

## 1. What is open cast mining? How does it affect the land? What are the alternatives to open cast mining? Discuss.

### Introduction

Open-cast mining is a surface mining technique of extracting rock or minerals from the earth by their removal from an open pit or borrow.

This form of mining differs from extractive methods that require tunneling into the earth, such as long wall mining. Open-pit mines are used when deposits of commercially useful minerals or rocks are found near the surface; that is, where the overburden is relatively thin or the material of interest is structurally unsuitable for tunneling (as would be the case for sand, cinder, and gravel). For minerals that occur deep below the surface—where the overburden is thick or the mineral occurs as veins in hard rock—underground mining methods extract the valued material.

### Body

#### Effect of open cast mining on land

- Open-cast mining changes geological, hydrological and geotechnical conditions.
- It influences the existing ecological system and landscape.
- During mining stage, land is damaged and degraded. Excavation of coal and overburden dumping along with other infrastructural development is responsible for this damage and degradation.
- Impact of land degradation is observed as loss of forest cover, reduction and extinction of wildlife, reduction of agricultural land, destruction of geologic column, soil erosion, hydrological imbalance, socioeconomic problems, etc. in active mining areas
- The dust and noise affect not only the atmosphere and soil, but also the whole human living space in the exploited territories.
- Open-pit mines create a significant amount of waste. Almost one million tons of ore and waste rock can move from the largest mines per day, and a couple thousand tons moved from small mines per day

#### Alternatives to open cast mining

- In-situ recovery (ISR), is an extraction process designed to leave a mine's physical location undisturbed. It is touted as an environmentally cleaner method of extraction. In a nutshell, in situ means "in the natural or original position," and the process seeks to remove mineral ore from right where it sits, as opposed to removing large amounts of rock and earth above and around it (which, of course, is typically how mine sites operate).

ISR is commonly used to recover uranium. However, the process is also used to mine copper, and to extract deposits of water-soluble salts such as sodium chloride and sodium sulfate.

- Block caving - Block cave mining is an underground mass mining method that allows for the bulk extraction of large, relatively lower grade, ore deposits with substantial vertical dimension. In block caving, a large section of ore is initially undercut by drilling and blasting, creating a large unsupported roof that will start to collapse under its own weight and instability. The broken ore then breaks apart and falls into a series of pre-constructed funnels, or drawbells, and access tunnels developed underneath the caving rock mass to form ore extraction drawpoints.

### Conclusion

Open-pit mining is to be considered one of the most dangerous sectors in the industrial world. It causes significant effects to miners' health, as well as damage to the ecological land. Alternative technologies must be made part of mining policies.

**2. What is land degradation? What are the most common factors that lead to land degradation? How does land degradation affect the livelihood prospects of the poor? Discuss.**

### Introduction

Land degradation is the temporary or permanent decline in the productivity of the land. Land degradation is caused by multiple forces, including extreme weather conditions particularly drought, and human activities that pollute or degrade the soil.

### Body

#### Factors for land degradation:

- Deforestation: Forests play an important role in maintaining fertility of soil by shedding their leaves which contain many nutrients. Therefore, cutting of forests will affect the soil adversely.
- Excessive use of pesticides and fertilizers: causes imbalance in the quantity of certain nutrients in the soil. This imbalance adversely affects the vegetation.
- Overgrazing: with loss of grass and other vegetation causes soil erosion.
- Salination: due to the low Quality of Irrigation Water, excessive fertilizer use, poor drainage of soil etc.,
- Water logging: Excessive irrigation and improper drainage facility in the fields cause rise in the ground water level which has salt content result in soil salinity.

- Desertification: due to Degradation of vegetative cover, water erosion, wind erosion, salinization, excess of toxic substances etc.,
- Soil erosion: where in the top most nutritious layer is eroded making the soil infertile.
- Wind Erosion: depletion of forests leads to loosening of soil particles due to lack of roots and moisture in soil.
- Water Erosion: which includes sheet erosion, rill erosion and so on leading to huge loss of top fertile soil along with plant nutrients through runoff water.
- Wasteland: include ravinous land, waterlogged land, marsh and saline lands, forest land, degraded land, strip land, mining and industrial wastelands.
- Natural disasters like Landslides, Earthquake, forest fires etc., causing sudden movements and causing vegetation loss, soil erosion etc., and resulting in soil degradation.
- Improper agricultural practices like lack of crop rotation, excessive and unscientific irrigation and so on.

#### **Land degradation resulting in livelihood loss for the poor:**

Land degradation threatens the livelihoods of billions of people around the world. This is particularly the case for populations living in rural areas where most of the poor people reside

- Agriculture: Farmers who depend on agriculture suffer loss in crop failures or low productivity due to
  - Soil alkalization owing to irrigation with water containing sodium bicarbonate leading to poor soil structure and reduced crop yields.
  - Soil salination in irrigated land requiring soil salinity control to reclaim the land.
  - Destruction of soil structure including loss of organic matter.
- The forest dwellers depending on the minor forest produce suffer due to low collection of raw materials.
- Animal husbandry would suffer due to lack of grazing lands, low fodder availability to feed the animals.
- Land degradation will also make the population vulnerable to natural disaster whose frequency and intensity increases. To illustrate, lack of vegetation leads to landslides, floods etc., which also threaten livelihood of the people of which poor are more vulnerable.
- Land degradation also impact rainfall pattern and climate change which has a direct impact on the rural poor and their livelihood specially in a agricultural country like India.

Further, all the above has a chain impact effect where in the dependent population like the landless agricultural daily wage labourers, poor middleman and so on whose livelihood will be indirectly in peril due to land degradation.

#### **Conclusion**

IPBES report shows that 75% of Earth's Land Areas Are Degraded which threatens human livelihood and very existence. Thus, the need is to reverse the trend by sustainable land management in agriculture, development and so on. There is a need to collaborate at state, national and international level and jointly implement programmes like Land degradation Neutrality project of UNCCD.

**3. What are the existing threats to the mountain ecosystem in India? Discuss. Suggest a sustainable strategy to maintain the ecological integrity of mountains.**

**Introduction**

Mountain ecosystems are an important source of biological diversity, along with water and mineral resources where mountains are ecosystems with a distinct identity just like the flood plains, deltas, mangroves, wetlands, and deserts. Mountain ecosystems are particularly fragile, subject to both natural and anthropogenic drivers of change. Therefore, their effective management is not only important for mountain communities, but also for a sizeable proportion of the global population.

**Body**

- Ecosystems are of fundamental importance to environmental functioning and sustainability, and they provide many goods and services critical to individuals and societies. Beyond their common characteristics of high relative relief and steep slopes, mountains are remarkably diverse and globally important as centres of biological diversity.
- Recent scientific opinion led by the Intergovernmental Panel on Climate Change (IPCC) is that global climate change is happening and will present practical challenges to local ecosystems. The analysis and predictions showing an increase in the magnitude of climate change with altitude (in terms of both temperature and variation in precipitation).
- Ecosystems in the mountains are being impaired and destroyed by a wide variety of human activities. The survival of the ecosystems and wildlife in the mountains is being threatened by human activities like timber harvesting, intensive grazing by livestock, and agricultural expansion into forestland.
- Rapid and unsustainable economic and population growth in the mountainous regions is imposing increasing stress on the natural environment. As a result, environmental deterioration in mountains is driven by numerous factors, including deforestation, overgrazing by livestock, and the cultivation of marginal soils leading to soil erosion, landslides, and the rapid loss of habitat and genetic diversity.
- Forest ecosystems are stressed by habitat change and fragmentation, which occurs as humans subdivide forest plots into ever smaller and more isolated sections.

- Pollution can also stress forest trees, especially in urban, industrial, and heavily populated areas. Non-native fungal diseases and insect pests can severely stress forests and cause the effective extinction of previously dominant trees and threaten others.
- Species in high altitude areas – especially in the transition zone between subalpine and alpine – are more vulnerable to climate change. In addition, the region's wetlands are being affected by the erratic weather observed in many parts of the region.
- Invasive species that outcompete native species and synergistically interact with climate change to threaten native organisms. Further, synergistic action between commercial harvesting and climate change will have detrimental impacts on subtropical and temperate timber forests.
- Environmental contamination- Nutrient enrichment from agricultural runoff could act synergistically with various factors due to increasing changes in biodiversity to enhance eutrophication in freshwater systems.

Proper management of mountain resources and the socio-economic development of people need immediate action. There is need to develop land use planning and management for mountain fed watersheds. Further, the government should give opportunities and following can be adopted to maintain the ecological integrity of mountains:

- Promote erosion control measures that are low in cost, simple and can be easily used; Enhance forest management policy for the protection of natural forests (control and stop deforestation and ecological damage), prevent desertification processes, and mixed-use strategies.
- Offer people incentives to conserve resources and use environmentally friendly technologies in mountainous ecosystems, help them to understand what is sustainable development in mountains and involve them in resource management;
- Provide information on alternative livelihoods involving, for example, crops, livestock, poultry, beekeeping, fisheries, village industries, markets and transport;
- Create protected areas to save Biodiversity (wild genetic resources); Adopt integrated ecosystem planning, monitoring, and management of vulnerable ecosystems.
- Identify hazardous areas that are most vulnerable to erosion, floods, landslides, earthquakes, snow avalanches and other natural hazards and develop early warning systems and disaster response teams;
- Identify mountain areas threatened by air pollution from neighboring industrial and urban areas;
- Create centers of information on mountain ecosystems, including expertise on sustainable agriculture and conservation practices where people can turn for help in learning about sustainable mountain development.

## Conclusion

Maintaining resilience in mountain ecosystems is the primary objective of adaptation strategies for protecting wildlife and habitats. Activities that conserve biological diversity, reduce fragmentation and degradation of habitat, and increase functional connectivity among habitat fragments will increase the ability of mountain ecosystems to resist anthropogenic environmental stresses, including climate change.

**4. Identify the most polluted stretches of the Ganga and its tributaries. What are the factors contributing to the massive pollution along these stretches? Discuss.**

**Introduction**

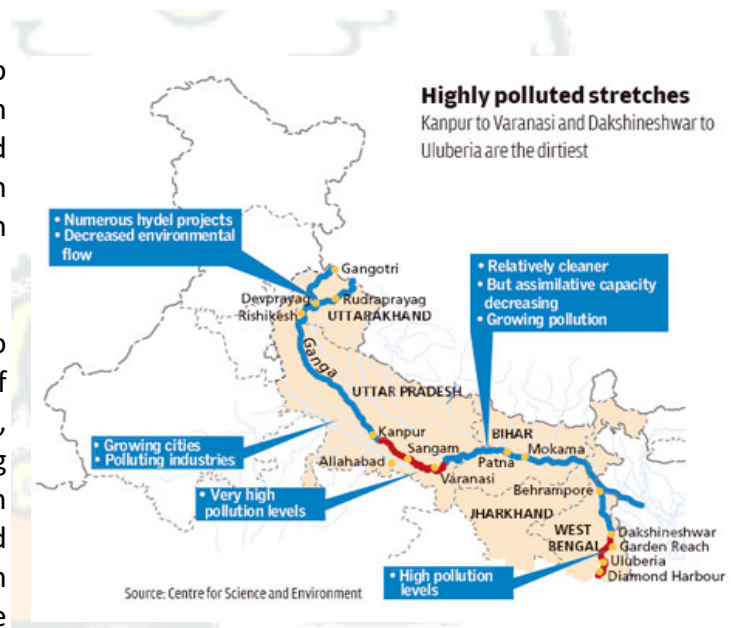
The Ganga rises on the southern slopes of the Himalayan ranges from the Gangotri glacier at 4,000 m above mean sea level. It occupies a unique position in the cultural ethos of India. It is one of the largest water drains of the world, densely populated and is critical for millions of people’s health, prosperity, and spirituality living in the northern part of India. While the severity of ecological stress is clear since some time, the diversity and sheer immensity of the Ganga tributary system makes generalization difficult.

**Body**

In the recent past, due to rapid progress in communications and commerce, there has been a swift increase in the urban areas along the river Ganga.

As a result, the river is no longer only a source of water but is also a channel, receiving and transporting urban wastes away from the towns. Today, one third of the country's urban population lives in the towns of the Ganga basin.

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- The purity of the water depends on the velocity and the dilution capacity of the river. A large part of the flow of the Ganga is abstracted for irrigation just as it enters the plains at Haridwar. From there it flows as a trickle for a few hundred kilometres until Allahabad, from where it is recharged by its tributaries.



- The Ganga receives over 60 per cent of its discharge from its tributaries. The contribution of most of the tributaries to the pollution load is small, except from the Gomti, Damodar and Yamuna rivers.
- Data from the past three CPCB reports, carrying water pollution monitoring figures on different stretches during 2002-17, shows that the number of polluted river stretches in the country increased from 121 in 2009 to 302 in 2015 and further to 351 in 2018.
- With regards to Ganga, only one of its five polluted stretches is in the critical category where the BOD level is more than 30 mg/l. This stretch was found where Varuna river, a minor tributary, meets Ganga in Varanasi. The other polluted stretches include Haridwar-Sultanpur, Kannauj-Kanpur (UP), Buxar-Bhagalpur (Bihar) and Tribeni-Diamond Harbour (West Bengal).

The principal sources of pollution of the Ganga river can be characterised as follows:

1. Domestic and industrial wastes - It has been assessed that more than 80 per cent of the total pollution load (in terms of organic pollution expressed as biochemical oxygen demand (BOD)) arises from domestic sources, i.e. from the settlements along the river course.
  2. Solid garbage thrown directly into the river.
  3. Non-point sources of pollution from agricultural run-off containing residues of harmful pesticides and fertilisers.
  4. Animal carcasses and half-burned and unburned human corpses thrown into the river.
  5. Defecation on the banks by the low-income people.
  6. Mass bathing and ritualistic practices.
  7. Due to over-abstraction of water for irrigation in the upper regions of the river, the dry weather flow has been reduced to a trickle.
  8. Rampant deforestation in the last few decades, resulting in topsoil erosion in the catchment area, has increased silt deposits which, in turn, raise the river bed and lead to devastating floods in the rainy season and stagnant flow in the dry season.
- Cleaning of river Ganga was started under Ganga Action Plan (GAP). GAP-I was launched in 1985 followed by GAP-II in 1993 with the objective of improving the water quality of river Ganga. These schemes were later merged with other schemes of National River Conservation Plan (NRCP).
  - Government of India is supplementing the efforts of the state governments in addressing the pollution of river Ganga by providing financial assistance to the states. Namami Gange Programme is an umbrella programme which integrates previous and currently ongoing initiatives by enhancing efficiency, extracting synergies and supplementing them with more comprehensive & better coordinated interventions.

## Conclusion

River Ganga has captured Indian's imagination since time immemorial. The river is believed by millions of Indians to have the capacity to wash away one's sins and purify the living and the dead. Such is the power of the Ganga that every region in India has its own small ganga. These showcase the need to safeguard and preserve the fragile ecosystem of the river Ganga and its tributaries.

**5. Do you think desertification is an ecological hazard? Examine. What are the man made factors leading to desertification? Discuss.**

**Introduction**

Desertification is a type of land degradation in which a relatively dry land region becomes increasingly arid, typically losing its bodies of water as well as vegetation and wildlife. It is caused by a variety of factors, such as climate change and human activities. Desertification is a significant global ecological and environmental problem.

**Body**

Desertification is an ecological hazard

- According to UNESCO, one third of world's land surface is threatened by desertification and across the world it affects livelihood of millions of people who depend on the benefits of ecosystems that drylands provides.
- Desertification is another major environmental concern and a major barrier to meeting human basic needs in drylands and are being constantly threatened by increases in human pressures and climatic variability.
- **Farming becomes next to impossible** – If an area becomes a desert, then it's almost impossible to grow substantial crops there without special technologies. This can cost a lot of money to try and do, so many farmers will have to sell their land and leave the desert areas.
- **Hunger** – Without farms in these areas, the food that those farms produce will become much scarcer, and the people who live in those local areas will be a lot more likely to try and deal with hunger problems. Animals will also go hungry, which will cause even more of a food shortage.
- **Flooding** – Without the plant life in an area, flooding is a lot more eminent. Not all deserts are dry; those that are wet could experience a lot of flooding because there is nothing to stop the water from gathering and going all over the place. Flooding can also negatively affect the water supply, which we will discuss next.
- **Poor Water Quality** – If an area becomes a desert, the water quality is going to become a lot worse than it would have been otherwise. This is because the



plant life plays a significant role in keeping the water clean and clear; without its presence, it becomes a lot more difficult for you to be able to do that.

- **Overpopulation** – When areas start to become desert, animals and people will go to other areas where they can actually thrive. This causes crowding and overpopulation, which will, in the long run, end up continuing the cycle of desertification that started this whole thing anyway.
- **Poverty** – All of the issues that we've talked about above (related to the problem of desertification) can lead to poverty if it is not kept in check. Without food and water, it becomes harder for people to thrive, and they take a lot of time to try and get the things that they need.

#### Man-made factors leading to desertification

- **Overgrazing** – If there are too many animals that are overgrazing in certain spots, it makes it difficult for the plants to grow back, which hurts the biome and makes it lose its former green glory.
- **Deforestation** – Without the plants (especially the trees) around, the rest of the biome cannot thrive.
- **Farming Practices** – By stripping the soil of its nutrients, desertification becomes more and more of a reality for the area that is being used for farming.
- **Urbanization and other types of land development** – As areas become more urbanized, there are less places for plants to grow, thus causing desertification.
- **Climate Change** – human induced climate change plays a huge role in desertification. As the days get warmer and periods of drought become more frequent, desertification becomes more and more eminent.
- **Stripping the land of resources** – activities like mining usually strips the soil of nutrients, which in turn kills the plant life, which in turn starts the process toward becoming a desert biome as time goes on.

#### Conclusion

Desertification is a huge problem that needs to be addressed accordingly, and if we take the time to do it now, we can prevent other problems from happening with it in the future. By taking that critical look at desertification, we have the tools that we need in order to get through the processes effectively.