

**E-Learning module
SEMESTER-IV
PAPER-GEO-A-CC4-10-TH
SOIL AND BIO GEOGRAPHY**

Biodiversity Definition, Types, Threats and Conservation Measures

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What is biodiversity

- The term biodiversity has been commenced by Walter Rosen in 1986. Biological diversity is abbreviated as biodiversity which refers to the sum total of species, populations, communities and ecosystems. It may also be defined as the variety and variability among the living organisms (fungi, protozoa, bacteria, and multi cellular organisms such as plants, fishes, and mammals) and the ecological complexes (including gens, habitats, and ecosystem) in which they occur



Definitions:

- As defined in convention on Biological diversity signed at Earth Summit held in Rio De Jenerio (Brazil) in 1992 by 154 countries, the Biodiversity defined as “the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic eco-systems and the ecological complexes of which the area part- this include diversity with in species, between species and of ecosystem.” According to IUCN in 1998, “the variety and variability of species of their population, the variety of species of their life forms, the diversity of the complex association with species with their interaction and their ecological process which influences perform.”

Elements of Biodiversity

- **Ecosystem Difference:** ecosystem diversity refers to number of ecosystems and different ecological processes operating in a certain area.
- **Temporal difference:** The biodiversity of an area is always measured in terms of temporal factor i.e. the condition of biological communities in the past, at the present time and in future
- **Genetic difference:** Which establishes richness of biological variety of a specified ecosystem because genetic difference within and between the populations of species of a ecosystem
- **Species difference:** Refers to variety of species of biological population including species of plants, animals and micro-organisms of a particular ecosystem

Types of biodiversity

- Biodiversity can be divided into following three levels; i. Ecosystem or ecological diversity ii. Species diversity iii. Genetic diversity
- Ecosystem diversity has three outlooks;
- **a) Alpha (α) Diversity** : It is the biodiversity within a particular region, community or ecosystem.
- **b) Beta (β) Diversity**: Beta diversity is a measure of biodiversity which works by matching up the species diversity between ecosystems or along environmental pitches.
- **c) Gamma (γ) Diversity**: It illustrates diversity of habitat over a total geographical area. It is a product of component ecosystems (alpha diversity) and the between component ecosystems (beta diversity). Gamma diversity can be expressed in terms of the species abundance of component

- Species diversity: Species is a fundamental unit of classification and is described as largest group of organisms in which two individuals can mate and produce fertile offspring, typically by sexual reproduction and thus, share a common ancestry. The numbers of species of flora and fauna that are present in an area comprise its species diversity.
- The natural world in numbers Animals:
- 0.77 million (12% described)
- Fungi: 0.61 million (7% described)
- Plants: 0.30 million (70% described)
- Protozoa: 0.04 million (22% described)
- Chromites: 0.03 million (50% described)

Genetic diversity

- Genetic diversity refers to the variation of genes within a population or species. The genetic variation is vital for a vigorous breeding population of a species. Each and every individual of any animal or plant species varies widely from other individuals

Functional Biodiversity

- Functional Biodiversity Number of scientists also identifies the fourth level of biodiversity as functional biodiversity .Here the way species act, obtain food and utilize the natural resources of an ecosystem is known as functional diversity.

Important Values of biodiversity

- Important Values of biodiversity Values related to biodiversity can be grouped into two categories as below:
 - i. Direct values and
 - ii. Indirect Values

Direct values The direct values

- Include
- (i) Consumptive use value and (ii) Productive use value. Consumptive use value: here the biodiversity² products are consumed directly for example food (plants, fishes), fuel (wood, coal, petroleum, natural gas) and drugs (Quinine, Penicillin, Tetracycline etc).
- Productive use values: In productive use the product is commercially sold in national and international market like textile, leather, silk, paper and pulp industry etc.

Indirect values

- Indirect values include social and cultural values, ethical values, aesthetic values, option values and environment service values.
- Social and cultural value: Some of the plants and animals are considered holy and sacred particularly in India like Tulsi, peepal, cow, snake etc
- Ethical values: As all species have a right to exist independent of our need for them and conservation of biodiversity laying ethical issue of valuable for the sustenance of human race so are related to conservation and preservation.

- Aesthetic value: There is a great aesthetic value which is attached to biodiversity. The natural landscapes provides prospects for leisure activities like bird watching, photography etc. promoting eco-tourism from zoological, botanical gardens, national parks, wild life conservation etc.
- Option values: unidentified potentials of biodiversity include option values.
- Environment service values: This is one of the important benefits of biodiversity which maintains environment services and includes: Carbon dioxide fixation. Maintaining of essential nutrients by carbon (C), oxygen (O), Nitrogen (N), Sulphur (S), Phosphorus (P) cycles. Maintaining water cycle, recharging of ground water.
- Soil formation and protection from erosion.
- recycling moisture into the atmosphere.
- Detoxification and decomposition of waste.

Major biodiversity threats

- Major biodiversity threats-
- i. Habitat destruction
- ii. Extension of agriculture, shifting agriculture³ iii. Filling up of wetlands
- iv. Pollution
- v. Conversion of rich bio-diversity site for human settlement and industrial development
- vi. Destruction of coastal areas
- vii. Poaching
- viii. Introducing exotic species
- ix. Uncontrolled exploitation of resources x. Diseases

Threats to **BIODIVERSITY**

Habitat destruction

Alien Invasive species

Genetic pollution

Over exploitation

Hybridization

Climate change

Diseases

Human Over Population



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THREATS TO BIODIVERSITY



Threats to the forest ecosystem

- Deforestation
- Poaching
- Overexploitation of resources
- Development activities (mining, dams)
- Changing land use patterns
- Fragmentation
- Habitat degradation



- ***Biodiversity conservation refers to the protection, up-liftment, and management of biodiversity in order to derive sustainable benefits for present and future generations.”***
- Biodiversity conservation is the protection and management of biodiversity to obtain resources for sustainable development.
- Biodiversity conservation has three main objectives:
 - To preserve the diversity of species.
 - Sustainable utilization of species and ecosystem.
 - To maintain life-supporting systems and essential ecological processes.

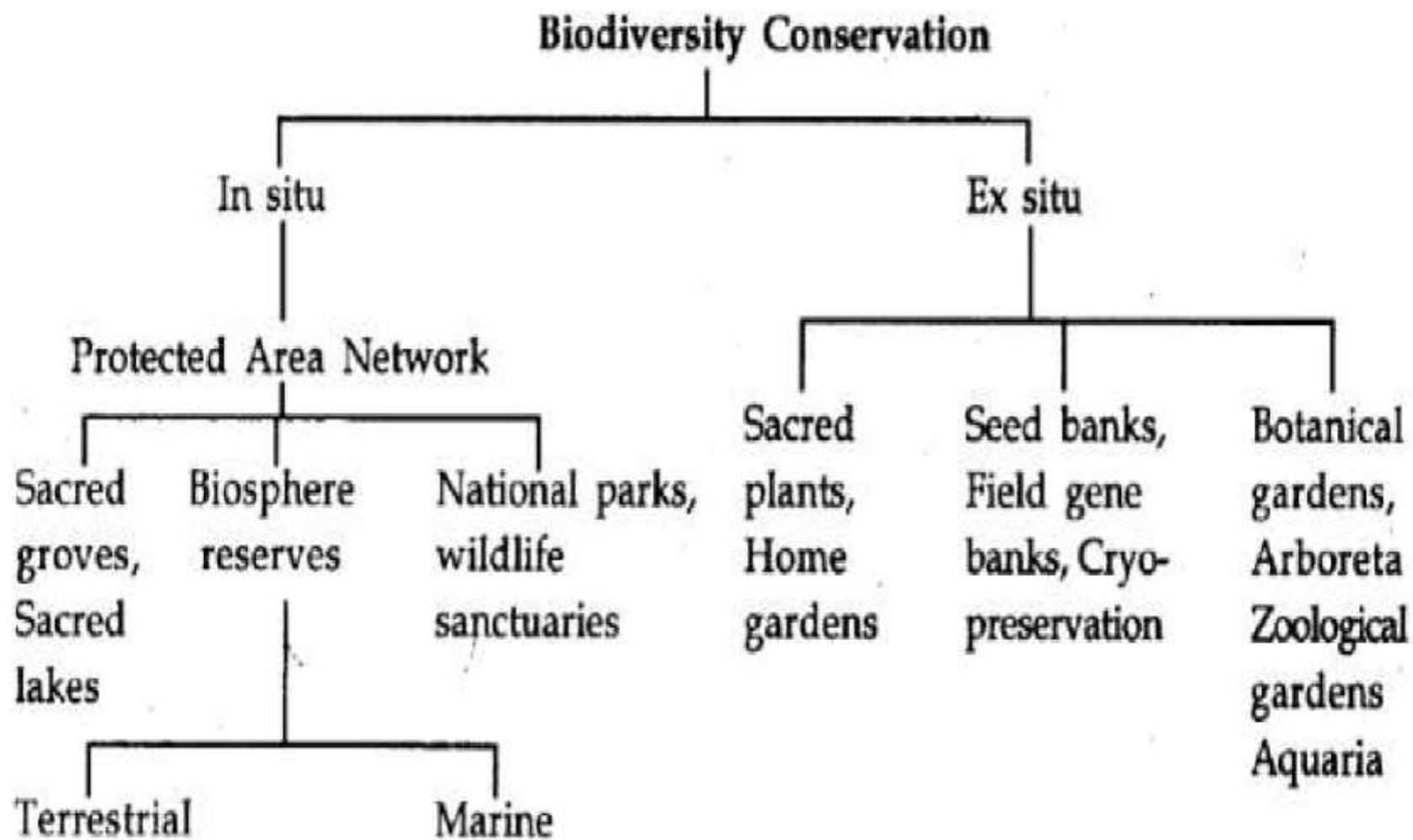


Fig. 1 The in-situ and ex-situ approaches of conserving biodiversity in India

10 Ways to Protect and Conserve Biodiversity

- Government legislation.
- Nature preserves.
- Reducing invasive species.
- Habitat restoration.
- Captive breeding and seed banks.
- Research.
- Reduce climate change.
- Purchase sustainable products.
- 9. Sustainable living
- 10. Education

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**CORAL REEF A BIOME
BIOGEOGRAPHY, UNIT-II**

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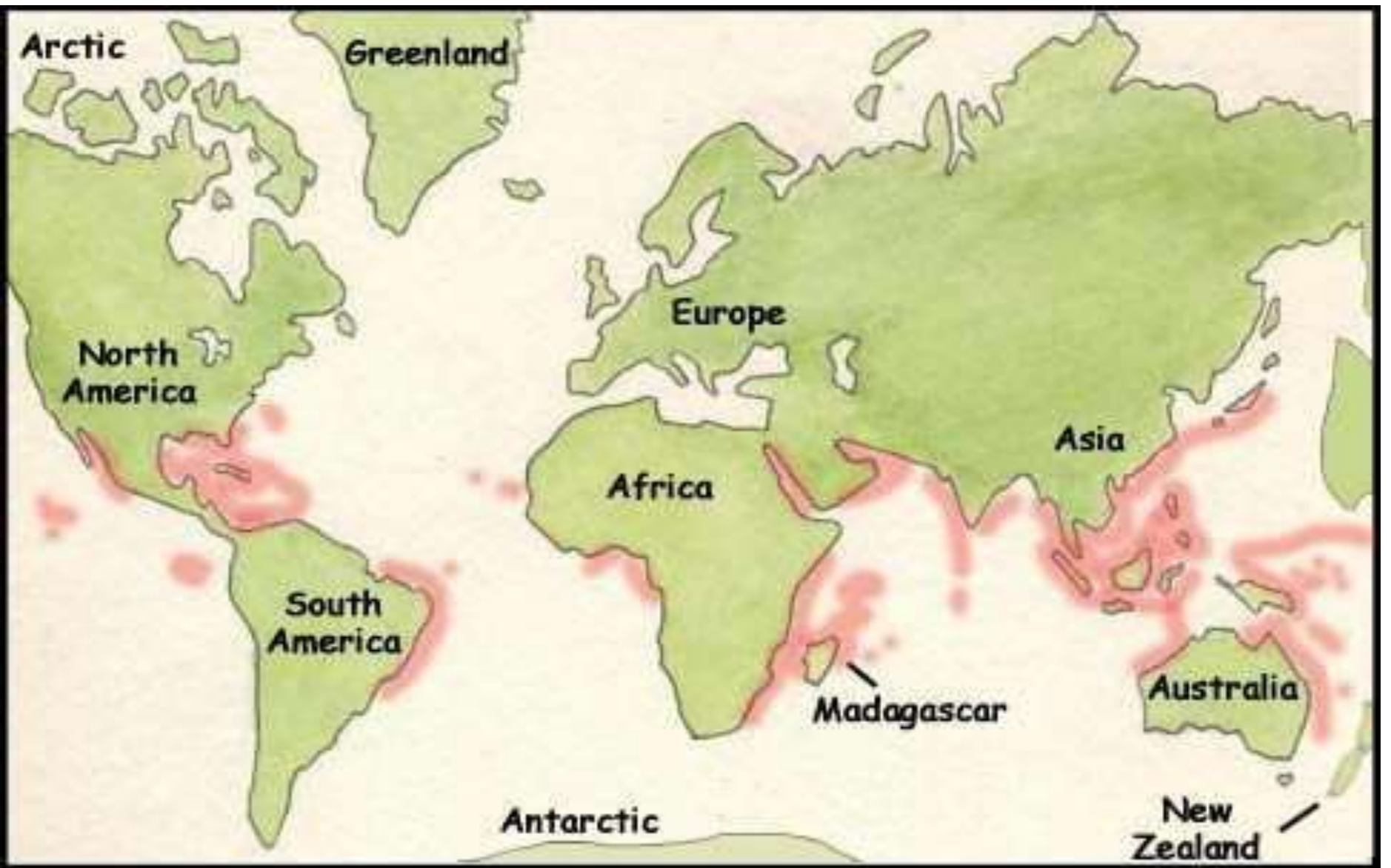
Is a coral reef a biome or ecosystem?

• Shell corals, reef-forming corals, and other reef organisms are found in 25% of the known marine species. Although reefs are relatively small, they are a relatively large part of the world's oceans. What is a coral reef? At first glance, you may think that coral reefs are made up of rocks, but they are actually live organisms.



What are the characteristics of a coral reef?

- **Characteristics of Coral Reefs.** Coral reefs are shallow-ocean habitats that are filled with sea life. The massive structure that the **coral reef** is comprised of is actually built out of **coral** polyps, which are small marine animals that thrive in colonies.



Coral reef map

- However, unlike rocks, **corals** are **alive**. And unlike plants, **corals** do not make their own food. ... The branch or mound that we often call “a **coral**” is actually made up of thousands of tiny animals called polyps. A **coral** polyp is an invertebrate that can be no bigger than a pinhead to up to a foot in diameter.

Types of Reefs

- All types of coral reefs provide habitat for thousands of marine fish and invertebrates. There are three main types of coral reefs:
- The first are called *fringing reefs*, which are built from rocky coasts.
- The second are called *barrier reefs* which grow on the outer seaward edge with lagoons between the reefs and the coast. One of the most famous is the Great Barrier Reef in Australia.
- The third are *atolls* which encircle a lagoon and are not near dry land.

Types of Reefs: The different types of reefs include:

- **Fringing reefs** are reefs that form along a coastline. They grow on the continental shelf in shallow water. **Barrier reefs** grow parallel to shorelines, but farther out, usually separated from the land by a deep lagoon. They are called barrier reefs because they form a barrier between the lagoon and the seas, impeding navigation

Coral Atolls are rings of coral that grow on top of old, sunken volcanoes in the ocean. They begin as fringe reefs surrounding a volcanic island; then, as the volcano sinks, the reef continues to grow, and eventually only the reef remains.

Coral Reef Locations

- Coral reef locations are primarily in shallow tropical and subtropical waters between 30 degrees north and 30 degrees south of the equator. 90 percent of the world's reef systems occur in the Indo-West Pacific biographical region. The Great Barrier Reef off the coast of Australia is the world's biggest coral reef. The second largest coral reef lies off the Caribbean coast of Mexico and Belize.
- Corals without zooxanthellae algae can also be found in oceans up to 20,000 feet (6,000 meters) deep around the world. These deep-sea corals do not have light to [photosynthesize](#). As a result, they grow much more slowly. These deep-sea corals can be found on seamounts, which are peaks under the water.

Temperatures in Coral Reefs

- The coral reef biome climate is tropical. Coral reef temperatures in the wild range from 68 to 97°F (20 to 36°C). The warm, shallow water is essential for photosynthesis of the zooxanthellae algae.
- Deep-sea corals are capable of living in temperatures as low as 30.2°F (-1°C).

Is a coral reef a biome or ecosystem?

• The **coral reef** is one of the **major** marine **biomes**. Although **reefs** are **relatively** **coral reef**? At first glance, you may think that **coral reefs** are made up of rocks, but they are actually live organisms.

Corals are animals

- And unlike plants, corals do not make their own food. Corals are in fact animals. The branch or mound that we often call “a coral” is actually made up of thousands of tiny animals called polyps. A **coral polyp** is an **invertebrate** that can be no bigger than a pinhead to up to a foot in diameter.

Plants in Coral reef biomes

- Besides **zooxanthellae**, **algae** and **sea grasses** are the main types of plants in the coral reef ecosystem. These plants give food and oxygen to the animals that live on the reef. **Sea grasses** are especially important because they provide shelter for juvenile reef animals like conch and lobster.



CORAL REEF PLANTS

Animals in Coral reef Biome

- Coral reefs are warm, clear, shallow ocean habitats that are rich in life. The reef's massive structure is formed from coral polyps, tiny animals that live in colonies; when coral polyps die, they leave behind a hard, stony, branching structure made of limestone.
- The coral provides shelter for many animals in this complex habitat, including [sponges](#), nudibranchs, fish (like Blacktip Reef Sharks, groupers, clown fish, eels, parrotfish, snapper, and scorpion fish), jellyfish, anemones, sea stars (including the destructive Crown of Thorns), crustaceans (like crabs, shrimp, and lobsters), turtles, sea snakes, snails, and mollusks (like octopuses, nautilus, and clams). Birds also feast on coral reef animals.



ANIMALS WORLD OF CORAL REEF



Human impact on coral reefs

Human impact on coral reefs is significant. Coral reefs are dying around the world. Damaging activities include coral mining, pollution (organic and non-organic), overfishing, blast fishing, the digging of canals and access into islands and bays. Other dangers include disease, destructive fishing practices and warming oceans. Factors that affect coral reefs include the ocean's role as a carbon dioxide sink, atmospheric changes, ultraviolet light, ocean acidification, viruses, impacts of dust storms carrying agents to far-flung reefs, pollutants, algal blooms and others. Reefs are threatened well beyond coastal areas. Climate change, such as warming temperatures, causes coral bleaching, which if severe kills the coral.

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Deforestation: Causes Consequences and Management

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Deforestation

- is the widespread destruction of major forests. It is mainly caused by environmental degradation by stakeholders such as farmers, ranches, loggers and plantation corporations. In 2009, India ranked 10th worldwide in the amount of forest loss, where world annual deforestation is estimated as 13.7 million hectares (34×10^6 acres) a year. **Deforestation** can involve conversion of forest land to farms, ranches, or urban use.

What is deforestation and its effects?

- The loss of trees and other vegetation can cause climate change, desertification, soil erosion, fewer crops, flooding, increased greenhouse gases in the atmosphere, and a host of problems for indigenous people.



Deforestation



The causes of deforestation

- Natural causes as hurricanes, fires, parasites and floods.
- Human activities as agricultural expansion, cattle breeding, timber extraction, mining, oil extraction, dam construction and infrastructure development.

Causes in detail

- According to the United Nations Framework Convention on Climate Change (UNFCCC) [secretariat, the overwhelming direct cause of deforestation is agriculture. Subsistence farming is responsible for 48% of deforestation; commercial agriculture is responsible for 32%; logging is responsible for 14%, and fuel wood removals make up 5%.](#)
- Experts do not agree on whether industrial logging is an important contributor to global deforestation. Some argue that poor people are more likely to clear forest because they have no alternatives, others that the poor lack the ability to pay for the materials and labour needed to clear forest. One study found that population increases due to high fertility rates were a primary driver of tropical deforestation in only 8% of cases.
- Other causes of contemporary deforestation may include [corruption of government institutions, the inequitable distribution of wealth and power, population growth and overpopulation, and urbanization.](#) Globalization is often viewed as another root cause of deforestation, though there are cases in which the impacts of globalization (new flows of labor, capital, commodities, and ideas) have promoted localized forest recovery.

- Another cause of deforestation is climate change. 23% of tree cover losses result from wildfires and climate change increase their frequency and power. The rising temperatures cause massive wildfires especially in the [Boreal forests](#). One possible effect is the change of the forest composition.
- [In 2000 the United Nations Food and Agriculture Organization \(FAO\) found that "the role of population dynamics in a local setting may vary from decisive to negligible", and that deforestation can result from "a combination of population pressure and stagnating economic, social and technological conditions"](#)

Environmental effects

- Deforestation is a contributor to [global warming](#), and is often cited as one of the major causes of the enhanced [greenhouse effect](#). Tropical deforestation is responsible for approximately 20% of world greenhouse gas emissions.
- In deforested areas, the land heats up faster and reaches a higher temperature, leading to localized upward motions that enhance the formation of clouds and ultimately produce more rainfall

Hydrological

- The water cycle is also affected by deforestation.
- Trees extract groundwater through their roots and release it into the atmosphere. When part of a forest is removed, the trees no longer transpire this water, resulting in a much drier climate. Deforestation reduces the content of water in the soil and groundwater as well as atmospheric moisture.

Soil

- Due to surface plant litter, forests that are undisturbed have a minimal rate of erosion. The rate of erosion occurs from deforestation, because it decreases the amount of litter cover, which provides protection from surface runoff.
- Soils are reinforced by the presence of trees, which secure the soil by binding their roots to soil bedrock. Due to deforestation, the removal of trees causes sloped lands to be more susceptible to landslides.

Biodiversity

- Deforestation on a human scale results in decline in [biodiversity](#), and on a natural global scale is known to cause the extinction of many species. The removal or destruction of areas of forest cover has resulted in a degraded environment with reduced [biodiversity](#). Forests support biodiversity, providing habitat [for wildlife; moreover, forests foster medicinal conservation.](#) With forest biotopes being irreplaceable source of new drugs (such as [taxol](#)), deforestation can destroy [genetic](#) variations (such as crop resistance) irretrievably.

Health Effects

- According to the [World Economic Forum](#), 31% of the emerging diseases are linked to deforestation. [Kate Jones](#), chair of ecology and biodiversity at [University College London](#), says the disruption of pristine forests driven by logging, mining, road building through remote places, rapid urbanization and population growth is bringing people into closer contact with animal species they may never have been near before, resulting in transmission of [zoonotic diseases](#) (animal related diseases) from wildlife to human.

Economic impact

- Damage to forests and other aspects of nature could halve [living standards](#) for the world's [poor](#) and reduce global [GDP](#) by about 7% by 2050, a report concluded at the [Convention on Biological Diversity](#) (CBD) meeting in Bonn in 2008. Historically, utilization of forest products, including timber and fuel wood, has played a key role in human societies, comparable to the roles of water and cultivable land. Today, developed countries continue to utilize timber for building houses, and wood pulp for [paper](#). In developing countries, almost three billion people rely on wood for heating and cooking.

15 Strategies How to Reduce and Prevent Deforestation

- 1. [Plant a tree](#)
- 2. [Use less paper](#)
- 3. [Recycle paper and cardboard](#)
- 4. [Use recycled products](#)
- 5. [Buy only sustainable wood products](#)
- 6. [Don't buy products containing palm oil](#)
- 7. [Reduce meat consumption](#)
- 8. [Do not burn firewood excessively](#)
- 9. [Practice eco-forestry](#)
- 10. [Raise awareness](#)
- 11. [Respect the rights of indigenous people](#)
- 12. [Support organizations fighting deforestation](#)
- 13. [Join a community forestry project](#)
- 14. [Help restore degraded forests](#)
- 15. [Fight governmental corruption](#)

Causes effect and solution or management

Causes

- Agriculture
- Logging
- Desertification
- Urbanization
- Forest fires
- Mining

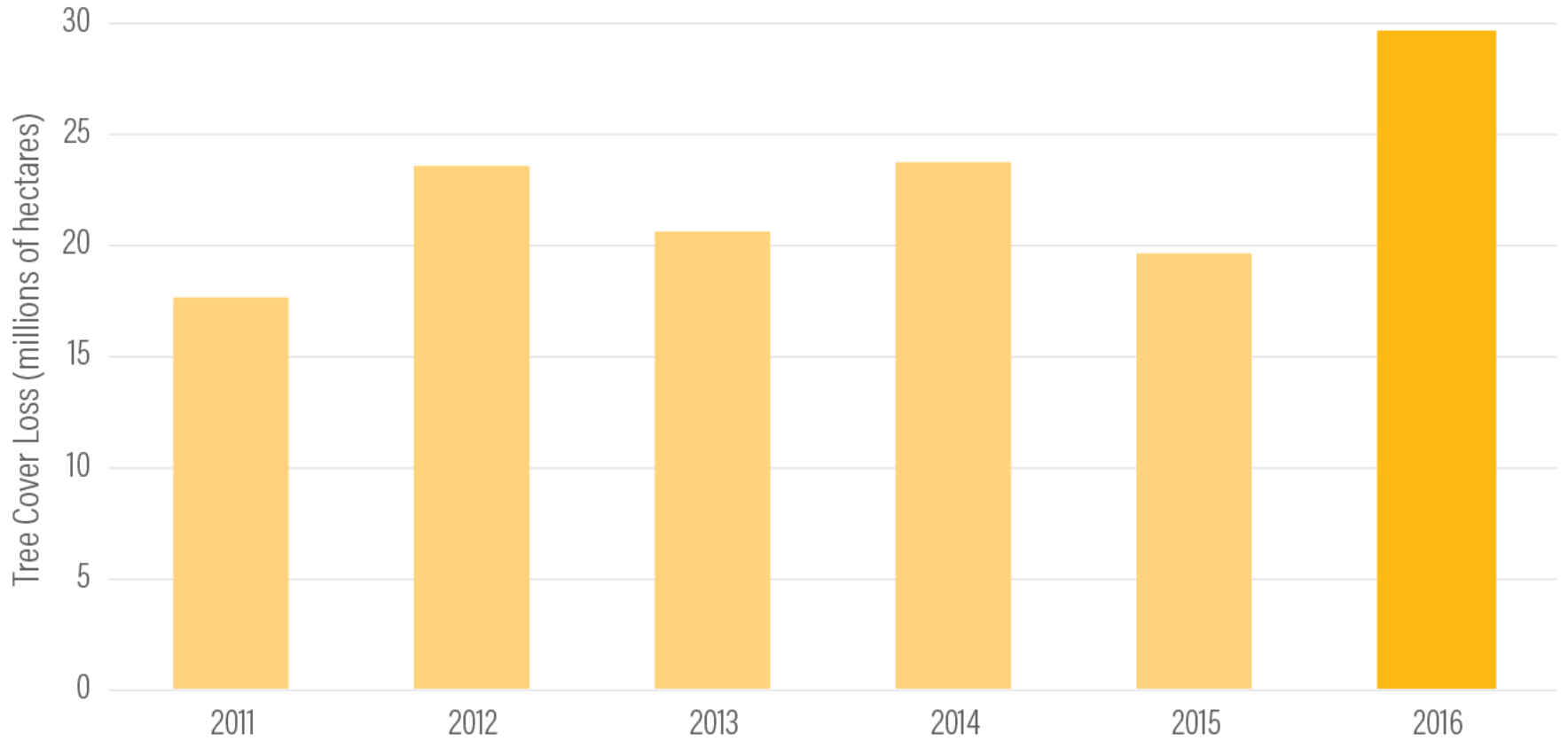
Effects

- Effects on climate
- Effects on animals
- Effects on humans
- Loss of living space for indigenous tribes
- Loss of biodiversity
- Soil erosion
- Hydrological effects
- Floods

Solutions

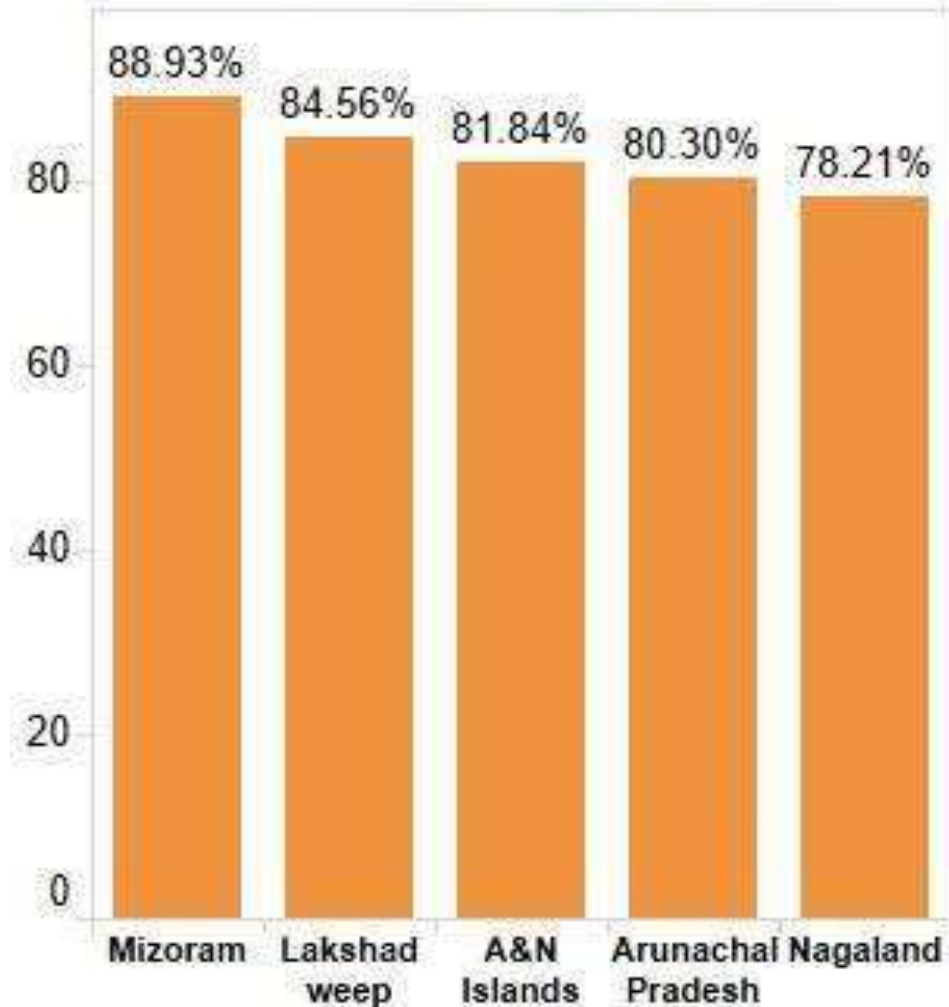
- Government regulations
- Convince farmers to avoid deforestation
- Reforestation and afforestation
- International projects
- Change our consumption behavior
- Education
- Convince others

Global Tree Cover Loss Reaches a New High in 2016

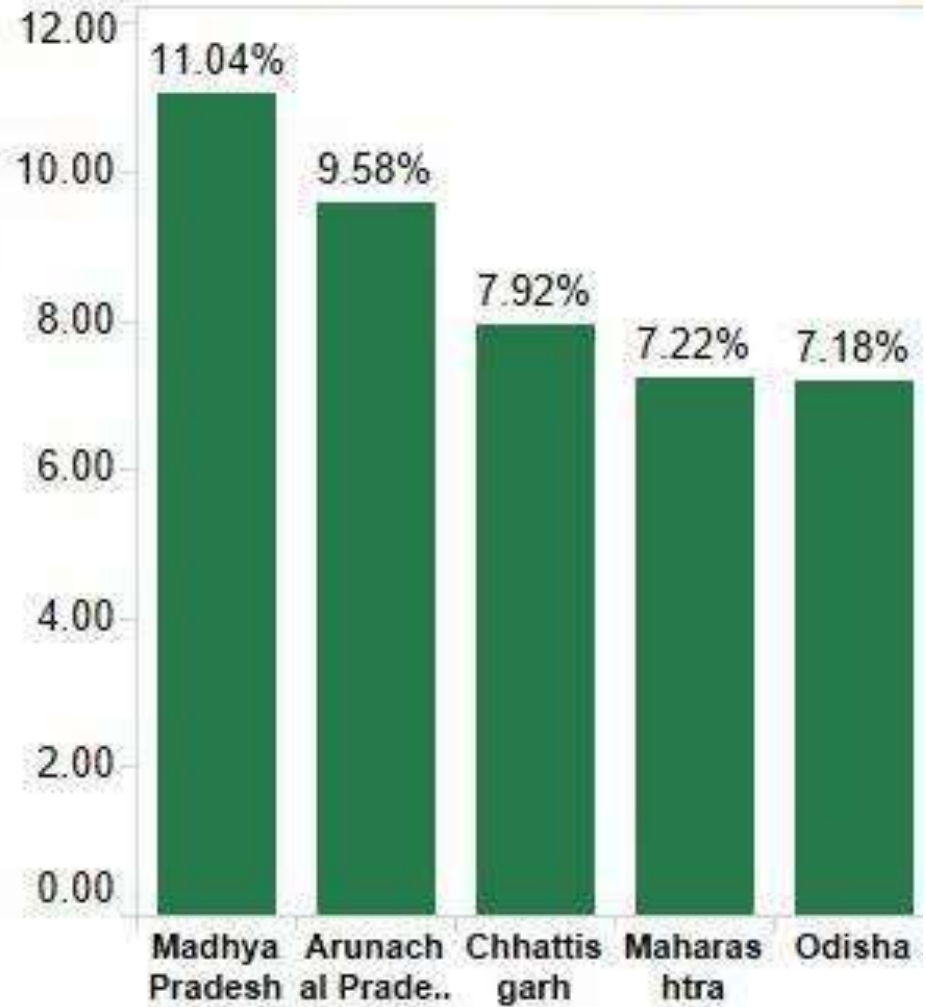


Forest Cover In India

Forest Cover (As % Of State Area)



Forest Cover (As % Of India's Forests)



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