SOUTH AFRICA:

COUNTRY REPORT TO THE INTERNATIONAL CONFERENCE AND PROGRAMME ON PLANT GENETIC RESOURCE

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Compiled by:

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CHAPTER 1
Introduction to South Africa and its Agricultural Sector

The Republic of South Africa occupies the southern extremity of the African continent and except for a relatively small area in the Northern Province, lies south of the Tropic of Capricorn, extending as far as latitude 34°, 51'S. The country has a total area of 1 221 037 km^2 and common borders with Namibia in the north-west, Botswana in the north and with Zimbabwe, Mozambique and Swaziland in the north-east. Lesotho, which is surrounded by South African territory, lies in the eastern part of the subcontinent.

1.1 PHYSIOGRAPHY

The surface area of South Africa falls naturally into two major physiographic regions i.e. the Interior Plateau and the Marginal Zone. The Great Escarpment forms the boundary between the Interior Plateau and the Marginal Zone and comprises a number of distinct mountain ranges.

1.1.1 Interior Plateau

The Interior Plateau occupies about two-thirds of the country. It varies in altitude from 600 m to 2,000 m above sea-level, with most of its surface above 900 m. Within the plateau the following major geographic regions can be distinguished:

The Highveld

This region covers most of the plateau and lies between 1.200 m and 1.800 m above sea-level. It is characterized by level or gently undulating terrain. The northern limit of the highveld is marked by a rock ridge, called the Witwatersrand.

The Middle Veld

This region comprises the western section of the plateau. It slopes downward in a westerly direction and lies generally between 600 m and 1,200 m above sea-level.

1.1.2 Marginal Zone

The Marginal Zone lies between the edge of the plateau and the eastern and southern coastline. It descends seaward in a series of steps. There are two steps along the eastern coast. The interior step is a belt of hilly country, called the eastern Uplands. The exterior step is a low-lying plain, called the eastern Lowveld. On the south, from the interior to the coast, the steps form a plateau called the Great Karoo, a lower plateau called the Little Karoo and a low-lying plain. A mountain range divides the Great and Little Karoo. South Africa also includes a part of the Kalahari Desert in the north-west and a section of the Namib Desert in the west.

1.2 CLIMATE AND VEGETATION

South Africa is divided into three main rainfall regions i.e. a winter, a summer and a region with rain throughout the year.

The winter rainfall region in the south-western Cape is characterized by its macchia (*fynbos*) vegetation, which includes plants of the well-known protea family. Further eastwards, where favourable rainfall may be expected throughout the year, natural forest extends almost to the sea, including trees such as Cape stinkwood (*Ocotea bullata*), yellowwood (*Podocarpus* spp.) and black ironwood (*Olea capensis*).

The Interior Plateau and parts of the Marginal Zone have a summer rainfall. The plateau comprises the upper Karoo, with its succulents, dots of grass patches, dwarf trees and shrubs. The ratio of shrubs to grass varies according to the rainfall and livestock numbers.

The central inland plateau or highveld is a natural grassland and trees are only found in sheltered ravines or along watercourses. The plateau stretches eastwards into Kwazulu-Natal where savannah predominates. Along the coast the vegetation is typical of humid, subtropical conditions.

Other vegetation zones include the sparse desert flora along the west coast, which gradually changes eastwards to a savannah type with *Acacia* and other thorn-tree species.

An important feature of the climatic zones is the increase in rainfall from the western to the eastern parts. Less than 125 mm a year occurs along the arid west coast with more than 1,000 mm along the eastern escarpment.

Only 10% of the total area receives an annual precipitation of more than 750 mm. This, together with the fact that rainfall is extremely variable, South Africa is often regarded as a country with limited agricultural potential.

Temperatures are modified by the altitude of the plateau. Due to a general rise in elevation towards the equator, there is a corresponding decrease in temperature from south to north, resulting in a remarkable uniformity of temperature throughout the country. The greatest contrasts in temperatures are between the east coast, warmed by the Mozambique current, and the west coast, cooled by the Benguela current (mean monthly temperatures -Durban, January 24,4°C, July 17,8°C; Port Nolloth, January 15,6°C, July 12,2°C) (see Figure 1).

Snow may fall occasionally over the higher parts of the plateau and the Cape mountains during winter, but frost occurs on an average for 120 days each year over most of the Interior Plateau, and for shorter periods in the coastal lowlands.

1.3 INDIGENOUS FORESTS

South Africa is poorly endowed with natural forests. The approximately 336,000 ha of true forest are found along the wetter south and east coasts. This true forest is divided into the temperate evergreen forests of the southern Cape and the largely evergreen subtropical bush, including palms and wild bananas, of the eastern Cape and KwaZulu-Natal.

These forests are facing stiff competition from other uses of the land, e.g. the expansion of agriculture, afforestation and denudation caused by rural people in search of firewood and building timber. However, all levels of Government are currently committed to curb and discourage these demands.

In contrast to other parts of the world where natural forests are under severe pressure, the most threatened biome in South Africa is its grasslands.

1.4 POPULATION

The total population of South Africa at the April 1994 census was 40 284 634. This implies an average population density of 33 persons per km^2.

The population is characterized by great racial, linguistic and cultural heterogeneity. The four broad groups making up the population of South Africa are Africans (76,1%), Europeans (12,8%), Coloureds (8,5%) and Asians (2,6%).

1.5 AGRICULTURAL AND FORESTRY SECTORS

Agricultural land comprises approximately 105,9 million ha or 87% of the total area of South Africa. This includes natural pasture (65%), cultivated land and permanent crops (16%), artificial pasture (3%), wood and forest land (2%) and other land (3%). The total area under irrigation is 1.2 million ha.

The contribution of field crops, horticultural products and animal products towards the gross value of agricultural production is approximately 35%, 21% and 43% respectively. The most important field crops are maize, wheat, sugarcane, oilseeds and grainsorghum.

Deciduous fruits, citrus, vegetables and viticulture are the main contributors towards horticultural production, while slaughtered fowls, slaughtered cattle and calves, fresh milk and eggs are the most important animal products.

Commercial plantations of pine, eucalyptus, wattle and poplar form the basis of forestry enterprise in South Africa.

1.5.1 Farming Systems

Approximately 98% of agricultural land is farmed under dryland or rainfed conditions. Farming systems vary from intensive production under irrigation to extensive farming in the arid regions.

The South African farming systems cover a wide spectrum ranging from large-scale commercial to small-scale subsistence farms.

1.5.2 Seed Supply Systems

Local and foreign seed companies provide seed of new cultivars, which is essential for agricultural progress. Access to commercial seed by small-scale farmers is often a problem as most commercial seed companies have only extended their distribution networks to the commercial farming sector and have established distribution points close to these centres. An appreciable amount of the seed used by subsistence farmers, therefore, is sourced on-farm.

1.5.3 Agricultural Production, Local Use and Export

South Africa is to a large extent self-sufficient in respect of the production of basic food products, e.g. maize, wheat, oilseeds and sugar. Certain products like red meat must, however, be supplemented by imports.

Owing to inadequate and erratic rainfall, even crops like maize and wheat have to be imported from time to time. Since recurrent drought is perhaps the most important constraint in agricultural production, research and breeding programmes have primarily focused on the development of drought-resistant cultivars.

As a result of scientific and technological progress, agricultural and forestry products feature prominently in South African exports. Depending on the volume of output, a large percentage of the local production of wool, maize, sugar, citrus, deciduous fruits, wine, preserved products, paper and viscose pulp is exported.

In processed as well as unprocessed form, agricultural and forestry products normally account for about one-third of the total export earnings.

CHAPTER 2
Indigenous Plant Genetic Resources

South Africa has a remarkably rich flora with an estimated 20,000 indigenous species. Many of these are endemic, placing South Africa amongst the countries with the highest diversity of plant species in the world.

With few exceptions the agricultural (agronomy), horticultural and forestry industries in South Africa are based upon introduced species. The sustainability of these industries is dependent upon their continued access to the worldwide genepool of resources.

South Africa has a high floristic diversity and it possesses more than 8% of the world's vascular plants. This offers a tremendous potential for the development of new crops, forages, ornamentals and medicinal plants. At present, however, relatively few wild relatives of commercially produced crop plants occur as indigenous resources. The fact that many internationally traded cultivars and varieties of particularly ornamental species have their origin in the flora of southern Africa, clearly shows that foreign parties have already taken advantage of, and exploited some of the most valuable indigenous plant genetic resources of South Africa.

2.1 FOREST GENETIC RESOURCES

Fifty eight thousand hectares of indigenous forests are managed by the State as primary conservation areas.

The development of plantations of indigenous species as an alternative to the exploitation of wild stocks has been proposed for fuel wood, building material and medicinal plants. These proposals have been met with little support as can be seen from the fact that only approximately 8,000 ha are currently managed for the commercial production of furniture timber.

A few examples of species that occur in natural forests and have economical or medicinal value are:

- *Curtisia dentata,*
- *Encephalartos villosus,*
- *Ocotea bullata,*
- *Podocarpus falcatus,*
- *Podocarpus latifolius,*
- *Cassipourea gerrardii,*
- *Cryptocarya latifolia,*
- *Prunus africana.*

2.2 OTHER WILD SPECIES AND WILD RELATIVES OF CROP PLANTS

2.2.1 Indigenous Wild Relatives of Crops

The following genera exist as ancestors or wild relatives of commercial crops in South Africa:

Bolusia	*Citrullus*	*Cynodon*
Decorsea	*Digitaria*	*Eleusine*
Lupinus	*Nicotiana*	*Panicum*
Setaria	*Sorghum*	*Vigna*
Vitex		

2.2.2 Medicinal Plants

A considerable proportion of the South African population uses herbal medicines made from indigenous plants for their health care. In KwaZulu-Natal, approximately 400 indigenous, and 20 exotic plant species are used as traditional medicines by the Zulu people in urban areas.Sales of these traditional medicines amount to between R750 million ($204 million) and R1 billion ($0,3 billion) a year.

Natural populations of many of the plants from which these medicines are obtained, are threatened by over exploitation. Therefore, *ex situ* seed and *in vitro* vegetative conservation of these socially important plants must receive urgent

attention. The establishment of commercial nurseries and sustainable planting schemes may help to relieve the exploitation of natural populations by an estimated 300,000 traditional healers.

Valuable medicinal and other important wild relatives of horticultural plants occur in the macchia of the Cape Floristic Region. This region, with a land area of approximately 90,000 km^2, includes approximately 9,000 species of which nearly 70% are endemic to the region.

Of these species approximately 1,400 are listed as Red Data taxa and the area can be described as the 'hottest' of the world's biodiversity hotspots. The term 'hotspot' is defined as an area that is characterized by high species richness, high concentrations of endemic species and which is experiencing high rates of habitat modification or loss.

The macchia flora is dominated by the families *Asteraceae, Ericaceae, Proteaceae, Fabaceae, Iridaceae, Cyperaceae, Restionaceae* and a number of others. Predominant genera are *Protea, Leucadendron, Leucospermum, Erica, Restio, Ficinia, Senecio, Cliffortia, Aspalathus* and many more.

These species have the potential to contribute substantially to the development of new plant products and they should receive immediate attention.

Examples of tree species with medicinal value (from different veld types) are as follows:

Acacia caffra	*Acacia erioloba*
Annona senegalensis	*Bridelia micrantha*
Capparis tomentosa	*Cassia petersiana*
Cassine aethiopica	*Cavacoa aurea*
Clausena anisata	*Croton megalobotrys*
Croton sylvaticus	*Cryptocarya latifolia*
Dialium engleranum	*Dialium schlechteri*
Dichrostachys cinerea	*Erythrina humeana*
Euclea undulata	*Euphorbia ingens*
Euphorbia tirucalli	*Ilex mitis*
Margaritaria discoidea	*Monanthotaxis caffra*
Ochna serrulata	*Portulacaria afra*
Pterocelastrus rostratus	*Sapium integerrimum*
Sclerocarya birrea	*Schotia brachypetala*
Senna singueana	*Vepris undulata*
Xeroderris stuhlmannii	*Ximenia americana*
Zanthoxylum capense	

Examples of plant species sold by wholesalers in the traditional medicine trade:

Agapanthus campanulatus	*Alepidea amatymbica*
Aloe aristata	*Artemisia afra*
Aster bakeranus	*Becium obovatum*
Boophane disticha	*Bowiea volubilis*
Callilepis laureola	*Cassine transvaalensis*
Clerodendrum triphyllum	*Conostomium natalense*
Convolvulus saggitatus	*Crabbea hirsuta*
Cyathea dregei	*Dioscorea sylvatica*
Elephantorrhiza elephantina	*Eriosema cordatum*
Eucomis autumnalis	*Eucomis cf. bicolor*
Gnidia burchellii	*Gnidia kraussiana*
Gunnera perpensa	*Helichrysum aureonitens*
Helichrysum herbaceum	*Helichrysum odoratissimum*
Helinus integrifolius	*Hypericum aethiopicum*
Ilex mitis	*Littonia modesta*
Myrica serrata	*Myrothamnus flabellifolia*
Pelargonium alchemilloides	*Pentanisia prunelloides*
Plectranthus grallatus	*Polygala gerrardii*
Polygala ohlendorfiana	*Protasparagus setaceus*
Prunus africana	*Psammotropha myriantha*
Rapanea melanophloeos	*Rhamnus prinoides*
Rhoicissus tridentata	*Rubia cordifolia*
Scilla natalensis	*Scolopia mundii*
Senecio coronatus	*Senecio serratuloides*
Silene cf. bellidiodes	*Turbina oblongata*
Vernonia neocorymbosa	*Zantedeschia albomaculata*
Ziziphus mucronata	

2.2.3 Grasslands

The grasslands of South Africa particularly, are under considerable threat and should be given high priority with regard to the conservation of their genetic diversity.

2.3 LANDRACES AND OLD CULTIVARS

Very little or only scattered information is presently available on the use of traditional varieties or landraces. Landraces, introduced by European farmers, as well as old cultivars developed by the local people from wild plants such as millets, cassava, plantain, sorghum, cowpea, okra, yams, and sweet lupins are still planted by subsistence farmers.

These plants are highly valued as a foodsource and some farmers are reluctant to change to new cultivars. This is a form of conservation, but it has not been documented. The changing political climate has resulted in more emphasis being placed on the upliftment of subsistence farmers and the important role they need to play in the future agricultural development of South Africa. As these farmers become more and more exposed to modern farming techniques, old cultivars will probably be discarded for more modern ones. Therefore, a very high priority should be given to the conservation of this traditional material before it is lost.

Assessments are currently being made of all indigenous material with economic, agricultural, horticultural and medicinal value or potential value, including landraces and wild relatives, in order to be able to plan future collecting strategies.

CHAPTER 3
Conservation Activities

The level of floristic endemism in South Africa is extremely high due to the environmental heterogeneity and unique combinations of historical factors. It comprises a distinct phylogenetic assemblage, with more or less 12 families being endemic or near-endemic. These are:

Achariaceae	*Bruniaceae*
Geissolomataceae	*Greyiaceae*
Grubbiaceae	*Lanariaceae*
Melianthaceae	*Penaeaceae*
Retziaceae	*Rhynchocalycaceae*
Roridulaceae	*Stilbaceae*

This diversity is not distributed uniformly, but is concentrated in at least seven localized hot-spots (see Table 1 and Figure 2).

Table 1 Major threats to South African hot-spots

Hot-spots	Threats
Wolkberg	Afforestation, invasive plants, overgrazing
Maputaland	Agriculture, afforestation, urbanisation, overgrazing, plant harvesting, invasive plants, mining, tourism
Eastern mountain	Afforestation, overgrazing, agriculture, plant harvesting, invasive plants
Pondoland	Agriculture, overgrazing, veld burning, plant harvesting, population growth
Albany	Overgrazing, agriculture, afforestation, invasive plants, urbanisation
Succulent Karoo	Overgrazing, mining, agriculture, plant harvesting
Cape	Invasive plants, agriculture(lowlands), urbanisation, plant harvesting

Table adapted from: Cowling, R.M. and Hilton-Taylor, C. 1994. Patterns of Plant Diversity and Endemism in southern Africa: An overview.

It is evident that South Africa is an extremely attractive prospect for foreign institutes seeking new material. Although functional, national activities to conserve this rich genetic resource, are generally inadequately financed and resourced. These activities will be discussed in brief.

3.1 *IN SITU* CONSERVATION ACTIVITIES

The *in situ* conservation of natural vegetation communities (and their associated indigenous flora) is accomplished by an extensive network of national parks and provincial game and nature reserves. These are located in most of the 75 vegetation types that occur in South Africa.

These protected areas are not optimally located with regard to the country's hotspots, owing to the fact that earlier national parks and reserves were established for the protection of game, rather than specific ecosystems. It has been determined that the lowland macchia, succulent Karoo and grassland ecosystems are in most need of conservation. Despite these shortcomings, national parks and privately-owned reserves in South Africa, cover approximately 70.000 km^2 or 5,9% of the country's land area. This area is much higher than that required for the maintenance of many of the target taxa, yet still dismally low compared with the universally accepted 10% standard.

Indigenous plants are a source of food, medicine, fuel, building material, craftwork etc. for the largest and fastest growing population group in South Africa. The over-exploitation and degradation of habitats that lead to a reduction in species diversity, can be slowed by providing sources of supply, other than natural areas.

No formal, on-farm, *in situ* conservation programmes exist to protect landraces, traditional varieties or wild relatives. Although this plant material is still being grown by the local subsistence farmers, they may soon turn to more modern cultivars and the 'old' material will be lost. This is an aspect which requires urgent attention.

About 84,316 ha is managed by the Department of Water Affairs & Forestry (National Government) as primary conservation areas of which 58,000 ha is natural high forest. Fifty-eight tree species are protected under national legislation, while many other tree species are protected by provincial legislation.

Since 1975, the government has embarked on an annual programme of designating a "Tree of the Year". A pamphlet is published on the "Tree of the Year" and the public is encouraged to plant this tree on National Arbor Day. A recent development has been the designation of threatened tree species as "Tree of the Year" and the encouragement of nurseries to grow and sell them.

3.2 *EX SITU* COLLECTIONS

The importance of South Africa's indigenous plant genetic resources as a source of future wealth is recognised. However, *ex situ* collections of plant genetic resources in South Africa are still fragmented and under the control of a variety of government, parastate and private concerns. For this reason plans are currently being made to establish a National Plant Gene Bank for agriculture to accommodate a base collection.

Decentralized collections at present are made up of indigenous, as well as foreign material. Of the 48,918 accessions in the country 1,156 are kept by the Department of Agriculture and consist mainly of wild, indigenous species. Most of the other accessions are located within the collections of the Agricultural Research Council (ARC) with the highest percentage being infraspecific germplasm of major crops.

The *ex situ* conservation of indigenous flora is provided by living collections of over 10,000 species in a network of eight National Botanical Gardens, controlled by the South African National Botanical Institute (NBI). A small number of accessions of indigenous flora are held by the Bolus Herbarium of the University of Cape Town. These accessions mainly consist of endangered, macchia species.

Unfortunately, the most important material in need of conservation in South Africa, such as the wild relatives of cultivated plants, landraces, old cultivars and traditional varieties, are seldom included in the germplasm collections held by breeding institutions.

Because most South African breeding material originates outside the country, very little attention has been paid to indigenous plant material as a potential source of new crops. Accessions of indigenous plant genetic resources are, therefore, very poor. This may have been acceptable in the past, but with the rapid increase in population growth and the fact that genetic material from abroad is becoming less accessible, South Africa will have to rely more on its previously unexplored indigenous genetic resources as a potential food source.

3.3 STORAGE FACILITIES

Storage facilities differ vastly between different organisations concerned with *ex situ* conservation of seed. At many institutions, conditions for the long-term storage of seed are less than optimum and the long-term viability retention of the stored material is questionable. Active working collections are maintained by most of the agricultural research institutes with no safety base collections as backup.

The importance of establishing a National Base Collection to contain material designated for long-term conservation, is recognised and planning is underway to create such a facility in South Africa.

3.4 DOCUMENTATION

Each of the 11 major institutions concerned with plant genetic resources, has its own information system to cater for the specific needs of that particular institution.

Most databases within the Department of Agriculture and the ARC are fully computerised, but not standardised. The potential value of genetic material is, therefore, sacrificed to a certain extent as its origin, logistics and maintenance records may not be readily accessible. Furthermore, certain institutions are reluctant to make data available as they are concerned that information on their breeding programmes will fall into the hands of potential competitors.

The Forestry Gene Bank uses a card index system and the documentation is not duplicated. A number and date is allocated to each collection so that it is possible to trace the origin of the seed. A simple computer programme exists, indicating the localities and the month of the year when seed should be collected. No specific obstacles exist for the general documentation of samples, as local expertise is readily available for the identification of such material.

The Department of Agriculture issued a database in DBase IV format to all relevant institutions so that an *Index Seminum* could be published on an annual basis. The intention was to standardise all relevant fields. This database was recently upgraded in anticipation of the possible establishment of a national base collection of plant genetic resources of importance, or potential importance to agriculture in South Africa. The database contains most of the relevant information needed to accompany accessions in a germplasm collection of this nature

and importance. None of the other existing databases in South Africa contains all the fields prescribed by the International Plant Genetic Resources Institute (IPGRI).

3.5 EVALUATION AND CHARACTERIZATION

A distinction is made between characterisation and evaluation, with the emphasis placed on evaluation. This is particularly true at crop research institutes, where most of the material in collections are improved or partly bred lines and characterisation may already have been carried out at a previous institute. More attention will have to be given to characterisation, as this is an integral part of germplasm collection management.

Characterisation and evaluation are mostly carried out by research institutes and seed companies developing new cultivars. Some seed companies have special, on-farm test sites, where farmers are involved in the evaluation of newly bred lines. At present South Africa does not have a National Base Collection and germplasm of national importance is scattered among institutions so that it is difficult to assess the percentage of accessions that have been characterised and evaluated. The ARC of South Africa spent about R23 million ($6 million) on primary and secondary evaluation of plant material in 1994.

Evaluation of crops includes field trials, biochemical analyses, physiological analyses, microbiological analyses, as well as disease and pest susceptibility. These data are often not fed back into the gene bank documentation systems by research centres or private seed companies and may thus not be available for other users. As far as forestry germplasm is concerned, improved seed for commercial purposes is evaluated and characterised by scientists employed by the respective commercial companies.

3.6 REGENERATION

Because of the different interests of institutions concerned with plant genetic resources in South Africa, a distinction must be made between multiplication and regeneration. The former activity is conducted by private seed companies and forestry research centres, in order to multiply improved material for sale to farmers. Selected farmers are used for multiplication activities. Parent material is seldom kept and multiplication is conducted on new material only.

Inadequate gene bank management and storage conditions in the past created the need for more frequent regeneration activities. Regeneration is, however, a very expensive and time consuming activity that needs land, skilled personnel, chemicals and specialised equipment. Furthermore, viability tests must be carried out on accessions to determine whether regeneration is necessary or not. This, in itself, is a very time consuming activity.

For these reasons, institutes have been reluctant to regenerate material and this, together with the failure to appreciate the advantages and importance of regeneration, has resulted in valuable material being lost.

Where attempts were made to regenerate material, the lack of land prompted the use of smaller samples, which could have affected the genetic character of the material in question.

Forestry seed is collected annually and sold within two years. Such seed is not stored for long periods and no regeneration programme is followed. The main aim of the central governmental seed centre in Pretoria is to supply seed to various nurseries.

Action should be taken to determine the viability of seed accessions in the country and regeneration programmes should receive a high national priority.

3.7 FOREST GENETIC RESOURCES

The genetic resources of natural forest are currently not protected, except for those forests within the boundaries of national and private reserves.

Long term monitoring of forests (in sample stands) is conducted on a range of sites. These sites have been selected due to their relative importance with regard to the conservation of biodiversity and ecological distribution. This affords a comparison of the distribution of species, floristic change and management efficiency/effectiveness.

The exotic, commercial plantation area increases approximately by 10,000 ha per annum. Ownership of these commercial plantations can be categorised as follows:

Major timber companies	55%
State owned company	25%
Commercial tree farmers	18%
Subsistence farmers	2%

There are several publications on the species composition of forests in South Africa.

CHAPTER 4
In-Country Uses of Plant Genetic Resources

4.1 USE OF PGR COLLECTIONS, CROP IMPROVEMENT PROGRAMMES AND SEED DISTRIBUTION

Crop plant genetic resource (PGR) collections are mainly used in crop improvement programmes by adapting imported germplasm to local needs and by introducing specific characteristics.

Users are primarily plant breeders attached to the crop-based research institutes of such bodies as the ARC and Universities. Very little in-country exchange takes place between universities, private companies and public sector research organisations.

It is estimated that seed of 120 indigenous and 180 exotic tree species is collected annually and sold to nurseries country-wide. A small percentage of seed is also introduced from other countries each year.

The main genetic resources used for commercial forestry purposes in South Africa are all exotics:

- *Eucalyptus fastigata,*
- *Eucalyptus grandis,*
- *Pinus elliottii,*
- *Pinus patula,*
- *Pinus radiata.*

This seed originates mainly from the gene banks of major commercial timber companies.

The seed most often sold by the Forestry Seed Centre is:

- *Casuarina cunninghamiana* (exotic),
- *Eucalyptus camaldulensis* (exotic),

- *Rhus lancea* (indigenous),
- *Rhus pendulina* (indigenous),
- *Celtis africana* (indigenous).

This seed is used mainly for social forestry, windbreak and ornamental purposes.

The relative importance of indigenous flower and ornamental species should also not be underestimated. The multi-billion dollar annual gladiolus trade rests largely on the genetic diversity obtained from South Africa. Other major species include those within the genera of *Agapanthus*, *Erica*, *Protea*, *Lachenalia*, *Leucospermum*, *Leucadendron*, *Ornithogalum*, *Cyrtanthus*, *Clivia*, *Freesia*, *Ixia*, *Gerbera*, *Sparaxis*, *Zantedeschia*, *Kniphofia* and *Watsonia*.

No provision has been made for farmers to acquire formal agricultural genetic resources, except via the sale of registered cultivars. However, much is done to promote genetic purity by means of plant and seed certification schemes.

At present, national plant breeding programmes primarily service the agricultural sector and some 2,000 varieties have been developed and introduced to all farmers. However, landraces and old, open-pollinated varieties are still preferred and grown by many subsistence farmers.

Current agroforestry breeding programmes aim to improve exotic species for increased production, disease resistance and drought tolerance. Both the government and private sector are involved in tree breeding programmes. Improved varieties are available to both commercial and subsistence farmers.

4.2 IMPROVING PGR UTILIZATION

The presently fragmented bureaucracy is a definite constraint to the improvement of PGR utilization in South Africa. It retards access to material and essential co-operation and co-ordination between all the role players to deliver improved products to the farmers and consumers of South Africa.

The fragmentation of PGR activities between so many role players has led to confusion and uncertainty. To rectify this situation will require an extensive training programme with the corresponding financial expenditure or, preferably, the rationalization of all PGR activities. Clear mandates must be defined and accountability devolved to the responsible authority/organisation.

4.3 USE OF FOREST GENETIC RESOURCES

The Department of Water Affairs & Forestry, as well as several commercial companies are involved in tree seed improvement. Seed of commercial tree species is made available by the state-owned and private companies. Seed of ornamental species and species for general rural and urban tree planting is made available mainly by the relevant Department.

Seed of many South African plants is propagated/cultivated worldwide for ornamental purposes. Seed of indigenous and exotic species growing in South Africa is available to other countries at an affordable price.

4.4 BENEFITS DERIVED FROM THE USE OF PGR

No species are maintained for the exclusive use of other countries. Many requests are, however, handled each year for the supply of indigenous material, mainly for research purposes.

Despite the political isolation of many years, South Africa continued to participate in the international exchange of germplasm. In order to ensure continued access, South Africa will have to become an active contributor to the international system for exchange of germplasm, as countries have become more aware of the potential value of their genetic resources and tend to restrict access to this material.

South Africa was, however, effectively isolated with regard to the exchange of the relevant science and technology necessary to promote the conservation of its genetic resources. This is perhaps the most important reason why a national programme has not yet been established in this regard.

CHAPTER 5
National Goals, Policies, Programmes and Legislation

5.1 NATIONAL GOALS, POLICIES AND PROGRAMMES

Since the signing of the Convention on Biological Diversity (1992) by the South African Department of Environment & Tourism, there has been a dramatic increase in the global emphasis on the importance of conserving all genetic resources. This prompted the Directorate of Plant & Quality Control (Department of Agriculture) to consider a national programme incorporating all plant genetic resources in the true sense of the word. For this task, all the relevant role players, such as Environment Affairs, Nature Conservation, Forestry and the private sector were approached for possible participation in a standardised national programme.

The Department of Agriculture, as one of these main role players, cannot accept sole responsibility for the co-ordination of a national body with such a wide range of interests. It sees its role as facilitating the introduction of a national approach and is of the opinion that the future co-ordination of such a national programme should be undertaken by the Department of Environment & Tourism.

A national body such as the proposed "National Plant Genetic Resources Committee" would be responsible only for the national co-ordination of aspects of common interest to all sectors concerned with the conservation of genetic resources. Resolutions adopted by this body would be submitted as recommendations to the respective Institutions/Departments represented on the national body.

The development of policy, legislation and managerial practice should not be centralized under the national body as the objectives and mandate of Environment Affairs and Nature Conservation on the one hand, and Agriculture and Forestry on the other hand, may be incompatible and this could inhibit technical co-operation. This, however, should not be taken to mean that there is not an urgent need for co-operation and effective communication on a national level, but merely stresses that the centralization of detailed strategies, policy, legislation and technical management of genetic resources may be an unattainable ideal.

Separate programmes for Agriculture, Forestry and Environment Affairs should, therefore, be drafted by the respective State Departments in accordance with the recommendations submitted by the corporate national body.

In the case of agriculture, a Working Group has been appointed by the National Department of Agriculture and the ARC.

Its terms of reference are as follows:

- To conduct a survey of all genetic resources that are presently maintained by the ARC Institutes, the Provincial Departments of Agriculture, as well as the Directorate of Plant and Quality Control of the National Department of Agriculture. This data must be kept in a central data base and must be updated at regular intervals.
- To conduct a survey of all genetic resource activities that are presently being conducted by these institutions. The specific objectives of each of these institutions should be noted. These include, amongst others, the strategies for collecting, exchange activities, as well as reading programmes.
- Recommendations should be made with regard to the establishment of gene banks with the necessary back-up facilities, which will guarantee sustained maintenance of genetic resources.
- Recommendations should be made with regard to new technology that has to be developed, or the adaptation of existing technology with the objective to develop an efficient way of maintaining genetic resources.
- Recommendations should be made in terms of international interaction that will facilitate the exchange of genetic resources between South Africa and other countries.
- The financial implications of the above-mentioned activities should be determined and indicated.
- A five year plan should be developed according to which activities will be prioritised.
- A plan of action should be worked out which will improve communication and co-operation between the ARC and the Department of Agriculture. This will include, amongst others, joint projects and activities in terms of the determination of priorities and sources of funding.
- A code of ethics will be established for the exchange of genetic material between various interested parties.

The Working Group have established four task teams to complete the work. These are:

- Technical Task Team for Plant Genetic Resources;
- Technical Task Team for Animal Genetic Resources;
- Technical Task Team for Lower Plant and Animal Genetic Resources;
- Regulatory Task Team for Genetic Resources.

In the case of the national programme, the following proposals have been drafted as guidelines for future policy;

- Although a centralized gene bank is the ideal, the diversity of material to be stored will make it extremely difficult if not impossible to manage and maintain efficiently. The technological demands and expertise necessary for the optimal storage of genetic resources in general are too diverse for such an enterprise to succeed, at least not in the foreseeable future.
- It is recommended that the Department of Agriculture establishes a national base collection for seeds of agriculturally important crops and species in South Africa. Financial support may be necessary for meeting this obligation.
- The maintenance of a base collection is in the national interest and such material for long term storage in base collections, could be maintained by two gene banks. From a technological point of view it is recommended that the seed gene bank be separate from the gene bank maintaining vegetative propagation material i.e. tissue cultures and *ex situ* conservation in the form of orchards. This separation of functions is purely for practical managerial reasons.
- It is recommended that similar national collections for forestry and the indigenous flora be the responsibility of the respective government departments responsible for those aspects of South African genetic diversity. Since the circumstances are now favourable for negotiating the necessary support from both government and international sources, time-frames should be decided upon by the National Plant Genetic Resources Committee with the consequent setting of deadlines for the total transfer of all responsibilities that are not sanctioned under Agriculture.

The relevant government departments should remain responsible for the maintenance of base collections of all plant species that are not maintained in active collections as part of their national responsibility. The following reasons are relevant:

- Government Departments remain, in most cases, the only role players with no direct financial interests in the conservation of genetic resources and could, therefore, be regarded as independent and objective in this regard.
- Government Departments, as administrators of the relevant legislation and Intellectual Property Rights, should have the necessary technological expertise for both the conservation and maintenance of genetic resources.
- Government Departments, due to their independence, would be in a better position to encourage private breeders to submit genetic material of South African-cultivated/ improved material for conservation in base collections.
- Owing to their national mission for the promotion and improvement of biodiversity in all spheres, government departments are in the best position to address Farmers' Rights in respect of genetic resources. In this way Departments could make significant contributions towards the South African government's Reconstruction and Development Programme.

To summarise, it is important that a national approach towards the conservation of all genetic resources in South Africa be continued and supported. This implies the restructuring of the National Plant Genetic Resources Committee as a national forum with representation across the national spectrum. The initial facilitation and co-ordination of this forum could be by the Department of Agriculture, although this function would be taken over at a later stage by the Department of Environment & Tourism.

The national forum/committee should serve only in an advisory capacity. Resolutions reached by consensus should be submitted as recommendations to the respective Departments and Institutions for consideration and possible adoption as policy or enactment as legislation.

The drafting of specific, official policy and/or enactment of legislation should remain decentralized under the auspices of the three major role players i.e. Departments of Environment & Tourism, Agriculture and Water Affairs & Forestry. This is necessary because of the divergence in managerial and technical approaches within these different disciplines.

A National Base Collection should be established to conserve the seed and vegetative material of plants with agricultural and potential agricultural importance to South Africa.

5.2 NATIONAL LEGISLATION

Legislation in South Africa is embodied in three Acts i.e. the Plant Breeders' Rights Act, 1976 (Act No. 15 of 1976); the Plant Improvement Act, 1976 (Act No. 53 of 1976) and the Agricultural Pests Act, 1983 (Act No. 36 of 1983). This legislation provides for:

- the compulsory registration of cleaners, sellers and testers of seed;
- the naming and recognition of cultivars and keeping of a list of cultivar names;
- requirements in respect of properties of seed;
- the marking of containers in which seed is sold;
- the introduction of plant and seed improvement schemes;
- restrictions on the importation and exportation of seed and other propagation material with regard to physical and physiological quality;
- intellectual property rights (IPR) in respect of new cultivars and the protection of the interests of persons who register such rights;
- phytosanitary requirements for preventing the introduction into, and the spread within South Africa, of any harmful plant diseases and pests, *inter alia*, by means of propagation material.

5.3 TRAINING

Although South Africa possesses a very strong core of biologists, there is a lack in trained personnel concerned with Plant Genetic Resources. In order for a national programme to succeed, personnel trained in all the skills of PGR conservation are needed.

No formal training courses in plant genetic resource conservation are currently presented in South Africa, although the necessary expertise is available at some of the various universities.

Courses offered by international organizations, such as IPGRI, are eagerly attended and valuable information is obtained.

Similar courses could be offered by Universities and Technikons in South Africa, but a sound policy will have to be in place for this to realise. International initiatives can help precipitate and speed up this process.

The significance of plant genetic resource conservation is only now being realised and this has sparked a new awareness of the importance of good training.

CHAPTER 6
International Collaboration

South Africa has been largely isolated from international discussions on plant genetic resources until fairly recently and consequently has had relatively little contact with international agencies. It can safely be assumed that international contacts in this field will increase greatly in future and such collaboration needs to be structured and formalized according to global norms.

In the past, contact and co-operation with international organisations involved with plant/seed production and quality control has been good. In this regard South Africa has collaborated extensively with the International Seed Testing Association (ISTA), the International Seed Trade Federation (FIS), the Organisation for Economic Co-operation and Development (OECD), the Union for the Protection of New Varieties of Plants (UPOV) and the International Plant Protection Convention (IPPC).

On a regional basis South Africa has played an active role in the conservation and development of agricultural resources with some southern African countries through the Southern African Regional Commission for the Conservation and Utilization of the Soil (SARCCUS).

Collaboration with the International Plant Genetic Resources Institute (IPGRI) has only recently been established when South Africa ratified the Undertaking on Plant Genetic Resources. In 1994, South Africa became a member of the FAO and the Southern African Development Community (SADC).

South Africa maintains a bilateral agreement with the Zimbabwean government in respect of the protection of Intellectual Property Rights of plant breeders in the two countries.

CHAPTER 7
National Needs and Opportunities

Although various strategies are currently in place to conserve biodiversity in South Africa, it must be emphasized that these strategies are still relatively poor resourced as far as plant genetic resources are concerned and, in many cases, poorly developed. In line with the International Convention on Biological Diversity, of which South Africa is a signatory, the country has adopted and started to develop a programme in which genetic resources are regarded as being of national strategic value.

Access to international genetic resources has become progressively restricted. In the past these resources were considered to be the heritage of mankind, available freely and without restriction. The concept of national sovereignty over genetic resources has, however, drastically changed this outlook.

Countries now feel they have a legal right to restrict access to germplasm originating in their country and may even demand a financial return from the use of such material. There is a growing concern over the alarming rate of genetic erosion because of the inadequacy of current attempts in certain countries to conserve these resources.

There is an urgent need to improve the taxonomic knowledge of the rich southern African flora. For many large groups (e.g. Mesembryanthemaceae, Crassulaceae) reliable identification is not possible. Any conservation efforts should rest on a firm taxonomic foundation.

The need exists for the active monitoring of populations of rare or endangered species and although such programmes have already been initiated, adequate funding remains a major constraint.

There is also a need to devise more efficient ways for conserving the lowland macchia, succulent Karoo and various grassland ecosystems in spite of the fact that the existing network is reasonably effective at the species level.

The importance of various grassland ecosystems is underlined by the fact that natural pasture comprises 65% of agricultural land. The contribution of animal products to the gross agricultural product is 43%. The production of these products is to a large extent dependent on natural pastures. The natural rangelands are, therefore, an important agricultural resource in South Africa, although this

is not reflected by research and development priorities. The rangelands are currently overstocked and the sustainability of their production potential is an urgent research priority.

Cultivated pastures, particularly those planted from imported legumes and temperate grasses, represent important means of significantly increasing animal production from grazing systems. There is an urgent need to ensure the sustainability of South African animal production systems by the *in situ* and *ex situ* conservation of pasture vegetation. This could be accomplished by the *inter alia* collection of genetic material of tropical grasses, which are suitable for grazing.

Germplasm of especially medicinal and ornamental plants must be conserved in *ex situ* gene banks, as the genetic integrity of such material must be maintained over the long-term.

As far as the other economically important genetic resources are concerned, access to international collections of material will be a crucial factor in allowing South Africa to diversify and compete in international markets. In addition, sustainable agriculture geared towards the small farmer will be a key ingredient in the new South Africa. The availability of the widest possible range of germplasm for adaptation and diversification will be of fundamental importance in achieving this goal.

In line with these issues the following needs are identified:

- The development of a national policy in line with international standards and requirements.
- The development of a national programme with at least the following characteristics:
    - a framework for the proper organisation of PGR-related activities of the country;
    - a mechanism for national decision-making, cutting across sectors and institutions to a certain extent;
    - a framework to assure a participatory approach to building national consensus around complex issues and resolving conflicting situations;
    - a mechanism to guarantee a better national balance between the conservation and utilization of PGR in general and between *in situ* and *ex situ* conservation in particular;
    - a mechanism to facilitate sub-regional, regional and international co-operation; and
    - a mechanism to assure continuity of PGR-related activities over time.

- The proper training of staff involved in formal PGR activities.
- The education and training of the informal sector for *in situ* conservation actions.
- The development of national PGR legislation in line with the International Convention on Biological Diversity.
- The establishment and in certain cases, upgrading of existing infrastructure with regard to the conservation of genetic resources. For achieving this goal international inputs and funding will be necessary.

If these goals can be achieved the following opportunities will be created:

- The possibility to unlock, promote and utilise the tremendous potential of plant biodiversity that exists in South Africa.
- The chance for South Africa, as a new role player in the conservation of genetic resources, to develop a national policy which will be in line with the latest international thinking and trends.

CHAPTER 8
Proposal for a Global Plan of Action

The South African Government of National Unity supports the global initiative on the conservation of biodiversity. It is also envisaged that South Africa will soon ratify the relevant Convention, which was drafted during the 1992 Earth Summit in Brazil. As a new role player in this field, South Africa is willing to participate and contribute in order that the global initiative may succeed.

As this country has been excluded from participation in this particular field for many years, it cannot be regarded as a pioneer or an authority on the conservation of biodiversity. However, technical expertise and the relevant experience and insight does exist within its corps of professionally trained personnel. Consequently, the following proposals are submitted for consideration in attempting to establish a Global Plan of Action:

- Definite attempts should be made to ensure that the international exchange of PGR is fair and equitable.
- A system of incentives should be designed for rewarding farmers for the *in situ* conservation of plant diversity.
- Prospective candidates interested in careers in the conservation of plant genetic resources should be encouraged to study at local institutions, especially if the relevant expertise does exist within the particular country. Training at foreign institutions has often proven irrelevant owing to the difference in biodiversity between countries and the subsequent lack of relevant expertise at such institutions.
- A system of international funding should be negotiated to expand and maintain collecting activities, storage facilities, documentation systems and the evaluation and characterisation of genetic resources. It should also enable the compilation of an inventory of the South African flora for ensuring full coverage of the genetic diversity.

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Cedara agricultural development institute

Csir: Forestek

Department of agriculture: Western cape region

Department of agriculture and environmental affairs: North-west province

Department of water affairs & forestry

Institute for commercial forestry research

Land and agriculture policy centre (LAPC)

National botanical institute

Orange free state provincial administration

Secretariat: Indigenous plant use (FRD)

South african national seed organisation (SANSOR)

Southern african nature foundation

University of the orange free state

The Report was checked for factual accuracy by Prof. **Patricia Berjak** (University of Natal) and Prof. **Braam van Wyk** (University of Pretoria).

References

Cowling, R.M. and **Hilton-Taylor,** C. 1994. Patterns of Plant Diversity and Endemism in southern Africa: An Overview. In: B.J. Huntley (Ed.). *Botanical Diversity in southern Africa*. pp. 31-52. Oxford University Press, Cape Town.

Hutcheson, A.M. 1994. Physical and Social Geography. In: *Africa South of the Sahara*, twenty third edition. Europa Publications Ltd. England.

Katzen, L. 1994. Economy. In: *Africa South of the Sahara*, twenty third edition. Europa Publications Ltd. England.

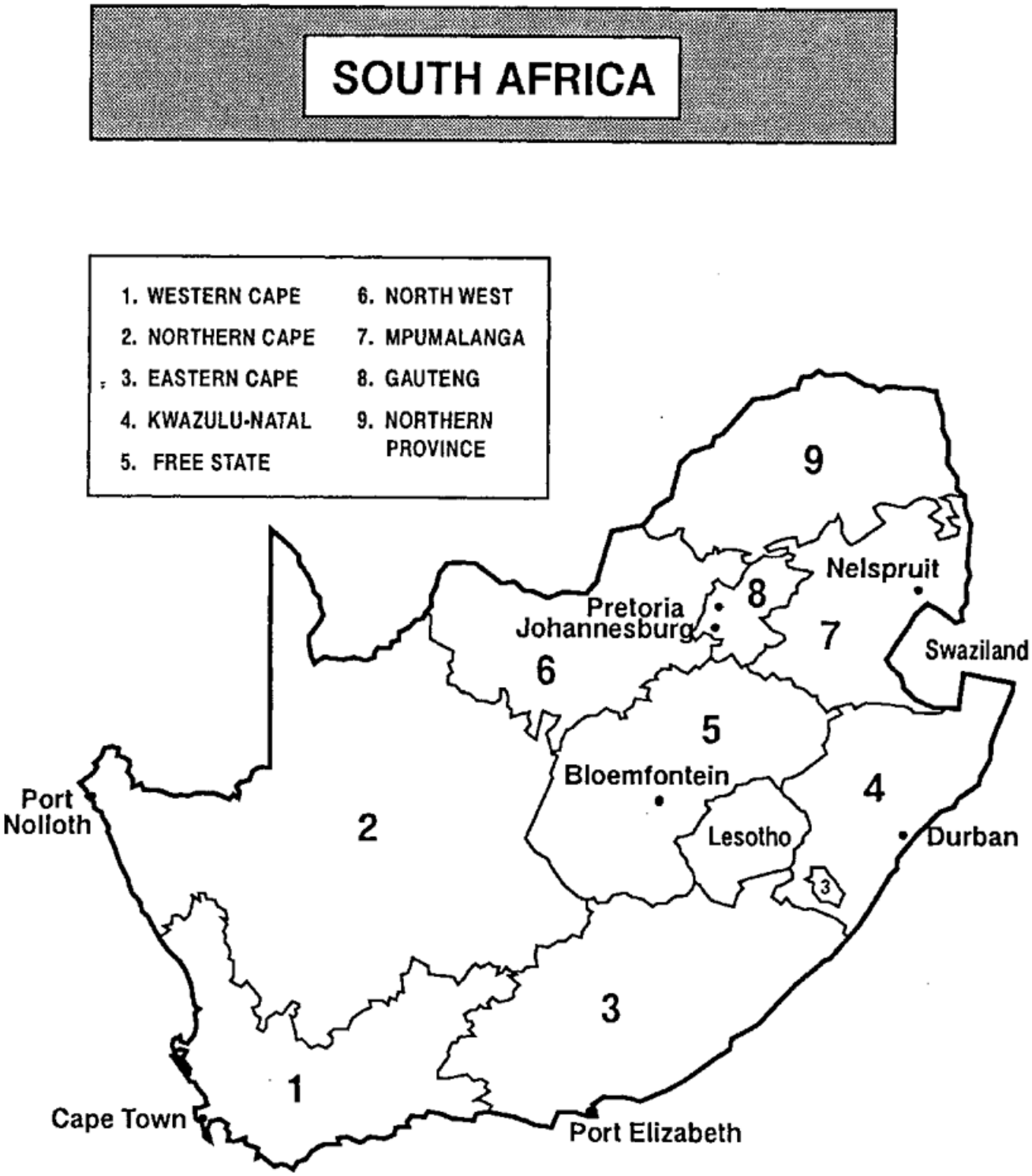

Fig. 1. Map of South Africa showing the nine provinces