

1. Why is North India affected by worst air quality during November-December every year? Discuss the cause. What short term and long term measures can be taken to address this problem? Suggest.

Introduction

The toxic levels of air pollution is developed North India affected by worst air quality during November-December every year creating quite a menace.

Body

Cause of worst air quality during November-December in North India every year

- One of the main reasons of increasing air pollution levels in North India is crop burning by the farmers in these states. Farmers burn rice stubbles in Punjab, Haryana and Uttar Pradesh. It is estimated that approximately 35 million tonnes of crop are set afire by these states. The wind carries all the pollutants and dust particles, which have got locked in the air.
- Pollution caused by the traffic menace in Delhi is another reason contributing to this air pollution and smog. The Central Pollution Control Board (CPCB) and the National Environmental Engineering Research Institute (NEERI) have declared vehicular emission as a major contributor to Delhi's increasing air pollution.
- As the winter season sets in, dust particles and pollutants in the air become unable to move. Due to stagnant winds, these pollutants get locked in the air and affect weather conditions, resulting in smog.
- Another reason of air-pollution is urbanisation and over-population in the NCR region. Over-population only adds up to the various types of pollution, whether it is air pollution or noise pollution.
- Investing less on public infrastructure is another reason of air pollution. In India, investment in public transport and infrastructure is low which leads to congested roads, and hence air pollution.
- Large scale construction in Delhi-NCR is another culprit that is increasing dust and pollution in the air.
- Industrial pollution and garbage dumps are also increasing air pollution and building-up smog in the air.
- Despite the ban on cracker sales, firecrackers are used indiscriminately. It may not be the top reason for this smog, but it definitely contributed to its build up.

Short term and long term measures can be taken to address this problem

1. Research

- Improving the fuel quality and engine design to easily move to Bharat Stage VI.
- Understanding the sources of the short-lived pollutants like black carbon and ozone.

- Improved cook stove technology for rural areas, diesel filters on trucks in urban areas etc

2. Regulation

- Satellite-level data along with ground-based information to get a holistic picture of the extent of air pollution in a given region.
- Uniform and tighter emissions standards for the entire country

3. Mitigation

- Developing business model for collection, transportation and storage of agricultural residue. This will reduce open burning of agricultural residue and can instead be used as a source of energy.
- Cleaner fuels like LPG through Ujjwala Yojana.
- Implementing wall to wall paving of streets and vacuum cleaning of roads.

4. Adaptation

- Shifting freight transport from road to lower-emission modes like rail and inland waterways and coastal shipping using Sagarmala project.
- Replacing coal by solar energy.
- National emission trading schemes (ETS)

5. Behavioral Change

- We can promote roads friendly bicycle to users

Conclusion

There is a need of holistic approach to deal with increasingly high social, economic and environmental cost of Air pollution. Formulation of "National Clean Air Mission" will be effective in this regard.

2. How is excessive plastic use impacting the marine ecosystem? What are its adverse effects on marine biodiversity? Discuss.

Introduction

As per IUCN report, over 300 million metric tons of plastic are produced every year of which around 13 million metric tons of plastic ends in marine ecosystem.

Body

Excess plastic impacting marine ecosystem:

Firstly, excessive plastic covers the top layer of the ocean water and prevent sunlight which impact marine ecosystems like Corals.

Secondly, the most visible and disturbing impacts of marine plastics are the ingestion, suffocation and entanglement of hundreds of marine species which affect the food chain and the entire marine ecosystem.

Thirdly, plastic being a petroleum product adds to the global warming and hence results in ocean warming as well as ocean acidification.

Finally, the release of chemicals leads to toxicity of ocean water which is a threat to marine ecosystem survival.

Adverse effects on marine biodiversity:

According to the United Nations, at least 800 species worldwide are affected by marine debris, and as much as 80 percent of that litter is plastic.

- Plastic consumption: Marine species suffer due to plastic debris. As per UN report,
 - On many beaches, plastic pollution is so pervasive that it's affecting turtles' reproduction rates by altering the temperatures of the sand where incubation occurs.
 - Plastic waste kills up to a million seabirds a year.
- Pathogen development: Plastic waste can encourage the growth of pathogens in the ocean. According to a recent study, scientists concluded that corals that come into contact with plastic have an 89 percent chance of contracting disease, compared with a 4 percent likelihood for corals that do not.
- Ghost nets: Sea turtles are also the most common victims of 'Ghost Nets' in the ocean and also harms the marine life by choking life-forms or by getting tangled in precious reefs, causing them to break apart.
- Plastic food chain: Plastic waste in the oceans also threatens the life of birds and other beings that depend on the oceanic life-forms for their food requirements.
- Ocean water pollution and toxicity: the amount of garbage in the seas also pollutes the oceanic waters. Toxic substance such as Bisphenol A, which has been found commonly in many plastic commodities, pollutes the water badly which makes it inhabitable.
- The garbage patches that are found like the great pacific garbage patch etc., are highly toxic and has high marine species mortality.
- Invasive species: Ocean garbage in the form of plastic also leads to invasion of non-indigenous species and organisms in naturally occurring marine colonies, thus posing a threat to the functioning of ecosystems. The billions

of micro-plastic particles floating in the ocean are all potential carriers of non-indigenous invasive species.

- Though, some species do not directly consume plastic, accumulation of toxicity through food chain is high.
- Microplastics are a major source of plastic pollution which is ingested even by small fishes and thus has potential to impact entire marine species.

Plastic in the sea is a result of human callousness. Since the annual consumption of plastic has been increasing every year globally, the amount of plastic waste that ends up in the seas also increasing drastically. And, in addition to the ill effects to the marine ecosystem, the plastic pollution also creates negative impacts on the economy as it affects sectors including tourism, fisheries and aquaculture, among others.

Conclusion

At the current rate of plastic pollution, there will be more plastic in the sea than fish by 2050 as per UNEP. Thus, there is an urgent need for integrated and collaborated national and international intervention to address the issue.

3. What are the man made factors leading to the melting of ice in the Arctic region? Do you think exploration of the Arctic region for resources is environmentally sustainable in the long run? Comment.

Introduction

According to a recent study, the steady melt of glacial ice around the world is largely due to man-made factors, such as greenhouse-gas emissions and aerosols where humans have caused roughly a quarter of the globe's glacial loss between 1851 and 2010, and about 69 percent of glacial melting between 1991 and 2010. Consequently, the arctic region has been the most affected region with regard to melting of ice.

Body

- Arctic sea ice has been rapidly declining since satellites first started tracking it in 1979, and according to NASA, roughly 13.3 percent of the ice disappears every decade. Further, air currents that are a part of Earth's natural variability have played a significant role in melting the ice, which helps explain why the earlier models have underestimated the melting.
- In this regard, the man made factors for melting of ice in the arctic region can be seen from below :
- Burning of fossil fuels - The burning of fossil fuels has resulted in the buildup of greenhouse gases in the environment thus influencing the warming trend because they trap heat in the atmosphere. Research shows that glaciers/ice cover are capable of absorbing about 20% of heat from the sun, reflecting

back the remaining 80%. The increase in temperatures is causing more and more glaciers and ice cover to melt, consequently, this ends up exposing the earth underneath.

- Oil and gas drilling - The oil and gas extraction process also emit Methane, which is the main constituent in natural gas. Plus, the gas is more damaging to the environment than carbon dioxide, locking in heat more efficiently and escalating global warming. In recent times, these industries have increased in arctic region.
- Deforestation - Trees play a very important function in balancing the ecosystem and the overall cooling of the planet. Perhaps, that is why they are called the planet's "natural fans". So, cutting down trees to create more space for human activities is actually proving detrimental to the environmental balance in the region.
- Ice breaking ships - During the months of summer, icebreaking ships head to the north into the Arctic Ocean, breaking through the ice at sea, the ships end up leaving trails of open waters. The Arctic sea ice is able to reflect most of the heat thus aiding in keeping the Arctic and the rest of the Northern Hemisphere cool.
- A recent study found that if the world warms 2 degrees Celsius over preindustrial times—the lofty goals laid out in the Paris climate agreement—there is still a 39 percent chance that the Arctic summer sea ice will disappear. Further, very little industrial development has taken place in the Arctic region and there are fears about the impact on the environment if – as expected – human use accelerates fast.
- As the Arctic warms, increased political interest in the region is occurring, driven by the belief that it will become accessible to greater commercial activity. Global warming is opening up the Arctic Ocean to transit by ships, which can cut east-west voyage times by one-third. Warmer weather allows oil and mining companies to tap into previously inaccessible new reserves.
- The melting of sea ice is progressively opening opportunities to navigate on routes through Arctic waters. This could considerably shorten trips from Europe to Pacific, save energy, reduce emissions, promote trade and diminish pressure in the main trans-continental navigation channels. But concerns regarding this such as drift ice, lack of infrastructure and environmental risks, nevertheless still remain.
- The impact of oil and gas exploration in the Arctic region include threats like noise pollution, water dispersal in the drilling phase and the actual drilling process which can release oil and chemicals into the water. Further, the transport of oil and gas in the Arctic region by tanker and pipeline poses severe problems of environment impacts.
- Long-lasting consequences often persist through industrial waste, tailings, and environmental contaminants. At sea, oil spills are the largest potential environmental threat. They are difficult to control and can spread over 100s – 1000s unnoticeably harming the ecosystems.
- Arctic ecosystems are simple in structure, but often have long food chains which link both terrestrial and marine ecosystems. Here, A number of species

can be affected by the rise in temperature and its results. This ranges from fish stock in the Arctic Ocean which is sensitive to the ocean temperature, even small can result in major shifts in the geographical locations and productivity in the stock.

- Another factor that can magnify the problem is the lack of emergency response capability for mitigating pollution and saving lives in the event of an accident. Hence, the opening up of new opportunities becomes a huge challenge to the arctic communities in both positive and negative ways.

Conclusion

The arctic environment is largely unspoiled but human actions including global warming are having a rapid impact. There are fears that diminishing arctic sea ice, which is one of the Earth's ways of deflecting heat from the sun, is shrinking. Only through approaching the tasks collaboratively will it be possible to find lasting solutions, so international cooperation becomes essential in having a sustainable arctic environment in the future.

4. Examine the adverse impacts of excessive sand mining on the river ecosystem.

Introduction

Sand mining is a practice that is used to extract sand, from various environments, such as beaches, inland dunes and dredged from ocean beds, and river beds of deltaic regions. Today, demand for sand and gravel continues to increase. By 2020, 1.4 billion tonnes of sand will be required in India. Sand mining is thus a lucrative business and fuels illegal extraction. Illegal and unscientific sand mining is turning out to be one of the biggest ecological disasters in modern India.

Body

- Sand is vital for sustenance of rivers. River supports an extraordinary array of species, many of which are under threat due to habitat destruction. During the past 3-4 decades, river systems of the world have been altered significantly due to indiscriminate sand mining. Sand mining has many deleterious direct and indirect effects on the physical, chemical and biological environments of river systems.
- Excessive sand mining can alter the river bed, force the river to change course, erode banks and lead to flooding. It also destroys the habitat of aquatic animals and micro-organisms besides affecting groundwater recharge.
- Depletion of sand in the streambed and along coastal areas causes the deepening of rivers and estuaries, and the enlargement of river mouths and coastal inlets. It may also lead to saline-water intrusion from the nearby sea. The effect of mining is compounded by the effect of sea level rise. Any

volume of sand exported from streambeds and coastal areas is a loss to the river ecosystem.

- Sand mining disturbs the equilibrium of a river channel because it intercepts material load moving within a dynamic system and triggers an initial morphological response to regain the balance between supply and transport. Channel widening causes shallowing of the streambed, producing braided flow or subsurface inter-gravel flow in riffle areas, hindering movement of fish between pools.
- It is now widely realized that, in spite of the short term benefits, the indiscriminate sand mining from the rivers is detrimental to these life sustaining systems, in the long run. Moreover, the effects of instream sand mining may not be visible immediately because it requires continuous monitoring and takes a decade or more to surface and propagate the effects along the river channel in measurable units.
- Mining which leads to the removal of channel substrate, resuspension of streambed sediment, clearance of vegetation, and stockpiling on the streambed, will have ecological impacts. These impacts may have an effect on the direct loss of stream reserve habitat, disturbances of species attached to streambed deposits, reduced light penetration, reduced primary production, and reduced feeding opportunities.
- Sand-and-gravel mining in stream channels can damage public and private property. Channel incision caused by gravel mining can undermine bridge piers and expose buried pipelines and other infrastructure.
- Apart from threatening bridges, sand mining transforms the riverbeds into large and deep pits; as a result, the groundwater table drops leaving the drinking water wells on the embankments of these rivers dry. Bed degradation from instream mining lowers the elevation of streamflow and the floodplain water table which in turn can eliminate water table-dependent woody vegetation in riparian areas, and decrease wet periods in riparian wetlands.
- The problem is serious in the case of the rivers in the southwest coast of India, especially in Kerala, where the rivers are small with limited river bed resources. At the same time, the mining of sand is on the rise to meet its ever increasing demand in the construction sector.
- Guidelines on the extraction of sand say that the amount of sand removed should be in proportion to its replenishment rate and river width. Mining from a braided channel with a wide floodplain will have less impact than from a narrow channel. Manual mining is preferred over the use of machines but enforcement and monitoring of these guidelines remain weak.
- A few states are exploring options like manufactured sand, produced by crushing of rocks and quarry stones, to meet the ever-increasing demand of the construction industry. The new sand mining framework suggests the use of geo-fencing, and GPS-enabled transportation to check illegal mining. Price control, the involvement of women self-help groups and regular audits of sand reserves have also been recommended.

Conclusion

Sand sustains the rivers and the percolation of water to far off distances both for the growth of trees to sustain drinking water and raise cultivation. It is almost a lifeline to the human existence. The nation is to advance industrially and economically by the proper development and exploitation of these resources. It has to be remembered that the sand once removed cannot be replaced in the next generation as it takes centuries for replacement.

5. What are the ecological hazards that the Aravali has been exposed to by illegal mining? Discuss.

Introduction

Recently, The National Human Rights Commission (NHRC) has sent a notice to the governments of Haryana and Rajasthan on the deforestation in the Aravalli Hills — the reason behind increasing dust-storms and air pollution in Delhi-NCR. These storms led to a serious spike in levels of air pollution.

The Aravalli Range is a range of mountains running in a southwest direction, starting from Delhi and passing through southern Haryana, Rajasthan and ending in Gujarat. It helps keep temperatures in check and recharge groundwater, besides hosting unique flora and fauna.

But today, they are not just one of the oldest mountain chains in the world but also probably the most degraded.

Body

Ecological hazards that the Aravali has been exposed to by illegal mining

- Forest Survey of India (FSI) report that confirmed continued illegal mining at more than 3,200 sites under the areas controlled by different states.
- The rain-induced erosion of mining areas brings nutrients as well as potential contaminants to adjoining agriculture tracts and the ecosystem.
- The protective belt is now facing disintegration due to the felling of trees to make room for urbanisation and mining projects.
- A survey by the Wildlife Institute of India in 2017 in south Haryana had shown that 12 vegetative gaps, which have appeared because of drifting of sand in the Aravallis, increases the risk of the area under it turning into an extension of the Thar desert.
- The great Indian Bustard, the state bird of Rajasthan is on the verge of extinction due to habitat loss and poaching.

Way forward

- There is an urgent need to stop mining in the specified areas of the Aravalli hills, as Supreme Court has directed the Rajasthan government recently.

- Enforcing the Tree Act in Delhi and Haryana for controlling deforestation, and enforcing The National Conservation Zone (NCZ), as defined in the Delhi NCR Regional Plan 2021, which covers the entire Aravalli range.
- Protected status should be granted to the Aravalli ecosystem and an integrated Aravalli management agency should be established.

Conclusion

These are some measures which should be taken to holistically conserve the Aravalli range and protect its ecology and adjacent environment.

