Regarding large stock, the MAWRD has an ongoing genetic project on indigenous Sanga cattle (see also section 2.8). Herds are kept at four research stations: Omatjenne (about 200 head), Sandveld (about 200 head), Sonop (about 350 head) and Sachinga (about 120 head). This project aims to conserve, characterise and evaluate the available gene pool, and to supply superior genetic material to farmers for upgrading of their herds. The Northern Regions Livestock Development Project (NOLIDEP) provides a link between the scientific and farming communities. NOLIDEP has selected five villages in which to implement this project.

**Gaps and problems**

*Ex situ* conservation needs and problems in Namibia can be summarised as four points:

- a shortage of Namibian graduates interested in careers in the conservation of genetic resources, biosystematics, or curation;
- an inadequate level of collaboration between relevant persons and institutions;
- an inadequate institutional capacity to determine the genetic display of indigenous species;
- a lack of adequate legislation to protect genetic resources from exploitation.

— Herta Kolberg

### 2.8 Genetic diversity knowledge and research needs in Namibia

Many people cannot really fathom the reasons for conserving genetic diversity. Even within the framework of the Convention on Biological Diversity, many national programmes operate almost exclusively at the species level. If they appear at all, safeguards for genetic variability are tacked on almost as an afterthought.

Why is genetic diversity important? Such variation can be thought of as the building blocks on which the all-important mechanism of evolution proceeds. It is the grist to the mill of natural selection. Any loss of this variation may be cause for concern, since genetic variation allows a species evolutionary options for coping with environmental change (section 2.2). Evolution is, after all, the main process by which species will survive the environmental changes and challenges that we humans throw at them.

To understand the role of genetic variation, consider the cheetah (below), a mammal with extremely low genetic variation and a high susceptibility to disease. In theory, at least, all cheetahs could be wiped out by a single epidemic, because their immune systems (designed on the ‘instructions’ of nearly-identical genetic codes) might all fail equally. A more variable species would probably contain individuals with some resistance to the disease, and these might survive.⁷⁰

Of more direct concern to our own survival and livelihood is the low genetic diversity of species on which we depend for food (below). We rely on only 30 major crops, of which three (wheat, rice and maize) provide 60% of the world’s food.¹¹⁰ In a risky attempt to improve agricultural production, indigenous crops are being replaced with genetically uniform cultivars.¹¹¹ We are, often obliviously, engaged in a dangerous evolutionary race—a race against the rapidly evolving crop pests and diseases which can decimate these genetically similar strains of wheat or maize over wide areas, inducing famine. A key part of the Biodiversity Convention, therefore, is to safeguard the genetic diversity of domesticated species and their disease-resistant wild relatives, as critical weapons in this evolutionary ‘arms race’.

Finally, in addition to these very direct benefits of genetic diversity *per se*, there is a great value in the genetic uniqueness of taxa in Namibia. Spanning much of the South West Arid Zone, Namibia holds many taxa which are genetically very different from their nearest relatives. *Welwitschia, Kaokochloa*, and the Herero chat *Namibornis* are a few of the
specialties of our area. These are not just of academic interest. Often strikingly well adapted to arid environments, Namibian plants and insects may be of potential use in land reclamation and agriculture (see below). They are emblems of Namibia, with which we can identify proudly. And as representatives of unusual taxa, they contain a large chunk of unique genetic material. So genetically, not all species are ‘created equally,’ but some have more unique information than others. These genetic ‘outliers’ must be rated highly when setting conservation priorities.
— Phoebe Barnard

Genetic diversity of microorganisms

Microorganisms such as algae, bacteria, fungi, protozoa, viroids, and viruses form a large proportion of the world’s biomass, and the major portion of global genetic diversity. Until recently, their diversity was largely ignored, and no realistic inventory of microbial diversity exists. A recent estimate suggests that less than 5% of species are known.112

The genetic diversity of Namibian microbes is completely unstudied. Since microorganisms underpin the maintenance of land productivity and other critical processes, Namibia should take explicit steps to survey them. Extreme environments are considered valuable sources of microbial genetic material.113 Microorganisms in hot, dry or saline habitats are often highly adapted to environmental extremes that other, more complex organisms cannot tolerate, and may thus be of immense ecological and economic importance.

Ex situ collections are the mechanism by which microbial diversity is conserved for study and possible exploitation.112 Namibia has neither the manpower nor the facilities to undertake microbial genetic inventories and ex situ storage, which elsewhere are done by regional microbial genetic resource centres, but could benefit by inviting these and other institutes to sample in Namibia and maintain collections at their own facilities. Legislation to protect Namibia’s intellectual property rights with respect to such material needs to be developed, so that our country can potentially benefit from its own unique microbes.
— Coleen Mannheimer

Genetic diversity of wild plants

Botany in Namibia has so far focused mainly on taxonomy, ecology and to a lesser extent ethnobotany. Little is known of plant physiology, biochemistry or genetics, particularly molecular genetics. Genetic diversity studies in Namibia are not given a higher priority than research on taxonomy, phytogeography, ecology, conservation or resource utilisation. If the Namibian flora is poorly known on a higher level, genetic data may also be of little use.

In recent years the International Plant Genetic Resources Institute and Kew Gardens have collected genetic resources from numerous plant taxa in Namibia.114-117 Extensive collecting for the pharmaceutical industry, or bioprospecting, has not taken place legally in Namibia, although there are local suspicions that material collected for academic research or without permit has served other purposes. However, there is little published literature describing Namibian genetic resources diversity.115,117,118-120 A national workshop on plant genetic resources111 served mainly to build awareness and plan future activities.

In situ genetic conservation of wild plants, mainly in the protected area network, is included in the mandate of the NPGRC, but has not yet been addressed. The present reserves of the country may not adequately conserve plant genetic diversity, as they were not established with genetic criteria in mind.121 Genetic variation studies could indicate ideal sites for reserves, and should be considered before the establishment of any future parks.

Namibian plants are likely to be important in the development of traits for arid-zone agriculture and land reclamation, such as drought and salinity tolerance. Wild relatives of existing crops, and new crops developed from wild plants such as cucurbits (Box 2.9), could have immense value in arid lands.
**Box 2.9 Namibian cucurbitae: potential dryland crops**

Southern Africa is an important centre of diversity for the family Cucurbitaceae (melons), of which 43 species in 14 genera occur in Namibia. Several endemics and near-endemics are found here, including the *Inara* melon *Acanthosicyos horridus*, which is endemic to the Namib.

Lucrative cultivated crops such as sweet melon *Cucumis melo* and watermelon *Citrullus lanatus* originated in southern Africa. Other cucurbitae are traditionally used in local agriculture and subsistence gathering. Many, especially *Citrullus*, can produce large fruits in dry seasons, yielding nutritious pulp and seeds with a high oil and protein content. They therefore have excellent potential for development to supplement or replace cereal production in arid regions. Even so, the Cucurbitaceae are poorly known. The taxonomy of the group is still in doubt; basic data on many species are lacking, and the ancestral forms of cultivated species have been largely ignored in crop improvement programmes.

The National Botanical Research Institute is investigating and documenting the agricultural potential of indigenous cucurbitae in a project cofunded by the MAWRD and the Danish Government. This aims to improve the yield and quality of selected species and promote agricultural use. Crop diversification will also permit the productive use of marginal lands by farmers with limited resources. Because the cucurbitae already occupy a niche in traditional agroecosystems, cuisine, culture and economy in Namibia, they are in many ways preadapted for a new level of exploitation.

— Gillian Maggs

**Recommendations**

- Prioritise species and habitats for study, including genetic diversity analysis.
- Include genetic diversity as a criterion for selecting new conservation areas.
  — Herta Kolberg

**Genetic diversity of indigenous food crops**

Crop genetic diversity is often overlooked as it is difficult to measure at a large scale. However, judging from the rest of Africa, it is safe to assume that substantial crop genetic variation exists both within and between areas in the Namibian subsistence farming sector. This variation is likely to contain highly valuable genes for resistance to drought and salinity, especially in pearl millet.

Until recently, neither government nor private institutions gave much research or development attention to crop production. Crops in Namibia are cultivated mainly by subsistence farmers in northern regions. Since Independence, new research and development work has begun, mainly in the form of collaborative projects between Namibian and international organisations. Regionally, concern over the conservation of genetic resources was addressed in 1989 with the establishment of the SADC Plant Genetic Resources Centre Project (section 2.7) to conserve and utilise the region’s resources by *ex situ* and *in situ* methods.

Other than watermelon *Citrullus lanatus* (Box 2.9), none of the world’s major crops have centres of diversity within Namibia or southern Africa. Watermelons originated in Namibia and Botswana and are considered the region’s most important crop genetic resource. However, unusual regional genetic variation has also been found in other taxa, such as millet.

Aside from an unpublished paper and short notices in various annual reports, there is no published literature on Namibian crop genetic diversity. The genetic diversity represented in the National Plant Genetic Resources Cen-
tre (NPGRC) has not yet been described, although the characterisation of this material started in 1995. From international principles and preliminary results, however, the following inferences can be cautiously made.

A great deal of genetic variability must exist in Namibian crops that have been cultivated in the country for many years.\textsuperscript{132,133} These are mainly the traditional crops of northern Namibian subsistence farmers (Box 4.7): pearl millet \textit{Pennisetum glaucum}, sorghum \textit{Sorghum bicolor} var. \textit{bicolor}, groundnut \textit{Arachis hypogaea}, Bambara groundnut \textit{Vigna subterranea}, cowpea \textit{V. unguiculata}, watermelon and others. This diversity is likely for three reasons. First, these crops have been grown in Namibia long enough to have developed distinct traits. Second, a degree of cultural isolation of crop farmers in the past, both from other countries and other areas of Namibia, could have enhanced the development of distinct local landraces. Third, a lack of ‘improved’ cultivars and the low priority given to agronomic research and development in the recent past must have allowed any distinct local landraces to be maintained. Indeed, modern agriculture in Namibia, as elsewhere, could be a major threat to this genetic diversity if there is insufficient appreciation of its value.

Differences in ecological conditions and cultivation practices within crop growing areas in Namibia seem to have produced different ecotypes. In controlled experiments,\textsuperscript{132-135} performance and morphological differences in Namibian landraces of pearl millet and sorghum could be linked to their areas of origin and cultivation. In general, genetic variation in crop plants is associated with their use and adaptation to habitat.\textsuperscript{126,136} Harlan\textsuperscript{123} suggests that on a global scale, the more marginal areas for cultivation contain less genetic variability, but study of more material from these regions is needed. For example, the cowpea is less variable in its centre of origin, southeast Africa, than in areas of more recent cultivation.\textsuperscript{137}

Inbreeding and outbreeding also have an effect on the genetic diversity of crops. Outbreeders are usually more heterozygous and polymorphic than are inbreeders.\textsuperscript{138} It can probably thus be assumed that pearl millet, an outbreeder, is genetically diverse because of its breeding system.

Crops grown in Namibia by commercial farmers are ‘improved’ varieties or cultivars.\textsuperscript{139} These must be genetically uniform to be registered. The genetic diversity of such crops within an area is thus assumed to be very low. There may be some genetic differences between areas due to the use of different cultivars.

Wild relatives of domesticated plants are numerous and diverse in Namibia. The genetic proximity of these species to the crop has not been well studied, and their agricultural value is mostly unknown. Several wild relatives, such as \textit{Citrullus lanatus} and \textit{Vigna unguiculata}, are regional endemics.

Fig. 2.37 Sorghum is expected to show significant genetic variation in Namibia. Courtesy HH Kolberg

The \textit{ex situ} conservation of domesticated plants in Namibia has been started with the establishment of the National Plant Genetic Resources Centre in 1993 (section 2.7). The pearl millet collection is fairly representative, but other crops require extensive collection (Table 2.15). It will take several more years to make the collection fairly representative. \textit{In situ} or on-farm conservation of crop diversity has not yet been attempted in Namibia. This falls within the mandate of the NPGRC, but is so far prevented by lack of expertise and manpower.
Genetic diversity is the basis for all advancement in agronomy. The adaptation of landraces of pearl millet to marginal and variable cultivation conditions has preserved genes enhancing drought tolerance. This is important nationally, regionally and globally, with droughts becoming a common occurrence. For increased food security, high yielding, locally adapted cultivars will be of vital importance. This potential is being used in the Sorghum and Millet Improvement Programme of SADC/ICRISAT. A Namibian Drought Tolerant Composite (NDTC) was formed from 400 collections in Namibia, and yielded some grain during the drought of 1991-92.

**Table 2.15** Namibian crop accessions in the National Plant Genetic Resources Centre

<table>
<thead>
<tr>
<th>Crop</th>
<th>No. of accessions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearl millet</td>
<td>1010</td>
</tr>
<tr>
<td><em>Pennisetum glaucum</em></td>
<td></td>
</tr>
<tr>
<td>Sorghum</td>
<td>126</td>
</tr>
<tr>
<td><em>Sorghum bicolor</em></td>
<td></td>
</tr>
<tr>
<td>Groundnut</td>
<td>22</td>
</tr>
<tr>
<td><em>Arachis hypogaea</em></td>
<td></td>
</tr>
<tr>
<td>Bambara groundnut</td>
<td>44</td>
</tr>
<tr>
<td><em>Vigna subterranea</em></td>
<td></td>
</tr>
<tr>
<td>Cowpea</td>
<td>10</td>
</tr>
<tr>
<td><em>Vigna unguiculata</em></td>
<td></td>
</tr>
<tr>
<td>Watermelon</td>
<td>63</td>
</tr>
<tr>
<td><em>Citrullus lanatus</em></td>
<td></td>
</tr>
</tbody>
</table>

**Gaps and problems**

The few small studies of genetic diversity in Namibian crops have been done on a morphological or performance basis. No molecular methods, which directly compare genetic diversity and eliminate environmental effects on gene expression, have been used. The NPGRC will over the next few years characterise germplasm morphologically, and has plans to use molecular methods. The current lack of competent staff is a severe constraint on these activities.

**Recommendations**

The following steps must be taken to obtain a clear understanding of crop genetic diversity in Namibia and its potential uses for the advantage of all Namibians:

- Ensure conservation of existing diversity through both ex situ and in situ methods to prevent any further loss of diversity;
- Characterise and evaluate local crops with morphological and molecular methods to establish genetic diversity patterns within Namibia, and later between Namibia and other regions;
- Develop the human resources capacity to achieve these aims.

— Herta Kolberg

**Fig. 2.38** Millet genetic diversity is a focus of the NPGRC. Courtesy Ministry of Information and Broadcasting (N Akukothele)

**Genetic diversity of wild animals**

Little information exists on the genetic diversity of any wild animal in Namibia, with several important exceptions. Most genetic work concerns red data mammals, and is already generating valuable information. Box 2.10, for example, describes current work on carnivores in Etosha National Park which will yield genetic, ecological and behavioural data on lions, *Panthera leo*. All of these forms of data can be essential for making informed management decisions, especially when conservation spending must be prioritised.
**Box 2.10 Genetic variation in Etosha lions**

The genetics of lions in Etosha National Park is one of the subjects of a joint carnivore research project of the Etosha Ecological Institute (EEI) and Chicago Zoological Society. This project is generating data on the genetic distance of Etosha lions from other populations in the region, levels of heterozygosity, pride lineages, paternity, and other aspects of behavioural ecology. These data will allow staff to estimate the genetic impact, if any, of management actions such as translocations. It will also help in judging the population effects of the large numbers of lions, mainly subadult males, which are shot every year just outside the park.

Early results? Etosha lions cannot be distinguished genetically from those in the Tsumkwe District, and share 99.4% of their genes (using 509 bases) with lions in South Africa’s Umfolozi Reserve. Many cat species have very little genetic variation within populations, but this seems to confirm that Etosha lions are not a distinct subspecies, as is sometimes suggested.

— Source: Venzke & Forge

Genetic diversity can be threatened by several processes, including hybridisation. Box 2.11 outlines some threats to the genetic integrity of the black-faced impala *Aepyceros melampus petersi*, an endangered antelope which is endemic to northwest Namibia and southwest Angola. This case study highlights the need for circumspect management to safeguard distinct populations. Since high species richness is valued by game farmers and tour operators, especially those catering for trophy hunters, land users may be tempted to maximise species richness at the expense of genetic integrity.

Cheetahs are genetically better known than many large mammals, due to research on problems experienced in captive breeding. Southern and east African cheetahs have such low levels of heterozygosity, or multiple forms of a gene (see Box 2.12), that their genetic variation is no more than that of deliberately inbred lab mice. Southern African populations have an average heterozygosity of 0.0004, less than that for east Africa and one or two orders of magnitude less than in other cat species.

The reasons for this have been hotly debated. Low genetic diversity could reflect population bottlenecks (Box 2.12) since the Pleistocene era, when mammalian extinctions in Asia and the Americas were widespread. It may be related to the cheetah’s hunting or breeding strategy, or may be fairly typical of carnivores. So far, there is no consensus on the reasons.

Whatever its causes, what might be the effects of this extremely low genetic diversity on cheetah conservation? As the nation with probably the largest cheetah population (section 2.5), Namibia has a particular responsibility for their conservation. A national cheetah management strategy, the first for any country in the cheetah’s range, has been drawn up to help preserve genetically viable populations in Namibia. Low heterozygosity has been blamed for reduced evolutionary fitness in captive cheetahs, as shown by susceptibility to disease, asymmetric body development, and breeding abnormalities, but it is not clear to what extent wild populations suffer from these problems. It has been argued that cheetahs suffer from inbreeding depression (Box 2.12), but until recently there has been no evidence that susceptibility to disease in captivity is matched in the wild. An important exception may be the vulnerability of cheetahs to anthrax *Bacillus anthracis* in Etosha National Park, where all six radio-collared cheetahs have succumbed to the disease after eating infected prey.

Although the authors did not link this mortality to low heterozygosity, further work is desirable to establish why cheetahs would not develop immunity to anthrax when this disease commonly afflicts their prey. Finally, cheetahs in captivity suffer from breeding abnormalities linked to low heterozygosity, such as defective sperm and high cub mortality. However, wild cheetahs do not seem to suffer. The Namibian cheetah population can double every five to seven years, in the absence of limiting factors.

More should soon be known about the genetic diversity of other Namibian mammals, as there is an increasing focus on tissue sampling for genetic study (section 2.7).
Box 2.11 Trading one threat for another: genetic pollution in the black-faced impala

The black-faced impala *Aepyceros melampus petersi* is an endangered subspecies, endemic to southwest Angola and northwest Namibia. It is of conservation concern due to the risk of hybridization with, or ‘genetic pollution’ by, the common impala *A. melampus*. Historically, its distribution was separate from that of the common impala, but the two have recently been extensively introduced onto game farms, in some cases onto the same farm. The Etosha National Park population is also at risk, as common impala, which are adept at moving through game fences, have been introduced onto numerous adjacent farms. The risk of interbreeding has been increased by economic and bio-political incentives for farmers to have both types of impala on their land. These incentives include:

- a much higher current price for black-faced (up to N$6500) than common impala (N$250), which encourages most game farm owners to stock common impala;
- the wish of many game farm owners to offer tourists and hunters a variety of mammal species, especially regional ‘specialties’; and
- trophy import restrictions on black-faced impala for U.S. hunters, who are perceived as paying more than other nationalities. This removes an important economic incentive for game farmers to stock black-faced impala: U.S. hunters will not hunt for a trophy they cannot bring home.

Due to the threat of extinction in its natural range, the black-faced impala was introduced into the Etosha National Park from the former Kaokoland (now Kunene Region) in 1968-71, with a founder population of 180 impala. Introductions into the national park have been highly successful: the Etosha populations have since increased to more than 1500. Meanwhile, Kaoko populations have increased little if at all; they are fragmented, and seriously threatened by poaching and competition with livestock, despite support among ovaHimba leaders in the region for their presence and reintroduction.

Ironically, the management strategy adopted to rescue this Kaoko endemic by translocating it into public (and then private) protected areas has inadvertently jeopardised its genetic integrity. The threat of future interbreeding can be addressed through concerted management action with game farmers, the Namibian Professional Hunters’ Association, and rural communities.

*Source: Green & Rothstein*[^144]

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Box 2.12 Conservation genetics terms in (fairly) plain English

### Heterozygosity
A measure of the genetic diversity in a population, based on the average proportion of an individual’s genes which exist in two different ‘versions’ (*alleles*). Populations with high heterozygosity can usually adapt better to environmental change.

### Population bottleneck
A dramatic crash in number of a population. During this process, genetic diversity is often lost, and the future genetic profile of the population is shaped by those individuals which survive.

### Inbreeding depression
A state of lowered survival, vigour and breeding success of individuals, due to negative genetic changes (*increased homozygosity*) caused by repeated breeding among relatives.

[^144]: Green & Rothstein
Genetic diversity of domesticated animals

Almost as diverse as its people and wild biota are Namibia's livestock. Livestock production in Namibia varies from small scale, extensive subsistence farming to large scale, extensive commercial farming. Table 2.16 gives background data on livestock numbers in the different regions. The former 'Owambo' (now Oshikoto, Ohangwena, Omusati, and Oshana Regions), western Kunene, Okavango and Caprivi Regions are communal farmland.

Most well known imported cattle breeds, plus indigenous Nguni or Sanga cattle, are found in Namibia (Table 2.17). Most imported breeds entered Namibia from South Africa, but two, the Simmentaler and Brahman, were imported directly to Namibia from Germany in 1894 and the USA in 1958 respectively. Namibia has few dairies, and there are no data on the number of breeders or animals per breed. Dairy breeds in Namibia are Frieslands and Jerseys.

Conservation of indigenous livestock has a high priority in the MAWRD's National Research Policy. 'Sanga' is a collective term for all the indigenous cattle breeds of southern Africa (Afrikaner, Tuli, Shangaan, Drakensberger, Pedi, Venda, and Namibian ecotypes), but due to the lack of a suitable distinct name, indigenous Namibian breeds are also referred to as Sargas by government agriculture staff.

North of Namibia's Veterinary Cordon Fence, the 'Red Line,' most cattle are Sargas, with very small numbers of other breeds introduced over the years. Of the roughly 2.04 million head of cattle in Namibia, approximately 700 000 are Sanga cattle held by northern communal farmers. Sargas are the most numerous of all breeds.

Sanga cattle have been undervalued by government agriculture staff for many years. They are a 'low maintenance' breed, naturally selected over centuries, with an inherent parasite resistance, high fertility and excellent maternal care. Communal farmers need to have animals that can thrive under harsh conditions, as their access to production supplements (e.g. salt licks and medicine) is often less than that of commercial farmers.

Sanga cattle are used for meat and milk production as well as draught purposes. They excel in standard indices of production: they are particularly fertile, have a low intercalving period, the highest weaning mass per unit of maternal body mass of any breed in Namibia, a high growth rate and a high feed conversion ratio. These features plus their small size, low maintenance needs and tolerance of dry environments mean that they crossbreed excellently with large bulls of introduced breeds to produce heavy offspring. There is thus now a considerable demand for Sanga cows by commercial cattle farmers. Purebred Sargas are only surpassed in terms of biomass production by crossbreeds of pure Sanga cows with large European type beef bulls. This latter fact, however, creates a strong incentive among farmers to crossbreed the indigenous and imported cattle, which may jeopardise the integrity of the Sanga gene pools.

Due to the presence of stock diseases in some areas, Sanga are the only large stock found there. Recent studies in Namibia and South Africa have found that Sanga cattle generally have a high resistance to ticks and other parasites, and the Caprivi Sanga has a strong resistance to trypanosomiasis. Sanga can also tolerate conditions from the humid Caprivi to the arid Kunene Region, and can survive under conditions where exotic breeds have died from starvation and thirst.

Fig. 2.40 The indigenous Sanga cattle breed. Courtesy P Hugo
### Table 2.16  Number of different livestock per region

<table>
<thead>
<tr>
<th>Area</th>
<th>Cattle</th>
<th>Sheep</th>
<th>Goats</th>
<th>Pigs</th>
<th>Poultry</th>
<th>Ostriches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caprivi</td>
<td>95 136</td>
<td>44</td>
<td>4 302</td>
<td>35</td>
<td>16 852</td>
<td>0</td>
</tr>
<tr>
<td>Okavango</td>
<td>106 209</td>
<td>137</td>
<td>34 799</td>
<td>2 491</td>
<td>37 562</td>
<td>0</td>
</tr>
<tr>
<td>Otjozondjupa</td>
<td>308 913</td>
<td>90 262</td>
<td>131 984</td>
<td>2 173</td>
<td>76 884</td>
<td>518</td>
</tr>
<tr>
<td>Owambo*</td>
<td>339 725</td>
<td>18 769</td>
<td>172 318</td>
<td>2 145</td>
<td>50 291</td>
<td>0</td>
</tr>
<tr>
<td>Kunene</td>
<td>272 611</td>
<td>128 854</td>
<td>389 521</td>
<td>1 882</td>
<td>28 739</td>
<td>116</td>
</tr>
<tr>
<td>Erongo</td>
<td>67 911</td>
<td>54 072</td>
<td>178 912</td>
<td>1 576</td>
<td>57 670</td>
<td>112</td>
</tr>
<tr>
<td>Omaheke</td>
<td>418 786</td>
<td>325 664</td>
<td>173 498</td>
<td>3 170</td>
<td>44 065</td>
<td>2 513</td>
</tr>
<tr>
<td>Khomas</td>
<td>175 390</td>
<td>159 161</td>
<td>32 198</td>
<td>1 952</td>
<td>64 000</td>
<td>2 811</td>
</tr>
<tr>
<td>Hardap</td>
<td>92 428</td>
<td>942 469</td>
<td>228 789</td>
<td>1 159</td>
<td>79 837</td>
<td>14 205</td>
</tr>
<tr>
<td>Karas</td>
<td>32 685</td>
<td>900 093</td>
<td>292 891</td>
<td>1 260</td>
<td>17 410</td>
<td>2 945</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1 909 794</td>
<td>2 619 525</td>
<td>1 639 212</td>
<td>17 843</td>
<td>473 310</td>
<td>23 220</td>
</tr>
</tbody>
</table>

*’Owambo’ is made up of the Omusati, Oshana, Oshikoto and Ohangwena Regions.

### Table 2.17  Cattle breeds, stud breeders, registered animals and participants in the Performance Testing Scheme, PTS

<table>
<thead>
<tr>
<th>Breed</th>
<th>No. of breeders</th>
<th>No. of cattle</th>
<th>Participants in PTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afrikaner</td>
<td>20</td>
<td>2 150</td>
<td>5</td>
</tr>
<tr>
<td>Bonsmara</td>
<td>31</td>
<td>4 615</td>
<td>31</td>
</tr>
<tr>
<td>Brahman</td>
<td>103</td>
<td>6 158</td>
<td>31</td>
</tr>
<tr>
<td>Charolais</td>
<td>18</td>
<td>692</td>
<td>0</td>
</tr>
<tr>
<td>Drakensberger</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Gelbvieh</td>
<td>8</td>
<td>121</td>
<td>2</td>
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<tr>
<td>Hereford</td>
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<td>-</td>
<td>0</td>
</tr>
<tr>
<td>Limousin</td>
<td>6</td>
<td>151</td>
<td>0</td>
</tr>
<tr>
<td>Nguni/ Sanga</td>
<td>11</td>
<td>721</td>
<td>0</td>
</tr>
<tr>
<td>Santa Gertrudis</td>
<td>-</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>Shorthorn</td>
<td>1</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>Simbra</td>
<td>10</td>
<td>1 350</td>
<td>7</td>
</tr>
<tr>
<td>Angus</td>
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<td>71</td>
<td>0</td>
</tr>
<tr>
<td>Sussex</td>
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<td>-</td>
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</tr>
<tr>
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<td>100</td>
<td>2</td>
</tr>
<tr>
<td>Brown Swiss</td>
<td>20</td>
<td>991</td>
<td>4</td>
</tr>
<tr>
<td>Pinzgauer</td>
<td>2</td>
<td>312</td>
<td>2</td>
</tr>
<tr>
<td>South Devon</td>
<td>2</td>
<td>70</td>
<td>1</td>
</tr>
<tr>
<td>Simmental</td>
<td>40</td>
<td>4 000</td>
<td>13</td>
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Source: Namibian Stud Breeders’ Association; Simbra and Simmental Breeders’ Association.

- = no data available
The Afrikaner is a breed indigenous to South Africa and Namibia, with a relatively small distribution and a limited gene pool. Genetic material is available only in these two nations, and is periodically imported to Namibia from South Africa. Afrikaner pure- and crossbred cows are used in rangelands for meat production in the commercial farming sector. They have good maternal care and are adapted to the harsh conditions.

Sheep are more numerous in Namibia than cattle, and play an important role in livestock production in the southern commercial and communal farming systems, as well as in the northwest of the country. Eight breeds of sheep occur in Namibia: Dorper, Karakul, Damara, Black-headed Persian, Afrikaner, Dohne Merino, South African Wool Merino, and Letelle.

The Dorper, developed in South Africa, is the most numerous breed. It is bred for mutton production and is highly fertile. It grew in popularity after economic hardship in the Karakul industry.

The Karakul, originally imported at the turn of the past century, has undergone such development since then that it could almost be called an indigenous breed. From the old traditional ‘pipe-curl’ pelts to the modern ‘water silk’ types, new variants have been selectively bred. Before the slump in this industry, Namibia produced 5 million pelts per year. The MAWRD also selectively bred the brown, grey and white Karakul sheep. At present, small nucleus herds of these different types are kept at Gellap-Ost Research Station, and are the only pure herds still in the country.157

The Damara sheep is the only true indigenous breed in Namibia, originating from the former Kaokoland and Damaraland (now Kunene and Erongo Regions). This is a hardy, fat-tailed breed with high fertility and excellent maternal care. Multiple births are not common. Damara sheep are adapted to the arid western areas, and all have predominantly red and black wool. The MAWRD has a herd, recently acquired in Kunene for comparison trials with a herd which has been selected for fertility and growth over the past forty years. This will determine the amount of progress made in terms of growth and fertility, but also the extent to which disease resistance may have been lost. The Damara sheep is more of a browser than other breeds.157

Goats are very important in Namibia’s livestock industry. In the commercial sector, goat farming is practised as a primary industry in the south and as a secondary industry in the central and northern regions in conjunction with cattle. Most goats on commercial farms are Improved Boer goats, a breed developed from indigenous goats in South Africa and Namibia. This breed is very fertile and long-lived, with good maternal care, milk production and meat production. There is a high incidence of multiple births.

Fig. 2.41 Damara sheep are the only truly indigenous Namibian sheep breed. Courtesy P Hugo

Fig. 2.42 Improved Boer goat. Courtesy MAWRD
In the southern communal farmlands of Karas Region, a local type of goat is often crossbred with Improved Boer goats for increased mass. Little is known about this breed. Two and possibly three indigenous goats are found in the northern communal areas: a long legged type in the Kunene Region, a small type in northern ‘Owambo’ similar to one in eastern South Africa, and a possible third type in the Okavango Region. Goats from Okavango and southern ‘Owambo’ have often been crossed with Boer goats, and may not be genetically distinct. A mission to collect genetic material from these breeds has just taken place, and the MAWRD has recently acquired goat herds from northern ‘Owambo’ and Kunene. The production and reproduction of these herds will be compared with those of the Improved Boer goat at Uitkomst Research Station. In the Okavango Region, a project will determine resistance to internal parasites.

Most pigs kept on farms are for domestic use, and the most numerous commercial breeds are Large Whites, Landraces, and Durocs. There are currently about ten commercial pork producers with 1500 breeding sows. Roughly 7000 indigenous pigs are found in the northern communal areas. These pigs differ from known commercial breeds by having short snouts with a pronounced dish in the forehead, short, potbellied bodies, and variable skin colours. They are much smaller and lighter than commercial pig breeds, and accumulate fat much more quickly. Very little is known of their production potential, disease resistance, or cultural role. A current joint project of the MAWRD and the Irene Animal Production Institute of South Africa aims to characterise these pigs genetically and estimate their genetic distance from a similar South African indigenous pig, the Colbrook.

Most chickens in Namibia are of commercial breeds and crosses between these breeds. In the northern communal areas, people keep chickens which appear to represent different ecotypes. Their production potential will be evaluated, and high quality chickens will then be selected and multiplied for local use.

There are no true wild horses in Africa, but a unique group of feral horses exists in the southwestern Namib Desert (Fig. 2.43). This group is probably descended from the herd of a German captain who kept about 350 horses at Duwisib Castle, 200 km distant, until World War I. Thoroughbred stallions were bred to English Warmblood mares there, and the crossbreds were renowned as military and police horses.

The horses came to public attention in 1987 when ten were sent to a South African veterinary institute. They show unique traits fixed by years of isolation, adaptation and inbreeding, and are related to the American and Shagya strains of Arabian horses, which were present in Namibia in early German colonial times. A 1994 study revealed about 124 animals, of which 54% were stallions, 46% mares, 38% immature and 62% adults, and foal survival was 60%. They had no immunity to horse diseases, and their progeny will be used to test vaccines for horse sickness and equine flu. The horses are strongly inbred, with extremely low genetic variation. Indeed this is the second lowest level of heterozygosity of any horse.

—— J.F. Els

Fig. 2.43 Feral horses of the southern Namib Desert. Courtesy P Tarr