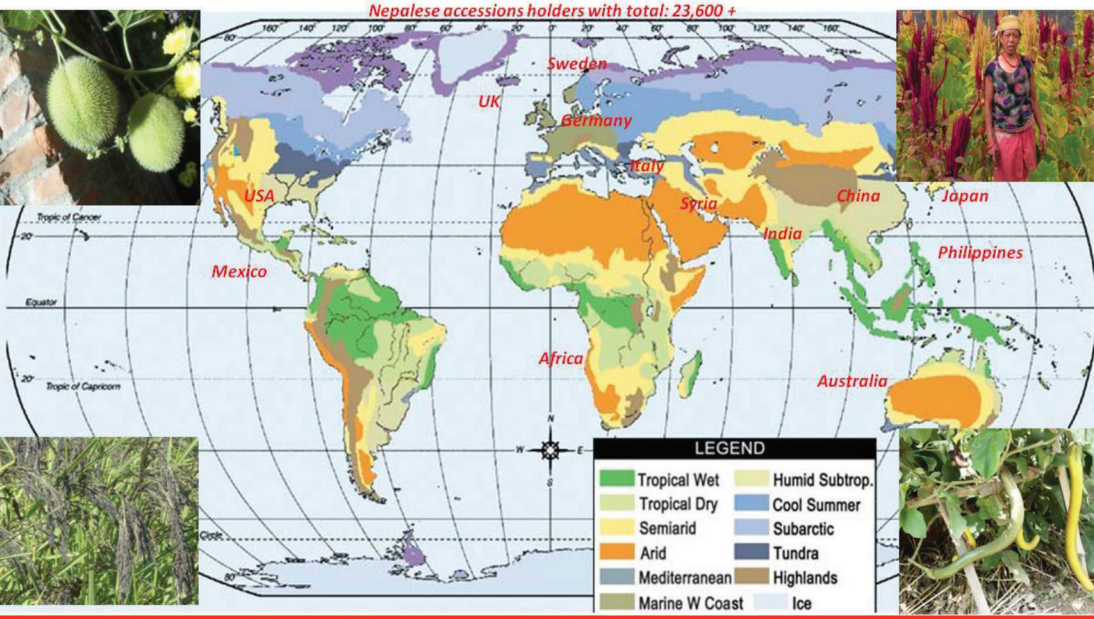
International Treaty on Plant Genetic Resources for Food and Agriculture and Multilateral System (ITPGRFA-MLS) Implementation Strategy and Action Plan (IMISAP) 2018-2025

Ministry of Agricultural Development
Kathmandu, Nepal



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2017

MoAD (Singhadarbar, Kathmandu, Nepal; http://www.moad.gov.np)
The Ministry of Agricultural Development (MoAD) is the central body of the Government of Nepal responsible for agriculture and allied fields. The ministry consists of six divisions, two centres, one research and development fund, three departments, five projects, and autonomous bodies, consisting of a research council, a corporation, two development boards, two companies, and several development committees. The Honorable Minister for Agricultural Development is in charge of the ministry; the secretary is the administrative head and chief advisor to the minister.

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Preface

Agrobiodiversity plays pivotal role in addressing food insecurity, hunger and malnutrition problems worldwide. Every country relies on other countries for agrobiodiversity or Agriculture Plant Genetic Resources (APGRs) for food and agriculture, as none of them is self-sufficient. Nepal is not immune too. Nepal occupies about 0.1 percent of global area, but harbors world's 3.2 percent flora and 1.1 percent fauna, making the country ranks the 31st richest country in the world and 10th in Asia in terms of biodiversity. A total of 284 flowering plants, 160 species of animals, one species of bird, and 14 species of herpeto fauna are endemic to Nepal. Despite holding such an exceptional biological diversity, Nepal relies 90-100% on other countries for genetic materials for major crops. A rapid loss of biodiversity for food and agriculture, often irreversibly, is further increasing the level of interdependence of farmers on each other – both at national level and global level. Climate change is further increasing the significance of interdependence.

The International Treaty on Plant Genetic Resource for Food and Agriculture (ITPGRFA) aims to facilitate the exchange of plant genetic materials listed in treaty's Annex 1 using a multilateral system (MLS). Being a signatory to the treaty, Nepal is obliged to prepare its own policy and laws in sharing and managing PGR (Plant Genetic Resources) in adherence to the ITPGRFA. Nepal can greatly benefit if things are handled appropriately and if a conducive policy is formulated. Nepal has already prepared an Agrobiodiversity Policy (2007), which was amended in 2014. The National Genebank operating under Nepal Agricultural Research Council (NARC) now preserves more than 2,275 accessions of 10 Annex 1 crops and 23,600 accessions are available from different global gene pools or the public domains. The genebank also coordinates with NGOs and Community Seed Banks to exchange genetic materials and devolve farmers' rights to conserve, manage and use their genetic materials. This has to be made more systematic and rigorous, with effective database management, monitoring and law enforcement systems in place.

To facilitate policy formulation and implementation, the Ministry of Agricultural Development (MoAD), NARC, and Local Initiatives for Biodiversity, Research and Development (LI-BIRD) jointly implemented a project 'Genetic Resources and Policy Initiatives (GRPI)' between 2003-2007 (First phase) and between 2012-2016 (second phase). GRPI-II team contributed to finalization of

the agrobiodiversity policy and prepared various documents, including a book "Implementing International Treaty of Plant Genetic Resources for Food and Agriculture in Nepal: Achievements and Challenges". However, we still lack guideline and strategy to guide us in effectively implementing ITPGRFA and Agrobiodiversity Policy. Inspired by the National Biodiversity Strategy and Action Plan (NBSAP 2014) and drawing lessons from it, MoAD, took an initiative to produce ITPGRFA-MLS Implementation Strategy and Action Plan (IMISAP). The purpose of this document is to bring together information on current status of PGR for food and agriculture, flow of genetic materials, dependency of the country on foreign genes, and present a strategy to translate policies into action for the benefits of farming communities. One of striking things of this strategy is the proposition of one-window system for export of PGR and multiple-window system for their import, and roles and responsibilities of different institutions and committees. Some committees, sub-committees and government institutions will take different roles in systematizing and streamlining the export and import process using MLS, which the MoAD commits to put in place and support.

Several individuals have put their efforts to produce this book. We are grateful to the team members for their painstaking jobs. The key people who put their time and effort include Dr. Bal Krishna Joshi, Dr. Devendra Gauchan, Mr. Anil K. Acharya, Mr. Krishna Ghimire, Mr. Madan R. Bhatta, Dr. Pashupati Chaudhary, Ms. Bidya Pandey and Mr. Shankar Sapkota. The NARC, mainly National Agriculture Genetic Resource Center (NAGRC), also known as National Genebank, and LI-BIRD also deserve special mention for their cooperation during GRPI projects and beyond. Lastly, our due respect also goes to the members of National Agrobiodiversity Conservation Committee (NABCC) for approving the strategy and guiding the team members in preparing this document. We are also happy to be a part of this initiative and believe it is a great contribution to the nation mainly in the field of agrobiodiversity conservation and policy reform. We believe this book will be read widely and used as a valuable reference in the field of agrobiodiversity conservation, use, management, and exchange, both within the country and outside through MLS.

Suresh Babu Tiwari
Joint Secretary
MoAD

Suroj Pokhrel, PhD
Secretary
MoAD

Contents

Abbreviation

ABS	Access and Benefit Sharing
ADS	Agriculture Development Strategy
AGRBS	Access to Genetic Resources and Benefit Sharing
APGR	Agricultural Plant Genetic Resources
APP	Agriculture Perspective Plan
AVRDC	Asian Vegetable Research and Development Center
BS	Bikram Sambat (Nepali date)
BSF	Benefit Sharing Fund
CBD	Convention on Biological Diversity
CG	Consultative Group
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	International Maize and Wheat Improvement Center
CIP	International Potato Centre
CSB	Community Seed Bank
DADO	District Agriculture Development Office
DoA	Department of Agriculture
EPA	Environment Protection Act
FAO	Food and Agriculture Organization
GMO	Genetically Modified Organism
GoN	Government of Nepal
GRPI	Genetic Resources Policy Initiative
ICARDA	International Center for Agriculture Research in Dry Areas
IMISAP	ITPGRFA-MLS Implementation Strategy and Action Plan
INGER	International Network for Genetic Material Evaluation and Research
INGO	International Non-Governmental Organization
IRRI	International Rice Research Institute
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
LI-BIRD	Local Initiatives for Biodiversity, Research and Development
MEA	Multilateral Environmental Agreements
MLS	Multilateral System
MoAD	Ministry of Agricultural Development
MoFSC	Ministry of Forest and Soil Conservation
NAES	Nepal Agriculture Extension Strategy
NAGRC	National Agriculture Genetic Resources Center
NAP	National Agricultural Policy
NARC	Nepal Agricultural Research Council
NBSAP	Nepal Biodiversity Strategy and Action Plan
NCCP	National Climate Change Policy

NGLRP	National Grain Legumes Research Program
NGO	Non-Governmental Organization
NGRCC	National Genetic Resource Conservation Council
NIAS	National Institute of Agrobiological Sciences
NPQP	National Plant Quarantine Program
NPWCA	National Parks and Wildlife Conservation Act
NRRP	National Rice Research Program
NSB	National Seed Board
NWRP	National Wheat Research Program
PGR	Plant Genetic Resources
PGRFA	Plant Genetic Resources for Food and Agriculture
PIC	Prior Informed Consent
SMTA	Standard Material Transfer Agreement
SQCC	Seed Quality Control Center
VDC	Village Development Committee
WTO	World Trade Organization

Background

Agricultural plant genetic resources (APGRs) are immensely important for securing food and nutrition in the country and world. Diversity at species and genetic levels is necessary to breed new cultivars with desired traits. APGRs available in the country alone are not enough to secure the food sufficiency; therefore, countries introduce APGRs from the global communities in a regular basis. In addition, genetic erosion demands agriculturists, breeders and producers to search APGR in other locations for agriculture research and development. Both national and global crop genepools should be utilized for sustaining the agricultural production system (**Figure** 1). Nepal also heavily relies on foreign genetic materials to develop new varieties and feed the population.

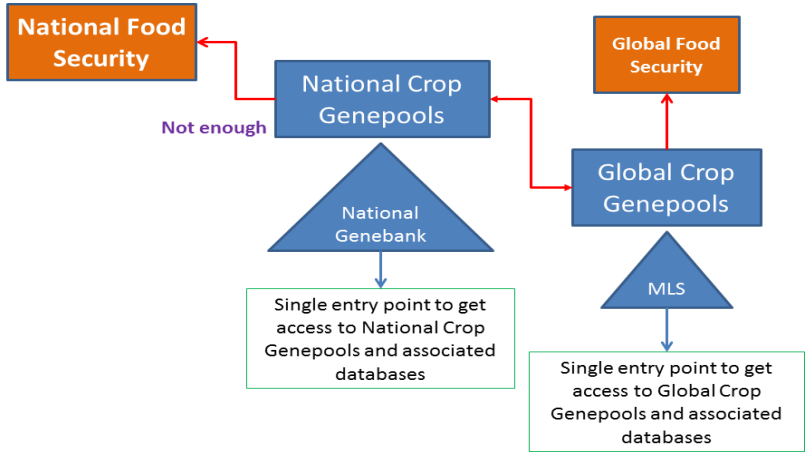

Figure 1.Genepools concept and access for food and nutrition security.
Note: National Genebank conserves APGRs and makes access to farmers and researchers. This is public domain and has been designated as a depository of the genetic materials..

Before Convention on Biological Diversity (CBD, http://www.cbd.int/convention/), there was almost free exchange of

plant genetic resources for food and agriculture (PGRFA) among countries around the world. CBD 1992 stated that countries have sovereign rights to legislate, manage, exploit and control access to their natural resources, including PGRFA. Nepal became a signatory to the CBD in June 1992 and ratified it in November 1993 and MoFSC is the focal ministry. Restricted access to PGRFA may lead to food and nutrition insecurity in the world, therefore, an international treaty was evolved to facilitate the access to PGRFA. The treaty, known as the International Treaty on Plant Genetic Resources for Food and Agriculture or ITPGRFA (http://www.planttreaty.org/) is a global treaty for food security and sustainable agriculture. Government of Nepal decided to be a member of ITPGRFA on 2 January 2007 and became a party on 19 October 2009 and MoAD is the focal ministry for the Treaty.

Special provision in ITPGFRA is the creation of multilateral System (MLS) to facilitate the access to PGFRA. The multilateral system is a global gene pool of a number of important crop genetic resources for food security, shared and managed jointly by all contracting parties. This system is also operative within 15 CGIAR systems and applicable to 35 food crops and 29 forage species listed in Annex 1, that account for >80% of human calorie intake from plants. The standard material transfer agreement (SMTA) of the ITPGRFA would bind the recipients and donors for the PGRFA available in public domains. The International Treaty offers immense opportunities for Nepal to access global crop genepools and equally enables other member countries to access the Nepalese genetic resources available in public domain.

To facilitate the implementation of ITPGRFA in Nepal, a project called Strengthening National Capacities to Implement the International Treaty on Plant Genetic Resources for Food and Agriculture (commonly called as GRPI-2 project) was initiated in 2012 with the financial support from Bioversity International. This project was able to make many stakeholders aware of ITPGRFA-MLS, draft governance mechanism including designated authority for MLS access and benefit sharing, generate some facts and figures on interdependence on PGR, revise the Agrobiodiversity Policy 2007 considering the provisions of ITPGRFA,

include the provisions of ITPGRFA in NBSAP (2014-2020) and generate huge information on different aspects of ITPGRFA-MLS.

On ratifying the Treaty, countries agree to make their genetic diversity and related information about the crops stored in their genebanks and public domains available to all through the MLS. Fifteen CGIAR centers together maintain over 700,000 samples of PGRFA in their collections and that are held in FAO trust that are accessible under the terms of the MLS. Contracting Parties and a Natural or a Legal person have also made available more than 500,000 and 3,000 accessions of Annex-1 Crops respectively through MLS. Japan became a Contracting Party to the Treaty on 28 October 2013 and Japan's Genebank (NIAS) submitted almost 18,000 crops and forages accessions into the Multilateral System with high-value associated data. Nepal has been able to submit 614 accessions of PGRs under MLS in 2017, which is the first initiative, eventhough very low in number after ratified the Treaty in 2009. Hence, this ITPGRFA-MLS Implementation Strategy and Action Plan (IMISAP) is developed to accelerate the inclusion of Nepalese accessions under MLS and to get the benefit as much as possible from the provisions of ITPGRFA in support of conservation and sustainable utilization of APGR.

Agrobiodiversity

Nepal is home to extraordinarily rich diversity of natural flora and fauna as well as cultivated crops due to its extreme variation in climate, ecology, farming systems, and socio-cultural settings. Comprising less than 0.1% of the earth's land area, the country harbors about 600 species of food plants, 400 species of agro-horticultural crops, 60 species of wild edible fruits, 200 species of commercially important medicinal and aromatic plants, 300 species of orchids, 5000 species of insects, 185 species of fishes, and a variety of other economically and ecologically important species (MoFSC 2002, Upadhyay and Joshi 2003, Gautam 2008). Agriculture Plant Genetic Resources (APGRs) which comprises cultivated crops, wild edible plants and crops wild relatives, play vital role in the national economy, food security and livelihood,

since more than three-fourths of the country population depends on agriculture for their livelihoods.

APGRs are essential for a sustainable agriculture and food security. FAO estimates humans have used some 10,000 species for food throughout history. However, only about 120 cultivated species provide around 90% of food requirements and 4 species (Maize, Wheat, Rice and Potatoes) provide about 60% of human dietary energy for the world's population. Unlike most other components of biodiversity, agricultural crops are essentially manmade; they are the product of the breeding work of farmers and breeders over many generations. Without continued human management, most agricultural crops would revert to the wild and be lost. Because of their special nature compared to other components of biodiversity, the ITPGRFA facilitates the access to crop varieties and their components for agricultural research and breeding of new varieties.

Of the myriad of varieties of these crops developed by farmers over millennia, which form an important part of agricultural biodiversity, more than 75% have been lost in the past 100 years (FAO 2010). In the recent times, Nepal is also losing its significant portion of APGR due to its liberal economic policy, *ad-hoc* promotion of modern varieties and lack of overall policy on the conservation and sustainable use of genetic resources for food and agriculture (Chaudhary et al 2004, Gauchan et al 2005, Joshi et al 2005). To conserve APGR effectively, GoN has established National Genebank in 2010 (Joshi and Bhatta 2012). Now the National Genebank is actively working on collections and conservation of APGR and has managed all kinds of APGRs through establishing different banks (Joshi et al 2013b), systematizing the APGR management and facilitating the access to APGR in the country. Many community seed banks (Joshi 2013) are also contributing on conservation of APGR.

Methodology in Developing IMISAP

This IMISAP aims to facilitate the implementation of ITPGRFA in Nepal by developing suitable strategies and action plans for agrobiodiversity conservation and sustainable use. The work on drafting IMISAP was initially started from 2014 during the implementation of Genetic Resources Policy Initiative Phase 2 (GRPI-2) project (2012-2015) with the financial support of Bioversity International. During the drafting of IMISAP, key personnel from NAGRC, LI-BIRD (a lead NGO working on agrobiodiversity conservation) and MoAD had discussed and developed the important points for inclusion in the IMISAP based on the experiences learned under the project 'Strengthening National Capacities to Implement the International Treaty on Plant Genetic Resources for Food and Agriculture (commonly called as GRPI-2 project). A working group was formed to develop the IMISAP under the leadership of Bal K. Joshi and Madan R. Bhatta and Krishna H. Ghimire as members. This group reviewed relevant literatures mainly report of the GRPI-2 project (GRPI-2 2015), NBSAP (MoFSC 2014), ITPGRFA (FAO 2009), Agrobiodiversity Policy (MoAD 2014), etc, discussed with key persons, and held several meetings with experts. Contents were presented in the regional workshop held in Rampur, Chitwan and Tarahara, Sunsari to receive inputs. The comments of the participants were incorporated to make its revision and elaboration. To materialize the IMISAP, Secretary, MoAD formed a central committee on 28 October 2016. Under the leadership of Joint Secretary, Food Security, Agribusiness Promotion and Environment Division, the initial draft of the IMISAP was further reviewed, elaborated and presented by the Committee Members in the relevant meetings at the national level for collecting feedbacks. Comments and suggestions on this IMISAP were also collected from the participants of 2nd National Workshop on Conservation and Utilization of Agricultural Plant Genetic Resources, held from 22-23 May 2017 in Dhulikhel for further improvement of the draft. The draft was revised finally with the inputs of the Technical Advisory Committee and submitted to National Agrobiodiversity Conservation Committee (NABCC) for the approval.

Country's Dependency on PGRFA

There is a global interdependency on PGRFA for food and agriculture since all countries largely depend on PGRFAs that originate elsewhere. No countries in the world are self-sufficient in PGRFA for their food security (IPGRI 1996, 2000). Even Brazil, a mega diverse country with about 4,000-50,000 species of vascular plants (18% of the world´s plant diversity), is highly dependent on PGR native to other countries for food and agriculture (eg coffee, rice, potatoes, wheat, sugarcane, etc). The North Western Indian Mega Center comprises about 14-15% of the world's cultivated plants, yet it heavily depends on PGR native to other countries for food security such as wheat, rice, potato, tomato, coffee, and several other crops (CBD 1992). Nepal's dependence is about 95 to 100% on foreign germplasm for varietal development (Joshi et al 2016).

Based on the origin of crop varieties, one can estimate how much one country is dependent on others. It is difficult, however, to track the exact origins of crop varieties because generally they incorporate traits from many different varieties from different regions. The studies by Joshi et al (2013a), Joshi (2004 and 2005) have shown the empirical evidence on how much Nepal is dependent on foreign rice and wheat genetic resources. Nepal has many important landraces however, a large number of crop genetics resources enter annually in the country from foreign countries for breeding research.

The majority of modern varieties have been developed outside the country using exotic ancestors and CG centers are the main source of APGR for adaptation, crop improvement and production trials. A total of 35 ancestors originated in 11 different countries were used to develop 28 rice cultivars. Eight countries are the origins for 28 rice cultivars. Pedigrees analysis of modern wheat varieties in Nepal showed that all ancestors (including landraces) were from other countries and international organizations. Only exotic ancestors were used for developing 35 modern wheat varieties. About 95% lentil breeding materials of NGLRP are the genetic resources received from external sources especially from ICARDA. Only exotic parents have been used to develop 8 modern varieties of potato in Nepal.

Complete pedigree tree of one of the very popular rice varieties ie Khumal-4 is depicted in **Figure** 2. Genic portion contributed from each ancestor is also mentioned along with their origin. A total of 13 landraces originated in 8 different countries were used to develop Khumal-4. This indicates how much breeders need to depend on foreign genetic materials. The genic portion of one landrace originated in Nepal was the highest. Very few numbers of local landraces were used in local crop breeding. Dependency will further increase mainly due to changes in climate and demand of growers and consumers (Chaudhary et al 2016).

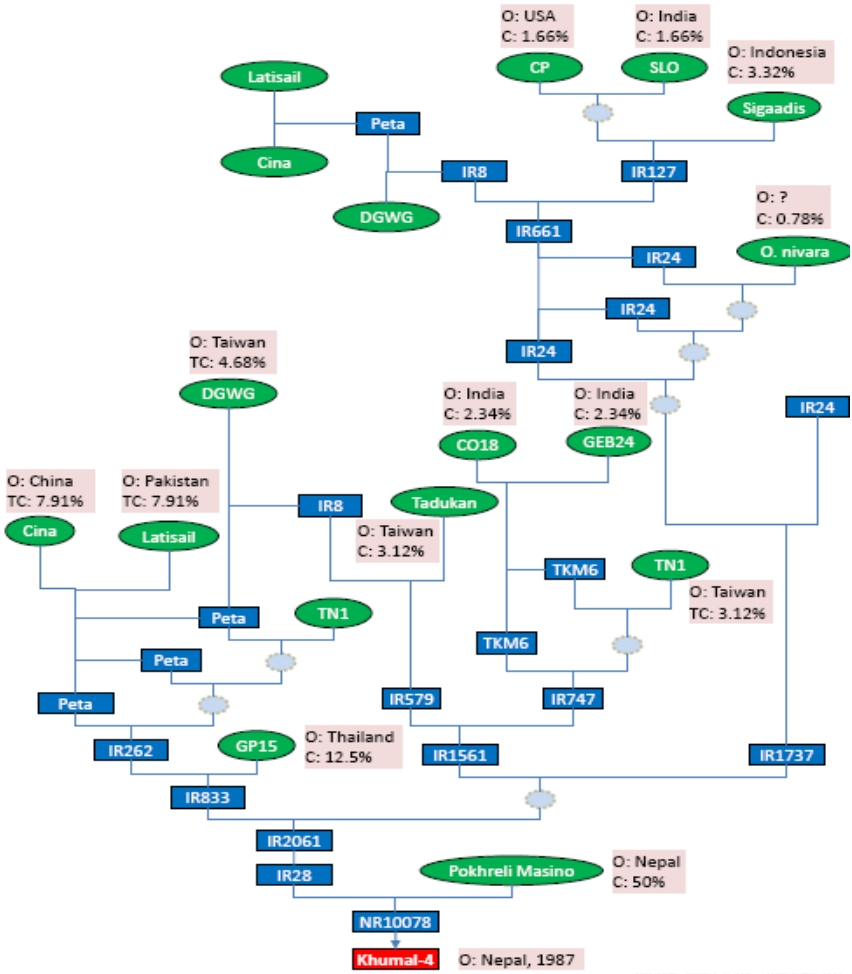

Figure 2. Pedigree tree of Khumal-4 rice variety along with genic portion of ancestors and their origin.
O, origin; C, Contribution (genic portion). Source: Joshi et al 2016.

CBD and ITPGRFA

Nepal, like other countries, has been an active member of the international community and is party to various conventions and

treaties of international importance. Amongst those, Convention on Biological Diversity, 1992 (CBD), International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), World Trade Organization (WTO) and it's attached agreements are the relevant treaties and conventions. The CBD (1992) brought genetic resources under the jurisdiction and sovereignty of national governments. However, the CBD recognized the special and distinctive nature of agricultural genetic resources: they were international - crossing countries and continents - their conservation and sustainable use requires distinctive solutions and they were important internationally for food security. Subsequently the IU (International Undertaking) was renegotiated, to bring it in harmony with the CBD, and was renamed as a treaty (**Table** 1). For the purpose of food security and sustainable agriculture, ITPGRFA was approved by the United Nations Food and Agriculture Organization (FAO) Conference on November 3, 2001. The Treaty came into force on June 29, 2004, and Nepal became a party to the Treaty on October 19, 2009. For a least developed and agro-based country like Nepal, ITPGRFA provides several benefits in terms of ensuring nations' food security and supporting agricultural development.

The ITPGRFA is a comprehensive international agreement in harmony with the CBD, which aims at guaranteeing food security through the conservation, exchange and sustainable use of the world's PGRFA, as well as fair and equitable benefit sharing arising from its use. It also recognizes Farmers' Rights: to freely access genetic resources, unrestricted by intellectual property rights; to be involved in relevant policy discussions and decision making; and to use, save, sell and exchange seeds, subject to national laws. Considering the interdependency on PGRFA, the treaty has implemented a multilateral system (MLS) of access and benefit sharing, among those countries that ratify the treaty, for a crop list of 64, some of the most important food and forage crops essential for maintaining global food security.

Policy, act and regulation are necessary at national level to materialize the ITPGRFA effectively as well as to handle Plant Genetic Resources for Food and Agriculture (PGRFA) scientifically. National Agriculture

Genetic Resources Centre (NAGRC) has been designated as a depository of the genetic materials. It is still not clear which institution can be the one to facilitate the process of MLS as envisioned in ITPGRFA.

Table 1. Differences between CBD and ITPGRFA

Feature	CBD	ITPGRFA
Scope	All forms of biodiversity, including both wild and domesticated species.	The Treaty covers all plant genetic resources for food and agriculture, but the multilateral system includes only those that are listed in Annex I and which are under management and control of the contracting parties and in public domain.
Objectives	Conservation of biological diversity, sustainable use of the components of biological diversity and fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	Conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of the benefits arising out of their use, in harmony with CBD, for sustainable agriculture and food security.
Access purposes	Conservation and sustainable use for any purposes, in principle, but CBD was conceived mainly for chemical, pharmaceutical, and/or other non-food/feed uses.	Utilization and conservation for research, breeding, and training for food and agriculture, and as long as it does not include chemical, pharmaceutical and/or other non-food/feed industrial uses.
Access and benefit-sharing	CBD recognizes the sovereign rights of states over their natural resources, and the authority to determine access to genetic	Contracting parties (of the FAO Treaty) agree to establish a multilateral system of access and benefit-sharing (which applies only to the 35 food

Feature	CBD	ITPGRFA
	resources rests with national governments and is subject to national access and benefit-sharing laws. Access depends on "mutually agreed upon terms," established through bilateral contracts between providers and users on a case-by-case basis. Access is subject to prior informed consent of the country of origin of resources, and to fair and equitable sharing of benefits deriving from their use. Access to associated traditional knowledge depends also on prior informed consent of Indigenous peoples and local communities.	crops and 29 forages listed in Annex I of the Treaty, under the management and control of the contracting parties and in the public domain). The SMTA establishes ABS conditions, and access is facilitated and expeditious. Benefit-sharing is mandatory only when commercialized products (that incorporate material accessed from the multilateral system) are not available without restriction to others for further research and breeding (eg, patented genetic materials). The equitable share corresponds to 1.1% of gross product sales minus 30%, which represents 0.77% *or* 0.5% of all product sales resulting from the same crop. Other benefit-sharing mechanisms are exchange of information, access to and transfer of technology and capacity building.
Forms of conservation	Ex-situ conservation is considered as complementary to in-situ conservation, and must preferably take place in the country of origin of genetic resources.	Articles 5 and 6 of the FAO treaty establish principles and guidelines for in-situ, on-farm, and ex-situ conservation of all plant genetic resources for food and agriculture. The multilateral system of ABS

Feature	CBD	ITPGRFA
		(Articles 12 and 13) applies only to plant genetic resources listed in Annex I and under management and control of the contracting parties and in the public domain. Access to plant genetic resources for food and agriculture found in in-situ conditions must be provided according to national laws.

Source: Santilli 2012.

Germplasm Flows

Historically, plant genetic resources were freely exchanged in accordance with the idea that these resources were the common heritage of humankind. Farmers have been involved in collective system of conservation and utilization, openly sharing these since the earliest time of crop domestications. Relatively open flows of plant germplasm resulted the spread of PGRFA from its center of origin to the centers of domestication.

There are historical examples of specific governmental rules restricting the export of certain specialized and industrial breeding materials such as pepper from India, oil palm from Malaysia, coffee from Ethiopia and tea from Sri Lanka.

On the contrary, in practice, various actors of Nepal have been accessing genetic resources from various sources and forms (eg CGIAR, India, China, AVRDC, etc) and facilitating access to Nepalese genetic resources to other countries. A large number of Nepal's plant genetic resources especially seed crops have been deposited at various seed banks abroad. Nepal’s agricultural research institutions, particularly National level commodity research programs, such as Rice, Wheat, Maize, Grain Legume, Potato, etc, and some NGOs have access to

various genetic resources from centres like Consultative Group on International Agricultural Research (CGIAR) seed banks and research centres. Consequently, they have been developing new varieties of crops, fruits, forages, and livestock. But such activities are operated either using Standard Material Transfer Agreement (SMTA) or informal channels or on an *ad hoc* basis. No formal regulatory mechanism has been developed. There is no institution mandated to keep records of Nepal's PGRs taken abroad and foreign PGRs accessed from Nepal.

There are more than 100 institutions involved on APGR conservation, improvement and utilization. Main institutions involved on germplasm flows are NARC, SQCC, DoA, and National Quarantine Office. Due to lack of governance mechanism of germplasm flows in the country, both private and public sectors are being involved directly for germplasm exchange. NAGRC is now playing vital role in germplasm flow within country. Germplasm flows within country are easy and free. There is no restriction for germplasm exchange within country. But for commercializing the variety, it should be either registered or released under the National Seed Board. Duplicates of some of collections in the Genebank are already being made internationally available through CGIAR centres, which have acquired materials from Nepal at different times. For example, IRRI holds 3,000 accessions of rice originally collected from Nepal. Recently, Nepal sent duplicate samples of approximately 2,000 accessions of rice, barley, finger millet, and wheat to IRRI, ICARDA and CIMMYT.

A large number of improved materials are being transferred from CG centres' breeding programs to Nepal. Breeding programs and seed suppliers are independently collecting APGR from within country as well from CG centers, India and China. Major crops introduced regularly from outside the country are rice, wheat, maize, potato, lentil, some vegetables and some forages. Rice, wheat and some vegetables are also regularly sent to other countries mainly Bhutan, India and Kenya, for research and production. Some vegetables have been regularly exchanged within SAARC countries. Important vegetables such as cauliflower, cabbage, tomato, cucumber, gourds, okra, radish, pumpkin,

etc grown in the country are hybrids and imported from different countries by private seed companies and traders.

A total of 14 INGER nurseries are being received by National Rice Research Program (NRRP) from IRRI each year and each nursery consists of 30-100 genotypes. NRRP had also sent three rice varieties for INGER nurseries to evaluate through IRRI in 2010. Similarly, Nepal regularly receives more than 50 genotypes of potato yearly from CIP. National Wheat Research Program (NWRP) is receiving wheat breeding nurseries and trials regularly from CIMMYT, Mexico since 1970. The NWRP receives more than 1,000 genotypes yearly however the number of entries varies every year. New trials and nurseries are added depending on biotic/abiotic stresses tolerance including high yielding lines.

NWRP has been regularly sending 100 to 125 advanced lines developed by itto Kenya every year since 2005 and also sending some selected F_3 and F_4 (40-60 crosses) segregating populations every year for screening against Ug 99 (stem rust of wheat) without SMTA. In addition to this, NWRP and Bangladesh wheat research program mutually share wheat advance lines without SMTA.

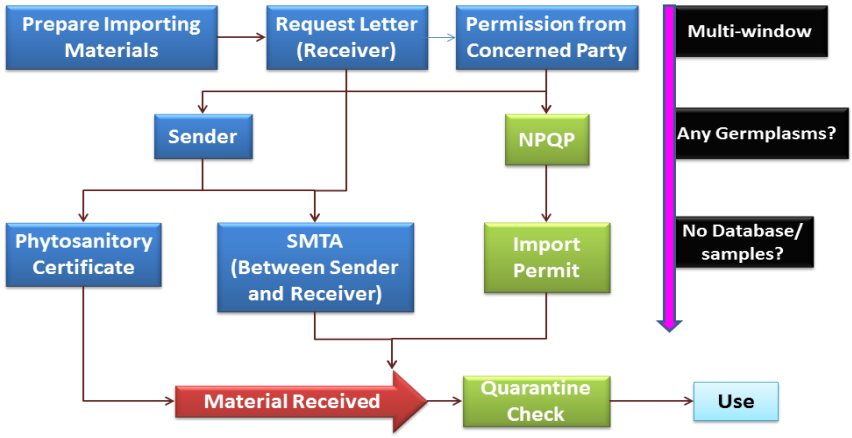

Figure 3. Existing mechanisms for germplasm import/ introduction (Material transport from foreign country).

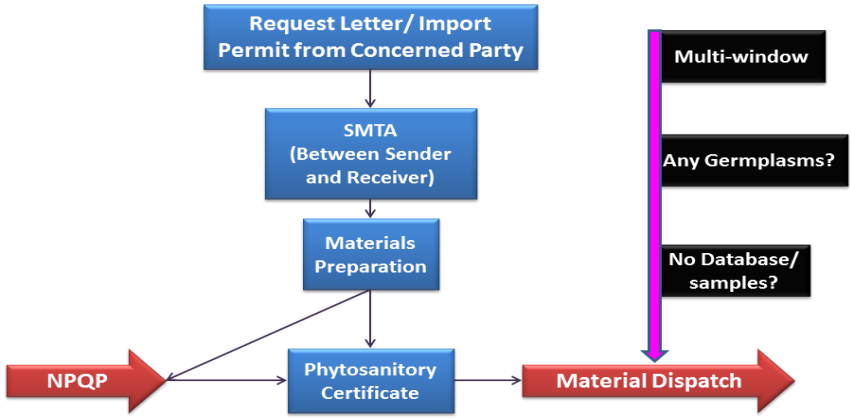

Figure 4. Existing mechanisms for germplasm export (Material transport from Nepal).

Agrobiodiversity related Policies, Acts and Strategies

A number of agriculture and natural resources related policies, acts, regulations and strategies have been adopted in Nepal and are amended time to time. Among the various policies, acts and regulations relevant to agrobiodiversity have been briefed below.

Nepal Treaty Act 1990

The objective of this act is to make legal provisions in regard to the procedure relating to signing, ratification, accession, acceptance, or approval of treaties or agreements to which Nepal or GoN is a party, as well as in regard to their implementation. The Act has defined "Treaty" as an agreement concluded in writing between two or more states, or between any state and any inter-governmental organization and this term also includes any document of this nature, irrespective of how it is designated.

The Act makes treaty provisions enforceable as good as laws (Section 9). Where a matter covered by a treaty conflicts with any law

in force, the provisions of the treaty are to prevail over national legislation to the extent of the inconsistency (Section 9.1).

When a treaty to which the government is a signatory, but which has not been ratified, acceded to, approved or accepted by parliament, creates additional obligations that require the enactment of legislation, the government must enact laws for its execution in a timely fashion (section 9.2). Despite these statutory requirements, implementation at the national level has remained weak, especially in the case of multilateral environmental agreements (MEAs), because the government has not enacted the required legislation.

It is obvious from the provisions of the Act that it has accorded supremacy to international treaties over national legislations stating that if any conflicts arise between an international law that Nepal has ratified and a national law, the treaty provisions should prevail (Section 9). Moreover, this is an important law that works as a bridge between national laws and international laws. The Act has also obliges Nepal to enact necessary legal and policy instruments in order to implement the provisions of ITPGRFA.

Environment Protection Act 2053 (1997)

The Environment Protection Act (EPA) was enacted with the objective to make legal provisions in order to maintain clean and healthy environment by minimizing, as far as possible, adverse impacts likely to be caused from environmental degradation on human beings, wildlife, plants, nature and physical objects; and to protect environment with proper use and management of natural resources, taking into consideration that sustainable development could be achieved from the inseparable inter-relationship between the economic development and environment protection (Preamble).

The Act has defined Biological Diversity as ecosystem diversity, species diversity and genetic diversity, and National Heritage as any such object, site, plant and animal related with the environment available within Nepal as is likely to be important to the human being from

natural, cultural, historical archaeological, scientific, spiritual, aesthetic or social point of view (Section 2 (j) and (k)).

The Act also includes provisions related to national heritage and assigns the concerned agency to protect National Heritage. For the purpose of the protection of National Heritage, the concerned agency is required to prepare and maintain an inventory and such inventory must also include the objects or places listed on the World Heritage List available within Nepal and such objects, places, plants, animals,etc included in the inventory must be protected as prescribed (Section 9).

The GoN is empowered by the Act to delineate as an environment protection area, any area which contains biological diversity, rare wildlife or plants and places of cultural and historical significance which are considered extremely important from the point of view of environment protection (Section 10).

Similarly, the Act has empowered GoN to frame necessary Regulations for achieving the objectives of this Act. Under the list of subject areas of perspective Regulations, biological diversity and the protection of National Heritage is also included in the 4th place (Section 10). But neither the GoN has formulated regulations for conservation of biodiversity and protection of national heritage nor prescribed guidelines and criteria for utilization thereof. Looking at the provisions, it seems that it has attempted to cover most of the environmental aspects but fails to provide framework for conservation and utilization of biological resources, and does not include provisions related to ITPGRFA.

Environment Protection Regulations 2054 (1997)

The Environment Protection Regulations framed under the EPA have included provision on permission for research which prohibits conducting research without permission. The Regulations prohibit foreign organization or association, or any person or institution affiliated to it to collect sample of any living being, bacteria and plant, and take any activity relating to research in biodiversity without taking

prior approval of the concerned body[1] (Rule 31). The provisions of the above mentioned rules are also relevant to the ITPGRFA.

National Parks and Wildlife Conservation Act 2029 BS (1973)

The National Parks and Wildlife Conservation Act (NPWCA) is the one of oldest laws of Nepal in the biodiversity conservation sector. The Act focuses on wildlife conservation through habitat conservation. Under the NPWCA, various pieces of Regulations like National Parks and Wildlife Conservation Regulations (NPWCR), Chitwan National Park Regulations, Bardiya National Park Regulations, Wildlife Reserve Regulations, Elephant Management Regulations, Mountain Protected Areas Regulations, Conservation Area Management Regulations, Conservation Area Government Management Regulations, Khaptad National Park Regulations, Kanchenjunga Conservation Area Regulations and Buffer Zone Management Regulations have been promulgated and are in force for the management of the protected areas especially to conserve wilderness, biodiversity and landscape.

However, the Act is more focused on wildlife conservation and related uses, it has also included provisions on the collection of samples of biological resources for scientific research except the wildlife listed in the Annex 1. Samples can only be collected after obtaining permission from concerned official (Section 15).

National Parks and Wildlife Conservation Regulations 2030 BS (1974)

The National Parks and Wildlife Conservation Regulations are the major tools to implement the NPWCA, and have included various provisions related to conservation and utilization of biological resources under in-situ conditions.

[1] For the purpose of the Regulations "Concerned Body" means any Ministry of Government of Nepal connected with the functions set forth in the Act or these Rules (Rule 2.b).

Rule 22 provides for provisions relating to collection of samples of wildlife, birds, insects or fishes or any other natural products for scientific research except the wildlife included in Annex 1 of the Act by charging fee as included in Annex 2 of the Regulations. However, Annex 2 does not include fee for collection of samples of plant and their products. It means that it does not cover and consider the aspects of food security and human benefit from the conservation of PGR through MLS of access and benefit sharing.

Importantly, the legal provisions, procedures and institutional set up under the NPWCA and Regulations promulgated under it are more focused to protection of extinct, rare, threatened and vulnerable species of wild fauna and flora as envisaged in the CITES, World Heritage Convention, Ramsar Convention and CBD including UNFCC and UNCCD.

Seed Act 1988 (Amendment 2008)

The Seed Act came into force in 1988 with the objectives of providing standard quality seeds in a well-planned system of production, processing and testing in order to increase production and productivity of different crops. The Act has included provisions on the formation of National Seed Board (NSB), sub committees under the Board, establishment of seed certification organization, and establishment of central seed testing laboratory. It has given powers to NSB to notify types and varieties of seeds, and prescribe minimum level of purity and germination for such notified types and varieties. The Act has required truthful labeling of container of notified types and varieties compulsory. In relation to regulation and technical back up, provisions of seed analyst and seed inspector have been included. For import and export of notified types and varieties of seeds, a permission system has been instituted. In addition to above mentioned provisions, the Act has included a provision of giving recognition to national and international organization for seed testing and certification.

One interesting thing about Seed Act 1988 is that it recognizes ownership rights of breeders on varieties, but it does not specify what exactly means by ownership rights.

Further, in relation to the MLS under the ITPGRFA, the Act has covered the seed component but taken seed as market commodity rather than as genetic resource. It has tried to regulate import, export, production, certification, release and supply of seeds which are ready to sow in the farms and nurseries but does not look at the aspects of breeding, conservation and safeguard of PGRs for the future.

Seed Regulations 2069 (2013)

The Seed Regulations 2013 were formulated to define rules, and regulate the production and marketing of quality seeds in the country. It has included provisions for institutional arrangements such as formation of sub-committees under NSB. It has laid down processes of approval, release and registration of new plant varieties, and provisions for documentation and certification of released varieties at the concerned authority. Ownership right of new plant variety is the key provision to promote and encourage individual breeders. Besides, there are other provisions such as permission should be taken from NSB for import and export of notified kind varieties from Nepal; provision of crop inspector, seed sampler, and seed analyst and their minimum qualification and examination procedures; ownership rights on traditionally used local varieties of crop; and compensation system to farmers in case of low quality and wrong information about seed.

Forest Act 2049 BS, 2nd amendment 2073 (2016)

GoN is empowered to impose restriction on collection, cutting, use, transport, sell and distribution or export of the prescribed forest products for the purpose of biodiversity and environment conservation. It may do so by publishing a notice in Nepal Gazette (Section 70 (a)). But it does not mention about access to genetic material or resources.

Forest Regulations 2051 BS, 5th amendment 2072 (2015)

The Regulations have included provisions related to timber and non-timber forest products including herbs, herbicides and fodders but do not contain provisions relating to PGRFA.

Plant Protection Act 2064 BS (2007)

The objectives of the Plant Protection Act are preventing the introduction, establishment, prevalence and spread of pests while importing and exporting plants and plant products, promoting trade in plants[2] and plant products.[3]

The GoN is empowered by the Act to designate any central level office related with plant protection as the National Plant Protection Organization (Section, 6(1)). The powers and functions of the National Plant Protection Organization include are, among others, to (a) prepare standards on the sanitation of plants or plant products to be imported or exported; (b) develop and enforce manuals on the examination, test, inspection and treatment of plants, plant products, biological control agents, beneficial organisms and other articles; (c) identify endangered areas and protect plants and plant products in such areas through quarantine process; (d) prescribe terms and restrictions relating to the trafficking and use of plants and plant products, biological control agents and beneficial organisms; (e) enforce the approved standards on the sanitation of plants or plant products to be imported or exported; and (f) make coordination with phyto-sanitary bodies of other countries and make understandings on the recognition of each other's permits and phyto-sanitary certificates.

Plant Protection Regulations 2066 BS (2010)

The Regulations require license to import plant or plant product and provide for fees too (Rule 5). A person who intends to import any plant or plant product has to make an application in the given format to the chief of National Plant Quarantine Program. At the time of application,

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[2] "Plant" means every kind of plant, whether alive or dead, or any part thereof; and this term also includes stem, branch, scum, layering and grafting (Kalami), bark, root, leave, fruit, seed and germ plasma (section 2 (a)).

3 "Plant product" includes any plant product not yet manufactured for use (including feeds) or any manufactured product that may, by the reason of nature of their processing or otherwise, create a risk for the introduction, establishment and spread of infectious pests (section 2 (b)).

applicant needs to submit a declaration form and such declaration form should also be accompanied by a duplicate copy of the declaration form to be provided by the exporting country (Rule 7).

For the purpose of export of plant and plants products, a certificate is required (Rule 8). A person who wishes to export a plants and plant products from Nepal to any country has to make an application to the Chief of Office along with the detailed description. In response, the Chief of Office is empowered to issue the phyto-sanitary certificate, if it does not see any obstacle.

Agro-biodiversity Policy 2063 (2007), 1st amendment 2071 (2014)

National agro-biodiversity policy aims at conservation and sustainable use of agricultural genetic resources and traditional knowledge, skill and practices and fair and equitable sharing of benefits for ensuring food security and reducing poverty in present and future generations.

The Policy has divided its working policies in four themes – a) conservation, promotion and sustainable use of agro-biodiversity; b) protection and promotion of the rights and interests of farmers', and traditional knowledge, skill, innovation, technology, use and practices of the farmers; c) arrangements for equitable and judicious distribution system of opportunities and benefits arising from access to and utilization of agricultural genetic resources and materials; and d) arrangement for equitable and judicious distribution system of opportunities and benefits arising from access to and utilization of agricultural genetic resources and materials. Some of the policies listed under these themes include strengthening traditional seed and other distribution system as well as exchange of seed among farmers; encourage use of scientific technologies and knowledge based on knowledge and skill of the farmers; and conservation of traditional knowledge, skill, research, use of technology and practice of farmers related to traditional and local food and management of agricultural genetic resources.

The policy constitutes National Agro-biodiversity Conservation Committee to implement the policy and monitor the progress. The Secretary of Ministry of Agricultural Development is the chair of the committee having representatives from public and private sectors including farmers. Genebank has been established in line with the objectives of the agro- biodiversity policy. Initially, the role of the Center in implementing the policy has not been incorporated in the policy document. But, its role in the revised policy has been mentioned.

National Agricultural Policy 2004

National Agricultural Policy 2004 (NAP) aims at improving the livelihoods of the people through transformation of the subsistence agriculture into a commercialized and competitive system. It encourages the conservation and sustainable use of natural resources and biological diversity. It also identifies the role of in-situ and ex-situ conservation in agriculture sector for conservation and promotion of sustainable use of genetic resources. NAP adopts the provisions of Local Self Governance Act and accordingly devolves extension services to the local bodies. It intends to strengthen local bodies by making them accountable and competent by allowing them to formulate local level agricultural plans as per the local needs and priorities and implement the activities.

Nepal Agriculture Extension Strategy 2007

The goal of Nepalese agricultural extension service is to contribute to the over riding national poverty reduction goal by increasing the efficiency and productivity of agriculture and competitiveness in the value chain of agricultural system (from production to marketing) within the sustainable livelihoods framework. NAES has assigned high priority to food and nutrition security, income generation, environment conservation and biodiversity utilization, equity and inclusion, value addition and quality products, commercialization, and sustainable livelihoods.

Agriculture Perspective Plan 1995

The agriculture perspective plan (APP) is a growth accounting framework for generating agricultural growth in the country. It focuses on agriculture-led economic growth for food security, poverty reduction and economic development. The APP is technology-driven based on priority inputs like fertilizer, irrigation, roads, electrification and technology. It does not directly emphasize on the seeds and plant genetic resources including germplasm exchange.

Agriculture Development Strategy 2015

The agriculture development strategy (ADS) document is developed by the government with a vision of a self-reliant, sustainable, competitive, and inclusive agricultural sector that drives economic growth and contributes to improved livelihoods and food and nutrition security.The ADS specifies four strategic components—governance, productivity, commercialization and competitiveness. Promoting community based seed production and agro-biodiversity in inaccessible remote areas is an activity for implementation of seed vision 2025 under the strategy of increasing agricultural productivity. The ADS emphasizes on strengthening the genebank and animal genetic resource program for the use of intellectual property right. For implementing the biodiversity policy the ADS proposes strengthening collection, classification, and assessment of diversified bio-resources relevant to agriculture; initiating a system of registration of agro-biodiversity; developing regulation for the research and experimentation of biodiversity and genetic resources and developing regulation for GMO having negative impact on biodiversity, genetic resources, and human health. The ADS, however, proposes nothing for exchange of genetic materials. The farmers' rights in the ADS includes ensuring farmers participation in the policy formulation, planning, decision making, implementation, and monitoring of the strategy. In addition, the ADS also proposes for formulating legislation related to food rights and food sovereignty consistently with the principles of the current Constitution.

National Seed Policy 1999

GoN formulated the National Seed Policy in 1999 which focuses on seven areas of seed sectors in Nepal. Variety development and maintenance, seed multiplication, quality control, increased involvement of private sector, seed supply, institutional strengthening and biotechnology are the seven sectors of the Policy. The main objective of seed policy is to provide policy framework and guidelines to ensure production and distribution of quality seeds, promote export by producing quality seeds, make seed business effective in terms of existing world trade, and to conserve and protect right over seeds of local crop varieties having distinct genetic traits.

Some important policies are conservation of agro- biodiversity and establishment of variety rights, coordination with national and international seed companies for seed development and production, production and regular supply of source seeds on the basis of farmers demand, export of high value seeds, balance sheet of source seed through NSB, authority of foundation seed production in private sector, contract seed production, seed certification and truthful labeling and introduction of quality declared seed system, involvement of private sector in seed testing, sample collection and crop inspection for quality control, rental facilities of seed processing plant and storage to private sector, seed pledging, strengthening NSB, establishment of quality control center and seed testing laboratory in private sector; provision of buffer stock for emergency, study research and regulation of GMO, transgenic plants and tissue culture, preparation of biosafety regulation, human resource development.

National Climate Change Policy 2011

NCCP has referred that there have been changes in rainfall patterns and seasons due to climate change, and these have direct and indirect impacts on water resources, agriculture, forests and biodiversity, health, infrastructure development, tourism, and livelihoods. It further states that the impacts of climate change are vivid in least developed, landlocked, and mountainous countries and Nepal is also highly affected by climate change. It realizes the urgency to address the issue

of climate change to minimize the existing effects and likely impacts in different ecological regions—from the Southern plains to the middle hills and to the high Himalayan Mountain in the north, and their peoples, livelihoods, and ecosystems. The adverse impacts of climate change have been noticed in agriculture and food security, water resources, forests and biodiversity, health, tourism and infrastructures. The goal of this Policy, among others, is to improve livelihoods by mitigating and adapting to the adverse impacts of climate change.

In the capacity building, the policy has included the provision on enhancing the adaptive capacity of food grains, species, ecosystem and health from probable effects of climate change (8.4.4). In the technology development, transfer and utilization section, more importantly, it has included a provision of identifying, developing and utilizing agricultural varieties/species that can tolerate drought (too little water) and floods (too much water). In relation to PGRFA, the provision of identifying, developing and utilizing agricultural varieties/species that can tolerate drought (too little water) and floods (too much water) is relevant and important for the future which can be taken as a realization of the need which ITPGRFA has tried to address and achieve.

Biotechnology Policy 2006

One of the strategy in the policy is to develop indicators to measure public benefit as may be provided by biotechnology for sustainability, natural resource management, environment and biodiversity conservation, and make such benefits to the public. The activities of biotechnology eg in-situ and ex-situ conservation and utilization of plant resources should be carried out thereby protecting as well as preserving natural resources and biodiversity.

National Seed Vision 2013-2025

One of the objectives is to promote local seed security through conservation and sustainable use of agrobiodiversity. Implementation of the National Seed Vision is visualized to contribute on food security, employment generation, biodiversity conservation. It supports VDC and

ward level resource centres and seed production at local levels to maintain seed quality and conserve biodiversity and promote VDC level seed bank. It also suggests to designate farms, stations, zones and pockets for variety maintenance and biodiversity conservation and to establish broader genetic base and biodiversity of crops and varieties using local land races, exotic germplasm and their wild relatives for developing climate resilient and nutrition rich varieties. Encourage to promote linkage between national genebanks, regional and international seed banks and community seed banks for exchange of materials and information for biodiversity conservation.

National Biodiversity Strategy and Action Plan 2014-2020

Conserving biodiversity is considered as an essential part of safeguarding the biological life support systems on Earth. It has been prepared to meet the national needs for managing biodiversity on a sustainable basis for the benefit of present and future generations. The NBSAP contains strategy for management of biodiversity, framework for Local Biodiversity Strategy and Action Plan as separate chapters. Some of the strategies in NBSAP for the management of agrobiodiversity are establishment of an efficient system for exchange of information on all kinds of agricultural genetic resources and implementation of ITPGRFA and multilateral system of exchange of PGRFA, strengthening community based management of agrobiodiversity, and expanding it to at least five additional districts by 2020, establishing and strengthening functional linkage between the National Agriculture Genetic Resources Center (Genebank) and community based seed or genebanks and development and implementation of incentive measures for on-farm conservation of agrobiodiversity, and elimination of perverse incentives (if any).

Access to Genetic Resources and Benefit Sharing Bill 2016

The draft Bill on access to genetic resources and benefit sharing (AGRBS) has included the provisions related to ABS as stipulated in the CBD. These provisions include ownership on genetic resources and genetic material. There are three categories of ownership:

(i) ownership of individual person or organization (ii) ownership of local communities (iii) ownership of Government of Nepal if genetic resources and materials do not fall under the first two categories. Any individual, local community, organization, local government body or Government of Nepal itself can separately or jointly prepare register of genetic resources and associated knowledge. However, this will require taking PIC from the owners of such genetic resources and associated knowledge. The Biodiversity Register prepared this way becomes a legal document after it is registered with the National Genetic Resource Coordination Council (NGRCC). To get access to genetic resources and materials, two procedures need to be followed: firstly, application for preliminary and scientific research and sample collection; and secondly, proposal for obtaining license for access, use and export. An institution named National Genetic Resource Coordination Council has been proposed to be established to coordinate access and benefit related affairs. Benefits arising from the access and use of genetic resources and materials are proposed to be shared among four parties: (i) local community, individual or organization; (ii) NGRCC; (iii) Government of Nepal; and (iv) local bodies.

Plant Variety Protection and Farmers' Rights Bill

Major objectives of the Bill are to develop agriculture, promotion of sustainable food security and biodiversity through development and conservation plant varieties and securing rights of breeders and farmers. It has defined seed, plant, plant species, farmer, local variety, local community, traditional knowledge, and provides for registration of new varieties and breeders' rights over new varieties. It does try to refer separate access and benefit sharing related law for access to local varieties and traditional knowledge and their benefit sharing provision.

NARC Vision 2010

One of the targets in NARC Vision is conserving, promoting, and harnessing agricultural biodiversity through the development and dissemination of environment friendly techniques. It focused that increased commercialization will be made compatible with biodiversity

conservation and environmental sustainability. It realized to further refine its policy on conservation of agro-biodiversity and agricultural genetic resources through in-situ and ex-situ conservation strategies.

IMISAP

Agrobiodiversity should be effectively and efficiently conserved and utilized, which requires to have easy access to a variety of germplam. ITPGRFA-MLS Implementation Strategy and Action Plan (IMISAP) is a guiding framework for effectively participating in MLS and harvesting both monetary and non-monetary benefits from the MLS. Underpinned principle of IMISAP is that there is no other alternative of agrobiodiversity for food and nutrition security, and of genetic diversity for sustainable agriculture. Large numbers of crop genetic resources are necessary to breed continuously new varieties. The Treaty is vital, therefore, in ensuring the continued availability of the plant genetic resources that countries will need to feed their people.

As a Party to the CBD, and ITPGRFA, Nepal has an obligation of developing a national strategy for conservation and sustainable use of agrobiodiversity. National Biodiversity Strategic Action Plan (NBSAP) 2014-2020 has been developed to materialize the provisions of CBD. To materialize the ITPGRFA, MoAD has revised Agrobiodiversity Policy 2007 including the provisions of ITPGRFA. Similarly this IMISAP has been framed for effective implementation of MLS targeting to harvest maximum benefits from MLS by systematizing germplasm flows outside the country (to advance the research, breeding, study as well training (as shown in **Figure** 5) and by harmonizing with existing policy, regulations, acts and guidelines, and ultimately contributing to global food and nutrition security.

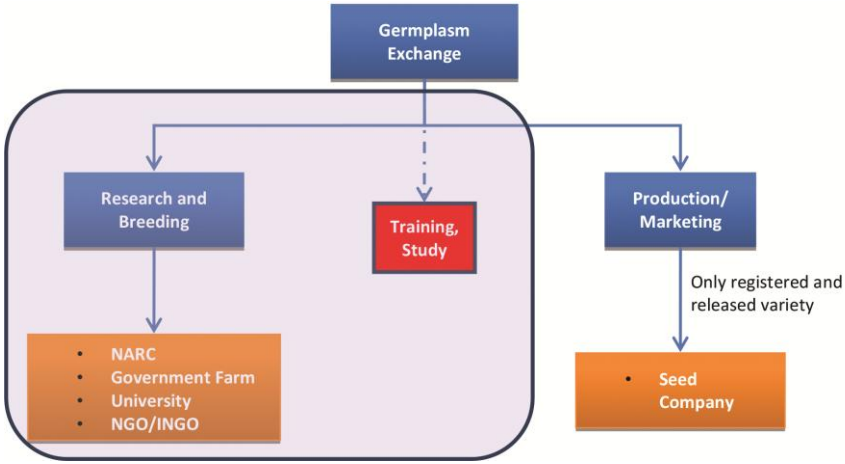

Figure 5. Scope of IMISAP.

Strategy

This strategy is developed for guiding exploration and collection, conservation, documentation, exchange of materials, non-germplasm base technology transfer, resources utilization, capacity building, germplasm export and import, and monitoring of germplasm flows. These activities are further elaborated below.

Exploration and Collection

- Exploration, collection and management of APGRs need to be systematized by giving authority to NAGRC and any of such works needs to be carried out with the involvement and guidance of National Genebank.
- Guidelines developed by NAGRC need to be followed while undertaking the work planned under this strategy.
- Portion of each accession collected by different institutions should be conserved in National Genebank.

Conservation

- Ex-situ, on-farm and in-situ conservation strategies should be institutionalized and implemented by engaging multiple public and private institutions.
- Short term, medium term and long term facilities shall be strengthened and equipped with required technologies.
- Field Genebank should be established across the NARC Stations, DADOs and Government Farms, parks and botanical garden. Twenty conservation and utilization activities listed in Annex 4 should be implemented by concern organizations.
- Cryo-preservation facility and DNA bank should be established and strengthened.
- Linkage between Community Genebanks (seed and field genebanks) with National Genebank with proper recognition should be established.
- Government support to CSBs through DADOs, Local Research Stations and National Genebank should be established.
- Collaboration should be established with relevant institutions for in-situ conservation of wild relatives and wild edible plants.
- Advanced technologies such as GIS and biotechnology should be applied to manage and conserve APGR.

Documentation

- National database system of each accession including phenotypic and genotypic characterization and evaluation data should be generated and maintained by National Genebank in collaboration with universities and research organizations.
- Finger printings of landraces should be developed, with focus on indigenous genotypes.
- National database system should be made available on line and be linked with MLS database.
- Agrobiodiversity indexing and catalog of crop landraces should be developed.

- Naming of crop landraces may be necessary in some genotypes. Plant glossary with images need to publish including English name, Nepali and local names and scientific names.

Materials for Exchange

- APGRs under exchange include domesticated APGRs, crop wild relatives and wild edible plants. A list of such plants should be prepared. Red listing system (Annex 4) should be put in place in order to identify threatened and vulnerable APGRs.
- Seeds and vegetative parts should be used for exchange.
- In-vitro plantlets (pathogen free), DNA (not able to regenerate), dry sample (DNA extraction) and artificial seeds should also be considered for exchange in future and facilities should be created for such kind of works.
- Initially only ex-situ materials should be in place for exchange. After creating systematic exchange system, material in on-farm and in-situ will be considered for exchange based on the exited policy and regulations.
- Mechanism should be developed to use on-farm materials and in-situ materials for exchange.

Non-germplasm base Technology

- Information such as inventories of crop diversity and results of technical, scientific and socio-economic research, for example, research related to evaluation and utilization of agricultural crops should be exchanged.
- Technology for the conservation, characterization, evaluation and use of crop diversity under the Multilateral System should be transferred and capacity of the users will be enhanced.

Resources Utilization

- Germplasm available in MLS along with database (information) should be made accessible to researchers, breeders, farming communities, agriculturists, and students.

- Linkage between farming communities including CSBs and researchers to global crop genepools will be established to promote exchange of knowledge related to APGRs through IT-based technologies.
- Non-germplasm base technologies and associated knowledge will be made available to Nepalese scientists.
- Nepalese researchers and institutions will be encouraged to access Benefit Sharing Fund. Capacity on developing high quality project will be enhanced.
- Mechanism will be put in place for recipients to pay an equitable share of financial benefits into the Treaty's Benefit-sharing Fund (BSF) whenever applicable.
- Enabling environment should be created to complement BSF with voluntary contributions from institutions, international foundations and the private sector.
- The funds that accumulate in the Benefit-sharing Fund will bemade accessible to the farmers who use and conserve crop diversity.

Capacity Building

- Technical capacity of individuals and public and private institutions will be enhanced.
- Programs will be developed for scientific and technical education and training.
- Research facilities should be further improved and budget allocation made accordingly.
- Linkage with national and international institutions will be established to foster knowledge exchange with experts and subject matter specialist.

Germplasm Import and Export

- One window system for germplasm export as depicted in **Figure** 6 will be adopted.
- Multi-window system will be adopted for import of germplasm as shown in **Figure** 7.

- Authority to consider requests for access to materials in the multilateral system will be defined.
- Germplasm Exchange Authority Committee (GAC) will be formed consisting of IT Focal Person, Chief of Agrobiodiversity Section, MoAD; Chief of National Genebank, Chief of SQCC and Chief of NPQP. Relevant technical experts may be invited in the committee. Technical advisory committee as well as other committees can be formed to support the GAC.
- Database will be maintained that will support to trace back and / trace forward the germplasm. All germplasm will have an accession number and have passport data.

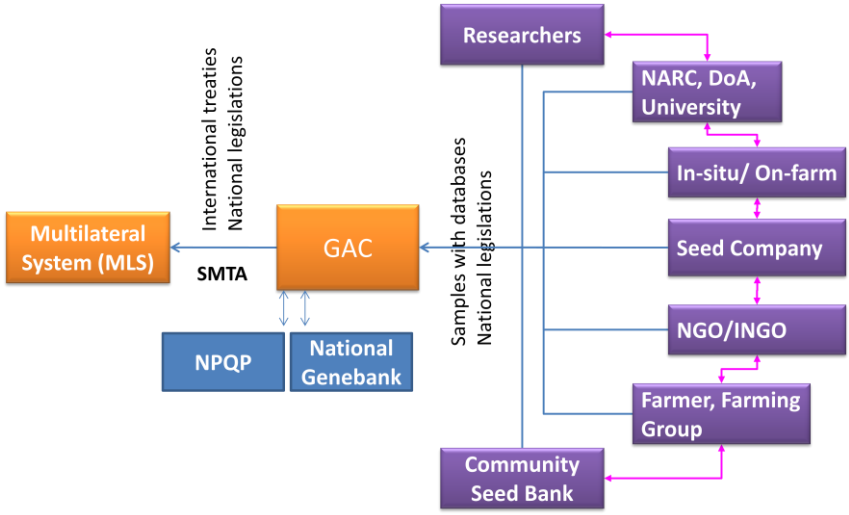

Figure 6. Export mechanism of germplasm under ITPGRFA-MLS.

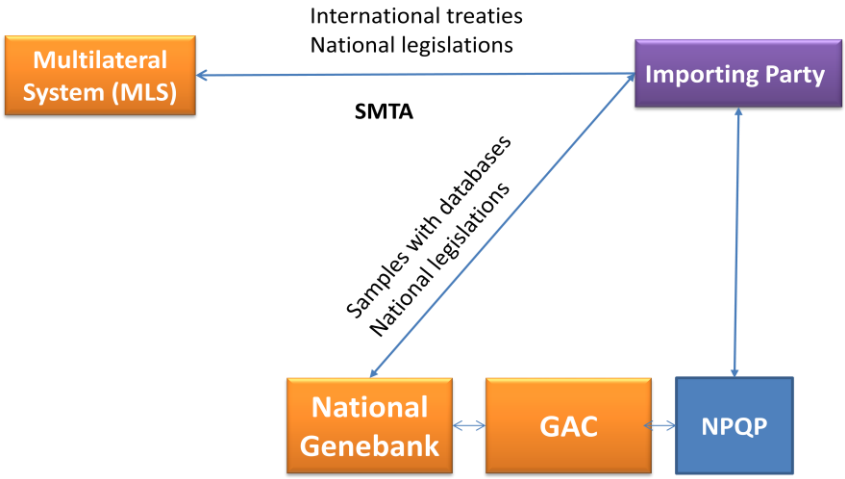

Figure 7. Import mechanism of germplasm under ITPGRFA-MLS.

Monitoring

- Strong monitoring mechanism should be developed to deliver all activities in timely manner including Farmers' rights, provision under SMTA and incentive to target communities.
- Impact will be assessed after one year of notifying the Nepalese accessions of crops to IT Secretary.
- This document can be reviewed and revised within five years and if necessary, GAC has right to do so.

Action Plan

SN	Activity	Responsible organization	Duration
1.	Capturing Benefit Sharing Fund (BSF) for AGRFA conservation and utilization	MoAD, NARC, DoA, NGOs, INGOs, University	2018-2025
2.	Agrobiodiversity conservation and utilization act	MoAD, NARC, NGOs, University	2018-2019
3.	Identification of National designated Authority (Germplasm exchange authority committee (GAC), legal authority for germplasm exchange)	MoAD	2018
4.	Farmers' friendly materials developed	MoAD, DoA, NARC, NGOs	2018-2025
5.	Safety backup and safety duplication with the MLS of ITPGRFA (one window for export and multi window for import with strong database)	MoAD, NARC	2018-2020
6.	Red listing crop landraces and identification of rare and unique crop landraces	DoA, NARC, NGOs	2019-2020
7.	Agrobiodiversity conservation and utilization regulation	MoAD, NARC, NGOs	2019-2020
8.	Linking CSBs with National Genebank and DoA	MoAD, DoA, NARC, NGOs	2018-2019

SN	Activity	Responsible organization	Duration
9.	Prepare database under MLS for Nepalese people and process of access	MoAD, NARC	2019-2025
10.	Locate hot spot areas and diversity mapping	DoA, NARC, NGOs, University	2019-2020
11.	Establish awarding system to agrobiodiversity rich farmers (custodian farmers)	MoAD, DoA, NARC, NGOs, University	2019-2025
12.	Revision of Nepal Annex 1 crops available across the country and international Genebanks (ex-situ, on-farm and in-situ)	MoAD, NAGRC, NGOs	2019-2025
13.	On-line access to germplasm and database	NARC , MoAD	2020
14.	Accessioning germplasm for inclusion under MLS	MoAD, NARC	2019-2025
15.	Awareness campaign regarding the potential use and benefit from MLS	MoAD, DoA, NARC, NGOs, University	2019-2021
16.	Collection and conservation of rare and unique crop landraces, organize germplasm rescue mission	DoA, NARC, NGOs	2019-2025
17.	Develop varieties and landraces catalog	DoA, NARC, NGOs	2021
18.	Organize exposure visit and training for the management of APGRs	MoAD, DoA, NARC, NGOs, University	2019-2025

SN	Activity	Responsible organization	Duration
19.	Develop local, district and provincial profile on agrobiodiversity	DoA, NARC, NGOs, University	2020-2025
20.	Mainstream diversity and food fairs; diversity rich solution and cultivars mixture	DoA, NARC, NGOs, University	2020-2025
21.	Publish database of Nepalese crop accessions that are conserved in foreign genebanks and accessible through MLS	NARC, MoAD	2022
22.	Study and document ethno botanical information on indigenous crops	DoA, NARC, NGOs, University	2022
23.	Impact study on MLS	MoAD, NARC, NGOs, University	2023-2025
24.	Integrate MLS and agrobiodiversity in education system	MoAD, University, NARC	2020
25.	Encouraging and linking natural and legal persons (CSBs and farmers) with the MLS	NGOs, MoAD, DoA, NARC	2023
26.	Study on geographical indication	DoA, NARC, NGOs, University	2022
27.	Establish agrobiodiversity park, conservation village, community field genebank, school field genebank and field genebank	DoA, NARC, NGOs, University	2020-2025

SN	Activity	Responsible organization	Duration
28.	Publish pictorial guide for crop species identification	DoA, NARC, NGOs, University	2023
29.	Strengthen household genebank	DoA, NARC, NGOs	2023-2025
30.	Landrace enhancement and conservation (LEC) program	DoA, NARC, NGOs, University	2022-2025
31.	Develop herbarium and image bank/ album	NARC, DoA, NGOs, University	2024
32.	Characterization at phenotypic and genotypic level before making access through MLS	DoA, NARC, NGOs, University	2025
33.	Develop ownership documents of indigenous crop landraces	DoA, NARC, NGOs, University	2025
34.	Addition of Nepalese crop accessions under MLS	MoAD, NAGRC	2020, 2022 and 2024

Implementation of Strategy and Action Plan

NABCC and Germplasm exchange authority committee are fully responsible for implementing, monitoring and regulating the IMISAP. NARC, DoA, MoAD and other relevant organizations should have annual program to materialize the IMISAP. Working group/committee may be formed as and when necessary for a particular task. All relevant national policies, acts, regulations should be integrated to implement this IMISAP. Project proposal calls for using benefit sharing fund and notification of important PGRFA under MLS should be regularly made to agriculturist, farmers, researchers and other stakeholders. Documentation system of APGRs at local, regional and national levels should be placed in action to facilitate the accessions under MLS. There is a need of special attention to recalcitrant seeds and vegetatively propagated materials to conserve and make access through MLS. Case study of particular action will be documented along with its impact to share to the Nepalese communities.

Issues and Challenges

- Germplasm collection in the country needs to be regulated and systematized.
- Crop wild relatives and wild food plant species are generally under the management and control of MoFSC, however, these are very important for agriculture research and development. There is a need of simple mechanism among MoFSC, MoAD, DoA and NARC to better utilize and conserve these resources.
- Germplasm should be regularly added to MLS using the criteria that Nepalese communities accept. Regular notification is therefore necessary from IT Focal Point to IT Secretary.
- Ex-situ materials mainly orthodox seeds are identified for inclusion under MLS. Options for the inclusion of on-farm and in-situ materials need to be identified.
- Monitoring mechanism for MLS and SMTA needs to be materialized and examples of benefit sharing from MLS and

SMTA should be documented and shared among the Nepalese people.

- Plant quarantine system is not strong enough to monitor all seeding materials as well as grains for food. Sometimes, grains imported from outside might be planted for production. There are many entry points of germplasm in Nepal and we do not have effective and equiped quarantine offices to all entry points.
- Nepal ratified ITPGRFA in 2009. Many exercises have been conducted to include germplasm under MLS, however, very few accessions from Nepal have been formally included under MLS.
- Contribution of foreign germplasm has been realized and appreciated, however, uses of Nepalese germplasm in breeding and production have not been documented for global food security.
- There are many holders of APGRs in the country and participation mechanisms of them need to be formulated for the inclusion of APGRs under MLS independently.

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Annex

Annex 1. IT Annex-1 Crops (accessible through MLS)

A. Food Crops = 52 genus (35 crops)

SN	Crop	नेपाली	Genus	Species	0bservations
1.	Breadfruit	रामफल	Artocarpus	altilis Fosb.	Breadfruit only
2.	Asparagus	कुरिलो	Asparagus	Officinalis L. var. altilis L.	
3.	Oat	जै	Avena	Sativa L.	
4.	Beet, Mangelwargel	चुकन्दर	Beta	Vulgaris L.	
5.	Brassica complex		Brassica		Comprises oilseed and vegetable crops (cabbage, apeseed, mustard, cress, rocket, turnip
6.			Armoracia		
7.			Barbarea		
8.			Camelina		
9.			Crambe		
10.			Diplotaxis		
11.			Eruca		
12.			Isatis		
13.			Lepidium		L. meyenii is excluded
14.			Raphanobrassica		
15.			Raphanus		
16.			Rorippa		
17.			Sinapis		
18.	Pigeon Pea, red gram, cajan pea, congo pea, no-eye pea	रहर	Cajanus	Cajan L. Huth	
19.	Chickpea, gram, garbanzo	चना	Cicer	Arietinum L.	
20.	Citrus		Citrus		

SN	Crop	नेपाली	Genus	Species	0bservations
21.	Citrus		Poncirus		As rootstock
22.	Citrus		Fortunella		As rootstock
23.	Coconut	नरिवल	Cocos	Nucifera L.	
24.	Major aroids, cocoyam, taro, arum	र्कक्लो, पिंडालू	Colocasia	Antiquorum Schott. Var. esculenta	Taro, cocoyam, dasheen and tannia
25.	Dasheen	गावा	Colocasia	Esculenta L. Schtt.	
26.	Major aroids		Xanthosoma		
27.	Carrot	गाजर	Daucus	Carota L. var. sativa DC.	
28.	Yams, greater yam, white yam	घर तरुल	Dioscorea	Alata L.	
29.	Finger Millet, Agrican Millet, Bird's food millet	कोदो, मरुवा	Eleusine	Coracana L. Gaertn.	
30.	Strawberry, alpine strawberry	भूई ऐंसेलु	Fragaria	NubicolaLindl. Ex Lacaita	
31.	Sunflower	तारामण्डल, सूर्यमुखि	Helianthus	Annus L.	
32.	Barley	जौ	Hordeum	Vulgare L.	
33.	Sweet potato	सखरखण्ड	Ipomoea	Batatas L. Lam.	
34.	Grass pea, chuckling vetch jarosse	खेसरी	Lathyrus	Sativus L.	
35.	Lentil	मुसरो	Lens	Culinaris Medic.	
36.	Apple	स्याउ	Malus	-	Pyrus malus L.
37.	Cassava, Tapioca, Manioc	सिमलतरुल	Manihot	Esculenta Crantz	
38.	Banana, Plantain, Adam's flag	केरा	Musa	Paradisiacal L.	Except M. testilis
39.	Rice, Paddy plant	धान,चामल	Oryza	Sativa L.	
40.	Pearl Millet	वाजरा	Pennisetum	Typhoidis	

SN	Crop	नेपाली	Genus	Species	0bservations
				L.C. Rich.	
41.	Beans	असारे सिमि, डालो सिमि	Phaseolus	Vulgaris L.	Except P. polyanthus
42.	Pea, garden pea,	कला, केराउ, मटर	Pisum	Sativum L.	
43.	Potato	आलु	Solanum	Tuberosum L.	
44.	Rye		Secale		Section tuberosa included, except S. phureja
45.	Eggplant, brinjal, aubergine, guinea squash	भाण्टा, वैगुन	Solanum	Melongena L.	
46.	Sorghum, great millet	जुनेलो	Sorghum	Vulgare Pers.	
47.	Triticale		Triticosecale		
48.	Wheat	गहू	Triticum	Aestivum L.	
49.	Wheat		Agropyron		
50.	Wheat		Elymus		
51.	Wheat		Secale		
52.	Faba Bean, Vetch, broad bean, horse bean	बकुला	Vicia	Faba L.	
53.	Cowpea et al.	बोडि	Vigna	Unguiculata L. Walp.	
54.	Maize, Indian corn	मकै	Zea		Excluding Z. perennis, Z. diploperennis and Z. lusurians

B. Forages = 81 species (29 forage crops)

SN	Forage	नेपाली	Genus	Species
Legume forages				
1.			Astragalus	chinensis
2.			Astragalus	cicer
3.			Astragalus	arenarius
4.	Sword bean	तरवारे सिमि	Canavalia	ensiformis
5.			Coronilla	varia
6.			Hedysarum	coronarium
7.			Lathyrus	ciera
8.			Lathyrus	ciliolatus
9.			Lathyrus	hirsutus
10.			Lathyrus	ochrus
11.	Sweet pea	केराउफुल	Lathyrus	odoratus
12.	Grass pea, chckling vetch jarosse	खेसरी	Lathyrus	sativus
13.			Lespedeza	cuneata
14.			Lespedeza	striata
15.			Lespedeza	stipulacea
16.		नखर सिम्वी	Lotus	corniculatus
17.			Lotus	subbiflorus
18.			Lotus	uliginosus
19.			Lupinus	albus
20.			Lupinus	angustifolius
21.			Lupinus	luteus
22.			Medicago	arborea
23.	Yellow Lucerne, falcate Lucerne, yellow clover	भिरिन साग, कोते मान्द्रो	Medicago	falcata
24.			Medicago	sativa
25.			Medicago	scutellata
26.			Medicago	rigidula
27.			Medicago	truncatula
28.			Melilotus	albus
29.			Melilotus	officinalis
30.			Onobrychis	viciifolia
31.			Ornithopus	sati vus
32.			Prosopis	affinis
33.			Prosopis	alba

SN	Forage	नेपाली	Genus	Species
34.			Prosopis	chilensis
35.			Prosopis	nigra
36.			Prosopis	pallid
37.	Tropical kudzu	कडुजु धास, विदारि लहरो	Pueraria	phaseoloides
38.			Trifolium	alesandrinum
39.			Trifolium	alpestre
40.			Trifolium	ambiguum
41.			Trifolium	angustifolium
42.			Trifolium	arvense
43.			Trifolium	agrocicerum
44.			Trifolium	hybridum
45.			Trifolium	incarnatum
46.			Trifolium	pretense
47.	White clover, ladino	प्याउलि, बेउलि	Trifolium	repens
48.			Trifolium	resupinatum
49.			Trifolium	rueppellianum
50.			Trifolium	semipilosum
51.			Trifolium	subterraneum
52.			Trifolium	vesiculosum
Grass forages				
1.			Andropogon	gayanus
2.			Agropyron	cristataum
3.			Agropyron	desertorum
4.			Agrostis	stolonifera
5.			Agrostis	tenuis
6.			Alopecurus	pratensis
7.			Arrhenatherum	elatius
8.			Dactylis	glomerata
9.			Festuca	arundinacea
10.			Festuca	gigantea
11.			Festuca	heterophylla
12.			Festuca	ovina
13.			Festuca	pratensis
14.			Festuca	rubra
15.			Lolium	hybridum
16.			Lolium	multiflorum
17.			Lolium	perenne
18.			Lolium	rigidum
19.			Lolium	temulentum

SN	Forage	नेपाली	Genus	Species
20.			Phalaris	aquatica
21.			Phalaris	arundinacea
22.			Phleum	pratense
23.			Poa	alpine
24.			Poa	annua
25.			Poa	pratensis
26.			Tripsacum	laxum
Other forages				
1.			Atriplex	halimus
2.			Atriplex	nummularia
3.			Salsola	vermiculata

Annex 2. Nepal Annex-1 Crops included under MLS (First list in 2017)

A. Food crops

SN	Nepalese Name	Common Name	Scientific name	Accessions
I.	**Safety duplicated accessions**			522
	Makai (**मकै**)	Maize	Zea mays L.	122
	Dhan (**धान**)	Rice	Oryza sativa L.	400
II.	**Released varieties**			**85**
	Jau (**जौ**)	Barley	Hordeum vulgare L.	2
	Bhanta (**भण्टा**)	Brinjal	Solanum melongena L.	1
	Chana (**चना**)	Chickpea	Cicer arietinum L.	3
	Bodi (**बोडी**)	Cowpea	Vigna unguiculata (L.) Walp.	2
	Kodo (**कोदो**)	Finger Millet	Eleusine coracana Gaertn.	2
	Masuro (**मसुरो**)	Lentil	Lens culinaris Medik.	2
	Makai (**मकै**)	Maize	Zea mays L.	12
	Jai (**जै**)	Oat	Avena sativa L.	6
	Kerau (**केराउ**)	Pea	Pisum sativum L.	2
	Mula (**मुला**)	Radish	Raphanus sativus L.	2
	Tori (**तोरी**)	Rapeseed	Brassica campestris (L.) var. toria Dutch	1
	Dhan (**धान**)	Rice	Oryza sativa L.	27
	Gahu (**गहुँ**)	Wheat	Triticum aestivum L.	23
Total				607

B. Forage crops

Nepalese Name	Common name	Scientific name	Accessions	Remark
Khesari (खेसरि)	Grass pea	Lathyrus sativus L.	1	
Bhirin Sag, Kote Mandro (भिरिन साग, कोते मान्द्रो)	Yellow Lucerne, Yellow Clover	Medicago falcate L.	1	
Lucerne (लुसर्न)	Lucerne (Alfalfa)	Medicago sativa L.	1	
Berseem (बरसिम)	Berseem	Trifolium alexandrinum L.	1	Released
Rato Clover (रातो क्लोभर)	Red Clover	Trifolium pratense L.	1	
Pyauli, Beuli (प्याउलि, बेउलि)	White Clover, Ladino	Trifolium repens L.	1	Released
Rye Ghas (राइ घाँस)	Rye Grass	Lolium perenne L.	1	Released
Total			**7**	

Total crops: 20; Food crops varieties 607 + Forage crops varieties 7=614

Annex 3. Nepalese APGRs conserved in foreign national genebanks and institutes including CG banks

Holder	Accession, n
National genebank database from EUROSIA	
Austria	3
Azerbaijan	2
Belarus	1
Belgium	1
Bulgaria	7
Czech Republic	17
Germany	1041
Greece	1
Hungary	7
Netherlands	639
Nordic Countries	8
Poland	5
Romania	8
Russian Federation	228
Spain	3
Ukraine	36
United Kingdom	1513
AVRDC	850
Japan database from NIAS	4136
Institute database from GENESys	
International Rice Research Institute	2672
International Centre for Agricultural Research in Dry Areas	1391
Department of Applied Genetics- John Innes Centre- Norwich Research Park	1308
International Crop Research Institute for the Semi-Arid Tropics	1050
National Small Grains Germplasm Research Facility- USDA-ARS	1034
Genebank- Leibniz Institute of Plant Genetics and Crop Plant Research	1034
Asian Vegetable Research and Development Center	848
Centre for Genetic Resources- the Netherlands Plant Research International	628

Holder	Accession, n
North Central Regional Plant Introduction Station- USDA-ARS- NCRPIS	395
Centro Internacional de Mejoramiento de MaÃz y Trigo	241
N.I. Vavilov All-Russian Scientific Research Institute of Plant Industry	228
Plant Genetic Resources Conservation Unit- Southern Regional Plant Introduction Station- University of Georgia-USDA-ARS	168
Western Regional Plant Introduction Station- USDA-ARS-Washington State University	151
Millennium Seed Bank Project- Seed Conservation Department- Royal Botanic Gardens- Kew- Wakehurst Place	137
Soybean Germplasm Collection- USDA-ARS	109
Welsh Plant Breeding Station- Genetic Resources Unit-Institute of Grassland and Environmental Research	51
Institute of Plant Production n.a. V.Y. Yurjev of UAAS	24
Northeast Regional Plant Introduction Station- Plant Genetic Resources Unit- USDA-ARS- New York State Agricultural Experiment Station- Cornell University	23
National Clonal Germplasm Repository USDA- ARS	21
Dale Bumpers National Rice Research Center- United States Department of Agriculture- Agricultural Research Services	20
International Livestock Research Institute	18
Genebank Department- Division of Genetics and Plant Breeding- Research Institute of Crop Production	17
Botanical Garden- University of Nijmegen	11
Centro Internacional de Agricultura Tropical	11
University of California	10
Botany Department- University of California	10
Ustymivka Experimental Station of Plant Production	10
Nordic Genetic Resource Center	8
Institute for Plant Genetic Resources 'K.Malkov'	7
Institute for Agrobotany	7
West African Rice Development Association	6
Fruit Laboratory- USDA- ARS Plant Germplasm Quarantine Office	5
Plant Breeding and Acclimatization Institute	5

Holder	Accession, n
Warwick HRI Genetic Resources Unit	5
SuceavaGenebank	5
International Institute of Tropical Agriculture	3
External Branch North of the Department Genebank- IPK-Potato Collection in Gross-Luesewitz	3
External Branch North of the Department Genebank- IPK- Oil Plants and Fodder Crops in Malchow	3
AGES Linz - Austrian Agency for Health and Food Safety / Seed Collection	3
National Arboretum-Germplasm Unit- USDA/ARS	2
Subtropical Horticultural Research Unit- National Germplasm Repository - Miami- USDA	2
Ornamental Plant Germplasm Center- Ohio State University	2
Junta de AndalucÃa. InstitutoAndaluz de InvestigaciÃ³n Agroalimentaria y Pesquera. Centro de InvestigaciÃ³n y FormaciÃ³n Agroalimentaria CÃ³rdoba	2
Genetic Resources Institute	2
Crop Germplasm Research Unit USDA- ARS	1
Plant Genetic Resources Unit- Cornell University- New York State Agricultural Experiment Station- USDA- ARS	1
Nottingham Arabidopsis Stock Centre	1
DiputaciÃ³n General de AragÃ³n. Centro de InvestigaciÃ³n y TecnologÃaAgroalimentaria. Banco de Germoplasma de HortÃcolas	1
Podil's'ka State Agrarian-Technical Academy	1
Institute of Volatile Oil Bearing and Medicine Crops	1
Research Institute for Cereals and Technical Plants Fundulea	1
Agricultural Research Station Suceava	1
Medicinal and Aromatic Plants Research Station Fundulea	1
Federal Research Centre for Cultivated Plants - Institute of Horticultural Crops and Fruit Breeding	1
National Botanical Garden of Belgium	1
Belarus Research Institute of Arable Farming and Fodders	1
Total	**20208**

Source: https://www.genesys-pgr.org/welcome

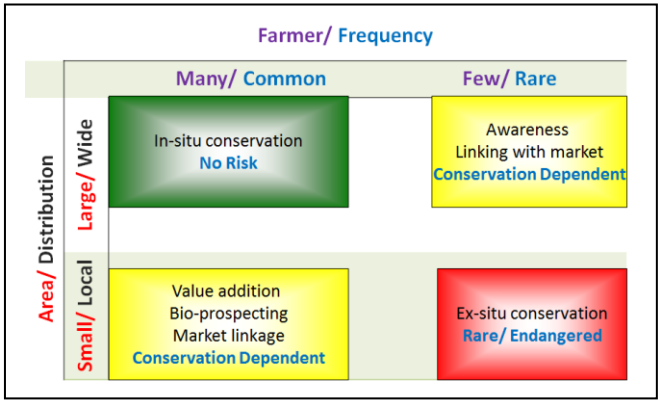
Annex 4. Conservation Programs

CONSERVATION PROGRAMS

Efforts should be made in coordination with all relevant stakeholders. Minimum inputs should be provided to crops that are considered for conservation. Enabling environment should be created in such way that crop diversity can interact with biotic and abiotic stresses. Followings are the programs that need to initiate at local, regional and national levels for conservation of APGRs.

i. **Development of landraces catalog**: Listing of local APGRs with traits and photos are the preliminary work for initiation of conservation. Existing landraces in the command areas of DADO and NARC stations should be collected, catalogued and published. Landraces catalog is necessary to develop as district crop profile. Three types of APGRs eg cultivated (introduced and landraces), crop wild relatives and wild edible plants should be listed separately. Format developed by NAGRC could be used.

ii. **Identification of rare and unique landraces**: Red listing of APGRs is necessary to prioritize the conservation work. Lapsi, Siplikan, olive tree and Tatelo are threatened tree species in mountain of Nepal (GoN/MoFSC 2014). Landraces could be grouped in different categories through focus group discussion. After identifying rare and unique landraces (simple methods of identifying rare and unique landraces are sketched in **Figure** 8), they should be collected immediately and conserved either in seed bank of the National Genebank or in the field genebank. Unique landraces can be used in breeding as well as distribution to other farmers for general cultivation.



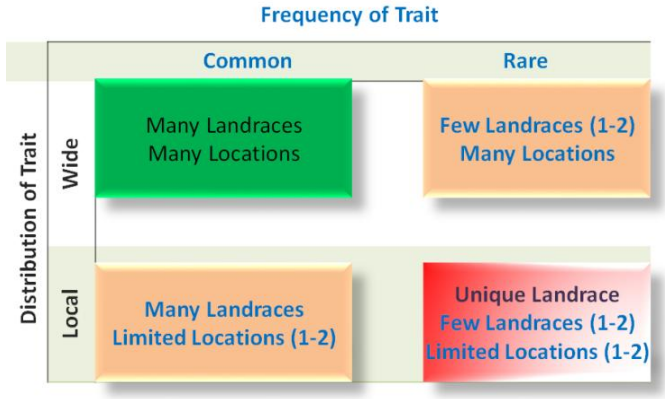


Figure 8. Grouping of landraces based on the distribution (above) and identification of unique landraces (below). Joshi et al (2016).

iii. **Diversity mapping**: DADO and research stations should have map of landraces diversity existed in their command areas. Diversity may be in terms of name given by farmers, intra and inter species of crops as well as diversity of functional traits of the given crops.

iv. **Diversity fairs of local crops**: Organizing diversity fairs based on the agro-ecozones help understand the diversity maintained by farmers. It is useful to collect crop diversity, to document diversity, to exchange germplasms and to initiate further conservation works eg community seed bank, community field genebank and household genebank. Incentive for those who have exhibited maximum diversity should be provided in such fairs.

v. **Diversity blocks**: Growing different landraces and varieties in some target environments is good strategy to provide opportunity to farmers for selection, observation and matching diversity during visit and interaction with them. This can be done in farmers' field where one can identify analog sites (GIS) to distribute/ introduce/ to maintain diversity blocks.

vi. **Diversity kits**: Simply distributing single crop to the farmers is not good strategy for conservation. Kits consisting of different landraces, varieties including best landraces in the district should be distributed as IRD, mini kit, PVS or FFT. Seeds of best landrace can be with large amount and others with little.

vii. **On-farm conservation village**: Some village where maximum crop diversity exist can be consider as model village for on-farm

conservation. Different activities can be implemented with the community in on-farm village.

viii. **Diversity field school**: This is a part of the farmers' field school, where use and importance of diversity rich solution /Intra-specific diversity are discussed. This brings awareness on the benefit of growing and maintaining diversity. One can organize diversity field school in cultivar mixture trials and similar activities can be done with other conservation programs. Different farmers' friendly materials can be developed and distributed to the farmers in such events.

ix. **Collection and conservation**: Exploration and collection missions can be organized regularly. Collections should be made before distributing any new varieties so that landraces will not be lost due to introduction of new variety. Collections of orthodox seeds should be sent to Genebank and non-orthodox to field genebank. Integration of landraces in formal seed supply system support to conserve landraces. Collection map and gap analysis should be generated regularly for designing collection mission.

x. **Rescue mission (rare)**: Many landraces are in endangered condition. Rare landraces should be identified from the command areas. Rescue mission for such landraces as well as from endangered locations should be organized to collect and to send to Genebank (orthodox in seed bank and non-orthodox in field genebank).

xi. **Field genebank**: Field genebank is very important to establish in different locations for conservation of non-orthodox crop species. There are different types of field genebank eg community field genebank (maintained by community in community land), community mango orchard (orchard maintained and managed in public land by the community), school field genebank (maintained in school), DADO field genebank (maintained around office), village level field genebank (maintained different landraces involving whole community in their private land). Recalcitrant crops eg citrus, mango and crops that do not produce seed eg banana can, palms also be maintained around the offices or along the road sides. Crop landraces available in the command areas should be listed, collected and maintained in the field genebank. Database of both passport and characterization should also be developed and maintained.

xii. **Crop specific parks**: Crop Specific Park is very useful for maintaining diversity as well as getting economic benefit. Such parks can be established in different locations eg school, offices, community forest

etc. Generally non-orthodox and perennial types of crops are useful for developing parks eg potato park, sugarcane park, etc.

xiii. **Community seed bank and seed network**: CSB is very useful to make farmers access to local crop diversity. Only orthodox crops can be maintained in CSB. This is also a platform for display of crop diversity, traditional tools and knowledge. CSB can multiply and sale any important landraces. If landraces are not good or not preferred by farmers, these can be sent to National Genebank for long term conservation.

xiv. **Household genebank**: Farmer who is rich in agro-biodiversity (also called custodian farmer) generally maintain orthodox and non-orthodox crop species. Such method is called household genebank which is consisted of household seed bank and household field genebank. Farmer with genebank mind should be awarded and linked with National Genebank and research stations. Agro-biodiversity rich farmers (custodian farmers) should be identified and profile of such farmers along with landrace diversity based on the different agro-ecozones should be published.

xv. **Characterization and naming**: Crop diversity needs to be characterized for effective management and utilization. Using local and national descriptors, collections can be characterized in field genebank, in diversity block and in farmers' fields. If landrace does not have name, it should be given name in consultation with farmers. Documentation including introduced year/ location is necessary for grouping under local or landrace. During the process, one can identify useful landraces at district level, can compare with released ones. Passport data of each collection should be developed. Standard format needs to develop for characterization.

xvi. **Landraces enhancement and conservation (LEC)**: Farmers do not grow any landraces if it does not have economic value. Simply employing participatory method of selection, landraces can be improved so that farmers continue growing them. This conservation is through utilization and in some cases; it should be linked with research stations for further genetic improvement. Potential landraces in the communities can be distributed in wider scale as mini kit, IRD, PVS or diversity kit. Addition of value to such landrace ensure them to continue growing by farmers.

xvii. **Collaboration with relevant stakeholders for crop wild relatives and wild edible plants**: Crop wild relatives and wild edible plants should be conserved as well collaborating with different stakeholders eg

stakeholders involved in protected areas, religious places, etc. This is a strategy of in-situ conservation. Documentation and locating such plants in in-situ are the initial step. Awareness should be created along with farmers' friendly materials. Plant population should be regularly monitored to know the status.

xviii. **Herbarium and photo album**: Maintenance of herbarium of seed/ fruits trees and crops are very useful to demonstrate the diversity and help in their identification. Photo album of whole plants, inflorescence, fruits and seeds should also be maintained as a part of district crop profile. Each district and office can develop such album.

xix. **Geographical indicators**: Some landraces can be produced with better quality growing them only in particular location, ie quality or particular functional traits linked with geo-location. Identification of such landraces and sites are necessary so that landrace can be used as geographical indicator. Farmers residing in such location can be benefited. There may be many locations that have potential to produce specific valuable landraces which needs detail survey and study.

xx. **Development of ownership documents for important landraces**: Community or farmer/s maintaining particular landraces should be identified that can be useful for benefit sharing. Supporting documents for ownership are archeological and historical evidences, phenotypic and genotypic data, finger print, distinct forms developed site and its maintenance and use by locals including cultural values. Registration is also equally important in National Seed Board for a landrace or variety to bring to commercial purpose and conservation thereof.

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