



IPM/YLM 1.0 TEST SERIES – 2022

TEST CODE 15: GS III SYNOPSIS

1. How does air pollution affect global temperatures? Discuss in context of recently released IPCC Sixth Assessment Report (AR6) on climate change.

<b>What to look for?</b>	Global temperature, IPCC, report, Climate Change
<b>Introduction</b>	A brief on the report
<b>Body</b>	Air pollution affecting global temperatures Discuss in context of recently released IPCC Sixth Assessment Report (AR6) on climate change
<b>Conclusion</b>	A relevant closing statement

**Introduction**

The recently released IPCC Sixth Assessment report, addresses the most up-to-date physical understanding of the climate system and climate change, bringing together the latest advances in climate science, and combining multiple lines of evidence from paleoclimate, observations, process understanding, and global and regional climate simulations

**Body**

- **Air pollution affecting global temperatures**
  - Air pollution occurs when the air contains gases, dust, smoke from fires, or fumes in harmful amounts
    - Tiny atmospheric particles - aerosols - are a subset of air pollution that are suspended in our atmosphere.
  - **Aerosols** have a measurable effect on climate change.
    - Thus, these affect Global Temperatures, by affecting the amount of incoming sunlight that is reflected or absorbed by the atmosphere, with some pollutants warming and others cooling the Earth
    - These short-lived climate-forcing pollutants (SLCPs) include methane, black carbon, ground-level ozone, and sulfate aerosols.
- The above phenomenon has been well captured in the **IPCC Sixth Assessment Report (AR6) on climate change**



- The **possible climate futures** listed in the report, in relevance to this are:
  - **Global surface temperature** will continue to increase until at least the mid-century under all emissions scenarios considered.
    - Global warming of 1.5°C and 2°C will be exceeded during the 21st century unless **deep reductions in carbon dioxide (CO<sub>2</sub>)** and other **greenhouse gas emissions** occur in the coming decades
  - Many changes in the climate system become larger in direct relation to increasing global warming.
    - They include increases in the frequency and intensity of hot extremes, marine heatwaves, and heavy precipitation, agricultural and ecological droughts in some regions, and proportion of intense tropical cyclones, as well as reductions in Arctic sea ice, snow cover, and permafrost
  - Many changes due to past and future **greenhouse gas emissions are irreversible** for centuries to millennia, especially changes in the ocean, ice sheets, and global sea level
- **How to limit the Global temperature extremes in the coming days?**
  - From a physical science perspective, limiting human-induced global warming to a specific level requires limiting cumulative CO<sub>2</sub> emissions, reaching at least net zero CO<sub>2</sub> emissions, along with strong reductions in other greenhouse gas emissions.
    - Strong, rapid, and sustained reductions in Methane emissions would also limit the warming effect resulting from declining aerosol pollution and would improve air quality.
- **Actions needed in this perspective**
  - Switching to renewable sources of energy (such as solar and wind energy) to power our homes and buildings, thus emitting far less heat-trapping gases into the atmosphere.
  - Where practicable, we can counterbalance our annual carbon dioxide emissions by investing in commercial services that drawdown an equal amount of carbon out of the atmosphere, such as through planting trees or carbon capture and storage techniques.
  - We can consider placing an upper limit on the amount of carbon dioxide we will allow ourselves to emit into the atmosphere within a given timeframe

## Conclusion

The consequences will be real, as predicted in the IPCC report. However, there is no one-size-fits-all approach to stopping or slowing global warming, and hence each individual, business, municipal, state, tribal, and the federal entity must weigh their options in light of their own unique set of circumstances



2. Identify the main threats to Biodiversity. Have the national and international efforts to mitigate the biodiversity loss been successful. Critically analyze.

Keyword/s	Threats to biodiversity; Biodiversity loss
Introduction	Define biodiversity and note the significance of addressing biodiversity loss.
Body	Enumerate the threats to biodiversity; Mechanisms at national and international levels to address biodiversity loss and their effectiveness
Conclusion	Conclude with the approach to be adopted now

### Introduction

As per CBD (Convention on Biological Diversity) - "**Biological diversity**" means the **variability among living organisms** from all sources including, inter alia, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes **diversity within species, between species and of ecosystems**.

#### Living Planet Report 2020:

- **India** has lost 12% of its wild mammals, 19% amphibians and 3% birds over last five decades.
- **Asia Pacific region has lost 45% of its vertebrate population** in four-and-half decades, while the global average was 68%. **In India**, the vertebrate population has been declining at a rate of about 60%.

The rapid pace of biodiversity loss calls for a rational **review of the hitherto available national and international efforts** in terms of biodiversity conservation.

### Body

#### Key threats to biodiversity:

- **Increasing habitat loss:**
  - Habitat loss due to **natural** (natural calamities, geological events) **or anthropogenic causes** (deforestation, construction activities, urbanization) leaves a specific **habitat non-functional** to support varied life forms.
    - E.g., Building dams, water transportations, etc in river systems of India have led to the decline in the population of **freshwater dolphins and Gharials**.
  - A consequence of habitat loss is the **fragmentation of the habitat range** of the species.



- Fragmentation leads to restricted pockets of habitat and results in a **decrease in the diversity** of species, especially of those that need large tracts of land such as **elephants, tigers, etc.**
- **Climate change:**
  - The looming threat of climate change and the associated factors such as **global warming, extreme weather events, rising sea level** pose serious challenges to populations across regions.
  - The **niche development** of various species gets **disrupted** due to changing climatic and weather patterns and the evolving ecosystems, leading to **population reduction in species that are less adaptable.**
- **Rising levels of pollution:**
  - Pollution of all forms - water, soil, air, land, and agricultural - release **toxic substances and chemicals** and **endanger the ecosystems** posing serious threats to biological diversity.
    - E.g., the increasing **microplastics pollution** is causing disruptions to marine biodiversity.
- **Unsustainable use of resources:**
  - Overexploitation, or unsustainable use of natural and biological resources, happens when **biodiversity is removed faster than it can be replenished**, and over the long term, can result in the **rapid pace of extinction** and **loss of ecosystems.**
  - E.g., **Overharvesting, overfishing, and overhunting.**
    - **Living Planet Report 2020** - In India, about 43% of forest land recommended for diversion in 2019 fell in ecologically sensitive wildlife habitats.
- **Introduction of invasive alien species:**
  - Coming in of invasive species causes major threats to native species - vegetation and wildlife - leading to **competition for resources, the spread of disease, and predation.**
    - **40% of India's tiger range has been invaded by Lantana Camara**, a tropical American shrub (one of the world's ten worst invasive species), and has also resulted in the **scarcity of native forage plants** for wild herbivores.
- **Other major threats:**
  - Spread of new diseases
  - Desertification
  - Depletion of wetlands and soils
  - Tourism and resultant disruptions to biodiversity

#### **International mechanisms to mitigate biodiversity loss:**

- **UN Convention on Biological Diversity (CBD)** - For the **conservation** of biological diversity, the **sustainable use** of its components, and fair and equitable **sharing of the benefits** arising from commercial and other utilization of genetic resources.



- Despite the implementation, **biodiversity is declining at an unprecedented rate** and the pressures driving this decline are intensifying.
- A key **flaw** is that the CBD offers the **States the sovereign right to exploit their own resources** pursuant to their own environmental policies.
- **2014 Nagoya Protocol - Benefits of genetic resources** must be **shared equitably** among all of those, including Indigenous communities, who have contributed to their development.
  - Nagoya protocol has **largely been successful** in its aims.
- **Aichi Biodiversity Targets** - The 20 Aichi Biodiversity Targets were agreed on by national governments through the CBD.
  - Though six targets have been partially achieved by 2020 (the deadline agreed), **none of the targets have been fully achieved**; their format makes progress hard to measure.
- **Other mechanisms**
  - Ramsar Convention on **Wetlands**
  - Convention on the Conservation of **Migratory Species** of Wild Animals (CMS)
  - Convention on International Trade in **Endangered Species** of Wild Fauna and Flora
  - International **Plant Protection** Convention (IPPC)
- Conservation efforts have led to **as many as 48 species being saved from extinction** in recent decades.
  - However, **human-driven biodiversity loss is about 20-50 times higher** than the background rate (natural rate) of extinction.
  - **Plastic waste has not been sufficiently dealt with**. About 2,60,000 tonnes of plastic particles have accumulated in oceans with severe impacts on marine ecosystems.
  - More than 60% of the planet's **coral reefs** are under threat.

#### National mechanisms for biodiversity conservation:

- **Party to international mechanisms:**
  - India is a signatory to the **Convention on Biological Diversity and the Nagoya Protocol**.
- **Legislation:**
  - India adopted the **Biological Diversity Act (BD Act) in 2002** that provided for the National Biodiversity Authority (NBA), state biodiversity boards (SSBs), and local biodiversity management committees (BMCs).
  - It aimed at reversing biodiversity loss and ensuring **conservation and sustainable use of resources**, leading to proper **sharing of benefits**.
    - **However**, over the years, the Act has not been given its due importance.
    - Most of the **local bodies across the countries** have **not prepared a register** that records the region's biological resources.
  - The Act focuses on safeguarding **traditional knowledge** in the preservation of threatened species and biodiversity.



- But in practice, these have **become secondary**, leading to human-made evils like **water scarcity and animal-human conflicts**.
- **Action plan:**
  - The **National Biodiversity Action Plan (NBAP)**, released in 2009, focuses on the conservation of biological diversity taking into account the existing legal frameworks, strategies, and plans and programs.
  - **National Biodiversity Mission** - To strengthen the science of **restoring, conserving, and sustainably utilizing natural heritage**, and embed biodiversity as a key consideration in all developmental programs.
    - However, due to the absence of a **Biodiversity Finance Policy/Plan**, presently, multiple institutions are involved in directing finance often with overlapping functions and no systematic tracking.
- **Conservation areas:**
  - The Botanical Survey of India lists 4 principal **biodiversity hotspots in India** on the lines of the criteria laid down by Conservation International, apart from **the national parks, wildlife sanctuaries, and biosphere reserves** created for biodiversity conservation.
    - Centre for Science and Environment's (CSE) report notes that **over 90% of the area under the biodiversity hotspots in India has been lost**.
- Overall, the robust legal document in theory (the BD Act and Action plan) is lacking integration with equally **strong legal and scientific research, legal practices, legal reviews, and policy applications**.

### Conclusion

Biodiversity loss is much a **development issue**. For effective implementation of the available mechanisms, the **monitoring and review modalities** have to be strengthened. Marching ahead, **more cooperation** is required between different states/countries to implement the above mechanisms and the recent **Kunming declaration on biodiversity** effectively on the ground.

### 3. Is India on the path to meeting its Sustainable Development Goals? Critically Evaluate.

<b>Keyword/s</b>	Sustainable Development Goals
<b>Introduction</b>	Briefly explain SDGs and their objectives
<b>Body</b>	SDGs - India's achievements and shortcomings; Status concerning the environment-related goals; Further actions required
<b>Conclusion</b>	Give an overview and conclude with the right approach needed to meet the goals





## Introduction

The Sustainable Development Goals (SDGs) are the **2030 Agenda for Sustainable Development**, adopted by all the UN Member States in 2015. The SDGs are a set of universally applicable goals (17 SDGs and associated 169 targets) that **balances the three dimensions of sustainable development - environmental, social, and economic.**

The **environmental dimension** of sustainable development calls for building an **inclusive, sustainable, and resilient ecosystem** for the people and the planet.

Body



### Achievements so far:

- **India's overall score** across SDGs improved by 6 points; from 60 in 2019 to 66 in 2020-21.
- India has made **steady progress** towards achieving the SDGs in areas of **health, energy, and infrastructure.**
- There have been nationwide **improvements in 'clean water and sanitation' and 'affordable and clean energy' goals.**
- Significantly, the total number of **States in the Front Runner category has risen** from 10 in 2019 to 22 in the current Index.
- **Kerala, Himachal Pradesh, and Tamil Nadu** with the best overall score are **on the path to achieving** the SDGs.

### Concerns with the Overall scenario:

- India's rank in 2021 has **slipped by two places** from 2020 to 117 out of 165 countries on the 17 SDGs.
- The overall SDG score of India is **61.9 out of 100.**



- With this, India **ranks below four South Asian countries** - Bhutan, Nepal, Sri Lanka, and Bangladesh.
- **Jharkhand and Bihar** are the **least prepared** to meet the SDGs by 2030. While Jharkhand lags in five of the SDGs, Bihar lags in seven.

#### Measures taken:

- **The NITI Aayog** has been in charge of **overseeing the national implementation** of the SDGs.
- **The Ministry of Statistics and Programme Implementation (MoSPI)** is one of the important participants in the implementation of the SDGs.
  - The MoSPI has created **306 national indicators** in line with the 169 SDG targets and the Global Indicators Framework to monitor the progress in SDGs.
- **The government** has launched a **range of national welfare and development projects** as part of its commitment to achieving the SDGs.

#### Status with respect to the environment-related goals:

- **SDG 7 - Affordable and clean energy:**
  - SDG 7 strives to **improve energy efficiency, expand renewable energy** use, and promote modern, sustainable energy for all.
  - There are schemes such as the National Solar Mission, Dedicated Green Energy Corridor, the Off-Grid and Decentralized Solar PV Applications Programme, etc, and **96.7% of the population now has access to electricity**.
    - However, India's energy system is **still based on fossil fuels** and is **highly carbon-intensive**.
- **SDG 11 - Sustainable cities and communities:**
  - By improving **resource utilization** and focusing on **lowering pollution and poverty**, urban spaces can address the constraints of rapid urbanization.
    - India's urban areas have an **average yearly PM 2.5 level of 90.9 g/m<sup>3</sup>, while in Delhi, it is 150 mg/m<sup>3</sup>**, much beyond the WHO recommended range.
    - Poorer regions of Indian cities continue to be devoid of open, secure public places, notably green space.
- **SDG 12 - Responsible consumption and production:**
  - This goal strives to develop strategies to manage and **utilise all-natural resources sustainably and efficiently**, and **reduce the material consumption per capita** of both developed and developing countries.
    - In this regard, the Supreme Court order made **environmental education** a core requirement in primary, secondary, and higher education, which is a welcome move.
- **SDG 13 - Climate action:**
  - It focuses on increasing **resilience and adaptability to climate-related hazards**, as well as incorporating such measures into national policies.



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### KEN-BETWA RIVER INTERLINKING PROJECT FIRST PROJECT UNDER THE NATIONAL PERSPECTIVE PLAN

### JUDIMA RICE WINE A HOME-MADE RICE WINE OF ASSAM'S DIMASA TRIBE BAGGED GI TAG

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- With the **National Action Plan for Climate Change (NAPCC)**, India produces an average of **1.9 tonnes of CO2 per capita from energy production**, which is low compared to China and the US but high compared to the world's least developed countries.
- Nevertheless, India is **on track to exceed its Paris target by 2030** for reduction of emission intensity and share of non-fossil fuel-based electricity generating capacity.
  - But in contrast, India's **progress in creating additional carbon sinks has been slowed down**, partly due to the post-Covid-19 recovery plan with the opening of the **coal mining sector** for private players and allocation of mines in dense forest areas.
- **SDG 14 - Life below water:**
  - It focuses on reducing marine pollution, ending illegal and damaging fishing activities, and **safeguarding marine and coastal ecosystems** in a sustainable manner.
  - India is also constructing a **Marine Observation System** along its coastline in order to better understand coastal processes and monitor water quality.
    - But the development processes have had a substantial **negative influence on the health of the country's oceans and waterways**.
    - India's Exclusive Economic Zone has a **58 out of 100 Ocean Health Index**, putting it in 191st place out of 221 countries and dependencies.
- **SDG 15 - Life on land:**
  - It aims to maintain, restore, and promote the **sustainable use of terrestrial ecosystems**, as well as do **sustainable forest management**, combating desertification, and land degradation.
  - Government initiatives here include the **National Environment Policy, 2006**; **National Agroforestry Policy, 2014**; **National Afforestation Programme**, etc.
    - However, **forests and wild animal habitats** have witnessed **collateral damage** with India's development trajectory.

**Measures needed:**

- **Developing metrics** - India should develop appropriate indicators and **metrics to adequately monitor the progress** in achieving the SDGs.
- **Better integration** - The 2030 Agenda's integrated character necessitates governments working beyond policy silos and setting **interconnected economic, social, and environmental goals**.
- **Increasing funding modalities:**
  - Achieving the SDGs in India by 2030 will **cost roughly \$14.4 billion**.
  - **Greater private sector investments**, particularly in infrastructure, food security, and climate change mitigation, is the need of the hour to close this funding gap.



## Conclusion

The SDGs are an **urgent call for action by all countries** - developed and developing - in a global partnership model.

**As far as India is concerned, one-third of the journey** towards achieving the 2030 Agenda is already **over**. **Addressing the funding gaps** and moving forward with an **integrated approach** will help India make firm progress with the rest of the Sustainable Development Goals.

4. **The World is undergoing a series of crises- climate change, biodiversity loss, the crisis of pollution, and waste crisis. What holistic solutions would you suggest to overcome these existential threats to Humanity? Substantiate with examples.**

<b>Keywords</b>	Climate change, Biodiversity loss, Crisis of pollution, Waste crisis, Holistic Solution
<b>Introduction</b>	Give a brief introduction to the existing crisis the world is facing with data
<b>Body</b>	Enumerate the steps that must be taken at various levels for overcoming the crisis
<b>Conclusion</b>	Conclude with the need for government to take action and make an integrated approach to all these crises

## Introduction:

As per UN Environment's **Global Resources Outlook 2019**, extraction of resources is responsible for **50%** of global greenhouse gas emissions and **90% of biodiversity loss** and water stress. A recent AR6 report of IPCC says that the average surface temperature of the Earth will cross 1.5 °C over pre-industrial levels in the next 20 years (By 2040) and 2°C by the middle of the century.

Also, **Air pollution** in India is the **second-largest risk factor** contributing to the country's disease burden. As per the **Waste Crisis**, recent studies have found that the world is **now producing over 2bn tonnes of solid waste** each year, with numbers set to rise in the wake of the COVID19 Pandemic.

## Body:

**A holistic solution to address and mitigate various crises:**

### **Policy measures:**

#### ○ **Design of taxes:**

- Taxes should incorporate the cost of **externalities e.g. E.g.** Colombian capital Bogota has announced a **Green tax** on Coal generation, India has such **Coal tax**
- Tax **exemptions** for components using recycled material
- Lower taxes for **secondary raw materials** to make it price-competitive.



- **Green Public Procurement:** Sustainable Public Procurement (SPP) policy is needed and focus should be on materials made using local resources
- **Financing through: Viability Gap Funding (VGF),** green bond, revolving funds, risk guarantee funds, seed funding for circular business models
- + **Global Governance: Montreal protocol** has shown how a combined effort helps secure a greener and sustainable future for the world. Thus the need is for a next Biodiversity loss mitigation target (in Kunming Declaration), a global pact against micro and non-degradable plastic use (e.g. India adopted India Plastic Pact) and a stricter target for INDC in 2022 (as world government adopted in COP26)
- + **Technology measures:** IoT and Blockchain can be used to revolutionize energy and resource extraction sectors
  - Use of **clean coal technology** (e.g. CCUS), hydrogen economy, and investment into cleaner energy such as **Fusion tests at ITER, France**
  - E.g. in agriculture (smart control panels), commercial (building management systems), municipal (Centralized Control Monitoring System-CCMS), domestic (electric cookstoves).
- + **Green economy:** one that improves human well-being and builds social equity, while significantly reducing environmental risks and ecological scarcities (UNEP)
  - E.g. **Korea** adopted a strategy for green growth by allocating **2% of its GDP** to investment in several green sectors such as renewable energy, energy efficiency, clean technology, and water.
  - **Move away from GDP to an indicator of inclusive wealth that measures all forms of capital:** Uttarakhand government recently adopted **Gross Environment Product**
  - The **UNEP Emissions Gap Report**, for example, found that a green recovery could cut 25 percent off 2030 emissions if these funds were invested wisely.
- + **Various stakeholder's role**
  - + **Government's role:** strategies for efficient use of resources, data compilation, Infrastructure creation (e.g. **Material Recycling Zones, Eco-labelling**, and certification of standards of products)
    - **Bring Equity:** Currently, the combined emissions of the richest one percent of the global population account for more than twice the poorest 50 percent.
  - + **Manufacturers' role:** increasing recovery and recyclability of a product by improving its design and upholding EPR
  - + **Consumers' role:** lifestyle change for resource-efficient products (e.g. use of Electric vehicle), increasing shared use of products (e.g. Ridesharing), and safe disposal of a discarded item
    - From avoiding **single-use plastics** to avoiding food waste, to being mindful of our travel and dietary choices.
  - + **Recyclers' role:** involving tie-up with the informal sector; and environmentally efficient recycling and disposal system





- + **Civil Society Organizations' role:** awareness generation (esp. for the informal sector) and advocacy of secondary material use (**Increasing awareness** of green products)
- + **Universities- Research institutes' role:** introducing '**Circular Economy**' and 'Resource Efficiency' in schools and colleges. Encouraging R&D in Circular economy

### Government of India measures

- + **Draft National Resource Efficiency Policy (NREP) 2019** envisions:
  - **'Sustainable' levels of primary resources** consumption for achieving SDG goals
  - Staying within the **planetary boundaries**
  - Generating higher value goods with less material, using **circular approaches**
  - **Waste minimization and Material security**
  - **National Resource Efficiency Authority (NREA):** to drive the agenda of resource efficiency across the country.
- + **For energy efficiency: UNNATEE** (Unlocking National Energy Efficiency Potential) towards developing an energy-efficient nation (2017-2031).
  - **Digital initiatives:** e-Bidding and e-Reverse Auction, Enabling payments through NPCI platforms such as BHIM, BBPS, Bharat QR, etc.
- + **Fuel Efficiency:** Corporate Average Fuel Efficiency/Economy (CAFE) Regulation, Bharat stage VI, transition to EV transportation, Bio-fuel policy 2018
- + **Construction sector:** National Housing and Habitat Policy, 2007 and the PM Awas Yojana (PMAY): emphasizes developing **ecological design standards** for building components, materials, and construction methods.
- + **National Strategic Plan on Energy Efficiency:** focuses on E-mobility, fuel cell vehicles (FCVs), integration of renewable & storage, net-zero buildings, district cooling, smart meters, internet of things, active appliance feedback, blockchain technologies, etc.
- + **Indian Resource Panel (InRP): (under MoEFCC)** to assess resource-related issues facing India and advise the government on a comprehensive strategy for Resource Efficiency.
- + **At the Global level:** UNEP established the International Resource Panel (IRP) in 2007: provides scientific assessments on sustainable use of natural resources and promotes decoupling economic growth from environmental degradation.

### Conclusion:

We must understand the inter-relationship between climates, biodiversity, cleaner air, and Less Waste. A cooler climate will protect biodiversity and slow down desertification, conserving nature, while healthier nature will help to store carbon and create natural buffers to the impacts of climate change. Each reinforces the other. Now, **the age of promises must turn into the era of action**. As the UN Secretary-General said in the State of the Planet speech in December 2020, making peace with nature is the defining task of the 21<sup>st</sup> century.





5. What do you mean by 'Cultural Model of Conservation'? Is it superior to the Colonial model of Conservation wherein human presence is taken as a threat to nature? Comment.

<b>Keywords</b>	Cultural Model of Conservation, Colonial Model of Conservation
<b>Introduction</b>	Give a brief introduction to the Cultural model of conservation
<b>Body</b>	Compare both the models and give some examples where the cultural model has been successful
<b>Conclusion</b>	Conclude with a balanced view on how to adopt the cultural model into the present system

**Introduction:**

The cultural model of Conservation involves forest dwellers in forest management and governance and acknowledges traditional rights of tribal over minor forest produce and provisions for making conservation more effective and more transparent. Internationally, the Kinshasa Resolution of 1975 by IUCN provides recognition to the cultural model of conservation.

**Body:**

**Comparison between 'Colonial Model of Conservation' and 'Cultural Model'**

Features	Colonial Model of Conservation	Cultural Model
<b>Foundation</b>	Based on Colonial legacy and laws such as <b>Wildlife Protection act 1972</b> divide the national park and wildlife sanctuary into core-buffer zones	Based on the <b>traditional rights</b> of forest people to conserve and use natural resources
<b>People</b>	In this model, human presence is taken as a threat to nature	<b>Co-existence</b> creates a win-win situation for both forest inhabitants and Wildlife
<b>Indigenous Rights</b>	Doesn't recognize indigenous rights and land ownership and discourages customary ways of living	It is based on a <b>respect for the rights of indigenous peoples</b> and other bearers of "traditional knowledge" and prevents social conflicts <ul style="list-style-type: none"><li>E.g. <b>Bishnois of Rajasthan</b> consider trees as sacred and protect the entire ecosystem including animals and birds</li></ul>



		that exists in their villages. The tribe has organized its own <b>Tiger Force</b> which is a brigade of youth actively pursuing wildlife protection
<b>Suitability for India</b>	This model is not suitable for India as many indigenous communities are believed to be in <b>co-existence with nature</b>	Recommended and the government has recognized it in form of <b>Joint Forest management</b>

#### Application by Cultural model of conservation in different tribes of India

- ✚ **Maldhari Tribe in Junagadh (Gujarat):** The success of lion conservation in the Gir forest area is due to the peaceful coexistence of the tribe with lions.
- ✚ **Chenchu Tribe of Andhra Pradesh:** They are involved in tiger conservation at **Nagarjunasagar Srisailem Tiger Reserve (NSTR)**. The tribe has been coexisting with tigers and wild animals for a long without disturbing the ecological balance, which ensures enough water and fodder for the herbivores.
- ✚ **Bugun Tribe of Arunachal Pradesh:** The tribe using Community-led conservation initiatives and traditional knowledge helped to protect the critically endangered bird **Bugun Liocichla**. For its efforts Singchung Bugun Community Reserve won the **India Biodiversity Award 2018**.
- ✚ **Nyishi tribe of Arunachal Pradesh** in conserving hornbills in the **Pakke Tiger Reserve**
- ✚ **Idu Mishmi Tribe of Arunachal Pradesh:** The Idu Mishmi people believe that tigers are their elder siblings. Tigers are never hunted by Idu Mishmi and even If a tiger is killed in self-defense, it will receive the same burial as a human being. Idu Mishmi in 2018 protested against the creation of the Dibang Tiger Reserve and instead asked for a Cultural Model of Conservation.

#### Conclusion:

India has traditionally managed forests through community participation e.g. **Sacred groves**. Even In-situ conservation under WPA 1972 recognizes the cultural model in form of Conservation Reserves and Community Reserves. Community forest management in India started through a collaboration between **Arabari's community (West Bengal)** and the forest department in the 1970s. Presently, more than **118,000 people's committees are managing 229,000 square kilometers** or over 38% of India's forests. (2011 Census data)

Government must recognize the cultural model in its policy of conservation and use innovative measures such as CAMPA funds, Green Credit schemes as well as help from CBO and NGOs in providing communities with the necessary skills and equipment for better forest management.



6. Discuss the significance of the National Initiative on Climate Resilient Agriculture (NICRA) for augmenting the living standards of small and marginal farmers from drylands.

<b>Keywords</b>	– NICRA, living standards, small and marginal farmers.
<b>Introduction</b>	– Bring the context in which NICRA is brought by ICAR
<b>Body</b>	– Give components of NICRA – Its role in climate resilience  – Why climate resilience is important for small farmers
<b>Conclusion</b>	– Conclude with how living standards will be improved

### Introduction

In light of the rise in global temperature and its effect on farmers, ICAR has come out with a plan for **climate-smart farming** under **NICRA**.

**NICRA** intends to ensure agriculture adapts to climate change along with mitigating agricultural sources of GHG so that rise of warming does not put farmers into a vicious cycle.

### Body

It has the following relevance for marginal and small farmers from drylands. Dry land agriculture **occupies 68%** of India's cultivated area it produces **44% of the food**.

Small and marginal farmers are actually **86% of total farmers** and their concentration in drylands is very high. While large farmers could overcome dryland issues by setting up mega irrigation, marginal and small ones were rain-dependent. This affected their living standard and wellbeing by bringing down incomes.

NICRA ensures they are made resilient from climate change led income volatility for such small and marginal farmers:

1. **Assessment of vulnerability** to climate change and categorization of the lands into low, medium, high, and very high vulnerability
2. In the high and very high zones excess funding, research, and institutional efforts are put in
3. **Heat and drought-resistant crop alternatives** for the crops grown there will be developed



and supplied at a subsidised cost

4. **GHG flux towers** will be installed to ensure GHG emissions are measured
5. Carbon footprint will be reduced by moving to low carbon systems like aerobic farming of rice, for instance, biofertilizer, etc.
6. **The ecological footprint** is reduced by conserving water—micro-irrigation, conservation tillage, techniques like System of Rice Intensification where low water is needed is ensured. So that finally drought is managed with sufficient moisture. By this climate shock on income is thwarted.

### Conclusion

**Economic survey 2018-19** said that, while in normal areas income will reduce by 15% it will be 25-28% in drylands and it can be more severe for a small and marginal group whose economies of scale in agriculture is already dismally low.

So, NICRA is a right instrument for shock proofing on living standards by keeping poverty, underdevelopment, and suicides at bay.

7. **A participatory and focussed approach towards urban forestry is the need of the hour in India considering its manifold benefits. Comment.**

Keywords	A participatory approach, urban forestry
Introduction	Define urban forestry
Body	<ul style="list-style-type: none"><li>• Mention the importance of urban forestry in India</li><li>• Mention need of participatory and focused approach towards urban forestry</li><li>• Give examples to enrich the answer</li></ul>
Conclusion	Mention role of public participation

### Introduction

Urban forestry is the care and management of single trees and tree populations in urban settings for the purpose of improving the urban environment. Urban forestry involves both planning and management, including the programming of care and maintenance operations of the urban forest

### Body

#### Importance of urban forestry in India

- **Reduce urban heat island effect:** Trees help moderate temperatures in cities, where heat radiated from concrete buildings and roads makes them warmer than the surrounding



countryside, in a phenomenon called the urban heat island effect.

- **Reduce air pollution:** They also whittle down levels of ozone, sulphur dioxide and particulate matter; remove large quantities of carbon dioxide from the atmosphere; and release oxygen.
- **Lower temperatures reduce emissions in parking lots:** Temperature reduction from shade trees in parking lots lowers the amount of evaporative emissions from parked cars. Unshaded parking lots can be viewed as miniature heat islands, where temperatures can be even higher than surrounding areas.
- **Carbon sequestration:** According to the Ministry of Environment, Forest and Climate Change, the development of Urban Forests will contribute to India's decision to sequester 2.5 to 3 billion tonnes of carbon dioxide equivalent in the country's forests; they will also function as urban lungs.
- **Other uses:** reduce noise pollution in cities, reduce storm water runoff, groundwater recharge, flood control buffers, wildlife habitat and natural recreational areas. Green corridors that provide space for nature and wildlife while improving the lives of city dwellers.
- **To conserve various organisms:** Destruction of Aarey Milk Colony in October 2019 in suburban Mumbai harmed various organisms. According to a scientific report, the site is home to 86 species of butterflies, 90 species of spiders, 46 species of reptiles, 34 species of wildflower and nine leopards.

#### Need of participatory and focused approach towards urban forestry

- **Lack of attention from Government:** No progress in Government initiatives. India's programme to create 200 urban forests has seen no progress in four years.
- **Lack of political will and outdated laws hamper the creation of urban forests in India:** power imbalances, the inadequacy of decentralized governance structures, and information for civic decision-making make public engagement challenges.
- **Public involvement in Environmental decision-making:** The Environment Ministry has asked state-owned Hindustan Petroleum Corporation (HPCL) to hold public hearing for its proposed Rs 37,230 crore refinery-cum-petrochemical complex in Barmer district of Rajasthan.
- **Induced participatory method that has had success in reducing structural inequities is Participatory Budgeting:** There are some efforts of induced participation in urban areas as well, such as participatory urban planning in Chhattisgarh, planning for street vending in Mumbai, for slums in Ahmedabad and neighbourhood level and urban ward planning in Kerala.
- **SHGs are also vehicles for prioritization of shortfalls in basic services:** Participatory micro-planning under Kerala's similar Kudumbashree programme nests within annual municipal planning.
- **Public opinion matters:** Social movements, claimed participation spaces, including organic





NGO-led participation, are a strong shaping force in India, surfacing important issues of social and environmental justice, entitlements and equity.

### Example for public participation in urban forestry

- **Public-private partnership model:** Maharashtra's first-ever urban forestry project, it was developed by TERRE, a non-profit, with Tata Motors under a public-private partnership model as a corporate social responsibility initiative. From a 16-hectare barren strip of land under the forest department encroached on by slums and builders,
  - Warje has been transformed into a thriving oasis of biodiversity. It hosts over 10,000 indigenous plant species, 29 local bird species, 15 butterfly species, 10 reptile species and three mammal species.
- Bengaluru Development Authority has ravaged urban forests by building in them. The **Turahalli forest in southern Bengaluru** is being saved from garbage dumping and vandalism thanks to legal action initiated by the **Environmental Support Group (ESG), a pan-India advocacy forum**. ESG has also teamed up with the Karnataka Forest Department to turn Turahalli into a space where bouldering/climbing, bird watching, natural history study trails can continue unimpeded without encroachments.
- **In south-east Delhi, the Asola Bhatti Wildlife Sanctuary** was remolded from degraded village common land to reserve forest and then was ratified as a sanctuary.
- **Delhi's Aravalli and Yamuna biodiversity parks** have also successfully recreated the natural habitats and ecosystems of these regions in the city.

### Conclusion

Effective public participation is meaningfully involving the broad public in issues that matter is key to good governance. UN Sustainable Development Goal 11 on sustainable cities and communities also incorporates enhancing capacity for 'participatory, integrated and sustainable human settlement planning and management' as a target. Public participation has instrumental value in improving democratic decision.

### 8. Groundwater contamination threatens the health of entire ecosystem. Comment. Also, what measures can be taken to mitigate this threat?

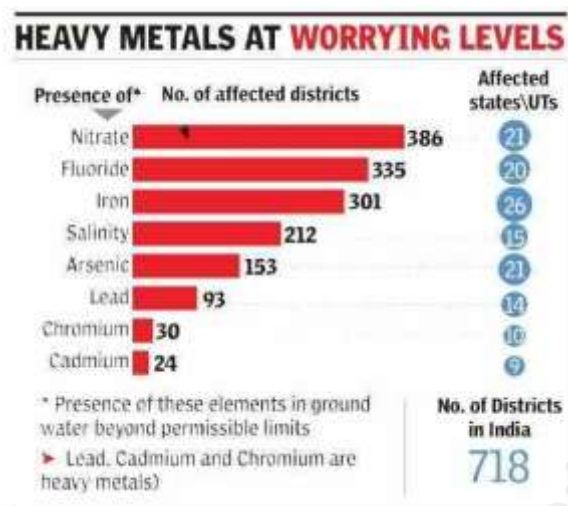
Keywords	Groundwater contamination
Introduction	Mention data/ facts related to Groundwater contamination
Body	<ul style="list-style-type: none"><li>• Mention threats of Groundwater contamination</li><li>• Mention mitigation measures to threat</li></ul>
Conclusion	Mention importance of Sustainable Development Goals related to groundwater



## Introduction

According to the **Composite Water Management Index (CWMI)** of Niti Aayog has confirmed that **70 percent of India's water supply is contaminated**. Globally, India is ranked 120th among 122 countries in WaterAid's water quality index.

## Body



## Impacts of groundwater pollution

Type of contamination	Impacts
<b>Uranium contamination:</b> As per the Bureau of Indian Standard (BIS), the maximum permissible limit of Uranium is 0.03 mg/l (as per WHO provisional guidelines) in all drinking water standards after following due process. BARC has found an alarming 600 µg/l of Uranium in groundwater.	<ul style="list-style-type: none"><li>Most ingested uranium is eliminated from the body. However, a small amount is absorbed and carried through the bloodstream.</li><li>Studies show that drinking water with elevated levels of uranium can affect the kidneys over time.</li></ul>
<b>Nitrate level:</b> According to WHO, Nitrate levels above 10 mg/L (10 ppm) in groundwater is harmful	It causes "blue baby syndrome" (acquired methemoglobinemia), the decreased ability of blood to carry vital oxygen around the body.



**Arsenic contamination:**

According to the report of the Central Ground Water Board (CGWB), 21 states across the country have pockets with arsenic levels higher than the BIS stipulated permissible limit of 0.01 milligram per liter (mg/l).

- Pigmentation of skin changes, skin lesions, and hard patches on the palms and soles of the feet (hyperkeratosis)
- The most alarming of which is the shift of arsenic from a point source contamination in terms of drinking water to a more diffused source contamination in the case of food products, with possibilities of biomagnifications.

**Increase in fluoride levels**

High levels of fluoride in groundwater which is used for drinking water, both dental and skeletal fluorosis can be prevalent and severe

**Pathogens**

Improperly placed wells can lead to drinking water contaminated with pathogens carried in feces and urine. Such fecal-oral transmitted diseases include typhoid, cholera, and diarrhea

**High Iron concentration**

Prolonged intake of high Iron content water can cause hemochromatosis.

**Increase in mercury concentration**

Mercury is reported to cause impairment of brain functions, neurological disorders, and retardation of growth in children, abortion and disruption of the endocrine system.

- **Coliform bacteria that move into rivers through untreated sewage also continues to pollute underground water:** A 2016 assessment of river Yamuna showed fecal coliform count as high as 92 lakh most probable number (mpn) per 100 millilitres in areas like Nizamuddin and Okhla Bridge. River water can be considered fit for bathing if faecal coliform count is under 500 and 2,500 mpn per 100 ml, according to government norms.
- **Spread of diseases through shallow groundwater:** Groundwater acts as a conduit for various viral and bacterial diseases especially in shallow aquifers through mixing of sewage and infiltration from latrine pits. Since shallow groundwater is used for drinking in much of the Eastern Gangetic plains, this is a common problem in this region.
- **Drop in agriculture yields:** According to study by MIT polluted water that being downstream of polluted stretches in India is associated with a 9% reduction in agricultural revenues and



a 16% drop in downstream agricultural yields.

- **Atmospheric Contaminants:** Since groundwater is part of the hydrologic cycle, contaminants in other parts of the cycle, such as the atmosphere or bodies of surface water, can eventually be transferred into our groundwater supplies.
- **Land degradation:** When groundwater becomes more contaminated in a given area, that area becomes less capable of sustaining human, animal, and plant life.
- **Biomagnification:** High pesticide content in groundwater has been reported in the agricultural intensive regions such as Punjab and Haryana. The health effects of pesticides are lesser known, but suspected to be harmful to humans and animals like biomagnifications.
- **Social and economic impacts:** health expenditure, less yield in land impacts socio-economic status.

### Measures to mitigate groundwater pollution

- **Groundwater Bill, 2017:** It is based on the recognition of the unitary nature of water, the need for decentralized control over groundwater and the necessity to protect it at aquifer level. The Bill is also based on legal developments that have taken place in the past few decades
- **Central Ground Water Board (CGWB):** Central Ground Water Authority (CGWA) has been constituted under "The Environment (Protection) Act, 1986" for the purpose of regulation and control of ground water development and management in the Country. So far, CGWA has notified 162 areas in the Country for the purpose of regulation of ground water
- **The Ministry of Drinking Water & Sanitation** has suggested all States to adopt water conservation measures like roof top rainwater harvesting, erecting sustainability structures for water conservation etc. For creating such sustainability structures, 10 % of National Rural Drinking Water Programme (NRDWP) funds are provided to the States.
- The Ministry of Rural Development in consultation and agreement with the Ministry of Water Resources, River Development & Ganga Rejuvenation and the Ministry of Agriculture and Farmers' Welfare has issued '**Mission Water Conservation Guidelines**' to be implemented by all the States for scientific planning and execution of water management works with the use of latest technology.
- The thrust is on **Planning and Monitoring Framework for Natural Resource Management (NRM)** related works under MGNREGA in convergence with Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), Integrated Watershed Programme (IWMP) and Command Area and Water Management (CAD&WM) schemes. This will lead to better outcomes of water conservation and water harvesting measures.
- **MoWR, RD & GR has also launched 'Jal Kranti Abhiyan'** (2015-16 to 2017-18) in order to consolidate water conservation and management in the Country through a holistic and integrated approach involving all stakeholders, making it a mass movement.
- **Water Treatment Technologies:** A recent technology from the National Chemical



Laboratory, Pune consists of new generation filters using ultra-fine porous membranes that do not allow viral and bacterial organisms from passing through the pores.

- **Natural Alternatives:** Use all natural/nontoxic household cleaners whenever possible. Materials such as lemon juice, baking soda, and vinegar make great cleaning products, are inexpensive, and environmentally-friendly.
- **Manage Waste:** Properly dispose of potentially toxic substances like unused chemicals, pharmaceuticals, paint, motor oil, and other substances. Many communities hold household hazardous waste collections or sites - contact your local health department to find one near you.

### Conclusion

Safe and affordable drinking water for all by 2030 (SDG-6 is to protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes) requires we invest in adequate infrastructure, provide sanitation facilities, and encourage hygiene. Protecting and restoring water-related ecosystems is essential.

9. Do you think that the increase in the pollution levels due to stubble burning in the Northern parts of the country is a legacy of the Green Revolution? Elucidate.

<b>Keyword</b>	– Stubble burning, Green revolution
<b>Introduction</b>	– Give brief details about stubble burning in a brief manner
<b>Body</b>	– Trace the connection between Green revolution and stubble burning
<b>Conclusion</b>	– A relevant closing statement

### Introduction:

**Stubble Burning, also known as “Parali”**, refers to the act of burning away the crop residue in the fields once the crops have been harvested. The problem is mainly seen in the Northern parts of India during the Kharif harvesting season, in the months of October and November. This often coincides with the onset of the winter season, thereby intensifying the problem of air pollution, due to stable atmospheric conditions.

### Body

For the past few years, every winter in Northern India starts with the surrounding of an envelope of smog. The problem is especially grave in the NCR region, which already grapples with multiple





sources of pollution, to which is added the pollution from stubble burning in the states of Punjab, Haryana and Uttar Pradesh. According to data from SAFAR, in early November 2020, stubble burning contributed to more than 40% of the total pollution in the NCR.

**This makes one introspect into the reasons as to why the stubble burning takes place:**

- **Sowing of the Rabi Crop:** There is a short interval between the harvesting of the Kharif crops and the sowing of the Rabi crops in the fields. If the farmers get late, it can cause them considerable losses. So they adopt the fastest way available to clear their field, i.e. burning them.
- **Mechanized farming:** The use of machines for harvesting the crops leaves some inches of stubble in the fields. Using labour or machines to just remove these stubbles is a costly affair, which farmers avoid by instead burning these stubbles
- **Termite attacks:** If as an alternative, these stubbles are left in the fields, there is a real danger of termites attacking the next crop.
- **Useless as Fodder:** the rice straw, (rice being the most common Kharif crop in the Northern parts of India) is high in Silica content. This prevents the use of these straws as animal fodder.
- **Punjab Specific problems:** In the state of Punjab, a law “Punjab Preservation of Subsoil Act, 2009” was passed, under which Kharif crops had to be sown later than usual, so as to prevent the depletion of groundwater, by letting the monsoonal rains water the crops when they required maximum irrigation instead. This led to a further reduction in the gap between the harvest of the Kharif crop and the sowing of the Rabi crops, forcing the farmers to burn their fields to save time.

A lot of the above-stated reasons for the stubble burning can be traced back to the advent of the Green Revolution in the country, especially in the states of Punjab, Haryana and Western UP, which currently are the hotspots of the problem of stubble burning.

**The green revolution brought in the following new technologies, each of which have been contributing to aggravating the problem of Parali in the country:**

- **Farm Mechanization:** It has led to the genesis of the problem of stubbles. Earlier, when the farmers used to harvest the crops themselves, they used to take out the whole stem along. With the advent of machines, this practice has been eliminated.
- **Constant Irrigation:** Due to the continuous availability of water, more stubble is produced than what had been the case without irrigation.
- **Dwarf Rice Varieties:** The Green Revolution introduces these varieties of Rice. Unlike the traditional rice varieties, the straw of this rice cannot be used as animal fodder due to its high silica content.
- **Commercial production in non-traditional areas:** the green revolution led to the start of



commercial levels of rice production in the traditionally non-rice producing and consuming areas. In order to prevent an additional cost of removing these stubbles from the fields, the farmers resorted to burning the stubbles, to save costs, and increase their profits.

- **Water shortages:** Rice is a water-intensive crop. The introduction of such a crop in the semi-arid parts of the country led to an unintended consequence of a decline in the water levels in the aforementioned states, often exacerbating the problem of desertification. The “**Punjab Prevention of Sub-soil Act**” law, is a result of this consequence of the Green Revolution.

### Conclusion

The Green Revolution was introduced in our country, with the noble aim of making India self-sufficient in terms of food grains. Though this purpose was served, in the longer term, there have been a lot of unintended problems that have cropped up due to the Green Revolution, the stubble burning problem being one of the major ones. We need to improvise our Indian agriculture, in order to fight the problem of air pollution in the Northern parts. Effective management of the crop residue (as manure, food-stock for thermal power plants, biogas plants), cheaper availability of the farm machines and labor for removing the stubble, and in the longer run, Crop diversification, maybe the ways ahead.

10. Describing the salient features of the Soil Health Card Scheme, analyse whether the scheme has helped mitigate soil degradation and improve the lot of farming communities in India.

<b>Keywords</b>	Soil Health Card scheme, Salient features,
<b>Introduction</b>	Brief introduction about the scheme.
<b>Body</b>	Salient features of the scheme. Pros and Cons of Soil Health card scheme in improving farming communities Recommendations and Way forward
<b>Conclusion</b>	Relevant conclusion

### Introduction

**Soil Health Card Scheme** was launched under **National Mission for Sustainable Agriculture**. It aims at promoting **integrated Nutrient Management (INM)** through judicious use of chemical fertilizers with organic manures and bio-fertilizers for improving **soil health and productivity**.



It is a **field-specific** detailed report of **soil fertility status** and other important soil parameters that affect crop productivity.

#### Salient features of Soil Health Card scheme

- Soil Health Card (SHC) is a printed report which contains the status of soil in **12 parameters** in **4 categories**.
  - **Macro-nutrients:** Nitrogen (N), Phosphorus (P), Potassium (K)
  - **Micronutrients:** Zinc (Zn), Boron (B), Iron (Fe), Manganese (Mn), and Copper (Cu)
  - **Secondary- nutrient:** Sulphur (S)
  - **Physical parameters:** pH, Electrical Conductivity (EC), Organic Carbon (OC)
- **Assistance to farmers**
  - Setting up of **mini soil testing labs** - Labs could be set up by **village youth** and farmers up to 40 years of age are
  - **Rs. 2500/ha** for distribution of micronutrients
- **Development of Model Villages** (pilot project in 2019-20) - one village per block is adopted for landholding based soil sampling, testing, and organization of a larger number of demonstrations.
- **Soil Health Card Mobile App:** captures GIS coordinates while registering sample details to indicate the location of the sample
- **Soil Health Card Portal:** Here farmers can track soil samples.

#### The role played by Soil Health Card in Improving farmer's welfare and mitigating soil degradation

- **Empowers farmers** to scientifically understand the health of their soil and optimizes their cost and increases their profits.
- **Improve productivity:** Issuance of the Soil Health Cards has enabled the farmers to improve productivity by judicious application of soil nutrients. **A study by the National Productivity Council** ( in 2020 - On completion of 5 years of SHC ) found that adoption of SHC has to lead to -
  - **Increased Savings:** Application of fertilizer and micronutrients based on Soil Health Card (SHC) recommendations resulted in 8-10 % of savings.
  - **Reduced cost of cultivation:** In the case of rice, the cost of cultivation was reduced by 16-25%, and savings of nitrogen was found to be around 20kg/acre.
  - **Increased Yield of crops:** Overall increase in the yield of crops to the tune of 5-6% was reported by adopting the SHC recommendations.
  - **Increase farm income:** Soil health card boosts farm income up to **Rs 30,000/acre** depending on crops.
- **Rural Employment generation:** The Soil Health Card Scheme along with other projects (under NMSA) for soil health management has **created jobs for the agrarian youth**.



- Village youth and farmers up to 40 years of age are eligible to set up Soil Health Laboratories and undertake testing under the scheme. 75% of laboratory costs are to be funded by the Central and State Governments.
- **Increased agriculture credit**, higher loan subsidy correlates with the fact that soil health card has been delivered to over 22 crore farmers as of now.
- **SHC plays a key role in correcting distorted NPK use ratio.**
  - On an all-India basis, currently, the NPK use ratio is **6.7:2.4:1** against an ideal **4:2:1** with the attendant adverse effect on the **health of soil and people**.
- **Restoring Soil fertility** due to judicious application of fertilizers helps in **reducing soil degradation**.

#### Lacuna in SHC Scheme

- **Limited Socio-Economic Impact** - Studies show that farmers are not taking SHC crop advice. Economic benefits are uncertain because of the marketing problem.
- **Operational challenges:** The current census approach, where soil samples are collected from every 2×2 hectare parcel of land in irrigated areas (10×10 hectare in dry areas) and transported en masse for analysis in a dated network of wet chemistry labs has put tremendous strain on the system and the **quality of soil analysis** has suffered.
- **Technical issues**
  - The number of soil samples per unit area is not based on **soil variability**.
  - **Microbial activity**, moisture retention activity are essential but missing in SHC.
  - The soil health card is more focused on **chemical nutrient indicators**; physical and biological properties have less focus.
- **Over simplistic solution:** The scheme's current design oversimplifies the **nutrient recommendations**. For example, if the health card shows that a farmer's soil is deficient in zinc, it recommends topping up zinc.
  - Research is showing that a **crop's yield response** to a nutrient is **far more complex**. It is determined not only by the deficiency of that nutrient, but also by **other variables** such as rainfall, production practices, the presence of other nutrients, soil acidity, and temperature to name a few.
- **Underestimation of own potential:** The large-scale collection of soil data sees little use outside of filling out a physical card.
  - This vast repository of data remains largely isolated from **researchers, start-ups**, and even state governments.
- **Lack of Coordination** among agricultural extension officers and farmers.
- **Limited Soil testing Infrastructure** with greater capacity.
- Many farmers are unable to **understand the content**, hence unable to follow the recommended practices.



**Recommendations and Way forward** - These shortcomings present a **remarkable opportunity** for Indian agriculture.

- There is a need to **develop predictive models** using big data to provide recommendations to farmers that account for all the factors that affect a crop's yield response.
  - For example, a recommendation that encourages the use of a **custom fertilizer blend** in addition to asking the farmer to reduce sowing depth.
- **Datasets** collected should be made available through an **open platform**.
  - This could help **Agri start-ups** to combine soil health card data with rainfall and irrigation data and deliver precision irrigation advisories to our farmers on their mobile phones.
  - **Fertilizer companies** building upon such a platform, leveraging soils data, weather data, and farmer demand patterns can shape the distribution of fertilizer blends in different districts. Such a platform can catalyze a **wave of innovations** in agriculture.
- **Precise Nutrient Management:** Site-Specific Nutrient Management relies on principles of '5Rs', the right time, the right amount, the right place, the right source, and the right manner.
- **Soil testing infrastructure:** The establishment of **state-of-the-art labs** in all district headquarters with a large capacity to meet the target in the district is the need of the hour. Minilabs need to be further upgraded for accuracy and speed.
- **Creating greater awareness:** Currently, it is being created by mass awareness activities on **World Soil Day (December 5)** every year.
- **Educating farmers** to change their **agriculture practices** and take up crops suited to their soil, and not resorting to **market-driven choices**.
  - **KVKs, SAUs, ICAR institutions, and Private companies** should participate in the program by involving educated local youth for soil sample collection, testing, and distribution.

**Conclusion** - Soil health needs to be **assessed at regular intervals** so as to ensure that farmers apply the required nutrients while taking advantage of the nutrients already present in the soil. Money saved is money earned, hence focusing on **reducing production costs** will definitely help to **double farmers' income** without compromising productivity.

#### Additional Information

##### **1. Andhra Pradesh using SHC and related data**

- Andhra Pradesh is currently bringing together years' worth of cropping pattern data, precipitation data, temperature readings, irrigation information, and SHC data and combining them with farmer production





practices to determine what impact different nutrients have on yield.

- This will act as a **decision support system** to do a more targeted extension and produce more customized fertilizer blends. Eventually, it can be used to offer recommendations to farmers to help improve yields.

## 2. Data: Awareness about SHC in developed and less developed states

State group	% of Sample Farmers are / saying			
	Awareness about SHC	Discussion results	Awareness about Portal	Portal info Useful
<b>Developed</b>	92.4	74.2	24.2	22.9
<b>Less developed</b>	55.1	17.2	0.8	0.7
<b>All</b>	82.1	58.6	18.1	16.8

## 3. Soil health card: Sample

SOIL HEALTH CARD		Name of Laboratory				
<b>Farmer's Details</b>						
Name						
Address						
Village						
Sub-District						
District						
Pin						
Aadhaar Number						
Mobile Number						
<b>Soil Sample Details</b>						
Soil Sample Number						
Sample Collected on						
Survey No.						
Khasra No. / Dag No.						
Farm Size						
Geo Position (GPS)	Latitude: Longitude:					
Irrigated / Rainfed						
		<b>SOIL TEST RESULTS</b>				
		S. No.	Parameter	Test Value	Unit	Rating
		1	pH			
		2	EC			
		3	Organic Carbon (OC)			
		4	Available Nitrogen (N)			
		5	Available Phosphorus (P)			
		6	Available Potassium (K)			
		7	Available Sulphur (S)			
		8	Available Zinc (Zn)			
		9	Available Boron (B)			
		10	Available Iron (Fe)			
		11	Available Manganese (Mn)			
		12	Available Copper (Cu)			

Secondary & Micro Nutrients Recommendations		
Sl. No.	Parameter	Recommendations for Soil Applications
1	Sulphur (S)	
2	Zinc (Zn)	
3	Boron (B)	
4	Iron (Fe)	
5	Manganese (Mn)	
6	Copper (Cu)	
General Recommendations		
1	Organic Manure	
2	Biofertiliser	
3	Lime / Gypsum	
<div style="display: flex; justify-content: space-between; align-items: center;"> <div>International Year of Soils 2015</div> <div style="text-align: center;"> </div> <div>Healthy Soils for a Healthy Life</div> </div>		

Fertilizer Recommendations for Reference Yield [with Organic Manure]				
Sl. No.	Crop & Variety	Reference Yield	Fertilizer Combination-1 for N P K	Fertilizer Combination-2 for N P K
1	Paddy (Dhan)			
2				
3				
4				
5				
6				

## Need for Soil Health Cards Scheme

- Land degradation:** India is facing a severe problem of **land degradation** ie. soil becoming unfit for cultivation. **About 29%** or about 96.4 million hectares are considered degraded. ( **Aim of SDG 15-** halt and reverse land degradation )



- A majority of our population is **dependent on agricultural activities** for their livelihood. **Deteriorating soil health** has been a cause of concern and that has been leading to **sub-optimal utilization** of farming resources.
- **Decrease in Soil fertility:** Imbalanced use of fertilizers, low addition of organic matter, and non-replacement of depleted micro and secondary nutrients over the years, has resulted in **nutrient deficiencies** and **a decrease in soil fertility** in some parts of the country.
- **Food production:** The health of the soil is directly related to the production of food grain. The deterioration of soil health would have a lasting impact on the food grain production in the country.

11. “National Highways cutting across wildlife corridors lead to a barrier effect for wild animals”.  
Comment. Suggest some remedial measures to tackle habitat fragmentation.

Keywords	<ul style="list-style-type: none"><li>– National highways</li><li>– Wildlife corridors</li><li>– Barrier effect</li><li>– Wild animals</li><li>– Habitat fragmentation</li></ul>
Introduction	<ul style="list-style-type: none"><li>– Definition of wildlife corridor and habitat fragmentation</li></ul>
Body	<ul style="list-style-type: none"><li>– How national highways are affecting wild animals?</li><li>– Remedies to tackle habitat fragmentation</li></ul>
Conclusion	<ul style="list-style-type: none"><li>– A forward-looking statement</li></ul>

#### Introduction:

Fragmented habitats are habitats that were once contiguous, but are now broken into several smaller pieces and are no longer connected. A **wildlife corridor** is a way of connecting these fragmented habitats. The corridor allows movement between isolated patches of habitat without other disturbances, such as traffic or development.



## Body:

### Benefits of the wildlife corridor

- **To cross the road:** 'Land bridges' or underground tunnels are artificial wildlife corridors that provide a safe way for animals (such as deer, squirrels, bears, and foxes) to cross a road throughout the day.
- Corridors don't just help animals that move between isolated patches on a daily basis, but also those that migrate between habitats seasonally.
- Wildlife corridors are also used by various species to breed and feed.

Human settlements, progressive projects such as major highways and infrastructural development, and expanding farmlands, especially around forests, have resulted in widespread habitat fragmentation and isolation.

Although the wildlife corridors have always helped the animals to move back and forth from one place to another, the human intrusion has created obstruction in the movement of the species.

### The highways cutting through the crucial corridors lead to

- Unwanted human-animal encounters, which create trouble for both.
- Wild animals get hit by speeding vehicles and lose their lives.
- **Highways don't just mean road kill:** they degrade habitat, produce noise and light that disorient animals, they break canopy connectivity for arboreal animals such as the endangered lion-tailed macaque; and, where traffic is high in volume and velocity, they become impermeable walls that splice up habitats.
- **Fragmentation of ecosystems** leads to loss of biodiversity in the remaining habitat patches, potentially local extinction of plant or animal species, because it can separate individuals within a population and can disconnect them from important resources.
- **The fragmentation of the habitat affects three kinds of wildlife species the most** – migratory species; species with fewer members and requirement of large home ranges, such as grizzly bears and tigers; and species that don't do well in altered environments and have specific needs like orangutans and tiger salamanders.

**Case Study:** The busy National Highway-37 bisects the **once-contiguous Kaziranga landscape** into two discrete regions: the floodplains of the protected area on its north and the Karbi Anglong hills on the south.

Satellite imageries of land use and land cover patterns in the corridor complexes around Kaziranga National Park (KNP), a World Heritage Site in Assam, show fragmentation of forests is forcing wildlife to be hemmed in, in secure areas only.

An analysis revealed a spontaneous decrease in core forest from 1176.69 square km in 2002 to



748.28 square km in 2013. Loss of secured habitats in the surrounding areas may have driven the wildlife into the safer and rich habitats of Kaziranga National Park. The unusual increase and concentration of animals in a single protected area with limited space and connectivity could be harmful in the long run. The much-trumpeted conservation success of Kaziranga due to the increasing number of rhinos, elephants, and tigers could be a dangerous indicator.

NH 44 cuts through wildlife corridors connecting Kanha, Satpura, Pench, Bandhavgarh, Panna tiger reserves and at least four other protected areas. NH 6 — India's second longest highway that runs across the breadth of the country from Surat to Kolkata — passes through corridors around Melghat, Bor, Nagzira, Simlipal tiger reserves and seven other national parks and sanctuaries.

**There could be a few unintended consequences of corridor creation based on their design:**

1. Where the fragmentation of habitats can cause defaunation, wildlife corridors could lead to dispersal of unwanted species. The corridors can increase the spread of invasive species too. These species are excellent colonizers with inherent characteristics to spread rapidly and displace native species.
2. Predation rates could increase as the predators can easily hunt down the dispersing prey through the corridors. Diseases and other parasites may also use corridors to enhance dispersal and transmission.

**Remedies to tackle habitat fragmentation**

1. Five actions need to be taken in response to habitat fragmentation: in priority order:
  - Protect existing high-quality wildlife greenspace
  - Manage and improve degraded greenspace
  - Restore sites of particular value that have been destroyed (such as wetlands)
  - Improve the permeability of land use between sites
  - Create a new green space.
2. **Eco-bridges** - to build an overpass for animals to walk over, instead of having to cross the highway and the railway tracks.
3. **Underpasses** - The first wildlife underpasses built under NH 44 could help reduce road kill on the Kanha-Pench corridor dramatically. These underpasses are India's first examples of 'wildlife mitigation measures' or attempts to remedy the impact of infrastructure on wild animals, and were achieved after a 10-year-long legal battle between environmentalists and NHAI.

**Conclusion:**

However, the importance of wildlife corridors cannot be denied. Regardless of the negative impacts, they play a vital role in the preservation and restoration of habitat and species. More corridors should be built to provide a safe traversing space to the species.



12. Analyze the problem of chemical pollution and thermal pollution in 'industrial belts' of India. Suggest alternative 'business models' for eco-friendly industrialization therein.

<b>Keywords</b>	– Thermal, chemical, industrial belts, suggestions, business models
<b>Introduction</b>	– Define industrial belts and their role as a causative agent for pollution of the area
<b>Body</b>	– Describe the various sources of chemical and thermal pollution – Explain its consequences in terms of degradation – Suggest green measures that can be taken to ensure ecofriendliness.
<b>Conclusion</b>	– The need for a regional approach to pollution abatement can be highlighted

**Introduction:**

Industrial belts are the continuous range of similar industries mutually dependent on each other wherein heavy industrialization takes place. They have a tendency to degrade the entire ecology— water, land, air, resource entities, and so on.

**Body**

Their interaction with the environment is highly harmful, they not only exploit the resources but also give away harm that pollutes the system. Two major forms of pollution are:

**A. Chemical Pollution Sources:**

- Discharge of effluents** from industrial belts manufacturing leather and textile goods like **Tiruppur belt** eg. Discharge of chemical dyes,
- Toxic gas emission from smelting industries like Sterlite** or power plants eg. Sulphur dioxide emission from copper industries like Sterlite
- Metallic pollution** in mining belts like Rajasthan copper mines or Kudremukh iron mines or Chromium mine belts in Odisha,
- Acid mine discharge** in coal mines where there is a chemical reaction in which acid is discharged

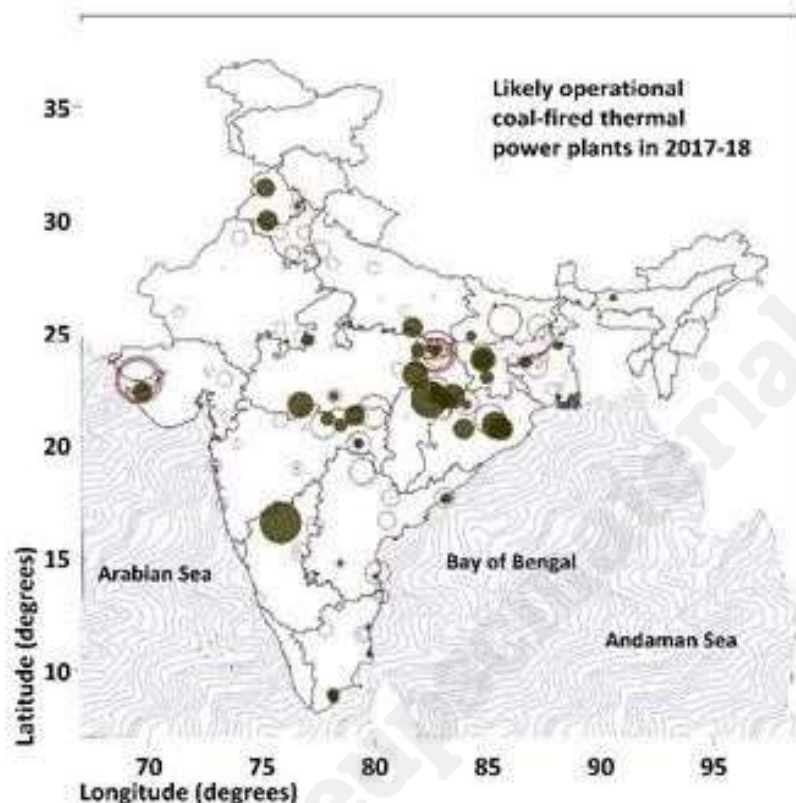
**Degradations:**

- Eutrophication of lakes** leading to high biological oxygen demand eg. Bellandur lake in IT belt of Bangalore
- River pollution** in which organic and inorganic effluents pollute rivers eg. Tetravalent chromium pollution of Brahmani river





- g. **Soil pollution** by acidification of forest soils in Jharkhand due to mining
- h. **Air pollution**—toxic gases and particulate matter emissions from industries have polluted air and many of these belts most polluted areas of the world now eg. As shown in the map areas of high PM emissions coincide with areas concentrated with power plants,



## B. Thermal pollution

**Description:** Thermal pollution is the degradation of ecology caused by temperature shocks—sudden rise or fall in temperature. Discharge of hot water may increase the temperature by 10 to 15 degrees Celsius and that is called thermal pollution.

### Causes:

There are two reasons for the occurrence of thermal pollution

- **Hot water discharge from power plants where water is used as coolant** and discharge of water used for other purposes like industrial washing,
- **Urban water run-off** in which rainwater flowing on hot surfaces like roads, parking lots, auditoriums and industrial platforms in cities and industrial clusters reach the water reservoirs, and lead to surface temperature changes,



### Effects:

- **BOD:** when temperature rise oxygen demand increases so that affects the aquatic life and causes their death
- Hot water **reduces the swimming efficiency** of aquatic organisms and affects food chain working like catching the prey by a predator
- The **reproduction and metabolism** of water organisms affect the population levels
- Overall the **biodiversity is reduced** and makes EXTINCTION easier in event of a crisis like floods or tsunamis or diseases

### NEW BUSINESS MODELS:

In order to ensure these pollutions are averted we need new business models that are non-interventionist and sustainable:

- a. **A circular economy model** is needed—this ensures the pressure on ecology by nature is low eg. **Recycling minerals leads to low mining needs**
- b. **Low ecological footprint** in which resources are used efficiently with low wastage eg. **Arresting leakages and unnecessary evaporation of water**
- c. **Ecofriendly strategies:**
  - Use of **sewage and effluent treatment plants (ETPs)** to prevent discharge of chemicals
  - **Cooling ponds** should be used to ensure water is discharged only after cooling
  - **Use of heat exchangers** in nuclear plants to before discharging hot water
  - **Cogeneration:** using waste hot water to generate power
- d. **Non-polluting energy regimes**—replacing polluting energy sources with renewable and clean energy sources so that chemical pollution of air is reduced
- e. **Biomining to prevent acid mine discharge**
- f. **Bioremediation** to handle organic and inorganic soil and water pollutions

### Conclusion:

Therefore, industrial belts should be the primary focus for pollution abatement since it is concentrated here. This regional approach has been missing in our pollution control policy. **Comprehensive Environmental Pollution Index (CEPI)** meant for different regions is a potential tool for this endeavor.



13. A GDP growth approach that integrates principles of 'deep ecology' along with 'precautionary and polluter pays' principle is expected to conserve 'natural capital' at a sustainable level. Elucidate.

Keywords	– Growth,
Introduction	– Define natural capital and introduce its components
Body	– Describe the meaning of three principles – Discuss the implication of these three principles for economic growth
Conclusion	– While highlighting the challenge end the answer on an optimistic note.

**Introduction:**

Natural capital is the sum total of all-natural resources of a region that provides ecosystem services and helps sustain life.

We know that an unsustainable approach to growth erodes natural resources eg. Since 1900, at least 20% of species are lost in all habitats due to economic activity.



**Body:**

**GREEN PRINCIPLES IN THE GROWTH PROCESS:**



A. **DEEP ECOLOGY PRINCIPLE** is a radical ecological philosophy that seeks to replace current attitudes about the environment,

- **Anti-anthropocentrism**—it believes humans are not important than other organisms, all creatures are as important as humans
- **Holistic approach**—believes entire ecology acts as one integrated whole, not in compartments, hence humans should not differentiate them from the rest of the environment
- **Non-coercion**—it is the idea that no human action should coerce the environment and the principle of no-harm towards the environment is needed.

For instance, the application of the deep ecology principle to forests in our growth journey must involve, establishing no-go zones in which no growth activities have to be allowed—

**In India, we have Eco-Sensitive Zones, Critical Inviolable Areas or Core zones of tiger reserves, and no-go zones in coal mine areas.**

Here, mining, hydroelectric projects, heavy tourism, human settlements are not allowed showing non-coercion and respect for other creatures to live. This ensures the integrity of forests which are crucial natural capital.

B. **PRECAUTIONARY PRINCIPLE**

- **Corporate social responsibility** towards the environment to do business with caution i.e. business without degrading the environment  
Eg. Not emitting toxic gases into the environment by installing a flue gas **desulfuration and collector**
- Carrying capacity principle involves using resources only to a limit that it renews back to original condition within the right time
  - e.g. **Land use planning** by Municipal bodies to not allow establishments in the same areas to ensure carrying capacity is not breached in a particular zone so that water, land, soil, are allowed to replenish periodically
- **Intergenerational equity principle** is necessary to ensure cautious use of resources so that future generations are left with a stock or a suitable condition to live **eg. Limiting GHGs and establishing adaptation mechanisms so that climate change can be tackled by future generations.**
- 

For this growth should happen through renewable energy, use of energy efficient appliances, e-Vehicles, compensatory afforestation, micro irrigation, geoengineering techniques like cirrus cloud thinning.

C. **POLLUTER PAYS PRINCIPLE**



It is a method to ensure polluters are penalized for degrading natural capital and also bring a deterrence to harm the environment, especially with monetary measures. The cost for harming the environment is forced to be accounted in the balance sheets.

Various methods of doing it are:

- Taking compensation under the **principle of strict liability** after an industrial disaster
- Collecting **royalty** from miners
- Carbon tax on petrol and diesel consumption
- Compensatory afforestation fund

These techniques if accompanied with our industrial policies will ensure sustainable use of natural capital.

However, the greed and rapid growth ambitions are limiting the genuine application of these principles eg. Carbon tax has not limited petroleum consumption effectively.

#### Conclusion:

But without overcoming the growth-environment dichotomy by the government, the deep ecology model will have superficial application only. Yet an active judiciary, social movements along with government policies are keeping these principles alive.

#### 14. Explaining the concept of ecosystem, enumerate the most critical factors causing ecosystem changes? How does this change affect human well-being and poverty alleviation?

<b>Keyword/s</b>	Ecosystem; Ecosystem changes and their effects
<b>Introduction</b>	Define shortly 'ecosystem' and 'ecosystem changes'
<b>Body</b>	Shortly mention the components of the ecosystem and the inter-relations; Factors behind ecosystem changes; Implications of ecosystem changes in terms of human well-being and poverty
<b>Conclusion</b>	Conclude by stating the importance to manage ecosystems better

#### Introduction

"**Ecosystem**" means a dynamic complex of plant, animal, and micro-organism communities and their non-living environment interacting as a functional unit.

**Ecosystem changes** refer to any disruption or **disturbances to the natural level of interaction** among the components of the ecosystem, its structure, output, etc, thus having **implications at varied levels**.





## Body

### Ecosystem:

- **Concept:**

- There are many ways that an organism interacts with and depends on various parts of its environment. An ecosystem view of the environment **understands nature in terms of these interactions among its components - biotic and abiotic.**
- While organisms in an ecosystem may be engaged in competition or predation or mutualism, the concept of ecosystem **focuses on all/any such interdependence.**

- **Components:**

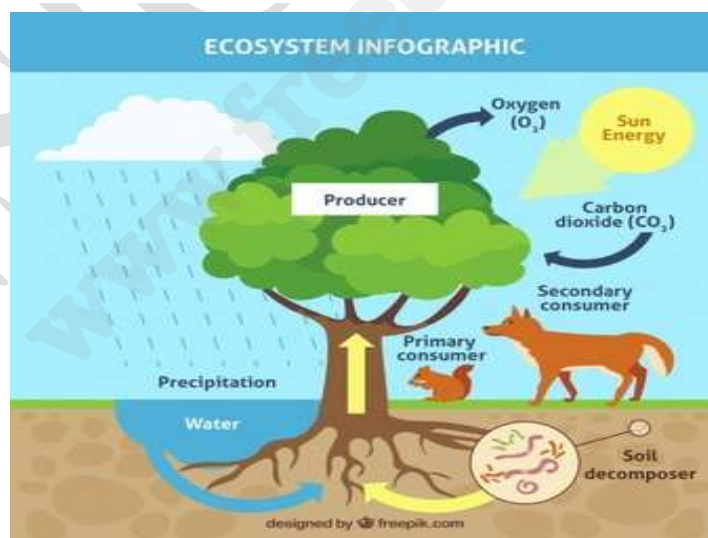
- An ecosystem consists of a **biological** community, its **physical** and **chemical** environment, and the **dynamic interactions** that link them.
- The **biotic or the living components** include plants, trees, animals, as well as bacteria, fungi, etc.
- The **abiotic or the non-living components** include the soil, water, air, rocks, temperature, rainfall, etc.

- **Types:**

- **Terrestrial ecosystems** – Desert, Grassland, Forest, Tundra ecosystems
- **Aquatic ecosystems** - Freshwater, Marine ecosystems

- **Ecosystem changes**

- **Driving forces** (or “drivers”) - any **events or processes** - behind ecosystem changes are almost always **multiple and interactive**, making it difficult to trace a particular causative factor for a particular change.
- So, the line between natural and human-caused changes is often blurred.



### Factors causing ecosystem changes:



### Direct Factors:

- **Variation in the population of species:**
  - When some consumers, like **tigers and lions**, are **poached to near extinction**, this change has a direct impact on the ecosystem.
    - When **predator populations decline**, **their natural prey will proliferate** and put a strain on other resources in the ecosystem.
  - On the other hand, an **increase in the population** of certain species may cause an imbalance in the ecosystem.
    - E.g., **invasive species** compete with the native species for limited resources and eventually cause a decline in native numbers disrupting the ecosystem.
- **Land-use change:**
  - For **terrestrial ecosystems**, **land cover change** (in particular, conversion to cropland) has been an important cause for changes in the past 50 years.
  - Also, the application of **new technologies** that have contributed significantly to the increased supply of services such as food, timber, and fiber has been a factor. E.g., **mechanization in agriculture and forest resource extraction**.
- **Overuse of resources:**
  - E.g., **For marine ecosystems**, **overfishing** has been the main driver of change in the past 50 years.
    - The biomass of some targeted species, especially larger fishes, and those caught incidentally has been reduced to 1/10<sup>th</sup> of levels prior to the onset of industrial fishing.
- **Excessive nutrient loading** has emerged as one of the most important direct drivers of ecosystem change in **terrestrial, freshwater, and marine ecosystems**.
  - Many ecosystem services are reduced when inland water and coastal ecosystems become eutrophic.

### Indirect factors causing ecosystem changes:

- **Increasing human population:**
  - With close to 8 billion population currently, the persistent population growth results in **increased consumption of ecosystem services**, creating **ecosystem stress**.
    - With increased consumption, **increasing the efficiency of the technologies used in production** can help reduce the harmful environmental impacts.
- **Nature of economic growth:**
  - The world economy has seen key changes **since industrialization began** in the 1800s. Global economic activity increased nearly sevenfold between 1950 and 2000.
    - With rising per capita income and the **changing nature of consumption** patterns, the **demand for many ecosystem services** has grown multifold.
    - Other indirect effects include the **by-products of industrialization**, like **acid rain**, which causes a decline in the number of plants and animals.



- **Other human activities:**
  - Activities such as the **construction of dams** that alter the natural flow of water and affect the **migratory patterns of fish** could lead to changes in ecosystems.
  - Humans also affect ecosystems by **reducing habitat, over-hunting, increasing the use of pesticides or fertilizers**, and causing other influences.
- **Climate change** is also an indirect driver that **affects the ecosystem's balance** through increased temperature, extreme weather events, stress on the population's living conditions, etc.

**Influence of ecosystem changes on human well-being and poverty alleviation:**

- **Demand and competition:**
  - As the **demand for ecosystem services** increases, the **poor people** have often disproportionately **lost access** to these services.
  - The **degradation of ecosystem services** thus affects many of the world's poorest people and is **sometimes the principal factor causing poverty**.
- **Policy flaws:**
  - The **reliance of the rural poor on ecosystem services** is rarely measured and is overlooked in national statistics and in poverty assessments.
  - This results in an **inappropriate policy outlook** that misses out on the **role of the environment in poverty reduction**.
- **Skewed impact:**
  - Given the **dependence on ecosystem factors** for their livelihood, the ecosystem changes often affect vulnerable groups such as the **tribals, indigenous and rural populations, pushing them into poverty**.
  - The declining state of **capture fisheries** is reducing a **cheap source of protein in developing countries to the poor**, depriving them of their affordable food choice.
- **Pre-existing vulnerability:**
  - Populations are ever-increasing in **low-lying coastal areas and dryland ecosystems**.
    - Drylands have the lowest per capita GDP and a high proportion of poor people.
  - **The vulnerability of these populations** has increased due to ecosystem changes that **aggravate the risks and impacts of natural disasters** such as floods or drought.
    - E.g., depletion of mangrove forests in coastal areas increasingly exposes coastal populations to the risks of cyclones, etc.
- **Worsens gender bias:**
  - Significant differences between the roles and rights of men and women in many societies lead to **women's increased vulnerability** to changes in ecosystem services.
    - E.g., Increasing **mechanization in agriculture** and the resultant **ecosystem changes** associated with traditional agricultural practices tend to **drive rural women out of the field**.
- **Larger impact on human well-being:**



- With **increasing vulnerabilities and declining human well-being**, the options available to people to regulate their use of natural resources at sustainable levels decline as well, further leading to **disparities within groups**.
- The other impacts of ecosystem changes **make the poor even more vulnerable** given their low resilience and backup options. Some of them include:
  - Increased **flooding** due to the erosion of soil and lack of trees
  - **Rising of the sea levels** due to the melting of the glaciers, caused by Global Warming
  - **Water shortage, food shortage**, pollution, rising temperatures, and the varied consequences of it.

## Conclusion

Earth's natural ecosystems are finding it **hard to cope with the different pressures** and are becoming unable to adjust. Continued depletion of resources and destruction of the environment would make them unfit for recovery. **Identifying and understanding the human- and naturally-induced stresses to ecosystems** at multiple spatial and temporal scales is thus crucial.

15. **Analyze the nature and extent of the Human-wildlife conflict in India. Why are current strategies not sufficient to address it? Can moving towards co-existence help mitigate Human-Wildlife conflict in India. Discuss.**

<b>Keywords</b>	Human-Wildlife conflict, Strategies, Conflict to Coexistence
<b>Introduction</b>	Brief about Human-Wildlife conflict
<b>Body</b>	Nature and Extent Reasons for Current approaches being insufficient. Moving from Conflict towards co-existence. Suggestions and Wayforward
<b>Conclusion</b>	Relevant conclusion

## Introduction

**Human-wildlife conflict** refers to the interaction between wild animals and people and the resultant **negative impact** on people or their resources or wild animals or their habitat. It occurs when growing human/animal populations **overlap** with established wildlife/human territory, creating a **reduction of resources** or life to some people and/or wild animals.

## Nature and Extent of Human-wildlife conflict



- The nature and extent of human-wildlife conflict have profoundly impacted humans, wild animals, and the environment in many ways such as :

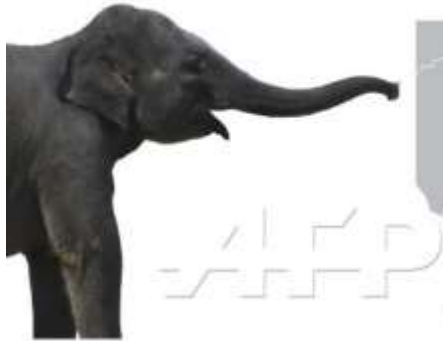
<b>Forms of Negative interaction</b> <ul style="list-style-type: none"><li>-Crop raiding and crop damage</li><li>-Habitat disturbance and destruction</li><li>-Livestock depredation</li><li>-Injury/ Killing of wildlife and humans</li><li>-Socio-economic impact</li></ul>	<ul style="list-style-type: none"><li>• <b>As a result,</b> local communities disliked wildlife inhabiting in and around their surroundings.</li><li>• This has a great <b>negative impact on the conservation</b> of wildlife.</li></ul>
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- **Development and Humanitarian issue:** As it affects the income of farmers, herders, and artisanal fishers particularly those with incomes **below the poverty line**.
  - It **indirectly impacts** people all over the world through the pressure it places on the **global supply chain** and production of agricultural goods, leading to food insecurity and decreased productivity among producers.
  - Human-wildlife coexistence is strongly linked and important to **sustainable development activities**.
- **The threat of extinction:** Human-wildlife conflict has driven the **decline** of once-abundant species and is pushing others to the brink of extinction.
- **Unregulated consumption** of wildlife animals: **COVID 19** is an example of such transmission of zoonotic diseases from wild to humans, living together.
- **Human-wildlife conflict on the rise** - As human populations and **demand for space continue to grow**, people and wildlife are increasingly interacting and **competing for resources**, which can lead to increased human-wildlife conflict.





## Human-animal conflict in India



### People killed by elephants

Year to end of March



### Elephants killed by humans

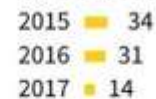
2014 - 2016

84



### People killed by tigers

Year to end of March



Another 13 people killed in just April and May 2017

### Tigers killed by humans

2014 - 2017

345

Source : WWF/Nat Geo/IUCN/World Animal Protection/India Ministry of Environment and Forests

© AFP

## Key Drivers and Pressures that lead to Human-Wildlife conflict

DRIVERS	PRESSURES	IMPACTS
<ul style="list-style-type: none"> <li>Human population dynamics.</li> <li>Human resource requirements.</li> <li>Land-use change.</li> <li>Extractive industries.</li> <li>Linear infrastructure.</li> <li>Perceptions of nature.</li> <li>Market forces.</li> <li>Policy effects.</li> <li>Wildlife population</li> </ul>	<ul style="list-style-type: none"> <li>Habitat loss, fragmentation.</li> <li>Disturbance of wildlife.</li> <li>Blocking of wildlife corridors.</li> <li>Extreme weather events.</li> <li>Natural calamities.</li> <li>Invasive species.</li> <li>Economic hardship.</li> <li>Attractants such as waste, human</li> </ul>	<ul style="list-style-type: none"> <li>Crop damage.</li> <li>Property damage.</li> <li>Livestock damage.</li> <li>Food and livelihood insecurity.</li> <li>Human loss of life and injuries.</li> <li>Decreased human wellbeing, health.</li> <li>Change in tolerance of</li> </ul>



dynamics. <ul style="list-style-type: none"><li>• Wildlife behavior.</li><li>• Climate change.</li></ul>	food, highly palatable crops, and livestock.	wildlife. <ul style="list-style-type: none"><li>• Non-lethal control of wildlife.</li><li>• Translocation of wildlife.</li><li>• Culling of wildlife.</li><li>• Retaliatory/defensive killing of wildlife.</li></ul>
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#### Current strategies for dealing with human-wildlife conflict are insufficient

- **Root cause not addressed:** Not addressing the root cause of the conflict which is often related to the **social dynamics**.
- **Conservation focus:** The focus on human-wildlife conflicts has often been a constraint to wildlife conservation, Strategies are **limited to reducing negative interactions**, rather than on increasing positive relations between humans and wildlife.
- **Reactive in Nature:** Efforts to manage conflicts have focused largely on **reactive measures** such as fencing, noise deterrents, and schemes to compensate people for their losses, to prevent and mitigate impacts.
- **Ignored by the policymakers:** Human-animal conflict, despite being strongly linked to the **Sustainable Development Goals (SDGs)**, continues to be overlooked by policymakers.
- **Lack of coordinated response:** There is also a lack of coordinated and adequate support from the many other **sectors** and organizations that are impacted despite the issue being so global.
- **Other reasons**
  - **The scale of the problem not addressed:** Current strategies and solutions don't match the scale of the problem. We need to have a **deeper understanding of land use** on a broader scale for management.
  - **Piecemeal approach:** Management measures are often implemented in a piecemeal manner.



## Moving towards Coexistence to mitigate Human-Wildlife conflict

- **Moving From Conflict To Coexistence:** The goal of Human-Wildlife conflict management should be to enhance the **safety of people and wildlife** and to create mutual **benefits of coexistence**.
  - **Coexistence is defined** as a **dynamic but sustainable** state in which humans and wildlife **co-adapt** to living in shared landscapes, where human interactions with wildlife are governed by effective institutions that ensure long-term wildlife population persistence, social legitimacy, and tolerable levels of risk.
  - Coexistence is helping people share the landscape with wildlife and using **innovative tools** to reduce the conflicts that often occur with wildlife in their natural habitats.
- **A Future For All Report 2021** report jointly published by World Wide Fund for Nature (WWF) and United Nations Environment Programme (UNEP) was titled: **A future for all - the need for human-wildlife co-existence**.
  - The report suggests an **approach of coexistence** between humans and wildlife, and **involvement of local communities**, as it is not possible to wholly suppress human-wildlife conflict.
  - **Successful example – Kavango Zambezi Transfrontier Conservation Area in Southern Africa**; the local communities installed fixed and mobile lion-proof corrals for night-time protection in risk-prone areas, which led to a 95% reduction in livestock killings in 2016, and there were zero retaliatory killings of lions in 2016 (compared to 17 killed in 2012 and 2013).

## Suggestions and Way forward

- **Community Participation:** The full participation of local communities can help reduce HWC and lead to coexistence between humans and wildlife.
  - Periodic **awareness campaigns to sensitize** guide and advise the general public on man-animal conflict, including dissemination of information through various forms of media.
  - It is necessary to include **positive interactions, coexistence, and attitudes of tolerance** toward wildlife.
- **Skill-development programs** for people living in and around the forest would offer them better opportunities for **self-employment** and consequently reduce the combined pressures on agricultural land as well as forest land.
- **Specific targets on coexistence** must be key elements within the **Global Biodiversity Framework** of the CBD.
  - **Global leaders** such as those at the CoP work hand-in-hand with **local communities** and other stakeholders across Asia and the world to secure a future in which Wildlife and people live in harmony.



- **Implementing Wildlife Institute of India Guidelines “Eco-Friendly Measures to Mitigate Impacts of linear infrastructure on Wildlife”**
  - These guidelines suggest **modification** in the designs of the linear infrastructures by way of providing an **eco-friendly structure** that will ensure the safe movement of wildlife across these linear infrastructures.

**Best Practice/Model - Sonitpur model of Assam for reducing Human-Elephant conflict**

Model	Impact
<ul style="list-style-type: none"><li>• WWF India had developed the ‘<b>Sonitpur Model</b>’ during 2003-2004</li><li>• In this, <b>community members</b> were connected with the state forest department.</li><li>• They were given <b>training</b> on how to work with them to drive elephants away from crop fields safely.</li></ul>	<ul style="list-style-type: none"><li>• <b>Crop losses dropped</b> to zero for four years running.</li><li>• Human and elephant <b>deaths also reduced</b> significantly.</li><li>• WWF India had developed a low-cost, single-strand, non-lethal electric fence to ease the guarding of crops from elephants.</li></ul>

**Conclusion**

**Human-wildlife conflict** will always exist as our world becomes increasingly crowded; however, effective, **well-planned management and holistic and integrated** approaches can reduce and minimize conflict in the long term.

We must **reassess the relationship** especially the direct interactions between people and wildlife to **improve our coexistence in the future**.

**Additional Information: Overview of Approaches to address Human-Wildlife conflict**



Wildlife	Habitat and separation	People, livestock, and property	
<b>Lethal</b> <ul style="list-style-type: none"><li>Physical (e.g., traps, shooting)</li><li>Chemical and biological (e.g., pesticides, biocontrol)</li><li>Selective (e.g., problem animal control) or unselective (e.g., general population control)</li><li>Regulated or unregulated</li></ul>	<b>Habitat manipulation</b> <ul style="list-style-type: none"><li>Habitat modification</li><li>Buffer crops</li><li>Alternative food sources</li></ul> <b>Separation</b> <ul style="list-style-type: none"><li>Zoning</li><li>Barriers: constructed (fences, walls, enclosures, nets)</li><li>Barriers: natural (other animals, landscape features)</li><li>Other forms of exclusion</li></ul>	<b>Human: economic</b> <ul style="list-style-type: none"><li>Compensation, insurance, performance payments</li><li>Alternative income</li><li>Increase benefits of wildlife (hunting, tourism)</li><li>Other financial incentives (e.g., loans)</li></ul> <b>Human: governance</b> <ul style="list-style-type: none"><li>Laws and policies (e.g., endangered species protection, hunting laws)</li><li>Institutions (e.g., staffing agencies)</li><li>Collaboration, participation, stakeholder engagement</li><li>Planning and evaluation</li></ul>	<b>Livestock and cultivation</b> <ul style="list-style-type: none"><li>Protection</li><li>Guarding (people, animals, physical devices like collars)</li><li>Improved management and husbandry (location, carcass disposal, etc.)</li><li>Modify crops, cropping cycles</li><li>Immunization</li></ul> <b>Human: other</b> <ul style="list-style-type: none"><li>Relocation of people</li><li>Education, information, communication, training</li><li>Verification and response</li><li>Modify behavior (e.g., driving, recreation)</li><li>Social and psychological interventions</li><li>Technology (e.g., modify gear)</li><li>Personal protection</li><li>Research and specialist networks</li></ul>
<b>Nonlethal</b> <ul style="list-style-type: none"><li>Capture and translocation or removal (in situ or ex situ)</li><li>Monitoring</li><li>Restraints</li><li>Deterrents and aversion (chemical, biological, lights, noise, harassing, vehicles, scarecrows, fladry)</li><li>Diversions feeding</li><li>Fertility control</li><li>Prey management</li><li>Disease management</li></ul>			

16. Describing the concept of Integrated Watershed Management, discuss the role of technologies and local communities for the management of watersheds in India.

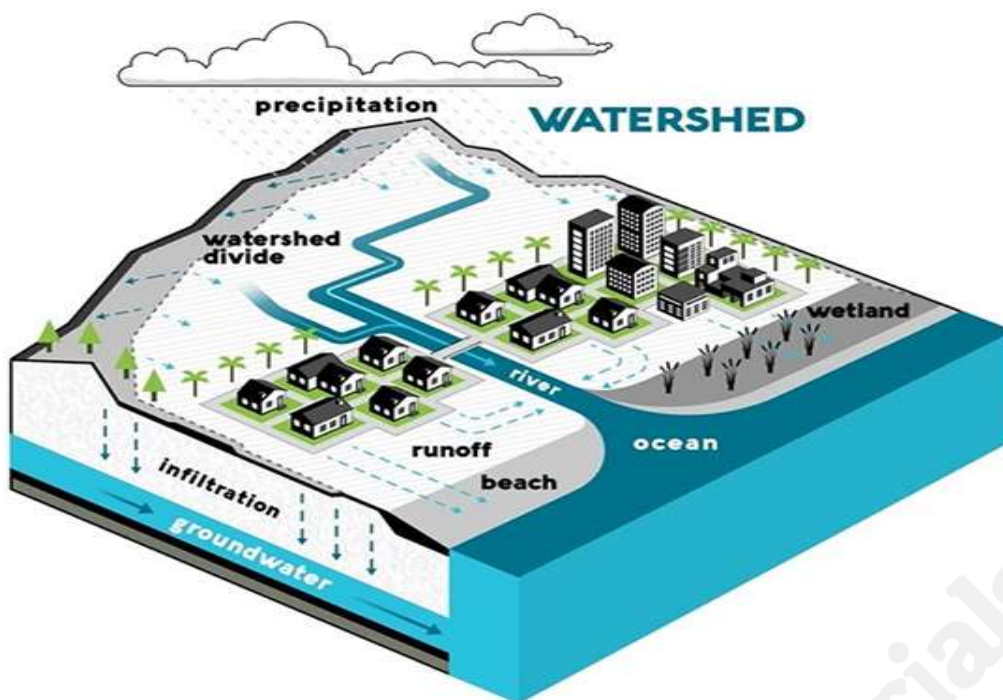
<b>Keywords</b>	Integrated Watershed Management, Role of technologies and communities
<b>Introduction</b>	Give a brief introduction to IWM
<b>Body</b>	Briefly enumerate the benefits of IWM and then discuss the role of technologies and also of local communities in IWM. Give examples for each
<b>Conclusion</b>	Conclude with a relevant suggestion

**Introduction:**

A watershed is an area of land that drains water into a specific waterbody. **Integrated Watershed Management (IWM)** is a process that promotes the **coordinated development and management of water, land, and related resources**, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

In India, it is being implemented by the **Department of Land Resources of the Ministry of Rural Development**. A successful IWM not only requires community involvement but also the use of the latest technology such as GIS, Big Data, Drones, etc.





### Body:

IWM is a general concept developed to improve the management of water resources based on four key principles adopted at the **1992 Dublin and Rio statements Conference on Water**. **Watershed management** could be considered as part (or as a tool) directed to achieve IWM

#### The benefit of IWMP:

- + **Conserve soil, rainwater:** As per **NITI Aayog's Composite Water Management Index (CWMI) report**, India is facing the worst water crisis and by 2030 demand for water may outstrip the supply.
  - So IWM aims to harness the **surplus water** in a watershed in addition to **groundwater recharge**.
- + **Sustainable farming practices and stable crop yield:** About **52% of the net sown** area is still rain-fed and is **3 times less productive**, compared to irrigated areas. Also, India is a **net water exporting country** due to the export of water-intensive crops such as Basmati rice.
  - So, IWM through suitable cropping and crop management systems aims to improve farmers' crop yield.
- + **Restore non-arable areas:** About 30% of India's land is degraded
  - IWM aims to restore land through horticulture, afforestation, agroforestry, and pasture land development based on the capability of the land.
- + **Enhance the income of the local communities:** Resource dependent communities esp. the tribal, are often vulnerable to the vagaries of climate
  - IWM aims to **stabilize the income of communities** and mitigate the risk due to aberrant weather situations.



- + **Optimal utilization of irrigation potential:** there exists a wide gap between **irrigation potential utilized and the irrigation potential available** due to non-maintenance of canal system, no participatory management, changing land use pattern, etc.
  - Therefore, IWM aims for **Integrated Watershed Management Practices**. It also aims to increase cropping intensity and land equivalent ratio through sequence cropping and intercropping.
- + **Economic Health:** A well-managed watershed produces energy and supplies water for agriculture, industry, and households. Wetlands and Forests help to prevent or reduce costly climate change and flooding impacts, contribute to tourism, manage drought, fisheries, agriculture, forestry, and mining industries.
- + **Sustainability of surface and groundwater resources:** Over-exploitation of groundwater has led to cropping up of '**Dark-zone**' in any part of India, with severe stress to groundwater reserves. Also, the over-use of surface water has led to an increase in waterlogging and soil salinity.
  - WM aims for harvesting surplus water, groundwater recharge, and maximum retention of surface water. It also aims to benefit the **man-animal-plant-land-water complex** in the watershed.

### Role of Technology and local communities in IWM in India:

#### Role of Technology:

- + **Remote sensing**
  - Remote sensing (RS) technology utilizes electromagnetic radiation reflected or emitted from Earth's surface to derive information and images about Earth's land and water surfaces.
  - This accurate and real-time data source provides a means of **surveying, identifying, classifying, and monitoring** various components within a watershed, such as land use/cover, physiography, soil distribution, and drainage characteristics
- + **Geographic information systems**
  - Used to assess watershed conditions through modeling impacts of human activities, as well as to visualize the impacts of alternative management scenarios.
  - As well, GIS enables the watershed to be subdivided into more discrete units vertically and horizontally, which enhances the IWM plans
- + **Global positioning system**
  - The Global Positioning System (GPS) is a freely accessible space-based global-navigational system that provides users with their precise location and time for almost anywhere on Earth
  - GPS can be used to **track the exact location of gauges, monitoring devices, study plots, etc.**



- **GPS combined with radio-tracking** has proved invaluable for tracking the movement of animals, birds, and fish within watersheds, enabling detailed studies to be made of where and when particular habitats are being used.



#### **Big data**

- Big data is a popular term used to describe the exponential growth and availability of data, both structured and unstructured.
- Big data is beneficial as it can dramatically reduce the cost and time dedicated to computing tasks related to surveying and interpreting digital maps created out of **SWAMITVA** and other landscape digitization projects.



#### **Multi-level social-ecological system analysis:**

- This includes system dynamic modeling, watershed simulation modeling, watershed decision-making systems, and stakeholder analysis modeling.
- **In Watershed mapping** for all India planning to include all the watersheds as each one affects the other. E.g. **All India Soil and Land Use Survey Organisation** has released a Micro watershed Atlas of India in 2019.

### **Role of Communities:**



**Awareness generation:** through farmer producer organization, Kishan Mitra, KVKs, taking help of SHGs, NGOs, and CSOs working for watershed management.



#### **Formation of user groups and water user associations:**

- For E.g. **Andhra Pradesh Farmer Managed Groundwater Systems (APFAMGS)** have the mechanism of Joint Management of Aquifers, Self-Regulation of groundwater extraction, and Induce behavioral change for the sustainable use of water.
- E.g. **Naigaon and Jalgaon** watershed management project where the community participation with “**Pani Panchayats**” created a sense of ownership among the people



**Conducting Participatory Rural/Urban Appraisal (PRA):** It brings out the **current resources utilization map** for the community and proposes immediate and long-term solutions to the existing problems.

- E.g. In the outskirts of Bangalore, communities helped prepare **multiple watersheds (micro-watersheds)** based on its use pattern, with an appropriate plan of action initiated for each- e.g. preventing buildings coming upon water bodies, setting up small individual treatment plants in each watershed to address pollution, creating rain gardens, etc.



**Capacity development of user groups and watershed management committees:** E.g. In Madurai, as a part of the capacity building program, **faculty members from Agricultural College and Research Institute** conducted workshops for user groups and women self-help groups in community-driven watershed management



**Provide technical assistance as per need:** Technical assistance in de-silting of river beds and water bodies, creating boulder checks to control water flow, and recharging aquifers,



renovation of **Ooranis or Johads**, construction of farm ponds, Conservation agriculture- Artificial and Natural Mulching, Zero Tillage, Micro-irrigation (MI) systems (sprinkler, drip), etc.

- + **Mobilization of community contribution:** through users' charges or membership fees, Rationalization of water tariffs, etc.
  - **E.g. Palampur model(HP) (Payment for ecosystem services)** of financing can be used wherein the city pays for the clean water and environment to the village communities upstream
  - **Haryali** is a watershed development project which aims at enabling the rural population to conserve water for drinking, irrigation, fisheries, and afforestation. It is being **executed by Panchayat** with the help of people's participation
- + **Monitoring mechanism through Gram Sabhas, Ward committees, Social Audits:** It will help keep track of the proposed output and corrective actions to be taken through participatory dialogues.
- + **Conflict resolution and follow-up:** through consensus or voting. They should be perceived as responsive, transparent, and fair in functioning.
- + **The inclusion, empowerment, and mainstreaming of women, the poor, and vulnerable groups in the decision-making processes:** This will not only increase their income but also enhance the social capital of the community.
- + **Networking and linking the Water user's group with local developmental agencies** (civil society, government, private agencies) is vital for value addition as well as for continued accessing of additional resources in the post-project period.
  - E.g. **Sujala** (for Karnataka Watershed Development) and **Gramya** (Uttarakhand watershed development) projects with help of NGOs, CBOs.

#### Conclusion:

The World Bank's Integrated watershed management projects in Himachal Pradesh and Uttarakhand (in higher elevation); Karnataka (in arid zones and rain-fed lowlands) combined **participatory micro-watershed planning** for soil and water conservation with broader livelihood support programs. This **Consortium based approach** has been successful in reviving water storage in catchment areas and well as enhancing income for the communities. E.g. Ralegan Siddhi (MH, through the efforts of Anna Hazare); Alwar (RJ, through the efforts of Rajendra Singh).

17. What do you mean by India Plastic Pact? Explain its need, significance, and challenges in the transition towards a circular economy for plastics in India.

What to look for?	India Plastic Pact, need, significance, challenges
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<b>Introduction</b>	A brief on the Pact
<b>Body</b>	Need, significance, and challenges of the pact in the transition towards a circular economy for plastics in India
<b>Conclusion</b>	A relevant closing statement

### Introduction

The India Plastics Pact is an ambitious, collaborative initiative that aims to bring together businesses, governments, and NGOs to reduce, reuse, and recycle plastics in their value chain

### Body

- The Pact aims to transform the current linear plastics system into a circular plastics economy that will:



- The India Plastics Pact aims to promote public-private collaborations that enable solutions to eliminate the plastic waste problem in India and bring innovation to the way plastic is designed, used, and reused
- India aims to enable businesses to transition towards a circular economy for plastics by 2030

### India Plastics Pact: The major targets

- It wishes to define a list of unnecessary plastic packaging and the items for which measures can be taken to address them through redesigning and innovation
- India targets to reuse plastic packaging on a 100% scale
- At Least 50% plastic packaging to be effectively recycled
- 25% average recycled content across all plastic packaging must be present

### Need for Plastic Pact





- Around 43% of all plastics produced in the country are used for packaging. The maximum part of this amount is single-use plastic. This proves hazardous as it cannot be recycled and is a direct source of pollutants to the environment.
  - Hence, to eliminate unnecessary and problematic plastic packaging through redesign and innovation
- Ensure all plastic packaging is reusable or recyclable
- India annually generates 9.47 million tonnes of plastic waste. Out of this total, almost 40 percent goes uncollected
  - Hence, to Increase the reuse, collection, and recycling of plastic packaging
- Increase recycled content in plastic packaging

### Significance of Pact, in the transition towards a circular economy for plastics in India

- In the Indian context, the Pact will provide **multi-pronged, systemic, and large-scale solutions**, to create a visible impact while **fostering innovation, collaboration, and healthy competition by**:
  - **Promoting Direct investment to recycling infrastructure**: to cater to increased demand for recycled content created by members of the Pact
  - **Providing guidance and support to businesses**: to design packaging and to be more recyclable or reusable, create demand for recycled content in packaging and products, and take action on problematic plastic items through redesign and innovation
  - **Demonstrating regional leadership**: as Indian pact is the first Asian Pact, and hence it can further catalyze action in the region
  - **Creating jobs in the waste management sector** (both formal and informal): increase in segregation, collection, and cleaning of plastics along with increased demand for recycled content will generate employment opportunities
  - **Reduce environmental impacts**: increased recycling and reuse can reduce plastics leakage into the natural environment
  - **Leading to carbon savings**: reduction in virgin plastics and increased recycling delivers significant carbon savings
  - **Engaging citizens**: to coordinate and galvanize action to encourage more sustainable lifestyle choices and implement better waste management practices

### Challenges in the transition towards a circular economy for plastics in India

- Segregation of waste at source and segregated collection, especially in rural areas, is non-existent
- Unorganized, informal mechanical recycling, with leakages and emissions
- Mixed input streams and 'pure' recyclate types of plastic have large variations in additives
- Chemical recycling requires large investments



- Occupational and health safety hazards linked with waste collection (for women and children in particular) and in recycling, such as the release of dioxins linked to cancer and reproductive problems
- Lack of strict enforcement of waste collection and disposal
- Open dumping and clogging of drains with plastic waste is still prevalent
- Lack of investment and funding to set up proper waste management infrastructure including operational costs of transporting waste for reprocessing
- Lack of market-based instruments and regulatory measures for effective functioning of business models
- Economically challenging to set up standard prices of plastic waste as raw material and market for recycled products
- Most plastics are reprocessed only once as plastic resins degrade in quality every time it is re-heated
- Lack of cooperation between stakeholders across the plastics value chain

## Conclusion

Thus, the pact offers great potential in way of reducing the Environmental impact of Plastics in India. Hence, the need for legislative, regulatory, and citizen level reforms in order to move towards more sustainable living in India

18. The mountain ecosystems of the Hindu Kush Himalayas need an integrated and transboundary ecosystem approach at the landscape scale for conservation and sustainable development. Explain.

<b>Keywords</b>	Hindu Kush Himalayas, Integrated transboundary ecosystem, landscape-scale, sustainable development
<b>Introduction</b>	Give a brief introduction to Hindu Kush Himalayas
<b>Body</b>	Enumerate the importance of the region and then list down the need for a landscape approach with examples
<b>Conclusion</b>	Conclude with a balanced view

## Introduction:

**The Hindu Kush Himalayas (HKH) region** is the source of **ten major river systems** and includes **four global biodiversity hotspots**. The rich biodiversity and diverse ecosystems services play a critical role in sustaining the wellbeing of the **240 million people of the region (India, Nepal, Bhutan, Pakistan, China, and Myanmar)**. Thus its conservation requires an integrated approach at Landscape-level.







**E.g. Kangchenjunga Landscape** (shared by Bhutan, India, and Nepal), has 19 protected areas, 17 in India (e.g. Khangchendzonga National park, Buxa national park) and one each in Bhutan (Jigme Khesar Strict Nature Reserve) and Nepal.

**Body:**



**The diverse ecosystem of HKH provide services with four values:**

-  **Social**—for public benefit- E.g. the community living around Koshi Tappu, a Ramsar site in Nepal, indicated 85% dependency on various ecosystem services provided by wetland
-  **Cultural**—for aesthetic and communal significance- e.g. Sacred groves and forest streams, holy mountain peaks, traditional agroforestry systems, and sacred lakes
-  **Ecological**—for environmental conservation and sustainability- e.g. the ecosystem of the HKH includes **Mount Everest** and is the highest biome in the world, unmatched by any other mountain system.
-  **Economic**—for livelihoods through the production of goods and services- E.g. The forested ecosystem contributes 80% of household income through provisioning services in some places

However, these services are poised for major changes in the current scenario of threats, chiefly as a result of climate change; local, regional, and global market forces; and the socio-political environment prevalent in individual countries. **IPCC reports** say, **64% of glaciers** in the Hindu Kush



Himalayan region may be lost by 2100, thereby threatening not only flora and fauna but also the lives of billions of people. There it needs cross country approach for Conservation and sustainable development.

**Need for integrated and transboundary ecosystem approach at the landscape scale for conservation and sustainable development:**

- + **To better monitor and model cryosphere change and to assess spatial patterns and trends:** Researchers urgently need expanded observation networks and **data-sharing agreements** across the extended HKH region.
  - This should include **in-situ and detailed remote sensing observations** on selected glaciers, rapid access to high-resolution satellite imagery, etc
- + **For monitoring and Assessment:** E.g. Kathmandu-based **International Centre for Integrated Mountain Development's (ICIMOD)** releases "Hindu Kush Himalaya Assessment" about various climatic projections and the need to mitigate them.
  - **Indian Scientists** developed a **common framework for Climate Change Vulnerability Assessment** for the Indian Himalayan Region. This could be further extended to neighboring countries
- + **For Protected Area Management:** E.g. Manas National Park (India) is contiguous with the Royal Manas National Park in Bhutan and therefore need an integrated approach for the conservation of Rhinoceros and stopping poaching
- + **For species conservation:** E.g.
  - The red panda is the flagship species in the temperate forest, confined to three global biodiversity hotspots—Himalaya, Indo-Burma, and the mountains of southwest China
  - **Living Himalayas Initiative (LHI)** is established as one of WWF's global initiatives to bring about transformational conservation impact across the three Eastern Himalayan countries of Bhutan, India (North-East), and Nepal.
  - **Global Snow Leopard and Ecosystem Protection (GSLEP) Programme:** The GSLEP is a high-level inter-governmental alliance of all the 12 snow leopard range countries in the HKH region
  - This would help achieve **Goal 14 (life on Land)** of SDG 2030
- + **For Disaster mitigation and Rescue and Relief:** e.g. 2005 Earthquake (Kashmir) and 2015 earthquake (Nepal) affected the Indian region as well and the HKH landscape thus requires an integrated humanitarian approach
  - Improved understanding of cryospheric change and its drivers will help reduce the risk of **high-mountain hazards**
- + **For the preservation of Traditional Knowledge:** E.g. The grazing and other resource management practices regulated through Dzumsa in North Sikkim, and in the northern part of Humla District, Nepal, in the Kailash Sacred Landscape



- ✚ **For cross-learning and capacity building from best practices:**
  - E.g. India can learn from Social forestry (Bangladesh), Community-based natural resource management (Nepal), etc.
  - **Grain-for-Green policy**, the largest land reforestation/afforestation program in China, was launched in 1999 to mitigate land degradation by returning steeply sloping cultivated land to forest or grassland
  - The Far-Eastern Himalaya landscape - Conservation and development in biodiversity hotspots- Arunachal Pradesh in India, Kachin State in Myanmar, and Yunnan in China
- ✚ **For cooperation at international level:** E.g. at UN, Climate change talk, and biodiversity targets
- ✚ **National and Global Investment—Securing Future of Biodiversity and Ecosystem Services in the HKH region:** There is a need for more investment in the HKH region from donors, governments, and the private sector to ensure the sustainability of the assets while pursuing the larger goals of poverty alleviation, economic development, and overall human wellbeing.

### Conclusion:

The mountain ecosystem of HKH is diverse with **four out of 36 global biodiversity hotspots** in the region. But despite the potential, lack of coordination and border disputes have constrained any real regional cooperation in the region. In this respect, SAARC, SCO, and other mechanisms must be explored for greater cooperation at the landscape level and to meet the SDG 2030 for shared prosperity.

Further, there needs to be **large-scale studies and research** to enhance knowledge and information about the four values that biodiversity and ecosystem services provide for informed decision-making.

- 19. No stone should be left unturned in the safe handling and disposal of Bio-medical waste to ensure that it does not snowball into the next crisis. Elucidate.**

<b>Keywords</b>	Bio-medical waste, safe handling, and disposal, Next crisis
<b>Introduction</b>	Give a brief introduction to the status of Biomedical waste in India esp. after the COVID19 crisis
<b>Body</b>	Enumerate the risks related to Bio-medical waste and what is being done to mitigate it.
<b>Conclusion</b>	Conclude with a relevant suggestion





### Introduction:

The **Bio-medical Waste (Management and Handling) Rules 2016** defines Biomedical waste (BMW) as “human and animal anatomical waste, treatment apparatus like needles, syringes and other materials used in health care facilities in the process of treatment and research”. Improper disposal of BMW has revealed the dark side of the Health care industry. In view of the Covid-19 pandemic, the National Green Tribunal (NGT), last year, directed all States and Union Territories to take adequate steps to mitigate risks in the disposal of bio-medical waste to prevent it from contaminating our ecosystem.

### Body:

According to a report filed by the **Central Pollution Control Board (CPCB)**, India generates about **126 MT/day of COVID-19** related bio-medical waste in addition to the regular bio-medical waste generation of about 609 MT per day. This may overwhelm the country's **198 common biomedical waste treatment and disposal facilities**. On top of it, Under-reporting, poor segregation, and lack of awareness ail India's COVID-19 Bio-medical waste management.

### Bio-medical waste if not treated could snowball into the next crises:

- ✚ **Groundwater contamination:** E.g. Certain types of biomedical pollutants are known to be **bio-active** even at low concentrations and can be non-degradable in the environment
- ✚ **Radioactivity contamination:** The use of **85 Kr and 133 Xe** is the principal source of gaseous radioactive waste in hospitals. When bio-medical wastes are mishandled, radioactive elements can enter landfills and other areas. Exposure to radioactive elements can lead to serious diseases.
- ✚ **Marine Ecosystem contamination:**
  - Discharge of biomedical poisons into the sea waters could mix into the food chain and eventually reach humans who consume sea creatures.
- ✚ **Single-use plastics:** According to a study, **85%** of disposable plastic materials make up all medical equipment. This volume of single-use plastics can catalyze the compounding health detriments caused by **macro and micro-plastics**.
- ✚ **Landfills:**
  - Biomedical pollutants containing high contents of heavy metals such as lead and silver have the potential to cause adverse **neurotoxic and nephrotoxic effects in the human body and livestock**.
  - **Post incineration, toxic ash residue** is often disposed of at landfills. These landfills are not protected by any barrier and the residue has the potential of reaching underground water that is often exposed to human use.
- ✚ **Air pollutants**



- Incinerated materials containing **chlorine can generate dioxins and furans**, which are human carcinogens and have been associated with a range of adverse health effects.



#### **Hazards to animals and birds**

- Animals and birds come after **scents or colors** and directly or indirectly consume BMW. Plastic waste can **choke animals**, which scavenge on open dumps.
- Heavy metals can even affect the **reproductive health** of the animals
- Change in **microbial ecology**, the spread of antibiotic resistance.

**Key features of Bio-medical Waste Management Rules 2016 (amended in 2018):** In order to mitigate the impact of BMW and allow for its safe disposal.



**Pre-treatment of waste:** Waste generated in laboratories, microbiological waste, blood samples, and blood bags to be pre-treated through disinfection or sterilization on-site in the manner as prescribed by WHO.



**Phasing out** of the use of chlorinated plastic bags, gloves, and blood bags.



**Better segregation:** Bio-medical waste has been classified into **4 categories**:

- Untreated human anatomical waste
- Animal anatomical waste
- Soiled waste
- Biotechnology waste



**Storage of waste:** Provision within the premises for a safe, ventilated, and secured location for storage of segregated biomedical waste.



**Training and Immunization:** Regular training to all its health care workers and immunizing all health workers.



**Transportation and handling:** Ensure that the bio-medical waste collected from the occupier is transported, handled, stored, treated, and disposed of without any adverse effect on human health and the environment.



**The procedure of Disposal:** The biomedical waste must be segregated in colored bags (**Yellow, Red, White, and Blue**) according to the category of the waste.

**Some of the scientific ways to safely dispose of biomedical wastes are:**



**Incineration:** It effectively removes the waste entirely, and safely removes any microorganisms. However, when burning hazardous materials, emissions can be particularly dangerous.



**Autoclaving:** Autoclaving introduces very hot steam for a determined amount of time. At the end of the process, **microorganisms have been completely destroyed**. This process is particularly effective because it costs much less than other methods, and doesn't present any personal health risks.



- Around **90% of materials are sanitized this way** before being sent on to a landfill.
- + **Microwaving:** During this process, waste is shredded, mixed with water, and then internally heated to kill microorganisms and other harmful elements. Microwaving **lowers the volume** of biomedical waste and it is reportedly **more energy efficient** to use this method than to incinerate.
- + **Biological processes:** Biological enzymes are used for treating medical waste.
  - Biological reactions decontaminate the waste and cause the destruction of all the organic constituents so that only plastics, glass, and other inert will remain in the residues.
  - **Bio-converter:** - It uses a solution of the enzyme to decontaminate medical waste, and the solid waste is sent to a landfill.
  - Another method of environmental BMW disposal is the use of **biodegradable plastics in medical devices**.

#### Way Forward:

- + CPCB to work out a **national bar-coding system** (a portal) for tracking biomedical waste.
- + Kerala is one of the few states that has been **bar-coding its waste bags** and this has been a major part of its response to the pandemic
- + **Deep burial systems:** Where waste is not going to incinerators, **deep burial systems** should be properly maintained as protocols taking all due precautions to prevent harm to the environment.
  - A deep burial system involves burying biomedical waste in **2-meter-deep ditches and covering them with a layer of lime and soil**.
- + **Awareness Campaign:** Initiatives like conducting an appropriate program on Doordarshan, All India Radio, and other media platforms to create mass awareness about the correct disposal of biomedical waste.
- + **Creating Infrastructure:** The government should set up recycling plants **across the country** (as envisaged under the **Smart cities project**) under the **Public-Private Partnership (PPP) Model**
- + **Innovation:** Incentivize **start-ups and Small and Medium Enterprises (SMEs)** offering solutions for waste segregation and treatment.

#### Conclusion:

It is our fundamental right to live in a **clean and safe environment**. Effective disposal of BMW should be shared teamwork with committed government backing, good BMW practices followed by continuous monitoring, and strong legislature. The pillar of BMW mitigation is the segregation of waste at the Source. This will help us guarantee a cleaner and greener environment.



- ✚ Ensure all waste generators and processors are **registered** on COVID-19
- ✚ **Limit the use of PPE kits** and other single-use paraphernalia only to frontline workers. Promote the use of reusable/cloth masks among the general public
- ✚ Use washable utensils in quarantine camps/ homes to minimize waste
- ✚ **Plug the gaps** in the guidelines by regularly updating them
- ✚ The Central Pollution Control Board (CPCB) should provide data that are segregated according to generation sources, waste types, and treatment facilities. Doing this will help strategize for any outbreaks or pandemic waves
- ✚ CPCB should also reflect on the rural scenario in terms of quantum of generation and the general practices followed to dispose of the COVID-19 biomedical waste
- ✚ Ensure that vaccination camps outside hospitals segregate the waste properly
- ✚ As per Bio-Medical Waste Management Rules, 2016, bar-code the bags used for collecting biomedical waste for tracking the source of the waste once it reaches the treatment facility.

20. In view of the recently concluded Kunming Declaration for Biodiversity and the failure of the world to achieve any of the Aichi targets, discuss the need for a new Global Biodiversity pact to slow biodiversity loss and protect habitats.

<b>Keyword/s</b>	Kunming Declaration for Biodiversity; Aichi targets; Global Biodiversity pact
<b>Introduction</b>	Bring out the importance of addressing biodiversity loss and protecting habitats.
<b>Body</b>	A brief note on Kunming Declaration; Assessment on the implementation of Aichi targets; Need for a new Global Biodiversity pact and the features it should entail.
<b>Conclusion</b>	Conclude with a few suggestions

### Introduction

**Biodiversity** (the variety of all living things on our planet) has been **declining at an alarming rate** in recent years, mainly due to human activities. Since living organisms interact in **dynamic ecosystems**, the disappearance of one species can have a far-reaching impact on the food chain at a global level.

Biodiversity loss is hence a **serious threat to the planet's survival**. Failing on the earlier targets, the world has reached a point where it is **now or never to work on biodiversity conservation**.



## Body

### Kunming Declaration:

- **Pledge:**
  - It came as part of the 15th meeting of the Conference of Parties to the **UN Convention on Biological Diversity (UN CBD)** held in Kunming, China.
  - More than 100 countries have pledged to **make the protection of habitats an integral part of their respective government's policies.**
  - The declaration suggests **increased funding for conservation in poorer countries**, as well as vowing to create more sustainable and **environment-friendly supply chains.**
- **Key objectives:**
  - With the theme **“Ecological Civilization: Building a Shared Future for All Life on Earth,”** the Declaration calls for “urgent and integrated action” to reflect **biodiversity considerations in all sectors of the global economy.**
  - It aims to **reverse the current loss of biodiversity** and ensure that biodiversity is put on a **path to recovery by 2030.**
  - It will also help in capacity building action plan for the **Cartagena Protocol on biosafety.**
- **Framework:**
  - The countries have committed to ensuring the development, adoption, and implementation of an effective **post-2020 global biodiversity framework.**
  - Being in line with the UN CBD, the framework will have **appropriate mechanisms for monitoring, reporting and reviewing,** and the necessary means of implementation.
  - It will set **21 targets and 10 milestones** for governments to meet by the end of the decade.

### Failure to achieve the Aichi biodiversity targets:

- Though six targets have been partially achieved by 2020 (the deadline agreed), **none of the targets have been fully achieved** because their format makes progress hard to measure.
- A target to halve the **loss of natural habitats**, including forests, has not been met.
- While **global deforestation rates** have decreased by about a third in the past 5 years compared with pre-2010 levels, degradation still remains high.
- **Wetlands** have continued to disappear and **freshwater ecosystems** remain critically threatened.

### Need for a new Global Biodiversity pact:

The adoption of the Kunming declaration will create momentum for a new global biodiversity pact.

- **To balance the failure on earlier targets:**





- The world **failed to fully meet any of the 20 Aichi biodiversity targets**. Global environmental governance is now facing "unprecedented challenges" as the **rate of global species extinction accelerates**.
- Given this, the global community must **invest much more and raise the scale and speed of its pledges** to protect nature and prevent species loss.
- **To avert the Increasing rate of biodiversity loss:**
  - **Plant and animal species are disappearing** at a rate not seen on earth for 10 million years.
    - There is an **average 68% fall in more than 20,000 populations** of mammals, birds, amphibians, reptiles, and fish **since 1970**.
  - In the absence of an effective global framework, populations will continue to fall, driving wildlife to **extinction and threatening the integrity of the ecosystems**.
- **To course-correct things:**
  - Currently, most countries are **spending more funds subsidizing activities that destroy biodiversity** (E.g., government subsidies for agriculture, fossil fuels, and fishing).
  - Changing the way the world **produces food, creates energy, manages the oceans, and uses materials** is essential.
  - A well-implemented global pact on biodiversity conservation can thus **halt and even reverse habitat loss** and deforestation.
- **To take forward the lessons from the pandemic:**
  - The Covid-19 pandemic, which showed **nature and humans are intertwined**, has injected **new urgency into biodiversity protection**.
    - But this understanding is not yet reflected in the "business-as-usual" post-COVID-19 stimulus measures; this needs regulation.
  - **Repairing the dysfunctional relationship with nature** is part of the efforts to mitigate biodiversity loss and **curtail future outbreaks of infectious diseases**.
- **To give biodiversity conservation its due importance:**
  - Biodiversity loss is one of the most **complex and multi-faceted problems** facing humanity to which **preservation of declining species and natural habitats** is crucial.
  - A global pact will make states realize and work in such a way that **issues related to nature are kept at the heart of all global issues**.

#### Essential features that the global biodiversity pact should have:

- **Avoid duplication** and enhance **complementarity with existing frameworks**, in particular the 2030 Agenda for Sustainable Development.
  - **It should reflect the objectives of the Convention on Biological Diversity** as well as the three components of biodiversity (species, ecosystems, and genes).
- Action targets must be **underpinned by the theory of change** reflecting a clear line-of-sight from now until the attainment of the Vision.



- It should have **focused, concrete, and measurable Action Targets**, so that their implementation and impacts can be monitored and assessed.
- Importantly, it should **embrace all voices** - those of **indigenous people and local communities**, regional and city governments, the private sector, NGOs, women, youth, and the society at large.

### Conclusion

Certainly, the **world cannot afford another lost decade**; protecting biodiversity is a crucial factor for the planet's survival. The rapid pace of biodiversity loss now calls for a **change in the perspective in dealing with nature**, with a **whole-of-society and whole-of-government approach**.



### Additional information

**First Draft of The Post-2020 Global Biodiversity Framework** proposes 21 targets for 2030 including the following:

- At least 30% of the land and seas should be conserved through effective, equitably managed measures
- There should be a 50% or greater reduction in the rate of introduction of invasive alien species, with controls to eliminate or reduce their impacts
- Nutrients lost to the environment should be cut by at least half
- Pesticide use should be reduced by at least two thirds
- The discharge of plastic waste should be eliminated
- Nature's contribution to global efforts to cut GHGs should be increased
- Incentives harmful to biodiversity should be redirected or eliminated by at least \$50b a year
- Funding for the conservation of nature should be increased to at least \$200b a year

### Aichi Targets

	Understand values		Reduce pollution		Enhance resilience
	Mainstream biodiversity		Reduce invasive spp.		Implement Nagoya Prot.
	Address incentives		Minimize reef loss		Revise NBSAPs
	Sustainable production		Protected areas		Respect and conserve TK
	Halve rate of loss		Prevent extinctions		Improve knowledge
	Sustainable fisheries		Conserve gene pool		Mobilize resources
	Manage within limits		Restore ecosystems		