

Environment Notes for UPSC CSE GS3 by Pmfias.com

Contents

| | |
|--|----|
| Solved Environment Prelims Questions (2011-15) | 3 |
| Environment | 32 |
| Habitat | 32 |
| Biosphere | 33 |
| Ecosystem | 33 |
| Components of an Ecosystem | 34 |
| Ecology | 37 |
| Ecotone | 42 |
| Ecological Niche | 43 |
| Functions Of Ecosystem | 44 |
| Ecological Succession | 44 |
| Homeostasis | 48 |
| Homeostasis in Ecosystem | 49 |
| Energy Flow Through an Ecosystem – Trophic Levels | 50 |
| Food Chain | 50 |
| Food Web | 52 |
| Biotic Interaction | 53 |
| Ecological Pyramids | 55 |
| Pollutants And Trophic Level | 58 |
| Biogeo Chemical Cycling or Nutrient Cycling | 60 |
| Nutrient Cycles | 60 |
| Carbon Cycle [Gaseous Cycle] | 61 |
| Nitrogen Cycle [Gaseous Cycle] | 62 |
| Phosphorus Cycle [Sedimentary cycle] | 66 |
| Sulphur Cycle [Sedimentary cycle] | 67 |
| Natural Ecosystem | 68 |
| Biomes or Terrestrial Ecosystems | 69 |
| Eutrophication – Algal Bloom | 78 |
| Harmful Algal Blooms | 79 |
| Aquatic Ecosystems | 80 |
| Wetland Ecosystem | 82 |

| | |
|---|-----|
| Measures to Protect Wetlands | 84 |
| Ramsar Convention on Wetlands | 84 |
| Ramsar Sites in India | 86 |
| Wetlands International | 93 |
| National Wetlands Conservation Programme (NWCP) | 94 |
| Estuarine Ecosystem | 94 |
| India Estuarine Ecosystem | 96 |
| Mangroves | 96 |
| Environmental Degradation | 99 |
| Human Modified Ecosystems and Environmental Degradation | 100 |
| Environmental Issues in Himalayas | 102 |
| Soil erosion | 105 |
| Desertification | 109 |
| Pollution | 110 |
| Air Pollution | 110 |
| Classification of Pollutants | 111 |
| Prevention and Control of air Pollution | 115 |
| Government Initiative | 118 |
| Smog | 119 |
| Sulfurous smog | 119 |
| Photochemical smog | 120 |
| Effects of Smog | 121 |
| Question: UPSC Mains 2015 | 121 |
| Ozone Hole – Ozone Depletion | 122 |
| Polar Vortex | 123 |
| Polar Stratospheric Clouds (PSCs) | 124 |
| Harmful Effects of Ozone Depletion | 125 |
| Measures to Prevent Ozone (O ₃) Layer Depletion | 126 |
| Acid Rain – Acidification | 127 |
| Ocean Acidification | 131 |
| Water Pollution | 133 |
| Causes of Water Pollution | 133 |
| Ground Water | 136 |
| Water Pollution Control Measures | 138 |
| Effects of Water Pollution | 140 |

| | | | |
|--|-----|---|-----|
| Water Conservation and Management.. | 143 | Insectivorous plants of India..... | 217 |
| Radioactive Pollution | 150 | Indian Vulture Crisis | 218 |
| Impact Of Radiation From Mobile Phone Towers | 153 | Major Global Environmental Issues .. | 222 |
| Soil Pollution..... | 154 | Climate Change | 222 |
| Noise Pollution | 156 | Greenhouse Effect | 222 |
| Solid Wastes..... | 156 | Greenhouse Effect And Global Warming 2 Due to Greenhouse Gases | 222 |
| Hazardous Waste | 158 | Greenhouse Gases..... | 223 |
| Electronic waste E – WASTE | 159 | Global Warming – Impacts..... | 225 |
| Heavy Metal Toxicity And Methods Of Their Prevention | 161 | Some methods to reduce CO2 in atmosphere | 226 |
| Occupational Health Hazards | 162 | Major International Conventions to Protect Environment | 229 |
| Treatment and disposal of solid waste . | 163 | UNCED - Earth Summit 1992, Rio De janeiro Brazil..... | 229 |
| Environmental Impact Assessment .. | 165 | Convention on Biological Diversity..... | 230 |
| Biodiversity | 172 | United Nations Convention to Combat Desertification (UNCCD) | 231 |
| Biodiversity of India..... | 174 | UNFCCC: United Nations Framework Convention on Climate Change..... | 231 |
| Wildlife Diversity Of India..... | 177 | Kyoto Protocol | 233 |
| Loss of Biodiversity..... | 178 | Flexible Market Mechanisms – Kyoto Protocol..... | 235 |
| Man - Animal Conflict..... | 180 | Important Summits Post Kyoto | 237 |
| Culling of animals – Conservation or Biodiversity loss?..... | 180 | Lima Summit, 2014..... | 239 |
| Invasive Alien Species..... | 182 | Paris summit, 2015..... | 240 |
| Species Extinction | 185 | REDD & REDD+ | 243 |
| Biodiversity Conservation | 185 | Intergovernmental Panel on Climate Change..... | 244 |
| Historic Citizen Movements to Conserve Biodiversity | 191 | Global Environment Facility | 244 |
| Biodiversity Hot Spots | 191 | Transition to green economy..... | 245 |
| Indian Biodiversity Hot Spots | 192 | Arctic Council..... | 246 |
| World Heritage Sites | 193 | India's National Action Plan On Climate Change..... | 246 |
| International Union for Conservation of Nature..... | 194 | Indian Network On Climate Change Assessment | 249 |
| IUCN Red List or Red Data List or Red Book | 196 | National Environmental Legislation | 249 |
| 2015 IUCN Red List India [As of April 24, 2016] | 197 | Pollution Related Acts..... | 249 |
| Steps Taken by the Government for Wildlife Protection | 215 | Environment and Biodiversity Related Acts | 250 |
| Misc | 215 | | |
| Insectivorous Plants | 216 | | |

| | |
|---|-----|
| Acts for Protecting Coastal Environment and Wetlands | 256 |
| Green Revolution – Modern Agriculture | 266 |
| Second Green Revolution For Sustainable Livelihood..... | 267 |
| Concept Of Sustainable Agriculture..... | 269 |
| Methods Of Sustainable Agriculture | 270 |
| Biotechnology – Genetically Modified (GM) | 276 |
| Newer Agricultural Practices..... | 278 |
| Crop Classifications..... | 281 |
| Renewable & Non-Conventional Sources Of Energy | 285 |
| Ministry of New and Renewable Energy (MNRE)..... | 290 |
| Non-Renewable Sources Of Energy | 292 |
| Energy conservation | 297 |

Solved Environment Prelims Questions (2011-15)

Solved Environment Prelims Questions (2011-15)

- The questions from the previous 3-4 years' prelims papers help us understand the nature of questions asked in prelims and the trend the UPSC is following.
- Environment is the high priority topic for prelims and can be studied in relatively less hours compared to other subjects [Very High Cost to Benefit Ratio].

Here I have not given explanation to location based question [Location of Biosphere reserves, Tiger reserves, National Parks etc.].

I will come up with a separate notes on Location Based Question that are important for Prelims under Geography and Environment.

Most of the questions below are explained in detail under respective headings.

If you found any mistakes, inform me at poormansfriend2485@gmail.com or My FB

Page: <https://www.facebook.com/PoorMansFriend2485>

I advise you to first go through the full notes before trying to understand these question. Page | 3

2011-2012

Q1. Which one of the following is not a site for in-situ method of conservation of flora?

- Biosphere Reserves
- Botanical Garden
- National Park
- Wildlife Sanctuary

In situ conservation = on the site conservation without displacing the affected organism.

Ex situ conservation = conserving the organism in an artificial habitat by displacing it from its natural habitat.

Botanical Garden = Plants are bred in a protected environment far from their natural home, especially for research purposes. So its Ex situ conservation.

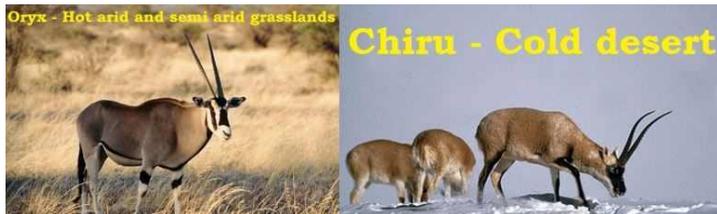
Rest all along with protected forests and reserved forests are In situ conservation methods.

Answer: b) Botanical Garden

Q2. What is the difference between the antelopes Oryx and Chiru?

- Oryx is adapted to live in hot and arid areas whereas Chiru is adapted to live in steppes and semi-desert areas of cold high mountains. .
- Oryx is poached for its antlers whereas Chiru is poached for its musk.
- Oryx exists in western India only whereas Chiru exists in north-east India only.
- None of the statements a, b, and c given above is correct.

They are both antelopes.



Q4. Consider the following:

1. Black-necked crane
2. Cheetah
3. Flying squirrel
4. Snow leopard

Which of the above are naturally found in India ?

- a. 1, 2 and 3 only
- b. 1, 3 and 4 only
- c. 2 and 4 only
- d. 1, 2, 3 and 4

Black-necked crane is commonly found in Tibetan and trans-Himalayan region. In winters they migrate to less colder regions of Indian Himalayas.

Cheetah is an extinct species. They have gone extinct during pre-independence era. Reason: They were hunted down by various Indian kings and British officers.

Flying Squirrels are found in many Indian forests.

Snow leopard is an 'endangered' specie found in the Himalayan ranges.

Answer: a)

Q3. Among the following States, which one has the most suitable climatic conditions for the cultivation of a large variety of orchids with minimum cost of production, and can develop an export oriented industry in this field ?

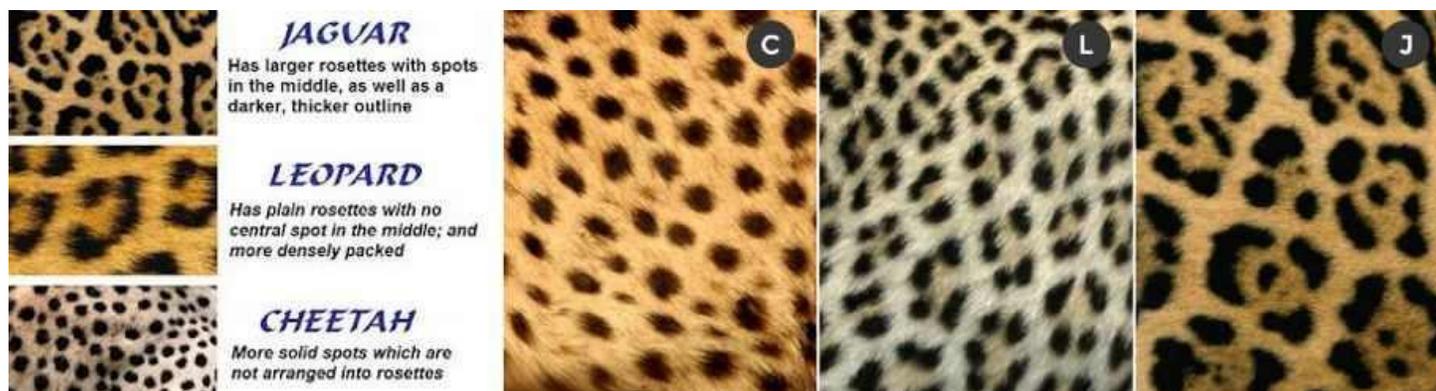
- a. Andhra Pradesh
- b. Arunachal Pradesh
- c. Madhya Pradesh
- d. Uttar Pradesh

Orchids are decorative flowering plants. They grow in regions with moderate climatic conditions [Sub-tropics with decent rainfall]

They are typical to North-Eastern states.

Great demand for these decorative flowering plants exists in South-East Asian region.

Answer: b)



Answer: b) 1, 3 and 4 only

Q5. A sandy and saline area is the natural habitat of an Indian animal species. The animal has no predators in that area but its existence is threatened due to the destruction of its habitat. Which one of the following could be that animal?

- a. Indian wild buffalo

- b. Indian wild ass
- c. Indian wild boar
- d. Indian Gazelle

Sandy saline area = Kutch region

Indian wild buffalo = Terai region

Indian wild boar = can survive in different types of habitat: grasslands,

2. That part of the Earth which is inhabited by living organisms – biosphere.
3. A community of organisms together with the environment in which they live – ecosystem.
4. The flora and fauna of a geographical area – biodiversity.

Q21. With reference to bio-toilets used by the Indian Railways, consider the following statements:

1. The decomposition of human waste in the bio-toilets is initiated by a fungal inoculum.
2. Ammonia and water vapour are the only end products in this decomposition which are released into the atmosphere.

Which of the statements given above is/are correct?

- a. 1 only
- b. 2 only
- c. Both 1 and 2
- d. Neither 1 nor 2

Decomposition of human waste in bio-toilets is carried out by anaerobic bacteria.

The final waste is CO₂ and CH₄. [Explained in detail under “Water Pollution”]

Answer: d) Neither 1 nor 2

Q22. With reference to the Indian Renewable Energy Development Agency Limited (IREDA), which of the following statements is/are correct?

1. It is a Public Limited Government Company.
2. It is a Non – Banking Financial Company.

Select the correct answer using the code given below.

- a. 1 only
- b. 2 only
- c. Both 1 and 2
- d. Neither 1 or 2

IREDA is Public Limited Government Company established as a **Non-Banking Financial Institution** in 1987 engaged in promoting, developing and extending financial assistance for setting up projects relating to new and renewable sources of energy and energy efficiency/conservation with the motto: **“Energy For Ever”**. Page

Answer: c) Both

Environment and Ecosystem - Components of an Ecosystem

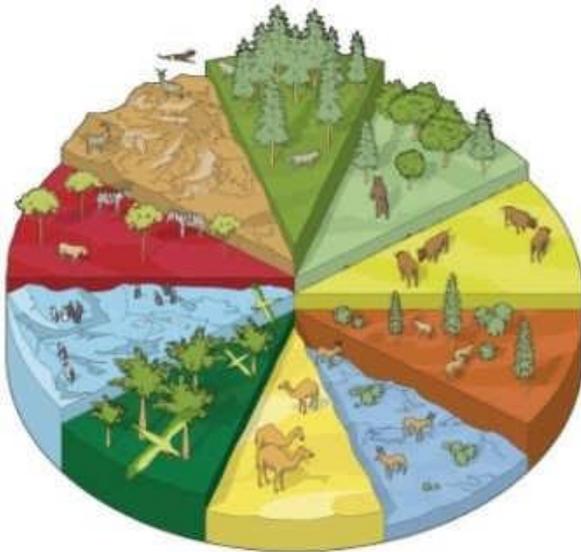
Environment

- Environment is the natural component in which biotic (living) and abiotic (nonliving) factors interact with each other. These interactions shape the habitat and ecosystem of an organism.
- In biological sense, environment constitute the physical (nutrients, water, air etc.) and biological factors (biomolecules, organisms) along with their chemical interactions (chemical cycles – carbon cycle, nitrogen cycle etc.) that affect an organism or a group of organisms.
- All organisms are dependent on the environment to carry out their natural life processes (birth to death) and to meet their physical requirements (food, energy, water, oxygen, shelter etc.).
- The environment is not static. Both biotic and abiotic factors are in a constant flux and keep changing continuously.

Habitat

- Habitat is the physical environment in which an organism lives (it corresponds to address of an organism).
- It is an ecological or environmental area inhabited by **particular species** of plants, animals, fungi, etc. **Many habitats make up the environment.**
- A single habitat may be common for more than one organism which have similar requirements.
- For example, a single aquatic habitat may support a fish, frog, crab, phytoplankton and many other kinds of organisms.

- The various species sharing a habitat thus have the same 'address'. Forest, river etc. are other examples of habitat.
- **All habitats are environments but all environments are not habitats.**



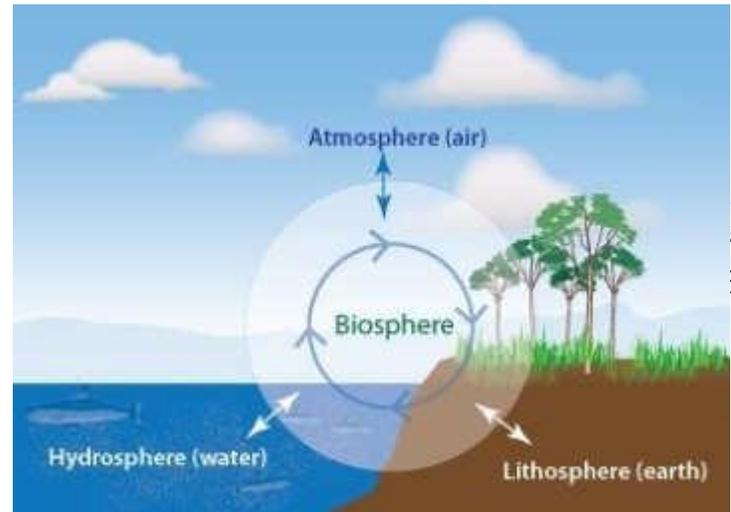
Difference between Habitat and Environment?

<http://www.differencebetween.com/difference-between-habitat-and-vs-environment/>

- A habitat always has **life** in it, whereas the environment does not necessarily have life in it.
- The habitat is a defined place or area of the environment according to the requirements of a particular life form. Therefore, a habitat is always an environment, but an environment is not always a habitat.
- A habitat is always a preference of **one species**, whereas an environment could be a preference of many species that could eventually become many habitats.
- Usually, the environment governs the properties of a habitat, but not vice versa.

Biosphere

- The biosphere is the **biological component** (supporting life) of earth which includes the lithosphere, hydrosphere and atmosphere.
- The biosphere includes all living organisms on earth, together with the dead organic matter produced by them.

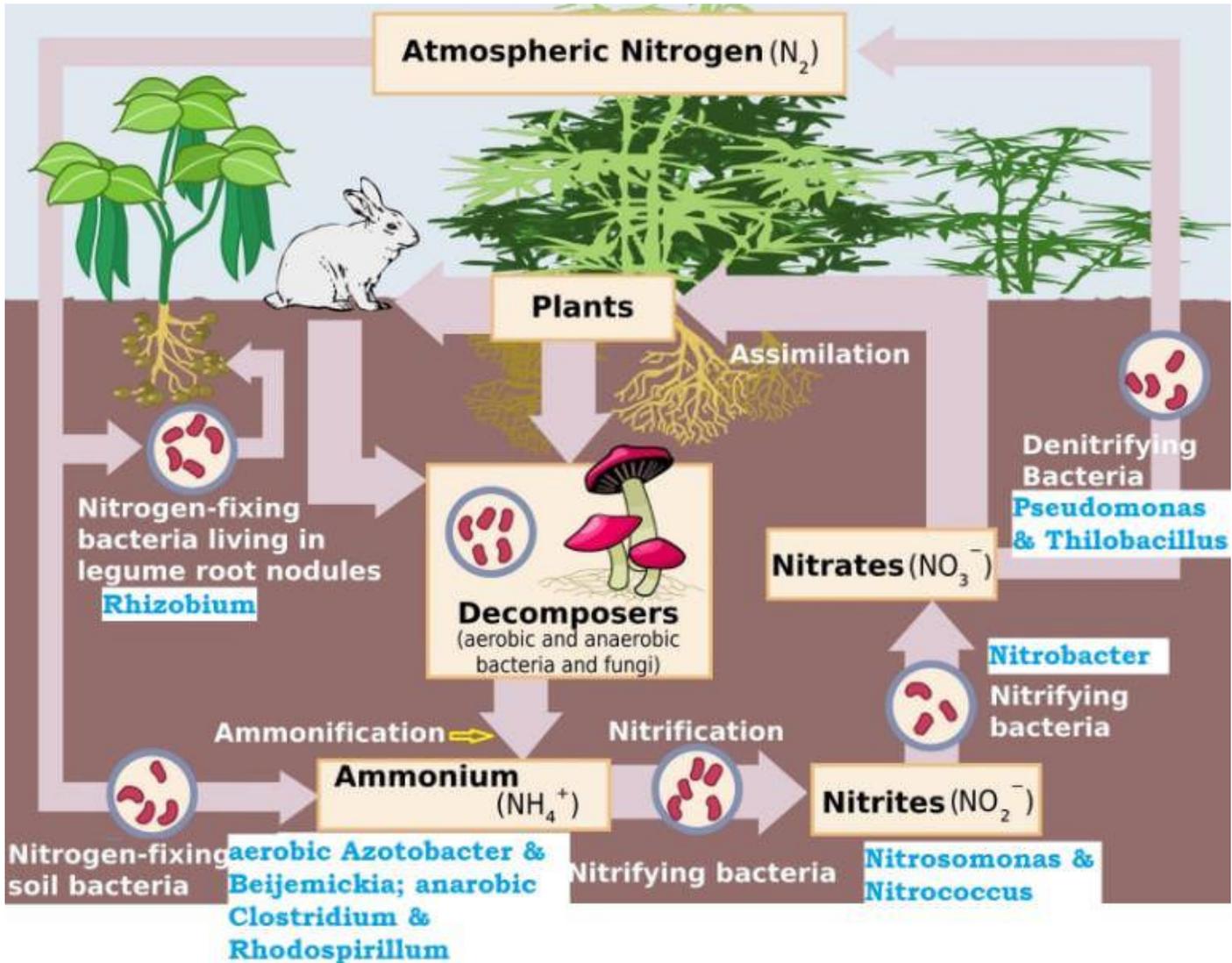


Picture Credits:
<https://briangrimmerblog.files.wordpress.com/2014/07/image.jpg>

- Biosphere is absent at extremes of the North and South poles, the highest mountains and the deepest oceans, since existing hostile conditions there do not support life [Life is the characteristic feature of biosphere].
- Occasionally spores of fungi and bacteria do occur at great height beyond 8,000 metres, but they are metabolically inactive, and hence represent only dormant life.

Ecosystem

- An ecosystem can be visualised as a **functional unit of nature**, where living organisms [**producers, consumers, and decomposers**] interact among themselves and also with the surrounding physical environment.
- Ecosystem varies greatly in size from a small pond to a large forest or a sea.
- Forest, grassland and desert are some examples of terrestrial ecosystems; pond, lake, wetland, river and estuary are some examples of aquatic ecosystems. Crop fields and an aquarium may also be considered as man-made ecosystems.
- In the ecosystem, biotic and abiotic components are linked together through **nutrient cycles** and **energy flows**.
- An ecosystem can be of any size but usually encompasses **specific and limited species**. Eg: Aquatic Ecosystem. [This is



Leguminous: denoting plants of the pea family (Leguminosae), typically having seeds in pods, distinctive flowers, and root nodules containing nitrogen-fixing bacteria.

Nitrification – Ammonia to Nitrates

- Ammonium ions can be directly taken up as a source of nitrogen by some plants.
- Others absorb **nitrates** which are obtained by oxidizing ammonia and ammonium ions.
- Ammonia and ammonium ions are oxidized to **nitrites or nitrates** by two groups of specialized bacteria.

1. **Ammonium** ions are first oxidized to **nitrite** by the bacteria **Nitrosomonas** and/or **Nitrococcus**.

2. The nitrite is further oxidized to **nitrate** with the help of the bacterium **Nitrobacter**.

- These steps are called **nitrification**. These nitrifying bacteria are **chemoautotrophs**.
- The nitrate thus formed is absorbed by plants and is transported to the leaves.
- In leaves, it is reduced to form ammonia that finally forms the amine group of **amino acids**, which are the building blocks of proteins. These then go through higher trophic levels of the ecosystem.

Nitrification is important in agricultural systems, where fertilizer is often applied as ammonia. Conversion of this ammonia to nitrate **increases nitrogen leaching** because nitrate is more water-soluble than ammonia.

explains why mangroves are confined to only tropical and sub-tropical coastal waters.

- Mangroves occur in a variety of configurations. Some species (e.g. **Rhizophora**) send arching **prop roots** down into the water. While other (e.g. **Avicennia**) send **vertical "Pneumatophores"** or air roots up from the mud.



Prop roots and pneumatophores



Stilt roots

- Adventitious roots which emerged from the main trunk of a tree above ground level are called **stilt roots**.
- Mangroves exhibit **Viviparity** mode of reproduction. i.e. seeds germinate in the tree itself (before falling to the ground).
- This is an adaptive mechanism to overcome the problem of germination in saline water.

Mangroves in India

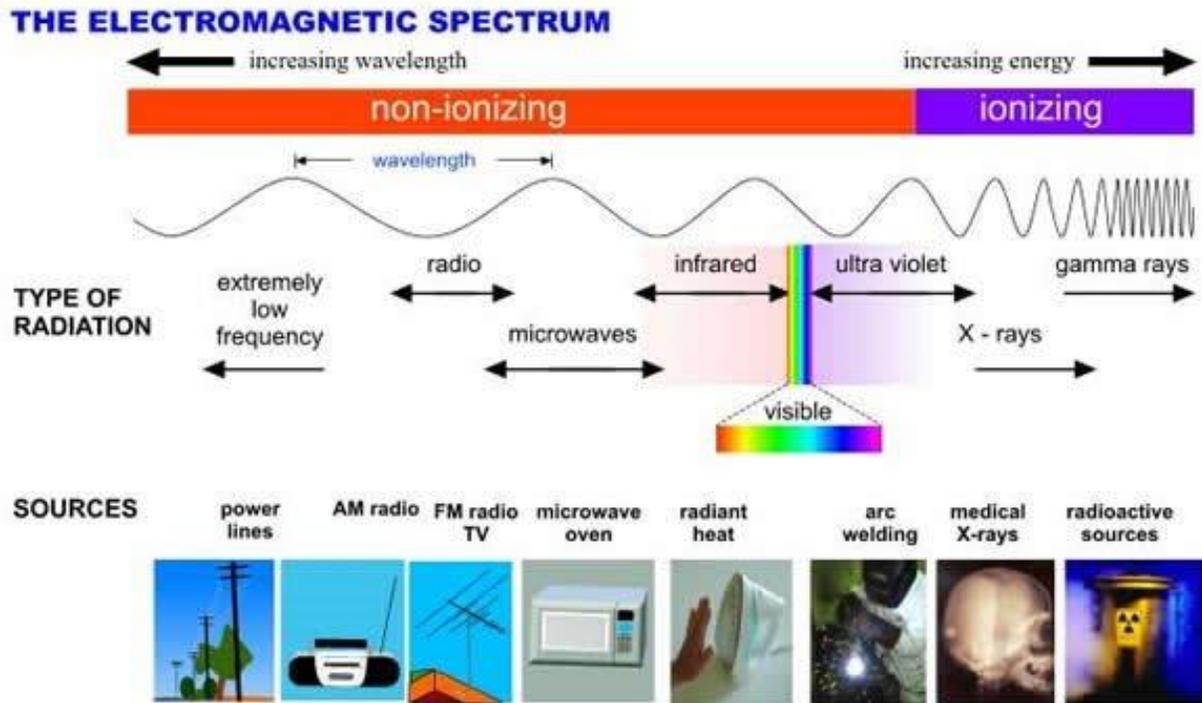


- The mangroves of Sundarbans are the largest single block of tidal holophytic mangroves of the world.
- The major species of this dense mangrove forest include *Herritiera fames*, *Rhizophora* spp., *Bruguiera* spp., *Cerriops decandra*, *Sonneratia* spp. and *Avicennia* spp., *Nypa fruticans* are found along the creeks.
- This mangrove forest is famous for the Royal Bengal Tiger and crocodiles. Mangrove areas here are being cleared for agricultural use.
- The mangroves of Bhitarkanika (Orissa), which is the second largest in the Indian sub-continent, harbour high concentration of typical mangrove species and high genetic diversity.
- Mangrove swamps occur in profusion in the intertidal mudflats on both side of the creeks in the Godavari-Krishna deltaic regions of Andhra Pradesh.
- Mangroves of Pichavaram and Vedaranyam are degraded mainly due to construction of aquaculture ponds and salt pans.
- On the west coast of India, mangroves, mostly scrubby and degraded occur along the intertidal region of estuaries and

through which they pass, causing them to vibrate faster but **not strong enough to ionize them.**

- In a microwave oven the radiation causes water molecules in the cooking medium to vibrate faster and thus raising its temperature.

- They may damage eyes which may be caused by **reflections from coastal sand**, snow (**snow blindness**) directly looking towards sun during eclipse.
- They injure the cells of skin and blood capillaries producing blisters and reddening called sunburns.



Ionizing radiations

- Ionizing radiations cause **ionization** (one or more electrons are peeled out from the outer shells of an atom) of atoms and molecules of the medium through which they pass.

Ionization is the process by which an atom or a molecule acquires a negative or positive charge by gaining or losing electrons to form ions, often in conjunction with other chemical changes.

- Electromagnetic radiations such as **short wavelength ultra violet radiations (UV), X-rays and gamma rays** and energetic particles produced in nuclear processes, electrically charged particles like **alpha and beta particles** produced in radioactive decay and **neutrons** produced in nuclear fission, are highly damaging to living organisms.
- Electrically charged particles produced in the nuclear processes can have sufficient energy to knock electrons out of the atoms or

molecules of the medium, thereby producing ions.

- The ions produced in water molecules, for example, can induce reactions that can **break bonds** in proteins and other important molecules.
- An example of this would be when a gamma ray passes through a cell, the water molecules near the DNA might be ionized and the ions might react with the DNA causing it to break.
- They can also cause chemical changes by breaking the chemical bonds, which can damage living tissues.
- Short range effects include burns, impaired metabolism, dead tissues and death of the organisms.
- Long range effects are **mutations** increased incidence of **tumors and cancer**, shortening of life-span and developmental changes.

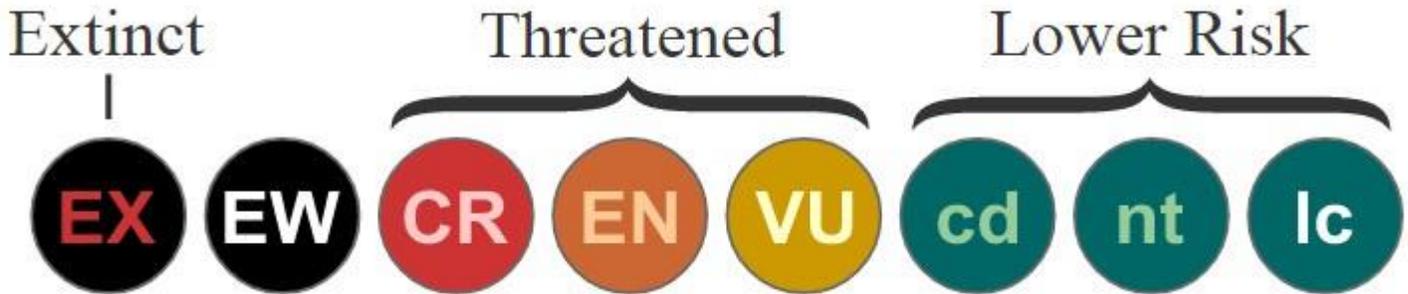
Non-ionizing radiations affect only those components which absorb them and have low penetrability.

IUCN Red List or Red Data List or Red Book

- The IUCN Red List of **Threatened Species**, founded in 1964, is the world's most

comprehensive inventory of the global conservation status of biological species.

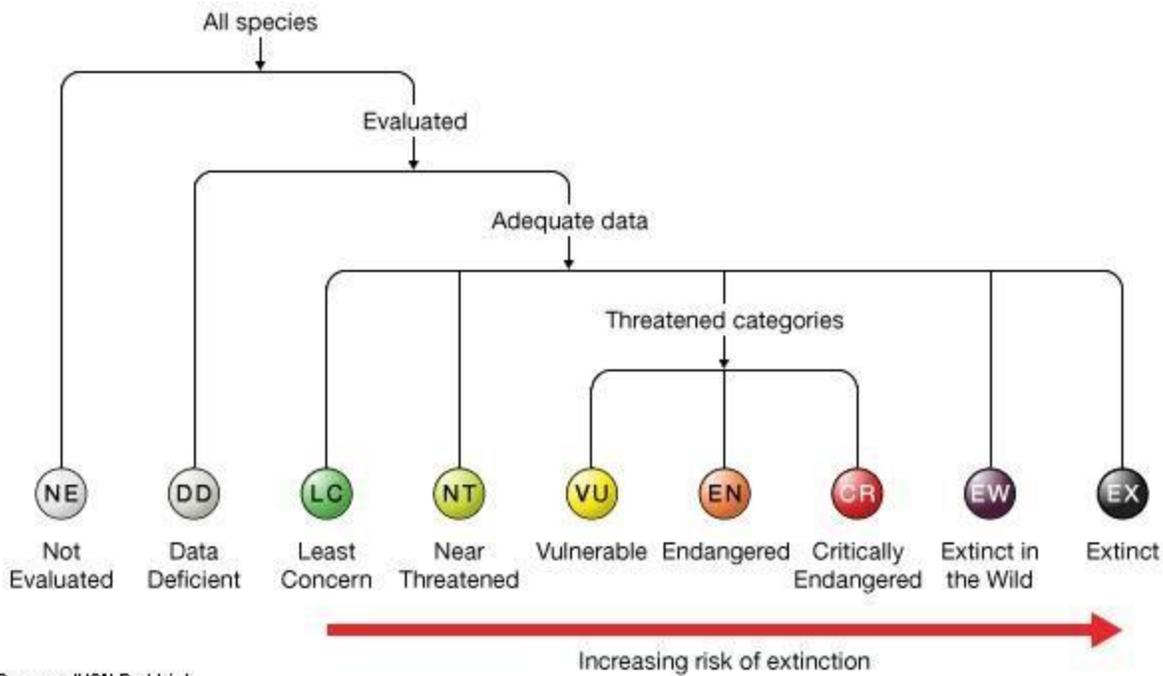
- When discussing the IUCN Red List, the official term “**threatened**” is a grouping of three categories: **Critically Endangered, Endangered, and Vulnerable**.



- The pink pages in this publication include the critically endangered species. As the status of the species changes, new pages are sent to the subscribers.
- Green pages are used for those species that were formerly endangered, but have now recovered to a point where they are no longer threatened.

- With passing time, the number of pink pages continue to increase. There are pitifully few green pages.

Species are classified by the IUCN Red List into nine groups



Source: IUCN Red List

Picture Credits: <http://media-2.web.britannica.com/>

- Extinct (EX)** – No known individuals remaining.
- Extinct in the wild (EW)** – Known only to survive in captivity, or as a naturalized population outside its historic range.

- Critically endangered (CR)** – Extremely high risk of extinction in the wild.

Criteria

- reduction in population (> 90% over the last 10 years),

- Gaur are largely confined to evergreen forests or semi-evergreen and moist deciduous forests, but also occur in deciduous forest areas at the periphery of their range.
- The domesticated form of the gaur, *Bos frontalis*, is called gayal or mithun.
- Threats: Habitat loss, habitat fragmentation.



Four-horned antelope, Chousingha



- The four-horned antelope must drink water regularly in order to survive.
- Distribution: Presently it is confined to the Indian subcontinent. Scattered between the foothills of the Himalayas in the north to the Deccan Plateau in the south. Gir National Park has 1000 of these animals.
- Threats: Loss of its natural habitat due to agricultural expansion. Four-horned skull and horns have made it a popular target for hunters.

Takin



- Distribution: Mountainous regions in the Himalayan Mountains and western China.
- Threats: Largely due to overhunting and the destruction of their natural habitat, takin are considered Endangered in China and Vulnerable per the IUCN.

Nilgiri marten

- Endemic to the Western Ghats. Inhabits areas that are far from human disturbance.
- Threat: habitat loss and fragmentation, hunting for its fur.
- Only species of marten found in southern India.

Barasingha or swamp deer (*Rucervus duvaucelii*)



- Habitat: Isolated localities in northern and central India, and southwestern Nepal.
- Threats: Hunting for horns, habitat fragmentation and habitat loss.

Oriental small-clawed otter/ Asian small-clawed otter (*Aonyx cinerea*)



- Semiaquatic mammals which feed on fish and shellfish, and also other invertebrates, amphibians, birds and small mammals.
- It is a smallest otter species in the world.
- Habitat: It lives in mangrove swamps and freshwater wetlands.

climate contributions (so-called Intended Nationally Determined Contributions, INDCs).

China-U.S. deal on emission cuts

- Prior to the summit, China and the United States have agreed on a timetable to limit emission of GHGs.
- It will impose fresh pressure on India to make a voluntary commitment.
- S. agreed to reduce by 2025 its emission of greenhouse gases by 26 per cent to 28 per cent below its 2005 level.
- China stated its intent to peak emissions of carbon dioxide in 2030, if not earlier (from 2030 it will start reducing its emissions). It also agreed to raise the share of non-fossil fuels to 20 per cent in the next 16 years.
- India's per capita emissions are estimated at **one-tenth** of the United States and **one-fourth** of China.
- China – US deal imposed a fresh pressure on India to make a voluntary commitment.
- India announced its INDCs in the end of 2015.



What is an INDC?

- During previous climate negotiations, countries agreed to publicly outline what actions they intend to take under a global agreement well before the Paris Summit 2015.

- These country commitments are known as Intended Nationally Determined Contributions (INDCs).

The main points of contention on INDCs

Inclusion of Adaptation, finance and transfer of technology

- Developed countries are of the view that only actions that help in reducing greenhouse gas emissions should be counted as 'contributions' in INDCs.
- Almost every developing country, including India, however, wants adaptation measures also to be counted.
- Developing countries also want efforts by developed ones on providing money or transferring technology to poorer nations to be included in INDCs.
- This will help in holding the rich countries (biggest culprits that contributed to the increase of GHG emissions since Industrial Revolution) accountable to their promises on ensuring financial and technology flows.

Commitment Period

- India, European Union, China etc. are in favor of a 10-year commitment period.
- The **United States**, however, wants five-year commitment period so that countries can make quicker reviews.

Ex-post Review

- Since the INDCs are 'nationally-determined' and voluntary, the level of ambition in making 'contributions' is likely to be low.
- Some countries want an assessment of each country's INDC to see whether these are in line with the global 2 degree target.
- **India** and the **United States** strongly resent any such provision, saying such an exercise will negate the 'nationally-determined' nature of the 'contributions'.

India's INDC objectives

- Announced in October, 2015 (Lima summit urged every country to announce its INDCs by Nov, 2015)