**Biodiversity Conservation: Maintenance and their Use in Agriculture**

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**Abstract:**

The aim of this book chapter is to aware a growing researcher and farmer of the concept behind the conservation of the plant genetic resources, their maintenance, and use in the further improvement program. Despite these, diversity also improves soil health and the dynamic equilibrium of the agro-ecosystem. To review the current status of agricultural biodiversity, identify gaps in our information base, and propose future research and development actions, diversity knowledge is required. The common goal is to boom the sustainable use of biodiversity in improving humans’ well-being and food and dietary security. The series scope is all components of agricultural biodiversity, starting from conservation biology of genetic assets to aware the farmers through agriculture extension sports, social sciences policy, and criminal components. Crop range presents the farmers with an extra choice within the production of a selection of vegetation in a given place to make bigger production-associated sports on numerous vegetation and also to convey down the feasible hazard in agriculture. It also covers the fields of research, information management extension education, communication and coordination, and knowledge sharing with the grower. It enables the farmers to grow surplus merchandise for sale at the marketplace and as a consequence enables to gain improved earnings to meet the opposite wishes associated with household nicely-being. Plant genetic resources are the important thing aspect of any agricultural production system and economic development and play a sizable position in global food safety. They underpin the capability of agriculture to cope with climate change and socio-economic conditions and enhance the use of bundles of variability “landraces cultivar” by their conservation and use. Biodiversity conservation is an important formula to conserve their natural agricultural biodiversity to achieve sustainable agriculture production improve the livelihood of growing farmers and global food security.

Keywords:Biodiversity, plant genetic resources, germplasm conservation

**Introduction:**

Plant Genetic Resources (PGR) are naturally available plant genetic material that has potential value to cope with this changing climate scenario and meet the food demand of the growing population. They consist of a large number of variables within the plants that leads to natural and human selection. They provide the raw material (genes) as germplasm or their wild relatives which are utilized to produce new and improved plant varieties and are an irreplaceable source of such characteristics *viz.* disease and pest resistance, adaptation, and high yielding with improved nutritional factors. Plant genetic resources are now and will continue to be used in the future, of inestimable value independently of whether breeders use them by employing conventional plant breeding and modern genetic engineering or non-conventional methods. The erosion of these plant genetic resources threatens to world food security. PGRs are a limited and perishable component of biodiversity. Some aspects in recent years have been causing rapid and extreme plant genetic erosion *viz.* uses of new technologies, the replacement of local or landraces varieties with improved ones, deforestation, and grazing, changes in crop cultivation methods, etc. This affects each cultivated species and masses of wild ones which have direct, oblique, or capacity for agricultural use. The erosion of these genetic assets should cause the extinction of precious material which has not but been exploited within the future. To maintain to boom the crop production and nutritional quality of food lies via the safety and green utilization of herbal plant genetic resources; this calls for their conservation, evaluation, documentation, and change. The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) becomes active on 29 June 2004 it becomes effective. This Treaty offers a framework for the international community to collaborate on issues like agrobiodiversity management, climate change adaptation, and food security while always keeping in mind the needs of farming communities, the hungry and underprivileged, and their right to food. For the sharing of all crop germplasm, the ITPGRFA supports a standard material transfer agreement. ITPGRFA is a thorough international agreement that supports Convention on Biodiversity (CBD). Through the protection, exchange, and sustainable use of PGR for food and agriculture around the world, ITPGRFA seeks to ensure food security (PGRFA). The Global Action Plan (GPA) supports ITPGRFA and CBD.

As a defence against a well-known unpredictable future, there are commitments needed to preserve and use this content. PGFRA, or plant genetic resources for food and agriculture, is the source of the raw materials used by farmers and plant breeders to increase the quality and production of crops. The promotion of the utilisation of genetic resources for commercial purposes and as a component of biotechnology are some of the key reasons for conservation in order to ensure the future adaptation of elite lines and wild relatives. Additionally, it protects the existing natural diversity employed in crop breeding programmes as well as the information and qualities necessary to guarantee sustainable agriculture output.

More than ten thousand years ago, PGR was used for the first time. The genetic diversity seen in wild species and landraces was used by farmers to create superior cultivars with high yield. To maintain each species' wide-ranging genetic variety and the capacity to use it in a hybridization programme to produce variability rather than selection, it is necessary to protect wild germplasm and landraces.

**Some institutes at the global and national levels related to plant genetic resources-**

IBPGR (International Board for Plant Genetic Resources) managed the germplasm or plant genetic material at the international or global level, it was established in headquarters in **Rome, Itlay**. IBPGR is an international scientific organization under the aegis of the Consultative Group on International Agricultural Research (CGIAR) established in 1974. In 1991 IBPGR changed into IPGRI (International Plant Genetic Resources Institute). At the end of 2006, INIBAP (International network for the improvement of Banana and Plantain) & IPGRI jointly adopted the name Biodiversity International. At the national level NBPGR (National Bureau of Plant Genetic Resources) managed plant genetic resources**.** It was established in 1976 with its headquarters in **New Delhi.**

CBD known informally as the biodiversity convention is a multilateral treaty. It is an agreement between countries based on natural and biological resources. The convention was opened for signature at the Earth Summit in Rio de Janeiro on 5 June 1992 and enforced into 1993. The convention has three main goals including the conservation of biological diversity, sustainable use of its components, and equitable sharing of benefits arising from genetic resources

**Some important points:** Naturally existing biodiversity is14 million spp. of plants expected by CBD and Estimated plant spp. around 0.33 million among that Described plant spp. Are 0.27 million.No. of mega-diverse countries are 17 among the world. Plant diversity found in India is 11.8 % among the 33% endemic plant species and 49 endemic crops are found in India.There are326 wild relatives of cultivated crops. TheGrassy stunt virus-resistant varieties of rice developed from *Oryza nivara.*The wild progenitor of the cultivated rice (Oryza *sativa*) is *Oryza nivara*is, it *is collected* from the Gonda district of Uttar Pradesh.There are427 endangered plant species listed by BSI (Botanical Survey of India), Kolkata. 141 genera belonging to over 47 families are endemic in India (Higher plants)**.** Highest endemism in India: Himalayan > Peninsular region>Andaman& Nicobar**.** India holds half of the world's aquatic floral diversity

**Some steps were taken by Govt. to conserve natural genetic resources:**

Biodiversity bill passed in Rajyasabha in 2002. Govt. Set up a board this is Biodiversity board placed in New Delhi and the Biological Diversity Act turned into surpassed in 2002. The biological diversity Authority was established in ChennaiNorthern hemisphere is rich in agro-biodiversity while the southern hemisphere is poor in the world. Agrobiodiversity hotspots in the country = 22.First gene bank in 1940’s Saint Petersburg (now Leningrad) in Russia 40,000 seed samples at a stated time.

* NBPGR is a nodal agency for a single window exchange.
* The national gene bank was established in India at NBPGR in 1983.
* National gene bank was established in the USA at NBPGR in 1958.
* The national gene bank was established in Ghana at NBPGR in 1964.
* The national gene bank was established in Japan at NBPGR in 1966.
* National gene bank was established in Canada, Germany, and Italy at NBPGR in 1970.
* The national gene bank was established in Poland at NBPGR in 1971.
* The national gene bank was established in Turkey at NBPGR in 1972.
* Sec- 41 leads to the promotion of conservation sustainable use and documentation of biodiversity at the local level.
* PPVFRA stands for Protection of Plant Variety and Farmers Rights Act. PPVFR Act – 2001, turned into enacted to provide for the status quo of an powerful device for the protection of plant range, and the rights of farmers and plant breeders. It is encouraging the development and cultivation of latest sorts of flora. PPVFR rules were notified in 2003. PPVFR **Authority** was established in 2005. PPVFR regulation was notified in 2006. Headquarters of PPVFR Authority in New Delhi. PPVFR Act covered 18 species of 14 crops. The period for protection given for trees and vines crops under PPVFR Act 2001 is 21 years. The period for protection given for crops under PPVFR Act 2001 is 18 years.
* A variety that is released and granted a certificate of plant variety protection under the legal status of a given country is referred to as a protected variety. The right is granted by the govt. to a plant breeder to exclude others from producing or commercializing the propagating material of that variety for a minimum period of 15-20 years is known to plants breeder’s right. The right is granted by the govt. to an inventor to exclude others from imitating, manufacturing, using, or selling the invention in question for commercial use during the specified period is called a patent.
* The researcher’s right under PPVFRA is given in section 30.
* No. of Agro biodiversity hot spots identified by the PPVFR Authority was 22.
* The nodal agency for implementing the PPVFR Act is the Ministry of Agriculture, GOI.
* The chairman of PPVFR Authority is Dr. K.V. Prabhu in 2020-21.
* Plant Variety Journal of India is published bimonthly by PPVFR Authority.
* Protection of Plant Variety and Farmer's Rights Act protects farmers and plant variety.
* PPVFRA Bill (2001), Act is based on benefit sharing and compensation to farmers.
* CBD 29 December 1993 FIRST legal mechanism dealing with biodiversity.
* IUPGR stands for International Undertaking on Plant Genetic Resources, 1983.
* Material Transfer Agreement (MTA) issued by CBD in Bonn guidelines.
* To access the genetic resources CBD Article 15 is established.
* For incentive measures CBD Article 11
* To in-situ conservation CBD Article 8(j)
* CBD Article 15.7 to benefit sharing with parties
* CBD Article 10(c) sustainable use of a component of biological diversity.
* CBD Article 16 for Access to and transfer of technology.
* CBD Article 19 for the handling of biotechnology and distribution of its benefits.
* CBD Article 20& 21 for financial resources and mechanism.
* CBD Article 22 for the relationship with other international connections.
* SMTA (standard material transfer agreement) released by ITPGRFA.
* SMTA is applicable for 64 crops in annexure-1.
* Any variety having (GURT- Genetic Use Restriction Technology) is barred from IPR protection in India.
* 4thInternational technical conference on PGR hosted by FAO at Leypzip, Germany, 1996.
* SAARC stands for South Asian Association for Regional Cooperation is established in Dec. 1985 with headquarters in Kathmandu (Nepal). It is an association of south countries in which Bangladesh, Bhutan, Nepal, Pakistan, Maldives, Srilanka, and Afghanistan added as a member of SAARC. The purpose of this organization is the development of member states in respect of collective, economic, technical, social, and cultural.

WTO (World Trade Organization) was set up on 1 January 1995, with headquarters- in Geneva, Switzerland. It is regulating the global exchange between nations. The outcome of the failure of negotiating governments ITO (International Trade Organization) become GATT. The first discussion of GATT changed into at some point of the United Nations Conference on Trade and Employment. After this, the signature of 123 countries in Marrakesh on 14, April 1994 of the Uruguay Round Agreements mounted the World Trade Organization. It is the successor to the GATT.

Geographical Indications of Goods (Registration and Protection), Act exceeded in 1999. GI Act is a sui generis Act of the Parliament of India for the safety of geographical indication in India.GI Tag guarantees that none aside from the ones registered as legal customers are allowed to use famous product names. Darjeeling tea have become the first GI Tagged product in India in 2004-2005, for the reason that then 323 items were added to this list. Initially, GI Tag has registered for 10 years length after this it can be renewed. Geographical Indications of Goods, Rules got here in 2003. Recently, in 2017 GI Tag became given by way of the Andhra Pradesh authorities to the Banganpalle mango variety. This range is known for its sweetness.

**Components of PGR**

Collections of genotypes or populations from cultivars, genetic stocks, wild species, etc. that are maintained as seeds, plants, tissue cultures, populations in the wild, or populations on farms are known as crop germplasm collections. Functionally, PGR includes crop plant relatives that are weedy or wild, improved/advanced cultivars, and landraces (either non-domesticated or domesticated). Although landraces still function as genetic reserves, they are quickly disappearing as more modern cultivars take their place. Advanced (current and obsolete) cultivars are resources that should be protected because they may be valuable to future breeders. Important sources of disease and pest resistance, as well as physiological adaptations not present in domesticated species relations, can be discovered in the wild and weedy relatives of crop species. The preservation of each of these is important to humanity because they are all gravely endangered with extinction. In general, changes made in response to farming have altered the genetic diversity in cultivated plants, which is derived from wild ancestor species. The changes also take into account the environment's physical, biological, cultural, and socioeconomic elements. The very unique nature of various settings has led to this domestication's many "ecospecific" adaptations, which have led to the emergence of landraces that are adapted to local environments.

**Germplasm Activities**

There are six important major actions related to plant germplasm:

1) Exploration and collection,

2) Conservation,

3) Evaluation,

 4) Documentation,

5) Distribution, and

 6) Utilization.

**Exploration and Collection:** Collection trips and collections that involve exploring the genetic diversity from numerous sources and gathering them all in one location make up exploration. Exploration is the process of seeking out new knowledge or resources. Exploration is a behaviour shared by all non-sessile animal species, including humans. It is an intriguing topic of study that has in the distant past drawn a sizable number of adventurers, naturalists, travellers, and plant hunters.

**Sources of Collection:** There are following five major sources of germplasm collections: viz., 1) Gene banks, 2) Centre of diversity, 3) Gene sanctuaries, 4) Farmer fields and 5) Seed companies. Furthermore, collections can be done through local exploration trips to the crop diversity. Among that some are explained here.

**Gene Banks**: Genetic resources are preserved via gene banks. The most fundamental job of a gene bank is to maximise a fresh sample's vitality while maintaining its quality. The samples, also known as accessions, are monitored to make sure they aren't deteriorating. Regeneration is a crucial part of gene bank activities. Plant samples must be regularly grown out, given time to regenerate, and then harvested for new seed because they will eventually deteriorate even under the best conservation conditions. To preserve and revitalise genetic resources, gene banks must first collect them. Gene banks aren't just there to keep genetic resources safe; they're also there to make sure that they're utilised, whether that's through breeding programmes, research facilities, or farmer's fields. To accomplish this, it is crucial to check that the collections are appropriately defined and recorded, and that the needed material is available. The information systems used by gene banks are becoming more and more important to researchers and breeders seeking information on the distribution of crops and their wild relatives. The Tropical Botanical Garden & Research Institute (TBGRI), Palode, and TVM for medicinal plants and spices. The National Bureau of Plant Genetics Resources, New Delhi, for crop plants and medicinal plants. For medical plants and spices, there is the Central Institute for Medical & Aromatic Plants (CIMAP) in Lucknow, as well as an animal research facility called the Central Drug Research Institute.

**Wildlife Sanctuaries:** As long as they don't have a detrimental effect on the wellbeing of the animals, human activities including wood harvesting, obtaining minor forest products, and private property rights are allowed in sanctuaries. A sanctuary is a place that is strictly protected and dedicated to the preservation of animals. The boundaries of sanctuaries are not clearly defined, and tourism and other forms of controlled biological intrusion are permitted.

**Merits and Demerits of Exploration and Collection of Germplasm**

Merits:

1. Collection aids in exploring crop genetic diversity and bring together in one place.
2. It decreases the loss of genetic material due to genetic erosion.
3. Sometimes, we get desirable genetic sources during germplasm exploration trips.

Demerits:

1. Collection of germplasm especially from other countries, sometimes there is a danger to the entry of new diseases, new insects, and new weeds.
2. In remote areas, the collector sometimes has an encounter with animals like elephants, rhinos, tigers, lions, and snakes which involve life.

The collection is a tedious job. The collection of germplasm has to be done generally from uncultivated areas like hills, mountains, river valleys, and forests, where the collector faces many problems *viz.* boarding, lodging, and transportation. Transportation of huge collections also faces difficulties in the exploration and collection.

**Table: 1 some important germplasm world collection**

|  |  |
| --- | --- |
| **Germplasm world collection** | **Crop** |
| Senegal | Groundnut  |
| Beltsville, USA | Small grain crops |
| Cambridge, U.K. | Potato  |
| Florida  | Sugarcane  |
| Ethiopia, Africa | Coffee |
| New Zealand | Sweet potato |

The major activities of germplasm enhancement may be summarized as follows:

* Preventions of genetic uniformity lead to reduce genetic vulnerability.
* Increasing yield in major world food crops *viz.* rice, wheat, and sorghum, were accomplished through introgression of unadapted desirable genes (e.g., dwarf genes).
* To introduce new and desirable quality traits (e.g., starch, protein).
* Introgression of disease-and insect-resistance genes.
* To introduce new environment-resistance genes (e.g., drought resistance).

**Centre of origin:** Areas that played a role in the emergence or diversification of a certain species or population are commonly referred to as "Centers of Origin." The starting point is the location where a group of organisms, both domesticated and wild, first developed their distinctive characteristics.  Vavilov initially identified a region of the world as a Vavilov Centre (1926), also known as the Vavilov Centre of Diversity, as an actual hub for the domestication of plants. A theory was suggested by Vavilov at the locations where cultivated plants were first created. He claimed that domestication of plant life did not occur randomly around the globe but rather in specific locations.

• Primary center of origin: crop plants originated from more diverse wild species found in the region.

• Secondary centre of origin: while not being the primary source, some regions exhibit a significant diversity of forms.

**Eight main and 3 sub-centre of origin were originally proposed by Vavilov in 1926:**

1. China
2. Hindustan
* Indo –Burma
* Malaya java
1. Asia Minor
2. Central Asia
3. Abyssinia
4. Mediterranean region
5. South America
* Peru
* Chile
* Brazil -Paraguay
1. Central America

**Note:** USA centre of origin also consider as a centre of origin, newly.

**Germplasm conservation:**

In situ and ex-situ preservation of germplasm are the two main methods.

***In situ* conservation:**

In this strategy, plant genetic resources are safeguarded in their natural habitat or on the origin site. It refers to the preservation and restoration of populations of species in their native habitats and, in the case of domesticated or cultivated species, in the contexts where their distinctive qualities have originated. It also clearly refers to the preservation of natural habitats and ecosystems. It can also be described as conservation taking place naturally or ordinarily within a species' natural range. For instance, natural parks, sanctuaries, and reservoirs.

***Ex-situ* conservation:**

 In Ex-situ conservation, germplasm doesn't preserve within the natural locations of starting place however below the supervision of breeders at expert websites called germplasm or gene banks. Ex-situ conservation method, "Off-site conservation". It is the technique of keeping an endangered plant or animal via disposing of a part of the population from a habitat that is in hazard and moving it to an exclusive area, which may be in the wild or below human supervision. Ex-situ conservation includes both more modern, really contentious laboratory strategies in addition to a number of the oldest and most famous conservation strategies. The established system of gene banks, which includes genetic sources facilities, zoos, botanical gardens, lifestyle collections, and many others, is used to carry out ex-situ conservation, which uses sample populations.

Ex-situ conservation serves many purposes, including the rescue of threatened genetic material, creating research materials for conservation biology, increase the amount of germplasm for storage in various types of ex situ facilities, provide materials for diverse uses to ease or lessen the pressure of wild amassing, grow the species with recalcitrant seeds that can't be kept in a seed store; material made to order for conservation education and display; create materials for management, habitat restoration, reinforcement, and reintroduction.

Depending on the lifetime of seeds or on their viability during storage, seeds can be categorised into two groups;

1. **Orthodox Seeds:** These seeds can be dried to a 5% or underneath five % moisture content without lack of their seed viability. These are frost-resistant and lengthy-time period saved seeds. Mostly orthodox seeds come from annual temperate crop species viz. Wheat, rice, barley, pearl millet, different cereals pulses, and oil seed vegetation. They contain moisture content material of 30–50% at physiological maturity at the time of maturity.
2. **Recalcitrant Seeds:** Recalcitrant seeds are short-term stored seeds that cannot be safely dried to a moisture level below 30%. These can't survive colder temperatures and are challenging to maintain because of their high moisture content, which encourages microbial infection and causes seeds to lose viability quickly. They are made up of fruits and the seeds from plantation crops including cocoa, coffee, and coconut.

**Types of germplasm collections**

Plant genetic resources are maintained by four types-

**Base collections:** These collections are kept in long-term storage arrangements rather than being assigned to researchers. The term "predominant collections" or "a wholeseries of genetically diverse species" is used to describe them. It keeps the germplasm in its original state. Depending on the species, germplasm is stored at lower humidity + 5%, temperatures (10–18°C), or cryogenic (150–196°C). Materials can be kept for many decades in the proper conditions.

**Backup collections**: It is responsible to supplement the base selection. It is a duplicate collection to ensure provides germplasm whenever disaster comes.

**Active collections:** Plant breeders are given access to active collections for research purposes. These are preserved at temperature below 15°C (often near 0°C), have an 5% moisture content, and are used for 10 to 15 years. These collections are utilised for dissemination, reproduction, and evaluation.

**Breeders or working collections**: The working collection is of utmost importance for plant breeders in the crop improvement program. Breeder's or working collections are known for short-term storage for 3-5 years and it stored at less than 15°C and preserve at low moisture content +10%

A core collection consists of a set of the minimum number of accession that together represents the genetic diversity of the concerned crop and its wild relatives. Therefore, each accession in a core collection is to some extent, representative of several accessions in the gene bank. However, a core collection should not replace the original collection.

**Gene pool concept:**

**Primary gene pool (GP1)**:

* It includes strains of the species in which hybridization between the GP1 is easy without any difficulty and resultant F1 hybrids are generally more vigorous than parents. They show normal meiotic chromosome pairing, normal gene segregation, and complete seed fertility.

**Secondary gene pool (GP2):**

* Cross between GP1 and GP2 exhibit some degree of difficulty, resulting in F1 Hybrid exhibiting partial fertility and partial Cross difficulty due to differences within crossing individuals at chromosome ploidy level, chromosome alterations, or genetic barriers

**Tertiary gene pool (GP3):**

* Germplasm of GP3 exhibit a high range of difficulty to cross with GP1 and F1 hybrid exhibits complete sterility.

**Quarter gene pool (GP4):**

* Member of GP4 includes ‘**Transgene**'. It is also called the **“Ocean of germplasm”**. In this Cross between the individuals does not possible.

**Table 2: Some important active germplasm collections maintained in India at Institutions other than NBPGR, New Delhi**

|  |  |
| --- | --- |
| **S. No.** | **Institutions**  |
| 1 | Central Institute for Cotton Research, Nagpur |
| 2 | Central Plantation Crops Research Institute, Kasargod |
| 3 | Central Potato Research Institue, Shimla |
| 4 | Central Tobacco Research Institute, Rajahmundry |
| 5 | Central Tuber Crop Research Institue, Thiruvanantpuram |
| 6 | NRRI, Cuttack |
| 7 | Directorate of Oilseeds Research, Hyderabad |
| 8 | Directorate of Wheat Research, Karnal |
| 9 | Project Directorate on Maize, New Delhi |
| 10 | Indian Grassland and Fodder Research Institute, Jhansi |
| 11 | Indian Institute of Horticultural Research, Banglore |
| 12 | Indian Institute of Pulses Research, Kanpur |
| 13 | Sugarcane Breeding Institute, Coimbatore |
| 14 | Indian Institute of Vegetable Research, Varanasi |
| 15 | National Research Centre for Groundnut, Junagarh |
| 16 | National Research Centre for Soybean, Indore |
| 17 | National Research Centre for Sorghum, Hyderabad |

**Protection of Plant Variety and Farmers Rights Act (PPVFRA), 2001:**

The special features of this act are:

It is an easy system to defend farmers' range. This act covers new plant types, essentially derived sorts, existing varieties, and farmers' varieties. Farmers' types and existing types don't need innovation, but they do need protection from the "terminator gene" and the genetic use restriction age. recognising farmers as growers' equals in terms of innovation, conservation, breeding, and plant variety preservation. It permits unique arrangements for profit-sharing and the establishment of gene funds for the preservation of agricultural biodiversity. When a material is supplied, if it no longer performs as expected overall, particular provisions are made to make up for the farmer's loss. Farmers get their expenditures covered. Failure to provide quality material to farmers at a reasonable cost is established a basis for mandatory licencing and the formation of a tribunal.

**Farmers' rights**

Except in cases where the sale is made for reproduction under commercial cultivation, farmers have the right to conserve, use, exchange, share, or sell their farm products of protected varieties. The rights that result from protecting, enhancing, and making genetic resources accessible are also included in the farmer's right. Additionally, it refers to the legal claims that result from farmers' past, current, and future efforts to preserve, enhance, and make available plant or animal genetic resources, particularly those in areas of origin or diversity.

**Researchers' rights**

As per this right “Protected varieties will be freely available for undertaking experiments or legitimate research projects. It is not prohibited for anyone to use a variety as the starting point for developing further variations. However, if a protected variety is used repeatedly as parental material in a commercial production or marketing arrangement, breeder permission will be required”.

**Benefit sharing**

It refers to the portion of the benefit that a claimant will be entitled to, as assessed by the Authority, that is gained by a breeder of a cultivar from an agent or a licensee of the cultivar, as the case may be.

**National Gene Fund**

In order to conserve genetic resources, a National Gene Fund will be established and funded through earnings from benefit-sharing agreements, royalties, community compensation, and contributions. Farmers that participated in the process of genetic resource protection were rewarded by this money. The Fund will be put to use through appropriate plans to increase their share to entities or people, compensate village communities, maintain and conserve plant genetic resources, and develop varieties.

**Compulsory licensing**

Any person may apply to the Authority at any time following the passing of three years following the registration of a variety, claiming that the public's reasonable needs for seeds or other propagating material of the variety have either not been met or are either not available at a reasonable price, and requesting the granting of a compulsory license to produce, distribute, and sell the seed or other propagating material of the variety.

* Royal botanical lawn situated at Kew, England, organized the advent of quinine and rubber trees from south America into India.
* Beltsville, USA collects the germplasm of small grain crops at the world level.
* Bambey, Senegal collects the germplasm of groundnut
* Canal point, Florida sugarcane
* FRI stands for Forest Research Institute, Dehradun in 1906.
* NBPGR has five substations for testing the introduced plant material
1. Shimla, Himachal Pradesh
2. Jodhpur, Rajasthan
3. Kanya kumari, Tamilnadu
4. Akola, Maharashtra
5. Shillong, Meghalaya

Following are some recommendations we would like to offer in light of the need to diversify agriculture in light of climate change and the rapid deterioration of natural resources, as well as the current state of diversification in our nation.

* The government should act right away to promote crop diversification in the nation by increasing funding for research and development, offering effective support services and credit institutions, marketing, processing, and packing agricultural products.
* NGOs and Panchayats Raj organisations might be active in educating farmers about the commercialization of agriculture and the existence of various government-sponsored programmes for the purpose and advantages of crop diversification.

**Table: 3 Eight main and 3 sub-center of origin**

|  |  |
| --- | --- |
| Centres | Crops |
| China | Soybean, Peach, citrus sinensis |
| Hindustan | Rice , brinjal, mung bean |
| Central Asia | Bread wheat , lentil, carrot, radish , chickpea |
| Asia Minor or near eastern centre | Einkorn wheat, durum wheat, melons, grapes, almond. |
| Mediterranean | Durum wheat, lettuce, broad bean, cabbage. |
| Abyssinian | Barley, lentil, pea |
| Central America | Corn, common bean , upland cotton |
| South American | Sweet potato, potato, tomato, papaya, tobacco |
| Subsidiary centres |  |
| Indo-Malayan | Banana, coconut, yam |
| Chile | Potato |
| Brazilian –Paraguayan | Peanut, rubber tree, pineapple, cocoa. |

**Conclusions:**

The fundamental objective of biodiversity conservation is to conserve the natural genetic resources, and maintenance of broad-based genetic diversity to improve potential value to ensure their availability for exploitation by present and future generations. It maintains the existence of extinct species which aids in existing natural variability and creates variability through a hybridization program. It helps the breeder to make the selection for crop improvement programs and develop high-yielding cultivars with good nutritional quality. It supports meeting the requirement for world food security and the economic development of growing farmers. There is a need to extend the basic knowledge of conservation, maintenance, and their use of wild spp. and landraces through agricultural extension activities to the growing farmers and researchers for the further improvement program.

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