

BT401 – GENETIC RESOURCES AND CONSERVATION

Final Term MCQs

Prepared by: Sir Mughal (Admin, BS Zoology Announcement)

Group link: <https://chat.whatsapp.com/BjC6W0jZx8o9yaC2ISh1Gu>

LECTURE# 61 & 62

1. Selection of plant material requires **two** important factors such as **nature** and **density**.
2. While selection of plant material, **density** should be **high**.
3. **Cryoprotectant** are chemicals that prevent **cryo-destruction**.
4. Generally, **two** Cryo-protective agents should be used together instead of single one as they are **more effective**.
5. **Two** common cryoprotective agents are **dimethyl sulfoxide (DMSO)** and **glycerol**.
6. **Glycerol** is used primarily for cryoprotection of **red blood cells**, and **DMSO** is used for protection of most other cells and tissues.
7. The sensitivity of cells to **low** temperature depends on the **plant species**.
8. **Cryopreservation** is based on the ability of certain small molecules to enter cells and prevent **dehydration** and formation of intracellular ice crystals, which can cause **cell death** and destruction of cell organelles during the **freezing process**.
9. There are **four** different types of methods of freezing.
10. In **Slow freezing method**, the tissue or plant material is **slowly frozen** at **slow cooling rate**.
11. In **Rapid freezing method**, vials are plunged in **liquid nitrogen**.
12. In **Rapid freezing method**, the temperature decreases from **-300 to -1000** degree rapidly.
13. **Combined freezing** method is combination of both **slow and rapid freezing** method.
14. In **Dry freezing method**, dehydrated cells and seeds are stored.
15. In general, the storage temperature is kept **-70 to -196** degree.
16. Prolong storage is done at temperature of **-196** degree in **liquid nitrogen**.
17. **Thawing** is usually carried out by plunging the vials into **warm** water bath with vigorous swirling.
18. As thawing occurs the vials are transferred to another bath at **0 degree**.
19. Measurement of Viability of cells is carried out by formula: **(No. of cells growing/No. of cells thawed) x 100**
20. The viable seeds are cultured on **non-specific growth medium**.
21. Genetic materials that are typically cryogenically preserved include **sperm**, **oocytes**, **embryos** and **somatic cells**.

22. Cryogenic facilities are called **gene banks** and can vary greatly in size usually according to the economic resources available.
23. **Cryo-conservation** is the process of freezing cells and tissues using **liquid nitrogen** to achieve **extreme low** temperatures with the intent of using the preserved sample to prevent the loss of genetic diversity.
24. **Semen**, **embryos**, **oocytes**, **somatic cells**, **nuclear DNA**, and other types of biomaterials such as blood and serum can be stored using **cryopreservation**, in order to preserve genetic materials.
25. There are **two** cryopreservation freezing methods. They are **Slow freezing** and **Vitrification**.

LECTURE# 63

26. **Cryopreservation** ensures the recovery of a small number of **spermatozoa** in several **male factor infertility**.
27. Embryo cryopreservation is used most often to store good quality excess embryos resulting from an **IVF treatment cycle**.
28. Embryos can be stored for a patient who elects to have her eggs fertilized with **donor sperms**. Pregnancies have been reported from embryos stored for **16 years**.
29. There are known side effects with fertility medication including the risk of **Ovarian Hyper Stimulation Syndrome** or **OHSS**.
30. **Ovarian Hyper Stimulation Syndrome (OHSS)** affects women taking injectable hormone medications to stimulate the development of **eggs** in the **ovaries**.
31. OHSS stands for **Ovarian Hyper Stimulation Syndrome**.
32. OHSS may occur in women undergoing **In Vitro Fertilization (IVF)**, ovulation induction or intrauterine insemination.
33. Too much **hormone medication** in system can lead to **OHSS**, in which ovaries become swollen and painful.
34. Less often, **OHSS** happens during fertility treatments using medications you take by mouth, such as **clomiphene (Clomid, Serophene)**.
35. Up to **60%** human body is composed of **water**.
36. The freezing point of water is **0** degree centigrade while the cryoscopy temperature can be as low as **-90** degree centigrade.
37. **Ice formation** can result in the **needle shaped** crystals resulting in the damage to cell membrane.

LESSON# 64

38. Since the 1st successful cryopreservation of **bull semen** has been used to propagate, the rare and endangered species using assisted reproduction techniques.
39. The 1st report on fish sperm cryopreservation was published by **Blaxter (1953)**.
40. To date milt (semen) of over **200** species of fresh water and marine fish have been cryopreserved and have been adequate for the purpose of **cryobanking (10,11,12)**.
41. **Low temperature** has been used in medicine and to prevent **food spoilage** since ancient time.

42. **Human oocyte** cryopreservation is a new technology in which a **woman's** eggs are extracted, frozen or stored.
43. Eggs frozen at the age of **35** are more usable than fresh **oocytes** produced at age **43** years of age.
44. Cryopreservation of immature **testicular** tissue is a developing method to avail reproduction to young boys who need to have **gonado toxic therapy**.
45. **Embryo cryopreservation** is used most often to store good quality excess embryos resulting from an IVF treatment cycle.
46. **Embryos** can be stored for a patient who elects to have her eggs fertilized with **donor sperms**.
47. Pregnancies have been reported from embryos stored for **16 years**.
48. **Ovarian tissue cryopreservation** is considered to be an experimental technique for fertility preservation.
49. **Ovarian Tissue Cryopreservation** is an option for patients who require immediate **gonadotoxic treatment** of **aggressive malignancies** when there is insufficient time to allow the woman to undergo ovulation induction, oocyte retrieval and cryopreservation oocytes and/or embryos.
50. **Human sperm** cryopreservation is widely used to store donor and partner spermatozoa before assisted reproduction treatments to preserve **spermatozoa** before therapy for malignant diseases, **vasectomy** or surgical in fertility treatments and to ensure the recovery of a small number of spermatozoa in several male factor infertility.
51. An important application of cryopreservation is in the freezing and storage of **hematopoietic stem cell**, which are found in the **bone marrow** rescue, hematopoietic stem cells are collected from a patient's **bone marrow** prior to treatment with **high-dose chemotherapy**.
52. Infusion of stem cells in body is necessary, since **high dose chemotherapy** is extremely **toxic** to the bone marrow.
53. Conservation of plant biodiversity can be performed **in situ** and **ex situ**.
54. **Vitrification** method of cryopreservation may bring new opportunities to research protocols.
55. There are **two** major concerns about **vitrification** - toxicity of high concentration of **cryoprotectants** used and microbial contamination of **liquid nitrogen**.
56. Several **IVF** programs have adopted the vitrification method as the sole procedure for **day-3** human embryos and for human blastocysts, with excellent survival and pregnancy rates.

LECTURE# 65

57. The earliest types of protected areas for the conservation of resources can be traced back to around **200 BC** when land owned by royalty was designated as **private hunting reserves**.
58. One of the earliest modern protected areas is considered to be **Yellowstone National Park**, designated in **1872** as a 'public park or pleasuring ground for the benefit and enjoyment of the people'.

59. In **1962**, the First Conference on **National Parks** was held and the **first** UN List of National Parks and **Equivalent Reserves** that amalgamated all of the world's protected areas was produced.
60. During the **1970s**, several global multilateral environmental agreements were adopted such as the **World Heritage Convention**, the Convention on Wetlands of International Importance and the Birds Directive in the European Union.
61. During the **1980s**, several regional frameworks for the protection of biodiversity were adopted such as the **Barcelona Convention** for the protection of **Mediterranean** areas.
62. According to the World Database on Protected Areas (WDPA) there are over **210,000** protected areas around the world.
63. WDPA stands for **World Database on Protected Areas**.

LECTURE# 66

64. **Protected areas** are strictly set aside to protect biodiversity where human visitation, use and impacts are strictly controlled to ensure protection of the conservation values.
65. In an increasingly modified ecology, it may become increasingly difficult to maintain **pristine areas** through **non-intervention**.

LECTURE# 67

66. **National Park** is large natural or near natural areas set aside to protect large-scale ecological processes, which also provide a foundation for environmentally scientific, educational, recreational and visitor opportunities.
67. **National Park** should contain representative examples of major natural regions, and biological and environmental features or scenery.
68. The composition, structure and function of biodiversity should be to a great degree in a "natural" state in **National Park**.
69. **Commercialization** of land and water in **category II** is creating challenges in many parts of the world.

LECTURE# 68-69

70. **Category III National Monument-Feature** protected areas set aside to protect a specific natural monument.
71. **Category III National Monument-Feature** protected areas are generally quite small protected areas and often have high visitor value.
72. **Category III** protected areas are usually relatively small sites that focus on one or more prominent natural features and the associated ecology, rather than on a broader ecosystem.
73. Protection of a cultural site also protects significant and important biodiversity, such as **archaeological** or **historical** sites that are inseparably linked to a **natural area**.
74. **Category III** can preserve samples of natural habitat in otherwise cultural or fragmented landscapes.

75. **Category III** developed by the **International Union for Conservation of Nature (IUCN)** with support of the **World Commission on Protected Areas (WCPA)** and other international institutions such as the **Convention on Biological Diversity (CBD)**, and assigned by national governments.
76. The classification of a **Category III** protected area requires that such areas are managed for conservation by legal or other effective means, and therefore legal recognition and protection at the national or subnational level is likely to be present in these sites.
77. The main emphasis of protection in **Category III** areas is on the natural features found in these sites. Their role in the conservation of species and habitats, hence, varies. In some cases, their contribution to biodiversity conservation may be indirect result of protection of natural features.
78. **Category III** areas are likely to hold **socio-cultural** values as they may have features such as sacred groves, springs, waterfalls, mountains, sea coves etc. of importance to one or more faith groups.
79. **Not** all natural monuments are **permanent**.
80. It is sometimes difficult to draw the boundaries between a natural monument and cultural site, particularly where **archaeological** remains are included within **Category III**.

LECTURE# 70-71

81. IUCN Management Category **IV** (Habitat/Species Management Area) refers to areas that are managed to protect particular species or habitats.
82. Category **IV** is defined by IUCN as protected areas aiming to protect particular species or habitats and management reflect this priority.
83. WCPA stands for **World Commission on Protected Areas**.
84. CBD stands for **Convention on Biological Diversity**.
85. These are often areas that have already undergone substantial modification, where a high degree of human pressure often exists, and significant management intervention is necessary.
86. **Category IV** areas are generally be **publicly accessible**.
87. Category IV areas are important for their role in '**plugging the gaps**' in conservation strategies by protecting key species or habitats in ecosystems.
88. While **Category IV** areas are not necessarily associated with human presence and intervention, many exist in crowded landscapes and seascapes where human pressure is comparatively greater, both in terms of potential illegal use and visitor pressure
89. Many **Category IV** protected areas exist in crowded landscapes and seascapes.
90. The **Category IV** protected areas that rely on regular management intervention need appropriate resources from the management authority.

LECTURE# 72-73

91. **Category V** area can be defined as A protected area where the interaction of people and nature over time has produced an area of distinct character with significant ecological, biological, cultural and scenic value.

92. Primary objective of **Category V** is to protect and sustain important **landscapes/seascapes** and the associated nature conservation.
93. Some category V protected areas act as a buffer around a core of one or more strictly protected areas.
94. **Category V** protected areas may also act as linking habitat between several other protected areas.
95. **Category V** offers unique contributions to conservation of biological diversity. In particular species or habitats that have evolved in association with cultural management systems and can only survive if those management systems are maintained.
96. A **high degree** of human intervention is to be expected within **Category V** areas, including agriculture and forestry, although these practices should be traditional and sustainable systems of land use.
97. The biodiversity importance of **Category V** areas is due to the important role they play in conservation at the **landscape/seascape** scale, particularly as part of a mosaic of management patterns, protected area designations and other conservation mechanisms.
98. Being a relatively flexible model, **Category V** may sometimes offer conservation options where more strictly protected areas are not feasible.

LECTURE# 74-75

99. In general, IUCN recommends that a proportion of the area is retained in a natural condition, which in some cases might imply its definition as a **no-take management zone**.
100. **Category VI** protected areas are particularly adapted to the application of **landscape** approaches.
101. The **Category VI** is not designed to accommodate **large-scale industrial** harvest.
102. The classification of a **Category VI** protected area requires that such areas are managed for conservation by legal or other effective means, and therefore legal recognition and protection at the **national** or **subnational** level is likely to be present for these sites.
103. **Category VI** areas are unique among the IUCN Categories as they seek to achieve biodiversity conservation through a synergy between the sustainable uses of natural resources together with protection.
104. As intervention within these areas is aimed at maintaining or restoring natural ecosystems, they can be anticipated to have **high** biodiversity values, and may include **no-take areas** as an integral part of maintaining these values.
105. There is also need for development of appropriate forms of governance suitable for Category VI protected areas and the multiple **stakeholders** that are often involved.

LECTURE# 76-77

106. **National Park** is an area which is strictly reserved for the betterment of the **wildlife & biodiversity**, and where activities like developmental, forestry, poaching, hunting and grazing on cultivation are **not permitted**.
107. National Parks are usually small reserves spreading in an area of **100 sq. km.** to **500 sq. km.**

108. In National Parks, the emphasis is on the preservation of a **single** floral or faunal species.
109. Hingol National Park spread over an area of about **1,650 square km** along the **Makran Coast, Baluchistan.**
110. Hingol National Park was for the first time declared reserved in **1988.**
111. Hingol National Park is an excellent habitat to wild animals including over **3,000 ibexes**, and **1,500 Urials** and more than **1,200 Chinkara.**
112. Kirthar National Park is the **second** largest national park of Pakistan spread over an area of **3000 square kilometres.**
113. Kirthar was designated a national park by the Sindh Wildlife Department in **1974.**
114. Kirthar National Park is the **first** of Pakistan's parks to be included in the UN's listing of National Parks of **1975.**
115. **Blackbuck** became virtually extinct in the **Cholistan** Desert but the species has been reintroduced in **Lal Suhanra.**
116. There is big **lake** in the centre of Lal Suhanra Park called **Patisar Lake**, which is ideal for **bird watching.**
117. Patisar Lake regularly holds between **10,000** and **30,000** ducks and common coot in midwinter.
118. **Nilgai Antelope** is also being bred in the **Lal Sunahra Park.**
119. **Margalla Hills National Park**, is located in the foothills of the **Himalayan range.**
120. Margalla Hills National Park is drained by the river **Kurang** and its tributaries, which flow into the river **Soan.**
121. Margalla Hills National Park is the most accessible park in Pakistan due to its **close proximity** to the national capital, **Islamabad.**
122. Birds in the Margalla Hills National Park include **Himalayan Griffon vulture & Laggar falcon.**

LECTURE# 78-79

123. A **zoological park** is a location where animals are kept in captivity for study and viewing.
124. Unfortunately, **not all** zoos are scientific in nature, and extreme controversy has arisen regarding how the animals are treated.
125. Conservation should always be the central goal behind any **legitimate zoo.**
126. **Zoos** provide the opportunity for people to see a glimpse of this side of nature.
127. **Zoo** plays important role in conservation of many threatened/endangered species.
128. Wild animals in captivity help us manage and conserve them in the **wild.**
129. Important Zoos of Pakistan are: **Bahawalpur Zoo, Changa Manga Wildlife Park, Clifton Fish Aquarium, Hyderabad Zoo, Islamabad Zoo, Jallo Wildlife Park, Jungle World, Karachi Municipal Aquarium, Karachi Safari Park, Karachi Zoo, Lahore Walkthrough Aviary, Lahore Zoo, Lahore Zoo Safari, Landhi Korangi Aquarium, Landhi Korangi Zoo.**
130. Nawab of former state Bahawalpur, **Sir Sadiq Muhammad Khan Abbasi**, established Bahawalpur Zoo in **1942.**

131. Bahawalpur Zoo covers an area of **25 acres.**
132. The Bahawalpur Zoo came under administration of Wildlife Department in **1982.**
133. The lion, black tiger, fish, watch, crocodile and many other animals which were mummified during **1942** and **1974** are kept in Bahawalpur Zoo Museum.
134. A Safari Zoo Lahore is established since **1996-2001** for public recreation within the suitable environmental location.
135. Lahore Zoo is just **13 KM** away from motorway link **Thokar Niazbaig, Multan Road, Lahore.**
136. In **2004**, the largest walkthrough aviary of Pakistan was constructed in the facility and was opened for visitors.
137. Amazing fact is that In **July 2016**, a record **34,340** tourists visited **Lahore's Safari Zoo** and an income of **Rs 0.93 million** was generated by wildlife and parks department.

LECTURE# 80-81

138. **Botanical gardens** are a garden dedicated to the collection, cultivation and display of a wide range of **plants** labelled with their botanical names.
139. Botanical gardens can promote **diversity.**
140. Plants can alter the **temperature** of the Earth's atmosphere.
141. Through the process of **photosynthesis**, plants use energy from the sun to draw down **carbon dioxide** from the atmosphere and then use it to create the carbohydrates they need to grow.
142. **Carbon dioxide** is one of the most abundant **greenhouse gases**, the removal of the gas from the atmosphere may temper the warming of our planet as a whole.
143. **Transpiration** in plants can **increase** water vapor in the atmosphere, causing more precipitation and cloud cover in an area.
144. List of Research Botanical Gardens of Pakistan:
 - Abdul Wali Khan University Botanical Garden, Mardan
 - Botanical Garden, Governor's House, Lahore
 - Botanical Garden, Govt Zamindar College, Gujrat
 - Danishmandan Botanic Garden, Lahore
 - Botanical Garden, University of the Punjab, Quaid-e-Azam Campus, Lahore
 - Faisalabad Botanical Gardens (part of Gatwala Wildlife Park), Faisalabad
 - Forman Christian College Botanic Garden, Lahore
 - Government College University Botanic Garden of GCU, Lahore
 - Karachi University Botanic Garden of Karachi University, Karachi
 - Lahore Botanical Gardens, Lahore • National Herbarium, Islamabad
 - Pakistan Forest Institute Botanical Garden of Pakistan Forest Institute, Peshawar
 - Quaid-i-Azam University Botanical Garden, Islamabad
 - Shah Abdul Latif Herbarium & Botanical Garden, Shah Abdul Latif University, Khairpur
 - University of Peshawar Botanical Garden of University of Peshawar, Peshawar
 - Living plants museum of medicinal plants, Pakistan Forest Institute, Peshawar

- Bagh-e-Jinnah, Lahore • Rani Bagh Arboretum, Hyderabad
- Sukh Chayn Gardens, Lahore

LECTURE# 82-84

145. **Ramsar** is one of the global inter-governmental environmental agreements.
146. The Ramsar treaty was negotiated in **1960s** by countries and NGOs.
147. In **18 nations** meeting it was adopted in the Iranian city of **Ramsar** On **2nd February 1971** and came into force in **21st December 1975**.
148. In **2013, 19 (nineteen)** Ramsar sites has been declared in Pakistan.
149. Ramsar Sites of Baluchistan include **Astola Island, Hub Dam, Jiwani Costal Wetland, Miani Hor & Ormara Turtle beach.**
150. Ramsar Sites of Sindh include **Keenjhar Lake, Haleji Lake, Drigh Lake, Indus Dolphin reserve, Jubho lagoon, Nurri Lagoon, Deh Akro-II, Indus Delta & Runn of Kutch.**
151. Ramsar Sites of Punjab include **Uchhali Complex, Taunsa Barrage & Chashma Barrage.**
152. Ramsar Sites of Khyber Pakhtunkhwa include **Tanda Dam & Thanedar Wala.**
153. The rapid industrial development at the beginning of **19th century** led to present-day situation of wetland being affected by human activities.
154. The introduction of **Nile Perch** to **Lake Victoria** has pushed many of the lake's native cichlid species to extinction.
155. Drainage and run-off from fertilized crops and pesticides used in industry introduce nitrogen and phosphorous nutrients and other toxins like **mercury** to water sources.
156. Worldwide there are now over **40,000** dams which alter the natural flow of water and impact on existing ecosystems.

LECTURE# 85-86

157. **Sanctuary** is an area which is of adequate ecological, faunal, floral, Geo-morphological, natural or zoological significance.
158. Boundaries of sanctuaries are **not** well defined and controlled biotic interference is **permitted.**
159. **Sanctuary** is created for the purpose of protecting **endangered** species with a limited territorial range
160. **Endangered species** in wildlife sanctuaries are typically closely monitored.
161. **Wildlife sanctuaries** help to preserve and bring back **endangered** species by giving them a natural environment to live in while they are in no danger of predators or humans.
162. Wildlife sanctuaries of Pakistan are **Astor Wildlife Sanctuary, Baltistan Wildlife Sanctuary, Chasma and Taunsa Barrage Dolphin Sanctuary, Cholistan Wildlife Sanctuary, Hab Dam Wildlife Sanctuary, Kargah Wildlife Sanctuary, Mahal Kohistan Wildlife Sanctuary, Naltar Wildlife Sanctuary, Nara Desert wildlife Sanctuary & Rann of Kutch Wildlife Sanctuary.**
163. Runn of Kutch Wildlife Sanctuary spreads over **566,375 ha** is part of the great **Thar** desert and comprises.

164. Threatened species of Runn of Kutch include the **Great Indian bustard, Houbara bustard, Sarus crane.**
165. Runn of Kutch used to have the only population of the **Indian Wild Ass** or **Onager** in Pakistan.
166. Chashma and Taunsa Barrage is very important breeding, staging and wintering area for a wide variety of waterfowl, including at least **one** threatened species (**Marmaronetta angustirostris**).
167. Mid-winter waterfowl counts in recent years have regularly exceeded **20,000 birds.**
168. The endangered **Indus Dolphin (Platanista indi)** occurs in the river both **upstream** and **downstream** of the barrage.
169. Since the **1970s**, the population of the Indus Dolphin has significantly **increased** here.
170. Cholistan Wildlife Sanctuary is part of the **Cholistan** desert in the south eastern portion of the province of Punjab.

LECTURE# 87

171. A **game reserve** is an area wherein controlled hunting and shooting is permitted on permit basis.
172. If hunting is prohibited, a game reserve may be considered a "**Nature Reserve**".
173. It is to ascertain the number of **female** animals, as this indicates the production potential.
174. It is an estimate that walking **6km** to **water** isn't unnatural for an animal.

LECTURE# 88

175. The **Buller's Fruit bat** is enlisted as **Critically Endangered (CR)** facing an extremely high risk of extinction in the wild, on the IUCN **red list** of threatened species.
176. The **2011 Red List** of birds, released by the International Union for Conservation of Nature (IUCN), has enlisted the bird in the Critically Endangered category.
177. The population of the Great Indian Bustard is estimated to be just **250.**
178. **Madagascar Pochard** is very rare and was known only from a single location in the northern central plateau, at **Lake Alaotra basin.**
179. In spite of several breeding attempts between **2006** and **2012**, only **21** adults of Madagascar Pochard were counted in **2012.**
180. **Pygmy three-toed sloths (Bradypus pygmaeus)** are entirely native to the island of **Escudo De Veragua**, off the Caribbean coast of **Panama.**
181. The most recent data on Pygmy three-toed sloths is dishearten, indicating there may be only **48** lefts, a significant decrease from the last estimate of **79** in **2013.**

LECTURE# 89-90

182. In **1972**, conservation of habitats rich in genetic diversity was recommended in the UN conference.
183. IBPGR stands for **International Board for Plant Genetic Resource.**
184. Since **1980**, in situ conservation has received high priority in the world conservation strategy.

185. Generally, plant seeds, vegetative propagules are used for storage for long time. The whole plants are preserved. This type of conservation strategy is called **in vivo gene bank**.
186. Plant cells and tissue cultures are brought to **zero state** of metabolism by subjecting them to ultra-low temperature i.e. **-196°C**.
187. Cryopreservation is done by using **liquid nitrogen** which provides approximately **-496°C**.
188. For conservation of cultured plant materials **low-pressure storage (LPS)** and **low-oxygen storage (LOS)** have been developed.

LECTURE# 91

189. Using **Tissue Culture Conservation** method, **millions** of genetically identical plants can be obtained from a **single** bud.
190. **Shoot tip propagation** is exploited intensively in **horticulture** and the nurseries for rapid clonal propagation of many dicots, monocots and gymnosperms.
191. Culture facilities aim for a room where the humidity is **40–50%**.
192. **High humidity increases fungal** growth, while low humidity dries cultures and creates dust problems.
193. Ensure a light intensity in the range from **10 to 1000 $\mu\text{mol S}^{-1} \text{m}^{-2}$** . Most plant cultures require **50–200 $\mu\text{mol S}^{-1} \text{m}^{-2}$** .
194. Common growth room temperatures range from **22°C to 28°C**, depending on species requirements.

LECTURE# 92

195. DNA banks can now be considered as a means of **complimentary** conservation.
196. **Long-term storage** needs and expected volume and number of samples to be stored will determine organization and **repository design**.
197. The quality of DNA extracted from plant specimens is dependent on the **condition of the specimen** before storage, the storage environment and the duration of storage.
198. Rapid drying of plant samples with **silica gel** or **lyophilisation** helps to preserve the **DNA**.
199. Once extracted DNA is a **stable** biomolecule, although it can easily be degraded during **extraction** and **storage**.
200. Drying the sample or storing it in freezers or liquid nitrogen achieves better preservation of DNA **molecular size**.
201. Information on the stability of purified DNA dissolved in buffer suggests that the overall fragment size decreases with storage time, and that the usefulness of the specimen for PCR-based assays may be **1–2 years** when stored at **4 °C**, **4–7 years** when stored at **-18 C°** and greater than **4 years** when stored at **-80 C°**.
202. The choice of temperature usually depends on the **moisture level** within the sample.
203. It is proposed that replicated DNA samples can be maintained at **-20°C** for short- and mid-term storage (up to **2 years**), and at **-70°C** or in liquid nitrogen for longer periods.

204. For rice, DNA clones, such as ESTs, full-length cDNAs, BACs, PACs and YACs, are maintained in labelled 96-well microplates or 384-well microplates stored in -80°C ultra low temperature freezers.
205. For cDNA clones, plasmid DNA is extracted from the host Escherichia coli, and stored at -30°C in labelled 1.5 ml Eppendorf tubes.

LECTURE# 93-95

206. Gene sanctuary is generally established in the centres of diversity or microcenter.
207. Gene sanctuary is also known as Natural Park or biosphere reserve.
208. In Ethiopia, gene sanctuaries for conservation of wild relatives of coffee was setup in 1984.
209. Gene sanctuaries not only preserve the existing genetic diversity present in a population, it also allows evolution to continue.
210. As a result, new allele and gene combination would appear with time.
211. A gene sanctuary is best located in the centre of origin of crop species concerned, preferably covering the microcenter within the centre of origin.
212. In situ conservation allows natural selection and evolution to operate.

LECTURE# 96

213. Seed storage is a relatively cheap method for conserving a broad range of germplasm.
214. Cryogenic storage at its current level of technology offers great promise for long-term storage of true orthodox and sub-orthodox seeds.
215. Recalcitrant seeds (both classes) cannot be stored cryogenically with current technology.

LECTURE# 97

216. Genetic resources of Invertebrates mean genetic material of actual or potential value from Invertebrates.
217. Invertebrates account for more than 95% of all animals and comprise many subgroups of diverse species ranging from tiny insects to giant squid.
218. Small, out-of-sight and uncharismatic these animals may be, but their significance is enormous. Some larger soil-dwelling invertebrates, such as earthworms, ants and termites, have been described as "ecosystem engineers".
219. It has been estimated that at least 35 percent of world food production comes from crops that are dependent on insect pollination.
220. Decline of wild and managed pollinators has caused such concern that it has been described as a "pollination crisis".

LECTURE# 98

221. Climate change is expected to affect all three of the main groups of invertebrate ecosystem-service providers as well as invertebrate pests.
222. Most invertebrates are expected to change their geographical distribution in response to climate change so as to remain in areas to which they are well adapted.

223. The current world is very different from that of the early **Quaternary Period**.
224. **Human activities** have created barriers to the migration of **invertebrate** species.
225. It has been suggested that, in the future, parts of the world will have **novel** climates that have no current equivalent anywhere on the planet.
226. **Warmer, shorter** winters will mean that many invertebrates become **active** and start reproducing earlier in the year.
227. Some species may be able to produce additional generations of offspring in a **single year**, which in the case of **herbivores** can have a major impact on host plants.
228. **Warmer winters** may mean that pests are able to establish themselves in areas **where they have not** previously caused problems.
229. **Temperature** is a key factor regulating many of the biogeochemical processes in which invertebrates participate or by which they are affected, including soil respiration, litter decomposition, nitrogen mineralization and denitrification.

LECTURE# 99

230. **Earthworms** help to maintain soil structure and the availability of water throughout the soil profile.
231. This is likely to **increase** demand for classical biological control agents, especially in places where the newly established pest population is separated from its original home by a physical barrier such as the **sea** or a **mountain range**.

LECTURE# 100

232. The IUCN's Red List of Threatened Species includes **44,838** species with assessed conservation statuses in its **2008 update**.
233. This number has been increasing each year and undoubtedly reflects the work of many, yet it still only represents **2.73%** of all described species to date.
234. Considering the better studied ones, mammals and birds, **100%** of the currently described species have been evaluated for their conservation statuses and, out of these, **21%** out of **5,488 mammal** species and **12%** out of **9,990 bird** species are considered to be endangered.
235. Turning our attention to one of the lesser studied groups, we see that only **0.13%** out of all the described insect species have an evaluated status, **50%** of which are endangered.
236. Extremely few out of the **950,000** calculated species known to science have been graced with conservational study.
237. It appears necessary to enrich the **Red List of Threatened Species** with many invertebrate species **endemic** and/or living in specific habitats easily endangered.
238. An example of how habitat conversion for human usage could be compensated would be achieved by a more frequent adoption of what is known as **Green roofs**.
239. Maintaining **insect** species that can provide pollination services for a wide range of crops is also vital to the future of **agriculture** in the face of climate change.
240. The presence of areas of natural and semi-natural habitat next to crop fields has been shown to **increase** the diversity of pollinator populations and enhance the services they provide.

241. Deliberate planting of **climate-resilient plants** that favour pollinators can serve as a means of maintaining the habitats and floral resources needed by wild pollinators and managed bees.
242. The world's most important managed specie is **honey bee**.

LECTURE# 101

243. Genetic refers to variation of **genetic DNA origin**.
244. The largest variation is between **species**, and loss of whole species is therefore also the most dramatic loss of **future options**.
245. In 2014, the **Food and Agriculture Organization** of the United Nations published the first **State of the World's Forest Genetic Resources**.
246. **Forest trees** are known for showing great **plasticity** in their response to climate changes, not all species are naturally capable to adapt at the pace necessary.

LECTURE# 102

247. Globally, forests remove **carbon dioxide** from the atmosphere and produce **oxygen**.
248. In Europe, one estimate put the value of “marketed non wood goods” from forests at **€2.3 billion** and the value of “marketed services” at **€619 million**.
249. Forests are under threat, chiefly as a result of **human activities**, including **climate change**.
250. It is **impossible** to assign a precise **economic** value to forests, it is clear that their contribution is huge.

LECTURE# 103

251. The standing genetic variation in populations may then not be large enough to create the rare new **genotypic** combinations that are required.
252. Ecosystems affected by **abrupt change** may sustain rapid and widespread transformation as ecological tipping points are exceeded.
253. Irreversible loss of ecosystem integrity and function may follow, with replacement by new **nonendemic** ecosystems.
254. Analysis suggested that dry season water stress is likely to increase in **eastern Amazonia** over the 21st century, with the region tending toward a climate more appropriate to **seasonal forests**.
255. **Fire** and **climate** are closely linked and are also associated with changes in land use.
256. **Malhi et al. (2009)** considered how tipping points may be reached in **Amazonian** rainforest by a combination of increased dryness and an increased incidence of fire events.

LECTURE# 104

257. Tree populations rely on **three** interplaying mechanisms to respond to environmental change.
258. Genetic adaptations that make a population more suited for survival are achieved through gene frequency changes across generation.
259. Many tree species have **high** genetic variability in adaptive traits and can therefore grow under a **wide** range of conditions.

260. **Pollen** is known on occasions to travel very long distances, particularly in wind dispersed broadleaves and conifers, but also sometimes for **animal-pollinated** species.
261. **Pale** ecological reconstructions of the decolonization of temperate zones during the **Holocene** have also suggested that seeds are capable of travelling long distances rapidly, in the range of **several hundreds** of meters per year.
262. **Cryptic refugia** may have been overlooked, considerably **reducing** migration estimates.
263. Modern estimates of contemporary seed dispersal, although pointing to the existence of **long-distance** dispersal events, generally indicate that median migration rates are in the range of a **few tens of meters** per year.
264. **Phenotypic Plasticity** is defined as the capacity of a particular genotype to express different phenotypes under different environmental conditions.
265. Even in species with very little genetic diversity, such as **Pinus pineal**, strong **phenotypic plasticity** is expressed for growth related traits, which may have helped the species colonise new environments.
266. **High plasticity** is likely to **favour** tree survival under changing environmental conditions, although trade-offs between traits can be expected.
267. **Phenotypic plasticity** has a heritable basis and may be selected for under changing environments, complex interactions between traits are possible, depending on the magnitude and structure of change.

LECTURE# 105

268. **North American conifers** have adapted to outbreaks of the defoliating insect **spruce budworm (*Choristoneura fumiferana* Clem.)** that have recurred at periodic intervals (**every 35 years**) at least since the middle of the **Holocene**, **6000** years ago.
269. **Climate** change may however cause range expansions in herbivorous insects and in diseases, causing increased mortality in **non-adapted** populations.
270. Populations of **Pinus contorta Dougl. ex Loud.** and **P. banksiana Lamb.** from parts of North America more prone to natural fires have a higher proportion of **serotinous cones** than those from elsewhere.
271. **Serotinous cones** remain tightly closed until a hot fire has destroyed standing trees, then releasing seed to initiate rapid post-fire regeneration.
272. **Co evolution** describes a situation where **two or more** species reciprocally affect each other's evolution.
273. In case of **host-pathogen** interaction, changes in **R-gene** resistance in the host lead to corresponding changes in **V-gene** virulence in the pathogen, triggering further rounds of change in one and then the other.
274. Important examples of co-evolution in trees include interactions with herbivores and **pollinators**.
275. Under climate change, **FGR** are likely to be increasingly threatened by **alien invasive species**.

276. The consequences of **exotic pest** invasions may be a catastrophic elimination of **FGR**, such as the cases of **chestnut blight** and **white pine** blister rust.

LECTURE# 106

277. In **France**, **FGR** are not explicitly mentioned in the national adaptation strategy.
278. To date, **few countries** have however taken practical steps to reduce the risk of **FGR loss** due to climate change.
279. To date, one of the most extensive programmers to develop trees with resistance to insect pests in temperate regions is in **British Columbia**.
280. Using **microarray** analysis, up to **113** genes were significantly induced by drought in two **Mediterranean** pine species.
281. Species-dependent features shape the transcriptome response; for example, almost none of the **27** genes reliably responsive to water stress in **Arabidopsis thaliana (L.) Heynh.**, differentially regulated under drought in poplar and pine.
282. Candidate genes for drought tolerance include those involved in the synthesis of **abscisic acid**, transcriptional regulators of drought-inducible pathways, and **late embryogenesis abundant proteins**; shifts at such loci have been linked to global warming.
283. **Populations vary** in their response functions.
284. In **Pinus contorta**, some populations have a high growth rate over a much wider range of climatic conditions than others do.

LECTURE# 107

285. For most forest tree species, management plans for the conservation units allow **silvicultural** interventions directed towards the support of and quantity of regenerating material
286. **Natural regeneration** should be the preferred means but if this fails to occur, assisted regeneration can be carried out using local seed lots to maintain local **phenotypic identity** natural regeneration both in terms of **quality**.
287. **Three** different strategies have recently been proposed to enhance resilience of forest stands to climate change in central **Europe**.
288. Conservation of **FGR** is likely to become more complicated with rapidly changing climate.
289. **Dynamic conservation** can take place in **ex situ** stands when natural selection occurs at a site and when artificially planted trees (species, provenances, families) can be regenerated from seeds without much intervention.

LECTURE# 108-109

290. A person could be held **guilty** if he **breaches** Law.
291. Some major laws dealing with different resources present in environment are:
- Pakistan Environmental Protection Act, 1997
 - Pakistan Penal Code, 1860
 - Forest Act, 1927
 - Pakistan Terrestrial Water & Maritime Zones Act, 1976

292. PEPA stands for **Pakistan Environmental Protection Act.**
293. **Forest Act, 1927** empowers **provincial** governments to manage **forests** under their area.
294. EEZ stands for **Exclusive Economic Zone.**
295. **Pakistan Terrestrial Water & Maritime Zones Act** means that a ship carrying nuclear and hazardous substances will have to inform the **Government of Pakistan.**
296. Some major laws dealing with different resources present in environment are:
- West Pakistan Fisheries Ordinance, 1961
 - The Cutting of Trees (Prohibition) Act, 1992
 - The Wild Birds and Animals Protection Act, 1912
 - The Prevention of Cruelty to Animals Act, 1890
297. **West Pakistan Fisheries Ordinance, 1961** is an ordinance to amend and consolidate the law relating to fisheries in the **West Pakistan.**
298. Government can declare any water area as **sanctuary.**
299. An **Inspector** of Fisheries may **without a warrant** arrest any person committing in his view any offence under section **6, 7, 8, 9 or 11.**
300. According to **The Cutting of Trees (Prohibition) Act, 1992,** if a person violates the law he will be punished by a fine up to **5000 rupees.**
301. According to **The Wild Birds and Animals Protection Act, 1912,** whoever does or attempts to do, any act in contravention of section **3** of this act, shall be punishable with fine which may extend to **fifty rupees.**
302. If any person overloads any animal, he shall be punished with fine which may extend to **fifty rupees,** or with imprisonment for a term which may extend to **one month.**
303. If any person employs in any work or labour any animal which by reason of any disease, infirmity, wound, sore or other cause is unfit to be so employed, or permits any such unfit animal in his possession or under his control to be so employed, he shall be punished with fine which may extend to **one hundred** rupees.

LECTURE# 110

304. **Treaty** is a binding formal agreement, contract, or other written instrument that establishes obligations between two or more subjects of **international law.**
305. Pakistan is signatory to a large number of international treaties and conventions. These are listed below:
- Convention on biological diversity, 1992
 - Cartagena protocol on Bio Safety, 2001
 - CITES, 1973
 - Ramsar Convention, 1971
 - Convention on the conservation of migratory species, 1981
306. CBD stands for **Convention on Biological Diversity.**
307. CBD was adopted in **1992** at **Rio De Janeiro, Brazil** and entered force on **January 1993,** which was **90** days after the **30th ratification.**

308. Pakistan signed CBD in June 1992 at United Nations Conference on Environment and Development held at Rio De Janeiro, Brazil.

LECTURE# 111

309. Access to genetic resources for their utilization shall be subject to the prior informed consent of the Party providing such resources.
310. Each Party shall take legislative, administrative or policy measures, as appropriate, in order that the benefits arising from the utilization of traditional knowledge associated with genetic resources are shared in a fair and equitable way with indigenous and local communities holding such knowledge. Such sharing shall be upon mutually agreed terms.
311. Nagoya Protocol shall apply to genetic resources within the scope of Article 15 of the Convention and to the benefits arising from the utilization of such resources.

LECTURE# 112

312. Access and Benefit Sharing (ABS) is a 2010 supplementary agreement to the 1992 Convention on Biological Diversity (CBD).
313. Nagoya Protocol was adopted on 29 October 2010 in Nagoya, Japan, and entered into force on 12 October 2014.
314. Nagoya Protocol has been ratified by 97 parties, which includes 96 UN member states and the European Union.
315. Nagoya Protocol is the second protocol to the CBD; the first is the 2000 Cartagena Protocol on Biosafety.

LECTURE# 113

316. Cartagena protocol was adopted on June 2001 in Cartagena, Spain. It entered into force on September 11th; 2003.
317. Pakistan signed the Cartagena protocol in June 2000 and has ratified it in May 2009.
318. Cartegena Protocol seeks to protect biodiversity from the potential risks of Living Modified Organisms (LMOs) resulting from modern biotechnology.
319. Cartagena Protocol does not cover products derived from LMOs.

LECTURE# 114

320. Quarantine legislation is in place in countries worldwide restricting the import of non-indigenous plant and animal pathogens.
321. Quarantine practices in most countries have at least three common functions
322. Animal and plant quarantine programs are intended to protect agriculture from the threat of entry of exotic hazardous organisms.

LECTURE# 115

323. Crop includes all agricultural and horticultural crops and all trees, bushes, grass or plants.

324. **Import** means the bringing or taking by sea, land or air cross and customs frontier as defined by the **Federal Government**.
325. **Infection** means infection by insect, fungus or other pest injurious to a crop or plant.
326. **Pest** means any living stage of any or all insects, nematodes, slugs, snails, protozoa, or other invertebrate animals, fungi, bacteria, or other parasitic plants or reproductive parts thereof, virus or any organism, or any infectious substance which may directly or indirectly injure or cause disease to any crop or plant.

LECTURE# 116

327. Plant material likely to carry **new complex of pests or diseases** may be imported into **Pakistan** in limited quantities by special permit in **Form I** for the purpose of introducing new varieties and propagating stock from countries which maintain regular plant quarantine and inspection service.
328. Before any plant or plant material is imported, an application for permit shall be submitted to the **Director** or to the **Entomologist (Quarantine)**.
329. The importer shall inform the **Director** or the **Plant Quarantine Officer**, of the probable date of arrival of the plant or plant material at the prescribed port or point of entry.
330. A permit to import plant or plant material may be revoked if, in the opinion of the **Director** or the **Entomologist (Quarantine)**, the importer has wilfully contravened any provision of these rules.
331. Plant or plant material imported through the post shall be inspected by the **Plant Quarantine Officer** upon notification or their presence at the **Post Office**.
332. If the plant or plant material upon inspection are found to be free from plant diseases and injurious insects, a certificate shall be issued by the **Director** or **Entomologist (Quarantine)** to the exporter to accompany the shipment.
333. If the **Director**, or as the case may be, the **Entomologist (Quarantine)** considers necessary he may, before issuing a **certificate** require the disinfestations or disinfection of plants or plant materials by fumigation through a person, firm, agency organization or company **registered** with the **Department**.
334. No **official certificate** shall be granted for plant or plant material which have been from or mixed with other plants which are diseased or infested.

LECTURE# 117

335. **Animal** includes all kinds of Birds, cold-blooded creatures, creatures by means of which any disease may be carried or transmitted; crustacean, fish, four-footed beasts which are not mammals, mammals, except man; and reptiles.
336. **Carcase** means the carcase of an **animal** and includes any part or portion thereof.
337. **Diseased** means suffering from or carrying any infectious or contagious disease or such disease as may be declared by the **Federal Government** from time to time by notification in the official **Gazette**.
338. **Fodder** means hay, roughage, concentrate or any other substance used for feeding animal.

339. whoever contravenes or attempts to contravene any of the provision of this Ordinance or the rules or any notification issued thereunder, shall, without prejudice to any penalty to which he may be liable under the provisions of the **Customs Act, 1969**, be punishable with imprisonment for a term which may extend to **three years**, or with fine which may extend to **five thousand rupees**, or with both.
340. One recent study (**Plucknett and Smith, 1988**) describes **six** principles of successful quarantine.
341. Sound scientific and technical principles should form the **foundation** of a quarantine program.
342. When **germplasm** must be planted and grown for the purposes of quarantine testing, it should be done in an area geographically and ecologically separated from the major growing areas for that crop, to prevent the establishment of crop-specific pests or pathogens.
343. When germplasm is endangered or the need for particular accessions is particularly urgent, some discretion should be possible on the part of quarantine officials in allowing exceptions for controlled entry, despite existing regulations to the contrary.
344. **Decentralized quarantine** services are generally more efficient because they enfold a wider range of expertise in germplasm assessment.

LECTURE# 118

345. PGRP stands for **Plant Genetic Resources Program**.
346. **Attack Oil Refinery** in **Rawalpindi** has also developed a biodiversity park as an environment improvement strategy for compensating the pressure on biodiversity due to industrial processing in the nearby vicinity.
347. **Plant Genetic Resources Institute** hosts the sole **National Gene Bank of Pakistan** for conservation of plant genetic resources and **six** labs.
348. National Gene bank of Pakistan at Plant Genetic Resources Institute has **two** types of conservation facilities: **Active collection** & **Base collection**.
349. Without **evaluation**, utilization of germplasm in crop improvement is not possible.
350. Plant Genetic Resources Institute was established in **1993**.
351. Various institutions are involved in the capacity building to develop **AnGR**, in the country.

LECTURE# 119

352. Much work is being done for the conservation of plant genetic resources but **Animal Genetic Resources (AnGR)** still need attention.

LECTURE# 120

353. Much progress has been made over recent years in linking the conservation and use of **PGRFA** with endeavours to increase food security and develop more sustainable agricultural systems.

354. There is a need to step up efforts to conserve landraces, farmers' varieties and **CWR** before they are lost as a result of changing climates.
355. There is a need for more efficient, strategic and integrated approaches to the management of **PGRFA** at the national level.
356. At the international level there is also a need for greater coordination and cooperation among agencies and institutions concerned with international and **intergovernmental** aspects of the conservation and use of **PGRFA** and those concerned with agricultural production, protection, sustainability and food security, as well as related areas such as health and the environment.
357. **Greater** efforts are needed to estimate the full value of **PGRFA**, to assess the impact of its use and to bring this information to the attention of policy-makers and the general public so as to help generate the resources needed to strengthen programmes for its conservation and use.