ZIMBABWE:

COUNTRY REPORT TO THE FAO INTERNATIONAL TECHNICAL CONFERENCE ON PLANT GENETIC RESOURCE

(Leipzig, 1996)

Compiled by:

P. Mapfumo
K. Mtindi

Harare, September 1995

Note by FAO

This Country Report has been prepared by the national authorities in the context of the preparatory process for the FAO International Technical Conference on Plant Genetic Resources, Leipzig, Germany, 17-23 June 1996.

The Report is being made available by FAO as requested by the International Technical Conference. However, the report is solely the responsibility of the national authorities. The information in this report has not been verified by FAO, and the opinions expressed do not necessarily represent the views or policy of FAO.

The designations employed and the presentation of the material and maps in this document do not imply the expression of any option whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal status of any country, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table of Contents

PREFACE

The future of each nation and humanity as a whole depends on how the present generation manages the world's natural resources of particular importance is the Plant Genetic Resources (PGRs). These resources sustain human life in terms of food, clothing, housing, medicine and energy supply. Nevertheless, despite their vitality mankind has hitherto ironically watched and seen these resources being squandered under socioeconomic factors. In many countries today, the total genetic variation of plant species (both between species and within species) has been grossly eroded and continues to do so unabated in many nations, particularly in developing nations.

Concerned with this colossal and perennial loss of plant genetic diversity FAO, as the United Nations agency mandated to ensure food security for both the present and future generations, is planning an International Conference on plant genetic resources. The conference is scheduled for next year (1996). The conference is aimed at formulating global strategies for the conservation of plant genetic resources.

To ensure that individual countries' needs are addressed by the proposed global strategies, FAO has invited countries to submit reports outlining their current status of plant genetic resources utilization and conservation. This report therefore is a product of that invitation.

We from the Seed Services: Department of Research and Specialist Services, as caretakers of the responsibilities of the future Zimbabwe Plant Genetic Resources Centre, on behalf of our government are proud to have had the opportunity to respond to this global call of a noble cause. It is our sincere hope that FAO will find this report succinct and useful.

CHAPTER 1
Introduction

1.1 LOCATION OF ZIMBABWE

Zimbabwe is situated in the southern part of the African continent. The country is totally land-locked. It borders with Mozambique, South Africa, Botswana and Zambia to the East, South, West and North West respectively. The country has a total land area of 390,759 square kilometres with a population of 10.4 million people.

1.2 GEOGRAPHY AND CLIMATE BASICALLY

Zimbabwe is a tropical country. Our year roughly falls into three seasons - namely dry winter, hot season and a wet season. Winter stretches from April to August. Ground frost can be experienced sometimes in some parts of the country during this period depending on altitude.

A hot season stretches from September to the first half of November with highest temperatures occurring in October. This hot season is followed by a wet season, which covers a period stretching from mid-November to early March.

As for the physical geography, Zimbabwe comprises of an undulating landscape. To the east, along the border with Mozambique, lies a chain of mountains. Among these mountains is Mount Inyanga which is the highest point in the country with a height of 2,592 m. The lowest points in the country, below 600 m, are found along the Zambezi valley and the Limpopo-Sabi basin.

Locally the country is recognised as falling into three zones: the Low Veld (below 900m), the Middle Veld (900m - 1,200m) and the High Veld (above 1200m). These zones represent about 35.5%, 40.5% and 24.2% of the total land area respectively. They are demarcated not only on the basis of elevation, but also on the basis of associated variations in the physical environment; namely natural vegetation, temperatures, soils, water supply and animal life.

1.3 AGRICULTURE AND THE ECONOMY

Zimbabwe's economy is agriculture-based. The country has a world-wide reputation for quality agricultural products. Its sector feeds the nation, with surplus for export and it is from these exports that the country has been coined the "Bread Basket for Southern Africa". It employs 26% of the working population and this is the largest share of employment across all sectors. Agriculture contributes over 15% to the Gross National Product (GNP) and generates approximately 40% of the country's foreign currency earnings. It provides the bulk of raw materials required by the manufacturing sector.

1.3.1 Agricultural Commodities and Their Relative Economic Importance

Agricultural production in Zimbabwe comprises of a number of commodity crops and animal products. Crop production includes food crops like maize and industrial crops such as cotton and tobacco. (see Table 1.3.1 for respective annual contribution by the each crop. The data are averaged over a nine-year period (1984-1992). The values are expressed in Zimbabwe dollars. These values could be converted to US dollars. by a multiplication factor of eight.)

1.4 NATURAL REGIONS (NR) AND AGRICULTURE

Zimbabwe is subdivided into five agro-ecological regions as shown in Figure 1 and Table 1.4.1. These regions are based on climatic and edaphic factors. Suitability for agricultural activities decreases from Natural Region 1 to Natural Region 5.

1.4.1 Scales of Farming Operations in Relation to Natural Regions

Generally there are three levels of farming operations in Zimbabwe. First, we have the Large Scale Commercial Sector (LSCS). This is the former European farming area during the colonial rule. This accounts for 60% of the best agricultural land in the country and 40% of total area of Zimbabwe. In this sector agriculture is very diversified and intensive. It has a total land area of about 157,000 square kilometres, with an average farm size of 2,200 hectares.

Second, we have the Small Scale Commercial Sector (SSCS). These are the former African Purchase Lands. This sector accounts for 4% of all land area in the country. About 75% of this area falls into natural regions 4 and 5 which are marginal farming areas. Farm size averages 125 ha.

Third, we have the Communal Lands. These are former Tribal Trust Lands. This constitutes about 42% of all area and most of it (75%) is located in natural regions 4 and 5. It is of interest to note that more than 50% of Zimbabwe population resides in these brittle environments and hence the serious land denudation thus far witnessed in these areas.

1.5 AGRICULTURE RESEARCH

Department of Research and Specialist Services (DR & SS), which falls under the Ministry of Agriculture, is responsible for the national crop and livestock improvement programmes. The main station is located in Harare, this is the Harare Research Station. There are about seven sub-stations situated in different agro-ecological zones across the country. All research on crop improvement is done by the Crop Breeding Institute (CBI), a branch within DR & SS. All research funding is by the government. International assistance has come in the form of staff training and special project funding.

Zimbabwe has one of the most advanced agricultural economies in Africa. This can be ascribed to the great importance that the country attaches to agricultural research. Zimbabwe is among the first countries in the world to use hybrid maize seed. Historically, all agricultural research has been directed to meeting the needs of commercial farmers. Little attention was paid to the need of the indigenous people. This has changed now with the advent of independence.

Crop improvement programmes focus on the following crops: maize (staple food), sorghum, pearl millet, finger millet, wheat, barley, oats, soybean, beans, cowpeas, bambara nuts, sunflower, groundnuts, castor bean, sugarcane, cotton, coffee and potatoes.

In addition to govemment-run crop improvement programmes, to date, there are four private organisations engaged in the production of improved cultivars. One of these organisations is the Tobacco Research Board (formerly a parastatal) which works exclusively on the tobacco crop, our most important cash crop in terms of foreign currency earning.

CHAPTER 2
Indigenous Plant Genetic Resources

2.1 TIMBER, FUEL-WOOD AND TREE FOOD EXPLOITATION IN ZIMBABWE

The importance of tree resources in the economy of Zimbabwe cannot be over-emphasised. Zimbabwe, like other tropical countries, exports a lot of timber products thereby earning the country the much needed foreign currency.

In rural Zimbabwe tree resources are exploited in a variety of ways. These provide fuel-wood, poles for construction purposes and timber. As a matter of fact some of these species have now been over-exploited to the extent that they are now on the brink of local extinction. One important example that comes to mind is *Bivinia jalbertii/Mutuputupu* tree (utilised for timber).

Since species distribution varies with climate across regions or localities, different areas will have different species that people can exploit. Even within an area, some species are more preferred than others depending on their properties. Table 2.1 gives a profile of the numbers of woody species utilised in some rural areas of Zimbabwe.

2.2 FOREST GENETIC RESOURCES ACTIVITIES

Under the terms of the Forest Amendment Act (No. 28) of 1953, the Forestry Commission as a parastatal Organisation falls under the Ministry of Lands but has since been relocated the Ministry of Environment and Tourism. All Forestry activities in Zimbabwe fall under the responsibility of this Commission. The Commission's functions cover both commercial and non-commercial activities. It is also charged with the development and implementation of general forest policies in Zimbabwe. It formulates these policies in consultation with the Ministry.

The non-commercial activities include forestry research, training, afforestation, woodland management, conservation, regulation and control of indigenous timber products.

The other division (of the commercial activities) comprises of industrial plantation development, timber harvest, production and marketing of timber products, fruit growing, cattle ranching and safaris.

Another important institution playing a crucial role in conservation of indigenous plants is our national herbarium and Botanic Gardens.

The National Botanic Gardens is located in Harare. It plays a significant role not only in the conservation issues but also in the identification of this indigenous flora. Its efforts in conservation compliment those of the Forestry Commission.

Apart from the living specimens it holds (*in situ* conservation), the Botanic Gardens runs a National Herbarium, which acts as a repository of dried and pressed specimens of plants. It holds about 350,000 specimens (Mr. Mapaure 1995, pers comm).

Even though this represents a relatively comprehensive collection which is helpful in mapping the distribution of most plant genetic resources in the country, there are still a few under-collected areas. These areas, which have remained under-collected for various reasons include:

- The border area from Chipinge to Limpopo River. The Mahenye area, in particular, is still under-collected if any collections were done at all in, the past.
- The border area from Hwange southwards to Gwanda. This area, though visited in the past, is still relatively under-collected.
- The Zambezi Escarpment warrants more intensive collecting.
- The Kanyemba border area in the Zambezi Valley.
- Nyanga North, especially the low altitude areas.

In the Botanic Garden, of the 1,230 known woody species of this country, 1080 species (including 20 from the Kalahari Sand ecosystem) have been established.

Thus about 87% of the woody plant diversity of Zimbabwe is represented in the Botanic Garden. Fifty species have proved impossible to grow whilst propagation material is required to grow the remainder.

2.2.1 Conservation of Forest Resources

Information on forest resources conservation is scant. In Zimbabwe there is no planned *in situ* conservation of plant biodiversity and protected areas are due to chance rather than enlightened planning (Muller 1993). In fact the management of these areas is driven by the effects of conspicuous mammal populations such as elephants.

According to Muller and Timberlake (1992), areas primarily conserved for their plants include the National Parks of the Eastern Highlands (Chimanimani and Nyanga), 19 State Forest Areas (account for 8250 km^2 and is under the Zimbabwe Forestry Commission), Botanical Reserves (under the Department of National Parks and Wildlife Management) and 18 protected areas gazetted under the Natural Resources Act (administered by Natural Resources Board).

Listed below are some of the areas conserved for their plant diversity. Of these centres Chimanimani Mountains and the Great Dyke are the most important for they are the ones richest in endemic species with 42 and 20 endemics respectively.

1. Chimanimani mountains	8. Gokwe Thicket
2. Nyanga mountains	9. Gonarezhou Thicket
3. Busi-Sengwe	10. Binga Dry Forest
4. Chiwore-Angwa	11. Nyoni Hills
5. Chirinda Forest	12. Mt. Buhwa
6. Bunga Forest	13. Mt. Hwezda
7. Great Dyke	14. Mazoe Bot. Reserves

There are a number of forests of national and international interest on private land. The majority of these are in reasonable condition as they are well protected by the land owners or by the raggedness of their terrain. Nevertheless, there is a need to give them a legal protection status as a guarantee for their long-term safety (Muller 1994).

Most of these, particularly those below the altitude of 1,500 m and face an imminent danger of clearance to give way to agricultural development. Legal protection should therefore be granted as a matter of urgency.

Of particular interest are the rainforests. These carry about half of Zimbabwe's total wood species (Muller, pers comm). It is fortunate that most of these lie in the National Parks and State Forest Land under the Forestry Commission and are quite well protected.

2.2.2 Reasons for Conservation

- Scientific and Educational values.
- Biodiversity. (i.e. other species of animals and plants).
- Historic Biological Collections.

2.2.3 Threats to the Reserve Forests

- Rapid rate of land development (i.e. Clearance for agriculture purposes in areas located on the watershed).
- Damage by large herbivores (i.e. elephants).
- Harvesting of fruit and seed.
- Timber and fuel-wood demands.
- Fire.

2.3 NATIONAL TREE SEED CENTRE

The indigenous woodlands of Zimbabwe are currently under serious threat from clearance of large tracts of land for agricultural purposes. In an effort to caution the resultant effects of genetic erosion, the national Tree Seed Centre, which is run by the Forestry Commission, launched a seed collection mission of five commercially valuable tree species. These species are: *B. plurijua, P. angolensis, E. caudatum, G. coleosperma and Colophospermum mopane*. These seeds are stored in the coldroom at 12° C. The seed are distributed to schools and local communities for planting / afforestation.

2.4 ENDEMIC TREE SPECIES OF ZIMBABWE

Zimbabwe has a lot of tree species that are endemic. Most of these are found in the Moist Forest (the Chirinda Forest). This forest supports a very high plant diversity, containing 740 of the 6,000 vascular plants recorded in Zimbabwe. They comprise 125 Pteridophytes, 3 Gymnosperms, 90 Monocotyledons (of which 46 are Orchidaceae and 17 Poaceae) and 520 Dicotyledons (Muller 1994).

Approximately 430 (almost 40%) of the 1,180 woody species recorded for this country are confined to rainforest. A number of species are endemic to the Great Dyke and others are either endemic or near-endemic to the moist forests of the Eastern Highlands. A list of endemics is given in Appendix 2.4.

Much of the area of the moist forest is reasonably protected in National Parks Estate and Forest Reserves. However, some small patches still remain in communal lands and private commercial farming land. It is these, particularly the former, that need immediate attention (Mapaure 1995, pers comm). Likewise, the Great Dyke is reasonably protected but threats from mining operations cannot be overruled.

2.5 IMPORTANT UNDER-UTILISED WOODY SPECIES

2.5.1 Fruit Trees

A number of indigenous plant species found in Zimbabwe are or can be used as a source of food in the form of fruit. Tredgold (1986) documented about 180 food plants found in the wild. Appendix 2.5.1 gives some of the common indigenous fruit trees found in Zimbabwe. Most of these fruit trees are under-utilised. Research work is required to develop some of these tree species into commercial fruit production. Of particular importance here are the *Sclerocarya birrea, Uapaca kirkiana and Ziziphus mauritiana*.

It is encouraging to note that the Horticultural Research Centre, based in Marondera, has just begun running trials on these species, inter alia, several other indigenous fruit tree species. This project is being funded by the European union. The aim of the trials is to evaluate these materials with the objective of introducing the best material, in terms of drought tolerance, to peasant farmers for cultivation.

2.5.2 Medicinal Plants

Zimbabwe is richly endowed with plants of medicinal value. It is believed that there are more than 5,000 species of flowering plants in this country. Of these, about 500 (10% of the total flowering species) are used as traditional medicine (Mavi 1993). To date some of these species have been collected for research purposes by the School of Medicine at University of Zimbabwe in collaboration with the National Herbarium and Botanic Gardens and the Zimbabwe

Traditional Healers Association. Some of this material is being propagated by a non-governmental Organisation (Fambidzanayi Permaculture Training Centre) for the establishment of *in situ* stands at the University Farm.

Work by Akerele (1992) has indicated the following as some of the most important medicinal plants in Zimbabwe used by traditional healers:

- Bilharzia

  Warburgia sulcata, *Ziziphus mucronata* and *Ximenia caffra*
- Diarrhoea

  W. sulcata, *Z. mucronata* and *Vernomia amygdalina*
- Malaria

  W. sulcata and *Z. mucronata*
- Hypertension

  W. sulcata and *Z. mucronata*
- Sexual Diseases

  W. sulcata, *Z. mucronata* and *X. caffra*

Although there is, in general, under-utilisation of medicinal plants in Zimbabwe, there are indications that in some cases over-exploitation of certain species is now pushing some of these essential plants to the brink of local extinction. A good example is that of *Warburgia salutaris*. Only two plants of this species are currently known to exist in the wild.

2.6 OTHER WILD SPECIES AND WILD RELATIVES OF CROP PLANTS

Information on wild progenitors is lacking because the country does not have a well documented profile of genetic wild resources.

Although it is very difficult to quantify the unique genetic diversity of economically or socially important wild plants, one area that one can say with confidence that it is not being fully exploited / utilised is that of indigenous vegetables. Some of these under-utilised indigenous vegetable resources are listed in Appendix 2.6.

Work by the Department of Agricultural Extension and Technical Services (AGRITEX) through its Horticultural Crops Specialist has indicated that there is a lot of untapped potential in the utilisation of the indigenous vegetable plants.

The problem here is of attitude. It has been noted thatt as the people develop economically, they tend to shun away from using these indigenous vegetables in favour of the exotics. The adoption of exotics is strongly associated with affluence or higher social strata. Serious extension work is needed to promote the utilisation of these resources, particularly among the town dwellers. If people in cities and towns could change their attitude towards the consumption of the traditional vegetables, it will become economically viable for the rural communities to grow these crops as they can then find a market for any commodity surplus. People in rural areas only eat these plants in years of drought when they have no choice.

It is interesting to note that our local scientists have started research endeavours on indigenous vegetables. The Horticultural Research Station is currently running agronomic trials on both local and introduced material. Imported material is from countries like Tanzania where seed of indigenous vegetables have long been commercialised and can be bought in supermarkets (Mr. Chigumira, pers comm).

2.7 LANDRACES AND OLD CULTIVARS

Information on use of traditional varieties is not readily available. No assessments have ever been made on a national scale to establish the significance of traditional crops and plant varieties on farms except for sorghum, pearl millet and rapoko. At present the government policies do not encourage the use of these materials by farmers. Government extension workers promote only the use of improved varieties. This sounds very rational since the farmers' Cost/Benefit analyses favour adoption of improved varieties. Because of ever increasing land pressure that is coupled by the goal of high returns from arable farming, farmers are being economically forced to grow hybrids in their best lands. The inevitable result is that traditional varieties get marginalised. This, generally, has led to severe genetic erosion in landrace materials.

There is a need to find out what traditional varieties are still available in rural areas. This information needs to be documented alongside with the traditional conservation methods (*in situ* and/or traditional seed storage techniques). In order to achieve this, there is need to develop institutional capacity that encourage farmers to both use and conserve their traditional varieties. This could be done in collaboration with Zimbabwe Farmers Union (ZFU). The ZFU is in a good position to encourage farmers to treasure their landraces as they have field officers at both provincial and district levels (Ms. T. Kaviza, pers comm). Because

these officers are recruited locally, they therefore understand and appreciate (at least in principle) the locals' value systems and socioeconomic conditions or problems.

What is needed at this point in time as a matter of urgency is to train its field officers in skills pertaining to genetic resources conservation. This will help a great deal in our genetic erosion awareness campaign.

2.8 FORAGE CROPS

a) Legume species

Work on pasture improvement is carried out by three Livestock Research Stations-namely Henderson, Grassland and Makoholi. Henderson Research Station is holding 196 legume accessions while Grassland has 649 accessions. Appendices 2.8.a. and 2.8.b. give the species composition of the held legume collections. Also included in the lists are the numbers of accessions in each of the species collected.

Out of the 196 legume accessions held at Henderson, only 25 of these are of local origin. The rest are introductions from other countries such as Australia through the International Livestock Centre for Africa (ILCA). Material at Grassland is a world-wide collection.

It covers countries like Argentina, Australia, Brazil, Canada, Colombia, England, France, Hawaii, Malawi, Panama, S. Africa, USA and Zambia. Of this material about 209 accessions are of local collections. More work on collection missions is called for with regard to local legumes germplasm.

However, it is unlikely that the stations will undertake this mammoth task for two reasons. First, the need of genetic resources conservation per se seem to rank low in the research policies of these stations. Second, even if the stations would like to collect germplasm for conservation purposes for the sake of future utilisation, the amount of resources currently at their disposal is very limited.

With regard to Makoholi, not much germplasm is held at this station. They have got only nine legume accessions currently under evaluation trials.

b) Grass species

The composition of grass species collection is somewhat different from that of legumes in that it contains a fairly significant amount of local material. No further collections are needed for grass species except in cases where seed viability or genetic fidelity is questionable. Appendices 2.8.c. and 2.8.d. give the names of grass species held at Henderson and Grassland Research Stations respectively. It is clear from this gathered data that Henderson tends to specialise on grass species while Grassland specialises on legume species.

CHAPTER 3
Conservation Activities

3.1 *IN SITU* AND ON-FARM CONSERVATION ACTIVITIES

Presently Zimbabwe has no formal nationally coordinated programme related to on-farm conservation of the genetic resources of landraces. To date the on-farm conservation landraces is done by individuals who are mostly women.

Information is lacking as to how much of these resources are still available in the various local communities. A national survey is required in order to map up the distribution of these resources. Current endeavours by some NGOs are nevertheless encouraging though still patchy.

Information on types and distribution of wild crop-relatives in protected areas is equally lacking.

3.2 *IN SITU* COLLECTIONS

Plant genetic resources collection in Zimbabwe is still no yet centralised since Zimbabwe has never had a National Genebank.

Things are slowly changing and we are currently constructing a genebank at the Department of Research and Specialist Services (Ministry of Agriculture). At the time of completion of the compilation of this report the building was at window-sill level.

All collected germplasm is currently in the hands of individual plant breeders in national breeding programmes and private breeders. Very few of these collections are base collections.

Most of this material is breeders' working collections and are comprised of seed and living collections for horticultural trees and crops like potatoes and sugarcane.

To date only two wide-range germplasm collections have been done in the country. These were carried out by IPGRI and ICRISAT collaboration with the Crop Breeding Institute. The information on the actual quantities of accessions that have been collected to date is very uncertain.

The duplicates of these collections that were left in the country were all later distributed to individual breeders or respective crop breeding programme. This has actually led to the loss of some of this material while the condition of the remaining material is very precarious. It is now difficult for the individual breeders to tell what they still have or have lost. This is because breeders who are bridled with financial constraint cannot distinguish between working collections and base collections.

Organisations that are currently involved in germplasm collection and utilisation in the country are as follows:

a) Department of Research and Specialist Services

b) Private Seed Companies, i.e. Seed Co-op Zimbabwe

c) International Organisation, e.g. ICRISAT

d) Tobacco Research Board

e) University of Zimbabwe

f) ENDA-Zimbabwe (and NGO)

g) AZTREC Trust (an NGO)

In situ conservation of forest genetic resources is done by the National Herbarium and Botanic Gardens. To date they have established several thousand of tree and wild plants. However, this method of conservation need to be married to *in situ* approach. *In situ* on its own offers very little hope of conserving a wider genetic variation of species. A single plant in a Botanic Garden cannot, surely, represent the genetic pool of an entire species. This is why there is need to develop and promote the *in situ* approach.

3.3 STORAGE FACILITIES

Low Temperature Facilities

The facilities currently used by the breeders in national breeding programmes are only suitable for short term storage. The material, which include inbred lines and some obsolete cultivars, are kept either in plastic tins or small pockets

(non- waterproof). These are then stored on shelves in a coldroom at 8-10° C. Some of the material is stored in a room with no form of temperature control. This material is regenerated every year. This is a risky and expensive procedure.

Germplasm storage at the Forestry Research Centre does not match standards recommended by the International Plant Genetic Resources Institute (IPGRI) as well. IPGRI recommends storage at -18° C with seed moisture content of between 1% and 5%. Seed is stored in two cold rooms. One of the cold rooms has a capacity of 27m^3 and is set at a temperature of 12° C. The facility has no control of relative humidity. In the other storeroom, which is insulated, temperature is set to a constant level of 4° C. Relative humidity is maintained at 12-20%. The seed is packaged in plastic bags, heavy plastic moulded boxes and bins.

Facilities under NGOs are equally of poor standard. The structures are designed to store material for only 1-2 years. There is a need to collect these plant material from NGOs for safe keeping at the National Genebank as soon as its construction is completed.

In the case of Tobacco Research Board (TRB), seed is stored in sealed glass bottles placed in a coldroom at a temperature of 5° C. Relative humidity is kept approximately at 40%. The cold room has a back-up generator that is used in times of power failure. The seed samples are checked regularly and moisture content is not allowed to go beyond 8%. Under these conditions the seed is preserving well for at least 10 years.

This is about the best genebank management standards in the country (excluding CGIAR Institutions like ICRISAT)

The TRB performs viability tests on its stored seeds at one year intervals and material is rejuvenated if germination percentage falls below 70% or when the seed is more than 10 years old.

All the stored material are duplicated in small, sealed glass vials and stored in a fire proof safe in the secretary's office at Kutsaga and at Zimbabwe Tobacco Seed Association.

Field Genebanks

The use of this method is primarily for crops like pasture species, potato and sugarcane. A good example here is that of the grass *Chloris gayana*. This species is useful in a tobacco crop rotation. In addition to the tobacco germplasm the TRB holds various strains of the species *Chloris gayana*. This is a grass species that is used in tobacco rotations. All materials are local. These materials are used for the breeding of nematode resistance grasses. Most of this material is main-

tained vegetatively as tufts in pots in the glasshouse or in small plots in the field. Only a few samples have been temporarily stored in air-tight glass jars in ordinary coldrooms (temperature 4-8° C) with no humidity controls. Usually duplicates of either plots or pots are maintained.

CHAPTER 4
In-Country Uses of Plant Genetic Resources

4.1 CROP IMPROVEMENT PROGRAMMES

The objectives of our national breeding programmes are many. However, they vary according to specific programmes/crops. In general, the ultimate national goal is to increase crop yields thereby ensuring that the country is self-sufficient in food, fibre requirement, etc. This goal is achieved through balancing several breeding objectives with regard to various agronomic characteristics. Specific examples of breeding objectives are given below:

4.1.1 Maize (*Zea mays*)

Breeding objectives:

- maturity,
- disease resistance,
- drought avoidance / tolerance,
- lodging resistance.

The number of maize accessions at the Department of Research and Specialist Services is uncertain. The Crop Science Department holds about 50 accessions and these were introduced from the USA, CIMMYT (Mexico), Tanzania, France, Canary Islands, South Africa and Israel (Mashingaidze and Tongoona, 1991).

4.1.2 *Sorghum (Sorghum bicolor)*

Breeding objectives:

- acceptable food grain and brewing quality,
- drought avoidance tolerance,
- pests and disease resistance,

Breeding objectives:

- shorter plant height,
- yields.

Sources of germplasm:

- local landrace collections,
- exotic collections from India, Ethiopia, ICRISAT Centre, USA, Nigeria and ICRISAT (SADC).

4.1.3 Pearl Millet *(Pennisetum typhoides)*

Breeding objectives:

- acceptable food grain and brewing quality,
- drought avoidance / tolerance,
- pests and disease resistance,
- shorter plant height,
- yields.

Most pearl millet landraces are very tall and late maturing. Breeding efforts generally aim to remove these undesirable agronomical characteristics.

Yield improvement is also given a top priority. A total of 824 local accessions have been collected.

There are also 400 accessions of foreign lines from India through ICRISAT.

4.1.4 Wheat *(Triticum aestivum)*

Breeding objectives:

- yield,
- adaptation to high winter temperatures,
- water use efficiency,
- baking qualities.

4.1.5 Barley *(Hordeum vulgare)*

- high yields,
- brewing quality / low nitrogen content.

Winter-cereals breeding programmes currently has in its possession the following materials (Mashingaidze and Tongoona 1991):

Crop Type	Number of Accessions
Bread wheat	2,113
Durum wheat	32
Triticale	73
Oats	46
Wild wheat	7
Rye grass	3
Winter barley	7
Spring barley	950
Hordeum spontaneum	100

In addition to the material held under the national programme, there is also some material that is under University of Zimbabwe (UZ). UZ has about 600 accessions of *Triticum aestivum*, 450 accessions of *Triticum durum*, and 14 accessions of *Triticum tauschii* (Tongoona, pers comm). These materials are basically introductions through CIMMYT. The remainder are direct collections from Zambia and China (Tongoona, pers comm).

4.1.6 Groundnuts *(Arachis hypoea)*

Breeding objectives:

- acceptable oil and protein content,
- acceptable plant and pod set,
- confectionery quality: kernel size, appearance, uniformity and colour,
- good keeping quality,
- good peg attachment,
- good pod characteristics,
- high yield or shelling percentages.

Breeding objectives:

- maturity,
- educed aflatoxin contamination,
- tolerance / resistance to drought, foliar diseases and pests.

It is important to note that the programme is divided into two parts. One part deals with long season cultivars while the other deals with short season cultivars. The former is targeted for large scale / commercial farmers and the later is for small scale and communal growers.

Present Major Challenges:

- breeding for resistance to invasion by aflatoxin, particularly *A. flavus*. ICRISAT is providing the programme with requisite germplasm.
- breeding for drought tolerance is another big challenge to meet the need of those farmers that practise dry-land cropping, i.e. rain fed crop. To this end the programme objective is to produce cultivars that can mature within 80-100 days.
- disease resistance greatly enhances crop yields. Major diseases of economic interest are Early Leaf Spot and Botrytis. Material from ICRISAT is currently being screened for tolerance to these diseases.

Limitations in the programme:

The major problem is the inability to test our material on a wide scale and in appropriate growing regions due to inadequate resources. Presently trials are confined to Research Centres and these are not representative of the farmers' field. Some kind of on-farm research is a prerequisite.

Another compounding issue is that the programme is too small and consequently it takes a very long time to produce results.

4.1.7 Soybean *(Glycine max)*

Breeding objectives:

- pod height,
- resistance to pest and diseases,
- resistance to pod shattering.

Soybean is a relatively new exotic crop in this country. However, to date about 5,000 exotic lines have been developed.

4.1.8 Cowpeas and Field beans

Breeding objectives:

- high yields,
- resistance to foliar diseases,
- lodging resistance,
- pod clearance,
- seed quality.

More research work is called for in this area. These crops offer a cheap source of protein in rural communities.

Sources of Germplasm: - Beans.

Most of the material was requested from CIAT in Colombia.

The michigan peabean material was obtained from breeding programmes in South Africa, Australia and Canada with a small portion from SADC region and East Africa.

4.1.9 Sunflowers *(Helianthus annus L)*

Breeding objectives:

- yield,
- oil content,
- disease resistance.

Work on this crop has been running for about 20 years now. The programme holds around 800 exotic accessions. These materials were obtained from all over the world and mainly Australia, Argentina, USSR, Romania, USA, and SA.

The collection is entirely through request. Its composition is 50% base material and 50% active material. Some material is thrown away every year.

This is includes some populations no longer required, inbred lines that show no desirable attributes and hybrids that fail to match standard commercial hybrids in the advanced plant variety trials.

Currently there is no international collaboration in this programme.

4.1.10 Cotton *(Gossypium hirsutum)*

Breeding objectives:

- pest and disease resistance,
- maturity,
- fibre strength,
- fibre length,
- ginning percentage.

Work on cotton breeding is done at Kadoma Research Station. The station currently has approximately 1000 accessions of *Gossypium hirsutum* and *G. barbadense*; wild species.

The collections are from all over the world. Sources include USA, China, Russia, Australia, India and African countries. Most of this material (90%) is stored under short term conditions with only 10% under long term conditions. It is also interesting to note that of the total germplasm held here only 1% is indigenous.

A heavy preference is placed on exotic material for genetic diversity and hence more useful genes. Like with most collections done on other crops, the collections are use driven rather than conservation driven.

4.1.11 Castor bean *(Ricinus communis)*

Breeding objectives:

Though not much of breeding is taking place, the University of Zimbabwe (Crop Science Department) is focusing on disease resistance. Major disease is Botrytis. Collections are held by both private and public organisations. Public collections are at DR & SS. University of Zimbabwe has approximately 150 accessions. 70% of this material is indigenous.

4.1.12 Tobacco *(Nicotiana tabacum)*

- disease resistance,
- pest (nematodes) resistance,
- low nicotine content.

The Tobacco Research Board (TRB) is the sole Organisation doing research work on tobacco in the country and is currently holding 634 tobacco varieties. Of these varieties 36 are male-sterile. The collection includes such types like oriental, burley (air-cured and virginia (which is flue-cured). Strictly speaking none of this material is indigenous in the sense of originating from this country. Nevertheless some this material, particularly the *Nicotiana rustica* accessions and other primitive types have been grown by the locals for years now.

In this organisation the germplasm collections are both use-value driven and conservation driven and in equal proportions. Of the total collection 80-90% is long-term based with 10-20% of their material short-term based. Approximately 30% of this material is used each year.

With regard to breeders' material, the board holds 800 lines. Some of material is bred at Kutsaga while some is brought in from outside the country (mainly USA).

4.1.13 Sugarcane *(Saccharum spp.)*

This is one of the most important cash crops in Zimbabwe. The crop is grown mainly by commercial farmers as its production is rather too capital-intensive. It needs irrigation facilities. All the research on this crop is done by the Zimbabwe Sugar Association Experiment Station (ZSAES). This was established in 1966. The station collecting germplasm as soon as it was established.

All the imported material is planted in controlled quarantine at a government research station on the outskirts of Harare for disease screening after which it released to ZSAES.

At present there are 661 varieties kept in germplasm collections at Chiredzi. Most of this material came from other sugarcane growing countries around the world. Roughly about 25 locally selected varieties and 20 imported varieties are added to the collection every year.

The maintenance of the germplasm is through field genebanks. The material is grown in single row plots of 5 m x 1.5 m with a l m path between varieties within the row. The plots are furrow irrigated and regularly fertilised. The canes are harvested every year and allowed to ratoon. After 7-10 ratoons the collection are replanted in a new field.

4.2 SEED DISTRIBUTION

Zimbabwe has a relatively sophisticated and effective formal seed system which evolved since the beginning of the century. It is well supported by research and extension (varietal development, seed production, marketing and distribution) and legislation system that has been in place since 1965.

The sale of seed in Zimbabwe is closely monitored by the government through the branch of Seed Services. Seed Services falls under the DR & SS. It is run by a team of seed inspectors.

The seed inspectors make up the seed inspectorate. The inspectorate is tasked with the responsibility of monitoring all seed production stages so as to guarantee the farmer high quality seed in terms of both physical and genetic purity.

Government supervision does not end in production. It also extends into distribution. In this regard, the government, through the Seed Certifying Authority (Seed Services) issues out licenses to all retail traders who wish to sell seed.

Recently Zimbabwe has stepped up the enforcement of the certification scheme ensuring that all the seed sold on the local market should have gone through and passes a seed certification scheme. This is ensuring that our farmers are being sold the best quality seed only.

Up until recently seed multiplication and distribution of government bred cultivars has been through one Seed Company. From the time this company ventured into private breeding progamme, there was some dissatisfaction on the part of government breeders now felt the company was biasing its seed production marketing promotion towards its own material. This was more so in the case of cultivars that had smaller national demand by virtue of the fact that they were too specific for limited production areas.

The production of small grain crops suffered seriously under this monopolistic set-up. As the company later tended to favour seed for those crops that met the needs of commercial farmers. As a result the country was now experiencing an acute shortage of seed crops that are of economic importance or traditional food value to communal farmers.

To date the set-up is that all government bred cultivars can be multiplied by any company except foreign ones. Nevertheless, this new agreement applies only to cultivars released after January 1994. This has served to introduce the much need competition in the seed industry. Thanks to the World Bank for encouraging the government to implement a Seed Industry reform programme.

4.3 USE OF FOREST GENETIC RESOURCES

Forest resources in Zimbabwe are broadly divided into exotic and indigenous resources. Exotic species have been and are still being systematically introduced for evaluation on growth potential and use in the production of timber. To date the Forestry Commission, a parastatal organisation, through its Research Centre has a very strong tree breeding programme.

The exotic forest germplasm collection is divided into two categories - namely germplasm for commercial plantation species and germplasm for agroforestry species.

Major thrust of the breeding programme is on hybrid seed production for commercial timber plantations. Here the tree species of priority are the Pines (from Mexico and South East Asia) and the Eucalyptus from Australia.

The breeding objectives are to improve yield and quality of timber. To date the research work has yielded highly bred superior seed, which in the case of Pinus patula has produced a 30% increase in timber yield, a five year reduction in rotation cycle, a 50% improvement in stem form and, as a result, increased profitability of the forest industry.

The most advanced breeding programmes are those for three Pinus species, namely Pinus patula, P. teada and P. elliotii and for three eucalypts: Eucalyptus camaldulensis, E. tereticonis and E. grandis. The first two were bred for dry areas while that last is for use in commercial plantations (in high rainfall areas).

The breeding of indigenous trees for both commercial and social forestry is still non-existent.

The present collection of seeds of indigenous tree species is not intended for breeding purposes nor long-term storage. It is used for distribution to users who include local rural farmers and schools. Some of this seed is used for study purposes such as germination tests.

The conservation of indigenous tree species in Zimbabwe is through *in situ* method. *In situ* conservation is generally through the forest Reserves that the Commission is managing through its extension division.

A good example is that of Mukwa tree reserves in Matabeleland. Further *in situ* conservation is afforded through the National Parks that the Department of National Parks and Wildlife Management runs across the country.

4.4 IMPROVING PLANT GENETIC UTILISATION

Crops

The main achievements of our plant genetic resources activities, i.e. plant breeding programmes have been increases in crop yield potential and tolerance to diseases and drought. This has greatly increased our national average crop yields in all major crops, i.e. maize, soybean and cotton.

The success that our national crop improvement programme has achieved over the years stands to fall away as government is continuously cutting its funding of research work. One possible way that has been suggested to overcome this financial barrier is for the government to commercialise DR & SS. This plan is currently under consideration.

However, this plan may not be a good solution. It is still not clear as to what extent this move will impact on farmers' access to improved cultivars. There is a possibility that under commercialisation research goals may shift in favour of the rich (large commercial farmers) who are in a better position to pay for services. In the case of a breeding programme, this means that the breeder will be forced to channel his resources and effort towards improving crops that currently enjoy the biggest market share. This happens to exclude all our traditional crops, i.e. small grain crops.

Forests

With regard to the forest genetic resources, more work is called for in the area of indigenous species. Research should be seen to generate information on:

- pruning effects,
- response to fertilisers,
- growth rate,
- easy of artificial establishment.

The information in these research endeavours might offer a hope in the implementation of ecological restitution in our degraded communal lands.

CHAPTER 5
National Goals, Policies, Programmes & Legislation

5.1 NATIONAL GOALS

- To further collection of genetic resources in areas of the country not previously covered by both the IPGRI and ICRISAT.
- To collection of old cultivars, obsolete breeding lines and any landrace collections currently in the hands of national breeders for safe keeping at the SADC Plant Genetic Resources Centre.
- The provision of modern equipment and storage facilities to the national genebank which is currently under construction.
- Establishment of efficient and user-friendly Computer based Documentation and Information System at the national genebank.
- Formulate and promote some *in situ* or on-farm conservation strategies.
- The need to involve, as many as possible, the NGOs in plant genetic resources activities.
- Training of local personnel entrusted with the conservation of our biological heritage (plant genetic resources).

5.2 POLICIES

Zimbabwe has no specific policies on plant genetic resources. There is need for putting in place some policies that govern the collection and exportation of plant germplasm. Recently (July 1995) the Ministry of Agriculture appointed a fourteen member committee on Plant Genetic Resources. The committee is tasked with giving advice to the Ministry on policy matters relating to plant genetic resources. What is needed now is for this committee to meet and formulate policy guidelines.

Presently there is no specific policy in place that focuses on promoting collaboration, between the government and non-governmental organisation (NGOS) in plant genetic resources activities. NGOs are an important link between grassroots initiative and national programmes on both the conservation and utilisation of plant genetic resources. It is, therefore, imperative that government should try to forge a strong link with these organisations. NGOs are willing to participate in national goals pertaining to genetic resources activities in the country.

The current economic structural adjustment programme entails a substantial reduction in the amount of resources allocated to government programmes. If government agencies involved in genetic resources conservation could identify areas of collaboration with NGOS, their workload would be greatly reduced.

To facilitate a sustainable national programme on conservation and utilisation of plant genetic resources, effective participation by local communities should be emphasized. Prime area of collaboration with NGOs is that of raising the awareness of the dangers of genetic erosion.

One of the major problems in plant genetic resources conservation is that of identifying appropriate methods of *in situ* germplasm conservation.

NGOs have for years been working with local communities on issues related to crop production and seed storage. It would be quite strategic if government could formulate, through the national genebank, an *in situ* conservation programme within the NGOs' community-based projects.

The process of reactivating the evolution of the remnants of traditional germplasm in traditional genebanks, i.e. at farmers' level could be easily undertaken by NGOS. This material can in the process undergo farmers' assessment which is a vital component in the evaluation and characterisation of germplasm.

There is a need to acknowledge women as the custodian of plant genetic resources of food crops since the majority of communal farmers are women. Because of this, they have the widest knowledge available on food-plant genetic resources. This makes women key stakeholders in issues of plant genetic resources utilisation and conservation.

As plants with medicinal properties are now a target for international gene hunters, many Zimbabweans now feel there is a need for the government to put in place strict laws that govern foreign collectors. Currently any foreigner who needs to collect any indigenous plants can simply go to the Department of National Parks or the Botanic Gardens and get a collection permit which is usually automatically granted unless the plant species concerned are listed as threatened species. NGOs in the country would want to see a situation where there are stiffer restrictions on foreign collections. These organisations are advocating for a

national plan of action that guarantees that the local communities benefit from the information on ethnobotany they supply to scientists, be they local scientists or foreigners.

5.3 NATIONAL PLANS

a) There is a need for launching of a national programme aimed at producing well documented information on the distribution of all plant species of economical and social importance. Of major importance here are the forage species and woody species with food value or medicinal uses.

b) On-farm genetic resources conservation: Some NGOs, in particular COMMUTECH, are planning to purchase a farm on which they can maintain all the traditional crops and their varieties.

AZTREC Trust has already acquired some land for this purpose and current activities include evaluation and characterisation of the material. They are also collecting agronomic information of these materials from the farmers.

The National Plant Genetic Resources Centre will work hand in hand with these NGOs. Since the former does not currently have any piece of land on which to carry out regeneration and multiplication of its *in situ* material, a collaboration with these organisations is a noble idea.

c) Fambidzanai Permaculture Training Centre: This is located near Harare. The centre runs diploma and short courses in permaculture. The clients range from rural people to town gardeners. Their major problem is of funding. Their current budget cannot allow them to employ well trained scientists even though the services of such personnel are strongly needed.

Definitely this centre needs to be expanded since its permaculture approach to farming is enlightening communal farmers on the importance of high biodiversity in their gardens or crop fields.

The centre also runs a genebank for the traditional varieties. Other NGOs, through their network of Natural Farming, are sending the germplasm they collect from farmers to this centre for safe keeping. This facility needs to be improved as a matter of urgency.

5.4 LEGISLATION

Presently Zimbabwe's economy is under-going some major reforms. One of the major agricultural issues presently under intense considerations is the option of commercialising some state controlled activities such as agricultural research and services. The Zimbabwe Farmers Union (ZFU) is deeply concerned that such a move might further marginalise the communal farmers. Market forces are likely to force researches to turn a blind eye to the smallholder farmers and their traditional indigenous crops. This is because the user-pay system will not be in their favour due to poor financial status.

One good example of this neglect that comes to mind is the production of open pollinated cultivars. These cultivars will never be bred as this will encourage the farmers to use retained seed thereby cutting down on future seed sales. This is quite regrettable given the ever increasing market price of hybrid seed.

CHAPTER 6
International Collaboration

1) SAREC (The Swedish Agency for Research & Co-operation in developing Countries):

This Organisation is funding Sorghum landrace Study of the Department of Research and Specialist Services (DR & SS). The project is aiming at promoting the utilisation and conservation of sorghum landraces among the communal farmers.

Zimbabwe also benefits from SAREC's activities in the field of forestry. For example SAREC is sponsoring an international Conference on Sustainable Management of Indigenous Forests in Dry Tropics which is to be held in our country in May/June 1996.

2) UNDP / FAO:
UNDP has in the past sponsored AGRITEX for the running of workshop of trainees / users. Following the workshop, two manuals on vegetable crops have been compiled - namely, Principles of Horticultural Crop Production: Vegetable Crops and Principles of Horticultural Crop Production: Fruit Crops.

3) ICRISAT:
This organisation, as an arm of the CGIAR, works in collaboration with the national breeding programmes in areas of crop improvement in small grain crops, namely sorghum and pearl millet.

The institution is also currently collaborating with the national groundnut programme. Various materials are presently being screened for leaf display resistance.

4) CIMMYT (International Maize and Wheat Improvement Centre):
CIMMYT collaborates with our wheat & maize national breeding programmes.

5) ILCA (international Livestock Centre for Africa):
ILCA has helped our Livestock Research Centres by supplying them with pasture germplasm (for both grasses and legumes).

6) Bilateral Intergovernmental Initiatives:

a) *EU*: the EU countries are currently funding research work at Zimbabwe's Horticultural Institute. The work is investigating on agronomic potentials of various indigenous fruit tree species.

b) *French Embassy*: The French government is currently financing a small scale AGRITEX project on exotic horticultural crops. The programme is aimed at improvement and extension of Horticulture in communal areas of Zimbabwe. There is at least one project in every province. The projects are currently experiencing some problems due to shortage of water as a result of the drought. Although these projects are currently focusing on exotic species, some most promising indigenous vegetable species could be promoted alongside these exotics.

c) *Zimbabwe-German Co-operation*: This project, known as the Vegetation Resources Information System (VegRIS) aims to establish an information system that will facilitate the sustainable management and utilisation of vegetation resources in our country.

7) Regional intergovernmental initiatives:

SADC states, which includes Zimbabwe, are now running a regional genebank that is based in Lusaka, Zambia. This regional centre is in turn helping individual member states in establishing and running their national plant genetic resources centres. This regional network on plant genetic resources centres is focusing on utilisation and conservation of regional plant resources and is getting financial help from the Nordic countries.

8) World Bank:

This Organisation has helped Zimbabwe in a number of ways. One area that is worthy of mentioning is financial assistance in gathering information on exploitation and management of indigenous forests in Zimbabwe. This has been done through the hiring of consultants who have written a book on policies of Forestry Management in Zimbabwe (World Bank Technical Paper No. 210).

9) Cornell International Institute of Food Agriculture and Development (CIIFAD):

This Institute is currently founding a project aimed at promoting the cultivation and utilisation of indigenous vegetables.

CHAPTER 7
National Needs And Opportunities

1) Our newly built National Genebank needs to be equipped with the following as a matter of priority:
   a) 12 anest type deep freezers
   b) One Oven Dual (2 x 1001)
   c) A Laboratory Disc Mill (seed grinder)
   d) Desiccator cabinet (225 x 200 x 168 mm)
   e) Electrical balances: capacities 600g and 1200g
2) Establishment of *in situ* conservation programme in which the National Genebank works closely with both the NGOs and farmers.
3) Training of staff in the fields of Conservation Biology, Ecology, Botany, Genetics, Biotechnology and Environmental lawyers.
4) Establishment of an information centre/library at the National Genebank. This library is vital for the dissemination of information to scientists, schools, and the general public.
5) Establishment of an institutional and legal framework that recognises the role of NGOs in plant genetic resources activities.
6) Wide-range collection of germplasm for both indigenous vegetables and indigenous crops. This should be supported with utilisation promotion.
7) A nation-wide inventory on the range and distribution of the national Biodiversity. This should be combined with the collection of the still under-collected areas.
8) Research on propagation on the fifty species that so far have proved impossible to grow is needed. At the same time continued effort and resources commitment is called for to make sure that propagation of the remainder of the natural flora in the Botanic Garden is completed.
9) In the area of forestry resources there is vast need to improve knowledge of natural forests in order to ensure their maximum exploitation but still maintaining the genetic diversity. There is also a need to boost the Forestry Commission's institutional capacity to support local initiatives in areas of

social forestry and woodland management. This could be easily achieved through strengthening its research capacity by way of training and linking it with other International Research Institutions.

CHAPTER 8
Proposal for a Global Plan of Action

The international community's endeavour to promote the conservation and utilisation of plant genetic resources should be rationalised (through A Global Plan of Action) to create an environment of co-operation among nations that is cognisant of the interdependence of nations in both conservation and utilisation of plant diversity. In this regard, the Global Plan of Action should reflect the provisions of chapters fifteen and sixteen of the Convention on Biological Diversity.

The following are some suggestions that Zimbabwe thinks may hold the key to the sustainable and equitable use of PGR and therefore should be an integral part to the core of the Global Plan of Action.

1. Development and establishment of a global protocol, which is binding, to become the mechanism and framework for global access to exchange of plant germplasm in line with the objective of chapter fifteen of the Convention on Biological Diversity which highlights the need for a fair sharing of the benefits of plant biodiversity conservation.
2. Establishment of a global fund to support the on-site conservation of the remnants of the rich plant diversity in developing countries.
3. Establishment of a FAO Commission on Plant Genetic Resources Technical Committee. Given the mandate of FAO on Food and Agriculture, which is to ensure food security (which is the basis of maintaining agricultural diversity) and it's well renowned apolitical stance in global issues, Zimbabwe proposes that FAO be tasked with the responsibility of seeing that fairness/equity prevails between the gene-rich South and the fund-rich North. The mandate of the above mentioned FAO Technical Committee should include, *inter alia*, the following:
    - to identify, recommend and develop criteria to be used in deciding which countries and what programmes shall receive financial assistance from the above mentioned international fund.
    - create an intergovernmental mechanism for technical and scientific co-operation in such areas as conservation and sustainable use of biological diversity, access to genetic resources and issues that relate to technology transfer like, for example, biotechnology.

- address implications related to Intellectual Property Rights (IPRs) and Patents as these impact on access to genetic resources by the indigenous communities through the developing of an acceptable framework or mechanism that recognises, rewards and protects the present and future contributions from indigenous peasant farmers towards the conservation of landraces as well as the supply of ethnobotanical information.

Unless the international community puts in place some economic incentives to deal with the problem of "public good characteristic" associated with the prevention of plant genetic erosion, the benefits of genetic conservation will remain a common property.

Consequently the demise of these resources will continue at local level as the countries endowed with these resources see no benefit in sacrificing development for sake of conservation whose benefits are so diffuse and long-term.

4. Develop guidelines designed to facilitate and promote access by farmers (who are the originators of these materials) to any plant material deposited in national, regional and international genebanks.

5. Promote development of PGR policy framework in countries where they currently do not exist (especially developing countries) with the view of encouraging participation of private sector, NGOs, Farmers' Organisations and Women's groups.

TABLE 1.3.1 Production Accounts of Agriculture, Forestry and Fishing: 1984-1992

Comodity	Value in Millions (Z$)
Tobacco	763.0
Grain Crops	243.1
Industrial Crops	404.1
Dry beans, Potatoes and Vegetables	49.0
Seed	40.0
Fruit	23.0
Cattle	247.0
Dairy Products	118.0
Poultry	122.0
Other Livestock	26.0
Fodder Crops	30.0
Other primary products: including fisheries, forestry and game skins	53.0

* SOURCE. Central Statistical Office (CSO) - Harare

FIGURE 1: MAP OF ZIMBABWE SHOWING THE BOUNDARIES OF ITS AGRO-ECOLOGICAL ZONES (NATURAL REGIONS)

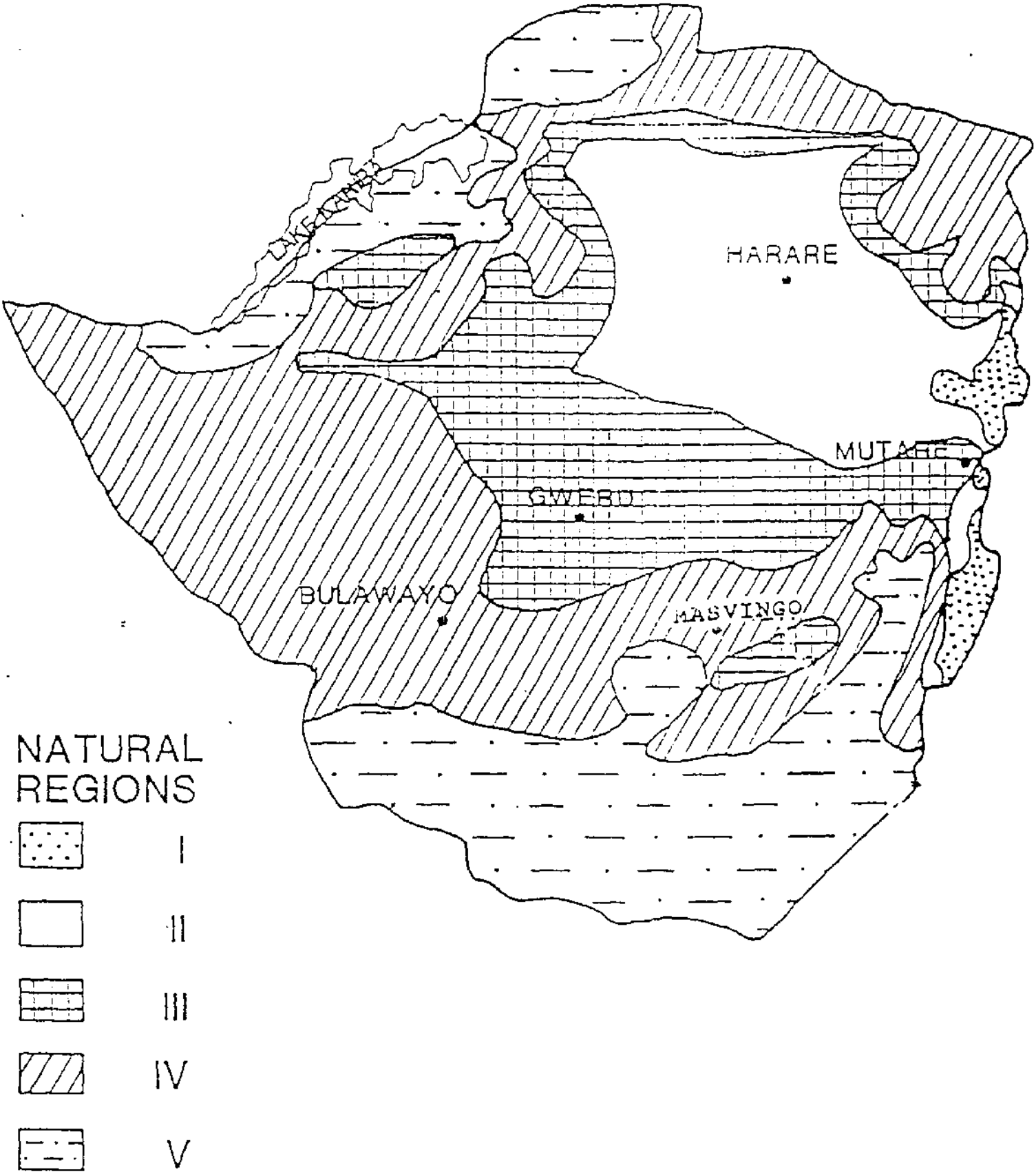

Figure 1: Map of Zimbabwe showing the boundaries of its agro-ecological zones (Natural Regions)

TABLE 1.4.1: Natural Regions

Attribute	Natural Regions (NR)				
	NR 1	NR 2	NR 3	NR 4	NR 5
Rainfall (mm/year)	over 1,000	750-1,000	650-800	450-650	Too low
Area in sq. km	7,000	58,600	72,900	147,800	104,400
Farming:					
a) Large Commercial Scale Land	74%	74%	49%	62%	45%
b) Communal Land	24%	22%	43%	34%	35%
c) Small Scale Commercial Land	2%		8%	4%	20%

TABLE 2.1 Numbers of some Woody Species Utilized in some Rural Areas of Zimbabwe for Various Uses Including Medicinal Purposes

Area	General Use				Medicinal Purposes		
	Fuel Wood	Building	Bark Rope	Fencing	Trees	Shrubs	Herbs
Mangwende	7	8	6	8	21	13	12
Chiundura	17	15	4	15	13	5	13
Ndanga	23	19	8	15	8	7	6
Maranda	9	5	5	7	7	4	1
Seukwe	9	10	9	14	9	5	3
Average	**13.0**	**11.4**	**6.4**	**11.8**	**11.6**	**6.8**	**7.0**

* After Whitlow (1979)

APPENDIX 1

List Some Endemic Tree Species Found In Zimbabwe

Species	Area
Adenia karibaensia	North (Zimbabwe Valley)
Aeschynomene aphylla	East
Aloe hazeliana	East
Aloe howmanii	East
Aloe orthlopha	Great Dyke
Aloe plowesii	East
Aloe wildii	East
Anisopappus paucidentatus	East
Barleria molensis	East
Centella obtriangularis	East
Clutia punctata	East
Convolvulus ocellatus var plicinervius	East
Crotalaria phylicoides	East
Dianthaus chimanimaniensis	East
Dissotis pulchra	East
Encephalartos manikensis	East
Erica lanceolifera	East
Erica pleiotricha	East
Erica wi1dii	East
Eriospermum phippsii	East
Erlangea westii	East
Euphorbia memoralis	Great Dyke
Euphorbia wildii	Great Dyke
Gazachloa chimanimaniensis	East
Helichrysus maestum	East
Helichrysum maestum	East
Helichrysum spencerianum	East
Hemizygia flabellifolia	East
Hemizygia oritrephes	East
Hesperantha ballii	East
Humea africana	East

List Some Endemic Tree Species Found In Zimbabwe

Species	Area
Impatiens salpinx	East
Leacas aggerestris	Great Dyke
Leacas hephaestis	Great Dyke
Lobelia cobaltica	East
Lotononis serpentinicola	East
Mesanthemum africanum	Great Dyke
Necepsia castaneifolia subsp. Chirindica	East
Pachycarpus graminifolius	East
Pavetta comostyla var. comostyla	East
Pearsonia metallifera	Great Dyke
Plectranthus caudatus	East
Protea crinita	East
Protea enervis	East
Pseudosbeckia swynnertonii	East
Rhynchosia stipata	East
Scadoxus pole-evansii	East
Struthiola Montana	East
Sutera fodina	Great Dyke
Swynnertonia cardinea	East
Thesium chimanimaniense	East
Thesium dolichomeres	East
Vellozia argentea	East
Vernonia accommodata	Great Dyke
Vernonia nepetifolia	East

* List compiled by Mr. Isac Mapaure of the National Herbarium, Harare

APPENDIX 2

Some Of The Common Indigenous Fruit Trees Of Zimbabwe

Scientific Name	Shona Name	Ndebele Name
Adansonia digitata	muuyu	umkhomo
Annona senegalensis	muroro	ububese
Azanza garckeana	mutohwe	uxaguxagu
Berchemia discolor	nyii	-
Ficus sur/capensis	muvonde	umkhiwa
Flacourtia indica	munhunguru	umqokolo
Lannea discolor	mugan'acha	umpwanda
Sclerocarya birrea	mupfura	-
Securinega virosa	muchagauwe	Sumhakawuwe
Strychnos spinosa	mutamba	ihlala/umngono
Syzygium cordatum	hute	imiswi/umdoni
Uapaca kirkiana	mushuku	umhobohobo
Vangueria infansta	nzviru	-
Vangueriopsis lanciflora	mutufu	umyiyo
Vitex payos	mutsubvu	umtshwankela
Ziziphus mucronata	muchecheni	umpakwe
Ziziphus mauritiana	masau	-

APPENDIX 3

Common Indigenous Vegetable Plants

Scientific Name	Shona Name	Ndebele Name
Amaranthus hybridus	mowa guru/bononGwe	imbuya
Amaxanthus thunberrgii	mowa	imbuya
Cleome gynandra	nyevhe/runi	elude
Cleome monophylla	mujakari	-
Corchorus olitorius	gwisha/nyenje/gusha	idelele
Sonchus oleraceus	rurimirwemombe	ulimilnkomo
Celosia trigyna	mundawarara	isihlabe
Triumfetta annua	derere renama	inama
Vigna anguiculata	nyemba	indumba
Senecio erubescens	chirevereve	-
Solanum nigrum	musungusungu	umsobo
Bidens pilosa	muuwu/nhungunira	ucucuza
Galinsoga parviflora	teketera	-
Hibiscus articulatus	derere rehambakachera	idelele

APPENDIX 4

Pasture Legume Germplasm Held At Henderson Research Station

Species	Number of Accessions
Acalla sp.	1
Aeschynomene sp.	10
Alysicarpus sp.	2
Arachis sp.	2
Cajanus sp.	2
Cassia sp.	8
Centrosema sp.	5
Chaemacrista sp.	1
Clitoria sp.	2
Crotalaria sp.	5
Codariocalyx sp.	2
Desmodium sp.	7
Glen giant vetch sp.	1
Indigofera sp.	7
Lablab sp.	7
Lespedeza sp.	7
Lotononis sp.	4
Lotus sp.	4
Macroptilium sp.	11
Macroptyloma sp.	9
Medicago sp.	4
Neonotonia sp.	6
Rhynchosia sp.	1
Rothia sp.	1
Sesbania sp.	1
Sphenostylis sp.	13
Tephrosia sp.	2
Teramnus sp.	4
Trifolium sp.	34
Vigna sp.	31
Zornia sp.	1
Total	***196***

APPENDIX 5

Pasture Legume Germplasm Held At Grassland Research Station

Species	Number of Accessions
Acacia spp.	9
Aeschynomene spp.	20
Acrocarpus spp.	1
Arachis spp.	2
Atriplex spp.	1
Atragalus spp.	1
Albizia falcataria	1
Alysicarpus spp.	10
Antopititia abyssinica	1
Crotolaria spp.	8
Cassia spp.	17
Cajanus spp.	17
Canavalia ensiformis	1
Centrosemma spp.	29
Covonilla varia	1
Codariocalyx spp.	2
Clitoria ternatea	1
Desmodium spp.	81
Desmanthus spp.	13
Dolichos spp.	5
Dwarf dahl	1
Eriosema spp.	4
Flemingia macrophylla	1
Galacta spp.	4
Glycine spp.	38
Indigofara spp.	30
Kotschya spp.	6
Lab lab spp.	46
Leucaena spp.	28
Lin seed	1
Lupinus spp.	10

Pasture Legume Germplasm Held At Grassland Research Station

Species	Number of Accessions
Lespedeza spp.	1
Lotus spp.	4
Lotononis spp.	5
Medicago spp.	45
Macrotyloma spp.	4
Macroptilium spp.	11
Mukuna puriens	4
Melilotus spp.	1
Neonotonia spp.	8
Onobrychis spp.	2
Phaseolus spp.	6
Psoralea spp	5
Pseudarthria spp.	5
Pueraria phaseoloides	1
Rothia hirsuta	1
Rhynchosia spp.	14
Serradella spp.	3
Sesbania spp.	9
Sphenstylis spp.	2
Stylosanhes spp.	21
Trifolium spp.	20
Trigonella foenum-graecum	5
Gotalaria juricea	1
Turbina shirensis	1
Teraminus spp.	8
Tephrosia spp.	9
Vigna spp.	58
Zonia spp.	5
Total	***649***

APPENDIX 6

Pasture Grass Germplasm Held At Henderson Research Station

Species	Number of Accessions
Acrocerus spp.	1
Axonopus spp.	1
Bothriocloa spp.	10
Brachiaria spp.	13
Cenchrus spp.	12
Cynodon spp.	86
Dicattium spp.	3
Digitaria spp.	17
Echinochloa spp.	1
Eragrostis spp.	4
Hymenachne spp.	1
Hybrid Ray Grass	1
Lolium spp.	1
Panicum spp.	12
Paspalum spp.	7
Pannisetum spp.	11
Setaria spp.	13
Urochloa spp.	12
Sorghum Hybrid	1
Vasey grass	1
Total	***209***

APPENDIX 7

Pasture Grass Germplasm Held At Grassland Research Station

Species	Number of Accessions
Amaranthus spp.	1
Avena sativa	1
Bracharia spp.	13
Cenchrus spp.	6
Panicum spp.	26
Setaria spp.	4
Total	***51***

Acknowledgment

The authors are indebted to the following organisations and people and acknowledge with profound gratitude their co-operation in the information gathering process that preceded the writing of this report.

Mr. **Utete**
Mrs. **Chasi**
AGRITEX

Mr. **C. Gonese**
AZTREC TRUST

Dr. **K. Mashingaidze**
Africa University

T.A. Mushita
R. Mupande
COMMUTECH

Mr. **G.B. Jones**
Cotton Research Centre

Dr. **A. Mashiringwani**
Dr. **S.A.M. van Oosterhout**
Dr. **O. Mukoko**
Mssrs. **G.N. Sithole**
P. Nyakanda
R. Madamba
L. Macida
T. Rukweza
S. Musendo
E. Gwata
M. Hiunwgani
N. Mangombe
Crop Breeding Institute

Messrs **D. Macheche**
M. Masoka
T.W. Ndiripo
ENDA-Zimbabwe

Mr. J. Turner
Fambidzanayi Permaculture

Messrs **C. Marunda**
D. Rukuni
J. Nyoka
Training Centre Forestry Research Centre

Messrs **L. Lungu**
G.T. Manyawu
Miss **R. Muchadeyi**
Grasslands Research Station

Mrs. **M. Moyo**
Mr. **J. Mkwena**
Henderson Research Station

Mr. **I. Mapaure**
National Herbarium and Dr. T. Muller Botanic Garden

Dr. **E. Mpandi-Khosa**
Development Centre 2Southern Centre for Energy

Dr. **S. Maya**
Environment Scientific & Industrial Research

Mr. **L.T.V. Cousins**
Tobacco Research Board

Dr.P.Tongoona
University of Zimbabwe

Mrs. M.T. Kavi
Zimbabwe Farmers Union

Special thanks go to Messrs **T.A. Mushita** and **R. Mupande** of COMMUTECH for they have not only contributed with some brilliant ideas but also generously offered their time to proof read this document.

Abbreviations

CBI	Crop Breeding Institute
CIMMYT	International Maize and Wheat Improvement Centre
DR & SS	Department of Research and Specialist Services
GNP	Gross National Product
ICRISAT	Internati nal Crops Research Institute for the Semi-Arid Tropics
ILCA	International Livestock Centre for Africa
IPGRI	International Plant Genetic Resources Institute
IPRs	Intellectual Property Rights
LSCS	Large Scale Commercial Sector
NGOs	Non-governmental organisations
PGR	Plant Genetic Resources
SAREC	Swedish Agency for Research and Cooperation in Developing Countries
SSCS	Small Scale Commercial Sector
TRB	Tobacco Research Board
ZSAES	Zimbabwe Sugar Association Experiment Station
AGRITEX	Agricultural Technical and Extension Services
EU	European Union
ZFU	Zimbabwe Farmers Union
VegRIS	Vegetation Resources Information System

References

Akerele, O. (1992). Importance of medicinal plants: WHO's Programme. pp 63-77. In: Natural Resources and Human Health: Plants of Medicinal and Nutritional Value. Shigeaki Baba, Olayiwola Akerele and Yuji Awaguchi (eds). Elsevier Science Publishers B.V., Amsterdam.

Tredgold, M.H. (1986). Food Plants of Zimbabwe. Mambo Press.

Whitlow, J.R. (1979). The Household Use of Woodland Resources In Rural Areas. Department of Natural Resources, P.0. Box 8070, Causeway, Zimbabwe.

Mavi, S. (1993). Medicinal Plants and Their Uses in Zimbabwe. In: Botanical Diversity in Southern Africa. p 169-173, B.J. Hunley (ed.). National Botanic Institute, Pretoria.

Muller, T. (1994a). Consultancy on the distribution, classification and conservation of rain forest in eastern Zimbabwe, Forestry Commission, Harare.

Muller, T. (1994b). Identifying and Describing Areas for vegetation conservation in Zimbabwe. In: Botanical Diversity in Southern Africa, p 125-139, B.J. Hunley (ed.) National Botanic Institute, Pretoria.

Muller, T. and **J. Timberlake** (1992). Areas for Plant conservation in Zimbabwe. The Zimbabwe Science News Vol. 26 Nos. 10/12 October/November. pp 88-95.

Muller, T. (1993). The Role a Botanical Institute Can Play in the Conservation of the Terrestrial Biodiversity in a Developing Country. Biodiversity and Conservation 3, 116-125.

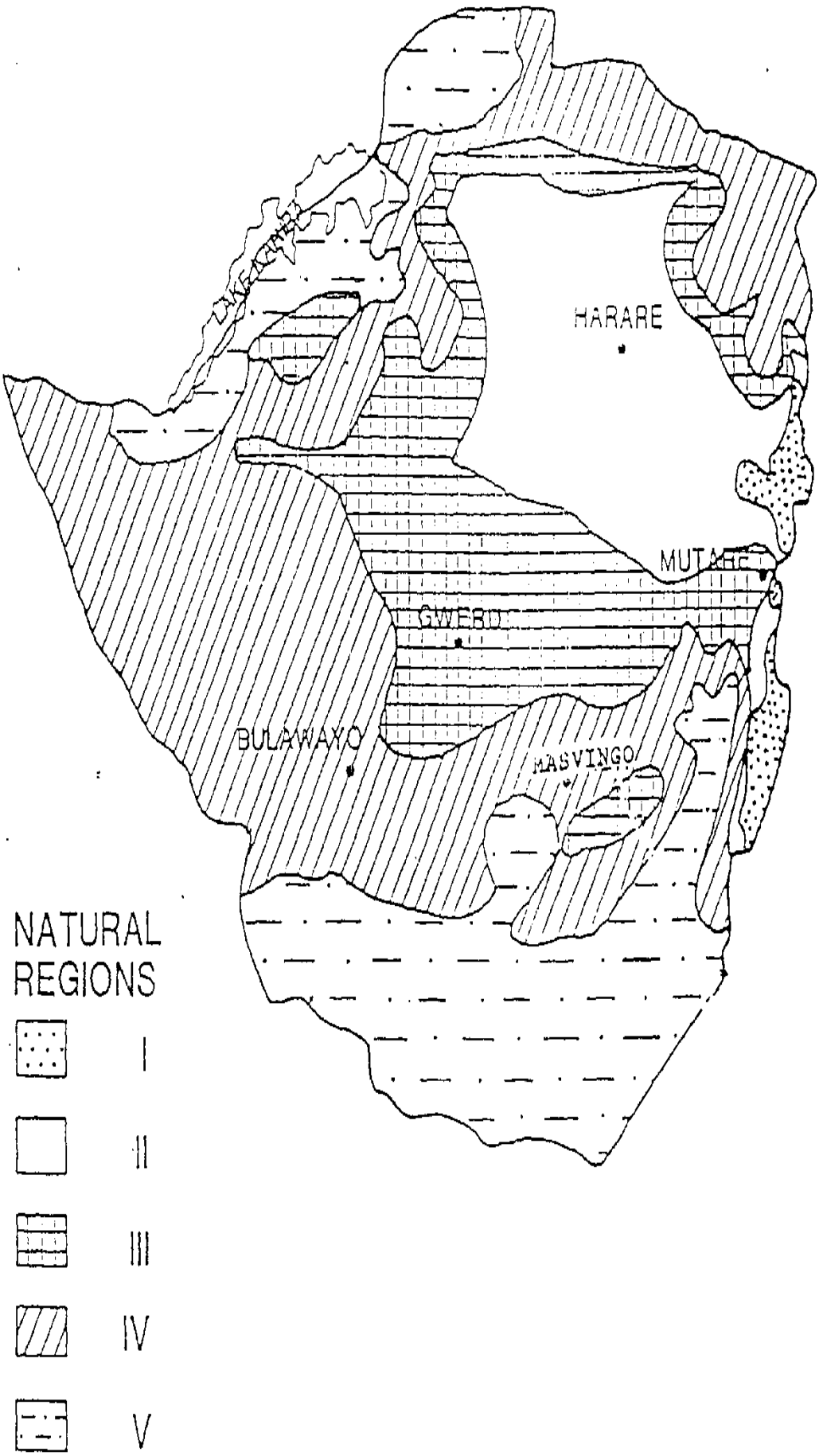

Figure 1: Map of Zimbabwe showing the boundaries of its agro-ecological zones (Natural Regions)