Current Environmental Issues and Challenges

---------- EDITORS ----------

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Nature Light Publications

ISBN- 978-81- 954002-9-4

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Publishing Agency : Nature Light Publications, Pune

Publisher Address Mrs. Pragati P. Patil
309, West 11, Manjari VSI Road,
Manjari Bk, Haveli, Pune, 412307
Phone: +91 9922489040 / 8625060096

Printed By Milan Digital Printers.
Shop No.6 Business Square, Tilak Road,
Sadashiv Peth, Pune - 411030

Edition Details : Ist

ISBN : 978-81- 954002-9-4

Publication Date : 15/07/2022

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Price: 700/-

EDITORIAL BOARD

Published by –

Nature Light Publications, 309, West 11, Manjari VSI Road, Manjari Bk, Haveli, Pune, 412307
Phone: +91 9922489040 / 9822489040/ 8625060096
Email: naturelightpublications@gmail.com
Website- www.naturelightpublications.com

Preface……

I am happy to welcome the idea of publishing a book on relevant topic, "Current Environmental Issues and Challenges". Further, it is good that the articles from various disciplines are included in the book. The scholars from life sciences and social sciences have attempted to identify the current issues of environment and to provide ideas to manage the issues. The environmental issues like solid waste management, structural deterioration of ecosystems, crop destruction and also destruction of vegetation cover due to pests especially aphids, climate change, impact of land acquisition in Marathwada region leading to rural urban migration and farmers suicide, broad idea regarding causes of environmental issues in India, e-waste and related issues, return migration of labourers during lockdown period, impact of irrigation, impact of variation in climate on zooplankton, etc. This exhibits how variety of topics have been discussed in the book. The book provides open forum for the scholars and even graduate students to discuss further so that they can think about strategic planning to resolve the issues associated with environmental degradation.

Most of the issues of environment have been created due to unethical management of resources and most importantly for improving the profitability of industries. Any step, in the name of "development" is mainly for the "comfortable life style" for small section of population in the world. Similarly, the same social and financial section of Indian society is responsible for about entire pollution, waste generation, e-waste generation, groundwater depletion, forest fire etc. and their ultimate impact is on global issues like 1) Climate change 2) Biodiversity depletion and 3) Ozone holes. Further the studies in environmental economics have clearly stated that the impacted population is from poor section of society.

Thus, the culprits of environmental degradation are the rich countries and rich people in the developing countries. On the other hand, sufferers of environmental degradation are the poorest of poor. For example, urban areas in our country are responsible for reducing their ecological ability of rivers to swallow the

waste. Additionally, our culture has been so "developed" (?) that we started generating per capita waste in geometric progression. High consumerism is promoted by corporates. Unless we adopt high consumerism as regular practice corporates cannot maintain their sale and profits. Most of the wars or war-like situations help the production in the name of defense, nationalism, national pride etc. However, such situations are created just to support "Defense- Industrial Complex" in the developed countries. It may be noted here that air & water pollution and solid waste generation have been observed to be highest in case of wars. However, there is no voice on this issue. We consider major source of air pollution is burning of fossil fuel. Estimation of air pollution due to war can be possible. There is one principle. "One bullet is fired in a war can be equivalent to firing 1000 bullets." This is mainly because huge amount of weapons are used for training. The ratio of weapons used in the war and used before war for practice may differ from weapon to weapon, missile to missile and rocket to rocket. If this kind of arm-race is stopped catastrophic impact of climate change would certainly be reduced. Here is the relevance of Gandhian' idea of non-violence and peace. Gandhiji's movement was not just to tell Britishers to quit India but to get rid of corporate culture that was being thrusted on Indian society through education, economy and political affairs. Gandhiji's idea of independence was "Swaraj" in which democracy, secularism, social equity, equal opportunity to all irrespective of caste, race and gender, were considered as important values. Degradation of environment is mainly caused by unethical or indiscriminate use of natural resources. This leads to disparity which further leads to declining democratic values. This is virus circle. Unless it is broken by civil society in India and other countries conservation strategies may not work in true spirit.

At the end I would like to suggest that young scholars from various disciplines should carry out analytical studies to identify culprits of environmental degradation and the social strata impacted most due to deterioration of ecosystem. This would make us to known what are pin-pointedly the issues of environment. Further, academician can provide solutions to resolve such issues. Hopefully the

present book covering various issues of environment would enthuse academia to come out of their field and understand the chain reactions from policies to ground realities. The scholar should not stop here but they should try to be active and focal to ensure peoples participation in this endeavor. Wishing great time ahead to the authors and readers. I hope the book will be instrumental in supporting conservation movements worldwide.

Dr. Pravin Saptarshi

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ISBN-978-81- 954002-9-4

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ISBN-978-81- 954002-9-4

URBAN SOLID WASTE MANAGEMENT IN MUNICIPAL CORPORATION GURUGRAM (MCG), HARYANA: AN ANALYTICAL STUDY

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ABSTRACT

The inappropriate management of solid wastes contaminates the environment and affects people's health. Because of the growing rate of migration from rural areas in search of employment and a higher quality of life, the solid waste problem in urban areas is severe. Municipal Corporation Gurugram records that the city alone generates solid waste of about 1100 tons per day. The facilities for collection and disposal of waste are inadequate resulting in a high proportion remaining uncollected. Though solid waste management is an essential service, it is given low priority in some municipal areas of Gurugram. Currently, waste is collected and dumped in the low-lying areas without consideration for the consequences of the dumping on the environment and soil. One of the most serious issues facing municipalities is effective solid waste management (SWM). Landfilling is the most widely used form of solid waste disposal in urban regions. The landfill site of the city already crossed 32 lakh tons of legacy waste. There are 514 bulk waste generators in the study area. The principle of integrated solid waste management (ISWM) is adapted to manage solid waste in urban areas, which entails the use of appropriate technologies and management programs to cover different types of solid waste from different sources to attain the dual targets of waste reduction and effective waste management.

Key Words: Urban, Solid Waste Management, Bio-degradable waste, Waste Generation, Waste Disposal.

INTRODUCTION

Municipal authorities also collect and handle solid waste, which is termed urban solid waste. It has become a critical function of municipal government all over the world, with a direct environmental impact and public health. Solid waste is a substance that cannot be advantageously utilized without appropriate processing. It is waste material that is left over from multiple methods, and it may or may not be usable. One of the most obvious implications of rapid urbanization is the increased generation of solid waste, which is causing unimaginable problems for many municipal governments in terms of the collection as well as proper waste disposal. Since the population and industrialization were low in the early days, urban solid waste did not have a significant negative impact; nevertheless, the population is now exponentially growing at a rapid rate, and accessible land is diminishing day by day. The rapid outburst of the population in urban areas, due to migrating from rural areas in seek of employment and modern amenities had led to major growth in the generation of solid waste and threatened the earlier system of waste management.

Everyone tries to rid of solid waste as soon as possible whenever the opportunity arises. Illegal dumps on sidewalks, open fields, water bodies, and wasteland are common outcomes of

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this behavior. Landfilling is the most common way of solid waste disposal in developing countries like India. Solid waste management encompasses all administrative, financial, legal, planning, and engineering aspects (Ramachandra and Varghese, 2003). The per capita solid waste generated is estimated to rise by 1.33 percent per year (Ojha and Goyal, 2007). Management of solid waste is one of the key challenges that most urban areas face worldwide (Zerbock and Candidate, 2003). Urban local bodies spend 5-40 percent of their total budget on the management of solid waste. The quantity and type of solid waste generated vary depending on the activities and the country's technological advancement. Thus, the prime task of urban solid waste management is to reduce negative effects on the environment and public health while maintaining economic growth and improving living standards.

Due to increased population urbanization, Gurugram's physical environment has deteriorated. One of the most pressing concerns for municipal authorities is the efficient management of solid waste. Excess waste generation, inefficient waste collection and transportation, and a scarcity of disposal options all have an impact on the area's wellness, environment, and quality of life. According to a field survey, the availability of land for garbage dumping is a major concern in the Gurugram municipal corporation.

STUDY AREA

Gurugram city has an urban area of 314 square km. with the number of population of more than 8 lakh (2011 census). It is located at 28°45′ N latitude and 77° 02′ E longitude.

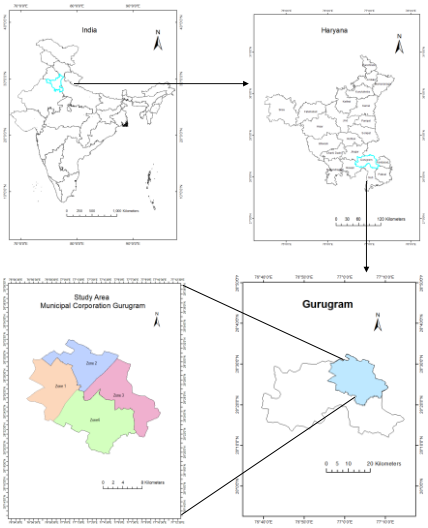

Fig.1 Study Area

The city is situated at 25 km distance from the national capital, and 285 km distance from the state headquarters named Chandigarh. It lies 217 meters above mean sea level. It lies under the part of NCR (National Capital Region). The municipal area is divided into 35 wards and 4 zones. Now Gurugram is known as the most important industrial and corporate hub of the state. Its name is derived from 'Guru Gaon' named after Dronacharya, a character of the epic Mahabharata. India's largest carmaker Maruti Udyog Limited office and manufacturing plant is situated here.

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OBJECTIVE

The purpose of the study is to investigate and assess the existing practices of Urban Solid Waste Management in Municipal Corporation Gurugram (MCG).

DATA AND METHODOLOGY

The secondary data on the city population was gathered from the population tables of the census of India, 2011. The information on existing urban solid waste disposal and management was obtained through discussions with officials from Gurugram's municipal corporation. The primary survey includes a Collection Point Survey, Dumping site / Landfill site survey, and transfer station survey for a fair idea of the different types of waste being generated in the city.

The website of Ecogreen Energy, a renowned waste management firm in Gurugram, has been used to gather some essential information. The integrated municipal solid waste management (IMSWM) in Gurugram city is the sole responsibility of Municipal Corporation Gurugram (MCG). Four administrative zones have been established in the city. These Zones are further divided into 35 wards, which have been established to enable better governance and to allow for phased development operations (the pioneer 13-04-2018).

RESULT AND DISCUSSION

Composition:

Table 1.
Composition of Urban Solid Waste at Gurugram

Category of Material	Old Gurugram	New Gurugram	Overall Gurugram
Paper	7.505 ± 1.612	6.857 ± 2.545	7.246 ± 1.355
Plastics	13.730 ± 1.142	10.872 ± 2.127	12.587 ± 1.095
Metal	1.223 ± 0.331	0.674 ± 0.327	1.003 ± 0.242
Glass	1.074 ± 0.304	0.872 ± 0.489	0.993 ± 0.258
Organics	28.747 ± 3.866	38.618 ± 8.989	32.695 ± 4.210
Others	47.722 ± 4.691	42.108 ± 7.048	45.476 ± 3.900

Source: TERI Report, 2019.

Generation:

Gurugram's per capita waste generation is estimated to be 560 gm/day, including residential, business, and institutional waste. It is linked to several factors, including food habits, living standards, and the level of economic and industrial activity in the study area. Within the municipal corporation of Gurugram (MCG), approximately 1100 tons of municipal waste is generated and controlled (Wet waste: 576 metric tons, Dry waste: 448 metric tons). According to the Indian situation, Gurugram's urban solid waste will be 50-52 percent biodegradable, 12-15 percent dry recycles, and 30-35 percent inert components. The future waste generation in Gurugram can be determined by population growth, economic growth, and personal income levels.

Collection and Transportation:

M/s Ecogreen Energy Pvt. Ltd. handles door-to-door (D2D) collection and transportation of solid waste. On August 14, 2017, M/s Ecogreen signed a 22-year concession agreement that

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would last until August 2039. Municipal Corporation Gurugram does its own sweeping in residential, commercial, and industrial areas.

Table 2.

Collection facilities of Urban Solid Waste at Municipal Corporation Gurugram

Sr. No.	Waste collection facilities	Current Numbers
1.	Total number of Primary Collection Points	From each waste generator 369600 Nos. (In addition to this there are 514 Bulk Waste Generators (BWG).
2.	Total number of Community Bins Dhalaos Garbage Vulnerable Points (GVP)	Secondary Points - 18 GVP – Nil
3.	Total number of Secondary Collection Points/Transfer Station	Secondary Points – 18 Transfer Station – 3
4.	Mapping the number of illegal dumpsites	N/A
5.	Total number of the Landfill site	1 No. (Bandhwari).

Source: Sanitation Department, Municipal Corporation Gurugram, 2021.

Table 3.

Urban Solid Waste Collection Status at Municipal Corporation Gurugram

Sr. No.	Waste Collection	Current Status
1.	D2D Collection and Transportation done by (ULB/Concessionaire/Both)	Concessionaire (Ecogreen)
2.	Processing & Disposal done by (ULB/Concessionaire/Both)	Concessionaire (Ecogreen)
3.	In how many streams waste is getting segregated?	4 Wet / Dry / Domestic Hazardous / Sanitary Waste
4.	Frequency of D2D Collection in Residential Areas for Dry Waste and Wet Waste	Daily
5.	Frequency of D2D Collection in Commercial/institutional Areas	Daily
6.	Number of wards where D2D collection is happening	35
7.	Percent of households giving segregated waste	77%

Source: Sanitation Department, Municipal Corporation Gurugram, 2021.

There are 1.5 cubic meter bins, three HUDA's (Haryana Urban Development Authority) waste collectors, and a private contractor's tractor-trailer has been placed in various areas for collection. According to the pattern of worker deployment, the road length to be covered by each sweeper seems to be rather long. The number of workers, road length, and equipment and vehicles required

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for collection and transportation were not stated in HUDA's SWM contract with the commercial operator. This has resulted in the appropriate sweeping of main roads, whereas interior roads and back roads are often neglected.

Table 4.
Transportation of urban solid waste at Municipal Corporation Gurugram

Sr. No.	Transportation of Waste	Details
1.	The number of Non-Motorized Vehicles and Motorized Vehicles	Non-Motorized – 253 Motorized – 430
2.	Number of the vehicles that have compartments for segregated collection	603 (80 Vehicles for Secondary Transportation are not compartmentalized).
3.	Total no. of vehicles with GPS (Global Positioning System) tracking system.	430
4.	Total Number of trips for the collection of waste between primary collection point and secondary collection points and between secondary and the landfill/dump sites and quantum of waste carried per day	Primary to Secondary – 1556 (3 Trip by Motorized and 2 Trip by Non-motorized). Secondary to dumpsite – 80 Trips

Source: Municipal Corporation Gurugram, 2021

People do not participate in solid waste management, and waste littering is frequent on vacant fields and roads. In addition, the lack of a reliable monitoring system has resulted in ineffective waste management activity supervision. With a workforce of 1,206 sanitary workers working under the supervision of the chief sanitary inspector, MCG controls waste generated only in the municipal area.

Processing and Disposal:

The current solid waste management plant is built in a public-private partnership (PPP) model at Bhandwari which is situated on the Faridabad-Gurugram Road. This project was built under the 'Jawaharlal Nehru Urban Renewal Mission (JNNURM)' scheme with the cost of 42 Crore INR of which 50 percent amount from the Government of India, 20 percent from the state government of Haryana, and the remaining 30 percent from municipal corporation Faridabad (MCF). While MCG provided the land at no cost. The MCG is using the facility to dump solid waste at the processing facility, where there are no costs for MCG to treat the waste.

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Picture 1 **Picture 2**

Pictures 1 and 2 show the current dumping site at Bandwari Village of Gurugram District. (Field Survey 18-03-2022)

The total area at the landfill site is about 30 Acre and 35 Lac MT of waste has accumulated at the Bandhwari landfill site. The site has almost exhausted its capacity to accommodate more waste and the situation is alarming. There's an ongoing legacy waste treatment facility at the landfill site with 6000 tons/ day.

The legacy waste is being processed and being monitor regularly. Compost, RDF (Refuse Derived Fuel), Inert, and C&D (Construction and demolition waste) are the outputs of the treated legacy waste. MCG has deployed 15 trommels and 03 high-capacity waste processing machines to treat the legacy waste by adopting Bio-remediation and Bio-Mining processes. MCG is sending RDF in Cement Industries such as JK Cements and Ultra Tech Cement and Waste to Energy Plants at Murthal, Sonipat. Erection of Waste to Energy (WtE) Plant is in the scope of M/s Ecogreen. The Consent to Erect the WtE Plant of 16 MW has been obtained. M/s Ecogreen has now applied for a 25 MW WtE Plant for which permission is still awaited from Haryana State Pollution Control Board (HSPCB).

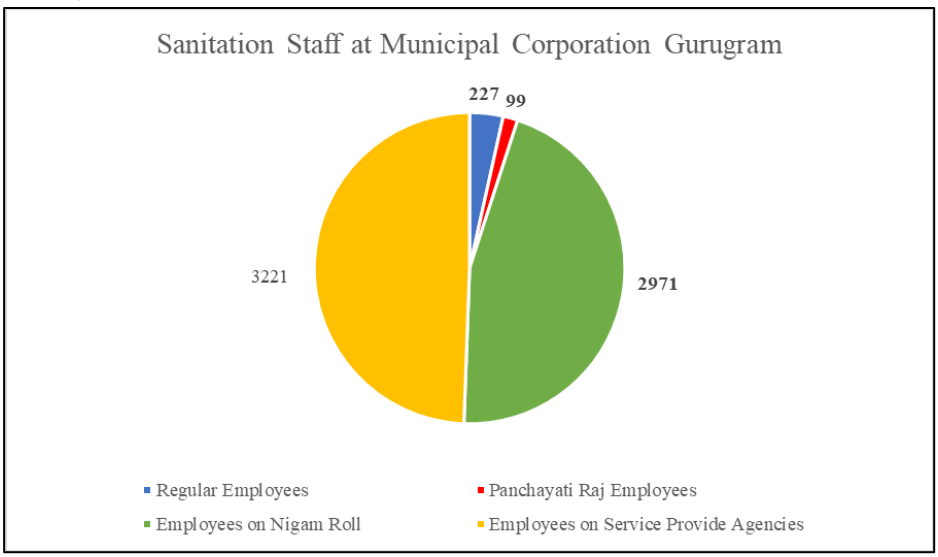

Fig: 2 Sanitation Staff at Municipal Corporation Gurugram

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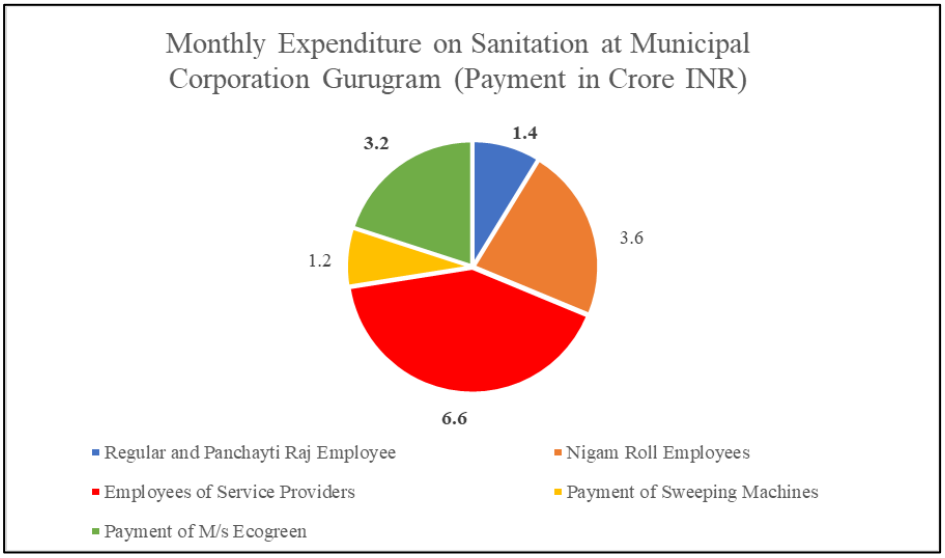

Fig: 3 Monthly Expenditure on Sanitation at Municipal Corporation Gurugram

Environmental Challenges:

The increasing urbanization process has spawned a slew of issues, one of which is solid waste, which is affecting MCG's environment. Although waste management in municipalities is a low priority, it can exacerbate social and environmental issues, posing health and environmental risks. Waste dumping is an urban local government's sole option that does not necessitate further action.

A 30-acre land near Bandwari village on the Gurgaon-Faridabad route is planned for a solid waste facility including a waste recycling plant. Within two years of operation, 50% of the land has been utilized as a dump yard while transporting waste from two cities. Nowadays, the most pressing challenge is reducing the quantity of land required for waste disposal by maximizing the appropriate treatment of various waste streams. Under the Public-Private Partnership (PPP) module, MCG has privatized collection and transportation in four zones. The privatisation of the balance areas is also being considered. The whole availability of trucks is available under transportation, however, there is a management shortage.

CONCLUSION

Waste management is a subject that every citizen of the country should be concerned about. The disposal of waste is not solely the responsibility of the city authorities. According to the 'Ministry of Environment, Forestry, and Climate Change (MoEFCC) 2016' SWM rules, generated waste should be categorized into three groups: biodegradable, non-biodegradable, and household hazardous waste.

Most cities in the developing world face a high level of waste-related issues due to insufficient waste management services such as segregation and collection. Consumption patterns, lifestyles, economic development, urbanization, and other factors have all contributed to an increase in the quality and complexity of solid waste generation in the country.

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The human, technological, and financial resources need to tackle this challenge. One of the most commonly recommended approaches is a participatory strategy in which the municipality and citizens share the responsibilities to clean their locality. Source segregation has an influence that extends beyond the recovery of recyclables and the conservation of virgin resources. It has been observed that source segregation of waste to enable a clean environment results in the creation of worker livelihood opportunities.

It has also been observed that a simple act, which requires no expenditure, can significantly alter people's perceptions of waste and is a prime stimulus for spreading the principle of reducing, reusing, and recycling.

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ISBN-978-81- 954002-9-4

CHERNOBYL NUCLEAR EXCLUSION: A CASE STUDY ON WORLD'S LARGEST NATURAL RESERVE

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Abstract

The Chernobyl nuclear power facility melted down catastrophically on April 26, 1986, releasing hazardous particles into the atmosphere. When a nuclear disaster occurred in 1986 at a nuclear power plant in Ukraine, it had a devastating effect on both the local economy and the surrounding ecological system. Many consider it to be the biggest nuclear disaster ever, both financially and in terms of human toll. The research is vital to demonstrate what happened at Chernobyl and how the earth recovers from a calamity of this magnitude. Unit 4 of the Chernobyl nuclear power facility was destroyed by an electrical surge during a reactor system test. Chernobyl's whole city was obliterated in the Chernobyl nuclear tragedy. Among the study's concerns are the importance of nuclear power plants, how to operate them safely to minimize accidents, and the long-term effects of nuclear power breakdowns on our world. This research finding could be implemented at nuclear power plants, and the primary benefit is that the public will be better informed about the Chernobyl accident's environmental consequences and its recovery.

Keywords: Chernobyl nuclear disaster, nuclear power plant, Ecosystem, Nuclear hazard, Environment.

INTRODUCTION

Chernobyl Nuclear Power Plant had an accident on April 26, 1986. According to numerous eyewitness accounts and rumours, the incident occurred more than two decades ago, yet its ramifications continue to be discussed and misunderstood to this day. In the aftermath of the disaster, the International Atomic Energy Agency (IAEA) and the United Nations Food and Agriculture Organization (UAFAO) founded the Chernobyl Forum to address the issue. The Chernobyl Forum resolved to establish itself as a permanent entity comprised of the organisations described above during its first organisational meeting in February 2003. To address the accident's health consequences and the environmental consequences of the radioactive material released, the Chernobyl Forum was established to develop authoritative consensus declarations. Its sessions were attended by government, business, and the general population. Additionally, the Chernobyl Forum provides guidance on cleanup and targeted healthcare programmes, as well as identifies areas for additional research.

The Chernobyl nuclear power plant in northern Ukraine, near the city of Pripyat, has been decommissioned. It was decommissioned in 1986. To guarantee optimal cooling, an artificial pond supplied by the Pripyat River was created around 5 kilometres northwest of the complex.

ISBN-978-81- 954002-9-4

Following the 1986 Chernobyl tragedy, the power plant is currently surrounded by a restricted area known as the Chernobyl Exclusion Zone. The State Agency for Exclusion Zone Management in Ukraine is responsible for both the exclusion zone and the area's decommissioned power facility. Due to the incident, just three reactors remained operating until 2000, when they were gradually decommissioned, and the site is currently being decommissioned until 2021. It is estimated that by 2065, all radioactive waste will have been disposed. Particles and gaseous radioactive contamination were discharged into the atmosphere as a result of the 1986 Chernobyl tragedy, which resulted in a large amount of radioactive contamination being emitted. During the Chernobyl tragedy, radioactive gas and compounds were released into the atmosphere, and the radiation level in 1996, as displayed in Fig 1(Papastefanou, Manolopoulou, Stoulos, Ioannidou, & Gerasopoulos, 2005), demonstrates the extent of the contamination.

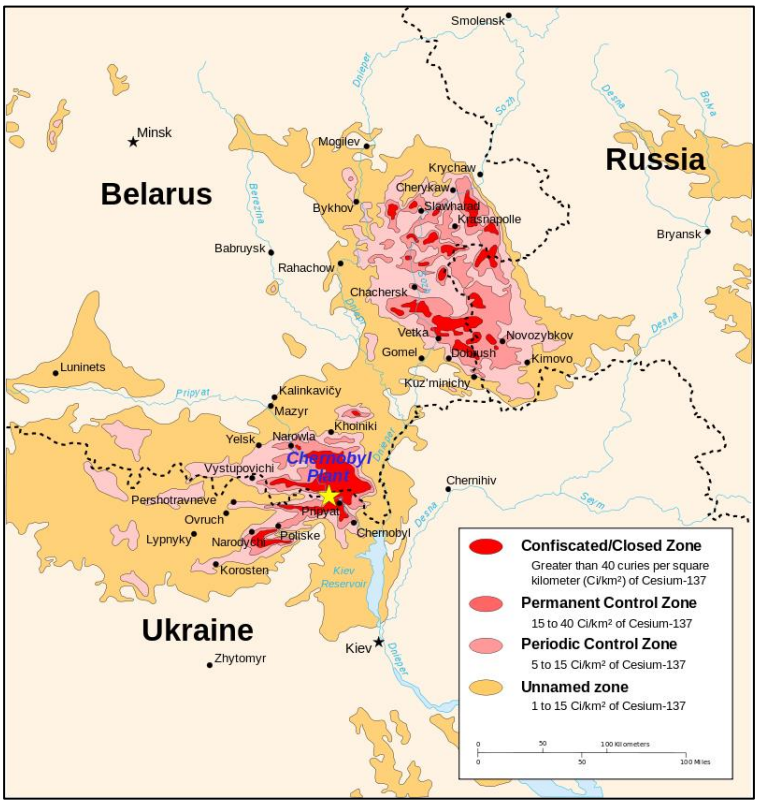

Fig. 1. Radiation level in Chernobyl,1996

When compared to other sources of energy, methane and carbon dioxide, two gases that trap heat in the atmosphere and contribute to global warming, are far less prevalent in nuclear power plants. Nuclear power plants are more environmentally friendly than natural gas or other fossil fuel-fired power plants because they generate energy through the breakdown of atoms rather than the combustion of natural gas or other fossil fuels. By increasing our reliance on nuclear

ISBN-978-81- 954002-9-4

energy, we can reduce the amount of greenhouse gases in the atmosphere, so decreasing the rate of global warming and lowering the world temperature. Nuclear reactors generate a significant quantity of energy via fission. As of now, nuclear fission is expected to provide ten million times the energy that a single atom of fossil fuel burns. Nuclear power plants are capable of providing enough electricity to meet the needs of industrial and commercial clients as well as residential consumers. In comparison to intermittent renewable energy sources such as solar, wind, and wave energy, nuclear energy is more reliable and predictable. When properly maintained and operated, nuclear power plants can provide year-round energy regardless of the weather. Along with their numerous benefits, nuclear power plants have a number of drawbacks that make them potentially dangerous. There is still no answer to the radioactive waste problem. Nuclear waste must be managed with extreme caution for several thousand years to avoid radioactive contamination. The following are some of the most major dangers: Despite the fact that the majority of people are well protected, accidents still happen. It is technically impossible to construct a factory that is completely safe. Due to the low probability of failure, this condition will endure indefinitely. If an accident occurred, the resulting devastation would be catastrophic for both humans and the environment.

1. CHERNOBYL DISASTER

According to the official report, the Chernobyl tragedy took the lives of 31 people, whereas the United Nations estimates the death toll at 50. There is considerable dispute on the exact number of individuals who will die as a result of the disaster's long-term health consequences. The evaluation of environmental damage and human radioactive exposure conducted by the International Chernobyl Study between 1990 and 1991 was a critical component of the project. To estimate the inhalation dose received by the general public, Caesium-137 deposition was utilised to determine the evacuation zone surrounding the plant and the time required for people to exit the evacuation zone. According to the 2005 and 2006 conclusions of a joint United Nations consortium, long-term mortality estimates range from up to 4,000 for the most exposed people in Ukraine, Belarus, and Russia to 16,000 for all those exposed throughout Europe, with figures as high as 60,000 when relatively minor effects are considered. They were developed using the problematic Linear no-threshold model. All of these contaminants are difficult to quantify since they do not reach the level of an epidemiological "threshold." There is no one-size-fits-all solution to this situation. Extremely low dosages are associated with an increased risk or death toll that can only be determined on an individual basis, and while much higher numbers would be regarded significant, smaller amounts are statistically insignificant and are unlikely to be published.

Until 2021, it will unintentionally send the most radiation into the atmosphere. To make a comparison between Chernobyl and atmospheric nuclear weapons tests, the Scientific Committee on Environmental Problems (SCOPE) states that it is impossible to determine which is worse(Akyüz, 2015). Rather than that, the entire occurrence must be reviewed. The emission of long-lived radioactive isotopes at Chernobyl, as well as the isotopes released following the detonation of a nuclear weapon, contribute to this. The economic cost of the accident is anticipated to reach $235 billion.

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1.1 Radiation Effects on Humans

According to a 2009 study conducted by the United Nations Scientific Committee on the Effects of Atomic Radiation, the Chernobyl disaster exposed 61,200 recovery workers and evacuees to 61,200 man-Sv of radiation, the entire population of Ukraine, Belarus, and Russia to 125,000 man-Sv of radiation, and the majority of Europe's more distant countries to 115,000 man-Sv of radiation (UNSCEAR). Numerous children tested positive for Iodine-131, a radioactive substance that can cause thyroid disease and insomnia in children. Additionally, it has been demonstrated that children's high absorption rate is inversely proportionate to their age. Children exposed to radiation in the aftermath of the disaster suffer a significant risk of acquiring thyroid cancer, which becomes more severe as the child grows older. It is likely that the inverted equilibrium is caused by the way iodine-131 is absorbed by children. In 2013 cohort research, a similar link between age and dose response was identified. All of the study's subjects were under the age of 18 at the time they were exposed to radiation in Belarus. The cohort enrolled a total of 12,000 individuals. While leukaemia and cataracts have increased among the 600 radiation-exposed individuals on the job, solid tumours and leukaemia have remained stable, according to the data.

Significant exposure to fallout can result in radiation illness and cataracts, both of which can be fatal. The long-term effects include an increased chance of thyroid cancer in children and adolescents, as well as leukaemia among workers who have been exposed to the medicine for an extended period of time. According to reports, the incident permanently altered the lives of numerous people. Within a few weeks after the disaster, 316 persons perished, the majority as a result of the first steam explosion, radiation burns, and cardiac arrest. Individuals living in Chernobyl-affected areas exhibit a wide range of symptoms that are frequently associated with traumatic occurrences. This category includes medically unexplained physiological problems, as well as a general sense of unwellness. As a result of the Chernobyl nuclear power plant accident, Belarusian researchers examined the health of 138 newborns whose mothers were pregnant and lived near the plant at the time of the accident, as well as 122 children whose mothers were pregnant at the time but received only low levels of radiation exposure (Kolominsky, Igumnov, & Drozdovitch, 1999). The surveys were completed twice, once when the respondents were 6 to 7 years old and again when they were 10 to 11 years old, to determine the influence of womb radiation exposure on their mental development. In both surveys, the prevalence of difficulty speaking and emotional disturbance was significantly higher in the exposed group than in the non-exposed group. In terms of cognitive quotient, fewer children in the exposed group were above average, whereas the proportion of children on the borderline between normal and mental retardation was significantly greater. The issue is that experts cannot agree on the number of health issues caused directly by the event. Individuals living in the region's direct experience, as well as research conducted since 1986, establish a link between the Chernobyl disaster and an increase in health problems in Ukraine and Belarus (Saenko et al., 2011) (Sumner, 2007). The American Academy of Pediatrics established a link between unsafe levels of Strontium-90 and an increased risk of certain congenital birth defects in a 2010 study. According to another United Nations

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Children's Fund (UNICEF) study, more than 20% of children in Belarus have disabilities as a result of birth defects (Cardis et al., 2006) (Havenaar et al., 1997).

1.2 Effect on Wildlife

The trees and other vegetation in the area surrounding the nuclear disaster zone have demonstrated extraordinary tolerance to the high radiation levels. Several coniferous forests in the vicinity of Chernobyl became a brilliant orange as a result of the huge radiation levels that rushed over the area following the tragedy, which killed numerous trees. Radiation has harmed or altered food crops, plants, and fruits. Clearly, plants and animals were harmed in the immediate aftermath. In a few months, about 4.3 kilometres of pine trees were destroyed, giving origin to the term "Red Forest". The International Atomic Energy Agency (IAEA) has declared a large number of soil-dwelling rodents and insects extinct (Hamblin, 2015) (Vreysen, Robinson, & Hendrichs, 2007). When high doses were sustained in close proximity to the reactor, the rate at which plants, animals, and humans died and reproduced increased significantly. In the first few years following the tragedy, radioactive contamination caused genetic damage to plants and animals in the Exclusion Zone. Plants and animals have survived in the Chernobyl Exclusion Zone, formerly considered uninhabitable. According to specialists, there are still areas where people are unable to travel, and this is expected to persist for another 20,000 years.

1.3 Effect on Climatic Change

Following the occurrence, a substantial amount of radioactive rain fell on open surfaces such as lawns, parks, and roadways. Wind, rain, traffic, street washing, and clean-up have all contributed to the reduction of urban surface pollution since then. Residents of the immediate area were also wreaked mayhem. On the other side, environmental activists are still concerned about climate change and human activity 35 years after the explosion. The most pressing issue is the Chernobyl Forest fire. As a result of the Chernobyl incident's climate change, forest fires in Chernobyl have become more frequent and intense. Radiation pollution continues to spread over Ukraine and Belarus as a result of the initial Chernobyl nuclear power plant disaster (De Meutter et al., 2021) (Williams, 2001).

1.4 Global Impact

The collapse of the Soviet Union (Union of Soviet Socialist Republics) and the launch of a global anti-nuclear campaign were other immediate consequences of the Chernobyl disaster. As of this writing, the disaster is expected to cost more than $235 billion. This impacted an area of over 100,000 square kilometres (39,000 square miles). Radioactive particles discharged into the atmosphere and precipitation were identified in remote areas of Europe, most notably Sweden, as well as in fallout-affected areas of Belarus, Ukraine, and Russia. In the world's only commercial nuclear power plant accident, a person died as a result of radioactive contamination. Within a few weeks after the disaster, 316 persons perished, the majority as a result of the first steam explosion, radiation burns, and cardiac arrest. Thyroid cancer has been connected to the Chernobyl disaster in Belarus, Ukraine, and the Russian Federation in approximately 20,000 children and adolescents

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under the age of 18 (International Consortium for Research on the Health Effects of Radiation Writing Committee and Study Team et al., 2006) (Little et al., 2015). According to the Committee on Radiation Effects, more than 20,000 cases of thyroid cancer in children under the age of 18 have been documented. Chernobyl's reactor quickly began producing massive amounts of radioactive iodine in the aftermath of the disaster, contributing to this. Due to the fact that cows grazed on radioactive iodine-contaminated meadows, the milk they produced and the children who consumed it contained high levels of the toxin (Flachowsky, Franke, Meyer, Leiterer, & Schöne, 2014) (Schöne et al., 2009). Due to the area's deficient iodine intake, the thyroid began to overproduce and expel radioactive iodine, causing the issue to worsen. Chernobyl's official death toll was 31, despite the UN's estimate that the tragedy killed only 50 people directly. Environmental experts in the impacted nations and international organisations have conducted extensive investigations into the Chernobyl nuclear power plant accident and meltdown. The evaluation of environmental damage and human radioactive exposure conducted by the International Chernobyl Study between 1990 and 1991 was a critical component of the project.

2 CHERNOBYL - A HAVEN FOR WILDLIFE

2.1 Chernobyl Exclusion Zone (CEZ)

Fig. 2(Shaw et al., 2019) depicts a 2,600-square-mile section of Ukraine's Exclusion Zone. As the world's most radioactively polluted region, public access and living in the immediate neighbourhood of the Chernobyl Nuclear Power Plant are strictly prohibited. Following the 1986 accident, the Soviet armed forces swiftly created it. The Exclusion Zone's primary objectives include preventing individuals from visiting potentially dangerous sites, stopping the spread of radioactive pollution, and undertaking research in these disciplines. Chernobyl is surrounded in Ukraine by a radioactively contaminated zone covering approximately 2,600 square kilometers (1,000 square miles), making it difficult for the public to visit or live there. Beyond the restricted exclusion zone, other mandatory resettlement and voluntary relocation sites exist in neighbouring regions and throughout Ukraine. The Associated Press reported in February 2019 that discussions were underway to alter the Exclusion Zone's limits to more accurately reflect the zone's surrounding areas' lowering radioactivity. There are numerous justifications for establishing a radiation exclusion zone, including restricting access to high-risk areas and preventing radioactive pollution.

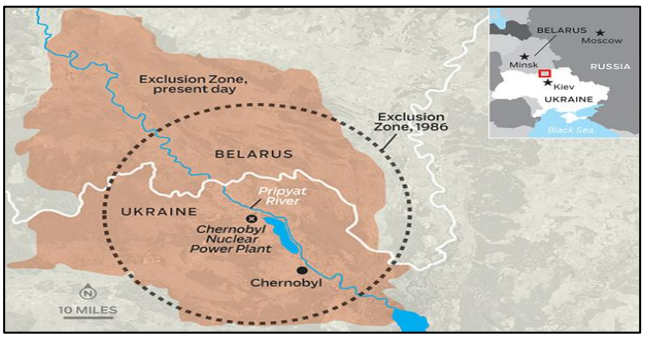

Fig. 2. Chernobyl exclusion zone,1986

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2.2 Flora and Fauna in Chernobyl Exclusion Zone

Plants have been able to grow in the most radioactively contaminated places. It piqued scientists' curiosity in how organisms adapt to ionising radiation in the aftermath of the Chernobyl nuclear disaster. Wildlife like as wolves, wild boar, and bears have repopulated the woodlands surrounding the decommissioned nuclear power facility. Except for the most delicate and exposed plants, all vegetation recovered within three years, even in the most radioactive locations. According to current research findings, plants may be able to flourish in radioactive situations such as Chernobyl. We investigated seeds from soybean and flax plants that grew in the Chernobyl nuclear reactor catastrophe area in 1986. Scientists believe that under certain conditions, plants are programmed to deal with radiation. The black locust, Robinia pseudoacacia, is already prospering in the area as a result of the Chernobyl tragedy. Human activity has resulted in the emergence of a number of unique lichen and grass species, as well as aggressive natural species colonies. Due to the breeding of Chernobyl plants with non-native species, new species are arising that were not previously there. Scientists began to notice a significant shift in the biology of the region's microscopic life in the decades following the disaster. The bacteria began to undergo more rapid mutations as a result of being exposed to high amounts of radiation. Apart from that, they were attempting to develop new radiation-resistant creatures.

The suburbs of Chernobyl have been restored with fresh life. Numerous plant and animal species have seen population increases since the crisis began. We investigated seeds from soybean and flax plants that grew in the Chernobyl nuclear reactor catastrophe area in 1986. According to specialists, plants may be genetically adapted to cope with radiation (Komissarova & Paramonova, 2019). The outcomes of this investigation were published in the Journal of Environmental Science and Technology. Such systems may have existed millions of years ago, when the environment exposed early forms of life to higher radiation levels.

Between 1987 and 1996, a survey found that the majority of species, including wild boar, Japanese macaques, marten, elk, wolf, and deer, were more abundant in contaminated zones where people were prohibited, as illustrated in Fig 3 (Beresford, Scott, & Copplestone, 2020). Indeed, the wild boar population has grown to the point where efforts are being made to eradicate them in order to prevent them from destroying structures in areas where people will eventually return (Beresford et al., 2016) (Krivolutzkii & Pokarzhevskii, 1992). Beasley (a wildlife ecologist) has visited the zone a dozen times, each time staying for one to two weeks. He was taken aback to see normally nocturnal boars "walking around during the day," he claims. Surprisingly, the team captured footage of a black bear in the plant's evacuation zone. "That was a species we had no idea we'd come upon", Beasley continues. The fact that animal populations have grown in the few years following the disaster illustrates that wildlife quickly recovers when humans leave an area. "These are fairly swift responses," he observes. "It is strikingly comparable to the situation at Chernobyl." (His investigation's findings were just published in Frontiers in Ecology and the Environment.) In terms of raw numbers, wild animals in the vicinity of Chernobyl may be thriving. Chernobyl's wildlife is extremely radioactive. Boars are highly radioactive due to their diet of Cesium-137-contaminated tubers, grubs, and roots. Additionally, Beasley and his colleagues discovered

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elevated levels in wolves that they trapped and tagged with GPS collars and radioactivity-tracking devices (Møller, Nishiumi, Suzuki, Ueda, & Mousseau, 2013) (Deryabina et al., 2015).

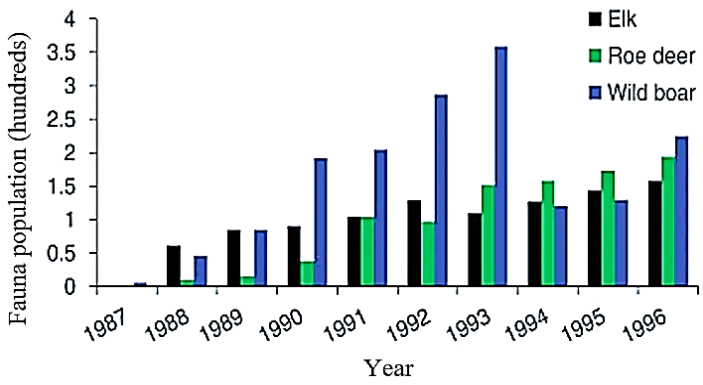

Fig. 3. Statistics of Fauna population in Chernobyl exclusion zone, (1987-1996)

3 SUMMARY

It is a decommissioned nuclear power facility known as the Vladimir Lenin plant located near the abandoned settlement of Pripyat in northern Ukraine. The Chernobyl tragedy occurred here in 1986. It was equipped with four reactors. The plant was cooled by a built pond. The 1986 Chernobyl disaster occurred at Reactor No. 4, and the power station is currently located within the Chernobyl Exclusion Zone (CEZ). As a result of the radiation, food crops, plants, and fruits were all destroyed or mutated. Numerous genetic effects on plants and animals from the exclusion zone have been reported (mutated). Numerous children have been affected by thyroid, leukemia, and cataracts. This disaster had a detrimental effect on the environment and economy, and countless businesses suffered as a result: The calamity is estimated to have a $235 billion economic impact. The entire power facility has been shut down for about 30 years. And completely inaccessible to humans, vegetation and fauna organically took over and began self-sustaining. Chernobyl has developed into one of the most significant natural parks in the world for wild animals and birds. Chernobyl also serves as a habitat for a variety of rare and endangered species, earning it the moniker "wildlife sanctuary".

4 CONCLUSION

This is the most comprehensive analysis to date, covering environmental radiation concerns, human health consequences, and social and economic aspects of the Chernobyl disaster. After the reactor's primary circulation pumps continued to spin and generate electricity for an extended amount of time following a power failure. The study is significant because it elucidates the causes of such disasters and their economic and social effects. The objective of this research is to prevent future Chernobyl-type accidents and to optimize the use of radioactive materials. The analysis provides a vivid depiction of the Chernobyl nuclear disaster and its consequences for humanity.

ISBN-978-81- 954002-9-4

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ISBN-978-81- 954002-9-4

ENVIRONMENT FRIENDLY SYNTHESIS AND CHARACTERIZATION OF BIOACTIVE SILVER NANOPARTICLES USING ZINGIBER OFFICINALE EXTRACT.

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ABSTRACT

The main objective of this topic is to describe a simple, rapid, eco-friendly and economically feasible green synthesis of nobel nanoparticles such as AgNP's using Zingiber Officinale root extract as reducing agent. In the present study Zingiber Officinale root extract which contain flavonoids phenolic compounds was used as stablising agent and the phytochemicals present in the extracts act as reducing agent. The synthesis of AgNP's was first monitored by using UV-Vis spectrophotometer; the UV spectroscopy shows absorbance at 424 nm. The morphology, size and structure stability were characterized by SEM and TEM.

Keyword- Green approach, UV–Vis-Spectrophotometer, SEM and TEM

Introduction

Nanoparticles having large surface area to volume ratio due to Nano scale and size of Nanoparticles. This is the main advantage of Nanoparticles [1] nanoparticles shows completely new and enhanced properties based on specific characters such as size, and morphology due to increase in surface area [2,3]. The metal nanoparticles show excellent antibacterial properties and which are useful in variety of fields such as catalysis [4], bio-molecular detection, diagnostics [5], optical receptors, bio labeling and sensors [6]. The greener synthesis of nanoparticles are superior than any other conventional methods, as they are one step, simple, cost-effective, ecofriendly and often result in more stable materials [7]. Green synthesis of silver nanoparticles using plant extracts and micro- organism have been suggested as more valuable alternative to conventional chemical and physical methods. Use of Plant extracts for the synthesis of silver nanoparticles has more advantages than microorganism due to ease of scale up, less biohazard, easily availability and elaborate process of maintain cell cultures [8]. Zingiber officinale (ginger) belong to the family Zingiberaceae [9] parts of ginger leaves and roots which are safe and nutritious for human consumption [10] both leaves and roots possess high natural antioxidant properties and antibacterial activity against gram positive and gram-negative bacteria [11,12]. In the present study we establishes that an aq.extract of gingiber roots were used for the reduction of Ag^+ into Ag metal and check the antimicrobial activity.

Experimental Methods-

Silver nitrate ($AgNO_3$) was purchased from Sigma– Aldrich Chemicals. All glassware are sterilized with nitric acid and further with distilled water and dried in oven before use. Ginger roots were collected from campus of Siddharth College, Jafrabad, Dist. Jalna, Maharastra, India.

ISBN-978-81- 954002-9-4

Preparation of Plant root extract

Fresh Ginger roots were collected from campus of Siddharth College, Jafrabad,Dist. Jalna, Maharastra, India. The ginger roots were washed with tap water to remove impurities. The plant roots dried under shade for 1 week, the dried roots were grinded in a mixer grinder into the powder form. Same process repeated 4 to 5 times. The aqueous extract of ginger roots was prepared by using 15 g of powder of roots which was added to 100 mL of deionized water at 60 °C to 80 °C for 25 min. This extract was filtered through Whattmann filter paper No-1. The filtered extract was stored in refrigerator at 4°C for further studies.

Green synthesis of silver nanoparticles (AgNPs)

The silver nitrate (A.R.) used in this study was obtained from Sigma–Aldrich Pvt. Ltd Mumbai, India. Aqueous solution (1 mM) of AgNO3 was prepared in deionized water. For synthesis of silver nanoparticles, the Erlenmeyer flask containing 90 mL of $AgNO_3$ (1 mM) was reacted with 10 mL of the aqueous root extract of Zingiber officinale and stirred on magnetic stirrer heated at 80^0C for 1 hour, for the reduction of $Ag^{+\ ion}$ from AgNO3 to synthesize AgNPs. The solution turns yellowish to dark brown indicating the formation of silver nanoparticles. The bioreduction of silver ion was also monitored by the UV-spectrophotometer.

Characterization of silver nanoparticle

The reduction of silver ions by root extract were performed instrumentally investigated by using UV- Visible spectrophotometer (Model EQ-826, Equip- tronics Pvt. Ltd.). The UV-visible absorption spectrophotometer with optical absorbance between 200 to 600 nm was used. Scanning electron microscope (Hitachi S-4500) was used to study the surface morphology of nanoparticles, energy- dispersive x-ray (EDX) analysis at 20 kV to dictate the elemental composition of the particles. The particle size and shape was confirmed using Transmission electron microscopy (TEM) at an accelerating voltage of 100 kV.Fig.1 UV–Vis spectra of silver nanoparticle containing solutions synthesised from Ginger root extract samples and AgNO3 after 1 h of reaction (424 nm)

Scanning Electron Microscopy (SEM)

The SEM images of silver nanoparticles from aqueous extract of Ginger roots after stirring for 1 hr at 800C. The average size was indicates that from 14 to 20 nm. (fig.2 & 3). The larger sizes of particles were observed due to highly agglomeration. The morphology and average size of synthesized silver nanoparticles was established by SEM-EDS The silver nanoparticles were criticize using EDX profile display an absorption peak around 3 kev due to their surface plasmon resonance (13) this proves the presence of nano crystalline elemental silver.

Fig.2 and fig.3 shows SEM image showing the size of synthesized silver nanoparticles obtained from aqueous extract of *Ginger root*

TEM analysis

Transmission electron microscopy (TEM) analysis has been clearly illustrated that the size, shape and morphology of nanoparticles. It is inform that silver nanoparticles are well

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dispersed and mostly silver nanoparticles are spherical in shape, while some of the nanoparticles were found irregular in shape.

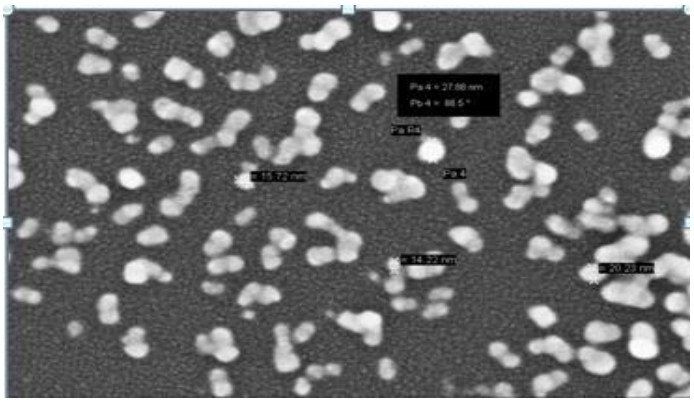

Fig 2

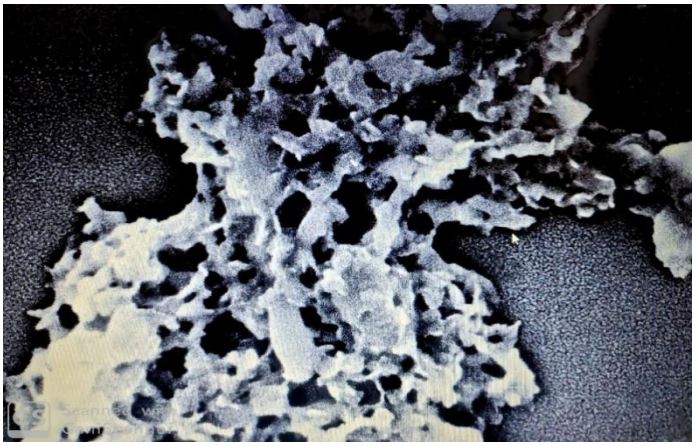

Fig 3

Result and discussion

Colour change and UV-vis spectroscopy

The initial formation of silver nanoparticles is represented by a change in the colour of the solution from yellowish to brown [13]. The addition of plant extract of Zingiber officinale into aqueous solution of AgNO3 (1mM) led to the instantaneous change in the colour of solution yellowish to brown within 1 hr reaction due to excitation of surface plasmon vibrations. The surface plasmon resonance band AgNP observed at 420-430 nm similar to those reported in literature [14]. From the UV-vis spectra recoreded, indicate that most rapid bio-reduction of silver ions was achieved using *Ginger root* extract as reducing agent. The visuals colour change and UV-vis spectra revealed that formation of AgNPs within 1 hr.

Conclusion

The biological synthesis of silver nanoparticles is rapid, simple, safe, one-step, cost effective, eco- friendly and novel synthesis route for preparing silver nanoparticles was carried out using Zingiber officinale (Ginger) roots extract as a reducing and capping agent at given

ISBN-978-81- 954002-9-4

temperature. The synthesized silver nanoparticles were characterized by UV-visible spectrophotometer, SEM-EDX and TEM analysis. The size of the nanoparticles ranges from 14 to 20 nm with spherical shape.

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ISBN-978-81- 954002-9-4

CLIMATE CHANGE & GLOBAL WARMING

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Abstract

This study is based on the climate change and global warming, global warming consider as social problem that has been mentioned in part of discussion. The climate change i.e. global warming has been discussed in details. This study contains the climate change which hits the planet on a faster path. The effect of global warming in order to decrease the coral population has been described. The changes of human activities and the effect of it have been stated in details. The climate change on the future aspects has been stated and sustainable development goal in the case of global warming has been described. The content has laid emphasis over the measures that have been taken up to solve the issues associated with global warming. Although there are several strategies that have been taken up by the government to reduce the level of carbon emission so that global warming can be reduced. Although there are several researchers that have shown that, the climatic changes are directly affected due to the rise in global warming. The climatic changes are getting more complex day by day because of the high rate of glaciers melting due to global warming. Global warming is a very important topic of concern and it needs to be given special attention to bring changes. Global warming as the social problem that has also been mentioned in this part of discussion. The global warming has been discussed in details. The effect of global warming in order to decrease the coral population has been described. The changes of human activities and the effect of it have been stated ion details. The climate change on the future aspects has been stated and sustainable development goal in the case of global warming has been described in details.

Keywords: Global warming, climatic change, weather, emission, government, greenhouse.

Introduction

"Climate change" highlights the rapid changes in the measures of climate over a specific period of time, which includes temperature, wind patterns, as well as precipitation. Not only Greenhouse gases but also CO2 ("Carbon Dioxide") is largely responsible for the rapid movement in global "climate change".

Overview: Weather, Global Warming, and Climate Change

Furthermore, it needs to be highlighted that in 2020, the surface temperature globally was 0.98 degrees Celsius higher than the average temperature of the twentieth century.

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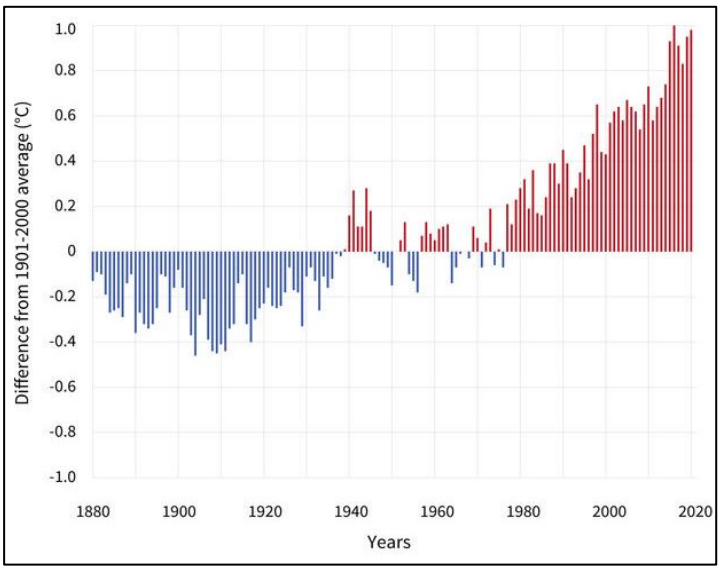

Figure 1: Average surface temperature globally
(Source: Zandalinas et al. 2021)

Therefore, it is clear that the rising temperature globally, as well as changes in the earth's atmosphere, is severely damaging the way all the living organisms used to live their lives on this planet. Furthermore, it needs to be highlighted that in 2020, the surface temperature globally was 0.98 degrees Celsius higher than the average temperature of the twentieth century. According to Zandalinas et al. (2021), the top ten hottest years since the inception of human life were recorded in between the last 15 years, which is caused by various human activities only.

Climate change

The climatic changes are getting more complex day by day because of the high rate of glaciers melting due to global warming. On the contrary, the term climate change refers to the broader changes that are basically the after-effects of global warming (Nordhaus, 2018). This process moreover includes the rising of the sea level, shrinking or melting of huge glaciers located in mountains, Antarctica, the arctic and many others. Moreover, these are some of the consequences that have been derived due to global warming in the climate. Another most important factor that has helped in boosting the level of global warming worldwide is the burning of fossil fuels and putting the heat-trapped gasses in the air.

Climate change is hitting the planet faster

The "Intergovernmental Panel on Climate Change" (IPCC) is a global body for assessing various issues as well as facts related to "climate change". According to the IPCC climate change is severely hitting the planet much faster than humans are predicting (Reynolds, 2021). However, IPCC along with the "United Nations Framework Convention on Climate Change (UNFCCC)" is jointly working to focus on the Paris Agreement and Kyoto Protocol. A majority of the negative effects are unavoidable and the UN warned that those would hit the world, its atmosphere, as well as vulnerable living organisms hardest (Masson-Delmotte et al. 2021).

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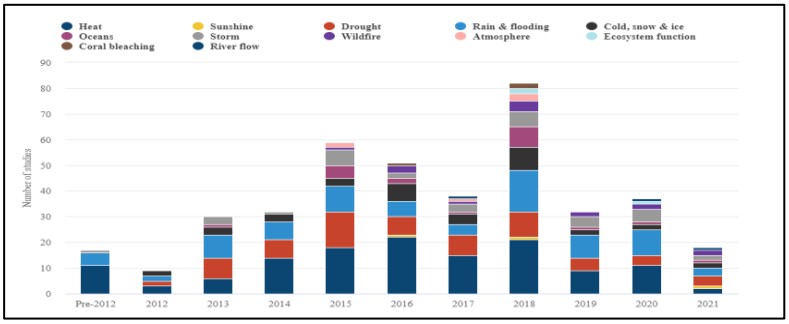

Figure 2: Extreme weather events from pre-2012 to 2021
(Source: Carbonbrief.org, 2022)

On the other hand, for these two reasons, Southern African people are experiencing the poorest harvesting seasons which is specifically caused by an excessive rise in global sea temperature (Zvobgo et al. 2022).

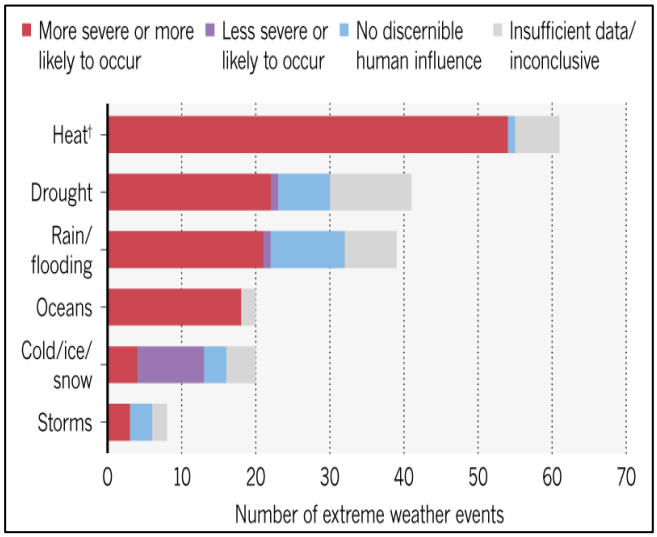

Figure 3: The role of human-induced "climate change" in several weather events
(Source: Schiermeier, 2018)

On the other hand, an island-based country like Japan, having only a 125 million population is also facing severe consequences due to global pollution, weather change, global warming, and "climate change" (Mori et al. 2021). Furthermore, all the countries in Europe are living under prolonged heat, with devastating wildfires, especially in Greece, and the Arctic region. According to Bennell et al. (2021), "drought-fuelled wildfires" are the main reasons that countries like Australia and the USA are facing severe consequences of "global warming" as well as "climate and weather change".

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Some regions are already facing extreme consequences of global "climate change", which seems to vary by region and is largely driven by various geographical factors (socio-economic status, how the region is governed, who is governing that region, and so on).

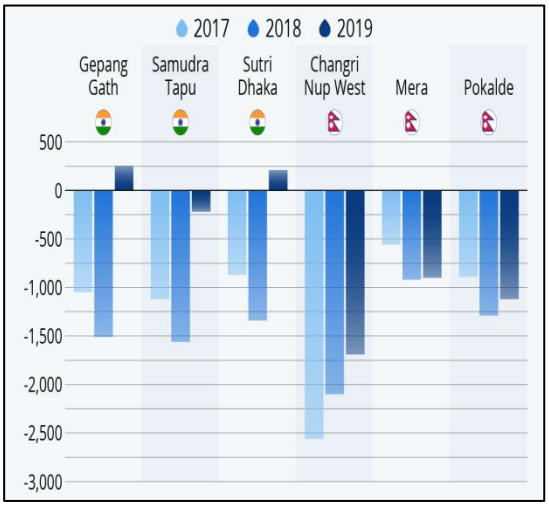

Figure 4: Current scenario of Himalayan Glacier
(Source: Buchhol, 2021)

The figure highlights that Himalayan glaciers are in severe distress due to "climate change" as well as "global warming". Furthermore, as per the report, it is observed that between 2016 and 2018 alone, glaciers in the Himalayan region have lost more than 0.5 to 2.5 metres in thickness.

Global warming decreases connectivity among coral populations

According to Chen (2021), the rising global temperature and changes in worldwide climate is the main reason that deteriorating the connectivity level of coral populations across all the oceans. In addition to this, CO2 absorbed in several oceans from the earth's atmosphere is the major reason behind the reduction in calcification rates in coral reef building. Furthermore, reef-related organisms are severely being destroyed due to altering seawater chemistry by lowering pH levels (Oceanservice.noaa.gov, 2021).

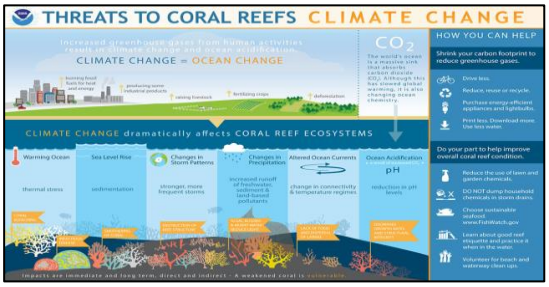

Figure 5: Climate change and threats to global coral reefs (Source: Oceanservice.noaa.gov, 2021)

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On the other hand, deforestation, fertilising crops, and various industrial activities are some of the vital factors that are severely damaging the way seawater used to be.

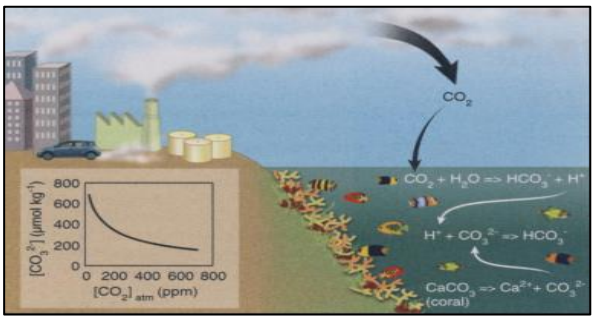

Figure 6: CO2 and the deteriorating connectivity of coral reefs
(Source: Hoegh-Guldbewrg, et al. 2022)

The above-depicted figure shows the linkage between the slowing of coral calcification and atmospheric CO2, due to excessive ocean acidification. In addition to this, approximately 25% of the carbon emitted by human beings in the period between 2000 and 2006 was largely observed by oceans all over the world (Hoegh-Guldbewrg, et al. 2022).

According to a Florida-based study, the worldwide temperature of the ocean has risen by more than 1.3 degrees Fahrenheit since the early 19th century, which is constantly rising. Furthermore, the study highlights that rising (falling or even rising) water body temperature can underline coral polyps, making them lose zooxanthellae (a type of algae) that survive on the polply's tissues (Floridakeys.noaa.gov, 2020). This result has severe consequences on corals, as the algae provide colour to coral reefs and when there are no algae the coral reefs would become completely white in colour.

Global warming as a social problem

The discussion has highlighted the core issues that are associated with global warming. Global warming has become a great matter of concern as it has been acknowledged as a social issue that has been faced by people all over the world (Harvey, 2018). Hence, the major factor that is responsible for the emerging rate of global warming is carbon. Hence, burning too much carbon has helped in increasing the rate of global warming.

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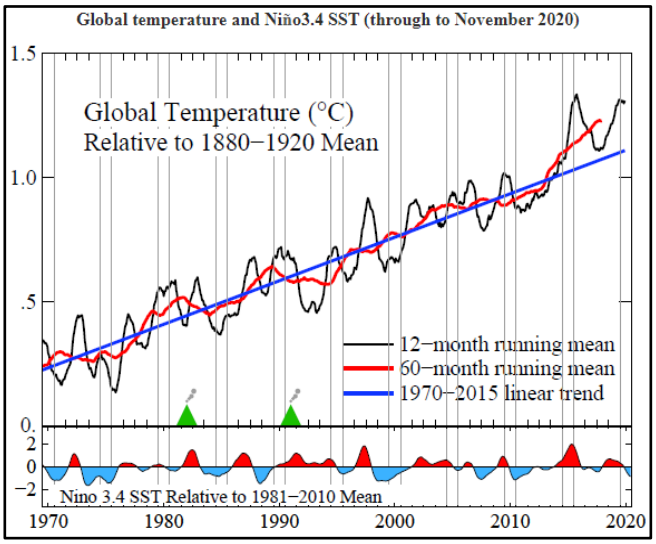

Figure A: The global temperature record of 2020
(Source: Co2.earth, 2020)

Moreover, taking the current scenario into consideration it has been evaluated that due to high industrial activities and cars running on roads the rate of carbon emission has increased (Giorgi et al. 2019). This is said to be the major reason which is responsible for the high rate of global warming. In this growing discourse about the changes in climate, there is the development of new terms and technicalities that are associated with global warming and climatic changes. The above image talks about the global temperature that has been recorded in the year 2020 and has highly affected the acceleration process of global warming. Moreover, it also implies that the increased growth rate of the climate globally will create an imbalance in energy on the earth. Hence, the growth as measured can also help in decreasing the period of warming by the implications of atmospheric aerosols.

One of the major factors among them as mentioned above is the process of decarburization (Gunnemyr, 2019). The process of decarbonization generally throws light over the process that helps in reducing the emission of carbon. The current research and surveys have shown that increase in the level of carbon emission has negatively affected the economy as well as the environment. Hence, it is very important to come up with effective strategies that will help in reducing the level of carbon footprints. The process used to attain this is called decarbonisation.

Global warming has become a critical social issue that needs to be reduced with the help of effective strategies and tools (Masson-Delmotte et al. 2018). Fossil fuels such as coal, gasses, and oil are said to be the largest contributor to global warming. These factors are majorly responsible for bringing drastic changes in the climate (Goldberg et al. 2019). These are the critical sources that has accounted for 75% of the greenhouse gasses and 90% of Co2 emissions (Nordhaus, 2020). The major causes of global warming are generating power, using a high amount of transportation, powering buildings, and consuming too much electricity. Apart from the above-

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mentioned causes, cutting down trees is said to be the major cause of the global warming rate rising continuously. Volcanic activities, changes in the rotation of the earth based on the earth's orbit and greenhouse effects are some of the reasons why the rate of global warming is increasing day by day.

Hence, the changes caused in the climate have caused a huge impact on the environment. This is the reason why global warming has been acknowledged as a social issue that needs to be paid special attention to. According to Change, (2018) Global warming has also stressed the ecosystem through water shortages, an increase in the fire threats, drought, and a rise in temperature. Hence, storm damage and the intense invasion rate of salt are also responsible for affecting the ecosystem through global warming (Leiserowitz et al. 2020). Declining water supply, reduction in agricultural yields and several other health impacts are the causes of global warming (Giorgi, 2019). These are the critical factors based on which global warming has been declared a social issue of the environment.

Human activities are changing the climate

"Climate change" consists of both "global warming" by human beings as well as shifts in global weather patterns. The interactions between various geographical, biological, chemical, and geological factors within the atmospheric system are causing the deteriorating health of the earth. "Climate change" can make the worldwide pattern of weather less predictable to the meteorological organisations (Xue et al. 2021).

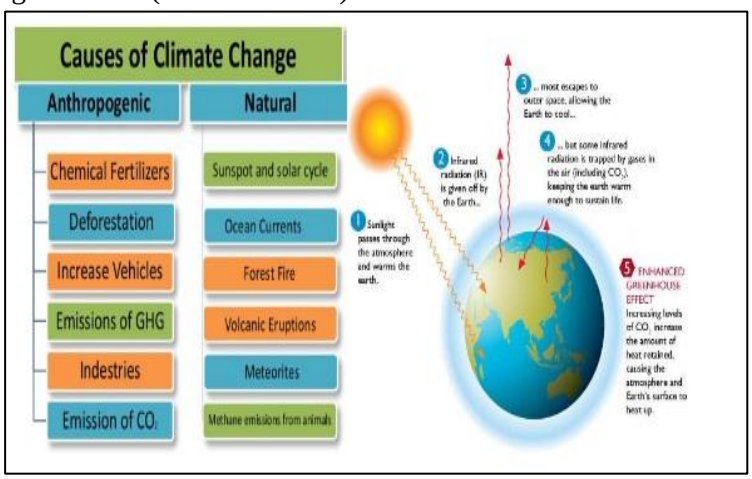

Figure 7: Climate change and its reasons
(Source: Insightsonindia, 2020)

The above-depicted figure shows both natural as well as anthropological accuses behind the deteriorating health of the global atmosphere and the excessive rise in "global climate change".

Following the inception of the "Industrial Revolution," the world has witnessed a rise in atmospheric greenhouse gases. This has led to more greenhouse gas absorption and retaining the health back in the atmosphere. The majority of the greenhouse gas is water vapour, which has less

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impact. On the other hand, greenhouse gases like CO2, CO, and so on are increasing the overall earth's temperature exponentially.

The majority of the land-use styles have been changed since the beginning of the "industrial revolution". Major forests have been cut down since then, resulting in fewer crops, desertification, "climate change", increased greenhouse gases, soil erosion, flooding, and a lot of issues for indigenous people living all across the globe (Berrang-Ford et al. 2021).

All these anthropogenic aerosols tend to be aboard excessive solar radiation and heat, resulting in atmospheric temperature rises. According to Wang et al. (2021), anthropogenic aerosols can largely affect climate change by reflecting or absorbing solar radiation.

How will climate change in the future?

The point helps in identifying the key measures that will help in maintaining climatic changes in future (Alfonso & Sadoul, 2021). Hence, it has been predicted that if the economy does not take the necessary steps in order to reduce its usage of things that lead to high carbon emissions the impact on the environment will be hazardous (Leiserowitz et al. 2020). In addition to it can also be stated that if the rate of global warming reaches the level of around 1.5 Celsius, it would be very difficult to control global warming. Hence, the future predictions have shown that by 2030, almost all the countries all over the world will experience high intensity of heat, whether it is due to pollution or extreme emission of carbon footprints and greenhouse gasses. The "GHG, Global Greenhouse Gas" has projected that the emission rate will be increased by the level of 50% by the year 2050. The primary growth will be stuck at 70% growth.

The atmospheric growth has reached the concentration level of 685 parts, which is equal to 687 million equivalents by the year 2050 (Reverter et al. 2020). Hence, it can also be stated that through the attainment of the decarbonization process less stress is given over the human activities, which is completely based on the strategies that are required for imposing it over the environment (Koutroulis, 2019). However, it can also be stated that the rate of global warming is increasing and has started influencing the environment in a negative manner. UN Sustainable development goals for a sustainable future

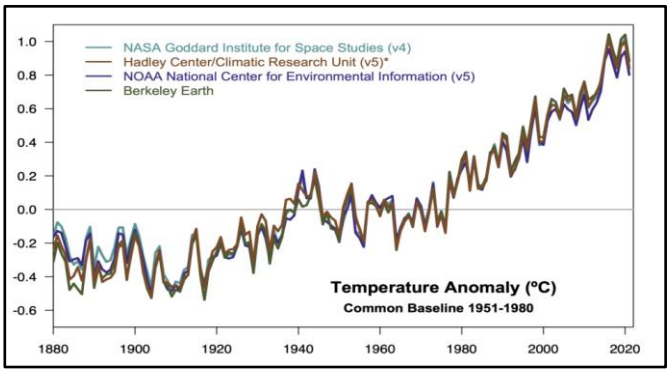

Figure b: Global warming current data (Source: Global Climate Change, 2020)

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These are the critical factors based on which global warming has been declared a social issue of the environment. Attainment of sustainability has helped in the achievement of quality products (Mudryk et al. 2021). The major sustainability process taken up is using cars that are fuel-efficient and can help in less emission of the harmful gases.

The researchers have also shown that with the emergence of the pandemic in the year 2020, the impact of global warming on the climate was highly noticeable (Choi et al. 2020). The climate changes will directly affect the core elements of the life of humans all around the world (Lionello & Scarascia, 2018). Due to this, there is a tendency that in the future millions of people can suffer hunger, coastal flooding, and shortage of water if the world becomes warm.

Global warming is a very important topic of concern and it needs to be given special attention to bring changes (Hoegh-Guldberg et al. 2018). The limitation changes have already affected the environment by bringing huge changes in the environment such as ecosystem degradation, water resources, a sharp decline of the cryosphere and aggravation of the erosion of soil.

Solutions to solve Global Warming

The discussion has shed light upon the solutions that are required to solve the major problems associated with global warming. Hence, a huge difference can be attained in climate change (Leiserowitz et al. 2020) through several effective ways. First is powering the home with renewable energy. By choosing green energy, one can effectively opt for renewable energy sources. Investing in appliances like energy-efficient can help in saving energy this is an advantageous process as it helps in saving costs and reducing the wastage of energy.

Reducing water wastage and driving a car is fuel-efficient can also help in checking sustainability (Diffenbaugh & Burke, 2019). These are the key measures through which global warming issues can be solved. Hence, it can also be stated that it is the responsibility of humans too, to use biodegradable materials in their day-to-day usage (Leiserowitz et al. 2020). For business and the industry, it is very important to make sure that they conduct all the working operations in a sustainable manner so that no harm is caused to the environment. Although there are several strategies that have been taken up by the government to reduce the level of carbon emission so that global warming can be reduced. Hence, the above-mentioned are the key measures through which the environment can attain sustainability.

Conclusion

Hence, it can be concluded that global warming is becoming an international phenomenon where the earth's surface is basically facing a hike in the level of temperature. Due to the accumulation of the chlorofluorocarbons at the level of the stratosphere, scientists have also predicted that the Antarctica continent has a huge ozone hole developed in it. Apart from the environmental causes, attention has been also laid on the diseases that have been caused due to the increase in the level of global warming. Certain diseases such as malaria are basically caused due

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to the rise in the level of global warming. This mechanism takes place, as there is the migration of species from one place to another due to drastic changes in the weather conditions.
Hence, people should start using materials are biodegradable. Reducing plastic wastage can also help in bringing huge changes in lifestyle so that the impact of global warming on the climate can be changed.

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ISBN-978-81- 954002-9-4

LANDSCAPE ECOLOGY: A SCIENTIFIC WAY OF SUSTAINABILITY

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Abstract

Landscape ecology is the study of the pattern and interaction between ecosystems within a region of interest, and the way the interactions affect ecological processes, especially the unique effects of spatial heterogeneity on these interactions. A landscape is part of the Earth's surface that can be viewed at one time from one place. It consists of the geographic features that mark a particular area.

Sustainability improves the quality of human life, protects natural ecosystem and preserves natural resources for future generations. In the corporate world, sustainability is associated with an organization's holistic approach, taking into account everything, from manufacturing to logistics to customer service. Sustainable development practices also help countries grow in ways that adapt to the challenges posed by climate change, which will in turn help to protect important natural resources for ours and future generations.

Key words

Landscape ecology, Sustainability, climate change, natural resources.

Introduction

Landscape ecology offers sustainability science a tangible system concept, the landscape that can be seen, perceived, enjoyed, and measured. Because of its tangibility, landscape can be a common platform, for different disciplines and sectors to work together to find common sustainable solutions [9]. Non-polluting, renewable resources provide the power to drive sustainable energy systems. More efficient farming techniques and new technologies are useful to improve yields to reduce consumption and to reduce waste. As a result, the environment can be preserved for future generations [4].

Ecological sustainability is defined as the maintenance or restoration of the composition, structure and processes of ecosystems including the diversity of plant and animal communities and in turn the productive capacity of the ecosystems. The scientific study of landscape ecology can considerably contribute to plan and manage sustainable development [8]. Thus, the landscape ecology provides an important framework for Critical Zone research through:

(a) Integrating 3D analysis of landscape systems.

(b) Contextualizing the Critical Zone processes both temporally and spatially.

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(c) Investigating problems related with scaling.

Landscape ecology describes and explains the landscapes characteristic patterns of ecosystems and investigates the flux of energy, mineral nutrients, and species among their component ecosystems, providing important knowledge for addressing land-use issues [10].

Sustainability Practices in 21st Century

By recognizing the impact of environmental and social issues, combined with changing technologies and consumer behaviour, companies will be able to integrate sustainability into innovation for 21st Century breakthroughs [7].It requires creativity communication and collaboration as the basic skill [13]. The aim is to forge a better understanding and help overcome the current gridlock on the most divisive issues. SD21 provides an empirical basis and a frame of analysis to better understand much of today's work on the key issues of sustainability.

Long-lived and healthy wetlands and forests are examples of sustainable biological systems. Invisible chemical cycles redistribute water, oxygen, nitrogen and carbon through the world's living and non-living systems, and have sustained life since the beginning of time. The quality of not being harmful to the environment or depleting natural resources, and thereby supporting long-term ecological balance [15]. The committee is developing sustainability standards for products that use energy. The principles of ESD include to address issues associated with economic, environmental, social and equitable considerations [10]. The principles of ESD require the effective integration of environmental resources and decision making [12].

By the year 2050, it is estimated that our global population will likely reach 9 billion people. While now a days many community dynamics are at work [11]. Economy, ecology, and equity are particularly important to building healthy and prosperous communities over the long term. Some of the human activities like construction of dam may be considered as biological activity it may cause floods, waterlogging, soil degradation, etc. and that can change landscape structure as mentioned by Gustafson (1998) [16] Further the clearing of forest land for agriculture or the expansion of urban areas have also caused significant changes in landscape structure [13].

Central Focus of the Field of Landscape Ecology

In landscape ecology, the matrix is defined as the background ecological system. The connectivity of a matrix indicates how well an organisms can move through it. E.g. a forest with few gaps in the canopy has high connectivity while highly densed one has very low connectivity in terms of movements by macro animals and human beings [14]. The most salient characteristics of landscape ecology are its emphasis on the pattern-process relationship and its focus on broad-scale ecological and environmental issues.

Principles of Landscaping

They are virtually a retreat for the public from the harsh strains and stresses of public life. Landscaping is done with a view to create a natural scene by planting of lawn, trees and shrubs. It

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is the imitation of nature in the garden and improves the total living environment of the people [9]. Sustainability is important for many reasons including environmental quality. In order to have healthy communities, we need clean air, natural resources and a nontoxic environment. Growth – UNTHSC's (*University of North Texas Health Science Centre)* enrolment continues to grow, so we require more resources such as energy, water, and space [7]. To attain an environmentally sustainable society, the progress of the society should be taken care of in relation to the environment. The needs of the society should be met to elongate their life and to enable them live a fulfilling life with health. [12].

A Scientific way of Sustainability

To live a more sustainable lifestyle we will try to, save energy by using less energy, we can help to reduce carbon emissions. Eat less meat, use reusable alternatives, go paperless, use renewable energy, recycle and reuse, grow our own produce, donate unused items. Environmental education promotes critical and creative thinking skills and inspires kids to become more engaged with their communities [8]. It helps kids understand why the environment is important and provides them with the building blocks they need to live eco-friendly and sustainable lives.

The term sustainability is broadly used to indicate programs, initiatives and actions aimed at the preservation of a particular resource [7]. The concept is based on ultimate human value like intergeneration equity. It refers to four pillars of sustainability viz. human, social, economic and environmental. Environmental sustainability is important because of how much energy, food and human-made resources we use every day. Rapid population growth has resulted in increased farming and manufacturing, leading to more greenhouse gas emissions, unsustainable energy use, and deforestation [9].

Sustainability is crucial to conserving natural resources and living a more fruitful life. We need to make decisions today that are sustainable for years to come. We need to stop making decisions that only provide quick near-term benefits [5]. Sustainability means meeting our own needs without compromising the ability of future generations to meet their own needs. In addition to natural resources, we also need social and economic resources [3]. There are four elements of environmental sustainability and environmental regulatory compliance i.e. air, water, management, and risk reduction. Sustainability looks to protect our natural environment, human and ecological health, while driving innovation and not compromising our way of life [9]. Environmental sustainability is responsibly interacting with the planet to maintain natural resources and avoid jeopardizing the ability for future generations to meet their needs.

Sustainable practices include planting new seedlings in deforested areas and reducing the number of trees cut down each year. Especially as the human population grows, it is critical that we reduce our depletion of forests, precious metals, and other natural resources [1]. Ecological sustainability is defined as the maintenance or restoration of the composition, structure, and processes of ecosystems including the diversity of plant and animal communities and the productive capacity of ecological systems [6]. Sustainable development is development that meets

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the needs of the present without compromising the ability of future generations to meet their own needs.

Ecologically sustainable development means development which uses, conserves and enhances the community's resources so that ecological processes, on which life depends, are maintained and the total quality of life, now and in the future, can be increased. Sustainability has three main pillars: economic, environmental, and social. These three pillars are informally referred to as people, planet, and profits [2]. There are three interconnected spheres of sustainability that describe the relationships between the environmental, economic, and social aspects of our world [4]. These spheres are a related set of concepts that, when taken together, can form a solid ground from which major decisions and actions can be made.

For sustainable development to be achieved, it is crucial to harmonize three core elements: economic growth, social inclusion and environmental protection. These elements are interconnected and all are crucial for the well-being of individuals and societies. Landscape ecology provides an important framework for Critical Zone research through (1) integrating 3D dimensionality in the analysis of landscape systems (2) contextualizing the Critical Zone processes both temporally and spatially and (3) investigating problems related with scaling [16].

Changes in Landscape Ecology structure

The goal of a landscape ecologist is to understand and describe landscape structure, how this structure influences the movement of organisms, material, or energy across the landscape and how and why landscape structure changes over time [15]. The goal of landscape ecology is to understand the relationships between landscape pattern and ecological process, the role of humans and other forces of landscape change on these pattern-process relationships and the principles required to make informed decisions in natural resource management [14].

Every disturbance to the eco-environment will prime to the subsequent alteration of disease patterns and our human exposure to the altered and later disease outbreaks that in effect guide to the increasing burdens on global health [15]. Landscaping has both negative and positive impacts on the environment. The negative impacts include deforestation, pollution (air, water, and land), as well as the modification of the ecosystem [2].

Exploring Variability in Landscape Ecology

Sugar mills impact the environment by producing wastewater, emissions and solid waste. The massive quantities of plant matter and sludge washed from mills which decompose in freshwater bodies and absorbing all the available oxygen. Due to this massive fish are kills. There are various agricultural practices on a sugarcane farm such as fertilisation and spraying. It increases leaching and water contamination with nutrients and agrochemicals, leading to Eco- toxicity, eutrophication, and acidification in atmosphere [20].

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Also the cultivation and processing of sugar produce environmental impacts through the loss of natural habitats, intensive use of water, heavy use of agro-chemicals, discharge and runoff of polluted effluent and air pollution. Sugarcane production often pollutes freshwater ecosystems with silt and fertilizers washed from farms, as well as plant matter and chemical sludge from mills. In the Great Barrier Reef and Mesoamerican Reef, those contaminants are flowing out to sea and damaging coral ecosystems [21].

Humans impact the physical environment in many ways such as overpopulation, pollution, burning fossil fuels, and deforestation. Changes like these have triggered climate change, soil erosion, poor air quality, and undrinkable water. The effects of soil erosion go beyond the loss of fertile land [18]. It has led to increased pollution and sedimentation in streams and rivers, clogging these waterways and causing declines in fish and other species. Degraded lands are also often less able to hold the water, which can worsen flooding. Deforestation, desertification, biodiversity loss, loss of productivity potential, soil erosion, and pollution are ongoing processes associated with landscape degradation. Reversing degradation requires time and consistent effort [22].

Lift irrigation is a method of irrigation in which water instead of being transported by natural flow requires external energy through animal, fuel based or electric power using pumps or other mechanical means. Groundwater depletion is primarily caused by sustained groundwater pumping. Negative effects of groundwater depletion are drying up wells, reduction of water in streams and lakes [15].

Groundwater is a prime natural resource in the Earth. It not only supports all types of life forms to exist in the Earth but also helps in the growth of human civilization. Contamination of ground water can result in poor drinking water quality, loss of water supply, degraded surface water systems, high clean-up costs, and high costs for alternative water supplies and potential health problems [23]. The consequences of contaminated ground water or degraded surface water are often serious. Various human activities like abstraction of the groundwater, its overexploitation, the building of reservoirs, and overuse of land have caused changes in groundwater levels and led to its depletion [11].

From a positive perspective, irrigation would reduce the erosion risk within the basin and also increase the opportunities for environmental enhancement. From a negative perspective, irrigation increases the risk of contamination of ground and surface waters and could adversely impact upon landscape values. The most effective solution to high evaporation losses of soil water is a cover of plant residues on the soil surface. Agronomic practices that increase shading of the soil surface, and physical structures that concentrate rainwater, encouraging percolation to deeper layers, also reduce evaporation losses [23].

Dairy cows and their manure produce greenhouse gas emissions which contribute to climate change. Poor handling of manure and fertilizers can degrade local water resources. And unsustainable dairy farming and feed production can lead to the loss of ecologically important areas, such as prairies, wetlands, and forests [19].

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The Agricultural Revolution impacted the environment, transforming forests and previously undisturbed land into farmland, destroyed habitats, decreased biodiversity and released carbon dioxide into the atmosphere [20]. Agriculture is the leading source of pollution in many countries. Pesticides, fertilizers and other toxic farm chemicals can poison fresh water, marine ecosystems, air and soil. They also can remain in the environment for generations.

Hence there is urgent need to developing pest- and disease-resistant seeds through traditional breeding or genetic engineering can increase yields and reduce pesticide use. Cultivars suited to local conditions and weather extremes, such as drought and heat, can also help farmers produce more food without degrading ecosystems.

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ISBN-978-81- 954002-9-4

IMPACT OF LAND ACQUISTION IN DROUGHT-PRONE MARATHWADA REGION OF MAHARASHTRA

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Abstract

Marathwada region of Maharashtra state comprises of eight districts viz. Jalna, Aurangabad, Parbhani, Hingoli, Nanded, Latur, Osmanabad and Beed. Since last 3 decades, five districts (Beed, Jalna, Parbhani, Nanded and Osmanabad) are affected by constant drought condition. Farmers have not able to sow the Rabi crops for the first time in last hundred years. Marathwada accounts for 16.84% of the state population. Its per capita GDP is Rs.10,373, which is 40% below the state per capita GDP that is Rs 17,029. It contributes just 8% of state industrial output. The most important cause of backwardness is the lack of governance of natural resources in the region and unsuitable climatic condition (drought). In an overall scenario where sixty-seven percent of the farmers (most of them being small and medium farmers) believing that their agricultural income is falling short of their household expenditure, will make them to change their occupations form primary to secondary and tertiary. These push and pull factors are becoming reasons for urban migration. These factors either lie in economic domain or social domain or both but they are not sustainable. Hence, there is need for alternate development models such as those on the foundations of 'Sustainability model' and Sen's Capability model. The overall paper have highlighted the impact of climate change on Land Acquisition and Drought in Marathwada region.
Keywords: Climate change, Land Acquisition, Planning, Drought, Five-year Plan, Regional Development.

I. Introduction

The Land Acquisition Act, 1984, defines "land acquisition as the action of the government whereby it acquires land from its owners in order to pursue a certain public purpose or for any company." This acquisition may be against the will of the owners but compensation is paid to the owners or persons interested in the land. This can be distinguished from an outright purchase of land from the market. Land acquisitions by the government are generally compulsory in nature, not paying heed to the owner's unwillingness to part with the land.

Land Acquisition in Marathwada Region

The Government of Maharashtra has acquired more than 3,500 hectares of farmland near Aurangabad - the biggest land acquisition of its kind. Over 3,000 farmers have given up their land to the Maharashtra Industrial Development Corporation (MIDC) for the Shendra-Bidkin Industrial Park on the Maharashtra side of the Delhi-Mumbai Industrial Corridor (DMIC).

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Using flexibility provided under the MIDC Act, 1961, the MIDC began bilateral negotiations with the affected farmers. This process ended with maximum remuneration being fixed at a record Rs 23 lakhs per acre. The feat on the front of acquisition of land for the irrigation projects has been reciprocated by allocation of around Rs. 2180 crores from the central funds and the NABARD. This would help the state to complete 26 irrigation projects adding 3 lakh hectares to its chunk of irrigated land, the officer added. Politicians and bureaucrats involved in the Shendra-Bidkin acquisition concede unhesitatingly that the negotiations were made easy by the fact that large tracts of land in this arid, drought-hit region are very difficult to cultivate. Just about 5 percent of the acquired land is irrigated. The loss of wells, standing orchards and other farm infrastructure were also compensated.

The Indian economy presents a very deplorable picture of inter-regional imbalances reflected in income distribution, agricultural and industrial production and the position of infrastructure in different states. Regional imbalances and lopsided growth are not conducive to the national goal of growth with stability and social justice and hence there is an imperative need for bringing about a progressive reduction in regional inequalities in the pace of development. One of the important problems of Indian economic development is that regional economic imbalances are fast increasing during all these years of planning.

1) According to Prof. Myrdal (1985) :

"The main cause of regional disparities has been the strong "Backwash Effects" and the "Week spread Effects." The genesis of regional imbalances has a non-economic basis, which existed with capitalist systems guided by profit motive. The profit motive results in the development where the prospects of profit are high while other regions remain underdeveloped. He says that an area is poor because it is poor. A poor area cannot provide adequate employment and sustenance to its people. The low productivity of those people is responsible for the low income which causes low capacity for saving and investment. Low investment in the region perpetuates them in a state of low income. They remain caught in the vicious circle of poverty, causing economic and social degradation in their area``

The missing link of spatial dimension in India's five-year plan has been largely responsible for the regional imbalances in economic development. A regional approach seems to be the only device for mitigating the unevenness of economic development. A regional approach to economic development is in no way parochial which may contradict the national goal. It is an operational technique for keeping the economy of a region moving along with the national growth process, without being adversely affected by growth activities of adjoining regions. Regional planning seeks balances in the growth of economic activities of all regions constituting a nation or a state by providing their basic requirement and mitigating any serious conflict with one another. So that people living in different areas are not pushed to the backyards of economic stagnation and social degradation by the inexorable laws of economic growth.

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2) According to John h. Cumberland (1971):

"Regional economic development doesn't necessarily alleviate poverty, nor do anti-poverty programmes necessarily lead to long run self-sustaining regional economic development. Emphasis must also be given to regional entrepreneurial capabilities, environmental qualities, cultural values, quality of local government, social justice and related phenomena, if satisfactory levels of economic development are to be achieved. Where expenditure are to be made for investment in human capital, priority is to be given to those areas with greatest growth potentials and the environmental protection measures should be written into economic change occurs. "Balanced regional development in India has been a major objective since the beginning of the planning era.

3) Third Five Year Plan stated:

"In the perspective of long-term development with the economy advancing rapidly towards the stage of self-sustained growth and with steady rise in living standards of the people, regional and national development are essentially two different facets of a common objective."

The third plan laid emphasis on balanced development of different parts of the country. It envisaged extension of benefits of economic progress to the less developed regions and widespread diffusion of industry. These were among the major aims of planned development.

The transition of growth impulses from the developed backward regions is essential for development of backward areas. It is necessary to strengthen the arrangement for area planning. There should be functional linkages between agriculture and industry. There should be policy for the optimum development of the potentialities of an area. Growth points should be developed in backward regions. The bulk of public investment should flow in providing infrastructural facilities to backward areas.

The concept of social justice has two implications: one, an egalitarian distribution of income and wealth and the other, a balanced development of the various regions of the country. In India even before the starting of the planning era, the dispersal of industries was considered desirable as a means of attaining balanced regional development of India. One of the objectives of the second industrial policy resolution of April 1956 was the spatial diversion of industries.

A nation has an economic landscape. Regional development has an integrated linkage with the incidence of economic growth. Regional planning endeavors to improve the organization of economic pace in accordance with the indicated goals.

4) Kedarnath prasad asserts (1967) –

"The region has its economic sector, its politico-govt. sector and its cultural institutional sector, each of these broad components can be conceived of as furnishing the framework of structure of the region. Regional Planning is an important and essential at local and national level planning for balanced development of the nation. Regional planning indicates the developmental policy during the next fifteen or twenty years and is the perspective plan for the region."

The trend in regional imbalances manifests into two forms, the first culminating in the emergence of select is land of prosperity confined to some few urban and industrial localities

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sprinkled sparsely over the vast innovating expanse of rural communities, and second conspiring to bring into sharp focus, yawning developmental inequalities as between different units of the same union popularly called the states, some of which surged fast ahead while others lagged for behind.

(5) According to Hirchman :

"Economic progress not only does not appear everywhere at the same time, but once it has appeared, powerful forces make for a spatial concentration of economic growth around the initial starting growth. Inter-regional inequality of growth is an inevitable concomitant condition of growth itself."

A conflict between economic growth and regional imbalances arises from the very nature of the growth process.

(6) J.G. Williamson asserts:

"Rising regional income disparities or increasing divergence is typical of the early stages of development, while reduction in differentials or regional convergence is typical of the more mature stages of national development."

Williamson has empirically proved that the relationship between national economic development and regional inequality is represented by the inverted. Planning is bound to create an imbalance because of the difference in natural imbalance in the availability of the resources. Balanced development does not mean equal development of all areas.

The necessary balance between agriculture and industry implies that industrialisation, even if it is of the exported variety in its latter phase, has prior dependence on the conditions which govern the progress of agriculture. It is one of the well-established lessons of history that successful industrialisation has almost always been crucially dependent on the extent to which agrarian relations are conducive to the development of agriculture.

(7) According to Sudipto Mundle (1993)

"It is evident that development policy cannot ignore the question of the home market. Industrialization can only be sustained on the basis of a prior or simultaneous revolution leading to sustained productivity increase in agriculture."

II. Climate of Marathwada

The climate of Maharashtra is tropical monsoon type. It rains for four months i.e. from June to September in Maharashtra. The annual average rainfall here is 750mm. However, the rainfall is abundant only to the coastal tracks and western Maharashtra comprising of Sahyadri range. The rainshadow region of Marathwada and Vidarbha are devoid of rainfall. Rainfall only from July to August is prominent in interior Maharashtra. Remaining part of the year remains dry. Nearly 32% of its 64,590 sq.km area in Marathwada comes under the rain shadow region. About 98% of the agriculture here is dry land farming and whatever cultivation is practiced here, is depended on irrigation. In last 105 years, the state has faced six major droughts – 1877, 1899, 1918, 1972, 2012

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an 2015. Erratic rainfall, high temperature during summer, high rate of evaporation, etc are the causes of sorrow for people in Marathwada region.

III. Effects of Drought Condition in Marathwada

1) Effect of drought on crop production in Marathwada

Maharashtra, and in particular Marathwada region is facing decline in crop production since 2014, due to recurring drought situation. The total food grain production in 2013-14 was 154.60 lakh metric tons. Apart from the natural drought situation, other serious aspects, which are responsible for this decline are lack of availability to loan to the farmers and prioritising the budget to irrigation projects. The problem intensified after the serious crop damage due to hailstorm in Vidarbha and North Maharashtra region.

Jowar, bajra and cotton were completely wiped out in 2012 when monsoon failed in Kharif season. Jalna, which is known for being the biggest producer of sweet lime, has been the worst hit in the drought. Sweetlime grown in about 55,000 ha in Jalna has been wiped out completely. This tree requires 5 years to bear a fruit. The hard work of farmers for years together was in vain.

In the year 2014, 8000 villages in Marathwada had a 50% fall in sugarcane yield. About 4% of farmers land in Maharashtra is under sugarcane, but it consumes 71.5% of the irrigated water, including wells. The state is the second highest producer of sugarcane after UP, but 79% of this is grown in drought prone regions. Sugarcane now co exists with tanker-fed villages. The sector has depleted ground water levels so dangerously that water management is becoming an alarming issue in drought prone region.

2) Farmer's Suicide in Marathwada

Poor farmers are under debt burden, which is impelling them to commit suicide. The rate of this dangerous situation has aggravated since last decade. As such all the eight districts of Marathwada are epicenter of drought but the condition being worst in Beed, Jalna and Osmanabad, which has so far reported the country's highest rainfall deficit in the current monsoon season (June to September) at 52 percent. According to the report published by 'The Indian Express' on 15th October 2015, Marathwada region has crossed the 800-mark of farmer's suicide in last 10 months of this year. Maharashtra Government has picked Osmanabad, one of the worst affected districts in case of farmer's suicide.

3) Migration

With failed irrigation projects and political terror, people are now on the verge of losing to last of their breath. This led to serious consequence. Some of the farmers choose their way to move to the state capital – Mumbai, while others thought of migrating to the nearby districts of Nagar and Amravati. The situation of the neighbouring districts is not good rather. Nearly 12,000 villages from the western Maharashtra and Vidarbha are drought affected.

4) Diseases due to muddy water

The circumstances became worst when the women from the villages need to walk up to three kilometers from their houses to fetch the water that is muddy. People have no choice but to

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use that water, because of which they fall prey to diseases such as cough, fever, jaundice and direahea.

5) Corruption at the State Level

Dams in Marathwada region are left with only 8% of water as compared to 18% last year. Jaikwadi Dam, the biggest in the state reportedly has only that much water remaining to sustain the drinking needs of the people. Condition worsens further when none of 4000 tankers, which are deployed by the State Government, reaches the needy people. Corruption even in this case is witnessed at the higher authority level. The statement of rich getting richer and poor getting poorer is valid in case of water facility in Marathwada region.

Apart from the people, who suffer drought, it is the cattle's, who are not left untouched by the problem. Average cattle need more than 100 rupees per day fetching them approximately 15kg of grass and fodder. However, the present reports highlights the fact that it is only 60 rupees fodder per cattle the Government has sanctioned and out of that 50% is thrashed to the godowns of the higher authorities. The records are only on papers. At the grass root level, the support is missing completely by the state Government. Recently few of the NGO is such as AASRA, Akanksha Foundation, Paryay are working on these types of projects and looking for reduction on farmer's suicide in the drought prone region of Marathwada.

IV. Measures to tackle the drought condition in Marathwada

There is no doubt that drought situation of Marathwada region was mainly the reason of lack of water governance and poor operation of watershed development and irrigational projects. This water scarcity has affected the agricultural operations in the region. The state has been endowed with a well-developed drainage network. The prime resource of the region is River Godavari. Its tributaries also serve the purpose and are considered as the boon for the region during the monsoons. To tackle the problem of drought, watershed development plan needs to be implemented. With the implementation of plan, regulation of available water resources will be appropriately carried out. With the development of this programme excess runoff of water, which lead to flood situation is western Maharashtra, can be diverted to drought prone region through irrigational canals. Several such projects on River Godavari such as Manjira valley project, Nizam Sagar project, Saraswathi Canal, Sriram Sagar, Pranhita Project, Dowleswaram Dam, Gangapur Dam, Vishnupuri Dam, etc are serving the purpose in the present scenario. Government of Maharashtra has also announced the upcoming major and minor river valley project on River Godavari and its tributaries to tackle the problem of drought (Fig 2).

Fig 1: Location of major and minor projects on River Godavari and its tributaries, by State Government in the districts of Beed, Jalna and Parbhani to tackle the situation of droughts in Marathwada

Apart from this groundwater storage, capacity would be enhanced and thus there will be appropriate use of even land resources in the area. This will enable timely supply of water to agricultural fields. Farmers, who are under tremendous debt, can develop financially because of such type of activity. This situation can even alter the conditions. The regions with only single

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cropped cultivation can develop into small scale industries allied to agriculture. Marathwada as such has a vast land as open space. This land can be widely used as grassland, so that the industries such as dairy products, fodder and compost factories can develop extensively. With very low investments, marginal profits of the farmers can improve.

V. Conclusion

There are instances like in Maharashtra where land acquisition affected the social and economic life of many villagers, the compensation they got was spent like water leaving them financially vulnerable, youth habituated for luxuries continued to search for them, leading to increased crime rate. Also, instances such as Gujarat's inclusive town planning schemes had developed infrastructure and supported the economy. In a mixed economy like India, it is necessary to grow fast and project ourselves in the global market, and having an arable area close to forty-eight percent, is an opportunity to increase the productivity of both sectors, the path chosen must help the sectors to grow in harmony, leading the nation towards sustainable growth.

While concluding it can be mentioned that intensive watershed, development programmes can only save this region from unprecedented pattern of rainfall. Secondly, ground water management and effective utilization of bore wells and tube wells can help the farmers fight against the problems. The bore wells can be used to trap the surface water during the rainy months in Marathwada region and these bore wells once connected to underground aquifers can help recharge the aquifers, which can be used during crisis. To tackle the situation of decline in crop productivity there is a need of establishing a strong integrated marketing system to avoid exploitation by the middelmen. The sytem of scientific harvesting and modern agricultural pratice needs to be implemented. Thus, time has come to use technology wisely.

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ISBN-978-81- 954002-9-4

ENVIRONMENTAL ISSUES IN INDIA & THEIR REMEDIES

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Abstract

The environmental issue in India become more serious every day and are visualized in terms of varieties of pollution, growth in population, climate change, industrialization, unplanned urbanization, desertification etc. All of these problems have global consequences *viz.* acid rain, depletion of the ozone layer, global warming and eventual ocean level rising from burning of coal and oil and the proliferation of greenhouse gases; ugly landscape, loss of diversity of species; tropical deforestation. Population growth and economic development are contributing to many serious environmental calamities in India. Environment has been deteriorated remarkably in the past 50 years due to severe increase in pollution level & decline in natural resources. One of the critical ecological problems is the climate change & global warming that caused by large emission of CO_2 in the atmosphere. Recently, as per the survey conducted by the Asian environmental protection society in India, Bombay, Delhi, and Calcutta are the most polluted cities in the world. This is certainly an alarming feature and need immediate protective measures.

Keywords – Desertification, Climate change, Pollution, urbanization, Population growth

Introduction

During the last two decades, Environmental problems have attracted the attention of wide cross-section of the people all over the world. Today, the environmental pollution is a growing threat to our country and has become a common phenomenon being observed both in towns and villages all over India. The rapid industrialization and economic growth has resulted in unhealthy air and water pollution affecting infant mortality rates and life expectancy rates. The heavy rush of population from villages to urban areas has resulted in over-crowding of cities. About 72 % of the air pollution is due to vehicular emissions which is responsible for 12 times high risk for respiratory problems. Since the industrial development started in India, the environmental issues also grew with it which took an ugly turn at the end of 20^{th} century.

The environment problems are inherently associated right from the inception with the invention and advancement of new techniques evolved by the modern science and we see that science and technology give birth to a new research every day and night but giving way to a new

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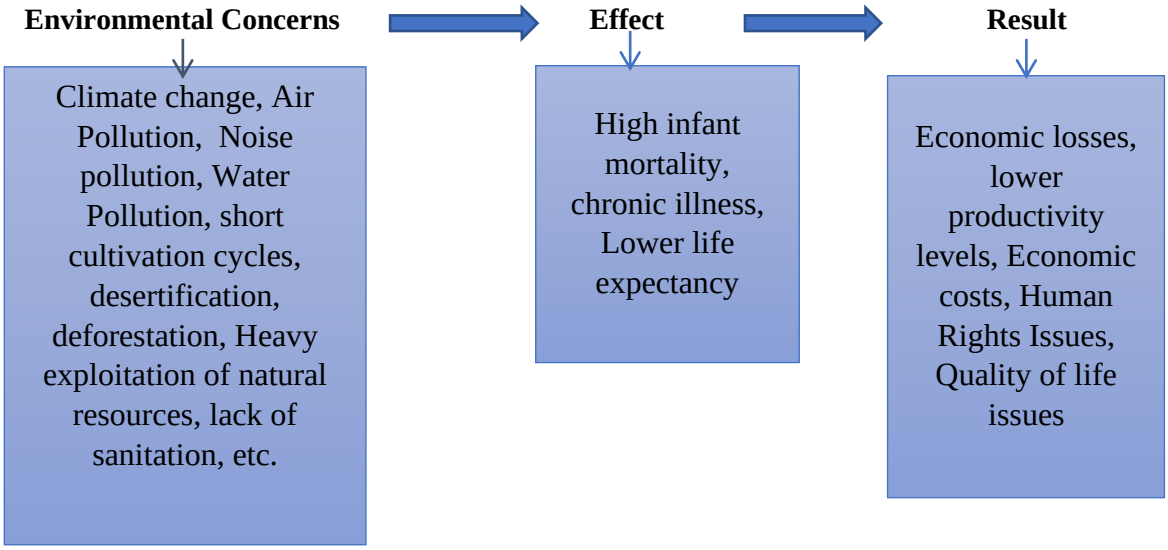
environment problem simultaneously as well. Therefore there is always an environmental threat from one end and solution from the other.

- **Current Environmental Issues in India –**
  - Heavy exploitation of natural resources
  - Noise pollution, which occurs mainly in commercial and residential areas.
  - Water is contaminated by noxious and toxic substances.
  - Air pollution from industrial effluents and vehicle emission.
  - Municipal solid waste management (MSWM) remains a challenge for India due to rising population and resultant infrastructural needs (Dube, Nandan and Dua ,2014)
  - Agricultural factors such as runoff of agricultural pesticides, short cultivation cycles, slash and burn practices, overgrazing, destructive logging practices, deforestation.
  - Energy related environmental problems such as oil & chemical pollution, Greenhouse Gas (GHG) emission (Greenstone and Hanna,2014)
  - Other issues include soil erosion leading to floods, salt deserts and, desertification, landslides, change of river directions, extinction of species, and vulnerable ecosystem in place of more complex and stable ecosystems.

❖ **A Schematic Representation of the Environmental Issues in India-**



1. **Climate Change-** *"A long-term change in the earth's climate, especially a change due to an increase in the Average atmospheric temperature"*

Earth's climate is at equillibriam state which favours existance of human race However the changes occurring today are speeded up because of human activities. In 21st century, irregular climate changes have been a big challenge for the human race.

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Climate change is a major problem of the century. This is evident from observations of increases in the global average air and ocean temperatures, widespread melting of snow and ice, and the rising global average sea level. It poses a variety of challenges with wide-ranging effects. It is projected to have significant impacts on conditions affecting agriculture, including temperature, precipitation and glacial run-off.

- ***Causes of Climate Change –***

1. Natural causes -

A. ***Sunspots-*** The increase in sunspot activity and a run-up of global temperature on earth are happening convergent and view regulation of carbon emissions.

B. ***Volcanic activity***-Volcanic eruptions discharge CO_2, emit aerosols, such as volcanic ash or dust, and sulphur dioxide. Aerosols scatter incoming solar radiation, causing a slight cooling effect. Volcanic aerosols can block a percentage of sunlight and cause a cooling that may last for 1-2 years.

C. ***The Milankovitch Theory*** – This explains the 3 cyclical changes in Earth's orbit and tilt that cause the climate fluctuations that occur over tens of thousands of years to hundreds of thousands of years.

2. ***Manmade Causes -***

A. ***Urbanization & Industrialization:*** The excessive exploitation of resources and nature due to rapid urbanization and industrialization let to climate change.

B. ***Deforestation***: Vegetation absorbs CO_2 from the atmosphere, converting this to carbon which is stored within all plants (i.e. it is a carbon sink). When vegetation is burned, this organic carbon is released into the atmosphere in the form of CO_2, and in so doing becomes a carbon source rather than a carbon sink.

C. ***Burning Fossil Fuels****:* Burning coal to generate electricity, burning oil to power vehicles and aircraft (vehicle emissions), or burning wood in fires used for cooking or to provide heat, etc. changes the state of stored organic carbon from a liquid (e.g. oil) or solid (e.g. coal/wood) into a gas (CO_2) which is released into the atmosphere.

- ***Impacts of Climate Change in India -***

i. ***Effect on Sea Level -***The next effect of climate change is rise of sea levels. Though a sea level rise in some Indian coastal cities has been quite mild so far, it did not specify its rise in recent years.

ii. ***Effect on Indian Monsoon –*** Human interference have certainly made the Indian monsoon fickle. There is a reason to believe that the tipping point for the Indian monsoon may have already crossed or is imminent. In 2006, there were unprecedented floods in Barmer district of western Rajasthan, where the average annual rain fall is hardly 120 mm.

iii. ***Effect on Himalayan Glaciers -*** Climate change, which is a result of global warming, is causing the glacier melt. Himalayan glaciers are a source of fresh water for perennial rivers in India. Excessive meltdown of glaciers may cause floods initially, but in the long run glacial retreat will reduce the water reaching the rivers. Also, the water from the meltdown is creating large lakes and there is a big risk of these lakes bursting out and causing enormous floods. If

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the glacial retreat continues, at some stage normal glacier melt will not be able to contribute to the region's water supply each year. The glacial retreat is adding to the irreparable ecological damage already suffered by the Himalayas.

On 16 and 17 June 2013, heavy rains together with moraine dammed lake (Chorabari Lake) burst caused flooding of Saraswati and Mandakini rivers in Rudraprayag district of Uttarakhand. The bursting of this lake led to its complete draining within 5–10min. The heavy rainfall together with melting of snow in the surrounding Chorabari Lake washed off both the banks of the Mandakini River causing massive devastation to the Kedarnath town.

iv. ***Effect on Agriculture*** **-** Agriculture will be adversely affected not only by overall amounts of rainfall but also by shifts in the timing of the rainfall. Any change in rainfall patterns poses a serious threat to agriculture, and therefore to the economy and food security. The rise in temperatures is likely to affect crops differently from region to region. Erosion, submergence of shorelines, and salinity of the water-table due to the increased sea levels are the factors that mainly affect agriculture. Increased frequencies of drought, floods, storms and cyclones are likely to increase the variability of agricultural production

v. ***Effects on Human Health*** **-** The Inter-governmental Panel on Climate Change (IPCC) has forecasted and observed various diseases which are caused due to climate change.

2 Natural Resource Depletion

Natural resource depletion is another crucial current environmental problem. Fossil fuel consumption results in emission of Greenhouse gases, which is responsible for global warming and climate change. Globally, people are taking efforts to shift to renewable sources of energy like solar, wind, biogas and geothermal energy. The cost of installing the infrastructure and maintaining these sources has plummeted in the recent years.

3 Population Growth

The rapid growing population & economic development is leading to a number of environmental issues in India. In 2022, the estimated total population in India amounted to approximately 1.38 billion. A growing population exerts pressure on agricultural land, causing environmental degradation, and forcing the cultivation of land of poorer as well as poorer quality. This environmental degradation ultimately reduces agricultural yields and food availability, causes diseases and death, thereby reducing the rate of population growth. Population growth creates pressure on the environment, & is major cause of varieties of pollution. An unbelievable bitter truth is that Indian population explosion adds an Australia to the country every year. Concentration of people in the urban areas which are already polluted is becoming heavier.

4 Pollution –

4.1 ***Air Pollution*** **–** It occurs when any harmful gases, dust, smoke enters into the atmosphere and makes it difficult for plants, animals and humans to survive as the air becomes dirty.

Today, air pollution has emerged as a global public health problem and is identified as a major environmental health hazard by agencies such as the WHO and governments around the world.

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The major sources of air pollution in India are fuel wood and biomass burning, fuel adulteration, vehicle emission and traffic congestion. According to the latest data released by WHO, indoor and outdoor air pollution were responsible for 3.7 million deaths of people aged under 60 in 2012. Automobiles emit by far the most CO_2 of all transportation modes. In recent years, air pollution has acquired critical dimensions and the air quality in most Indian cities that monitor outdoor air pollution fail to meet WHO guidelines for safe levels. The sustainment of all things living is due to a combination of gases that collectively form the atmosphere; the imbalance caused by the increase or decrease of the percentage of these gases can be harmful for survival.

The Air (Prevention and Control of Pollution) Act was passed in 1981 to regulate air pollution and some of the measures for the prevention of air pollution. However, the 2016 Environmental Performance Index ranked India 141 out of 180 countries. In 2015, Government of India, together with IIT Kanpur launched the National Air Quality Index.

- **Effects of Air Pollution-**

i. Asbestosis disease is found in pipe filters & insulation worker that are to air borne asbestos fibres. Besides this, air pollutants can also causes many other human diseases such as emphysema, chronic bronchitis, pollen allergies, lung cancer, etc. In Delhi, about 12% of the school children are suffering from asthma.

ii. In 2013, the WHO concluded that outdoor air pollution is carcinogenic to humans. Increasing temperatures are directly linked to poor air quality which, in turn, can affect the heart and accelerate cardiovascular disease. Examples of this may include a rise in pollen, due to increased plant growth, or a rise in molds, due to severe storms -both of which can worsen allergies and other lung diseases, such as asthma. Indoor & outdoor air pollution has caused about 2.5 million pre-mature deaths since Independence.

iii. Recently, Delhi facing more problem of SMOG. The people were affected by some diseases. In India, Vehicles contribute more than 30% of the photochemical smog in the atmosphere. The major cities of the country have an average of more than 15,00,000 vehicles each. More than 2.5 million different types of vehicles are running in our capital Delhi. Burning crackers, cigarette smoke, vehicular pollution and burning of crops over the last few days let to an increase of particular matter in Delhi air.

4.2 . Noise pollution –

"Noise is an unwanted or undesired and unpleasant sound."

Noise disturbance is the disturbing or excessive noise that may harm the activity or balance of human or animal life. Some examples are-

- Airplanes, helicopters and motor vehicles
- Construction or demolition noise
- Human activities such as sporting events or concerts.

Problem of noise pollution is increasing everyday especially in urban and industrial areas. Poor urban planning may give rise to noise pollution, since side-by-side industrial and residential buildings can result in noise pollution in the residential areas.

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Outdoor noise can be caused by machines, construction activities, and music performances, especially in some workplaces. The metropolitan cities if India are considered as a noisiest in the world due to lack of proper sound control system in our manufacturing plants and automobiles & also due to blasting high sounding horns. Our industrialization, mechanisation & vehicles have raised the level of noise in the metro cities.

According to the survey conducted by All India Institute of Medical Science, New Delhi, the average noise level in India's metropolitan cities is more than prescribed international limit.

- **Effects of Noise Pollution -**

i. Noise pollution has created general nuisance for the human population. High noise levels can contribute to cardiovascular effects in humans and can be disruptive to human stress levels may be harmful to unborn babies. Noise level above 100 decibel will be unbearable & injuries to various organs of man such as brain, heart & eardrum

ii. According to the recent test report on firecrackers National Physical Laboratory, New Delhi, most of the firecrackers available in the market produce noise beyond permission limits of 125 decibels as per the environment protection (second amendment) rules 1999. Some of them have been observed to produce noise near the threshold of pain.

iii. The wild & other domestic animals also get badly affected by the sudden & large noise. For example, the supersonic jets during their testing & launching projects are known to cause disturbance to wild animals, mammals & domestic livestock. In animals, noise can increase the risk of death by altering predator or prey detection and avoidance, interfere with reproduction and navigation, and contribute to permanent hearing loss.

4.3 Water Pollution-

Water pollution means one or more substances have built up in water to such an extent that they cause problems for animals or people. Oceans, lakes, rivers, and other inland waters can naturally clean up a certain amount of pollution by dispersing it harmlessly. Water pollution almost always means that some damage has been done to an ocean, river, lake, or other water source.

BOD concentration of wastewater is expressed in mg/L. BOD of clean fresh water is 2 mg/L whereas value exceeding 5 mg/L indicates contamination. When BOD levels are high, there is decline in DO levels.

- ***Sources of Water Pollution –***
  - ***Point Source pollution*** *– It is a single identifiable localized source of water pollution. It includes Municipal Sewage Treatment Plant discharge & industrial plant discharge.*
  - ***Diffused or Non-point Source pollution*** *- It generally consists of polluted runoff from farmland & mines, forest, land development & other activities.*
- **Causes of Water Pollution –**
  - Pollutants coming from chemical & industrial process are the major causes of water pollution. When factories & manufactures pour their inorganic & organic wastes directly into streams & rivers, the water becomes poisonous & oxygen levels are depleted causing

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many aquatic organisms to die. The heated water from the industries also causes thermal pollution. This kills the aquatic animals & plants by reducing oxygen content of water.

- Another cause is polluted runoff from farmland & mines. Farm pesticides, chemical fertilizers & organic wastes pollute the water bodies.
- Sewage coming from household is the main cause of water pollution in India.

➢ **Effects of Water Pollution in India –**

- The effects are not only devasting to human but also to animals. Polluted water destroys aquatic life & reduces its reproductive ability. Polluted water is unsuitable for drinking, recreation, agriculture & industry. It diminished the aesthetic quality of lakes & rivers.
- In fact as far as India is concerned polluted water is one of the major factors behind the general low levels of health in India, especially in the rural areas. Polluted water can lead to diseases such as cholera, tuberculosis, dysentery, jaundice, diarrhoea, etc. In fact, around 80% stomach ailments in India happen because of consuming polluted water.
- Chloride which is added to water to control the growth of algae & bacteria in the cooling system of power station may persist in streams for long time & causes mortality of planktons & fishes. The Best example of chlorine toxicity is seen in U.P where the free chlorine content of the chemical wastes that are discharged by factories near Mirzapur (U.P), have resulted into heavy fish mortality in river sane located in Bihar.
- Mercury is a highly toxic & poisonous & gets accumulates in the body tissues of fishes which are exposed to heavy industrial waste & when human eats such mercury contaminated fishes develpoes a fatal disease called **Minamata disease**. The Best example of this mercury poisoning was seen Japan in 1950.
- The pathological & toxic effects of some important heavy metal water pollutants are given below:

Sr No.	Metal	Pathological effect on Man
1.	Mercury	Abdominal & chest pain, haemolysis
2.	Lead	Anaemia, Loss of appetite, damage of brain, liver & kidney
3.	Zinc	Renal damage, Vomiting
4.	Cobalt	Lung irritation, bone deformities, paralysis
5.	Cadmium	Hypertension, kidney damage, growth retardation
6.	Copper	Coma, Uraemia, hypertension

4.4 Soil /Land Pollution –

"It is a condition that occurs when soil loses its structure, biological & chemical properties due to the use of various man-made chemicals & other natural changes in the soil environment"

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Occurance of soil pollution is correlated with the degree of industrialization & intensities of chemical usages.

➢ ***Causes & Effects-***

- ***Deposition of oxides of sulphur & Nitrogen –*** The oxides of sulphur & Nitrogen, chlorides, fluorides, etc., emitted into the atmosphere due to combustion of fossil fuels from vehicles & various industries come down as dry or wet deposition (acid rain) onto the soil & lower the soil pH.
- ***Uncontrolled deforestation, intensive irrigation and mining*** – These activities are the major cause of land degradation. Deforestation on a massive scale has resulted in an unmanageable fast flow of water from upstream areas. The eroded soil has led to siltation of rivers. It has been estimated that about 23 billion tonnes of soil are lost every year.

  The Thar-desert is expanding at the rate of one km per year. Drought-prone areas have been ever expanding, as a result, some of the districts in U.P. like Tehri and Uttarkashi, Bankura in West Bengal and large areas of Rajasthan fell to acute scarcity of water.
- ***Use of pesticides, insecticides & herbicides*** – Various chemicals used in agricultural practices cause soil pollution. Herbicides affect the biological & chemical properties of soil. These substances pollute the soil depending on their volatility, biodegradability, persistence, leaching, chemical reactivity & adsorption on the soil particles.

  Although each pesticide is meant to kill a certain pest, a very large percentage of pesticides reach a destination other than their target. It does not only kill but also affect the living organisms in an immense level of danger. They enter the air, water, sediments, and even end up in our food. Pesticides can easily contaminate the air, ground and water when they run off from fields, escape storage tanks, are not discarded properly and especially when they are sprayed aerially
- ***Radioactive pollutants*** – A variety of radioactive waste materials like Strontium -90, Cesium-137, Plutonium, Uranium, etc., are added to soil from nuclear activities. These substances may be washed into water or may be directly added to water

  In March 2009, the issue of Uranium Poisoning in Punjab attracted press coverage. It was alleged to be caused by fly ash ponds of thermal power stations, which reportedly lead to severe birth defects in children in the Faridkot and Bhatinda districts of Punjab. The news reports claimed the uranium levels were more than 60 times the maximum safe limit.
- ***Release of sewage matters, industrial effluents & solid waste*** – Decomposition of sewage may release various toxic heavy metals that cause an increase in heavy metal toxicity. Detergent substances may also be release from sewage causing damage to the soil.

  A study conducted by Baba Farid Centre for Special Children (Jan 2009 – Jan 2018) across Punjab shows the level of toxicity in the urine samples of 200 children shows a drastic increase of heavy metals in blood. For example the dangerous metals like lead, Nickel, Mercury and Cadmium have been found present in the blood of such children up to 94% more than the prescribed limits which resulted in a massive increase in the prevalence of mental retardation and learning disabilities.

ISBN-978-81- 954002-9-4

Large quality of solid wastes like unused & rejected chemicals, unwanted industrial wastes generated during manufacturing process are dumped over on the Surface of soil. All these solid materials are bound to change the nature of soil besides contributing large quantity of pollutants to underground water- whenever rain water passes through them. Lakes, rivers and streams are drying day by day. The water area of Chilka (Orissa) has been reduced from 1165 sq km to 900 sq km. Loktak lake, the largest freshwater inland lake, has been reduced from 495 sq km to 390 sq km in ten years causing a serious ecological problem in Kashmir valley. The defective drainage system and encroachment on Dal Lake and the closure of the Nallah are hindering the flood channel linking the Dal with the Jhelum.

❖ **Remedial Measures –**

- There is no dearth of laws for the protection and conservation of the environment. However, the implementation of these laws continues to be very poor. There is a dire need of protection of ecology, otherwise coming generation will going to suffer a lot**.** Proper environmental protect development is a great challenge we face today. Implication of some regulatory measures may control vehicular & industrial emission. There is also a need to introduce eco - friendly refineries & thermal power plants to reduce pollution. It should be checked strictly whether factories & industrial units did not violet the standards set by various relevant act & laws.
- To meet the food demand for growing population, rise in agricultural production is of most important. The use of pesticides should be managed in such a way that it will not pose any threat to the environment & human life. To ensure conservation of resources to provide the basic needs of millions of people.
- To control the population growth, there is a need to provide health care, improve female literacy, sex education, job opportunities for woman & to motivate people to take up family planning. Involvement of voluntary organizations in social education & effective communication for promoting contraceptive methods may also be effective in this mission.
- We have to plan our development efforts in such a way that a harmonious balance is maintained between man & his environment. Any process of planning should be based on the principle of Development without Destruction. The society & all concerned need to be convinced of the importance of the environment & we have to realize the fact that the way how to live today will influence tomorrow.

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ISBN-978-81- 954002-9-4

E-WASTE- A GROWING CONCERN FOR ENVIRONMENT AND OPPORTUNITY FOR ECONOMY

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Abstract:

Technology innovations and advancements are a consistent phenomenon which is giving rise to new electrical and electronic products every now and then. These gadgets equipped with easy interface, new attractive features at affordable prices are attracting people to buy them at a faster rate than before. An increase in supply of new electronics is making people discard their older ones earlier than they become obsolete generating a huge amount of E-Waste. It is a type of hazardous waste containing various heavy metals and harmful elements which may harm environment if not treated in an organized manner. Most of the recycling of e-waste is done by informal recyclers or waste pickers who don't use protective measures and tools. Thus, they expose their laborers to harmful chemicals and elements. E-waste is exported from developed countries into developing countries and treated by many informal recyclers in totally unsafe manner. Environmentally sound management and recycling can save e-waste going into landfills and incineration in open. WEEE (Waste Electrical and Electronic Equipment) is a global concern which has drawn the attention of various countries to take action upon. On the other hand, recycling of such heavy and precious metals and urban mining of rare earth elements can boost up the economy of any country by recycling of such materials at lower cost than mining the new ones and also increasing many employment opportunities. Thus, Recycling can save the environment in both ways- protecting the environment from various pollutions by hazardous materials and preventing unnecessary mining. This article focuses on various negative and positive aspects of e-waste and gives an overview on the current scenario of e-waste in the world. It also tries to give the solutions to reduce the intensity of the problem and suggests methods for a sustainable management of e-waste in future.

Keywords: E-Waste, Hazardous Waste, WEEE, Heavy Metals, Rare Earth Metals, Urban Mining.

Introduction:

In this era of technology, increasing consumption habits of the techno-goods and resulting generation of E-waste are parallel events. According to the OECD (Organisation for Economic Co-operation and Development), e-waste is ''Any appliance using an electric power supply that has reached its end-of life''.E-waste is often misinterpreted as related to old computers or IT equipment in general, while the synonymous term Waste Electrical and Electronic Equipment (WEEE) is also used in the international literature.(Gaidajis et al., 2010)

Composition of e-waste is very diverse and differs in products across different categories. It contains more than 1000 different substances, which fall under "hazardous" and "non-

ISBN-978-81- 954002-9-4

hazardous" categories. Broadly, it consists of ferrous and non-ferrous metals, plastics, glass, wood & plywood, printed circuit boards, concrete and ceramics, rubber and other items. Iron and steel constitute about50% of the e-waste followed by plastics (21%), nonferrous metals (13%) and other constituents. Non-ferrous metals consist of metals like copper, aluminium and precious metals e.g. silver, gold, platinum, palladium etc. The presence of elements like lead, mercury, arsenic, cadmium, selenium and hexavalent chromium and flame retardants beyond threshold quantities in e-waste classifies them as hazardous waste.(Uddin, 2012)

These metals can deteriorate the environment if e-waste ends up on landfills instead of being recycled. Moreover, mining of these elements over and over again is also a threat to the environment and less economical.

Recycling of aluminium 95%, copper 85%, iron and steel 74%, lead 65%, Zinc 60%, plastics 80% energy can be saved and for extraction of virgin material CO2 emission takes place for each tone of metal. So, this environmental loading also can be avoided if recovery of metals is done from e-waste and put in the recycling of the metals for further use. (Cui, 2003 as cited by C. VATS & SINGH, 2014). In order to reduce the mining of virgin materials, a term has been coined named 'Urban Mining'. This concept emphasizes on the extraction of valuable materials from existing products instead of mining the new ones and thus, saving the e-waste to go into landfills deteriorating the environment.

In addition to reducing the demand for mining virgin materials and resource competition, urban mining delivers the benefit of reducing the flow of material into landfills. Landfills present a significant environmental challenge, as they are sources of toxic material leakage and carbon emissions. On an annual basis, landfills emit 0.03 Gtons of carbon, which equates to approximately 40% of that emitted by the energy sector. (Archer D, 2012 as cited by JK et al., 2017)

Various Categories of E-Waste

Table 1: Categories of E-Waste

	Category
1.	Large household appliances
2.	Small household appliances
3.	IT and telecommunications equipment
4.	Consumer equipment and photovoltaic panels
5.	Lighting equipment
6.	Electrical and electronic tools (with the exception of large-scale stationary industrial tools)
7.	Toys, leisure and sports equipment
8.	Medical devices (with the exception of all implanted and infected products)
9.	Monitoring and control instruments
10.	Automatic dispensers

Source: Categories of EEE covered by the EU WEEE Directive during the transitional period (until August 2018)

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Note: Cited from *E-Waste Training Manual* (2018)

Table 2: Categories of E-Waste

	Category
1.	Temperature exchange equipment
2.	Screens, monitors, and equipment containing screens having a surface greater than 100 cm2
3.	Lamps
4.	Large equipment (any external dimension more than 50 cm) including, but not limited to: Household appliances; IT and telecommunication equipment; consumer equipment; luminaires; equipment reproducing sound or images, musical equipment; electrical and electronic tools; toys, leisure and sports equipment; medical devices; monitoring and control instruments; automatic dispensers; equipment for the generation of electric currents. This category does not include equipment included in categories 1 to 3
5.	Small equipment (no external dimension more than 50 cm) including, but not limited to: Household appliances; consumer equipment; luminaires; equipment reproducing sound or images, musical equipment; electrical and electronic tools; toys, leisure and sports equipment; medical devices; monitoring and control instruments; automatic dispensers; equipment for the generation of electric currents. This category does not include equipment included in categories 1 to 3 and 6
6.	Small IT and telecommunication equipment (no external dimension more than 50 cm)

Source: Categories of EEE covered by the EU WEEE Directive after the transitional period (after August 2018)

Note: Cited from *E-Waste Training Manual* (2018)

Literature Review:

According to Research Unit (Larrdis) Rajya Sabha Secretariat, (2011) "E-waste typically contains complex combinations of materials and components down to microscopic levels. The wastes are broken down in not just for recycling but for the recoverable materials such as plastic, iron, aluminium, copper and gold. However, since e-waste also contains significant concentration of substances that are hazardous to human health and the environment, even a small amount of e-waste entering the residual waste will introduce relatively high amount of heavy metals and halogenated substances. Such harmful substances leach into the surrounding soil, water and air during waste treatment or when they are dumped in landfills or left to lie around near it. Sooner or later they would adversely affect human health and ecology".

Forti et al., (2018) states "In most developing countries, an enormous number of self-employed people are engaged in the informal collection and recycling of e-waste. They usually work door-to-door to buy e-waste from consumers at home, and then sell it to be refurbished and recycled. Electronic products are mostly recycled through "backyard recycling" or substandard methods, which can cause severe damage to the environment and human health. The e-waste can also end up in normal "waste bins". In this scenario, consumers directly dispose of e-waste in normal

ISBN-978-81- 954002-9-4

dustbins with other types of household waste. As a consequence, the disposed e-waste is then treated with the regular mixed-waste from households. This waste is most likely incinerated or landfilled without material recycling, depending on the waste management infrastructure in a country. Neither option is regarded as an appropriate technique to treat e-waste because both could potentially negatively impact the environment and lead to resource loss".

Uddin (2012) says "Informal recycling involves minimal use of technology and is carried out in the poorer parts of big cities. The standard recycling drill involves physically breaking down components often without any protective gear, burning poly vinyl chloride (PVC) wires to retrieve copper, melting of lead and mercury laden parts. The extraction of gold and copper requires acid processing. The plastic parts, which contain brominated flame retardants (BFR) are also broken into small pieces prior to recycle. All these processes release toxic fumes into the atmosphere and polluted water into soil and water bodies leading to contamination. Most of those who work in the recycling sector are the urban poor with low literacy lacking awareness of the hazards of the toxic e- wastes. Children and women are routinely involved in the operations. Most of the work is done by bare hands. Waste components which do not have resale value are openly burnt or disposed of in open dumps".

E-waste is a complex and difficult form of waste to recycle, and problems such as elevated concentrations of heavy metals in the air have even been found in state-of-the-art facilities in developed countries. Workers and local residents are exposed to toxic chemicals through inhalation, dust ingestion, dermal exposure and oral intake. Inhalation and dust ingestion impose a range of potential occupational hazards including silicosis (Lepawsky & McNabb, 2010 as cited by Karin, L. 2012).

Aquino (2017) in her thesis explains about the extraction of precious metals from e-waste "The low barrier to entry precious metals recycling technology is a bioreactor that recycles crushed electronic waste and recovers precious metals such as gold, silver, platinum, palladium, and other elements. The proposed low barrier to entry technologies will allow precious metals and gold specifically to be recycled from mobile phones close to where the devices are consumed, used, and discarded".

Research Objectives:

1. To know the difference between the generation and collection of e-waste quantities in the world.
2. To know the harmful impacts of e-waste on environment and health.
3. To evaluate the economic benefits of E-waste.
4. To find out the major barriers in proper management of e-waste.
5. To assess the future prospects of e-waste generation in the world.

Research Methodology:

The design of this research paper is a mix of both quantitative and qualitative research and is entirely based on secondary data extracted from various journal articles, e-waste training manuals and reports. The tables and figures are based on the data from website for global e-waste

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statistics (https://globalewaste.org/country-sheets/). All the figures have been prepared using MS-Excel 2016.

Analysis and Discussion:

Global E-Waste Scenario: According to Global E-waste Monitor Statistics "The fastest growing domestic waste stream in the world: amount of e-waste grew by 9.2 Mt between 2014 and 2019.On average, every person in the world generated 7.3 kg of e-waste in 2019. Only 17.4% of global e-waste generated in 2019 was documented to be collected and properly recycled. Africa generates the least amount of e-waste per capita at 2.5 kg. However, environmentally sound recycling infrastructure and e-waste legislation are mostly absent".

Table 3: E-Waste Scenario in Continents of the World

Continents	E-waste Generated (in Kilo tones)	EEE Put on Market (in Kilo tones)	E-waste Collected formally (in Kilo tones)	Waste generated per capita (in kilo grams)	EEE put on market per capita (in kilo grams)
Asia	24896	42130	2921	5.6	9.5
Americas (Both northern southern America)	13120	16203	1228	13.3	16.5
Europe	12013	13631	5106	16.2	18.4
Africa	2905	4409	26	2.5	3.8
Oceania	667	817	59	16.1	19.7

Source: *Country Sheets*. (n.d.). Retrieved June 29, 2022, from https://globalewaste.org/country-sheets/

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Asia generated the highest quantity of e-waste in 2019 at **24.9 Mt** with a formal collection and recycling rate of only **11.7%**.

Europe ranked first worldwide in terms of e-waste generation per capita: 16.2 kg per capita. However, Europe has the highest e-waste collection and recycling rate (5%).

Figure 4: Difference between the generated and collected e-waste globally

Table 4:E-Waste in the countries around the world

Country	**E-waste generated (in kilo tones)**	**E-waste formally collected (in kilo tones)**	**E-waste generation per capita (in kilograms)**
USA	6918	1020	21
China	10129	1546	7.2
Japan	2569	570	20.4
India	3230	30	2.4
Germany	1607	837	19.4
Australia	554	58	21.7
Mexico	1220	36	9.7
South Africa	416	18	7.1
France	1362	742	21

Source: *Country Sheets*. (n.d.). Retrieved June 29, 2022, from https://globalewaste.org/country-sheets/

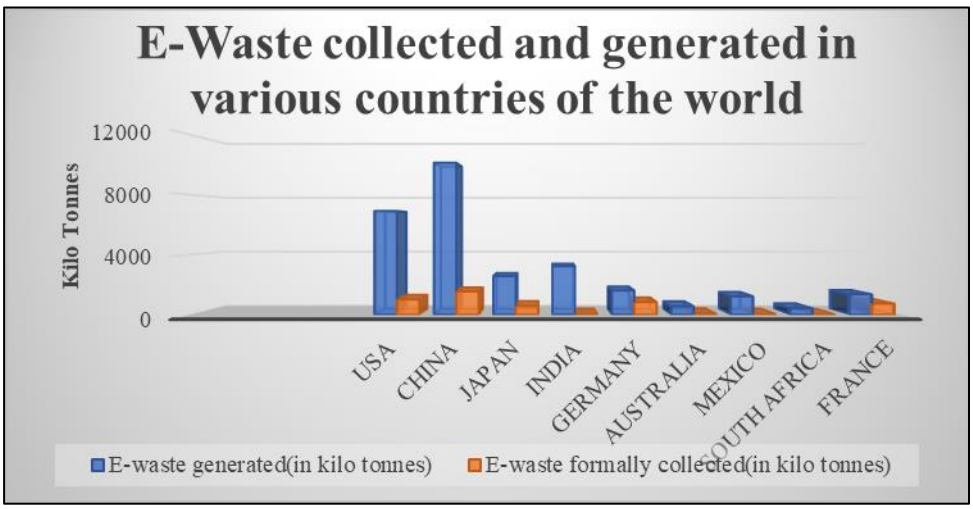

Figure 5: Difference between the generated and collected e-waste in different countries

Effects of E-waste on Environment:

1. The toxicants used in manufacturing (as intermediate inputs) can also leave a long trail of toxicity. For example, fluorinated greenhouse gases, used in manufacturing of LCD flat-

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panel displays, involves chemicals with atmospheric lifetimes beyond 3,000 years and thousands of times more global warming potential than CO2.(Parajuly et al., 2019)

2. Open burning or 'Incineration' can emit hazardous gases (CO2, NO2, SO2 etc) in the atmosphere.
3. Several studies report the contamination of soil, air, and water by heavy metals and organic contaminants in and around the informal working areas.(Vaccari et al., 2019)
4. Lead presented in E-Waste can accumulate in the environment and can affect organisms.
5. Brominated Flame Retardants (BFRs) present in circuit boards and other components of e-waste is a toxic element and can stay in the atmosphere for long.
6. E-Waste contains mercury which can transform into methylated mercury after mixing with water and can enter into food chain especially through fishes.

Effects of E-waste on Human Health:

E-waste being processed not only harm the workers but also nearby residents, animals and plants too. It can cause both short and long-term effects on health of them. Various studies reported the impacts on the labourers, nearby people, agriculture and animals due to contact with e-waste.

A case study was **done by Rakib & Ali(2014)** on the people involved in the e-waste business at Rangpur division city of Bangladesh and they found that out of the total number of respondents, 52 identified who were not affected by E-waste evolving diseases and also 48 respondents were affected by different types of diseases. Subsequently, at least 8 diseases were identified among the local technology repairing worker and other relevant working activities. However, from the observation a number of diseases were identified among the respondents in the study area like as Itching (4.2 percent), Digestive problem (1.68 percent), Respiratory problem (4.2 percent), Pulmonary and Cardiovascular diseases (4.2 percent), Depression (17.65 percent), Headache (25.21 percent), Insomnia (13.45 percent) and Fatigue (29.41 percent) due to lack of precautionary measure, knowledge, environmental education and ignorance. Although, not a single person was identified known about personal protective equipment (PPE) and health perspective.
Another study done by **Wang et al (2012)** on sampling sites from northern Guangdong Province, South China where e-waste processing units were close to agriculture fields. They found that "Uncontrolled recycling and disposal of e-waste have resulted in severe contamination and in the migration of PAHs (Polycyclic aromatic hydrocarbons) into the surrounding environment. The levels of PAHs in the soil and vegetation samples collected near the e-waste dumps were significantly enriched relative to those from other locations. Gaseous emission and particle deposition from the e-waste open burning activities were the main sources of PAHs in the recycling area. PAHs have entered the food chain through vegetables and result in high daily dietary intakes via vegetables in the e-waste recycling area".
Bae et al. (2020) identified a spatial relationship between incineration facilities and asthma-related hospital admissions in Seoul, Korea. The relative risk of asthma-related hospitalization decreased with increasing distance from incinerators but increased among those living within a 2-km radius.
Olafisoye O. B., et al. (2013) carried out a study in Lagos state, Nigeria on plants sampled around e-waste dumpsite and found high concentrations of heavy metals in plant roots and vegetables.

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Table 5:Impact of various constituents of E-waste on health

Source of e-wastes	Constituent	Health effects
Solder in printed circuit boards, glass panels and gaskets in computer monitors	Lead (PB)	• Damage to central and peripheral nervous systems, blood systems and kidney damage. • Affects brain development of children
Chip resistors and semiconductors	Cadmium (CD)	• Toxic irreversible effects on human health. • Accumulates in kidney and liver. • Causes neural damage. • Teratogenic.
Relays and switches, printed circuit boards	Mercury (Hg)	• Chronic damage to the brain. • Respiratory and skin disorders due to bioaccumulation in fishes.
Corrosion protection of untreated and galvanized steel plates, decorator or hardener for steel housings	Hexavalent chromium (Cr)	• Asthmatic bronchitis. • DNA damage.
Cabling and computer housing	Plastics including PVC	Burning produces dioxin. It causes • Reproductive and developmental problems; • Immune system damage • Interfere with regulatory hormones
Plastic housing of electronic equipment and circuit boards.	Brominated flame retardants (BFR)	• Disrupts endocrine system functions
Front panel of CRTs	Barium (Ba)	Short term exposure causes: • Muscle weakness • Damage to heart, liver and spleen.
Motherboard	Beryllium (Be)	• Carcinogenic (lung cancer) • Inhalation of fumes and dust. Causes chronic

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		beryllium disease or berylliosis. • Skin diseases such as warts.

Source:(Rao, 2014)

Economic benefits of e-waste-

Besides precious and base metals, small IT waste also contains rare earth elements, such as Nd(Neodymium), Pr(praseodymium), Dy(dysprosium), and Gd(gadolinium) which are considered critical for the development of renewable energy technologies by the U.S. Department of Energy (DOE, 2011 as cited by Lister et al., 2016) can also be obtained from various parts of e-waste which can be recycled and thus, reused in making of new products. Moreover, cost of recycling is cheaper than mining of them and also comes at the cost of environmental degradation. In global market, exporting rare earth elements and such precious metals can add a big amount into GDP of any country and can give employment at several levels of e-waste handling.

E-waste engages enormous unskilled manpower for the collection, segregation, manual dismantling, packaging, transportation of e-waste. So, there is and would be a huge demand of all kind of manpower if e-waste profession is organized professionally in the country(C. VATS & SINGH, 2014).

Main Hurdles in Proper E-Waste Management

1. Lack of availability of actual data for generation of e-waste, mostly based on estimation-based models and formal collection of e-waste.
2. Lack of data for total recycled waste in a particular area as in most countries informal recyclers are into this business.
3. Unavailability of the data on total imports and exports of e-waste.
4. Awareness among consumers about the harms of e-waste is very low.
5. Improper management by informal sectors due to lack of knowledge and awareness about the harmful elements in the waste they are dealing with. They even hire children into dismantling and recycling of the products.
6. No specific rules and regulations through proper legislation and if there, no strict application and execution of them.

Future prospects of e-waste generation:

It is obvious that with population growth, need of the easy-to-use technology and high purchasing rate, the demand of e-products will increase in future.

There is a modest correlation between the weight of e-waste generated per person and GDP per person based on data from 168 countries in 2015. This correlation was combined with the population and GDP-growth forecast under the Shared Socioeconomic to estimate future e-waste generation. This estimate shows the global amount of e-waste will be 75 million tons by 2030 and grow to 111 million tons by 2050. The Middle East and Africa (MAF) and Asia (ASIA) will see more than three-fold increase by 2050 compared to the e-waste generated in 2010. The

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OECD will be the second largest generator of e-waste with less than double quantity for the same period.(Parajuly et al., 2019)

Conclusion:

It can be concluded that there is a huge gap between the data of generation and collection of e-waste around the world as most of the e-waste is being handled by unauthorized dealers. Informal recycling deteriorates the environment during handling and even after when residuals end up into landfills. Elements presented in E-waste are dangerous for human health and vegetation in contact with e-waste can absorb the contaminants that can cause serious illness. Though, proper processing of such waste can bring prosperity to the economy of any country and can open up the doors for opportunity of employment. Many precious metals and rare earth metals can be recycled which can stop virgin mining and again can save the environment. It can be forecasted that e-waste generation will be almost doubled in 2050 with the increasing technological advancements.

Recommendations for Sound Management of E-Waste:

As it is not easy to reduce the usage of these products. though adapting some sustainable approach is the only option to cope with the problem of huge generation of e-waste There are many ways and methods that can be applied to reduce the quantity of e-waste in future, such as:

1. Manufacturers can initially reduce the waste by making some changes in product design and giving extra years of life cycle.
2. Reducing the amount of the hazardous substances in processing of products and using less hazardous or non-hazardous elements.
3. Spreading awareness among, retailers, consumers (especially bulk consumers) and recyclers of e-products about storage
4. Encouraging people to follow the three-tier concept of E-waste- 'Reduce', 'Reuse' and 'Recycle'.
5. Linking small informal recyclers with formal recycling system as they can contribute in door-to-door collection.
6. Appropriate rules, regulations and policies should be made by federal and state government and should be implemented strictly.
7. Using GPS tracking for illegal exports and imports of the waste.
8. Determining buffer zone around waste processing industries.

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ISBN-978-81- 954002-9-4

FOOD CRISIS DURING COVID-19 PANDEMIC AMONG MIGRANTS: A STUDY WITH REFERENCE TO ROHTAK CITY (HARYANA)

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Abstract:

Covid-19 Pandemic has brought many and diverse challenges to human society, among these challenges issues about safety, security, and wellness of migrants were at the forefront. As many countries including India, adopted lockdowns as a potent instrument to curb the spread of the infectious virus, the impact of lockdowns on migrants was also most visible in all parts of the country. In India, millions of migrants migrate to different areas of the country, including Maharashtra, Gujarat, and Haryana to earn their and their families' livelihood. Due to uncertainties caused by unforeseen economic lockdown migrants and their families had to suffer a lot. In this paper, an attempt has been made to understand the nature of the suffering of migrants, and their families during the period of uncertainties and suffering.

In this paper, Rohtak an emerging city of NCR- Haryana has been taken as the study area. As Rohtak has emerged as a very important site for migrants, industrial and agricultural laborers from different parts of the country have always preferred Rohtak as it has the potential to provide year-round employment. The present study is based on data collected from interviews with the head of the laborers' families who were present in the study area just before lockdown. And their interviews were conducted once they are back after lockdowns were over. In this paper, an attempt has been made to understand the qualitative aspects of their life rather than dealing with issues quantitatively.

Keywords: Lockdowns, Food crisis, Migration, Mobility

Introduction:

Migration along with fertility and mortality is the main component that brings the population changes in an area. The nature of migration is different from fertility and mortality, as both fertility and mortality are biological phenomena. Migration is caused by the combined effect of social, cultural, and economic conditions. It is an age-old phenomenon, which has remained prevalent throughout history for man's survival and existence. Migration can be defined as the geographic movement of people from one region to another in a permanent or semi-permanent manner. Migration is a universal phenomenon of population redistribution. World over, poor people migrate to ensure their survival as their native places (in most cases rural areas) are devoid of resources and facilities required for quality of life. In the Indian case, most of the migrants move away due to miseries and sufferings at their source/origin place. Rural areas in India have trapped the problems of the vicious circle of low agricultural productivity, underemployment, low income,

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and poverty. These problems leave no scope for the poor other than to migrate in the search of better opportunities for themselves and their families.

The world is witnessing unprecedented events in the wake of the Covid-19 pandemic, as its spread is unparalleled to any other disease in human history. The different nations responded to the crisis in different manners. The coronavirus is believed to have originated from Wuhan in China and spread across nations as it is highly infectious. Most scientists believe that migration and mobility of people have contributed to its spontaneous spread. Its fatality and adverse health impacts made nations have to take measures such as lockdowns, home isolation, and social distancing methods to curb the spread of the deadly virus. Many countries, including India, adopted 'lockdowns' as the most preferred mechanism to minimize the spread of the virus by reducing community gatherings. Severe restrictions on normal mobility and economic activities brought many hardships to most individuals, especially to migrants and their families mainly due to the sudden declaration of lockdown.

It is fact, that the life of every individual is hard during covid-19 related lockdowns; among others, the migrants were the most sufferers as their capacity to cope with any form of unforeseen event is minimal. As it is often said that in any calamity poor people suffer most; it was also true in the context of the Covid-19 crisis. Most of the migrants had to suffer the dual burden of being in poverty and migrant have very few social, political, and economic rights at the destination. In the absence of any political, social, and economic strength plight of the migrant can be well understood given the responsibilities on them as on one hand they have to earn for themselves and on the other, they have to send remittances to their families back home.

As per Kumar (2021), along with many other countries, India also initiated lockdowns to curtail the spread of the Coronavirus, but still, India ranks among the most affected country in the world. The sudden and prolonged lockdowns in India led to panic, chaos, insecurity, and fear among people, particularly migrants. Sudden lockdown pushed already marginalized migrants into deeper distress as they lost their jobs and had to face a food crisis in the absence of any earnings. Few migrants also reported that they had to face many hardships, especially, because of the rental house as they were not able to pay rent and other charges. In India, most of the migration is due to the push factors or negative factors of the source region including unemployment, poverty, and other forms of human suffering. Many studies have found that regional variations in the level of development and migration streams are highly interlinked and most of the time male migrants pour into developed regions in the search of better employment opportunities (Malhotra, 2016).

Migrants after losing their jobs and living days without food were even not able to return to their native places during lockdowns as all forms of transport facilities were also curtailed, to restrict the spread of the virus. Job losses, non-payments of old due salaries by companies, no savings, and unable to pay rents of rental houses were the few common issues that had to be confronted by every migrant world over. In general, it is found that the rate of in-migration is higher in higher-income group states; whereas, low-income group states witness a

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higher rate of out-migration (Bhagat et al.; 2020). Migrants move out of economically underdeveloped regions towards areas of better economic opportunities in the form of gainful employment. Over the last few decades Delhi, Haryana, Punjab, and Maharashtra have remained the focus of in-migration. As per NSSO, 2010 study, only 1/3 of total migrants are employed as irregular or are working in informal sectors. Migrants working as informal workers had to suffer even more as compared to other workers from economic lockdowns and related events. As most of the migrants had limited savings, they were entirely dependent upon the merciful deeds of generous peoples. This made the situation out of control for most of the migrants and their families.

Scholars see lockdowns as barriers to the natural flow of migrants, restrictions in the movement of people, and stoppage of mass modes of transport bringing much suffering to poor migrants and their families. Migrants being poor and marginalized were the worst affected community during covid-19 related lockdowns. Migrants died due to reasons ranging from starvation, suicide, exhaustion, road and rail accidents, police brutality, and denial of timely medical care (Guha et al., 2020). Geographically, long lockdowns caused panic among migrants triggering reverse migration from urban centers to their native places. This reverse migration too was not free from suffering as migrants had to return to their place on foot in the absence of any transport mode. Carrying loads of household materials, small children without food or money. Some died while returning and some had so much physical, mental, and economic suffering that this period became unforgettable for them. Apart from economic problems the migrants also had to encounter various psychosocial issues like high degrees of anxiety and fears due to various concerns related to the COVID-19 pandemic. Occasionally, they also face harassment and adverse reactions from the local community (Das et. al., 2016).

Moreover, the lockdown and resulting economic conditions in India also changed the food status of most of the migrants. Therefore, in the light of the above, this paper is an attempt to look into the food status of migrants coming to Haryana from different parts of the country. It is a matter of great curiosity how a food surplus state of India had handled the food issues of migrants during the lockdown.

Study Area

The present study is based on the Rohtak district; it lies in the state of Haryana which is the agriculturally and industrially most prosperous state of India. Having a special position in terms of economic development in Haryana as per the census of India out of total migrants' 2.17 percent of migrants come to Haryana (Table 1). Migrant laborers from different states of India come to Haryana in the search of better economic opportunities and higher wages. Haryana is a state where the green revolution began; with the starting and diffusion of green revolution technology from core areas to non-core areas employment opportunities also increased tremendously. The need for labor in different agricultural processes was met by migrant workers as local workers were not able to meet the needs of large number of manual labor requirements.

Patterns and reasons for Migration:

Man has remained mobile ever since its origin on the earth's surface and man tends to migrate to different places for different causes. In all geographical studies

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based on migration, analysis of migration patterns and their causes are very important. Haryana is an agriculturally and industrially prosperous area large of migrants get attracted to it. As far as migration pattern is concerned Rohtak, the study found that a large number of migrants from NCT of Delhi, Uttar Pradesh, Bihar, Punjab, Rajasthan, and Uttarakhand migrate towards Rohtak. Its location near Delhi and better connectivity both via train and road route, along with agricultural prosperity and industrial development make Rohtak a hot destination for migrants (Sahni et al., 2020). Moreover, over the year many new industries have emerged in and around Rohtak have also added to the attraction for the migrants.

Another dimension that is crucial in the analysis of migration is knowing the causes for which migration is taking place. As per different migration theories in population geographies such as Ravenstein's Law of Migration (1885), Stouffer's theory of Mobility (1940) and Everett Lee's theory (1966) migration is a short distance, the majority of migrants tend to travel a short distance. And at the same time theories also asserted that migration is always age, and sex-selective; it underlines that majority of migrants will be male in the working age group venturing out for economic causes. Data obtained from the census of India, 2011, also shows a similar picture as brought by the above-discussed theories. As per data, most of the migrants are males migrating to Rohtak for economic causes that include better job opportunities.

Objectives:

The main objective of this paper is to analyze the impact of lockdowns on the food status of migrants and their families. At the same time paper is also attempts to present some short and long-term policy suggestions to overcome any such future event.

Data Source and Methodology

The present paper is based on primary and secondary data sources. Primary data is collected from field interviews of migrants who were in Haryana during the starting of lockdown; and later, they have now returned on foot or through any other mode to their native places. During the field, survey migrants were interviewed in a structured manner to know their sufferings and experiences of Covid-19-related lockdowns and economic crises. Infield interviews remove any regional biases 50migrants from different states were selected and interviewed openly and transparently. The secondary data is also utilized to know the number of migrants and some other characteristics of migrants are collected from the Census of India 2011, D-2 migration table.
In terms of methodology, the present study attempts to analyze the issues of migrants, especially, issues on food in a qualitative manner. As the suffering of migrants was much more than just numbers, therefore, to reach the crux of the issue qualitative approach has been adopted.

Results and Discussions

During field interviews with respondents, questions were asked related to their experiences of Covid-19-related lockdown in the state of Haryana when they were doing labor just before the lockdown was announced. They all had some experiences and the present study is based on sharing those experiences.

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The sudden stoppage of all forms of economic activities was the cause of all the other worries and sufferings migrants had to face (Kailash, 2013). As in today's world availability of money drives every decision. And all the respondents replied that economic causes were the cascading cause of all the other worries. In most cases, migrants had Job losses and in a few, they were paid a reduced salary. Although there is no data from the government on the unemployment caused during the said time some prominent economists predict that nearly 2-3 crores of people lost their job. In the case of the migrants, the situation was even more critical as most of them are working in the unorganized sector and have a little social security net. Moreover, absence of any compensation or expectation for the revival of the economy they left their workspace in the absence of any hope for a bright future.

Similarly, all the migrants that were on daily wages were under very economic and other forms of stress due to Covid-19-related economic lockdown. The informal nature of their job suddenly came to halt leaving no scope for their and their family's survival. Women narrated how they have to feed their children by begging for food and milk as they had to walk around for 10 days without any help. These kinds of suffering from migrants put a serious question mark on the claim of India of being the 5th largest economy, where we are not able to provide just basic needs to children and women. Some brave heart migrants decided not to return and instead keep working whatever work is available. They were aware that the situation in terms of food and employment is not so rosy back in their home. They kept doing whatever work was on offer. Respondents narrated their experience that how to work as home cleaners as factories were had closed too well below the normal salaries.

A similar sorrow study was presented by migrants that were on some form of formal jobs that their salaries were also reduced as their factories were not functioning. Daily wage workers and contractual workers shared their views that they were not paid full salaries. Uncertainties about their future and a very high level of insecurity made them suffer.

Views in terms of Social Aspects during lockdown

As it is a well-known fact that in present-day society social relationships are governed by economic status. And due to lockdowns, everyone was suffering from one form of problem or the other. Even close relatives were also not able to help as they were under heavy economic stress. Parents were not able to pay school fees resultant schools closed their doors to online classes for such students. The worst sufferers were the female students as they are marginalized even on normal days and now during the lockdown; they had no scope of getting back to school. The economic crisis in families led to an increase in dropouts in the general contest and girls children especially. Long periods of lockdowns wiped out their savings and they were funding their basic needs using savings in the absence of no job and no earning scenario.

One more long-lasting consequence was the economic slowdown and which resulted in a total halt in production. This combined with higher fuel prices led to a phenomenally very higher rate of inflation. This time inflation is different from all other previous inflation levels, as people were suffering from job losses and they are feeling hard to stay alive in much higher prices of essential commodities such as edible oil, pulses, and petroleum have pushed many to below

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subsistence level. Abject poverty has altered the food status of millions as not all people are finding it hard to run their families; it is especially more in the case of migrants. One other aspect needs to be understood that being residing away from their home state most of the migrants do not have any entitlement under the food security net as most of them do not have any access to ration facilities from PDS. Therefore, most of the respondents replied that as they do not have any social or political rights their sufferings are much higher as compared to normal citizens.

Few migrants from Bihar said that they had to walk Chapra in Bihar for hundreds of miles on foot to reach their home villages. One migrant was in deep sorrow while narrating his long walk and the ill-treatment he received way in between Rohtak back home. The return migration of migrants is seen as the largest mass return migration from the workplace to the birthplace. It was true in the context of migrants within India, but Indian migrants from all over the world have also returned. They reported that they were not given any prior information about the period of lockdown and no window was given to them so that they can move back to their native places.

One other sorrowful picture was about the behaviour of their state government and police administration where they were treated badly and even trashed as they were seen as the potential carrier of infection. Even after returning to their native places, migrants were thrown in camps for 20 days without many basic facilities. Some of the respondents were those who got infected by corona their voices became weak while narrating their experience at the workplace and at the hospital where they had spent 3-4 weeks. Fear of getting infected doctors and other staff members of the hospital were behaving in such a manner as if they are not human.

Some complained that governments halted transportation overnight to contain the spread of the virus; migrants from large urban centres started travelling on foot from Haryana, Uttar Pradesh, and Maharashtra to their native states, therefore, in the absence of any prior information they had to suffer a lot. Some migrants expressed their gratitude to NGOs and Haryana government as they arranged food, water, and medicines as and when it was required. Being a welfare state states offered to help migrants by sheltering them, with water, food, and medicines to the needy. During this need of the hour, many individuals and NGOs also came forward with a helping hand. Haryana Government by going a step ahead also helped stranded migrants to travel back by registering migrants digitally.

Policy Suggestions and way forward

Migration will always play an important role in the Indian economic scenario. As most of the migrants migrate due to economic causes they always have low coping strength with unforeseen events, like Covid-19 and lockdowns (Rajan, et al., 2020). Therefore, in case of any such future scenario following issues should be kept in mind while dealing with the issue at the government or societal levels.

Better information dissension methods and mechanisms should be followed so that rumors may not spread about the safety of migrants. Moreover, as migration is bound to happen, it is for the betterment of our economy that the free flow of migration takes place. Therefore, to safeguard the interests of migrant's proper return policy should be in place. In this regard, the need for the hour is to have better coordination between centers and states. Keeping in mind the interests of

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migrants a better framework for safe migration should be made to avoid unnecessary panic and problems. Moreover, the government should implement policies for better food opportunities at subsidized rates through PDS. Similarly, the one nation-one ration card policy is rolled out for all included migrants so that they can have legal entitlement for ration under PDS.

Conclusions:

Conventionally, migration in India is not considered a positive event, most of the time migration is caused by prevalent socio-economic compulsions. Aiming for higher wages and quality of life poor migrants migrate to economically developed regions of the country. At the time due to some natural or economic emergencies, their dream and aspirations fail to bear fruits. Covid-19 and related lockdowns provided such conditions that were very hard for all the people, especially, for migrants, and their families as they stand last in terms of resources and capacity to cope with such unforeseen events. Poor and deprived sections of the society had to bear brunt of the suffering. Field surveys and interviews of migrants suggested that they suffered on more than one front, on one hand, economic losses due to job losses and reduction in salaries. On the other, due to economic losses many other related issues cropped up in their life, these were food insecurity, reduction in expenses in the household and higher dropouts from schools; these all seriously affected the quality of life in the family. Covid-19-related lockdowns were not just economic losses as they had effects ranging from social and psychological, along with others. All these also had a profound impact on the food status of migrants that including a reduction in expenditure on food items, reduction in meals per day, uncertainties of availabilities of food articles especially milk and vegetables, dependence on NGOs or other social groups for daily needs, and borrowing from other relatives had changed their food status to highly insecure during said time.

It emerged from the study that lockdown was required for containing the spread of the virus. Problems emerged due to faulty procedure of the lockdowns and keeping information including its probable period a secret from migrants was not justified. Ration to all, arrangement for child education, essential daily items, and medicines should have remained at the priority for policy measures. It emerged from the study that the Haryana government did relatively better as compared to most of the other states. Among many steps taken by the state government for the welfare of migrants during the said period, the most appreciated was the provision for free ration, psychological counselling of migrants, and arrangements done for migrants to return to their native places. Similarly, providing information on lockdowns, and steps to reduce job losses and sufferings for those who tried to go to their native villages on foot needs to be rectified in the future, so that, the suffering of poor migrants can be minimized.

Table 1
Migration Flow from the Different States to Haryana, 2011

States	Number of Migrants
Uttar Pradesh	378,173
Rajasthan	179,562
Bihar	149,701

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Punjab	**146,075**
Delhi	**120,001**
Chandigarh	**36,937**
West Bengal	**35,377**
Uttaranchal	**28,046**
Chhattisgarh	**26,609**
Himachal Pradesh	**20,179**
Madhya Pradesh	**16,268**
Maharashtra	**10,229**
Jharkhand	**9,227**
Orissa	**7,090**
Jammu & Kashmir	**6,291**
Assam	**5,231**
Others	**20,700**

Source: Calculated from Census of India 2011, D-2 Migration Table (www.censusindia.gov.in)

Table 2
Number of Inter-State Migrants to Rohtak District from the Major States in India, 2011

Source of Migration	Number of Migrants
NCT of Delhi	19,086
Uttar Pradesh	18,937
Bihar	6,365
Punjab	4,679
Rajasthan	4,219
Uttarakhand	1,485
Madhya Pradesh	1,186
West Bengal	1,176
Maharashtra	665
Assam	632
Chandigarh	540
Himachal Pradesh	445
Chhattisgarh	296
Jammu & Kashmir	267
Gujarat	223
Odisha	219
Jharkhand	214
Tamil Nadu	147
Andhra Pradesh	104

Source: Calculated from Census of India 2011, Migration Table (www.censusindia.gov.in)

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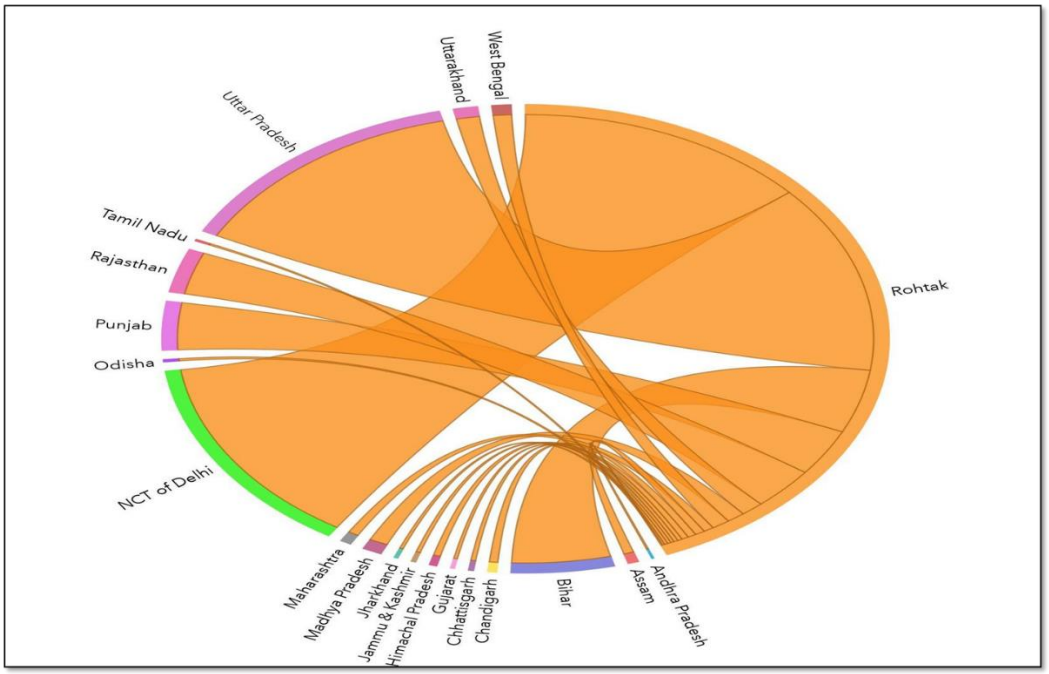

Figure 1

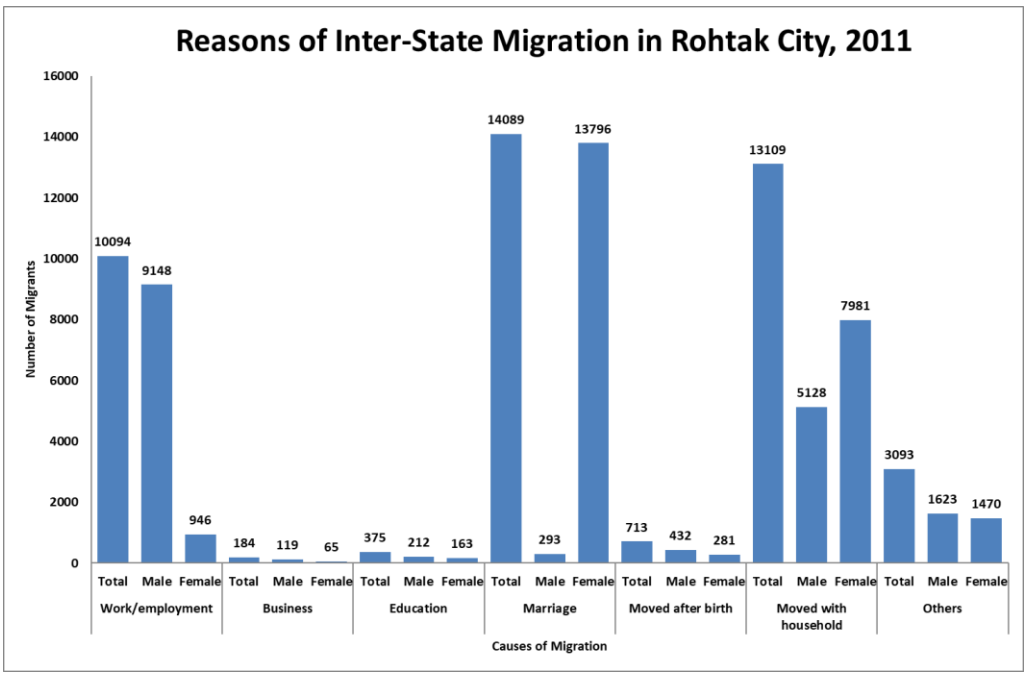

Figure 2

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ISBN-978-81- 954002-9-4

EXPANSION OF IRRIGATION FACILITIES AND ITS IMPACT ON CROPPING INTENSITY: A SPATIO-TEMPORAL ANALYSIS WITH REFERENCE TO HARYANA

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Introduction

Haryana is predominantly an agricultural economy. About 70 percent of its residents earn their bread and butter from agriculture directly or indirectly. Haryana has occupied a pioneering position in agriculture in a very short period and it is widely regarded as the granary of India. Adoption of green revolution technology can be seen as the biggest push in the agricultural performance of the state. The spread of green revolution technology from core areas of the green revolution to the non-core areas has led to a steady increase in area under irrigation, and the use of pesticides and fertilizer in the state. Regarding cropping patterns, Wheat and rice are the major crops grown in the state. Haryana is self-sufficient in food production and the second largest contributor to India's central pool of food grains. The state has made rapid progress in the field of agriculture since 1966-67 and holds a leading position among other agriculturally advanced regions of India. The state which constitutes only 1.44 percent of the geographical area and 2.4 percent of the total population of the country now contributes as much as about 7.2 percent towards the country's total food grains production. The cropping intensity of the state of Haryana has increased regularly. The present study is an attempt to study Spatio-temporal variations of cropping intensity in Haryana and tries to analyse the role of irrigation in cropping intensity.

In multiple cropping systems, water is one of the predominant elements. Besides this, the annual rainfall of most of Haryana is insufficient for raising more than one crop in a year. Therefore, irrigation becomes essential for raising two or three crops in a year. The cropping intensity has a direct correlation with assured irrigation which enables farmers to go for multiple cropping and use a higher dose of fertilizers and HYV seeds. A cropping system in irrigated areas can be developed to make the best use of all the resources available in a particular situation by Shafi (2006).

Dhawan and Datta (1992) found a positive relationship between the intensity of cropping and irrigation. Area irrigated more than once during and agricultural year grew much faster, which is a measure of the intensity of cropping. Sharma (1997) examines the trends in cropping intensity in Karnatak. He has found in his study that expansion of irrigation in the North Maidan and Malnad has led to faster growth of multiple cropping. His study shows that deficiency of irrigation appears to be the main cause of low cropping intensity in the state. Karunakaran and Palanisami(1998) examine the impact of irrigation on cropping intensity in Tamilnadu at the state level. In the state, dug-well irrigation showed a significantly positive impact on the cropping intensity up to 1979-80. After that tube well irrigation had more impact on cropping intensity.

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Pal (2008) has examined the Spatio-temporal pattern of agricultural development emphasizing crop intensity, and irrigation status at the mesco and micro level in the Kandi Block. He finds out that on the one hand the massive development of agriculture has been doubling or tripling the production and productivity level and on the other hand there is depletion of groundwater as well as environmental quality.

Objectives

The main objectives of the study are:

(i) To analyse the Spatio-temporal variations in cropping intensity in Haryana for a period of seventeen years i.e., from 1991-92 to 2017-18.

(ii) To evaluate the role of irrigation in cropping intensity in Haryana.

Study Area

Haryana lies between 27°39' N and 30°55'5" N latitudes and 74°27'8" E and 77°36'5" E longitudes, covering an area of 44,212 sq. km. It constitutes 1.44 percent of the total geographical area of the country. It is situated in the northwestern part of India and is a part of the Indo-Genetic plain. It is bounded by Himachal Pradesh in the north, Uttar Pradesh and Delhi in the east, Punjab and Chandigarh in the northwest, and Rajasthan in the southwest. According to the 2011 census, the population of the state is 25,353,081. The average density of the population of the state is 573 persons per square kilometer. Starting originally with seven districts and one division, at present, the state has twenty-two districts and six divisions i.e. Gurgoan, Ambala, Rohtak, Karnal, Faridabad, and Hisar divisions. It must be noted that as the study pertains to a comparative analysis of the period 1991-94 and 2015-18, therefore for analysis purposes only 21 districts have been taken.

The northern part of the state is bounded by Siwaliks which provides a slope towards the south and south-west. Likewise, the Aravalli in the south and south-east provides a slope towards the north. It is the only one in the eastern part of Gurgaon that land in general slopes towards south and south-east. The state is characterized by arid and semi-arid type of climatic conditions. The state is normally deficient in rainfall over its greater part. It is located in the transition zone between the Thar Desert of Rajasthan and the moderately humid upper Ganga plain.

Database and Methodology

The present study is based on secondary data drawn from published as well as unpublished sources. The time-series data relating to various aspects of agriculture such as net area sown, total cropped area, and gross irrigated area at the state and district level have been obtained from the Statistical Abstract of Haryana published by the Department of Economic and Statistical Analysis, Haryana, Government of Haryana for the period 1991-92 to 2017-18. As agriculture is a very dynamic activity and it tends to change under given geo-climatic conditions, to minimize the impact of fluctuations due to weather and climatic factors study is based on triennial averages of the variables for the year 1991-94 and 2015-18. Cropping intensity is a statistical measure for expressing the total cropped area as a proportion of net sown area in percent as:

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$$\text{Cropping Intensity} = \frac{\text{Gross Cropped area}}{\text{Net area Sown}} \times 100$$

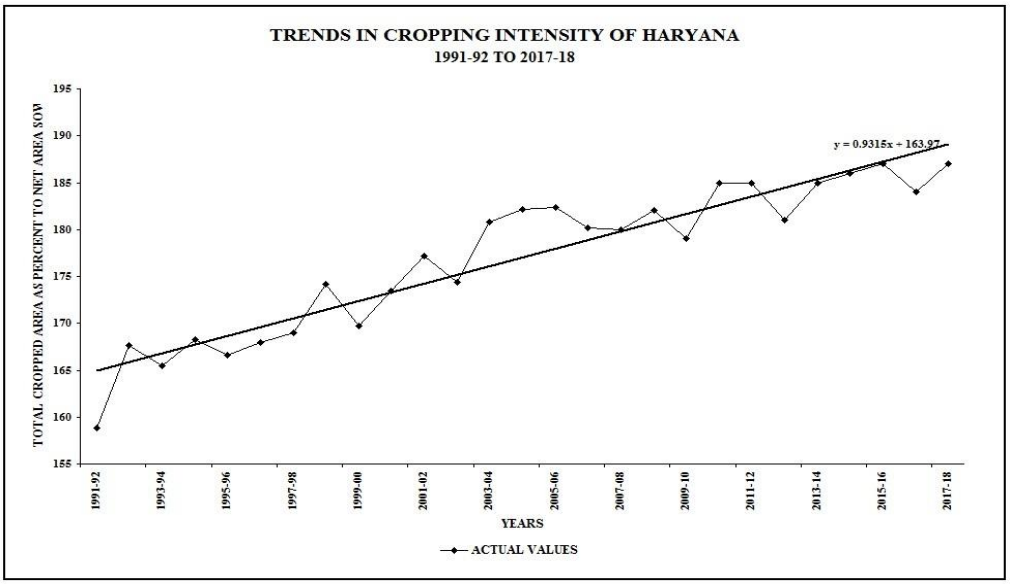
To understand the association of cropping intensity with the irrigated area has been established with the help of Karl Pearson's coefficient of correlation and a t-test has been done to test the significance of the correlation.

Results and Discussion

Trends of Cropping Intensity in Haryana

The trend line drawn for time series data shows the rapid increase in cropping intensity with time. Figure 1 shows that the cropping intensity fluctuates highly from year to year. It is revealed that fluctuations in cropping intensity do not occur with any definable regularity. The cropping intensity was fairly high up with a few fluctuations.

Figure 1



In 1991-92 cropping intensity was 159 percent which increased to 187 percent in 2017-18. A glance at the line graph reveals that cropping intensity followed the trend line which shows the ideal increase in cropping intensity. The consistent increase in cropping intensity in the state may be attributed to well development irrigation facilities.

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Spatial Pattern of Cropping Intensity:

Haryana is one of the most intensively cultivated states in India. More than 87 percent of the net sown area sown in the state is cultivated more than once (2017-18). But within the state, there have been wide spatial variations in the cropping intensity.

Cropping intensity regions (1991-94):

i) **Very low cropping intensity regions (<157):**
In the year 1991-94, the districts of Rohtak, Jhajjar, Rewari, Gurugram, Nuh, Faridabad, Palwal, Sonipat, and Bhiwani comprised the very low cropping intensity region. The soil and water quality of these districts are saline. Apart from this irrigated area was also very low.

ii) **Low cropping intensity regions (157-170):**
Mahendragarh, Yamunanagar, Ambala, Panchkula, Fatehabad, Hisar, and Sirsa districts were in the low cropping intensity region. In most of these districts, there is less area under irrigation.

iii) **High cropping intensity regions (171-184):**

Kaithal, Panipat, Jind, and Kurushetra constituted the high cropping intensity region. In these districts, the net irrigated area to the net sown area was above 86 percent.

iv) **Very high cropping intensity regions(>184):**
In the year 1991-94 cropping intensity of Karnal district was the highest in the state i.e. 194 percent.In this district, 98.52 percent of the net sown area is under irrigation.

Cropping intensity regions (2015-18):

i) **Very low cropping intensity regions (<157):**
Rewari hadthe lowest cropping intensity i.e 156%. This district is a large deficit in water resources.

ii) **Low cropping intensity regions (157-170):**
Rohtak, Jhajjar, and Gurugram, the high cropping intensity region. These districts are flood-prone

iii) **High cropping intensity regions (171-184):**
Nuh district constituted the high cropping intensity region.

iv) **Very high cropping intensity regions(>184):**

Yamunanagar, Palwal, Bhiwani, Sonipat, Faridabad, Mahendragarh, Panchkula, Ambala, Fatehabad, Hisar, Sirsa, Panipat, Kaithal, Jind, Kurukshetra, and Karnal were in the high cropping intensity region.During2015-18 cropping intensity of Karnal district was the highest in the state i.e. 198 percent followed by Sonipatand Panchkula (197 and 196 percent respectively). From 1991-94 Sonipat district maintained a low status, but in 2015-18 Sonipat district has been raised to a very high cropping intensity region. The main reason for the highest concentration in this district was because of in the freshwater zone, which has been harnessed

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for irrigation. During both periods Karnal district has been identified as a very high cropping intensity region. Fertile soil and adequate irrigation facilities offer greater opportunities to the farmers to produce more than one crop during the same year.

Table 1
District-Wise Cropping Intensity and Percentage Net Irrigated Area Out of Net Area Sown in Haryana, 1991-1994 and 2015-18

Districts	1991--94		2015-18	
	Cropping Intensity	% Net Irrigated Area Out of Net Area Sown	Cropping Intensity	% Net Irrigated Area Out of Net Area Sown
Jhajjar	131	69.29	162	95
Rohtak	131	69.29	169	96.33
Rewari	148	77.03	156	96.3
Gurugram	152	44.29	162	100
Nuh	152	44.29	171	64.6
Faridabad	153	77.88	193	97.93
Palwal	153	62.5	191	98.67
Sonipat	153	97	197	99.77
Bhiwani	156	47.18	186	65.2
Yamunanagar	158	76.53	185	96.93
Ambala	163	60.7	192	96.27
Panchkula	163	60.7	196	82.53
Mahendragarh	164	55.69	189	52
Fatehabad	167	62.5	193	96.87
Hisar	167	77.88	195	97.9
Sirsa	170	75.67	188	96
Kaithal	176	97.44	191	99.1
Panipat	180	97.06	188	100
Kurukshetra	182	99.23	189	98.1
Jind	183	86	188	98.13
Karnal	194	98.52	198	99.83
HARYANA	**164**	**74.59**	**186**	**89.8**

Source: Calculated by the author

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Relationship between the extent of irrigation and cropping intensity:

Table 1 reveals that the cropping intensity has increased all over the state. An increase in irrigation facilities in the state either by canals or tube wells has also played a significant role in the increase in cropping intensity. The net irrigated area as a percent of net area sown was 74.59 percent in 1991-94 whereas it increased by 89.8 percent in 2015-18. But it should also be kept in mind that cropping intensity has increased even in western parts of the state where there are limited water resources. The increasing population pressure on the cultivated land has also led to the vertical expansion of the cultivated area.

Table 2

Haryana: Correlation between Cropping Intensity and Percentage of Net Irrigated Area Out of Net Area Sown

DISTRICT	r Value	DISTRICT	r Value
Jind	0.91*	Rohtak	0.54*
Karnal	0.85*	Bhiwani	0.52*
Sirsa	0.84*	Kaithal	0.50*
Hisar	0.81*	Panchkula	0.31**
Ambala	0.79*	Gurgaon	0.22**
Faridabad	0.76*	Palwal	0.2**
Kurukshetra	0.73*	Jhajjar	0.08**
Sonipat	0.69*	Nuh	0.05**
Yamunanagar	0.60*	Rewari	0.05**
Panipat	0.55*	Fatehabad	0.02**
Mahendragarh	0.54*	Haryana	0.93*

*Coefficients are significant at a 1 percent level of significance

**Coefficients are not significant at 10 percent of significance

Table 2 shows the correlation coefficient between the extent of irrigation and cropping intensity. The correlation coefficient has been computed for districts on the time series data. For the state as a whole the correlation between cropping intensity and irrigated proportion of net area sown shows nearly perfect positive (r=0.93). It has been found that in all 21 districts there is a significant positive correlation between these two variables. Among all the districts Jind shows the highest positive relationship (r=0.91). Out of these districts in Jind, Karnal, Sirsa, Hisar, Ambala, Faridabad, Kurukshetra, Sonipat, Yamunanagar, Panipat, Mahendragarh, Rohtak, Bhiwani, and Kaithal districts correlation is significant at 1 percent level of significance.

Conclusion

Cropping intensity is the most essential role to play in agriculture, agricultural practices, and agricultural production. Rainfall is deficient in the state, there is an acute need for irrigation that has been identified for agricultural development in the state. It is assumed that the increase in

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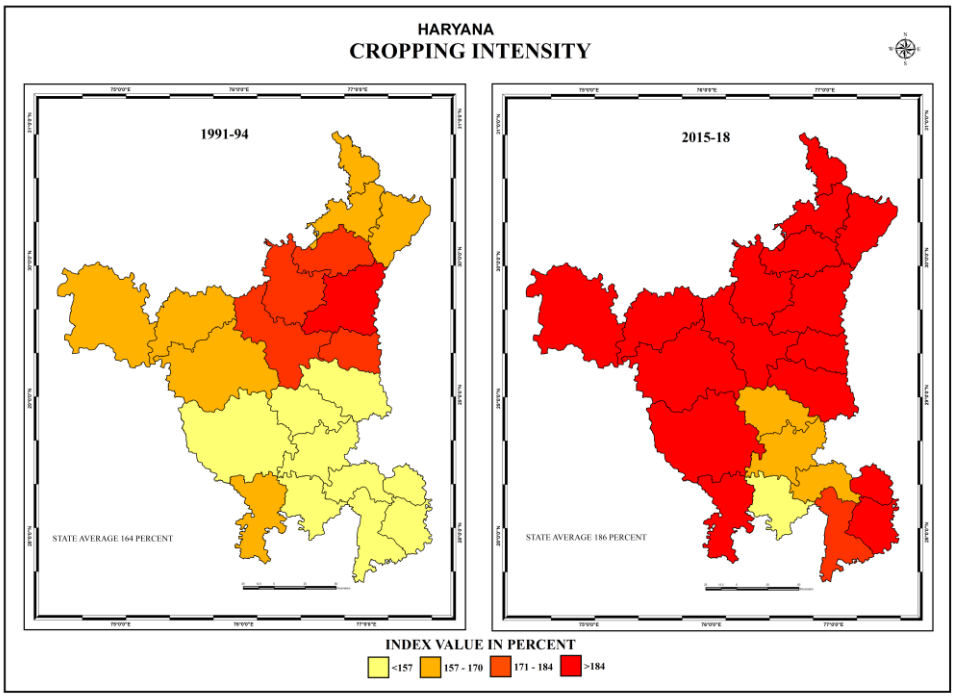
irrigation facilities might enhance the probability of more cropping intensity. The study marked variations in cropping intensity in Haryana during the post-liberalization. The interplay of several economic and cultural factors with varied agro-ecological conditions determines the magnitudes of crop diversification in Haryana. In general, cropping intensity has been increased as a result of the increase in irrigation intensity. But exceptions have also been observed. Yamunanagar, Palwal, Mewat, Bhiwani, Sonipat, Ambala, Mahendragarh, Hisar, Jind, Karnal, Sirsa, Fatehabad, Rohtak, Panipat, and Kurukshetra have followed the general trend while Panchkula, Rewari, Jhajjar, Gurgaon, Faridabad and Kaithal districts are exceptions. Due to favorable physical agro conditions and the substantial use of modern technology like chemical fertilizers, high yield verity seeds have played a significant role to increase cropping intensity in addition to the use of irrigated water. The correlation between cropping intensity and irrigation shows positive in all the districts.



The introduction of a modern irrigation system through tube wells and canals has changed the agricultural landscape in many ways. The percentage of arable lands has increased enormously. With the development of irrigation, Haryana state showed a sharp fall in the area under dry crops while rice and double cropping have gained increasing popularity. Early rice is more important in the tube well-irrigated area while at present rice in the canal is irrigated. Due to the expansion of irrigation, this natural resource is facing tremendous stress. In-state freshwater zone the larger part of irrigation is being sustained by groundwater irrigation through tube wells. This has resulted in the continuous lowering of the water tables in the state. On the one hand, the water table is rising due to the poor quality of groundwater and inadequate drainage facilities leading to the problems of waterlogging. The unfavorable geo-hydrological conditions in the state coupled with changing

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patterns in favor of water-intensive crops have been the major reason for the degradation of water resources. If suitable measures are not taken in time the situation will become unmanageable.

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ISBN-978-81- 954002-9-4

MONTHLY VARIATION OF ZOOPLANKTONS FROM KURNUR DAM IN AKKALKOT, MAHARASHTRA (M.S.) INDIA.

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Abstract

The present paper deals with the study of monthly variation of zooplanktons from Kurnur dam in Akkalkot, Maharashtra (M.S.) India. This monthly evaluation of water was carried-out during the year, June- 2015 to May 2016. The plankton plays a very important role for maintaining the productivity of every water body in the freshwater ecosystem. In this monthly evaluation of water there are 19 zooplankton species was found and these are belonging to Protozoa, Rotifera, Cladocera and Copepoda were present.

Key-words: Zooplankton diversity, Kurnur dam in Akkalkot.

Introduction

Ecosystem is complex of biotic and abiotic features operating in a very harmonious manner. It maintains population and healthy communities of interacting with organisms. The floating and drifting organisms' carried-out movement of water rather than by their own swimming activity constitutes as plankton. The plant portion of plankton constitutes as phytoplankton and animal portion constitutes as zooplankton. Zooplankton includes a varied assemblage of taxonomically unrelated organism, their common ecological characteristic being their habit, are free-swimming many species of zooplanktons are primary consumers and feeds on the phytoplankton diversity.

Materials And Methods

The Zooplankton samplings were done on monthly basis for period of one year i.e. June-2015 to May 2016. Zooplanktons were collected by filtering 5 lit water through zooplankton net which was made-up of fine mesh, collected and bring to laboratory zooplankton preserved in 4% formaldehyde solution for further evaluation. Zooplanktons were identified under light microscope with the help of standard literature given by APHA (1998), Chattopadhyay C. and A. Barik (2009), Harding and smith (1974), Tonapi (1980), Pennak (1989), Dhanpati (2000).

Result And Discussion

Zooplanktons consisting of Rotifers, copepods, cladocerans and ostracodes. This monthly evaluation of water was carried-out during the year, June- 2015 to May 2016 and given in following table.

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Results-

Table No.01

Monthly variation inZooplankton of Kurnur Dam from June-2015 to May-2016.

Class	Genera	Jun	Jul	Aug	Sep	Oct.	Nov.	Dec.	Jan.	Feb.	Mar	Apr.	May
Protozoa	*Balantidium Species*	05	03	06	06	05	02	08	01	09	08	16	11
	Ceratium Species	06	09	14	15	09	0	10	05	04	07	03	05
	Stentor Species	05	09	05	04	04	08	05	09	11	12	13	08
Rotifer	*BrachionusangularisSps.*	26	28	29	14	11	06	08	05	12	13	10	08
	BrachionuscaudatusSps.	14	13	15	10	12	16	11	19	09	10	11	07
	BrachionuscalciflorusSps.	19	11	14	14	13	06	09	06	13	16	11	09
	Filiniaopoliensis	18	14	16	17	19	21	14	10	18	12	07	04
	KeatellaprocurcaSps.	20	19	16	19	19	18	20	13	16	12	09	07
	KeatellacochlearisSps.	20	19	14	11	10	11	12	15	18	10	07	05
	Lecane bulla	20	14	16	18	11	06	10	11	16	13	09	04
Cladocera	*Daphnia carinata*	11	14	15	17	29	26	21	21	11	13	12	14
	Chydorus ciliates	07	17	16	15	19	20	22	17	17	18	11	07
	Moniabrachiata	11	15	11	12	13	19	21	27	19	13	11	07
Copepod	*Mesocyclopsleucarati*	18	14	28	21	19	20	13	16	15	15	10	09
	Mesocyclopshyalinus	17	22	19	24	08	15	16	19	20	16	11	07
	Nauplius larvae	19	11	17	15	20	27	22	23	18	19	20	13

Discucssion-

These are the microscopic structure free-swimming living components present in the water body. The feed on the phytoplankton in water body so it was also called as primary consumer during the zooplankton study of Kurnur Dam, it has been distributes into 4 groups i.e. protozoans, Rotifers Cladocera and copepod. The distribution of various species was dependent on the physic-chemical parameter [4] such as temperature, conductivity, pH, chloride and free CO_2 content of water. In the present study, among the all groups zooplankton the Rotifers are dominant group in its distribution and such type of results was observed by Adeyemi, S. O.; Adikwu, L. A.; Akombu, P. M. and Iyela, J. T.: , Akin–Oriola, F. A.: , Balamurugan, S. Mohideen B.M.G. and Subramanyam P. , Basu BK, Pick FR: , Benarjee G, K Srikanth, G Ramu, KNarasimhaRamulu and B Ravinder. , Davies, O. A.; Abowei, J. F. N. and Otene, B. B. , Jalilzadeh A.K.K., Yamakanamardi S.M. and Altaff K, Raghunathan, Suresh Kumar V. etc

Zooplankton - *Protozoa:*

During the investigation, the monthly period observation, i.e. June 2015 to May 2016, the Maximum number of Group *Protozoa* was observed at sampling stations A, B, C and D respectively. In the observation of this group, there are 3 species are recorded during investigation period i.e. *Balantidium Species, Ceratium Species, Stentor Species., etc.* Out of these all 3 species the *Stentor* was dominant than other species.

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Zooplankton - *Rotifer:*

During the investigation, the monthly period observation, i.e. June 2015 to May 2016, the Maximum number of Group *Rotifer* were observed at sampling stations A, B, C and D respectively. In the observation of this group there are 7 species are recorded during investigation period i.e*Brachionusangularis Sps., Brachionuscaudatus Sps., Brachionuscalciflorus Sps., Filiniaopoliensis sps., Keatellaprocurca Sps., Keatellacochlearis Sps., Lecanebullasps., etc.* Out of these all 7 species the *Keatellaprocurca* was dominant than other species.

Zooplankton - *Cladocera:*

During the investigation, the monthly period observation, i.e. June 2015 to May 2016, the Maximum number of Group *Cladocera* were observed at sampling stations A, B, C and D respectively. In the observation of this group there are 6 species are recorded during investigation period i.e. *Daphniacarinatasps. ,Chydorus ciliates*sps.,*Monia brachiate sps., etc.* Out of these all 6 species the *Daphniacarinata* was dominant than other species.

Zooplankton - *Copepoda:*

During the investigation, the monthly period observation, i.e. June 2015 to May 2016, the Maximum number of Group *Copepoda* were observed at sampling stations A, B, C and D respectively. In the observation of this group there are 3 species are recorded during investigation period i.e. *Mesocyclopsleucaratisps.,Mesocyclopshyalinussps., Nauplius larvae sps., etc.* Out of these all 3 species the *Nauplius larvae* was dominant than other species.

Annual Percentage of Zooplankton of Kurnur Dam from June-2015 to May-2016.

Class	Annual Percentage
Protozoa	**10.22%**
Rotifer	**43.54%**
Cladocera	**22.20%**
Copepod	**24.03%**

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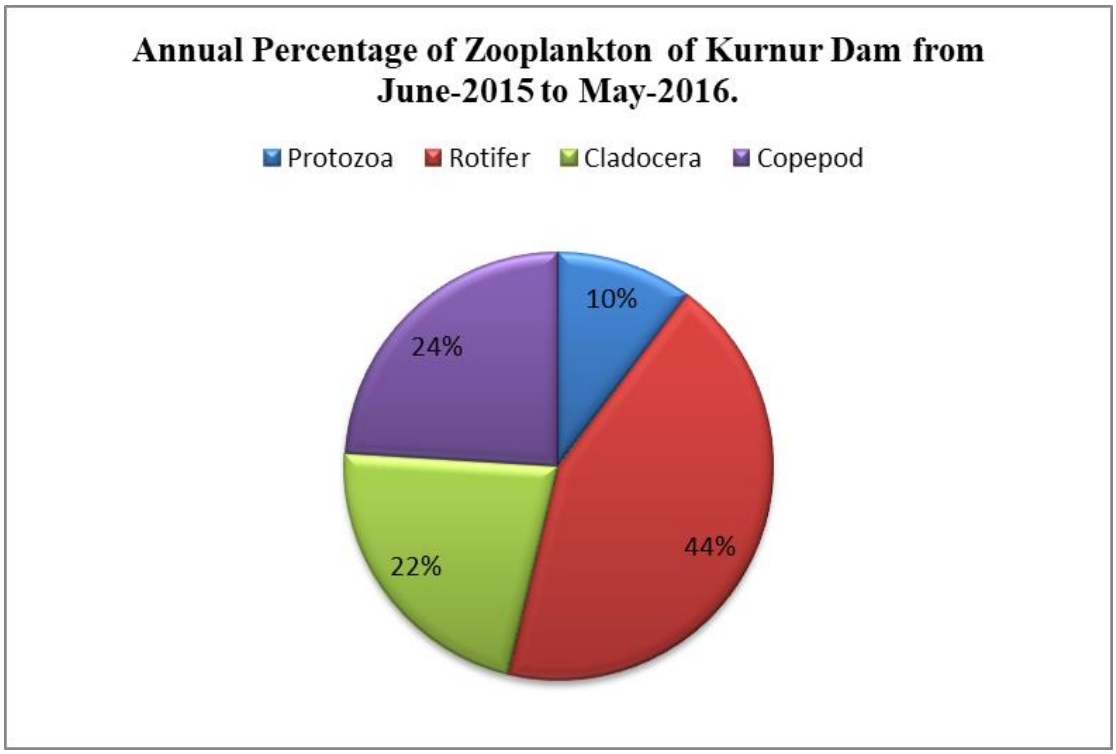


Annual Percentage of Zooplankton

During the investigation, the monthly period observation, i.e. June 2015 to May 2016, the Maximum number of Annual Percentage of Zooplankton was observed 10.22%, 43.54%, 22.20% and 24.03% at sampling stations A, B, C and D respectively, i.e. in this the maximum percentage was *Rotifer* groupi.e 43.54 % and the minimum value of Annual Percentage of Zooplankton was observed *protozoa* group i.e 10.22% from sampling stations A, B, C, and D respectively.

Conclusions

The Diversity of zooplanktons is rich in number and this presence and dominance of zooplankton species play very significant role in the functioning of freshwater ecosystem. In the present investigation, there are 16 species belonging to 04 different classes from Zooplankton diversity. The work has been concluded with future strategies for development of fish production as well as zooplankton diversity conservation of Kurnur Dam from Akkalkot.

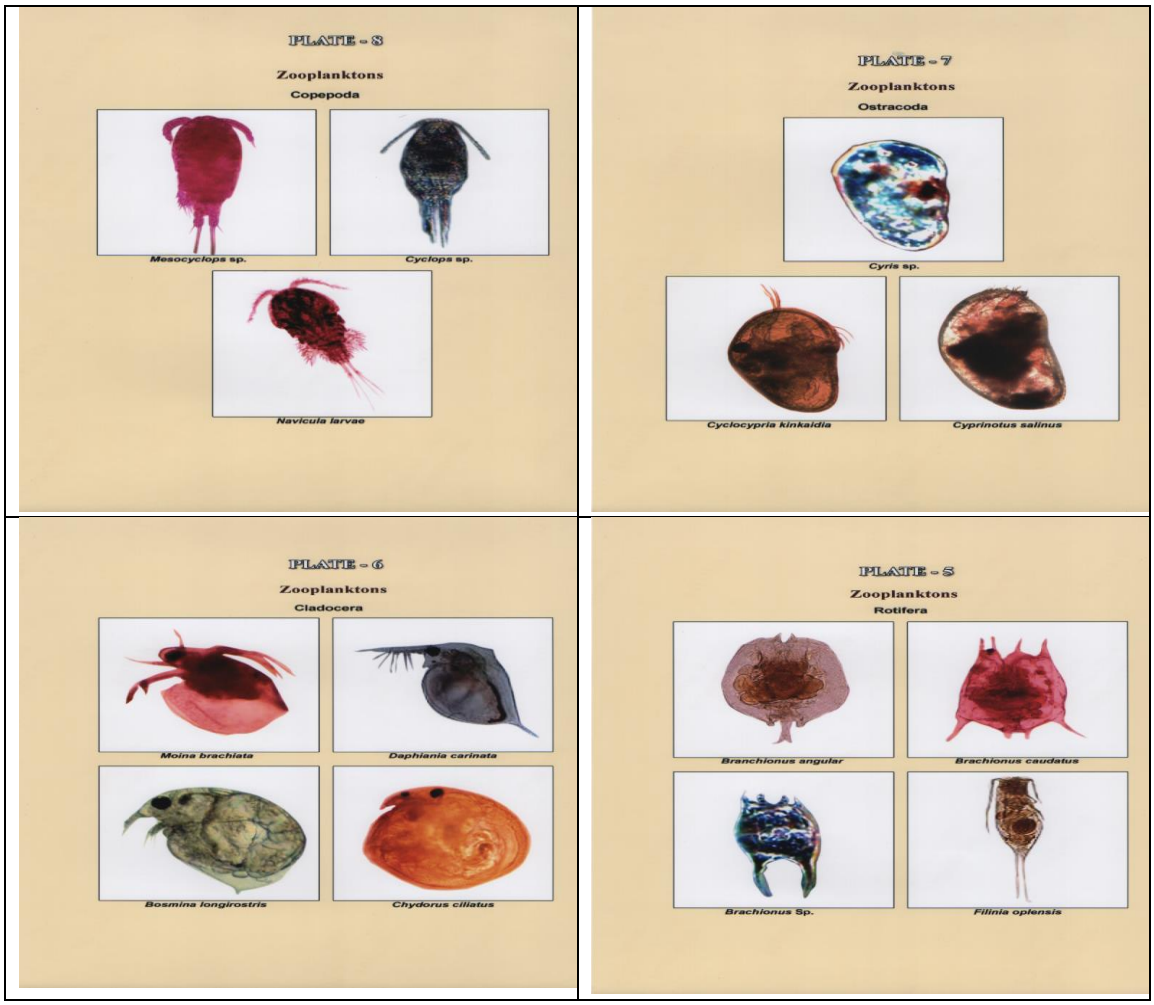
The presence and dominance of zooplankton species play very significant role in the functioning of freshwater ecosystem of Kurnur Dam.

ACKNOWLEDGEMENT

The Authors are thankful to the Management Balaghat Education Society, Naldurg. Dist-Osmanabad for providing necessary library and laboratory facilities.

ISBN-978-81- 954002-9-4

Photo plates-



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ISBN-978-81- 954002-9-4

EFFECT OF CLIMATIC VARIATION ON ZOOPLANKTON DIVERSITY IN LOWER TERNA RESERVOIR AT MAKANI, DISTRICT OSMANABAD, M.S. INDIA.

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Abstract

Plankton diversity is most important factor in aquatic community. The health of aquatic community depends upon phytoplankton and zooplankton community. As zooplankton are dependent on phytoplankton and fishes are dependent on both. The zooplankton is considered an important link between fishes and phytoplankton. So study of zooplankton diversity is very important in terms of ecosystem of a particular water body. The present study is based on observations of diversity of zooplankton in lower Terna Reservoir. This, monthly variation of zooplankton is observed during June 2015 to May 2016. Out of 21 species in the reservoir eight species were of rotifers class, four species of Cladocera class, six species of Copepods class and three of Ostracoda class. The seasonal variation of zooplankton analysis shows that the zooplankton diversity is abundant in winter season, lower in monsoon due to different environmental condition of water bodies.

Keywords- Zooplankton, Diversity of Plankton, Lower Terna Reservoir, Makani.

Introduction

The freshwater ecosystem is the composition of biotic and abiotic factors. The biotic factors are important for aquatic ecosystem. There are limited sources of fresh water like lakes, reservoirs, rivers etc. There for study or management of water bodies is most important part in environmental management. As per diversified geographical, geological, climatic and demographical reasons, the availability and quality of fresh water can also be diversified in nature. Plankton is a natural food of many fishes, especially zooplankton, consumes many omnivorous and carnivorous fishes. Most of the larvae corps are feed on zooplankton (Dewan et.al. 1977), because zooplankton provides protein for good growth and development of gonad for fishes (Prasad and Singh 2003). The variation in nutrient and other favorable conditions of water (water temperature, pH, salinity, DO, alkalinity, free CO2 etc.) during the plankton production is occurred due to variation in population (Welch P.S. 1952). Plankton communities integrated by various human environmental activities, they are providing by urbanization and climate changes of climate changes (Kunz and Richardson 2006). The change of climate effect on plankton and fisheries.

The various studies has been done on the condition of ecology and freshwater bodies in various regions in India (Sinha B. 2002, Singh S.P. 2002, Smith P.G. 2007), but the study of variation of zooplankton diversity on climatic is not that much discovered in Lower Terna reservoir, so this investigation is for zooplankton diversity in lower Terna reservoir.

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Materials Methods-

Zooplankton samples are collected in different seasons from four stations at various parts of Lower Terna Reservoir as from June 2019 to May 2020. The net samples were collected from stations with a 120μm mesh also called plankton net with reducing cone attached at mouth of cone. Till the sample reached the laboratory for analysis and counting from collection point, physical, chemical, and biochemical changes may happen which leads alteration in quality of water sample. So it is quite important to preserve it before shipping. This is done by various methods such as keeping sample in dark, adding chemical preservatives, lowering the temperature to retard the reactions by freezing or a combination of these methods. In this investigation we have added formalin as preservative in collection sample. After filtering through plankton nets, the samples were concentrated in 100ml bottles and fixed with 40% formalin (10ml per sample) which forms a solution as a final formaldehyde concentration with 4%. For Counting purpose sample above made are taken, and Drop count method was used. In this method one drop of sample is taken on a glass slide with the help of calibrated pipette and the planktonic organisms are counted in strip. The total area under the cover slip represents the number of organisms present per given volume of the sample. The organism per liter of water of the lake is yield from this volume of sample expanded to an appropriate factor. For analysis, a colony of plankton is accounted as a single count as some plankton are unicellular while others are multicellular.

Formula for Calculating organisms per liter is:-

Total Plankton count per liter= $A \times \left({}^{1}/_{L}\right) \times \left({}^{n}/_{V}\right)$

Where, A=number of organisms per drop (no)

L=Volume of original sample (l)

n=Total volume of concentrated sample (ml)

V=Volume of one drop (ml)

Observation Table No-1

Season	Rotifera	Cladocera	Copepoda	Ostracoda	Total
Winter	935	480	738	207	2276
Summer	908	395	526	275	2220
Monsoon	734	360	501	123	1802
Average Of all Season	897	412	588	202	

Fig.01- Chart for Seasonal variation of Zooplankton at Lower Terna Reservoir.

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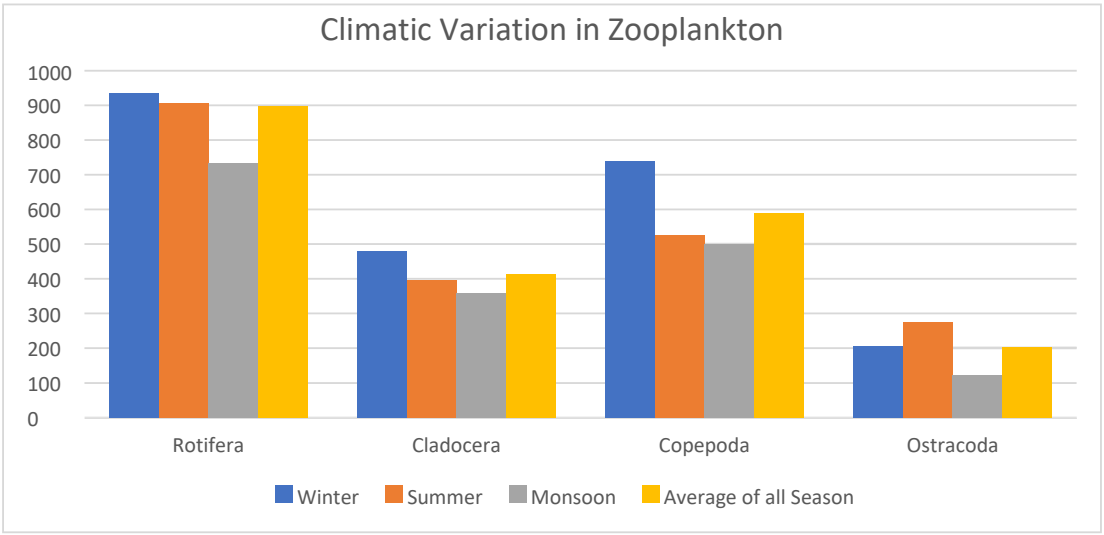

Result and Discussion

In the present study 21species of zooplankton were reported, among those 8 species are of Rotifera, 4 species are of Cladocera, 6 species are of Copepoda and 3 species are of Ostracoda. The record of each species belongs to Four classes are shown in Table No.1.

The seasonal variation of zooplankton are illustrated in Fig.1 shows that, species richness was high in winter season and it was minimum during monsoon season. Same observation was observed by A.M. Watkar and M.P. Barbate (2012).

Rotifers: - The Rotifer are the most important group of zooplankton. It is soft bodies invertebrate (Hutchinson G.E. 1967). In aquatic ecosystem Rotifers are play an important role in food chain. In rotifer Brachinous, Filinia, Keratella are the most dominant species in the Lower Terna Reservoir, which is recorded during this present study. According to Hutchinson G.E. (1967)'s observation the Brachinous species are very common in temperate and tropical waters, indicates alkaline nature of water. In the present study population density of rotifers was maximum in summer season same result is in winter also. Taxonomic dominance of rotifer was reported in several water bodies (Dhanapathi, 2003). The presence of Rotifer are the important indication of pollution of water (Saksena D.N. 1981).

Cladocera: - It is commonly called as "water flea". It is present at deep water and most of the fishes feed on it. So it is most important part of food chain in aquatic life (D. Sinha 1992). In the present study Cladocera are abundant in winter season, when food supply is more and avoiding competition with rotifers because it is less than summer and minimum in monsoon season, some investigation carried by A.M. Watkar and M.P. Barbate (2013). The maximum population in winter season for suitable temperature, availability of food there are most important parameter to controlling the Cladocera (Edmondson, 1959).

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Copepoda: - This group of zooplankton are majorly present in all water bodies, most source of food for fishes and play important role in aquatic ecosystem in an ecological pyramid. In present study the population density is maximum during winter season and minimum during monsoon. The factors like rainfall, river discharge, phytoplankton density are controlled the growth of Copepoda (Bijay Mandan S. and P.K. Abdul A., 1994).

Ostracoda: - The marine and fresh water bivalve of crestaceans are including in the group Ostracoda. They occurs in all kind of water bodies. It provides a good food for all aquatic organisms. In the present investigation three species of Ostracoda are recorded. The maximum population of Ostracoda in summer season while the minimum population in in winter season. Similar observations were also investigated by H.S. Patil (2004). The more species of Ostracoda in fresh water are inhibited by pollution of water (Edmondson, W.T., 1959)

Conclusion

The present study of Zooplankton analysis showed that, the total population density of Zooplankton are more in winter season due to low temperature, it is favorable climate for Phytoplankton growth as an maximum source of food and the low growth of Zooplankton is in the monsoon season due to dilution factors but in summer season the growth of Zooplankton is medium due to stability of water bodies. Availability of food is more due to decomposition of organic matter.

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ISBN-978-81- 954002-9-4

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ISBN-978-81- 954002-9-4

IMPACT OF CLIMATE CHANGE ON ANIMAL DIVERSITY

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Abstract:

Climate change is the most serious environmental issue all over the world. From ecosystems to human civilizations - all life on earth is vulnerable to climate change. Anthropogenic activities such as burning of fossil fuels, eutrophication, and altered land use are the main causes of emission of greenhouse gases leading to global warming. Changes in temperature, changes in precipitation patterns, changes in rainfall, floods, wildfires higher sea levels, Ocean acidification, reduction in ice, snow cover and permafrost, have severe impact on various organisms ranging from marine photosynthetic organisms to higher vertebrates such as reptiles, birds and mammals. These changes have forced various species to either adapt, migrate, or die. Species that adapt or migrate have to undergo ecological, physiological, behavioral, genetical and phenotypic modifications, for survival. Species that have become extinct, were either unable to increase their tolerance towards increasing temperature of land, water and air, sea water pH, or, due to loss of habitat, loss of food, and invasion by new species.

Key words: Climate change, anthropogenic activity, Ocean acidification, greenhouse gases, global warming.

Introduction:

Biodiversity in nature is a self-sustaining engine. It contains all the components to function properly. However, climate change is a friction that impedes the smooth functioning of this engine. It is the most serious and widespread environmental threat faced today by mankind. It has influenced the existence of wildlife all over the planet. Warmer temperatures over a long time are changing the weather patterns and disrupting the usual balance of nature. Changes in temperatures cause changes in rainfall resulting in more severe and frequent storms leading to floods and landslides thereby destroying many habitats. Draughts, rising sea level due to melting of ice, loss of species, more health risks etc. are some of the other effects of climate change. Though earth's climate is influenced and changed by some natural causes such as volcanic eruptions, Ocean currents, the earth's orbital changes, solar variations and internal variability, many anthropogenic activities are also responsible for climate change. Burning of fossils fuels such as coal, oil and gas, for electricity, heat and transportation, release carbon dioxide in the air and is the primary source of human generated emissions, causing the planet to warm. Greenhouse gases like carbon dioxide, methane, and nitrous oxide occur naturally in the atmosphere, while chlorofluorocarbons (CFC'S) and excess carbon dioxide are produced by man. These greenhouse gases absorb some of the infrared radiations released from the sun and cause the planet to heat up. Second major cause is deforestation, which releases sequestered (or stored) carbon in the air.

ISBN-978-81- 954002-9-4

Logging, clear-cutting and forest fires release on an average 8.1 billion metric tons of carbon dioxide in the atmosphere accounting for more than 20% of all global carbon emission. Other anthropogenic activities such as use of fertilizers, livestock productions, and excessive agriculture are some of the causes of global warming.

Effect of extreme weather:

As the earth's temperature rises, it changes weather patterns making wet areas wetter and dry areas drier. Higher temperatures worsen and increase the frequency of many types of disasters such as storms, floods, droughts, uncontrollable forest fires, air pollution leading to destruction of habitats and in turn loss of life. More than 85 percent of the threatened species in Amazon could have lost their habitats due to forest fires since 2001. (Feng et.al, 2021.)

Effect of rising sea levels:

A rise in sea levels is one of the most well-known consequences of global warming. It may occur in two ways:

1. Melting ice sheets and glaciers and

2. Thermal expansion of seawater.

The amount of sea level rise depends in larger part on the amount of warming.

According to the Fifth Assessment Report of Intergovernmental Panel on Climate Change (IPCC), from 1880 to 2012, the average global temperature has risen from about 13.7 ° C a century ago to about 14.3 ° C. i.e. by 0.85°C (Warren et al., 2018). The direct impact of rising temperature is on the sea level. Due to rise in global temperature, the ice sheets have begun to melt and the melted water is flowing into the ocean, gradually raising sea level. The average sea level in the world has risen 10 to 20 cm over the same period. As melted water gets added to the ocean, its salinity gets altered. Changes in salinity alter sea water density, which in turn can change major ocean currents that transport heat through the ocean driven by the currents, stimulating more climate change.

The Arctic is warming up twice as fast as any other parts of the world. As its ice sheets melt into seas, the oceans rise, there by threating costal ecosystem and low-lying areas. According to the National Wildlife Federation, the amount of Arctic Sea ice observed in 2012 was 49 percent less than in the 1980s and 1990s. Reduction in Arctic ice has reduced the habitat of Polar bears. Polar bears live on Arctic ice and hunt there for seals. There is evidence that Arctic Sea ice has receded by up to 40% in recent decades. Alpine continental glaciers are also receding. Due to reduction in Arctic ice their habitat is reducing and they may strive of hunger if they fail to hunt for their food. According to the U. S. Geological Survey two-thirds of the world's polar bear sub-populations will be extinct by 2050.

Rising level of sea has not only affected the survival of Polar bears but also some of the migratory birds. More than two-thirds of all goose species, and almost all sandpipers, breed in the Arctic. Therefore, this area is very important for waterfowl.

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Weather conditions directly affect the breeding success of these birds. Indirectly, long-term changes also change breeding success through changes in vegetation and habitat structure. Climate change is expected to lead to changes in major habitats in the Arctic, creating an environment unsuitable for waterfowl breeding. A rise in global mean temperature of about 1 ° C has serious and often unexpected effects on species, affecting their abundance, genetic composition, behavior and survival.

In the southern hemisphere, the Antarctic Peninsula is also experiencing rapid warming, about five times faster than the global average. Glaciers and ice sheets in Antarctica and Greenland are also melting.

Effect of warmer and more acidic Oceans: Since industrial revolution global average temperature has been linearly correlated with atmospheric carbon dioxide concentration (IPCC, 2013a). Earth's oceans are changing due to rising levels of carbon dioxide in the atmosphere. Burning of Fossil fuel, tropical deforestation, and altered use of land have caused the atmospheric CO2 concentration to rise from 280 ppmv before the Industrial Revolution to 409 ppmv in 2018. These anthropogenic activities has led to an increases in atmospheric CO2 of about 0.5% per year, resulting in global warming and, after dissolving in surface seawater, also cause ocean acidification (OA) (Gao *et al*., 2019). Carbon dioxide released in the atmosphere due to burning of fossil fuels, gets dissolved in the ocean water, thereby increasing its dissolved CO2 and lowering its pH, in turn making it acidic. Ocean's acidification is a change in pH of sea water, which is normally neutral. Earth's oceans have become 30% more acidic than they were during the pre-industrial era. Ocean acidification has caused a serious threat to aquatic creatures particularly those with calcified shells or skeleton like oysters, clams, and corals (Kroeker, 2013) Acidification has a negative impact on these creatures (Kroeker, 2010). This in turn can also affect shellfisheries as well as fishes, birds and mammals that depend on these creatures for food.

Greenhouse warming of ocean surface has resulted in stratification and shoaling of upper mixed layers, thereby exposing the photosynthetic organisms dwelling there, to increased visible and UV radiations as well as decreasing the nutrient supply. Ocean warming and anthropogenic eutrophication also reduces the dissolved oxygen in sea water leading to hypoxic zones. All of these global changes interact to affect marine primary producers, such as diatoms, calcifying algae, nitrogen fixing diazotrophs etc. (Gao *et al*., 2019).

Acidification can also occur due to deforestation. The more trees that are felled, more the carbon- dioxide is released in the atmosphere. Plants turn carbon dioxide into organic tissue such as wood and leaves. When trees are felled, this carbon is turned into

ISBN-978-81- 954002-9-4

carbon dioxide when these trees get decayed or are burnt. Rising ocean temperature are also altering the range and population of underwater species and contributing to coral bleaching events that are capable of destroying the entire reefs- ecosystems that support 25 percent of all marine life.

Effect of rising temperature leading to changes in the species: Rising temperatures, changing precipitation patterns, and increasingly unpredictable and extreme weather patterns have shown that climate change has already significantly disrupted land and sea organisms and ecosystems. Animals not only change range and timing of important life stages, but also differ in sex ratio, heat resistance, and body. Some of these changes can help the species adapt, while others can lead to its death. Animals can respond to climate change in only three ways: they can move, adapt, or die.

Climate change has not only destroyed the habitats but has also lead to changes in the species themselves, threatening their survival. Changes occurring within the species due to climate change may be ecological, physiological, behavioral, and genetical. Ecological changes include migration of Chinook salmon (*Oncorhynchus tshawytscha*) to the Arctic, and species behavioral changes include the early breeding season of the North American swallow (*Tachycineta bicolor*). Another example of behavioral changes seen in wildlife include signs of auto-cannibalism where they feed on their own eggs which reduce their hatching rate. Climate change also cause significant physiological changes. In the endangered green turtle (*Chelonia mydas*), the rise in temperature during egg hatching causes an imbalance between male and female sex ratios, with 99% of newly hatched sea turtles becoming female on some breeding beaches. Among the genetic changes resulting from climate change are hybridizations (crossing when species habitats change) that affect species such as the European toad (*Bufo bufo*) and the green toad (*Bufotes balearicus*) in southern Italy. The Quino checkerspot butterfly (*Euphydryas editha quino*), once common in Mexico and Southern California, was thought to be at risk of extinction because of climate change and habitat loss. To the surprise of scientists, it adapted by shifting its range to higher altitude and choosing a completely new host plant for depositing its eggs (Parmesan, 2015). Another most obvious impact of climate change is the rapid evolution of wild species, leading to the loss of mutations and genetic variation. Genetic variation is essential for survival because it is associated with adaptation. These behavioral, physiological, and genetic changes, in turn, affect the normal life of the animal and thus the entire ecosystem. Some sudden changes have a big impact on other species. A typical example of a change in balance is when a decrease in the number of tigers leads to an increase in the number of deer. This results in less grass coverage and ultimately less rainfall, destroying the entire biome.

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Effect of climate change on ecosystems: Rise in temperature is also the cause of shifting ecosystems, either expanding towards poles or contracting towards equator. This may result in either expansion or decrease of the geographical range of specific types of habitats, or changing the timing of seasons. Example, studies have shown that populations of European butterflies have shifted north by 114 km between 1990-2008 due to increasing temperatures and expansion of suitable habitat. Sometimes expansion of geographical range may bring new invasion species, which may cause native species to decline or go extinct, which alters the ecosystem. Slight changes in temperature may cause spring thaw to happen earlier and fall frost to come sooner. This may change the timing of the growing season for the plants and trees. This may further change the availability of food, which can affect the size and health of the populations within the ecosystem. As temperature is rising, many species are no longer able to thrive in places where they once lived. Near the equator where earth's biodiversity is highest, many species are not able to adapt to rising temperatures. Reef fish are already living in the warmest water cannot tolerate and survive in ore warmer waters.

Rise in temperature also increases the frequency of hot, dry conditions leading to wild fires, thereby reducing the changes of existence of many species. Example, a bushfire in Australia that started due to alighting strike following an especially hot, dry spell, killed about one billion animals. Many of the animals that died in these fires are found only in Australia. In another example, an extreme heat wave that hit Cairns, Australia, caused the death of one – third of the flying foxes, who had adapted to the typical Australian heat, in just two days as temperature raised to 42^0 c.

Effect on climate change on migration of animals: Migration is another phenomenon that is important for the survival of wild animals, especially birds. They are the seasonal guests with positive impact. Birds migrate to find better nesting places for breeding and sufficient food for successful broods.one of the major effect of climate change is loss of habitat. Rise in temperature, floods, desertification are some of the causes of loss of habitats. Coastal wetlands that the migratory birds use for nesting and foraging are one of the examples. During migration birds rely on these areas for food and resting places. Due to loss of these areas, birds do not get sufficient reserves to continue their long journey and find difficulty in completing their journey. It also influences the routes of many migratory birds and their annual migration rhythm. Climate change is rapidly changing the vegetation structure. Increasing temperature is making permafrost soil thaw, enabling forest to expand. Rise in temperature is also causing the migratory birds to migrate earlier than their normal season. The Siberian cranes used to migrate to Keoladeo National Park but due to the inhabitable condition of Bharatpur Lake, their number has decreased.

ISBN-978-81- 954002-9-4

The earth's climate has been changing through ages. Some species on Earth were able to adapt to the changing climates, but some species failed and have become extinct. However, due to the rapid acceleration of anthropogenic global warming today, many birds and other animal species are unable to adapt to the rapidly changing environment and threaten their survival. One piece of evidence of anatomical changes was found in birds in Australia and North America. In California, drier conditions have meant less food for desert bighorn sheep. The drying up of ponds in Yellowstone National Park has led to the decline of four amphibian species. And in the Sonoran Desert in the southwest, some bird species stop breeding altogether during extreme drought conditions. Species that adapt, evolve through natural selection over many generations. Some individual species, can change their features (developmental, behavioral, and physical) during their lifetime in response to environment through phenotypic plasticity. Plasticity enables organisms with identical genes to exhibit different traits in reaction to climate conditions through altering gene expression. Species with genes that allow plasticity, adapt to climate change more quickly than those without these genes. Organisms that do not have phenotypic plasticity or genetic variation that enable them to adapt to changing conditions, may become extinct. For example, the endangered red-cockaded woodpecker, which depends on the longleaf pine forests in the southeast U.S., has not shifted its range north at all. As its habitat changes, scientists do not know if the bird will survive. Phenotypic plasticity, however, in some species may limit adaptive evolution. Example butterfly from Malawi, when born at a warm, wet time of a year, speeds up its growth and reproduction and lives a short life but, if born in a cool dry season, it leads an inactive long life with delayed reproduction. While the butterfly has a lot of variety in gene expression, scientists have found very little actual gene variation for this plasticity (Oostra, 2018).

Action to be taken: According to IPPC 6th Assessment report, limiting earth's warming to not more than 1.5 degree must be our common goal. Every government at every level—national, state, city, town including every private sector, every individual must be involved in the alignment. Decisive and immediate steps must be taken to reduce greenhouse gas emissions and rising CO2 level, and to preserve the earth's natural carbon sinks—its oceans, its forests, its soils, its permafrost. Steps towards energy conservation and use of renewable energy sources like solar and wind, should be adopted urgently. Ecofriendly products should be chosen. '4R's- Reduce, Reuse, Repair and Recycle, should be implemented.

ISBN-978-81- 954002-9-4

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ISBN-978-81- 954002-9-4

POTENTIALS OF *MYCORRHIZA* IN SOIL RECLAMATION FOR SEMIARID ZONES

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Introduction of Green revolution, new farming technologies, improvement of seed quality and continuous use of fertilizers have increased the grain productivity to many folds but excessive and increased use of chemicals and fertilizers in agriculture has caused many environmental problems / hazards especially in India. The present world is facing the crisis of environmental degradation and climate change due to various factors.

The concept of Sustainable agriculture using organic farming methods is gaining acceptance in India due to rapid degradation of natural resources, increase of production cost of conventional farming and deterioration of land (Gaur,2010). Environmental conservation, soil sustainability and application of new technologies used to improve Agricultural productivity are the main concern for Research and development.

Microbes are essential components of the ecosystem. The soil harbours many types of beneficial microorganisms that help in soil reclamation and improve the soil fertility. The mycorrhiza are symbiotic associations of fungi and plant roots that helps in promoting the nutrient absorption for the plants. Most of the land plants form symbiotic associations with mycorrhizal fungi. These fungi play an important role in terrestrial ecosystems as they regulate nutrient and carbon cycles that influence soil structure and ecosystems. Up to 80% of plant N and P is provided by mycorrhizal fungi and many plant species depend on these symbionts for growth and survival (Marcel et. Al 2015). There are different types of mycorrhiza in nature that are associated with different types of plant communities. The most common type is endomycorrhiza also termed as Arbuscular mycorrhizal fungi (AM fungi) .

The AM fungi are important components of rhizosphere ecosystem, as they play an important role in establishment of plant community especially for the tropical plant community. They are mutually associated with the plants for getting water and minerals such as phosphorus from the rhizosphere soil. In return they get reduced carbon for their growth and development. They are also playing a critical role in influencing the nutrient cycle, soil structure stabilization, transfer of organic matter and its accumulation (Landis & Fraser 2008; S. Kulkarni & A. Kulkarni, 2018 ; Tisdall ,1991; Barea 1991). Mycorrhizae are one of the potential biofertilizers that can help in improving the quality of soil especially for the semiarid zones from India. They help in mobilizing the phosphates, conserve plant nutrients, are natural renewable sources with low cost inputs and eco-friendly. (Yawalkar et. Al.). Mycorrhizal fungi have been suggested as having a role in uptake of water at during drought stress, and heavy metals contaminated soil (Courtecuisse, 1999). Studies have suggested that the relatedness of plant and AM fungal communities might

ISBN-978-81- 954002-9-4

change in response to shifts in the biotic or abiotic environment. The preferential carbon allocation towards AM fungi is found to increase under nutrient limitation (Ji & Bever, 2016). Legumes have a high demand for nutrients, especially P for N-fixation, and are therefore thought to strongly rely on AM symbiosis to increase nutrient uptake (Azcon *et al*., 1991).

Mycorrhizal fungi in the rhizosphere support or inhibit plant growth naturally. Plant growth-promoting fungi help to improve crop yield and crop sustainability in adverse environmental conditions including soil salinity, drought, high and low temperatures, and infections from pathogens and pests. Mycorrhizal fungi secrete plant growth-promoting substances, enzymes, and other metabolites, all of which play a vital role in enhancing the productivity of economically important plants. These fungi also reduce the need to use chemicals in agriculture, which helps to minimize soil pollutants. (R. Radhakrishnan, 2021)

The study of mycorrhiza is reported since long back in nature. The study of mycorrhiza started in the 19th century with the work of Frank (1885) followed by contribution in the study by Mosse (1953), Gerdmann and Nicolson (1963), Glenn (1982), Hepper (1984), Bagyaraj (1990-2000), Nair (1995), All the research have improved the knowledge regarding the morphology, taxonomy, identification, status, potentials and functions of mycorrhizal establishments with plants and their role for sustainable agriculture.

The plants growing in disturbed lands or semiarid conditions require the help of mycorrhizal technology to improve the growth conditions for the plant in their initial stages esp. in seedling stages. In recent years more emphasis have been given on production and improvization of this technology. It has been useful for the forest plants, horticultural crops and agroforestry plants. The benefits of mycorrhizal associations are reported in crop plants like wheat, maize, tomato, brinjal, soybean (Kulkarni, 2013), medicinal plants and observed that the crop productivity was enhanced by 35-50%. There is need to popularize and improve the biofertilizer technology with respect to quality improvement of crops in the nurseries and fields through Agricutural universitites and Forest management programmes (kulkarni, 2016).

The recent advances in molecular biology, biotechnology and microscopy has provided insight for mechanisms of interaction between mycorhizza and plants (J. Gilbert et.al 2013). It includes the role of mycorrhiza in stress tolerance management and Genetic analysis of AM fungal communities. These studies will help to understand the molecular mechanism of ecological and evolutionary roles of arbuscular mycorrhizal (AM) fungi in communities and ecosystems. In the recent studies on utilization of mycorrhizal is a sustainable method to reduce the translocation of metal ions to the shoot by improving the immobilization of metal in the root and rhizosphere through phytostabilization. It is studied with respect to agricultural lands that are getting contaminated with heavy metals due to the extensive utilization of agrochemicals and their accumulation in the edible parts of crop plants enhances the chances of heavy metal exposure to human beings (E. Janeeshma, 2022).

ISBN-978-81- 954002-9-4

All the advances in molecular genetics clearly permit the analysis at finer and functional scales than the previous techniques. The classical methods have limitations and thus exploration with molecular analysis is essential for improvement in technology. The research is in progress to understand the the cellular signals at molecular levels and their role in interactions (Enrico Gobbato, 2015).

The studies indicate that alternative technologies like mycorrhiza is a promising technology for sustainable agricultural development and have proved the potential for reclamation of soil types and plant growth from semiarid zones.

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ISBN-978-81- 954002-9-4

OCCURANCE OF CYPRINIFORMES FISHES FROM KURNUR DAM IN AKKALKOT TAHSIL OF SOLAPUR DISTRICT (M.S.) INDIA

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Abstract

The present task deals with the study of the occurrence of cypriniformes fishes from From Kurnur Dam in Akkalkot Tahsil of Solapur District (M.S.) India. The work was carried out during the Year June 2015 to May 2016. For this evaluation, fishes were collected and identified only cypriniformes fishes with the help of standard literature. The order cypriniformes was represented by 14 species. The labeo rohita species were dominant in the Kurnur Dam.

Key-words –Cypriniformes fishes – Kurnur dam, Solapur.

Introduction

The freshwater resources such as reservoirs, tanks, dams lakes as well as rivers containsnear about 20,000 fish species in world Nelson (2006) and 2179 number of fishes in India Gupta et. al. (2006). The Fishes are rich source of food and nutrition and become an important and delicious food in diet. Fishes also provide various byproducts such as fish oil which act as a good medicinal food value in pharmacy industry Gupta et. al. (2006). The waste part of fish like bones and scales useful as a food and manure for plants. The Kurnur Dam mainly used for irrigation, drinking and fishery purposes.

Materials And Methods

For this the fish were collected with the help of local fishermen with the help of drag nets. The collected specimen brought to the laboratory and preserved in 4-5% formalin and subsequently it was transferred in to rectified spirit after 3-4 hr. of washing and fixation. During the identification of every specimen stress was given mainly on stable characters both meristic as well as morphometric both meristic as well as morphometric during this process we observe the shape of snout, presence or absence of barbell's, number of dorsal fin rays, number of scales on later line, scales in transverse lines, pectoral scale, etc. The identification was carried out with the latest authentic books on fish systematics which was suggested by Daniels R.J.R. (2012), Day (1978-89), Jayram (1981, 95), Talwar and Jhingran (1991), etc.

Results And Discussions

During the investigation there are many fish species were observed hence the Kurnur Dam is rich in fish diversity. The Kurnur Dam mainly used for irrigation, drinking and fishery purposes. The work was carried out during the Year June 2015 to May 2016. The details about this diversity

ISBN-978-81- 954002-9-4

in Kurnur Dam in Akkalkot Tahsil of Maharashtra shown in Table No. 1. Present study there 10 species belonging to 04 but our study concern with order cypriniformes so there are 05 species was found during study period. The genus Labeo rohita is dominant and shows five species. The work has been concluded with future strategies used for fishery development and to plan conservation strategies of Kurnur Dam.

Table No. I

Cypriniformes fishes profile of Kurnur Dam in Akkalkot Tahsil of Maharashtra. (June 2015 to May 2016)

Name of fish	Status
Catla- catla	++
Labeo-rohita	+++
Cirrhina mrigala	++
Cyprinus carpio	++
Ctenophyarengodon idella	++

Acknowledgement

The Authors are thankful to the Management of Balaghat Education Society, Naldurg for providing necessary Library and laboratory facilities to complete this work.

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ISBN-978-81- 954002-9-4

BIODIVERSITY LOSS

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Abstract

Biodiversity is the product of genetic and environmental factors effect of particular species. These species live in different environmental conditions and possess several adaptation factors which are the activity of genes present in their genome. Variation and variability in organisms is notified as diversity and in biological world we consider it as biodiversity. Biodiversity is under the threat of species extinction due to human activities as well as incapability of species to survive in particular condition. During course of evolution various species are produced and many species have extinct but the rate of extinction is much more in today's scenarios as compare with past. There are several action mechanisms are available for to overcome the biodiversity loss.

Key words- Biodiversity, Extinction, Species, Variation, Variability

Introduction

In this over expanding universe, there are several galaxies are present. One of them is our Milky Way Galaxy. In our Galaxy, there are various solar systems are present, in our solar system and there are 8 planets among them, only one planet which is at number three shows life. That is our mother Earth. (Irwin et al., 2014).

The reason of existence of life on Earth is very simple that presence of water in liquid condition. No doubt life arose underwater. But, have diversified into various different species depending upon the environmental conditions. These environmental conditions are uneven throughout the planet with respect to polar and Equatorial regions (De Duve, C. 1995).

Image: Milky Way Galaxy,(Source istockphoto.)

The diversity among different creatures is result of variation in climatic condition this variation and variability among the different species or individual of species is nothing but the *biodiversity* (Ammer, C. 2019). Biodiversity is noticeable from ancient time from historical to present scenario. Roughly 4.7 billion years ago, the planet Earth came into existence and around 3.8 billion years

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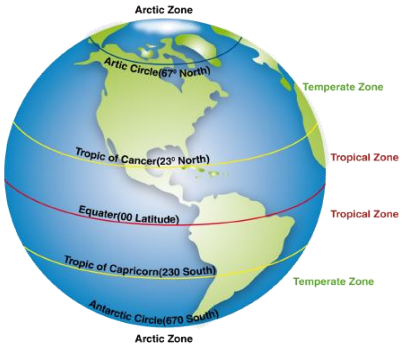
ago the planet Earth came into existence and around 3.8 billion years ago the first Organism lived on this planet was a prokaryotic with very simple architecture and performing various metabolic activity utilizing limited resources, but as evolutions takes place around 1.8 billion years ago first eukaryotic Organism which Occurred in unicellular state was somewhat complex and very much diverse in their metabolic activities (Panno, J. 2014).



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Up till today we have various different types of eukaryotic organisms present on this planet can be categorised into different kingdoms. The biodiversity study is intended to highlight the diversity of these organisms with respect to variation and variability. And can be studied in Genetic, Species and Ecosystem diversity (Ammer, C. 2019). If we elaborate each and every Kingdom, we will have very vast diversity among the organisms on the planet. The root of diversity is hidden in an environment where that species representative organism is living if you look at the planet Earth which is not completely circular but oval in shape with elliptical motion causes seasonal changes on the surface of planet because of different latitude and longitude which has an effect on organism's physiology and morphology, in addition to that altitude also play's very much important role. (Blewitt et. al., 2001).

A Red data Book of Biodiversity

Planet can be divided into polar and equatorial region, if we talk about the organism's diversity in region. Is always shows adaptation capabilities to suit, in particular environmental conditions. To face these conditions, organism performs various metabolic changes within which requires time and results into the formation of different different species and can be highlighted in simple classification systems we have as species under genus, genus under families, families under order, order under class and finally a Kingdom (Goodwin et al., 1972). The Biodiversity includes the study of biological diversity which occurs in particular environmental conditions with respect to the resources the region on this planet can be decorated as high low and medium biodiversity regions in term of ecological niche the species which occurs in particular area which are dependent upon food and shelter are adopted for particular conditions (Peterson, A. T. 2011). but the global urbanisation process head laid to rapid transformation of various urban suburban habitats which

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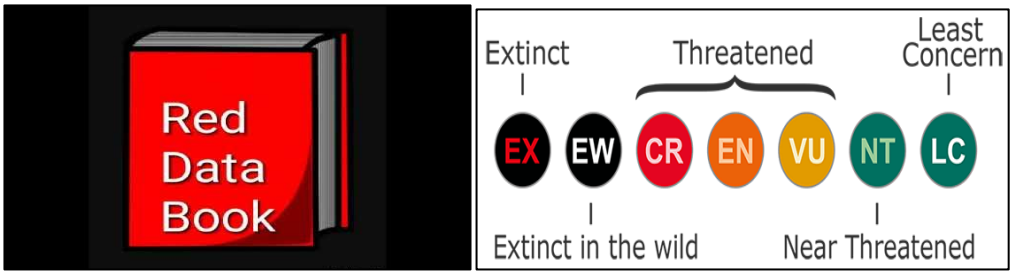
have profound consequences on biodiversity it is visible in occurrence of species according to the Publication from IUCN read data book which is a documentation highlights the rare and endangered species of plants, animals, fungi and also few species that exist within state or country (Wells et al., 1983). More than 40,000 species are threatened with extinction in which various amphibian, mammals, birds, sharks, coral reefs, crustaceans, reptiles and cycads are included.

Established in 1964 by International Union of conservation of nature's redlist of threatened species. perhaps the red data book helps us in in providing complete information of research studies and also monitoring the programs on rare endangered species and their habitats, this book is mainly created to identify and protect those species which are on the verge of extinction (Daly, B., & Friedmann, Y. 2004). The red data book consists colour coded information sheet which are arranged according to the extinction risk of many species and subspecies according to the book black represents species that are confirmed to be extinct the red colour represents species that are endangered the amber of those species have status is considered to be vulnerable whereas white colour indicates 4 species that are rare and green species that were formerly endangered but their number have started to recover.



The grey colour of species that are classified as vulnerable endangered or rare but sufficient information is not available to properly classify them in index of biodiversity loss and can be studied as per threatened, non-threatening or unknown reason of biodiversity loss.

The information which will help in identifying all animals, birds and other species about their conservation status will also help to use or to evaluate the population of particular species in the available data. Current status of biodiversity can be used to evaluate the taxa at the global level and definitely by studying the biodiversity loss we will have the framework or guideline for improvement in protective measures of endangered species. Further biodiversity loss study is very useful to identify vulnerable species that vulnerability is mainly caused due to the loss of habitat (Goodwin et al., 1972).

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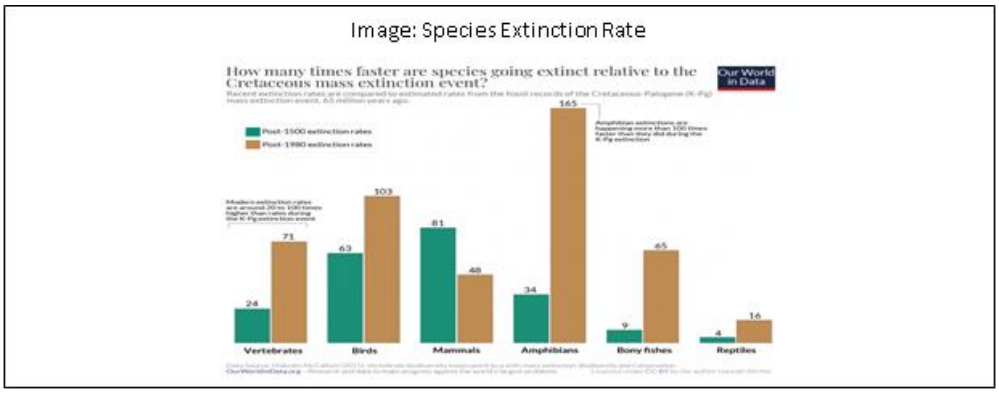
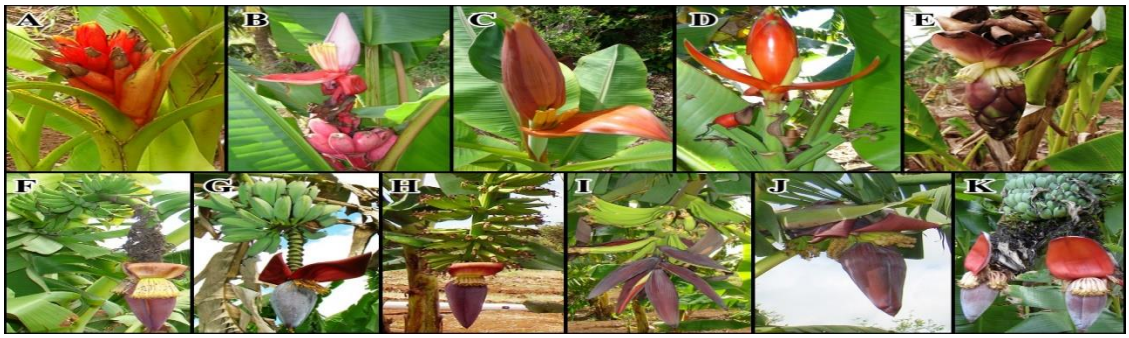


Genetic Diversity (Diversity within species)

The biodiversity loss study can be done by the basic information in which genetic diversity plays very much important role which includes the availability of genes in a population. The typical gene has 2 or multiple alleles in a population this allele's frequency have tremendous effect upon the species populations variability. A typical population which is belonging to particular species shows little variation in there body architecture for example the strips on tiger, the fingerprints on palm will always be different for different individuals due to any returns of alleles for particular gene (Hughes et al., 2008). It is very essential to understand the genetic diversity because in many species the homozygous status for genome of that species can be resulted into the extinction of that species in particular viral or disease condition. It is always appreciated to have heterozygous status for some genes which is required for existence of that species on the planet for example in case of cheetah the homozygous city status is very prominent as compared to other species that gene which are required for defence mechanism in immunology or immune system of that cheetah will be absent throughout the population. In particular species repeated inbreeding may cause heterozygosity status and will be responsible for biodiversity loss (Terrell et al., 2016).



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Species Diversity (Diversity between species)

Another scenario is species diversity where speciation mechanism plays very important role. speciation is dependent upon the habitat of particular environment for example organisms which are belonging to one genus shows several remarkable differences in their physiology, biochemistry metabolism and also these species are sexually isolated from each other, for example

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in case of donkey and horse they look very similar to each other but they are sexually isolated and shows physiological differences diversity (MacArthur, R. H. 1965). This speciation is not restricted only to the morphology point of view but also can be visible in ethologal phenomenon in different species. Ethology deals with the behaviour diversity in organisms (Beer, C. G. 1973). Rapid industrialization roads and pollution have increased the chance of reduction of particular species in that habitat. Changes in environment definitely will have effect upon the existence of particular species and may result in biodiversity loss.

Image: Species Diversity in family Felidae

Ecosystem Diversity (Diversity over larger area)

3rd level is ecosystem level there it is essential to understand what is ecosystem post ecosystem is made up of different communities this communities are nothing but the compilation of different different species which are living in one area, we have alpha, beta and gamma ecosystems on the basis of size. Ecosystem is very essential topic in environmental studies. Unit of Ecosystem is species, those do interact with each other and species interaction is very essential for existence of ecosystem for example plants which requires pollinating agent insects, these plants will not be able to survive in absence of pollinating agents these pollinating agents will not be able to survive in absence of these plants so there is a coevolution scenario. Seed's dispersion can be another example where Organism interact with each other, we categorise them in symbiosis concept which is divided into *mutualism*, *commensalism*, *amensalism* and *parasitism* categories (Lapin, M., & Barnes, B. V. 1995).

In mutualism we will find two organisms interacting with each other are getting mutually benefited there are various examples of mutualisms we can notice, in case of crocodile many birds eats the remnant of food between the teeth's of crocodile by doing this bird is getting food and crocodile is getting rid of waste. In case of lichen we have algae and fungi living together getting mutually benefited (Pound, R. 1893).

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Image: Mutualism *Image: Mutualism* *Image: Commensalism*

In certain scenario it is noticeable that what Organism is getting benefited while another Organism is getting harm that is what parasitism many diseases are the example of this parasitism where is infection and infestation can be considered in parasitism. Then we have commensalism Where species interact with each other one species is getting benefit while other species remains unaffected for example where herbivorous animal do browsing on land many birds utilizes that condition to eat (Murata et al., 1986) insects which are present in grass. In case of aquatic life some fishes take shelter from sea anemone which are highly electrically charged.

In case of amensalism where you will notice two species or organisms interact with each other and no one is getting benefited and no one is having loss directly but indirectly they are interdependent on each other so in ecosystem diversity it is essential to understand the presence of one species in ecosystem have effect on other species eradication of one species completely will have definitely the effect and result into the biodiversity loss (Liu et al., 2018).

Species Extinction

2021 UN report warned and the current rate of species extinction is at historic high level and continues accelerating today there are approximately 1,000,000 species of animals and plants are at risk of extinction many of which can disappear within years even not in decades. Biodiversity loss is serious issue considering the importance of species in an ecosystem (Mittermeier, R. A. 2022). We can highlight the causes of Biodiversity loss which are mainly due to the habitat loss by the human activities such as, (Tilman, D. 2000)

1. Deforestation
2. Industrialization
3. Habitat fragmentation
4. Pollution
5. Transport system
6. Invasion of species
7. Genetic modification

8. Overpopulation

1. **Deforestation**: Forest provides habitat for large number of organisms which includes plants, animals Fungi and microorganism but overexploitation of forest for Timber medicine food and clearance of plant in particular area for agricultural practice resulted in to the decrease in number of forest per year. Vijay et al., 2016). As a result, wildlife species are losing significant natural habitat with every passing day more than 80% of terrestrial species of animal plant and

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insect on planet concluded as biodiversity loss. In just 6-year period from 2010 to 2015 the human beings' activities have cost at least 3.3 million hectares of forest area lost.

Image: Deforestation

Not just terrestrial environment but also aquatic life is also suffering from the issue of biodiversity loss mainly by the over fishing and by-Catch. The rate at which fish are being caught at a much faster rate than their stocks can be replenished (Moyle, P. B., & Leidy, R. A. 1992).

According to UN Food and Agriculture organization report annual increase in global food fish consumption is 3.2% whereas the outpost population growth is 1.6% there has been a 39% of decrease recorded in marine species (Moyle, P. B., & Leidy, R. A. 1992). Wildlife poaching is another illegal wildlife trade is the biggest direct threat to many of the world most threatened species and the biggest cause of biodiversity loss millions of animals from thousands of species across the world are captured and killed every year run the biggest victim of wildlife poaching for which they are targeted (Clarke, R. V., & de By, R. A. 2013).

Image: Poaching

Invasive species

A foreign species introduced to population of species that has become established in an environment that is not their native causes biological harm. In India there is one species of plant known as parthenium is considered as invasive species. Most of the time in these species are acting as weed which are responsible for resource partitioning mainly in agricultural sector, along with agriculture the plants which are native or endemic who have to compete with the invasive species

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and there is a big chance of biodiversity loss of local or endemic species due to the invasion of other species (McNeely, J. 2001).

Climate change

A climate change is unsurprisingly one of the greatest challenge and cause of biodiversity loss. Rapidly rising temperature causing large number of species to move from region that they are not suited, according to 2004 study scientists estimated that millions of species worldwide would face extinction as a result of climate change in next 50 years. (Williams et al,. 2022)

Industrialization and habitat fragmentation goes hand in hand which also includes the transport system the requirement of new region for establishment of industry which requires roads availability, to do this clearance of forest in a particular region in creation of roads for career facilities result into the fragmentation of forest habitat. fragmentation is one of the major causes of biodiversity loss as animal are unaware about the rules of road many animals die in road accident and in addition to this habitat fragmentation result into the resources partitioning and affect upon the organisms interaction with each other, it also has effect upon the mating system of species in that area. Landscape level management approach is essential to overcome the problem caused by habitat fragmentation. (Fahrig, L. (2003).

In an addition, the **pollution,** which is caused by human activities such as soil pollution and water pollution, are major reason of biodiversity loss because. The aquatic flora and fauna has getting affected by polluted water. Tremendous loss in biodiversity has been noticed. The bio-magnification concept shows how toxic and harmful materials are getting transmitted through the food chain and are affecting various species in an ecosystem (Barker & Tingey, 2012).

There is an urgent need for many countries to increase the level of investment in biodiversity conservation and ecosystem services. Various conservation practices are available by which various Vulnerable Endangered and Rare species can be conserved. The conservation of biodiversity includes various approaches as given in a figure to overcome the loss of biodiversity. In situ conservation and exited conservation are major focus of conservation practices.

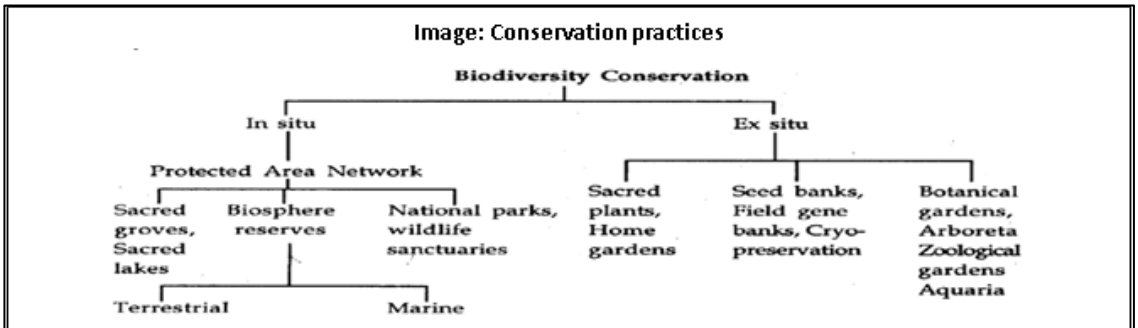

Fig. 1 The in-situ and ex-situ approaches of conserving biodiversity in India

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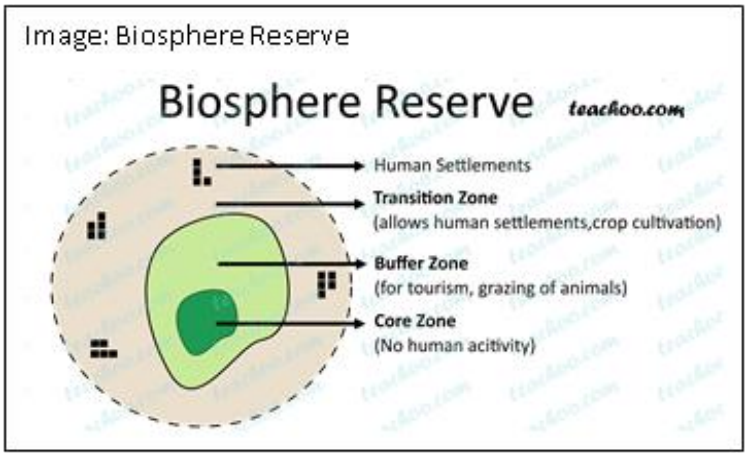
In-situ conservation.

In this In situ conservation the conservation practices are carried out for especially wild and endangered species to conserve an area in their natural habitat. Through the use of Biosphere reserve national Parks and Wildlife centuries (Heywood, V. H. 2005).

There are 738 Biosphere reserves in 134 countries working to diminish the Biodiversity loss, Biosphere reserves place very significant role with proper structure in which there are three sections are created the external transition zone, second buffer zone and the central core zone, the tribal, local people which lives in that area and researchers are allowed only in buffer region but restricted entry in core region (Batisse, M. 1982).

There are 565 wildlife sanctuaries exists in in India. Another 218 sanctuaries are proposed in the protected area network covering in area 16,000 kilometres square, including 20 Tran's boundary sites. India has 12 Internationally recognised biosphere reserves. The Odisha government has proposed a second biosphere reserve in the southern part of the state at Mahendragiri Hill, ecosystem having rich biodiversity. The area of the proposed Mahendragiri Biosphere reserve is around 4,70,000. 955 hectors. and spread over Gajapati. Angham District in eastern ghat. Recently. 20 March 2022. The rich flora in Mahendragiri represent 40% of the reported Flora in Odisha, which around 1358 species of plants, 41 species of threatened medicinal plant found in Odisha, according to the National Union of Conservation of Nature. is recent. At international level, Africa's Forest are now critically endangered and endangered due to the population decline caused primarily by poaching and habitat loss (Ma et al.,2009)

The sacred grooves are the fine example of in situ conservation, where local people worship a God considering a particular section of forest as divine. The size of sacred grooves varies. From 0.5 to 500 Hector. Which are protected by religious communities (Bhagwat & Rutte 2006).



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Ex-situ conservation.

Ex-situ conservation is a type of conservation in which species are conserved outside their natural habitat (Engelmann & Engels 2002). An artificial type of habitat has been created for such organisms and it also involves transfer of genetic material away from their location where they actually belongs for conservation. Botanical gardens or in the form of gene pool and gametes storage as Germplasm bank for seed (Chen & Sun 2018).

On April 18th, 2022, China announced at the leaders summit of 15th meeting of the Conference of the Parties to the Conservation of Biological Diversity. That China has started building a system of national Botanical gardens. The species of plants that can be conserved in future ranging from tropical rainforest, species of Alpine and desert. Over 17,000 species will be conserved including 643 species of rare and endangered plants and 337 species of national protected wild plants (News Globaltimes, 2022).

In India there are several. Botanical gardens are present, such as. Hanging garden in Mumbai. Brindavan garden in Mysore. Rose Garden in Chandigarh. These botanical gardens are intended to preserve or conserve well known national and globally endangered plants. The Lal-bagh Botanical Garden in Bangalore is present in the middle of the city having 240 Acre Park area conjures 1854 plant species. These botanical gardens are playing very much important role, not only conservation of endangered or vulnerable plants, but also are useful site for getting information and for study purpose for upcoming generations (Iyer et al., 2012).

Biodiversity is a complex topic with millions of plants and animal species scattered across every Biome on the planet. New survey published in a journal Frontier in Ecology and Environment. Has been attempted to fill the gaps in understanding by synthesising the perspective of thousands of biodiversity experts worldwide. The survey revised 3331 responses from scientist in biodiversity in 187 countries, covering all major groups of species. Habitat and ecosystem (ScienceDaily, 2022).

It is noticeable that manmade activities are responsible for extinction of many species and destruction of habitat and ecosystem, but in history or in past It is noticeable that many

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environmental conditions such as forest fire have also contribute for serious mass extinction over millions of years ago which is promoted by rapid greenhouse gas emission from volcanoes, extreme warming and drying led to wildfires across vast region that were previously permanently wet.

Five major mass extinctions

Huge number of species disappeared in relatively short period of time is known as mass extinction. Paleontologist know about this extinction from the remain of Organism with a durable skeleton that fossilised. Mass extinction is cause, which reduces the number of species of plants and animal another microbes tremendously drastically up to the level where biodiversity loss is remarkably noticeable. Such event happened 5 times, such as. (Elewa & Abdelhady 2020).

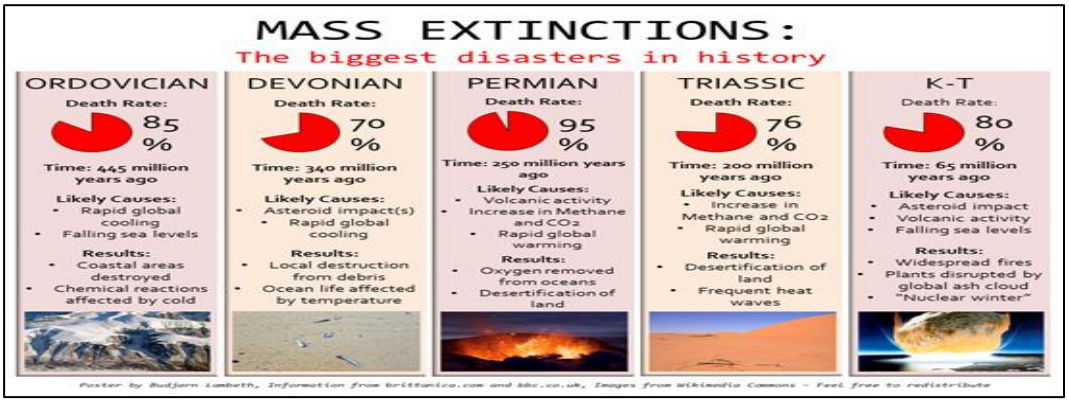
1. At the end of the Cretaceous 66,000,000 years ago. Extinction of both marine interested habitat, including. Pterosaurs, marine reptiles, many insects and all non avian dinosaurs. Scientific conclusion is that the mass extinction was passed by environmental consequences from the impact of largest meteoroid impact on the Earth in the city of what is now Mexico.

2. Late Triassic one 99,000,000 years ago. Extinction of many species especially marine sponges Gastropods, bilobed cephalopods, Brachiopods as well as some terrestrial insects and vertebrates with massive volcanic eruption along the margin of what is now the Atlantic Ocean.

3. End Permian. 252 million years ago, Earth largest extinction event, decimating most marine species searches all trilobite. Plus, insects and other terrestrial animals, most scientist evidence suggests. The causes were global warming and atmosphere changes associated with huge volcanic eruption. Is what is now Siberia.

4. Late devonian. 378 million year ago extinction of many species including coral brachiopods and single celled organisms. The cause is not actually understood yet, but resulted large Biodiversity loss

5. Late Ordovician. 447 million years ago. Extinction of marine organisms shares. Brachiopods, Trilobites, Graptolites And Conodonts as a result of global cooling glaciation and lower sea level.



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Are we the part of 6th mass extinction?

At the end of last ice age arpound 10,000 years ago. many north american animal were extinct, including mammoth. While climate changefactor, paleontologists have evidence that the overhunting by human was also to blame. Starting in the 1800 century, industrialization Drove up extinction rate and has continued to do so.

However. several climate change and peak in fire activity during the extinction event seems to have pushed even these higher adopted plant over tipping point, from which the entire ecosystem could not recover for millions of years. The researchers highlighted that today's world wildfire have caused shocking mass animal die offs in several region around the world. For example, in California 2018, 2020, in Australia 2019-20 (Lindenmayer et al., 2022). But still species overcomes from such issues and which results into formation of diversity. Plant, animal and microorganism wave of extinction of species underway across the globe might be more intense than previously thought. A new research led by University of Minnesota indicated. Nearly 30% of species have been facing global listing sons since year 1500. According to the new survey, published in July 18th, 2022 in the frontier in ecology and Environmental Journal residential crisis is really a part and parcel of climate change. It took many years for climate change to become prominent household concern.

The threat of extinction of all species on Earth now is much higher than previously thought, a new study suggested after Biodiversity survey found that percentage of species of globally threatened to a limit of extinction since year 1500

1690. dodo bird extinct from prediction by introduced pigs and cats (Roberts & Solow 2003)
1768. Steller's sea cow. Extinct from hunting for 4 and oil. (Sharko et al., 2021)
1870. Labrador dog. Extinct from human competition with Shellfish. (Chilton & Sorenson 2007).
1900. Rocky Mountain Lotus. Extinct from habitat conservation to farmland. (Lockwood et al., 1094)
1936. Tasmanian wolf. Extinct from hunting, habitat loss. (Lowenstein et al., 1981)
1952. Deep water, Cisco fish. Extinct from competition and prediction (Van Oosten, J. 1930).
1989. Golden toad. Extinct from climate change or other impacts.(Crump et al., 1992)
2004. St. Helena Olive Tree. Extinct from logging and plantations.(HELENA 1999)

Recent studies estimate about 8,000,000 species on Earth out of which at least 15,000 are threatened with extinction. It's hard to point out the exact extinction rate, because many endangered species have not been identified or studied yet. Regardless, scientists agree that today's extinction rate is 100 or even 1000 time much higher than natural baseline rate. The natural baseline extinction rate is one species per every 1,000,000 species per year. (Smith et al., 1993). Natural baseline extinction= 1 Species/ 1 million species/ year Relation of carbon level with global warming and species extinction can be relate from following graph

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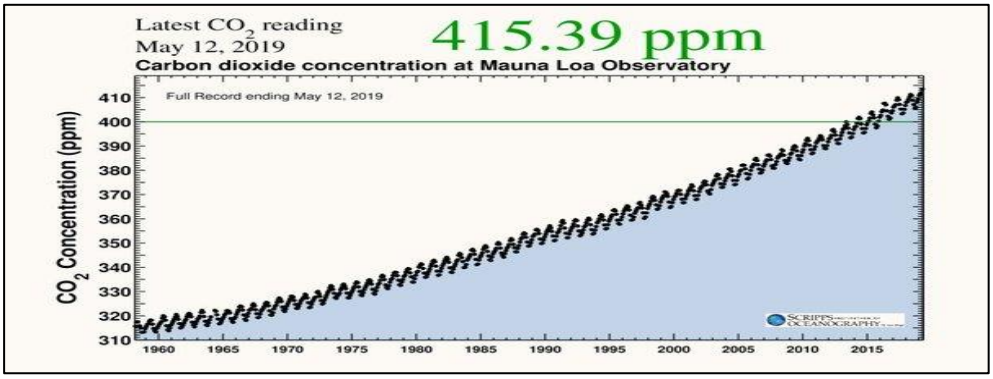

It is a probable hopeful question. Can we reverse the extinction process? The answer is hidden in genetic engineering, where recent improvements in genetic engineering have raised question about bringing extinct species back to life. In maybe many movies, it has been shown that the extinct dinosaur species can be brought on planet by genetic engineering practices. The example of a Dolly ship was cloned in 1996. Scientists know it is possible to create an Organism from DNA in a single cell. Throughout the world, there are specimens of thousands of extinct organisms which is Containing their DNA. The idea of using DNA to reverse extinct species and repopulating them is controversial. Because. What would be the impact caused by those species on today's Earth are unanswered.

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ISBN-978-81- 954002-9-4

OCCURRENCE OF APHIDS IN AND AROUND KARJAT, MAHARASHTRA

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ABSTRACT

An investigation is conducted from the month of July 2021 to March 2022 to record the existence and affluence of aphids with their associated host plants in the agricultural fields around Karjat, Maharashtra. The aphids are the sap suckers and are considered as a notable agricultural pest of great importance. About 11 species of aphids belonging to family Aphididae are found during the field investigation. It is observed that, of the 11 species recorded, 5 species of aphids are more detrimental and in turn they disturb major host plants like Milkweed, Butterfly weed, Rubber wine belonging to family Asclepiadaceae, acacia, alfalfa, almendron, green bean of Fabaceae and Hibiscus, Gossypium, Alcea of family Malvaceae and datura , ground cherry, tomato, potato, brinjal of family Solanaceae are the most noteworthy floral species favoured by aphids in the area of Karjat of Ahmednagar district of Maharashtra where the study is conducted. For this survey, the area about 10-12 km area towards east, west, south and north from Karjat of Ahmednagar district was designated. The documentation of aphids is completed by using standard taxonomic keys. The composed data is concise in tabular form.

KEYWORDS: Malvaceae, Fabaceae, Solanaceae, Asclepiadaceae, Aphids, Host plants.

INTRODUCTION

Aphids or plant lice establish one of the most important groups of phytophagous insects because of their polymorphism, host alternation, heteroecious behaviour and reproductive behaviours. They are extraordinary for their role as largest group of insect vector of vegetal viral diseases. These insects are measured as obligatory floral parasites. Several impairment signs are observed in flora as a result of aphid invasions. They relish more or less diverse distribution. Aphids feed by sucking plant juices, causing distortion of young leaves and stunting new growth. Hence, aphids are considered as serious agricultural and horticultural pests (Hill, 1997). The sap-suckers or belongs to order Hemiptera and family Aphidiae are small, slow-moving, soft-bodied inconspicuous insects with piercing-sucking mouthparts that feed in groups near the tips of new shoots and flower buds. They transmit various floral viruses that are pathogenic to their hosts (Schepers, 1987), Honey dew excreted by the aphids attracts saprophytic fungi which cover the leaves leading to reduction of photosynthetic capacity of the host plant (Schepers, 1987).

About 4702 species of aphids are recorded in the world (Agarwal, B. K., 2007) and about 300 species are known as vectors of 300 different viruses, infecting large number of plants (Eastop V.F., 1977) and (A. J. Dhembare, et.al, 2012). Thus, the present investigation reveals some of the aphid species affecting the flora of Karjat and its nearby localities.

Material and Method:

ISBN-978-81- 954002-9-4

The present investigation is related to the study of aphids from four different sites around Karjat in Ahmednagar district from the state of Maharashtra by considering the limit of 10-15 km to east, west, south and north during July 2021 to February 2022. During this investigation, mostly the leafy vegetables, fruits plants, flowering plants, grasses, weeds, herbs and shrubs are taken into consideration for collection of aphids.

The observed aphids with their host plant material are collected using fine forceps and stored in vials containing 70% ethyl alcohol (A. J. Dhembare, et. al, 2012). The collected aphids are observed under microscope and identified using aphid identification keys (Blackman, R.L. & Eastop, V.F. 2006) and by using internet source.

RESULTS AND DISCUSSION:

The aphid species appear to be more diverse during the cooler months than any other period of the year. There is profusion in insect biodiversity due to specific agricultural zones developed by the farmers in and around Karjat. The village is fenced by number of agronomic and floral farms. Survey of these fields in and around Karjat is conducted for a particular period i.e. during July 2021 to March 2022.

The aphids were observed causing damage to their host plants in agricultural fields, floral farms, gardens and floral grassland. During this survey, it is observed that the crops like sorghum, bajra, wheat, soyabean, maize, castor and brinjal as well as flowers like rose and crysanths having high market value are found to be infested by aphids.11 species of aphids are collected and identified along with their host plants.

It is observed that the existence of aphids is more in the month of October to March although there were fluctuations in the raining pattern in this study year. Because of the polyphagous feeding habit, aphids are serious pest of almost all agricultural crops as well as floral farms (Minks and Harrewijn, 1987). As they feed upon different parts of plant like leaves, stem, fruits, flowers, blossoms and even roots (Blackman and Eastop, 2000). They cause severe damage to the commercial crops as well as to other host plants.

About 34 host plant species were recorded and it was observed that *Aphis gossypii* became the most common aphid species attacking about 10 plants species in this survey. It is also observed that the winter season is favourable for the growth of aphids as the population of aphids is recorded more in the month of December and January of the investigation period.

Several vegetable farms Around Karjat village producing vegetables like brinjal, lady's finger, tomato, cabbage, green peas, etc. are found damaged by different species of aphids. The severe infestation was observed in Chrysanths farm by *A. gossypii* and *Microsiphoniellasanborni* while the cash crop like soyabean was badly destroyed by *A. gycines.*

For prevention of such crop pests, farmers are applying different insecticides. Due to the excessive application of such insecticides, the quality of crop, vegetables or fruits

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gets badly affected with some other problems like residues in water, soil, destruction of natural enemies of these pests as well as ecosystem disturbance of that location (Palikhe, 2012). Hence the proper management of aphids through biological control is needed. There should be an integrated pest management programme against aphids and other insect pests along with the applications of eco-friendly pesticides so that the production of crop, its quality and ecosystem of the farm can remain in good condition.

Thus, the conducted survey provides the information about the polyphagus aphid species and their different host plants. By using this information, the changing crop pattern can control the infestation of aphids at certain level, which will result in proper production of crops having good market value, and the farmers can yield considerable production of their crops Aphids can also be controlled with biological methods, for example, ladybugs that prey on these pests. This approach is more eco-friendly but shows limited control over large infestations.

Table 1: List of host plants and the aphids found associated with them.

Sr.No	Aphid species	Host plants	Common names of host plants
1	*Aphis gossypii*	*Daturametel(L.)*	Angel's trumpet
		Solanummelongea(L.)	Brinjal
		Ricinuscommunis(L.)	Castor
		Hibiscus rosa-sinensi	China rose
		Chrysanthemum sp. (	Chrysanths
		Gossypiumhirsutum(L.)	Cotton
		Hibiscus mutabalis	Cotton rose mallow
		Cucumissativus(L.)	Cucumber
		Abelmaschusesculent	Lady's finger
		Urticadioica. (L.)	Stinging nettle
2	*Aphis crassivora*	*Cajanuscajan(L.Mills*	Pigeon pea
		Vignaunguiculata(L.)	Cow pea
		Ocimum sanctum (L.)	Tulsi
3	*Aphis nerii*	*Zea mays (L.)*	Maize
		Triticumaestivum(L.)	Wheat
		Vincarosea(L.)	Periwinkle
		Citrus limonium(L.)	Lemon
		Gomphocarpus sp.	Cotton bushes,
		Asclepias(E.mey.)	Milk weeds
4	*Aphis fabae*	*Lycopersiconesculentum(L.)*	Tomato
		Tageteserecta(L.)	Marigold
		Helianthus annuus(L.	Sunflower
		Chenopodium album (L.)	Pigweed
5		*Gossypiumhirsutum(L.)*	Cotton

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	M.persicae	*Solanummelongea(L.)*	Brinjal
		Brassica oleracea(L)	Cabbage
		Momordicacharantia	bitter gourd
		Caricapapaya L	Papaya
		Spinaciaoleracea(L.)	Spinach
6	*Acyrthosiphonpisum*	*Pisumsativum*	pea aphid
7	*Aphis helianthi*	*Helianthus annuus*	Sunflower aphid
8	*Macrosiphumrosae*	*Rosa indica*	Rose aphid
9	*Macrosiphoniellasanborni*	*Chysanthemum*	Chrysanths
10	*Aphis glycines*	*Glycine max*	Soyabean
11	*Toxopteraaurantii*	*Citruslimonium(L.)*	Lemon

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ISBN-978-81- 954002-9-4

BIOLOGICAL INVASION: A GROWING PROBLEM FOR ENVIRONMENT AND HEALTH

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"In many areas, ecosystems are weakened by pollution, climate change and fragmentation. Alien species invasions are a growing pressure on the natural world, which are extremely difficult to reverse." Jacqueline McGlade, EEA Executive Director

ABSTRACT

Invasive alien species are species that are introduced into new areas and, once there, are able to adapt, become established, reproduce and spread, colonising the environment, creating new populations and impacting on biodiversity, health and the economy. Invasive alien species can transform the structure and species composition of ecosystems by dominating the ecosystems and repressing or excluding native species. The issue of invasive alien species is caused by human activities associated with international movement, but measures have to be taken at national and local levels. International cooperation can assist it. Prevention is the first step, but where the damage has been done, it can still be reversed if we all work together. nvasive alien species have devastating impacts on native biota, causing decline or even extinctions of native species, and negatively affecting ecosystems. Invasive alien species are animals, plants, fungi and microorganisms entered and established in the environment from outside of their natural habitat.

INTRODUCTION

Purposely or accidentally, people often bring non-native species into new area where the species have few or no natural predators to keep their population in check. These non-native species are known as invasive species or alien species or exotic species. They have devastating impacts on native biota, causing decline or even extinctions of native species, and negatively affecting ecosystems. Invasive alien species may be animals, plants, fungi and microorganisms. These species either introduced deliberately or entered inadvertently and established in the environment from outside of their natural habitat. They reproduce rapidly, out-compete native species for food, water and space, and are one of the most important causes of biodiversity loss. Introduction of invasive or alien species into new areas are known as Biological invasions. A biological invasion can also have an impact on human health, since several species can transmit disease, cause allergies, and even be poisonous. They also cause economic and environmental havoc. Invasive species can also alter fire cycles, nutrient cycling and the hydrology and energy budgets in native ecosystems. The problem of invasive species will rise severely through climate change.

ISBN-978-81- 954002-9-4

Invasive species are major global change drivers and many studies have shown that they can alter biodiversity and ecosystem functioning (Linders *et al*., 2019). Direct effects of invaders on ecosystem functioning could arise through alterations in disturbance regimes or nutrient levels. Indirect effects of biodiversity loss will only be important in comparison if invaders strongly reduce biodiversity.

Invasive species can harm both the natural resources of an ecosystem as well as threaten human use of these resources. An invasive species can be introduced to a new area via the ballast water of oceangoing ships, intentional and accidental releases of aquaculture species, aquarium specimens or bait, and other means.

Human health and economies are also at risk from invasive species. The impacts of invasive species on our natural ecosystems and economy cost billions of dollars each year. Many of our commercial, agricultural, and recreational activities depend on healthy native ecosystems.

Invasive species are capable of causing extinctions of native plants and animals, reducing biodiversity, competing with native organisms for limited resources, and altering habitats. This can result in huge economic impacts and fundamental disruptions of coastal and Great Lakes ecosystems.

What Makes a Species "Invasive"?

Not all introduced species are invasive. Some of them are unable to adapt to their new environment or spread freely, as is the case with many farm animals and garden plants, meaning that they are not a threat to the area. Others acclimatize and spread without damaging the ecosystem, such as potatoes and corn, becoming established species.

An invasive species can be any kind of living organism, an amphibian (like the cane toad), plant, insect, fish, fungus, bacteria, or even an organism's seeds or eggs, that is not native to an ecosystem and causes harm. They can harm the environment, the economy, or even human health. Species that grow and reproduce quickly, and spread aggressively, with potential to cause harm, are given the label "invasive."

An invasive species does not have to come from another country. For example, lake trout are native to the Great Lakes, but are considered to be an invasive species in Yellowstone Lake in Wyoming because they compete with native cutthroat trout for habitat.

How Invasive Species Spread:

Invasive species are primarily spread by human activities, often unintentionally. The global economy, with increased transport of goods and travels and they often carry uninvited species with them and facilitated the movement of live uninvited species over long distances and beyond natural boundaries. While only a small percentage of transported organisms become invasive, they have a tremendous impact on the health of plants, animals and even humans threatening lives and affecting food security and ecosystem health.

Invasive species often travel hidden away in aircraft holds, shipping containers and ships' hulls. Ships can carry aquatic organisms in their ballast water**, whi**le smaller boats may carry them

ISBN-978-81- 954002-9-4

on their propellers. Insects can get into wood, shipping palettes, and crates that are shipped around the world. Some ornamental plants can escape into the wild and become invasive. And some invasive species are intentionally or accidentally released pets. For example, *Burmese pythons* are becoming a big problem in the Everglades.

In addition, higher average temperatures and changes in rain and snow patterns caused by climate change will enable some invasive plant species such as garlic mustard, kudzu, and purple loosestrife to move into new areas. Insect pest infestations will be more severe as pests such as mountain pine beetle are able to take advantage of drought-weakened plants.

As many individuals witnessed in the infamous "Tiger King" documentary, there is a large market for exotic pets. When families take on foreign pets that are difficult to manage, the animals can escape, or owners may release them into the wild. If the land they invade acts as a suitable home, they may settle there for life.

Similarly, homeowners enjoy displaying foreign plants around their houses. Ornamental species are lovely additives to a dull room, but they must remain inside the home. When residents realize that their house plant is turning, they often throw them outside as a means of disposal. The seeds from these foreign species can spread in a non-native habitat, invading the new region.

Threats to Native Wildlife:

An alien or non-native species is an organism which humans have introduced intentionally or accidentally -outside its previous range. It is deemed 'invasive' if it has negative effects on its surroundings, for example by outcompeting or predating on native species that have evolved without specific adaptations to cope with them. In such cases populations of native species can be devastated. There are more than 10000 alien species present in Europe, and the rate of new introductions has accelerated and is still increasing. At least 15 % of these alien species are known to have a negative ecological or economic impact.

Invasive species are among the leading threats to native wildlife. Approximately 42 percent of threatened or endangered species are at risk due to invasive species. These can cause numerous problems, such as acting as predators, hindering the growth of native species, altering the habitats, causing physical and chemical changes to the soil, competing with native species for food and space, hybridizing with native species, introducing new parasites and diseases.

Invasive species cause harm to wildlife in many ways. When a new and aggressive species is introduced into an ecosystem, it may not have any natural predators or controls. It can breed and spread quickly, taking over an area. Native wildlife may not have evolved defenses against the invader, or they may not be able to compete with a species that has no predators.

The direct threats of invasive species include preying on native species, outcompeting native species for food or other resources, causing or carrying disease, and preventing native species from reproducing or killing a native species' young.

Trade in exotic plants and animals is the main cause. Illegal trafficking of wildlife is a crime that turns over between 10 and 20 billion Euros a year, according to the Worldwide Fund

ISBN-978-81- 954002-9-4

for Nature (WWF). Hunting and fishing were responsible for the introduction of animals such as the Barbary sheep and the catfish across large parts of Europe.

The fashion industry and horticulture have also been gateways for mammals such as the American mink in Europe, and for plants such as the erect prickly pear in Africa and Oceania.

There are indirect threats of invasive species as well. Invasive species can change the food web in an ecosystem by destroying or replacing native food sources. The invasive species may provide little to no food value for wildlife. Invasive species can also alter the abundance or **diversity of species** that are important habitat for native wildlife. Aggressive plant species like kudzu can quickly replace a diverse ecosystem with a monoculture of just kudzu. Additionally, some invasive species are capable of changing the conditions in an ecosystem, such as changing soil chemistry or the intensity of wildfires.

Threats to our biodiversity:

Ecosystems are threatened by global change drivers including land use change, invasive species and climate change, all of which are altering biodiversity and the functioning of ecosystems (Sala *et al*., 2000; Prakash, 2021; Verma, 2021; Prakash and Verma, 2022).

Many studies have looked at how global change directly and indirectly affects biodiversity (Adler, Dalgleish, & Ellner, 2012; Alexander, Diez, & Levine, 2015). The variety of plants and animals that functions together to makeup an ecosystem defines a region's biodiversity. Invasive alien species are species that have been introduced, either naturally, accidentally or intentionally, into an environment that is not their own. After a certain amount of time, they adapt to their new environment and begin to colonies it. When invasive species invade foreign regions, they throw off the ecosystem's balance and cause environmental degradation.

Once established, eradication is the most desirable solution, but it can be very expensive to do. The negative effects of invasive alien species on biodiversity can be intensified by climate change, habitat destruction and pollution. Isolated ecosystems such as islands are particularly affected. The issue of invasive alien species is caused by human activities associated with international movement, but measures have to be taken at national and local levels. International cooperation can assist it. Prevention is the first step, but where the damage has been done, it can still be reversed if we all work together.

According to the United Nations Development Programme (UNDP), such species are the second biggest cause of loss of biodiversity in the world. Globalization has opened up new places, cultures and people to us. However, it has also given us access to animal and plant species that are extremely harmful to our biodiversity, such as the Asian giant hornet (*Vespa mandarinia*) which appeared unexpectedly in North America in 2019. According to the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES), such biological invasion are increasingly frequent, and are one of the main threats to the survival of one million of the world's native species**.**

Invasive alien species are one of the main threats to our biodiversity. Recently it was estimated that more than 400 European native species listed as critically endangered species due to interference of the invasive species (Bennett *et al.*, 2016). In addition 110 species are in danger

ISBN-978-81- 954002-9-4

because of invasive alien species. These foreign species continue to destroy habitats, deplete natural resources and act as predators to previously protected organisms.

Amphibians around the world are in decline, in part due to the invasive chytrid fungus. Other alien species can spread diseases, as is the case with the red swamp crayfish, which carries the 'crayfish plague'. The disease often proves deadly to European crayfish, as they have not evolved to cope with the disease.

Hybridisation can also be a problem. For example, Japanese knotweed is a particularly virulent hybrid of two alien species originating from different parts of Asia, which first came into contact as alien species in central Europe. The hybrid has been found to spread faster than its parents, outcompeting other plants and altering ecosystems with effects on other species.

Invasive alien species harm native species through predation, as is the case of feral cats killing smaller creatures. Cats have been introduced to approximately 180 000 islands worldwide, and have a significant impact - in Britain alone, cats are estimated to kill 25-29 million birds every year.

In addition to ecological support, biodiversity also supports our economy. Humanity relies on the production and consumption of raw materials for employment and progress. Moreover, biological diversity also supports outdoore recreational activities like hiking and camping. Increasing trade and tourism in recent decades may have led to increasing numbers of alien species. Climate change may also play a role in the spread of these species, the report says, making some areas more favorable to plants and animals originally from elsewhere.

Thus biodiversity plays a key role in mediating global change effects on ecosystem functioning and highlights the necessity of reversing biodiversity loss in order to reverse environmental degradation.

Impact of Invasive species on Economy:

Their negative impact on the economy costs countries billions of dollars in losses to agricultural production and some trillion dollars of environmental cost worldwide annually. Loss of native wildlife and natural resources will have major consequences on human well-being. This includes the decline of food diversity, leading to malnutrition, famine and disease, especially in developing countries. The impact on the economy can be significant, leading to a reduction in or even the disappearance of fishing, livestock breeding and crop cultivation, and damage to the tourism industry. It will also have an important impact on our economy and culture. If humanity continues to mismanage resources, pets, plants, and other wildlife, our global ecosystem will crumble. A dysfunctional ecosystem will restrict humanity's access to food, raw materials, clean water etc. Evidence shows that in a growing number of cases invasive alien species even cause harm to human health and society.

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Impacts on human health:

For humans, one of the most dangerous effects of invasive alien species is as a carrier of disease. The Asian tiger mosquito has been linked to more than 20 diseases, including yellow fever and chikungunya fever. It has come to Europe mainly through the intercontinental trade in used tyres, and is now prevalent in several southern European countries, especially Italy. Climate change projections show that the mosquito will likely extend its range further north in coming years.

Climate change is also enabling the spread northward of the common ragweed. The plant is originally from North America, the seeds first coming to Europe in mixes of grain intended as bird feed. It is a powerful trigger of hay fever and other allergies.

Changing landscapes are another result of invasive alien species. For example, the red palm weevil is destroying large numbers of palms in the Mediterranean region, transforming the green spaces in cities. There are also effects on ecosystems which indirectly affect humans. In some cases ecosystems altered by invasive alien species may be less able to provide important 'ecosystem services' which support human activity. For example, the pollination carried out by honeybees may be affected by invasive alien species the yellow-legged hornet, native to Asia, has been found to devastate beehives in France.

Invasive alien species cost Europe around € 12 billion per year, according to one estimate. Species such as the Spanish slug, now found in most European countries, can devastate crops. Other species such as the pervasive zebra mussel can also cause high costs by fouling water filtration plants and water cooling reservoirs of power plants.

Curbing the Spread of Invasive species:

One way to **curb the spread of invasive species** is to plant native plants and remove any invasive plants in your garden. There are many good native plant alternatives to common exotic ornamental plants. In addition, learn to identify invasive species in your area, and report any sightings to your county extension agent or local land manager.

Regularly clean your boots, gear, boat, tires, and any other equipment you use outdoors to remove insects and plant parts that may spread invasive species to new places. When camping, buy firewood near your campsite (within 30 miles) instead of bringing your own from home, and leave any extra for the next campers. Invertebrates and plants can easily hitch a ride on firewood you haul to or from a campsite you could inadvertently introduce an invasive to a new area.

Individuals should also use local wood when building fires rather than carrying alien logs, along with their critters, into a new environment. Before adapting a new foreign species of plants and animals you may conformed that it is not an invasive species. If any doubt, stick to what you know. Exotic organisms may be beautiful, but their destructive effects are ugly.

Conclusion:

The negative effects of invasive alien species on biodiversity can be intensified by climate change, habitat destruction and pollution. Isolated ecosystems such as islands are particularly affected. Loss of biodiversity will have major consequences on human well-being. This includes

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the decline of food diversity, leading to malnutrition, famine and disease, especially in developing countries. It will also have an important impact on our economy and culture.

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ISBN-978-81- 954002-9-4

BIODIVERSITY: SURVEY, MONITORING AND EVALUATION METHODS

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I. INTRODUCTION:

Biodiversity (Animal, Plants and Microorganisms) have multidimensional role in the sustainable development of ecosystem or environment. As human is the dominant factor of ecosystem as he is altering anything according to his interest. Anthropogenic activities are the principal cause directly relates to biodiversity disturbance all over the world in large extent. Among various causes of biodiversity loss, anthropogenic activities are at first rank. Destruction of habitat, agricultural expansion at the banks of river and lakes, sand mining, unplanned tourism, deforestation, construction of roads and railway lines through forests and Grasslands, Quick expansion in industrial areas are some of the prominent anthropogenic practices responsible for biodiversity loss. Scientific study of biodiversity includes survey, monitoring and evaluating the threats and restoration of ecosystem.

The success of every survey programme is depends upon being clear about what you want to do and why; i.e. your objectives. It is therefore very important to define what monitoring is and how surveys relate to monitoring. Survey and monitoring consider for wide range of objectives, viz. quality of sampling site, to measure species abundance, richness, diversity, evenness, habitat trends, Environmental impact assessment (EIA) studies, preparation of Government and Non-Governmental Organization (NGOs) reports and to assess compliance with international conservation agreements.

The term survey defines the collection of spatial and/or temporal data about a species, a community, ecosystem or a habitat. Survey includes a predetermined set of questions regarding the sample. There are two principal kinds of survey, online survey and survey by questionnaire. Monitoring is often loosely regarded as a programme of repeated survey, based on qualitative or quantitative observations. The monitoring programme and methods selected for monitoring must be focussed and fit for their purpose and it should not attempt to describe the general ecology of the site.

II. SURVEY AND MONITORING:

Steps involved in a monitoring programme:

1. Identify the features that should be monitored on the site
2. Select attributes for each feature
3. Define limits or targets for attribute
4. Select methods for monitoring each attribute
5. Repeat for other attributes of the feature
6. Devise sampling strategy where necessary
7. Collect data

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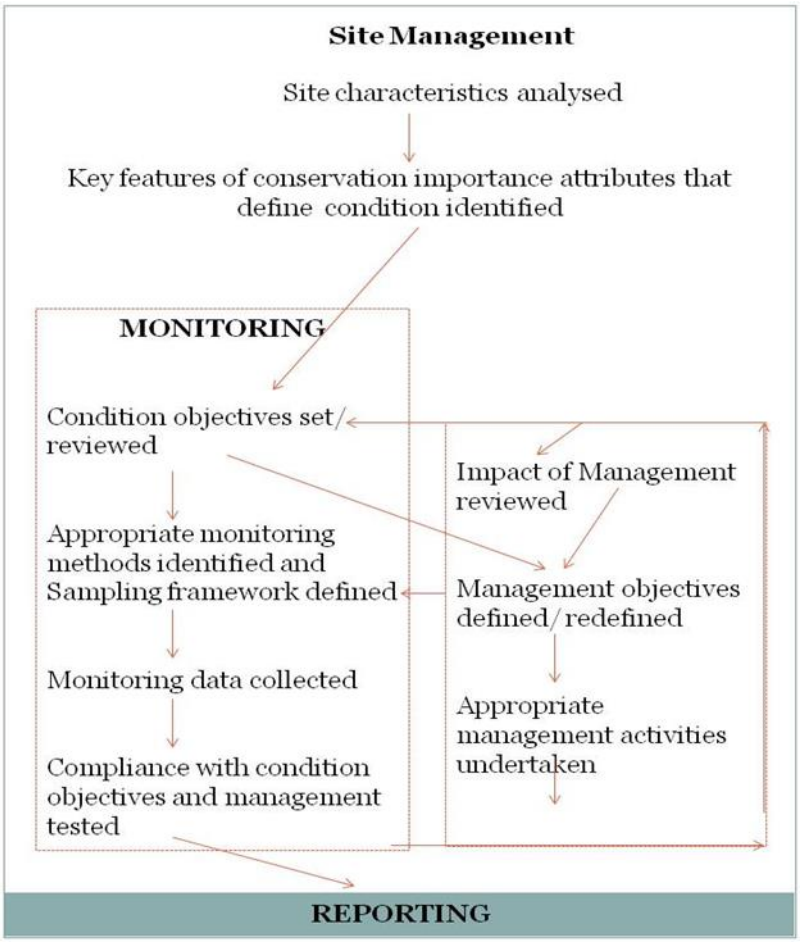

Figure: 1. A schematic view showing the relationship between site management and monitoring.

8. Analyse data
9. Determine whether attributes achieve targets set
10. Once all attributes have been assessed, determine feature condition
11. Repeat for other features
12. Act on findings if features not in acceptable condition

A CHECKLIST OF CONTEMPLATION FOCUSSED DURING THE PREPARATION OF A MONITORING PROGRAMME:

1. Setting Objectives for the Monitoring Programme

What features of conservation interest are to be monitored and evaluated?

What is the objective for each feature under study? What attributes define condition in these features and what are their acceptable limits?

How often should monitoring be carried out?

What are the operational and/or management objectives for the site?

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Is there any external factor that may have significant impacts on the site?
What type of monitoring has been undertaken, and are baseline surveys required?
Should the site be subdivided into monitoring units?

2. Selection of methods for Monitoring each attribute:

Is the method likely to damage the environment?
Are samples required?
Will the method selected for survey and monitoring provide the accurate measurement?
Can the selected method measures the attribute across an appropriate range of conditions?
Is the method prone to substantial measurement error?

1. Designing a Sampling Strategy:

Has the method been thoroughly tested or require any preliminary survey?
Is the method sufficiently precise?
Should sample locations be permanent or not?
When should the data be collected?
How will consistency be assured?

2. Reviewing the Monitoring programme:

Are there sufficient long-term resources available?
Are personnel sufficiently trained and experienced?
Are licences required?
Is specialist equipment required and available?
Are there health and safety issues to consider?

3. Data Recording and Storage:

How will data be recorded in the field?
How will the data be stored?
Who will hold and manage the data?

4. Data Analysis, Interpretation and Review:

Who will carry out the analysis and when?
How will the data be analysed?
Which will be the appropriate statistical tests to analyse the data?
Is of the data transformation required before statistical analysis?

ATTRIBUTES THAT SHOULD BE CONDERED TO DEFINE THE CONDITION OF HABITATS AND SPECIES:

HABITAT ATTRIBUTES	SPECIES ATTRIBUTES
Quantity area	Quantity presence/absence range population size

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	frequency number/density and cover
Quality: Physical attributes geological (e.g. presence of bare rock, open land or deep peat) water (e.g. presence of open water or deep water table)	Population dynamics recruitment mortality emigration and immigration
Quality: composition communities richness or diversity typical, keystone or indicator species presence–absence frequency number or density cover biomass	Population structure age sex ratio fragmentation or isolation genetic diversity
Quality: structure inter-habitat (landscape) scale (e.g. fragmentation, habitat mosaics) intra-habitat scale macro-scale horizontal (e.g. plant community mosaics) vertical (e.g. ground-, shrub- and tree-layer topography) micro-scale horizontal (e.g. patches of short and tall vegetation) vertical (e.g. within-layer topography)	Habitat requirements favourable Conservation status is dependent on the availability of sufficient habitat. physical vegetation type and structural attributes availability of suitable micro-habitats abundance and availability of prey species
Quality: dynamics succession reproduction or regeneration cyclic change and patch dynamics Quality: function physical and biochemical (e.g. soil stabilisation, carbon sinks) ecosystem (e.g. net producer)	-------

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DATA COLLECTION:

The data collection begins after formulation of research problem and research design planned out. Data collection is nothing but collecting information from all the relevant sources to find answers to the research problem, test the hypothesis and evaluate the outcomes. Data can be collected on any formulated topic for any purpose, meaning that it is used in everything from scientific research and finance to business management and retail.

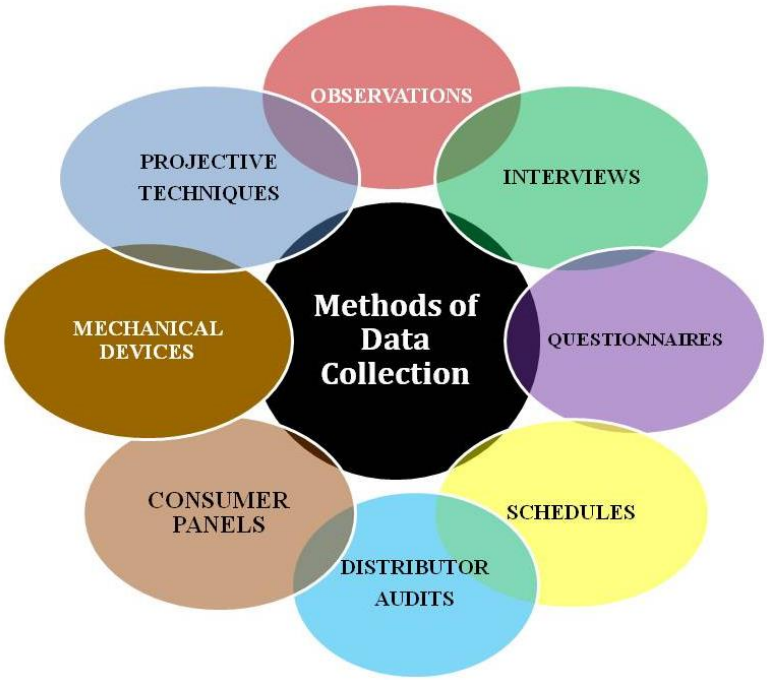

Fig. 2: Methods of Data Collection

DATA PROCESSING:

Data processing is the collection and manipulation of data to produce meaningful information. Data processing is a form of information processing, which is the modification of information in any manner detectable by an observer.

Six stages of Data Processing:

1. Data Collection
2. Data Preparation
3. Data input
4. Data Processing
5. Data Output/ interpretation
6. Data Storage

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III. METHODS OF DATA EVALUATION:

The diversity work will not be completed until the data collected is analysed with diversity indices. Some of the diversity indices, used for quantitative data analysis are as follows.

Number of taxa (*S*): Number of species in a community.

Total number of individuals (*n*): Total number of individuals of all species found.

Dominance (D) = 1-Simpson Index. It is used to identify dominant species in the community. Values ranges from 0 indicates all taxa are equally present to 1 represent one taxon dominates the community completely.

$$D = \sum_i \left(\frac{n_i}{n}\right)^2$$

Where,

n_i - Number of individuals of taxon *i*.

n – Total number of individuals of all taxon.

Simpson index (1-*D*): Simpson index measures 'evenness' of the species found in community. Its value ranges from 0 to 1.

$$Simpson\ index = 1 - \sum_i \left(\frac{n_i}{n}\right)^2$$

Where,

n_i - Number of individuals of taxon *i*.

n – Total number of individuals of all taxon.

Shannon Diversity Index (*H*):

It considers both numbers of individuals as well as number of species in a community. Its value ranges from 0 for community with only one species to higher value for community with many species each with many or few individuals. It is calculated as follows

$$H = -\sum \frac{n_i}{n} ln \frac{n_i}{n}$$

Brillouin's Index: $HB = \frac{\ln(n!) - \sum_i \ln(n_i!)}{n}$

Menhinick's richness index: $\frac{S}{\sqrt{n}}$

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Margalef's richness index: $(S-1)\ /\ \ln(n)$

Berger-Parker dominance: It is simply the number of individuals in the dominant taxon. It is calculated as

$$d = \frac{N_{max}}{N}$$

Fisher's alpha: It is a parametric index of diversity and assumes that the species abundance follows the log series of distribution among the taxa. It is calculated as follows

$$S = a * \ln(1 - n)\ /a$$

Where,

S - Number of taxa.

n - Number of individuals.

a - Fisher's alpha.

IV. SUMMARY AND CONCLUSION:

Monitoring and evaluation for biodiversity has been aimed at gathering of data to enable detection of changes in the status, security and utilization of biological diversity for the purpose of improving the effectiveness of management of that biodiversity. Monitoring and evaluation are two sides of the same coin and require adequate resources, including budget and institutional capacity, clear institutional responsibilities and reporting mechanisms. It is important to build incentives and capacity to collect, use and maintain data for monitoring and evaluation. The information gathered through Monitoring and Evaluation activities is useful both for assessing the impacts of the individual project and to provide input into the design and implementation of future biodiversity projects and ongoing biodiversity management programmes.

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ISBN-978-81- 954002-9-4

Indian Prospective of Climate Change: A Review of current trends.

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An overview of Climate change in India:

The world is facing the consequences of environmental changes such as temperature rise. According to a study in 2018 India is at 6th position having a high risk of climate change and facing many natural calamities**. (Global Climate Risk Index 2018)** leading to death of 2,119 individuals and with high economic losese. The country is unable to recover itself from such natural calamities facing it repeatedly. A recent study indicates the rise in temperature of India leading to many environmental issues. **(Centre for Science & Environment, New Delhi 2017).**

Environmental crises being a major cause of concern from Indian perspective. We have studied that history is the tale of climate change and how humans have adapted to it till date. The Human evolution itself indicates the process of adaptation of humans to the everchanging climate and catastrophic events. Mother earth has been continuously facing storms, volcanoes and metriote attacks yet has survived for the last 4.5 billion years.

The process of Change:

The Indian Economy largely depends on the Climatic Conditions. The alarming increase in Population rate. The increasing temperature, more land brought under industrialization leads to loss of habitat. Therefore, Indians involved in climate change related decision making should think on abrader scale and wisely think to decrease the effect. **(Amit Garg, Vimal Mishra, Hem H. Dholakia 2015).**

Most of the Indians are confined to rural areas reliant on climate dependent services like farming and agriculture related business-like aquaculture, sericulture, pearl culture for there income generation. Their dependency on climate and climatic changes being high

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has a direct effect on their livelyhood and income source. The poor economic conditions of most of the farmers in India is a major issue of worry. **(Government of India 2008, National Action Plan on Climate Change).**

The developmental strategies of the country are less effective due to lack of support from the legislative sector. There are no long term and short-term goals set in order to achieve climatic protection prospective. **(Adaptation to Climate Change with a Focus on Rural Areas and India"2018).**

The development at cost of Nature

The Roads authority of India (NHAI) indicates the 151,019 km of national highways. (March 2021) with Maharashtra having as long as 17,757 km. The development of roads is done at the cost of cutting down large amount of trees. Deforestation is a major concern in the developmental policy. The Industrial development is done on mostly less fertile land but the rate at which land is being brought under industrialization is increasing at an alarming rate. The habitat destruction is leading to loss of habitat and shifting diversity. **(UNEP 2017.The Adaptation Gap Report 2017).**

The roadways are increasing leading to a network of roads connecting near and far away places.The habitat destruction is leading to roadkills where migration of species takes place.The migratory species are killed due to extencive use of vehicles and animals moving continiously in search of resourses. The greed of man for development and sediantery lifestyle leads to the destruction of nature. **(WMO, 2017).**Antropogenic activities give rise to greenhouse gases and melting of ice caps on the poles adding to the imbalance of nature.

Most of the issues can be countered by implementing the tradational approaches. The tradational knowledge of locals must be brought into use.The conservational approaches which are ecofriendly and tradational should be practised to minimize the effect of climatic changes. **(Vineet Kumar 2018)**The remedation on Climat change must start at personal level and grow as we reach to local and global levels.The personal

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knowledge of some local folks must be experimented and practised at larger scale.Remedial practises such as the agricultural practises must be ecofriendly with tradational croping pattern.

Scope of the study

The scope of the study is to investigate the effect of climate change overa period of time on India.The field like the Agriculture, Economy, Biodiversity and social wellbeing of the citizens is changing with changing climate. The agriculture sector is the most affected in relation to the climatic changes. The present-day agricultural practices are leading to global warming and climatic changes. The natural resources like the Water resources are adversely affected destroying & detoriating its quality. The biodiversity is at a threatened condition due to the forest degradation & irreversible changes in it. The economic losses caused every year due to floods, hurricanes and draught is cause of concern. a proper and through knowledge of geographical, climatic and anthropogenic activities is necessary to limit the effect of climatic uncertainties.

Key observations

The steady increase in temperature throughout the globe is leading to many climatic disasters. There have been rise in frequency as well as the density of drought condition leading to migration of all species. The Natures Cycles are disturbed which can be witnessed every year during monsoon. The Indian climate has changed drastically during the last few decades in a irreversible manner. We are facing towards the world of Desertification with extreme cold at night and hot and humid during the days.

The Climate Change reducing activities such as change in Approaches in Agriculture, lifestyle and Conservation are needed. Accept Ecofriendly alternatives to modern detoriating actions & processes. Use of Biofertilisers or biopesticides and green approaches in Agriculture, check Soil erosion and land degradation. Minimizing the effect of chemicals in agriculture can be achieved using cow dung manure and vermicompost. **(Centre for Sustainable Agriculture, 2017)** Effect of anthropogenic activities on habitat

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loss is a major factor observed. It is the cause of concern as it destructs vital habitats in India.

Construction of Roadways and railways is contributing to forest degradation and cutting. Progress at the cost of nature can be observed in most of the metro cities. Airey Colony Metro no 3 developmental projects where Environmental Impact assessment report is not appropriate and in line with other research findings. This report indicates negligence from government, NGOs and layman in selection of Site.

Factors influencing Climate change Incentives.

The is no or very less information at local level on how to fight climate change. The effect of effect of climate change is predominantly seen in Eco sensitive zones and vulnerable areas like Biodiversity hotspots, such areas must be considered keenly from conservation perspective. This might lead to improvement in the rate at which climate is detoriating. The climate impacts the cropping pattern and yield at a larger scale. There is ahigh need of through research on the agricultural cycles and improvement of high-quality seeds, green practices and proper utilization of resources.

There are problems where lot of planning and efforts are needed like the harsh weather and climatic uncertainties. The rise in the level of sea water leading to decline in coastline. There must be efforts to counter water soil and air pollution and to conserve these natural resources. Efforts must be made to incalculate conservational practices. The animal husbandry ,inland fisheries and mangrove cultivation must be given top priority.

Lack of clarity on climate change

The actual problem of climate change is underestimated and not studied properly at smaller scale. Monitoring and investigation of issues must be done at Management and Ethical level. The Reports of Government agencies and research papers are not easily available to layman. The environment has become vulnerable due to lack of knowledge and flaws in action plans. No changes are initiated in agriculture sector to fight climate

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change. Lack of knowledge on current status of climatic impact and Proper funding unavailability to mitigate this situation is a constrain. The countries all over the globe have started implementing new wats to tackle the environmental impact and its consequences yet India is lagging behind in such planning or its implementation.

Indian government has been planning and creating committees and implementing many action plans but the plans are not executed well due to lack of funds, lack of knowledge in implementing authority and lack of contribution of local and common man. Region wise plan and its implementation is adviced.

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ISBN-978-81- 954002-9-4

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Nature Light Publications
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ISBN 978-81-954002-9-4

NL004