MSc Part-I

Paper - VI

Topic- Management of Forest resources

Prepared by – Ajai Kishore Sharan

Mobile no: 9430266073(Contact after 20 June)

Email: ajaiksharan@gmail.com

.

.

Topic-1

Social forestry

Social forestry is the practice of forestry on lands outside the conventional forest area for the benefit of the rural and urban communities. The term was coined by J.C. Westoby. It was first recognized as an important component of forestry for meeting rural needs in the interim report of the National Commission on Agriculture (NCA, 1976).The objectives of social forestry adopted by the NCA were to fulfill the basic and economic needs of the community.

The scope of social forestry defined by the NCA included farm forestry, community woodlots and reforestation in degraded lands. By mid-1980, the concept of social forestry was firmly established as forestry of the people, by the people and for the people.

Social forestry includes within its scope the following:

a) Farm Forestry: Farm forestry is the practice of forestry on farms in the form of raising rows of tree on bunds or boundaries of field and individual trees in private agriculture land as well as creation of wind breaks, which are protective vegetal screens created round a farm or an orchard by raising one or two lines of trees fairly close with shrubs in between.

b) Extension Forestry: Extension forestry is the practice of forestry in areas devoid of tree growth and other vegetation and situated in places away from the conventional forest areas with the object of increasing the area under tree growth. It includes within its scope the following:

i. Mixed forestry: Mixed forestry is practice of forestry for raising fodder grass with scattered fodder trees, fruit trees and fuel-wood trees on suitable waste lands, panchayat land and village commons land.

ii. Shelterbelts: Shelterbelts is defined as ‘a belt of trees and/or shrubs maintained for the purpose of shelter from wind, sun, snow-drift, etc. they are generally more extensive than the wind-breaks covering areas larger than a single farm and sometimes whole regions on a planned pattern.’ Or Shelterbelt is wide belt of tree, shrubs and grasses which goes right across the land at right angle to the direction of prevailing wind in order to Reduce wind velocity Deflect wind current Protect public properly in leeward side

iii. Wind breaks: It is a protective planting around a garden, a farm or a field to protect it against strong winds. It usually consists of 2-3 rows of trees or shrubs, spaced at 0.5 m to 2.5 m apart, depending on the species.

iv. Linear Strip Plantation: These are plantations of fast-growing species on linear strips of land on the sides of public roads, canals and railway lines.

c) Community Woodlots: The community woodlots, consists of plantations of fuelwood species on community village lands, with intended objective of increasing a villager's access to fuel wood, fruits and fodder.

d) Rehabilitation of Degraded Forests

As a third component, the interim report of the NCA, 1976 suggested reforestation of degraded forests to achieve the following objectives:

1. To grow short rotation fuel and timber species for meeting the requirements.

2. To organize fuelwood supplies at reasonable rates, this will prevent pilferage from neighbouring commercial forests.

3. To tie up degraded forest areas with the nearby rural and semi-urban centers for their requirements of fuelwood.

4.To provide employment.

5.To rehabilitate the degraded forests in the process.

e) Recreation Forestry: Recreation forestry is the practice of forestry with the object of raising avenue/flowering trees and shrubs mainly to serve as recreation forests for the urban and rural population. This type of forestry is also known as Aesthetic forestry which is defined as the practice of forestry with the object of developing or maintaining a forest of high scenic value.

Social forestry refers to the management of forests for the benefits of local communities. It includes aspects such as forest management, forest protection, and afforestation of deforested lands with the objective of improving the rural, environmental, and social development. Unlike other forestry projects, in the setting of social forestry, the needs of local communities come first.

For this reason, the main goal of social forestry is to grow trees and plantations to meet the growing needs of people in reference to increased demand for timber, wood, food, fuel, and food to reduce the pressure and dependency on traditional forest areas.

The practice also aims to protect agriculture from adverse climatic conditions by improving the environment, increase the natural beauty, and increasing the supply of forest produce for local use.

Although the concept and practice of social forestry have existed for centuries, it is constantly gaining a new dimension because of its benefits including its potential for tackling the challenges of global warming. Here, the benefits and types of social forestry are explained in detail.

Benefits of Social Forestry

1. Increased Biodiversity

Growing of trees in barren lands within the community helps to increase biodiversity value. As trees grow larger, the nature of the habitat will change. Well managed forests encourage biodiversity as they offer habitation for various animals, plants, shrubs, insects, and birds among others. In nature, wherever there are trees, other plants and wildlife follow.

In social forestry, trees and associated plants become the source of food and shelter for a variety of small animals and birds. Furthermore, mature trees create an environment that encourages the growth of other plants that would otherwise not be existent thereby increasing food varieties for animals and the local people.

2. Carbon removal – trees act as carbon sinks!In the fight against the global warming effect, trees play an essential role in the removal of carbon from the environment. Trees use carbon dioxide when growing and thus, removing it from the environment.

Social forestry is seen as the best way to reduce carbon dioxide in urban settings. Trees' energy-saving effect also indirectly lowers carbon dioxide emissions by reducing the demand for power.

It is estimated that planting of 100 million trees would help save 22 billion kilowatt-hours and about 33 million tons of carbon dioxide annually after ten years according to a 1990 study by Akbari and others.

However, it is worth noting that the actual amount of carbon dioxide removed from the air depends on the types of trees and vegetation in the forest.

On its own, a mature Bradford pear can store up to 306 kg of carbon dioxide in its aboveground biomass. Trees help to reduce carbon dioxide by acting as a carbon dioxide sink and by reducing energy use. Neighborhoods well covered with trees can be up to 6 to 10 degrees cooler than areas without tree cover.

3. Soil conservation

Another critical benefit of social forestry is soil conservation. Communities that embrace social forestry enjoy significant benefits in terms of improved agricultural activities. Tree roots prevent soil erosion by holding soil in place, mitigating the negative effects of soil erosion.

In a medium-sized city, planting trees in parks and along paths and roads can help save up to 10. 886 tons of soil annually. It is also worth noting that trees reduce soil erosion by reducing the impact of raindrops on barren surfaces.

Decaying tree leaves also help form an organic layer on the ground that makes the soil rich while also allowing water to percolate into the soil, reducing the likeliness of runoff and soil erosion.

They also act as mulch reducing evaporation. Roots also reduce soil compaction, increasing the rate at which rainfall infiltrates soil as well as the capacity of soil to store water, reducing the likeliness of overland flow.

4. Health benefits

The effects of trees and nature on human health are well researched. Trees and nature are natural remedies for stress and anxiety. When people are stressed, they usually take a walk in the parks and other nature trails for the calming effect.

Therefore, bringing trees to human habitats can contribute to better health and improved general wellbeing. It is also becoming common to find hospitals growing trees due to the healing effect of trees.

Studies have shown that hospital patients with a view of trees outside their windows can help them recover faster and with fewer complications.

Trees also absorb tailpipe pollutants that can have a negative effect on people's health such as carbon dioxide, nitrogen oxides, volatile organic compounds, and particulate matter. Traditionally, trees and forests have been a source of medicinal value for communities around the forest.

5. Community enrichment

Trees make the neighborhood more attractive and more serene. An area with an abundance of trees is more likely to attract newcomers than an area without trees.

Furthermore, properties in an area with an abundance of trees are more valuable than the same properties in an area without trees. Trees create shade that helps improve the longevity of outdoor furniture and even pavement.

Studies have shown that providing 20 percent shade can help improve the condition of your pavement by up to 11 percent resulting in up to 60 percent savings in resurfacing costs. It is also worth noting recreational areas that are well stocked with trees can help keep the community together at home.

6. Noise reduction

Noise is a big trigger of anxiety and stress. Loud noises can disrupt sleep, affect how people relate with others, and even cause illness. In fact, prolonged exposure to high levels of noise and noise pollution is considered a major cause of hearing loss.

Although rules and regulations are being put in place to reduce noise pollution in many nations across the globe, embracing social forestry in urban areas can mitigate the effects of noise pollution.

Trees reflect and absorb sound energy reducing noise pollution. Furthermore, the noise of trees caused by branches and leaves as they swirl on a windy day helps to mask man-caused sounds reducing the negative noise.

7. Improve air quality

Although most people relate trees with the removal of carbon dioxide from the environment, it is worth noting that trees also help to clean and improve the quality of air.

An acre of trees is adequate to generate enough oxygen for up to 18 people. Trees also absorb gaseous pollutants that negatively affect people's health by creating conditions such as asthma and breathing difficulties.

Particularly, trees help to clean air by absorbing gaseous pollutants into their leaves and then trap and filter particulates on and through their stems, leaves, and twigs. Some of the pollutants that can be controlled by trees include carbon monoxide, sulfur dioxides, nitrogen oxides, carbon dioxide, ozone and small particulates that are less than 10 microns in size.

8. Energy conservation and reducing overall atmospheric temperatures

Trees act as natural air conditioners. The evaporation from a single tree can have the same cooling effect as ten room-sized, residential air conditioners operating 20 hours a day.

Planting two or three trees in the compound can shade your home from the hot sun eliminating the need to cool your home and thus, lowering the energy needed to heat the house.

Trees can also make good screens and act as windbreaks when placed in the path of the prevailing winds improving heating efficiency.

9. Social benefits

Trees are associated with various social benefits that make the neighborhood more attractive and valuable. Social forestry helps to create inviting and cool areas for relaxation and recreation such as parks and playgrounds. Trees also add exciting color and beauty to the neighborhood as seasons change.

The color green creates a calming effect and helps relieve eye strain contributing to the wellness of the community. Trees also help to screen unattractive views and soften the harsh outline of metal, masonry, steel, asphalt, and glass. Trees also encourage interaction with neighbors by providing areas where people regularly meet.

Types of Social Forestry

1. Agro-forestry

Agro-forestry involves the growth of trees and agriculture in the same setting to provide landowners with agricultural and tree products on a commercial basis. The objective of the agro-forestry is to gain positive interactions between the two systems. The systems can be separate or fully physically integrated within a single business enterprise.

This type of social forestry is ideal for an individual looking to venture into farm forestry while maintaining the existing agricultural enterprise. Agro-forestry offers businesses economic benefits, social benefits, and increased productivity as well as the provision of ecological goods and services.

2. Farm Forestry

In the farm forestry setup, the objective is to manage trees for a specific purpose within a farming context. The common purpose is usually timber plantations on private land, but the setup can be applied to a range of enterprises that are managed in a variety of ways using different parts of the trees.

Farm forestry offers many benefits that include shelter and pasture for animals, additional diversified earnings, improved living environments, an increase in the capital value of the plantation, improvement, and maintenance of soil and water health, sustainable management of natural resources, and increases in biodiversity.

3. Extension Forestry

Extension forestry is increasingly becoming common in urban centers and most living estates. Extension forestry involves the planting of trees on the sides of canals, roads, and railways as well as on wastelands. This type of social forestry is beneficial in the creation of forests on the common village lands, panchayat lands, and government wastelands.

4. Community Forestry

Community forestry refers to the management of communal land. The village members collectively decide and implement projects on the communal land. The local population takes part in the planning, managing, and harvesting of forest crops.

The population also shares a proportion of the socio-economic and ecological benefits from the forest. The purpose of community forestry is to increase the involvement and reward for local people. It also seeks to provide a balance between outside and community interests.

*

Topic-2

Agroforestry

Agroforestry, is cultivation and use of trees and shrubs with crops and livestock in agricultural systems. Agroforestry seeks positive interactions between its components, aiming to achieve a more ecologically diverse and socially productive output from the land than is possible through conventional agriculture. Agroforestry is a practical and low-cost means of implementing many forms of integrated land management (which seeks to reduce human impacts on land), and it contributes to a green economy by promoting long-term, sustainable, and renewable forest management, especially for small-scale producers. Integrating trees with crops and animals are a long-standing tradition throughout the world. In 2004 the World Bank estimated that agroforestry practices were being used by 1.2 billion people. Agroforestry practices are intentional combinations of trees with crops and/or livestock which involve intensive management of the interactions between the components as an integrated agroecosystem. These four key characteristics - intentional, intensive, interactive and integrated - are the essence of agroforestry and are what distinguish it from other farming or forestry practices. To be called agroforestry, a land use practice must satisfy all of the following four criteria:

Intentional: Combinations of trees, crops and/or animals are intentionally designed and managed as a whole unit, rather than as individual elements which may occur in close proximity but are controlled separately.

Intensive: Agroforestry practices are intensively managed to maintain their productive and protective functions, and often involve annual operations such as cultivation, fertilization and irrigation.

Interactive: Agroforestry management seeks to actively manipulate the biological and physical interactions between the tree, crop and animal components. The goal is to enhance the production of more than one harvestable component at a time, while also providing conservation benefits such as non-point source water pollution control or wildlife habitat.

Integrated: The tree, crop and/or animal components are structurally and functionally combined into a single, integrated management unit. Integration may be horizontal or vertical, and above- or below-ground. Such integration utilizes more of the productive capacity of the land and helps to balance economic production with resource conservation.

The Benefits of Agroforestry

Over the past two decades, a number of studies have been carried out analyzing the viability of agroforestry. The combined research has highlighted that agroforestry can reap substantial benefits both economically and environmentally, producing more output and proving to be more sustainable than forestry or agricultural monocultures. Agroforestry systems have already been

adopted in many parts of the world.According to the Agroforestry Research Trust, agroforestry systems can include the following benefits:

a)They can control runoff and soil erosion, thereby reducing losses of water, soil material, organic matter and nutrients.

b) They can maintain soil organic matter and biological activity at levels satisfactory for soil fertility. This depends on an adequate proportion of trees in the system- normally at least 20% crown cover of trees to maintain organic matter over systems as a whole.

c) They can maintain more favourable soil physical properties than agriculture, through organic matter maintenance and the effects of tree roots.

d) They can lead to more closed nutrient cycling than agriculture and hence to more efficient use of nutrients. This is true to an impressive degree for forest garden/farming systems.

e) They can check the development of soil toxicities, or reduce exiting toxicities-both soil acidification and salinization can be checked and trees can be employed in the reclamation of polluted soils.

f) They utilize solar energy more efficiently than monocultural systems different height plants, leaf shapes and alignments all contribute.

g) They can lead to reduced insect pests and associated diseases.

h) They can be employed to reclaim eroded and degraded land.

Agro forestry can augment soil water availability to land use systems. In dry regions, though, competition between trees and crops is a major problem.

Nitrogen-fixing trees and shrubs can substantially increase nitrogen inputs to agro forestry systems.

Trees can probably increase nutrient inputs to agro forestry systems by retrieval from lower soil horizons and weathering rock.

The decomposition of tree and pruning can substantially contribute to maintenance of soil fertility. The addition of high-quality tree prunings leads to large increase in crop yields.

The release of nutrients from the decomposition of tree residues can be synchronized with the requirements for nutrient uptake of associated crops. While different trees and crops will all have different requirement, and there will always be some imbalance, the addition of high quality prunings to the soil at the time of crop planting usually leads to a good degree of synchrony between nutrient release and demand.

In the maintenance of soil fertility under agro forestry, the role of roots is at least as important as that of above-ground biomass.

Agro forestry can provide a more diverse farm economy and stimulate the whole rural economy, leading to more stable farms and communities. Economics risks are reduced when systems produce multiple products.

As well as building on practices used in forestry and agriculture, agroforestry also works towards land protection and conservation through more effective protection of stock, control of soil erosion, salinity and water tables and a higher quality control of timber.

A denser, more-dependable tree covering can provide shelter to livestock during the warmer months allowing the animals can conserve energy. That same tree covering helps block out wind, helping to boost water retention levels that can help produce a more robust crop yield.

Salinity and water table control:

Salinity is mainly caused by rising water tables. Trees help to lower water tables, acting as pumps to take up water from the soil and then evaporating it to the atmosphere.

Soil erosion control:

Soil erosion or loss results from the action of wind and water on unprotected soils. The forest canopy, roots and leaf litter all have a role in controlling soil erosion.

Water logging:

Through water removal, established trees can substantially reduce water logging in their immediate area, which may result in improved land uses, e.g. pasture or crop.

Topic-3

Forest Management

The forestry and natural resources community has debated the concept of "sustainability" for decades. A high level of political commitment to advancing "sustainable forest management" was achieved at the United Nations Conference on Environment and Development (Rio de Janeiro, 1992). Considerable effort has been invested subsequently in intergovernmental processes to define criteria and indicators of sustainable forest management.

1 Beyond this, governments have committed staff, time and resources to develop a programme to advance sustainable forest management (e.g. the Intergovernmental Panel on Forests, the Intergovernmental Forum on Forests and the UN Commission on Sustainable Development). In spite of all these efforts, sustainable forest management remains an elusive goal.

The objectives of sustainable forest management

References to sustainable forest management are universally vague and ambiguous. The lack of precision stems from a current inability to reach agreement on a complex set of issues that are largely determined by culture, personal values, and individual hopes, fears and concerns about uncertainty.

The forests of the world provide numerous amenities and ecosystem services in addition to being a source of wood products. The various public, industrial, and private owners of forestland may have quite different objectives for the forest resources they control.

Sustained yield

Forest management originated in the desire of the large central European landowners to secure dependable income to maintain their castles . Today forest management is still primarily economic in essence.Sustained-yield principles are likewise applied to minor forest produce. Turpentine and pitch are obtained by the systematic tapping of the lower trunk of certain subtropical pines. Successive cuts with a chisel-like tool every few days during a succession of summers eventually kill the trees. To ensure continued yields, crops of young pines are raised rotationally to replace those felled. A similar system is followed for the rubber tree (Hevea brasiliensis) that is grown in plantations.

Forest products

The culture of trees in natural forests and plantations for the yield of lumber, pulp, chips, and specialty products is a principal management objective. In many parts of the world the harvest of wood for firewood and charcoal is the dominant use, and these products are often in short supply. Timber stands must be felled and regenerated in an orderly sequence to meet continuing industrial demands.

Natural regeneration

In established forests the selective cutting of marketable timber, taking either one tree at a time (single-tree selection) or a number of trees in a cluster (group selection) and leaving gaps in which replacements can grow up from natural seedlings, can prove economical and also ensure the best possible use of available soil, light, and growing space. The best examples of single-tree-selection forests are found in Switzerland, on slopes where any clear felling could lead quickly to soil erosion and avalanches.

Artificial regeneration

Artificial regeneration is accomplished by the planting of seedlings (the most common method) or by the direct planting of seeds. Direct seeding is reserved for remote or inaccessible areas where seedling planting is not cost-effective. A few tree species, such as poplars (Populus species) and willows (Salix species), are artificially reproduced from cuttings.

Range and forage

Important among the broad spectrum of forest resources are the understory plants that can provide forage for grazing animals, both domestic and wild. Grazing livestock are useful to the forest manager. Dense old-growth forest or vigorous second-growth stands with closed canopies generally have sparse, low-quality forage.

Recreation and wildlife

From the earliest times human beings have looked to the forests for recreation. Today, recreation in forests assumes ever-growing importance with the growth of cities whose inhabitants need a change of scene, fresh air, and freedom to wander, as a relief to the stresses of industrial and commercial life. Imaginative planning is essential to ensure that people actually find what they are seeking without damage to the forest environment or conflict with the pleasures of others. The most popular outdoor recreation activities utilize forestland and include hunting and fishing, picnicking and camping, hiking, mountain climbing, driving for pleasure, boating and other water sports, winter sports, photography, and nature study. The challenge is to balance the varied demands for recreational use with the other forest uses.For many recreationists the main attraction of the woods is the abundance of animal and plant life. The forest manager must attempt to satisfy the diverse needs of hunters and sportsmen, outdoorsmen, and preservationists. This requires a broad expertise drawing on principles from the social sciences, natural history, wildlife management, conservation, landscape design, law, and public administration, among other disciplines.

Watershed management and erosion control

Not only is the presence of water in soils essential to the growth of forests, but improved water yield and quality are becoming increasingly important management objectives on many forested lands. Forests and their associated soils and litter layers are excellent filters as well as sponges, and water that passes through this system is relatively pure. Forest disturbances of various kinds can speed up the movement of water from the system and, in effect, reduce the filtering action. While disturbances are inevitable, in most instances they need not contribute to poor water quality.

In mountainous territory the value of forests for watershed and erosion protection commonly exceeds their value as sources of lumber or places of recreation. The classic example is found in Switzerland and the neighbouring Alpine regions where the existence of pastoral settlements in the valley is wholly dependent on the maintenance of continuous forest cover on the foothills of the great peaks. This is combined skillfully with limited lumbering and widespread recreational use by tourists.

Fire prevention and control

A forest fire is unenclosed and freely spreading combustion that consumes the natural fuels of a forest—i.e., duff, grass, weeds, brush, and trees. Forest fires occur in three principal forms, the distinctions depending essentially on their mode of spread and their position in relation to the ground surface.

Insect and disease control

Enormous numbers and varieties of insects, fungi, bacteria, and viruses occur in forests and are adapted to live on or around trees. Many of these are beneficial, and even the destructive ones are usually held in check by their natural enemies or an unfavourable environment. The normal population levels of pest organisms result in limited reduction in tree growth or the total destruction of only a small number of trees in the forest. The losses are generally accepted by foresters as unavoidable and are tolerated as long as the annual destruction does not seriously affect the net annual increase in wood production.Generally the healthier the forest, the more resistant it is to widespread pest attack. Overmature, weak, wind-thrown, and lightning- or fire-killed trees have little or no defense against infestation and are a factor in the buildup of pest populations. Selective cutting of susceptible trees, thinning that accelerates growth, and other similar long-range forest management practices that stimulate vigorous tree growth are good methods for indirect control of insects and diseases. These practices reduce the host material and breeding grounds of pests that may spread to healthy trees. In regions with a high incidence of a known pest, foresters attempt to avoid serious trouble by planting only trees known to resist existing pests in the regions where the trees are grown. Many forest genetic programs have as a major goal the selection and breeding of trees with insect and disease resistances.

Agroforestry

Agroforestry is a practice that has been utilized for many years, particularly in developing countries, and is now widely promoted as a sustainable land-use approach that yields both wood products and crops. Trees and crops may be grown together on the same tract of land in various patterns and cycles. The trees may be planted around the perimeter of a small farm to provide fuelwood and to serve as a windbreak. The limbs and foliage may be removed periodically for livestock fodder. Trees also may be planted in rows that alternate with crops or they may be planted more densely with interplanting of crops until crown closure of the trees precludes further crop production. These practices are most extensively used as a part of subsistence agriculture, but their use in large-scale production systems is becoming more common.

Urban forestry

Urban forestry, which is the management of publicly and privately owned trees in and adjacent to urban areas, has emerged as an important branch of forestry. Urban forests include many different environments such as city greenbelts; street and utility rights-of-way; forested watersheds of municipal reservoirs; and residential, commercial, and industrial property. An important distinction between urban and rural forestry is that urban trees are more highly valued than rural trees and often receive expensive individual care and attention. Many professional foresters are trained to handle the special problems of urban trees and to foster the diverse benefits they provide.

Topic-4

Man and Biosphere Programme

Man and the Biosphere Reserves (MAB) programme

Introduction

The MAB programme was launched in the early 1970s, and was substantially revised in 1995 with the adoption by the United Nations Education, Scientific and Cultural Organisation (UNESCO) General Conference of the Seville Strategy and the Statutory Framework of the World Network of Biosphere Reserves (WNBR). The MAB programme proposes an interdisciplinary research agenda and capacity building initiative aiming to improve the relationship of people with their environment globally.

The Statutory Framework of the WNBR (the Statutory Framework) defines Biosphere Reserves as "..areas of terrestrial and coastal/marine ecosystems or a combination thereof, which are internationally recognised within the framework of UNESCO's Programme on Man and the Biosphere (MAB), in accordance with the present statutory framework"

These sites are designated by the International Coordinating Council of the MAB Programme at the request of the State concerned. Individual biosphere reserves remain under the sovereign jurisdiction of the state where they are situated. Collectively, all biosphere reserves form a world network in which participation by states is voluntary.

Biosphere reserves are much more than "protected areas". They should not be viewed as islands isolated from its surroundings, but rather as an integral part of a regional planning and development strategy aimed at promoting sustainable development. Physically they contain three elements as follows:

Core areas: are securely protected areas for conserving biological diversity, monitoring minimally disturbed ecosystems, and undertaking non-destructive research and other low-impact uses(education) e.g. national parks, nature reserves, world heritage sites and Ramsar sites

Buffer zone: usually surrounds or adjoins the core areas, and is used for cooperative activities compatible with sound ecological practices, including environmental education, recreation, ecotourism and applied basic research; and

Transitional area: contains a variety of agricultural activities, settlements and other uses in which local communities, management agencies, scientists, non-governmental organizations, cultural groups, economic interest and other stakeholders work together to manage and sustainably develop the area's resources.

Each biosphere reserve is intended to fulfill three basic functions, which are complementary and mutually reinforcing. These functions are the following:

‘conservation’ (conserving genetic resources and ecosystems and maintaining biodiversity)

‘logistics’ (an international network of areas related to MAB field research and monitoring accompanied by education and training); and

‘development’ (associating environmental protection with resource development)

An example of an attempt to define the objectives of sustainable forest management

Participants at a conference on sustainable forest management (held at the University of California in March 1997) discussed the specific objectives of forest sustainability, starting with those from Agenda 21. These objectives included:

- to preserve biodiversity;
- to maintain economic productivity;
- to take advantage of present economic opportunities;
- to maintain future options;
- to respect inter-generational equity; and
- to respond to social and cultural needs.

Participants then added more objectives to those given above, including:

- to satisfy the values of indigenous peoples and local communities;
- to take into account aesthetics;
- to provide recreation opportunities;
- to avoid of off-site consequences and the export of environmental problems;
- to satisfy existence values; and
- to provide flexibility.

Some participants suggested that the list should be broadened even further to include human and non-human issues, environmental rights, ethical restraints on behaviour, fair land tenure practices and the creation of political structures for environmentally sensitive development..

Reserve of India

1. Nilgiri Biosphere(connected to MAB)- 1 August,1986- Tamil nadu, Karnataka,Kerala-, Lion-tailed macaque
2. Gulf of Mannar (connected to MAB)- 18 February,1989, Tamil Nadu- Dugong or Sea Cow
3. Sunderbans (connected to MAB)-29 March ,1989, West Bengal- Royal Bengal Tiger
4. Nanda Devi National Park & Biosphere Reserve (connected to MAB)- 18 January,1988,Uttarakhand- Himalayan Snow Leopard
5. Nokrek (connected to MAB)-1 september,1988, Meghalaya- Red Panda
6. Pachmarhi Biosphere Reserve (connected to MAB)-3 March,1999, Madhya Pradesh- Giant squirrel
7. Similipal (connected to MAB)-21June-1994,Odisha- Gaur, Royal Bengal Tiger, Wild Elephant
8. Achanakmar- Amarkantak (connected to MAB)-30 March,2005, Madhya Pradesh and Chhatisgarh- Leopards, gaur, chital
9. Great Nicobar Island Biosphere Reserve (connected to MAB) -06-Jan-1989Andaman and Nicobar Islands- Saltwater Crocodile
10. Agasthyamalai Biosphere Reserve (connected to MAB)- 12-Nov-2001-Tamil Nadu, Kerala- Nilgiri Tahr, Elephants
11. Manas-14-Mar-1989 Assam Parts of Kokrajhar, Bongaigaon, Barpeta,Nalbari, Kamprup and Darang districts East Himalayas Golden Langur, Red Panda
12. Dibru-Saikhowa-28-Jul-1997-Assam- Golden Langur
13. Dehang-Dibang- 02-Sep-1998 Arunachal Pradesh-NA
14. Khangchendzonga-7-Feb-2000 Sikkim- Snow Leopard, Red Panda
15. Great Rann of Kutch-29-Jan-2008,Gujarat Parts of Kutch, Rajkot-Indian wild Ass

In summary, biosphere reserves add value to the existing protected areas network as follows:

(a)International level

Provide practical ways to resolve land use conflict and to protect biological diversity

Provide opportunities and share ideas for education, recreation and tourism to address conservation and sustainability issues

Cooperate on thematic project based topics (e.g. agricultural practices or climatic change) or on ecosystem types (e.g. fynbos)

Create a connection among people and cultures worldwide on how to live in harmony with the environment and each other

Promotes an integration approach towards the implementation of the Convention on

Biological diversity through the application of the ecosystems approach

(b) Local level

Help create and maintain a healthy environment for people and their families

Maintain productive and healthy landscapes

Reduce conflict among people

Encourage diverse local economies to revitalise rural areas

Increase the involvement of communities in land use decisions and thus the connection to the land

Support and facilitate interconnected scientific studies and monitoring

Celebrate cultural diversity and provide opportunities to maintain existing traditions and

Lifestyle.

The MAB programme therefore targets to reconcile the conservation of biodiversity, the quest for economic and social development and the maintenance of associated cultural values of communities. It uses its World Network of Biosphere Reserves as vehicles for knowledge sharing, research and monitoring, education and training, and participatory decision-making.

Institutional arrangements for the MAB programme

The MAB programme is managed by UNESCO through the International Coordinating Council of the Man and the Biosphere Programme (ICC). It is composed of 34 elected representatives of Member States of UNESCO. The Council normally meets once every two years, usually at the UNESCO headquarters in Paris. Although each member state has only one vote, it can send as many experts or advisers as it wish to the council sessions.

Guide and supervise the MAB programme;

Review the progress made in the implementation of the programme (cf. Secretariat report and reports of National MAB Committees);

Recommend research projects to countries and to make proposals on the organisation of regional or international cooperation;

Assess priorities among projects and MAB activities in general;

Co-ordinate the international cooperation of Member States participating in the MAB Programme;

Co-ordinate activities with other international scientific programmes; and

Consult with international non-governmental organisations on scientific or technical questions.

To date (2011), there are 580 sites in over 114 countries listed on the World Network on Biosphere

Topic- 5

Major causes of loss of Forest resources

Causes of Forest Degradation

Climate Change

Changes in world's climate due to extreme alterations of average atmospheric temperatures are a leading cause of forest degradation. These changes in climate cause extended droughts and extremely dry or cold periods which create undesirable environmental conditions for tree covers to thrive.

Prolonged dry conditions and droughts can equally dry out the water systems running through the forests thereby gradually reducing the number of trees and species in such areas. Climate change causes extreme alterations in forest ecosystems. In most cases, animals are forced to migrate to other regions, reducing the quality of forest ecosystems.

Forest Fires

Forest fires such as the ones that commonly happen in dry tropical forests are a major cause of forest degradation. Forests fires may arise on the account of natural, accidental, and human causes. Whenever forest fires are experienced, thousands of acres of trees and vegetation cover are wiped out. Almost every year, forests fires are witnessed across different forest region on earth which persistently affects the economy and biodiversity.

Pests and Diseases

Just like in agricultural practices where farmers incur crop and animal production losses from the impacts of pest and diseases, so is the case in forest lands and vegetation cover. Numerous trees and vegetation covers are destroyed by pests and diseases throughout the year. The general outcome is a reduction in quality of specific aspects of the forests such as biodiversity and food chain relationships because of the death of certain plant and animal species.

Air Pollution

Air pollution is a substantial causal factor for forest degradation. Pollution of the air by harmful gases and emissions leads to atmospheric acidification and acid rain that causes damage to trees and vegetation cover. Acid rain destroys the leaves of trees and vegetations needed for photosynthesis and alters the acidity of the water systems supporting the forests. The acidic compounds present in acid rain can also extensively damage vital forest ecosystems and biodiversity.

Forest Fragmentation

Fragmentation can also contribute to forest degradation. Fragmentation pertains to separation of large forest areas into smaller pieces. It mainly occurs due to natural causes such as tectonic movements or flooding. Fragmentation destroys healthy ecosystems since large forest animals mostly flourish in large forest regions as opposed to pieces of forests. Fragmentation also changes the food chain interactions and the mutual relationships within the forest physical environments.

Land Pollution

One of the calamitous effects of land pollution is the destruction of nearby forests together with its ecosystems. Discharge of various kinds of chemicals on land adjacent to forest regions makes the environment unappealing to the survival of trees, vegetations, and animal species. It even interferes with the animals interactive food chains because the chemicals contaminate plants and waters which are consumed by the animals.

Soil Erosion and Sedimentation

Soil erosion and sedimentation is linked to forest degradation essentially because many stable lands supporting healthy, rich, valuably matured forests disappear due to the erosion of river banks and sedimentation. Studies reveal that this type of forest degradation is common hill forest areas.Deforestation is the permanent removal of trees to make room for something besides forest. This can include clearing the land for agriculture or grazing, or using the timber for fuel, construction or manufacturing.

Deforestation

Forests cover more than 30% of the Earth's land surface, according to the World Wildlife Fund. These forested areas can provide food, medicine and fuel for more than a billion people. Worldwide, forests provide 13.4 million people with jobs in the forest sector, and another 41 million people have jobs related to forests. Forests are a resource, but they are also large, undeveloped swaths of land that can be converted for purposes such as agriculture and grazing. In North America, about half the forests in the eastern part of the continent were cut down for timber and farming between the 1600s and late 1800s, according to National Geographic.

Effects of deforestation

Forests can be found from the tropics to high-latitude areas. They are home to 80% of terrestrial biodiversity, containing a wide array of trees, plants, animals and microbes, according to the World Bank, an international financial institution. Some places are especially diverse — the

tropical forests of New Guinea, for example, contain more than 6% of the world's species of plants and animals.

Forests provide more than a home for a diverse collection of living things; they are also an important resource for many around the world. In countries like Uganda, people rely on trees for firewood, timber and charcoal. Over the past 25 years, Uganda has lost 63% of its forest cover, Reuters reported. Families send children — primarily girls — to collect firewood, and kids have to trek farther and farther to get to the trees. Collecting enough wood often takes all day, so the children miss school.

According to a 2018 FAO report, three-quarters of the Earth’s freshwater comes from forested watersheds, and the loss of trees can affect water quality. The UN's 2018 State of the World's Forests report found that over half the global population relies on forested watersheds for their drinking water as well as water used for agriculture and industry.

Natural fires in tropical forests tend to be rare but intense. Human-lit fires are commonly used to clear land for agricultural use. First, valuable timber is harvested, then the remaining vegetation is burned to make way for crops like soy or cattle grazing. In 2019, the number of human-lit fires in Brazil skyrocketed. As of August 2019, more than 80,000 fires burned in the Amazon, an increase of almost 80% from 2018, National Geographic reported.

Topic-6

Forest ecosystem

A forest ecosystem is a community of organisms that lives within a forest. A forest is usually defined as a large group of trees.

However, other important aspects of a forest are the shrubs, the leaf mulch on the floor and the plants that live in tandem with the trees.

A forest ecosystem is not just about the forest environment, however. It is also about the animals that live in the forest. For example, birds nest in the trees of a forest, members of the fungus kingdom grow on the forest floor, and a variety of insects and mammals also take up their homes in a forest.

An ecosystem can be defined as a community that is relatively self-contained. So, a forest ecosystem is an ecosystem that is distinct, with distinct boundaries. We will clearly be able to see where the forest ecosystem begins and where it ends.

There are various types of forest ecosystem throughout the world. But, before we go in to more depth about forest ecosystems, let's recap what we already know about them.

Distinct communities of organisms, which Lives in a forest, which can be defined as a sizeable group of trees.In this ecosystem we will find:

a) Plant life and fungi, and

b) Many different animals, birds and insects.

Types of forest ecosystem.

1. Rainforests: Some of the most biodiverse ecosystems on the planet, with the Amazon being a prime example. The north-eastern part of India is particularly rich in rainforests. Further, the tropical rainforests in India are found in Assam, Andaman and Nicobar islands, and Western Ghats, etc.

Rainforests tend to be humid inside, not just because they are often based around rivers. Water drips from the trees and humidity is contained within the forest environment thanks to thick canopies of leaves. Fantastically beautiful flowers and gorgeous birds and insects live here, as well as some rare mammals.

Boreal forests are home to many of the plants and animals typically thought of as forest-dwellers, such as: foxes,moose,reindeer,bears,squirrels,wolves

2. Mangroves: Mangroves are a unique mix of trees and tidal swamps. These fascinating forest ecosystems change greatly throughout the day. During part of the day they are dry and during much of the rest of the day they are waterlogged and home to crocodiles and other swamp creatures. These may be some of the most dynamic ecosystems in the world, for this very reason.

3. Inland forests: Here, plenty of mainland animals and birds (such as foxes and owls) are found. Inland forests can be vast and ancient, or they can be smaller, like copses.

4. The Taiga: The taiga is the name for the sparse forest right towards the polar regions of the world, where conditions can be very cold and quite harsh. In fact, many of the forest ecosystems in the Taiga are arctic or polar ecosystems.

5. Lakeside forests: Waterbirds and other water wildlife can be found in these forest ecosystems. These types of forest ecosystems tend to be very humid and the types of organisms that live in them reflect this.

6. Mountain forests: The forests that grow on mountains (such as mountain pines) help to create unique ecosystems. For example, the Himalayan mountain forests in India. The peaks of mountains tend to be cold and rocky and the organisms that live in forest ecosystems at the top of mountains tend to be very well adapted for life in harsh conditions.

Characteristic features of forest ecosystems.

Forest ecosystems are so rich and diverse, and they have so many exciting and fascinating features. Below, you will find a discussion of some of the key features of these ecosystems.

1. Seasonality: In countries that have seasonal climates, forest ecosystems will change with the seasons.

2. Deciduous or evergreen: A forest may be deciduous (i.e. it sheds its leaves in winter) or evergreen (i.e. its leaves stay green and intact all the time), or it may be a mix of both deciduous and evergreen trees.

3. Different levels: Some forest ecosystems such as rain forests, feature several distinct levels – such as the forest floor, the lower canopy, the upper canopy and the tree tops.

4. Attractive to birds: Many bird species nest in tree tops and this makes forest ecosystems attractive to birds.

5. Attractive to insects: Many insects live in tree bark, leaf mulch or flowers and as such they find forest ecosystems very attractive places to make their homes.

The importance of forest ecosystems.

Forest ecosystems are so important not just for the community close to the forest but for the whole world. Read on to find some reasons why.

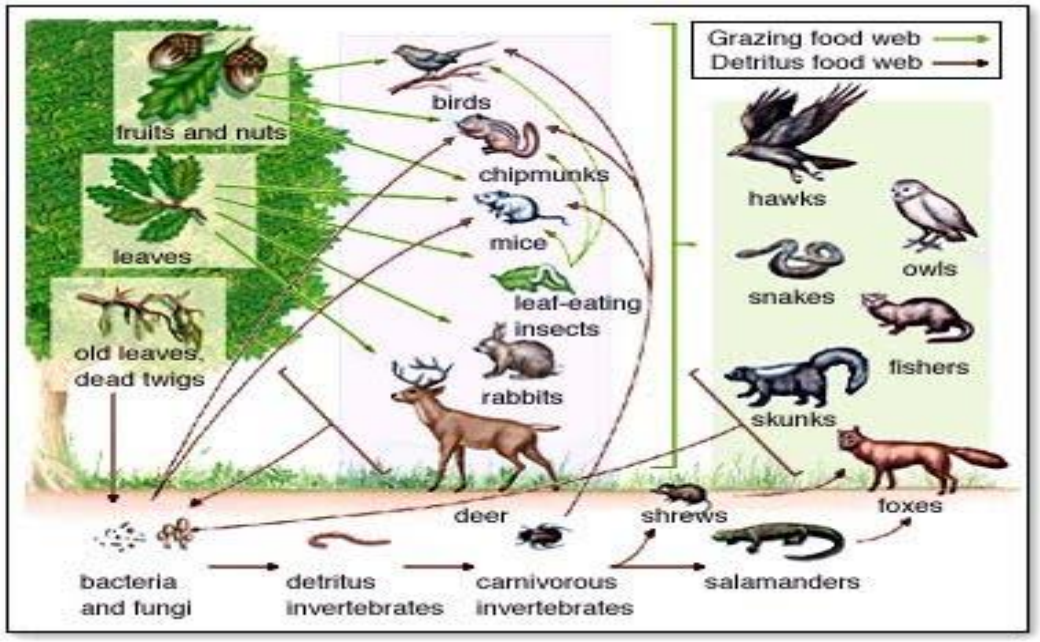
1. The lungs of the world: The Amazon rain forest is described as a biotic pump – like a giant green lung that releases oxygen into the atmosphere and locks away carbon.

2. Ancient: Some of our forests are truly ancient, and much older than many human civilizations.

3. Biodiversity: All of our forest ecosystems are so important for biodiversity. In fact, biologists very often claim that they are still discovering new species in the Amazon rain forest on a regular basis.

4. Homes for humans: Forest ecosystems are not just habitats for animals. Many human communities, including indigenous communities, live in forests all over the world.

5. Protecting the earth: Forests keep the earth rich in minerals, protect it from desertification by providing a shield against winds, and so on.



Topic-7

Benefits of Forest

Forests cover nearly a third of all land on Earth, providing vital organic infrastructure for some of the planet's densest, most diverse collections of life. They support countless species, including our own, yet we often seem oblivious of that. Humans now clear millions of acres from natural forests every year, especially in the tropics, letting deforestation threaten some of Earth's most valuable ecosystems.Forests for granted, are indispensable for everyone on the planet.

1. They help us breathe.

Forests pump out oxygen we need to live and absorb the carbon dioxide we exhale (or emit). A single mature, leafy tree is estimated to produce a day's supply of oxygen for anywhere from two to 10 people. Phytoplankton in the ocean is more prolific, providing half of Earth's oxygen, but forests are still a key source of quality air.

2. Reduce the effect of natural calamities: In the case of natural disasters like the tsunami, floods, hurricanes, cyclonic winds. Presence of abundant forests helps us minimize the effects of these disasters. Hence when there are tsunamis, the areas with more trees at the shore have less damage. Further, healthy forests are necessary to combat global warming

3. Home for animals (Ecosystem):Forest are Home to animals Forests are some of the safest and comfortable home providing habitats for animals and birds. Many animals, birds can dwell peacefully without the threat of extinction in woods as it is a natural home for them.They even finds sufficient food for the day and live together with their herds or groups. Forests are heaven for animals nowadays as they do not find them.

4. Minimize the pollution: Forest help to Minimize pollution presence of forests nearby can reduce air, sound and even thermal pollution. Forest has many plants and trees which minimize pollution. The wind on the earth moves from one place to another and reduces the concentration of harmful gases. Similarly, gas and air pollution diffuses all over the air and get less severe. Presence of forest nearby helps to absorb these pollutants like carbon dioxide from the air by the trees. Hence, forests have environmental benefits too.

6. Economic importance: Forest provides many resources which have significant economic benefits. Few countries economy depends mostly on forest products. Forests cover a wide range of natural resources which are of excellent value for money.

7. They form Biodiversity

Nearly half of Earth's known species live in forests, including 80% of biodiversity on land. That variety is especially rich in tropical rainforests, but forests teem with life around the planet: Insects and worms work nutrients into soil, bees and birds spread pollen and seeds, and keystone species like wolves and big cats keep hungry herbivores in check. Biodiversity is a big deal, both for ecosystems and human economies, yet it's increasingly threatened around the world by deforestation.

8. They keep us cool.

By growing a canopy to hog sunlight, trees also create vital oases of shade on the ground. Urban trees help buildings stay cool, reducing the need for electric fans or air conditioners, while large forests can tackle daunting tasks like curbing a city's "heat island" effect or regulating regional temperatures.

9. They keep Earth cool.

Trees also have another way to beat the heat: absorb CO2 that fuels global warming. Plants always need some CO2 for photosynthesis, but Earth's air is now so thick with extra emissions that forests fight global warming just by breathing. CO2 is stored in wood, leaves and soil, often for centuries.

10. They make it rain.

Large forests can influence regional weather patterns and even create their own microclimates. The Amazon rainforest, for example, generates atmospheric conditions that not only promote regular rainfall there and in nearby farmland, but potentially as far away as the Great Plains of North America.

11. They refill aquifers.

Forests are like giant sponges, catching runoff rather than letting it roll across the surface, but they can't absorb all of it. Water that gets past their roots trickles down into aquifers, replenishing groundwater supplies that are important for drinking, sanitation and irrigation around the world.

12. They block wind.

Farming near a forest has lots of benefits, like bats and songbirds that eat insects or owls and foxes that eat rats. But groups of trees can also serve as a windbreak, providing a buffer for wind-sensitive crops. And beyond protecting those plants, less wind also makes it easier for bees to pollinate them.

13. They feed us.

Not only do trees produce fruits, nuts, seeds and sap, but they also enable a cornucopia near the forest floor, from edible mushrooms, berries and beetles to larger game like deer, turkeys, rabbits and fish.

14. They heal us.

Forests give us many natural medications, and increasingly inspire synthetic spin-offs. The asthma drug theophylline comes from cacao trees, for one, while a compound in eastern red cedar needles fights drug-resistant bacteria. About 70% of known plants with cancer-fighting properties occur only in rainforests, yet fewer than 1% of tropical rainforest plants have been tested for medicinal effects.

15. They create jobs.

More than 1.6 billion people rely on forests to some extent for their livelihoods, according to the U.N., and 10 million are directly employed in forest management or conservation. Forests contribute about 1% of the global gross domestic product through timber production and non-timber products, the latter of which alone support up to 80% of the population in many developing countries.

16 Prevent Soil erosion: Soil erosion is an everyday natural activity happening due to winds and floods. Growing forests help minimize this soil erosion in the nearby farms. The importance of soil is too much that we cannot afford to lose the fertile top layers. This top layer of soil is essential to grow crops and trees.

17 Tourism/Picnic spots/leisure: many forests are exploited as picnic spots. Though this may be disturbing to the native animals and people, still the governments encourage it for tourism revenue. There are various picnic and holiday packages offered to spend time amid forests.

18. Wood for Furniture: Forests are the sole reserve for best woods needed for wood products. There are many kinds of woods for different purposes like insect repellent ones (neem), red sandal, teak, etc.

Other useful products

Honey: This is a sugary liquid produced by honey bees after consuming nectar from flowers. It is widely used in medicine, ice-creams, sweets and other confectionery. It is mostly obtained by cultivation using honey bees in controlled boxes. But honey from the wild forest has its taste and strength than the farmer made one.

Insect Wax: Lac insect produces this. They are found in forests, and the lac isolated is used for cosmetics and also a dye.

.

Topic-8

Integrated pest Management

Integrated Pest Management (IPM) is a sustainable and scientific approach to managing pests. IPM practitioners base decisions on information that is collected systematically as they integrate economic, environmental and social goals. This approach applies to any situation, agricultural or urban, and is flexible enough to accommodate the changing demands of agriculture, commerce and society.

Integrated Pest Management (IPM) is an effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment.

IPM's emphasis is on the management of problems, rather than their eradication. Pesticides are only one weapon in the arsenal of IPM practices, and they are typically used only after a number of other tactics have been tried.

Avoiding Pest Problems

Prevention is the key to IPM. This means always selecting the right plant for the right place, choosing pest-resistant varieties, and maintaining healthy plants with appropriate watering and fertilizing strategies. Some of the important strategies are as follows:

1. Plants in locations not suited to them may be stressed and thus more susceptible to pests.
2. IPM begins at planting time, with the selection of plants that are pest-free and pest-resistant.
3. Using appropriate amounts of water and fertilizer is the best defense against pests.
4. Keep an eye on your yard's plants to detect pest problems early, before significant damage occurs.
5. Too much of water or fertilizer can cause excessive growth, making plants vulnerable to some insects and diseases. Encourage healthy growth by applying fertilizer and water only when they're needed and in moderate amounts.
6. Mowing grass too short and severely pruning trees and shrubs weakens them, potentially inviting problems.

7. Learn to recognize the insects in your garden that help manage pests and let them continue their good work!

Detecting Pest Problems

Inspecting plants frequently helps detect pest problems early. Give plants the once-over anytime you water by hand, mow, or do other outdoor chores. Set aside a time twice or more each week to walk through your yard and look at plants. Some small insects complete their life cycles in one week, so a weekly wander through the yard may not be frequent enough.

Common plant pests include aphids, mealybugs, scales, whiteflies, thrips, plant-feeding mites, caterpillars, and chinch bugs. If chewed or deformed leaves, sooty mold, many ants scurrying up and down plant stems, or discolored "trails" on leaves, it is likely that a pest is lurking somewhere.

Detecting small insects and mites can be difficult. One method that works well is to flick the leaves of small branches against a sheet of white paper. Use a ten-power (10X) magnifying glass to search for movement or evidence of pests. Chinch bugs can be collected from lawn thatch using a shop vacuum.

Look on the branches and on both the upper- and undersides of leaves for pests that attach to the plant, such as scales and whitefly nymphs. Sooty mold on leaves is a telltale clue to an infestation by what are known as piercing-sucking insects (aphids are one example). These pests pierce the plant with sharp mouthparts and suck the sap. Some piercing-sucking insects secrete a sugary substance called honeydew, on which the black-colored sooty mold fungus grows. Sooty mold doesn't injure a plant directly, but it does block sunlight from leaves, reducing photosynthesis. Ants also signal the potential presence of pests, since they feed on honeydew and often protect the insects that produce it.

If you see plant damage but few pests, beneficial insects may already be working on your behalf. These may include lady beetles (commonly called ladybugs) and their larvae, lacewings and their larvae, assassin bugs, spiders, parasitic wasps, and parasitic flies (syrphid or hoverfly larvae and tachinid flies).

Treating Pest Problems

IPM is the best strategy for dealing with pest management, and it relies on the use of chemicals only as a last resort. Check out these IPM techniques as described below:

a) Affected leaves or plant parts are immediately removed. When pests are heavily concentrated on a plant, the problem can often be reduced or eliminated by simply removing the affected leaves or stems.

Pick insects off by hand. This easy step can often defeat infestations of large, slow-moving pests. Dispose of any captured insects so they do not return to feed again. Try one of these methods:

Drop pests into soapy water or isopropyl alcohol.

Place them in the freezer overnight (in a baggy or plastic container).

Crush them and put them in your household trash.

Look for beneficials. If you see a pest outbreak, determine if it's being managed by natural enemies already present. Many beneficial insects prey on pests, and harming them will just help the pests.

Don't treat by default. Plants with aesthetic damage don't necessarily need to be treated. Consider the amount of damage you're willing to accept. Remember that there will always be insects in any healthy landscape, and don't worry about minor damage.

Start with low-impact techniques. Always try the safest alternatives first, such as handpicking insects or pruning affected parts of a plant. If pesticide use does become necessary, choose products that are the least harmful to people, pets, and wildlife. These products include insecticidal soap, horticultural oil, botanicals (e.g., pyrethrum, neem, and rotenone), microbials (e.g., spinosad, abamectin, and Bacillus thuringiensis), and entomopathogenic nematodes (small worms that kill insects).

Avoid using broad-spectrum insecticides. They're not selective, meaning they also kill beneficials. Instead, choose targeted products, which are designed to harm only specific pests. For example, products that contain an extract of the bacterium Bacillus thuringiensis 'Kurstaki' are used to manage caterpillars without affecting other organisms.

Spot-treat only. Use pesticides to treat only the affected areas of a plant or lawn. Never use blanket applications to treat problems.

Read and follow all label instructions. Be careful and remember that the label is the law!

Apply pesticides during the cooler part of the day. Heat combined with soaps, horticultural oils, and other pesticides can injure plants.

Use products only on recommended plants. Always read the label to find out which plants a product can be applied on and which plants are sensitive to the product. If you're unsure about applying a product to a plant, test it on a small area of the plant first. Check for leaf burn in the tested area after one to two days. Phytotoxicity, or chemical injury, often looks like a burn on the edge of leaves.

The IPM approach can be applied to both agricultural and non-agricultural settings, such as the home, garden, and workplace. IPM takes advantage of all appropriate pest management options

including, but not limited to, the judicious use of pesticides. In contrast, organic food production applies many of the same concepts as IPM but limits the use of pesticides to those that are produced from natural sources, as opposed to synthetic chemicals.

IPM is not a single pest control method but, rather, a series of pest management evaluations, decisions and controls. In practicing IPM, growers who are aware of the potential for pest infestation follow a four-tiered approach. The four steps include:

Before taking any pest control action, IPM first sets an action threshold, a point at which pest populations or environmental conditions indicate that pest control action must be taken. Sighting a single pest does not always mean control is needed. The level at which pests will either become an economic threat is critical to guide future pest control decisions.

Monitor and Identify Pests

Not all insects, weeds, and other living organisms require control. Many organisms are innocuous, and some are even beneficial. IPM programs work to monitor for pests and identify them accurately, so that appropriate control decisions can be made in conjunction with action thresholds. This monitoring and identification removes the possibility that pesticides will be used when they are not really needed or that the wrong kind of pesticide will be used.

Prevention

As a first line of pest control, IPM programs work to manage the crop, lawn, or indoor space to prevent pests from becoming a threat. In an agricultural crop, this may mean using cultural methods, such as rotating between different crops, selecting pest-resistant varieties, and planting pest-free rootstock. These control methods can be very effective and cost-efficient and present little to no risk to people or the environment.

Control

Once monitoring, identification, and action thresholds indicate that pest control is required, and preventive methods are no longer effective or available, IPM programs then evaluate the proper control method both for effectiveness and risk. Effective, less risky pest controls are chosen first, including highly targeted chemicals, such as pheromones to disrupt pest mating, or mechanical control, such as trapping or weeding. If further monitoring, identifications and action thresholds indicate that less risky controls are not working, then additional pest control methods would be employed, such as targeted spraying of pesticides. Broadcast spraying of non-specific pesticides is a last resort.

Topic-9

Cryopreservation

Cryopreservation, is the preservation of cells and tissue by freezing. 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. Two common cryoprotective agents are dimethyl sulfoxide (DMSO) and glycerol. Glycerol is used primarily for cryoprotection of red blood cells, and DMSO is used for protection of most other cells and tissues. A sugar called trehalose, which occurs in organisms capable of surviving extreme dehydration, is used for freeze-drying methods of cryopreservation. Trehalose stabilizes cell membranes, and it is particularly useful for the preservation of sperm, stem cells, and blood cells.

Most systems of cellular cryopreservation use a controlled-rate freezer. This freezing system delivers liquid nitrogen into a closed chamber into which the cell suspension is placed. Careful monitoring of the rate of freezing helps to prevent rapid cellular dehydration and ice-crystal formation. In general, the cells are taken from room temperature to approximately −90 °C (−130 °F) in a controlled-rate freezer. The frozen cell suspension is then transferred into a liquid-nitrogen freezer maintained at extremely cold temperatures with nitrogen in either the vapour or the liquid phase. Cryopreservation based on freeze-drying does not require use of liquid-nitrogen freezers.

Cryopreservation Procedure

Prepare a freeze medium consisting of complete growth medium and 5% DMSO (ATCC® 4-X™). Do not add undiluted DMSO to a cell suspension as dissolution of DMSO in aqueous solutions gives off heat.

Collect cells by gentle centrifugation (10 minutes at 125 × g) and resuspend them in the freeze medium at a concentration of 1 × 106 to 5 × 106 viable cells/mL. Continue to maintain the cells in culture until the viability of the recovered cells is confirmed .

Allow cells to equilibrate in the freeze medium at room temperature for a minimum of 15 minutes but no longer than 40. This time is usually taken up in dispensing aliquots of the cell suspension into the vials. After 40 minutes, cell viability may decline due to the DMSO.

Place the vials into a pre-cooled (4°C), controlled-rate freeze chamber and place the chamber in a mechanical freezer at -70°C (or colder) for at least 24 hours. Alternately, use a pre-cooled (4°C) programmable freezer unit set to cool the vials at -1°C per minute until a temperature below -40°C is achieved and then set to abruptly drop to -130°C.

Quickly transfer the vials to a liquid nitrogen or -130°C freezer. Frozen material will warm up at a rate of 10°C per minute and cells will deteriorate rapidly if warmed above -50°C.

Record the location and details of the freeze.

After 24 hours at -130°C, remove one vial, restore the cells in culture medium, and determine their viability and sterility.

Recovery of Cryopreserved Cells

The cell solution in the frozen vial needs to be warmed as rapidly as possible and then immediately combined with complete culture medium and seeded into an appropriate flask. While cells grown in monolayers can be recovered from cryopreservation in multiwell plates, the results are not as consistent as with flasks.

There are mainly three approaches for the in vitro conservation of germplasm:

1. Cryopreservation (freeze-preservation)

2. Cold storage

3. Low-pressure and low-oxygen storage

The principle involved in cryopreservation is to bring the plant cell and tissue cultures to a zero metabolism or non-dividing state by reducing the temperature in the presence of cryoprotectants.

i. Over solid carbon dioxide (at -79°C)

ii. Low temperature deep freezers (at -80°C)

iii. In vapour phase nitrogen (at -150°C)

iv. In liquid nitrogen (at -196°C)

Among these, the most commonly used cryopreservation is by employing liquid nitrogen. At the temperature of liquid nitrogen (-196°C), the cells stay in a completely inactive state and thus can be conserved for long periods.

Mechanism of Cryopreservation:

The technique of freeze preservation is based on the transfer of water present in the cells from a liquid to a solid state. Due to the presence of salts and organic molecules in the cells, the cell water requires much more lower temperature to freeze (even up to -68°C) compared to the freezing point of pure water (around 0°C). When stored at low temperature, the metabolic processes and biological deteriorations in the cells/tissues almost come to a standstill.

Technique of Cryopreservation:

An outline of the protocol for cryopreservation of shoot tip has been depicted below. The cryopreservation of plant cell culture followed by the regeneration of plants broadly involves the following stages

Protocol for Cryopreservation of Shoot Tip

1. Development of sterile tissue cultures

2. Addition of cryoprotectants and pretreatment

3. Freezing

4. Storage

5. Thawing

6. Re-culture

7. Measurement of survival/viability

8. Plant regeneration.

Topic-10

Principle of Tissue culture/Protoplast culture

Tissue culture is applied in plant research for such purposes as the growing of new plants, which in some cases undergo genetic alterations. Here, the plant of interest is taken through the tissue culture process and grown in a controlled environment.

The Process of Plant Tissue Culture

This process involves the use of small pieces of a given plant tissue (plant of interest). Once the tissue is obtained, it is then cultured in the appropriate medium under sterile conditions so as to prevent various types of microorganisms from affecting the process.

The following is a general procedure for plant tissue culture:

Medium preparation

The appropriate mixture (such as the MS mixture) is mixed with distilled water and stirred while adding the appropriate amount of sugar and sugar mixture. Here, sodium hydroxide or hydrochloric acid is used to adjust the pH - Contents used here will depend on the plant to be cultured and the number of tissues to be cultured.

Agar is added to the mixture, heat and stirred to dissolve

After cooling, the warm medium is poured into polycarbonate tubes (to a depth of about 4 cm)

With lids sitting on the tubes, the tubes are placed in a pressure cooker and sterilized for 20 minutes

Plant preparation

Cut the plant part in to small pieces (e.g. cauliflower can be cut to florets of about 1cm across). On the other hand, such parts as the African violet leaves can be used as a whole.

Using detergent and water, wash the plant part for about 20 minutes

Transfer the plant part in to sterilizing Clorox solution, shake for a minute and leave to sock for 20 minutes

Using a lid, gently discard the Clorox and retain the plant part in the container and then cap the container

Transferring the plant material to a tissue culture medium

* 70 percent alcohol should be used for the sterilization of the equipment used and containers

Open the container and pour sterile water to cover half the container

Cover with a sterile lid again and shake the container for 2 to 3 minutes in order to wash the tissue and remove the bleach

Pour the water and repeat this three times

Using sterilized gloves, remove the plant part from the container and on to a sterile Petri dish

Using a sterile blade cut the plant material to smaller pieces of about 2 to 3 mm across avoiding the parts that have been damaged by bleach

Using sterile forceps, place a section of the plant in to the medium

Cauliflower - partly submerged in medium with flower bud facing up

Rose with shoots at level with medium surface

African violet leaf laid directly in surface of medium

Replace the lid/cap and close tightly

This procedure will result in the development of a callus, which then produces shoots after a few weeks. Once the shoots develop, then the plant section may be placed in the right environment (well lit, warmth etc) for further growth

For plants, the medium culture acts as a greenhouse that provides the explant with the idea environment for optimum growth. This includes being free of microorganisms, nutrients as well as the right balance of chemicals and hormones. Such media as BAP, TDZ are used while such hormones as IBA and IAA are used to induce growth.

Some of the major reasons tissue culture is used for plants include:

To produce large quantities of a given plant

To accelerate the production of new varieties of a plant

To maintain a virus free stock of the plant of interest

Technique for Plant In Vitro Culture

Micropropagation - This technique is used for the purposes of developing high- quality clonal plants (a clone is a group of identical cells). This has the potential to provide rapid and large scale propagation of new genotypes.

Somatic cell genetics - Used for haploid production and somatic hybridization

Transgenic plants - Used for expression of mammalian genes or plant genes for various species it has proved beneficial for the engineering of species that are resistant against viruses and insects.

Types of Tissue Culture

Seed Culture: Seed culture is the type of tissue culture that is primarily used for plants such as orchids. For this method, explants (tissue from the plant) are obtained from an in-vitro derived plant and introduced in to an artificial environment, where they get to proliferate. In the event that a plant material is used directly for this process, then it has to be sterilized to prevent tissue damage and ensure optimum regeneration.

Embryo Culture : Embryo culture is the type of tissue culture that involves the isolation of an embryo from a given organism for in vitro growth.Embryo culture may involve the use of a mature of immature embryo. Whereas mature embryos for culture are essentially obtained from ripe seeds, immature embryo (embryo rescue) involves the use of immature embryos from unripe/hybrid seeds that failed to germinate. In doing so, the embryo is ultimately able to produce a viable plant.

Callus Culture : This is the term used to refer to unspecialized, unorganized and a dividing mass of cells. A callus is produced when explants (cells) are cultured in an appropriate medium - A good example of this is the tumor tissue that grows out of the wounds of differentiated tissues/organs.

Organ Culture : Organ culture is a type of tissue culture that involves isolating an organ for in vitro growth. Here, any organ plant can be used as an explant for the culture process (Shoot, root, leaf, and flower).

Protoplast Culture : A protoplast is the term used to refer to cell (fungi, bacteria, plant cells etc) in which the cell wall has been removed, which is why they are also referred to as naked cells.Protoplasts may be cultured in the following ways:

Hanging-drop cultures

Micro culture chambers

Soft agars matrix

Once a protoplast has regenerated a cell wall, then it goes through the process of cell division to form a callus, which may then be subcultured for continued growth.

Protoplast culture is an important method that provides numerous cells (single cells) that can be used for various studies.

These include:

Protoplast culture regenerated into a whole plant

Development of hybrids

Cell cloning

Genetic transformations

Membrane studies

In protoplast culture, a number of phases can be observed.

These include:

Development of a cell wall

Cell division

Continuous growth or regeneration to a whole plant

For plants, some of the special requirements include:

Less amounts of iron and zinc and no ammonium

Higher concentration of calcium

High auxin/kinetic ratio for cell division and high kinetin/auxin ration for regeneration

Glucose and vitamins

Some of the other types of tissue culture include:

Single cell culture

Suspension culture

Anther culture

Pollen culture

Somatic Embryogenesis

CONSULT SLM PROVIDED TO YOU FOR ANY CONFUSION