ZAMBIA:

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

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Note by FAO

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CHAPTER 1
Introduction

1.1 PHYSIOGRAPHIC AND CLIMATIC FEATURES

Zambia is a land locked country covering an area of 752,629 km^2, lying on a plateau between altitudes 900 to 1,500 metres above sea level. The highest parts of the plateau are in the North East, with the plateau sloping gradually to the South West. The country lies between latitude 8° and 18° S and longitudes 22° to 35° E respectively and is bordered by Zaire, Tanzania, Malawi, Mozambique, Zimbabwe, Botswana, Namibia and Angola.

1.1.1 Climate

The country's climate is very much influenced by its high altitudes. It has three distinct seasons; a cool dry winter (May to August), a hot dry summer (September to October) and a hot/wet season (November to April). The temperatures range from 10°C to 27°C in the dry season and from 27°C to 38°C in the hot/wet season.

1.1.2 Population

The estimated population of Zambia is 8.6 million with an annual growth rate of about 3.5%. About 43% of the population lives in the urban areas.

1.1.3 Farming Systems

Rainfall is the dominant factor influencing climatic pattern in the country. It is, therefore the decisive factor in distinguishing the agro-ecological regions of the country (Regions I, II and III). The ecological regions and their farming systems are briefly described below:

i. Agro-Ecological Region I lies between altitudes 300-900 metres above sea level and receives an annual rainfall of between 600 and 800 mm. This region has three farming systems:

- The sorghum/millet based hand hoe farming system;
- The Pearl millet, sorghum, cassava, oxen based Farming systems, and
- The sorghum/maize and cattle based farming system.

ii. Agro-Ecological Region II - lies between altitude 900-1300 metres above sea level and receives between 800 and 1,000 mm of rain annually. This region has four farming systems:

- The maize based hand hoe farming system;
- The maize/cattle mixed system;
- The cassava based hand hoe farming system;
- The Central Zambezi flood plain farming system (ox-based sorghum, maize, Pearl millet and cassava).

iii. Agro-Ecological Region III - lies between altitude 1100-1700 metres above sea level and receives annually over 1000 mm of rain. There are four main farming systems in this region:

- Cassava based hand hoe farming system;
- The sorghum based hand hoe farming system;
- The mound (fundikila) Farming system;
- The finger millet based slash and burn (chitemene) farming system.

1.1.4 Main Forest Types

The country's vegetation is predominantly open miombo type woodland (species of *Bracystegia, Julbenadia* and *Isoberlinia*). This vegetation type covers about 89% of the country. Other types of forests, woodland and grassland exist with their distribution being influenced by rainfall and altitude. The minor forest types are the mopane, munga and kalahari woodlands.

The forest cover has been affected by a number of factors, arising mainly from human activities such as clearing for agriculture, demand for fuel wood including charcoal production and industrial demand for timber.

The total woodland area deforested by charcoal and agriculture in central Zambia is 2.5 and 19.3 percent respectively (Serenje W, et al, 1994).

1.2 AGRICULTURAL SECTOR

Output of the agricultural sector has failed to expand sufficiently to change the sector's share of 14% of GDP. Agriculture's annual growth rate of about 3.5% has been below the annual population growth. The country has, however, an under utilized base of natural resources which are more than adequate to permit a rapid expansion in agricultural production in the short run and ensure the sustainability of agricultural incomes and promote exports in the long run. There is at present about 750,000 ha. of underutilized farmland in Zambia.

1.2.1 Agricultural Enterprises

There are three categories of farmers engaged in agricultural production in Zambia.

- Small scale farmers who cultivate an average of 2 ha., using family labour and simple hand tools. They cultivate primarily for subsistence and usually with little surplus for cash.
- Medium scale farmers who cultivate an average of 10 to 20 ha., usually using animal draft power, improved crop cultivars and fertilizers. They produce crops for food and market a substantial surplus.
- Commercial farmers - cultivate between an average 30-600 ha. using mechanized farm power and machinery on a broader technological base.

1.2.2 Seed Supply Systems

The country's seed production and supply system, essentially comprises of informal and formal sectors.

i. The Informal Seed Sector

The informal sector is characterized by the use of traditional varieties and to some extent recycled improved seed which may have earlier been certified. This system accounts for well over 70% of the national seed supply system especially for non hybrid varieties.

ii. The Formal Seed Sector

The formal sector has been mainly dominated by the use of improved and certified varieties, especially hybrids. Supply systems under this sector accounts for about 30%. The major suppliers have been seed companies who have marketed the seed through a network of seed stockists, agencies and NGOs who are scattered throughout the country.

1.3 TRENDS IN CROP PRODUCTION

Crop production has generally been on the increase during the period from 1964 to 1990 mostly due to increased areas under cultivation and improved production technology facilitated by government subsidies to farmers. The main beneficiary crop, however, was maize.

With the liberization of the economy in 1991, subsidies on agricultural production were withdrawn. This has resulted in the reduction of areas under the production of high input crops like maize, wheat and cotton. This scenario is likely to bring about crop diversification in which traditional crops are likely to feature prominently. The full extent of this change in policy on crop production has, however, not been fully analyzed.

Crop production has in general been affected by the droughts of varying severity that have occurred during the last 11/2 decades. There have been sporadic outbreaks of pests such as armyworm, red locust and cassava mealy bug. The effects of such attacks on the traditional and improved varieties has, however, not been fully determined.

CHAPTER 2
Policies, National Goals, Programmes and Legislation

2.1 AGRICULTURAL POLICIES

The Zambian agricultural policy statement to the year 2000 and beyond sets out basic guiding principles for the operation of the agricultural sector as it evolves from a highly controlled and regulated industry to one which is fully liberalized and market force driven.

It is envisaged that these policies would by and large ensure that the following objectives are fully realized:

i. Ensure household, national and regional food security through dependable annual production of adequate supplies of food stuffs;

ii. Ensure that the existing resource base is maintained and improved upon;

iii. Generation of income and employment;

iv. Contribute to sustainable industrial development, and

v. Significantly expand the sector's capability to contribute to the national balance of payment.

In order to achieve the above objectives, the government has embarked on ten (10) strategies of which the following relate to genetic conservation:

a. Diversification of crop production

b. Improved use of available natural resources

c. Full utilization of land suitable for agriculture

d. Help farmers deal with natural disasters, and

e. Emphasis on sustainable farming systems.

2.1.1 Policies Related to Crop Research & Improvement

In order to achieve some of the policy objectives and strategies set out in the national agricultural policy, the agricultural crop research objectives have been redefined to ensure:

i. Provision of stable and high yielding varieties of both food and cash crops.

ii. Breeding of food crops for high nutritional value, storability and acceptability to end users.

iii. Breeding for resistance and tolerance to pests, diseases, drought and soil condition such as soil acidity and salinity.

In an effort to address the objectives given above, a programme to mobilize and conserve plant germplasm to ensure sustainable crop development and improvement has been initiated.

Policies towards conservation efforts have not fully evolved. Real incentives for farmers as a way of recognising their rights are yet to be established and as such farmers have not been encouraged and motivated to participate in conservation efforts.

In many cases, seed of improved varieties is expensive and do not fully meet the requirements of the village farmer. This has left little choice for farmers, but to continue to use traditional varieties. In the process conservation of such varieties has been inadvertently promoted.

2.2 NATIONAL PROGRAMMES

Earlier efforts in plant genetic resources conservation were not organized into a well coordinated national programme. As a result the real problem of plant genetic resources in management was not effectively addressed.

2.2.1 National Plant Genetic Resources Centre

The National Plant Genetic Resources Centre (NPGRC) was established in 1989 with the following specific responsibilities:

- To gather through exploration and collecting missions carried out in different ecological zones, information and materials of plant genetic resources of all indigenous and adapted exotic crops, their wild relatives as well as useful or potentially useful wild species.
- Characterization and evaluation, rejuvenation, maintenance, multiplication and documentation of collected and stored material in collaboration with the Regional SADC Plant Genetic Resources Centre (SPGRC).
- Preserve through *in situ* conservation other useful wild plant species.
- Maintain active collections under short to medium term storage for indigenous and adapted plant genetic resources.

The management of wild plant populations (*in situ*) is spearheaded by other institutions such as the National Parks and Wildlife, National Heritage Conservation Commission, Natural resources department Forestry department and National Council for Scientific Research in close collaboration with the NPGRC.

2.2.2 Organization of the Programme

The national programme is an integrated government funded activity falling directly under the Crops Division of the Ministry of Agriculture, Food and Fisheries. The Head of the National Programme is technically responsible to the Chief Agricultural Research Officer in-charge of Crops Division and administratively to the Chief Agricultural Research Officer responsible for agro-ecological region II. The position is comparable to Heads of other programme such as cereals research, food legumes, national oil crops, etc.

The Curator is assisted by the Documentation Officer, Conservation Officer, In-situ Officer and five (5) technicians.

The programme has its budget line and the government is committed to its funding. The major difficulty has been that funding has always been inadequate to the extent that the programme has no adequate equipment and transport to execute the major activities.

Other than these difficulties, the other factor mitigating against the smooth and effective conservation efforts is the inadequate coordination between current conservation and development efforts. In many cases, conservation principles are not included in the planning of development projects. There is no clear cut policy for each organization to consider the needs and activities of others with respect to natural resources while carrying out its operations.

National Plant Genetic Resources Committee

The National Plant Genetic Resources Committee (NPGRCOm) is responsible for liaising with other relevant institutions on formulation of policy guidelines that govern operations of NPGRC. The committee guides the Centre and ensures that there is some funding to the programme. Similarly work programmes are drawn by the Centre in close consultation with the NPGRCom.
The committee comprises representatives from various organizations.

There are eight working groups (WG) which advise the National Programme on several technical issues related to different crops. These WGs are however not yet functional mainly due to problems of funding.

Planning of Agricultural projects involves staff at the level of researchers and Team Leaders of the various programmes. This approach has enabled the Plant Genetic Resources staff to participate in the planning of the agricultural projects in general and agricultural research in particular. As a consequence the Plant Genetic Resources Programme features prominently in the recently planned Agricultural Sector Investment Programme (ASIP).

2.3 TRAINING

Most of the staff working at National Plant Genetic Resources Centres have been trained to M.Sc. level under the sponsorship of the International Plant Genetic Resources Institute (IPGRI), SADC Plant Genetic Resources Centre (SPGRC) and Zambia Agricultural Research and Extension Programme (ZAREP). More advanced training leading to Ph.D. is required along with short term specialized training through workshops and seminars.

Problems in obtaining and maintaining motivated good and well trained staff still exists. Staff turnover is rather high in many sectors of the Civil Service. Uncompetetive salaries and poor conditions of service poses a real threat to the retention of trained staff.

Basic skills mainly related to the general aspects of plant genetic resources conservation are available but skills in specialized and complementary fields in the programme such as botany, biotechnology, taxonomy and anthropological techniques are lacking.

Training in plant genetic resources is not currently available at higher institutions of learning in the country. Some topics related to genetic resources are, however, taught at the University of Zambia. But these topics are only meant to give stu-

dents some basic awareness on the subject and are not necessarily tailored to produce specialists. Specialized training has been obtained as of now from the University of Birmingham, U.K.

The University of Zambia, in collaboration with the International Plant Genetic Resources Institute (IPGRI), has developed a detailed M.Sc. optional course in plant genetic resources.
In order to implement this programme and meet its regional (SADC) obligations, the university will rely on a core of staff from the Department of Crop Science, Soil science and Biology Departments. In additional, assistance will be arranged from the National Gene Bank and the SADC regional genebank (SPGRC). Internationally, short-term assistance will be arranged with IPGRI and the University of Birmingham and any other institution with relevant expertise.

Apart from the M.Sc. option in plant genetic resources, the University of Zambia is collaborating with IPGRI, the University of Birmingham (with partial funding from the Darwin Initiative Programme) and SPGRC, to organise short-term courses in plant genetic resources with assistance from the NPGRC.

As the PGR programme gets established, such short-term courses will become part of the normal PGR training programme at the University of Zambia.

Since the country has limited capacity to host a regional course covering all aspects of genetic resources, it is felt that initial assistance from international and regional institutions would be beneficial in starting the course.

2.4 LEGISLATION

2.4.1 Plant Genetic Resources Legislation

Zambia has no specific legislation regarding the regulation of the collection, conservation and use of plant genetic resources. However, other legislation exists that regulate the management of natural resources, conservation of forests, conservation of wild and vegetation in the National Parks, quarantine, the seeds and plant varieties.

However, based on the FAO Draft international code of conduct for plant germplasm collecting and transfer, an administrative draft document has been put in place. This document although not legally binding, seeks to provide the following:

- To regulate the collection, conservation and use of plant genetic resources in ways that respect the environment, local traditions and cultures.
- To bring farmers, Non Governmental Organization (NGO) participation in areas where germplasm is collected and in activities aimed at conservation and utilization of plant genetic resources.
- To avoid over harvesting of gemplasm that may lead to permanent loss of genetic resources.
- To promote safe exchange of plant genetic resources as well as related information.
- To provide standards of conduct and define obligations of collectors and others handling plant genetic resources.
- To bring recognition, incentives and respect to local communities who manage and make available plant genetic resources.
- To ensure all collection activities and transfer of germplasm are officially sanctioned by the National Plant Genetic Resources Committee.

In order to realize the above, the following rules have been formulated:

i. Foreign exploration and collection missions should seek authority before collecting.

ii. The NPGRCom shall be the only authority designated to issue collection permits.

iii. All collections of genetic resources shall be carried out only with active participation of the NPGRC and all relevant data should be recorded.

iv. Duplicate samples with relevant data should be deposited with NPGRC.

v. Quarantine requirements shall be met before export or import of germplasm.

2.4.2 Plant Breeders Rights (PBR)

Crop breeding and improvement research is undergoing some major changes with the transformation of some public research stations into Agricultural Research Trusts (ART). These would be separate entities and private sector driven while the seed production and marketing has already been transformed from monopolistic to a competitive one with the coming into market of three more seed companies.

In order to encourage private initiative in these areas, it has now become imperative for the government to put in place Plant Breeders Rights to ensure that efforts of breeders are not abused and that they are rewarded adequately to encourage further investment in the development of more varieties.
Plant Breeders Rights legislation is not yet in place in the country but a draft is being made with the assistance of UPOV (Union for the Protection of Plant Varieties). Other than encouraging investment in crop breeding and improvement through protection of breeder material and rewards, its direct effect on genetic resource programme is not yet established.

2.4.3 The Agriculture (Seeds) Act

The act provides regulations regarding the release of varieties, testing of seeds, inspections and imports of seeds. It also gives conditions for sale of seeds in the country. Under this act, only varieties that have been adequately tested under the Zambian conditions and are entered into the official variety list are eligible for marketing in the country.

2.4.4 Plant Pests and Diseases Act

This act provides for the eradication and prevention of the spread of plant pests and diseases as well as the prevention of the introduction into Zambia of plant pests and diseases.

Quarantine procedures now in place are not rigorous. They do not affect movement of genetic resources as yet.

2.4.5 Forests Act

This act was enacted in 1973 to provide for the establishment and management of national forests, conservation and protection of forests and trees, the licensing and sale of forest products.

CHAPTER 3
Indigenous Plant Genetic Resources

3.1 FOREST GENETIC RESOURCES

The country's natural vegetation can be categorized into forests, woodlands, termitaria and grasslands. It is estimated that there are about 5,000-6,000 (Chisumpa, 1990) species of plants in the country. The estimated total flora of each vegetation type is shown in Table 3.1. The vegetation greatly varies from evergreen forests to semi-desert types, due to influence of landscape, soils, drainage, topography and weather patterns in their sub ecosystems.

3.1.1 Important Indigenous Forest Species

The natural vegetation and forests are a source of useful and potentially useful indigenous plant species. The plant species include wild fruits, timber, medicinal and industrial plant species. A list of the above category of species and some information pertaining to their status is shown in tables 3.2,3.3,3.4 and 3.5.

Table 3.1 The estimated total flora in Zambian vegetation types

Vegetation Type	No. of Species
Dry evergreen forest	600
Dry deciduous forest	400
Montane forest	400
Swamp forest	300
Riparian forest	900
Miombo woodlands	650
Kalahari woodland	500
Mopane woodland	300
Munga woodland	500
Terminatria	700
Grasslands	100

Source: Chisumpa,S.M (1990)

i. Indigenous Wild Fruit Tree Species

Most of these species are currently largely underutilized in the sense that only the rural populations harvest and consume them directly. The fruit trees exhibit a lot of variation expressed in fruit size, shape and taste. Some of the species occur throughout the country while a few are confined to certain areas.

Preliminary studies have been carried out on some of the species. This includes *Anisophyllea spp., Uapaca kirkiana, Parinari curatellifolia, Ricinodendron rautananii* and *Zizyphus mauritania.* The potential use for commercial products is high, but little has been realized.

Table 3.2 List of some commonly used indigenous wild Fruit Tree Species

1.	*Adansonia digitata*
2.	*Anisophyllea spp.*
3.	*Annona benegalensis*
4.	*Azanza garckeana*
5.	*Berchemia discolor*
6.	*Bridelia micrantha*
7.	*Cordyla africana*
8.	*Diospyrus kirkii*
9.	*Garcinia huillensis*
10.	*Guibourtia coleosperma*
11.	*Hexalobus monopetalus*
12.	*Landolphia parvifolia*
13.	*Parinari curatellifolia*
14.	*Ricinodendron rautenanii*
15.	*Zyzygium guineense*
16.	*Tamarindus indica*
17.	*Uapaca kirkiana*
18.	*Vanguirea spp.*
19.	*Ximenia americana*
20.	*Zizyphus muaritiana*

ii. Important Timber Species

These species are widespread or confined to certain areas of the country. Most of them have good timber characteristics. The most important species are *Baikiaea plurijuga* and *Pterocarpus angolensis* in terms of both local and commercial timber production.

The timber species face a much bigger threat of being lost than fruit trees as their harvesting entails chopping down entire trees. There are currently no measures for restocking the natural populations. Some of the important natural forest timber species are given in table 3.3.

Table 3.3 List of some common timber species

1.	*Afzelia quanzensis*
2.	*Albizia adianthifolia*
3.	*A. Antunesiana*
4.	*A. Versicolor*
5.	*Baikiaea plurijuga*
6.	*Burkea africana*
7.	*Entandrophragma delevoyii*
8.	*Erythrophleum africanum*
9.	*Faurea saligna*
10.	*Khaya nyasica*
11.	*Pericopsis angolensis*
12.	*Pseudolachnostylis maprouneifolia*
13.	*Pterocarpus angolensis*
14.	*Trichilia emetica*

iii. Medicinal Plant Species

A great number of wild plant species are utilized for medicinal purposes. Most of these plants have, however, not been studied. Knowledge for their use is also not readily available as it is held by few individual medicine men or herbalists. Local knowledge concerning medicinal plants will need to be sufficiently documented.

iv. Industrial Plants

Several plant species with potential for industrial use occur in many parts of the country. Some of these species have traditionally been used for several industrial products such as dyes, resins, oils and tannins.

v. Indigenous Wild root and vegetable plants

There are several wild plant species which are commonly used as relish among rural communities. Some of them are semi-cultivated while others are gathered from the wild (Table 3.4).

Table 3.4 List of some indigenous wild root and vegetable plants

1.	*Bidens pilosa*
2.	*Celosia trigyna*
3.	*Ceratotheca sesmoides*
4.	*Cissampelos mucronata*
5.	*Cleome gynandra*
6.	*C. hirta*
7.	*C. monophylla*
8.	*Coleus esculentus*
9.	*Commelina africana*
10.	*Corchorus spp.*
11.	*Cordyla africana*
12.	*Cucumis anguria*
13.	*Dioscorea hirtiflora*
14	*Gallinsoga parviflora*
15.	*Hebenaria sp.*
16.	*Hibiscus cannabinus*
17.	*Justicia sp.*
18.	*Oxygonum simulatum*
19.	*Portulaca oleracea*
20.	*Premna senensis*
21.	*Sesamum angustifolium*
22.	*Sphenostylis erecta*
23.	*Triplochiton zambesiacus*

vi. Pasture and Forage Species

This group of species provides the main grazing material for livestock. The species are widespread throughout the country. They continue to face the threat of genetic erosion and loss due to overgrazing, soil erosion, drought and clearing for agricultural use.(Table 3.5).

Table 3.5 List of Pasture and Forage Species

1.	*Acrocerus macrum*
2.	*Aeschynomene spp.*
3.	*Anthephora elongata*
4.	*Brachiaria spp.*
5.	*Chamaecrista mimosoides*
6.	*Chloris gayana*
7.	*Desmodium spp.*
8.	*Digitaria spp.*
9.	*Echinochloa scabra*
10.	*Indigofera capitata*
11.	*I. demissa*
12.	*Kotschya africana*
13.	*Mimosa pigra*
14.	*Opliusmenus hirtiellus*
15.	*Panicum spp.*
16.	*Paspalum scrobiculatum*
17.	*Phacelurus huillensis*
18.	*Sacciolepis africana*
19.	*Sesbania spp.*
20.	*Setaria spp.*
21.	*S. Pumila*
22.	*S. phacelata*
23.	*S. Venticillata*
24.	*Stereochlaena cameronii*
25.	*Tricholaena monachne*
26.	*Zornia glochidiata*

3.2 MANAGEMENT OF NATURAL FORESTS

The overall responsibility for safeguarding the environment lies with the Environmental Council of Zambia. The specific responsibility for protecting and management of forests lies with the Forest Department. The Forest Act alluded to earlier provides for the establishment and management of national and local forests, the conservation and protection of forests and trees and finally for the licensing and sales of forest produce.

About 9.6%(State of environment report, 1994) of the total land area in Zambia is gazetted as forest reserves.

Other programmes which play some role in the protection of natural forests are those under the Department of National Parks and Wild Life. The areas set aside for the protection of wild life have also served to protect the natural forests that these areas contain. National Parks occupy a total of 59,000 sq. kilometres (National conservation strategy for Zambia,1985).

Local people have played a significant role in safeguarding useful wild tree species. Most traditional practices include passive conservation of semi-wild or wild useful tree species. Many semi- wild or protected fruit trees and useful trees and shrubs are usually left dotted about the cultivated patches of farm lands. Desirable wild fruit trees are left when clearing woodland for cultivation. The abundance of wild fruit trees in cultivated areas reflects patterns of fruit tree use. The conservation, of such plants should be appreciated and can be enhanced by maintaining a mosaic of such habitats.

Non governmental organizations and some donors have played a role in conservation efforts. Activities have ranged from propagation of local tree species for agroforestry to creating awareness campaigns about the role and importance of trees.

3.3 THREATENED SPECIES

It is estimated that there are about 250 (Chisumpa, 1990) endangered plant species in Zambia. Almost all the known timber species are regarded as threatened. This is mainly because of the over exploitation of timber tree species for commercial use such as in mining operations, charcoal and fuel wood. The most important species in this group include *Baikiaea plurijuga* (Zambezi teak) and *Pterocarpus angolensis* (Mukwa). *Fagara chalybea,* a mound shrub is a favourite leaf vegetable which face threat because the entire plant is cut down to facilitate harvesting from the prickly stems and branches.

The emergency and growth of towns have created concentrated demand for wood fuel, firewood and charcoal by the majority of urban households who have limited resources or no access to modern energy sources. Consequently Miombo woodland are being cleared to supply fuel wood to urban areas in Zambia.

Overgrazing and overbrowsing also degrade Miombo woodland through excess removal of grass and tree foliage.

3.4 OTHER WILD SPECIES AND RELATIVES OF CROP PLANTS

A wide range of other useful and potentially useful wild plant species exist and require attention for their conservation. Useful categories of these wild plants include the pasture and fodder species and the various herbs and shrubs used as relish foods and sources of local traditional medicine (Table 3.6).

Table 3.6 Wild relatives of crop plants

Wild Species	Related Crop
1. Hibiscus sp	Kenaf
2. Oryza barthii	Rice
3. O. brachyantha	Rice
4. O. longistaminata	Rice
5. Pennisetum spp.	Pearl millet
6. Sesamum alatum	Sesame
7. S. calycinum	Sesame
8. Solanum spp.	African Eggplant
9. Sorghum spp.	Sorghum
10. Vigna spp.	Cowpea
11. Cucumis spp.	Various

Government plans through the National Plant Genetic Resource Programme include preventing plant genetic erosion through conservation of wild relatives of plants. Studies are required regarding the need and suitability of conservation methods. External assistance would be greatly appreciated in form of funds, improvement of capacity for botanical field studies, herbarium research, facility improvement and technical and professional development. Generally the wild species and wild relatives have not been sufficiently studied to ascertain their unique genetic diversity.

Not many of the wild relatives of crops have been utilized in the development or improvement of cultivated varieties. Some wild relatives of cowpea and rice collected from Zambia have been used at IITA and IRRI. Certainly some of the wild germplasm resources may possess some useful adaptive traits. For example, wild sorghum is being utilized in the sorghum improvement programme to create forage sorghum.

3.5 USE OF LANDRACES AND OLD CULTIVARS

Small scale or resource poor farmers who constitute the majority of the farming community in Zambia (about 70%), largely use their own landraces or traditional varieties. Landraces are more commonly used for indigenous crops like millets, sorghum, cow pea, bambara groundnuts and other minor crops. Farmers also use landraces for introduced crops like maize, cassava, sweet potato, groundnuts, beans and pumpkins.

The rural small scale farmers have relied on landraces for decades. Landraces are genetically diverse and well adapted to diverse and adverse growing conditions compared to improved cultivars. Landraces are not only stable and adapted, but also require lower purchased inputs for their cultivation.

The extent of cultivation of landraces has, however, been reduced due to adoption of improved varieties, especially cereals, and maize in particular.

The current government policy of crop diversification includes the promotion of traditional food crops like cowpeas, sorghum, millet and cassava. The government is also committed to encouraging community based seed production activities. Traditional farmers do value indigenous plant genetic diversity because of certain desired traits such as good storability and taste. Rural farmers especially women have played a key role in the selection, improvement and management of crop diversity on the farm for many decades. The land tenure system makes it difficult to implement land use policies that may include protection of wild genetic resources.

CHAPTER 4
Conservation Activities

The conservation activities within the National Plant Genetic Resources Programme were planned to include both *in situ* and *ex situ* conservation methods. The former method is applied mainly in the management of genetic diversity within wild plant species in general while the latter method is applied mainly in the management of agricultural and horticultural crops.

4.1 *IN SITU* CONSERVATION ACTIVITIES

There are presently no programmes or projects which are specifically meant to serve as *in situ* conservation for plant genetic resources in the country. There are, however, activities under the Forest Department which provide for the protection of forest areas (refer to forest act in Chapter 2).

The Dry Forest Management Project initiated in 1987 under the Forest Research Division gives the best example of *in situ* activities carried out in the country. The project was located within the teak production forests of Western province in Sesheke district. A complete list of species included and their respective uses is given in Table 4.1.

The laws and regulations governing the establishment and management of these protected areas could be used for setting up *in situ* conservation sites for some plant species. The Forest Research Division of the Forest Department has the mandate to carry out research activities pertaining to the ecology and botany of the main natural forest species including description of population stands representing different vegetation types (as described in Chapter 1). The division has undertaken some ecological surveys resulting in the demarcation of about 59 botanical reserves most of which have been described in terms of species composition. The botanical reserves were demarcated on the basis of distinct vegetation types, containing species which are poorly distributed or being located on the source of rivers.

Table 4.1 Species included for in situ conservation in the Dry Forest Management Project

Botanical Name	Major Uses
1.Baikiaea plurijuga	Timber,general construction, mining timber, parquet, etc.
2.Pterocarpus angolensis	Timber, handcraft, dyes, medicines
3.Guibourtia coleosperma	Timber, handcraft, edible seeds
4.Afzelia quanzensis	Timber, handcrafts,
5.Entandrophragma caudatum	Timber, tannin constructing, veers, etc.
6.Erythophleum africanum	Timber, general construction
7.Albizia versicolor	Timber, parquet construction etc.
8.Ricinodendron rautanenii	Handcrafts, canoes, pulp and edible fat from seed
9.Burkea africana	Joinery, mining timber construction, etc.
10.Brachystegia speciformis	Timber, veneers, handcrafts, boat building, etc
11.Julbernardia	Timber, handicrafts & implements

Source: Malaya, F.M (1990)

4.2 *EX SITU* COLLECTIONS

The National Plant Genetic Resources Centre (NPGRC) collection is composed of mainly the country's major traditional crops which include those regarded as being indigenous by virtue of being of African origin and those that were introduced at a relatively early stage and are now important components of the traditional cropping systems with useful local adaptation.

The total collections held in store at the NPGRC was 4619 as at 1st January, 1995. A list of some crops included in the collection is given in Table 4.2.

Table 4.2 Crop/Plant species with major contribution to the germplasm collection at the NPGRC

SPECIES NAME	COMMON NAME	NO. OF ACCESSIONS	PERCENT TOTAL
1.Sorghum bicolor	*Sorghun*	649	14.1
2.Eleusine coracana	F/millet	351	7.6
3.Zea mays	Maize	210	4.5
4.Pennisetum americanun	P/millet	284	6.1
5.Oryza sativa	Rice	136	2.9
6.Vigna unguiculata	Cowpea	338	7.3
7.Arachis hypogea	Groundnuts	435	9.4
8.Phaseolus vulgaris	Common beans	129	2.8
9.Vigna Subterranea	Bambara nut	110	2.4
10.Cajanus cajan	Pigeon pea	137	3.0
11.Cucurbita spp.	Curcubits	191	4.1
12.Oryza longistaminata	Wild rice	50	1.1
13.Heliauthas annuus	Sunflower	50	1.1
14.Capsicum spp.	Chilli	53	1.1
15.Mucuna deeringiana	Velvet bean	23	0.5
16.Cucumis melo	Melon	18	0.4
Total		**3164**	**68.4**

Within the NPGRC collection landraces of indigenous crops and adapted traditional crops are given priority. To this effect the general policy which has been adopted is that in the event of shortage of storage space these categories of crops will be stored first.

A few local plant breeders have done preliminary evaluation of the material from the NPGRC with a view to identifying material with desirable traits which could be used in their breeding programmes. This has happened for finger millet and currently being done for maize and beans. In general terms, however, the level of utilization of the material from the genebank is still low.

4.2.1 Collection Activities

Collections of locally occurring plant germplasm have been planned and carried out by both local, regional and international scientists. The locally organized collection missions are based on set priorities, planned and executed in collaboration with relevant crop experts.

While local missions have essentially been multicrop most regional and international collections have targeted particular crops or groups of crops. In 1992 for instance, IRRI conducted a wild rice collection mission while ICRISAT collected sorghum and pearl millet. These collections are, however, done with the full participation of the NPGRC staff.

4.3 STORAGE FACILITIES

Seed samples conserved at the NPGRC are stored in deep freezers which are located in an insulated room previously used as a cold room. There is no humidity control or ventilation system installed in the room. An exhaust fan was installed to assist in air circulation.

Power cuts do occur and make the maintenance of constant temperatures in the deep freezers somewhat difficult. The seed is dried to between 10-7% moisture content using a ventilated heated drier operating within the temperature range 25-35°C. This drier has been found inappropriate due to problems associated with temperature control and regulation.

The provision of a more appropriate drier preferably a dehumidified type operating at lower temperatures (15-20°C) would help in achieving recommended standards for drying seed samples.

The NPGRC is holding an active collection meant for short to medium term storage. Duplicate samples of all the material at the NPGRC are supposed to be maintained at the SADC Plant Genetic Resources Centre (SPGRC) which holds the base collection for the region. Only a small proportion has been deposited in the base collection. The major problem is that most accessions have smaller seed samples. Priority in the activities of the NPGRC will have to given to seed multiplication to solve this problem.

When material is received either from collections or as donations, it is processed and placed into storage as quickly as possible. The seed drying largely determines the processing period before the material is placed in storage. The currently available dryer will hold a maximum of 90 seed samples averaging about 250 gms. Drying to desired moisture contents takes about two weeks for most seed types. With the available facilities the center is able to process about 90 seed samples and place them into storage within three weeks of the date of receipt. To some extent the number of samples collected and brought to the NPGRC is influenced by the processing capacity. From experience the longest time it has taken for a sample to be placed in storage from the time of receiving is about three months. The major problem is the limited capacity of the dryer.

The deep freezers used have the capacity to hold approximately 800 accessions of about 250 gm per deep freezer. It has been estimated that one deep freezer will be required each year for the next five years to be able to handle an expected increase of approximately 600 samples per year. The room holding the seedstore is about 90m^3. This would hold approximately 15 deep freezers of the size that we are currently using (420 lts). With five deep freezers currently available it appears that the storage room would remain adequate in the next five years or so. A bigger room to include a provision for drying is, however, desirable.

The present arrangement of the NPGRC holding only the active collection and the base collection maintained by SPGRC appear to be satisfactory.

There are no other storage facilities other than those for seed at the NPGRC. Field collections for major vegetatively propagated crops (cassava and sweet potato) have been established by the researchers under the crop improvement programme. The NPGRC staff are collaborating closely with the breeder to ensure that proper maintenance is achieved.

Field collections are also being established for fruit species such as mango and bananas under the tree crops development and improvement programme.

The forest department has attempted to establish an arboretum for some selected useful indigenous tree species.

4.4 CHARACTERIZATION AND EVALUATION

Both characterization and evaluation from our understanding and in the context of plant genetic resources work are aimed at the description of the material in the collection. The difference between the two is that the characters or traits mostly used in characterization are those that are highly heritable and little influenced by environmental factors. On the other hand traits that relate to the agronomic performance, reaction to both biotic and abiotic factors and quality become important in evaluation.

Characterization has mainly been carried out by the NPGRC staff sometimes in consultation with the relevant crop experts. This has been done by growing out the material in the field and taking observations on morphological and agronomic characters. Evaluation is regarded to be mainly the responsibility of plant breeders and other researchers involved in crop improvement work. In both cases the IPGRI descriptor lists have been used. Modifications and additions have in a few cases been made to the characters used in evaluations to fit the specific requirements of individual researchers.

Future plans for characterisation includes the possible use of biochemical and molecular methods which are reported to be more reliable in identifying genetic differences between accessions.

The characterization and preliminary evaluation carried out so far has been carried out in close collaboration with breeders. The material characterized in this regard includes 293, 225 and 121 of finger millet, cowpea and bean germplasm accessions respectively.

The proportion of the material characterized and partially evaluated, taking into account what has already been and what is currently been done is approximately 14 percent of the total material in the collection. There is no material which has yet been subjected to full evaluation. The data from the characterization has been compiled and awaiting to be analyzed and ultimately published.

Measures are normally taken to ensure that our collaborators in both characterization and evaluation send back all data and information generated on material obtained from the genebank.

Although the NPGRC could initiate activities on evaluation deliberate efforts are made to ensure full involvement of breeders and other commodity specialists. Systematic evaluation of the material may not easily be achieved as individual researchers under different improvement programmes have different priorities. The partial evaluations by individual breeders may be effective in promoting the use of genebank material in the short term. In view of the current objectives of agricultural research, expenditures on systematic evaluation of the genebank material could be justified especially as this relates to the cultivar improvements and development of traditional crops.

International and regional collaboration will, however, be required to complement national efforts.

4.5 MULTIPLICATION AND REGENERATION

IPGRI recommendations on regeneration and multiplication are being applied. For most crop material included in the NPGRC collection, regeneration is carried out when the germination falls below 85 percent.

Multiplication has also been carried out for material received from international and regional genetic resources centres. This material is part of the collections made earlier through international collection missions which is now being repatriated following the establishment of the NPGRC. The amount of seed sent has generally been small making it necessary to multiply the samples.

Most of the material regenerated and multiplied are self-pollinated crops whose isolation in the field does not exceed 25 metres. The inadequate knowledge and lack of facilities such as screen houses has generally made it difficult to handle most of the cross-pollinated crop/plant species with more stringent isolation requirements.

The lack of irrigation facilities to provide supplementary moisture when rainfall is inadequate has also affected the efficiency of regeneration and multiplication. Moisture stress during the regeneration process could introduce differential survival of individuals within an accession and lead to selective elimination of valuable variation.

4.6 DOCUMENTATION

Initially the various data and information on the collections was manually documented in files and notebooks. The NPGRC documentation includes data from the collection (passport), accession management (registration, germination %, moisture content, etc.), characterization and evaluation.

The computerization of the documentation system began in 1993 following the acquisition of a computer.

A database information system developed at the SPGRC is being used. This system will enable us to enter passport, accession management and characterization data. So far all the accessions in the collections have been entered in the accession management database.

A computer based regional information network to facilitate exchange of information among the SADC NPGRCs is under development at SPGRC.

The major problems associated with the documentation of wild relatives is the botanical identification of the material. Local taxonomic expertise is inadequate, often making it necessary to seek assistance from international experts.

4.7 FOREST GENETIC RESOURCES

The Forest Research Division of the Forest Department has the mandate to carry out research activities on the botany, ecology and tree improvement of the main natural forest species. It includes studies on their distribution, description of population stands, regeneration and conservation.

Previous work of the Division has included botanical and ecological surveys resulting in the demarcation of 59 botanical reserves most of which have been described in terms of main species composition. Other activities carried out include the setting up of management resource areas or *in situ* sites for selected indigenous commercially important timber species.

Apart from being managed as *in situ* conservation sites management resources areas have also been used for seed collection. The Division has also maintained a seed store under coldroom conditions.

The regional SADC tree seed project currently being implemented in collaboration with the division is expected to strengthen the seed collection and maintenance programme in the country.

The other institution that has carried out activities pertaining to the improvement of forest tree species is the National Council for Scientific Research (NCSR) through the Tree Improvement Centre. The activities centre on ecological, breeding, physiological and silviculturing studies of three species, namely; *Uapaca kirkiana*, *Ricinodendron Rautanenanii*, and *Phytolaca dondecandra*.

The first species is a fruit tree whose fruit has commercial potential for the manufacture of squash and wine. The last species is a shrub and produces berries which contain a chemical compound with molluscidal properties. The information from the above studies could be used to select candidate sites and populations for possible *in situ* conservation.

CHAPTER 5
Uses of Plant Genetic Resources in Zambia

5.1 UTILIZATION OF PLANT GENETIC RESOURCES

Prior to the establishment of the National Plant Genetic Resources Programme in 1989, a number of germplasm collection missions were organized by the International Board on Plant Genetic Resources (IBPGR) under the Food and Agricultural Organization (FAO). This was done in collaboration with some international research centres like the International Institute for Tropical Agriculture (IITA) and the International Crop Institute for Semi-Arid Tropics (ICRISAT).

In most cases collected subsamples were left in the country with each particular commodity or crop research programme for conservation and utilization. A total of 4372 samples of various plant species were collected.

The establishment of the National Plant Genetic Resources Programme resulted in an organized collection, characterization and documentation of plant genetic resources in the country. However, much of the efforts have been directed towards collection.

Not much of the collected germplasm have been requested for by breeders and other scientists partly because not much has been done in the areas of characterization and evaluation. Most of the breeders have used germplasm from sources outside the country including international research centres like ICRISAT, IITA, International Rice Research Institute (IRRI), CIAT and the International Centre for Maize and Wheat Development and Improvement (CIMMYT), in their programmes.

5.2 CROP IMPROVEMENT PROGRAMMES AND SEED DISTRIBUTION

Crop development and improvement activities in the country are conducted on a commodity basis, covering major staple food crops like cereals, food legumes, oilseeds, fibre crops, vegetables, tree and plantation crops and roots and tuber crops. Basically all research is government run.

The plant breeding programmes focus their activities towards improving local plant varieties and on adapting imported germplasm to local needs. In both cases introduction of specific desired traits such as pests and disease resistance, drought and acid tolerance and improved yield and quality are among the specific objectives included.

Farmers get benefits from breeding through many channels like fellow farmers, farming systems research team, extension service as well as primary cooperatives. They also get involved in evaluating the products of plant breeding activities on their farms through demonstrations conducted by individual commodity scientists, extension staff and farming systems agronomists.

Field days are also conducted on research stations where farmers are invited. For example more than 65% (Howard J. et al, 1992.) of improved maize varieties were already grown by farmers within a period of less than 10 years from release.

Many crop breeding programmes have had good achievements. Others, however, have not because they have suffered from inadequate funding and staffing. Currently more than 75% (ASIP Research Subprogramme Report, 1994.) of research in Zambia is donor funded.

Many seed companies have evolved in the country, whose main activity is selling seeds, while research activities have still remained in the hands of the government. So far more than four seed companies are now established. These include Carnia and Pannar from South Africa, Cargill and the Zambia Seed Company. However, Zambia Seed Company remains a major seed supplier in the country. Recently, companies mentioned above have started distributing seed to farmers.

However, due to poor transportation and infrastructure in remote areas, high cost of seed of improved varieties, and other related inputs like fertilizers coupled with poor storability of some of the so called improved crop varieties have discouraged farmers from adopting and buying such seed.

Lack of knowledge of seed production and technology in many rural farmers' areas has also contributed to inadequate seed availability.

The above constraints in seed production and distribution could be overcome by putting in place a sustainable programme of on-farm seed production projects in outlying areas which would be run by farmers and research and extension scientists.

5.3 USE OF FOREST GENETIC RESOURCES

The Department of Forestry falls under the Ministry of Environment and Natural Resources. Within the department are two divisions, that of Management and Forest Research. The Forest Research Division through the Tree Improvement and Seed Section has undertaken some tree improvement work for both exotic and indigenous species.

Large forest plantations, about 50,975 ha. (Forestry dept. reports) have been established on the Copperbelt province to provide timber for the mines and other wood based industries. Plantations were also established in other rural provinces (6,600 ha.) to provide poles and fuelwood to local communities. Of the total hectarage under plantations, 75.9%, 22.7% and 1.4% is planted to pines, eucalyptus and other species respectively.

There is no organized association or company selling or distributing seed of forest species. The department itself and all those involved in forestry activities like agro-forestry research, arrange for seed sales and distribution to farmers and other users through provincial nurseries, extension services and Non Governmental Organizations.

5.4 BENEFITS DERIVED FROM THE USE OF PLANT GENETIC RESOURCES

The National Plant Genetic Resources Programme, having been in place for less than six years has concentrated most of its efforts mainly on capacity building and germplasm collections. All the plant genetic resources material in the collection has been obtained from within the country and includes both indigenous as well as adapted exotic plants. Those considered indigenous would include finger millet (*Eleusine coracana*), *sorghum (Sorghum bicolor), cowpea (Vigna sp*), Sesame *(Sesamum indicum)* and amaranth *(Amaranthus spp.).* Tree species would include *Sesbania sesban, Tephrosia vogelli, Flacourtia indica* and *Pericopsis angolensis as* indigenous while exotic crop species would include maize (*Zea mays*), beans (*Phaseolus vulgaris*), groundnuts (*Arachis hypogea*), Pigeon pea (*Cajanas*

cajana), sunflower (*H. annuus*), soyabean (*Glysine max*) and peppers (*Capscum spp*). Tree species would include *Gliricidia sepium*, *Luecaena leucacephala* and *Pinus spp.* as exotic.

The country has directly benefitted from the mentioned indigenous crop and tree species. Plant breeders, agronomists and agro-foresters have made some limited but effective use of these species.

Genetic variability in crops like cowpeas, finger millet, sorghum and amaranthus, to name a few have been used in developing and improving different varieties of crops adopted by various farmers. Multipurpose trees like *Sesbania sesban* are used in farmers' fields as fodder, live fences, mulch, as well as fuel wood. Germplasm of these species is exchanged with other institutions outside Zambia for crop improvement and adaptability purposes.

It can be assumed that indirectly the local plant breeding programmes do benefit from such germplasm in the long term through exchange of materials and information.

On the other hand Zambia benefits directly from non indigenous germplasm of crops like maize, rice, beans, groundnuts, soyabean and sunflower by using germplasm from outside sources for crop development and improvement. This has, however, mainly been conducted on individual programme exchange basis with outside institutions.

5.5 IMPROVING PLANT GENETIC RESOURCES UTILIZATION

The National Plant Genetic Resources Programme's main achievement has been in the area of collections and staff training and capacity building as well as provision of conservation facilities.

To date 4619 genetic resources accessions of various plant species are conserved at the genebank. Three professional members of staff have been trained to M.Sc. while one is presently undertaking the same degree. There is however need to identify and recruit additional staff to strengthen *in situ* conservation activities.

There are five members of staff with diploma or certificates in agriculture. These have also received various in-service training in different areas of plant genetic resources.

The National Plant Genetic Resources Programme works closely with scientists in commodity research programmes. Areas of collaboration include collection, characterisation and evaluation.

Continuous and unchecked use of improved cultivars may lead to rapid replacement of old cultivars and landraces. This would cause genetic erosion. Breeders usually prefer to use elite materials in their breeding programmes since this provides them more chances for achieving the set objectives and may forget that the other neglected genetic materials have a potential value for future use in crop improvement and hence need to be maintained.

CHAPTER 6
International Collaboration

Being a signatory to the Convention on Biodiversity, Zambia will adhere to the principle of plant genetic resources being in the ownership of individual countries. Realising, however, that no country has all the plant genetic resources required to meet its needs and the capacity to fully conserve and utilise these resources, Zambia attaches great importance to international collaboration pertaining to plant genetic resources programmes.

6.1 UNITED NATIONS INITIATIVES

Zambia is part of the Food and Agricultural Organizations (FAO) global system, a member of the Commission on Plant Genetic Resources and a signatory to the Convention on Biological Diversity. International collaboration is necessary to assist Zambia implement the Biodiversity Convention. FAO through the International Plant Genetic Resources Institute (IPGRI) has participated in germplasm collection missions. FAO has provided training scholarships to the national genetic resource programme as well as conservation facilities.

6.2 INTERNATIONAL AND REGIONAL AGRICULTURAL RESEARCH CENTRES

The International and Regional Agricultural Research Centres have played an important complementary role in strengthening national expertise and efforts in germplasm collection and conservation. Collaboration has been in the area of germplasm collection.

Major efforts in germplasm collection have been spearheaded by the various international research centres such as the International Rice Research Institute (IRRI), International Centre for Research in Semi-Arid Tropics (ICRISAT) and the International Institute for Tropical Agriculture (IITA). Sub-samples of earlier collections under the auspices of IPGRI were stored at the respective

International Agricultural Research Centres International Agricultural Research Centres have also provided germplasm and scientific information to the national crop improvement programmes.

6.3 REGIONAL INTER-GOVERNMENTAL INITIATIVES

The National Plant Genetic Resource Centre in Zambia like other member states was formed as part of the regional network for plant genetic resources programme in the Southern Africa Development Community (SADC).

The SADC Plant Genetic Resources Programme is implemented and coordinated by the Southern African Centre for Cooperation in Agricultural Research (SACCAR). The SADC Regional Plant Genetic Resources Centre (SPGRC) which is located in Lusaka, Zambia, executes this regional initiative.

The responsibilities of SPGRC includes holding base collections for the member states. The SPGRC is expected to develop an information data base system to facilitate the exchange of information in the region. The SPGRC has also provided training in plant genetic resources to the NPGRC staff through both short-term specialised courses and long-term degree programmes.

Another collaborative regional initiative is the Tree Seed Project in which Zambia through the forest Research Division is an active participant.

6.4 BILATERAL INTER-GOVERNMENTAL INITIATIVES

Bilateral inter-government initiatives contribute to the conservation of plant genetic resources. The major donor funding agencies are the Swedish International Development Authority (SIDA), Norwegian Development Authority (NORAD), Canadian International Development Authority (CIDA), and the Germany Technical Cooperation (GTZ) who have been involved in various agricultural development projects. SIDA bilateral funding has assisted in the establishment and strengthening of the national genetic resource programme through the provision of, equipment and staff training.

6.5 NON-GOVERNMENTAL ORGANIZATIONS

There are several non-governmental organizations that play some role in the conservation of natural flora in Zambia. These include volunteer organizations running agro-forestry projects among small scale farmers. These activities indirectly promote conservation of plant genetic resources. At national level, the International Union for the Conservation of Nature (IUCN) and the World Wide Fund for Nature (WWF) are involved in some conservation related activities.

CHAPTER 7
National Needs And Opportunities

A number of gaps in plant genetic resources conservation activities have been identified in the various foregoing chapters. The needs and opportunities given below are to a large extent based on these gaps.

- There is an urgent need to put in place an effective legislation that will specifically deal with plant genetic resources management and utilization.
- This would need to be harmonized with the existing legislation on such aspects as natural resources management, quarantine and seed and the relevant aspects of the Convention on Biodiversity.
- There is generally serious shortage of qualified botanists, population geneticists, breeders, biotechnologists and taxonomists in the country. This calls for urgent need to strengthen these disciplines in the institutions that are involved in such work. The University of Zambia should be assisted to implement courses in plant genetic resources management.
- A modern genebank building with facilities for seed drying and testing require to be constructed to enhance conservation of the country's plant genetic resources material.
- There is need to develop the appropriate infrastructure such as irrigation facilities and screen houses for effective multiplication and regeneration of genetic resources conserved in the National Genebank (NPGRC).
- Strengthening the role of the National Plant Genetic Resources Committee by establishing a specific fund aimed at enhancing its coordinating roles.
- There is need to develop national policies that would provide for the recognition of the role of traditional farmers in plant genetic resources conservation. This would purposely aim at establishing community based conservation programmes which would include aspects of germplasm evaluation and local seed production as a way of providing incentives to the traditional farmers.

This should also recognise the need to preserve indigenous knowledge concerning plant genetic resources use and conservation.

- National awareness campaigns directed at sensitizing traditional farmers, the user community at large and policy makers in principal affected government ministries and other stake holders need to be carried out.
- There is need to carryout a national assessment study on biological diversity to facilitate the development of a national strategy for the implementation of the convention on Biological Diversity.
- The conservation of plant genetic resources should be included as one of the objectives in the research and extension activities of agro-forestry.
- The crop working groups formed under both the National and Regional Plant Genetic Resources Programmes require to become fully functional in order to strengthen the relationship between the NPGRC and end users and thereby promote the utilization of plant genetic resources collections held at the genebank.
- The existing legislation on the protection of forests and wildlife would need to be examined and possibly adapted for possible use *in situ* conservation.

CHAPTER 8
Proposal for a Global Plan of Action

Drawing from the identified national needs and opportunities in Chapter 7, the following elements are suggested for possible inclusion in the global plan of action.

- Mobilization of human and financial resources to strengthen the activities on conservation, collection characterization, identification and evaluation of plant genetic resources. This is aimed at promoting utilization.
- Support for regional and national training programmes in plant genetic resources.
- International assistance is required to develop practical guidelines and strategies for *in situ* conservation.
- Assistance in national capacity building in the area of botany, taxonomy and biotechnology.
- Assistance in the promotion of community participation, and awareness in plant genetic resources and related biological diversity issues.

8.1 PRIORITIES FOR THE GLOBAL PLAN OF ACTION

Out of the issues that are suggested for inclusion in the global plan of action, the following elements are regarded as priorities. The achievable measures or targets are outlined under each priority element.

Priority 1 Mobilization of human and financial resources to strengthen conservation, collection characterization, identification and evaluation activities.

Targets - Training of breeders, taxonomists, biotechnologists, population geneticists and agronomists.

- Material currently in the NPGRC collection will be characterized and evaluated.
- Modern genebank building constructed.

- Irrigation and screen house facilities available.

Priority 2 Assistance in capacity building in the area of botany, taxonomy, genetics and biotechnology.

Targets

- Training of staff in the above areas.
- Provision of facilities in these areas.
- Increased collaboration with relevant institutes.

Priority 3 Assistance in the promotion of community awareness and participation in on-farm *in situ* conservation of plant genetic resources and other biodiversity issues.

Targets

- Number of workshops, seminars for extension staff, farmer groups, NGOs, etc.
- Number of on-farm conservation activities.

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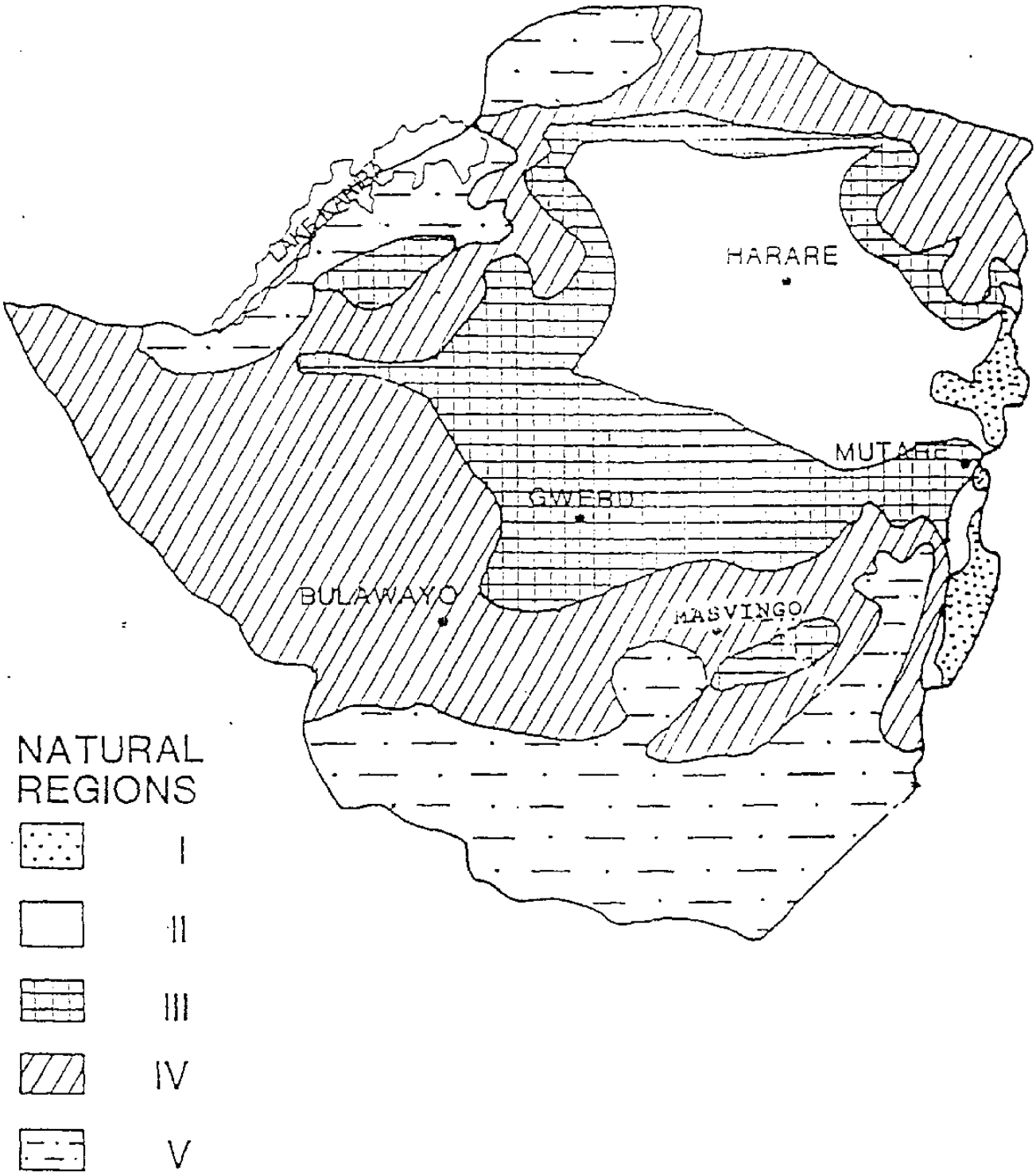

Figure 1: Map of Zimbabwe showing the boundaries of its agro-ecological zones (Natural Regions)