
UNIT 3 VEGETATION AND WILDLIFE IMPACT ANALYSIS

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3.0 INTRODUCTION

Ever increasing human population growth is exerting stress and causing a change in the environment and its resources for both plants and animals. Due to human interplay and anthropogenic activities vegetation and wild life resources are being threatened. The anthropogenic activities such as fishing, hunting, ecosystem fragmentation, deforestation (fuel wood, gathering, fire and overgrazing), human settlement etc. have caused tremendous ecological effects on vegetation as well as wild life. Human beings in order to fulfil their material ambitions have depleted the natural renewable and non-renewable resources. Natural resources are assets that are necessary for our survival. Globally, human populations are increasing continuously, and in 2150, population will reach to 8-10 billion. Due to overpopulation and increasing demand of urbanization, each year 20-30 million people migrate from rural area to urban areas. Over population and poverty leads to urbanization and industrial revolution which have major impact on global health, global warming, food scarcity and environmental health. All these factors have negative impacts on vegetation and wild life.

In general, vegetation is a plant life of any region and is the most copious biotic element of the biosphere. This regulates the flow of numerous biogeochemical cycles, most critically, carbon, nitrogen, oxygen and water which are of great importance in global energy balances. Global vegetation is the primary source of oxygen. It play critical role in biosphere at all possible spatial scales. Disruption in all these biogeochemical cycles leads to elevation in the ozone concentration and ecosystem acidification. Vegetation serves as wildlife habitat and energy source. Impact of environment on vegetation can lead to decline in amphibian population, death of coral reef, global warming etc. which ultimately decrease the biodiversity.

Wildlife is a precious gift to this planet. It covers all life form including birds, insects, plants, fungi and ever microscopic organisms. It play an important role in balancing the environment and provide stability to different process occur in nature. It has its both ecological and economic importance. It includes the interaction of organisms with the biotic and abiotic factors of its environment for their survival and continuity of species. Each and every organism has its unique place in food chain and has its contribution to the ecosystem. Environmental degradation is a serious threat leading to wild life extinction which has a fatal impact on human race. Environmental pollutant can alter the wildlife viability. It is estimated that in the last 40 years, 50% of the total wildlife has been lost. By the year 2020, 68% of the world wildlife will be lost or extinct. In 2018, a study published in PNAS showed that till date 83% of wild animal, 80% of marine animal, 50% of plants and 15% of fish have been lost due to human civilization.

3.1 OBJECTIVES

After reading this unit, you should be able to:

- understand the various biological concepts and terms;
- describe the mitigation measures for vegetation and wildlife environmental impacts; and
- explain the assessment methodologies for flora and fauna assessments.

3.2 BIOLOGICAL CONCEPTS AND TERMS

The analysis of environmental and occupational impact on vegetation and wild life will be done with the help of system which comprise of environmental laws, mathematical matrix model, measurement tools, risk assessment, analytical techniques etc. Some of the important biological concepts and terms:

Biological assessment: It is an assessment of the condition of any water body by sampling the species that spend all or part of their lives in that water body.

Biological survey: A systematic method for collecting a consistent, reproducible and reliable sample of the aquatic biological community in a water body.

Biological indicators: They are generally certain groups of organisms that can be employed to assess the condition of an ecosystem or environment. Depending on the type of water body being sampled, biological indicators used in biological surveys may include the following:

Reference Sites: Data collected at reference sites provide a benchmark for assessing the biological condition of surveyed sites. Reference sites are sites that have not been disturbed by anthropogenic activities or stress. They have been influenced to some extent by human activities and may represent our best approximation of natural conditions.

Data from reference sites can be used to develop management targets for protection and restoration of aquatic resources.

- ✓ Fish (trout, sunfish, perch, salmon)
- ✓ Benthic macroinvertebrates (insects, snails, crayfish, worms)
- ✓ Periphyton (algae)

- ✓ Amphibians (frogs, salamanders)
- ✓ Macrophytes (aquatic plants)
- ✓ Birds (residential or migratory)

Species: It is the basic unit of classification and a taxonomic rank, as well as a unit of biodiversity.

Community: Also called **biological community**, in biology, an interacting group of various species in a common location. For example, a forest of trees and undergrowth plants, inhabited by animals and rooted in soil containing bacteria and fungi, constitutes a biological community.

Habitat: It is a type of natural environment in which a particular species of organism lives. It is characterized by both physical and biological features. A species' habitat is those places where it can find food, shelter, protection and mates for reproduction.

Endangered species: It is a species of animal or plant that is seriously at risk of extinction.

Check Your Progress 1

- Note:** a) Write your answer in about 50 words.
b) Check your progress with possible answers given at the end of the unit.

1) What is biological assessment?

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3.3 ENVIRONMENTAL IMPACT ASSESSMENT

Impact assessment is a process to improve decision-making and to ensure that the project/programme options under consideration are environmentally and socially sound and sustainable. It is concerned with identifying, predicting and evaluating the foreseeable impacts, both beneficial and adverse, of public and private (development) activities, alternatives and mitigating measures, and aims to eliminate or minimise negative impacts and optimise positive impacts. (Roe, *et. al.*, 1995)

Though EIA techniques vary from country to country and organisation to organisation there are stages common to most EIA processes. The role of flora and fauna investigations in Environmental Impact Assessment (EIA) is to provide sufficient data to allow a complete identification, prediction and evaluation of potential impacts of proposed developments upon that flora and fauna. EIA is more established and is used throughout the paper as the standard of measure for other impact assessment techniques. Impact assessments are standardised processes of analysing proposed projects, programmes, or policies for their possible impacts on existing environmental or social structures and of identifying and proposing measures to mitigate these impacts. An impact assessment is conducted after the core idea for a project, programme, or policy has been developed but before it is given permission to be carried out. Permission depends on a thorough impact assessment and adequate mitigation measures. In this way impact assessments inform decision making processes

to ensure a project, programme, or policy has minimal adverse impact on environmental or social structures. This is to ensure that potential impacts, where identified, are avoided or reduced if at all possible.

Check Your Progress 2

Note: a) Write your answer in about 50 words.
b) Check your progress with possible answers given at the end of the unit.

1. Define Environmental Impact Assessment?

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2. What is the use of EIA, in your own words?

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3.4 MITIGATION MEASURES

Mitigation measure is the development of mitigation plans for the prevention of loss of flora as well as fauna present at the construction site

Mitigation procedures: Appropriate measures for the mitigation of habitat loss or degradation depend on the habitat type and the specific degrading activities, stressor processes, and habitat impacts.

Specific mitigation information is provided in the regional sections of this document. In this section, general considerations for habitat mitigation are discussed, for a mitigation to be successful; the ecological integrity of the habitat must be maintained. This can be accomplished directly by preservation measures that avoid impacts. In other cases, careful mitigation plans can reduce or eliminate impacts on the integrity of the habitat.

Mitigations Guidance to address the habitat impacts of destruction, fragmentation, simplification, and degradation include the following given below:

Preservation:

- Outright purchase or set aside of land
- Partial purchase through conservation easements, long-term leases, or management agreements.

Management practices:

- Rotation and method of timber harvesting
- Timing and extent of grazing
- Control of pollution
- Elimination of structures

Restoration:

- Direct manipulation through seedings, plantings, physical or chemical treatment
Creation of wetlands
- Control of pollution
- Removal of barriers to fish migration
- Control of livestock access to riparian areas.

Compensation:

- Purchase of lands of comparable habitat size and quality
- Provision of financial restitution.

Mitigation Principles:

The development of specific mitigation plans must be based on a thorough understanding of the site conditions and the activities impacting habitats. Nonetheless, certain basic principles of ecological management should be followed when specific mitigation measures are developed.

The following seven general mitigation principles apply to all habitat conservation efforts:

1. Base mitigation goals and objectives on a landscape-scale analysis that considers the needs of the region.
2. Mimic natural processes and promote native species.
3. Protect rare and ecologically important species and communities.
4. Minimize fragmentation of habitat and promote connectivity of natural areas.
5. Maintain structural diversity of habitats and promote the natural diversity in the area.
6. For the management of site-specific environmental conditions and impacts of the specific activity causing degradation.
7. Monitoring the habitat impacts from activities and thereby plan mitigation processes.

Check Your Progress 3

- Note:** a) Write your answer in about 50 words.
b) Check your progress with possible answers given at the end of the unit.

1. What is mitigation measure?
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3.5 ALTERNATIVES

Let us now learn about the alternate assessment strategies.

Alternate Means of Addressing the Impact:

Knowing the impact the next step is to determine what can be done about it. The proponent identifies several means of addressing the impact and its causes including a 'do-nothing' alternative. Brainstorming sessions, open dialogues with stakeholders and surveys of similar impacts and responses can help this process. Innovative solutions should be encouraged and considered at this stage.

Example: Taking the Wood duck as an example, the person in charge/executive notes the response of concerned individuals to create habitats by building wooden nesting boxes and placing them near water bodies. One option for the executive is to produce wooden boxes ready for assembly. Another option is to give funds to an NGO that conducts detailed studies regarding the Wood duck's nesting habits, and also determines the optimal location for woodland along the river, and reforestation is done. One more option is to produce a paper nesting box. With open discussion, the list of options can go on and would likely include some innovative alternatives. Similarly numerous options are available to the policy proponent. He can institute a policy which bans or limits Wood duck hunting or he can introduce a new subsidy for the reintroduction of wetlands which creates an incentive for conservation. Some more options include to repeal the existing legislation which removes the perverse incentives of the Swampland Drainage and Flood Control Acts.

Assess the Costs and Benefits of Each Alternative

Each alternative is subjected to an analysis of the social, economic, and environmental costs and benefits to determine which alternative is a 'best response'. This analysis also determines the distribution of those costs and benefits which will help proponents meet the fair and equitable sharing objective of the CBD.

The analysis should use monetary valuations where possible but can also include qualitative information. Though quantitative data often relies on economic or ecological expertise qualitative data most often comes from community sources. Including as well as equally considering qualitative data ensures public participation is taken seriously and carried out effectively.

Case Study: To carry out Wood duck, the executive gathers all of the alternatives identified and determines the qualitative and quantitative costs and benefits of each alternative. He opens the process to the community as a whole and they help identify the winners and losers of each alternative. The policy proponent subjects his alternatives to a similar process. To take the policy proponent's situation as an example let us say the first option, a hunting ban, costs the government \$10,000 in enforcement, \$5,000 in lost hunting licences, and much angst from hunters. The benefits are an additional 200 Wood ducks after a year of the ban and positive reactions from the conservation community.

The second option, legislating a new subsidy for reintroducing wetlands, costs \$50,000 in subsidies distributed, and \$5,000 in administration. The benefits are blessings from the conservation and hunting communities and an additional 1,000 Wood ducks in five years time.

The third option entails \$5,000 in administration costs and angst from farmers losing their subsidies but results in 1,000 Wood ducks in five years time, blessings from hunters and conservationists, and no additional costs for subsidies. Doing nothing has no monetary costs but results in negative reactions from the hunters and conservationists and 250 fewer Wood ducks.

Select an Alternative

From the above analysis one alternative is selected. Recognizing the constraints the country and region's social, cultural, and political values the selection should reflect an equitable sharing of the distribution of benefits derived from the use of biological resources. Making the selection and supporting reasons explicit and public helps to ensure equitable distribution.

Having identified the costs and benefits of each alternative and the distribution of those costs and benefits, the policy maker decides to repeal the existing subsidies as this is clearly the best option for the stakeholders.

However, if the political situation was such that the farmers had a particularly strong lobbying position this option may not be feasible. At this stage the policy proponent may go back to the drawing board and discover that a policy of replacing the perverse incentives with more benign subsidies would allay the angst of the farmers and make this option politically feasible.

Check Your Progress 4

Note: a) Write your answer in about 50 words.

b) Check your progress with possible answers given at the end of the unit.

1. What is an Alternative Assessment?

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3.6 ASSESSMENT METHODOLOGIES

Let us now learn about the methodologies for the assessment of terrestrial flora and fauna in the following paragraphs.

Methodology for Terrestrial Flora and Fauna Assessment

1. Desk-based evaluation of all relevant information:

This is done through review of existing literatures and databases and site-specific information for the study area. A list of potentially threatened flora and fauna species should be made, a land cover/vegetation map should be secured and the area of the proposed development project is overlaid so as to determine the direct impact areas for flora and fauna. This will be used to delineate and stratify sampling sites for flora and fauna assessment.

2. **Baseline Studies:** An important first stage in gaining an understanding of how the system might be changed by the proposed project is to take a “snap-shot” of the existing conditions – the baseline environment. The baseline survey provides the necessary information on the site-specific environmental setting of the project, and should include information about the components of biodiversity (ecosystems and species, in particular) that may be affected. Baseline studies establish a foundation for impact prediction, for monitoring predicted impacts and for evaluating the success of mitigation measures.

Things to consider in the baseline survey:

Site characterization: This should include the location of the study area and the different vegetation/habitat types.

Survey methods: It is advisable to adopt standard survey methodologies, which are widely accepted so that baseline information gathered could be easily verified and results of different studies compared. The details of the baseline surveys including the methodologies, adopted, locations, time, frequency and duration of surveys should be stated clearly in the EIA report for reference.

A combination of the different methods is being used:

- **Transects:**

Transects are usually used to survey changes in vegetation along an environmental gradient, from a source of impact or through different habitats. The Line Transect method is to count the plant species and their abundance that touch the transect line. Belt transect was done by was done by laying a transect line with 50m length and 10m width on each side of the transect line. All the trees within the belt transect with diameters greater than 5cm at breast height will be identified, measured for diameter at breast height, and counted.

- **Quadrats:**

This are used to define sample area within the study site. The locations of the quadrat chosen should be representative to various vegetation types present within the study area and usually several quadrats are sampled to obtain more representative results. Plant species inside the quadrats are identified, density, frequency and relative cover estimated. This allows for the computation of the Importance Value Index of species present in the area.

- **Transect count:**

This is used to survey birds in large open areas of relatively uniform habitat. All birds seen on both sides of the transects are identified and counted up to a distance where birds are still detectable or within a fixed distance from the observer.

- **Mistnets:**

This is used to capture bats and birds. Nets were placed in travel lanes of bats at dusk and tended constantly. Any captured bats must be removed individually upon entangled and placed in temporary holding devices (e.g. cloth bags). The same is done with birds but only at dawn.

- **Trapping:**

Box traps with appropriate bait is an effective means for trapping small terrestrial mammals unharmed. Pitfall traps could also be used to trap small mammals such as shrews when the animals fall through the opening into the container.

- **Active searching.** An effective way to survey amphibians and reptiles is by active searching, particularly during the daytime. This method is applicable for both nocturnal and diurnal species.

Sampling effort: The baseline survey aims at collecting ecological data through sampling. The actual sampling effort would generally depend on the physical size of

the site, diversity of the habitats, flora and fauna and availability of existing ecological baseline information. The environmental consultants should determine the appropriate amount of sampling effort based on their professional judgement and actual site situations. In all cases, they have to ensure that there are adequate samples to be able to gather data representative of the population of the area.

Duration of the survey: The duration of an ecological baseline survey should be long enough for gathering the necessary baseline data. Generally, the duration of an ecological baseline survey should be commensurate with the scale of the proposed development, the diversity of habitats within the study area and the diversity of flora and fauna within the study area.

Identification of Important species, endemism and its conservation status: These species should be in the priority list for propagation and use in the rehabilitation of the area to maintain and possibly increase their extant population

Biodiversity Index: This is quantitative measure that reflects how many different types (such as species) there are in a dataset, and simultaneously takes into account how evenly the basic entities (such as individuals) are distributed among those types.

3. Evaluation (Impact Analysis): After establishing the baseline, it is then necessary to work systematically through the various activities and aspects of development to determine the likely effects of those activities on the baseline. The following should be considered:

- **The nature of the impact** (direct or indirect, long term or short term, effects from cumulative impacts, etc.);
- **The type of impact** (positive – enhancing biodiversity; negative – causing biodiversity loss; or neutral – no net change).
- **The likely magnitude of the residual impact** (x hectares/area of an ecosystem or habitat, x number of individuals of a species, etc.).
- **The level of impact** (species or ecosystem level e.g species richness/diversity, endemism, vulnerability etc.)

Check Your Progress 5

Note: a) Write your answer in about 50 words.
b) Check your progress with possible answers given at the end of the unit.

1. What are Quadrats?

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3.7 EXAMPLES OF BIOTIC ASSESSMENT

Biotic factors are used for the analysis of the environmental impact on vegetation and wild life. They are categorized as biotic assessment. Biotic assessment uses the presence, condition and abundance of species of fish, mammals, birds, insects, algae, plants and other organisms to determine the health of an ecosystem and to provide information on the physical and chemical characteristics present, e.g. nutrient

enrichment, pollutants, flow rates and sediment levels. These factors are important tools to assess the environmental impacts. Bioindicators help us to predict the natural state of any region or the degree of contamination present at that site. They are currently being utilized and endorsed by various organizations such as the World Conservation Union, International Union for Conservation of Nature, as a means to handle the process of bio monitoring and evaluate environmental effects.

1. Biodiversity:

- species extinction rate,
- Threatened species.

2. Land and soil :

- land use and CO₂ emission,
- land use change,
- wet land surface change,
- land degradation,
- net primary production,
- land use efficiency, soil pollution

3. Fresh water:

- fresh water specie decline,
- river altered,
- river running dry,
- water pollution,
- environmental water scarcity,

4. Forest:

- forest area,
- forest degradation,
- tropical forest specie population

5. Atmosphere:

- ozone depletion,
- GHG emission,
- earth temperature,
- air pollution

6. Bio monitoring :

- plant indicator,
- animal indicator and microbial indicator

An example of Biological assessments in the field:

A biological survey has been conducted on different streams to in order determine their communities' structures. In this case, the benthic macro invertebrate assemblage is the biological indicator, and metrics such as relative richness have been selected. The condition represented by undisturbed/minimally disturbed streams, or reference sites, is used to assess changes in different metric values from other communities with increasing stress. As the level of stress increases in these streams, the aquatic communities' compositions were measurably changed. Species that are sensitive to stress disappeared and more pollution tolerant species were found. Those species were identified in order to indicate their general level of sensitivity to stress and ability to tolerate pollution:

- Intermediate species: S.
- Moderately tolerant species: M.
- Tolerant species: T.

Check Your Progress 6

Note: a) Write your answer in about 50 words.
b) Check your progress with possible answers given at the end of the unit.

1. What is biotic assessment? Give example.

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3.8 LET US SUM UP

In this unit we have studied the biological concepts related to vegetation and wildlife environmental impacts. The unit also describes the various methodologies and biological indicators for the assessment of vegetation and wildlife impacts caused due to developmental activities. The unit also details on the mitigation measure with some case studies for the process of mitigation. We also studied the role of alternatives used for the process of impact assessment of environment.

3.9 KEY WORDS

- Biological assessment** : A biological assessment is an evaluation of the condition of a water body by sampling species that spend all or part of their lives in that water body.
- Biological survey** : A systematic method for collecting a consistent, reproducible and reliable sample of the aquatic biological community in a water body.
- Impact assessment** : Is a process to improve decision-making and to ensure that the project/programme options under consideration are environmentally and socially sound and sustainable.

3.10 REFERENCES AND SUGGESTED FURTHER READINGS

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3.11 ANSWERS TO CHECK YOUR PROGRESS

Your answers should include the following points:

Answers to Check Your Progress 1

1. Biological assessment: A biological assessment is an evaluation of the condition of a water body by sampling species that spend all or part of their lives in that water body.

Answers to Check Your Progress 2

1. Impact assessment is a process to improve decision-making and to ensure that the project/programme options under consideration are environmentally and socially sound and sustainable. It is concerned with identifying, predicting and evaluating the foreseeable impacts, both beneficial and adverse, of public and private (development) activities, alternatives and mitigating measures, and aims to eliminate or minimise negative impacts and optimise positive impacts.
2. The role of Environmental Impact Assessment (EIA) is to provide sufficient data to allow a complete identification, prediction and evaluation of potential impacts of proposed developments upon that flora and fauna. EIA is more established and is used throughout the paper as the standard of measure for other impact assessment techniques.

Answers to Check Your Progress 3

1. Development of mitigation plans for the prevention of loss of flora as well as fauna present at the construction site.

Answers to Check Your Progress 4

Recognising the constraints the country and region's social, cultural, and political values the alternative is selected so as to reduce the impact of the project undertaken.

Answers to Check Your Progress 5

This are used to define sample area within the study site. The locations of the quadrat chosen should be representative to various vegetation types present within the study area and usually several quadrats are sampled to obtain more representative results. Plant species inside the quadrats are identified, density, frequency and relative cover estimated. This allows for the computation of the Importance Value Index of species present in the area.

Answers to Check Your Progress 6

Biotic assessment uses the presence, condition and abundance of species of fish, mammals, birds, insects, algae, plants and other organisms to determine the health of an aquatic ecosystem and to provide information on the physical and chemical characteristics present, e.g. nutrient enrichment, pollutants, flow rates and sediment levels.

