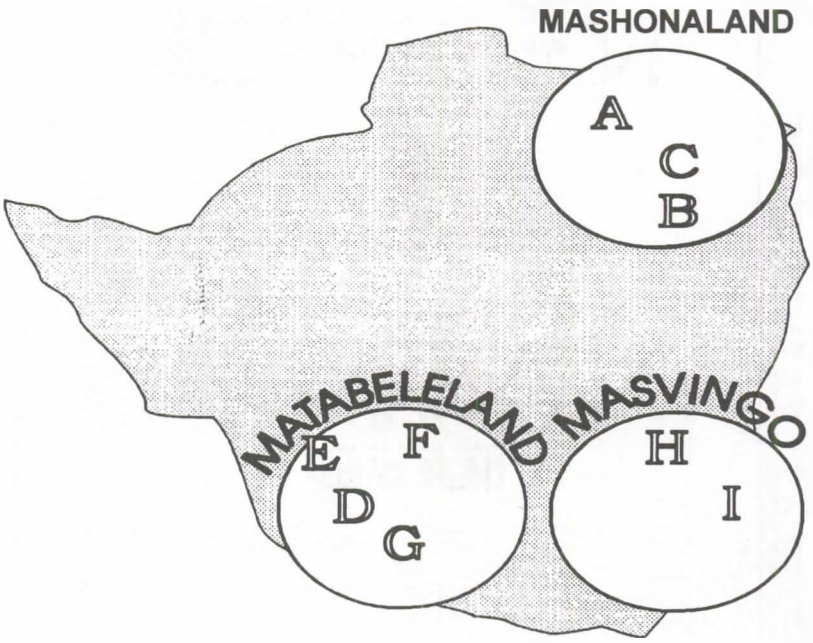
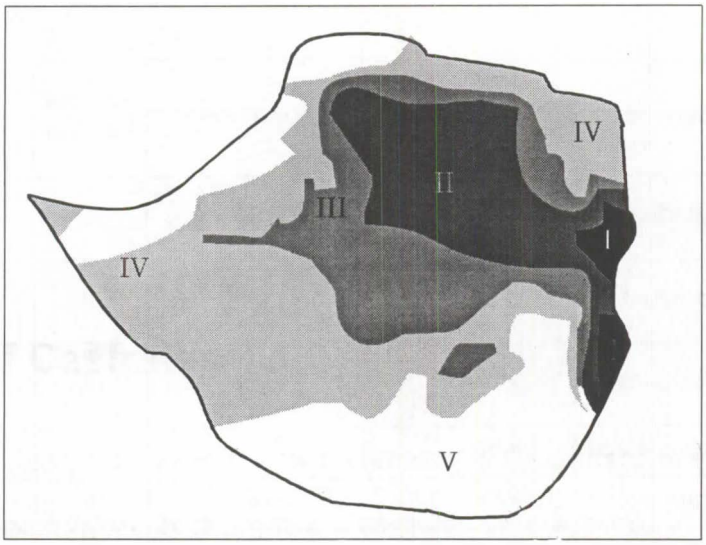


Table 1: Constitution of survey teams

	Province	Place	Supervisor	Natural Region	No of flocks
A	Bindura	Muzarabani	Veterinary Services	IV	32
B	Bindura	Madziwa	Veterinary Services	III	58
C	Bindura	Kandeya	Veterinary Services	III	43
D	Matabeleland	Kezi	DR&SS	V	9
E	Matabeleland	Tsholotsho	AGRITEX	IV	24
F	Matabeleland	Mzingwane	AGRITEX	IV	22
G	Matabeleland	Guyu	University of Zimbabwe	V	9
H	Masvingo	Matsai	Bikita Goat Project	IV	29
I	Masvingo	Chiredzi	Bikita Goat Project	V	49

D.CLIMATIC RECORDS

1. Agro-ecological regions



Region I:
High altitude area (over 1700m). Over 1000 mm of rain a year well distributed with rainfall all during the year. Possibility of frost on high ground.

Region II:
750 to 1000 mm of rain well distributed during the rainy season (from November to April).

Region III:
650 to 800 mm from November to April. Possibility of a short dry season during the rainy season. High temperatures in summer.

Region IV:
450 to 650 mm of rain unevenly distributed during the rainy season.

Region V:
Erratic, low rainfall (less than 450 mm of rain). Prone to droughts . Very high temperatures in summer.

2. Meteorological records in 90-91

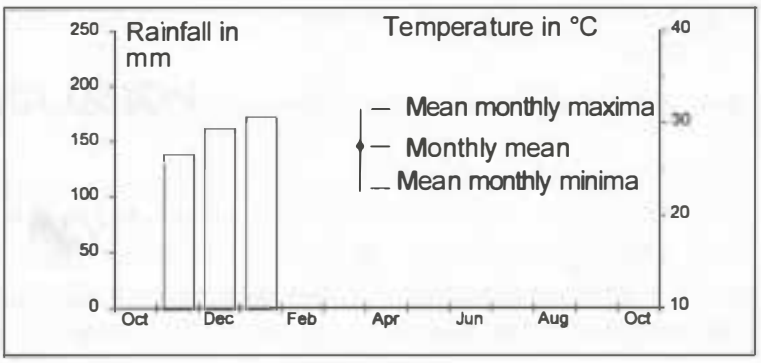
From 1 October 1990 to 31 October 1991, daily recordings of maximum and minimum temperatures and daily rainfall were made (Figures 3 to 8).

Meteorological data were recorded in the primary schools associated with study regions with the help of a pluviometer and a maximum and minimum thermometer.

Using these data, monthly parameters were calculated: average monthly maxima and minima and total monthly rainfall were plotted.

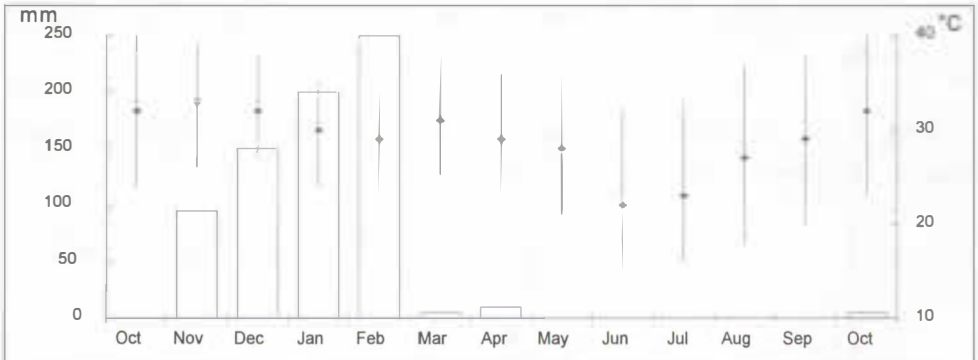
Legend is presented in Figure 2. Results are presented in Figures 3 to 9.

Figure 2: Explanation of the legend for Figures 3 to 9



Muzarabani is situated in the Zambezi valley at an altitude of 500 m. It is characterised by high maximum temperatures in the hot season and temperate minimum temperatures in the cold season, compared to high-altitude regions. The 90/91 rainy season was particularly short: November to the end of February.

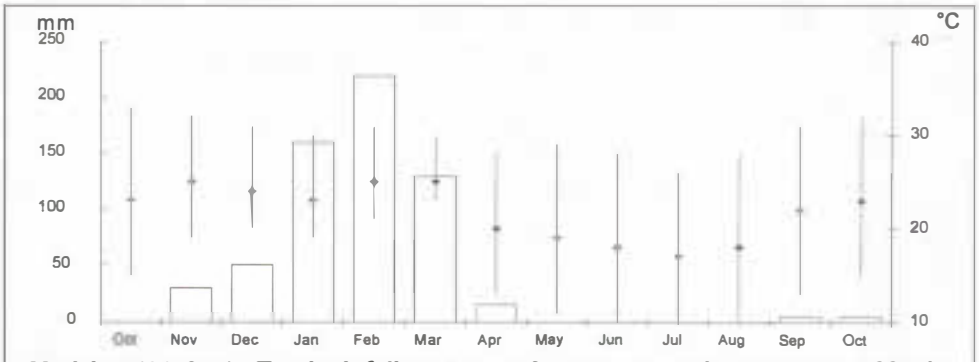
Figure 3: 1990/91 rainfall and temperature in Muzarabani (Region IV)



Muzarabani (500 m) - Total rainfall: 704 mm - Average annual temperature: 29 °C

At an altitude of 1450, Madziwa is characteristic of high-altitude regions: a temperate annual temperature (22.5°C) and maxima rarely exceeding 30°C; on the other hand, night temperatures can be low and winter thermal ranges are among the highest in Zimbabwe.

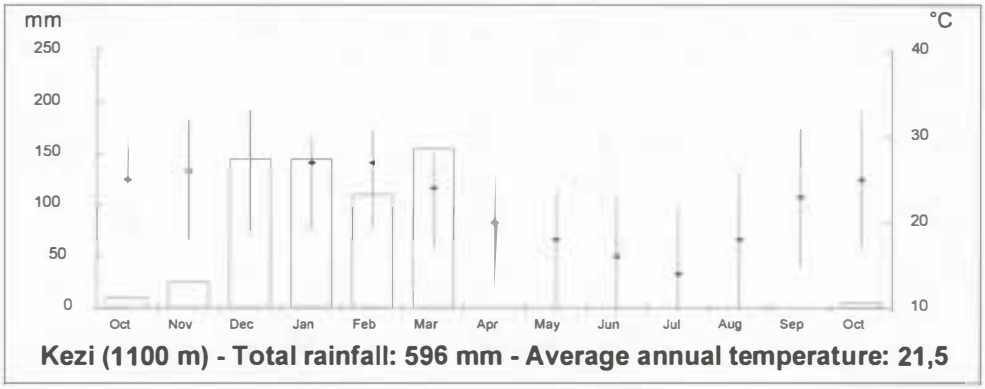
Figure 4: 1990/91 rainfall and temperature in Madziwa (Region III)



Madziwa (1450 m) - Total rainfall: 615 mm - Average annual temperature: 22,5 °c

Kezi records show a temperature curve similar to that of Madziwa: the two groups are situated at comparable altitude. The total rainfalls for that year resulted from storms in March of the same intensity (600 mm) although these two groups are in two very different climatic regions. (I and V)

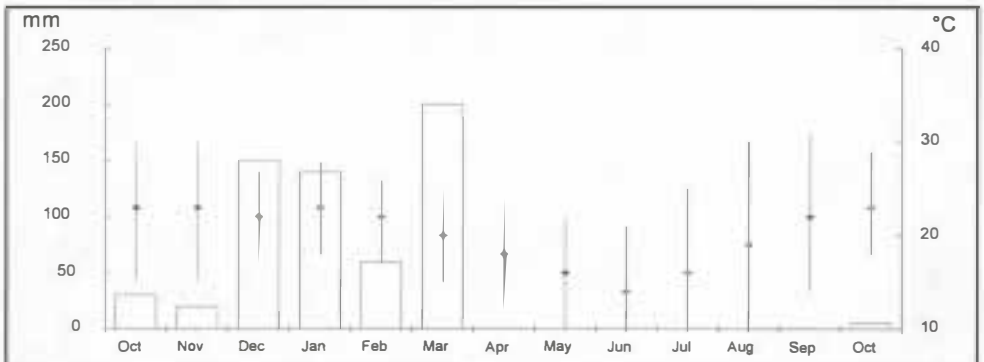
Figure 5:1990/91 rainfall and temperature in Kezi (Region V)



Kezi (1100 m) - Total rainfall: 596 mm - Average annual temperature: 21,5

The greatest differences between day- and night-time temperatures in the cold season were recorded in Mzingwane (1300 m, Over 25°C range compared with 17°C in Muzarabani). A net reduction in rainfall in February was noted. The peak in March was the result of heavy localised storms around Bulawayo.

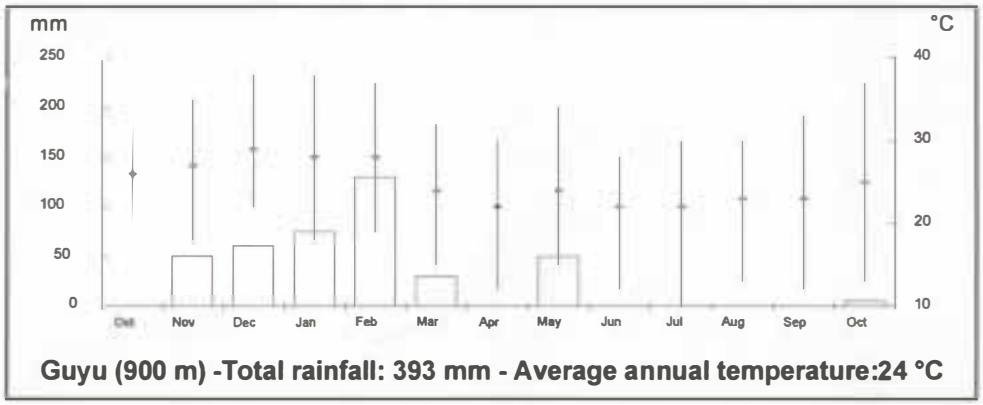
Figure 6: 1990/91rainfall and temperature in Mzingwane (Region IV)



Mzingwane (1300 m) - Total rainfall: 602 mm - Average annual temperature: 20,5 °C

The temperatures observed in Guyu (Matabeleland) were intermediate between those recorded in Muzarabani and Kezi; they are fairly typical of the Lowveld. Guyu region belongs to climatic zone V, that with poorest rainfall: not even 400 mm in the 90/91 season. There were no storms in March, unlike the other Matabeleland groups.

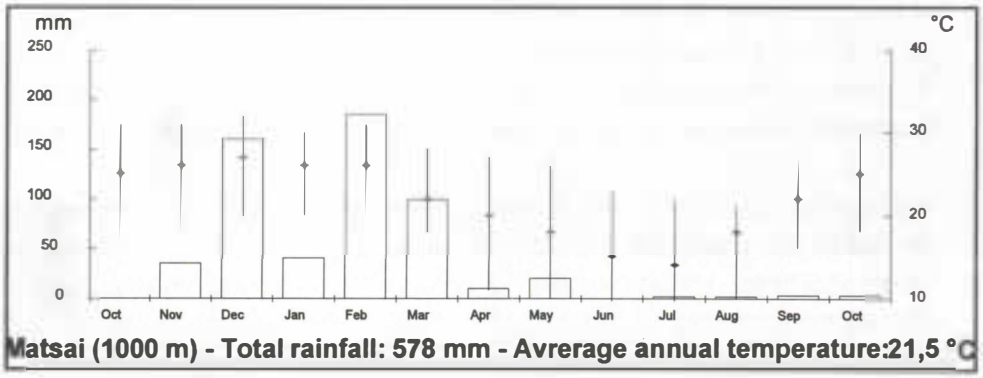
Figure 7: 1990/91 rainfall and temperature in Guyu (Region V)



Guyu (900 m) -Total rainfall: 393 mm - Average annual temperature:24 °C

Monthly rainfall records show a considerable dry period during January: such variations during the rainy season can have disastrous consequences on annual harvests.

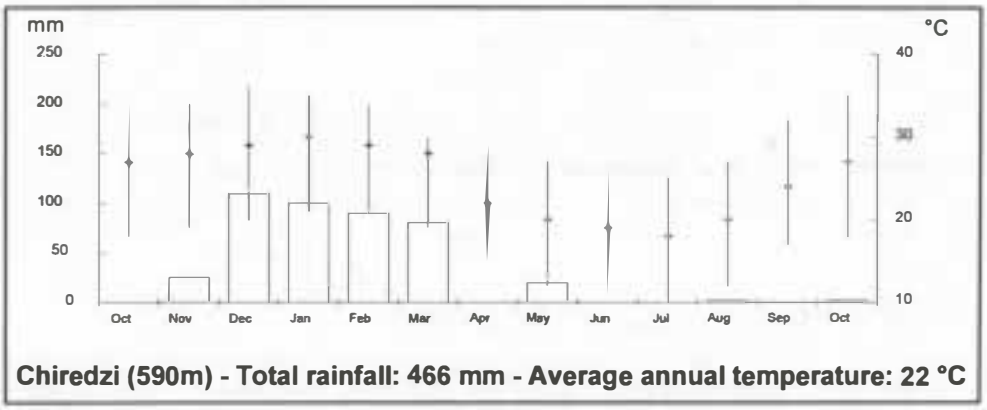
Figure 8: 1990/91 rainfall and temperature in Matsai (Region IV)



Matsai (1000 m) - Total rainfall: 578 mm - Avrerage annual temperature:21,5 °C

A longer rainy season over a longer period can be seen, compared with the other groups, with some rain falling in late storms in May: although part of climatic region V like Guyu, Chiredzi reached 466 mm of rainfall in 90/91 because of this.

Fifure 9: 1990/91 rainfall and temperaure in Chiredzi (Region V)



Chiredzi (590m) - Total rainfall: 466 mm - Average annual temperature: 22 °C

3. Environment

Three main types of environment were observed during the survey. Reference to those types are made in the different chapters. These environment were:

The primary (or virgin) bush, which is still in good condition, was observed in the Zambezi Valley.

The secondary bush is degraded due to overgrazing . This situation was observed especially in Matabeleland.

The peri-urban areas like Mzingwane where the bush has totally disappeared due to high population density.

D. THE PROTOCOL OF THE SURVEY

1. Inventory

From September to October 1990, an inventory of all the small ruminants present on the farms being surveyed was done.

When this inventory was made, all the goats and sheep were identified with an ear tag, then weighed and described (colour of their coat, length of hair, presence or absence of horns, ...). For each female, the last kidding before the inventory was described.

2. Monitoring and a follow-up

For 14 months the enumerator in charge of the survey team kept records for all the animals which were identified at the time of the inventory. At each visits all events occurring in the flock were recorded (kiddings, illnesses, deaths, castration, removals from the herd, ...). All the kids aged less than 6 months were weighed at each visit. All the animals which joined the flock between visits (births, purchases, loans,...) were identified.

3.Description of the farms and practices.

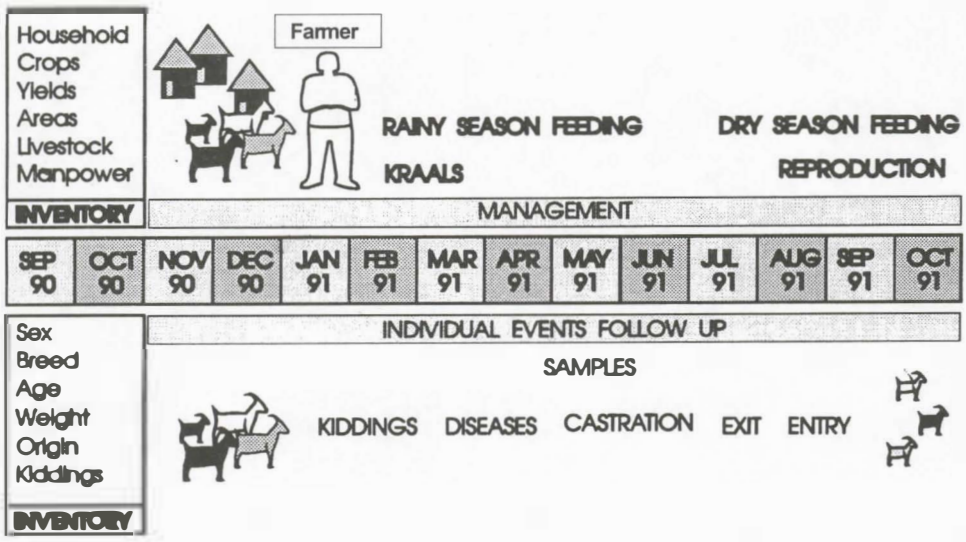
A precise description of each farm was carried out (which included characteristics of the head of household, people living on the farm, work force, crops, other animals present, ...).

At the various follow-up visits, specific questionnaires (see appendix) seeking infiormation on specific technical points about management (like feeding during the rainy season or during the dry season, reproduction, ...) or the infrastructure (descriptions of the kraals, ...) were filled in by the enumerator.

4. Samples of blood and faeces

At the end of the rainy season in 1991, blood samples were taken from all the animals present in the farms being studied. In the laboratory, these samples were screened for the principal diseases of goats and sheep (brucellosis, virus infections, ...).

In addition, faeces samples were taken in order to determine the type and the level of parasite infestations in the flock being surveyed.



THE FARMER'S OBJECTIVES IN DIFFERENT SYSTEMS

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A. INTRODUCTION

B. FOUR FARMING SYSTEMS

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A. INTRODUCTION

I. Objective.

The main objective for each smallholding in the communal areas is to produce enough to satisfy the requirements of the people who live and work there.

These requirements differ in importance and nature:

Nutritional requirements which can be met by production on the smallholding itself or in the area nearby: maize, sorghum, beans, fruit, animal husbandry or hunting, ...

Nutritional requirements which cannot be satisfied by produce from the smallholding and which need to be bought: sugar, tea, oil, ..

Non-nutritional needs which require money in order to be met: seeds and tools, clothes, school fees, health care, ...

Requirements necessitated by traditions and social rites: lobola payments, funerals, religious holidays.

Requirements for general well-being: parties, relaxation, leisure activities, etc.

As all the family's needs cannot be met entirely from production from the farm, it is essential for the family to sell or to work outside the farm to have some resources.

Small ruminant sales help to stabilize the farmer's financial position and to meet cash demands such as buying farm inputs, food and other things like lobola...

2. Constraints

A farm has to cope with numerous constraints:environmental, socio-economic and technical constraints

2.1. Environmental constraints

Climate and **type of soil** have a direct influence on the quality and quantity of livestock and crops produced on a farm or present in its immediate environment (forage and trees). **Wildlife** can also have a detrimental effect on animal and crop production of the farm: predation by lions, leopards, or baboons, destruction of crops by elephants...

2.2. Socio-economic constraints

Division and use of the land are governed by rules, customs and laws which determine access to the land. Land in communal areas is collectively owned. This type of land ownership has its own problems.

Laws and regulations approved by the state can limit the movement and sale of animals (i.e. regulation against foot-and-mouth disease).

Lack of marketing structures and facilities can prevent smallholders from selling their surplus and can stop production development.

Lack of labour force can cause the farmer to limit his production according to the work force he has on the farm.

Lack of external income (members working elsewhere) can prevent the farmer from investing in farming implements.

2.3.Technical constraints

A lack of knowledge of appropriate techniques and practices is also a constraint.

3. Importance of analysing and understanding smallholdings

The requirements and the constraints of each farm and the objectives set by the farmer will together determine the appropriate crops and animal production systems.

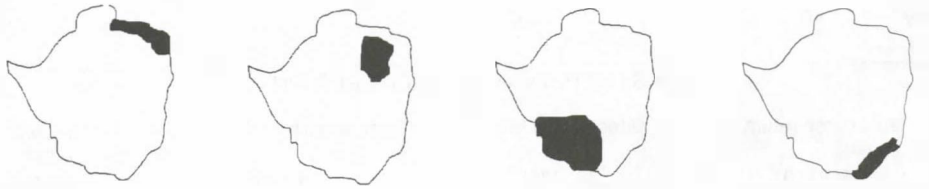
In order to understand goat production and subsequently offer the best assistance, it is necessary to get to know the farm, its constraints and its objectives as well as its various components (Appendix).

Combinations are numerous but in practice certain similarities can be observed which allow us to group farms together into well-defined relatively homogenous system types.

B FOUR FARMING SYSTEMS

A description of 4 farms typical of the main systems of small ruminant production found in the communal lands of Zimbabwe will serve as a guide to describe systems of crop and animal production associated with each. Data was gathered in detail and is summarised in the following tables for each farm system.

Figure 1: Geographical location of the four farming systems



The Mixed Farmer Zambezi Valley | The Crop Farmer Highveld | The Goat Farmer Matabeleland | The Resettlement Farmer Lowveld

B1 THE MIXED FARMER

1. Results

Mr X came to the Zambezi valley from Manicaland in 1961. Up to 1986, he had a small farm in Muzarabani communal land. In 1986, the government gave him 6 hectares in Gutsa resettlement area, 30 km away from his original communal area.

In 1990, Mr X (62), had two wives and 27 children (his third wife had died some years ago). Thirty-two people lived full-time on the farm.

Table1: Description of the farm owned by Mr. X in Muzarabani communal land (Zambezi Valley)

FARMER	PEOPLE LIVING OR WORKING ON THE FARM
61-70, married,2 wives,27 children 6 years of primary education,Master Farmer No paid employment elsewhere	32 people resident full-time 13 people working full-time 2 people working part-time 3 people working elsewhere

CROP PRODUCTION IN 90-91	Area in hectares	Kg Produced	Kg sold
Maize	2	2500	0
Cotton	3	5000	5000
Groundnuts	1	1750	350
Sunflowers	0,5	0	0

OTHER ANIMALS	
Poultry	40

ANIMAL PRODUCTION IN 90-91	Cattle	Small ruminants
Present on 1.10.90	37	53
Slaughtered	0	21
Sold	5	3
Died	0	7
Born	8	35
Acquired	0	8
Present on 1.10.91	40	65

GROSS RETURN AND FINANCIAL RETURN

Gross crop return	Gross cattle return	Gross small ruminants return	Drought relief
Z$ 4370	Z$ -1200	Z$ 1400	Z$ 0
Crop financial return	Cattle financial return	Small ruminants financial return	External income
Z$ 2753	Z$ 1950	Z$ 10	Z$ 8500

Two of Mr X's children who lived there were employed on a cotton farm which belongs to the government, 15 km from the resettlement area. A third child was employed by Muzarabani District Council. These 3 children earned Z$ 8500 between them from 1.10.90 to 1.10.91. Mr X was more interested in investment for the crops (tractors). The cattle, apart from their traditional role (capital, draught power, manure) were also a source of income. They were bought and sold in a closed system. These sales between farmers had to do essentially with draught animals and future draught animals.

2. Advantages

In the Zambezi valley, harvests and subsequent residues can be good when the rains are good.

Because of the low density of the farms and the recent date of settlement, the quality of communal rangelands is also good. Consequently, the herds of cattle and goats are large.

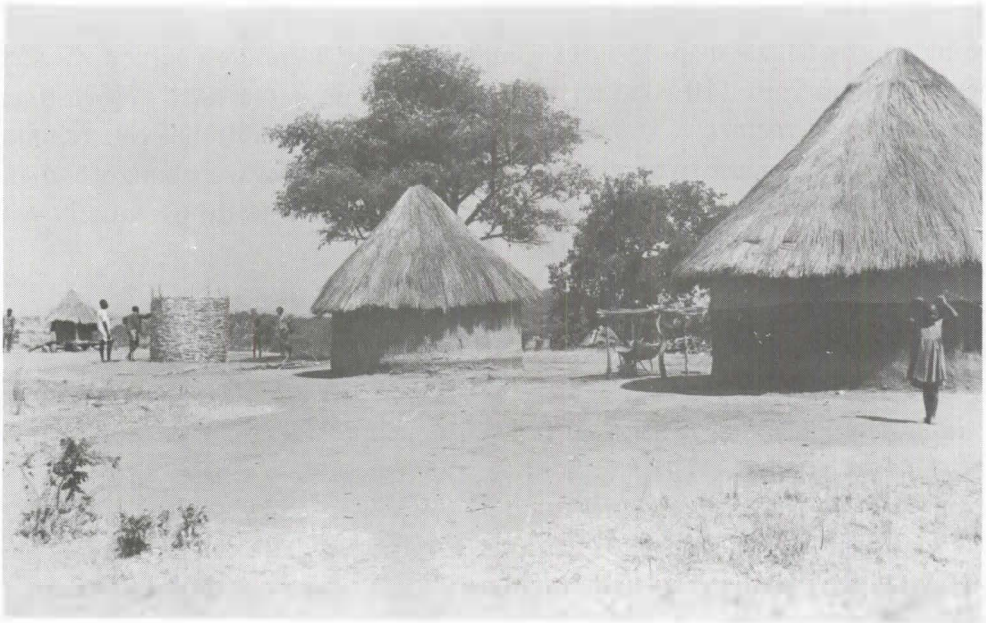
3. Constraints

The small ruminants could only be used for home consumption. Two reasons can explain the low financial return.

1. Most of the farmers had herds similar to Mr. X, so that there was no local demand.

2. There was no organised marketing structure in this part of the Zambezi valley (CSC, butcheries, ...). In spite of good technical results and a favourable natural environment, improvement of the small ruminants in this region was blocked. Mr X. was not prepared to invest time and money in his flock of small ruminants. This would explain the high figures of goats which died. Mr X. did not deal with the predators, ticks and trypanosomiasis.

Farm in Muzarabani (Zambezi Valley)



4. Conclusion and recommendations

Small ruminants will definitely remain a secondary production.

But the establishment of marketing centres could allow people to improve the return from their small ruminants. As there is no local demand, it should be more profitable to sell in towns. Middle-men could sell in cities further afield.

The second aspect which could be improved with little investment is the control of predators and thefts (use of dogs, for instance).

B2. THE CROP FARMER

1. Results

Mr Y's farm was in Kandeya communal land 15 km north of Mt Darwin (Mashonaland North). Situated at the edge of climatic regions II and III and at an altitude of 1400 m, rainfall (amount and area covered) was favourable for the cultivation of maize and cash crops (tobacco, cotton, ...)

No member of the family living on the farm worked elsewhere, either in Mt.Darwin or on the commercial farms surrounding this communal land.

Table 2: Description of the farm owned by Mr Y in Kandeya communal land (Highveld)

FARMER
41-50, married,2 wives,16 children
6 years of primary education,Master Farmer
No paid employment elsewhere

PEOPLE LIVING OR WORKING ON THE FARM
20 people resident full-time
5 people working full-time
3 people working part-time
No-one working elsewhere

CROP PRODUCTION IN 90-91	Area in hectares	Kg Produced	Kg sold
Maize	3,8	18.200	16760
Cotton	0,5	870	870

OTHER ANIMALS

Poultry 10

ANIMAL PRODUCTION IN 90-91	Cattle	Small ruminants
Present on 1.10.90	41	23
Slaughtered	0	4
Sold	0	2
Died	1	5
Born	3	11
Acquired	0	1
Present on 1.10.91	43	24

GROSS RETURN AND FINANCIAL RETURN

Gross crop return	Gross cattle return	Gross small ruminants return	Drought relief
Z$ 5678	Z$ -200	Z$ 550	Z$ 0
Crop financial return	Cattle financial return	Small ruminants financial return	External income
Z$ 5230	Z$ O	Z$ 50	Z$ 0

2. Advantages

Large residue from harvest and good quality pastures allowed people to have large flocks. The existence of a local market for goats allowed farmers to sell some of them in case of unforseen financial needs.

3. Constraints

In general there was a certain lack of concern by the farmer for his animals. The herd of cattle was scarcely productive. In the flock of the small ruminants, performances were average and losses significant. Moreover, the extension of land under cultivation reduced the rangeland areas.

4. Conclusions and recommendations

The farmer did not intend to increase his herd in the years to come because he intended giving priority to cash crops, especially tobacco. Nevertheless, by improving the productivity of the existing flock by simple measures requiring little investment, Mr Y would be able to increase his family's meat consumption and, if he wished, sell more on the local market.

Some possible recommendations are the following:

- rear some females tethered
-plant fodder crops in the garden or around the house (grasses, fodder trees which can be cut and given to tethered animals)
- put litter in the kraal in the rainy season in order to reduce parasite infestation among goats
- practise hand-rearing of the good males for tethered females.

B3. THE GOAT FARMER

1. Results

Mr Z lived in Guyu communal land which is 140 km south of Bulawayo. Guyu communal land is in one of the driest areas of Zimbabwe, characterised by low rainfall very unevenly distributed in time and space.

Mr Z had only one wife and 9 children. He and his wife together with two of his children worked full-time on the farm. Two other children were employed elsewhere with a total salary of Z$ 500 per month.

Table 3: Description of the farm owned by Mr Z in Guyu communal land (Matabeleland South)

FARMER
61-70, married,1 wife,9 children
6 years of primary education,Master Farmer
No paid employment elsewhere

PEOPLE LIVING OR WORKING ON THE FARM
11 people resident full-time
4 people working full-time
4 people working part-time
2 people working elsewhere

CROP PRODUCTION IN 90-91	Area in hectares	Kg Produced	Kg sold
Maize	1,5	50	0
Sorghum	3,5	400	0

OTHER ANIMALS

Donkeys 4

ANIMAL PRODUCTION IN 90-91	Cattle	Small ruminants
Present on 1.10.90	15	77
Slaughtered	0	6
Sold	2	17
Died	0	7
Born	1	30
Acquired	0	4
Present on 1.10.91	14	81

GROSS RETURN AND FINANCIAL RETURN

Gross crop return	Gross cattle return	Gross small ruminants return	Drought relief
Z$ 100	Z$ 1650	Z$ 1600	Z$ 320
Crop financial return	**Cattle financial return**	**Small ruminants financial return**	**External income**
Z$ 0	Z$ 1200	Z$ 650	Z$ 6000

2. Advantages

Extensive rangelands were suitable for goat needs. Systems for collection and marketing were already in place.

3. Constraints

This area was prone to severe droughts, and the rangelands were overgrazed and degraded. Animal performances were poor.

4. Conclusions and recommendations

The flock of small ruminants brought in income, even during drought years, despite poor performances;

Mr Z. needed to improve the profitability of his herd, and as he appreciated the importance of this herd in his income, he may be receptive to our recommendations.

B4. THE RESETTLEMENT FARMER

1. Results

In 1986 Mr T came to village 3 in Chiredzi resettlement area, situated at th edge of Gonarezhou National Park in Masvingo Province. His parents worke on a commercial farm in the Midlands. Aged 41, Mr T had a wife and 4 children

Chiredzi district is reputed to be one of the most arid in Zimbabwe. In fact, i has been suffering from persistant drought since 1988. Village 3 where Mr lived was situated in the middle of a former commercial farm where extensiv livestock and game farming were practised. This area had never been inhabite before the arrival of the first peasant farmers to be relocated.

Table 4: Description of the farm owned by Mr T in Chiredzi ressetlement area (Lowveld)

FARMER
31-40, married,1 wife,4 children
2 years of primary school
No paid employment elsewhere

PEOPLE LIVING OR WORKING ON THE FARM
6 people resident full-time
2 people working full-time
1 person working part-time
No-one working elsewhere

CROP PRODUCTION IN 90-91

	Area in hectares	Kg Produced	Kg sold
Maize	3	0	0
Sorghum	1	250	0
Sunflowers	11	500	500

OTHER ANIMALS

Poultry	40

ANIMAL PRODUCTION IN 90-91

	Cattle	Small ruminants
Present on 1.10.90	14	7
Slaughtered	0	2
Sold	0	3
Died	2	1
Born	1	6
Acquired	0	0
Present on 1.10.91	13	7

GROSS RETURN AND FINANCIAL RETURN

Gross crop return	Gross cattle return	Gross small ruminants return	Drought relief
Z$ 340	Z$ -800	Z$ 150	Z$ 90
Crop financial return	Cattle financial return	Small ruminants financial return	External income
Z$ 280	Z$ O	Z$ 150	Z$ 0

Farm in Chiredzi ressetlement area (Lowveld)

2. Advantages

There were few advantages, except the special attention given to resettlement areas by government.

3. Constraints

There were numerous constraints. The area is very dry and the relocated peasants were unfamiliar with the area. Predators limited grazing time. Ticks were a problem. There were no marketing structures for the moment, though the goats had an important role in the financial return.

4. Conclusions and recommendations

Mt T. thought in terms of survival. Faced with the failure of crop production, he would like to increase the size of his goat flock which, despite its present small size, enabled him to survive. Unfortunately, he had no money to invest

in the purchase of extra goats, as a result of his subsistence requirements.

This farmer needed not only technical but also financial assistance.

For future sales, the setting up of a marketing structure and lending facilities would be useful.

Perhaps it would be profitable to mix the management of wildlife and small ruminants.

C. APPENDICES

Appendix 1. Some Definitions

Production systems: the combination of methods of production employed by the farmer in order to obtain various animal or crop produce.
At a given moment, each farm has its production system which comprises several sub-systems dependent on each other.

System of animal husbandry: the totality of techniques and practices used by a peasant or a community to make use of resources (chiefly vegetal) by animals in order to meet certain requirements (meat, capital, money, ...)

Cultivation system: the totality of plant rotation and techniques used on a plot to obtain one or several crops.
A cultivation system is characterised by the level of cultivation it provides and by its influence on the fertility of the area. On a farm, several cultivation systems usually co-exist.

Market-oriented smallholding: a farm is considered commerce-orientated when it sells part of its produce on the market. If all the smallholding's produce is used or consumed directly by the family, the farm is described as subsistence.

Gross return: Gross return is the value of all that has been produced over one year on a farm. This production may have been consumed, stored or sold.

Total gross return is subdivided into gross vegetable return (crop production) and gross animal return (production of the various herds present on the farm).

Financial return: Financial return is the value of the produce sold on the market. Financial return is subdivided into crop financial return and animal financial return.

Other, more complicated economic indicators exist, but will not be used in the monographs: **net value** (gross return less intermediary consumption, less losses), **income and agricultural income.**

Appendix 2. How are gross returns calculated?

Gross animal return is calculated as follows:

gross animal return

=

value of produce consumed by the family (meat, milk, hides...)

+

total from sale of produce (live animals, meat, milk...)

-

total spent on animal purchase

+

difference in the value of the herd between the beginning and the end of the period being considered

Gross crop return is calculated as follows:

gross crop return

=

amounts harvested

X

market price (per unit) at harvest

Appendix 3.How to characterise a smallholding

1) Describe the environment of the farm and the people who live there, and consider its constraints.

2) Review the history of the farm, its members and the agricultural and animal farming techniques and practices.

3) Describe how the different production units are organised and combined in space and time, and for each of them look for limiting factors.

4) Calculate and analyse the technical and economic results obtained, and compare them with the farmer's objectives.

5) Propose solutions and methods to improve the factors limiting each production, taking into account the farm's constraints and the farmer's objectives.

MANAGEMENT OF MALE GOATS

TABLE OF CONTENTS

INTRODUCTION

Though males contribute half of the genetic material to their offspring, their importance and role is often not a priority in traditionally managed flocks, where males run together with the females throughout the year and reproduction is mainly perceived to be influenced by the environment.

The future use of males either for reproduction (bucks) or for meat (castrates) tends to determine their subsequent management.

A survey to study current productions in communal areas (CAs) and identify areas of concern was conducted by the French team. The results of this work are presented and discussed in this booklet. The communal areas studied were in :

The Zambezi valley which represents virgin or primary bush

Matebeleland with mostly secondary bush

Mzingwane which is peri-urban.

A. MANAGEMENT OF MALES INTENDED FOR REPRODUCTION

1.The male population

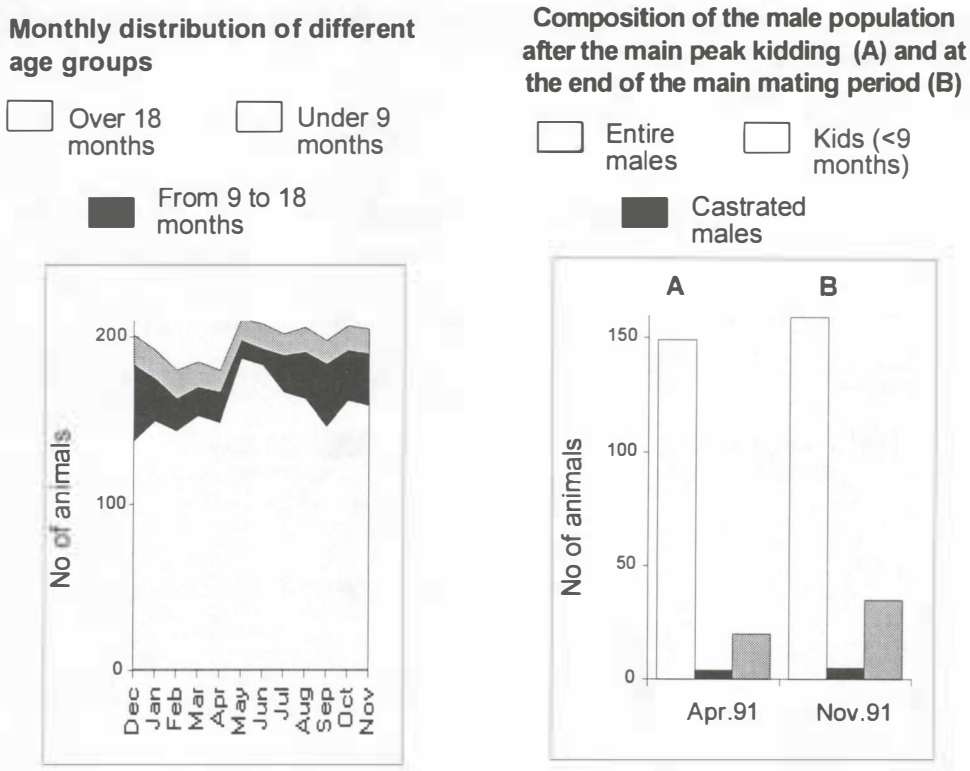
The population and proportion of males in different age categories differed greatly in the regions under study (Zambezi valley, Matebeleland, Mzingwane), and in time, mainly due to rainfall distribution, feed availability and farming systems practised (Table 1 and Figures 1 - 3).

Table 1: Distribution of the male population in the areas studied

	Zambezi Valley Virgin Bush	Matabeleland Secondary Bush	Mzingwane Peri-Urban
Kids under 9 months (%)	65	41	41
Proportion of adults (% > 9 months)	24	5	25
Proportion of castrates (%)	11	54	34

In the Zambezi valley, where browse is available throughout the year and kidding occurs throughout the year, numbers of entire males in all age categories (see figure 1) remained stable throughout the year. A high proportion of young males (less than 9 months of age) left the flocks before they could progress to the next age category. The number of entire males did not appear to be a constraint on mating.

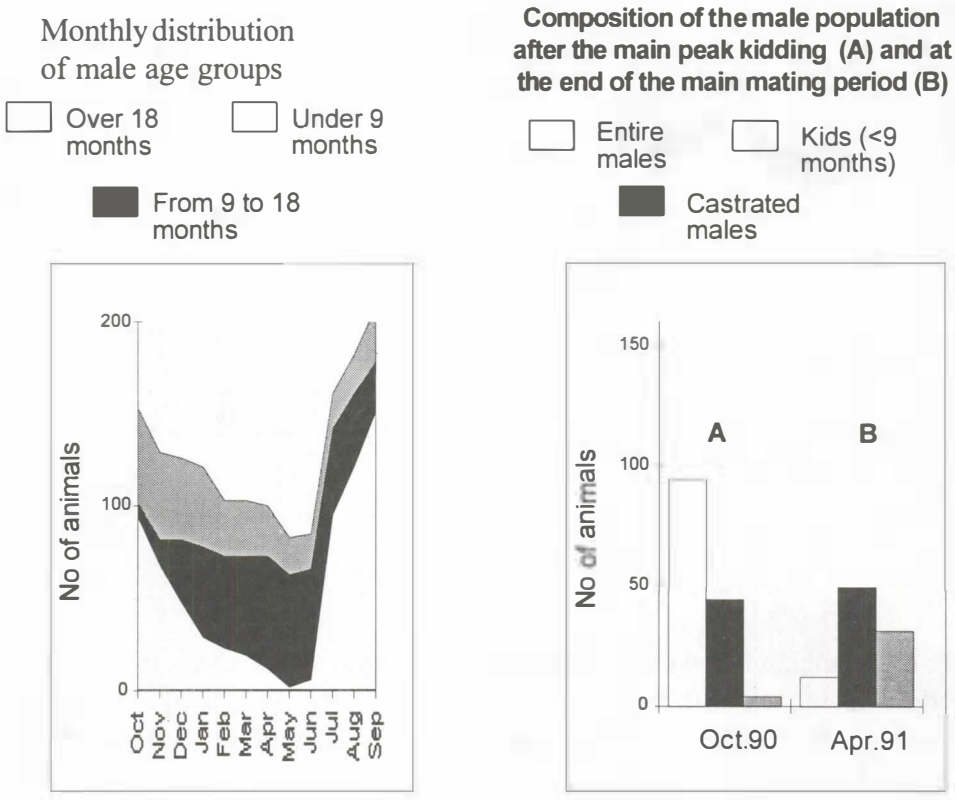
Figure 1:
Zambezi Valley (virgin primary bush)



In Matebeleland, however, where kidding periods are naturally restricted to the dry season (March to July), the population of entire males tended to follow the kidding pattern and therefore was variable throughout the year (figure 2). Males born between March and July were kept in the population until the following mating period between December and March. They were subsequently disposed of at the ages of between 9 to 18 months of age. Most of the mating may have been done by young entire males (8 - 10 months of age). However, another reason for the presence of large numbers of young males may be that these males need a rainy season to attain slaughter weights.

Once the mating season which coincided with the rainy season was over, most of the young males were castrated and a few entire males were kept (Table 1) until the next mating. Older entire males from the previous generation were also disposed of at this time.

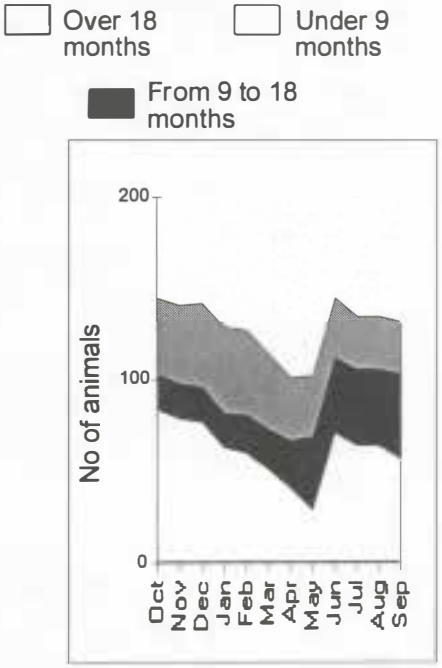
Figure 2:
Matabeleland (secondary bush)



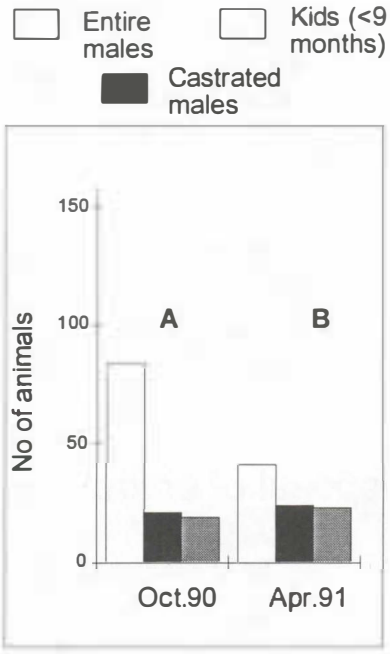
In Mzingwane (figure 3) male numbers were stable throughout the year, with most matings taking place between November and April.

Figure 3:
Mzingwane (peri-urban)

Monthly distribution of male age groups



Composition of the male population after the main peak kidding (A) and at the end of the main mating period (B)



2. Buck to doe ratio

The availability of bucks during mating periods seemed to be adequate in all the communal areas under study (from 12.2 in the Zambezi valley to 16.2 in Matebeleland see table 2). In controlled breeding systems the buck to doe may be much higher 1:50 (see Appendix 3). The above ratio for CAs may be an under-estimate since the animals were grazed communally with flocks without bucks. A more meaningful buck to doe ratio would be the one where all bucks and does grazed together are considered.

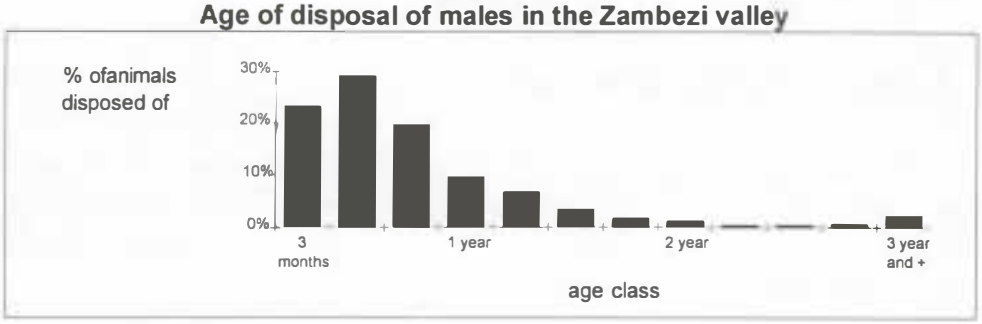
Table 2:
Proportion of entire males in flocks in the areas studied

	Zambezi Valley	Matabeleland	Mzingwane
No of females exposed per buck	12,2	16,2	12,3
Average No of bucks per flock	8,2	7,2	3,6
maximum No of bucks present	21	22	10
Flocks without bucks	0	0	2

3. Disposal of entire males

Males may be disposed of by slaughtering, sales and social rites or castrations. In the Zambezi Valley where nutrition may not be limiting, 52 % of entire males left the flock before the age of 9 months. Of the males which left the flock, 8 % were those above 2 years of age (Figure 4). Since the Zambezi Valley was favourable to goat production, farmers tended not to retain excess animals from year to year.

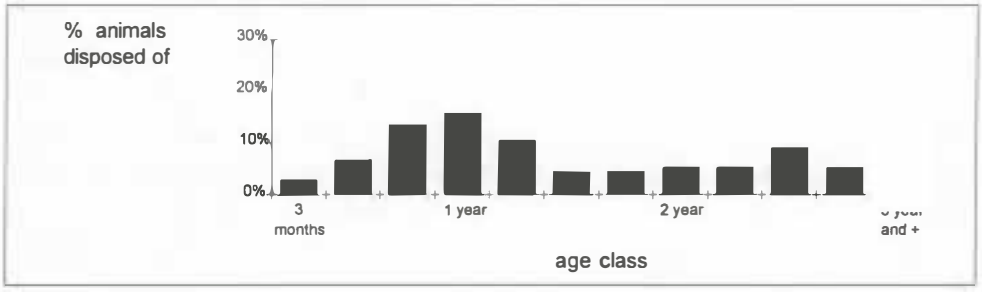
Figure 4:
Age of disposal of males in the Zambezi valley



On the other hand, males in Matebeleland were disposed of when they were much older (figure 5) with only 10 per cent disposed of before they were 2 years old. The majority of the males (46 per cent) left the flock as castrates over 2 years of age (Figure 5). Three possible reasons for late disposal in Matebeleland are:

-Matebeleland being intrinsically dry, animals would need a wet season to attain slaughter weights
-Excess stock were kept as 'insurance' against drought years
-People in the region prefered meat from older animals.

Figure 5:
Age at disposal of males in Matabeleland



B. MANAGEMENT OF CASTRATES

1.Reasons for castration

The number of castrates and timing of castration varied from region to region (Table 1; Figure 1 to 3). The reasons for castration varied but few farmers used it as a breeding 'tool'. Over half of the farmers believed castration enhanced growth (table 3).

Table 3:
Reasons given by farmers for castration

Reason	Per cent response
Weight increase	53
Improve taste of meat	34
Breed improvement	11
Other	1

Castration was practised systematically in Matebeleland on males between 8 and 12 months at the end of mating. About 40 per cent of entire males were retained from year to year as a 'safety margin' before the next mating season.

In the Zambezi valley, on the other hand, castration did not appear to be a breeding practice associated with any particular management system but rather used in a haphazard manner depending on circumstances. Often it coincided with the visits of veterinary service technician, who designated, at the farmer's request, animals to be castrated. As a general rule, goat keepers with large flocks or richer farmers used castration as a breeding technique.

2. Age at Castration

One third of the males were castrated before 6 months of age, with about half being castrated between 6 and 9 months of age (Table 4).

Table 4:
Age at castration

Class	Age	% castrated
Kids	0-3 months	19
	3-6 months	15
Young males at puberty	6-9 months	48
	9-12 months	6
Mature	> 12 months	12

3.Methods of Castration

Most castrations were done by the farmer (78 per cent) using elastic, a knife or sometimes teeth (Table 5). Young males 4.5 to 5 months were castrated using elastic, with the knife used on animals around 6.5 months and the burdizzo was used on older animals of over 30 months. The operations were carried out without medical treatment and no post-operation complication was reported. In remote areas e.g. in Matsai, farmers used teeth on kids for castration.

Extension agents used the burdizzo (3 per cent of total castrations).

Table 5
Castration techniques

Method	% Application
Elastic	50
Knife	44
Burdizzo	6

4. Use of Castrates

In Matebeleland, the castrates were preferentially slaughtered or sold.

In the Zambezi valley, both entire and castrates were disposed of in equal proportions. The end result was that most males were slaughtered before they were 2 years old. In this case the benefits of castration on carcass traits were not realised since slaughters can be only a few weeks after castration.

In Mzingwane, there seemed to be a preferential disposal of castrates when they were over 18 months of age.

Table 6: Fate of males (entire and castrates) in flocks studied between 01.09.90 and 01.09.91

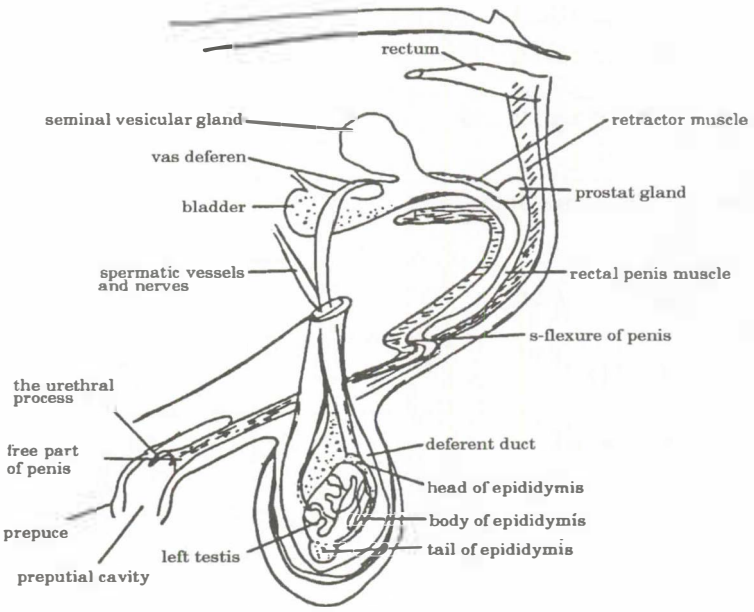
	Castrates	Entire males
Number surveyed	259	342
Number present a year later (%)	43	35
Deaths or disappearances (%)	8	11
Slaughtered (%)	25	33
Sold (%)	23	17
Others (%)	1	4

C. CONCLUSION

Records should be kept to enable selection to be carried out. Desirable characteristics need to be defined and all males which do not meet the criteria should be castrated before mating periods. Introduction of 'new blood' i.e. indigenous males from other communal areas, should be encouraged to avoid in-breeding. Weights at which castrates should be marketed for slaughter should be well-defined.

C. APPENDICES

Appendix 1. Anatomy of the male genital organs



Puberty is the age at which reproduction becomes possible. It varies according to the season of birth, the weight of the animal and the quality of its food. Young bucks reach puberty at 6 - 8 months (average weight between 14 and 18 kg) but the optimal age for them to begin reproduction is over 9 months.

The production of spermatozoa starts before puberty and a full production cycle lasts two months. The quantity and quality of sperm are linked to numerous factors: age, weight, general condition and environment (food availability, time, day, influence of outside temperature: extreme heat retards the maturation of spermatozoa and reduces the sperm quality) ...

Appendix 2. Patterns of mating in farm animals

	Cattle	Sheep	Goat
Duration of oestrus	15 hrs (5 to 30)	24 hrs (12 to 50)	32 hrs (24 to 96)
Time of ovulation after onset of oestrus	4 to 15 hrs	30 hrs	30 to 36 hrs
Penis	fibroelastic	fibroelastic with filiform process	
Volume of ejaculate	5 to 8 ml	1 ml	1 ml
Average No of ejaculations to exhaustion	20	10	7

From : Alexander, G.; Signoret, J.P. and Hafez, E.S.E. (1980). Sexual maternal and neonatal behaviour. In Reproduction in Farm Animals, Fourth Edition, E.S.E. Hafez (ed). Philadelphia, Lea & Febiger.

Appendix 3. Reproductive characteristics of the ram and the buck

Characteristic	Ram	Buck
Age at puberty (months) Spermatogenesis	4 to 6	4 to 6
Sexual season	none	none
Duration of seminiferous epithelial cycle (days)	10,3	?
Semen volume (ml)	0,8 to 1,2	0,1 to 1,5
Semen concentration (billion / ml)	1,5	2 - 6
Mating (male / female)	1 / 30	1 / 50

From Jainudeen , M.R. and HAFEZ, E.S.E. (1987). Sheep and Goats. In Reproduction in Farm Animals, 5th edition; E.S.E., Hafez (ed). Philadelphia, Lea and Febiger

Appendix 4 : Breed improvement

In controlled breeding systems, superior males are selected using either their performance or that of their parents. In communal areas, though some selection may be practised, there was no organised selection procedure and no pedigree records were kept. Usually animals in the whole community grazed together which made it difficult to identify bucks which actually mate the does in the field.

Objectives of the goat farmer on the type of the animal should be clearly be defined.

In most CAs, in-breeding may be of concern. There is need to establish the levels of in-breeding. In the absence of information of in-breeding levels in CAs, farmers should be encouraged to procure bucks from distant farmers occasionally.

Although cross-breeding may yield rapid results in productivity, its use must be well-planned.

Appendix 5: Reasons and techniques for castration.

1. Why castrate males ?

The objective of castration is to eliminate the genital function of the male. A castrate is sterile and cannot be used for breeding. Being without male hormones, the carcass will have a different fat ratio and its odour will be less strong.

The main effects are to eliminate poor breeding males, to improve the genetic potential of the herd, to assist fat production on the carcass, to improve the taste of the meat and to influence the male's character.

2. Castrating the males in a flock means ...

-Selecting the males intended for breeding and eliminating the poor ones. This enables improvement of the genetic potential of the herd by limiting in-breeding without running the risk of having females covered by a poor quality male which would harm the eventual performance of the flock. Thus improvement of the flock goes through a phase of selecting good breeding males and then castrating the males barred from breeding on well-defined criteria.

-Encouraging fattening of the carcass which will thus acquire a commercial value higher than that of a normal male.

-Improving the taste of the meat which will become more succulent.

-Influencing the character of the male and limiting problems related to mating and the fights associated with this.

-Reducing the straying of males and consequently risks of losses, disappearances (theft, predators, ...), making it easier to keep males in.

3. Precautions

Selecting good breeding males requires good knowledge of the criteria which reveal the males' suitability for breeding and for the genetic improvement of the flock.

Castrating an animal requires a sound knowledge of techniques and suitable equipment: at what age to castrate the animal, which technique to use, what risks to be aware of, what precautions to take ...

4. Criteria for selection for castration

It is generally recommended to select one breeding male for every 20 or 30 females. The other undesirable males are then castrated. Nevertheless, for small flocks, more than one breeding male should be kept, since accidental sterility of the latter could compromise an entire mating season.

In order to combat the negative effects of in-breeding which always appear as a decrease in performance, it is desirable that the breeding males kept do not have any blood relation with the females of the flock. It is always preferable to replace the breeding males subsequently by other males bought outside the flock rather than to select their direct descendants.

For breeding (c.f.Introducing New Animals Into Flocks), bucks should be selected which have good general conformation, sturdy, in a good state of health, with normally developed sexual organs, with no morphological or functional anomaly, with testicles in place and of normal size. The males selected should also have good ancestors, come from crossing a prolific buck and female (which have never had any particular kidding problem), both of good general conformation.

Bucks not satisfying these conditions should be eliminated from breeding and castrated.

5. Different castration techniques

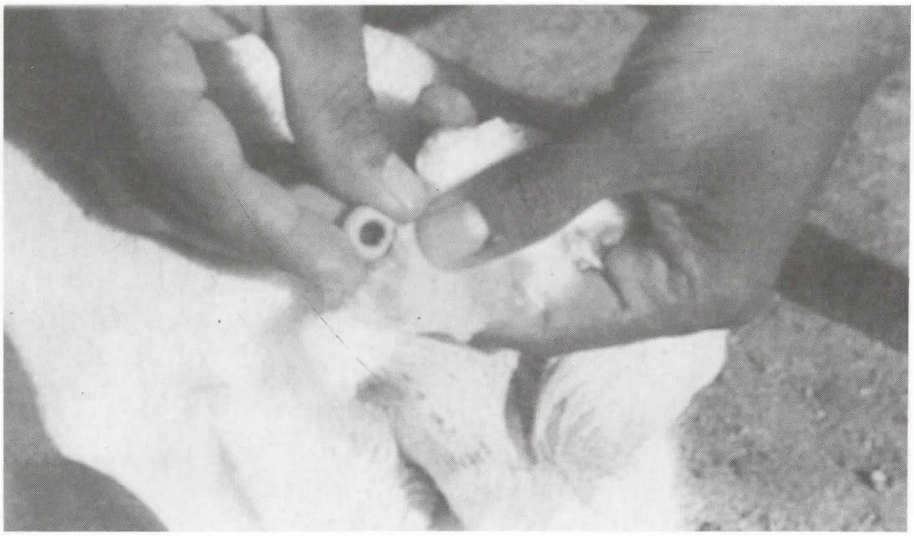
(Pictures from *Sri Lanka - German Goat Development Project - GTZ*)

2.1. castration using the elastic technique

This technique has the advantage that it can be used very early, since it is recommended from two or three weeks, but it is not recommended after the age of two months.

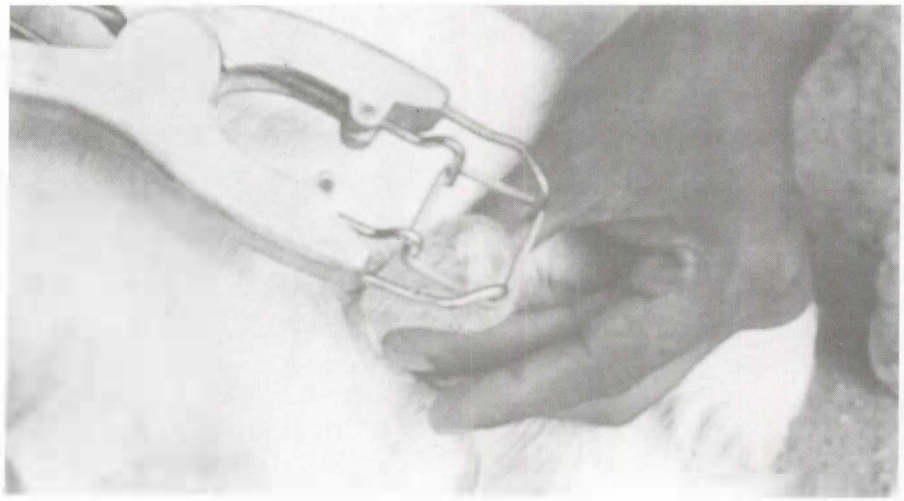
One should be more vigilant using this technique during the rainy season because of the humidity and risks of parasitic infestations.

After disinfecting the scrotal area and the elastic ...

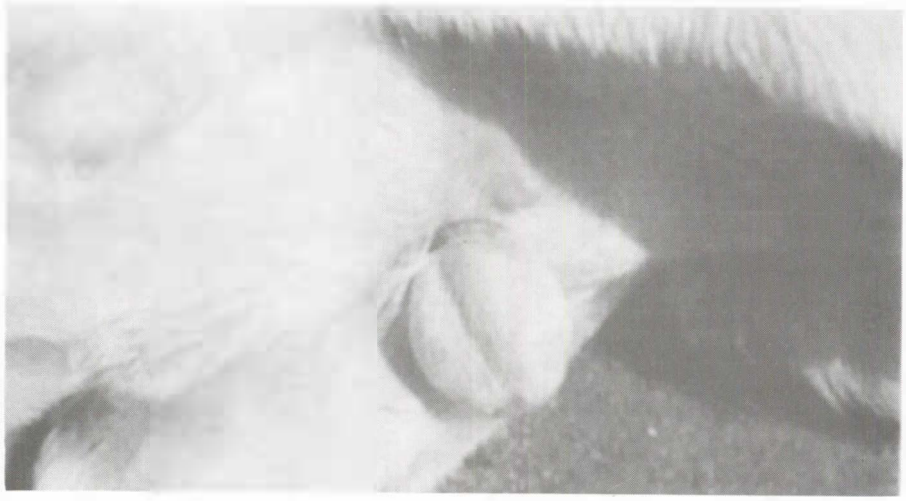


It is placed on the applicator ...

The tongs are opened in such as way as to enclose the base of the scrotum with the elastic strip.



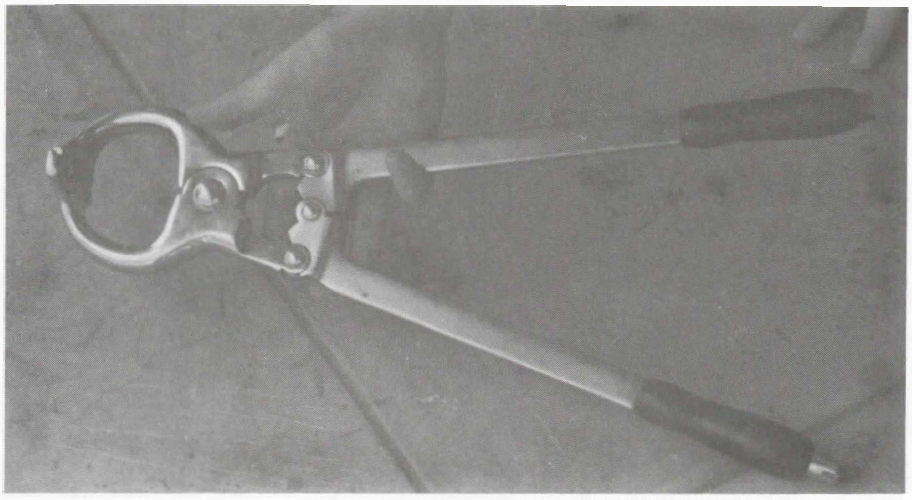
The elastic is left in place until the degeneration of tissue 3 or 4 weeks later. Keep a close watch on tissue change and disinfect regularly and thoroughly in the case of appearance of scabs or sores.



2.3. Castration with a Burdizzo:

The age suggested for use of this technique is between 6 and 8 months.

A Burdizzo...



The burdizzo is kept tightly squeezed for at least three minutes.
The burdizzo is then removed.

2.4. Open castration

This technique can be used at any time from the age of two weeks up to two months.

Equipment:-antiseptic solution
-very sharp knife or razor blade
-pincers

-Make an incision in the lower quarter of the scrotum, extract the first testicle and twist until the tube is severed.

-Disinfect the wound by injecting a little antiseptic solution inside the scrotum.

-Repeat for the second testicle

GOAT HOUSING IN RURAL ZIMBABWE

TABLE OF CONTENTS

A. INTRODUCTION

The classification of small ruminant housing structures, using data from the French survey team (1990-1991) is mainly based on type, size, materials used for roof and walls and presence or absence of a roof. Historically, reasons for shelter (animal protection from predators, thieves and the weather, and to protect crops etc.) may have influenced the present day structures.

Goat housing in rural Zimbabwe

B. RESULTS

1. General Classification of shelters

In all the four areas studied (Zambezi Valley, Highveld, Matebeleland and the Lowveld), from observations made, goat shelters were divided into 2 major groups (Table 1). An 'open kraal' was defined as a roofless enclosure made of either wooden poles, thorny hedge or scrap material, where small ruminants are normally confined overnight. A 'covered kraal' was where walls and a roof were provided, irrespective of the materials used.

Table 1 Classification of kraals

TYPE	Average size-m² (range)	Number of units recorded	MATERIALS (walls & roof)
Open Kraal	Small -13 (3 to 22)	36	70% walls are of wood
	Large - 57,5 (26 to 148)	26	96% walls are of wood
Covered Kraal	Small - 5,4 (3 to 9)	50	wooden walls and thatch roof
	Large - 23,8 (12 to 80)	37	
	Small modified - 5,7 (2 to 10)	35	Walls: wood, brick or scrap. Roof: thatch or scrap.
	Large modified - 24,4 (10 to 99)	18	
	Other unstructured - 8 (3 to 80)	16	Any materials

Table 2: Percentage of the different kraal types in rural Zimbabwe.

	Zambezi Valley	Highveld	Matabeleland North	Matabeleland South	Masvingo (a)	Masvingo (b)
Small Open	0	0	0	100	16	16
Large Open	0	9	23	0	12	65
Large Covered	35	7	0	0	68	10
Small Covered	45	37	0	0	0	6
Modified Large Covered	7	6	41	0	4	3
Modified Small Covered	13	30	13	0	0	0
Other Unstructured	0	11	23	0	0	0

(a) Matsai
(b) Chiredzi

2. General characteristics of kraals

2.1. Size

The general size of shelters varied from region to region. All kraals in Matebeleland South were larger than 20m² (Table 3). Densities varied from moderate (O.94 animals/m²) to high densities (2,7 animals/m²). The density would be higher if the calves housed together with the small ruminants were considered (Table 4). Of the large open kraals where calves were present, 22% had a partition made of poles to separate the two species.

Table 3:
Number of small ruminants and percentage of kraals also housing calves.

Kraal type	% with calves	No of Small Ruminants	Density (animals/m²)
Small Open	25	15,1	1,2
Large Open	19	49,4	0,94
Small Covered	17	13,6	2,7
Large Covered	51	24,5	1,5
Modified Small Covered	6	12,5	2,2
Modified Large Covered	11	27,5	1,4
Other Unstructured Covered	0	13,8	2,3

Table 4: Percentage of kraals by size

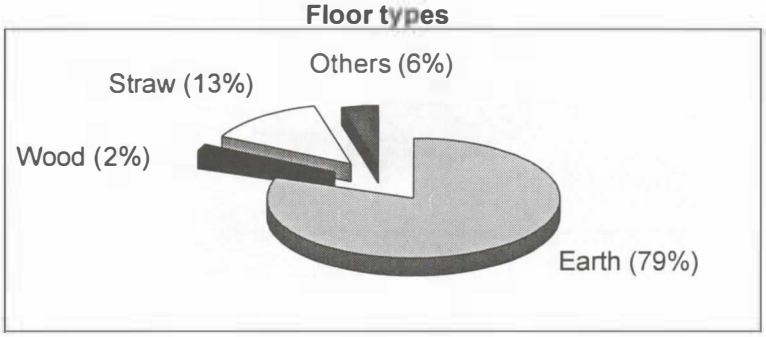
Area / Size	Zambezi Valley	Highveld	Matabeleland South	Matabeleland North	Masvingo (a)	Masvingo (b)
<10 m²	58	83	0	23	0	23
10-20 m²	35	17	0	50	28	48
>20 m²	7	0	100	27	72	29

(a) Matsai
(b) Chiredzi

2.2. Floors

Over three-quarters of the floors were natural earth (Figure 1). Floors not made of earth were termed "improved". Most modifications to floors were at the beginning of the rainy season when bedding was placed on earthern floors. A large proportion of the floors improved at the beginning of the rainy season was in covered modified kraals (42%), followed by 38% for the covered unstructured kraals, and only 16% of the remainder had their floors improved.

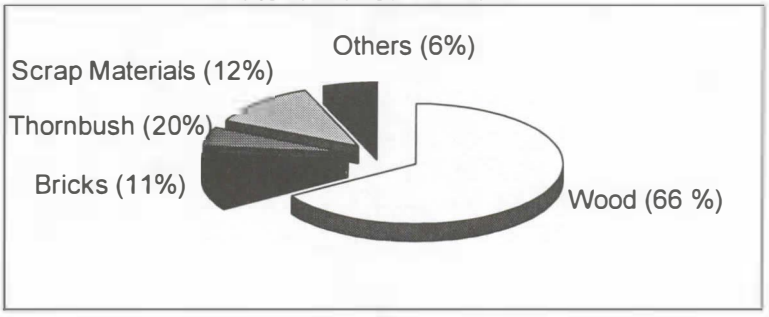
Figure 1:
Floor types



2.3. Walls

Walls were made of wood (66%) and only 16% were made of bricks (Figure 2).

Figure 2 :
Materials used for walls



2.4. Roofs

Climate may influence provision of a roof . There were regional differences with all the kraals in the Zambezi Valley roofed, but none had a complete roof in Matebeleland South (Table 5). About half of the roofed kraals were grass thatched (Figure 3).

Figure 3 :
Materials used for roofing

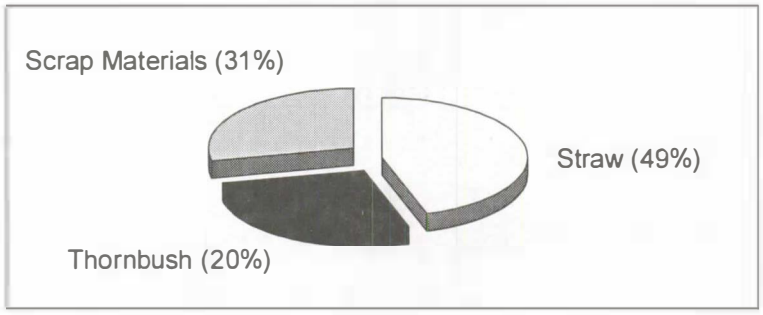


Table 5: Percentage of kraals having 100% roof cover and only 1 section

	Zambezi Valley	Highveld	Matabeleland South	Matabeleland North	Masvingo (a)	Masvingo (b)
Roof 100% (%)	100	90	0	32	72	28
1 section (%)	90	99	31	86	98	

2.5 Site

There was no regional influence on siting of kraals. Sixty-two per cent of the farmers considered the site of their kraals favourable. Most of the kraals were under a tree or adjacent to a building (93% in Zambezi valley, 50% to 70 % in Matebeleland North, Mzingwane and Matsai, 33% in Guyu, none in Kezi). Farmers in Kezi and Guyu considered their kraals to be heavily exposed to the wind. The distance of kraals from the living quarters was: 10m in Masvingo and Mzingwane; 20m in Chiredzi and Matebeleland South; 40m in the Zambezi valley; and 70m in the Highveld.

2.6 Repairs to Kraals

Necessary repairs took place during the dry season (mainly September and October), forty-four percent of the covered and unstructured kraals being repaired, while only 20% of the remaining kraals were repaired.

3. Four models of kraal

Detailed study of housing units for small ruminants showed a great variation in both their construction (design, position, materials, ...) and utilisation (types of animal, densities, ...). This variation seemed to depend more on the geographical, climatic and socio-economic environment than on the farming systems (livestock farmers, crop farmers; ...) as defined in the farm profile in the survey.

Type of housing unit did not determine *a priori* either the importance of small ruminants in the farming system, or technical and economic results obtained.

Analysis of the data collected pointed to four kraal models. All the situations encountered in the sample farms visited fell into one of these models or a simple combination of the four models.

3.1. The large covered kraal

The large covered kraal was predominant in the Matsai area.

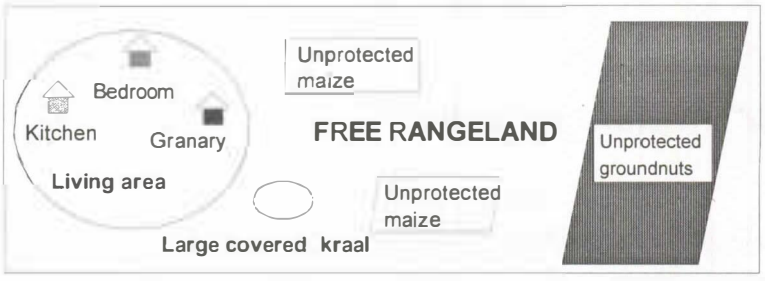
3.1.1. Types of housing unit and materials used

This kraal type was made of pole-and-thatch in 80 % of the farms visited. Materials used were those found in the locality.

3.1.2. Position of the kraal

The kraals for small ruminants and for cattle were very close to (9 m), if not part of, the living area. The areas for crop lands were scattered within the communal grazing areas and not protected. Animals therefore needed to be herded until the harvest. Where this was not possible (at night or too few workers), the goats were kept shut in the kraal...

Figure 4: Position of the large covered kraal as found in the Matsai area



3.1.3. Functions of the kraal

The kraal's main functions were:

- protection against natural elements (rain and wind);
- protection against predators (baboons, stray dogs, leopards, ..) which were present in the area.

- protection against thefts .

For these reasons the traditional kraal was most often found near the dwelling huts, allowing the farmer to react quickly to incidents.

Density of small ruminants per kraal (1.5 animals /m²) was below the survey average and in most cases satisfactory. Eighty-four percent of kraals housed unweaned calves, in contrast to the 21 % on average for the whole study.

In one-third of the cases, the farmers indicated that during the rainy season the young kids were kept in the dwelling huts at night and not in the kraal.

3.2. The small covered kraal

In communal areas with favourable agronomic conditions, crop farming was more important than livestock farming. The covered kraals were on average smaller than the one observed in the Matsai area. This showed a marginalisation of the small ruminant flock.

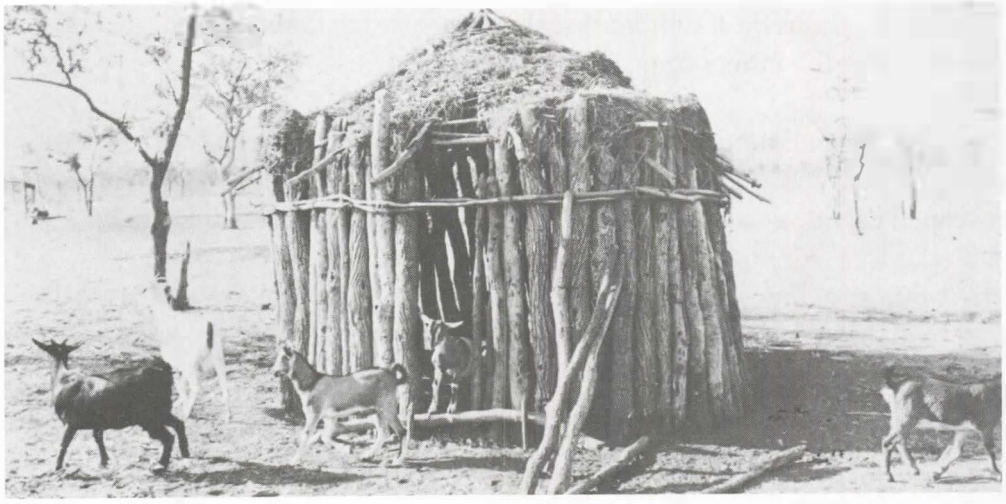
This kraal type was found in the Highveld.

3.2.1. Types of housing unit and materials used

Sixty-eight percent of the housing units studied in the Highveld were of the 'small covered kraal' type, and 13 percent the 'large covered kraal' type. Half of these kraals were built with local materials (wooden poles for the walls and thatch for the roof). For the other half, other materials were used (fencing for the walls, corrugated iron roofs, ...).

In these communal areas where rainfall is heavy during the rainy season, the presence in the sample of 11 % of shelters providing partial protection against climatic elements was observed.

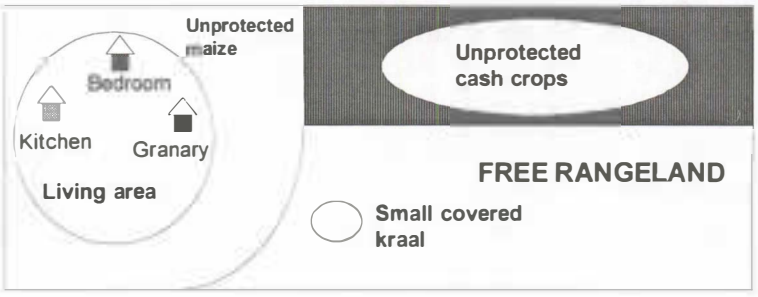
Small covered kraal



3.2.2. Position of the housing unit

Contrary to traditional practice as observed in the Matsai region, the small ruminant housing unit was situated far from the living area of the farm (the average distance from the kraal to the living area was 72 m, as compared to 9m in the Matsai region).

Figure 5:
Position of the small covered kraal as found in the Highveld



3.2.3. Functions of the housing unit

Of four traditional protective roles (natural elements, predators, thefts and raids), the kraal in the Highveld has only retained the first. Wild predators (leopards, hyenas, baboons, jackals, ...) have practically disappeared in these areas and stray dogs are rare. The distance of the kraals from the living area limited effective protection against thefts.

On the other hand, the kraal retained a role in the protection of crops (unfenced) at night and during the day in case of temporary shortage of manpower. In 50 % of the housing units (mainly small kraal type), despite the small size of the flocks, densities were very high (more than 3 animals per m^2).

Calves were not kept in the small ruminant kraal. In less than a quarter of all cases (22 %), the floor was declared muddy or very muddy at the time of the visit.

3.3. The large uncovered kraal

The large open kraal was found in the driest regions, predominantely in Matabeleland and in Chiredzi.

In these areas droughts are severe and unpredictable. Livestock farming (cattle and small ruminants) is the main source of farm income, and the entire communal area farming system is centred around animal production.

Cereals (if there is a harvest) are for home consumption. If the drought is too severe, government assistance («drought relief») is distributed to all families.

3.3.1.Types of housing unit and materials used

Kraals were rectangular in shape and generally large (57 m^2). The large open kraal was made of wooden poles sunk into the ground close together and about 1,6 m high.

Only 18 % of these kraals in the study had a covered area (on average 22 % of the total size of the kraal was covered with corrugated iron or harvest residue). Three per cent were situated under a tree and thus partially protected from the natural elements. Half were divided into two or three parts. In the case of subdivision, kids were separated from adult animals.

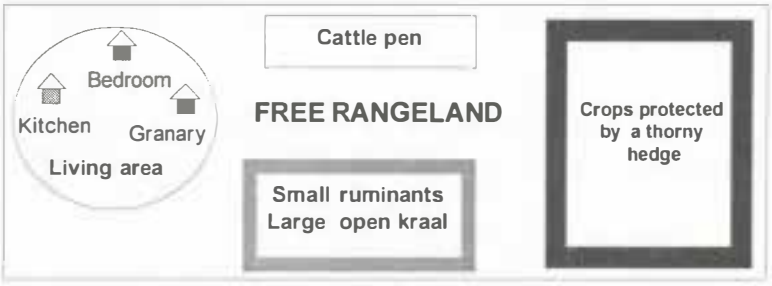
Cattle were kept in separate kraals which were sometimes attached to the small ruminant kraal.

Large uncovered kraal

3.3.2. Position of the housing unit

The large uncovered kraal type was located near the living areas (22 m on average). In contrast to areas where crop farming is dominant, crops were protected from domestic animals by thorny hedges or barbed wire fences. Because of this, the domestic animals were not herded at any time of the year.

Figure 6:
Position of the large open kraal as observed in arid regions



3.3.3. Function of the kraal

The kraal's function in protecting against predators and thieves was a nocturnal one. During the day, wandering without herdsmen, the animals were at the mercy of attacks by predators and stockthieves. The pen was a poor protector of livestock against the natural elements (no roof against rain, poles with gaps between them letting the wind through).

Density of small ruminants in the kraals was generally satisfactory (0.94 animals/m^2).

The quality of the floor depended directly on atmospheric conditions (open to the sky and floor of beaten earth). The floors could be very muddy when there were heavy rains.

3.4. Other unstructured kraal

These structures existed mainly on farms where non-agricultural income (as a rule the farmer's salary) was very much higher than that coming from crops and livestock farming. In this case, small ruminants played a marginal role in the farm's economy. This situation was found chiefly in peri-urban areas (46 % of the housing units in Mzingwane situated 20 km from Bulawayo were of the 'unstructured kraal' type).

3.4.1. Types of housing unit and materials used

These unstructured kraals were small to average in size (8 m² and 1.5 m. high).

They were built with the cheapest (or most abundant) materials found in the surrounding area: recycled materials such as corrugated iron, plastic, ...

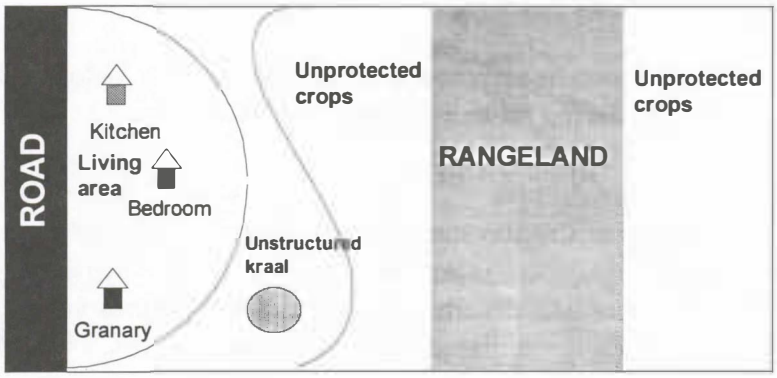
Unstructured kraal

3.4.2. Position of the housing unit

The small pens were not covered, and were most often in the shade of a tree or built onto a dwelling.

In peri-urban areas where human population densities are often high, priority in the farming system was given to food crops, which limited livestock holdings and marginalised rangelands. In these regions, the small ruminant kraal was generally very near the living area to prevent theft (average distance 9 m) and far from the communal rangelands .

Figure 7:
Position of the unstructured kraal as observed in the peri-urban area of Bulawayo



3.4.3. Functions of the kraal

For this type of kraal, the triple role of protection is reduced to its absolute minimum: little or no protection against the natural elements or against theft.

4.Conclusion

A general classification and characterisation of small ruminants housing in rural Zimbabwe has been presented. In this study, biological response assessment and economic analysis were not performed to evaluate the benefits of housing in traditional systems. The diversity of kraals studied depended more on the characteristics of the environment and animal numbers per household than the perceived importance of goat production in the different regions.

C. APPENDIX

1 The construction of a new building

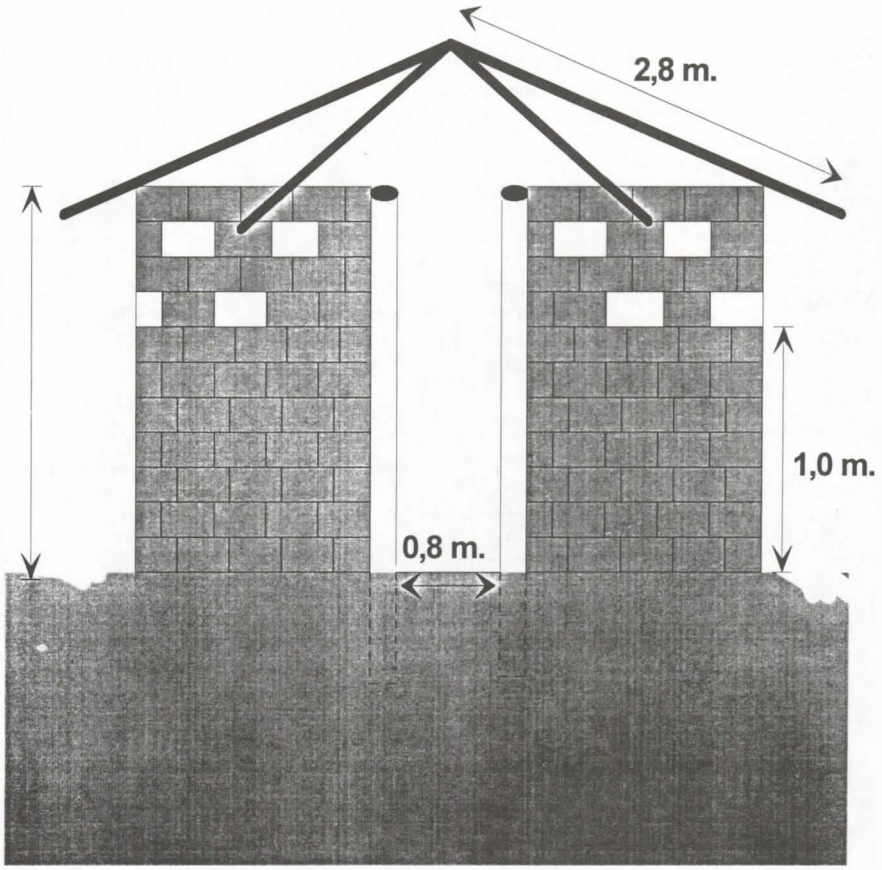
The aim of a goat house is to protect animals from adverse factors, such as bad weather (wind, rain during the rainy season), thieves and predators (baboons, etc).

It is important to note that too small a space brings with it inadequate or even non-existant ventilation, which is how pulmonary diseases may begin. An over-populated building (too high a density) creates a hot, humid atmosphere favourable to microbial proliferation and disease which, if contagious, may spread rapidly. Elementary rules must therefore be followed if the building is not to become a constraint on the technical results of the flock.

1. Basic rules

- There must be adequate ventilation. (Completely closed buildings are to be avoided. Walled buildings should have air holes.)
- Ventilation should not cause draughts (which can cause sudden drops in temperature and reduce the animal's resistance to disease). Air holes should be at least 1 m. above the ground
- In areas of high rainfall, the building should be roofed, so that the animals are sheltered from rain and the floor remains dry.
- Floors should be kept clean and dry to avoid risks of contamination.
  Litter (dry grass) can also be used; this should be changed when it is too soiled.
- It is desirable to separate nursing does and kids.

2.The Bikita goat house



Surface: 18m²
Diameter: 4,8 m
Perimeter: 15 m.
53 bricks per layer, 17 layers therefore 900 bricks

8 poles (10 cm x 2,8 m) } **roof**
8 poles (5 cm x 2,8 m)

4 poles (10 cm x 2,0 m) } **door**
15 poles (10 cm x 1,2 m)

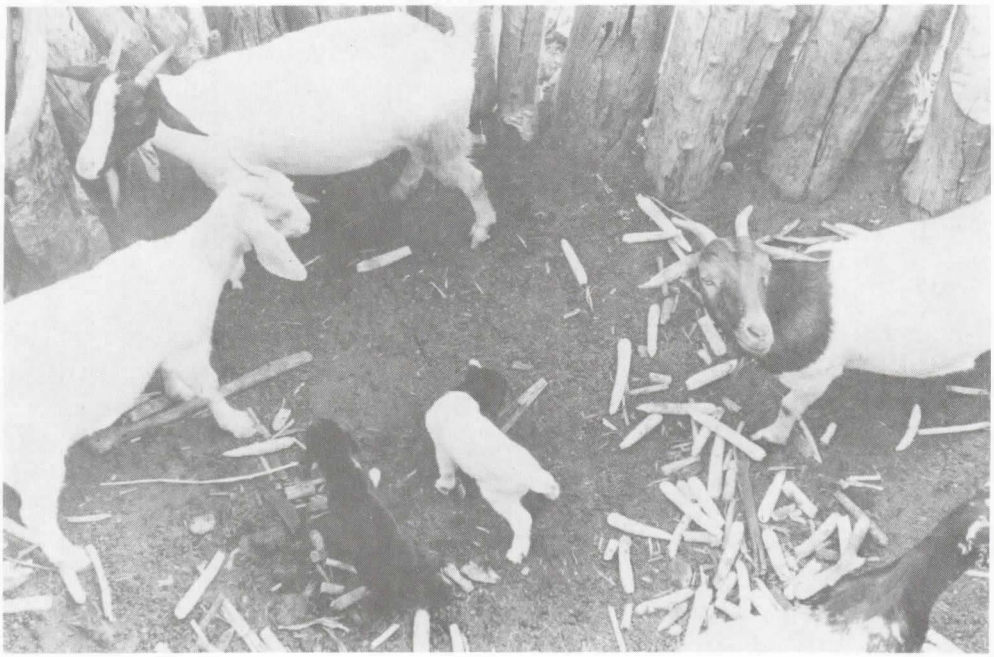
3. Materials used for the building of the Bikita goat house

		5 goats	10 goats	15 goats	20 goats
BRICKS	Surface - round	1,2 x 5 = 6 m²	12 m²	18 m²	24 m²
	Diameter	2,8 m	4 m	4,8 m	5,6 m
	Perimeter	8,8 m	12,6 m	15 m	17,6 m
	Height (walls)	1,5 m	1,5 m	1,5 m	1,5 m
	Bricks per layer	8,8 : 0,8 = 30	44	53	62
	Total bricks (x 17)	30 x17 = 510	748	901	1054
	Bricks per goat	102	75	60	53
	Surface - square shelter	6 m² (2,45 x2,45)	12 m² (3,5 x 3,5)	18 m² (4,25 x 4,25)	24 m² (4,9 x 4,9)
	Bricks per layer	33	49	60	69
	Total bricks	561	831	1020	1183
	Bricks per goat	112	83	68	59
	Roof & Door	8 poles (2 m) 4 poles (2 m) 15 poles (1,2 m)	16 poles (2,5 m) - -	16 poles (2,8 m) - -	16 poles (3,2 m) - -
WOOD	Wood shelter round	40 poles (20 cm x 2 m)	59 poles (20 cm x 2m)	71 poles (20 cm x 2m)	84 poles (20cm x 2m)
	*	8 per goat	5,9 per goat	4,7 per goat	4,2 per goat

- It should not be recommended to roof a brick shelter over 24 m², unless walls are strengthened with pillars to support the weight of the roof, especially during the rainy season.
- For more than 20 goats, building another smaller shelter nearby is recommended.
- In order to avoid overuse of the natural environment (cutting down trees...), it is preferable to build a brick shelter.
- Buying treated gum poles for a wooden shelter is not recommended at present because of the prohibitive cost of materials.

Example of a kraal built according to the "Bikita Goat House" model

INTRODUCTION OF NEW ANIMALS INTO FLOCKS



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A. INTRODUCTION

Why introduce new animals into a flock?

The introduction of new animals is an important element in the management of flocks by livestock farmers. Reasons for doing so are numerous and varied. Understanding the nature of animal movements is essential in formulating recommendations for improving the quality of the flock.

A survey of 250 flocks throughout the country was conducted between 1991 and 1992. The results on movement of animals between flocks are presented.

B. RESULTS

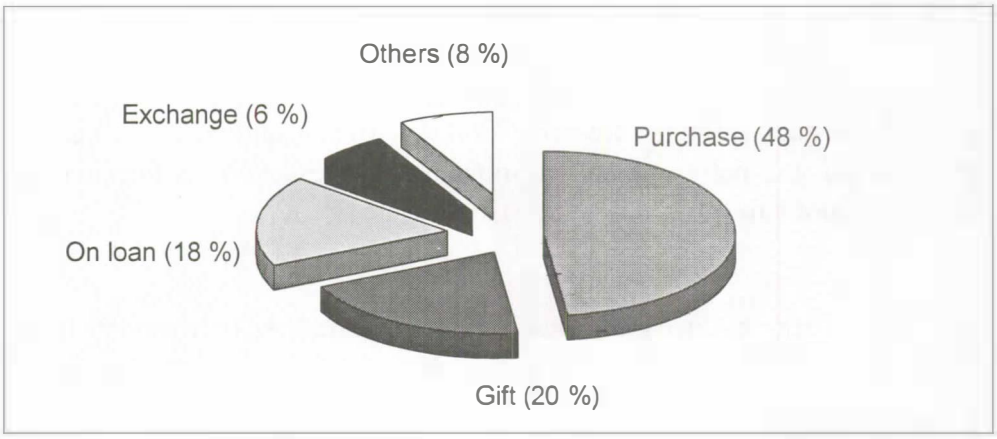
1. Different introduction practices

The purchase of new animals represented nearly half the animals introduced, whether males, females with kids at foot or not, young or adult animals.

Different social rites made up the remaining transfers, in the form of exchanges on weddings, inheritance, gifts, trade, ...

Finally, taking in animals belonging to a third party for a fixed period was a factor of introduction not to be overlooked.

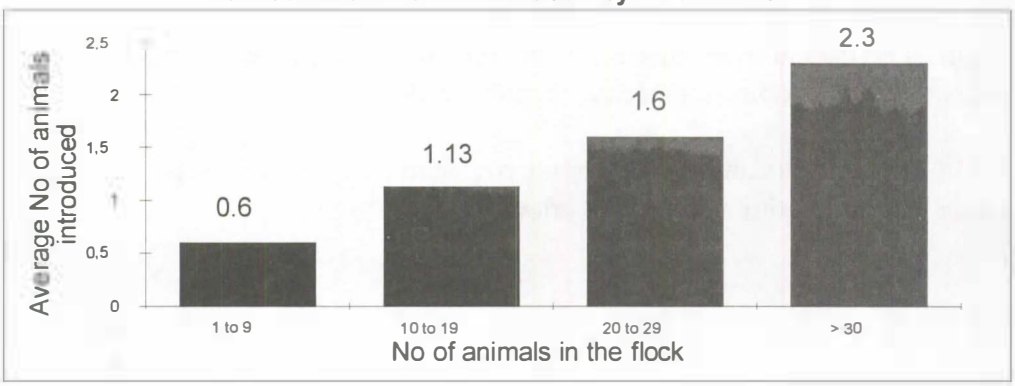
Figure 1
Different introduction practices observed in communal areas



2. Effect of introduction on flock size

Fifty per cent of the flocks did not introduce animals during the survey period. Among flocks which introduced at least one animal, the average number of animals introduced increased with the size of flock (figure 2). The number of animals entering was equal to that of animals leaving.

Figure 2 :
Number of animals introduced by size of flock



3. Classification of animals introduced

Goats made up 85% of the 287 small ruminants introduced during the year of the study, which corresponds to the average proportion of goats observed in the flocks. Sheep made up a much smaller proportion of the population and contributed less than 15% of animals introduced.

In both goats and sheep, females made up the larger proportion of animals introduced (82% of what was brought in). By contrast males made up 18% of introductions.

The average weight of animals introduced was 22 kg for males and 24 kg for females. For both sexes, therefore, they were adult animals, i.e. of reproductive age. Nevertheless, there was a great variation in the weight of animals introduced into the various farms. The weight ranged from 7 to 47 kg.

Table 1:
Distribution of small ruminants introduced into flocks from 01/09/91 to 30/02/92

	Females	Males	Total
SHEEP	12 %	3 %	15 %
GOATS	70 %	15 %	85 %
Total	82 %	18 %	

4. Source of animals

The animals introduced came from farms belonging to the same family or situated in the immediate neighbourhood of the farmer (Tables 2 & 3). The role of middle-men in this acquisition was not significant.

Table 2 :
Previous ownership of animals introduced

Extended family	56 %
Neighbouring farms	43 %
Middlemen	1 %

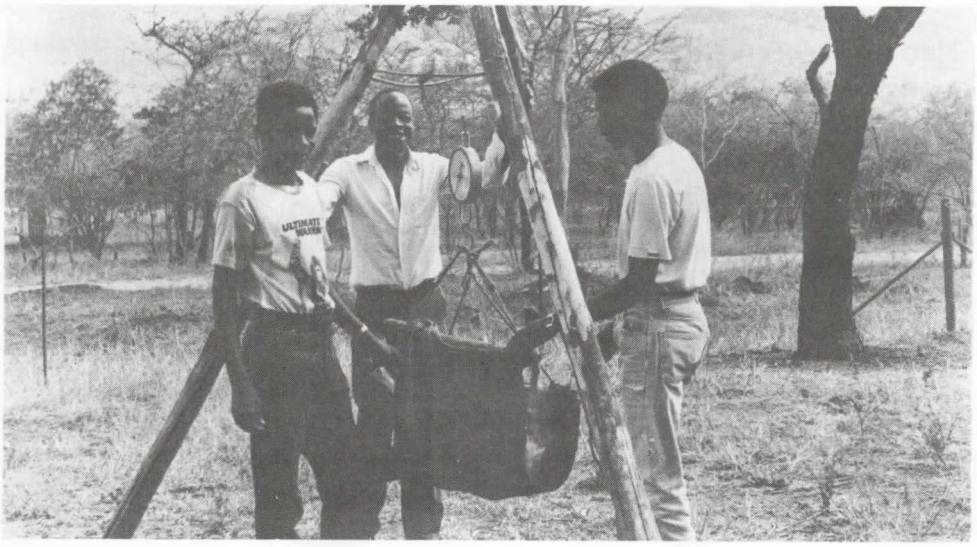
Table 3:
Geographical origin of the animals introduced

Same village	33 %
Same ward	37 % (70)
Same district	26 % (96)
Same province	3 % (99)
Other province	1 % (100)

5. The purchase price of animals

The average price of male and female goats purchased between 1.10.90 and 1.10.91 was the same at around $Z42 for an average weight of 23 kg per head.

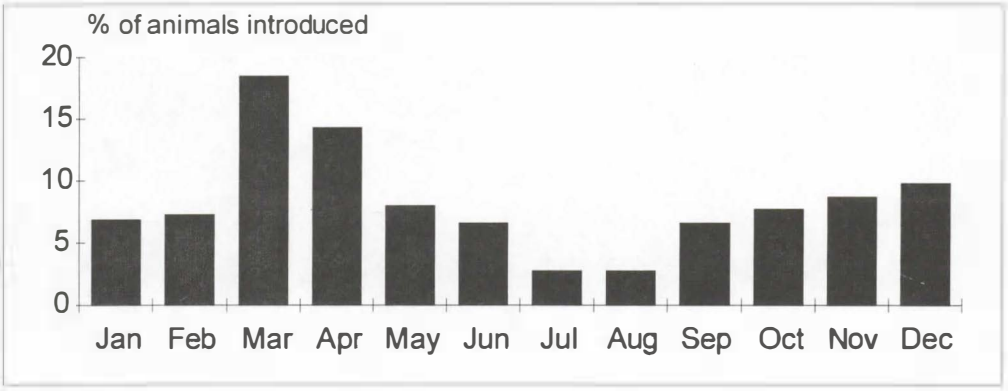
Goat sale using scales



6. Season of introduction

The peak introduction was observed in March and April. It picked up again from September, at the end of the dry season, and increased to a new peak during the end-of-year holidays.

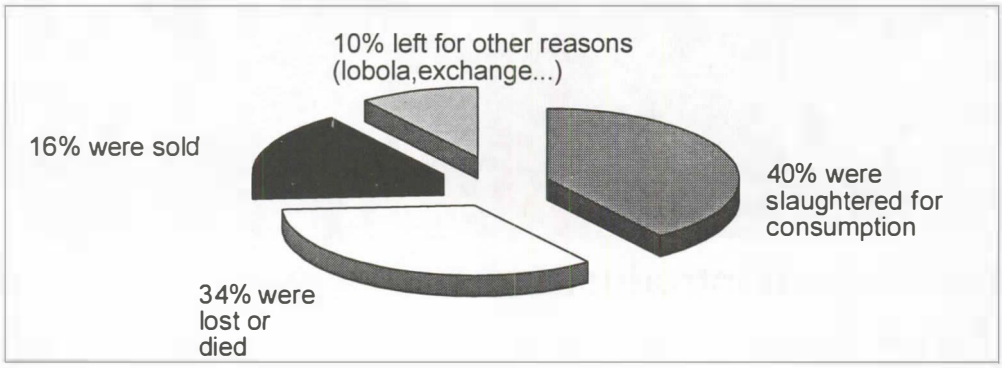
Figure 3:
Percentage of introductions by month



7. Reasons for disposal of introduced animals

Thirteen per cent of the introduced animals left the flock during the year of introduction. The reasons for their leaving are shown in Figure 4.

Figure 4:
Reasons for disposal of animals introduced into the flocks between 01/09/91 and 30/02/92



C. DISCUSSION

1. The availability of cash and social rites determine the period of introduction

Part of the surplus money is reinvested straight away in the purchase of animals introduced into the flock. Cash reserves are then exhausted and the market falls away until the start of the rainy season.

2. The animals introduced come from nearby

Ninety-six per cent of the animals did not leave the surrounding district. This very limited movement of animals limits risks of contamination in cases of infectious disease -generally spread from farm to farm by the introduction of sick animals. This may partly explain the low rate of contagious diseases observed in the small ruminant flocks (see booklet 7).

3. Reasons for introduction

Flock size was maintained throughout the study period.

The introduction of males for the genetic improvement of a flock did not appear to be a fundamental consideration. More females than males were introduced, evidencing farmer preference.

Price appeared to be independent of the type and potential of the animal.

In summary, introduction means ...

1. Increasing (or maintaining) the farm's capital...
...by increasing the number of small ruminants.

2. Increasing the production capacity of the flock...
...by increasing the number of females

3. Acquiring an animal with a view to its immediate or short-term use...
...for example, the purchase of an adult castrate which will be slaughtered for a party or special occasion.

4. Taking in animals following a contract...
...made with a member of the family, another farmer or people who, having bought animals, are unable to look after them.

D. RECOMMENDATIONS

Attempts to improve the genetic quality of the flock by introducing new breeding animals (male or female) chosen on criteria for improvement should be encouraged.

1. How to choose a new animal for introduction into a flock: rules to follow

1.1.The selection criteria used will depend on the purpose for which animals are introduced...

Where young females are purchased as replacement, selection should as far as possible be based on reproductive performances, either her own and/or that of her relatives. This should be higher than the performance of animals in the farmer's flock for the purchase to be worthwhile.

1.2.Selection of animals for slaughter or sale

This can be based on weight. Age is also important as it determines the meat quality of the animal. A well-grown young animal should be ideal for slaughter.

2. Beware, however ...

2.1. The animal introduced may be sick...

...and could infect the rest of the flock, previously healthy.

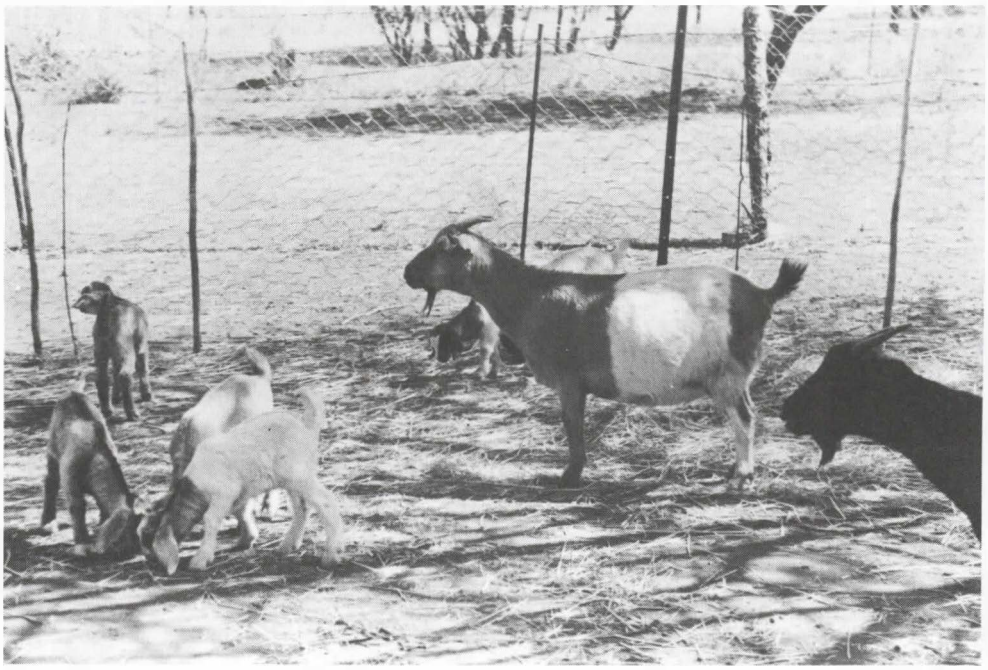
2.2. After introducing several animals, the flock can become too big...

...for the farm: food resources, size of the kraals. All the animals risk suffering and the flock's performance will reflect this.

2.3. The animals introduced may have poor genetic qualities...

...and risk degrading the performance of subsequent generations (birth weight, prolificacy, growth, ...)

REPRODUCTION IN FEMALES



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A. INTRODUCTION

Kidding in relation to rainfall was studied, so as to determine the relationship between goat production and nutrition availability. Productivity was measured in terms of: age at first kidding, fertility, and prolificacy. Definition of these terms and the relevant statistics are presented for the Zambezi Valley, Gwanda and Mzingwane. These areas represent natural bush, degraded bush and a peri-urban area respectively.

B. RESULTS

1. Mating paterns

1.1. Survey results

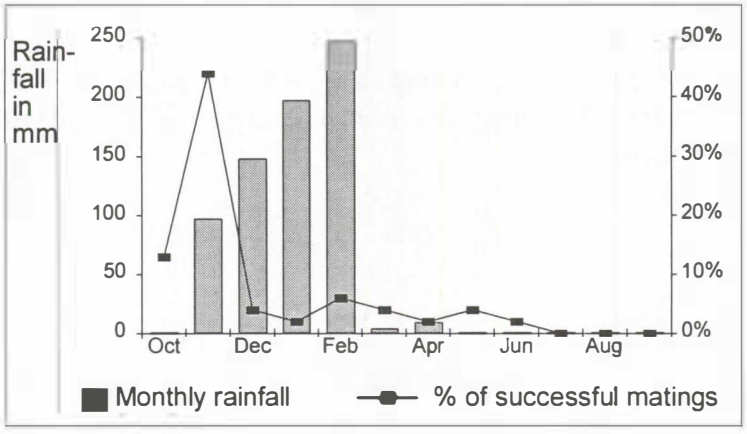
In all three areas studied, the period of active mating in maiden does was different from that of mature does.

In the Zambezi Valley, the majority of maiden does were successfully mated around November (Figure 1), a period which coincides with the onset of the rainy season. Peak kidding occurred in April.

In Matebeleland, the majority of maiden does were successfully mated in January, the mid-rainy season. Peak kidding was in June (Figure 2).

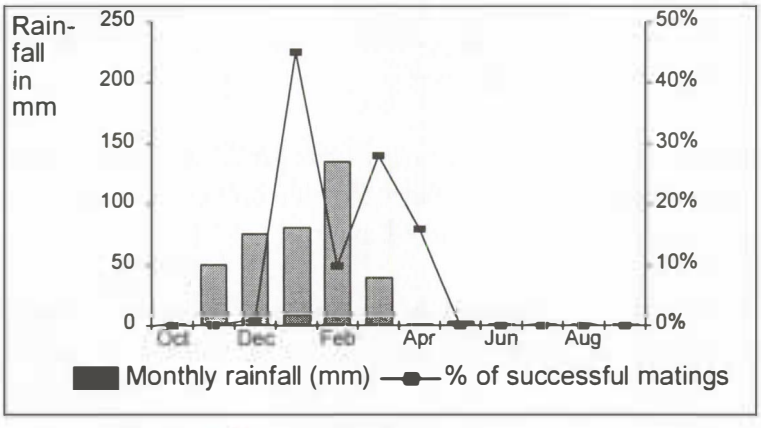
In Mzingwane, peak mating of maiden does was not until March, towards the end of the rainy season. Peak kidding occurred in August (Figure 3).

FIGURE 1:
Relationship between successful matings* and rainfall distribution in the Zambezi Valley (Natural Bush)



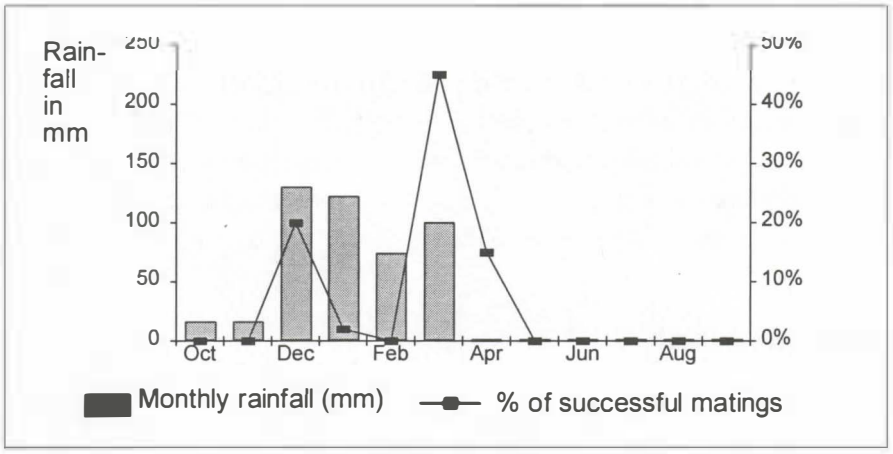
* Where mating month = Kidding month - 5 months Gestation

FIGURE 2:
Relationship between successful matings* and rainfall distribution in Matebeleland South (Degraded Bush).



* Where mating month = Kidding month - 5 months Gestation

FIGURE 3:
The relationship between successful matings* and rainfall distribution in Mzingwane (Peri-urban).



* Where mating month = Kidding month - 5 months Gestation

1.2. Discussion

The gestation period for goats is five months. Theoretically goats could kid twice a year. This is not always possible, as demonstrated by the survey results. In all areas, there was a distinct peak mating period. This is thought to be related to nutrition availability, which is influenced by the rainy season. In some areas, there was a second, though lower, peak mating period within the same rainy season. The remainder of the flock, and, the few exceptions that kidded twice within the same year, did so "outside the peak mating periods". It is interesting to note that maiden does almost always mated successfully during the rainy season.

Although we have limited our discussion to rainfall and nutrition availability, other factors such as light intensity, temperature and humidity may affect mating.

2. Age at first kidding

2.1. Survey results

2.1.1. Natural Bush

Females born during the peak kidding period (February-April) gave birth for the first time at the age of twelve months. Females born after the peak kidding period (August-December) were too young to conceive, being only 6-8 months old during the peak kidding period. These females were successfully mated during the subsequent rainy season, kidding at the age of 20-24 months.

2.1.2. Degraded Bush

The average age at first kidding was 24 months. Nearly all primiparous births occurred during the peak kidding season of June/July.

2.1.3. Peri-urban area

In Mzingwane communal area, the mating season was interrupted during the cropping season. The oldest females, often the heaviest (average age at conception 910 days, average weight at the end of the dry season 22 kg) conceived during the first part of the mating season. They kidded for the first time at the age of 35 months.

The youngest females, often the lightest (average age at conception 680 days, average weight at the end of the dry season 15 kg), conceived during the second part of the mating season , after they started putting on weight again.They kidded for the first time at 22 months, 3 months after the oldest.

2.2 Discussion

Physiological puberty in goats may be achieved at 4-5 months. Most goats

that conceive at this age abort, are immature and of insufficient liveweight to sustain pregnancy. Given sufficient feed to attain optimum liveweight, indigenous goats can conceive at 7-8 months of age, to kid at about 12-13 months. Of the three study sites, an average age at first kidding of 12 months was only achieved in the Zambezi Valley. Poor growth rates, due to insufficient feed in the other study sites, may be the reason for delayed primiparous births.

3. Prolificacy

3.1. Survey results

Prolificacy or average litter size was calculated as:

$$\frac{\text{Total No. of kids born}}{\text{No of does kidding for the first time}}$$

In all three environments studied, average litter size was 1.1. This represents only one twin birth in ten.

3.2. Discussion

A prolificacy rate of 1.1 is very low. However, this may be the true genetic potential, since it was the same for the different sites.

4. Fertility

Fertility was measured as :

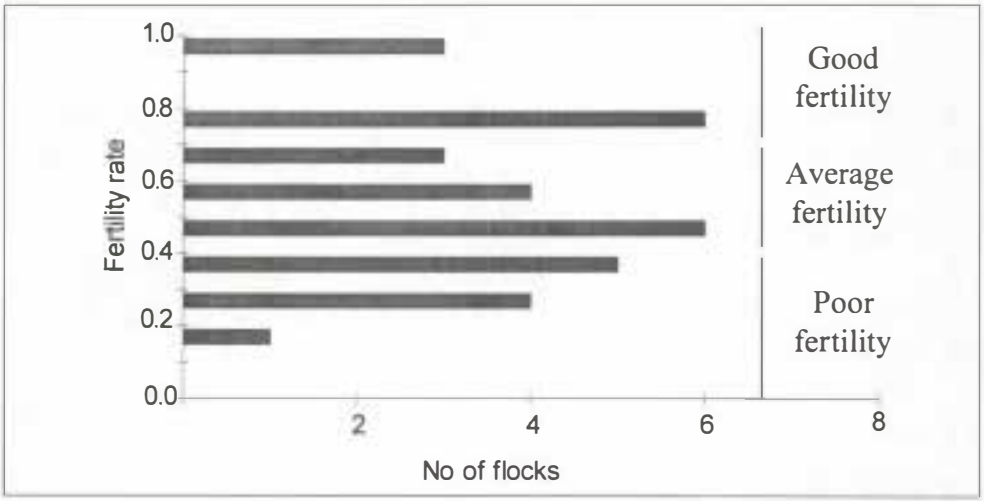
$$\frac{\text{Number of young females that kidded under 23 months old * 100}}{\text{Number of young females present during the mating season}}$$

Fertility for the three study sites was:

62% for Natural Bush (Zambezi valley)
31% for Degraded Bush (Matabeleland)
17% for Peri-urban Area (Mzingwane)

Between- farmer comparisons were done for the Zambezi Valley (Figure 4). Fertility ranged from 10%-90%. The fertility rates were categorised into: Poor (10%-39%); Average (40%-59%); Good (60%-90%). Thirty-eight per cent of the farmers had good fertility rates; average farmers and poor farmers accounted for 31% each.

Figure 4:
A comparison of fertility rates between farmers in the Zambezi Valley



4.2.Discussion

Fertility in females depends, amongst other factors, on the number of does that are physiologically mature, and of sufficient weight at the time of peak mating. In the Zambezi Valley, most females born during the peak

kidding season were in good condition at nine months old due to the lush pastures of the rainy season. Consequently, conception rates in maiden does were high. In Matebeleland, does born during the peak kidding season June/ July were only six months old and in poor condition during the rainy season. As a result, very few maiden does were able to mate successfully in this area. For Mzingwane, poor conception rates are thought to be due to poor condition of the does, as a result of restricted grazing during the cropping season.

C. CONCLUSION AND RECOMMENDATIONS

1. Mating patterns

In the three case studies presented, the majority of the kiddings occurred during: April in the Zambezi Valley, April-August in Gwanda, May-August in Mzingwane. Evidently, there is little that the farmer can do to influence the seasonal mating pattern.

2. Age at first kidding

The earliest age at first kidding reported was 12 months, in the Zambezi Valley. In the other sites, primiparous births did not occur until the goats were 24 months old. Under the prevailing circumstances, where natural rangelands are the only feed resource available for goats, there is very little that farmers can do to encourage earlier successful conceptions.

3. Prolificacy

With an average prolificacy rate of 1.1 for all three study sites, we can conclude that genetically, Matebele goats have a low propensity for twinning.

4. Fertility

Except for the Zambezi Valley, conception rates for the other sites which were below 50% were very poor. Nutrition seemed to be the reason for the long kidding intervals in Gwanda and Mzingwane.

5. Conclusion

In conclusion, it appears nutrition is a major limitation to productivity in the degraded and peri-urban areas. Improving nutrient supply will lead to conception at an optimum age, high conception rates and low kidding intervals. Since distibution of the naturally available feeds is poor in these areas, improving the status quo will require additional feed and labour which, at present, are not readily available.

GOAT HEALTH

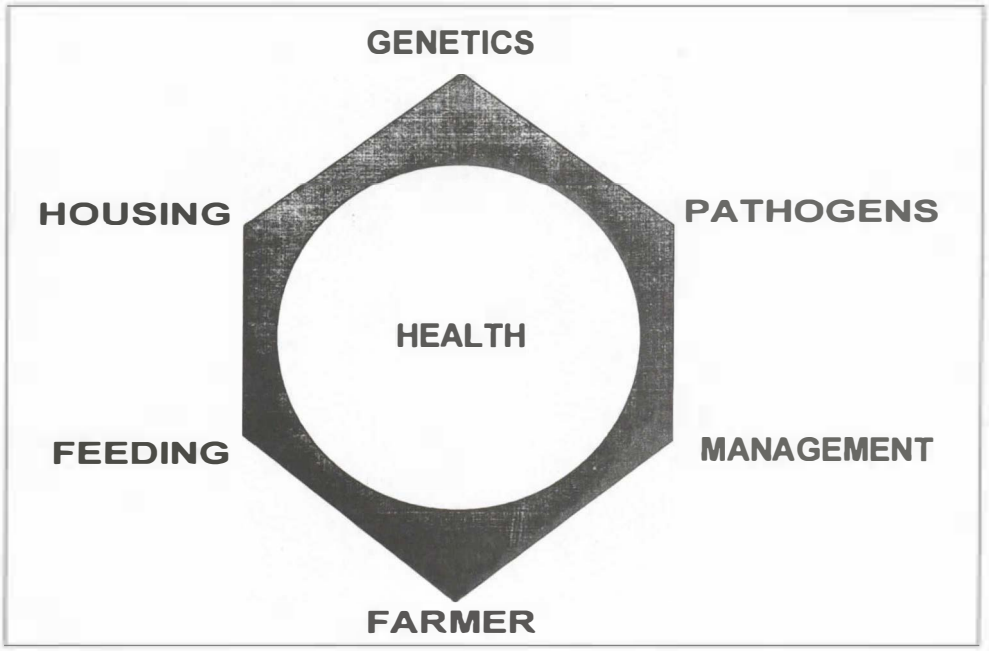
TABLE OF CONTENTS

A. INTRODUCTION

Good health is the result of a complex balance between a living organism and its environment. The animal's environment is inclusive of climate, nutrition, shelter and the disease threat (Fig 1).

Conversely, disease, which is the opposite to health, results from a total or partial breakdown of this balance.

Figure 1 : Factors influencing health



Disease is the consequence of a combination of several factors:

Determining or triggering factors. These are mainly micro-organisms (bacteria, viruses, parasites, ...) which by multiplying in the animal's organism will trigger various observed symptoms.

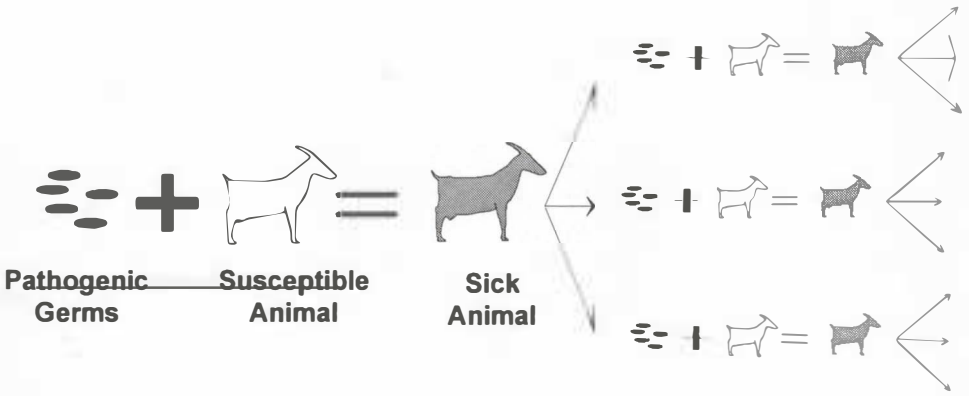
Predisposing factors are those which weaken the animal's body and make it vulnerable to attack. For example, insufficient, imbalanced or poor quality feed weaken the animal and predispose it to disease. Conversely, contact with a pathogenic microbe will not have the same consequences for a well-nourished animal as for one in poor condition.

B. CONTAGIOUS DISEASES

A single factor can cause a disease such as bacteria, viruses, parasites and toxic substances.

When the disease is the consequence of one single cause which is both necessary and sufficient, the disease is termed monofactorial. This is the case for contagious diseases which are provoked by extremely pathogenic germs (bacteria, viruses, certain parasites). These are transmitted from one animal to another through contact, vectors, air or water, eg. foot-and-mouth, rabies, brucellosis, etc...

In this case, contact of the pathogen with a susceptible animal, ie. an unvaccinated animal which does not benefit from acquired immunity, turns into the appearance of symptoms and in most cases the excretion of further pathogenic agents which in turn will contaminate other susceptible, healthy animals. The disease spreads until all animals susceptible to contact are affected.



C.DISEASES ASSOCIATED WITH POOR MANAGEMENT

The accumulation of a large number of factors (predisposing and determining) trigger the appearance of symptoms in an animal.

In this case, when disease is the consequence of a combination of factors (triggering and/or predisposing), the disease is termed multifactorial. This is the case for most diseases associated with poor respiratory pathologies, diarrhoea, etc., and of nearly all non-transmissible diseases.

In most cases, these are diseases which occur at regular intervals in a flock or a population, from one year to the next or from one season to the next, when conditions are the same. For example, in the communal areas of Zimbabwe, respiratory pathologies in goats are observed every year after the first rains and diarrhoea often occurs with the first growth of new grass.

The seriousness of management diseases varies from flock to flock, but they rarely affect all the animals in a flock or population, as is the case of the main contagious diseases like foot-and-mouth or brucellosis.

D. DETRIMENTAL EFFECT OF DISEASES

1. Contagious diseases

Contagious diseases have serious economic consequences for the farmers, the communal areas and Zimbabwe as a whole. Economic consequences can be direct (mortalities, abortion, lack of growth in young animals) or can be the result of measures taken by the authorities to limit or eradicate the disease (ban on the movement or trade of animals, stopping export, ...).

2. Diseases associated with poor management

Although less spectacular, these diseases cause the greatest loss to the animal farmer. Their consequences are usually disastrous for the production of the flock and the farm. Usually, the farmer or livestock extension agent pays little attention to them. They are part of the "scene" and generally considered a necessary evil. The results will be deaths spread over time, a reduction of the reproductive performances, a decrease in the weight gain of the kids.

As a general rule, such diseases cannot be prevented, nor can they be eliminated by use of medication, vaccines or slaughter, as can be done for the main contagious diseases. At present, there are no drugs or vaccines available to prevent diarrhoea or respiratory problems in kids. When symptoms appear (coughing, diarrhoea, stomach pains), it may be too late to save the animal.

On the other hand, even if definitive cures are not available, it is possible to prevent or limit the appearance and spread of these diseases in a flock or population through good husbandry practices.

E. APPENDICES

Veterinary diagnosis makes it possible to recognise a debilitating disease in an animal or flock.

It is based on clinical examination, questioning the farmer, visiting the farm and in some cases, autopsy of a dead animal and laboratory tests.

Appendix 1. The clinical examination

In particular, the following should be observed:

General condition of the animal	Good general condition, thin, emaciated
Behaviour of the animal	Prostrate, lying down, agitated, stiff, unsteady
Upset appetite	Disappearance of appetite (anorexia), decrease of apetite, abnormal feeding behaviour (tendancy to lick walls, stones, swallowing fur...
Condition of skin and coat	Wounds, abcesses, scabs, blisters, rashes, peeling, dry, slack skin...
Condition of the mucus (inside mouth and eyes, genital mucus)	Pale (anemia), red (congestion, yellow (liver problems) presence of blisters or ulcers

Appendix 2. The farm visit

Questioning the farmer completes the clinical examination and makes it possible to obtain information on the history of the disease (appearance, evolution), the normal condition of the animals, similar cases which have occurred previously in the flock or the neighbourhood.

The farm visit involves looking methodically and systematically at the whole animal farming system in order to identify the different factors (predisposing or triggering) which could be implicated in the appearance or development of the pathology observed.

As a general rule, the following aspects should be studied:

The flock: demography (purchases and sales with origin and destination of animals), breeds, general condition, in-breeding, vaccinations, contacts with other flocks or with wild animals, pathological history.

Feeding: Condition of the bush and type of vegetation, access to agricultural by-products, fallow land, protection of crops in the vicinity, shepherding (none, collective, individual), grazing time, distribution of supplementary feed, access to water, use of the same area for other species (cattle, game, ...). Feed should be considered over the three crucial periods of the year: rainy season, beginning of the dry season and especially end of the dry season.

Housing: presence or absence of housing, covered or open-air, area, volume, type, nature and condition of walls and floor, mixing species in the same building, use in the dry season or the rainy season.

Rearing practices and use of the flock: reproduction practices, use of the flock, sales and home consumption, accidents and predators, etc.

Farm hygiene, water points, grazing areas.

The farmer and his family: training, technical skills, involvement, means at their disposal, etc.

Appendix 3. Autopsy and laboratory tests

In some cases, diagnosis of the debilitating disease in an animal or flock can only be carried out by autopsy or laboratory tests.

3.1.Autopsy

Autopsy consists of opening up the dead body in order to:

1. Look for lesions symptomatic of the disease in the internal organs
2. Take samples for laboratory tests

It should be carried out by a competent technician (Veterinary Services or AGRITEX officer). A number of precautions should be taken to prevent possible contamination of the man or other animals in the flock by micro-organisms present in the body:

1. Autopsy carried out away from people and animals
2. Total destruction of the body after the autopsy by burning or deep burial
3. Wearing of gloves in the case of suspected disease transmissible to man (rabies, brucellosis, ...)

3.2. Collection and Preservation of samples

In all cases, taking samples for analysis must be carried out by competent staff in the most aseptic conditions possible. All samples sent to the laboratory must be accompanied by an explanatory card describing symptoms observed, the sick animal, the place, etc.

Listed below are some common diseases found in goats; the specimens to take and the preservatives used when transporting them to the laboratory for diagnosis.

Disease	Specimen	Preservative
Heartwater	brain crash smear	Fresh
Mange	Skin scraping, skin biopsy	Nil for scraping 10% formalin for biopsy
Orf	Scabs	Cold
Brucellosis	Serum Milk Whole foetus and placenta	Nil Cold Cold
Coccidiosis	Faeces Intestines	Fresh 10% formalin
Helminthiasis	Faeces Worms	Fresh 10% formalin
Pasteurellosis	Lung	Cold or Glycerine saline or 10 % formalin

3.3. Laboratory tests

These laboratory tests make it possible to confirm a clinical diagnosis. They can be carried out on blood samples (serological tests), faeces (parasitological tests to look for parasites), fur, pus, internal organs after an autopsy (liver, lungs, intestines, bones, ...)

APPENDIX 4: some common diseases

4.1. Mange

This is a parasitic, contagious disease affecting the skin.

4.1.1. Aetiology

There are several kinds of mange caused by different acarids and affecting different parts of the animal, their seriousness varying according to the parasite in question.

4.1.2. Risk factors

High animal density, poor hygiene in their living area, lack of external anti-parasite treatment favour the appearance of mange.

4.1.3. Symptoms

The main type of mange is sarcoptic mange which can seriously affect the animal. It is found particularly on the head and neck and leaves the skin with a lichen-like appearance, akin to eczema, thickened and pruritic. Heavily infected animals lose weight and appear in poor condition.

4.1.4. Autopsy

Simple external sample (cf samples)

4.1.5. Diagnosis

Liaisons are fairly characteristic. The most reliable method remains a smear with microscopic examination.

4.1.6. Treatment

Acaricide dips can be effective.

Prophylactics

medical: regular external removal of parasites.
animal health: hygienic living area.

4.2. Anthrax

This is an extremely serious animal disease normally leading to rapid death of the animal.

4.2.1. Aetiology

A bacterium, *Bacillus anthracis*, causes anthrax. Its spore, a resistant form, can remain in the ground for years and infect grazing animals.

4.2.2. Risk factors

Poor upkeep of pastures, bodies left where they drop, straying animals.

4.2.3. Symptoms

Very high fever (41°C), generally rapid, violent death.

4.2.4. Autopsy

Haemmhoraging
Handle using gloves (dangerous to man). Autopsy on a plastic tarpaulin, since the blood is very contagious.
Blood sample.

4.2.5. Diagnosis

Anthrax should be considered in the case of rapid, violent death and haemmhoraging.

4.2.6. Treatment

None available. Slaughter and incineration.

4.2.7 Prophylactics

Medical: There is a vaccine (vaccination of cattle up to two or three years ago in Masvingo province, for example.)
Animal health: incineration of dead animals.

4.3. Orf

This is a highly contagious skin infection among goats and sheep, affecting essentially the mouth and the udder.

4.3.1. Aetiology

A viral disease transmitted directly from animal to animal or through tainted items. One of the most common means of transmission is from mother to suckling young.

4.3.2. Risk factors

Young animals seem more susceptible, but they can all be infected.

4.3.3. Symptoms

Pustules appear at the corner of the mouth (especially in suckling kids), on the teats, at the base of the hooves which become big scabs interfering with the animal's feeding.

In man, the sores are painful.

4.3.4. Autopsy

Simple external sample (cf samples)

4.3.5. Diagnosis

The clinical picture is quite obvious. Definitive diagnosis is established by examination of the scabs under electron microscope.

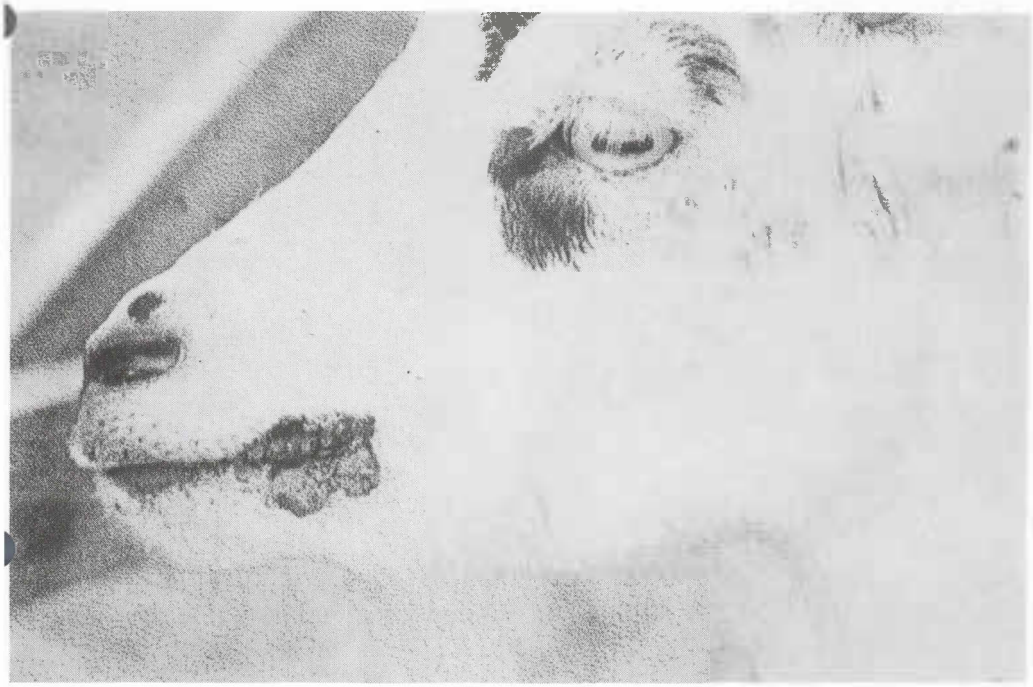
4.3.6. Treatment

Local treatment is often sufficient (gentian violet or tincture of iodine). To prevent secondary infection, use of AB (oxytetracyclines) is recommended.

4.3.7. Prophylactics

Administration of vitamin A.
Possible auto vaccination.

CONTAGIOUS DISEASES



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Previous page: Goat with Orf
(from SHEEP AND GOAT PRACTICE- Ed. Edward Boden- Baillière Tindall)

A. INTRODUCTION

Contagious diseases are caused by micro-organisms, invisible to the naked eye, which are transmitted from a sick animal to a healthy animal by various means. These infectious agents may be bacteria, viruses, mycoplasms or certain parasites.

Not all micro-organisms in contact with an animal are harmful. A large number live in the organism of healthy animals and some are indispensible for the animal's health. For example, in small ruminants, digestion of the cellulose contained in plants is only possible because of the presence of a large microbe population present in their stomachs.

Micro-organisms which cause disease are called pathogens. Infectious agents which penetrate an organism bring with them various reactions depending on the species. When the presence of the micro-organism leads to no reaction on the part of the host, the species is resistant, otherwise it is susceptible.

Certain diseases are characteristic of a single species, for example African swine pest for pigs, rinderpest and pneumonia. Other diseases affect several species, for example brucellosis and botulism are common among all mammals, foot-and-mouth attacks all hooved animals indiscriminately (cattle, goats, pigs, buffalo, antelopes, ...), tuberculosis affects all domestic animals and man. Finally, some contagious diseases can be transmitted from animal to man. These are zoonoses like rabies, brucellosis.

The passage of a pathogenic agent from one animal to another takes place in various ways according to the disease. For each contagious disease, it is very important to know the main methods of transmission in order to be able to prevent its appearance in a flock and to limit its spread.

1. Direct transmission from one animal to another: The virus or bacteria is emitted into the air by expiration and will infect a nearby animal. In some cases, the wind can transport germs over long distances (foot-and-mouth).

2. Indirect transmission through water: Some infectious diseases (forms of diarrhoea) and parasites are transmitted through drinking water. At periods of high concentrations around watering places at the end of the dry season, there is a big risk of infection from one animal to another or from one species to another.

3. Indirect transmission by means of an instrument: a dirty syringe, a knife or even a farmer's hands can transport pathogenic agents from a sick animal to a healthy one.

4. Transmission by an insect: Some diseases need an insect in order to be transmitted from one animal to another: Rift Valley Fever (mosquito), trypanosomiasis (tsetse fly).

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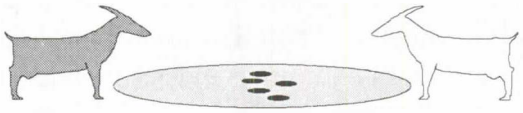

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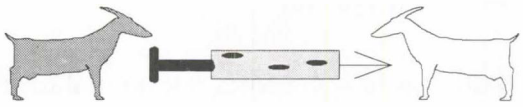

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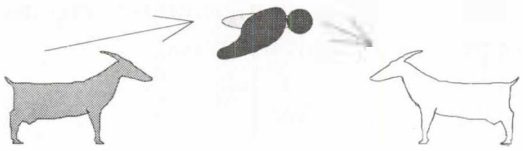


Blood samples (2850) were taken in all the survey areas, at the end of the 1991 rainy season (from 15 April to 15 June), in order to appreciate the importance of contagious diseases of small ruminants in the communal areas of Zimbabwe. Samples were only taken from small ruminants identified as being over 6 months old. Twenty five cc of blood were taken from each animal and tested in the laboratory for the main contagious diseases whose presence was suspected or had been previously diagnosed in the communal areas.

Table 1:
Distribution of blood samples by sex and species.

	Females	Males	Total
Goat	2157	430	2587
Sheep	214	53	263
Total	2371	483	2850

At the laboratory, systematic analyses were carried out to look for the three of the contagious diseases having the most serious effect on animal health, public health and the economy of the rural areas: foot-and-mouth, brucellosis and Rift Valley fever.

Furthermore, research is actually under way to look for the presence of less contagious infections such as abcesses and abortions other than brucellosis. Lastly, serum collected will be used to finalise some diagnostic techniques not available at present (serological diagnosis of heartwater).

B. FOOT-AND-MOUTH

1. Results

Goats, like all ruminants and all hooved animals are susceptible to the foot-and-mouth virus. However all the 2850 small ruminants tested negative for foot-and-mouth virus.

2. Discussion

This result is logical for groups situated in areas without foot-and-mouth, where the virus has been eradicated by the veterinary services to permit the export of meat to Europe .

On the other hand, none of the small ruminants in areas where foot-and-mouth is endemic tested positive.

Several hypotheses could explain this state of affairs:

1. Small ruminants are less susceptible to foot-and-mouth than pigs and cows.

2. There has been no transmission of diseases through the goats monitored by the project and animals infected by the virus in spite of the fact that animals carrying and excreting the virus exist in these areas (cattle and wild animals like buffalo and antelope). For example, in the Chiredzi group, on the edge of Gonarezhou National Park, contacts between small ruminants and wild animals are common.

3.Recommendations

Foot-and-mouth is a constant threat to Zimbabwe because of its highly contagious nature and its economic consequences. Because of this, even if it is rare or exceptional in small ruminants, this disease should be suspected as soon as symptoms attributable to it are observed in goats and sheep. All legal and regulatory measures should be set into motion to confirm or remove this suspicion.

C. BRUCELLOSIS

1. Results

All small ruminants monitored in the study tested negative for brucellosis.

Brucellosis (*Brucella melitensis*) is a serious disease in small ruminants. Extremely contagious, it causes serial abortions in a flock and can be transmitted to man. Once it appears in a flock, it is very difficult to eradicate or control except by slaughtering the seropositive animals.

2. Interpretation

Small ruminant brucellosis has been observed and described in several communal areas of Zimbabwe in recent years (Seke communal land near Harare, communal areas bordering Mozambique, ..) .

There are several reasons for the limited importance or even the absence of this disease in traditional animal farming systems.

Dairy animals are susceptible to brucellosis which is not the case for small ruminants in the communal areas of Zimbabwe.

Brucellosis is transmitted from one animal to another through contact with after-birth or with a contaminated abortion. For this to occur, a carrier animal must be introduced into a healthy herd. The survey has shown that in traditional systems, animal farmers in the communal areas introduce very few animals into their breeding flock. When they do so, the animals introduced come from nearby farms and are generally bought from their family or neighbours (cf. chapter on the introduction of animals).

Though brucellosis is not at present a very serious risk for small ruminants in communal areas, it could become one. Intensification of production, resulting in mixing animals from one communal area with another, may cause the spread of the disease from the few areas where it exists at present through the practices of traditional animal husbandry. This risk is particularly great in peri-urban communal areas and in resettlement areas where the arrival of people from different areas with their animals increases the risks of introduction and then spread of the disease.

3. Recommendations

In order to limit risks of introducing the disease into a healthy flock, two measures must be taken:

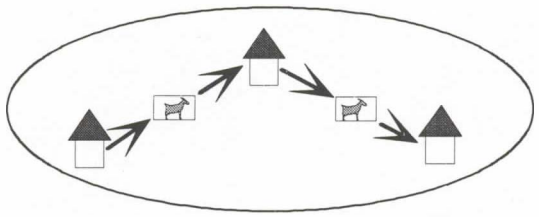
1. Purchase animals from a nearby flock, known to the farmer and in good condition.

2. Put the purchased animals into quarantine as soon as they arrive.

Minimum risk of introducing brucellosis into a flock:

1. Animals coming from a healthy flock from the same neighbourhood or the same communal area.

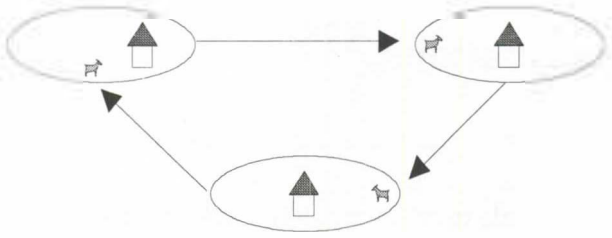
2. Quarantine on entry for animals intended for a reproductive flock.



Maximum risk of introducing brucellosis into a flock:

1. Exchange of animals between different communal areas coming from flocks not known to the farmer.

2. No quarantine on entry when introducing the animals.



D. RIFT VALLEY FEVER

1. Results

Twenty-seven animals were positive for Rift Valley fever. These came from communal areas where rainfall is the heaviest and where vector mosquitos can multiply during the rainy season.

2. Discussion

The number of animals in contact with the virus of Rift Valley fever is small in all communal areas (between 0% and 3% of the animals monitored).This disease, or the vector mosquitos which spread it, seemed absent from the driest communal areas (Matabeleland, Chiredzi).

In the communal areas where rainfall is heaviest, only a few animals were found to be positive. They were generally older goats (over 3 years old, on average, as against 1,5 years old for the negative animals).

Table2: Prevalence of Rift Valley fever in communal areas

Geographical Locality	Rainfall from 1.10.90 to 1.10.91	No of positive animals	% of positive animals
Highveld (Madziwa)	615 mm	11	3
Highvel (Kandeya)	670 mm	7	2,1
Zambezi Valley	704 mm	8	1,7
Bikita (Matsai)	578 mm	1	2
Matabeleland (Kezi)	417 mm	0	0
Matabeleland (Mzingwane)	458 mm	0	0
Matabeleland (Gwanda)	393 mm	0	0
Lowvveld (Chiredzi)	406 mm	0	0

In areas where the disease was present, no severely affected flocks were found and only 1 or 2 animals per flock were positive. Rift Valley fever appears to be a sporadic disease in small ruminants in the communal areas of Zimbabwe. It does not at present pose significant problems to animal or public health. Outbreaks have already been recorded in some flocks of sheep belonging to commercial farms. Thus in cases of favourable climatic conditions (heavy rainfall and serious multiplication of the vector mosquito) and changes in the environment (creation of numerous mini dams), outbreaks of Rift Valley fever could be found in some communal areas.

3. Recommendations

It is advisable, therefore, to pay careful attention, mainly at the end of the rainy season, to symptoms characteristic of this disease (sudden mortality among young animals and adult female abortions) in order to be able to prevent by vaccination a possible epidemic development.

E . HEARTWATER

1. Results

The vast majority of small ruminants in the communal areas of Zimbabwe may be less susceptible to heartwater, a disease transmitted by ticks. In the survey the few cases recorded (25) occurred at the end of the dry season.

2. Discussion

Heartwater diagnosis was based on clinical symptoms (nervous difficulties followed by the animal's death within 48 hours). It is possible that a certain number of cases went unnoticed by the farmers and the researchers. Furthermore, since no reliable serological test is at present available, the presence of antibodies directed against the parasite (cowdria ruminentum) could not be identified in serums as was the case for the other contagious diseases.

25 cases of suspected heartwater were recorded. All occurred in the middle or the end of the dry season in the Masvingo province and Matabeleland survey groups.

However, all the work done so far shows that there are large populations of bont ticks carrying the parasites in most communal areas. This is why all cattle in Zimbabwe are treated at regular intervals (dipping or pouring-on acaricides).

Small ruminants in the communal areas, living in the same environment as the cattle, rarely exhibited clinical symptoms of infection. Two factors could explain this state of affairs:

1. A population in permanent contact with the parasite becomes immune and resistant to the disease. Young animals are infected very early by the parasite, being partly protected by antibodies received from their mother during suckling. Only a few poorly protected or particularly fragile animals develop the disease. There exists a balance between the parasites and the small ruminant population.

2. Small ruminant populations in the communal areas are largely sedentary and do not normally move outside a small area. Thus the animals remained in contact with the same strain of the parasite against which they were protected. Similarly, very few animals from other communal areas are introduced which would be susceptible to the local strain or carriers of other strains against which the population is not protected.

On the other hand, in the case of movement or mixing the population, it is entirely possible to see numerous cases of clinical heartwater appear in a flock or a sub-population. For example in the following cases:

1. Introduction of goats from another region for genetic improvement.
2. Mixing animals from different areas when a new resettlement area is formed.
3. Mixing animals in communal areas where there is a lot of movement (peri-urban communal areas where animals coming from all over the country are regularly introduced.).

F. CONCLUSION

In conclusion, traditional animal farming systems in the communal areas at present limit the seriousness and spread of contagious diseases in the communal areas' small ruminant flocks.

Exchanges of live animals, population regroupings and production intensification are the main factors threatening the increase of these diseases in the years ahead.

G. APPENDICES

Appendix 1. Rift Valley fever

Rift Valley fever is a common disease among cattle and small ruminants, and transmissible to man.

1.1. Aetiology:

An arbovirus, a viral disease transmitted from one animal to another through the intermediary of an insect (generally a mosquito).

In man, it causes a flu syndrome, accompanied by fever, headaches, muscular and joint pains and can sometimes lead to blindness. Contamination in man is by direct touch, without the protection of masks or gloves, of aborted foetuses or carcasses of infected animals.

1.2. Favourable factors:

Rift Valley fever basically affects animals between January and July and disappears when climatic conditions become too cold for mosquito reproduction. It causes high mortality in young animals, and can cause abortion in gestating females.

1.3. Main symptoms:

In young animals, the clinical signs appear very rapidly (about 12 hours after the mosquito bite) and manifestations are high fever, accompanied by lack of motor control; the animal collapses and death follows within the next two days.

In adults, abortions are the chief clinical manifestation. Death can also occur. Goats are less susceptible to the disease than sheep, and generally display subclinical asymptomatic forms.

Appendix 2. Foot-and-mouth disease

Foot-and-mouth is a very contagious disease which can attack all hooved animals.

2.1. Aetiology

Foot-and-mouth is caused by a virus. It is a disease directly transmissible by contact with infected animals or any item tainted by these animals.

2.2. Risk factors

The importation of animals from unknown origins is a risk factor.

2.3. Symptoms

Vesicles appear on the lips, tongue, nibbles or foot pads and then ulcerate. In goats infection is often slight if not unnoticeable, but the animal is contagious, nevertheless.

2.4. Autopsy

A sample can be taken from the vesicles for analysis at the Veterinary Services' Laboratory, and for serology to be carried out.

2.5. Diagnosis

Diagnosis is generally clinical, ulceration lesions and their location being indications.

2.6. Treatment

None available.

2.7. Prophylactics

medical: vaccination
animal health: quarantine of in-coming animals.

Appendix 3: brucellosis.

This is an infectious disease, contagious, transmissible to man, essentially affecting the genital organs.

3.1. Aetiology

Brucellosis is caused by a bacterium of the group *Brucella* (essentially *Brucella melitensis*, occasionally *Brucella abortus*). It is transmissible through blood, milk and contact with contaminated abortions and their after-birth.

3.2 Risk factors

Poor control of births (keeping account of abortions, monitoring reproductive females) as well as poor hygiene can allow the chronic spread of brucellosis. Introduction of unchecked animals coming from unknown flocks is also a risk factor. Cases have come to light in Manicaland following the introduction of animals coming from Mozambique, for example.

3.3. Symptoms

The most obvious symptom is abortion in the last term of gestation in an animal apparently in good condition. Brucellic mastitis, generally sub-clinical, can also occur.

3.4. Autopsy

A sample from the abortion and after-birth, blood test.

3.5. Diagnosis

Brucellosis should be considered in all cases of unexplained abortion. For reliable diagnosis, serology should be carried out, or if necessary the ring test on milk.

3.6. Treatment

None available. Infected animals should be destroyed.

3.7. Prophylactics

Medical: It is possible to vaccinate, but this is expensive and difficult to organise.

Animal health: attention to newly introduced animals, good hygiene for births, serology in case of doubt.

1.4. Diagnosis:

Rift Valley fever can be suspected in cases of atypical abortions and unusually high mortality among young animals. Confirmation diagnosis is ,by serological test showing the presence of antibodies. Post-mortem examination reveals heavy liver inflammation, hence it is possible to isolate and identify the virus in the laboratory.

1.5. Treatment:

None available.

1.6. Health Prophylaxis:

The transfer of animals to high-altitude areas where mosquitos are absent is a possible strategy but difficult to put into action.

1.7. Medical Prophylaxis:

Annual vaccination remains the best protection: there are two types of vaccine, an unactivated vaccine for gestating females (to limit risks of abortion and giving them immunity for about a year) and a live vaccine for the others.

Appendix 4. Heartwater

Cowdriosis is a serious, frequently fatal, disease affecting cattle, goats and sheep.

4.1. Aetiology:

The causal agent is a form of rickets, cowdria ruminantium, transmitted by ticks.

4.2. Favourable factors:

The disease is predominant in the Lowveld in the south, where the tick population (essentially Amblyomma hebracum) is endemic. Cowdriosis occurs particularly during the rainy season, with the increase in the tick population.

Young animals generally have an immunity passed on by the mother, but animals over 5 to 6 months are susceptible to the disease. Local breeds are more resistant than those crossed with imported breeds, for which mortality rates are often very high. Some infected animals survive the disease, and acquire lasting immunity (for several years). They then become healthy carriers within the flock. This rôle of healthy carrier is also observed in wild ruminants, resistant to the disease.

4.3. Clinical indications:

The first clinical signs appear in the 10 to 14 days following inoculation of the agent by the tick:

- very high temperature (41 - 43 °C)
- anorexia, exhaustion, ..
- nervous signs such as blinking, nystagmus, walking in circles and changes in walking behaviour (exaggeratedly high big steps)
-convulsions, lateral decubitus, stiffness of limbs followed by a coma phase preceding death of the animal.

The average duration of the illness is three to four days. In typical cases of cowdriosis, the following pattern is frequently observed: anorexia and change in behaviour the first day, nervous signs appear on the second day and the animal goes into **decubitus**, on the third day the animal can no longer move and succumbs after a coma phase. Mortality is generally over 60%. Some animals are victims of extreme forms, overwhelming and asymptomatic or else sub-clinical benign forms in which only a slight fever is observed.

4.4. Autopsy:

Presence of a liquid in the abdominal and thoracic cavity, with **hydropéricarde**: lung oedema (with froth in the trachea), hypertrophied rate, signs of haemorrhage on the **péricarde** and in the trachea.

4.5. Diagnosis:

This depends on whether or not the region is considered at risk (presence of ticks, frequency of dippings, prevalence of the disease), symptoms observed and autopsy results.

Diagnosis is confirmed in the laboratory by microscopic test of samples of cerebral matter. There is at present no serological diagnosis.

4.6. Treatment:

Early injection of tetracyclin in the first stage of the disease is effective. If the animal is already in **décubitus,** only intravenous injection has any chance of success.

Treatment until disappearance of the fever with:

- **Terramycin 100, Hi-Tet 120 or Oxyvet by daily injection**

- **Terramycin LA, or Hi-Tet SA by injection every three days**

4.7. Health prophylaxis:

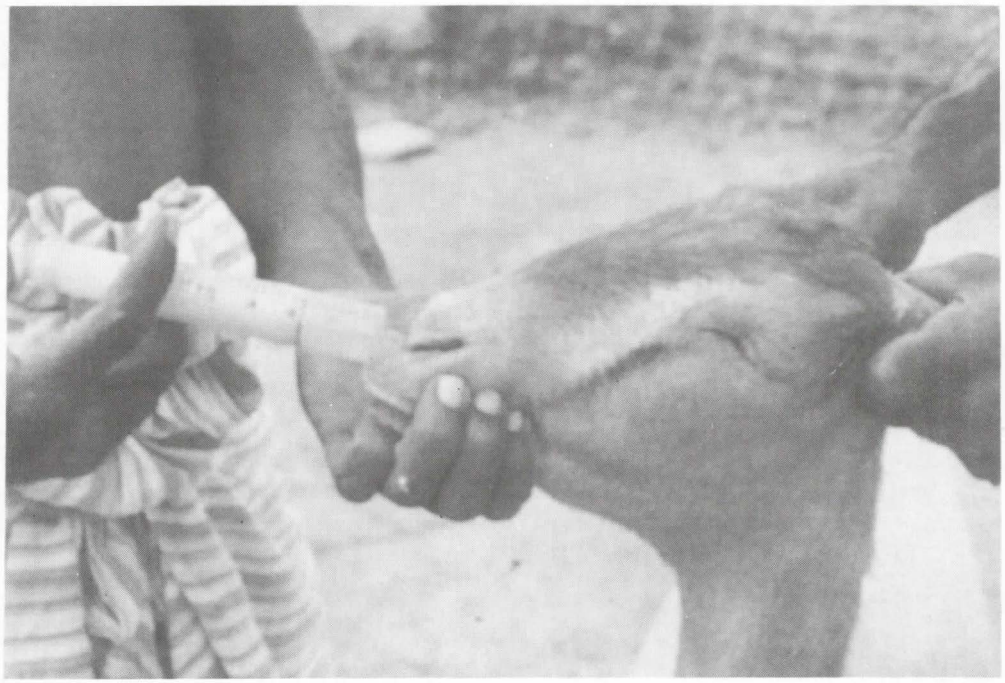
Limit the transfer from one communal area to another of animals intended to become part of a breeding flock (particularly from the Highveld to the Lowveld).

In cases of high tick infestation, carry out regular dipping of the animals in external antiparasite dips. But beware, excessive recourse to dipping can interfere with immunity balances existing between the parasite, ticks, and the animal population.

4.8. Medical prophylaxis:

Vaccination is possible by intravenous injection of contaminated blood from an infected animal, but this is a risky procedure only to be undertaken under the strict control of a veterinarian: the animal's temperature should be checked and an antibiotic injection administered at the first signs of hyperthermia (generally 10 - 12 days after inoculation), which enables the animal to fight against the disease and to acquire protective immunity.

GASTROINTESTINAL PARASITISM



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A. INTRODUCTION

The presence of gastrointestinal parasitism in goats can be a major cause of impaired productivity and mortality. Even subclinical levels of infection can have considerable economic effects. The adverse effects on productivity are manifested in a variety of ways, with changes of body weight and condition being the predominant features. However, parasitic infection in goats can be associated with enteritis, anaemia, diarrhoea, colic, pulmonary diseases, emaciation, malnutrition, retardation of growth and even death, especially among kids.

At present, the information available on gastrointestinal parasitism in goats in traditional farming systems in Zimbabwe is fairly limited. Some of the information is based on the post-mortem examination of the gastrointestinal content of goats slaughtered in urban abattoirs. Since most animals slaughtered at these abattoirs are of unknown history, data obtained from such studies cannot properly reflect the parasitological situation in the different parts of the country, especially in communal lands.

In order to provide reliable information on the incidence of gastrointestinalis parasitism of goats in the traditional husbandry system in communal areas, faecal samples were collected in the flock used for the general survey in May 1991. The samples were always taken from three different age groups as follows:

- aged less than 6 months (kids)
- aged between 6 and 18 months (young goats)
- aged over 18 months (adults)

A flock was considered positive when at least one of the samples of the different age groups was positive for helminths eggs or coccidial oocysts. Samples were taken directly from the rectum, obtaining about 20 grams, placed in plastic containers kept in cold boxes and submitted for examination to the Veterinary Research Laboratory, Harare.

B. RESULTS

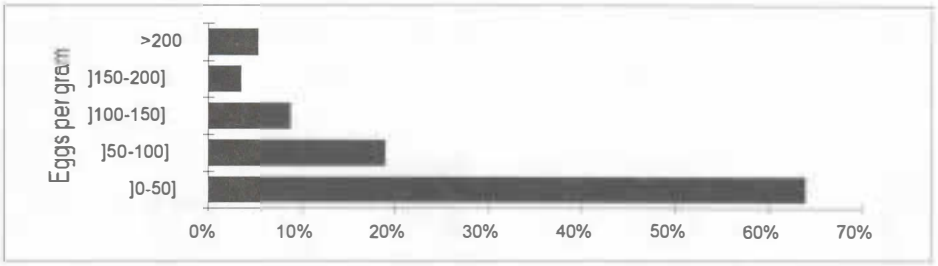
1. The different parasites.

1.1. Percentage of flocks positive by survey area

Latin Names (Common Names)		MASH.EAST %	MATABELELAND %	MASVINGO %
NEMATODES (roundworms)	*Strongyles* (roundworms)	78	82	98
	Trichuris spp (whipworm)	3,8	5,6	0
	Strongyloïdes papillosus (white bankrupt worm)	0	0	0
TREMATODES (flukes)	*Fasciola gigantica* (liver fluke)	11,7	11,4	2,2
	Schistosomia (bilharzia fluke)	1,3	0	0
	Paramphistome spp (conical fluke)	21	74,3	19,6
CESTODES (tapeworms)	*Moniezia expansa* (tapeworm)	28,6	8,6	6,8
	Coccidial oocysts	16,4	13,9	57,4

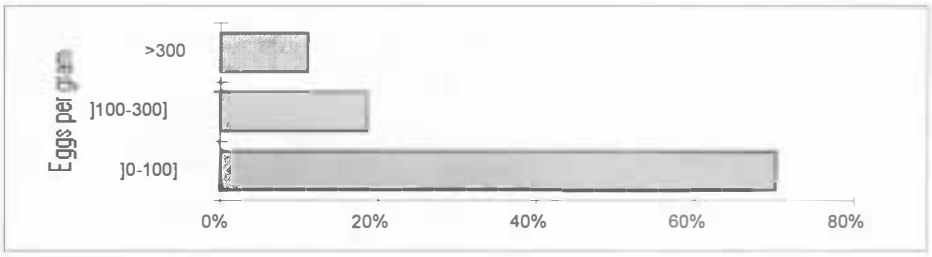
1.2. Distribution of number of *strongyles* eggs per gram of positive samples.

Most animals found to be positive present a small number of roundworms eggs, so certainly a subclinical infection.



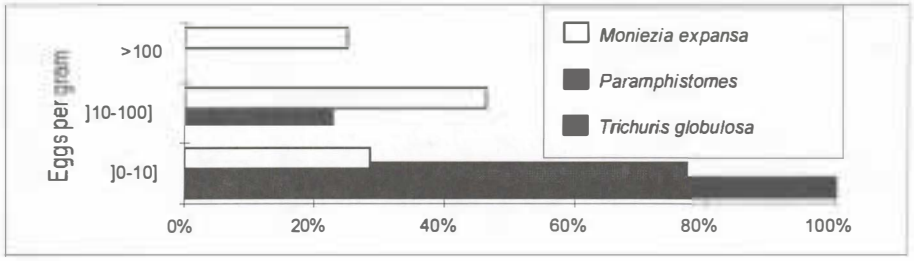
1.3. Distribution of the number of eggs of *Moniezia expansa, Paramphistomes spp and Trichuris globuloia* per gramme of positive samples

As in the case above, a small number of eggs are found for whipworms and conical flukes. *Moniezia expansa* presents more massive infestations.



1.4. Distribution of the number of oocysts of *Eimeria spp* per gram in the positive flocks.

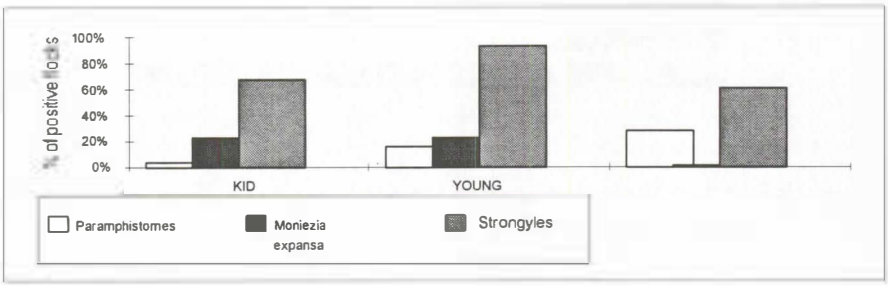
The number of oocysts is small in most positive samples for coccidiosis, but more massive infestations during the rainy season should be anticipated.



2. Influence of age

2.1. Influence of age on the percentage of positive flocks for *paramphistomes, strongyles and Moniezia expansa.*

Roundworms seem to affect all age groups, whereas *Moniezia* is found more often in young animals and conical flukes in adults.



2.2. Identification of *strongyles* by age group.

If roundworms affect all age groups, distribution of the various species nevertheless varies according to age group.

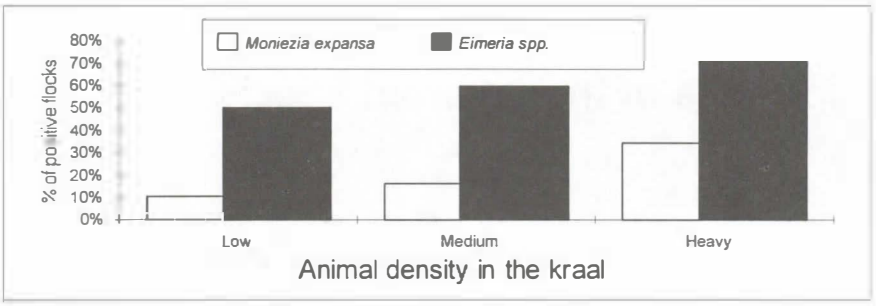
	Haemonchus contortus	Cooperia punctata	Oesphagostomum columbianum	Tricho colubriformis
Kid	56 %	13 %	16 %	13 %
Young	28 %	5 %	2 %	65 %
Adult	15 %	0 %	0 %	85 %

3. Influence of the animal density in the kraal, and management factors.

Three classes of density are used:

Low density	Less than 1,3 animals / m²
Average density	From 1,3 to 2,5 animals / m²
High density	More than 2,5 animals / m²

Influence of animal density in the building on the carrying of *Eimeria spp. and Moniezia expansa.*



This graph confirms a known fact but one should always be borne in mind: parasitism increases with animal density.

C. DISCUSSION

1. Importance of the different species.

The results of this study seemed to confirm the low rate of parasitic infection previously reported in goats under the traditional husbandry system. Disease records of animals surveyed between September 1990 and August 1991 revealed that only 3,5% of digestive problems originated from gastro-intestinal parasitism and 13,8 % of the pathologic cases recorded during the survey were characterized by diarrhoea from unspecified causes.

However, the sampling period (1 to 2 months after the end of the rainy season) was not the best for evidence of parasitic infections, and the results obtained in this study may not be representative due to the relative drought experienced that year.

1.1. Nematodes

Among the strongyles, the most prevalent species were *Haemonchus contortus* and *Trichostiongylus colobriformis*. *H. contortus* is recognised as an important pathogen in goats in this country but *T. colubriformis* is not of great pathogenic importance.

Oesophagostomum columbianum which is believed to be one of the most important nematodes affecting goats was found to be relatively rare in this study.

In conclusion, it may be said that the infection of goats with strongyles is low. From all the 95% faecal samples positive for strongyles eggs, only 20% had from 100 to 400 *eggs per gram* (EPG), the rest had under 100 *eggs per gram.*

The infections with non-strongyle nematodes (*Trichuris spp* and *strongyloïdes papillosus*) were low. Because flocks carrying *Trichuris spp* and *S. papillosus* were rare, this may indicate that these parasites were of limited significance, since the clinical forms of diseases were very rare and necessitate a massive infection whereas these species never exceded 10 *egs per gram.*

Moniezia expansa is a common tapeworm of Zimbabwe and affected 17,6% of flocks in this study.

1.2. Trematodes

The percentage of flocks infected with *F. gigantica* and *S. matthei* was relatively low even in areas of high rainfall where climatic conditions would appear to be more favourable to the biological cycle of these parasites. A recent survey showed only 0,7% of the total inspected from June 1986 to August 1987 at the Bulawayo abattoir affected by these two nematodes. This suggests that the goats could be less receptive to these parasites. In contrast, *Paramphistomes spp* were prevalent parasites and occurred in 34,2% of the flocks examined.

1.3. Coccidiosis sp.

Although *coccidiosis* is believed to be one of the main diseases affecting goats, only 28 % of the flocks were found to be positive of *Eimeria oocysts.*

2. Predisposing factors

Generally infection (infection levels and intensity) can be affected by primary factors such as:

-environmental conditions
-management practices
-parasite contamination

-host resistance
-drug treatment with anthelmintics or coccidiostats.

Since there is no control programme in traditional goat management in the communal areas, the other listed factors were more important.

2.1. Geographical and climatic factors

The percentage of flocks positive for strongyles was low everywhere but was significantly higher for the survey groups in Masvingo province than in the other groups. Thus the rainfall rate did not seem a major influence on the prevalence of these parasites, at least during the time of the study.

In contrast, the number of flocks carrying *M. expansa* was considerably higher in the areas to the north with more rainfall, than in the dry southern areas of the country. The continuation of this infection appeared to depend on the reservoir of *cysticercods* in the mite vectors. The *oribatid mite* vectors are largely dependent on moisture which is essential for their breeding and for providing a suitable surface for migration of the mites to the upper levels of the herbage.

The percentage of carrier flocks of *Paramphistomes spp* was significantly higher in the Matabeleland areas than in the others, possibly because they were the first to experience the dry season. During the dry season the concentration of animals at the water points contaminated with these parasites favours the spread of infection. Besides that, the snail population, vectors of parasites, were present in large quantities in water points at this time of year.

Geographical distribution of *coccidial oocysts* in goats could not be properly established in this study because there were few susceptible kids under 6 months old at the time in the various geographical areas. As a general rule, *coccidiosis* is associated with young susceptible animals and with the wettest time of year. In Zimbabwe the variation of the prevalence of *coccidiosis* in goats was closely connected with the seasons. Following the rainfall graph, it peaked in January and drops to a stable low level in April.

In this study, the percentage of flocks positive for coccidial oocysts in Masvingo province was highest but EPG (*eggs per gram*) was low in old goats, which are only carriers. Due to acquired resistance of the older goats, fewer coccidia can complete their life cycle and fewer oocysts are found in adult goat faeces .

2.2. Host resistance factor

This resistance varies with age, vigour, genetic constitution, presence or absence of an established infection and in some instances acquired immunity.

Youth is a considerable factor of predisposition in parasitic diseases of the digenstive tract. In the current study, the percentage of samples carrying strongyles was highest in the young groups, possibly as a result of lack of development of strong resistance. It is well known that a general increase in resistance to strongyle infection with age is observed in goats. However, such resistance may break down in the face of overwhelming attack or as a secondary result of malnutrition, poor management or disease. Thus the lack of effective resistance in older animals generally increased the burden of worms, resulting in high EPG. In addition, decreased resistance of goats at kidding may be a factor.

The identification of the strongyles species according to age shows that *H. contortus* was the predominant species infecting the kids, followed by *O. columbiamum* and *T. colubriformis* which was the predominant species infecting adults.

Finally, the percentage of carriers of *Paramphistomes spp* was higher in older animals but the youngest animals most often produced samples carrying *Moniezia expansa* eggs.

2.3. Management practices

In all cases, animals in the study were allowed to graze on permanent pastures during the daytime and were housed at night.

The relationships between animal density in the kraal and the carrying of coccidial oocysts confirms the role of contact as a risk factor of these parasites.

The relationships between animal density in the kraal and the carrying of Moniezia have not been shown here. It is probable that the relationships shown in this study were due to unknown factors. The high density is perhaps associated with the higher rate of environmental contamination with higher density of the orebatid mite vectors or with certain characteristics of pasture.

D.RECOMMENDATIONS

1. Treatment

Parasitic infection rates were low but polyparasitism was considerable. It would therefore be better to treat animals with broad spectrum drugs.

All animals (kids, young goats, adults and even those showing no signs of disease) must be dosed. Dosing twice a year is recommended.

- at the end of the dry season
- at the end of the rainy season

By this method, it is possible to control strongyles, cestodes and trematodes.

With regard to coccidiosis, usually farmers do not use drugs for prevention but treat when animals show signs of coccidiosis. In this case, all the goats kept in the same shed must be treated quickly on first appearance of symptoms.

2. Management

Dosing animals alone is insufficient. The goats should start the rainy season in clean sheds with fresh litter. There should also be periodic changes of litter as the season progresses.

Very wet litter and warm, damp housing favour coccidia and allow build-up of oocysts which can overcome the kids' defences.

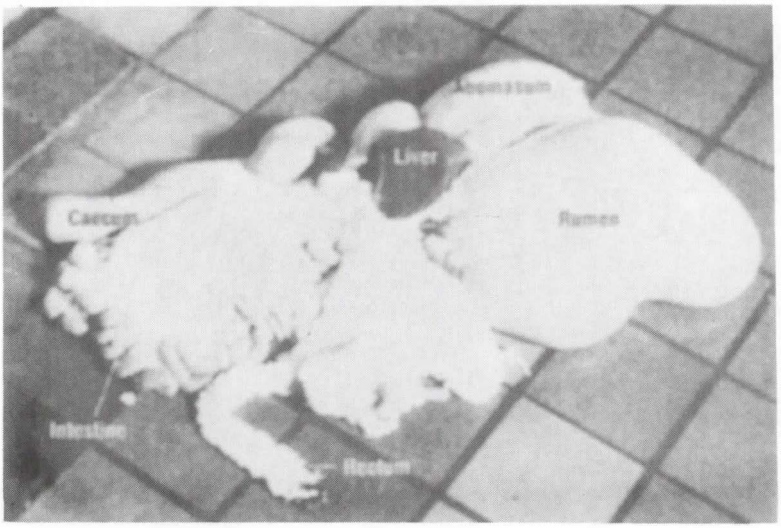
Lastly, overcrowding kraals should be avoided and water containers cleaned regularly in order to limit contamination from droppings.

E. APPENDICES

Appendix 1. The different parasites by localisation

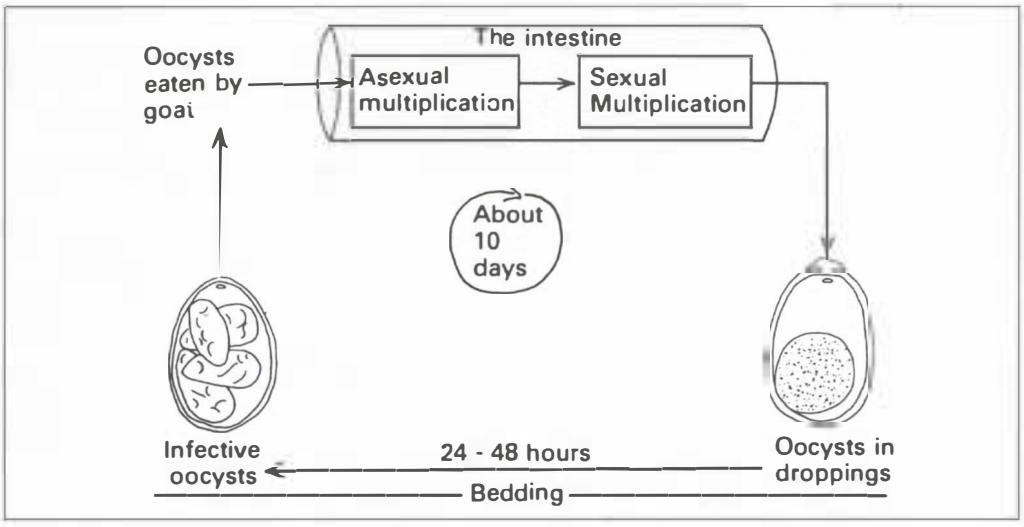
LOCALISATION	NAME	CLASSIFICATION	DESCRIPTION	LIFE CYCLE
ABOMASUM	Paramphistomes spp	Trematode Platevorm	Length 4-9 mm cone shaped	Bulinus
STOMACH	Haemonchus contortus	Nematode Roundworm	Length 10-30 mm reddish	Monoxène
INTESTINE	Cooperia punctata	Nematode Roundworm	Length 5-10 mm	Monoxène
	Trichostrongylus colubriformis	Nematode Roundworm	Length 4-6 mm	Monoxene
	Strongyloïdes papillonus	Nematode Roundworm	Length 3-6 mm	Monoxène
	Moniezia expansa	Cestode Tapeworm	1 to 5 m x 1,5 cm whitish	oribate
	Coccidia spp	Protozoan parasite	--	Monoxène
CAECUM & RECTUM	Oesophagostomum columbianum	Nematode Roundworm	Length 12-18 mm	Monoxène
	Trichuris globulosa	Nematode Roundvorm	Length 40-70 mm	Monoxène
LIVER	Fasciola gigantica	Trematode Fluke	Length 25-75 mm greyish	Limnea spp
VESSEL	Schistosomia mattheei	Trematode Fluke	Length 9-20 mm	Bulinus

Stomachs and intestines of an adult goat *

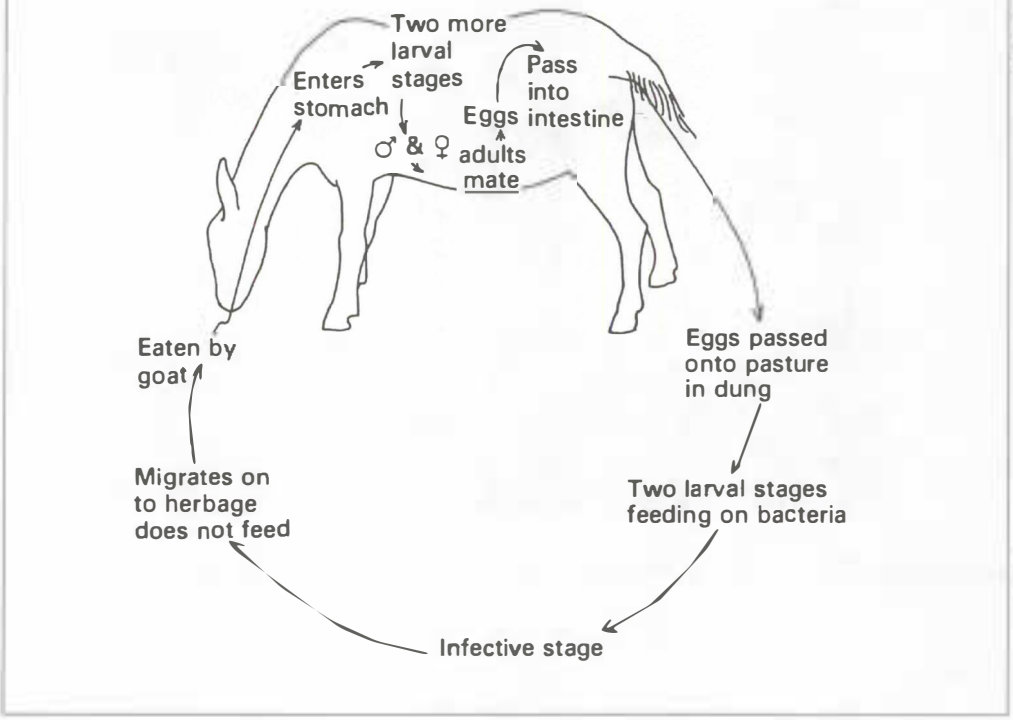


Appendix 2. Examples of infestation cycles

Life cycle of a coccidium *



Life cycle of the gut roundworm in the goat *



*** From The GOATKEEPER'S VETERINARY BOOK, Second Edition, Peter Dunn**

Appendix 3. Diagnosis

2.1. Clinical diagnosis

Symptoms of worm parasitism may range from mild to severe. The type of symptom exhibited may also vary with the age of the goat, adults tending to be more resistant than kids. Symptoms may also depend upon the type of helminths involved. *Haemonchus contortus* are blood suckers, and cause anaemia. Intestinal worms such as *trychostrongylus* cause irritation and hence symptoms of diarrhoea. Normally, however, many species of worm are present at the same time, with the result that a mixture of symptoms is noticed.

Goats suffering from slight infestation may show a loss of body weight or, in kids, simply no increase in weight.

More obvious changes may be noticed with heavier burdens, including lank coats, reduced appetite and perhaps diarrhoea.

Concerning *coccidiosis*, three forms may occur. The mild form is most common. Kids are off their food with symptoms of diarrhoea. The animals are dehydrated and may show peristent straining in their attempt to pass faeces.

The very acute form is rare and results in death of the kid within twenty-four hours.

2.2. Laboratory diagnosis

Eggs and oocysts in droppings can be used to identify adult parasites.

Faecal samples can be examined using a modified MacMaster technique for quantitative analysis of nematodes and cestodes eggs and *coccidial oocysts*.

Briefly, 2 g of faeces are vigorously mixed in 60 ml saturated solution with specific gravity 1.3. This suspension is sieved through a tea strainer and while stirring steadily, a 0,6 ml suspension is removed and placed into a MacMaster counting chamber. The number of nematode and cestode helminth eggs or coccidial oocysts within the etched area of the MacMaster counting chamber are multiplied by 100 to yield *eggs/oocysts per gram* of fresh faeces (EPG or OPG).

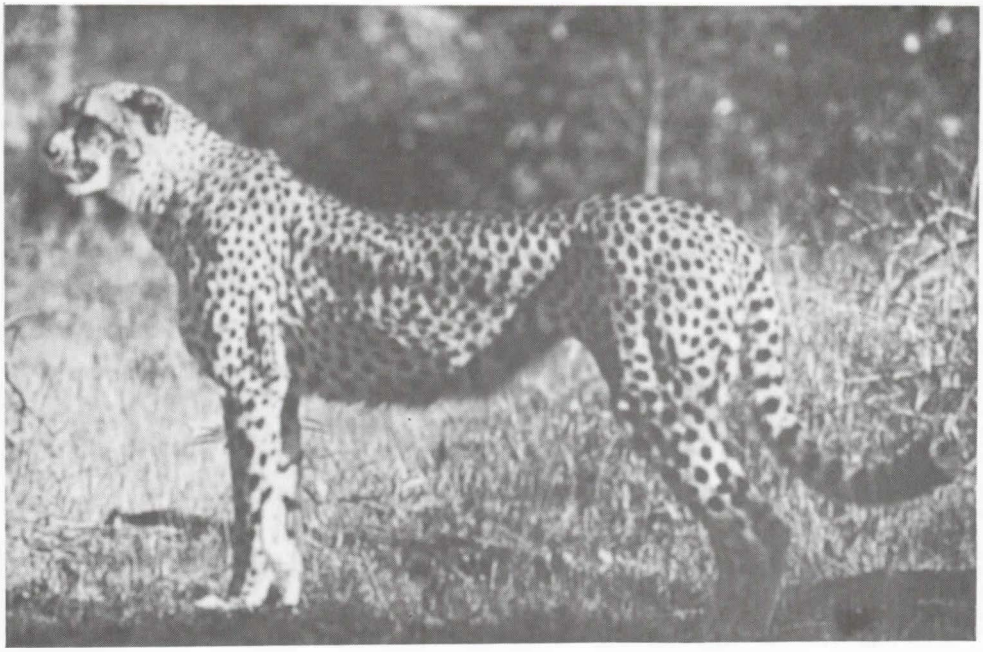
For trematode eggs, the quantitative sedimentation method can be used.

For nematodes, cultured larvae can also be isolated. 10 g of faeces are mixed with tepid water and placed in Petri dishes, which are placed in the humified chamber of a large plastic container containing moist paper towels with an airtight cover. The chamber is placed in an incubator at 27°C for one week. Then cultured larvae are collected and identified.

Appendix 4. Treatment

Drug	Trade Names	Activity spectrum			Withholding time for meat (days)	Remarks
		Round worms	Tape worms	Fluke		
Albendazole	Valbazen	Adults Larvae	YES	Adults	10	2l. (250)
Levamisole	Ripercol	Adults	NO	NO	3	1l. (100)
Rafoxamide	Ranide	Adults	NO	Young	28	1l.
	Ridafluke	Adults	NO	Young	?	1l.
Morantel	Banminth II	Adults	NO	YES		500ml
Closantel	Sepouver	NO	NO	YES	28	inj. (500)
Iverméctine	Ivomec	YES	YES	NO		inj. Ticks Mange

DEATHS, PREDATORS, THEFTS AND DISAPPEARANCES



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A. INTRODUCTION

Losses observed in small ruminant flocks in the communal areas of Zimbabwe result from disease, undernourishment, disappearance, accident, theft, or predators. These losses were studied to see what could be done to improve the economic performance of the flocks.

Example 1

For Mr Y , a Matebeleland goat keeper, the disappearance of an animal in the bush usually went unnoticed. On 10 November 1990, his 70 animals left in the morning without a shepherd and in the evening, 69 return to the kraal. One doe 3 years old had disappeared and Mr Y had not noticed it. This happened 9 times during 1991, entailing a lack of increase much more serious than the 3 kids found dead from diarrhoea one morning in the kraal. However, Mr Y was convinced that to improve his flock's production, the most important thing was to treat his animals against diarrhoea.

Example 2

Mr X , a farmer in Gwanda communal area, Matabeleland. On 1st September 1990, his livestock consisted of a herd of 63 cattle and a flock of 74 goats (56 females and 18 males).

Between 1st October 1990 and 1st October 1991, 35 goats entered the flock (1 purchase and 34 births).

During the same year, 33 goats left the flock: 8 were sold to the Cold Storage Commission, 6 were slaughtered for family consumption and 19 animals died or disappeared. The reasons for these losses are the following:

October 1990	1 female (9 months): Disease due to under-nourishment
November 1990	2 adult females: Disease due to under-nourishment 1 male (4 months): Diarrhoea 1 male (15 months): Predator (jackal) 1 adult female: Suspected theft
December 1990	1 female (6 months): Under-nourishment 2 females (5 and 18 months): Predators
May 1991	1 adult female: Accident 1 adult female: Disappearance (cause unknown)
June 1991	3 kids (less than one week): Mother without milk 1 male and 1 adult female: Suspected thefts 1 castrated male: Suspected predator
September 1991	1 kid (2 months): Diarrhoea 1 castrated male: Disappearance 1 adult female: Predator (jackal or dog)

The financial results of Mr X's goat herd for the year are as follows:

Financial return from the sales of goats 336 Z$ ⊕ Financial value of home consumption 252 Z$ ⊕ Increase of the financial value of the flock 75 Z$ ⊖ Total losses Z$ 760 ⊜ Z$ 97

In Mr X's flock, losses were greater than gains by Z$ 97.

These 2 examples show that losses have more serious consequences on the flock than could have been imagined.

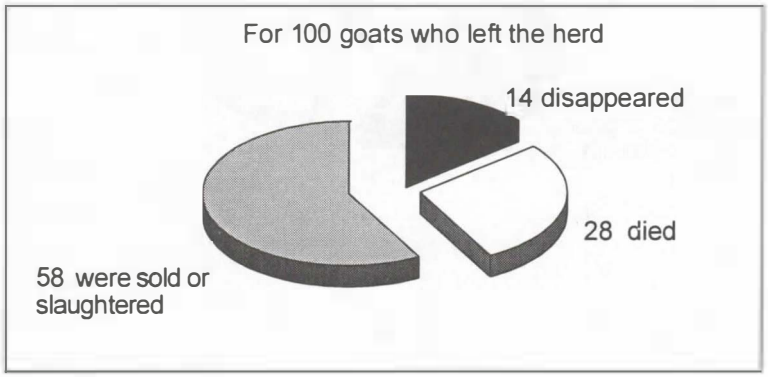
B. RESULTS

1. Proportion of losses

From the 1st October 1990 to the 1st October 1991, 13 % of the 7478 small ruminants identified in all the study groups died or disappeared.

These deaths and disappearances made up 42 % of the total number which left the flock.

Figure 1:
Causes for goats leaving the flock during the survey period



2. Causes of confirmed deaths

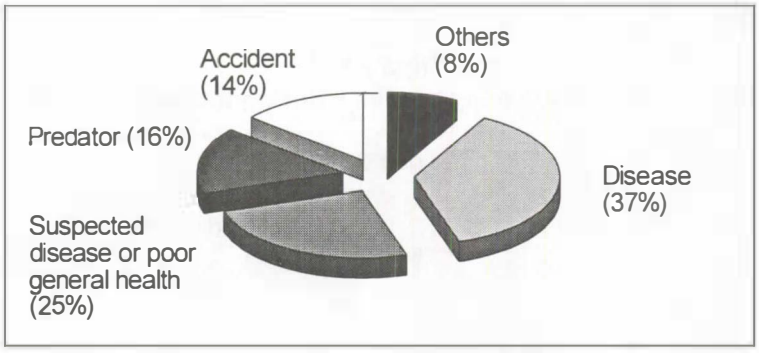
Diseases (diagnosed or suspected) and under-nourishment of the animals made up two-thirds of confirmed deaths.

Predators were directly involved in 16 % of the confirmed deaths (all or part of the body having been found by the farmer).

In order of importance, baboons, jackals and stray dogs inflicted the greatest losses on herds. In the Zambezi valley, crocodiles regularly killed goats drinking at the main tributaries of the river.

Causes of accidents are numerous: an animal run over by a car or lorry, falling into holes or ravines, animals struck by lightning. In areas where crops are not protected (highveld, outskirts of urban areas) a number of goats were stoned by farmers upset at seeing them feeding in their fields.

Figure 2:
Causes of confirmed deaths

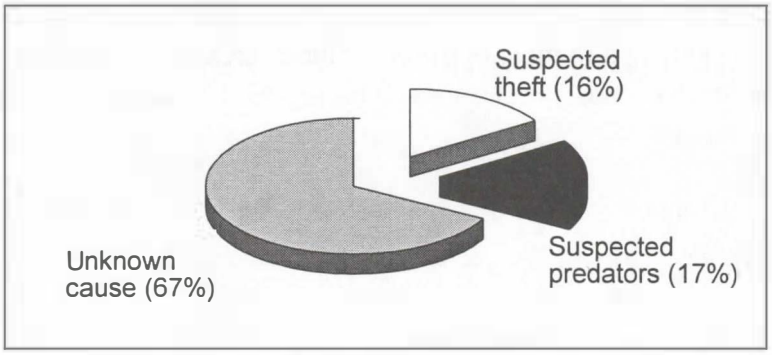


3. Causes of disappearances

Two-thirds of animal disappearances could not be attributed to any precise cause. The animal left in the morning with the herd and did not return to the kraal in the evening with the other animals and the farmer's staff did not notice.Predators played a major role in some communal areas: baboons in the Zambezi valley, jackals and stray dogs in Matabeleland, lions, hyenas and leopards in communal areas adjacent to national parks. Predators seemed particularly active at the end of the dry season when their habitual prey were less numerous. They also made the most of the poor condition and weakness of small ruminants at the end of the dry season which made them easier prey.

Thefts were recorded mainly in Matabeleland and peri-urban Bulawayo area.

Figure 3:
Suspected causes of disappearances



4. Proportions of losses vary according to the area

4.1. Total losses

Losses varied according to location and ranged from 11 % in the Zambezi valley to 23 % in the peri-urban communal area around Bulawayo.

Disappearances were significant in the economy of the flocks. In some communal areas (Matabeleland, Zambezi valley), they made up more than 40 % of total annual small ruminant losses.

Table 3:
Proportion of losses in 4 regions

	Total losses (% of identified small ruminants)	Dead (%)	Disappeared (%)
Zambezi Valley	11	57	43
Highveld	12	77	23
Matabeleland	15	56	44
Bulawayo peri-urban area	23	70	30

4.2. Losses of weaned kids to 1 year

Between 15 % and 35 % of the kids under one year old died or disappeared during the year. But in most of the communal areas in Zimbabwe, losses of kids under one year old were around 20 %. In peri-urban areas, one kid in three died or disappeared.

Table 4: losses of weaned kids to 1 year in 4 regions

	Total losses
Zambezi valley	16 %
Highveld	15 %
Matabeleland	18 %
Bulawayo peri-urban area	35 %

5. Losses according to the season

Losses of small ruminants were most at the end of the dry season and during the rainy season.

In the **Zambezi Valley**, losses occured mainly during the rainy season because of diseases and parasites.

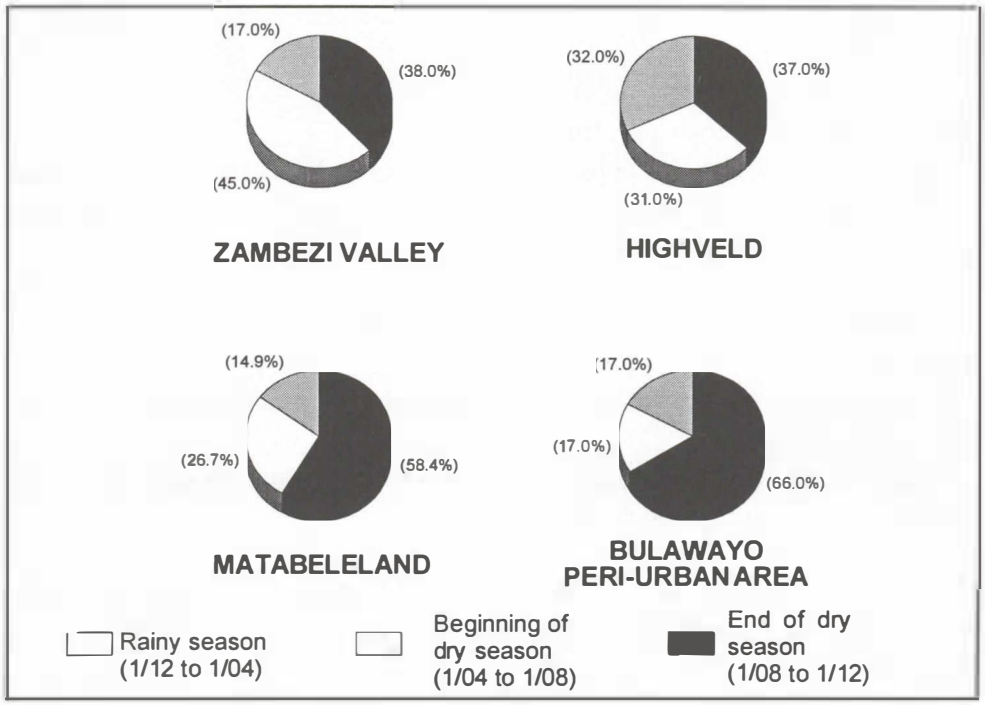
In the **Highveld** losses were spread throughout the year. The predominant diseases have parasitic and infectious origins.

In **Matabeleland**, losses were high and occurred mostly towards the end of the dry season. Animals suffered from under-nourishment and predators were particularly active during this season and killed a considerable number of animals, especially kids.

In the **peri-urban area of Bulawayo**, one animal in four died or disappeared during the year. The seasonal spread of losses was the same as that observed in Matabeleland.

Figure 2:

Distribution of animal losses according to season and environment



6. Causes of losses, according to the natural and socio-economic environment

In the **Zambezi valley**, the predators represented the most serious danger to the flocks.

Diseases made up only a third of the losses and occurred mainly during the rainy season.

In the **Highveld**, the risk was from disease.

Accidents were a major cause for lack of increase. They were numerous, varied and sometimes unexpected: vehicles, drowning in latrines, stoning of animals destroying crops, etc...

In **Matabeleland**, the two main causes of mortality identified were diseases and predators.

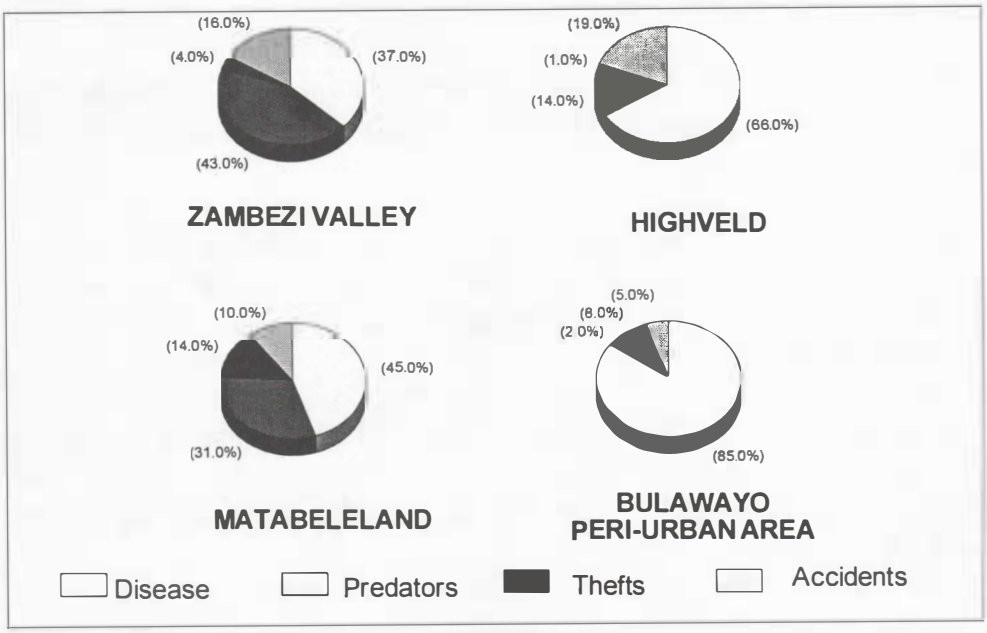
Sixty percent of the losses were observed during the last 4 months of the year (end of the dry season).

Diseases recorded were mostly the consequence of under-nourishment of animals, mainly at the end of the dry season.

The greatest losses were recorded in the **peri-urban area of Bulawayo** (23 % of all the small ruminants identified died or disappeared during the year of the study).

Sixty-six percent of these losses occurred at the end of the dry season and the majority were the consequence of disease, most often linked to severe under-nourishment, which was common at this time of year.

Figure 5:
Causes of deaths and disappearance in 4 regions



C. DISCUSSION

Conservation of the bush...

In farming systems where the natural environment is badly degraded, the feed resources from the bush are poor in quantity, especially at the end of the dry season.

In Matabeleland, the bush was degraded due to overgrazing. The poor feed resources (58,4 % of losses at the end of the dry season), added to the main peak kidding period observed at this time, explain the losses linked to the animals' under-nourishment.

In the peri-urban area of Bulawayo , where the high population density and the maximum use of land for crops caused the disappearance of the arboreal bush, losses were also linked to under-nourishment (66 % of losses at the end of the dry season).

In the Zambezi Valley, where the natural bush has been preserved because of low human and animal density, losses were less important at the end of the dry season (38 % of losses).

Predation ...

At the end of the dry season, predators seemed particularly active, when their habitual prey were less numerous.

This was observed in areas bordering "Safari Areas" or "Wilderness Area" like in the Zambezi valley (43 % of losses). Troops of baboons coming down from the Zambezi escarpment could really decimate the flocks.

In heavily populated areas (Peri-Urban Areas) where the goat's natural predators have practically disappeared, only a few stray dogs attacked the flocks and the predation was far less important (2 %).

In Matabeleland (31 % of losses) at this time, goats travelled long distances to find water and forage necessary for survival.

Socio-economic environment ...

The results showed that the more extensive the farming system (Zambezi Valley, Matabeleland), the more numerous were the disappearances of animals into the bush, representing up to half the total losses recorded (respectively 43 % and 44 %). This could be explained by the importance of predation and accidents when the animals moved far from the farm unattended.

Losses of kids...

In the peri-urban area of Bulawayo, all the constraints causing lossses of small ruminants were found:

- High population density.
- The disappearance of the shrub strata because of crops.
- Unprotected crops.

In this area the losses of kids under one year old were very important (38 %).

In the three other areas studied losses of kids were around 15 %

These results should be considered in context of the study carried out by the Veterinary Department of the University of Zimbabwe in Seke communal land, on the outskirts of Harare, where losses of kids reached 40 %.

Kids born during the dry season and nursed by does in poor condition, were the main victims of an environment which is becoming degraded as man's use of the land encroaches upon the whole territory.

Diseases...

Diseases appeared to be the major cause of deaths. But they may be linked to the poor condition of the animals due to under-nourishment (especially end of the dry season, beginning of the rainy season).

See chapter "Contagious diseases" and "Goat Health".

D. RECOMMENDATIONS

When the natural bush has not yet been degraded (cf Zambezi Valley), it provides good feed, especially at the end of the dry season, as we saw before.
Different simple measures have to be taken to preserve it as it is:

Conservation and preservation of natural bush area by protecting the shrub area.
Controlled grazing by sending a shepherd with the goats.
Controlled grazing by the use of a grazing scheme.

Control of animal density (population) to avoid overgrazing.
Quick use of unproductive animals by home-consumption.
Early use of animal products through marketing structures, which would provide an income to the household.

When the bush is already degraded (cf. Matabeleland or peri-urban area of Bulawayo), measures have to be taken either to restore the bush, or to supplement the animals to limit losses due to under-nourishment, at the end of the dry season.

Reconstitution of the shrub strata by new plantations.
Protection of the remaining shrubs by controlled grazing (eg. herding or grazing schemes)
Collective organisation and control of the use of the pastures.
Control of the animal population

Supplement the animals' feeds (i.e. with maize) at the end of the dry season (especially the pregnant females and mothers with kids).

Cut grass in the rainy season and **make hay** to give to the animals during the dry season. The grass can be cut in January or February and dried in the sun before storing it until needed.

Herding the animals...

Sending a shepherd with the animals can be one way of protecting the bush (controlled grazing), but it can also help limit losses.

Advantages of herding would limit
accidents (animals run over by vehicles, falling into ravines).
attacks by predators (baboons, stray dogs...)
disappearances by death in the bush.
thefts.

Herding the animals simply requires investments of time which can be shared between the parents, the young children who are not going to school, and the older children when they are back from school.

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