

Priority setting for a wild species collecting programme in Namibia

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Introduction

The wild species to be considered in an initial genetic resources collecting programme can be broadly divided into three categories: firstly, species of *direct economic or utilitarian value*, secondly, the wild relatives of crop plants representing the wider genepool of those crops, and thirdly, forages. The former category comprises plants whose value is immediate and obvious; the second group has a value which is largely unknown, impossible to predict, and therefore intangible, and the last group, the wild forages, may be either of known or unknown value.

Genetic resources work worldwide is becoming increasingly user-driven. This approach is justified by the enormous costs involved in collection and conservation, and by the vast quantities of material stored in genebanks which remain unevaluated, uncharacterised and therefore unutilizable. This more rational approach means that collecting is becoming more closely focused and targeted to the specific needs of the breeder or user. While it is sensible for crop and landrace collections, the adoption of this strategy could have disastrous consequences for wild species collection and conservation. Wild species are always a last resort in plant breeding because of the difficulty in eliminating wild or undesirable characters, and in breaking genetic linkages. This is demonstrated by the surprisingly few instance of wild species having been successfully incorporated into crop cultivars. The implication is that by the time there is a clearly defined need for the incorporation of wild species into breeding programmes, i.e. once all the available diversity in the landraces and primitive cultivars has been exhausted, these wild species may no longer exist in their original habitats. If they have not been collected and conserved in a genebank, the genetic diversity which they represented will have been lost.

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The importance of wild species in Namibia from a genetic resources viewpoint

Of all the SADCC countries, the genetic diversity of wild species represented in Namibia is probably the most valuable from a genetic resources point of view. This is primarily because of the high genetic integrity of, and the extreme environments in which these plant populations occur. Large parts of Namibia represent some of the harshest habitat types of southern Africa, and may be viewed as untapped reservoirs of genetic diversity with exceptional environmental resistance and tolerance traits. It is these traits, in the form of genes and finely-tuned adaptive complexes, that are required in increasing number for breeding and introduction programmes geared to producing agricultural lines adapted to and productive in the marginal areas of the world.

These areas with their hardy genotypes, previously little used, are facing mounting pressures mainly from livestock as well as possibly from the greenhouse effect. Paradoxically, it is these very genotypes which man requires to allow expansion into - and the sustainable utilization of - these areas.

From a genetic resources viewpoint the arid and marginal areas of Namibia are of particular interest for the following reasons:

1) They represent a series of naturally functioning, often climax ecosystems. Although these may be damaged to a certain extent, relative to comparable extensive marginal rangelands elsewhere in the world, it is considered likely that they still maintain a moderately high genetic and species diversity as well as high genetic integrity.

2) Many of the component species of the various vegetation types include genotypes adapted to very specific "problem environments" which could be used in degraded parts of Namibia and elsewhere in the semi-arid and arid world.

These include:

- Halophytic species of the Etosha Pan and northern Namib salt flats, which are able to survive a combination of high salinity, high reflection and insolation levels, and extreme aridity. The Etosha Pan supports sizeable herds of migratory game, pointing to a high seasonal productivity of the vegetation. These salt tolerant species and genotypes may well be able to improve productivity levels in the many hot semi-arid areas of the world currently affected by agricultural salinization.

- Plants adapted to acid soil in an arid environment. These acid sand pockets occur in the region of Walvis Bay and any associated species could be of agronomic importance.

- Plants with the ability to cope with the extremely complex, unusual and possibly fluctuating pH balance of the coastal Namib sands. The several kilometres of sand

immediately adjacent to the coast are mainly gypsic, and thought to be acid. The regular fog which rolls in from the sea is laden with sulphates from the upwelling zone. It is thought that these sulphates may create an acid micro-environment in the top few centimeters of sand, in contrast to the high pH of the lower layers of sand. Slightly further inland the situation can be reversed: the sand is of carbonate origin, which is also basic. Here the sulphate from the fog percolates through the top layers of sand and would appear to create an acid environment lower down.

-Species able to withstand the unusually high levels of ultra-violet radiation known to occur in several locations in the Namib. As levels of absorbed U-V penetrating the atmosphere are expected to increase due to the hole in the ozone layer, so this feature will be of increasing importance as a character to be transferred into commercial forage and crop lines.

-Genotypes adapted to and productive under nutrient-deficient conditions, particularly low phosphate levels.

-Genotypes with wide temperature tolerances able to withstand frost in winter and temperatures above 45 degrees C in the summer.

3) Genotypes adapted to desert conditions may possess a greater degree of genetic plasticity than populations of the same species growing in more favourable environments. These genes may be able to confer traits of high adaptability to commercial forage and crop lines.

4) There is concern that the current low stocking and utilization rates of many of Namibia's marginal areas could change as the new government sets about honouring promises of land to its people. The areas most likely to be first affected and probably hardest hit are the marginal zones, which to date have been relatively little used. These would largely be the Namib and Kalahari fringes. A further consideration is that as development aid pours into the rural sector, it could be expected that genetic erosion may increase in these fragile arid ecosystems as a result of unsuitable and unsustainable development projects, as has happened in the Kalahari in neighbouring Botswana. Thus it is important to pinpoint the areas of high genetic diversity at highest risk and to initiate germplasm collection as soon as possible.

5) The effects of global warming can not yet be accurately predicted, but it is considered likely that deserts and semi-deserts may be adversely affected. Many desert species are already growing at the extreme limit of their tolerance ranges. Thus even a small increase in temperature or long-term aridity may induce a genetic shift and alter or compromise the genepool, or even result in extinction. Should this prove to be the case, then the diversity of the genetic resources of the Namib and Kalahari rangeland systems may be rather vulnerable.

Short and medium-term priorities for a wild species collecting programme in Namibia

In setting priorities for genetic resources activities in Namibia, it is important to take into account the two different and sometimes opposing approaches required for crop collection on one hand and for wild species collection on the other. While at this stage the user-driven approach is most appropriate for crops, a pre-emptive strategy is essential for wild species collecting. What this means in practice is that collecting must be undertaken before genetic erosion has taken place. Otherwise the genetic integrity of the population may be so compromised that the genepool is no longer representative of the original genetic diversity available. In that case one would be collecting genes, not genetic diversity or adaptive complexes.

Although the field of wild species is broad and it is difficult to predict future needs, some sort of collecting priorities have to be set. The following list could be used as a guide in determining the groups to be given the most immediate attention. In the longer term, these priorities will shift, but this is suggested as a starting point.

- 1) Crop relatives which have a primary or secondary center of diversity in Namibia. These are known to be concentrated sources of genetic diversity. Apart from providing often unique genetic diversity, these areas are the most cost-effective collection sites, because the genetic diversity is high over a relatively small area. Examples are the Cucurbitaceae, *Hibiscus* and *Vigna*, amongst others.
- 2) Crop relatives growing in harsh or unfavourable environments. Such genotypes are frequently the source of resistance and tolerance traits, and these areas are coming under increasingly greater pressure.
- 3) Wild forages growing in marginal environments. New forage genotypes adapted to and productive in arid habitats are in increasing demand because of the worldwide acceleration in desertification, and because of rising pressure on the use and productivity of marginal zones. This trend is likely to be exacerbated by the greenhouse effect.
- 4) Any wild species or genotypes which are in demand by breeding and research programmes in Namibia or elsewhere in the world. Even though a certain species may not fall within the national priority list, it may be a priority for another country and is thus worth conserving. The whole world is totally interdependent on each other's genetic resources, and a xenophobic approach to genetic resources will inevitably backfire. It is suggested that an active effort be made to establish links between research and breeding institutes around the world to establish collaborative programmes.
- 5) Areas of impending genetic erosion, particularly in the case of unique environments or ecosystems not represented elsewhere in Namibia. The national programme

will have to perform a close and careful monitoring function, gathering information on such activities as change in land-use, resettlement schemes, deforestation, dam-building and other development schemes. It is suggested that a watchdog committee be set up for this purpose.

6) Indigenous crops or wild species with an economic or utilitarian value, particularly in cases where their use or relative importance is decreasing. Medicinal plants are included in this category.

It is important to reach a balance between collecting sufficient genetic diversity and filling up the genebank with large amounts of similar material. The latter situation is expensive, wasteful and highly undesirable, and the sheer volume involved can deter interested breeders and users. It can be avoided by the careful use of distribution maps and species inventories. By this method collecting can be done right across the geographical and habitat ranges of the species in question, but only collecting once or twice per habitat type.

A genetic resources collecting programme has already been initiated in the Namib and Namib fringes by the International Board for Plant Genetic Resources, in close collaboration with the Namibian NPGRC, with two wild species collecting trips already having been carried out. It is hoped that this will act as a sound basis for a cogent long-term strategy to conserve these valuable genotypes and make their finely-tuned genes and gene complexes freely available for research, breeding, improvement and introduction programmes.
