
UNIT 16 SUSTAINABLE HARVESTING OF BIODIVERSITY

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16.1 INTRODUCTION

In the previous unit, you learned that the biodiversity of Earth is the foundation and key for the sustainable future. It provides both tangible benefits and intangible benefits which are collectively represented as ecosystem services. It is believed the biodiversity richness can ensure the resilience even when natural disaster torments. For generations the biodiversity richness in plant kingdom has been exploited by the humans. This unit deals with sustainable harvesting.

16.2 OBJECTIVES

After studying this unit you would be able to:

- Understand sustainable harvesting of different types of biodiversity;
- Explain sustainable harvesting of forest resources;

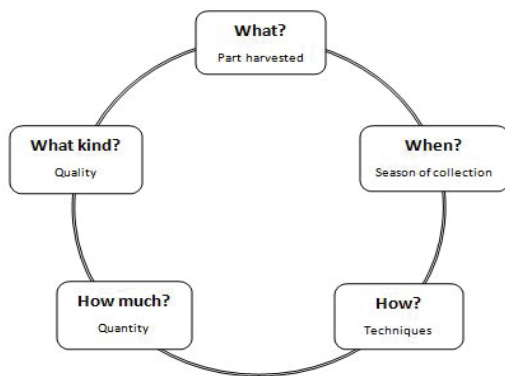
- Explain sustainable Harvesting of Agriculture;
- Describe sustainable Wildlife Management;
- Describe sustainable use of Marine Resources;
- Describe sustainable Harvesting of Aquaculture.

16.3 SUSTAINABLE HARVESTING

The basic idea behind sustainable harvesting is that a natural resource should be harvested within the limits of its capacity for self-renewal. In addition, the manner of its harvest should not degrade the environment by any means. The simplest definition for sustainable harvesting can be the use of natural resources at the levels of harvesting in such a way that nature is able to continue to supply indefinitely, which places an emphasis on maintenance of species population in the wild irrespective of high demand from all over the world. It is important to conserve the populations of many commercially exploited species in the wild, which face the threat of going culturally, ecologically and commercially extinct.

<p>Why should we harvest sustainably?</p> <ul style="list-style-type: none"> • Too frequent harvesting will cause the extinction. • Sustainable harvesting ensures that seed banks are maintained and new seedlings are produced. • Sustainable harvesting ensures that enough plant material is available for the next season which ensures sustained income. 	Harvesting season	Ensure the harvest at right time to maintain sustainability
	Seed bank protection	For rejuvenate population enough seed is required.
	Habitat protection	A plant will disappear if the habitat is destroyed
	Corridors and connections between areas	Retain natural corridors between land areas so that pollinators and seed distributors can move around.
	Erosion prevention	To protect the seeds on top layer of soil
	Pollinator protection	To protect pollinators from the pesticides
	Fire	Frequency of fire season and intensity effects on the existence of resources.
	Invasive plant	These plants impact on the availability of resources, changing the occurrence of fires and causing erosion. Precaution must be taken.

Sustainable harvesting and ecological sustainability are interlinked concepts. In such a way, the practice of sustainable harvest will lead to ecological sustainability.



Elements for sustainable harvesting framework

Fig 16.1: Elements for sustainable harvesting framework

16.4 SUSTAINABLE HARVESTING OF FOREST RESOURCES

Forests are the habitat for most of the wild plants and animals and invariably humans do depend on the forest for their source of revenue. There is no logical sense in computing human's reliance on forests. Unfortunately, our unsustainable utilization and exploitation have withered this priceless resource. Periodically, FAO gives its Global Forest Assessment Report to highlight the way in which we lose our forest. There are only a few patches of virgin forest and the rest of the forest has some human intervention in one form or other. With an ever-growing population, we are dependent on the forest for our needs. So our demands have to be met without endangering the resources. Sustainable Forest Management is a viable solution where the forest is least disturbed while meeting human needs. Good forest managers or foresters maintain a balance between human needs along with the necessity of protecting the environment and wildlife. There are some real stories and incidents where the forest-dependent communities are provided with livelihood by involving them into conservation. It can be as simple as the establishment of cooperatives for the collection and marketing of Non-Timber Forest Products or engaging the communities to maintain a formal Ecotourism.

Major producers of forest products

Percentage of global production (2017)

- **Wood fuel:** India (16%); China (9%); Brazil (6%); Ethiopia (6%); Democratic Republic of Congo (4%).
- **Industrial roundwood:** United States of America (19%); Russian Federation (10%); China (9%); Canada (8%); Brazil (8%); Indonesia (4%); Sweden (4%); Finland (3%); India (3%).
- **Wood pellets:** United States of America (21%); Canada (8%); Germany (7%); Sweden (5%); Viet Nam (5%); Latvia (5%); Russian Federation (4%); France (4%); Estonia (4%); Austria (4%); Republic of Korea (3%); Poland (3%); China (3%).

- **Sawnwood:** China (18%); United States of America (17%); Canada (10%); Russian Federation (8%); Germany (5%); Sweden (4%); Brazil (3%).
- **Wood-based panels:** China (50%); United States of America (9%); Russian Federation (4%); Germany (3%); Canada (3%); Poland (3%); Brazil (3%).
- **Pulp for paper:** United States of America (26%); Brazil (10%); China (9%); Canada (9%); Sweden (6%); Finland (6%); Japan (5%); Russian Federation (5%); Indonesia (4%); India (3%); Chile (3%).
- **Recovered paper:** China (24%); United States of America (20%); Japan (9%); Germany (6%); Republic of Korea (4%); United Kingdom (3%); France (3%); Italy (3%).
- **Paper and paperboard:** China (28%); United States of America (17%); Japan (6%); Germany (6%); India (4%); Republic of Korea (3%); Brazil (3%); Indonesia (3%).

Major consumers of forest products

Percentage of global consumption (2017)

- **Industrial roundwood:** United States of America (18%); China (11%); Russian Federation (9%); Canada (8%); Brazil (8%); Sweden (4%); Indonesia (4%); Finland (3%); India (3%); Germany (3%).
- **Wood pellets:** United Kingdom (22%); Republic of Korea (11%); Denmark (9%); Germany (7%); Italy (7%); United States of America (6%); Sweden (6%); France (4%); Belgium (4%).
- **Sawnwood:** China (26%); United States of America (21%); Germany (4%); Canada (4%); Japan (3%).
- **Wood-based panels:** China (48%); United States of America (12%); Germany (3%); Russian Federation (3%); Poland (3%).
- **Pulp for paper:** United States of America (25%); China (20%); Japan (5%); Sweden (5%); Finland (4%); Canada (4%); India (4%); Russian Federation (3%); Brazil (3%); Germany (3%).
- **Recovered paper:** China (35%); United States of America (13%); Japan (7%); Germany (7%); Republic of Korea (4%); India (3%).
- **Paper and paperboard:** China (28%); United States of America (17%); Japan (6%); Germany (5%); India (4%); Italy (3%). (www.fao.org)

Fig 16.2 : Major Producers and Consumers of forest products

For sustainable forest management steps are suggested:

16.4.1 Establish Protected Areas & Conserve Biodiversity

Conserving forest diversity means protecting water resources, soils, all plant and animal species. Forest managers take efforts to reduce soil erosion, maintain continuous water flow in streams, identify and conservation of endangered species through a holistic-Protected area approach. The 'Protected Area' concept has indeed proved to be successful means for *in situ* conservation. More than 2.4 % of the world's land is declared as protected. In the Indian context, it 4.90 % of the land area, is declared as national park or sanctuary or biosphere reserve. Even the UNESCO has declared some of the places as World Natural Heritage Sites and India have few sites too. All these are protecting biodiversity in one form or other.

16.4.2 Forest Conversion

To attain sustainability, forest managers need to protect the natural forests against deforestation, especially, to reduce the forest. Recent development in logging techniques such as selective harvesting to limited, small-scale clear-cutting, reduced impact logging are reducing disturbance to the forest. These techniques ensure the total ecological health of the forest and make the environment conducive for regeneration; thereby the forest is restored even after harvesting timber. Reduced Impact Logging (RIL) method can change the face of the harvesting and logging of trees in natural as well as managed forests. In RIL the collateral damage caused by the falling timber is minimized to a greater extent and subsequently, it reduces the damage to regeneration, soil erosion and disturbance.

16.4.3 Boost Income and Profitability

It has been proved that sustainable forest management technique improves the economic output from the, per area of forest. One more key component of a sustainability program is the Forest Certification. In terms of a large entity, the certification will help the products to enter the global market, thereby making the product more competitive. All this need active forest management which leads to capacity building and skill development too.

Provisioning Services <ul style="list-style-type: none"> ○ Genetic resources ○ Food, Fiber and Fuel ○ Fresh Water ○ Biochemicals 	Cultural services <ul style="list-style-type: none"> ○ Education ○ Recreation ○ Religious value ○ Knowledge system
Regulating services <ul style="list-style-type: none"> ○ Climate regulation ○ Seed dispersal ○ Pollination ○ Pest regulation ○ Erosion regulation ○ Water purification 	Supporting Services <ul style="list-style-type: none"> ○ Soil formation & retention ○ Nutrient cycling ○ Oxygen production ○ Water cycling

Fig 4: Forest ecosystem goods and services

16.5 SUSTAINABLE HARVESTING OF AGRICULTURE

Sustainable agriculture has been defined as “an integrated system of plant and animal production practices having a site-specific application that will last over the long term”. The phrase ‘sustainable agriculture’ was given by the Australian agricultural scientist Gordon McClymont.

For sustainability in agriculture following key principles are associated:

To incorporate the biological and ecological processes into agricultural production

practices. For example, soil regeneration, nutrient cycling and nitrogen fixation.

Reduction in amounts of non-renewable and unsustainable inputs that are environmentally harmful.

The expertise of farmers can be used to increase production and to promote the self-sufficiency.

Agricultural and natural resource problems can be solved through the cooperation and collaboration of people.

Sustainable agriculture is as an ecosystem approach to agriculture.https://en.wikipedia.org/wiki/Sustainable_agriculture - cite_note-6 Agricultural practices that can cause long-term damage to soil include excessive tilling operation of the soil and irrigation without adequate drainage.

Methods of sustainable harvesting:

It is matter of choice to what grows where and how it is grown. Crop rotation and soil amendment are two of the many possible practices of sustainable agriculture. Both practices designed to ensure that crops can obtain the necessary nutrients for healthy growth. Soil amendments include using locally available compost from farms and recycling centers.

Recycling centers utilize kitchen waste and commonly available resources. In the past these resources were thrown away into large waste disposal sites. Now these are used to produce low cost organic compost for organic farming. Growing a diverse number of perennial crops in a single field, each of which would grow in separate season so as not to compete with each other for natural resources is another practice. Nitrogen fixation from legumes helps to allow the land to be reused annually. Legumes will grow for a season and replenish the soil with ammonium and nitrate. In the next season other plants can be seeded and grown in the field. This system would result in increased resistance to diseases and decreased effects of erosion and loss of nutrients in soil.

Similar to forestry, sustainable harvesting is also applicable to agriculture too. Agricultural crops productivity depends upon soil fertility and water availability. Every harvest of crops is literally harvesting the nutrients from the soil and this has to be replenishment in the soil for maintaining productivity. However, the present tillage and irrigation practices are not facilitating the nutrient replenishment. The alternate approach is Sustainable agriculture which is an ecosystem approach. On the whole, there is a minimized use or careful use of non-renewable resources; it may be fertilizers, pesticides, etc. Crop Rotation, Soil amendment and Conservation Agriculture are some of the practices that are in the realm of sustainable agriculture.

The repeat cultivation of the same crop again and again on the same piece of land is called Monoculture farming. This can endanger the productivity and brings question on sustainability. As an alternative to monoculture, Polyculture and Integrated Farming Systems (IFS) are now recommended. This maintains crop diversity and ensures productivity. There is less nutrient loss and doesn't endanger the beneficial microorganisms. However, these will not be evident

in the beginning stage as in the case of conventional agriculture. The lack of knowledge of its paybacks is a major barrier in the adoption of sustainable agriculture.

16.5.1 Multifunctional agriculture vs. ecosystem services

Sustainable agriculture can be viewed through two distinct lenses: Multifunctional agriculture (MFA) and Ecosystem services (ES). Ecosystem services are anthropocentric concept indicating the natural functions and processes of ecosystems that provide the value to humans. It mainly focuses on the intangible benefits like nutrient recycling, prevention of soil degradation, etc. Multifunctional agriculture is a philosophical approach that focuses on the farm-centred approach and mostly quantified based on the tangible products derived from the farm. The key idea is that agriculture as such has numerous functions like biodiversity conservation and natural resource management apart from food and fibre production. As such there exists no major difference, sometimes they tend to overlap each other.

16.6 SUSTAINABLE WILDLIFE MANAGEMENT

Sustainable wildlife management is the logical management of wildlife species to maintain their populations and habitat over time, taking into consideration, the socioeconomic needs of human populations. This requires that all stakeholders within the wildlife habitat to be aware of and consider the effects of their activities on the wildlife resources.

Wildlife is a valuable renewable natural resource, with significance for areas such as rural development, food supply, land-use planning, tourism, scientific research and cultural heritage. Sustainably managed wildlife can provide unending nutrition, income and contribute towards the alleviation of poverty as well as to protecting human and environmental health.

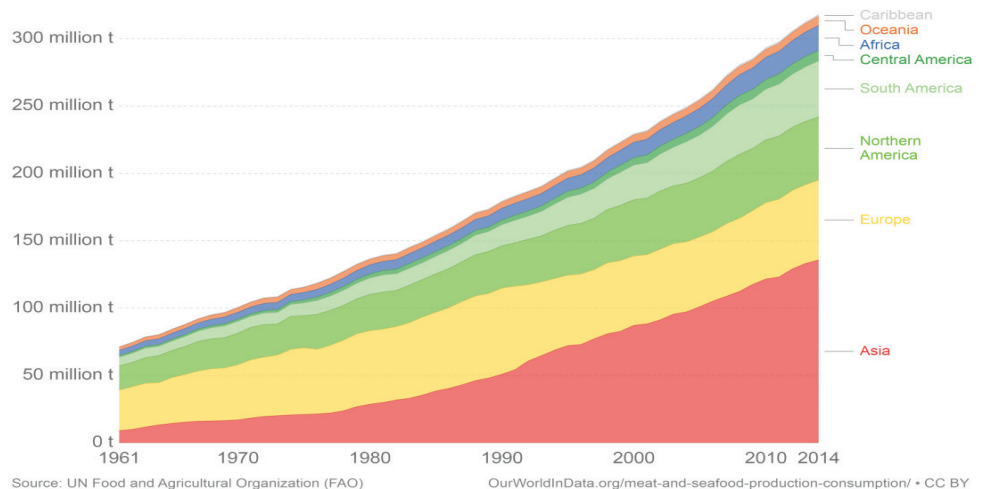
Wild animal hunting can be undertaken for commercial, recreational and subsistence purposes. The benefits obtained from wildlife are directly consumed or used by the hunter and his family in subsistence hunting. The food security and livelihoods of rural people in the tropics and subtropics depends on the use and trade of wild animals.

Increased exploitation of the resource has been driven by advances in hunting technologies, the emergence of a booming commercial wild meat trade and fast growing human populations. Sustainable wildlife management refers to the suitable management of wildlife species to sustain their populations in nature over time and considering the socioeconomic needs of human populations

Meat production, tonnes

Total meat production, measured in tonnes. Meat includes cattle, poultry, sheep/mutton, goat, pigmeat, and wild game. Figures are given in terms of dressed carcass weight, excluding offal and slaughter fats.

Our World
in Data



Source: UN Food and Agricultural Organization (FAO)

OurWorldInData.org/meat-and-seafood-production-consumption/ • CC BY

Source: UN Food and Agriculture Organization (FAO) <https://ourworldindata.org/meat-and-seafood-production-consumption>

Fig. 5: Total meat production worldwide (Tonnes)

16.6.1 Species and habitat loss

Efforts to achieve Sustainable Wildlife Management have severe challenges. Many wildlife species are under threat, and some have become extinct locally due to a variety of causes. Wildlife loss has consequences for crucial ecological processes that support biodiversity and may have serious socioeconomic impacts. As humans are encroaching and loss of habitat, nearby wildlife habitats also results in human-wildlife conflict. These types of problems are often dealt with locally through the unregulated killing of the animals. While such problems may be solved through wildlife conservation and management and land-use planning.

The challenges in framing the participatory sustainable harvesting practices include:

- Large numbers of species their diversity, ecology, habitat and pressure on the resource have posed severe problems in maintaining the biological diversity.
- The need to develop good collection practices for each species
- Unpredictable environmental factors that influence annual yield of wild populations
- Unclear land and management
- The large number and variety of products
- Complex & long supply chain between source and market
- Lack of proper post-harvesting techniques
- Lack of awareness on better quality of produces.

16.6.2 Ensuring sustainable trade and consumption by raising public awareness

Wildlife management could also benefit from the application of the REDD+ mechanism. It is forest carbon stock conservation and restoration measures designed to mitigate climate change in developing countries.

Sometimes, legalization and taxation of the sales of wildlife species can help enable communities to benefit from wildlife. In this regard, relevant organizations could also provide further support to national capacity-building of law enforcement, judiciary, prosecution and legislation to prevent illegal hunting.

There are ample evidences for hunting regulations, law enforcements and crime prevention which are more effective when communities to enforcing authorities work together over the long term. Communities can be the “eyes and ears” of law enforcement by providing actionable intelligence to an arresting authority, such as the police or the national park service or Rangers, which ensures the anonymity of informants, reducing the risk of retribution. When indigenous peoples and local communities benefiting from wildlife, see poaching as stealing from them and are highly motivated to halt the illegal or illegitimate use of their wildlife.

16.7 SUSTAINABLE USE OF MARINE RESOURCES

Over the last decade, fisheries have considerably expanded on the high seas and currently represent approximately 5 % of total world landings. The provisions of the United Nations Convention on the Law of the Sea, on the marine living resources of the high seas set forth rights and obligations of States with respect to conservation and utilization of marine resources.

Globally, management of high seas fisheries, including the monitoring, adoption and enforcement of conservation measures, is inadequate in and some resources are over utilized. There are problems of unregulated fishing, overcapitalization, huge fleet size, improper selective gear, unreliable databases and lack of cooperation between Stakeholders, who are the main beneficiaries. Such action and cooperation can address fisheries statistics, shortfall in fishing practices and improvement of systems for handling data. Multi-species management should be emphasized, and other approaches should consider the relationships among species, especially when dealing depleted species, and in identifying the potential of underutilized or unutilized populations. Marine living resources provide an important source of protein in many coastal areas. The use of marine resources is often of major importance to local communities and indigenous people. Marine resources provide food and livelihoods to millions of people. If sustainably utilized, it offers an increased potential to meet nutritional and social needs, particularly in developing countries.

Coral reefs and other coastal and marine habitats like mangroves and estuaries, are among the most highly diverse, integrated and productive of the Earth’s ecosystems. They often serve as valuable ecological functions, provide coastal

protection and are critical resources for food, tourism, energy and economic development. In many parts of the world, such marine and coastal systems are under stress or are threatened by both human and natural factors.

Improved knowledge and identification of marine living resource stocks is required to realize this potential, particularly of underutilized and unutilized stocks and species. The use of new technologies, better handling and processing facilities to avoid wastage, improved quality and training of skilled personnel to manage and conserve effectively the marine living resources of the exclusive economic zone and other areas is the basic requirement for the proper management of resources. Emphasis should be given on multi-species management and other management approaches that consider the relationships among species.

There should be commitment towards the conservation and sustainable use of marine living resources on the high seas. Here it is necessary to:

- a. Develop and increase the potential of marine living resources so that it can meet human nutritional needs, as well as social, developmental and economic goals.
- b. Maintain the populations of marine species at the levels that can produce the maximum sustainable yield as qualified by relevant environmental and economic factors.
- c. Promote the development of selective fishing gear and practices that minimize wastage in the catch of desired species and minimize the by-catch of non-target species.
- d. Ensure effective monitoring of fishing related activities.
- e. Protection of endangered marine species.
- f. Preservation of habitats and other ecologically sensitive areas.
- g. In the high sea promote scientific research with respect to the marine living resources.

16.8 SUSTAINABLE HARVESTING OF AQUACULTURE

The total world fisheries production was 158 million tons in 2012, of which aquaculture contributed 66.6 million tons, about 42%. The growth rate of aquaculture has been sustained and rapid worldwide, averaging about 8% per year for over 30 years. The market of aquaculture was of \$86 billion in 2009.

“Aquaculture is the farming of aquatic organisms which includes fish, molluscs, crustaceans and aquatic plants. Farming implies some form of intervention in the rearing process to enhance production, such as regular feeding, stocking, protection from predators, etc”. Sometimes it is performed without consideration for potential local environmental impacts. Local concerns with aquaculture may include waste handling, side-effects of antibiotics, competition between farmed and wild animals or foreign pathogens. It should be considered particularly if unprocessed fish are used to feed carnivorous fishes which are

more marketable.

Fish waste is organic and composed of many nutrients which are necessary in all components of aquatic food webs. The waste collects on the ocean bottom, damaging or eliminating bottom-dwelling life. Wastes can also decrease dissolved oxygen levels in the water column, putting further pressure on wild animals.

16.8.1 System level changes arising from fishing

Food webs, trophic relationship and the flow of energy are central to the functioning of aquatic systems. The trophic balance of an aquatic system can be disrupted by direct and indirect effects of commercial fishing. Estuaries and near-shore ecosystems have perhaps been most affected due to their productivity and accessibility. Fishing in estuarine and near shore habitats has clear impacts on the structure and functioning of these ecosystems. Fishing in these areas can disrupt the nursery functions, trophic cascading and potential for local species extinctions. For years commercial fishing has been implicated in the collapse of wildlife populations, especially birds. Overfishing in coastal areas can result in starvation of fish-eating birds.

16.8.2 Habitat degradation arising from fishing

In addition to physical damage to the habitat, loss of fishing gear can result in “ghost fishing” when gear continues to capture and kill fish and other organisms while unattended. Noise pollution can also contribute to making waters less suitable for some fish species. Superficially, recreational fishing is considered to cause less habitat degradation than commercial fishing.

In small inland waterways or near-shore areas, vessels can also generate waves that erode shorelines, suspend sediment, and may disturb fish, especially where movements are excessive and uncontrolled. This leads to the collapse of banks, loss of riparian vegetation, and on a subtler level, change of littoral water temperatures that directly affects juvenile growth and recruitment. Lead fishing sinker deposition from angling can have major negative consequences on local environments. Collectively, recreational and commercial fishing both result in considerable habitat degradation. Efforts to reduce habitat degradation should be a common goal for both fishing sectors.

Overall, there is evidence that changes in trophic structure and ecosystem function can be altered by both commercial and recreational fishing. Additional research and modelling to elucidate general patterns of fishery impacts on ecosystem function would benefit both sectors.

Check Your Progress 1

Note: a) Use the space given below for your answers.

b) Check your answers with those given at the end of unit

1. What is sustainable harvesting and why it is important?

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2. Explain sustainable harvesting of forest resources.

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3. Describe sustainable Harvesting of agriculture resources and linkages between ecosystem services?

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16.9 LET'S SUM UP

The main idea behind sustainable harvesting is that biological resource should be harvested within the limits of its capacity for self-renewal. It should be harvest in the manner such that it should not degrade its environment in any way. Sustainable harvesting can be defined as the use of plant resources at the levels of harvesting in such a way that the plants are able to continue to supply it indefinitely & regularly. Sustainability is the most effective tools to protect and conserve biological resources. The experience gained from sustainable use can be applied to all biodiversity components such as agriculture, forestry, fisheries, tourism, water management and other sectors. Therefore, importance is given to sustainable use of biodiversity at the ecosystem level. It is necessary because it is linked to health and livelihoods of the present and future of mankind.

Over-exploitation, unscientific and unsustainable use of biodiversity and its components have led to the loss of species and destruction of habitats. Unsustainable harvesting of plant species is the major causes for the decline in their population. It has been estimated that around one-fifth of the global plant species are under threatened category. Several valuable plant species native population like Indian mahogany, Taxus, Ginseng, Berberis have reduced to a very small number. Collectors and dwellers have depleted many orchids in the wild to a threatened level. Many birds and fish have also been threatened by unrestricted hunting for the pet trade. Certain plants and animals are threatened due to international trade for the live or parts such as meat, horns, bones, ivory, skin, fiber, claws, roots, flowers etc. These species pose high value as food, ornamental, medicinal and other uses. Trade of biodiversity or wildlife components is rampant in South American, Asian and African countries. Hunting pressure on wild animals like mammals, reptiles, amphibians and birds is increasing rapidly and it contributes the unsustainable harvest of bushmeat

by local community. In some protected areas, which serve as breeding grounds for animal species are not effectively protected to allow regeneration of populations. Efforts have been made to tackle the problems and challenges associated with bush meat. The main solution to address them is, by providing sustainable solutions so that long term food security for human populations is ensured. It will also help to save species from extinction.

Non-Timber Forest Products (NTFPs) are among major sources contributing to the economic development of local communities. These also play a major role in the enhancement of lifestyle and healthcare of tribal and rural people. A large number of local communities rely upon forest products for bonafide use and commercial purpose to generate a livelihood. It is necessary to conserve the populations of many commercially exploited species in the wild, which face the threat of going ecologically and commercially extinct. Unscientific collections from wild had led to the threat of extinction and suffer a severe genetic loss in the wild. There is an urgent need to frame a strategy for appropriate management of NTFPs to meet the local needs and also to maintain the biodiversity. Sustainable harvesting can improve the livelihoods of people through supplementary income and employment. The issues related to uncertainty in developing sustainable harvest methodologies such as local knowledge, tenure rights, empowerment, autonomy to a local institution, institutional capacity, political system affecting the equity and resource access, market policy, trade linkages, etc., need to be taken care through a well-developed and operationalize adaptive management strategy.

Sustainable development requires an integrated and holistic approach, in which a structure of inter-linked components is taken into account. This structure contains environmental, economic, demographic, water resources, socio-cultural and institutional subsystems. Institutional issues play an extremely important part in striving towards sustainable development.

Several ministries like agriculture, forestry, environment, industry, construction etc can hold the responsibilities. Frequently the coordination between these national bodies is very limited, which need to sort out.

Sustainable development can be achieved on the principles of:

1. Local and private sector participation
2. Decentralization of responsibility
3. A demand-driven cost recovery approach

The principles of decentralization and involvement of communities pose ambitious challenges for education and training. It is essential to involve communities in the process of consultation to make them understand, accept and support plans.

You may undertake following investigations related to biodiversity & sustainable use of resources.

(1) **Biodiversity loss**

- Documentation of biodiversity

- Documentation of diversity loss
- Documentation of the causes of biodiversity loss
- Activities undertaken by the Government and Non Government Organizations
- Documentation of remedial measures taken by authorities
- Documentation of technical & financial assistance given by the Government and Non Government Organizations
- Visit to national parks, sanctuaries and biosphere reserves
- Visit to gene bank, zoo, aquaria & botanical garden

(2) Sustainable Harvesting

- Documentation of forest biodiversity of your area
- Visit & documentation of protected area
- Documentation of agriculture biodiversity
- Documentation of farming system practices of your area
- Documentation of wildlife and identification of threat to them
- Documentation of Marine & Aquatic diversity of your area
- Gathering of data on loss of marine & aquatic diversity
- Estimation of cause that threaten the marine and aquatic resources
- Documentation of remedial measures taken by the authorities

16.11 KEYWORDS

Sustainability: Sustainability is expressed as meeting present environmental, social, and economic needs without compromising these factors for future generations.

Sustainable use: Sustainable use means the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations.

Ecological sustainability - The capacity of ecosystems to maintain their essential processes and function and to retain their biological diversity without impoverishment.

Sustainable Forest Management: the management of forests according to the principles of sustainable development- trying to find a balance between social, economic, and environmental values.

Forest Resource Inventory: a provincial database of all Crown forests, providing information on species composition, age and volume. FRI data is collected via aerial photography and analyzed by trained interpreters

Carbon Sequestration: “Carbon sequestration is the process through which

agricultural and forestry practices remove carbon dioxide (CO₂) from the atmosphere.

Conservation Tillage: Conservation Tillage is a term that covers a broad range of soil tillage systems that leave residue cover on the soil surface, substantially reducing the effects of soil erosion from wind and water.

16.12 REFERENCE AND SUGGESTED FURTHER READINGS

Further Reading

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<https://ourworldindata.org/meat-and-seafood-production-consumption>

www.fao.org

16.13 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

1. Refer section 16.3
2. Refer section 16.4
3. Refer section 16.5