Enhancing Access to Plant Genetic Resources in Kenya

Key messages

• Enhance the capacity to undertake comprehensive conservation of the country’s plant genetic resources. It will be critical to formulate national policies that take cognizance of the vast potential plant genetic resources can offer in food and nutrition security, environment management and climate change adaptation and mitigation.

• Strengthen institutions mandated with plant genetic resources conservation by providing adequate infrastructure, human and financial resources to enhance conservation efforts both in situ and ex situ. Mechanisms for initiating and maintaining strategic partnerships, including defining their roles and responsibilities in conservation of genetic resources need to be developed to enhance synergy and complementarity.

• Support research on plant genetic resources and their agronomic, environmental, nutritional and socio-economic contributions to resilient production systems. There is need to establish national and regional inventory of plant genetic resources. Furthermore, there is need to collect, organize and make available geographic, morphological, biochemical, nutritional, genetic and anthropological data on plant species held by the various communities. More critical is the need to expand research on the role of indigenous species in strengthening the resilience of agricultural production systems to climate change.

• Develop policies and strategies that promote access and benefit sharing of genetic resources. Participatory characterization and evaluation, linking farming communities with existing formal conservation initiatives and establishment of community genebanks are effective ways of facilitating access by farmers, communities and other stakeholders to a wide diversity of crops. Given the contribution of genetic resources to intellectual property, clear and comprehensive access and benefit sharing policies and legal frameworks need to be developed to enhance their utilization for socioeconomic development.

• Promote awareness creation on the importance of conservation and sustainable utilization. Efforts are required to sensitize institutions and communities on the need to conserve plant genetic resources as the basis for economic development and improved livelihoods. National databases need to be developed as well as platforms for information sharing and exchange. In addition, knowledge and information on plant genetic resources need to be appropriately packaged and accurately disseminated to different target groups, including, farmers, policy makers, researchers and development agents.

Introduction

Plant genetic diversity is the variety within and between plant species both within and across ecosystems. Plant genetic resources may take the form of seed collections stored in gene banks, germplasm of domesticated and wild species, and elite breeding lines. Kenya has a rich reservoir of genetic diversity, the conservation and utilization of which could significantly contribute to promoting economic development. Plant genetic resources are a biological basis of a country’s food security and directly or indirectly support the livelihoods of the people. They consist of a diversity of genetic material contained in traditional varieties and modern cultivars grown by farmers as well as crop wild relatives and other wild plant species that can be used as food, medicine, essential oils, gums and resins, fodder and forages, fibre, shelter, wood, timber and fuel wood among others.

The most obvious use of genetic resources is as a source of food for human and animal populations. They are also used in breeding programmes to enhance agricultural, forestry and livestock productivity, and as raw material in Kenya’s medicinal, food and timber industries. Therefore, genetic resources, and in particular indigenous ones, are of immense economic and environmental importance to the wellbeing of human population. Kenya has over 7,500 plant species growing naturally. The Plant Genetic Resources Research Institute holds approximately 50,000 seed samples representing 2000 different types of plant species which have been assembled through both in-country collection missions and donations from within and outside Kenya. Despite this effort, only 4,000 of these samples have been distributed for use in the last 15 years, representing about 8% of the total collection.
Key roles of Plant Genetic Resources

**Environment management**

The need to maintain the integrity of environmental systems to ensure that their functions and beneficial uses are upheld for present and future generations cannot be overstated. Environmental service functions provided by plant genetic resources include nutrient recycling, soil formation, watershed protection, waste disposal, pollination, climate regulation and carbon sequestration, among others. This explains the need to conserve the resources so as to ensure continuous provision of food sources, drugs, industrial raw materials, fuel and timber, and non-consumptive utilization such as ecotourism. Protecting these resources from degradation, pollution and loss, so as to enhance system resilience and adaptability to change is necessary.

*Ex situ* and *in situ* conservation of genetic diversity in Kenya is a principal function of the Genetic Resources Research Institute (GeRRI), one of the semi-autonomous institutes of the Kenya Agricultural and Livestock Research Organization (KALRO). Other institutions involved in genetic resources conservation initiatives by way of their functions include: National Museums of Kenya (NMK), Kenya Forestry Research Institute (KEFRI), Kenya Forest Service (KFS), Kenya Wildlife Service, communities, public universities and to a small extent, private organizations. There are at least 14 *ex situ* germplasm repositories in the country with seed storage facilities majority of which have short-term to medium-term storage capacity. The Plant Genetic Resources Centre, now operating under the auspices of GeRRI, is the only long-term *ex situ* conservation facility in the country which currently holds a repository of about 50,000 plant accessions representing 165 families, 893 genera and 2000 species. Unfortunately due to limited capacity (infrastructure, human and finance), the current conservation initiatives are yet to effectively secure and enhance utilization of the country’s rich genetic heritage.

Valuable genetic resources including wild relatives of crops, medicinal plants, under-utilized food and beverage plants, fodder and forage plants, as well as a wide range of other economically important plants and microbial organisms are preferably conserved in situ. In situ conservation is essential as it provides a fall back for recollection of lost genetic resources in *ex situ* conservation areas/facilities. More importantly, it is a reservoir of genetic resources in form of landraces, cultivars and farmer varieties existing in agricultural landscapes. The in situ strategy in form of on-farm conservation provides for a continuous source of farmers’ breeding material for farmer preferred traits while ensuring resilience of the agricultural production systems.

There are various challenges and threats to genetic resources conserved in situ. These include destruction of natural habitats due to agricultural expansion and socio-economic developments, over-harvesting of specific plants, displacement of indigenous plants by alien and invasive species and climate change. For example, ongoing mega projects like the standard gauge railway, lapset, and the one million acre irrigation scheme may lead to loss of biodiversity. Efforts need to be put in place to ensure that such projects are sustainably implemented without eroding the biodiversity. Some communities are known to unsustainably harvest plant resources. There is need for urgent steps to widen knowledge on utilization and management of genetic resources for enhanced livelihoods and improved incomes of Kenya's population.

The conservation of plant genetic resources is imperative for sustainable livelihoods, agricultural productivity, climate change resilience and economic development. In addition, maintaining a rich diversity of economically important species, indigenous food crops along with crop wild relatives is critical in the development and breeding of superior plant varieties that are able to withstand a range of biotic and abiotic stresses and in enriching the food diversity available to the population of Kenya. However, the diversity of plant genetic resources in Kenya is on the decline. Indigenous crop varieties continue to be increasingly replaced with elite cultivars as minimal efforts have been made on their conservation despite their importance. In order to ensure on-going sustainable use of Kenya's genetic resources, it is imperative that they remain genetically diverse. Not only does this ensure a broad base from which selection can be undertaken, but it also enables the resources to be better adapted and cope with the changing environment.

The wealth of knowledge among mandated institutions and indigenous communities plays a significant role in the identification and utilization of the valuable plant species. There exists a big opportunity to integrate this knowledge into the conservation, domestication and commercialisation agenda of these plant species. Presently, there are very few institutionalised system of documenting and sharing indigenous knowledge on plants species and popularising this indigenous knowledge down the generations. In addition, indigenous knowledge, innovations and practices of plant genetic resources have not been afforded the necessary Intellectual Property Rights protection much as they have continued to gain international attention. There is, therefore, an urgent need to formulate an array of incentive measures to ensure that the public will want to learn, value, adapt, and apply the knowledge, innovations and practices. Also important is to ensure that this knowledge is documented and made available for future generations.

**Food and nutrition security**

The diversity of plant resources is a key component of biodiversity and it lends itself as a resource to be tapped as human needs and economic demands change. The majority of Kenya's population derive most of their food, medicine and industrial products from both wild and domesticated components of these plant resources including seeds. However, the current agricultural policies and markets favour a limited number of genetically uniform high yielding staple commodity crops such as maize, wheat, Irish potato, tea and coffee. For many farmers especially those in areas where high yielding crop varieties cannot perform optimally, indigenous plant species (e.g. millet, sorghum, cassava and sweet potato) have evolved and adapted and over time have become the main sources of food and income for the rural households. Furthermore, these indigenous species are increasingly gaining prominence even
in the upper market segment as awareness on their nutritive value is continuously raised.

The proportion of people suffering from chronic hunger and undernourishment in Kenya still remains an issue of concern. The Ministry of Agriculture, Livestock and Fisheries estimates that 1.5 million people in Kenya’s arid and semi-arid lands (Asals) continue to experience food insecurity, while 11 million people are undernourished according to the FAO report (FAO, 2013). Despite this scenario, policies addressing food security have by and large focused on increasing productivity of a limited number of crop species, with little attention to the nutritional value of indigenous food systems. The policies have often overlooked the food systems of diverse diets based on a variety of nutritious foods accessible to the communities. The range of plant genetic resources available among communities in Kenya have much to offer and compare favourably if not better than the staple crops in terms of nutrients (Vitamins and micronutrients) and can be used to enhance food security and dietary diversity.

Kenya’s plant genetic resource heritage is faced with genetic erosion as a result of anthropogenic activities including pollution, destruction of natural habitats, changes in land use, ethnic conflicts, drought, floods and ironically, the advancement in agricultural development. Introduction of new plants, including invasive species, have further contributed to the decline of the indigenous flora. Reports over the last decade indicate that a significant degree of genetic erosion has taken place mainly due to replacement of traditional varieties and other socio-economic factors.

Kenya like many other countries relies only on a few plant species for food. They include: maize (Zea mays), wheat (Triticum aestivum), common bean (Phaseolus vulgaris), peas (Pisum sativum), banana (Musa spp.) and potato (Solanum tuberosum) among others. Maize is the principal staple food for Kenya and it is grown in 90% of farms in the country while the common bean is the most important legume. Today some ecosystems are severely disturbed to the point that species diversity, extent and quality of these habitats are severely eroded. The IUCN (2015) Red list assessments has identified 371 threatened plant species in East Africa.

Access to and use of the genetic resources reservoir is constrained by a number of issues including: a) limited knowledge and awareness of existence and functions of the Plant Genetic Resources Centre and other national ex situ conservation facilities; b) lack of adequate information on taxonomy, passport data, performance records, characterization and evaluation data; and c) poor linkages between the Centre and potential users. While the Plant Genetic Resources Centre has made considerable efforts in documentation, characterization and evaluation of germplasm, considerable progress needs to be done since only 18,303 accessions representing about 37% of the germplasm holdings at Centre have been characterized for agro-morphological traits. None have been characterized using molecular techniques.

Kenya is party to the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA). The Treaty established a multilateral system of Access and Benefit Sharing (ABS) to facilitate access to plant genetic resources of crops most important for food security. The crops are listed under Annex 1 of the Treaty. The on-going process of developing regulations, policies, and other instruments to facilitate access and benefit sharing need to be fast-tracked.

### Table 1. Observed temperature changes 1960 – 2006

<table>
<thead>
<tr>
<th>Region</th>
<th>Minimum (night) Temperature</th>
<th>Maximum (day) Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trend</td>
<td>Minimum / °C</td>
</tr>
<tr>
<td>Western</td>
<td>Increase</td>
<td>2.9 – 0.8</td>
</tr>
<tr>
<td>Northern &amp; N Eastern</td>
<td>Increase</td>
<td>1.8 – 0.7</td>
</tr>
<tr>
<td>Central</td>
<td>Increase</td>
<td>2.0 – 0.8</td>
</tr>
<tr>
<td>South Eastern</td>
<td>Increase</td>
<td>1.0 – 0.7</td>
</tr>
<tr>
<td>Coast</td>
<td>Decrease</td>
<td>1.0 – 0.3</td>
</tr>
</tbody>
</table>

Source: (GoK, 2013a)

### Adapting to and mitigating climate change

Climate change and variability negatively impacts on a broad range of environmental and developmental areas. Data from the Kenya Meteorological Department over the last fifty years, as well as the Annual State of the Environment Reports provide clear evidence of climate change in Kenya. Though not overly significant, lower rainfall levels have been observed in annual rainfall records. There has also been a notable trend of temperature increases over most of the country between 1960 and 2006 as shown in Table 1.

Climate change presents one of the most important threats to biodiversity and associated ecosystem services in protected and non-protected natural ecosystems. The impacts are complex but potentially arise from temperature increases, shifts in climatic zones, sea level rise, droughts, floods and other extreme weather. The result is a number of complex interactions with other factors, e.g. extreme events (heat, floods, and...
droughts), soil, pests and diseases, and complex interactions with other key sectors, e.g. water availability for irrigation, which will affect the agricultural sector. Given that much of Kenya’s agriculture is currently rain-fed, there are wide ranging effects from the potential changes in rainfall, including shifts to producing new varieties or species. The wide range of plant species grown alongside major food crops help farmers adapt and mitigate against climate risks. These plant species/varieties are typically adapted to local conditions, often stress-tolerant and better resistant to drought and other related climate hazards. They therefore have an important role in strengthening resilience of agricultural production system as climate continues changing.

**Strengthening capacity**

The core purpose of conserving plant genetic resources is to ensure their availability, unlock their potential and utilize them in addressing food security, environment management and mitigating climate change. To achieve this, there is need to develop strong linkages between conservation and user programs. This calls for integrated approaches that provide effective linkages between conservationists and managers of plant genetic resources and users of the same. Barriers constraining the realization of the agronomic and yield potential of plant genetic resources to spur agricultural growth and development need to be addressed from a systems perspective rather than in isolation. Constraints such as availability and access to genetic resources, threats to genetic diversity decline and extinction, and loss of associated indigenous knowledge need to be addressed in a holistic manner.

**Bibliography**


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GeRRI is an institute of the Kenya Agricultural and Livestock Research Organization (KALRO).

GeRRI Policy briefs aim to deliver concise key messages and relevant reading on genetic resources conservation, utilization and access for decision makers. These decisions will be expected to impact on poverty reduction by contributing to increased productivity, commercialization and competitiveness of the agricultural sector propelled by science, technology and innovation.

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