



- **Our Ecosystem**
- **Agripreneurship**



OUR ECOSYSTEM

Chapter 1: Safeguarding Oceans

Introduction:

The oceans are the most significant source of our present and future energy requirements. About two-thirds of our Earth's surface is covered by water, and the oceans hold about 96.5 percent of the entire earth's water. There is about 70 percent water in the protoplasm of millions of cells, the basic biological unit of plants and human beings.

- The marine ecosystem is home to the richest and most diverse faunal and floral communities.
- India has a coastline of 8,118 km, with an exclusive economic zone (EEZ) of 2.02 million sq km and a continental shelf area of 468,000 sq km, spread across 10 coastal States and seven Union Territories, including the islands of Andaman and Nicobar and Lakshadweep Indian coastal waters are extremely diverse attributing to the geomorphologic and climatic variations along the coast.

Diversity in oceans:

- Different organisms are found in different ocean depths, providing a colourful spectrum to marine life and its ecosystem.
- According to scientific studies, so far, about 2.5 lakh marine life species have been identified all over the world.
- Evidence of diversity is also found in their size. They range from 0.2 micrometres of small sea creatures to about 110 feet long blue whales found in the sea.
- Sunlight permeates about 200 metres below the sea surface called the sunlight or Epipelagic Zone.
- From 200 metres to 1000 metres, the faint light of the sun percolates, hence it is called the twilight zone or Mesopelagic Zone.
- The depth from 1000 metres to 4000 metres is called the midnight or Bathypelagic Zone.
 - Due to the absence of light, creatures in this zone use bioluminescence.
 - The water pressure in this zone is very high.
 - The sea creatures here are primarily black or red in the absence of light.
 - The average temperature remains below 4 degrees celsius in this region.
- The Abyssal Zone with a depth of 4000 to 6000 metres is very dark and the temperature is almost freezing point.

Marine Biodiversity of India

- The coastal and marine habitat includes near-shore gulf waters creeks tidal flats mud flats coastal dunes mangroves marshes wetlands seaweed and seagrass beds deltaic plains estuaries, lagoons and coral reefs.
- There are four major coral reef areas In India-along the coasts of the Andaman and Nicobar group of islands the Lakshadweep group of islands the Gulf of Mannar and the Gulf of Kachchh The Andaman and Nicobar group is the richest in terms of diversity.
- Mangrove ecosystems are found along both the east and west coasts of India covering an estimated area of 4 120 sq km Important mangrove areas are in the Sundarbans, Bhitarkanika Krishna and Godavari delta of Andhra Pradesh, Andaman and Nicobar Islands, Gulf of Kachchh, and the Pichavaram-Vedaranyam area of Tamil Nadu coast.

As a lifeline for coastal economy and livelihood

- **Employment generation:** It will provide jobs, and improve the livelihoods of many. This will help in inclusive growth. E.g improving fishery resources exploitation can provide a livelihood to many.
- **Food security:** It will lead to food security through the fishery sector and other seafood resources. It would also help in reducing the malnutrition issue in India as fishes are a good source of nutrition.
- **Essential mineral:** Seawater contains economically useful salts such as gypsum and common salt. Gypsum is useful in various industries.
- **Efficient transportation and logistics:** Indian Ocean is a major gateway of trade with 80% of global oil trade happening through it. Better connectivity in the region will significantly cut transport costs and will reduce logistics inefficiencies.

Weakness and threat:

- **Sewage:** Sewage or polluting substances flow through sewage, rivers, or drainages directly into the ocean.
- **Toxic Chemicals From Industries:** Industrial waste which is directly discharged into the oceans, results in ocean pollution. Also, they raise the temperature of the ocean and cause thermal pollution. Aquatic animals and plants have difficulty surviving at higher temperatures.
- **Land Runoff:** Land-based sources (such as agricultural run-off, discharge of nutrients and pesticides and untreated sewage including plastics) account for approximately 80% of marine pollution. The runoff picks up man-made,

harmful contaminants that pollute the ocean, including fertilizers, petroleum, pesticides and other forms of soil contaminants.

- **Large Scale Oil Spills:** Pollution caused by ships, is a huge source of ocean pollution, the most devastating effect of which is oil spills.
- **Ocean Mining:** Ocean mining sites drilling for silver, gold, copper, cobalt, and zinc create sulfide deposits up to three and a half thousand meters down into the ocean.
- **Plastic Pollution:** In 2006, the United Nations Environment Programme estimated that every square mile of ocean contains 46,000 pieces of floating plastic.

Issue of Marine Pollution

- Over 300 million tons of plastic are produced every year for use in a wide variety of applications.
- At least 8 million tons of plastic end up in our oceans every year, and make up 80% of all marine debris from surface waters to deep-sea sediments. Marine species ingest or are entangled by plastic debris, which causes severe injuries and deaths.
- Floating plastic debris are currently the most abundant items of marine litter. Plastic has been detected on shorelines of all the continents, with more plastic materials found near popular tourist destinations and densely populated areas.

How does plastic threaten the oceans?

- The most visible and disturbing impacts of marine plastics are the ingestion, suffocation and entanglement of hundreds of marine species. Marine wildlife such as seabirds, whales, fishes and turtles, mistake plastic waste for prey, and most die of starvation as their stomachs are filled with plastic debris. They also suffer from lacerations, infections, reduced ability to swim, and internal injuries.
- Invisible plastic has been identified in tap water, beer, salt and are present in all samples collected in the world's oceans, including the Arctic. Several chemicals used in the production of plastic materials are known to be carcinogenic and to interfere with the body's endocrine system, causing developmental, reproductive, neurological, and immune disorders in both humans and wildlife.
- Toxic contaminants also accumulate on the surface of plastic materials as a result of prolonged exposure to seawater. When marine organisms ingest plastic debris, these contaminants enter their digestive systems, and overtime accumulate in the food web. The transfer of contaminants between marine species and humans through consumption of seafood has been identified as a health hazard, but has not yet been adequately researched.
- Plastic, which is a petroleum product, also contributes to global warming. If plastic waste is incinerated, it releases carbon dioxide into the atmosphere, thereby increasing carbon emissions.

What can be done?

- Recycling and reuse of plastic materials are the most effective actions available to reduce the environmental impacts of open landfills and open-air burning that are often practiced to manage domestic waste.
- Governments, research institutions and industries also need to work collaboratively redesigning products, and rethink their usage and disposal, in order to reduce microplastics waste from pellets, synthetic textiles and tyres. This will require solutions which go beyond waste management, to consider the whole lifecycle of plastic products, from product design to infrastructure and household use.
- Legal efforts like 1972 Convention on the Prevention of Marine Pollution by Dumping Wastes and Other Matter (or the London Convention), the 1996 Protocol to the London Convention (the London Protocol), and the 1978 Protocol to the International Convention for the Prevention of Pollution from Ships (MARPOL) have been made but there is little compliance due to limited financial resources to enforce them.
- The United Nations Environment Program (UNEP) considers plastic marine debris and its ability to transport harmful substances as one of the main emerging issues affecting the environment. At the 2015 G7 summit in Bavaria, Germany, the risks of microplastics were acknowledged in the Leaders' Declaration.

Marine resources as next frontier of man's quest for development –

1. **Energy resources security:** The main energy resources present in Indian Ocean are petroleum and gas hydrates. Petroleum products mainly includes the oil produced from offshore regions. Gas hydrates are unusually compact chemical structures made of water and natural gas. It will help in diversification of energy resources and will provide new resources for energy e.g. gas hydrates.
2. **Employment generation:** It will provide jobs, improve livelihoods of many. This will help in inclusive growth. E.g improving fishery resources exploitation can provide livelihood to many.
3. **Food security:** It will lead to food security through fishery sector and other sea food resources. It would also help in reducing malnutrition issue in India as fishes are good source of nutrition.

4. **Efficient transportation and logistics:** Indian Ocean is a major gateway of trade with 80% of global oil trade happening through it. Better connectivity in the region will significantly cut the transport cost and will reduce logistics inefficiencies.
5. **Women empowerment:** It will help in women empowerment especially fishery sector by providing them jobs. As these jobs do not require high skills, women will find it easy to earn a livelihood.
6. **Climate Change:** Oceans provide an alternate and cleaner source of energy. It also act as an important carbon sink. This will help in mitigating climate change.
7. **Manganese Nodules and Crusts:** Manganese nodules contain significant concentrations of manganese, iron and copper, nickel, and cobalt all of which have a numerous economic uses and development of humanity.
8. **Sustainable development:** Marine resources from Indian Ocean can serve as the backbone of India's economic growth and can help India to become a 5 trillion dollar economy by 2022. Blue economy, through sustainable use of oceans, has great potential for boosting the economic growth.

Why marine resources extraction is limited –

- Much of these resources, however, are not easily accessible, so their recovery involves technological challenges and high cost.
- Drilling in these oceanic deposits could destabilize the seabed, causing vast swaths of sediment to slide for miles down the continental slope.
- There are issues involved in issuance of licenses by International seabed authority etc.

Action areas in this regard for marine sustainable development:

- Reducing marine pollution and debris including from land-based activities.
- Promoting sustainable exploitation of marine resources.
- Halting the destruction of marine resources especially through acidification.
- Eliminating harmful subsidies that promote fishing overcapacity.
- Ensuring full implementation of regional and international regimes governing oceans and seas.
- Protecting marine resources in areas beyond national jurisdiction, including by establishing Marine Protected Areas.
- Encouraging sustainable small-scale fisheries.

Conserving Marine Resources

The government of India has undertaken several initiatives focusing on the conservation of coastal and marine resources through the implementation of law and continuous monitoring.

- The **Wild Life Protection Act of India (1972)** provides legal protection to many marine animals. There are total of 31 major Marine Protected Areas in India covering coastal areas that have been notified under Wildlife Protection Act, 1972.
- **The National Committee on mangroves, wetlands and coral reefs** constituted in 1993 advise the Government on relevant policies and programmes regarding marine species.
- **The Coastal Regulation Zone (CRZ)** notification (1991 and later versions) prohibit developmental activities and disposal of wastes in the fragile coastal ecosystems.
- **The Biological Diversity Act of India, 2002** and the **Biological Diversity Rules 2004**, and the guidelines thereof advise the Government on matters related to the protection and conservation of biodiversity, sustainable use and equitable sharing of its components, Intellectual Property Rights, etc.
- **Pradhan Mantri Matsya Sampada Yojana (PMMSY):** for sustainable and responsible development of fisheries sector in India. Two of the key objectives of the scheme are (a) harnessing of fisheries potential in a sustainable, responsible, inclusive and equitable manner and (b) Robust fisheries management and regulatory framework.
- **The Centre for Marine Living Resources and Ecology (CMLRE)**, an attached office of Ministry of Earth Sciences (MoES) is mandated with the management strategies development for marine living resources through ecosystem monitoring and modelling activities.
- **Involvement of local communities** is often seen as an integral part of preserving the marine resources. CMLRE is implementing a national R&D programme on Marine Living Resources (MLR) with an inbuilt component on Societal Services to support the fisher folks of Lakshadweep Islands. The societal services initiative intends to enhance the ornamental and baitfish stocks in the wild. Under the program, CMLRE has organised a series of hands-on trainings on "Marine ornamental fish breeding and rearing at Lakshadweep Islands".
- **Under the Pradhan Mantri Matsya Sampada Yojana (PMMSY)** scheme of the Department of Fisheries, there are provisions for encouraging sustainable marine fisheries activities, development of fisheries management plans, development of Integrated Modern Coastal Fishing Villages, promotion of Sagar Mitra, installation of bio-toilets in fishing vessels, communication and tracking devices, livelihood support during fish ban period to fisher families etc. for conservation of fisheries resources.

Note: Marine Protected Areas (MPAs)

- An MPA is a marine protected area that provides protection for all or part of its natural resources.
- Certain activities within an MPA are limited or prohibited to meet specific conservation, habitat protection, ecosystem monitoring, or fisheries management objectives.

Deep ocean mission (DOM)

- Initially, the Rs. 4,077-crore mission will entail scientists travelling to a depth of 500 m to test various technologies being developed for the purpose before taking a deeper dive into the unknown.
- The DOM will also help India map the ocean bed, which is a rich source for metals and minerals.
- The mission will help scientists identify and demarcate resource-rich areas which could be exploited later when suitable technology is available for deep-sea mining.
- The exploration studies of minerals will pave the way for commercial exploitation in the near future as and when such a code is evolved by the International Seabed Authority.
- This mission is also directed towards development in marine biology which will provide job opportunities in Indian industries.

Samudrayaan Mission:

- It is India's First and Unique Manned Ocean Mission
- India joins the elite club of nations such as USA, Russia, Japan, France and China to have such underwater vehicles for carrying out subsea activities
- Will help in carrying out deep ocean exploration of the non-living resources such as polymetallic manganese nodules, gas hydrates, hydro-thermal sulphides and cobalt crusts, located at a depth between 1000 and 5500 meters
- The underwater vehicles are essential for carrying out subsea activities such as high-resolution bathymetry, biodiversity assessment, geo-scientific observation, search activities, salvage operation and engineering support.

Chapter 2: Zoological Diversity

India represents

- Two of the major realms, the Palearctic and Indo-Malayan
- Three biomes viz. Tropical Humid Forest, Tropical Dry Deciduous Forests, and Warm Deserts/Semi-Deserts.
- Indian landmass has been classified into 10 Biogeographic Zones.

In order to protect biodiversity

- 990 Protected Areas sprawling over 5.27% of the country's geographical area have been designated, of which faunal communities have been thoroughly listed among 120 Protected Areas by the Zoological Survey of India (ZSI).
- 1,03,258 species have been documented in India.
- Among the animals reported from the country 2,841 species are protected under different schedules of the Wildlife (Protection) Act, 1972 for better conservation.
- In 2021, ZSI discovered one new genus and 131 species and recorded 102 species.

Coastal and Marine Biodiversity:

- Long coastline of 7516.6 km on the mainland, Lakshadweep, and the Andaman & Nicobar Islands.
 - The coast is diversified into the categories of bay, cover, gulf, estuaries, and peninsula.
 - Indian coasts are endowed with different ecosystems such as mangrove swamps, coral reefs, seagrass beds, beaches, dunes, salt marshes, and mud flats.
- 18th largest Exclusive Economic Zone (EEZ) with a total area of 2.37 million square kilometres.
- In the Indian Ocean region, India is one of the highest marine biodiverse countries with 20,444 species.
- 9,457 species from freshwater, 3,939 species from estuarine, and 5,747 species from mangrove ecosystems recorded
- 5,632 species included in various categories on the 'IUCN Red List' = requires much attention for conservation.

Status Survey by ZSI:

- **Significant progress** = Monitoring of the status of the endangered/rare species of animals by ZSI.
- **Recent initiative by ZSI:** Massive tagging programme of Olive Ridley Turtles along the Odisha coast and Leatherback turtles in the Great Nicobar Island for tracking their migration in the Indian Ocean.
- Initiated several innovative programmes from the molecular level to the monitoring of fauna.

- At least 37 species of mammals genetically identified from Himalayan regions through non-invasive genetic study techniques.
- Population genetics of the Arunachal Macaque (*Macaca munzala*) and population genetics of Barking Deer (*Muntiacus muntjak*), as well as Chinese Pangolin
- Advanced research on soundscape (acoustics) through spectrogram of vocalisation of animals
- The impact of forest fire on faunal diversity in the Northeastern Region of India
- Studies dealing with chromosomal mapping, PCR, and DNA Barcoding of animals including threatened species have been taken up by ZSI and more than 8,000 DNA sequences have been barcoded and registered in the National Centre for Biotechnology Information (NCBI) database

India's Long-Term Monitoring of Fauna: Long-Term Ecological Observatories (LTEO) programme

- Long-Term Ecological Observatories (LTEO) programme = A constituent activity of the Climate Change Action Programme of the country.
- A multi-institutional programme that aims to set up long-term ecological monitoring for different taxa in six landscapes across India.
- India LTEO = Nine themes including forests, grasslands, soil, herpetofauna, marine ecosystems, arthropods, freshwater fish birds and movement ecology.
- LTEO landscapes = Western Ghats, Western Himalayas, Eastern Himalayas, Central India, North West Arid Zone and the Andaman and Nicobar Islands.

Mapping of Fauna:

Implementation of geospatial modelling studies: The mapping of biological corridors, landscape change analysis, and climate change risk modelling for several studies of Himalayan as well as other areas in collaboration with the State Forest Department.

- Out of 5.7 million specimens, 3.8 million specimens are identified and geo-tagged to 4.2 unique localities, pertaining to about 40,000 animal species.
- Mobile Applications and Web GIS have been developed in collaboration with National Remote Sensing Centre, ISRO, to provide specific information on different animals in Protected Areas of India.
- A geospatial database has been created for the threatened vertebrates of the Indian Himalayan Region which will be useful in understanding the diversity and richness of wildlife species in the Himalayan region.
- Studies on pollinators, invasive and alien species, and climate change with reference to faunal diversity and conservation have been envisaged.
- Studies have also been made to understand the impact of forest fires in Northeast India and also to predict the fire-prone area.

Reef Restoration:

- Approximately, 1050 square metre area of degraded coral reefs has been restored with branching coral species belonging to the family Acroporidae, which are the dominant reef contributors in all world reefs, in collaboration with the Government of Gujarat through World Bank-Integrated Coastal Zone Management (ICZM).
- Presently, the translocation of corals in the Gulf of Kutch is being carried out for Indian Oil Corporation.

ALL ABOUT REEFS

What Is A Coral Reef?

- Coral is actually a living animal.
- Coral has a symbiotic relationship (each gives something to the other and gets something back in return) with 'zooxanthellae' microscopic algae which live on coral.
- Referred to as 'The rainforests of the sea', coral reefs harbor rich biodiversity.
- In warm shallow seas reefs are built by coral polyps which produce casing of limestone.
- Zooxanthellae algae covers the reef and provides it a vibrant colour.

Two Main Types Of Corals

Stony (Hard) Corals and Soft Corals.

- Some stony corals obtain their food from one-celled organisms called zooxanthellae.
- Zooxanthellae are single-celled organisms that use sunlight for photosynthesis and transfer 95% of the food they produce to coral polyps.
- Both coral and the zooxanthellae benefit from this association. These corals are called hermatypic corals.
- Individuals polyps of hermatypic corals secrete calcium carbonate (limestone) skeletons which, in time form coral reefs. Therefore, hermatypic corals are also known as reef building corals.



Features of the Corals

- They occur in shallow tropical areas where the sea water is clean, clear arid warm
- The coral reef cover in Indian waters is roughly estimated upto 19,000 sq.Km.
- Coral reefs are one of the most productive and complex coastal ecosystems with high biological diversity.
- The high productivity is owing to the combination of its own primary production and support from its surrounding habitat.
- Reef building coral are symbolic association of polyps (coral animals) and 'zooxanthellae' (the microscopic algae).
- The corals are generally slow growing colonies of animals while zooxanthellae are fast growing plants.

Ideal conditions for the formation of Reefs

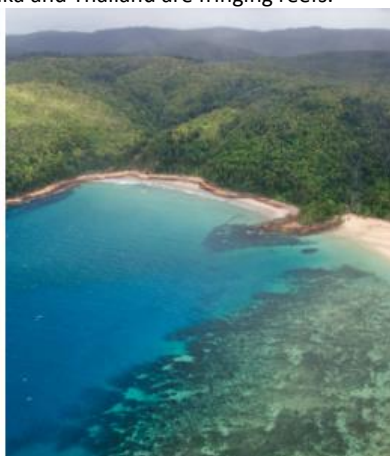
- High Temperature:
- Availability of Sunlight:
- Salinity:

Types of reefs

- 1) Fringing Reefs
- 2) Barrier Reefs
- 3) Atolls Fringing Reefs

Fringing reefs are coral reefs that grow in shallow waters.

- They closely border the coastline or are separated from it by a narrow stretch of water.
- Many of the reefs round Sri Lanka and Thailand are fringing reefs.



Barrier reefs

- Barrier reefs grow parallel to the coast but are separated from land by a lagoon.
- They are found sometimes many kilometers from shore (10–100km). Barrier reefs can grow in fairly deep water, because, often, the living coral builds upon remains of corals that grew in the same area when sea level was lower, during the last ice age.
- The Great Barrier Reef of Australia extends about 2,010km parallel to the east coast.



ATOLLS

- Atolls grow surrounding (or partly surrounding) an island which then sinks relative to sea level (usually because volcanic activity forming the island stops) or was flooded as sea level rose after the last ice age.
- Atolls surround (or partly surround) a central lagoon.
- It is a ring-shaped island reef that encircles (sometimes completely surrounding) a central lagoon in which detrital material collects.
- In some oceanic Atolls calcareous Algae forms the bulk of the reef.

Note: The Lakshadweep and Maldives islands in the Indian Ocean are composed of Atolls.



Threat to coral reefs:

- Overexploitation (Over-fishing) for food,
 - for aquarium trade,
 - for the trinket trade,
 - for medicinal purposes and Destructive fishing practices.
- Coral mining (Overexploitation/ Habitat Destruction)
- Sediment, nutrient and chemical pollution: One of the greatest threats to coral reefs is human development that alters either the marine or land-based physical environment. Certain development activities lead to increases in freshwater runoff, resulting in large amounts of sediment being washed into the sea.
- Marine based pollution
- Global warming and climate change

Significance of Dead Coral Reef

- According to a recent study by researchers from University of Queensland (UQ), Australia, more life can be supported by dead coral remains than live corals.
- Dead coral reefs support cryptic organisms like hidden sea creatures, including fishes, snails, tiny crabs and worms, who hide under its rubble to save themselves from predation.

Four new corals recorded from Indian waters

Scientists have recorded **four species of azooxanthellate** corals for the first time from Indian waters

- These new corals were found from the waters of **Andaman and Nicobar Islands**.

- Azooxanthellate corals are a group of corals that **do not contain zooxanthellae** and derive nourishment not from the sun but from capturing different forms of plankton.
- These groups of corals are deep-sea representatives, with the majority of species reporting from between 200 m to 1000 m.
- Their occurrences are also reported from shallow coastal waters. Zooxanthellate corals, meanwhile, are restricted to shallow waters
- All the four groups of corals are from the same family **Flabellidae**.
 - Truncatoflabellum crassum,
 - T. incrustatum,
 - T. aculeatum
 - T. irregulare
- Under the family Flabellidae were previously found from Japan to the Philippines and Australian waters while only crassum was reported within the range of Indo-West Pacific distribution including the Gulf of Aden and the Persian Gulf.

Azooxanthellate corals are a group of hard corals and the four new records are not only solitary but have a highly compressed skeletal structure. These isolated, solitary or colonial forms rarely build big constructions.

NOTE: Global Coral Reef R&D Accelerator Platform has been launched by G20.

About Great Barrier Reef

- It is the world's most extensive and spectacular coral reef ecosystem composed of over 2,900 individual reefs and 900 islands.
- The reef is located in the Coral Sea (North-East Coast), off the coast of Queensland, Australia.
- It can be seen from outer space and is the world's biggest single structure made by living organisms.
- This reef structure is composed of and built by billions of tiny organisms, known as coral polyps.
 - Polyps are tiny, soft-bodied organisms.
 - At their base is a hard, protective limestone skeleton called a calicle, which forms the structure of coral reefs.
 - These polyps have microscopic algae called zooxanthellae living within their tissues. The corals and algae have a mutualistic (symbiotic) relationship.
 - It was selected as a World Heritage Site in 1981.

Initiatives to Protect Corals

- International Coral Reef Initiative
- Global Coral Reef Monitoring Network (GCRMN)
- Global Coral Reef Alliance (GCRA)
- The Global Coral Reef R&D Accelerator Platform
- The Ministry of Environment and Forests and Climate Change (MoEF&CC), India has included the studies on coral reefs under the Coastal Zone Studies (CZS).
- The Zoological Survey of India (ZSI), with help from Gujarat's forest department, is attempting a process to restore coral reefs using "biorock" or mineral accretion technology.
- National Coastal Mission Programme, to protect and sustain coral reefs in India.

Why should we conserve corals?

- Corals occupy less than one per cent of the ocean floor but over one billion people benefit directly from the reefs.
- The value of goods and services provided by coral reefs is estimated to be \$2.7 trillion per year. This includes \$36 billion in coral reef tourism.
- The net economic value of the world's coral reefs could be nearly tens of billions of dollars per year.

What is **bleaching**?

- Bleaching occurs when healthy corals become stressed by changes in ocean temperatures, causing them to expel algae living in their tissues which drains them of their vibrant colours.
- Bleaching was first seen on the reef in 1998 — at the time, the hottest year on record — but as temperature records continue to tumble its frequency has increased, giving coral less time to recover.

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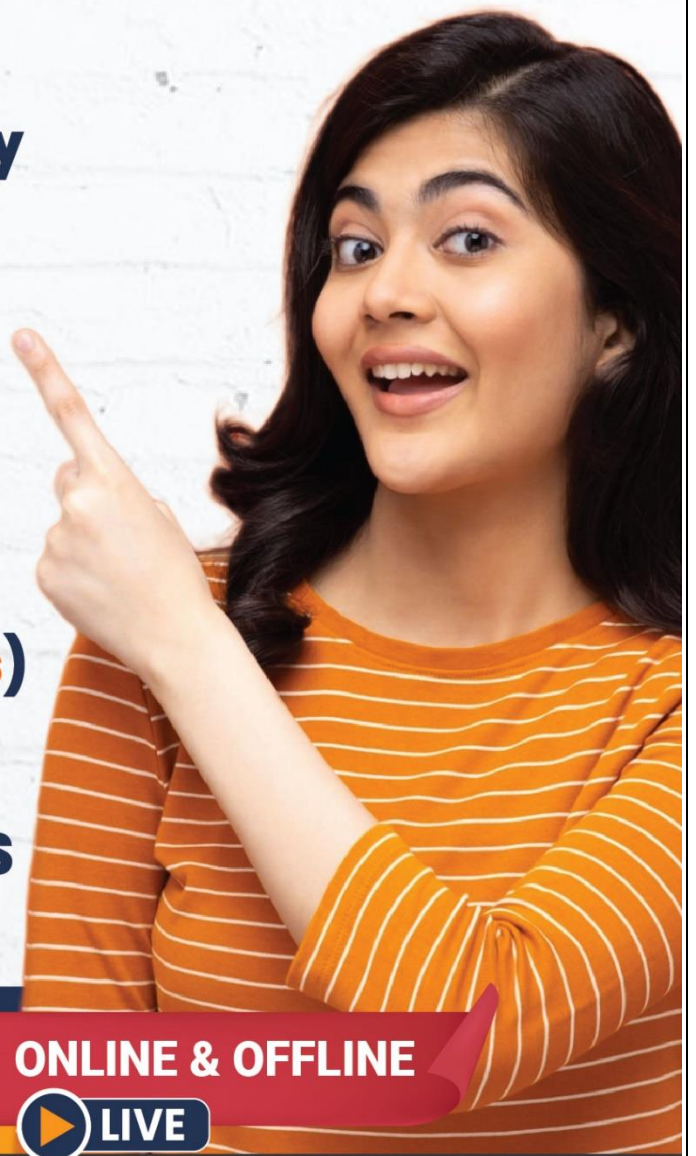
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Chapter 3: Indigenous Bioresources of NER

The Northeastern Region (NER) of India shares both Himalaya and Indo-Burma biodiversity hotspots which are the natural habitats of several endemic species, which are unexplored, untouched, and extremely beneficial. Its scenic beauty and exotic biodiversity have attracted scientists, policymakers and various stakeholders to work together as one coherent unit for the overall wellness of the people of NER. Landlocked by international borders, NER states are innately connected with nature and have a rich socio-economic and cultural heritage.

Farming Strategies

- The majority of the tribal community practice jhum shifting cultivation → accelerates habitat destruction, deforestation and environmental pollution.
- To have self-sufficiency in agriculture, policymakers are aiming for doubling farmers' income through the **introduction of high-yielding varieties and modern scientific farming strategies** that prove productivity.
- Recent studies show that extensive urbanisation, wild harvests of natural flora and changing environmental conditions become an extreme threat to NER.
 - As a result, many medicinally and commercially important plant species are on the verge of extinction.
 - In such a scenario, **in-vitro plant tissue culture techniques** are a highly reliable approach for germplasm conservation, eco-restoration and phytopharmaceutical production, especially for several medicinally and commercially important plant species.

Qualitative Improvement of Genetic Resources of Indigenous Tree Species – *Camellia* sp:

- Tea plant (*Camellia* sp.) is an evergreen socio-economic crop species and belongs to the family 'Theaceae'.
- The indigenous tea cultivator of Assam is named *Camellia assamica* ssp. *assamica* (TV21) having broad leaves and high content of catechins, dominates in black tea production as compared to China-type tea (*Camellia sinensis*).
- The extreme cross-pollinating nature of tea plants results in high heterozygosity (high variability), which leads to inconsistent quantity and quality of phytochemicals.
- Conventional methods of plant propagation through seeds do not produce genetically uniform clones/identical plants and, on the other hand, stem-cutting and grafting have a poor survival rate and require adequate care to best suit the changing environmental conditions.
- Being a woody perennial, tea plants require a longer time period to attain reproductive maturity, which causes less success rate of the development of superior clones/plants from existing parent plants following conventional farming strategies.
- Furthermore, the improvement of genetic constituents and a further selection of superior varieties require several years in conventional breeding practices.
- In such a scenario, the in-vitro tissue culture method not only acts as a potential way of qualitative development of superior plants but can also produce a large number of true-to-type (identical) plants in a comparatively shorter duration.
- The in-vitro-developed plants could serve as a potential source for the development of pure breeding plants and would also facilitate the consistent production of medicinally important bioactive metabolites, independent of seasonal variation.

Azadirachta Indica:

- *Azadirachta indica*, commonly known as the Neem plant, is native to the Indian subcontinent and Southeast Asia. All parts of the Neem tree, the leaves, stems, roots, flowers, fruits, and seeds contain medicinal metabolites and are used for household remedies against various diseases.
- It is also renowned for its eco-friendly, insect-eliminating properties, thus regularly used in agriculture. The extreme cross-pollinating nature of Neem plants causes high variability in plants which leads to inconsistent quantity and quality of phytochemicals.
- To satisfy the growing demand and the vast need for pharmaceutical industries, attaining enhanced production of metabolite compounds should be our utmost priority.

- In-vitro tissue culture methods would be the most suitable alternative strategy for the production of homozygous clones (purebred plants) containing high amounts of metabolites compared to seed-borne trees.

Stevia Rebaudiana:

- It is a medicinally important plant containing low-calorie sweeteners (steviol glycosides) in leaves. Excess consumption of sucrose in the diet is associated with diabetes and cardiovascular diseases.
- Vegetative propagation of *Stevia Rebaudiana* is limited by unfavourable climatic conditions, and seeds of the stevia plant show low viability in the field. However, in-vitro propagation is a rapid reliable system for the production of a large number of genetically uniform disease-free plantlets, irrespective of the seasonal variations.

Tinospora Cordifolia:

- *Tinospora cordifolia* or Giloy is a multipurpose woody liana that generally grows in tropical climates and is readily available in Northeast India.
- It is widely known for its immunomodulatory, hepatoprotective, anti-hypertensive, and antioxidant properties, hence called a rejuvenating herb.
- The nutraceutical features are also mainly due to the presence of high protein, carbohydrates, calcium, phosphorus, potassium, and iron.
- Recent studies show that the consumption of Giloy has increased the recovery rate in dengue and SARS-CoV-2 patients.

Musa Balbisiana and Musa Paradisiacal:

- The *Musa* sp. commonly known as banana belongs to the family Musaceae and is one of the most widely distributed and consumed fruits with high content of minerals, vitamins, carbohydrates, flavonoids, and phenolic compounds.
- In Assam, farmers are growing bananas commercially due to high profitability. There are 15-20 different varieties of bananas available to Assam.
- Rutin, a flavonoid, naturally present in banana leaves has antioxidant properties and is beneficial to health.
- Banana leaves also have the potential for use as an inexpensive and new source of bioactive metabolites.

Wonder in the West

The richness of Gujarat's biodiversity:

- Presence of 7,500 species of flora and fauna, among these 2,550 are angiosperms and 1,366 are vertebrate species (of which 574 are bird species and the rest are mammals, reptiles, amphibians, fish, etc.).
- **Biodiversity hotspots:** Little Rann of Kutch, Greater Rann of Kutch, Marine National Park, Jamnagar, wetlands and forests of Barda Sanctuary, Porbandar, Grasslands of Velavadar, Thol Lake and Nalsarovar, Northern part of Western Ghat in South Gujarat, etc.
- **Flora:** Unique in nature as the species have developed many adaptations like resistance to salinity to sustain themselves in hostile and adverse climatic conditions in arid and semi-arid regions.

Conservation Status:

- **Four National Parks**
- **23 Sanctuaries**
- **1 Conservation Reserve**
- **4 Ramsar sites**, i.e., wetlands of international importance and several wetland-based Important Bird and Biodiversity Areas (IBAs): Nalsarovar and Thol Bird Sanctuaries near Ahmedabad, Khijadia Sanctuary near Jamnagar and Wadhvana wetland near Vadodara.
- **Indroda Nature Park (INP):** Was subsumed into Gujarat Ecological Education and Research (GEER) Foundation which was founded in June 1982 to undertake activities such as ecological education, research, natural history

interpretation, climate change research, wetland monitoring, biodiversity monitoring of Sanctuaries and National Parks.

- INP now serves as the headquarters of the GEER Foundation.
- The GEER Foundation was also recognised as the Scientific and Industrial Research Organisation (SIRO), Gujarat State Centre on Climate Change by the Department of Science and Technology, Government of India and the Nodal Agency of Gujarat State Wetland Authority by the State Government.
- The Union Ministry of Environment, Forest and Climate Change has assigned the work of the Long Term Ecological Observatories (LTEO) Project under the Climate Change Action Programme.
 - LTEO project was launched during the Conference of the Parties (COP) of the UNFCCC in Paris in December 2015.
 - The main aim of this project is to know the biophysical and anthropogenic drivers of ecosystems in selected biomes as well as their effect on social-ecological responses.
 - The GEER Foundation along with the Indian Institute of Science (IISc), Bengaluru, has established three field stations in the Asiatic lion landscape area viz. **Sasan Gir, Bajana and Hingolghadh and one in Jessore for the North Western Arid Zone** under Forests and Soil Theme.
 - The observations recorded at these sites will be correlated with data on various climatic parameters collected from Automatic Weather Stations (AWSs) which are installed therein as per the guidelines of the World Meteorological Organisation to know the effect of climate change.
- GEER Foundation under the National Green Corps' Programme of MoEF&CC, GoI has been sensitising young minds about environmental conservation through Eco-Clubs established in 16,500 schools and 162 colleges in the State.
- The GEER Foundation is also involved in the creation of the "Cactus Garden" at "The Statue of Unity" in Kevadia. It is said to be a "Grand Architectural Greenhouse" consisting of 450 species of cactus and succulents from India and 17 other countries.

A Biological Paradise - The Andaman and Nicobar Archipelago

About the Islands

- Consists of 836 islands, islets, and rocky outcrops, extending over 800 km.
- The islands were once a part of the Asian landmass but then got disconnected some 100 million years ago during the **Upper Mesozoic Period due to geological upheaval**.
- Separated by the **Ten Degree Channel** which is about 150 km wide and 400 fathoms deep.
- The highest elevation is **Saddle Peak** (732 m) in North Andaman and **Mount Thullier** (642 m) in Great Nicobar Island.
- Support very luxuriant and rich vegetation due to its tropical, hot and humid climate with abundant rains.
- **Types of forests**
 - Tropical Wet Evergreen
 - Tropical Semi Evergreen
 - Tropical Moist Deciduous
 - Littoral and Swamp Forests, in addition to this, 13 different types of forests are classified.
- The total geographical area under forest land is i.e., 6,742.78 km (81.74 per cent) as per the State Forest Report of 2019.
- An extraordinary variety of habitat types, ranging from sandy beaches to coral reefs, mangroves and mountains with dense forests, characterize the Andaman and Nicobar Islands.
- The coral reefs of Andaman and Nicobar are the **second richest** found in the world.

- According to the available literature
 - Total of 21,663 marine species, includes marine algae and mangroves.
 - Out of these, 20,444 species contributed by animals have been distributed in Indian seas.
 - Overall, 1,200 species of terrestrial and marine fauna of Andaman and Nicobar Islands have been listed under various Schedules of the Wildlife (Protection) Act, 1972.
 - More than 10% of the plants are endemic and, estimated about 871 species from the terrestrial ecosystem.
 - Among the invertebrates, butterflies have more than 70% of endemism at the sub-species level.



Marine Ecosystem:

- **Porifera:** Around 512 species of sponges are recorded from Indian waters. Among them, Andaman and Nicobar Islands represent 130 species. A total of 12 species of calcareous sponges were reported from Indian waters and are protected under the Schedule III of the Indian Wildlife (Protection) Act 1972.
- **Scyphozoa:** The Scyphozoans are commonly known as true jellyfish.
 - 191 species belonging to three orders, and 20 families were recorded.
 - A total of 5 scyphozoan species were reported from Andaman and Nicobar Islands.
- **Anthozoa (Scleractinian corals):**
 - A total of 424 species of Scleractinian corals belonging to 19 families were reported from the Andaman and Nicobar Islands.
 - The reefs are mainly dominated by the family Acroporidae, Faviidae, Poritidae, Fungidae and Agariciidae.
- **Octocorals:** Octocorals are commonly called Alcyonarians, Order Octocorallia (eight polyp tentacles) are distinguished from the hard corals (six or multiple of six polyp tentacles) by their number of polyp tentacles.
 - They consist of soft corals, seafans, seawhips, seapens, tubecorals and blue corals.
- **Platyhelminthes:** Flatworms, also known as polyclads, belong to the Order Polycladida, Class Turbellaria under the phylum Platyhelminthes.
 - They are exclusively marine and free-living organisms - one of the common inhabitants of coral reefs.
 - 47 species under 10 genera which includes 7 new records to Indian waters and 6 new species.
- **Crustacea:** Crustaceans belong to the phylum Arthropoda, and include both marine and terrestrial forms of life.
 - These highly diverse animals consist of economically important groups such as crabs, shrimps and lobsters.
 - Out of 2,394 species of crustaceans that have been reported from India, marine species (94.85%) contribute the most.
 - A total of 897 species were recorded from Andaman and Nicobar Islands of which 388 species are brachyuran crabs and 129 species are shrimps.
- **Mollusca:** Mollusca are the mainly assorted phylum in reef ecosystems and also, second species-rich phylum in the world after the arthropods.

- 5,070 species of Mollusca have been recorded from freshwater (183 species); land (1,487 species) as well as from marine habitats (3,370 species).
- **Echinodermata (Holothuroidea – Sea cucumbers):** Commonly known as sea cucumbers, are an abundant and diverse group of worm-like and usually soft-bodied echinoderms. About 1,100 species have been recorded worldwide till now whereas India represents 179 species.
- **Ascidians:** Ascidiacea is a marine invertebrate animal, commonly known as the ascidians or sea squirts.
 - Categorized under the subphylum Tunicata and phylum Chordata - includes all animals with dorsal nerve cords and notochords.
 - A total of 442 species were recorded from Indian waters - 57 ascidians were recorded from Andaman and Nicobar Islands.
- **Pisces:** The Ichthyofaunal diversity of India accounts for a total of 2,735 species, of which Andaman and Nicobar Islands contribute to 58% of the total diversity.
- **Mammalia:**
 - Cetacea (whales, dolphins and porpoises)
 - Sirenia (manatees and dugong)
 - Carnivora (sea otters, polar bears and pinnipeds).
 - A total of 26 species of marine mammals were recorded from Indian waters. Andaman and Nicobar Islands represented 07 species of marine mammals.

Terrestrial Ecosystem:

- **Protozoa:** They are important bioindicators for pollution and environmental biomonitoring, particularly in water purification plants and activated sludge processes.
 - Out of 2,577 species of protozoans only 9 species of Protozoans were recorded from the Andaman and Nicobar Islands.
- **Molluscs (Land and freshwater):** Land snails form - A total of 152 species of freshwater and land molluscs were reported from the Andaman and Nicobar Islands.
- **Annelida:** Known as the ringed worms or segmented worms, are a large phylum with over 17000 extant species including ragworms, earthworms, and leeches.
 - 193 species were recorded from the Andaman and Nicobar Islands.
- **Insects:** The composition of the insect group indicates that seven orders viz. Lepidoptera, Coleoptera, Hemiptera, Diptera, Hymenoptera, Orthoptera and Odonata comprise the bulk (93 per cent) of the fauna.
- **Lepidoptera (Butterflies & Nymphs):** 305 species belonging to 125 genera under 9 families of butterflies are reported from Andaman and Nicobar islands; of these, 155 species are endemic to these islands.
- **Odonata:** These are amphibiotic insects commonly known as dragonflies or damselfly. The adults are large predacious living insects.
 - 72 species belonging to 39 genera, pertaining to 11 families are reported from Andaman and Nicobar Islands so far. Only 11 species are endemic to these Islands.
- **Pisces:** A total of 951 species of freshwater are reported from Indian freshwater of which 77 species are recorded from the Andaman and Nicobar Islands.
- **Amphibia:** A total of 19 species of amphibians were recorded from the Andaman and Nicobar Islands.
- **Reptilia:** A total of 82 species were recorded from Andaman and Nicobar Islands including 39 species of snakes, 15 species of geckos, 11 species of skinks, nine species of lizards, seven species of tortoises and one species of crocodiles who have contributed to the description of species of reptilia.
- **Aves:** Out of 377 species/subspecies (268 species and 81 subspecies), around 30 species are endemic, of which 21 species are recorded from the Andaman Island group and 9 species from the Nicobar Island group. A total of 42 species are threatened birds.
- **Mammalia:** A total of 60 species of mammals were recorded from the Andaman and Nicobar Islands.

Representative Fauna of A&N Islands:**1. Coconut Crab: *Birgus latro*:** Robber crab, Palm Thief Crab

- Comes under the family of Cocnobitidae and Infraorder Anomura.
- Largest terrestrial arthropod in the world which is related to hermit crabs and lobsters. The only species of the genus 'Birgus' that can be adapted to exist on land and is also dependent on marine water for the pelagic larvae.
- Varied sizes: can grow up to 40 cm; a leg can reach more than 0.91 m.
- Carries an empty gastropod shell for protection at the juvenile stage, but the adults develop a strong exoskeleton on their abdomens and stop carrying a shell.

2. Long-tailed Macaque: *Macaca fascicularis umbrosa*:

- Inhabits Great Nicobar Island – Katchal island and Little Nicobar Island in the Nicobar Islands.
- Preferred habitats: Mangroves and coastal forests; also found in inland forests at altitudes of up to 600 m above sea level.
- The long-tailed Macaque is an endangered primate in India and it has been listed in Schedule-I of the Wildlife (Protection) Act. 1972.

3. Narcondam Hornbill: *Aceros nareondami*:

- 55 different species of hornbills found in Asia and Africa, of which 31 species of hornbills are present within Asia.
- There are 9 species of Indian hornbills, of which 4 species are endemic in India, and among them, one species is present in Narcondam Island.
- 'Vulnerable' according to the IUCN red list.
- Protected under Schedule I under the Wildlife (Protection) Act,1972.

4. The Nicobar Megapode (*Megapodius nicobariensis*):

- Belongs to the family of megapodes, Megapodiidae.
- IUCN has listed them as vulnerable
- Found only in the Nicobar Islands of India.

Conclusion:

- In order to conserve the ecosystem, 87% of the areas are declared as protected areas. There are 105 protected areas (nine National Parks and 96 Wildlife Sanctuaries) that have been established over an area of 1271.12 km on land and 349.04 sq.km in the surrounding territorial sea.
- Apart from this, the Great Nicobar is declared a Biosphere Reserve to protect the endemic fauna of these islands.

AGRIPRENEURSHIP

Chapter 4: Agripreneurship

Agriculture plays a very crucial role in realising an Aatmanirbhar Bharat. Agriculture continues to be the source of livelihood for the majority of the population. In a nutshell, agriculture has a vast impact on every citizen of the country, either directly or indirectly.

- Accounts for around 18 to 20% share of the GDP
- About 70% of the rural population relies on agriculture and allied sectors for their livelihood.

But we see = An increase in rural-urban migration

Why: The poor infrastructural facility has + Better job opportunities in urban areas

- The ratio of urban population to the total population of the country has grown at a rapid rate of 2.76 percent i.e. urban population which stood at 27.81% in 2001 increased to 31.16% in 2011.
- So, how to mitigate the burden that exists on Agriculture?

SOLUTION = Agripreneurship

- The adoption of innovative methods, processes and techniques in agriculture and its allied sectors
- That ensures better output and profits → becomes a catalyst of progressive change in the rural economy.
- Increasing demand for an entrepreneur in the agriculture and allied set-up has grown: Due to the rapid integration of global supply chains and the associated compliances required in maintaining ecological balance.
- Sectors available: food processing, fisheries, seed processing, smart agri-tech provisioning, soil testing, vermicompost, rice mills, pulses mills, sugar factories, bakeries, fertiliser production units, food processing units, agro-service centres, etc.

Agripreneurship can change lives and status-quo...

Agripreneur: The one who utilises information at the right time, relies on innovative solutions, and uses state-of-the-art technology in cultivation.

- Ensuring that losses involving perishable commodities are minimised, consumer benefits are enhanced and price discovery is attained effectively.
- As Agripreneurs are also involved in post-production operations such as processing and marketing which require specialised handling, higher investments can be attracted.
- Promotes and provides a boost to the cooperatives, e.g. dairy cooperatives.
- Act as a tool for women's empowerment.
- A solution for the increasing rate of the disguised and unemployed workforce and provide them with a remunerative alternative.
- Makes use of local resources which thereby decreases the possibility of post-harvest losses and reduces the push factor for rural-urban migration.

The Contribution to Economic Development

- Setting up of agri-enterprises such as apiaries, food processing units, seed processing units, mushroom production units, commercial vermicompost units, goat rearing, organic vegetable and fruits retail outlet, bamboo plantation and jatropha cultivation has helped to **increase profitability** in agriculture and allied sectors.
- Easy access to technology, the emergence of microfinancing, liberalised government rules, and awareness and training programmes on agri and allied sectors have prompted people to **take up self-employment** in the field of agriculture which has **enhanced the potential of agriculture**.
- According to the recent trends in agricultural markets, agriculture has shifted from a deficit-driven to a **surplus-driven industry**.

What are the Skills required to be an Agripreneur?

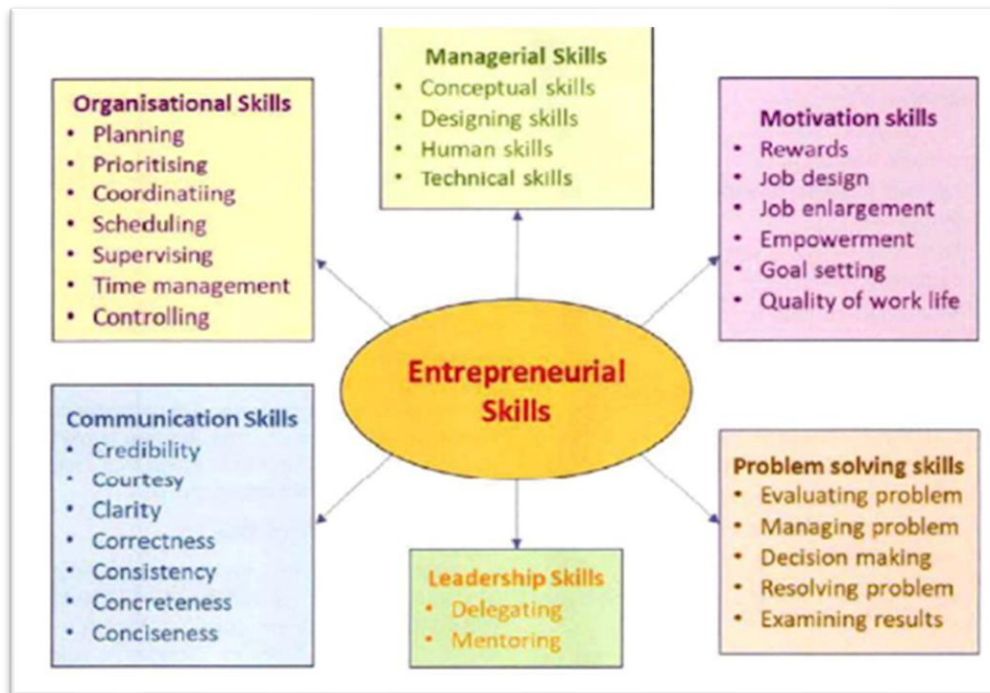


Image Source: Kurukshetra magazine

Different Skills Required for Agripreneurship by Global Forum for Rural Advisory Services (GFRAS)

- Aligning business objectives with the value proposition
- Identifying a value proposition that meets customers' requirements and preferences
- Situational analyses by collecting, arranging, analysing, and interpreting information
- Diagnosing problems and finding pertinent causes
- Evaluating and contrasting potential solutions to a given problem
- Forecasting and estimating the work and time to execute jobs
- Implementing, monitoring and evaluating activities
- Selecting, designing, running, managing, and updating the agricultural production system
- Planning on what and how to produce and making choices about the timing of production processes
- Choosing and operating farm equipment and machinery
- Designing the workflow from arranging inputs to the packaging of produce and sale of agricultural produce

Agri-Tech Startups

Working with technology at the core of their work philosophy and their uniqueness lies in the innovative ways they follow to link technological advancement to farmers.

In India:

- The number of agritech start-ups has increased from 43 in 2013 to 1,300 by April 2022.
- According to a study by India Brand Equity Foundation, the investments and growth phase for agritech start-ups started in 2019 and India has received total funding of USD 1.6 billion in these entities till 2021.
- Agritech funding stood at USD 245.2 million in 2019 which increased at a whopping 90% CAGR to USD 889 million as of 2021.
- **Surge:** Due to the special focus on agri marketing and the use of technology in agriculture

Agri Start-ups have emerged here

- Market linkage and supply chain
- Farm inputs
- Precision agriculture and farm management
- Farming as a Service (FaaS)

- Financial Services

Bringing Technology to the Fields

- **Vertical Farming:** India is a country of small and marginal farmers with about 86% of the total farmers having less than 5 acres of land.
 - Seen as a viable solution to the problem as this technology facilitates farmers to cultivate over 4-5 times more crops on a single piece of land.
 - Called four-level or five-level cultivation in which different types of crops are selected on the basis of their place of fruiting.
 - Helps in increasing income and ensures efficient use of water.
- **Hydroponics, aquaponics and aeroponics:** these methods are also part of vertical farming where the necessary nutrients are supplied directly from water or air.
 - The most important aspect of these technologies is that they help people cultivate in their balconies or terraces or even drawing rooms.
 - This has gained significant importance considering the ever-increasing urban population.
- **AI Farming and Precision Farming:** Help farmers with weather forecasts based on real-time data, increase crop yield, pest control and monitor the soil.
- **Robotics and Drone Technology:** Using robotics and drone technology in agriculture can help address health hazards such as excessive use of pesticides and fertilizers. Help to increase the efficiency of agriculture as it helps in the conservation of soil health and groundwater.
- **Agri Fintech Platform:** According to the data from RBI only 41% of the small and marginal farmers are covered by public and private banks. In this context, the Agrifintech platforms play a crucial role in filling this gap.
- **Organic farming:** Agri startups involved in organic farming are playing a significant role in ensuring the authentic quality of bio-fertilisers, bio-pesticides, vermicompost, natural compost, and jeevamrut at affordable prices.
- **Livestock Farming Technology:** The Livestock Sector which is an agri-allied sector has been growing at a CAGR of 8.15% between 2014-15 to 2019-20. There are various start-ups that are helping the farmers in setting up these businesses apart from providing inputs and creating infrastructure for them.

Role of AI in the Agriculture Sector

- **Soil management**
 - With the help of AI, the farmers would have prior information regarding the type of soil, when to sow the crops and when to apply herbicides and when to anticipate insect outbreaks.
 - AI would help the farmers in acknowledging the practices which are harmful to the soil profile and cause long-term damage to its profile. Such information would help the farmers in practising sustainable agriculture.
- **Farm management:**
 - Help in accessing the quality of the crops, and taking remedial measures in case of an aberration.
 - Can advise farmers regarding the optimum practices that should be followed in the field of agriculture.
 - Comprehensive planning and accessing the requirement of the labours to service the crop production.
 - Production can be boosted and farmers' input costs can be reduced to a drastic level.
 - Cut down waste production by a substantial level and make agricultural practices sustainable.
- **Weather forecast:** Analyse the long-term weather in greater detail and recommend to the farmers the changes they need to introduce in agriculture in order to make it sustainable and environmentally friendly.
- **Market access:**

- Help in improving the efficiency of the resources and overcome market asymmetry that prevent the farmers from accessing the markets.
- The use of AI such as agriculture credit scoring and 'smart' farms will help in reducing the cost of servicing for small landholders.
- Can play a role in precision farming. With the help of precision farming, every aspect of agricultural practices is analysed in greater detail and effective measures are taken to improve the malpractices that have crept into the system.
- **Irrigation management:** With the help of AI, soil quality is analysed in greater detail along with the type of crops to be produced. Thus, the amount of water needed by the crops is spelt by AI. It will thus help in reducing the wastage of farms.

What are the Key challenges for Agri-Entrepreneurship?

- Lack of technological dissemination
- Complex legal formalities
- Lack of technical understanding
- Poor quality control and other bottlenecks in the growth of agripreneurship

How to make Agripreneurship a mainstream activity?

A converging approach is required to ensure that the agripreneurs set them up on a path to self-reliance right from the beginning.

- **Subject of Entrepreneurship should be taught in colleges:** To inspire more youngsters to hone their skills and make it their career. Also, to encourage children of farmers to continue pursuing the profession but with a different angle. **Rural Entrepreneurship Awareness Development Yojana (READY)** can be successful in generating awareness and interest among the youth.
- **Agripreneurship policies need to incorporate the region-specific potential and demands.**
- **Ensuring effective management** of soil, seed, water, etc. as well as supply of source materials
- **Financial institutions and banks** must assure prompt financial security to entrepreneurS

Agripreneurship and Women Empowerment

Dr. APJ. Abdul Kalam said, *“empowering women is a prerequisite for creating a good nation, when women are empowered, society with stability is assured. Empowerment of women is essential as their thoughts and their value system lead to the development of a good family, good society and ultimately a good nation”.*

- Women entrepreneurs, especially women agripreneurs, represent the fastest-growing category of entrepreneurship worldwide.
- Women play a vital role in the integrated development of agriculture and allied sectors, by adding considerable value to the transformation of society and powering robust growth of the rural economy in India.

Scope and Prospects for Promoting Women Agripreneurship

- At present, women in India contribute to about 14% of agri-business owners.
- According to various estimates and survey findings, more than 1/3rd of the total Agri/rural start-ups are being managed by women agripreneurs, which is setting new benchmarks for viable and profitable business enterprises.
- Recent studies and research have observed that women can start new agri-businesses which are catering to an entirely different market segment or unique and niche markets when compared to their male counterparts.
- There is unlimited scope for promoting women agripreneurs because nearly 70% of agriculture and its allied activities are predominantly managed by women.
- Women are expected to dominate the workforce trends and leadership positions in India in the upcoming few decades, and this trend is almost similar in the case of women agripreneurs, thereby supporting to improve India's future by 2030.
- A significant number of Agri-based business opportunities have emerged recently in the agro-spheres such as agro-product processing, agri-based food packaging, export of fresh vegetables and fruits, organised retail-supply of agricultural semi-processed/processed products. This has got significant growth potential due to the enhanced availability of institutional micro-finance.

Challenges

- Dual responsibility of home and enterprises
- Serious threats from established corporate players
- Lack of knowledge/market awareness
- Lack of knowledge in branding, and required skill sets.
- Not enough support from their families.
- The fear of failure and low risk-taking capacity
- The infrastructure challenges such as storage, warehousing, electricity and credit facility and finance continue to trouble the women agripreneurs.

Government Policies and Programmes

- **Rashtriya Krishi Vikas Yojana – Remunerative Approaches For Agriculture and Allied sector Rejuvenation (RKVY- RAFTAAR)** – This scheme aims at making farming a remunerative economic activity.
 - This will strengthen farmer's efforts through creation of agriculture infrastructure that help in supply of quality inputs, market facilities etc.
 - This will further promote agri-entrepreneurship and support business models that maximize returns to farmers.
 - [RKVY-RAFTAAR](#) includes agripreneurship orientation, with a stipend for the entrepreneur; seed stage funding and funding for incubatees.
- **PM Formalisation of Micro Food Processing Enterprises Scheme (PMFME)** – This scheme of the Ministry of Food Processing Industries provides financial, technical and business support for the upgradation of existing micro food processing enterprises.
 - One District One Product (ODOP) Approach: The States would identify food products for districts keeping in view the existing clusters and availability of raw material.
 - Other Focus Areas: Waste to wealth products, minor forest products and Aspirational Districts.
 - Financial Support:
 - Existing individual micro food processing units desirous of upgrading their units can avail credit-linked capital subsidy at 35% of the eligible project cost with a maximum ceiling of Rs.10 lakh per unit.
 - Initial funding of Rs. 40,000- per Self Help Group (SHG) member would be provided for working capital and purchase of small tools.
- **Agriculture Infrastructure Fund** – This programme was launched under the AatmaNirbhar Bharat Package in 2020.
 - **Financial Support:** Rs. 1 Lakh Crore will be provided by banks and financial institutions as loans to be provided for Agriculture Infrastructure projects.
 - **Interest Subvention:** Loans will have interest subvention of 3% per annum up to a limit of Rs. 2 crore. This subvention will be available for a maximum period of seven years.
 - **CGTMSE Scheme:** A credit guarantee coverage will be available for eligible borrowers from the scheme under Credit Guarantee Fund Trust for Micro and Small Enterprises (CGTMSE) scheme for a loan up to Rs. 2 crore.
 - **Management:** The fund will be managed and monitored through an online Management Information System (MIS) platform. The National, State and District level monitoring committees will be set up to ensure real-time monitoring and effective feed-back.
- **Udyam registration portal** – Designed to help MSMEs emerge out of the ill effects of the COVID-19 pandemic.
- **Gramodyog Vikas Yojana** – A scheme of the Ministry of MSME, which is an artisan-centric programme implemented with the aim of the revival of traditional and inherent skills of rural artisans in village industries, has a special focus on Processing Industry such as Oil Industry, Aromatic Oil, Honey and Bee-Keeping.

- **Collateral Guarantee Scheme** – A scheme of the Ministry of MSME which involves the provision of collateral-free loans for MSMEs.
- **Special Credit Linked Capital Subsidy Scheme (SCLCSS)** – By the Ministry of MSME to promote the setting up of new enterprises by aspiring entrepreneurs of the SC/ST communities.
- **PM Employment Generation Programme (PMEGP):**
 - It is a major credit-linked subsidy scheme launched by merging two schemes namely Prime Minister's Rojgar Yojana (PMRY) and Rural Employment Generation Programme (REGP)
 - It aims for generating employment opportunities by establishing micro-enterprises in urban and rural areas in the non-farm sector.
 - Implemented by Khadi and Village Industries Commission (KVIC)
- **A Scheme for Promotion of Innovation, Rural Industries and Entrepreneurship (ASPIRE)**
 - Objective of the Scheme includes Creating new jobs and reducing unemployment, promoting entrepreneurship culture in India that will promote grassroots economic development at district level
 - It involves setting up network of technology centres and incubation centres to accelerate entrepreneurship and also to promote start-ups for innovation in agro- industry and MSME sector.

Other initiatives

- **National Spot Exchange Limited (NSEL)** which is a nationalised transparent electronic spot exchange based in Mumbai, is offering a cutting-edge marketplace that offers solutions to agricultural producers, processors, exporters and other stakeholders.
- The **e-Seva Kendra of the Grameen Sanchar Society (GRASSO)** offers agri-related services such as market access, the price for agricultural products, availability of cold storage facilities and labour and job opportunities.
- **Agricultural Marketing Information System (AGMARKNET)**, the internet-based information system, seeks to provide a "single window" service appealing to various information demands.
- **Farmers Market** is a unique move by some state governments known as Uzhavar Santhai (Tamil Nadu), Rythu Bazaars (Andhra Pradesh), and Apna Mandi (Punjab). These markets research the huge potential of agri-entrepreneurship training.
- **The Agrilclinic and Agribusiness Centre scheme**, launched by the Ministry of Agriculture along with NABARD, aims to tap the expertise of the large pool of agri-graduates.
- The organisations such as the National Institute of Micro, Small and Medium Enterprise (NIMSME), Indian Institute of Entrepreneurship (IIE), National Institute for Entrepreneurship and Small Business Development (NIESBUD), National Skill Development Corporation, National Skill Development Agency and National Skill Development Fund have been engaged in training, consultancy and research to promote entrepreneurship and skill development.
- NABARD has been a partner of the Government in implementing schemes for Agri-Entrepreneurship such as the **New Agricultural Marketing Infrastructure (AMI)** sub-scheme of the Integrated Scheme for Agricultural Marketing (ISAM), **Agri Clinics and Agri Business Centres Scheme (ACABC)**, and **National Livestock Mission – Entrepreneurship Development and Employment Generation (NLM-EDEG)**.

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