

## CONTRIBUTION OF THE ETHIOPIAN FLORA PROJECT TO THE ETHIOPIAN PLANT BIODIVERSITY CONSERVATION AND SUSTAINABLE USE

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**ABSTRACT:** Customary, exclusionary and inclusionary conservation approaches in Ethiopia are highlighted in relation to the historical aspects of conservation in general and plant biodiversity conservation in particular. Currently, plant biodiversity conservation is one of the mandates of the Ethiopian Biodiversity Institute (EBI). EBI has expanded its activities from *ex situ* conservation to *in situ* conservation since Ethiopia became signatory to the Convention of Biological Diversity (CBD) with the expansion of its mandates. In this paper, the need of Floras and authenticated plant specimens for conservation efforts of EBI and the contribution of the Ethiopian Flora Project to Ethiopian plant diversity conservation are discussed. Finally, among many joint projects executed by EBI and the National Herbarium (ETH), two are discussed.

### History of conservation in Ethiopia

Records on conservation efforts in Ethiopia dates back to the days of Emperor Zera-Yakob (1434-1468) who brought juniper seedlings from Wof Washa of North Shewa and planted them in Managesha Suba area (now Suba-Sebeta Forest). This period falls in the customary conservation era, where communities protected biodiversity by customary laws. Modern conservation began during the reign of Emperor Menilik the second in 1908. This conservation initiative eventually evolved to the formulation of National Parks in the late 1960s. Many of the Ethiopian National Parks were established by excluding people from the parks and it was the time where conservation by exclusion started by Centralized Government Institutions using scientific knowledge and excluding local communities. Conservation practices in the Ethiopian National Parks are still exclusionary and oriented to conserve game animals.

The need for plant biodiversity conservation in Ethiopia received attention after the conference in Beltsville, 1972, where the Consultative Group on International Agricultural Research (CGIAR) recommended formation of

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Plant Genetic Resource Centre (PGRC) in Ethiopia. Ethiopia was given the highest priority to establish PGRC as it was one of the 12 Centres of crop origin and/or diversity. In 1973, Ethiopia requested the German Government for assistance in feasibility study for the establishment of PGRC/E. In 1974, feasibility study was undertaken by the German Ministry of Economic Cooperation and in 1976 PGRC/E was established, and a bilateral agreement was signed between Ethiopia and Germany. The German Technical Cooperation (GTZ, now GIZ) was assigned from the German side and a Director was assigned from the Ethiopian side, to establish and manage the PGRC/E.

### **Major activities of EBI in relation to the Flora of Ethiopia and Eritrea (FEE)**

Botanical exploration and collection management are the major activities of EBI which include conducting field trips to assess the status of endemic, endangered and economically important plants. The assessment data would help to visit the sites at the right time of seed setting to collect the seeds. Seed collection is always accompanied by herbarium specimen collection. Upon the arrival of the samples collected from the field to EBI, the seeds are sent to the gene bank while the herbarium specimens are delivered to the National Herbarium (ETH) for the proper identification of the samples.

The *ex situ* conservation is done by using cold storage facilities for orthodox seeds (with storage volume of 375 M<sup>3</sup> + Forestry Gene Bank). These include a room with a temperature of -20°C (for wild plants), three rooms with a temperature of -10°C (for cultivated plants) and a room with a temperature of +4°C (temporary storage). So far (as of December 2013), over 73,438 accessions of about 423 plant species have been conserved. Field gene banks are used for *ex situ* conservation of recalcitrant and seeds with unknown behaviour at Choche (Jima Zone), Goba (Bale Zone), Bedesa (Western Harerge) and Shashamene (West Arsi Zone) of Oromia Region and Wendo Genet (Sidama Zone) of South Nations, Nationalities and Peoples Region (SNNPR).

As of December 2013, the Gene Bank of EBI has distributed more than 107,516 seed samples of crops to local agricultural institutions. The Gene Banks are the major sources of initial seeds for plant breeders to develop high yielding varieties that are resistant to pests and diseases and with higher tolerance to abiotic stresses. The samples from EBI Gene Bank have, therefore, significantly contributed in the development of more than 100 high yielding varieties. As of December 2013, International Institutions

have received more than 12,463 samples of crops from the EBI Gene Bank.

At the beginning of seed conservation in 1976 at PGRC/E, samples were registered and conserved by using their common names (wheat, barley, etc.). Identification of these collections and using botanical names began with the start of conservation of wild plants. Thus, the Flora of Ethiopia and Eritrea was taken up as the standard of Botanical Nomenclature at the EBI.

After the establishment PGRC/E, Plant Genetic Resource (PGR) collection and conservation in the Gene Bank was intensified until the idea of conservation by inclusion came up with the Convention on Biological Diversity. Ethiopia promoted PGRC/E to the former Institute of Biodiversity Conservation (IBC), now Ethiopian Biodiversity Institute (EBI) in 1994. Then, the Institute started catering for plants, animals and microbial genetic resources.

EBI have enjoyed free access to the National Herbarium facilities and about six technical assistants have received frequent short term trainings in “Herbarium Techniques” at the National Herbarium (ETH). Among the current permanent staff of EIB, six researchers were trained in MSc in botany and two of them are now PhD holders in Botany.

In addition to the FEE, EBI still needs access to other Floras such as that of the Flora of Tropical East Africa and the Flora of Somalia as there are new records of plant species from unexplored areas or plant species new to science. The documentation of such plants needs wider collaboration.

### **Projects executed in collaboration with the National Herbarium (ETH)**

The following major projects by the EBI have been accomplished in collaboration with staff of the National Herbarium and the published volumes of FEE:

- The National Biodiversity Strategy and Action Plan (NBSAP). Data in the published volumes of FEE were used in the preparation and setting priority of conservation during stocktaking for formulation of NBSAP. Scientific communication of plant names in NBSAP totally relied on Flora of Ethiopia and Eritrea. The importance of FEE in policy development was proved in NBSAP development.
- Forest Genetic Resources Conservation Project/Inventory of Genetic resources which covered 36 Forest Priority Areas in Ethiopia. All plant specimens collected during inventory were identified and deposited in the National Herbarium (ETH).

- A Dynamic Farmers Based Approach to the Conservation of Ethiopia's Plant Genetic Resources in which the National Herbarium was involved in the collection and identification of crops conserved in the community gene banks and their wild relatives. This project was a model for new conservation approach where the conservation was led by farmers through the establishment of Crop Conservation Associations.
- Conservation and Sustainable Use of Medicinal Plants Project which supported collection and the establishment of Goba and Wendo Genet Field Gene Banks. In this project, the National Herbarium helped in the botanical identification and labelling of live collections of medicinal plants in the Field Gene Banks.
- The UNEP/GEF project: *Removing Barriers to Invasive Plant Management in Africa* was executed by the Ethiopian Institute of Agricultural Research (EIAR) in collaboration with many stakeholders among which both EBI and the National Herbarium (ETH) were involved.

Contribution of the National Herbarium in conservation of medicinal plants, identification of endemic plants and invasive species management are presented in detail.

### **1. Conservation and sustainable use of medicinal plants**

In Ethiopia, medicinal plants are seen as an economic commodity for some members of the society who make their livelihoods on their collection, trade or through use for treating patients as traditional medical practitioners or healers. About 80% of human population and 90% of livestock rely on traditional medicine. According to the 2005 survey report of Marketing of Medicinal Plants in Ethiopia, on average, 48 million consumers use some 56,000 tonnes of medicinal plants per annum (Mander *et al.*, 2006). Importantly, the consumption is based largely on plants from wild plant source. Some 87% or 49,000 tonnes are harvested from wild stocks. This implies that, in addition to the natural calamities, the medicinal plant diversity is being depleted and seriously affected due to unsustainable collection of the resource from the wild.

Therefore, in order to alleviate such problems, “Conservation and Sustainable Utilization of Medicinal Plants Project” was developed and implemented by former Institute of Biodiversity Conservation and Research (IBCR), now EBI in collaboration with a number of stakeholder

organizations. The National Herbarium (ETH), Addis Ababa University, was one of the collaborative institutions which have contributed a lot for the conservation of medicinal plants in general and for establishment of medicinal plants database and medicinal plants identification in particular through the Medicinal Plants Field Gene Banks of EBI.

The Conservation and Sustainable Use of Medicinal Plants Project (CSUMPP) was one of the plant genetic resources conservation projects conducted by EBI and other stakeholder institutions.

As part of this project, two Field Gene Banks (FGB) were established. The first one is the Bale Goba MPFGB established near Goba Town in the Oromia National Regional State, around 458 km South of Addis Ababa. The FGB was established in August 2004 to conserve threatened, rare and endemic medicinal plants found in and around Bale Mountains National Park (BMNP) and other medicinal plants collected from other highlands of the country (> 2,000 m a.s.l.) as well as to complement the *in situ* conservation activities that have been conducted in Bale Mountains National Park. The altitude of this FGB is around 2,722 m a.s.l. with an area of 30,000 m<sup>2</sup> (3 ha). The FGB is subdivided into blocks to accommodate plants with different habits i.e., annuals and perennial herbs, shrubs and trees. There are also blocks for nursery and shade-loving plants.

The second one is the Wendo Genet MPFGB established at about 264 km South of Addis Ababa, in the Southern Nations, Nationalities and Peoples Regional State. The area of the FGB is 16,016 m<sup>2</sup> (1.6 ha) and its altitude is about 1,830 m a.s.l. Wendo Genet MPFGB was established in August 2001 to conserve threatened, rare and endemic medicinal plant species found around Wendo Genet and other medicinal plants collected from other midlands (intermediate altitude) localities of the country (1,000 to 2,000 m a.s.l.).

Three institutions namely, Ethiopian Biodiversity Institute (EBI), the former Essential Oils Research Centre (EORC) and Ethiopian National Traditional Medicine Preparation and Study Association (ENTMPSA) have actively participated in the establishment of the FGB; which was being coordinated by EBI.

## **2. Conservation of endemic plants**

High quality conservation service is not only seed collection but also the aggregation of high quality data and herbarium voucher for correct taxonomic identification of the material collected. Information on plant

endemism, plant uses (medicinal values), plant distribution, vernacular names, valid botanical names (taxonomic identification) and seed availability (ripening) period are very crucial for planning a collecting mission. So that, these and several other sources of information gathered using the FEE and data on herbarium specimens at the National Herbarium (ETH). Therefore, FEE and the National Herbarium have contributed a lot for the conservation of biodiversity in general and that of medicinal plants conservation in particular. Based on this information more than 620 threatened, endangered, rare and endemic medicinal plant accessions were collected and conserved in two Field Gene Banks. These include endemic species such as: *Echinops kebericho* Mesfin, *Taverniera abyssinica* A. Rich., *Lobelia rhynchopetalum* Hemsl., *Gladiolus balensis* Goldblatt, *Milletia ferruginea* (Hochst.) Bak. and *Haplocarpha hastata* Lewin and other indigenous medicinal plants such as *Hagenia abyssinica* (Bruce) J.F. Gmel, *Silene macrosolen* A. Rich. and *Thymus schimperi* Ronniger.

### 3. Documentation of invasive alien species (IAS)

Invasive alien species (IAS) are: 1) introduced species which invade natural habitats, 2) non-native (or alien) to the ecosystem under consideration, and 3) whose introduction causes or is likely to cause economic or environmental harm or harm to human health (Cork and Fuller, 1995; Heywood and Watson, 1995). There are already a number of examples of invasive species that are threatening the environment, societies and the economies in many parts in the African continent. Under current trends, it is likely that these threats will increase. The current and potential impact of IAS and the barriers constraining IAS management in Africa are the motivations behind the UNEP/GEF project: *Removing Barriers to Invasive Plant Management in Africa*. The participating countries are Ethiopia, Ghana, Uganda and Zambia, with project coordination being undertaken by CABI and IUCN. In Ethiopia, the project is being executed by the Ethiopian Institute of Agricultural Research (EIAR).

According to the World Conservation Union, the encroachment of IAS has been a major cause of extinction of native species next to habitat destruction (GISP, 2000). A study conducted to document IAS in the Awash National Park with the supervision of staff of the National Herbarium, AAU and EBI, with the financial support from the above mentioned UNEP/GEF project recorded the following two known (*Prosopis juliflora* (Sw.) DC. and *Parthenium hysterophorus* L.) and five potential invasive species (*Parkinsonia aculeata* L., *Datura ferox* L., *Senna occidentalis* (L.) Link,

*Xanthium strumarium* L. and *Cryptostegia grandiflora* Roxb. ex R. Br.).

Except for *Prosopis juliflora* and *Parthenium hysterophorus*, information on the other five species are not well documented in Ethiopia as IAS. Currently *Parkinsonia aculeata* is being multiplied and distributed to growers by different development organizations, although it (*Parkinsonia aculeata*) continues to threaten Australia's mainland invading 70% of it (March and Cobon, 2007). Thus, effort should be made at least to stop the intentional distribution of such an invasive species. Lessons should be learnt from other countries and we should not repeat a similar case of *P. juliflora*; which was introduced for an agro-forestry purpose and now has invaded more than 1.1 million hectares of land in Ethiopia.

### CONCLUSION

The published volumes of the FEE have been used as standard nomenclature for conservation of plant biodiversity which falls within the mandates of EBI. A large proportion of staff members of the EBI are graduates of Addis Ababa University at the Department of Plant Biology and Biodiversity Management and have strong association with the National Herbarium (ETH), and consider it one of their own. No access permission is required for EBI staff to use facilities at the National Herbarium. Although the National Herbarium (ETH) is the main reference for plant identification in Ethiopia, EBI also needs international collaboration with the herbaria that host international collections for two reasons. First, some of the endemic plants of Ethiopia have been deposited in foreign herbaria. Any conservation related to these endemic plant needs collaboration for the proper identification in the foreign herbaria. Secondly, the exploration and collection activities of EBI have been done with some plants which are new to FEE or science. The identification or description of such plants also needs collaboration with major herbaria mostly in Europe.

As the source of accumulated knowledge on plants and as indicated in the execution of conservation projects in Ethiopia, the role of National Herbarium (ETH) is becoming indispensable. It is the benefit of any conservation project to include the National Herbarium while running conservation projects.

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