

1. How do changes in the pattern of the Asian Monsoon affect various parts of the world? Explain with the help of recent examples.

Approach

Introduction can be about definition of Monsoon. Explain the process of monsoon in brief. Link it with Indian and other part of world for example Australian bushfires etc,. Give a brief conclusion.

Introduction

Monsoon is derived from the Arabic word 'MAUSIM', which means seasonal reversal of winds. Shift of ITCZ toward north in summers and change in direction of south-east trade winds once it crosses equator results into southwest monsoon. Once the land gets started cooling up the ITCZ regains its pre-summer position and there is reversal of wind resulting into retreating monsoon.

Body

- The Asian monsoon is one of the most vigorous climatic phenomena on Earth and also one of the most societal important. The monsoon drives vital seasonal rainstorms that water crops and forests as well as damaging typhoons and floods.
- Research has confirmed that Monsoon in Asia is entwined with several aspects of global climate along with having an influence over the global atmospheric circulation as well.

Phenomenon:

- The fundamental driver of all monsoon systems is the solar heating of the land during the Spring season (February-March in India) which helps establish a land-sea temperature difference.
- Land heats up faster than water, causing the air to expand and lower the pressure, triggering winds from the seas to the land (wind flows from a high-pressure area to a lower-pressure area).
- This moisture is rained out through the process of convection (cloud-building) over the monsoonal regions, mainly India and South-East Asia, during the summer.
- Due to the change in season, peak solar heating moves towards the Equator and then into the Southern Hemisphere, thereby heating the adjacent ocean more than the Asian land.
- As a consequence, the winds reverse, and the monsoon rainfall moves to the opposite hemisphere during the Austral summer (summer in the South Hemisphere, December-February).

Effect of change in pattern of the Asian monsoon on various parts of the world:

- Asian monsoon is considered a 'textbook phenomenon' clearly defined which has not changed much in the preceding century.
- However this process has hit an erratic front, with floods in the northwest and the northeast and rainfall deficit in southern part of the nation.
- Rainfall extremes have increased threefold over the last few years and now extend over all of central India – from Gujarat to Odisha.
- Onset of monsoon has delayed every year since 2002 and it also lasts for shorter duration, compressing the Indian monsoon.
- The interspersed breaks in the monsoon have increased resulting in larger drier periods in the monsoon itself.
- Rainfall intensity, duration, frequency and spatial distribution have significantly undergone change in the past decade or two.
- Cycles of droughts and floods have become more common in many parts of India and their intensity has changed over the time. e.g. Cyclone Amphan.
- Also now cyclones are also started to occur on the western coast of the countries. e.g. Cyclone Vayu.
- Areas that have traditionally received plenty of rainfall are often remaining dry, while places that are not expected to get a lot of monsoon rain have sometimes been getting flooded.
- The intensity and amount of rainfall over the region has increased drastically. For instance, Typhoon Kammuri in Phillipines and Flooding in parts of China.
- The agricultural cycle of sowing to harvesting is facing tremendous challenge as unprecedented breaks and excess rainfall in short period of time making difficulty to set sowing pattern.
- Many of the metro cities are receiving excessive rainfall as compared to their average normal. e.g. Recent flooding in Mumbai.
- Also some experts opined that Australian bushfires partly due to late monsoon ending in India.
- The lack of water in other areas has hit water table levels. By 2030, India is expected to require almost 1.5 trillion m³ of ground water, where the current supply is only 740 billion m³, putting a huge pressure on the river basins, which are facing challenges of their own due to fast-disappearing glaciers and reduced rainfall.
- The positive IOD, which warms the western basin of the Indian Ocean relative to the East, boosts an Indian monsoon and is considered the nemesis of the Australian summer monsoon. Delayed withdrawal of the Indian monsoon, with the Australian landscape primed for bushfire weather and heatwaves in summer resulted in raging bushfires witnessed in Australia this season.

Conclusion

Ongoing climate change has increased the unpredictability of monsoon rains, whose effects are now felt across the world. Need of the hour is a global effort, not just on paper but also in practice to arrest this climate change and save our coming generations.

2. Why are certain forests more susceptible to fires? How do local weather patterns add to this susceptibility? Explain. In this light, examine the factors that led to the recent Australian bushfires.

Approach

Introduction can be either definition of forest fires, or any recent incident or new related to forest fires. In body, write the type of forests prone to fires and also what factors aid this fire. Explain factors behind Australian bushfires. Give a brief conclusion.

Introduction

Wildfire, also called forest, bush or vegetation fire, can be described as any uncontrolled and non-prescribed combustion or burning of plants in a natural setting such as a forest, grassland, brush land or tundra, which consumes the natural fuels and spreads based on environmental conditions (e.g., wind, topography). Wildfire can be incited by human actions, such as land clearing, extreme drought or in rare cases by lightning.

Body

- The most common hazard in forests is forest fire. Forest fires are as old as the forests themselves. They pose a threat not only to the forest wealth but also to the entire regime to fauna and flora seriously disturbing the biodiversity and the ecology and environment of a region.
- As per the Sentinel-3 World Fires Atlas developed by European Space Agency (ESA), compared to August 2018, there were almost five times as many wildfires across the world in August 2019.
- The data revealed that 49% of the fires were detected in Asia, around 28% were detected in South America, 16% in Africa, and the remaining were recorded in North America, Europe and Oceania.

Certain forests are more susceptible to fire:

- The bulk of forest fires occurs in the tropical dry forests, an umbrella category encompassing scrub, savanna grassland, dry and moist-deciduous forests.
- Presence of fuel in certain forests make them more prone and hard to control the fire like the fires in Bandipur Tiger Reserve were immensely difficult to control because of ample fuel supplied by the alien invasive species *Lantana camara*.

Impact of local weather conditions on forest:

- Lightning is the biggest natural cause of forest fires. Lightning fires are always more common immediately after dry seasons when vegetation is still dry.
- Extremely hot and dry weather coupled with heat waves, can cause spontaneous combustion of dry leaves and vegetation resulting in huge forest fire in presence of fuel.

- In rare occurrences, volcanic activities such as eruptions and lava flow can cause fires which are difficult to put out because of the lava flow and other associated risks.
- Apart from weather conditions, human activities near or within forested areas are the number one cause of forest fires. Lightning, burning campfires or cigarettes, hot winds, and even the sun can all provide sufficient heat to spark a wildfire.
- Traditionally Indian forests have been affected by fires. The menace has been aggravated with rising human and cattle population and the consequent increase in demand for Forest products by individuals and communities. Causes of forest fires can be divided into two broad categories: environmental (which are beyond control) and human related (which are controllable).

Factors that caused Australian bushfires:

- Dry continent- Australia, where the summer starts around October, is known to be the most fire-prone of all continents. This is mainly because Australia is also the driest inhabited continent. Almost 70% of its area comprises arid or semi-arid land, with average annual rainfall less than 350 mm.
- Availability of fuel- The forests in Australia are susceptible to fires given the presence of a large volume of bark, leaf litter and other natural dry material that is consumed by the fire as fuel.
- Prolonged drought- Much of Australia is facing a drought that is a result of three consecutive summers (36 months) with very little precipitation.
- Harshest summer- The prolonged blaze this year has coincided with Australia's harshest summer. Parts of the country recorded their highest recorded temperature in December. Daytime temperatures were, on average, 2°C higher than normal, while the average rainfall for the country was 40% below normal.
- Positive Indian Ocean Dipole (IOD)- In 2019, the problem has been compounded by the presence of one of the strongest-ever positive IOD events. Positive IOD events are often associated with a more severe fire season for South-east Australia.
- Delayed withdrawal of Indian monsoon- The 2019 monsoon in India started its withdrawal on October 9, against the normal date of September 1, and is the most delayed in recorded history. This led to late onset of summer monsoon in Australia resulting in prolonged increase in temperature.
- Wind speed- Stronger winds bring more fuel into the path of fires, allowing them to grow bigger and spread. Winds are also able to create new fires via the transference of embers, which then ignite other patches around the original fire. This process is known as 'spotting' and can happen up to 30km away from a fire.

EFFECT OF FOREST FIRE:

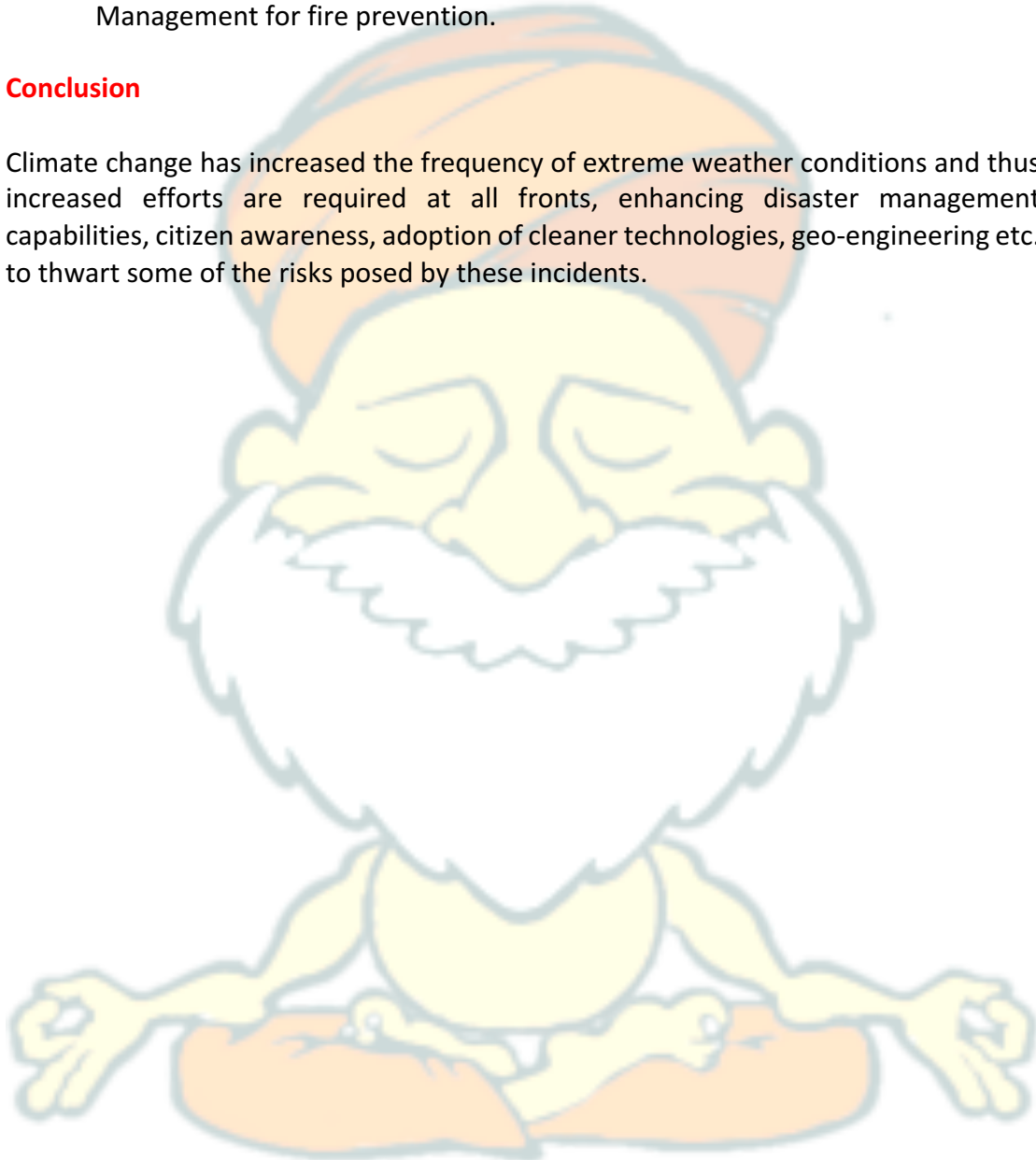
- loss of biodiversity and extinction of plants and animals.
- loss of wildlife habitat and depletion of wildlife.
- loss of natural regeneration and reduction in forest cover.

The needs of the fire management:

- For successful fire management and administration, a National Fire Danger Rating System (NFDRS) and Fire Forecasting System are to be developed in the country.
- Prevention of human-caused fires through education and environmental modification. It will include silvicultural activities, engineering works, people participation, and education and enforcement. It is proposed that more emphasis be given to people participation through Joint Forest Fire Management for fire prevention.

Conclusion

Climate change has increased the frequency of extreme weather conditions and thus increased efforts are required at all fronts, enhancing disaster management capabilities, citizen awareness, adoption of cleaner technologies, geo-engineering etc. to thwart some of the risks posed by these incidents.



3. What is environmental economics? What are its key principles? With the help of suitable examples, discuss its applications in policy formulation and governance.

Approach

Define environmental economics, simply write few key principles. Then discuss a few examples linked to government policies and there applications candidates can also mention few challenges in application, at last give brief conclusion.

Introduction

Environmental economics is a discipline of economics that studies the economic effects of environmental policies around the world. Its main focus is on the efficient allocation of environmental and natural resources and how alternative environmental policies deal with environmental damage, such as air pollution, water quality, toxic substances, solid waste, and global warming.

Body

Principles of environmental economics:

Valuation:

- Valuation is an important aspect of environmental economics, as it helps to evaluate a variety of options in managing challenges with the use of environmental and natural resources. The valuation of ecological resources is a complex process, as it is difficult to assign value to intangible benefits, such as clean air and an unpolluted environment.

Market Failure:

- Market failure occurs if the functioning of a perfect market is compromised; hence, it is unable to efficiently allocate scarce resources at a given price as conditions for laws of demand and supply are not met.
- An example can be an environmental good such as clean oceans. It is difficult to price the value of clean seas and oceans, and there exist no markets for clean water bodies where it is traded depending on the degree of cleanliness. It is a standard case of market failure.

Externalities:

- Externalities are inadvertent consequences of economic activity that affect people over and above those directly involved in it. Externalities are also another form of market failure. They can either be negative or positive.

Cost-Benefit Analysis:

- Cost-benefit analysis (CBA) involves weighing the benefits arising from a policy against the perceived benefits. Hence, the best policy is one in which there is the greatest surplus of benefits over costs.
- CBA starts with a base policy where no changes are made to the status quo. A time horizon is selected where the perceived costs and benefits are expected to be realized. Benefits are instances where human well-being is improved, and costs decrease human well-being.

Application of environmental economics:

Example of Environmental Economics

- A prominent contemporary example of the use of environmental economics is the cap and trade system. Companies purchase carbon offsets from developing countries or environmental organizations to make up for their carbon emissions. Another example is the use of a carbon tax to penalize industries that emit carbon.
- Corporate average fuel economy (CAFE) regulations are another example of environmental economics at work. These regulations are prescriptive and specify the gallons per mile of gas for cars for car makers. They were introduced during the 1970s to promote fuel efficiency in an era of gas shortages.
- Fuel economy standards set by the Environmental Protection Agencies are another example of the balancing act required by policy proposals related to environmental economics.
- Gujarat has launched the world's first "cap and trading" programme to curb particulate air pollution. Put simply, the government sets a cap on emissions and allows factories to buy and sell permits to stay below the cap.

Environmental Economics Challenges:

- The challenge relating to environmental economics is the degree to which its findings affect other industries.
- Implementation of solutions proposed by environmental economists is equally difficult because of their complexity.
- The presence of multiple marketplaces for carbon credits is an example of the chaotic transnational implementation of ideas stemming from environmental economics.

Conclusion

The role of environmental economics in the design of environmental policies and their implementation is exponentially increasing. The measurement and estimation of the variables are an important aspect of environmental economics are useful for efficient allocation of environmental resources and crucial to find out if policies are yielding the intended objectives.