

## **STRENGTHENING THE CONSERVATION AND SUSTAINABLE USE OF PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE IN MONGOLIA**

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### **Global status of Plant Genetic Resources for Food and agriculture (PGRFA)**

With global average temperatures rising between 1.8 and 4 degrees Celsius until the end of the century, climate change will alter current growing conditions dramatically.

The concern is that going forward the combination of climate change, rapid population growth, the anticipated addition of 2 billion people by 2050 and other aggravating factors, like the diversion of food crops to biofuel production and rapidly rising incomes in developing countries is steering the world onto dangerous ground.

Over one billion people are already suffering from chronic hunger and malnutrition today, and the world population continues to grow to reach over nine billion by 2050. FAO estimates that food production will need to increase by 70 percent over the next four decades to keep pace with demand. Expanded access to and the preservation of a wide and deep gene pool of crop varieties will be the critical factor in ensuring the development of a new generation of high-yield crops, conclude Food and Agriculture Organization (FAO) experts.

However, the availability of a broad genetic base of agricultural crop varieties – a diversity of which 75 percent has already been lost forever – is most crucial to breed crop varieties that achieve higher yields and are adapted to new climate pressures. Therefore, existing crop diversity must be conserved and crop genetic resources need to be broadly available for research and breeding activities. Agricultural crops and the traits they contain (e.g. drought resistance, pest resistance, high yields) are the building blocks which constitute the very base of our food security. The broader the genetic base we can rely on, the better equipped we are to adapt to changing climate conditions in order to guarantee global food security. Agricultural crops are different from other components of biodiversity because they depend on continued human management. Every country relies on crop genetic material that has originated in other countries. This

interdependence will further increase under the growing pressures of climate change.

International recognition of the importance of genetic diversity and the increasing threat of genetic erosion grew significantly when FAO held the International Technical Conference on Exploration, Utilization and Conservation of Plant Genetic Resources in 1967. At this meeting, the term "plant genetic resources" was first used and the scientific principles which underlie strategies and methodologies for collecting, conserving, evaluating and documenting genetic resources were comprehensively addressed for the first time.

In 1974, the International Board for Plant Genetic Resources (IBPGR) was established under the aegis of the Consultative Group on International Agricultural Research (CGIAR), with a mandate to promote and coordinate an international effort to collect, conserve, document, evaluate and use plant genetic resources. IBPGR joined the 8 CGIAR Centers already in existence (IRRI, CIMMYT, CIAT, IITA, CIP, ICRISAT, ILRAD and ILCA). Most of the Centers have large ex situ genetic resources collections, although these were largely to support their breeding programs rather than for conservation. In 1994, International Plant genetic resources institute (IPGRI) became the legal successor to IBPGR.

In the 1980s, the environmental movement became increasingly influential, drawing public attention to the loss of biodiversity and calling for solutions -- primarily through in situ conservation. In 1983, the 'International Undertaking on Plant Genetic Resources' (IU), a voluntary instrument had been adopted which is aimed at the conservation and sustainable use of plant genetic resources.

The scope of the environmental movement widened considerably in the 1990s, partly as a result of the 1992 United Nations Conference on Environment and Development in Rio de Janeiro. At the Conference, 150 countries signed the Convention

on Biological Diversity (CBD). The Convention, which came into force on 29 December 1993, sets the legal and policy framework for the Global System. It obligates all signatories to develop national strategies, plans or programs for the conservation and use of biological diversity and stresses the importance of regional and international cooperation.

In June 1996, 150 countries reached an agreement on the 20 most urgent actions needed to protect the world's rapidly shrinking supply of plant genetic resources for food and agriculture. The agreement, enshrined in the first Global Plan of Action for the conservation and use of plant genetic resources was negotiated and approved at the International Technical Conference on Plant Genetic Resources, in Leipzig, Germany. It was the largest intergovernmental conference in history dedicated to this issue.

In 2001, the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) has been adopted which is based on a multilateral approach to access and benefit-sharing of PGRFA. ITPGRFA entered into force in 2004 and

has been ratified by some 135 countries (PGR and food security 2011, FAO).

As a result of global efforts the countries became aware of the danger of genetic erosion and the need for conservation, greater priority was given to collecting plant genetic resources in the field and establishing ex situ genebanks. The total number of accessions in collections held in genebanks worldwide has increased by approximately 20% since 1996, reaching 7.4 million. Both the number and size of genebanks have increased. There are some 1750 individual genebanks worldwide and the number of botanical gardens has increased from about 1500 to more than 2500. These gardens are important repositories of crop wild relatives. Also, a number of national PGRFA programs have increased with a greater engagement of stakeholders. Most countries have adopted or revised legislation dealing with PGRFA and seed systems. Several new initiatives, networks and foundations have been established to coordinate agricultural research and to support activities in PGRFA (Synthetic account. The Second report on State of the world PGRFA, Syntetic account 2009).

### **State of the plant biodiversity in Mongolia**

The main feature of Mongolia's climate is extreme continental nature. The short growing season, low precipitation and high evaporation are the overriding constraints in Mongolian agriculture. Particularly, unseasonable frosts and severe drought can cause harvest losses 10 to 30 percent of crops.

Mongolia's specific character of climate condition, biosphere and geographic location and tremendous latitude spread of Mongolia have resulted the development of the unrepeatable flora with its own specific species diversity, life style, origin and development. Mongolian flora mainly consists of representatives from Siberian taiga and Central Asian steppe. On the other hand the penetration of plant species from Manchuria (east) and Kazakhstan-Turan (west) affected to the formation of specific flora in Mongolia (Монголын шинжлэх ухаан, цуврал №95).

Mongolia located near the Chinese and central Asian centers of origin of cultivated plants and it's well known that Mongolia has remained a specific agricultural society for several hundreds of years.

The surveying and inventorying activities of natural PGR in the country are done quite sufficiently since 1970s. The several projects or activities related to survey and inventory of PGRFA carried out under the program of joint Mongolian-Russian Complex Expedition since 1970s. The projects were implemented mainly by the Institutes of Mongolian Academy of Sciences (MAS).

It is reported that Mongolian flora comprises of 2823 species of vascular plants belonging to 662 genera 128 families. There are also 417 species of moss belonging to 162 genera, 32 families, and 930 species of lichen belonging to 133 genera and 39 families, 875 species of fungi in 136 genera and 28 families as well as 971 species of algae belonging to 221 genera in 60 families (table 1). The unexplored areas such as Khentii, Khubsugul and Altai mountain, surrounding areas of Onon, Ulz river and Gobi desert areas in Zuungar and Borzon are still existing. Therefore the number of vascular plant species estimated to be more than 3000 species.

Table 1

Status of plant species in Mongolia			
Classification	Family	Genus	Species
High plants	128	662	2823
Moss	59	191	445
Lichens	53	175	930
Fungi	28	136	more 900
Algae	76	221	1236
<b>Total</b>	<b>344</b>	<b>1385</b>	<b>6334</b>

The largest families within the vascular plant are **Clynelymus New ski** (85 species), **Oxytropis DC.** (82 species), **Astragalus L** (80 species), **Artemisia L** (78 species), **Saussurca DC.** (44 species), **Potentilla L** (43 species), **Salix L** (41 species), —**Pedicularis L** (33 species) and **Allium L** (32 species). There are more than 2200 species of economically important species including 845 medicinal plant species food plants 200 species for

food, 200 for industrial use. The number of threatened plant species recorded 128 including 75 medicinal species ( 6 deeply destroyed), 11 natural food (6), 16 industrial (4), 55 ornamental (10) and 15 species for sand movement control. Causes of threat are population increases, industrialization, past and present economic policies and pollution, as well as power, mining and minerals industry.

#### State of the In situ and Ex Situ conservation of PGRFA

The significant activities conducted by the government of Mongolia to promote **in-situ conservation** of wild plants and wild genetic resources in Mongolia. At present totally 38 protected areas covering! 7.4 million hectare which is 11.1% of the country have been established. These include 12 strictly prohibited areas, 7 National conservation parks, 13 nature reserves and 6 natural and historical monuments.

Mongolia started PGRFA conservation activities in cooperation with the former Soviet Union, especially focused on collecting local landraces in 1960s. The effective activities of conservation of crop genetic resources started later only 1990s.

The **Ex-Situ** conservation of PGRFA mainly carried out at the Institute of Plant and agricultural Sciences (IPAS) of Mongolian University of Life sciences (MULS). The IPAS in Darkhan-Uul has been designated as the national base collection for both crop and forage species and plays leading role in collaboration with other institutes.

The total number of accessions preserved at IPAS and related institutes increased constantly due

to intensive international cooperation with international genetic resources centers and genebanks. The National Genebank established at IPAS with technical assistance of FAO and support from IPGRI, in 2000. The IPAS has short-term seed storage facilities with holding capacities of 30,000-35,000 accessions and long-term storage facilities for 10,000 accessions. In the long-term storage seeds stored in aluminum foil packets and stored in chest deep freezers under temperature  $-18^{\circ}\text{C}$  and in short-term storage seeds dried to 12-13% of moisture content are packed in paper envelopes and aluminium bags and stored under the temperature  $5 - 10^{\circ}\text{C}$ .

The 83.3% of total national germplasm collection stored at IPAS. The IPAS holds 20500 seed accessions belonging to over 60 crops stored under the short and long-term storage condition. In addition, the 740 plant stand belonging to 192 accessions of 52 Genus 113 species of fruit and ornamental trees, perennial plants for food and medicine as well as wild species of rare and potentially useful plant species stored in the field collection (table 2).

Table 2

**Present status of crop genetic resources conservation in Mongolia. 2015**

<b>Institute name</b>	<b>No.of accessions</b>	<b>Crop category</b>	<b>Location</b>	<b>Type of storage</b>
Institute of Plant and Agricultural Sciences (IPAS)	20500	Cereals, vegetables, industrial, oil crops, wild relatives, fruit tree	Darkhan-uul	Short-term Medium-term
Research Institute of Animal Husbandry	1800	Fodder grasses. Legume crops	Ulaanbaatar	Short-term
IPAS branch in ulaangom.	513	Cereals	Ulaangom	Short-term

Among this collection there are over 40 major traditional medicinal plants under the National Plant genetic Resources Project. The passport data of medicinal plant collection in the field genebank exists on manual format indicating the passport data and collecting data at Plant Genetic Resources Division of IPAS.

**The Experimental Station** located at “Khuduu aral” Co.Ltd in Kherlen – BayanUlaan in Khentii province holds field collection of 46 accessions belonging to 46 species and 33 Genus of common and rare medicinal plants distributed in Eastern Mongolia. This station is situated in 211 km to the South-East from Ulaanbaatar in steppe zone at the elevation of 1240m above sea level (Ligaa.U, 2004, personal communication).

### Characterization and utilization of PGRFA

The characterization and evaluation of PGRFA aim at quantitative and qualitative traits for agronomic value according to the crop descriptors and evaluation by the needs of specific breeding program.

At the national level annually 500-700 accessions of PGRFA planted for characterization and evaluation according to morphological, biological and productive characters. The Vavilo Research Institute (VIR) and IPGRI descriptors are used mainly. In recent years the Mongolian version of crop descriptors developed for 20 major crop species.

Under the crop improvement program totally

### State of the legislation and national program on PGRFA

Mongolia has taken substantial steps towards achieving legal protection of wild plant species inside and outside of the protected areas. The several relevant documents such as “ Law on

Mongolia depends heavily on animal husbandry and is rich forage plant genetic resources. Conservation of forage species is as important as food crop species. The Research Institute of Animal Husbandry (RIAH) is the key Institute for collecting, characterization, evaluation and documentation of forage genetic resources in the country. The forage plant seed conservation facilities improved at RIAH in 2000 by USA-Mongolian collaborative project. Now RIAH has 1800 accessions of 319 species, 180 genera, 46 families for grasses and legumes genetic resources.

The herbarium specimens collected from wild species are kept in the Institute of Botany. It holds 100.000 floristic collection amounting specimens.

200 varieties of various crops including 93 of cereals, 10 of potatoes, 30 of vegetables and varieties of fodder and industrial crops as well as 40 of different fruit trees and ornamentals were developed at IPAS and relevant affiliated institutes. More the 80 varieties out of 200 are widely grown in major crop production areas of the country.

At present the research orientation of plant breeders relied on high yield, drought and sun heat tolerance, early maturity and quality.

The passport data, characterization and evaluation data of each accessions available on the manual and electronic forms at IPAS Genebank.

Natural Plants of Mongolia” in 1995; “ Mongolian Law on Forests”; “ National Biodiversity Action Plan”; “ National Action Plan for Specially Protected Areas“; “ Government Guidelines on

Ecology and National Security“; “ Law on medical treatment”, ”The red book of Mongolia” in 1987 and 1997, Law on natural plants, Law on protected areas, Law on Natural protection, Law on Forest conservation etc.

In, 2002 the Government Resolution No.105 on “Conservation and sustainable use of rare plants of Mongolia” and other documents concerning to conservation, restoration and sustainable utilization of medicinal plant species of Mongolia have been released.

In September 1993, Mongolia has entered into an agreement to implement the Convention on Biological Diversity (CBD) and in 1996, the government of Mongolia approved the “National Biodiversity Action Plan” and this document focused mainly on safe and sustainable conservation of genetic resources but put aside the issue of equitable sharing of benefits raised from the use of it which is essential part of the CBD.

In 2002, the Government Resolution No.105 on “Conservation and sustainable use of rare plants of Mongolia” and other documents concerning to conservation, restoration and sustainable utilization of medicinal plant species of Mongolia have been released.

In 2012, the parliament approved 2 separate law on the ratification of Nagoya protocol on the Access to genetic resources and fair and equitable sharing of benefits arising from their utilization to the Convention of Biological Diversity an law on ratification of Nagoya-Kuala Lumpur supplementary protocol on liability and redress to the Cartagena protocol on Biosafety.

Also, the Ministry of Environment and Green Development and Tourism (MEGDT) Mongolia in collaboration with World Bank and Government of Netherlands implementing project on the development of “Law on Genetic Resources” in Mongolia.

But, there is not any official legal framework or government unit which is responsible for planning, coordination and implementation of national strategy on conservation and sustainable use of PGRFA and regulation of access and benefit sharing of PGRFA.

There is only law on “Crop varieties and

seed” where only statement about conservation of crop germplasm resources indicated. The article 4 indicates that “ .. **the crop plant genetic collection will be under the government control** and the enrichment, regeneration and utilization activities should be implemented by the professional institution authorized by central government organization in charge for agriculture...”. In addition few major legal documents mainly focused on crop production regulations exist in Mongolia including: “Law on crop production” /2004/, “Law on state resources” /2007/, “Law on plant protection” /2007/, “Law on state control over resources” /2010/ and “Law on the phytosanitary control over animal and plant raw materials and products across the border” /2002/.

Basically, access to plant genetic resources of food and agriculture under ex-situ conservation mainly exchanged free based on mutual agreement between research institutions.

The Ministry of Food and Agriculture (MoFA) and the Ministry of Education, Culture and Science (MECS) play important role making policies and funding activities on plant genetic resources for food and agriculture. At the moment the conservation of PGRFA and research for utilization mainly implemented by IPAS of Mongolian University of Life Sciences and in collaboration with relevant research institutes.

The export and import permission are issued to any plant genetic material from the State Department of Professional Control and Regulation (SDPCR). The relevant documents including mutual contract, certificate of origin, phytosanitary certificate and no commercial letter etc are required.

There is big need for development of strong national program on conservation and utilization of PGRFA in the country and legal framework including issues on access and benefit sharing of PGRFA and revision of existing law on “Crop variety and seed” in line with new emerging government efforts for renovation of seed production system in the country .

The government support to national research organizations holding PGRFA and genebanks will be more available if strong legal frame work is in place.

### **International and regional collaboration**

Mongolia is one of the 150 countries that met in Leipzig, Germany in June, 1996 and adopted the Global Plan of Action (GPA) as the global tool for the conservation and sustainable utilization of Plant Genetic Resources for Food and Agriculture (PGRFA).

But, Mongolia is still not a party to the ITPGRFA. But has strong wish to be a party of Treaty. As a result of active efforts on raising awareness on the safe conservation and use of PGRFA with government officials we reached to

common understanding on the importance of joining the Treaty.

Active efforts taken including some crop landraces are duplicated in the CGIAR international agricultural research centers CIMMYT, ICARDA and Svalbard seed vault under with the support from Trust, established NISM, safety back up at RDA Agro Biodiversity center Korea, talk to treaty people on organization of raising public and politicians awareness on PGRFA and treaty in place. the development of "Law on Genetic Resources" in Mongolia.

In 2011-2013, number of landraces are duplicated or safely backed up at international institutions including 150 barley landraces in ICARDA Tunisia, 343 wheat landraces in CIMMYT are duplicated, another 160 landraces deposited in Svalbard with Crop Trust support.

Mongolia is a member of East Asia Regional PGR Network under Bioversity International. But, not very active since 2010. Also, country is member of NISM development project by FAO and Japan and IMPGRFA project of AFACI republic of Korea.

### **Challenges in conservation and utilization of PGRFA in Mongolia**

Mongolia is also facing the climate change impact, particularly the drought and heat in main crop production areas which cause big loss in yield and crop production potential of the country.

The growth parameters of most major crop cultivars doesn't fit to climatic changes and have complete loss of yield, the soil tillage technology causes intensive soil erosion to disasterous level, the soil organic matter in major crop production areas reduced by 37-52% during last 40 years and the pasture land degraded due to continuous dry weather and overgrazing. Also, the number of pasture species decreased by 2-4 times and the pasture yield by 4-6 times. On the other hand the intensive movement of new settlers from Western Mongolia to Central part of the country is one of major factor of the rapid degradation of pastoral land.

Crop production sector in Mongolia is very young has only 50 years of experience. The crop

There are not specific official network for crop improvement available in Mongolia. Only, agricultural research institutes including IPAS, RIAH and IPAS branch in western Mongolia as well as RIAH branch in Eastern Mongolia are implementing conservation and utilization of PGRFA in the country.

After continuous effort of PGR people in the country, the objectives to develop a legal document on safe conservation, sustainable use and access and benefit sharing of PGRFA has been committed in the strategic plan of Government Mongolia for 2012-2016.

At the Ministry level, we reached to common understanding with government officials on the importance of joining the Treaty as it is essential for improving the safe conservation and sustainable use of PGRFA. We are getting full support from high ranking of the Ministry of Food and Agriculture (MoFA) Mongolia to speed up the process joining to the Treaty. The official work team for implementation of joining process to ITPGRFA has been assigned by the minister.

diversification is needed to meet present food demand of people of Mongolia. However, this sector heavily dependent on the crop varieties of foreign origin. At present over 80% of total cultivated varieties are from foreign countries. However, the national crop improvement programs suffering lack of valuable sources of new genetic materials for drought tolerance, disease resistance and productivity improvement.

In Mongolia, a lack of clear policy and priority on PGRFA, insufficient funding, technical capability and facility for conservation PGRFA, lack of competent research staff are the main limiting factors in the conservation and utilization of PGRFA and the support from regional and international organizations needed.

Based above factors it is the most essential to make a rational use of soil, climate and economic resources as well as the safe conservation and utilization of PGRFA for development of new potential varieties adaptable to climate changes and obtain guaranteed, sustainable production.

### **Mongolian Strategy on conservation and Use of PGRFA**

- Development and implementation of strong national program on conservation and utilization of PGRFA in the country,
- Development of legal framework including issues on access and benefit sharing of PGRFA,
- Acces
- sion to ITPGRFA at an earliest,

- Upgrade IPAS and relevant institutions, strengthen genetic resource management, seed systems, and research in crop varietal development and management
- Capacity building and training of different stakeholders in seed systems, crop varietal improvement, plant genetic resources management, breeding and law and policy regulation etc.
- Strengthening regional and international collaboration through crop and PGRFA networks and international centers,
- Increasing public awareness about conservation and sustainable use of PGRFA for food security,

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