

1. Name of second largest park? 2 marks

Ans: Kirthar National Park is the the second largest national park of Pakistan spread over an area of 3000 square kilometres. Kirthar was designated a national park by the Sindh Wildlife Department in 1974, This is the first of Pakistan's parks to be included in the UN's listing of National Parks of 1975 This is natural haven for Urial sheep, Ibex, Chinkara gazelle, Jungle cats, desert cats, occasional leopard, desert wolf also prowl the park.

2. Define forest genetic resources? (2) marks

Forest genetic resources or **forest tree genetic resources** are genetic material of forest shrub and tree species of actual or future value. Forest genetic resources are essential for forest-dependent communities who rely for a substantial part of their livelihoods on [timber](#) and [non-timber forest products](#) (for example fruits, gums and resins) for food security, domestic use and income generation. These resources are also the basis for large-scale wood production in planted forests to satisfy the worldwide need for timber and paper. Genetic resources of several important timber, fruit and other non-timber tree species are conserved [ex situ](#) in gene banks or maintained in field collections

Forest genetic resources are the heritable materials maintained within and among tree and other woody plant species that are of actual or potential economic, environmental, scientific or societal value

3. What is Aquatic genetic resources? 3 marks

Aquatic genetic resources also comprise all water-dwelling genetic resources

Aquatic genetic resources include all genetic resources living in water

➤ It include;

- Fish
- Cyclostomes
- Mussels
- Decapods
- Marine mammals
- Aquatic plants
- All other water dwelling organisms

There is a huge diversity of aquatic species in the world's water bodies

Aquatic genetic resources (AqGR) for food and agriculture underpin production in both capture fisheries and aquaculture. ... They underpin the productivity and sustainability of world aquaculture and capture fisheries, and the essential services provided by **aquatic** ecosystems in marine, brackish and freshwaters.

4. What is Phenylketonuria (PKU)

It is a human genetic condition caused by mutations to a gene coding for a particular liver enzyme. In the absence of this enzyme, an amino acid known as phenylalanine does not get converted into the next

amino acid in a biochemical pathway, and therefore too much phenylalanine passes into the blood and other tissues. Change in environment (lowering Phenylalanine consumption) can affect the phenotype of a particular trait, demonstrating a gene-environment interaction

5. What is the second closest breeding of inbreeding

1. Close Inbreeding

Animals are very closely related and can be traced back to more than one common ancestor. Closest form of inbreeding in domestic animals involves mating between full brothers and sisters (full siblings). Second closest form of inbreeding involves mating between grand-parents and grand-offspring, half brothers and sisters (half siblings)

6. White moth agar brown moth waly area mein ja k breed kry r white moth produce hon toh kya hoga

Gene flow in Moths

A population of moths that are white in color migrate to a population of brown-colored moths and successfully mate to give rise to viable offspring. Here, we can say that there is a change in the allele frequency. Over time, the number of these white moths will increase.

7. The services provided by PEPA? Features

Pakistan Environmental Protection Act, 1997

- Protection
- Conservation,
- Rehabilitation and
- Improvement of the environment;
- PEPA provide framework for prevention and control of pollution
- Helps in protection of sustainable development.

8. Reasons of extinction

The causes of extinction are as follows

1. Climate change
2. Habitat destruction
3. lack of genetic diversity
4. Better-adaptive condition
5. Pollution
6. Human over-population
7. Poaching and hunting

Objective of habitat species management area.

Purpose of wildlife sanctuary.

Sanctuary is an area which is of adequate ecological, faunal, floral, Geo-morphological, natural or zoological significance.”

The Sanctuary is declared for the purpose of protecting, propagating or developing wildlife or its environment

9. Why do Salmon migrate.

2. Migration in Salmon

Salmon live out most of their lives at sea, however after sexually maturing, they migrate back upriver to spawn at the very same place where they were born. This migration can cover hundreds of miles in distance and is very difficult and dangerous for the fish as most of them are killed on the way or die soon after spawning

10. Advantages of tissue culture conservation

- Source of disease-free material.
- It is most appropriate for rapid multiplication purposes, dissemination and active collections.

11. Mass Extinction:

Extinction event (also known as a **mass extinction** or **biotic crisis**) is a widespread and rapid decrease in the biodiversity on Earth.”

Biologists suspect we're living through the sixth major mass extinction. Earth has witnessed five, when more than 75% of species disappeared. Paleontologists spot them when species go missing from the global fossil record.

“We don't always know what caused them extinct but most had something to do with rapid climate change”

12. Habitat-Species Management Area

Definition: IUCN Management Category IV (Habitat/Species Management Area) refers to areas that are managed to protect particular species or habitats. They are defined by IUCN as *“protected areas aiming to protect particular species or habitats and management reflect this priority.*

Primary objective: To maintain, conserve and restore species and habitats.

13. Social Cluster value of national monument? 2

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. These areas are often of significant tourism value and can be managed with the objective of promoting sustainable tourism.

14. Tissue culture conservative 5 marks

- Using this method, millions of genetically identical plants can be obtained from a single bud. This method has, therefore, become an alternative to vegetative propagation. Shoot tip propagation is exploited intensively in horticulture and the nurseries for rapid clonal propagation of many dicots, monocots and gymnosperms.
- Conservation in tissue culture in in vitro genebanks is often combined with cryopreservation. Cultures in the active genebank are maintained by successive subculturing allowing culture renewal and distribution. For medium term storage, sub-culture intervals are extended, reducing processing costs by arresting growth using cold treatments, adapted light conditions, culture medium modifications (osmotic active compounds, growth retardants). This increases efficient use of resources and staff time and offsets selection risks and contamination

Advantages of tissue culture conservation

- Source of disease-free material.
- It is most appropriate for rapid multiplication purposes, dissemination and active collections.

Tissue Culture Conservation

- labour intensive
- risk of losing valuable germplasm
- genetic instability

15. define Line Breeding 2 marks

- Mating animals that are more distantly related which can be traced back to one common ancestor.
- e.g. Cousins Grandparents to grand offspring, Half-brother to half-sister. Line breeding increases genetic purity amongst the animals of progeny generations.

How conserve plant diversity

The conservation of plant diversity is critical for sustainable development and botanic gardens are playing a key role as centers of conservation action. Botanical gardens can promote diversity. Because they include many species of plant.

16. Conservation role of botanical garden? 5 marks

The first **role of botanical gardens** in plant **conservation** is the horticulture and cultivation functions towards the plants. ... With the better growth of plant, our environment also can become better because plants helps to absorb the carbon dioxide when undergo photosynthesis process.

17. What is cryoprotectant in cryopreservation 3 marks

A **cryoprotectant** is a substance used to protect biological tissue from freezing damage. Due to ice crystal formation cell membrane and cell integrity can ruptured. **cryoprotectants** are usually antifreeze compound.

Types of Cryoprotectants:

1. **Membrane permitting** which can freely diffuse the membrane such as **glycerol (G)**, **ethylene glycol (EG)** and **dimethyl sulfoxide (DMSO)**

2. **Non Membrane permitting** which cannot **permeate** the cell membrane such as **sugars**

18. Three botanical gardens

1. cacti and succulent plants.
2. herb gardens.
3. greenhouses, shade houses.

19. What is a botanical gardens?

4. It is a garden dedicated to the collection, cultivation and display of a wide range of plants labeled with their botanical names. It may contain specialist plant collections such as tropical plants, or other species of plants.

20. Close inbreeding and Line inbreeding

2. Close Inbreeding

Animals are very closely related and can be traced back to more than one common ancestor. Closest form of inbreeding in domestic animals involves mating between full brothers and sisters (full siblings). Second closest form of inbreeding involves mating between grand-parents and grand-offspring, half brothers and sisters (half siblings)

Line Breeding

Mating animals that are more distantly related which can be traced back to one common ancestor.

e.g. Cousins Grandparents to grand offspring, Half-brother to half-sister. Line breeding increases genetic purity amongst the animals of progeny generations.

13. In Situ Conservation

This method involves protection of endangered species in their natural habitats. It helps in recovering populations in the surroundings where they have developed their distinct features.

Example: National Parks, Biosphere reserves, Gene sanctuaries etc.

21. Write 3 importance of botanical garden 3 marks

Importance of Botanical garden

- 1- **Enjoyment**
- 2- **Economic**
- 3- **Scientific research**

22. Pure breeding 2 marks

Pure-breeding

Pure-breeding is the mating of rams and ewes of the same breed or type. A purebred flock can be managed as a single flock because all ewes and rams are of the same breed. The goal of purebred sheep production is to provide superior genetics (seedstock) to the commercial sheep industry. Seedstock are marketed as rams and replacement ewes to other seedstock producers or to commercial sheep operations.

23. History of the messenger pigeon 3

Passenger Pigeon

The passenger pigeon may have once constituted 25 to 40 percent of the bird population. The 19th century brought widespread hunting and trapping of the birds, which severely diminished their populations. The last passenger pigeon, named "**Martha**" died at age 29 at the Cincinnati Zoo in 1914.

24. Storage strategy of the cryopreservation 5

3. Storage

The maintenance of the frozen cells or material at specific temperature is very important. In general the temperature is kept -70 to -196 degree. Prolong storage is done at temperature of -196 degree in liquid nitrogen. To prevent damage, continuous supply of nitrogen is done.

25. Define plant genetic resource 2

. Plant genetic resources

Plant Genetic Resources for Food and Agriculture (PGRFA) are the raw material that farmers and plant breeders use to improve the quality and productivity of crops. They can be defined as any genetic material of plant origin of actual or potential value for food and agriculture, e.g. seeds, tubers, mature plants etc.

26. The main objective of CBD 5marks

Objectives of CBD, 1992

The three inter-related objectives are:

- The conservation of biological diversity;
- The sustainable use of its components;
- The fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate
- Access to genetic resources,
- Transfer of relevant technologies,
- Funding.

Difference Between Genetic Drift and Gene Flow:

- **Gene flow** occurs via mixing of genes with other populations while **genetic drift** takes place when the allele frequency is changed between two generations of a population.
- **Genetic drift** takes place between two generations whereas **gene flow** takes place between two populations
- **Genetic drift** occurs in only one species while **gene flow** could take place between either two populations or two species.
- Physical barriers matter for the gene flow but not for the genetic drift.

27. history of Ramsar Convention

History: Ramsar is one of the global inter-governmental environmental agreements. The treaty was negotiated in 1960s by countries and NGOs. To avoid the increasing loss and degradation of wetland habitat for migratory water birds. In an 18 nations meeting it was adopted in the Iranian city of Ramsar On 2nd February 1971. Came into force in 21st December 1975

28. how human activities causes migration of invertebrates

The current world is very different from that of the early Quaternary Period. Human activities have created barriers to the migration of invertebrate species. These barriers are likely to affect species in natural ecosystems rather more severely than those associated with agro-ecosystems. The movement of the latter is likely to be facilitated rather than hindered by human-induced landscape changes. In situ adaptation of invertebrate species is expected to be most marked where movement is not an option (e.g. on low, isolated islands)

29. national animal of pakistan and its number

Markhor is the national animal of Pakistan. The total global population of Markhors is estimated to be 2,500. About 1,500 Markhors are found in Pakistan. This species is in high risk of extinction nowadays.

30. Obstacles of cryopreservation future of cryopreservation

Obstacles

Upto 60% human body is composed of water. What's the issue then?

- Actually the freezing point of water is 0 degree centigrade while the cryoscopy temperature can be as low as -90 degree centigrade. • Very expensive Technique
- Ice formation can result in the needle shaped crystals resulting in the damage to cell membrane.
- Unequal distribution or over distribution of cryoprotectants.
- Moreover, thermal gradients can induce mechanical stress due to uneven expansion or contraction in the biomaterial.
- The cooling rate required for optimal survival varies by several orders of magnitude between different cell types. • Mass transfer limitations

31. why genetic diversity is important

The huge variety of different gene sets define an individual or a whole population's ability to tolerate stress from any given environmental factor. Some individuals might be able to tolerate an increased load of pollutants in their environment. Others carrying different genes might suffer from infertility or even die under the exact same environmental conditions.

32. Cryo-preservation

Cryo is Greek word. (krayos – frost). It literally means preservation in “frozen state.”

Cryo-preservation or **cryo-conservation** is a process where organelles, cells, tissues,

extracellular matrix, organs or any other biological constructs susceptible to damage caused by unregulated chemical kinetics are preserved by cooling to very low temperatures (typically -80 °C using solid carbon dioxide or -196 °C using liquid nitrogen)

Cryopreservation can be done at

Over solid carbon dioxide (at -79 degree) Low temperature deep freezer (at -80 degree)

In vapor phase nitrogen (at -150 degree)

In liquid nitrogen (at -196 degree)

33. Freezing step of cropreservation(5)

Cryopreservation technique:

- Slow freezing and thawing
- Rapid freezing and thawing
- Vitrification
- Ultrarapid freezing

1. Slow Freezing- Slow thawing

With this method organs are labeled into vials after equilibration with a cryoprotectant solution and then cooled at rate of 0.5-2 °C per minute down to -1 °C. Seeding is then induced and a holding period of 5 to 15 minutes allows equilibration of the temperature. Thereafter embryos are cooled to -60 °C or lower at a rate of 0.3 to 0.5 °C per minute before being transfer to liquid nitrogen. Frozen embryos must be slowly thawed at a rate of less than 25 °C per minute to prevent osmotic shock

2. Rapid cooling and rapid thawing

In this technique, however cooling is terminated at -30 to -40 °C and embryos are then plunged into liquid nitrogen for rapid cooling to -196 °C. Thawing is therefore performed rapidly (200 to 500 °C per minute) to prevent recrystallization

3. Vitrification

Vitrification is the process of cooling where the water in the tissue becomes glass rather than crystals. Glass is a liquid that is too cold (too viscous) to flow. In other words vitrification is solidification due to increased viscosity rather than crystallization.

4. Ultrarapid Freezing

In this technique serial equilibration of embryos in high concentration of DMSO (3-5 M) supplemented with sucrose (0.3 to 0.5 M). The embryos are then plunged into liquid Nitrogen. Thawing is then done with warm water bath (approximately 500 °C per minute).

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.

The sensitivity of cells to low temperature depends on the plant species. There are four different types of methods :

1. **Slow freezing method** - the tissue or plant material is slowly frozen at slow cooling rate. The advantage is the plant cells are partially dehydrated and survive better.

2. **Rapid freezing method** - it involves plunging the vials in liquid nitrogen. The temperature decreases from -300 to -1000 degree rapidly.
3. **Combined freezing method** - this is combination of both slow and rapid freezing method. The process is carried out in step wise like manner.
4. **Dry freezing method** - in this method dehydrated cells and seeds are stored.

34. What is a National Strategy for PGRFA?

A National Strategy for PGRFA is the blueprint for the management of a country's PGRFA as a continuum of interventions in order to achieve clearly defined time bound goals.

35. Do microorganism live in hash conditions

36. Define phenotypic plasticity.2 marks

Phenotypic plasticity is defined as the capacity of a particular genotype to express different phenotypes under different environmental conditions.

37. Define phenotypic plasticity? 3

Ans: "Phenotypic plasticity is defined as the capacity of a particular genotype to express different phenotypes under different environmental conditions." A degree of phenotypic plasticity is found in most trees, but varies substantially amongst and within species.

Even in species with very little genetic diversity, such as *Pinus pinea*L, strong phenotypic plasticity is expressed for growth related traits, which may have helped the species colonise new environments **Pakistan terrestrial water and maritime zone act?**

Ans: 1 It includes provisions for preservation, development and protection of marine environment

2 This law controls marine pollution and exploration, development, conservation and management of living resources in Pakistan's Exclusive Economic Zone (EEZ)

3 This law means that a ship carrying nuclear and hazardous substances will have to inform the Government of Pakistan.

38. Habitat of species that affect climate change?

Global warming resulting from human emissions of greenhouse gases. The consequences include habitat loss; shifts in climatic conditions and in habitats that surpass migrational capabilities; altered competitive relationships.

39. Objectives of Cartagena Protocol on Biosafety 3

The Protocol states that it aims to;

- Contribute to ensuring an adequate level of protection in the field of the safe transfer, handling and use of living modified organisms resulting from modern biotechnology that may have adverse effects on the conservation and sustainable use of biological diversity,
- It takes into account risks to human health, and specifically focusing on transboundary movements.
- It seeks to protect biodiversity from the potential risks of living modified organisms (LMOs) resulting from modern biotechnology.

40. Application of cryopreservation 5 marks

☐ In Animal Husbandry

The introduction of cryopreservation technology leads a major breakthrough in animal husbandry .Since the 1st successful cryopreservation of bull semen has been used to propagate the rare and endangered species using assisted reproduction techniques.

☐ In fishery science

The 1st report on fish sperm cryopreservation was published by Blaxter (1953). To date milt (semen) of over 200 species of fresh water and marine fish have been cryopreserved and have been adequated for the purpose of cryobanking(10,11,12) . In fish aquaculture the successful cryopreservation of gametes and embryos could offer new commercial possibilities, allowing the unlimited production of fry and potentially healthier and better conditioned fish as required

☐ In medical science

Low temperature have been used in medicine and to prevent food spoilage since ancient time. Now- a- days it is used in fertility treatment the transport of human organs and the long- term storage of biological specimens, either for future or simply as a record of biodiversity.

☐ Cryopreservation of testicular tissue

Cryopreservation of immature testicular tissue is a developing method to avail reproduction to young boys who need to have gonado toxic therapy

☐ Embryo cryopreservation

Embryo cryopreservation is used most often to store goodquality excess embryos resulting from an IVF treatment cycle. Embryos can be stored for a patient who elects to have her eggs fertilized with donar sperms. Pregnancies have been reported from embryos stored for 16 years

41. Processing of sample in Dna bank? 5 marks

DNA preserved in DNA banks will be stored either within cells and extracted upon retrieval from storage or extracted from cells and purified before storage. The quality of the DNA is expressed through yield, purity, molecular weight, amplification efficiency and authenticity of sequences. 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. Rapid drying of plant samples with silica gel or lyophilisation helps to preserve the DNA.

42. Storage capacity of DNA banks 3 marks

43. Difference between Laws & Legislation

Laws

The system of rules which a particular country or community recognizes as regulating the actions of its members and which it may enforce by the impossible penalties.

- A person could be held guilty if he breaches Law

Legislations

The process of making or enacting laws.

44. Treaty? 2 marks

“Treaty, a binding formal agreement, contract, or other written instrument that establishes obligations between two or more subjects of international law” • Treaties do not need to follow any special form. • A treaty often takes the form of a contract, but it may be a joint declaration or an exchange of notes.

45. Invasive species 2 marks

Alien invasive species have had severe impacts on local aquatic flora and fauna, and can upset the natural balance of an ecosystem. For example, the introduction of Nile perch to Lake Victoria has pushed many of the lake's native cichlid species to extinction.

46. What Allopatric speciation?

Gene flow blocked by physical barriers results in Allopatric speciation

47. Different steps of Allopatric speciation?

1. A geographic change separates members of a population into more than one group.
2. Different gene mutations occur and build up in the different populations over time.
3. The populations become so different that members of the different populations can no longer breed with each other anymore if were they to be in the same habitat in the same time. If this is the case, allopatric speciation has occurred.

47. How do allopatric and sympatric speciation differ

Allopatric speciation is speciation that results when a population is separated by a physical barrier. It is also referred to as geographic speciation. Sympatric speciation is speciation that occurs without physical separation

of members of the population.

48. Merits and Demerits of Ex situ Conservation 5 marks

Merits:-

- It can be used to protect individual animals in a controlled environment. This means that issues such as predation and hunting can be monitored and managed more easily.
- It can be used to reintroduce species that have left an area.

Demerits:-

- Usually only a small number of individuals can be cared for.
- It can be difficult and expensive to create and sustain the right environment.
- The animals that are habituated (used to) human contact may be less likely to exhibit natural behaviors and may be more likely to catch a disease from humans.
- This type of conservation is usually less successful as many species can't breed successfully in captivity or don't adapt to their new environment when moved to a new location.

49. What is the reason of twin candido goddi

. The reasoning: Candido Godoi has a twin rate nearly 1,000 percent higher than the rest of the world. However, more recent research has led people to point to a genetic founder effect as the real reason. The small town of around 6,000 was formed by a small number of families, specifically German immigrants.

Role of botanical garden in climate change research 5 marks

Plants can alter the temperature of the Earth's atmosphere. 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. Since 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. *transpiration in plants can increase water vapor in the atmosphere, causing more precipitation and cloud cover in an area. The additional cloud cover often reinforces the cooling by blocking sunlight. *Contribute to soil fertility and prevent soil erosion.

50. Name lab of plant genetic resources?

Plant Genetic Resources Institute hosts the sole National Genebank of Pakistan for conservation of plant genetic resources and six labs including

1. germplasm exploration lab
2. seed preservation lab
3. in vitro conservation lab
4. germplasm evaluation lab
5. plant introduction and seed health lab
6. Data management lab

51. Types of Ex Situ conservation

- Gene bank
- Botanical garden

1. Gene Bank

Gene bank refers to a place or organization where germplasm can be conserved in living state. Gene banks are also known as germplasm banks.

Types of Seed Bank

Seed Gene Bank

A place where germplasm is conserved in the form of seeds is called seed gene bank. Seeds are very convenient for storage because they occupy smaller space than whole plants.

Field Gene Bank

Field gene banks also called plant gene banks are areas of land in which germplasm collections of growing plants are assembled.

2. Botanical Garden

A botanical garden or botanic garden is a garden dedicated to the collection, cultivation and display of a wide range of plants labeled with their botanical names

52. Historical Background of CBD?

The **Convention on Biological Diversity**, was opened for signature at the Earth Summit in Rio de Janeiro, Brazil, on June 5, 1992 and by the end of July 1993, 165 countries had signed the treaty. ... The initial sessions were referred to as meetings of the "Ad Hoc Working Group of Experts on **Biological Diversity**."

53. Briefly explain historical background of Ramsar convention. 3

History: Ramsar is one of the global inter-governmental environmental agreements. The treaty was negotiated in 1960s by countries and NGOs. To avoid the increasing loss and degradation of wetland habitat for migratory water birds. In an 18 nations meeting it was adopted in the Iranian city of Ramsar

On 2nd February 1971. Came into force in 21st December 1975

54. Effect of Climate changes on FGR? And Climate effect organisms which are changes associate with tree? 10 marks

Climate change may also result in high variability in temperature and precipitation, with an increase in incidence of extreme events, such as flooding, late frosts and intensive summer droughts, amongst other events. In some areas, such as the Mediterranean and the Neo-tropics, an increase in seasonality is also expected. Under such conditions, natural selection may not result in efficient adaptation because selection pressures are multi-directional, involving traits that may be inversely correlated at the gene level. The standing genetic variation in populations may then not be large enough to create the rare new genotypic combinations that are required. Ecosystems affected by abrupt change may sustain rapid and widespread transformation as ecological tipping points are exceeded. Given the pivotal role of trees in ecosystem function, abrupt climate change impacts on them may thus have profound consequences for forests as a whole. Irreversible loss of ecosystem integrity and function may follow, with replacement by new nonendemic ecosystems.

موسمیاتی تبدیلی کے نتیجے میں درجہ حرارت اور بارش میں اعلیٰ تغیر پذیر ہو سکتی ہے، جس کے نتیجے میں انتہائی واقعات جیسے سیلاب، دیر سے بر فباری اور گرمی کے شدید قحط کے واقعات میں اضافہ ہوتا ہے۔ کچھ علاقوں میں، جیسے بحیرہ روم اور نواشکنلبنڈی علاقوں میں، موسمیات میں بھی اضافے کی توقع ہے۔ اس طرح کے حالات میں، قدرتی انتخاب موثر موافقت کا نتیجہ نہیں بن سکتا ہے کیونکہ انتخاب کے دباؤ کثیر جہتی ہوتے ہیں، جس میں ایسے خصائل شامل ہوتے ہیں جن کا تعلق جین کی سطح پر الٹا سیدھا ہو سکتا ہے۔ آبادیوں میں کھڑی جینیاتی تغیرات اس وقت اتنے بڑے نہیں ہو سکتے ہیں کہ ضرورت کے مطابق نایاب نئے جینیاتی نوعیت کے امتزاج بنائیں۔ ایکولوجی نظام اچانک تبدیلی سے متاثر ہو سکتا ہے کیونکہ تیزی سے اور وسیع پیمانے پر تبدیلی برقرار رہ سکتی ہے کیونکہ

ماحولیاتی ٹینک پوائنٹس سے تجاوز ہو جاتا ہے۔ ماحولیاتی نظام میں درختوں کے اہم کردار کو دیکھتے ہوئے، ان پر موسمیاتی تبدیلیوں کا اچانک اثر پڑنے سے مجموعی طور پر جنگلات کے گہرے نتائج مرتب ہو سکتے ہیں۔ ماحولیاتی نظام کی سالمیت اور فنکشن کا ناقابل تلافی نقصان، اس کے نتیجے میں نئے نوڈیمک ماحولیاتی نظام کے ذریعہ تبدیل ہو سکتا ہے

Direct impacts of climate change

These include high tree mortality through extreme climatic events, particularly drought in combination with widespread regeneration failure, for example, examined the evidence for anthropogenic climate change leading to future large-scale "dieback" in Amazonian rain forest. Analysis suggested that dryseason 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.

ان میں انتہائی آب و ہوا کے واقعات کے ذریعہ اعلیٰ درختوں کی اموات شامل ہیں، خاص طور پر خشک سالی میں بڑے پیمانے پر نو تخلیق کی ناکامی کے ساتھ مل کر، مثال کے طور پر، امیتومون بارش کے جنگل میں مستقبل کے بڑے پیمانے پر "ڈائی بیک" کا باعث بننے والی انسانیت یابی آب و ہوا کی تبدیلی کے ثبوتوں کا جائزہ لیا گیا۔ تجزیہ کیا گیا ہے کہ 21 ویں صدی کے دوران مشرقی امیزونیا میں خشک موسم کے پانی کے تناؤ میں اضافہ ہونے کا امکان ہے، اس خطے کے ساتھ موسمی جنگلات کے ل to مناسب آب و ہوا کی طرف راغب ہونا ہے۔

Effects of changing climate on organisms associated with trees

In particular, changes in the biology of insect pests and diseases may make ecosystems more susceptible to tree mortality. Because of improved environmental conditions for the pest and reduced tree resistance due to increased stress, pests may react to climate change with range expansions and/or increases in attack severity.

خاص طور پر، کیڑوں کے کیڑوں اور بیماریوں کی حیاتیات میں بدلاؤ ماحولیاتی نظام کو درختوں کی اموات کے ل to زیادہ حساس بنا سکتا ہے۔ بڑھتی ہوئی تناؤ کی وجہ سے کیڑوں کے لئے ماحولیاتی حالات بہتر اور درختوں کے خلاف مزاحمت میں کمی کی وجہ سے، کیڑوں میں حد کی توسیع اور / یا حملے کی شدت میں اضافے کے ساتھ آب و ہوا کی تبدیلی پر رد عمل ظاہر ہو سکتا ہے۔

Changes in abiotic disturbance regimes

These include changes in fire regimes, flooding, landslides and/or hurricanes. Fire and climate are closely linked and are also associated with changes in land use. Coupled climate and fire-risk models suggest not only an increase in the frequency of fires but also in fire size and length of the fire-risk season, with some areas subject to risk that were not before. **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

ان میں آگ کی حکومتوں، سیلاب، لینڈ سلائیڈنگ اور / یا سمندری طوفان میں تبدیلیاں شامل ہیں۔ آگ اور آب و ہوا کا آپس میں گہرا تعلق ہے اور زمین کے استعمال میں بدلاؤ سے بھی وابستہ ہیں۔ جوڑے ہوئے آب و ہوا اور آگ کے خطرے والے نمونے نہ صرف آگ کی فریکوئنسی میں اضافہ بتاتے ہیں بلکہ آگ کے خطرہ اور آگ

کے خطرے کے موسم کی لمبائی میں بھی، کچھ ایسے خطوں کے ساتھ جو پہلے نہیں تھے۔ ملیشی اللہ (2009) اس پر غور کیا گیا کہ کس طرح بڑھتی ہوئی سوجھاپن اور آگ کے واقعات کے بڑھتے ہوئے واقعات کے امتزاج سے امیزونیا کے بارشوں کے جنگل میں نوکری کے مقامات تک پہنچ جاسکتی ہے۔

Invasion by organisms foreign to local ecosystems

This includes the increased risk of establishment by invasive species which accidentally arrive into ports of entry, through globalized commerce. By making new niches available, climate change will facilitate the survival of mammals, insects, diseases and/or weeds foreign to endemic ecosystems.

اس میں حملہ آور نسلوں کے ذریعہ اسٹیبلشمنٹ کا بڑھتا ہوا خطرہ بھی شامل ہے جو عالمی سطح پر تجارت کے ذریعہ حادثاتی طور پر داخل کی بندرگاہوں میں پہنچ جاتا ہے۔ نئی جگہوں کو دستیاب بنانے سے، آب و ہوا کی تبدیلی سے ستنداریوں، کیڑوں، بیماریوں اور / یا خارجی ماتی لباس کے ماحول کو خارجی ماحول سے بچنے میں مدد ملے گی

55. Responses of tree populations to environmental change 10 marks

Tree populations rely on three interplaying mechanisms to respond to environmental change:

1. adaptation
2. Migration
3. phenotypic plasticity

1. Adaptation and standing genetic variation

Genetic adaptations that make a population more suited for survival are achieved through gene frequency changes across generation. Many tree species have high genetic variability in adaptive traits and can therefore grow under a wide range of conditions. Indeed, phenotypic traits of adaptive importance, such as drought tolerance, cold-hardiness, resistance to pests and diseases, and flowering and fruiting period, have been shown to vary across ecological and geographic gradients to an extent that may be as important as the differences observed amongst species.

2. Migration via pollen and seed movement

Pollen is known on occasions to travel very long distances, particularly in wind dispersed broadleaves and conifers, but also sometimes for animal-pollinated species. 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. Landscape genetic approaches, macrofossil evidence and theoretical studies, however, indicate that cryptic refugia may have been overlooked, considerably reducing migration estimates. In addition, 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.

3. The role of phenotypic plasticity

Phenotypic plasticity is defined as the capacity of a particular genotype to express different phenotypes under different environmental conditions. The concept is often extended to populations and species, with plastic trees those with flexible morphology and physiology that grow at least reasonably well under a range of different environmental stresses without genetic change. A degree of phenotypic plasticity is found in most trees, but varies substantially amongst and within species. Even in species with very little genetic diversity, such as *Pinus pinea* L., strong phenotypic plasticity is expressed for growth related traits, which may have helped the species colonise new environments. At least in the short term, high plasticity is likely to favour tree survival under

changing environmental conditions, although trade-offs between traits can be expected. Since 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.