STATE OF PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE IN ZIMBABWE

(1996-2008)

A Country Report

Department of Agricultural Research for Development, Ministry of Agriculture, Mechanization and Irrigation Development

March 2009

COMPILATION OF REPORT

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FOREWORD

The ground work for this report was laid in September 1995 when the Ministry of Agriculture submitted its country report to FAO for the proceedings of the 4th International Techical Conference on Plant Genetic Resources in Leipzig, Germany in 1996. That report, together with 153 others, was consolidated into a world report.

In September 2008 the Ministry again, responded to the call for the 2nd Country Report by the 9th regular session of the Governing Council of the Commission on Genetic Resources for Food and Agriculture by embarking on an elaborate exercise that was initiated by the Department of Agricultural Research for Development ($DAR_{for}D$). The process started with the drafting of questionnaires in accordance with FAO guidelines and the search for a local consultant.

As soon as the consultant was engaged in December 2008, extensive consultations started with various stakeholders in government departments, private companies, quasi-government and Private Voluntary Organizations (PVOs). These consultations and responses to the questionnaires resulted in the production of a zero draft that was refined with the assistance of an international consultant and reviewed at a national workshop in March 2009. At the workshop, the draft report was subjected to scrutiny by a combination of group work and plenary.

This report is, therefore, an accurate reflection of the status of Zimbabwe's plant genetic resources for food and agriculture and will hopefully be useful in assisting national, regional and global efforts to enhance food security, rural and institutional development and sustainable agriculture.

Ngoni Masoka
Secretary for Agriculture, Mechanization and Irrigation Development

EXECUTIVE SUMMARY

Zimbabwe is a Southern African landlocked country situated between 15°40" and 22° 30" south and 25° 15" and 33° 05" east latitudes and covering in the region of 39 million hectares. The country is bordered by Botswana to the west, Mozambique to the east and north east, South Africa to the south and Zambia to the north (Figure 1). Namibia's Caprivi Strip touches the western border at the intersection with Zambia. To the north of Zimbabwe flows the Zambezi River and the southern border is bounded by the Limpopo River which are the main drainage systems of the country. The country can be divided into three phytogeographic regions namely the Afromontane, the East African coastal, and the Zambesian. The Zambesian region covers over 95% of the country comprising five woodland types - acacia, miombo, mopane, teak, and Combretaceae. It has been estimated that Zimbabwe has about 6 000 indigenous plant species representing approximately 1 500 genera and 200 families.

Although Zimbabwe lies within the tropics, its climate is sub-tropical being tempered by altitude. The climate and ecological conditions support a varied range of flora and fauna which play a critical role in the social, economic and environmental well-being of the country. The rainfall pattern, together with altitude, and geology determine the five natural regions (NR) of Zimbabwe. NR I has an annual rainfall of over 1000 mm and is suitable for forestry-based activities, agriculture and intensive livestock production, and crops such as tea and coffee are grown in the frost free areas. NR II has an annual rainfall of 800 -1000 mm and is suitable for intensive crop and pasture production and in normal rain fall seasons accounts for about 90% of the country's annual crop output. NR III has an annual rainfall of 650 – 800 mm and is recommended for livestock based production systems supplemented by short season and drought tolerant crops like sorghum, millet and root crops. NR IV has an annual rainfall of 450 – 650 mm and is suitable for livestock ranching and wildlife management and utilization. Lastly, NR V has an erratic annual rainfall of less 450 mm and is mostly utilized for extensive cattle and game ranching.

Land is recognized as the key to food security in Zimbabwe and agriculture is the cornerstone of the Zimbabwean economy. About 60% of the economically active population depends on it for food and employment. Women play an important role in agriculture and it is estimated that 70% of small-scale farmers are women. The agricultural sector accounts for about 11-14% of the country's gross domestic product, 60% of the raw materials required by the manufacturing industry and 40 % of total export earnings.

Agricultural products in Zimbabwe fall into four broad categories. These are the grain and cereals group consisting of maize, wheat and the small grains such as sorghum and millet. The second group comprises the major export crops such as tobacco and cotton, the third group oil seed crops featuring soyabean, sunflower and groundnuts and the final group is composed of plantation and horticulture crops such as sugarcane, tea, coffee, citrus, flowers and vegetables.

Cultivated crops cover almost a third of the land area of Zimbabwe. Major grains and cereals in Zimbabwe are maize (*Zea mays*) which is the staple of the country accounting for 47% of the calorie intake, sorghum (*Sorghum spp*) which is a principal food source for marginal areas with erratic rainfall and poor soils and wheat (*Triticum spp*). Small grains such as pearl millet (*Pennisetum glaucum*), finger millet (Eleusine *coracana*), and rice (*Oryza sativa*) also contribute significantly to the diets of the local people.

The horticultural crops in Zimbabwe can conveniently be classified into six groups; temperate fruits, tropical fruits, leaf vegetables, fruit vegetables, roots and tuber and flowers. Due to its temperate and sub-tropical climate, the country produces a wide variety of fruit such as apples, pears, peaches, plums, apricots, nectarines, grapes, strawberry, and kiwi. Other fruits and agricultural products include oranges, nartjies, lemons, bananas, litchis, mangoes, sugarcane, and coffee. In this broad group are minor crops such as sunflower (*Helianthus annus* – 800 exotic lines and 1440 locally bred), castor bean (*Ricinus communis* 85 accessions) and coffee (*Coffea arabica* - 133 accessions with 6 wild species). Sugarcane (660 accessions) is grown in the South-Eastern parts of the country in NR IV and V. However, sugar production has declined in recent years resulting in a shortage of the product on the local market.

Poverty levels in Zimbabwe increased dramatically in the last ten years. In 1997 about 25.5% of the population lived below the poverty datum line but estimates from 2008 suggest that over 75% of people are living in poverty. Annual inflation in August 2008 was officially at 231 million percent, the highest in the world and unemployment was above 80% There are a number of factors that have contributed to this situation among them successive droughts, poor investment in production, equipment and fertilizers, seed unavailability, inappropriate and sometimes lack of production and pricing policies, veld fires on plantations, socio-economic and political instability, the fast track land reform programme that began in 2000, and a serious shortage of labour in the agricultural sector. As a result, the country has not been able to produce enough food to feed its people for the past eight years.

The national Biodiversity Strategy and Action Plan (BSAP) of 1998 clearly articulated the status and needs of the country in the area of biodiversity conservation and utilization. Although Zimbabwe has not developed procedures to monitor and measure genetic erosion at national level some progress has been made in carrying out inventories and surveys of the rich diversity of plant genetic resources. As a result of the economic problems currently being faced in the country, no significant activities have been undertaken with reference to *in situ* and *ex situ* biodiversity conservation. In the short term, sustainable land utilization and maintenance of agro-biodiversity requires agricultural, land and economic policy measures that will boost productivity and investment. Policies that promote the utilization of indigenous varieties also need to be formulated and activated. Promotion of conservation farming and low input agriculture will also encourage the preservation of Plant Genetic Resources (PGR). Linkages need to be forged between organizations involved with biodiversity matters so that coordinated surveys and inventories of PGRFA can be carried out.

Although there has been considerable genetic erosion of traditional crops, there are still areas where sorghum, millet and legume diversity is still evident. In some of these areas, community seed banking still exists and these regions could be targeted for conservation initiatives. Such initiatives could include improved on-farm storage facilities and storage methods developed in conjunction with the farmers themselves in order to use and conserve of traditional varieties. There are no official national programmes for the prevention or control of genetic erosion *in situ.* Against this background, the survey and inventorying of plant genetic resources needs to be carried out. The contribution and involvement of the "keepers of biodiversity" is a prerequisite. The inventorying would provide a baseline for monitoring and establishing an early warning mechanism in order to arrest genetic erosion where detected.

The management of *ex situ* collections of PGR in Zimbabwe is conducted in a decentralized manner by various players that include the public sector, parastatals, private sector, NGOs and individuals, particularly farmers, with the Genetic Resources and Biotechnology Institute (formally known as the National Genebank of Zimbabwe) as the lead organisation. The GRBI is currently holding 3 464 accessions of PGR in 24 freezers operating at -18^0C. Storage facilities in most other public and some private organisations involved in ex-situ management are not fully functional. In general more that 60% of all *ex-situ* conserved germplasm in Zimbabwe requires immediate regeneration in order to rescue the materials and this includes accessions in the Genebank. Most of the accessions in Zimbabwe lack safety duplication at national level (GRBI) and regional level (SPGRC). Characterization and documentation of PGR is very slow and incomplete to the extent that some organizations do not know what materials they are holding. The main constraints in *ex situ* management are inadequate staffing levels coupled by a high staff turnover and shifts in budget priorities. Policy makers need to be made aware of the need for increased funding for *ex-situ* conservation and for capacitating GRBI to coordinate more efficiently PGR conservation in Zimbabwe. Furthermore, priority should also be given to promoting and enhancing conserved PGR utilization by breeders and farmers.

The demand for *ex-situ* collections at GRBI is low. Potential users of the materials are either not aware of the facility or the *ex-situ* collections do not have adequate information required by researchers and breeders. Characterization has been targeting morphological characteristics and agronomic traits over the years but progress has been very slow. Molecular characterization and evaluation of bio-physical traits is also lagging behind. There are efforts to promote on-farm conservation through utilization of marginalized crops in Zimbabwe.

There are both formal and informal seed systems in existence in the country. The formal system is made up of seed companies that are centrally coordinated by the Zimbabwe Seed Trade Association (ZSTA). However, seeds are regulated by DARS under the Ministry of Agriculture through the Seed Act (Chapter 19:13 of 1971) and the Plant Breeders Rights Act (Chapter 18:16). The informal seed supply system involves the saving and sharing of seed by family, friends and neighbours and scales up to local markets at national level. This supply system hinges on the cultural heritage principle where farmers save, sell and exchange germplasm amongst themselves. There are also some NGOs involved in the informal seed supply system of Zimbabwe. They distribute seed to farmers

through seed fairs and seed pack handouts. There are, however, no specific policies that promote farmers' rights to sell their germplasm on formal markets.

The GRBI in collaboration with NGOs, universities and farming communities leads efforts in the training programmes on both *in situ* and *ex situ* management in Zimbabwe. Funding of these programmes is done by both the public and private sector although it is limited. To support these programmes, Zimbabwe has put in place legislation to regulate access to PGRs. However, there is no clear legal framework regulating the same. This status quo requires support of the GRBI to establish the information center and funding of database formulations, management and documentation. There is also need to streamline PGR activities in the education curriculum and support the establishment of an institutional and legal framework and policy on PGR including the harmonization of existing laws, policies, standards and procedures related to PGR.

Zimbabwe participates in a number of both regional and international networks. At the regional level it mainly collaborates with the SPGRC, SABPI, SARRNET, and the Southern Africa Biodiversity Support Programmes on aspects of PGR legislation, incentive measures for conservation, participatory plant breeding/participatory varietal selection programmes on small grains and indigenous vegetables. At the international level, Zimbabwe collaborates mainly with the CBDC, CGIAR, ICRISAT, CIMMYT, ILCA, IITA, Bioversity International and IRPI initiatives on the same issues as indicated above, including the development of appropriate technologies for agro-biodiversity conservation through supporting seed banks and seed fairs. However, for the country to fully benefit from this collaboration there is need to support exchange programmes, collaborative research, databases and websites creation for both *in situ* and *ex situ* collections and link these initiatives to Farmers' Unions in existence within the country.

The two related issues of access to genetic resources and benefit sharing have been widely discussed for more than 15 years in Zimbabwe. Yet there is still no comprehensive Act regulating the same but only a number of laws related to access to PGR. However, exchange of PGR from both *in situ* and *ex situ* collections and improved varieties is being done at both the national and community level without the supporting legislative framework, a situation which may lead to biopiracy. In order to facilitate access there is need to document and register the available seed and crop varieties; support PPB/PVS activities and develop a legal framework that harmonizes plant breeders' rights and farmers' rights.

ACKNOWLEDGEMENTS

The report compilation team gratefully acknowledges the support of the Directorate of the Department of Agricultural of Agricultural Research for Development ($DAR_{for}D$) in the Ministry of Agriculture, Mechanization and Irrigation Development throughout the implementation of this project. The comments and assistance rendered by members of the National Steering Committee and the National Genetic Resources Committee are also acknowledged.

Thanks are due to various organizations and individuals who contributed information used in this document and to enumerators who assisted in gathering information through questionnaires.

The team is grateful to the Food and Agriculture Organization (FAO) of the United Nations for financial and technical assistance during the compilation of this report and also to Dr R.C. Agrawal, the FAO consultant, for the review of the document and for his insightful and helpful comments on his visit to Zimbabwe.

Special thanks are also due to friends and colleagues who critically evaluated this report.

ABBREVIATIONS

AIBST	African Institute of Biomedical Science Technology
ARDA	Agricultural and Rural Development Authority
CBD	Convention on Biological Diversity
CBDC	Community Biodiversity Development and Conservation
CBI	Crop Breeding Institute
CEPA	Center for Environmental Policy and Advocacy
CFU	Commercial Farmers Union
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	International Maize and Wheat Improvement Center
CLFPA	Communal Lands Forest Produce Act
CTDT	Community Technology Development Trust
CVL	Central Veterinary Laboratory
$DAR_{for}D$	Department of Agricultural Research for Development
DARS	Department of Agricultural Regulatory Services
EMA	Environmental Management Act
FAO	Food and Agricultural Organization
FOSUP	Farmer Support Organization
FTLRP	Fast Track Land Reform Program
GDP	Gross Domestic Product
GRBI	Genetic Resources and Biotechnology Institute
HURID	Institute of Human Rights and Intellectual Property Development
ICRISAT	International Crops Research Institute for Semi-Arid Tropics
IITA	International Institute of Tropical Agriculture
ILCA	International Livestock Centre for Africa
IPGRI	International Plant Genetic Resources Institute
IPPC	International Convention on Plant Protection

IRRI	International Rice Research Institute
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
NBA	National Biotechnology Authority of Zimbabwe
NETCAB	IUCN Regional Networking & Capacity Building Initiative
NGOs	Non Governmental Organizations
NPGRC	National Plant Genetic Resources Committee
NPPO	National Plant Protection Organization
NR	Natural Regions
NUST	National University of Science and Technology
PGR	Plant Genetic Resources
PGRFA	Plant Genetic Resources for Food and Agriculture
PQS	Plant Quarantine Services
PRECIS	Pretoria Computerization Information System
SABONET	Southern African Botanical Diversity Network
SABPI	Southern Africa Biodiversity Initiative
SACCAR	Southern Africa Centre for Co-operation in Agriculture and Natural Resource Research and Training
SAFIRE	Southern Alliance for Indigenous Resources
SARRNET	Southern Africa Root Crops Research Network
SPGRC	SADC Plant and Genetic Resources Centre
TRIPS	Trade Related Intellectual Property Rights
UPOV	International Union for the Protection of New Plant Varieties
UZ	University of Zimbabwe
ZCFU	Zimbabwe Commercial Farmers Union
ZFU	Zimbabwe Farmers' Union
ZSTA	Zimbabwe Seed Trade Association

INTRODUCTION

BACKGROUND INFORMATION

Zimbabwe's location

Zimbabwe is a Southern African landlocked country situated between 15°40" and 22° 30" south and 25° 15" and 33° 05" east latitudes and covering in the region of 39 million hectares. The country is bordered by Botswana to the west, Mozambique to the east and north east, South Africa to the south and Zambia to the north (Figure 1). Namibia's Caprivi Strip touches the western border at the intersection with Zambia. To the north of Zimbabwe flows the Zambezi River and the southern border is bounded by the Limpopo River which are the main drainage systems of the country. A high proportion of the land mass totaling around 80% is at an altitude of at least 600 metres, with the remainder below this level. An interesting feature of Zimbabwe's topography is the central plateau running from the northeast and narrowing towards the southwest referred to as the Highveld which is about 650 km long and 30 km wide. On either side of the Highveld is the Middleveld which ranges between 600 and 1 200 metres above sea level and extends towards the northwest. The Lowveld is comprised of the lowest points in the country that are below 600 metres. These regions are found along the Zambezi valley and the area between the Limpopo and Save Rivers. The Highveld represents about 24% of the land area and the Middle and Low Veld cover 40.5% and 35.5% respectively. Along the border with Mozambique are ranges of mountains known as the Eastern Highlands rising above 1 800 metres amongst which is Mount Inyangani, the highest point in the country at 2 592 metres.

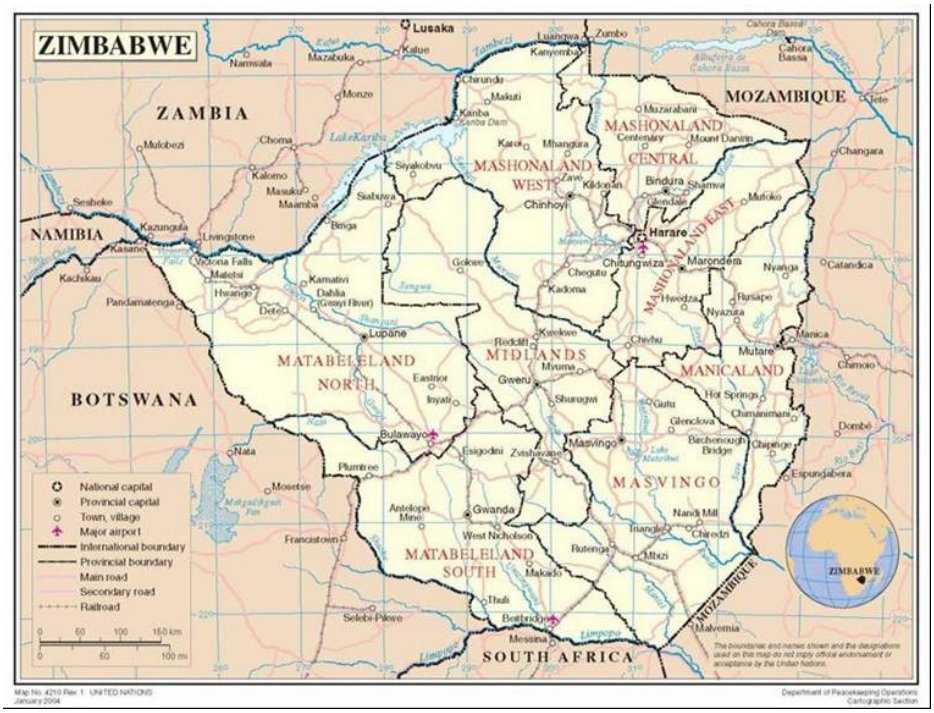

Figure 1: A Map of Zimbabwe

Source: Surveyor General Zimbabwe

Soils

Approximately 70% of Zimbabwe's soils were derived from granite and are sandy and light textured with little inherent agricultural potential. These soils are low in nitrogen, phosphorous, sulphur and in cation exchange capacity. However, there are areas across the country with soils that are derived from basic igneous material and thus have greater clay content making them more suitable for agriculture. The extreme west of the country has large tracts of deep Kalahari sandy soils which have very low agricultural potential.

Climate

Although Zimbabwe lies within the tropics, its climate is sub-tropical being tempered by altitude. The climate is also subject to maritime influence from the Mozambique Channel, influence of the mid-continental high pressure (the Botswana upper high) and the volatile, warm, moist conditions of the inter-tropical convergence zone. The climate and ecological conditions support a varied range of flora and fauna which play a critical role in the social, economic and environmental well-being of the country. Rainfall is the major climatic factor influencing the performance of sectors such as agriculture, forestry, wildlife and aquatic life in Zimbabwe. The rainy season begins around the 15th of November and usually tails off in March. This is followed by a cool dry season from April to mid - August with October and November being the hottest months. As a result of altitude, temperatures rarely go above 33℃ in the hot season and below 7℃ during the day in the cool months. Annual rainfall ranges from an average of below 400 mm in the low lying areas to over 900 mm over the central watershed and 1500 mm in parts of the Eastern Highlands. The rainfall pattern, together with altitude, and geology determine the five natural regions (NR) of Zimbabwe as shown in Figure 2.

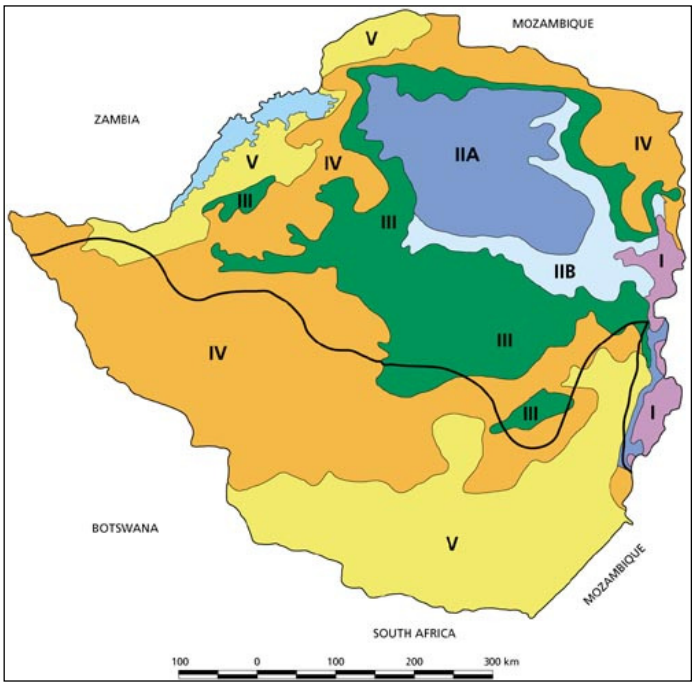

Figure 2: Zimbabwe's Agro-ecological Regions

Source: Vincent V. and Thomas R.G. 1960

NR I (5 835 km^{2}) has an annual rainfall of over 1000 mm in all months. This region is suitable for forestry-based activities, agriculture and intensive livestock production, and crops such as tea and coffee are grown in the frost free areas.

NR II (72745 km$^{2)}$ has an annual rainfall of 800 -1000 mm usually confined to summer. This region is suitable for intensive crop and pasture production and in normal rain fall seasons accounts for about 90% of the country's annual crop output.

NR III (67 690 km$^{2)}$ has an annual rainfall of 650 – 800 mm. The area is subject to seasonal drought. The region is recommended for livestock based production systems supplemented by short season and drought tolerant crops like sorghum, millet and root crops.

NR IV (128 370 km$^{2)}$ has an annual rainfall of 450 – 650 mm and is subject to frequent seasonal droughts and severe dry spells during the rainy season. The region is suitable for livestock ranching and wildlife management and utilization.

NR V (112810 km$^{2)}$ has an erratic annual rainfall of less than 450 mm. The region is suitable for extensive cattle and game ranching.

Water Resources

There are few perennial rivers in Zimbabwe and the country has no natural lakes. Most farming is, therefore, practiced in the rainy season. Zimbabwe is marginal for agricultural production and has considerably invested in dam construction. Rain water is stored in a variety of dams and lakes totaling over 8000 and with a storage capacity of approximately 4 900 million cubic metres. Underground water sources are used fairly extensively for irrigation purposes, principally in the drier areas. The overall groundwater resource is small when compared to estimates of surface water resources, mainly because the greater part of Zimbabwe consists of ancient igneous rock formations where groundwater potential is comparatively low.

Vegetation

The Zimbabwean landscape is characterized by savanna woodland interspersed with open grasslands and the dambos (seasonally water-logged low lying areas) of the central watershed area. Sub-tropical forests occur in the Eastern parts of the country. The country can be divided into three phytogeographic regions namely the Afromontane, the East African coastal, and the Zambesian. The Zambesian region covers over 95% of the country comprising five woodland types - acacia, miombo, mopane, teak, and Terminalia Combretaceae The Miombo woodlands dominate over 60% of the forest areas in Zimbabwe and are composed primarily of *Brachystegia* species with *Julbernadia globiflora*. Many tree species in these woodlands are economically important and are used for timber, poles, firewood, fruit and medicines. The Eastern Highlands are part of the Afromontane region and have the highest level of endemism, particularly in the Chimanimani Mountains. It is estimated that the total flora of Zimbabwe numbers approximately 5930 taxa. Zimbabwe's vegetation distribution is shown in Figure 3.

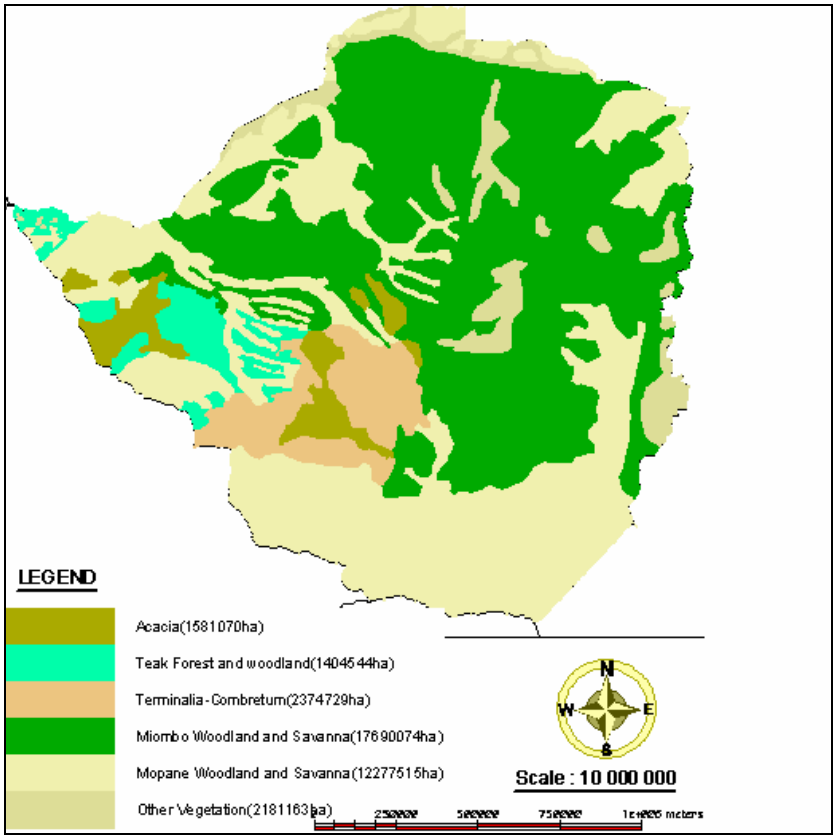

Figure 3: Vegetation Classification in Zimbabwe

Source: Forestry Commission of Zimbabwe

Human Population

The last population census was done in 2002 and the human population then was 11.6 million. In 2007, the United Nations estimated that the population of Zimbabwe was 13.34 million with those aged between 15 and 49 totaling 6.92 million. The population growth rate was estimated at 0.6% in the period 2005-2010. The HIV/AIDS pandemic has had a significant impact on the population of Zimbabwe. HIV/AIDS related deaths peaked in the years 1997/8 but figures released by UNAIDS/WHO in 2008 indicated that the adult population (older than 15 years) living with HIV had dropped from approximately 1.9 million in 2001 to 1.3 million in 2007.

Information supplied by the Population Reference Bureau in 2001 indicated that 65% of the population was rural. Harare, the capital city had a population of approximately 1.7 million

There are more people per unit area (65 per square kilometer) in the wetter areas (NR I and II) than in the drier areas (NR III – V), 11 people per square kilometer in NR V. Large tracts of land have been opened up for settlement and cultivation leading to land degradation. The

high density of population in areas around urban and rural service centres has also impacted negatively on biodiversity.

In common with other developing countries, Zimbabwe has high poverty levels. In 1997 about 25.5% of the population lived below the poverty datum line but estimates from 2008 suggest that over 75% of people are living in poverty. Annual inflation was officially at 231 million percent in August 2008, the highest in the world and unemployment was above 80%. There are a number of factors that have contributed to this situation among them successive droughts, poor investment in production, equipment and fertilizers, seed unavailability, inappropriate and sometimes lack of production and pricing policies, veld fires on plantations, socio-economic and political instability and a serious shortage of labour in the agricultural sector. As a result, the country has failed to produce enough food to feed its people for the past eight years.

Land Tenure

Prior to 2000, the agrarian structure in Zimbabwe was characterized by the coexistence of four different land tenure systems namely communal areas, resettlement areas, large-scale commercial and small-scale commercial farms. This classification was determined by factors such as agro-ecological aspects, farm sizes, crop and livestock production systems and levels of technology use.

It is estimated that 70% of all fertile arable land at independence in 1980, was held by a minority group of white commercial farmers and by 1994, only 400 of the 4400 registered large-scale commercial farmers were indigenous. In an attempt to redress the existing land imbalances, the government of Zimbabwe embarked on a Fast Track Land Reform Program (FTLRP) from 2000. The massive land redistribution programme resulted in thousands of hectares of land being unalienated by the state using the Land Acquisition Act. The Act empowered the government to compulsorily acquire land for redistribution to the landless indigenous people. Two farm models were adopted, namely A1 and A2 (Figure 1). The A1 model farms are based on the village concept, with shared residential and grazing areas, but separate farming areas. A2 farms are much larger and are expected to engage in commercial farming. The new landowners requested the government to provide to grant secure tenure for the acquired land in order to unlock the investment potential of the holdings for sustainable production. The government responded by adopting a 99-year leasehold as the type of land tenure for the acquired A2 model farms. The other forms of land tenure are still recognized in the country.

Table 1: The status of land redistribution into A1 and A2 models as a result of the Fast Track Land Reform Programme

Province	A1 resettlement			A2 resettlement		
	No of farms	Area (ha)	Beneficiaries	No. of farms	Area (ha)	Beneficiaries
Manicaland	240	215,427	11,921	211	102,215	1,040
Mashonaland Central	340	568,197	14,939	319	259,489	2,243
Mashonaland East	446	437,269	26,027	370	314,233	4,512
Mashonaland West	772	811,033	25,501	665	873,111	4,269
Masvingo	219	750,563	26,400	166	341,000	1,160
Matabeleland North	263	520,214	8,311	142	259,659	230
Matabeleland South	226	383,140	9,839	145	288,324	574
Midlands	240	451,242	17,760	262	243,611	828
Total	2,740	4,137,085	140,698	2,280	2,681,642	14,856

Source: Ministry of Lands, Land Reform and Resettlement, 2006

Economy, Agriculture and Food Security

Agriculture is the cornerstone of the Zimbabwean economy and about 60% of the economically active population depends on it for food and employment. Women play an important role in agriculture and it is estimated that 70 % of small holder farmers are women. The agricultural sector accounts for about 11-14% of the country's gross domestic product (GDP), 60% of the raw materials required by the manufacturing industry and 40% of total export earnings according to the Industrial Development Corporation. In the past, in years of good rainfall, the country produced enough to feed the nation and enjoyed a surplus for export. However, one of the major constraints to agricultural production in the country has been the frequent droughts, accompanied by high temperatures. For this reason, as well as the others mentioned above, the country has been in food deficit for at least 8 years and is dependent on food imports from neighbouring countries. The major imports have consisted of maize and wheat, the main staples of the country. UN estimates suggest that up to 7 million people required food aid at the beginning of the year 2009.

Land is recognized as the key to food security in Zimbabwe and in this regard the government of Zimbabwe had embarked on improving irrigation schemes, and prioritized the building of small and medium-sized dams in all the districts though lack of funding had impacted negatively on these initiatives. Inputs to farmers such as seed, fertilizers and agro-chemicals to boost production had also been provided. Supportive programmes, which included the Crop and Livestock Input Credit Scheme and the Agricultural Sector Productivity Enhancement Facility resulted in loans being extended to farmers for working capital and equipment at concessionary rates. However, due to operational problems, the goals of productivity and food security at both the household and national levels are still to be realized.

Constraints to Productivity in the Agricultural Sector

Zimbabwe needs a stable socio-economic and political environment in order for the agricultural sector to thrive. The current hyper-inflationary environment militates against attainment of food security. It has been suggested that empowering the small-scale farmer is the quickest route to achieve food security once again. Whilst large-scale commercial

farming is necessary, enabling the small scale producers with, among others, appropriate inputs and incentives, and affordable transport to markets could have the desired effect on food security.

There is need for a coordinated effort in addressing the whole issue of plant genetic resources for food and agriculture. More comprehensive and directed programmes are required for the management of *ex situ* and *in situ* conservation. Surveying and inventorying of available resources is also a necessity in order for a more collaborative and coordinated approach to be adopted by all concerned players. To fully benefit from regional and international collaboration, there is need to support human capacity building through exchange programmes, collaborative research, databases and website creation for both *in situ* and *ex situ* collections and link these initiatives to Farmers' Unions within the country. In the area of access to PGR and benefit sharing, there is need to document and register the available landraces; support participatory plant breeding/participatory varietal selection activities and develop a legal framework that harmonizes plant breeders' rights and farmers' rights. Zimbabwe is currently working on legislation specifically addressing farmers' rights.

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CHAPTER 1

THE STATE OF DIVERSITY

1.1 The State of Diversity and Relative Importance of Major Crops for Food Security

In order to plan for the conservation, sustainable use and development of plant genetic resources, it is necessary for the country to have comprehensive inventories of its resources. In the past 10 years Zimbabwe has made great strides in taking inventories and documenting its flora. It has been estimated that Zimbabwe has about 6 000 indigenous plant species representing approximately 1 500 genera and 200 families. Of the species found in the country, about 500 are known to be used in traditional medicine; around 230 are endemic while about 500 are listed as under threat of extinction. The largest family is that of the grasses (Poaceae) with about 600 representatives, followed by the Papilionoidea (the pea family) with about 520 members. The other large groups are the Cypraceae (sedges), Euphorbiaceae and Rubiaceae that each consist of over 200 members.

Exotic or introduced plant species number approximately 1 500. Families with the largest representation in this group are Fabaceae. (200 spp) Poaceae (114 spp), Asteraceae (103 spp) and Myrtaceae (77 spp).

Cultivated crops including small grains, cereals, grain legumes, roots and tubers, indigenous and exotic vegetables and horticultural crops cover almost a third of Zimbabwe and this area is progressively increasing. Due to its temperate and sub-tropical climate, the country produces a wide variety of fruit such as apples, pears, peaches, plums, apricots, nectarines, grapes, strawberry, and kiwi. Other fruits and agricultural products include oranges, nartjies, lemons, bananas, litchis, mangoes, sugarcane, and coffee.

1.1.1 Grains and Cereals

Major grains and cereals in Zimbabwe are maize (*Zea mays*), sorghum (*Sorghum spp*) and wheat (*Triticum spp*).

Maize

Although it is an introduced plant, maize is now a main staple food of the country and accounts for some 47% of total calorie intake. It is grown in most parts of the country even in natural regions IV and V which receive as little as 400 mm rain per annum. There is significant diversity of maize in Zimbabwe in terms of grain colour and type, yield potential, plant height, time to maturity and stress tolerance. Information available from the national Genetic Resources and Biotechnology Institute (formerly Genebank, GRBI) shows that there are over 30 landraces collected from various parts of the country, 28 accessions being used in population improvement programmes, 34 accessions from crosses of Mexican varieties with local material, and more than 124 accessions of inbred lines and exotic breeding lines. According to the Department of Agricultural Regulatory Services (DARS, formerly Seed Services) Annual Reports both hybrid and OPV maize varieties have dominated the market in terms of local seed registrations, followed by wheat.

Wheat

Wheat is ranked as the second most important cereal crop in Zimbabwe. There are over 1000 accessions available. These lines originated from countries such as Mexico, China, South Africa, United Kingdom, and Canada and represent wide genetic diversity for traits

such as height, maturing period, stress tolerance and yield. The crop is grown mostly in winter under irrigation in natural regions I-III.

Sorghum

Sorghum is the third most important cereal crop in Zimbabwe (FAO, 2002) and is a principal food crop for many Zimbabweans predominantly those living in semi-arid regions. Sorghum is used for making porridge, brewing and as a fodder crop and is grown largely by communal or small-scale farmers. In parts of Zimbabwe, many indigenous varieties of sorghum are still grown with up to 13 in some regions. Approximately 2000 accessions of landraces have been collected and there are about 1378 Zimbabwean sorghum accessions at the International Research Institute for Semi-arid Tropics (ICRISAT) (Bioversity International/ICRISAT). Morphological and agronomical traits such as seed colour, seed shape and size, plant height and taste have been used to differentiate approximately 830 of these accessions whilst GRBI holds germplasm collected since 1982 that has not been characterized. Five races of sorghum, specifically bicolor, guinea, kafir, duvra and caudatum, are found in Zimbabwe but their diversity and occurrence has only been partially determined.

1.1.2 Industrial and Horticultural Crops

The horticultural crops in Zimbabwe can conveniently be classified into 6 groups; temperate fruits, tropical fruits, leaf vegetables, fruit vegetables, roots and tuber and flowers. In this broad group are minor crops such as sunflower (*Helianthus annus* – 800 exotic lines and 1440 locally bred), castor bean (*Ricinus communis .* 85 accessions) and coffee (*Coffea arabica* 133 accessions with 6 wild species). Sugarcane (660 accessions) is grown in the South-Eastern lowveld parts of the country in NR IV and V. However, sugar production has declined in recent years resulting in a shortage of the product on the local market.

Flowers

Most flowers for export are grown in green houses within the highveld and in close proximity to airports. The main flowers grown for export include roses, asters, solidagos, bulperium, hypericum and protea. The main importing countries are the EU, Nordic countries, Australia and South Africa.

Tobacco

Tobacco (*Nicotiana spp*) is a major cash crop in Zimbabwe and is mostly grown in NR I-III. There are over 500 varieties, and approximately 80 known landraces of the flue-cured or Virginia variety. In addition there are some 102 varieties of Burley and about 91 varieties of Oriental variety. Zimbabwe also has about 3000 lines and 5000 selections of tobacco available.

Cotton

Another important cash crop in Zimbabwe is cotton (*Gossypium herbaceum*) which is mostly grown in the north and northeastern areas of the country during the rainy season. There are over 2500 accessions currently available.

Timber

Approximately 60% of Zimbabwe is covered by forests with about 2% of that being protected area. The Indigenous forest area accounts for about 800 000 ha. The forestry industry contributes 3% to the country's Gross Domestic Product.

1.2 The State of Diversity and Relative Importance of Minor Crops for Food Security

1.2.1 Grains

The most important members of this group are Pearl millet (*Pennisetum glaucum*), finger millet (*Eleusine coracana*), and rice (*Oryza sativa*).

Pearl millet

Pearl millet (*Pennisetum glaucum*) is important in the semi-arid regions of Zimbabwe. Local landraces are very tall and late maturing and have been crossed with lines obtained from ICRISAT in order to produce higher yielding, early maturing superior varieties. There are about 824 accessions that have been collected locally and a further 400 have been acquired from ICRISAT, India.

Finger millet

Finger millet (*Eleusine coracana*) is grown in wetter areas and is used for beer brewing. Some 700 accessions have been collected and these have been augmented by lines from East and Central Africa and India.

Rice

There were only a few accessions of rice (*Oryza sativa*) that came from the International Rice Research Institute but the country has recently acquired and is evaluating higher yielding NERICA varieties. These were developed from crosses between African rice and Japanese rice and are now widely grown in West Africa. Wild relatives of rice including *O. punctata, O. longistaminata* and *Lersia spp* are also found locally.

1.2.2 Industrial and Horticultural Crops

Temperate fruits

These are grown mainly in the cool eastern highlands of Zimbabwe that cover Nyanga, Chimanimani and Chipinge Districts. The pome fruits at the Horticulture Research Institute (HRI) comprise apples and pears (40 and 20 cultivars respectively); stone fruits are peaches (15 cultivars), apricots (10 cultivars), plums (5 cultivars), and nectarines (4 cultivars). Kiwi has also been introduced and is maintained and propagated for sale at Nyanga.

Other fruits

These are grown in the warmer districts that cover most of the country. They include mangoes, oranges, lemons, nartjies, litchis, bananas, avocados, pineapples, strawberries, blueberries and grapes.

Leaf Vegetables

There is a wide diversity of leaf vegetables of temperate origin. These are mainly brassicas like cabbage (*Brassica oleracea* var capita), rape (*Brassica napus*), tsunga (*Brassica juncea*, mustard rape) and covo (*Brassica oleracea)*.

Fruit Vegetables

Most of the fruit vegetables cultivated in the country are exotic and of tropical origin. These include butternut (*Cucurbita moschata),* pumpkin (*Cucurbita maxima),* melons (*Citrullus lanatus),* cucumbers (*Cucumis sativus),* tomatoes (*Lycopersicon esculentum),* okra (*Abelmosclus esculentus)*, egg plant (*Solanum macrocarpon*) and pepper (*Capsicum annum*).

Roots and Tubers

These comprise crops of tropical origin like cassava (*Manihot esculenta*) and sweet potato (*Ipomoea batatas*) and those of temperate origin like Irish potato (*Solanum tuberosum*), carrots, and radish. The growing and consumption of cassava is still very localized, but efforts are being made to popularize the tuber.

Sweet potatoes are, however, very popular throughout the country. Although the country has over 30 varieties of sweet potato, the Horticultural Research Institute propagates and distributes over 15 varieties which include are German 2, Mozambique white, Brondal, Magutse, Pamhai, Chigogo and Chizai, the last being the most popular traditional variety.

The most popular temperate tuber crop is the Irish potato. The country grows 7 varieties of potato and these are Montclair, BP1, Amethyst, Jasper (for table), Pimpernel, Garnet and Diamond (for processing). The last two varieties were released in the last 10 years, 1998 and 2008 respectively. Irish potato production is governed by very strict pests and diseases legislation. Seed potato varieties are maintained by the Crop Breeding Institute and the initial stages of bulking by a few selected farmers takes place on a 259 ha quarantine area located at Nyanga.

The Livingstone Potato (*Plectranthus esculentus*) known locally as Tsenza is an example of a crop whose full potential has not been realized despite its acceptance and nutritional value. The indigenous tuber is grown in both the dryland and wetland areas in parts of the eastern districts of Zimbabwe and there are at least 15 Tsenza known accessions domesticated from the wild. HRI initiated a project to use *P. esculentus* to improve food security and generate income for rural communities. Other little-documented tuber crops include cocoyams known locally as madumbe (*Xanthosoma sagittifolium*), taro (*Colocasia esculenta*), yams (*Dioscorea* spp).

Jatropha

The oil plant *Jatropha curcas* (L) (Jatropha) or physic nut is a multipurpose and drought tolerant large shrub or small tree. Although a native of tropical America, it now thrives throughout Africa and Asia. In Zimbabwe, the plant has gained national importance and is being grown for the production of biodiesel. The national target for establishment of the shrub is 150 000 ha. A processing plant with a capacity of 60 000L/day for processing Jatropha seeds into products such as diesel, and soap was commissioned in 2007. However, the plant is currently operating below capacity as feed stock of Jatropha seed are still being built up.

Pulses and Oilseeds

Zimbabwe has a rich diversity of pulses including groundnuts (*Arachis hypogea*), cowpeas (*Vigna unguiculata*), soyabeans, bambaranuts (*Vigna subterranean*) and field/common beans (*Phaseolus vulgaris*) (Table 1.1). Diversity between pulses is clearly seen in seed size, colour, growth habits cooking duration, reaction to both abiotic and biotic stresses, and adaptation to different production environment (mono-cropping vs intercropping). Cowpea has diversity in use since both leaves and grain are generally consumed, but in some cases only the grain is eaten. Bambara nuts are diverse in seed colour, shape and tolerance to biotic stresses.

Table 1.1: Summary of Pulses found in Zimbabwe

Crop	Accessions	Comment
Bambaranut	90	Grown mainly in rural areas
Bean	1100	Focus on breeding for disease resistance
Cowpea	150	Drought tolerant
Groundnut	2400	Mostly from the USA, local characterization not done
Soyabean	5000 exotic lines, 1240 locally developed lines	Very few local lines. Dominant oilseed crop in Zimbabwe
Sunflower	800 exotic lines, 1440 locally bred	Grown mainly for oil production

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1.2.3 Grasses and Forage Species

There are several key institutions in Zimbabwe that carry out research and promote the development of forages. These include government, parastatal and private organizations. $DAR_{for}D$ and Agritex under the Ministry of Agriculture, Mechanization and Irrigation Development are the two most important government departments involved. $DAR_{for}D$ has a mandate to conduct research on sustainable livestock production from rangeland and pastures, while Agritex provides technical advice on livestock and crop production to farmers. There are approximately 80 pasture grasses held by Henderson Research Institute and 250 legume and grass accessions at Grasslands Research Institute.

1.2.4 Medicinal Plants

Zimbabwe has a great diversity of plants of medicinal value. However, rapid deforestation in communal areas and other human settlements has led to a drastic drop in populations of the medicinal plant species. There are some 500 plants that have medicinal value that are used in Zimbabwe. The School of Medicine of the University of Zimbabwe, and the National Herbarium and Botanic Garden of Zimbabwe in collaboration with the Zimbabwe Traditional Healers Association spearheaded the collection of the plant species.

Some wild mushrooms, for example, *Ganoderma lucidum* and the sclerotia of *Lactarius tuber-regium* are also used for medicinal purposes.

1.3 State of Wild Plants Harvested for Food Production

Mushrooms

Over 60% of Zimbabwe's forest area is dominated by Miombo woodlands consisting principally of *Brachystegia spiciformis, Julbenardia globiflora* and *Uapaca kirkiana* where wild mushrooms occur in abundance during the rainy season. Of these, about 50-60 species are eaten in Zimbabwe with species such as *Cantharellus cibarius, C. pseudocibarius, Amanita zambiana* and *Termitomyces spp* contributing substantially to household food security when in season.

Wild Fruit and Vegetables

The fruit of a number of indigenous plant species is utilized as food and is an important source of important vitamins, minerals and other nutrients which complement the staple crops eaten by communities. However, proper documentation and characterization of all the varieties has not been carried out. The University of Zimbabwe commenced a project in 2007 to promote wild plant foods which can contribute substantially to household food security. There are around 25 fruit species (Table A1, Appendices) but the most common ones include *Uapaca kirkiana* (muzhanje), *Ziziphus mauritiana* (musau), a naturalized plant, *Azanza garkeana* (mutowe) and A*dansonia digitata* (muwuyu); and *Berchemia discolor* (umnyi), *Mimusops zeyheri* (umbumbulu) and *Vitex payos* (cumtshwankela) in Matebeleland.

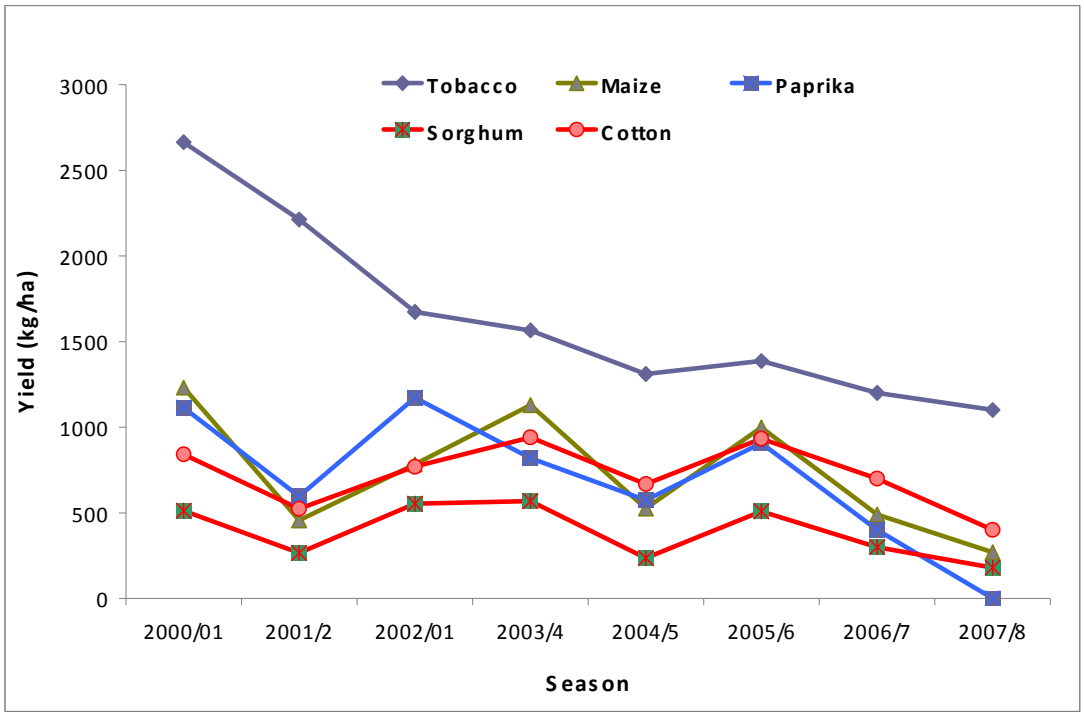
Leaf vegetables of tropical origin are mainly the indigenous vegetable like muboora (*Cucurbita pepo*), nyemba (*Vigna unguiculata),* nyevhe (*Cleome spp*), mowa (*Amaranthus spp*). These number about 50 (Table A2, Appendices) and are mainly enjoyed during the rainy season when they spring up from the soil seed bank. In the last 10 years these vegetables have become increasingly popular even in urban areas due to advocacy regarding their beneficial nutritive properties particularly in HIV and AIDS programmes.

1.4 Factors Affecting the State of Diversity

The post independence period witnessed a significant growth in the agricultural sector. Major achievements were recorded by both small scale and large scale farmers in the production of food and cash crops mostly due to the introduction of hybrid varieties which had higher yields. As a result, there was a reduction in the diversity of varieties grown particularly by the communal farmers. The fast track land reform programme that began in 2000, successive droughts, poor investment in production, equipment and inputs, lack of relevant farming knowledge, and labour shortages are all factors that severely affected the Zimbabwean agricultural sector and resultantly impacted negatively on biodiversity. The African Institute for Agrarian Studies estimates that the land reform programme reduced the extent and intensity of land use to about 40%. The country is currently faced with a critical shortage of the staple foods maize and wheat and has been unable to produce enough to feed its people for the past eight years. Imports of food have, therefore, become a necessity. However, due to shortages in foreign currency, periodic shortages of maize and wheat have been experienced.

Agricultural products in Zimbabwe fall into four broad categories. These are the grain and cereals group consisting of maize, wheat and the small grains such as sorghum and millet. The second group comprises the major export crops such as tobacco and cotton, the third group oil seed crops featuring soyabean, sunflower and groundnuts and the final group is composed of plantation and horticulture crops such as sugarcane, tea, coffee, citrus, flowers and vegetables. There has been a substantial decline in productions and yield in all four categories. Figure 1.2 shows the yield trend from 2000 to 2008 for some of the crops grown in Zimbabwe according to figures supplied by Agritex.

Figure 1.2: Yield trends for some crops grown in Zimbabwe for the years 2000-2008



A direct result of the food shortages was an increased consumption of wild fruits and vegetables prior to and during the 2008 rainy season. The World Food Programme said in a recent statement (October, 2008) “Many hungry families are reportedly living on one meal a day, exchanging precious livestock for buckets of maize or eating wild fruits such as baobab and amarula”. There was a marked increase in the consumption of hacha, the fruit of *Parinari curatellifolia*. The pulp of the fruit was even processed into a meal for a kind of porridge known locally as mukandabota. Clearly, factors that inhibit the cultivation of domesticated crops lead to an increased utilization of a diversity of other food sources. It is, therefore, important to ensure that a concerted effort is made to maintain the diversity of alternative food sources.

Other factors leading to genetic diversity loss throughout the country include neglect of local breeds, land degradation, the use of hybrids at the expense of local or indigenous

landraces and the introduction of new agricultural technologies that favour mono-cropping. Factors that drove the move to hybrids and neglect of indigenous landraces included:

i. The lack of markets for local landraces
ii. Labour constraints leading to farmers growing less labour-intensive crops such as maize
iii. Lack of policies promoting the use of local landraces

1.5 Future Needs and Priorities

The national Biodiversity Strategy and Action Plan (BSAP) of 1998 clearly articulated the status and needs of the country in the area of biodiversity conservation and utilization. Although Zimbabwe has not developed procedures to monitor and measure genetic erosion at national level some progress has been made in carrying out inventories and surveys of the rich diversity of plant genetic resources. As a result of the economic problems currently being faced in the country, no significant activities have been undertaken with reference to *in situ* and *ex situ* biodiversity conservation. In the short term, sustainable land utilization and maintenance of agro-biodiversity requires agricultural, land and economic policy measures that will boost productivity and investment.

There is a general lack of research on indigenous crops and demand-driven research programmes with a bias to small-holder farmers would have to be put in place. The issue of lack of markets could be addressed by the identification and/or creation of suitable markets both within and without the country.

Policies that promote the utilization of indigenous landraces need to formulated and activated. Promotion of conservation farming and low input agriculture will encourage the preservation of PGR. Linkages need to be forged between organizations involved with biodiversity matters so that coordinated collections of PGRFA can be carried out.

A stable socio-economic environment is required so that matters of staff remuneration and retention can be addressed since there is a shortage of staff to accurately survey and inventory PGR in the country. Credit facilities need to be availed and the provision of seed and other agricultural inputs would boost the maintenance of crop biodiversity. Another area that needs to be addressed is that of increasing the number of extension workers so that the extension worker: farmer ratio is more favourable. This would have the effect of raising awareness amongst farmers of the importance of maintaining PGRFA.

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CHAPTER 2

THE STATE OF *IN SITU* MANAGEMENT

2.0 Introduction

The Parks and Wildlife Act in Zimbabwe sets out six types of protected areas which may be established, namely national parks, safari areas, sanctuaries, botanical gardens, botanical reserves and recreational parks. At present, the Parks and Wildlife Estate constitutes 13% of the total land mass of the country. The purposes of these parks include the preservation and protection of the natural landscape, scenery of wildlife and plants and the natural ecological stability of wildlife and plant communities found therein with the ultimate objective being public enjoyment; education and inspiration. The Forestry Commission accounts for the other 2% and in its capacity as the State forest authority, is responsible for the *in situ* and *ex situ* conservation of forest biodiversity.

2.1 Plant Genetic Resources Inventories and Surveys

Zimbabwe has no formal programmes in place for the monitoring, inventory and surveying of *in situ* plant genetic resources for food and agriculture. However, there have been isolated and generally uncoordinated efforts by organizations such as the Genetic Resources and Biotechnology Institute (GBRI, formerly Gene Bank), CIMMYT (International Maize and Wheat Improvement Center), ICRISAT (International Crops Research Institute for Semi-Arid Tropics) and non-governmental organization (NGOs) such as CTDT (Community Technology Trust) to carry out some surveys. The national BSAP of 1998 identified this as a key area needing addressing and efforts are currently underway to carry out this exercise.

2.2 Conservation of Plant Genetic Resources in Protected and Non-protected Areas

Zimbabwe's national parks and wildlife estates contain a large diversity of plant genetic resources. Wild crop relatives such as sorghum, cotton, rice, bambara nut and cowpeas are in abundance in these areas. However, there are no mechanisms in place to survey, monitor and conserve these resources.

Non-protected areas such as communal lands and commercial farms and ranches also contain a rich diversity of plant genetic resources. But, as in the case of protected areas, there have been very few, if any, efforts to survey and inventory the resources for food and agriculture for the purposes of conservation.

2.3 On-farm Management and Improvement of Plant Genetic Resources

This is an area that has received some attention from a number of NGOs, and institutions such as ICRISAT, CIMMYT, ICRAF (International Centre for Research in Agro-forestry) and IPPGRI (International Plant Genetic Resources Institute) and government departments such as the GRBI, and the HRI (Horticultural Research Institute) with the objective of surveying and improving current on-farm conservation and management of plant genetic resources. Most of the work done has concentrated on the small grains, particularly sorghum, and legumes. In addition, it was noted that many farmers use landraces of

traditional crops such as cowpeas, millets, bambara nuts, cucurbits and groundnuts. It was noted in the studies that farmers were most interested in morphological and agronomic variation. However, farmers were not interested in *in situ* conservation for its own sake but rather imported and discarded diversity according to specific needs at specific times. On-farm conservation projects succeeded most in areas where financial compensation was used as a motivating factor. Monoculture has had an adverse impact on on-farm biodiversity conservation as farmers concentrated on the cultivation of cash crops particularly maize hybrid varieties. Communal farmers, however, generally intercrop. The BSAP document of 1998 suggested a number of initiatives that were pursued in order to maintain on-farm plant diversity. These included: mapping the distribution of local landraces and documentation of traditional knowledge systems in order to facilitate their on-farm conservation conducted by the GRBI; the promotion of on-farm conservation of traditional landraces of sorghum, pearl millet, cowpeas, and bambara nuts by various NGOs and specifically, the on-going *in situ* conservation and sustainable utilization of traditional vegetables and fruits being conducted by CTDT.

2.4 Support of Farmers in Disaster Situations to Restore Agricultural Systems

Zimbabwe has suffered from recurrent droughts, most notably the 2002 cropping season and flooding induced by cyclones. This has resulted in substantial loss of *in situ* plant diversity. Disaster recovery programmes led by the government, in most cases, focused on providing chiefly mostly hybrid seed of maize, sorghum, pearl millet, rice, cowpea, beans and groundnuts and fertilizers. NGOs in some of the cases provided open pollinated maize varieties. There are no records of attempts to restore the landraces and other plant genetic diversity of the affected areas, which suggests that material lost, is not recovered.

2.5 Future Needs and Priorities

Although there has been considerable genetic erosion of traditional crops, there are still areas where sorghum, millet and legume diversity is still evident. In some of these areas, community seed banking, whereby all members contribute seed to an annual store, still exists. Undoubtedly, these areas could be targeted for conservation initiatives. Such initiatives could include improved on-farm storage facilities and storage methods developed in conjunction with the farmers themselves in order to use and conserve of traditional landraces.

There are no official national programmes for the prevention or control of genetic erosion *in situ.* Against this background, the survey and inventorying of plant genetic resources needs to be carried out. The contribution and involvement of the “keepers of biodiversity” is a prerequisite.

The inventorying would provide a baseline for monitoring and establishing an early warning mechanism in order to arrest genetic erosion where detected.

Coordination of the efforts of various interest groups such the Forestry Commission and GRBI is a necessity. A comparison of inventories is also important in order to establish the extent of the *in situ* collections.

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CHAPTER 3

THE STATE OF *EX SITU* MANAGEMENT

3.1 The State of Collections

The management of *ex situ* collects of PGR in Zimbabwe is conducted in a decentralized manner by various players that include the public sector, parastatals, private sector, NGOs and individuals, particularly farmers

The public sector plays a very vital role as it enunciates PGR conservation policy direction and is a leading player with infrastructural and human resource development and the operational environment necessary for the implementation of various PGR conservation programs. The main organs involved in the *ex situ* management of plant genetic resources are Ministry of Agriculture, Ministry of Environment and Tourism and Ministry of Home Affairs.

3.1.1 The Ministry of Agriculture is the lead public organ that functions through the following institutions in $DAR_{for}D$ as illustrated in Table 3.1

Table 3.1: Conservation Status of Department for Agricultural Research for Development Institutes

Institute	Goal	Conservation status	Remarks
Genetic Resources and Biotechnology Institute for National Gene bank of Zimbabwe	Inventory, collect and conserve germplasm of PGR that are important for food and agriculture.	Holds 3 464 accessions, stored at -18^{0}C in 24 freezers and airtight aluminium foil bags used.	Accessions are first cool dried (RH 15% and 10^{0}C) to 6% moisture. Germination and viability checks are carried out at 10–year intervals, regeneration carried out if the germination is below the expected Gene bank standards.
The National Herbarium and Botanic Garden	The focal point for Flora Zambesiaca collections in the region	Holds about 500 000 plant specimens in its herbarium, around 3 000 type specimens.	The National Botanic Garden grows over 50% of the indigenous trees and shrubs of the country.
Horticultural Research Institute and Nyanga Experiment Station	The institute majors in applied research on over 120 cultivars of deciduous fruits and a wide range of	.	Fruits such as apples, peaches and grapes are conserved in field gene banks

	vegetables.		
The Coffee Research Institute		t has 44 varieties of coffee (*Coffee arabica*) at three localities. Chipinge, 6 varieties currently on the market, ART Farm and Piringani with 38 Columbian varieties still under evaluation..	70% of coffee materials are safely duplicated as live collections at ART farm, Piringani, Chikukwa and Honde Valley. However, none of their materials are conserved *ex situ* at the National Gene bank and anywhere outside the country. The institute is planning to access FAO Global coffee collections in order to boost present collections
Cotton Research Institute	Developed 15 cotton cultivars during the last 25 years and serviced the cotton growing areas of the middleveld (600 – 1 200 metres above sea level) and the Lowveld (300 – 600 metres above sea level).	Hold more than 10000 materials stored in a cold room. 70% of the materials require regeneration.	These materials lack safety duplicates at the GRBI. They lack a proper registration and documentation system. Storage cold rooms are malfunctioning. Apart from the production of cotton wool, cotton seed is a very important source of oil in Zimbabwe.
Crop Breeding Institute	Developments and maintaining field crop varieties for the agriculture industry.	Works on 13 field crops which include maize, wheat, rice, soya bean, groundnuts, cowpea, bambara nut, potato, sunflower, bean, and sorghum, pearl and finger millets. Cold rooms are used for storing most of the germplasm at Harare Research Centre and there is also one store room for potato germplasm at Nyanga Research Station.	Some of the materials are duplicated at the GRBI. A deliberate effort is necessary to duplicate al the materials.
Grasslands Research Institute	Livestock research station	250 accessions of grass and legume germplasm. The germplasm is stored	There is a need to regenerate these and send duplicates to the

		in a seed store at room temperature.	GRBI
Henderson Research Institute,	Livestock research station based at Mazowe,	Holds 80 accessions of grass germplasm. Stored in a seed store at room temperature.	There is a need to regenerate these and send duplicates to the GRBI
Matopos Research Institute	The summer small grains breeding programme of Crop Breeding Institute is based at Matopos.	Holds 300 accessions of small grains. Cold room facility mal-functional and the institute is using an ICRISAT facility operating at 0-5℃ and 20% relative humidity.	Materials sent for safety duplication both nationally and Internationally could not be ascertained due to incomplete documentation system, which is still in progress. Approximately 50 % of materials require immediate regeneration
Makoholi Research Institute	Livestock research station.	Lacks proper documentation system for conserved materials and the total number of stored materials is unknown.	None of their materials are conserved at the National Gene bank of Zimbabwe. It was estimated that almost 60% of the materials require immediate regeneration

3.1.1 **Ministry of Environment and Tourism** through National Parks and Wildlife Authority manages herbaria in a number of its National Parks, Safari areas, recreational parks and botanical gardens. Most of these herbaria specialize in plant collections endemic to the area.

3.1.2 **Ministry of Home Affairs** manages *ex situ* collections of plant genetic resources mainly through the Department of National Museums and Monuments. The department has two main herbaria in Mutare and Bulawayo.

3.1.3 Parastatals

The main parastatals that are involved in *ex situ* management of germplasm are the Tobacco Research Board (TRB), Forestry Commission and Agricultural and Rural Development (ARDA). The TRB has over 1100 varieties and cultivars in storage. These include wild type tobacco, and the cultivated tobaccos. The Forestry Commission has approximately 20 000 accessions for tree species stored at the seed centre. These include over 400 provenances and introductions of exotic species as well as indigenous tree species from seed stands, seed orchards and

trials. Some of these, particularly for the indigenous tree species, have not yet been characterized.

3.1.4 Private Sector

The major players are seed houses such as, Seedco (10 maize accessions), Pannar (12 maize accessions), and National Tested Seeds (25) amongst others.

3.1.5 Non Governmental Organizations

The NGOs that are working with communities in setting up community gene banks include CTDT, Southern Alliance for Indigenous Resources (SAFIRE) and Fambidzanai Permaculture Centre. There are three well established community seed banks in Zimbabwe located in Uzumba Maramba Pfungwe, Chiredzi, and Tsholotsho districts. These have been established under the CBDC international programme which Zimbabwe is a member through CTDT.

3.2 Storage Facilities

Almost all the crop research institutions under DAR4D store their germplasm in cold rooms and sheds. These cold rooms are supposed to be maintained at an optimum temperature of between 2^0C and 5^0C, and a relative humidity of between 10% and 20% to maintain viability of the collections. However, most of the cold rooms are currently not functioning under optimum conditions. The freezers at the GRBI are functioning properly at -18^0C and have ample space but very few institutions, with the exception of Crop Breeding Institute (CBI), are depositing their duplicates there. Drying facilities (cold room plus dehumidifier) operating at a temperature of between 5℃ and 10 ℃ and 15% relative humidity are also present and functioning well at GRBI.

The collections that are stored in herbaria storerooms are progressively being destroyed by pests due to inadequate monitoring and failure to fumigate the premises as required. There have even been reports of theft of germplasm.

3.3 Security

Some of the materials stored at GRBI are safety duplicated at SADC Plant Genetic Resources Centre (SPGRC) with about 1886 accessions of mainly sorghum, pearl millet and finger millet currently there. Zimbabwe has been sending materials for safety duplication to the SPGRC since 1993 and to date about 54% of the accessions at GRBI are duplicated at the regional gene bank. However, safety duplication has not progressed as desired in the last decade for reasons that include lack of capacity of GRBI to regenerate and multiply the accessions. Additionally, there is need for coordinated efforts by all national institutions to safety deposit their collections with the GRBI.

3.4 Constraints to Sustaining *Ex situ* Collections

Ex situ collections are usually in a static mode given the low demand for utilization. The activity is faced with great challenges as the collections must be sustained today for use in the future. Zimbabwe is confronted with the following challenges in maintaining *ex situ* collections:

i. The economic recession, on-going for the past decade, has had a great impact on the fiscus allocation for research which includes *ex situ* conservation. The external

funding from donors has been decreasing in the past decade although GRBI was generally well-funded in this period. All of the other institutes holding accessions reported that there had been no budget specific for *ex situ* conservation activities in the past ten years and these had been funded from other line items.

ii. Zimbabwe has experienced massive brain drain in the past decade resulting in inadequate human capacity to carry out *ex situ* conservation activities.
iii. Inadequate use of facilities for molecular characterization and evaluation of materials.
iv. Limited human capacity building opportunities. There is lack of expertise on appropriate seed testing protocols for wild species, handling of difficult seeds and of molecular characterization.
v. Due to staff shortages, most conserved materials have unknown germination percentage and viability.
vi. The SADC region has been greatly affected by power shortages (electricity) and Zimbabwe has not been spared. This has compromised the quality and longevity of *ex situ* conserved materials due to the frequent power cuts since most institutions do not have back-up power or do not have the fuel to keep generators running.
vii. Most of the institutes have the facilities for *ex situ* conservation but lack the capacity for their maintenance. Poor maintenance and servicing have reduced the normal expected life span of most of the facilities.
viii. Droughts in the past decade have also had their toll on *ex situ* collections as Irrigation facilities for regeneration and multiplication activities are frequently not available.

Some of these challenges can be addressed if *ex situ* conservation is centrally coordinated and there is due recognition of the activities at national policy level. Facilities such as a biotechnology laboratory where tissue culture, cryo-preservation and molecular characterization can be done to add value to the *ex situ* collections are also required. This entails addressing the human capacity constrains. Staff would need to be trained on testing protocols, seed storage behavior, regeneration and characterization. Above all, there is need to develop a practical strategy that links conservation and utilization. Materials conserved in the gene bank should be available on request to breeders and researchers in harmony with the provisions of the ITPGRFA.

3.5 Documentation and Characterization

Characterization was done for cowpea, pearl millet and sorghum although documentation lagged behind except in the case of sorghum landraces where some progress has been made. GRBI uses both a manual and an electronic system for managing information on *ex situ* collections. Efforts have been made to capture the data into a regional gene bank database called SDIS (SADC Documentation and Information System) but limited staff capacity has hindered progress.

Active research has been going on since inception of the GRBI with the main focus being on inventory and eco-geographic surveys mapping distribution of germplasm, and identifying collection gaps that need to be filled. Documentation of the various components of the plant genetic resources of Zimbabwe has also been in progress in the past decade driven mainly by the Southern African Botanical Diversity Network

(SABONET), a regional program to strengthen botanical expertise that was co-funded by USAID and GEF between 1996 and 2004. This culminated in the publication of *The Vascular Plant of Zimbabwe, The Grasses of Zimbabwe, The Endemic Plants of Zimbabwe, Threatened Plants of Zimbabwe, The Zimbabwean Bryophytes, Eragrotis Species of Zimbabwe, Vernacular Plant Names and Indigenous Fruits and Vegetables.* It also saw the computerization of the Zimbabwe plant collection at the National Herbarium into a regional herbarium database called PRECIS.

3.6 International Arrangements and Networks in PGR collections.

Zimbabwe is party to a number of international agreements dealing with issues of conservation of plant genetic resources for food and agriculture among them the ITPGRFA, and SPGRC, which also a center for safety duplications. Further, Zimbabwe is a member of SANBio (Southern African Network for Biosciences), NEPAD (The New Partnership for Africa's Development), and the Botanic gardens are involved in a number of initiatives such as SABONET.

3.7 Planned and Targeted Collections

Since inception of the GRBI in 1987, collection missions were specific for cultivated crops and wild crop relatives of materials such as sorghum and rice. Table 3.2 below shows the collection missions carried out from 1998 to 2008. GRBI is the lead organization on agro-biodiversity conservation in Zimbabwe and has carried out a great deal of developmental research work, including germplasm collection, *ex situ* conservation, multiplication, regeneration, characterization and promotion of on-farm (*in situ*) conservation in semi-arid areas of Zimbabwe. It currently holds 3 464 accessions which are composed of different varieties. Table 3.3 summarizes accessions held at the GRBI.

Table 3.2 Collection Missions done by Genetic Resources and Biotechnology Institute in the period 1998-2008

Period	Scientific name	Common name	No. of accessions collected	Collecting Area
1998-1999	*Oryza barthii*	Wild rice	1	Guruve, Hurungwe, Kadoma, Binga, Tsholotsho, Hwange, Victoria falls Nyanga, Chiredzi, Tsholotsho,and Uzumba Maramba Pfungwe,, and Gokwe
	O.longistaminata	Wild rice	1	
	O. puncanta	Wild rice	1	
	Pennisetum glaucum	Pearl millet	2	
	Sorghum bicolor	Sorghum	2	
	Vigna ungiuculata	Cowpea	1	
1999-2000	*Citrullus lanatus*	Water melon	1	Mutoko, Chivi Tsholotsho
	Corchorus sp	Okra (Wild)	8	
	Cucumis sp	Cucumis (wild)	5	Guruve, Masvingo and Chipinge
	Oryza longistaminata	Wild rice	1	Guruve
	Oryza sativa	Rice (traditional variety)	14	
	Vigna subterranea	Bambara nuts	20	Mutoko, Chivi, Tsholotsho
	Vigna ungiuculata	Cowpeas	16	
	Zea mays	Maize	3	
2000-2001	*Cucumis metuliferus*	Cucumbers	1	Mutoko, Chivi, Tsholotsho
	Citrullus lanatus	Water melon	96	Matebeleland, Mashonaland Central Midlands and Masvingo province.
	Cucumis metuliferus	Cucumber	10	
	Cucumis sativus	Cucumber	26	
2001-2002	*Arachis hypogaea*	Ground nut	8	Muzarabani
	Curcubita sp	Pumpkin	3	
	Phaseolus sp	Beans	8	
	Vigna ungiuculata	Cowpea	3	
	Zea mays	Maize	13	
2004-2005	*Vondzeia subterranea*	Bambara nut	Total collected=129	Makoni, Buhera and Wedza districts.
	Eleusine coracana	Pearl millet		
	Pennisetum glaucum	Finger millet		
	Vigna ungiuculata	Cowpea		
2007-2008	*Sorghum bicolor*	Sorghum	9	Tsholotsho. Uzumba Maramba Pfungwe
	Eleusine coracana	Pearl millet	11	
	Vigna ungiuculata	Cowpea	7	
	Vondzeia subterranea	Bambara nut	6	
	Phaseolus vulgaris	Beans	5	
	Arachis hypogaea	Ground nuts	3	

Table 3.3 Accessions held at the Genetic Resources and Biotechnology Institute.

Taxon	Type	Number Of accessions
Adansonia	Traditional cultivar/Landrace	1
Amaranthus	Traditional cultivar/Landrace	8
Arachis	Traditional cultivar/Landrace	47
Brassica	Traditional cultivar/Landrace	19
Ceratotheca sesamoides	Wild relatives	5
Chenopodium	Wild relatives	1
Cleome	Traditional cultivar/Landrace	11
Corchorus	Traditional cultivar/Landrace	22
Coffee arabica	Traditional cultivar/Landrace	2
Cucumis	Traditional cultivar/Landrace	45
Curcubita	Traditional cultivar/Landrace	234
Eleusine	Traditional cultivar/Landrace	299
Glycine max	Traditional cultivar/Landrace	35
Hibiscus	Traditional cultivar/Landrace	25
Lagenaria	Traditional cultivar/Landrace	418
Leersia	Wild relatives	5
Oryza	Traditional cultivar/Landrace	55
Panicum	Wild relatives	2
Pennisetum	Traditional cultivar/Landrace	140
Sambacus anadensis	Wild relatives	1
Sesamum	Wild relatives	4
Solanum	Wild relatives	1
Sorghum	Traditional cultivar/Landrace	1793
Tenelepsis cerasiformis	Wild relatives	1
Triumfetta annua	Wild relatives	5
Vernonia	Wild relatives	1
Vigna	Traditional cultivar/Landrace	162
Voandzeia	Traditional cultivar/Landrace	93
Zea mays	Traditional cultivar/Landrace	29
Total		3464

3.8 Regeneration

From the information gathered, indications are that more that 60 % of all *ex situ* conserved germplasm is Zimbabwe require immediate regeneration in order to preserve the materials.

3.9 Roles of Botanic Gardens

Zimbabwe has three botanical gardens; two are administered by the National Parks and Wildlife Authority [Ewanrigg (286 ha) in Shamva and Vumba (242 ha) in Manicaland] and the National Botanic Garden (68 ha) in Harare that falls under the $DAR_{for}D$.

The National Botanic Garden, which has a 48 ha outstation, Mazowe Botanic Reserve, some 32 km north of Harare, is used extensively as a centre for botanic research and environmental education by schools, colleges and universities. It has collections of over 300 plant species representing the natural vegetation of the Highveld. About 35 ha are dedicated to the exhibit of major vegetation types of the country, while the desert house displays some of the interesting plants of arid areas within southern Africa. Ewanrigg is popular for its collections of Aloes and cycads while Vumba is renowned for its Montane forest.

3.10 Future Needs and Priorities

i) There is need for public institutions to deposit their collection or duplicates at the GRBI.
ii) The role of the GRBI as the focal point for coordinating and spearheading PGR activities needs to be emphasized.
iii) There is need to promote “current” use of germplasm rather than hold onto the concept of “future” use especially with regards to GRBI collections.
iv) There is need for a collaborative approach to germplasm collection missions, involving stakeholders at all levels.
v) There is urgent need to address storage facilities through refurbishing old ones and constructing additional ones.
vi) Collection, characterization and documentation of underutilized plant species should be made a priority by Plant Genetic Resources and Biotechnology Institute if potential to contribute to national food security and poverty alleviation is to be realized.
vii) There is urgent need to update the regional gene bank database at GRBI.

CHAPTER 4

THE STATE OF USE

4.1 State of Plant Genetic Resources Utilization

$DAR_{for}D$ is a public organization responsible for conducting crop research focusing on crop development and agronomy. The department has institutions with specific crop research mandates. For example, the Coffee Research Institute is responsible for development of coffee varieties in Zimbabwe, whilst the HRI's mandate is to spearhead public research in all horticultural crops except tea and coffee. However, the Institute is currently biased towards temperate crops - partly because of limited funds and shortage of trained experienced staff.

Some of the varieties arising from the research work are registered with DARS. Table 4.1 shows the varieties that are currently registered.

Table 4.1: Varieties registered with DARS

Crop	Type	No. Of Varieties on market	Delisted Varieties	Total
Bambara	Pure lines	2	-	2
Barley	Pure lines	8	-	8
Beans	Pure lines	6	2	8
Cotton	Hybrid	13	-	13
Cowpeas	Pure lines	5	1	6
Finger-millet	OPV	2	-	2
Groundnuts	Pure lines	9	-	9
Maize	White Hybrids	80	15	95
Maize	Yellow Hybrids	18	6	24
Maize	OPV	8	-	8
Pasture Grasses	Pure lines	11	-	11
Pasture Legumes	Pure lines	9	-	9
Potatoes	Pure lines	8	-	8
Sorghum	OPV	5	1	6
Sorghum	Hybrid	3	-	3
Soyabeans	Hybrid	15	6	21
Sunflower	Hybrid	9	2	11
Tobacco	Hybrid	21	8	29
Wheat	Pure lines	16	16	32
Grand Total		248	57	305

GBRI conserves germplasm at two levels, the first level is base collection and the second level is active collection. Base collections are kept as back-up for the active collection and are usually conserved on a long term basis. Active collections have short term conservation objectives and mainly are used as distribution materials to breeders, researchers and farmers.

Demand for *ex situ* collections in the Gene bank is generally low as can be seen in Table 4.2. Potential users of the materials are either not aware of the facility or the materials in the *ex situ* collection do not have adequate information required by researchers and breeders.

Table 4.2: Number of accessions distributed from 1997-2008

Year / Crop	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08
cereals	-				-	5	10		-	-	32	19
legume	-				15	2			-	-	24	22
vegetable	-				5	2			-	-	2	9
wild	-				4				-	-	-	-

Passport and characterization data is given to the receiver upon request. Universities are the major recipients of accessions from the GRBI and use the materials mainly in research work, although very few requests have been targeted at breeding research.

The GRBI in partnership with the Biotechnology Trust of Zimbabwe, promoted on-farm production of under utilized crops under a project called Orphan Crops in 2006. Accessions of pearl millet, sorghum, cowpea, taro and bambara were re-introduced in Hwedza, Rusape and Murambinda. However, due to capacity constraints the project only lasted two seasons.

4.3 Characterization

As mentioned previously, characterization of gene bank materials is not up-to-date and sorghum is the only main crop that has been characterized to some extent.

4.4 Molecular characterization

Molecular characterization of accessions has not been fully exploited. However, some work was done on landraces collected in the Nyanga and Tsholotsho areas and accessions that were held in the GRBI.

4.5 Seed Supply Systems and the Role of Markets

Zimbabwe has both a formal and informal seed supply system. The formal system is made up of seed companies which are centrally coordinated by the Zimbabwe Seed Trade Association (ZSTA) that speaks on behalf of the seed companies. However, seeds are regulated by DARS under the Ministry of Agriculture through the Seed Act (Chapter 19:13 of 1971) and the Plant Breeders Rights Act (Chapter 18:16).

The informal seed supply system involves the saving and sharing of seed by family, friends and neighbours and scales up to local markets at national level. This supply system hinges on the cultural heritage principle where farmers save, sell and exchange germplasm amongst themselves. There are also some NGOs involved in the informal seed supply system of Zimbabwe. They distribute seed to farmers through seed fairs and seed pack handouts.

4.6 Constraints to Increased Markets for Local Landraces and Diversity Rich Products

There are a number of factors that undermines the promotion of local varieties at the markets. Some of these factors are:

i. There is no policy that promotes farmers' rights to sell their germplasm on formal markets.
ii. Local varieties have become less popular due to the promotion of improved varieties, leaving a perception that local varieties are 'poor man's varieties' or inferior crops.
iii. Very little research has been directed towards local varieties.
iv. Some local varieties are used mainly for traditional purposes like brewing beer for appeasing spirit mediums.

4.7 Underutilized Crops

The GRBI holds 782 accessions of indigenous vegetables and 40 taro accessions and yet the demand for utilization is low.

The consumption of underutilized crops has been promoted by various organizations including NGOs and the Government in the past ten years. Government initiated a programme that promoted the use of small grains by supplying the seed and technical back up for production. The Traditional Healers Association in the Ministry of Health and Child Welfare also supported the increased utilization of indigenous crops in the country particularly as they have high nutritional value and have been shown to sustain immune-suppressed individuals.

4.8 Future Needs and Priorities

i. Since PGR work in Zimbabwe is done in a decentralized manner, there is need for effort towards coordinated conservation activities, to enhance access to information and materials for improved utilization of plant genetic resources.
ii. The Ministry of Health and Child Welfare should continue with the promotion of indigenous foods. Also nutritional food baskets that constitute a balanced diet for the immune suppressed and children under five (5) should be researched and information made public. This will enhance the utilization of plant genetic resources.
iii. Most of the accessions in *ex situ* conservation are underutilized due to lack of characterization information. Hence there is need for improved research towards characterization and evaluation of gene bank materials.

CHAPTER 5

THE STATE OF NATIONAL PROGRAMMES, TRAINING AND LEGISLATION

5.0 National Programmes

5.1 Purpose and Basic Function of National Programmes

The purpose of national programmes in Zimbabwe is to increase the capacity of stakeholders on the issues of conservation, sustainable utilization of PGRFA and equitable benefit sharing mechanisms. The program promotes participation of farmers in plant breeding and varietal selection projects so as to equip them with skills to develop maintain and preserve their own local seed varieties. The government of Zimbabwe through the GRBI, and in collaboration with NGOs leads efforts in these training programmes.

5.1.2 Existing Institutions and their Programmes

There are two types of national programmes in Zimbabwe, namely the formal centralized national programmes and the formal sectoral programmes mainly undertaken by NGOs.

Public Sector Programmes

The Genetic Resources and Biotechnology Institute of Zimbabwe

The GRBI is responsible for the implementation of national programmes on *in situ* and *ex situ* management. Its main objectives are: inventorying, collection and conservation of plant genetic resources important for food and agriculture; characterization, multiplication, regeneration and documentation of all conserved germplasm; promotion of on farm conservation activities and making recommendations on all policy issues that affect PGR in Zimbabwe. The GRBI also work in close collaboration with national plant breeding institutions, NGOs, and the farming community in undertaking PGR related activities; and is responsible for recommending policy and legislative proposals to the government, designing of training programmes, identification of capacity building needs, and designing of strategies for implementation in consultation with the National Plant Genetic Resources Committee (NPGRC).

NPGRC

The specific functions of the committee are to provide advice on plant genetic resource activities to be carried out by the GRBI and recommend policies and legislative frameworks to the government of Zimbabwe. The committee has been operational since the year 1993. The NPGRC comprises of representatives from government departments, parastatals, universities, research institutes, legal experts, farmers' organizations and NGOs.

Forestry Commission and National Herbarium and Botanic Garden of Zimbabwe

In situ conservation of fruit trees for food and agriculture is managed by the Forestry Commission and the National Herbarium and Botanic Garden of Zimbabwe. The Forestry Commission propagates fruit trees, ornamental and commercial trees, whilst the latter conserves specimens of most of the tree species that are found in Zimbabwe. The Forestry

Commission has a gene bank in place whose forest species are duplicated at the GRBI of Zimbabwe.

5.1.3 Funding of public sector programmes

Funding of national programmes is done by both the public and private sectors. The Zimbabwe government has shown commitment in providing funding for the GRBI, and DARS However, the funding is limited and donor organizations and NGOs generally assist with providing support for national programmes.

The above analysis of existing institutions and their programmes clearly shows that Zimbabwe does not have a well coordinated national programme on plant genetic resources for food and agriculture except for isolated projects implemented by government departments and NGOs. Although no comprehensive national programmes exist to support plant genetic resource conservation and utilization a number of activities were undertaken to improve the overall management of genetic resource in the country. Notable actions include the enactment of the Environmental Management Act, Establishment of the Environmental Management Agency, Biotechnology and Biosafety Institute and GBRI.

5.2 Training

The main local stakeholders in providing training in PGRFA include CTDT, Universities, Fambidzanai Permaculture Training Centre, and others.

Private Initiative Programmes: NGOs and Universities

These are mainly involved with training and are discussed below.

Community Technology Development Trust (CTDT)

CTDT is a local NGO established in 1993 and undertakes training programmes on participatory plant breeding and varietal selection, conservation farming through its farmer field schools, farmers' rights and biodiversity related issues. CTDT operates in 9 districts of Zimbabwe namely: Goromonzi, Nyanga, Murehwa, Mutoko, Mudzi, Chiredzi, Tsholotsho, Uzumba Maramba Pfungwe and Chegutu. CTDT initiatives focus on the promotion and conservation of small grains, indigenous vegetables for food security and the facilitation of participation by the civil society in policy formulation discussions and debates on trade, biodiversity and biosafety issues. CTDT is also a member of the NPGRC of Zimbabwe.

Fambidzanai Permaculture Training Centre

This institute is located near Harare and it runs diploma and short courses in permaculture. The center also runs a gene bank for the traditional varieties and these are collected from farmers within their network of Natural farming for safe keeping.

Universities

A number of universities are involved in agricultural research training. These include the University of Zimbabwe (UZ), Africa University, Chinhoyi University, and the National University of Science and Technology (NUST). NUST has been involved in undertaking few studies mapping sorghum genetic diversity.

5.3 Training Needs and Priorities

- Development of education curriculum on PGRFA for primary, secondary, university and tertiary education
- Database formulation; documentation and information management
- Exchange visits to institutions on PGRFA in developed countries and within the region

5.4 National Legislation

Zimbabwe acceded to the World Trade Organisation Trade Related Aspects of Intellectual Property Rights (WTO /TRIPS) Agreement, the CBD and the Union for the Protection of New Plant Varieties (UPOV) 1978 which are international instruments critical for regulating PGRFA. Under its Constitution, Zimbabwe is obliged to domesticate the provisions into national law. At the regional level, Zimbabwe is party to the African Model Law: The Protection of the Rights of Local Communities, Farmers and Breeders, and for the Regulation of Access to Biological Resources which recommends African states to develop national laws.

Zimbabwe has a number of policies which regulate or have a bearing on PGRFA which include the following:

i. The Zimbabwe Alleviation Action Plan
ii. Zimbabwe Biodiversity Strategic and Action Plan
iii. Environmental Management Act and related policies (Forest Act, Communal Lands Forest Produce Act (CLFPA), National Environmental Policy)
iv. National Environmental Policy
v. Agricultural Polices and Strategic documents (Plant Breeders' Rights Act; Department of Agriculture Research and Extension Strategic Plan; Agriculture Research Act; Plant Pests and Diseases Act; Noxious Weeds Act and the Fertilizers, Farm Feeds, and Remedies Act)
vi. Zimbabwe Food Security Issues Paper

It is important to note that Zimbabwe agricultural policies regulating the various aspects of agricultural activities refer to genetic resources generally as livestock and crops. With specific reference to plant genetic resources, the following are noted: pasture grasses, cereals, pulses, industrial and horticultural crops, indigenous and exotic vegetables, roots and tubers, medicinal plants, landraces and wild relatives of cotton, rice, sorghum, pearl millet, finger millet, cowpeas and bambara nuts. However, particular policies dealing with agricultural research and technology transfer (Plant Breeders' rights; Plant Pests and Diseases Act; Seed Act, Noxious Weeds Act and the Fertilizers, Farm Feeds, and Remedies Act) make references to genetic resources in the form of new crop varieties and livestock breeds obtained through research, and the transfer and adaptation of these through technical service provision, extension, training and on-farm demonstrations. Policy and legislative frameworks that protect community rights, their innovations and their contribution to the conservation and sustainable utilization of PGR were also put in place among them the Environmental Management Act and Policy and Draft Regulations on Access to Biological Diversity and Protection of Traditional Practitioners Rights. The Biotechnology Act and Policy were put in place to ensure safe handling and transfer of GM products in a manner that does not cause damage to the environment or cause genetic erosion. However, the EMA and related policy documents refer to genetic resources with special reference to flora, fauna, diversity, and biodiversity in two different ways as follows:

- Biological diversity – as adopted in the United Nations Convention on Biological Diversity (CBD) adopted in 1992
- Natural resources – the mammal, bird, fish and other animal life of Zimbabwe; the trees, grasses and other vegetation of Zimbabwe.

With special reference to plant genetic resources this is viewed as part of natural resources but covering trees, grasses and other vegetation of Zimbabwe.

5.4.1 Access to Genetic Resources

There is no clear legal framework regulating access to genetic resources in Zimbabwe although there are various frameworks related to genetic resources.

The Regulation of access to PGR is mainly provided for under the Environmental Management Act (Chapter 20:27) which empowers the Minister to formulate regulations on conservation of and access to biological diversity. Section 116 of the Environmental Management Act (Chapter 20:27) mandates the Minister to take such measures as may be necessary for the conservation of biological diversity and implementation of Zimbabwe's obligation under the CBD. The Minister is also mandated to protect the indigenous property rights of local communities in respect of biological diversity; support the integration of traditional knowledge on conservation of biological diversity; prohibit or restrict access by any person to or the exportation of any component of biological diversity of Zimbabwe.

An analysis of the above provisions shows the top down nature of the environmental laws of Zimbabwe. They also illustrate the central nature of tenure systems in ABS regulations in that while indigenous property rights of communities are being promoted, the access to and control over resources is centralized and lies with the Minister responsible for the conservation of biodiversity. Furthermore, currently draft regulations on Access to Biological Diversity and Protection of Traditional Practitioners Rights are in place and issues of PGRFA are not included. Any regulations to be developed have to contain clauses that include consultation with local communities and verify local community decision making processes.

Indirectly the government of Zimbabwe encourages programmes and policies that promote access to genetic resources by communities. Although the Poverty Alleviation Action Plan, does not explicitly mention the term '*genetic resources or plant genetic resources*' it recognizes poverty in rural areas as exacerbated by land pressure and overuse of resources.

5.4. 2 Phytosanitary Regulations

Zimbabwe is party to the International Plant Protection Convention (IPPC) and enacted various legislative frameworks such as the Plant Pest and Diseases Act (Chapter 19:08) and Control of Goods Act (Chapter 14:05) in order to fulfill its obligations,

Plant Pest and Diseases Act (Chapter 19:08)

Importation of agricultural commodities in Zimbabwe is regulated by the Plant Pests and Diseases Act (Chapter 19:08) and the Control of Goods Act (Chapter 14:05). The import or export of agricultural commodities has been associated with the spread of plant pests and diseases that often become injurious in new agro-ecosystems to which they are introduced. The Plant Quarantine Services (PQS) a department under DARS enforces the Plant Pests

and Diseases Act. PQS is situated 33km along the Harare-Bindura road and has well-developed laboratories, glasshouses, incinerator and offices. It provides both internal and quarantine services throughout 8 provinces of Zimbabwe and 21 border posts (Figure 5.1). Plant inspectors inspect all agricultural produce and wood material and assist with the issuance of import and export permits. The main objectives of the quarantine measures is to protect maize, fruits, tobacco, wheat and others from quarantine pests and diseases such as the devastating maize Larger Grain Borer (*Prostephanus truncatus*), Fruit flies (*Bactrocera invadens*), tobacco blue mould (*Pernaspora tabacina*), karnal bunt disease of wheat (*Tillitia indica*) and others. However, due to the current economic hardships resulting in an elevated agricultural commodities importation level, Zimbabwe is faced with an increased risk importing foreign pests and diseases.

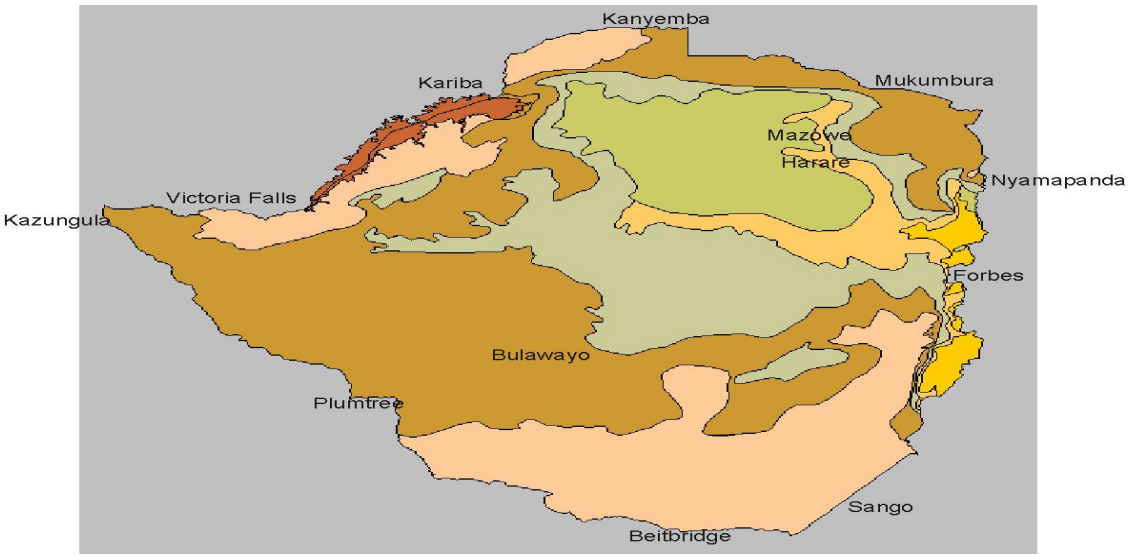

Figure 5.1: Border Posts and Agro-ecological Zones in Zimbabwe

5.4.3 Seed Regulations (Chapter 19:13)

Zimbabwe has put in place the Seed Act to regulate production of high quality seed by seed houses but there is no specific legislation regulating the sale of local landraces. In terms of the Seed Act, small holder farmers, can produce and sell only seed of prescribed crops as standard grade seed. The sale by small holder farmers of open pollinated maize varieties can only be done through seed houses. Considerations of establishing a "Quality Declared Seed system" should be made to allow for informal seed sales of quality local seed land races by small holder producers.

5.4.4 Plant Breeders Rights

The Plant Breeders Right Act (Chapter 18:16) as amended by Act No 11 of 2001 defines a breeder in relation to a new variety, as the person who directed the final breeding of the variety, who developed/discovered it or the legal representative of such person. A protectable plant variety under the Act is one that: is clearly distinguishable from any other variety, has not been commercialized, and is sufficiently homogeneous and stable.

The Act creates a monopoly over the production, marketing and sale of seeds and restricts the ability of farmers to breed, save and exchange seeds. Zimbabwean rural life is one of sharing and as such seed passed on from the ancestors is regarded as common property,

for use by family and neighbors, and not for sale. However, with commercialization, it is now acceptable to sell to outsiders, although the existing law prohibits a rural farmer without a seed breeder's certificate from marketing his family-bred seed on the formal market but can only sell it as grain.

5.5.5 Other Policies which affect the conservation and utilization of PGR

Trade, Commercial and International Agreements:

Whilst the CBD and the ITPGRFA Agreements provided mechanisms for the protection of PGRFA and promote its sustainable utilization, the WTO Related Agreements [TRIPS, Technical Barriers to Trade (TBT), Sanitary and Phytosanitary Standards (SPS) and the Agreement on Agriculture (AoA)] regime are more liberal and may have adverse effects on the conservation of PGR. The main challenge is the regulation of modern biotechnology in a manner that does not result in the depletion of PGR.

Biotechnology and Genetic Resources Conservation

Zimbabwe is a signatory to the Cartagena Protocol on Biosafety (Biosafety Protocol). The protocol complements efforts of the CBD and allows countries that are Parties to the Protocol to apply the precautionary principle and prohibit or severely restrict the import of GMOs into their countries, where they believe scientific uncertainty exists concerning the safety of GMOs in terms of the environment and human health. The application of modern biotechnology, as in other parts of the world is controversial in Zimbabwe although it is accepted that traditional biotechnology techniques can be employed for the enhancement of PGR.

National Biotechnology Act of 2006 (Chapter 14:31)

The introduction and use (experimental or commercial) of GMOs is controlled by the National Biotechnology Authority of Zimbabwe, which was established through the National Biotechnology Authority Act [Chapter14:31] (No.3 of 2006) and fall under a fully fledged Ministry of Science and Technology Development created in 2005. Zimbabwe also now has an explicit policy on biotechnology which was approved in 2005. The Act states that all greenhouse and field trials with GM crops are to be supervised by the Authority; all food, feed and seed importers are to obtain biosafety permits prior to any imports; seed and feed should be GM free; and no unmilled GMOs may be imported into the country unless authority and guidance is sought from the Authority. All these measures are meant to reduce risks of contamination of the genetic diversity and of the environment upon which crops survive.

The NBA is also responsible for licensing laboratories that meet the stringent requirements to import or work on GMOs in the country and supervise any work on GMOs that is conducted in Zimbabwe. There are currently three competent laboratories that have been licensed to conduct research with GMOs. These are the Tobacco Research Board (Kutsaga Research Station), African Institute of Biomedical Science Technology (AIBST) and Central Veterinary Laboratory (CVL). Three other institutions namely the University Zimbabwe, National University of Science and Technology and the Southern Africa Research and Development Centre (SIRDC) are in the process of registering their laboratories. Experimental work that has been conducted to date includes crops such as maize and cotton that have been field-tested.

5.6 Future Needs and Priorities

- Establishment of an information center/ library at the GRBI for information dissemination to various stakeholders. The GRBI should have its own website, wide band internet and email installation for enhanced information dissemination.
- Capacity building and financial assistance on database formulation; documentation and information management on PGR and biosafety and linking it at regional and international levels.
- Development of education curriculum on PGRFA for primary, secondary, university and tertiary education.
- Promoting public awareness, education and participation on PGR programmes biosafety management and risk assessment. These can be promoted through participation in agricultural shows, community seed fairs, national farmers' technical conferences and organizing short courses on PGR management and biosafety related issues.
- Funding of exchange visits to institutions on PGRFA in developed countries and within the region with functioning *In situ* and On-Farm conservation programmes.
- Institutional support to establish and/or upgrade national research and testing facilities on GMOs to meet appropriate quality standards.
- Institutional Support for the establishment of an institutional and legal framework and policies that recognizes farmers' rights including the right to commercialize their seeds and harmonization of frameworks, policies, laws, standards and procedures related to PGR (national, regional and international).

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CHAPTER 6

THE STATE OF REGIONAL AND INTERNATIONAL COLLABORATION

6.1 Collaboration at the Regional and Sub-Regional Level

Zimbabwe participates in a number of networks and these are briefly discussed below.

SADC Plant Genetic Resources Center

Zimbabwe is a member of the SPGRC which was established in 1989 within the framework of the Southern Africa Center for Co-operation in Agriculture and Natural Resource Research and Training (SACCAR), the institution which coordinates agriculture and national resources research within the SADC region. The SPGRC was established in order to conserve indigenous plant genetic resources (PGR) within the region, provide training in PGR and promote germplasm collection, characterization, evaluation, rejuvenation, multiplication, documentation and utilization. The SPGRC also issue catalogues of PGR available in the SADC gene bank; publishes an SPGRC Newsletter; organizes plant genetic resources annual planning meetings; and plans for human resources development. In Zimbabwe the focal point is the GRBI which received 24 upright freezers, one dehumidified drier, one moisture meter and one aluminum foil sealing machine for *ex situ* germplasm conservation.

SPGRC-CTDT- Stiftung Umverteilen Organisation Assessment of Seed Requirements Assessment

SPGRC, CTDT and the Germany- based Stiftung Umverteilen (Foundation Redistribution), launched an initiative in March 2000 in the aftermath of Cyclones Eline and Gloria to restore sustainable agriculture in the affected areas using short, medium, and long term approaches. Crops included in this initiative were maize, sorghum, pearl millet, rice, cowpea, beans and groundnuts and it covered Zambia, Malawi, Swaziland, Tanzania, Botswana, Namibia, Zimbabwe and South Africa.

Southern Africa Biodiversity Initiative (SABPI)

SABPI is a sub-regional network in Southern Africa established in July 2006 and its membership is composed of Zimbabwe (CTDT), Zambia [Institute of Human Rights and Intellectual Property Development (HURID), Farmer Support Organisation (FOSUP)] and Malawi (Center for Environmental Policy and Advocacy (CEPA)). The main mandate of the network is to implement complementary activities pertaining to national and regional policy on biodiversity, biotechnology, food security, international trade and intellectual property rights including linkages among these.

The Southern Africa Root Crops Research Network (SARRNET) was launched in September 1993. The mandate of SARRNET is basically applied/participatory research and development on cassava and sweet potato.

SABONET was a regional programme involving 10 SADC countries established for strengthening botanical expertise, expanding and improving herbarium and botanic garden collections and fostering closer collaboration among botanists in Southern Africa. The project started in 1996 mainly with funding provided through the NETCAB programme and continued with GEF/UNDP funding until the end of December 2003. In Zimbabwe its main

achievements were the computerization of the National Herbarium collection (99% completed); training of four research officers in Systematics and Biodiversity Science (MSc level) at the University of Cape Town and the development of a strong core of professional botanists who produced more than 10 publications on the plants of Zimbabwe.

The Southern African Biodiversity Support Programme: Access and Benefit-Sharing initiative was launched in 2003 and the implementation period was up to 2005. Zimbabwe was involved in the initiative together with other SADC members. The lead organizations were IUCN and UNDP/GEF with the overall goal of providing institutional capacity to implement legislation regulating access and benefit sharing and incentive measures for conservation.

6.2 International Programmes

Key amongst Zimbabwe's international partners are the following: Community Biodiversity Development and Conservation (CBDC) Programme; the Consultative Group on International Agricultural Research (CGIAR); CIMMYT; International Livestock Centre for Africa, (ILCA); the International Institute of Tropical Agriculture (IITA); Bioversity International; the International Rice Research Institute (IRRI) and ICRISAT. Other collaborative initiatives are listed in Table 6.1. The main problem, however, is that these international organizations are not linked to Farmers' Unions within the country. Currently there are four registered Unions namely, Zimbabwe Farmers' Unions (ZFU), Zimbabwe Commercial Farmers' Unions (ZCFU), Zimbabwe National Farmers' Union (ZNFU) and the Commercial Farmers' Unions (CFU). As a result farmers' unions are weak in seed multiplication, characterization and sustainable utilization of underutilized crops.

Table 6.1: Summary of International Collaborative Initiatives in Zimbabwe

National Partner	Activity	International Partner	Crops
Southern African Unit for Local Resource Development (SALRED Trust)	Community Seed Centres, Participation of farmers in on-farm, farmer managed trials	CIMMYT	Wheat, maize
Practical Action	Food production programme supports projects on development of technologies for agro-biodiversity conservation e.g. promotion of community seed banks & diversity fairs	Practical Action	

CTDT	Community based crop genetic resources management. Strong focus of the farmers seed supply system Development of strategies for *in situ* conservation and utilization of plant genetic resources in desert prone areas of Africa	CBDC, Plant Research International, Wageningen FAO, Bioversity International	Sorghum, millets, cowpea sorghum
National Genebank and Biotechnology Research Institute (NGBRI)	Genetic Diversity Assessment of sorghum landraces in Zimbabwe Using Microsatellites and Indigenous Local Names	FAO, Bioversity International	Sorghum
Department for Agricultural Research for Development ($DAR_{for}D$)	Biodiversity of Leafy green vegetables (phase 1)	Bioversity International	African leafy vegetables
SADC Centre of Communications for Development	The Links project: local knowledge to support biodiversity conservation and food security	FAO	
University of Zimbabwe	Wild Food Plants of Africa Project: documentation of how the foods are prepared and preserved as well as their nutritional content.	Kellogg Foundation	Wild vegetables and wild fruits

6.3 Future Needs and Priorities

i. The creation of data bases and websites for both *in situ* and *ex situ* collections at the regional level that are also linked at the international level.
ii. Support capacity building of farmers' unions in seed multiplication, characterization and sustainable utilization of underutilized crops as complementary effort to GRBI initiatives
iii. Support exchange networking programmes on information sharing and dissemination and technology transfer at regional and international levels
iv. Support creation of data bases and websites for both *in situ* and *ex situ* collections at the regional level linked at the international level.
v. Support collaborative research on PGR for such activities as collecting, conservation, distribution, evaluation and genetic enhancement amongst regional and international institutions.
vi. These international initiatives should also be linked to Farmers' Unions in existence within the country. There is need to capacity build

members of these farmers' unions to become seed growers and multipliers of underutilized crops and open pollinated varieties such as finger millet, bambara nuts groundnuts, cowpeas, indigenous vegetables, sorghum and others.

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CHAPTER 7

ACCESS TO PLANT GENETIC RESOURCES AND SHARING OF BENEFITS ARISING OUT OF THEIR USE, AND FARMERS' RIGHTS

7.0 Introduction

The two related issues of access to genetic resources and fair and equitable sharing of benefits derived from the use of the genetic resources has been widely discussed in Zimbabwe over the last 15 years. Zimbabwe subscribed to a number of international agreements relevant to access to plant genetic resources and sharing of benefits arising out of their use namely the ITPGRFA, CBD, UPOV, WTO/TRIPs and the Cartagena Protocol on Biosafety. Section IIIB of the Constitution of Zimbabwe mandates the government of Zimbabwe to domesticate the provisions of signed and ratified international agreements through an Act of Parliament. The country has domesticated the provisions of some of the agreements and put in place various laws and policies to that effect. However, the country is still in the process of undertaking consultative processes towards the development of appropriate legislative frameworks on access to plant genetic resources and sharing of benefits arising out of their use and Farmers' Rights. The country should also take into considerations the Bonn guidelines as reference in the process of domestication of the ITPGRFA.

7.1 The Legal and Policy Framework

Zimbabwe has put in place various legislative frameworks and policies related to access to PGR and the sharing of benefits arising out of their use namely:

- Environmental Management Act and Policy;
- Regulations on Access to Genetic Resources and Benefit Sharing;
- Patents Act (Chapter 26:03),
- Plant Breeders' Rights Act (18:16) as amended in 2001
- Biotechnology Act and Policy of 2006.
- Plant Protection and Pests Control Act (Chapter 19:08)
-

However, there is no Farmers Rights (FRs) legislative framework in place and efforts are underway to domesticate the provisions of the ITPGRFA.

7.2 The State of Access to PGR

There is no regulatory framework on access to PGR and knowledge of the procedures for access by individuals or institutions is limited. It is generally easier to access crops for food and agriculture than for commercial purposes where strict patent laws apply. Notably customs duty charged on materials from outside the SADC region is excessive and the Zimbabwe Import Regulations Authority (ZIMRA) requirements are lengthy and cumbersome and are thus prohibitive in nature.

7.2.1 Exchange of PGR from *in situ* conditions and *ex situ* collections and improved varieties

Exchange of PGR from both *in situ* and *ex situ* collections is done at both national and community level. At national level, the GRBI facilitates access to local crop varieties and

DARS does so for hybrid seeds. At the community level, farmers exchange seeds amongst themselves at seed fairs or access seed from community seed banks. Farmers can also access seeds for multiplication from the GRBI.

7.2.2 Restrictions on Access

Zimbabwe has put in place laws to restrict access to PGR mainly on the basis of food security; intellectual property rights (IP) and phytosanitary reasons. The Plant Pest and Diseases Act (Chapter 19:08) regulates the import or export of agricultural commodities to minimise the spread of plant pests and diseases that are detrimental to agro-ecosystems as was discussed in Chapter 5. Access to endangered species is also restricted (e.g the flame lily – *Gloriosa superba*) to guard against extinction. The Patents Act and the Plant Breeders Rights Act also restrict access by creating monopoly over the production, marketing and the sale of seeds and the ability of farmers to breed, save and exchange seeds. There are no strict laws regulating access to communal farmers' varieties and plant breeders can use these research purposes, improve the varieties, register the varieties and obtain rights and in turn sell the seeds to the farmers.

7.2.3 Regulation of Access and Benefit Sharing

The policies and laws regulating access to PGR and benefit sharing are currently in a state of flux. The Plant Breeders' Rights (PBRs) and Seed Act are administered by the Ministry of Agriculture, Mechanization and Resettlement, whilst access to PGR is under the Ministry of Environment. Of importance is the New National Environmental Policy (Second Draft 2003), whose policy objective is 'to alleviate poverty and improve the quality of life of the people of Zimbabwe'. The policy goals include the following:

- Conserve biodiversity and maintain the natural resource base and basic environmental processes to enhance environmental sustainability.
- Promote equitable access to and sustainable use of natural and cultural resources with an emphasis on satisfying basic needs, improving people's standard of living, enhancing food security, and reducing poverty.

The Plant Breeders Rights Amendment Act (No. 11 of 2001; Chapter 18:16), grants rights to plant breeders on development of plants which are distinct, stable, and sufficiently uniform. They are thus entitled to royalties whenever use is made of their landraces. However, from the above criteria, it is clear that traditional plant varieties developed by local communities are not protected because they do not meet the criteria of distinctiveness, uniformity and stability, and besides an individual owner of the right could not be identified since this is a collective right.

The application of sanitary and phytosanitary standards and patents, for example, difficulties in accessing Bt genes, are some of the restrictions that limit access to PGR in Zimbabwe.

Actions to facilitate access to PGRFA

A number of actions need to be undertaken in Zimbabwe in order to facilitate access to PGRFA. These include:

- Documentation of available crop varieties
- Development of national and community seed registers

- Establishment of institutional frameworks to administer prior informed consents and mutually agreed contracts linking the national and community focal points
- Establishment of community seed banks and promotion of seed fairs in all districts of Zimbabwe
- Supporting participatory plant breeding and varietal selection amongst plant breeders and local farmers.
- Development of a legal framework that harmonizes plant breeders' rights and farmers' rights. The legal framework should provide for the acknowledgement of the source of origin of the genetic material or associated knowledge during registration of intellectual property rights.

7.3 Benefits Derived From the Conservation and Utilization of PGRFA

Through participation in regional and international collaborative programmes, Zimbabwe benefits through access to germplasm and improved varieties; technology transfer; scientific collaboration and capacity building. Farmers and communities benefit from PGRFA when they access seed from community seed banks, GRBI, exchange seed amongst themselves at seed fairs and participate in plant breeding and varietal selection programmes. However, farmers in Zimbabwe can fully benefit from PGRFA conservation and utilization when sui generis systems, intellectual property rights and other legal mechanisms, to benefit farmers and communities are developed. Such benefit sharing mechanisms should have incentive measures and ensure the cascading of benefits to institutional, community and individuals.

In order to fully benefit from the sustainable utilization of PGR, the following needs and priorities have to be addressed:

- Support participatory plant breeding and varietal selection initiatives amongst farmers
- Identify markets for farmers' varieties and training of farmers on marketing
- Training on negotiating contracts on PGR access on mutually agreed terms and prior informed consent
- Coordination of Ministries responsible for PGRs management
- Support the development of sui generis systems, intellectual property rights and other legal mechanisms that benefit farmers and communities

7.4 Financing PGRFA Activities

PGRFA activities are predominantly funded by the Ministry of Agriculture, Mechanization and Irrigation Development through the GRBI as the national focal point. Although the Ministry of Environment has the mandate to regulate access to genetic resources, it does not have a budget for this as it is presumed to be the prerogative of the Ministry of Agriculture, Mechanization and Irrigation Development. However, funding of these activities is also obtained from the SPGRC, international collaborating partners (FAO, CGIAR), the private sector (seed houses) and NGOs.

7.5 Implementation of Farmers' Rights

As indicated before, Zimbabwe lacks proper legislation to implement fully farmers' rights since there are no policy and legal frameworks in place yet. Communal farmers have limited understanding of their rights in relation to the plant varieties they grow and they are also not clear on how they should engage the big companies in economic partnership when marketing their crops.

However, the Plant Breeders' Rights Act [Chapter 18:16] through amendment no Amendment No. 11 of 2001 now recognises the input of small holder farmers by insertion of the provision which allows the small holder farmers to—

(a) retain products of their harvest for replanting;

(b) exchange with any other such farmer—

(i) any prescribed plant which he has grown or reproduced on his land; and

(ii) any seeds from a plant referred to in subparagraph (ii).

However, there is no mechanism on how communities who have maintained varieties over a long period of time can be rewarded collectively. It should be noted that the existing laws recognises 'farmers' privilege' rather than farmers' rights.

7.5.1 Challenges towards the effective implementation of Farmers' Rights

Several factors are limiting the attainment of farmers' rights in Zimbabwe including the following:

- **Absence of Comprehensive Policy and Legislative Framework** as noted above
- **Coordination challenges amongst Ministries:** The regulation of access to biological resources is vested in the Minister of Environment in compliance with the CBD, and on the other hand, the Ministry of Agriculture, Mechanization and Irrigation Development are obliged to domesticate the provisions of the FAO ITPGRFA.
- **Limited Awareness and Vision**: Most of the farmers, farmers' representatives and institutions providing services on agro- biodiversity currently do not full understanding of the principles of farmers' rights and the ultimate objectives and importance.
- **Research:** Plant breeders in Zimbabwe mainly focus on hybrid varieties, particularly maize. Very little is done on local land varieties and consequently, farmers have lost some landraces for crops such as finger millet and sorghum.

7.6 Future Needs and Priorities

- Support the development of a stand alone policy on plant genetic resources and a Farmers' Rights legislative framework to be implemented and coordinated by the GRBI under the Ministry of Agriculture;
- Support the review, harmonization and amendment of the Plant Breeders Rights, Seed and Patents laws to be supportive of farmers' rights and recognize farmers as contributors to the diverse PGR;
- Support national consultative processes leading towards the development of national policies and legislation designed to protect farmer's rights;
- Support the development of regulations to existing Agricultural Acts;
- Support the creation of farmers' rights information management systems and database;
- Support and finance research, participatory breeding and varietal selection, community and national seed banking programmes on local landraces
- Regional rationalization and harmonization of farmer's rights policies and legislation;
- Promoting national and regional networks for PGRFA;
- Developing comprehensive information systems for PGR and monitoring PGR erosion; and
- Promoting public awareness on the value of plant genetic resources.
- Build national capacity on biotechnology research and development for the sustainable utilization of genetic resources

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CHAPTER 8

THE CONTRIBUTION OF PGRFA MANAGEMENT TO FOOD SECURITY AND SUSTAINABLE DEVELOPMENT

8.0 Sustainable Use and Management of PGRFA

Sustainable use and management of PGRFA leading to food security requires protocols for the acquisition of the necessary germplasm, methods for the characterization and evaluation of the material and also suitable conservation strategies. In Zimbabwe agriculture is the cornerstone of the economy and it is, therefore, critical that the PGRFA are properly managed in order to ensure food security. Approximately 60% of the population relies on agriculture for food and employment and the agricultural sector accounts for 11-14% of the GDP of the country. The main staple food of the country is maize and it continues to be an important crop. However, production of other food crops such as sorghum, millet, groundnuts, soybeans, sweet potatoes and cassava is being encouraged particularly in the areas that are marginal for maize production. The Chibememe people in South Eastern Zimbabwe are an example of a community that successfully grows varieties of traditional sorghum, millet and groundnuts in a multiple cropping system. The agricultural sector had also diversified into the production of cash export crops such as tobacco, cotton, oil crops, flowers and other horticultural crops like vegetables and fruits. In the past, Zimbabwe used to be self-sufficient in terms of food production and in surplus years even used to export to neighbouring countries. However, for reasons mentioned earlier, the country has failed to produce enough food to feed its people for the last eight years. The situation was exacerbated by serious labour shortages as people emigrated to neighbouring and other countries in order to escape the economic hardships being experienced or went to search for diamonds in the Chiadzwa diamond fields, about 80 km from the city of Mutare.

Food security has become increasingly an important issue for both urban and rural populations in Zimbabwe and information available on Reliefweb.org for 2008 indicated that 4.1 million people were food insecure and required food aid. Natural disasters such as floods and droughts increase the vulnerability of rural people and subsistence farmers to food insecurity. Therefore, a secure PGR base is necessary to secure the livelihood of the majority of the nation. To most communities, availability of seed is a prerequisite for sustainable food production and PGR management systems should ensure that appropriate seed is made available to all those that require it. During the planting season of 2008-2009, farmers who could not access hybrid seeds relied heavily on their farm saved seeds. Availability of PGRs also broadens the base for breeding, for example ability to breed hybrid seeds and Open Pollinated Varieties (OPVs).

In addition, PGRs contribute immensely to the economic development of Zimbabwe. This is evidenced by the involvement of the Reserve Bank of Zimbabwe in the support of agricultural production through its various policies and programmes like the Agricultural Sector Productivity Enhancement Facility (ASPEF) that capital to finance agriculture and related activities at concessionary interest rates.

Although Zimbabwe has an abundance of diversity of genetic resources which contributes to food security, sovereignty and economic development of the country there is limited utilization of these resources, especially wild fruits and vegetables. Such foods form an integral part of the daily diets of many poor rural households and this was clearly evident during the 2007-2008 agricultural season when the country experienced a severe drought

coupled with failed agricultural policies. Wild foods are a source of important vitamins, minerals and other nutrients which complement the staple crops eaten by many of the more vulnerable people, including children and the elderly. These resources play an important role in agricultural development, food security and the alleviation of poverty.

8.1 Challenges Associated with Effective Utilization of PGR

The low crop productivity, which has sometimes led to food insecurity at both national and household levels, has been attributed to the following factors:

- Combined impact of climatic change -erratic rain, floods and droughts
- Economic hardships - continued price rises as a result of a hyperinflationary environment made life difficult for most communities by drastically reducing their purchasing power to procure agricultural inputs
- Poor performance of the agricultural sector exacerbated by recurring droughts. The Zimbabwe Vulnerability Analysis Committee (ZimVAC) report of 2009 stated that 33% of the assessed households were food insecure compared to 24% in November 2006.
- The effects of HIV/AIDs pandemic has further aggravated food insecurity
- Unreliable and poor service delivery particularly for small-scale farmers
- Marketing constraints especially in outlying areas as a result of poor road infrastructures and low prices
- Inadequate agricultural finance and credit, especially for small scale farmers with no collateral security
- Poor pricing policies and restrictions on access to PGR posed by existing seed laws

8.2 Needs and Priorities.

- Support research geared towards small grains production
- Support for infrastructure development and biotechnology research
- Support capacity building of farmers on commercial handling of local varieties like cassava, sweet potato, and wild fruits
- Support irrigation projects to reduce high dependence on rainfall
- Facilitate identification of markets for smallholder farmers
- Support the development a legal and policy framework on PGRs

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APPENDICES

Table A1: List of Contributors to the Report

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Shamwarira. Mr	ICRISAT
Tererai. B. Ms	Henderson Research Station
Thembani M. Mr	Forestry Commission

Table A2: Common Indigenous Fruit

Latin Name	Common Names
Adansonia digitata	• Baobab/ cream of tartar tree (E) • Mbuyu /mubuyu/muuyu/mawuyu (S) • Umkhomo (N) • Mubuyu (T)
Annona senegalensis	• Wild custard apple (E) • Muroro (S) • Ububese (N)
Annona stenophylla	• dwarf custard apple (E) • muroro (S) • ububese (N)
Antidesma venosum	• Tarsel berry/ antidesma • Musambarahwahwa/murungamunyu/chimande/mushongo/ • chisama (S)
Azanza garckeana	• Snot apple/ tree hibiscus/quarters (E) • Mutohwe/mugurura/mugururu/mutobwe(S) • Uxakuxaku (N) • Munengo (T)
Bridelia cathatica	• Kei apple (E) • Mutsvoritsvoto/munhungura/musvisvirondo (S) • Umqokolo (T)
Bridelia cathatica	• Blue sweet berry (E) • Mumbarembare/mutsvitsvirondo/ mupurungu/ murapambare (S) • Munyanyamwenda (T)
Berchimia discolor	• Bird plum/brown ivory (E) • Munyii/mutatya/munhacha/mugaramhanga (S) • Umnyi/umncaga (N) • Munjiyi (T)
Diospyros mespiliformis	• African ebony/ jackal berry (E) • Mushuma/mushenje/ mushumbo (S) • Umdlawuzo (N)
Ficus sycomorus	• Sycamore fig/common cluster fig (E0 • Mukuyu/ muonde/ mutsika/ musvingizu/kuwani/kuwane (S) • Umkhiwa (N) • Mukuyu (T)
Flacourtia indica	• Bakoka plum (E) • Munhunguru/mutombototo/mutudza/mutunguru (S) • Umqokolo/ umthunduluka (N) • Muntumbula/ mutumbula (T)
Friesodieslsia obovata	• Northern dwaba berry (E) • Muchinga/mushinga/munyani/mukodzombo (S) • Umkozombo (N) • Muchinga (T)
Grewia bicolor	• White-leaved grewia/donkey berry (E) • Mutongoro (S)

	• Umklampunzi/umpumpulwane (N) • Mwingili/ndeywa/ngiri (T)
Hexalobus monopetalus	• Baboons breakfast (E) • Mukodzombo/mupodzongwa/mukwingiziri/munyani/ musakama (S)
Lannea discolor	• Live long tree (E) • Mugan'acha/mumbumbu/chizhenje/muhumbukumbu/musha mba/mupuri/mupwanda (T) • Isigangatsha (N) • Sigangatsha/magangacha/mubumbu (T)
Mimusops zeyheri	• Common red milkwood (E) • Muchechete/muchirenje/mukaurura/mutunzi (S) • Umbumbulu (N)
Parinari curatellifolia	• Mobola plum/ hissing tree (E) • Muchakata/muhacha/muisha/mushakata/mubuni (S) • Umkhuna (N) • Mumbula (T)
Sclerocarya birrea	• Marula (E) • Mupfura/ musomo/mushomo/mutsomo (S) • Umganu (N) • Munogo (T)
Strychnos cocculoides	• Coky-bark monkey apple • Mushunwi/mutamba/muzhumu (S) • Umkhemeswane (N) • Muono (T)
Syzigium cordatum	• Waterberry (E) • Mukute/muisu (S) • Umdoni (N)
Strychnos madagascariensis	• Shiny-leaved mukwakwa/black monkey orange (e) • Muhwakwa/mukwakwa (S) • Umteme/ umwawa (N)
Strychnos spinosa	• Spiny monkey orange (E) • Mutamba/mun'ono/mutamba-mun'ono (S) • Umhali/umngono (N) • Muntamba (T)
Syzygium guineense	• wayer berry (E) • mukute/muisu (S) • umdoni (N) • katope(T)
Uapaca kirkiana	• Wild loquat (E) • Mushuku/mutongoro/muzhanje (S) • Umhobohobo
Vangueria infausta	• False medlar (E) • Munzvirwa/ munzviru/munzviro/ munjiro (S) • Umthofu/umviyo (N) • Mububuzuka/ musilingwa (T)
Vitex payos	• Chocolate berry (E) • Mutsubvu/mutsere/muhubva/mukubvu/mudyagava/ Chikubvusike, Umtshwankela (N), Mfudu (T)

Ximenia caffra	• Large sour plum/sour plum • Munhengeni/mutengeni/mutsvanza (S) • Umthunduluka (N) • Menampeli

Notes: ***E - English***

S - Shona

N - Ndebele

T - Tonga

ADAPTED FROM KAMUMVURI G. (2004) INDIGENOUS FRUIT TREES OF ZIMBABWE

Table A2. Common Indigenous Vegetable Species

Latin Name	***Common Names***
Achyranthes aspera	• Prickly chaff flower (E) • Nama/kasita (S) • Umdombe/amazinyenja (N) • Nama (T)
Adansonia digitata	• Baobab/cream of tartar tree (E) • Muuyu/mubuyu/mbuyu (S) • Umkhomo (N) • Mubuyu (T)
Adenia gummifera (tuber)	• Monkey rope (E) • Muboori/wore/deveramvumi/muhore/muhoro/muwore (S)
Aerva lencura	• Aerva (E) • Fototo/ furanondo/hoto/nyarotarota (S) • Uzadublana (N)
Alternanthera sessilis	• Chambodya (S)
Amaranthus hybridus	• Pigweed (E) • Mowa guru/mowa ramkura/mowa (S) • Imbuya/imbuya yamabizen (N)
Amaranthus spinosus	• Thorny pigweed (E) • Mowa-danga/mowa/bowa/munzwa (S) • Imbuya (N)
Amaranthus thunbergii	• Poor man's spinach (E) • Mowa/bononGwe/bowa (S) • Imbuya (N)
Bidens pilosa	• Blackjack (E) • Guza/muuwu/nhungunira/sina/nyamaradza (S) • Ucucuza/umhlabangubo (N) • Nama (T)
Ceratotheca triloba	• False foxgloves (E) • Mudyangaringa/zinyaruninga/munuwenhuwe (S) • Inkunzane enkulu (N)
Cissus integrifolia	• Wild grape (E) • Revereve/redza/chitafu/chikomba/renza (S) • Debelebe (T)
Cleome gynandra	• Spider flower (E) • Nyevhe/rune/runi/nyovhi/tsuna/bangara/rudhe (S) • Ulude (N) • Suna/shingwa (T)
Cleome monophylla	• Spindlepod (E) • Mujakari/musemwasemwa/mutyangetyange/chikangechikange/mushangishangi (S)
Corchorus asplenifolius	• Jute (E) • Derere/gusha/gwisha (S) • Idelele/ingogola (N) • Ngenge (T)
Corchorus olitorius	• Jute (E) • Derere/gusha/gwisha (S) • Idelele/isileleda (N)

	• Siachikwiye/telele buyu (T)
Cucumis anguria	• Gherkin/wild gherkin (E) • Mujachacha/ muchacha/mubvunzandadya (S) • Amagaka • Siila (T)
Cuvurbita maxima	• Pumpkin/hubbard squash (E) • Mubovora/mumhodzi/muboora (S) • Ibhobola (N)
Ddioscorea schimperana	• Mutenderi (S)
Dicerocaryum zanquebarium	• Boot protectors (E) • Ruredzo/chikada/feso/soso (S) • Inkunzane/intenkelane (N)
Dioscorea bulbifera (tuber)	• Air potato (E) • Idiya (S)
Dioscorea steriscus (tuber)	• Gandaazungu/manyanya (S)
Dolichos kilimandsharicus (tuber)	• Wild lupin (E) • Jero/gumbakumba/nhindiri (S)
Galinsoga parviflora	• Kew weed/gallant soldier (E) • Teketera (S)
Hibiscus articulatus	• Wild hibiscus (E) • Derere/ hambakachere (S) • Idelele (N)
Plectranthlus	• Scrambled egg (E) • Mubvumbe/tsaya/tsenza (S)
Solunum nigrum	• Black nightshade (E) • Mukundanyama/musungusungu/ musaka (S) umsobo/ixabaxaba (N)
Sonchus oleraceus	• Snow thistle/milk thistle (E) • Rurimirwemombe/dzengetsenge/livave (S) • Ulimilwenkomo (N) • Dimilangombe/kalulalula (T)
Triumfetta annua	• Derere/derere renama (S)
Triumfetta rhomboidea	• Burweeed (E) • Derere/derere rechijonga/nzunzu (S) • Idelele/inama (N)
Virgina unguichlata	• Cowpea (E) • Nyemba (S) • Indumba (N) • Kanyangube (T)

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ADAPTED FROM CHAPANO C (2004) INDIGENOUS VEGETABLES OF ZIMBABWE